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computers and people

formerly *Computers and Automation*

COMPUTER-ASSISTED INSTRUCTION FOR ELEMENTARY SCHOOL STUDENTS

"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

The Fly, the Spider, and the Hornet

Once a Fly, a Spider, and a Hornet were trapped inside a window screen in an attic. For several hours they walked up and down, left and right, here and there, all over the screen. They could look through the screen at the summer woods, feel the summer breezes, and smell the summer smells; but they could not find any hole to pass through the screen to the woods and fields so tantalizingly close, yet so far away.

Finally they decided to hold a conference on the problem of getting through the screen. The Fly spoke first, and said, "My Colleagues, ...

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 . . . .

The Fire Squirrels

Scene: Two squirrels, a young one named Quo, and an older one named Cra-Cra, are sitting by a small campfire in a field at the edge of a wood. Behind them hung on a low branch of a tree are two squirrel-size hammocks. Over each of the hammocks is a small canopy that can be lowered to keep out biting insects. It is a pleasant summer evening; the sun has just recently set, and the stars are coming out: ——

Quo: Cra-Cra, you know I don't believe the old myths any more. Tell me again how it really happened.

Cra-Cra: Just this: we received our chance because they dropped theirs. It is as simple as that.

Quo: In other words, they were the first animals to use tools, and we are the second?

Cra-Cra: Yes. There is a mode of surviving in the world . . . .

Missile Alarm from Grunelandt

Once upon a time there were two very large and strong countries called Bazunia and Vossnia. There were many great, important, and powerful leaders of Bazunia who carefully cultivated an enormous fear of Vossnia. Over and over again these important and powerful leaders of Bazunia would say to their fellow countrymen, "You can't trust the Vossnians." And in Vossnia there was a group of great, important, and powerful leaders who pointed out what dangerous military activities the Bazunians were carrying on, and how Vossnia had to be militarily strong to counteract them. The Bazunian leaders persuaded their countrymen to vote to give them enormous sums of money to construct something called the Ballistic Missile Early Warning System, and one of its stations was installed in a land called Grunelandt far to the north of Bazunia.

Now of course ballistic missiles with nuclear explosives can fly any kind of a path all around a spherical world, and they do not have to fly over northern regions. But this kind of reasoning had no influence on the leaders of Bazunia who wanted the money for building BMEWS. Nor did it have influence on their countrymen, who were always busy, trying to make money — in fact often too busy to think clearly . . . .

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27 authors
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computers and people

formerly *Computers and Automation*

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

Front Cover Picture

This little girl is learning her Three R's with the assistance of a computer in the Los Nietos School District, Whittier, Calif. Under a specially funded program, the children in her class are provided with computer terminals that enable them to communicate with the computer to learn and practice reading, writing, and arithmetic. The computer instructs and converses at a level and pace which is adapted to each individual child's ability to learn. The system has proved to be a very effective addition to regular classroom instruction. See the story on page 24.

Announcements

Key

[A]	–	Article
[C]	–	Monthly Column
[E]	–	Editorial
[F]	–	Forum
[N]	–	Newsletter
[R]	–	Reference

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

Editorial

Computer Professional vs: Information Engineer

Is there a kind of person who should be called a computer professional? Is there a kind of person who should be called an information engineer? And what is the difference between them, if any?

It would appear that a computer professional is a person whose profession is computing. He would have a deep knowledge of:

— the structure of computers;

— the programming or instructing of computers; and

— the use of computers in systems.

He would be a person who could be relied upon to give good advice to persons who may hire his services in regard to how to choose computing equipment, provide programming for it, operate it, and design useful and reliable computer systems for many purposes.

As a professional person he would be expected to have two responsibilites: one, toward whoever would hire him; and second, a responsibility to his profession. Nowadays, he would not be expected to have any special responsibility toward society, any more than a lawyer for a criminal would be expected to have a special responsibility toward society, that the criminal should be appropriately punished.

It would also appear that an information engineer is an engineer whose special field is information. He would be an engineer in the sense that a graduate of an engineering school is an engineer. In the specialty of information he would be expected to have a deep knowledge of:

— the nature of information;

— ways to deal with information;

— machines and systems (including both computer methods and non-computer methods) for dealing with information.

As an engineer, he would have three responsibilities:

— to the person who hired his services;

— to his profession; and

— to society.

We would compare him to a civil engineer building bridges, who has responsibility for the safety of his bridges. The bridge must not collapse and kill people — no matter how much the contractor for the bridge may desire to increase his profits by selling most of the cement in the local black market. (Do you remember Daniel Ellsberg, who released the Pentagon Papers, commenting on the cement schools in South Vietnam built with American taxpayers' money under the Thieu regime — and seeing them blow away in the wind because most of the cement had been diverted to the black market?)

The best guide I know to the social responsibilities of an engineer is "An Engineer's Hippocratic Oath" proposed by Prof. Charles Susskind of the University of California at Berkeley in his excellent book "Understanding Technology" (Johns Hopkins University Press: Baltimore, 1973, p. 118).

Here is the text:

[Beginning of Quotation]

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

[End of Quotation]

So there are some profound differences between a computer professional and an information engineer. A computer professional would say, "use a computer for ...." and an information engineer would say, "use a computer if ...." And a computer professional has no special responsibility toward society, whereas an information engineer does.

All of humanity would benefit if computer professionals should become information engineers.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

MULTI-ACCESS FORUM

IBM OPERATING FIGURES FOR 1975

Peter F. Judice
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International Business Machines Corporation has announced its preliminary results for the year 1975. IBM world-wide consolidated net earnings for the year ended December 31, 1975, amounted to $1,989,876,966 or $13.35 a share on 149,044,427 shares, the average number of shares outstanding during the year. This compares with net earnings for the year of 1974 of $1,837,639,361, equal to $12.47 a share on 147,400,733 shares, the average number outstanding in 1974.

Earnings before income taxes amounted to $3,720,876,966, compared with $3,434,639,361 in the year 1974.

Consolidated gross income for the year 1975 amounted to $14,436,541,062, compared with $12,675,291,832 in the year 1974.

Operations outside the United States for the year 1975, included in the consolidated results, showed gross income of $7,271,473,429, an increase of $1,324,575,371 over the year before. Net earnings from these operations were $1,105,713,738, an increase of $185,877,262 over 1974. This is the first year that gross income from operations outside the United States has exceeded that of the U.S. operations.

Consolidated gross income from rentals and services in 1975 increased 17.8% over the previous year.

Outright purchases of data processing equipment increased quarter by quarter during the year from a relatively low amount in the first quarter to a record high in the fourth quarter, with the total for the year 1975 slightly exceeding the previous record amount of 1974. However, the accelerating trend in these purchases experienced during 1975 is not expected to continue.

Shipments were below 1974's record pace. Incoming orders improved as the year progressed and for the full year showed a small increase over 1974. The backlog at year-end is virtually unchanged from 1974.

Inflationary rates throughout the world, while moderating somewhat in 1975, continue to run substantially above historic levels. During 1975 the company continued its efforts to offset the effects of these pressures through cost and expense control, increased productivity, and selective price changes.

A NATIONAL ACTION PROGRAM TO BE DIRECTED AGAINST THE POLICY OF HONEYWELL INFORMATION SYSTEMS

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A new national action program was suggested for the Honeywell Users Group at its steering committee meeting that took place in late January in Phoenix, Arizona.

William White, a vice-president of Integrated Computer Services, Inc., a New York-based computer services company, told representatives attending the week-long Honeywell Users Group planning session that a strong national position should be taken by the Group to protest Honeywell's policy on software as it applies to used computers.

White is the past president of the National Honeywell Users Group. He said that, "up to date, Honeywell has been contemptuous of users of repurchased computers. Its policy toward licensing software to buyers of such computers is tantamount to destroying the market for used equipment, and drastically affecting the business of all users of these computers."

To offset Honeywell's position, White suggested that members increase their dues so that a forceful national program can be developed, including, if necessary, utilization of legal counsel and public relations counsel. As part of his recommendation to the national users group, White said that such a program would include action at all levels: Congress, the Federal regulatory agencies, customers, the media and financial community. This would permit each audience to understand Honeywell's present actions.

Integrated Computer Services has more than passive interest in Honeywell Information Systems and its software policy. ICS has asked the Supreme

(please turn to page 11)

The Impact of Computer Technology — A Case Study: The Dairy Industry

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"Efficiency cannot be an end in itself; it must serve some other purpose. When that other purpose relates to society as a whole rather than some tiny minority, the advantages of specialization are frequently outweighed by its disadvantages."

Introduction

This paper is addressed to people in or connected with the computer field who have an interest in the societal effects of computer technology. We examine a particular computer application in order to raise specific questions which illustrate the need to understand the ramifications of any computer application. We discuss the application from a broad point of view, rather than focusing on the minutae of the computer implementation, because this broad perspective is a prerequisite for understanding the impact of a technology.

The application is a use of computers in the U.S. dairy industry. Computers provide the technological basis for the National Cooperative Dairy Herd Improvement Program (NCDHIP). NCDHIP is credited by many people with having greatly improved the efficiency of milk production in the U.S.

In what follows we inform the reader about those aspects of dairying which are most affected by NCDHIP, discuss in detail the organizational structure of NCDHIP, and then raise some questions about the long-term effects of the current system. Where possible, we suggest generalizations of both questions and effects that are appropriate to other computer applications. For some questions we propose an approach to finding answers.

Purpose of the NCDHIP

The major purpose of the NCDHIP is to help dairy farmers improve the production efficiency of their herds. NCDHIP does this by providing a computerized system which makes critical information accessible to the farmer at reasonable cost. The primary inputs to this system come from the dairy farms. This data is processed and analyzed by both regional and national data processing centers. The results of this analysis are sent back to the dairy farms to aid in the farmer's decision-making.

These results help the farmer cull the least profitable cows, feed the rest according to their production requirements and select the most suitable animals for breeding. Other herd management decisions are also facilitated, but we will focus on these three as the most important.

Culling

A dairy herd will be more profitable if the lowest producers are removed from the herd. Monthly records for each cow that show her production and its dollar value, the cost of her feed, and so on permit each cow's profitability to be compared. These records make it possible to determine the level of production below which a cow must be culled to avoid financial loss and to obtain the greatest returns for capital and labor invested.

Culling decisions will be influenced by such factors as feed supply, milk supply, labor force, barn room, age of cow, hard milker, slow breeder, health problems and the price of meat. By culling the poorest cows, the breeding value of the herd is also improved.

Feeding

Feed represents the greatest single cost of producing milk. A herd will produce milk and butterfat more efficiently if each cow is properly fed. Many cows are low or unprofitable producers because they are not given as much high protein/high energy feed as they could convert into milk; others are unprofitable because they are given more of such feed than they can use for milk production. With production records as a guide, each cow can be fed at her most profitable level.

Many factors influence profits from milk production. If grain is high in price and milk low, it may be profitable to feed less grain and depend more on roughage, even though less milk is obtained. For instance, the high price of feed grains since 1974 has led to more reliance on roughages and has had some effect on production volume. Whatever the ratio between price of feed and milk, the feed and production records show the level of feeding to maximize profits.

Breeding

Regardless of how well a herd is fed and cared for, it cannot produce more than its own inheritance enables it to. Once a herd is culled carefully and the remaining cows fed properly, the next and most important step in increasing production efficiency is to improve the inherited producing capacity of the herd. The quickest and surest way to do this is through the use of good sires. Usually 20% to 25%

of the cows in a herd are culled each year and replaced by "first calf" heifers. Thus within four to five years the herd is an entirely new group of animals. If herd sires are carefully selected, this will not only be a new herd but a greatly improved one.

