computers and people

July – August, 1980

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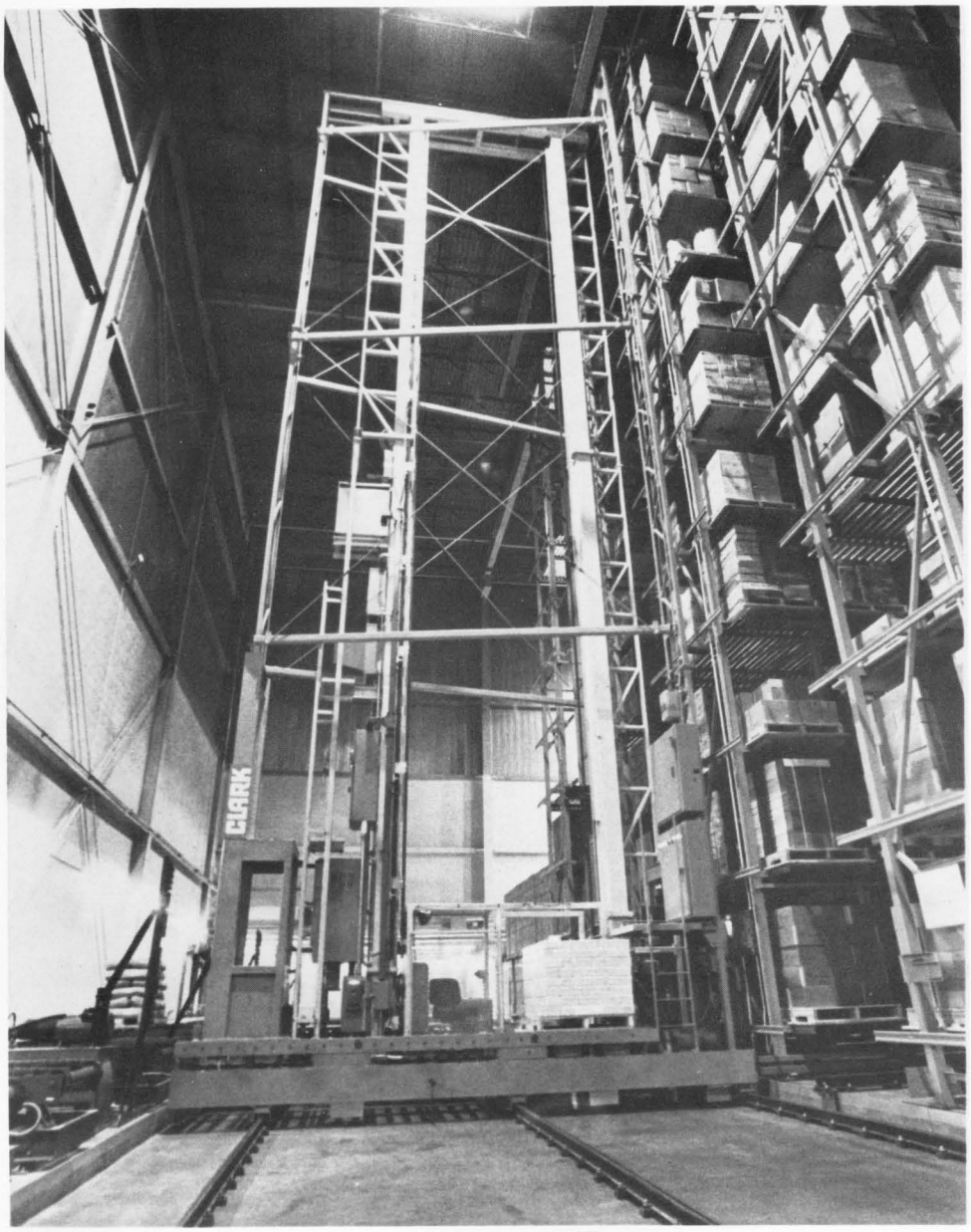
formerly *Computers and Automation*



COMPUTER-CONTROLLED CRANE PLACES PALLET IN PROPER BIN

The Computer Almanac and Computer Book of Lists — Instalment 14

Neil Macdonald
Assistant Editor

83 TOPICS OF THE COURSE "MANAGEMENT OF TECHNICAL HUMAN RESOURCES" OFFERED FOR EFFICIENT MANAGEMENT OF PERSONNEL IN COMPUTER INSTALLATIONS (List 800701)