Genetic improvement in herd performance is accomplished by the recognition and use of superior bulls and cows. The use of sires of known genetic excellence is the most effective single method because one bull may have many progeny. Some bulls in use today have sired over 20,000 daughters through the use of artificial insemination. Sires are now evaluated by the method of "herdmate" or "contemporary" comparisons. The basic principle is that a sire can be evaluated by comparing the production of his daughters to the production of other sire progeny groups that were fed and managed under the same conditions.

Records of cow identification and milk production provide the data for this evaluation. In contrast to culling or feeding, the information provided to the dairy farmer is based not on that farmer's herd, but the herds in which the evaluated sires have progeny: possibly tens of thousands of herds across the country.

Data Collection

Not all dairy farmers participate directly in the NCDHIP. As of 1974, out of a total U.S. population of 11.2 million cows, approximately 3.4 million are involved in this program. Those farmers who do participate have a choice of several plans which differ in the degree of supervision of data collection, and thus the cost of participation and the objectivity of the data. In the minimal available plan, a farmer makes use of NCDHIP as a data processing center for farm records by sending monthly milk production data to a regional dairy records processing center and receiving cumulative records of cow and herd milk production. The farmer is responsible for the accuracy of the data. In this study we restrict out attention to more extensive plans in which the data is gathered by a supervisor in the employ of a regional Dairy Herd Improvement Association. Only this data is regarded as "official" and used for such purposes as sire evaluation. More than two million cows in approximately 34,000 herds are involved in "official" plans.

The supervisor is responsible for the accuracy and completeness of herd records. These records contain milk production and concentrate comsumption reports for each cow in the herd, as well as milk price and forage amount and quality reports on a herd basis. The records are used by the farmer, the regional Dairy Herd Improvement Association, the state extension services, and the Dairy Cattle Research Branch of the USDA at Beltsville, Maryland. They are used in research and educational programs and are a vital part of the USDA Sire Evaluation Program.

The supervisor visits each herd once a month. During the evening milking, feed consumed and milk produced by each cow is weighed, and a small sample of her milk is saved. The same procedure is followed the next morning. The milk samples saved are tested for butterfat content by the supervisor, or sent to a testing laboratory. The weights and test results are used to calculate each cow's milk and butterfat production for the month. At the end of the year a record summary for each herd is made. Studies have shown that yearly records based on weights and tests for one day each month are within 2% of the actual milk production and 3% of the actual butterfat production.

The supervisor makes all entries in a herd-record book that the dairy farmer keeps to use as a guide in managing the herd. In addition, breeding and calving records of the cows are kept. These records are needed to indicate the breeding worth of sires used in the herd. A lifetime record for each cow is developed.

After the supervisor has obtained basic information from the farm on "test day," the "barn sheet" (data processing form on which the test day data have been recorded) is sent to the regional dairy records processing center. There the data are inspected for completeness and accuracy, coded onto cards or tape, verified and sorted into appropriate order for handling by electronic data processing equipment.

The data collected on test day (including the results from the milk testing laboratory) are added to accumulated herd data stored on magnetic tape. Computations are made by computer with current herd and cow records listed on forms developed for use in the region served by the processing center. The results are mailed back to the dairy farmer.

The farmer pays the cost of processing to the local dairy herd improvement organization as part of the service charge for the particular program in which the farmer's herd is enrolled. Central processing costs per cow per month vary from region to region between ten and fifteen cents. Total program costs per cow per month may vary from under fifty cents to over one dollar. Summaries and studies of the data are provided to extension workers in each state on a monthly or annual basis. Most processing centers have additional evaluations and tabulations which are sent periodically to the dairy farmer and to other cooperating agencies.

Genetic Merit

Sire Summaries and Cow Indexes represent an effort at ranking bulls and cows according to their producing capacity, so that the best bulls and cows can be chosen for breeding purposes. Their offspring would then have a higher inherited producing capacity than the average of the preceding generation. In this way milk production per cow can be increased. The USDA estimates that the current rate of increase due to genetic improvement (in the northeastern U.S.) is one hundred pounds of milk per cow per year, roughly one per cent of average annual production.

Much of the research connected with dairy herd improvement has focused on developing a sound basis for evaluating the genetic merit of bulls and cows. This has required selection of the traits of interest: primarily, quantity of milk produced and secondarily, quantity of fat produced. The particular gene or genes for these traits are not known. Sources of indirect information about each animal's genotype (genetic makeup) must be used. Statistical techniques have been developed to analyze the data contained in the herd and cow lactation records described previously, so that environmental effects on production can be separated from genetic effects. Techniques are used to adjust the production information to a standard basis (the "two times per day, 305 day Mature Equivalent" lactation record). A sophisticated method of comparison involving considerable calculation is then used to recognize the genetic component of production and rank animals accordingly.

The dairy records processing centers throughout the U.S. send copies of the cow and herd records to the USDA at Beltsville, Maryland. More than two million lactation records are provided for genetic evaluation of sires and cows. With this data more than fifteen thousand sire summaries and twenty-four thousand cow indexes are calculated, printed and distributed to dairy farmers, artificial insemination organizations, breed registry associations, and others who use the information for genetic improvement of dairy cattle or for advertising purposes. These summaries and indexes are in essence national rankings of the genetically best bulls and cows involved in the NCDHIP.

Sire summaries are provided by the USDA quarterly. Each sire included has at least five progeny who are production tested and have production tested herdmates for comparison. Summaries of individual sires are distributed to:

1. extension specialists in charge of testing in each state in which a sire's progeny are represented;
2. national breed associations;
3. in the case of bulls used for artificial insemination (AI), to the AI organization that owns the bull.

The value of these national sire summaries is directly tied to the technology of AI, which makes it possible for one bull to sire thousands of progeny in geographically dispersed herds.

Cow summaries are provided semi-annually. These are based on a combination of the cow's milk and butterfat yield (as compared to her herdmates), as well as the genetic transmitting ability of her sire. The top 2% of the cows on official tests are thus recognized. Many are used selectively in the development of better bulls.

Review

The National Cooperative Dairy Herd Improvement Program is basically a large information system. Data inputs are provided by the participating dairy farms and data outputs are sent back to these same farms, as well as to others concerned with the program. Part of the data output, such as culling or feeding information, is dependent upon individual herds and represents an aspect of the system which could be handled on a local basis. (We are not here concerned with other valid uses of the local data, e.g., for research and education which aggregate this data nationally.)

Another part of the data output, sire summaries and cow indexes, is based on information from many different herds and depends upon the system's national nature. This required standardized data gathering and recording, electronic data processing, and extensive calculation by high speed digital computer.

The charts on the following pages display the important interrelationships we have discussed. Also illustrated is a data processing form used to record "test day" results. (See Figures 1 & 2, p. 11)

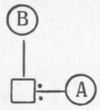
Legend for the "NET" Descriptions

The boxes represent activities of exchange, material and/or informational, between a set of participating agents. An inscription in a box designates the frequency with which that particular activity takes place (1/2D = twice a day, M = monthly, Q = quarterly, SA = semi-annually.)

The circles represent agents in their capacity to participate in the activities to which they are linked: the farmer, the herd, the milk storage system, a data processing form and so forth. Sometimes the names are chosen to stress the material or informational aspect of the agent. Sometimes the links are directed to stress the direction of flow of material or information.

The pattern □⁝—(X) specifies the possibility of more than one agent of type X connected to the activity. Similarly, the pattern (X)⁝—□ specifies the possibility of more than one activity with the same exchange structure, connected to an agent of

Thus



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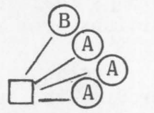

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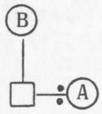

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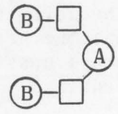


type X. The pictures portray several levels of detail. These levels are related by topological mappings known as net morphisms. A discussion of the formal basis for net descriptions can be found in INTERPRETATIONS OF NET THEORY by C. A. Petri 7/18/75, an internal report of the Gesellschaft für Mathematik und Datenverarbeitung, Bonn.

Effects of NCDHIP

This program is meant to be and is effective in several ways. In this section we pose some questions about side effects which may become irreversible main effects in the long term. The questions are prototypical of what must be asked to understand the impact of an existing or planned computer based information system. The set of questions is by no means exhaustive. Different kinds of issues are raised: some primarily technical, some societal and some touching upon ethical considerations. We suggest an approach to answering a few of the questions. The consequence of not looking at such questions is that every decision is determined only by short-term economic considerations.

Small Versus Large Farms

Who is helped most by the NCDHIP? Smaller farms have some natural advantages because the farmers have an intimate knowledge of each cow. This is compensated for on large farms by the use of computerized records. For instance, computer reports give the identification numbers of the hundreds of cows to be bred or culled each month.

As small farmers lose their advantages they are less able to compete with the giant dairy operations and cannot stay in business. Should public money be used to research and develop systems which promote trends toward largeness? Should public money be used to help the small farmer who still accounts for the majority of farmers, to stay in a competitive position? Does it make sense to do both?

Promotion of Artificial Insemination

Artificial insemination is used on the largest and smallest herds. In general, a farm or cooperat-

(please turn to page 12)

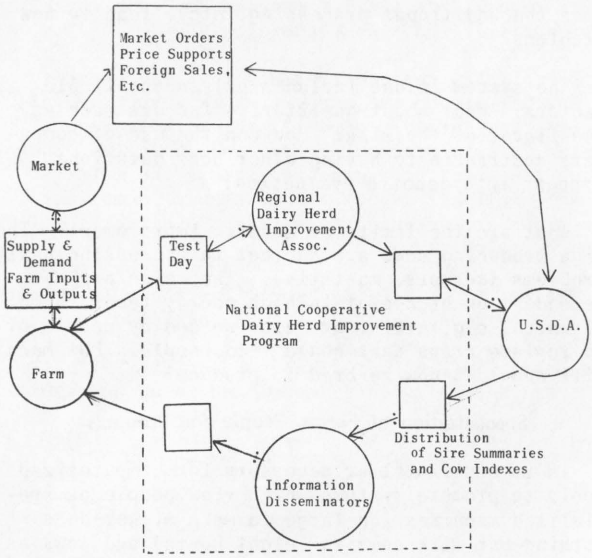


Figure 1

Forum — *Continued from page 7*

Court of New York State to rescind and cancel agreements between it and Honeywell in regards to ICS's purchase of two H3200 computers, which were purchased in late December 1974, delivered in the spring of 1975, and returned to Honeywell in August 1975 after ICS found that the computers were failing to provide sufficient operating "throughout and reliability."

ICS, however, has had a long business relationship with Honeywell. Since it was founded in February 1967, ICS has used Honeywell computers exclusively, and, in fact, has suggested their use to many potential customers.

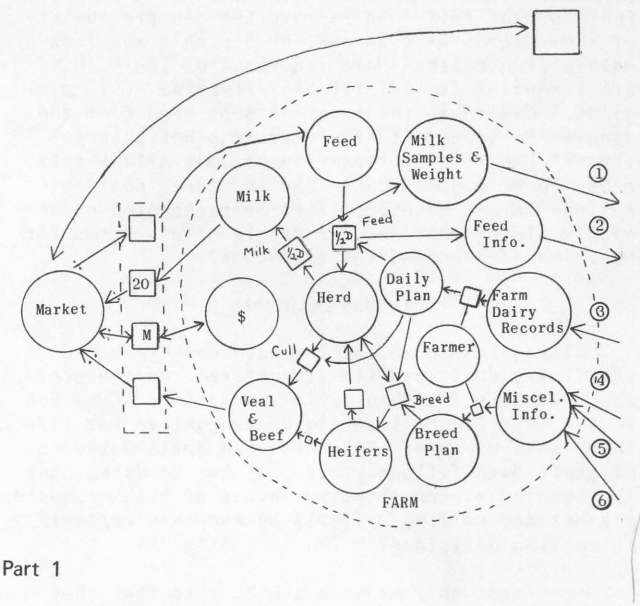
At the Phoenix meeting, White told other users that Honeywell failed to provide useful software that would meet its needs. Despite a nine-year relationship with Honeywell, White said that the computer manufacturer failed to furnish software that could meet the needs of a service company.