1. Characteristics of Data Processing Personnel
   A. Loyalty to themselves or employer
   B. Professional self-image
   C. Creative vs. laborer self-image
   D. Communications skill level
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2. Management View of Data Processing Personnel
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3. Some Causes of Technical Personnel Turnover
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5. Barriers to Conflict Resolutions
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6. Verbal Communication
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   C. General confrontation; facing others with reality; a skill to use when people delay, stall, bluff, or can't make up their minds
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   E. I/We/You/Them statements; how to utilize them for the best purposes of management
   F. Fighting fair
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9. How to Identify and Deal with Problem People
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   B. Helpless, poor me, victim
   C. Look at me, showoffs, other exhibitionists
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10. Managing Technical Personnel
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   C. Viable job descriptions
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   E. Management by objectives: pros, cons
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   I. Maintaining productivity in non-crisis times; also in crisis times
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11. Developing the Technical Manager
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(Source: announcement of a new course "The Management of Technical Human Resources" by Robert Wainwright, Donald Foulk, and Stan Winter of TSI Sales and Marketing Inc., 19 West 44 St., New York, NY 10036, (212) 764-3070.)

(please turn to page 3)

Forum

WHY THE RULES FOR THE COMPUTER ART EXPOSITION 1980?

1. From the Editor's invitation to some 120 computer artists, to submit drawings for the "Computer Art Exposition 1980" to be in the September-October issue of "Computers and People":

— Each drawing should show at least three kinds of forms. For example the forms could be crystals, leaves, and icicles. Or they could be trees, animals, and the sun. Or they could be pine needles, hoof prints, and pebbles.

— The forms should appear in various sizes, perspectives, and orientations.

— If a first form is in front of a second form, then the first form should appropriately conceal parts of the second form as in ordinary drawing.

2. From: Kerry Jones
1500 Sparkman Dr. 20J
Huntsville, AL 35805

The "Computer Graphics and Art" Yearbook is outstanding. My congratulations to the editor (and printer) for a job well done.

I find your rules for the 18th Annual Computer Art Exposition most interesting. I feel compelled to ask "Why?" It seems to rule out most graphic art work previously published. While I certainly see nothing wrong with your desire for more "realistic" computer art, I also see nothing wrong with the more common graphics based on "mathematical" or optical principles. The latter do indeed have a powerful and emotional appeal to me (well, some of them).

I look forward to seeing the art you publish in this exposition.

3. From the Editor:

Thank you for your letter. I am forwarding a copy of it to the Computer Art Editor of "Computers and People" and to the editor of the Yearbook of "Computer Graphics and Art." This is one and the same person, Assoc. Professor Grace C. Hertlein, Computer Science Department, Calif. State Univ.-Chico, Chico, CA 95926.

For "Computers and People" this year, and the exposition of computer art this year, I have chosen the topic of showing at least three kinds of forms, in various sizes, perspectives, and orientations, and with due regard to what is "in front" and what is "behind."

Almost everybody to whom I show computer art of many years in various examples does not find it satisfying or appealing or emotionally moving or intellectually interesting. The subject this year seeks to call forth a different direction. For more explanation see my editorials in the 1979 and 1978 Computer Art issues of "Computers and People."

We invite comments from readers who are not computer artists on the question:

> What kinds of topics would you like to see portrayed or illustrated in computer art?

COPIES OF EDITORIALS

1. From: Barbara Lewandowska
Univ. of Lodz, Dept. of English
Kosciuski 65
9-909 90-514 Lodz, Poland

I would very much appreciate a copy of your recent editorial "The Frightening of People by Words."

2. From the Editor:

I am pleased that you find my editorial "The Frightening of People by Words" interesting. I enclose a copy.

You may make as many copies as you wish for your teaching purposes.

3. From the Editor:

Henceforth we shall send copies of editorials on request to readers of this magazine.