ICS, for example, replaced three 200 series computers with two 3200 series. ICS has the expectation, based on Honeywell's technical advice, that ICS could expect to double its production at a monthly increase in cost of $6,000 to $7,000. Instead, the new and larger computers reduced computer capacity.

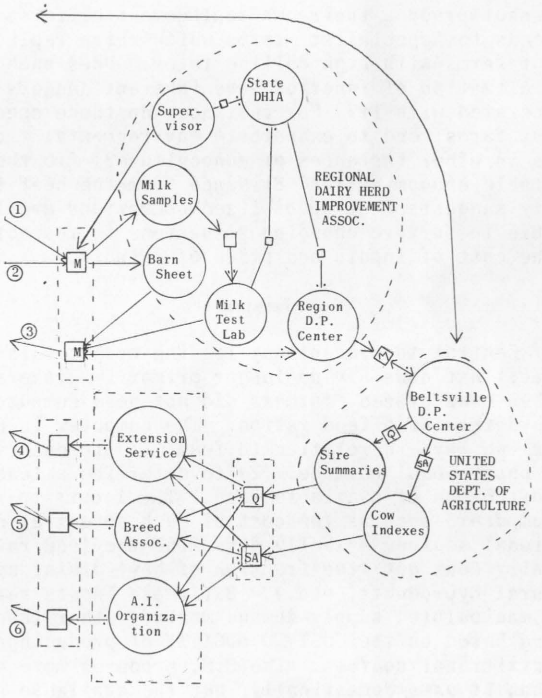
Following ICS's return of the Honeywell 3200 computers, it purchased two used 200 series computers, and started a program to rebuild sales and business credibility, both damaged severely during the period when Honeywell 3200 computers were below operating efficiency.

Similarly, its business volume, as a result of the 3200 computers, White said, slumped from an annualized $2 million base to $1.2 million approximately.

"If individual companies like ICS cannot equitably settle with Honeywell, perhaps a strong and viable national users association can take appropriate legal and public relations action," White said. □



Part 1



Part 2

Figure 2

Ludwig — *Continued from page 17*

on all of Award Service's Customers — what each bought, where the bill was sent, the dollar volume, what product groups were being stressed. This daily report is used by the sales department to gauge its activities, quickly spot lines that are growing in volume, others that are slipping.

"Complete Sales Analysis and Inventory Control"

Once a month the computer produces a store-by-store series of three sales reports: the volume of each store per account, the weekly service average (including year-to-date figures), and all the products each store has bought during the month.

"We can give customers' dollar for dollar sales, group totals, and average totals," says Cassese. "The sales department can keep track of the product

(please turn to page 13)

Shapiro and Hardt – *Continued from page 10*

ing group of farms can improve the genetic quality of their herds at less cost by buying semen than by maintaining bulls. Some functions of the NCDHIP are essential for maintaining effective A. I. programs. Can these functions be separated from the management aspects that primarily benefit large farms? Under what circumstances does A.I. itself cease to be a good idea? For instance, could a serious latent genetic defect be propagated on a vast scale by the use of a single sire's semen for breeding one hundred thousand cows?

Culling Decisions

Culling 20% to 25% of the herd each year means that individual cows are slaughtered, on the average, by their fourth or fifth lactation. Cows can live a much longer life and be productive for fifteen years or more. Mab Acres Rag Apple Daisy, a Holstein born fifteen years ago, has produced over two hundred eleven thousand pounds of milk. Should present day culling criteria be the only criteria in culling decisions?

Some farms cull at such a high rate that they cannot produce their own replacement heifers. This leads to 'specialist' farms which raise replacements for farms with high culling rates. Does such a specialization of function have inherent dangers associated with it? For instance, do these specialist farms tend to exacerbate environmental troubles, as in other instances of monoculture? Are they less stable economically? Evidence from the beef industry suggests that specialized operations are less able to survive changing situations in respect to the cost of inputs and price of outputs.

Feeding

Central to present-day feeding programs is the fact that cows are no longer primarily grazers. When cows grazed, farmers did not need computers to determine a feed ration. The computer is used in two ways in relation to feed: (1) to determine a nutritional balance, (2) to determine a least-cost blend of available feed. The inputs to the computer, such as the cost of each potential nutritional source, actually determine the feed ration dairy cows get (the fraction of hay, grain, agricultural byproducts, etc.). But these inputs reflect a manipulated supply-demand market rather than being based on the COST TO SOCIETY of producing the nutritional sources. The U.S. produces more grain than it uses domestically, but the available supply is determined by policy (for instance, how much grain is sold to foreign countries or given in aid; consider the effect the grain sales to the USSR have had on domestic prices).

Since feed cost is determined by policy and not by production costs based on resource utilization, how can a sensible feeding program be arrived at? If the current system discourages farmers from planning a feed program by encouraging specialization of function (i.e., buying feed from specialists instead of growing it) where does the responsibility for intelligent use of feed-producing resources now reside?

Breeding

What is genetic superiority? Is increasing milk yields the most important quality to breed for? What about the composition of the milk? Increases in yield have been accompanied by decreases in the percentage of protein and fat. Should we breed for higher production of less nutritious milk? Is reconstituting milk an answer to this problem, or does the additional processing, etc., lead to new problems?

The system in use includes only quantifiable factors. What about qualitative factors such as the flavor of the milk? How can the use of computers contribute to having other considerations brought into genetic evaluation?

What are the limits of genetic improvement? The high producing cows are subject to increasing health problems (ketosis, mastitis). They also are more dependent on high protein/high energy feeds, some of which, e.g. grain, are also needed by people or to replace crops that could feed people. How much milk should a cow be bred to produce?

Specialization of Farms, People and Products

Is it beneficial or necessary for computerized tools to promote systems which view people as specialized machines (on large farms a milker does nothing but milk cows for eight hours) and cows as production units?

What is the long-term effect of increased agricultural specialization (monoculture) on the environment? For instance, many large California dairy operations do not raise their own forage. The reasoning behind this is as follows. If you raise your own forage you have to use it, whether it comes out first rate or not. If you buy forage on the market, from specialists in forage production, you can pick and choose the best. In consequence, cow manure becomes a pollution problem instead of being used to fertilize a feed or food crop.

Data Collection and Processing

How can it be insured that information is processed quickly enough to really help the farmer make decisions? Does centralization improve service to the farmer in this respect? In the past, supervisors carried milk fat test kits and analyzed milk at the farm on test day. Now in Massachusetts, a central laboratory does the analysis. Instead of getting the results on test day, they are sent several days later, which delays the computer processing of the test day results.

National, Regional and Local Systems

How does one decide that a regional electronic data processing system is better than a local manual system? Have efficient manual systems been offered to farmers?

What are the advantages and disadvantages of a national rating system for genetic merit? A national system increases the sample size for comparing production records, but it intentionally sacrifices the potential of genetic adaptation to local environments. Consider two bulls, Tom and Joe, each with progeny on farms in two very different locales, NORTH and SOUTH. The progeny of Tom may be better able to convert the grass in locale NORTH to milk. The progeny of Joe may be better able to convert the grass of locale SOUTH to milk. The average of the comparisons (both NORTH and SOUTH together) yields no difference in the genetic merit of Tom and Joe.

An example of the interplay between genetic and environmental factors was observed during the Second World War. Cattle of 'improved' dairy breeds kept on the cold wet grazings of Dartmoor (Great Britain) produced less milk than the indigenous cattle. Certain British breeds do not thrive in the tropics partly because they cannot adjust to the climate and partly because they are less resistant to local infections (e.g. trypanosomiasis) than indigenous breeds.

A system of rating is necessary, but is a NATIONAL system needed to get good breed improvement from the use of artificial insemination?

The Holstein breed rates the highest terms of volume of milk production. The percentage of Holsteins (now over 80% of the dairy cow population) increases each year because of this. If this leads to the elimination of the other major dairy breeds, how damaging is the resulting loss of genetic diversity?

Some dairy experts propose an international rating system. What criteria should be used to evaluate this proposal? The technology of high speed digital computers encourages such ideas. Are there inherent dangers in global schemes like this? Under what circumstances must such risks be accepted and what can be done to minimize them?

Conclusion

The questions we have posed can be restated in more general terms that make them applicable to many situations other than the dairy industry. In brief outline here are a number of categories which seem appropriate to think about in connection with information systems.

Whom Does It Help?

Frequently, some group of people benefit more than other groups. This differential, not necessarily an intentional aspect of the system, can cause very significant long-term changes that are entirely unrelated to the original purpose of the system.

Scale Effects and Centralization

Computers make it possible to analyze and coordinate information over larger and larger geographical areas. What is possible is not necessarily beneficial. System expansion (contrasted with the proliferation of many smaller systems) must be examined carefully to make sure that the increased coordination does not sacrifice flexibility, locally significant effects, and so on.

Destruction of Natural Barriers

Associated with scale effects, the destruction of natural barriers creates potential difficulties. Information systems do this by making it possible to maintain and make available data on a large scale. We have already suggested a possible difficulty in the dairy industry: artificial insemination plus a national or international rating system for bulls could lead to dangerous overuse of one bull's semen. Another example would be an international life-time dossier on every citizen.

Quantification

Setting up a computer based information system always requires deciding what information is significant and worth recording. In this choice, those aspects which are difficult to quantify are frequently left out or dealt with as meaningless averages. Other forces then "accidentally" determine what happens to these aspects. One possible outcome is harmful uniformity. Another is the deterioration of a quality that the system has ignored.

The "Production Unit" Mentality

Associated with quantification, computerized systems encourage a view which perceives animals or people as production units. This is not a new view, but as an intermediary the computer provides more distance between 'the controllers' and 'the controlled'.

Specialization

Related to the production unit mentality and quantification, specialization is promoted by the urge to be more efficient. The disadvantages of specialization are rarely considered. Efficiency cannot be an end in itself; it must serve some other purpose. When that other purpose relates to society as a whole rather than some tiny minority, the advantages of specialization are frequently outweighed by its disadvantages.

Short-Term Economic Criteria

If we do not take these questions seriously, if we restrict our vision to those technical issues which appeal to our sense of scientific aesthetics, then we must expect computers to serve primarily short-term economic interests. Long-term effects will then come about unplanned and unanticipated. Computers will determine our future by accident, instead of serving us as instruments of our own rationality and humanity.

Acknowledgements

The 'Net' descriptions were developed at the Gesellschaft für Mathematik und Datenverarbeitung, Bonn, with the cooperation and support of members of the Institute für Informationssystemforschung.

Pamela Hardt and Robert Shapiro are researching the use of computers in agriculture. They are interested in working with consumer, farmer and farmworker organizations concerned with agricultural politics and technologies. They can be reached care of Meta Information Applications Inc., Box 943, Wellfleet, Mass. 02667; (617) 349-3121. On the west coast write to Pamela Hardt, 318 Jay Street #40, Davis, Calif. 95616; (916) 756-9527. □

Ludwig — *Continued from page 11*

groups that are selling and the ones that aren't. It gives us complete sales analysis and inventory control. Also, we can verify that there's no mistake in the arithmetic. When the system was manual, who knows how many mistakes in extension were being made?"