See, in List 800702 of the "Computer Almanac and the Computer Book of Lists," the titles and dates of issue of a number of recent editorials. □

CACBOL - *Continued from page 2*

14 TITLES OF RECENT EDITORIALS IN "COMPUTERS AND PEOPLE" (List 800702)

Distraction, Camouflage, and Deception / May-June, 1980
The Frightening of People by Words / Mar.-Apr., 1980
Computers and Mathematical Objects / Jan.-Feb., 1980
The Density of Information / Computer Directory and Buyers' Guide, 1978-79 Issue / Oct. 31, 1979
The Nature and Function of Ridicule / Nov.-Dec., 1979
The 17th Annual Exposition of Computer Art / Sept.-Oct., 1979
Government and Crime / July-Aug., 1979
"A Series of Question Marks": Nuclear Errors, Computers, and Lies / May-June, 1979
The Nine Most Important Problems in the World, and Their Relation to Computers — II / Mar.-Apr., 1979
Computers and Spelling — II / Jan.-Feb., 1979

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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.

QUIZ NO. 1 FOR READERS OF "COMPUTERS AND PEOPLE"

Which is the most important of the following aphorisms?

1. A vast amount of time and energy is wasted on solving the wrong problems.
2. One should always produce quantities of computer printouts from a computer installation to demonstrate how valuable it is.
3. To use a source of energy for which no one has a good method of waste disposal is criminally wrong. – *The Editor*

Front Cover Picture

The front cover shows a computer-controlled stacker crane which delivers pallets to a bin selected by the computer. It also picks up a pallet on computer command. A microprocessor in the crane reports when the job is finished, or if there is a problem. See the story on page 23.

Key

[A]	–	Article
[C]	–	Monthly Column
[E]	–	Editorial
[EN]	–	Editorial Note
[F]	–	Forum
[FC]	–	Front Cover
[N]	–	Newsletter
[R]	–	Reference

Notice

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

"THE COMPUTER DIRECTORY AND BUYERS' GUIDE": NEWS AS OF JUNE 15, 1980

"The Computer Directory and Buyers' Guide" for 1978–79 contains: a Roster of Organizations of more than 1500 entries; a Buyers' Guide to Products and Services under 23 categories, including Computer Dealers; and a listing of Digital Computer Characteristics including over 800 computers made by more than 100 organizations.

The issue has been mailed. If you have not received a copy you are entitled to, please tell us.

Editorial

The Crisis in Home Heating, and Computers

Edmund C. Berkeley
Editor

There are two kinds of problems in the heating of space, the consuming of energy to heat buildings in winter in cold weather. One kind of problem faces businesses, government, factories, hospitals, doctors, lawyers, landlords, etc. They can solve that problem simply: charge more (raise prices) for what they sell or give. The other kind of problem faces wage earners, consumers, retired persons, sick persons, students, reliefers, unemployed, etc. They simply cannot charge any more for their work or their nonwork, for they have almost no bargaining power. They are squeezed, not only by the economic and political system, but by the hard facts of exhaustion of material resources.

Recently I listened to a panel discussion on "Energy Problems of the Eighties." I came away far more disturbed than before. One speaker said "Suppose that due to unrest, or revolutions, or war, or military actions, etc., no oil at all came from the Near East for many months. What would happen?" There would be a staggering collapse of the economy of the United States. Another speaker said "By far the largest source of energy in the United States now is conservation."

I wrote to the company (with 10,000 customers) who for decades has been delivering oil to my home in Newtonville, winding up this spring with charging me at $1 per gallon. I said:

((Beginning of quotation))

I am deeply concerned and distressed about the rising cost of fuel oil for heating my house. The only personal income I am receiving currently is $444 a month from Social Security. Furnace oil cost me last winter season more than $1400, more than 1/3 of that income annually. Rumors say that the cost of fuel oil will go to $2 a gallon by next October. I will not be able to pay for much of that, and I have no desire to pay any of that.

1. I do not intend to pay more than $900 for fuel oil this coming heating season.
2. I intend to shut off most of my house in November, and leave the rooms unheated, except on a demand basis, in the same way that I light a lamp when I enter a room, and turn it off when I leave the room.
3. I intend to eliminate all the leaks I can, of heat flowing into the great outdoors, in the same way as I button up in a winter coat.
4. I intend to turn off certain portions of my plumbing in November so that when the freezing days come those portions of the pipes won't freeze, in much the same way as people do in country houses from November to April.

Do you have any suggestions for allocating wisely a given total cost for my house heating Nov. 1980 to May 1981?

If my forefathers could get along from 1650 to 1830 with "demand heating" (fireplaces in rooms, iron stoves in kitchens, warming pans in beds) and without central heating in their homes, why can't I?