Moving Steadily Ahead

Moving steadily ahead, Award Service now is giving the computer yet another task. As part of the ordering system, the computer also will make stickers for orders going to the warehouse. These are the tiny tags showing customer code, date and price code that are pasted onto merchandise to show customer's product price, with the store's own name printed on the surface. At present, the tags are still produced manually, "but the new system is flexible enough to take on the added chore," Cassese says. Also looming

(please turn to page 16)

The Future of Telecommunications: Competition and Computers Part 2

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"In one sense, we are witnessing a struggle between market structure on one side and technology on the other — a structure that acts to preempt and narrow market opportunities in the equipment market."

Recent Developments in Antitrust

Amidst the struggle between market structure and communication technology, the communications industry has also been buffeted by a series of antitrust suits, both public and private. In the late 1960's the General Telephone System aggressively pursued a policy of acquiring new telephone companies including the acquisition of the Hawaiian Telephone Company. The purchase of Hawaiian prompted an antitrust suit filed by ITT. ITT argued that once Hawaiian Telephone Company would be absorbed by the General Telephone Company, the company would be under pressure to buy its equipment from General Tel's manufacturing affiliate, thus leaving ITT out in the cold. ITT thus charged that General Telephone's horizontal acquisition, would result in vertical foreclosure — that is, prevent ITT from selling equipment. ITT at first sought to enjoin the merger, but later amended its complaint and requested that the District court order divestiture of General Telephone Company's equipment affiliates — Lenkurt and Automatic Electric.

The circuit court of appeals ruled in favor of ITT and ordered that GT&E divest itself of its recent telephone company acquisition as well as equipment suppliers — a divestment in excess of some two billion dollars. Upon appeal, the circuit court ruled that although General Telephone was guilty of violating Section II of the Sherman Act, a private party nevertheless could not seek the divestiture of the defendant firm. The case has been remanded to the original District court and the court has been instructed to consider other alternatives in opening the equipment market to market competition.

Holding Company Control

In November of 1974 another antitrust shoe was dropped. This time it was dropped upon AT&T. The Department of Justice brought a suit alleging that Bell had monopolized both the telephone equipment market as well as the private line market. In its relief, the Department of Justice sought to spin off both Western Electric and Long-Lines from AT&T.

Bell has vigorously opposed the suit and has contested the Department of Justice's complaint on jurisdictional grounds. Bell insists that the FCC holds proper jurisdiction over AT&T's structure and conduct rather than the forum of the courts. The matter of jurisdiction is pending at this time.

This article is based on Chapter 8 of the 160 page study "The Unbundling of AT&T: Implications and Opportunities" by Dr. Manley Irwin, formerly Chief, Western Electric Group, AT&T Task Force, Federal Communications Commission, Washington, D.C. The first part of this article was published in "Computers and People", February, 1976. For information about the study, write to "The Yankee Group".

Finally, the FCC is in the process of evaluating the performance and conduct of Western Electric, — its prices, costs and investment decisions. In this particular docket — 19129 — both ITT and General Electric have testified that the vertical relationship to the Bell Companies and Western Electric foreclose them from selling equipment to the operating companies. In addition an FCC trial staff witness has testified that the only meaningful way of restoring competition in the equipment market is to require divestiture of Western Electric from the Bell System and to impose the requirement that carriers buy equipment on a competitive bid basis.

The eventual outcome of these various suits, whether private or public, remains uncertain. But the thrust of the complaints is clear. Antitrust suits are attacking the premise of holding company control over both buyer and seller of equipment, of both the utility and the manufacturer — to the exclusion of outside vendors or competition.

Technological Struggle

In the meantime, technology continues to challenge the structure and the practices of the industry. In one sense, we are witnessing a struggle between market structure on one side and technology on the other — a structure that acts to preempt and narrow market opportunities in the equipment market. How does this struggle bear on the role of competition in the future? Surely, no one can effectively declare a moratorium on the productivity that is associated with the research and development of the activities of the telecommunications and its related electronic and computer industry. Whether in transmission, switching, terminal apparatus or local loops, each of the basic components of telephone plant investment finds itself exposed to the influx of new technology, new products and new services. Semi-conductor firms find themselves in telecommunications and its various submarkets. The computer industry finds itself increasingly oriented toward a distributed digital system, and thus inherently ties into communications and telephone lines. Perhaps it should not be surprising that IBM is manufacturing switching equipment, PBX equipment, data modems, display terminals and is now moving aggressively into communications satellites. Despite the short-term strategy of the carriers to extend regulation so as to resist and even repress market entry, these actions must be regarded as holding actions only. In the longer term, the advance of technology will persist relentlessly. In the long run, technology will tilt this industry toward more competition, more diversity, and more entry of firms. Indeed, competition is likely to question the very premise of a private monopoly subject to public regulation.

The Future of Computation and Communications

In the area of communications and data processing, three developments or scenarios have occurred over time. A first scenario was the separation of computation from communications; a second resulted in the interdependence of computation and communications; a third has seen a blurring and softening of the demarcation between computation and communications. The latter scenario is bound to continue in the foreseeable future.

Consider the first scenario. Traditionally, the computer and the communication have been separate and unrelated. The computer industry supplied mainframes, software and peripheral devices. The user bought or leased these systems from a variety of suppliers. Data processing was conducted in a batch mode; the user was located on the computer site. Computation was essentially automated accounting. Service bureaus bought or leased computers, provided data processing service to the customers on a fee basis — services ranging from payroll, accounts receivable, inventory and the like. Computer centers were geographically dispersed.

During this first stage (prior to the 60's) the communications industry was essentially unrelated to computers. Having said this, it is true that computers began to be contemplated for large switching systems. But the majority of switching machines operated on cross-bar or step-by-step technology. All segments of telephone hardware, and terminal devices were owned and leased by the regulated carrier. The subscriber leased voice service on an exchange or private line basis and communicated over a voice analog network.

A Second Scenario

A second scenario began to evolve in the early 1960's. It can be described as the interdependent stage between computation and communications. Here computer systems began to operate in an "on-line" mode — with remote terminals tied into the logic and memory of central computers. The second stage witnessed the growth of computer time-sharing, once heralded as a device which would enable computer power to be dispersed to multiple users, however remote from the central computer site. Thus the 1960's saw the growth of on-line services, including airline reservations and stock quotation services. Computers were becoming dependent upon telephone lines in order to effect the connection between the terminal and the central computer. The 1960's saw the growth of computer networks — particularly among time-sharing services; and terminals took on an interactive mode of operation.

In the second scenario the communication industry began to experience the traffic and the requirements of the computer user. Data processing customers exhibited different requirements from the telephone user in terms of lines, quality, the billing of usage and the interconnection of equipment. Indeed, the computer industry argued that the carriers ought to relax their foreign attachment structure in order to permit a host of peripheral devices to be tied to telephone lines. Foreign attachment tariffs were attacked by the FCC in partial response to the pleas of the computer industry. In fact, the FCC fostered the development of new firms to supply customized communication services or digital data networks. At the same time the common carriers, specifically AT&T, introduced new switching plant, digital transmission facilities and moved into domestic satellites. Nevertheless, in this sequence the computer was dependent upon carrier service and facilities — and hence interdependence was the order of the day.

Blurring of Communications and Computation

The current development or scenario can best be termed a blurring of computation and communications. A look at the computer industry reveals this blurring momentum. Computers today are employed to switch both voice and digital messages; microprocessors are now being employed as office PBX's. The computer industry is becoming the satellite business (consider IBM's satellite proposal); data processing services are moving toward a distributive network in which the terminal devices possess memory and logic of their own — placing greater intelligence capability in the terminal rather than the computer main frame. Finally, the telephone equipment can be programmed to monitor toll usage and to perform billing and accounting requirements.

A glance at the communications industry reveals similar developments. In switching, carriers are introducing micro-processors with memory capability — whether in toll, exchange or PBX hardware. In transmission, digital data services are oriented toward computer users without requiring modems that convert digital to analog signals. The carriers as noted are establishing satellites for domestic purposes.

The Bell System recently introduced a display terminal with printing capability — the so-called model 40 teletype machine. At present, the model 40 is a "dumb" terminal. But subsequent generations of this terminal will incorporate data processing capability and thus this might evolve and undoubtedly will find the terminal capable of logic, memory and computation ability — the so-called "smart" terminal. The Bell System is also experimenting with the transaction telephone, a credit card verification unit which might be viewed as a specie of computation. Future generations of Digital Data Service might well incorporate software applications — programs enabling the carrier to perform mixed elements of communications and computation. Such services are speculative, of course; but should they evolve, what is to be the regulatory status of computation and communication?

In a sense the FCC attempted to deal with this issue in the early 1970's by promulgating rules dealing with services that consisted of a mix of EDP and communications services — so-called hybrid services. The commission issued a general rule stating that if the data processing component exceeded the communications component, the FCC would exercise regulatory forbearance. But should the communications component exceed the data processing segment of the service, the FCC ruled that the firm would be required to file appropriate tariffs.

The 1956 Consent Decree

For the Bell System, the FCC was guided by a Consent Decree set forth by the Department of Justice in 1956. The Decree stated that Bell would be prohibited from offering non-common carrier or nonregulated services. As far as non-Bell operating companies were concerned, the FCC ruled that should such firms decide to enter data processing services, per se, they would do so through a corporate affiliate — separated from the activities of the regulated utility activities. Subsequently the FCC amended its ruling and ordered that no transactions be permitted between the EDP affiliate and the telephone carrier. Upon court appeal, that section of FCC's proposal was overturned.

Today the communication industry is moving closer to data processing. The computer industry is moving closer to communications. The overlap in switching, in transmission, in terminal devices and in service is obvious and apparent. What is perhaps less evident is that the carriers are establishing beachheads in the area of computation through the mechanism of filing tariffs before the state regulatory agencies. The result may be that within two or three years such services will be upgraded into some software or manipulative capability rendered to the public. It is possible that regulated carriers will be offering a species of computation on a tariff basis.

It is conceivable that public policy will witness identical computation services sold by one firm subject to regulation and sold by another firm subject to the constraints of the market competition. The question before the policy agenda is how to disaggregate this blurring or mix of both data processing and computation. Invocation of the primary business test may be insufficient as a guideline. In the dialogue that will ensue, it is possible that the carrier will argue that regulation takes precedence over competition — that EDP/Communications must be subject to regulatory overview. Bell's stance in its current debate with the Department of Justice may well be instructive and a precursor of a position in the future. In the choice between competition and regulation in the manufacturing of wire, cable and a host of telecommunications equipment and apparatus, the Bell System has invited more regulation than competition.

Conclusion

We have noted that there is a collision course of computers and communications. But where will the next five years lead us? The answer, of course, is speculative. But if the driving force of technology continues tomorrow as it has in the past, we will undoubtedly see more, rather than less, of an overlap between computers and communications. That overlap, in turn, suggests that we can expect a greater juxtaposition between an industry subject to regulation and an industry subject to market competition.

IBM Invites the Status of a Public Utility

It is inaccurate, however, to describe the computer industry as exhibiting the the characteristics of free competition. If one defines the industry as data processing in a broad sense, such a characterization may be appropriate. But if one designates computer main-frame manufacturing as the essence of the industry, then it is not clear that the industry will remain a viable industry, given the exodus of such firms as General Electric, RCA and Xerox. Bluntly stated, if IBM continues to account for more and more of the percentage of computer main-frame market on grounds of corporate efficiency, IBM is inviting nothing less than the status of a public utility. Certainly in the past public policies have been reluctant to assign the bulk of an industry's output to one firm and to entrust to that firm the prices, profits and investment decisions. It is perhaps ironic then that to a large extent the regulated nature of the main-frame computer industry rests on the government's antitrust suit. One could make a persuasive case that an IBM victory may well spell an industry defeat; that an IBM loss may very well spell an industry victory.

And what about the communications industry? Certainly no responsible authority at the state or FCC level has advocated that public utilities "turn in" their franchises out of public convenience and necessity. On the other hand some have observed that the monopoly firm has extended itself into markets best reserved for competition. In a sense, the carriers occupy two markets; one a monopoly market — the other a competitive market. The intermixture of both has tended to confound and confuse a rational attempt to separate and identify each market.

Not unlike the computer industry, the communications industry, too, is subject to questions of structural reform as well. Should reform alter the rules of the game so that once again a clear line might be established between markets susceptible to entry and markets subject to monopoly? This may imply that the traditional demarcation between competition and monopoly may have shifted and that indeed the area capable of sustaining competition has expanded. Alternatively it may imply that public policy will have to consider whether some markets — traditionally regulated — are now candidates for deregulation.

Controversy for a Decade to Come

That these are controversial policy decisions needs no emphasis. Restructuring a carrier's format — the holding company — or restructuring the rules in the communication game are of course controversial. In a real sense, antitrust, be it in the computer or the communications industry, marks a beginning of a policy of dialogue that will impact a broad facet of our economic environment in the decade to come. □

Ludwig — *Continued from page 13*

in the near future is the inclusion of general ledger handling in the computer's duties. This now is done manually by a full-time bookkeeper.

To handle the rapidly growing requirements, Cassese is considering buying another terminal and a higher speed printer than the present 200-line-per-minute unit. The present system was supplied by Basic/Four Corporation, Irvine, California. □

Dotto — *Continued from page 26*

Category-3C is referred to in aviation parlance as "zero-zero". That means you can't see a thing — and one of these days, someone's going to land a plane carrying several hundred people in just those conditions.

What does all this mean for the pilots? Will they become little more than babysitters for black boxes, or simply a public relations redundancy to satisfy the passengers that there is a human being at the helm?

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Applying A Small Business Computer To Merchandise Wholesaling

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" 'We couldn't stay on top of customers' needs. And, getting your money into the bank and keeping your inventory under control — that's the point in any business.' "

Robert Cassese, the controller of Award Service, Inc., a wholesale merchandising service in Mountain View, California, can tell when he is not wanted. He watched gloomily as a local computer service bureau steadily raised the monthly fee it was charging to handle Award Service's accounts receivable.

From $300 a month, it climbed to $600. Then on to $1200 , and $3000 after that. He got the message: The bureau had changed ownership, and the new owners disliked using the special programs written for Award Service's work.

One-Week Turnaround Data Lag

Cassese, whose firm's sales tally about $6 million a year, had been increasingly unhappy with using a service bureau anyway. There was a one-week turnaround lag on data sent to the bureau. "We couldn't stay on top of customers' needs. And, getting your money into the bank and keeping your inventory under control — that's the point in any business."

In order to regain control over skyrocketing office and computer service bureau expenses, he bought a small business computer which not only handles accounts receivable at very high speed, but deals with a variety of other tasks as well. Handling of order entries and accompanying invoices, previously a manual task, has been placed on the computer. This speeded processing and enabled Award Service to expand its product lines. The minicomputer also produces daily and monthly sales analyses and now produces price stickers to be fastened to customers' merchandise. And some time this year, Cassese plans to put the general ledger onto the unit.

Data Preparation Done Manually

Award Service, a fifteen-year-old company, distributes and services products to large drug and grocery stores. The range of items which it wholesales includes pet foods, hair care preparations, sewing notions, shoe care products, dyes, batteries, candles, paper, party favors, manicure kits, and vacuum cleaner bags.

Although its accounts receivable were being handled by a service bureau, most of the preparation of data for input was done manually. Salesmen wrote on carbonized forms, clerks "extended" this information — collated and reworked it for other forms — and then it was sent to the service bureau. A week later, the computerized reports and invoices were returned.

Cassese bought a small business computer. The system consists of two disc drives, two fixed and two removable discs, two video display terminals, and a high-speed printer. The equipment was installed in October 1974, primarily to get the accounts receivable work away from the slow, increasingly expensive service bureau.

But the on-site abilities of the computer, in addition to speeding the processing of receivables, soon altered the firm's entire approach to handling merchandise paperwork. Previously, the salesmen filled out carbonized order entry forms as they visited customer stores. The merchandise would be delivered a week later, but the computerized bills came much later because of the time required for manual "extending" of the order forms and subsequent service bureau handling of the accounts receivable.

Invoices Arrive with Merchandise

Now, the salesman still writes his orders in the field. Back at headquarters, these are checked off at the computer terminal and sent to the warehouse or plant with an invoice attached. Thus, two days later, when the salesman delivers the goods, the invoices arrive with the items.

Also, the process is very flexible. Some accounts request duplicate copies for headquarters, and producing as many as four copies is no problem. And the company can bill all the products on one invoice or by product groups or separately.

Product Lines Increased from 3 to 18

This speed-up in processing has enabled the company to expand the number of product lines it distributes from three to eighteen. This increase would have required eight or nine clerks working with calculators all day to "extend" the salesmen's orders into invoices and other data. But two clerks working at the minicomputer terminals handle the entire larger chore. "There was no way we could have maintained the manual system," says Cassese.

In addition, the computer is providing two types of sales analysis. Each night it produces a report

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Dangers from Computers, and the Social Responsibilities of Computer People

Edmund C. Berkeley
Editor, "Computers and People"

"We need to stop justifying our conduct on the basis of small differences that are not really important, and base our conduct on the real and huge differences that need to shake and alter our basic assumptions."

It is clear that there are extraordinary implications for society from computers and their applications. Golden possibilities exist for harnessing computers to the advantage of human beings. Yet at the same time fearful dangers exist for bringing about destruction and death as a result of the use of computers — the intercontinental ballistic missile with nuclear warhead guided by a computing mechanism. (It can be argued that the results come "not only from computers"; but this can be answered by the fact that computers are an essential part, a sine qua non, in producing the results.)

What is to be done? Is it the duty of computer people, the persons who are professionally involved with computers and their applications, to be concerned with the social consequences of computers? Or do they have no special or unusual duties, but only the duties of any citizen of a society? And if the duty of concern over the specific social consequences of computers does belong to other groups in society, which ones?

The Thule False Alarm

That the danger is not fictitious is shown by the story of the Thule false alarm of October 5, 1960. The following account of what happened is put together from the Manchester "Guardian Weekly" (England) of December 1, a United Press International dispatch datelined Chicago, published in the Boston "Traveler" on December 13, and an Associated Press dispatch datelined Washington, published in the New York "Times" on December 23.

On October 5, 1960, the station of the Ballistic Missile Early-Warning System at Thule, Greenland: "... picked up signals which were analyzed by the computers there as a flight of missiles coming up over the horizon from Russia and heading in the direction of America. The famous red telephone rang at Strategic Air Command headquarters in Nebraska. All over the world SAC crews stood to their planes. Someone in Nebraska signalled Thule for confirmation. There was no answer...."

It happened at just this time that three American businessmen were touring the North American Air Defense Command (NORAD) headquarters at Colorado Springs, Colorado; they were the president of International Business Machines Corporation, and the president and executive vice-president (Peter G. Peterson) of Bell and Howell. The guide showed the

> This article deals with a subject of perennial significance to computer people: what is the social responsibility of a man who opens a box full of troubles, like the mythical Greek demigoddess who opened Pandora's box?
>
> This article is based on two chapters (15 and 16) of "The Computer Revolution" by Edmund C. Berkeley, published by Doubleday and Co., New York, 1962, 249 pp. Although written 15 years ago, there is considerable food for thought in these paragraphs, as well as an account of the Thule False Alarm of October 5, 1960, a brush with megadeaths which should never be forgotten.
>
> *— Neil Macdonald*

three executives the equipment designed to detect the presence of missiles, and pointed out a lighted panel with a series of numbers running from one through five.

"As I recall it," Peterson said, "we were told if No. 1 flashed, it meant only routine objects were in the air. If No. 2 flashed, it meant a few more unidentified objects, but nothing suspicious. If No. 5 flashed it was highly probable that objects in a raid were moving toward America."

As they watched the screen, the number changed from 1 to 2, then a pause, then to No. 3, then the number changed to 4.

"When the number rose to 4," Peterson said, "key NORAD generals came running from their offices. Then the number rose to 5."

Quickly Peterson and the other two executives were escorted from the main room into another office; they did not know what happened in the great defense room after their departure. They were almost stunned, and waited through twenty minutes of "absolute terror."

"We talked," Peterson said. "Our first thoughts were of our families; they weren't with us and we could not reach them. It was rather a hopeless feeling. But then you realize there's very little one can do if a missile attack is on the way."

In NORAD, at that time, Canadian Air Marshal C. Roy Slemon, deputy commander-in-chief, was in command, in the absence of U.S. Air Force General Laurence S. Kuter, away on inspection. Slemon "refused to be panicked" by the radar information which made it appear that long-range missiles had been launched against North America. In a half minute he decided the radar report was highly questionable; and he telephoned the commander at Thule, and learned that the Ballistic Missile Early-Warning System "was not operating properly."

By the time that Thule had discovered the error, that they "had picked up not a squadron of rockets, but a large earth satellite ... called the moon," they were prevented from passing on the correction to Nebraska "because an iceberg had cut their submarine cable link."

A fuller story, which frankly praises the military warning system, was published six months after the incident, in the "Reader's Digest" of April 1961. It was written by John G. Hubbell and is entitled "You Are Under Attack! — The Strange Incident of October 5 — For a few heartbeats, time stood still. It looked as if the missile war had started." This story says that the Ballistic Missile Early-Warning System had reported a range of 2200 miles, because "it had divided 3000 miles into the distance to the moon, and had reported the distance left over — 2200 miles — as the range." But Air Marshal Slemon lacked other confirming evidence: (1) Air Force Intelligence said that Khrushchev was in New York on October 5; (2) none of the other radar lines, the Distant Early-Warning Line, the Mid-Canada Line, or the Pinetree Line, reported any strange echoes; (3) the equipment that predicts areas of impact of missiles showed no areas of impact at all. And finally, the information came in from Thule that the radar pulses were taking 75 seconds to echo, whereas from missiles they would echo in 1/8 of a second.

Of course, BMEWS has now "been taught" to disregard radar echoes from the moon.

It may be argued that this false alarm was due to more factors than only computers. That is, of course, true. But nevertheless without the essential and fundamental contribution of computer scientists towards the computing and data-processing elements of BMEWS, the system would not exist.

Beginning of Discussion in the Computer Field

From the start of the computer field in 1944 until the end of 1957, people working in the field had more or less automatically assumed that computers and data processors were a great benefit for human beings, a marvelous extension of man's intellect, one of the most exciting and beneficial developments of the Twentieth Century. This was the pervasive atmosphere in the computer field.

This was different from the feeling of special social responsibility felt by the nuclear scientists, who unlocked the atomic bomb. This feeling led to the founding of the Federation of American Scientists to push for the wise use of nuclear energy, the efforts of scientist through the MacMahon Act to put nuclear energy under a civilian agency (the Atomic Energy Commission) instead of under a military agency, and the publication of the "Bulletin of the Atomic Scientists."

But in October 1957, the Russians launched Sputnik I, the first earth satellite, with its computer-calculated table of arrival here and there all over the earth. Now no one can put a satellite into orbit successfully without many applications and uses of computers; and there is no doubt that satellites and the opening up of space have profound implications for society.

In the computer field the first ripple of recognition of the social responsibilities of computer people seems to have been a letter sent to the editors of the magazine "Computers and Automation" by a person who received a subscription promotion letter and refused to subscribe to the magazine. This letter, from Mrs. P. Cammer, Huntington, Long Island, said:

"I have no interest in computers and automation except in so far as they can better the human lot. It is my opinion that apart from noted achievements to that end, they are on the whole more of a curse to humanity than they are a blessing. I think it is an outrage to civilization for great minds — for all minds — to work on devices for A-bombs, H-bombs, and the tribe of idiot missiles and other weapons that are the foundation of modern economics."

That letter aroused the editors of the magazine, and it was published. Since then much discussion of the social responsibilities of computer people has taken place. In 1958 the magazine "Computers and Automation" organized a ballot and collected votes on the question, "Should computer people discuss and argue the social responsibility of computer scientists?" The result of the balloting was reported in the September 1958 issue and amounted to some 250 yes's and 140 no's. For the magazine, this settled the question whether discussion of the subject should take place in its pages. The answer was yes.

Comments

Over fifty comments came in from readers and were published. The comments could be separated into three groups, the affirmative, the middle ground, and the negative. Here are three samples, one from each group:

Norman E. Polster, Southampton, Pennsylvania: "I have just polled a few of my associates in the Research and Development Department on the question raised in 'Readers' and Editor's Forum.' 'Should we discuss and argue the social responsibility of computer scientists?' Each said emphatically 'Yes!' One said there should be good reason before an editor should refrain from expressing his ideas and those of his readers.

"Mahatma Gandhi once illustrated the importance of choosing the right issue: it is best not to argue about segregation in barrooms if you are fundamentally opposed to barrooms themselves. Our technical organizations do just this when they sidestep the issues of personal social responsibility of the scientist regarding the uses for his work, by discussing instead integrity in any work.

"The scientist has a special moral responsibility to society in our modern world because of the widespread devastation that his inventions can produce. It is not sufficient to continue at a job that you feel is morally wrong, and then say I will do all in my power as a citizen of a democracy to change the result of the work. It is necessary to be active as a citizen, to be sure, but it is more important for one's own moral strength to continue to examine the use to which one's work is put and then make a moral judgment. It is as simple as saying 'For me this is right, or for me this is wrong.' Until scientists measure up to the tremendous social responsibility that is placed on their shoulders, our world will continue to be a precarious mixture of 'curse or blessing.'"

Edward I. Jordan, Poughkeepsie, New York: "In regard to discussing and arguing the social responsibility of computer scientists, I believe an occasional article is worthwhile; however, such subjects are usually treated with too much emotion and sentiment and too little logic and common sense."

Lawrence Wainwright, Encinitas, California: "I'll volunteer my opinion that to have the magazine carry the type of controversial articles you are apparently contemplating would be a grave mistake. They would repel me, for one, and probably a great many others who wouldn't bother to express an opinon. However worthy the discussion may be, it is out of place in the type of magazine which I believe "Computers and Automation" is seeking to be. What you need is more worthwhile technical articles, not material which will inevitably irritate a substantial fraction of your subscribers. The polemics belong elsewhere."

Are Computer Scientists To Be Judges of Social Responsibilities?

But the essential question, the essential argument, that needs to be discussed and analyzed is this one:

The social responsibility of computer scientists is a topic in the field of ethics, in the field of social sciences, not a topic in the field of computers and data processing. A computer scientist cannot be expected to be competent as a social scientist. He is hired to do a job; he is not hired to think about the consequences or implications of his work with computers. This is outside of his territory of competence, and is the concern of his employer.

Computer scientists have no special social responsibilities as computer scientists, only the responsibilities of all scientists and citizens.

There are a number of rebuttals to this argument, though when one suddenly encounters it for the first time, one may not be able to answer it well and clearly.

To make the answer as vivid as possible, let us begin with the story of a certain locksmith.

The Story of the Locksmith

Once there was a man who was in the business of making locks and keys, and who was very skillful. One day a stranger walked into his shop and said to him, "I want you to make a key which will open a certain safe." The locksmith said to him, "Whose safe is it?" The stranger said, "Never you mind whose safe it is. I will pay you handsomely for the key. I'll blindfold you, and take you to the place where the safe is. You can have all the tools you want — I'll pay for them — and you make me a key. Besides, while you make the key, you will have a chance to work out some intensely interesting scientific theories, and after the safe is cracked open, I will give you permission to publish some papers, those that don't reveal too much information. Think it over; I'll be back tomorrow."

So the locksmith wondered about the remark "Never you mind," and the blindfolding, and the secrecy; but he knew it was hard enough to earn a living, and the promises of the stranger sounded attractive and exciting. So he said to himself, "Well, that fellow would just get another locksmith if I did not go," and so he decided he would go. And the next morning the stranger came for him, and he allowed himself to be blindfolded and went.

For several years the locksmith tried to open the safe, and then at last he succeeded. But the stranger did not allow him to look inside; all the locksmith saw was the door swing open. The stranger then said to him, "Here is your pay — now go away and remember not to talk about this — or you will get into a lot of trouble."

After a few more weeks, the locksmith read in the newspaper that what the stranger had taken out of the safe was a supremely intelligent directing mechanism for flying weapons, from the size of a wasp to the size of an eagle, which would enable him to pinpoint and exterminate any person, any community, and town, any city in the whole world. And he read the stranger's declaration that henceforth the world was to do exactly as he commanded, and that any opposition to his commands or dictates would be precisely and completely destroyed.

The Questions Presented

This story presents us with four questions at least: Is the story entirely fictitious and impossible? Was the stranger a criminal? Could the locksmith have recognized the stranger as a criminal? Did the locksmith do what was right?

The story, of course, is more parable than it is fiction. We know with sadness the many points where it agrees with the facts of past and current history, and predictions of the future.

The Criminality of the Stranger

As to the second question, it seems to me that it is not necessary for us to argue the criminality of the stranger because that has been settled, by the Nuremberg trial after World War II of the leaders of Nazi Germany. This trial is reported well in "Tyranny on Trial: The Evidence at Nuremberg" by Whitney R. Harris. The book has an introduction by Justice Robert H. Jackson of the Supreme Court of the United States, who participated in that trial, and contains a full story of the trial of the German war criminals. The author, Harris, served as trial counsel on Justice Jackson's staff. The report is an extraordinary, breath-taking, and blood-curdling story, worth careful reading to show how and in what way the German state under Hitler planned, prepared and carried out aggressive war under a thick screen of lies. Let me now quote from Chapter 38, "The Law and Aggressive War" (p. 514 ff.): /1/

[Beginning of Quotation] ...In the first few years of the thermonuclear age there has been placed in the hands of men a new power potential capable of such destructiveness as to threaten the users of the power as well as the intended victims. War has always been homicidal; now it has become suicidal. Civilization may see an end to war, because it cannot survive a renewal of war. The second factor [possibly causing the end of war] is the universal condemnation of aggressive war, of which the Nuremberg judgment is both source and reflection. For many years prior to World War II, the peoples of the world had thought of aggressive war as wrongful and wicked. The Nuremberg judgment gave expression to that feeling by punishing the individuals responsible for launching World War II.

...The difficulty of applying the concept [of aggressive war] in close cases does not mean that courts are powerless to recognize inexcusable aggressive action when it clearly occurs.

...The defendants could not have been surprised as to the moral aspects of their conduct. No one sends millions to die without a qualm of conscience.

...Aggressive war does not become defensive war by the simple act of calling it such.

...The slaughter of civilians in concentration camps, ordered by Hitler, was a crime of Hitler, even though he directed his mass killing as head of the German state.

...It is after all moral condemnation which underlies legal prosecution. The killing of innocent human beings by order of heads of states is subject to substantially the same moral blame whether it is the killing of civilian populations in connection with war or the killing of troops resisting unlawful aggression.

...Of course, no one should be heard to assert absolute immunity for acting in accordance with the orders of anyone else, even in such a fundamental matter as war. [End of Quotation]

At almost the end of the chapter, the International Military Tribunal is quoted: "War is essentially an evil thing. Its consequences are not confined to belligerent States alone, but affect the whole world. To initiate a war of aggression, therefore, is not only an international crime, it is the supreme international crime differing only from other war crimes in that it contains within itself the accumulated evil of the whole."

Harris continues: "This statement is law, and what is more, 'This law applies for all times, in all places, and for everyone, victor and vanquished. The initiating and waging of aggressive war is now indisputably criminal. No more important decision was ever made by any court."

It seems to me that this settles the second question, the criminality of the stranger; it settles the law and the morality; the wrongfulness and wickedness of aggressive war; of sending millions to die with or without qualms of conscience; the moral condemnation that underlies legal prosecution; and the impermissibility of arguing immunity for acting in accordance with the orders of someone else.

Recognition of the Stranger as a Criminal

As to the last two questions, the responsibility of the locksmith for recognizing the stranger as a criminal and for doing what was right, there is no doubt that according to law a locksmith has to satisfy himself that a customer has a bona fide right to the locksmith's help in opening a safe. Locks and keys and safes have been in existence long enough for the judgment of society to agree that a locksmith must satisfy himself that a man who comes to him to open a safe has a good right to have the safe opened. The more valuable the goods in the safe, the more necessary is the examination of the stranger, and the more important is the responsibility to do what is right.

The Towering Problem of Our Time

So much for the general argument. Now for the specific example, the towering problem of our time, intercontinental ballistic missiles with megaton nuclear warheads guided by computing mechanisms. In this case, three groups of scientists play the role of locksmith: the men who make the nuclear warheads, who are the atomic scientists; the men who make the rocket motors that will propel the missiles; and the men who make the guidance systems, the computer scientists. Let us talk about the computer scientist.

The computer scientist, according to law and morality, does not have the right to shut his eyes in regard to the stranger, no more than the locksmith has. Both have to keep their eyes open.

The computer scientist like the locksmith must judge the stranger. The stranger will not say what his real purpose is. The stranger, in fact, may be altogether unable to say what his purpose is; he may be in the grip of strong psychological forces (paranoia, for example) that he has no understanding of whatever. Certainly Hitler did not consider that he himself was a psychopath. But deeds speak louder than words, and the locksmith must look at the deeds.

Therefore, let us set up a number of criteria for the locksmith to decide what is the purpose of the preparations for opening the safe. For example, in the case of an arms race between two countries A and B, in order to decide what these preparations really mean, the locksmith can make up a long list of objective tests:

Test 1: Does country A have armed bases surrounding country B? and vice versa?
Test 2: Is country A (or country B) increasing or decreasing its military forces? expanding or contracting its testing of nuclear weapons? ...
Test 3: What are the claims announced by each country for political or territorial changes, which probably can be obtained only by force?
Test 4: Can the economy of country A (and country B) remain stable and function well without heavy war preparations?

The computer scientist, like the locksmith, has the moral and legal duty to study these questions and answer them objectively. He does have a special responsibility because without him the safe cannot be opened.

And so we arrive at the proposition that it seems to me we have to support:

> Computer scientists have a special responsibility as computer scientists, more than and in addition to the responsibilities of most other scientists and citizens — the responsibility of the locksmith.

The Avoidance of a Certain Logical Fallacy

In all the discussion and argument about the social responsibility of computer scientists, there is undoubtedly present in the minds of all of us a logical fallacy that is begging continually to be accepted as truth, because it is truth so much of the time. We want to go on with "business as usual." We do not want to see that "something new has been added." We want to work tomorrow and the next day on our usual problems and not think about the new ones. We do not want to act on the basis that something has really changed, that a new and most terrible power has come into the possession of the governments of the United States and the Soviet Union.

In the possession of the United States and the possession of the Russians are more than enough nuclear explosives to put an end to the life of man on earth. We want to say, "yes, that may be, but somebody will do something about it, and I do not have to make any change in what I am doing."

The logical fallacy is the failure to respond realistically to a real change when a real change has occurred.

The same fallacy, refusal to realize a change, operated widely before World War II. In 1938 the government of Great Britain under Chamberlain and the government of France under Daladier, renounced their agreement with Czechoslovakia, and told Hitler that it was all right for him to take the Sudetenland from Czechoslovakia, since Hitler said this was his last demand; and Chamberlain returned from Munich announcing "Peaçe in our time!" The governments of Great Britain and France were in the grip of this same fallacy, the failure to see that a new and very real and terrible change had actually occurred.

In one of the best books on logic that I know, "Applied Logic" by W. W. Little, W. H. Wilson, and W. E. Moore, this fallacy, the failure to acknowledge a real change, is given a name, "The Argument of the Beard." From the book: /2/

[Beginning of Quotation] In a sense, the argument of the beard may be considered the opposite of the black-or-white fallacy. We are guilty of the black-or-white fallacy if we fail to admit the possibility of middle ground between two extremes. We are guilty of the argument of the beard if we use the middle ground, or the fact of continuous and gradual shading, to raise doubt about the existence of real differences between such opposites as strong and weak, good and bad, and white and black. ... The fact that we cannot determine the exact point at which white ceases to be white does not prove that there is no difference between white and black.

The very name of the fallacy is derived from the difficulty of deciding just how many whiskers it takes to make a beard. Surely one whisker is not sufficient. Possibly even 25 are too few. Then let us say that 350 whiskers make a beard. Why not 349? 348? and so on. We would have trouble determining an exact minimum. Does this fact mean that there is no difference between having a beard and not having one? ...If a car can carry seven persons in an emergency, why not just one more? and if eight, why not just one more? By the argument of the beard, a car should be able to carry an infinite number of passengers. ... This error...is especially pernicious in value judgments because it is frequently used to justify unethical conduct. [End of Quotation]

Avoiding the Fallacy

We may guard against the argument of the beard by reminding ourselves that although a difference may be small, it may nevertheless be so real that an accumulation of such differences may bridge the distance between great extremes.

Now, a computer scientist may say: "Well, it makes no difference if I work on an early-warning radar network, and the computers that go with it, because I help to defend my country against attack."

And another computer scientist may say: "I am not doing any worse than that fellow in the early-warning radar network, because I am working on the guidance system for an air-to-air missile which can be used to knock down an enemy missile to be detected by the early-warning system."

And a third computer scientist may say: "Well, it is true that I am working on the guidance system for an intercontinental ballistic missile, BUT it will only be launched if an enemy ICBM comes over to destroy one of the cities in my country."

And a fourth computer scientist may say: "Well, I am working on the computations relating to the spread of poison gases, BUT I am very sure that my country will only use poison gas if the enemy uses poison gas."

And finally some kind of mistake occurs in the whole tragic pattern — information comes in that poison gas has been used when in fact it has not, or that ICBM's are on the way when in fact it is only the moon rising over the horizon, or some poorly maintained computer in a distant country has a failure. ... Then all these fine differences count for nothing at all — ICBM's land on Moscow, Leningrad, and Kiev, others land on New York, Chicago, and Los Angeles, and at least 40 million human beings are dead — more deaths in a day from less than twenty bombs than all the deaths of World War II in six years from all weapons combined.

Inattention to the accumulation of small differences constitutes the fallacy of the argument of the beard, the fallacy of failing to acknowledge a real and huge change because it has been gradual.

We need to stop justifying our conduct on the basis of small differences that are really not important, and base our conduct on the real and huge accumulations of differences that need to shake and alter our basic assumptions. The megaton nuclear bombs exploded by both Americans and Russians, the ballistic missiles created by both, the earth satellites orbiting around the earth, the computing mechanisms that launch and guide them, make a real and huge accumulation of differences.

References

/1/ From "Tyranny on Trial: The Evidence at Nuremberg," by Whitney R. Harris, Reprinted by permission of the Southern Methodist University Press, Dallas, Texas, 1954.

/2/ From "Applied Logic," by W. W. Little, Reprinted by permission of Houghton Mifflin Co., Boston, 1955. □

Dotto – *Continued from page 16*

Capt. Stinson doesn't think so. "I still feel there is a lot of challenge left — in understanding the equipment, in knowing how to operate and program it, and in knowing that when the computer gives up, you can still do it."

He admits that "a lot of the dash and daring has gone out of it — but then so has a lot of the suspense."

In general, he says, pilots accept the new technological advances as a fact of life. He says this has always been the way in aviation — "you move with it or you get out." But he notes that many commercial pilots have taken to flying their own small planes.

In short, while there are new technological challenges for pilots, it appears the Waldo Pepper days are a thing of the past. □

Computing and Data Processing Newsletter

JAPAN'S LARGEST EXPRESS CARRIER DEVELOPS INFORMATION SYSTEM TO SOLVE FREIGHT TRANSPORTATION PROBLEMS

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Nippon Express Company Ltd., Japan's largest express carrier operating a nationwide network of integrated transportation services, is developing a management information system designed to solve many of the problems experienced by freight transportation concerns throughout the world.

The system is known as the Nittsu New Information System, and is planned for implementation in April, 1976. A computer system is installed at the company's Tokyo headquarters. High-speed data communication lines link the central computer to 210 terminals located in the firm's major branches and sales offices. Typical tasks which the Nittsu system will perform include: finding the best way to economically transport cargoes of various types and sizes (from art treasures to giant transformers); coordinating shipments via diverse modes of transportation — air, road, rail and sea; and scheduling distribution and collection of freight in major cities in order to minimize delays caused by traffic congestion.

As part of its future development plan, Nippon Express expects to establish a physical distribution information system to schedule the most efficient means of transporting shipments, to assist in rapid cargo tracing and to obtain quick and accurate information on all facets of operations. The company envisions that the system will eventually capture data almost instantaneously from all of its 2415 branches and sales offices.

The information system will also incorporate applications dealing with the control of sales information, by consignor, and the management of shipments from packing to custody, including insurance computations, temperature control and transportation fees. In addition, the Nittsu system will furnish an exchange of information about consignors' names and shipments, and provide for the prompt reporting of the arrival of freight shipments so that their correct location can be quickly ascertained.

THE ELECTRONIC FUNDS TRANSFER SYSTEM HAS BEGUN IN ILLINOIS

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The long-predicted "age of the checkless society" has begun in the Chicago area with the start-up in November, 1975 of the first electronic funds transfer system (or "EFTS") in Illinois. This system — called "The Money Service" or "TMS" — has gone into operation at First Federal Savings of Aurora (about thirty miles west of the Chicago "Loop") and at two National Food supermarkets in the Aurora area.

Electronic funds transfer is a computer-based system that enables consumers, with a coded plastic card, to deposit and/or withdraw savings account funds from any location equipped with a remote computer terminal.

Initially established by a savings association in Lincoln, Nebraska, the system now is operating or in a start-up stage in sixteen states. It is expected that TMS should spread rapidly across the entire nation because of its many real benefits, not only for consumers, but also for the saving associations and participating merchants.

For consumers, TMS means a family now can keep the bulk of its weekly or monthly household bills and grocery money in a savings account, earning interest day-by-day until the money is needed, rather than holding it in a non-interest-bearing checking account. In addition, money is saved by eliminating check charges and checking account service fees.

A family, with a $200 per month food budget for example, would deposit the full amount at the first of the month. If $50 were spent weekly, one week of interest would be earned on $150, one week on $100 and one week on $50 each month of the year.

Even greater amounts of interest would be earned, of course, by leaving larger amounts on deposit for groceries, utility bill payments, cash withdrawals, etc., and making electronic withdrawals only when actually needed.

For participating merchants, such as National Foods, the system dramatically reduces the cost of "courtesy" check cashing services. When a customer withdraws funds through a store, the TMS computer instantaneously transfers money from the customer account to the store account. Thus a store actually receives its money two or three days faster than through typical check cashing operations, and less capital is tied up for this customer service.

Eliminated also for the stores is the problem of insufficient-fund checks, for the computer assures there are ample funds in the customer's account to cover any withdrawal or payment.

For savings and loan associations, the computer system also reduces costs in comparison with "window" transactions and, more important, gives the institution a means of supplying customers with an additional, convenient financial service.

To use TMS, the customer opens a TMS savings account at the participating savings and loan association. Each saver also selects a four-digit "security code" number known only to himself. This can be any easy-to-remember number such as an anniversary date, month and day of birth, etc. Then the customer is issued a plastic card similar to a credit card, which is magnetically encoded with his account number.

To make deposits or withdrawals the customer fills out a transaction ticket, then hands the ticket and his TMS card to the supermarket service counter clerk or teller. The information then is keyed into the computer through the store's terminal, authorization is received, and the deposit ticket or cash is returned to the customer.

Instead of a savings passbook, the customer has a logbook in which he can list deposits, payments and cash withdrawals. The customer also receives a quarterly statement from the savings and loan association listing all transactions by date.

"THE RIGHT TO PRIVACY: THE RESPONSIBILITY OF INDUSTRY" – POSITION PAPER BY THE ASSOCIATION OF DATA PROCESSING SERVICE ORGANIZATIONS (ADAPSO)

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ADAPSO is a national association representing data centers, software organizations, and time-sharing and facility management companies in the $4 billion computer services industry.

Following is the statement of position:

Where a computer services organization maintains personal data files for its own account, the organization has a responsibility to take reasonable steps to safeguard information pertaining to the individuals and organizations whose data is being processed or otherwise handled. That responsibility includes at least the following:

1. Reasonable steps to insure that the existence of any personnel data record keeping system is not unnecessarily kept secret.

2. Reasonable steps to permit an individual to find out, where appropriate, what information about him is in a record, and how it is used.

3. Reasonable steps to permit an individual to prevent information about him that was obtained for one purpose, from unnecessarily or improperly being used or made available for another purpose without his consent.

4. Reasonable steps to permit an individual, where appropriate, to correct or amend a record of identifiable information about him.

5. Reasonable steps to assure the reliability of data for its intended use, and to prevent misuse of such data.

Discussion

In a complex society, reasonable privacy and reasonable access to information are fundamental but sometimes conflicting human rights. Safeguarding those rights is a most difficult problem, requiring the balancing of a great number of disparate interests.

ADAPSO has already proposed the "privacy impact statement" approach to regulation by government where such regulation is necessary or appropriate (see ADAPSO Position Paper on the Right to Privacy). But government regulation should not be a first resort and indeed may well be premature (see ADAPSO Position Paper urging a Moratorium on State and Local Privacy Regulation until the Federal Privacy Commission concludes its work). To the extent that the private sector recognizes its responsibilities and takes action in this important area, the need for government regulation and interference can be minimized. At the same time, each organization will be in the best possible position to balance the special considerations applicable to its own operations.

ADAPSO urges its members and all other organizations in the computer services industry — as well as industry generally — to analyze their own operations and take reasonable steps to safeguard human privacy. This will insure more prompt attention to this problem, as well as limit the necessity for ill-considered regulatory action.

COMPUTER-ASSISTED INSTRUCTION IMPROVES ATTITUDES, ATTENDANCE, ACHIEVEMENT – AND HAPPINESS – FOR ELEMENTARY SCHOOL STUDENTS

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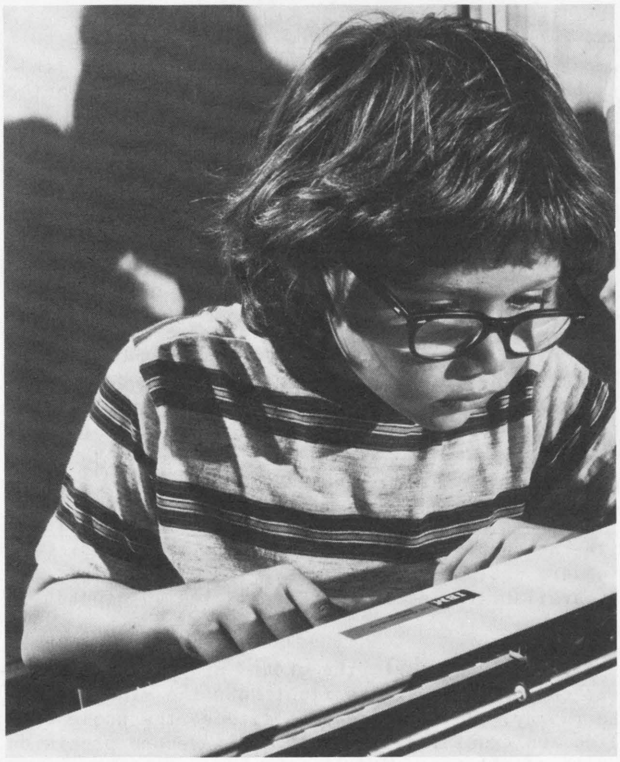
Ever see a group of children hover around a line of chairs and then, on signal, rush to grab a seat? Children in Los Nietos School District, Whittier, California, do this, but it isn't a game of musical chairs. And while it may be fun, it isn't a game they're playing. The students are anxiously seeking their turns at rows of computer terminals, where they will spend the next hour period working very hard at mastering arithmetic and reading and writing skills. Funding is provided through the Emergency School Aid Act to help districts in the process of integrating; so Los Nietos installed a computing system. The computer provides each student with a tailored work session geared to his own ability to learn.

"Achievement levels among our students have increased dramatically since we initiated this computer-



In the Los Nietos School District, Los Angeles, California, 5th through 8th grade students work at rows of computer terminals in a specially funded computer-assisted instruction program. The computer reacts to all children in the same way and provides them instant feedback on their performances. Computer response time is so fast that each student gets the impression that the computer is serving him alone.

assisted instruction program last January," said Martin Montano, district superintendent. "The students enjoy this method of learning and they eagerly look forward to their learning sessions with the computer. Truancy has decreased and an astonishing number of students come in to work with the computer on their own time," Mr. Montano said.

The Los Nietos School District, in southeastern Los Angeles County, operates five elementary schools serving 2,500 students. About 81 per cent of the children are of Hispanic origin.

"Most of the teaching methods in this country are geared to the learning style of the middle class majority and can often lead to frustration, feelings of incompetence and alienation for many students in our district," said Mr. Montano. "Yet attempts to give such students easier subjects — to make success easier — does not fool the child. It even tends to reinforce his negative self-image when he discovers that an 'easy' program leaves him with a background inadequate for high school, college or the job market. But with computer-assisted instruction, we have approached some of the problems and, at the same time, helped improve the attitudes of many of our students. For example, the computer reacts to all children in the same way, and gives them instant feedback on their performance. The child also can see a direct relationship between his efforts and the results. These benefits help narrow the 'learning gap' between our students and those in districts serving primarily the middle class majority."

As each student begins his computer-assisted instruction period, he types his initials and birth date. The computer identifies the student from this "code," activates his file and responds by printing the student's full name. Based on a cumulative record the computer maintains of each student's progress in each learning area, the system poses questions or problems appropriate to that student's learning stage. For example, if the student is learning addition, the computer will pick up where the student finished the last work session. As the session proceeds, the computer prints increasingly difficult work problems. So long as the student continues to type in correct answers, the problems get tougher. When the student starts getting wrong answers or is unable to solve the problems in the allotted time, the system automatically "backs up" to give the student more practice at easier problems. By evaluating a student's answers and recording the time it takes for him to answer the questions, the computer diagnoses his level of achievement and moves him ahead or back as needed. The so-called "common denominator" drawback of moving at a pace geared to the average is to a great degree eliminated with this program.

Because the system works at a high rate of speed, it handles numerous students at the same time, each working on different problems. Computer response time is so fast that the student gets the impression that the computer is serving him alone. Fast learners can progress rapidly and remain challenged, while slower students can spend more time mastering each phase of their work. The slower students have made significant progress because of this feature. The computer automatically selects a drill level that assures each student of achieving a score of at least 70 per cent, but never more than 80 per cent. This guarantees the slower students that they'll be successful and keeps them encouraged; at the same time, it ensures that the brighter students remain challenged. The peer pressure — for success or failure — is eliminated by this scoring system. No one fails, but no one makes a perfect score. At the conclusion of each work session the computer prints the student's score, so that he can see how he performed. This serves as an immediate reward and lets the student see instantly the relationship between his efforts and the results. With manual testing, when it takes a day or two for the student to get his test results, the reward effect is somewhat lost because of the slow feedback.

Student and teacher acceptance of computer-assisted instruction is good. There is a novelty aspect to using a computer terminal in the learning process, but primarily the students enjoy the independence. Unlike a classroom situation, where the teacher runs the show, the student feels very much in charge when he works with the computer. Since the program started, truancy has decreased markedly and a substantial number of children stay after school to do additional work with the computer. Many students come in on days when school is out of session. Summer school applications doubled when it was announced that computer-assisted instruction would be available. One school had to turn off the computer terminals during the lunch hour because so many students skipped lunch in order to continue working!

Teachers find that the program frees them from the drudgery of drill work and gives them more time to teach concepts and processes that are then reinforced by the computer. The computer has not replaced the teacher; instead it has augmented his or her work. Teachers report that large numbers of heretofore unmotivated students have suddenly become interested in their school work; their attitudes have changed. Interestingly, at a time when vandalism is on the rise in neighboring school districts, a decrease in school vandalism has been noted in Los Nietos. Because the system maintains a file on each student, teachers can obtain data at any time on each student's progress as well as composite achievement profiles for entire classes.

The computer-assisted instruction program is used mainly for students in fifth through eighth grades; but it is made available to exceptional students in lower grades and to certain high school students — on a voluntary basis — who require remedial work. Adults are offered refresher education on the system in the evenings. The computer is an IBM system 370 Model 115.

LANDING AIRPLANES IN ZERO-ZERO WEATHER WITH AUTOMATIC LANDING EQUIPMENT

Lydia Dotto
The Globe and Mail
Toronto, Canada

If you've flown in an Air Canada 747 or L-1011 jet, the chances are about one in ten that you've been landed by a black box, rather than a flesh and blood pilot.

The airline's entire fleet of eighteen large jets is equipped with computerized automatic landing systems and, according to Air Canada supervisory pilot D. E. Stinson, about ten per cent of the landings these planes make are carried out solely by the autoland system.

Capt. Stinson, 28 years a pilot, admits he is "not without pride" in his flying abilities. Yet he flatly states that the computer can "out-land a human pilot three to one. I'll admit it can outfly me. All its reactions are like that . . ." and he snaps his fingers.

But he is equally firm in stating that the human pilot will not become obsolete, no matter what the advances in technology. "People will always want people to take them where they are going."

What he's really saying, of course, is that airline passengers will always want a human being up there in the cockpit, ready and able to take over from the machines if something goes wrong with the computer. You can talk all you want about out-landing human pilots three to one; you still won't get passengers on pilotless planes.

Capt. Stinson says the computer never makes errors as long as it is functioning properly, but things can go wrong with it. For the pilot, there will always be the option of manually over-riding the computer, he said.

Air Canada's Toronto public affairs officer Michael De Wilde also predicts that "we will always have pilots on board." But he says the public accepts the idea of automatic landings. He has been on several of the airline's commercial flights when the captain announced that an automated landing had taken place; in all cases, he says, the passengers broke out in a round of applause.

The 747s and L-1011s come from the manufacturer with the sophisticated autoland electronics as standard equipment. Their use, however, depends on the availability of equally sophisticated ground equipment.

Working in concert, the ground and airborne equipment can bring the plane right down the middle of the runway, juggling speed, altitude, the angle of glide and exact location with split-second precision. And they will toss a gentle touchdown into the bargain.

Another piece of equipment also plays an important role. It involves high intensity light beams that cut across both ends of the runway to receivers on the other side, giving a precise measurement of visibility conditions on the runway.

This is important because the main purpose of the automatic landing system is to keep the planes flying when a pilot cannot see because of murky atmospheric conditions. For some time now, Air Canada has been making automatic landings in Category-2 conditions.

Category-1 means a minimum of half a mile visibility and a ceiling of 200 feet. (The term, ceiling, refers to the bottom of the cloud cover.) Category-2 means you have a ceiling of 100 and can see 1,200 feet down both ends of the runway. (The runways at Toronto airport are about 9,500 feet long.)

Capt. Stinson says there are stringent rules about landing in Category-2 conditions, for instance, all onboard equipment must have backup systems and everything must be working properly.

But it's when you get to Category-3 that the fun begins. Category-3 conditions close down any airport in Canada. Capt. Stinson says Category-3A means you can see 700 feet down the runway. He is asked what the ceiling is.

He laughs. "No ceiling." That means the bottom of the cloud sits on top of the runway and "it's soup-time."

Category-3B gives you 150 feet of runway. At this point, Capt. Stinson shakes his head. He is not unfamiliar with low visibility conditions, but 150 feet — a distance covered by the aircraft in perhaps a few thousandths of a second — clearly boggles his pilot's mind. "That isn't even the width of the runway." Nothing but a black box could land a plane then.

(please turn to page 16)

GAMES AND PUZZLES for Nimble Minds – and Computers

Neil Macdonald
Assistant 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.*

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.)

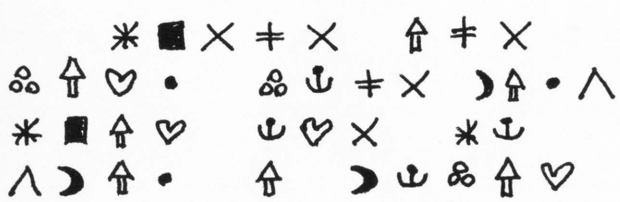
NAYMANDIJ 763

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

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 763



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 763

```
            S A T A N
        x   C O M E S
        -------------
          T M L O T C
        S L O N I I
      N O T C C S       K D = E O
    C I L E T M
    K L N L O
    -----------------
= T C T S N S S I M C

    73470 95364 5173
```

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

SOLUTIONS

NAYMANDIJ 762: Make a V of 5's.

MAXIMDIJ 762: Change changes and even changes changers.

NUMBLE 762: It is too late to water last year's crop.

Announcing a new quarterly magazine:

COMPUTER GRAPHICS AND ART

To all persons interested in:

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. . . .

February 15, 1976

Dear Colleague,

In our announcements, we said we hoped to publish the first issue of COMPUTER GRAPHICS AND ART, a new magazine on interdisciplinary computer graphics and computer art aimed at the college level, in January 1976.

We have had to delay our original plan, due to a temporary illness and hospitalization of the editor. The first issue of COMPUTER GRAPHICS AND ART is now at the printer.

An advisory board of distinguished people and a group of contributing editors well known in graphic fields has been assembled. We need your feedback concerning the graphic interests that you have and that you know of. We want this magazine to be useful to you and your colleagues.

Accordingly, this is your invitation to submit material and to begin subscribing to COMPUTER GRAPHICS AND ART. Or you may wish to enter a Library Subscription, whereby you and your colleagues may share this new quarterly.

You and your colleagues are cordially invited to submit papers, articles, computer graphics, photographs, reviews, computer art, ideas, etc. — no holds barred — for us to consider for publication. In addition, your suggestions about authors whom you would like to have papers from will be most welcome. One of our goals is to publish materials on computer graphics early; and then authors can more quickly establish their professional claims for origination of good ideas and programs. Every author receives permission to reprint his or her material unlimitedly, although the magazine is copyrighted by the publisher.

We look on subscribers as colleagues in a mutual effort, and not as listeners in a lecture room.

Your help and cooperation in this mutual undertaking is warmly invited and will be most appreciated. May we hear from you?

Cordially,

Grace C. Hertlein

Grace C. Hertlein
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Here is your chance for feedback to us:

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

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