Please do not deliver fuel oil automatically to my house in the way you have done in the past. If I can't pay for fuel oil, I have to go without.

((End of quotation))

Since I am a computer person, I naturally think of applications of computers to demand heating of selected small portions of a house, according to the following algorithm:

1. Deliver heat to any space only when being used.
2. Otherwise, deliver no heat, except for sufficient heat to water pipes so that they won't freeze.

Essential ingredients for this procedure: (1) a number of programmable thermostats; (2) cheap, light-weight, insulating, movable partitions to produce small spaces; (3) intelligence.

I believe this could save more than 50% of the cost of winter fuel for homes in the United States. And I think it could save heat starting in the autumn of 1980. □

Payments, People, Privacy:

A Challenge of the Eighties

James D. Robinson III, Chairman
American Express Co.
American Express Plaza
New York, NY 10004

"Technology holds many promises provided that it is applied wisely."

New Forces and Directions Emerge First in California

California — I can't think of a better place to talk about the future than in California. Many social scientists call this a bellwether state, where new political, social and economic forces first emerge before sweeping the country. Proposition 13, Proposition 4 and the end to mandatory retirement are representative of the recent tides you have unleashed.

It seems to me that no discussion of the eighties can avoid the ghost of George Orwell. His grim vision of 1984 has haunted our thinking about this decade.

The Spectre of "Big Brother" of George Orwell's 1984

Orwell predicted a world in which individual privacy was doomed by the all-seeing eye of technology, personified by Big Brother. In effect, he warned us against a new form of tyranny. He dramatically painted the villain as the impersonal, push-button world of science and technology.

In doing so, Orwell echoed a debate that has raged since the industrial revolution, and with greater urgency, since the Atomic Age. Is technology the instrument of progress or, in fact, a new form of human bondage?

Electronic Transfer of Money

This issue confronts those of us in the financial services business every day. It is basic to commerical transactions. In some respects, we still buy and sell like the Phoenicians. On the other hand, technology is increasingly supplanting personal transactions and the use of paper. Take, for example, the various new electronic techniques for transferring money, the so-called EFT systems. Will they totally or partially supplant paper and people in the financial services industry? I believe the answer is highly dependent on whether consumers believe this technology expands their economic choices, by adding valuable new services, or whether they see it as impinging on their privacy and reducing their monetary freedom. Indeed, the whole question of automation in the financial service industry is a variation on the theme of man's love-hate relationship with technology.

Authorization in Phoenix of Credit in Hong Kong: Six Seconds!

Few of us believe George Orwell's political world of Big Brother will overtake us in 1984. But the truth is the technology of Big Brother is already here. Computers, satellites, lasers, fiber optics and microprocessors have indeed revolutionized the way we store, access and relay information. Messages and images that once took days and hours to circle the globe now take seconds. If, for example, an American Express cardholder wishes to purchase an airline ticket in Hong Kong, our authorization system, located in Phoenix, can approve the purchase in six seconds. Our Travelers Cheque dispensing machines employ much of the latest electronic hardware. So the technology of instant communication and on-line service is here.

Technology is basically neutral. How we use it makes it good or bad. So, in the 1980s, will we be moving towards a world of increasing uniformity and authority in which people have less choice, less freedom and less privacy? Or will we be moving in other directions?

The Direction of More Choices

I am optimistic that the eighties will offer individuals greater choice and freedom in a variety of areas, including financial services and payment systems. My optimism is based, in part, on some of the major trends that have emerged in this country during the seventies.

By and large, as general hindsight, we can see that the years between 1945 and '65 were a period of reasonable social unity. The breakdown of that unity took place during the late sixties and seventies. For a complicated set of reasons the social and political consensus of Americans vanished. The mood and direction of the country changed. While we have all been bewildered and often dismayed by the fragmentation that has taken place, perhaps we have overlooked some of the more recent developments - many of them positive.

The Direction of New Preferences

A new set of values is emerging from the negative, post-Vietnam, post-Watergate era. We may not agree with all of them, but we must certainly learn to deal with them. They revolve around:

- The movement away from Big Government to local government initiative;
- Deregulation and less regulation as a national priority;
- The replacement, in part, of the Protestant work ethic by the Society of Entitlement;
- The psychology of high inflation and its complex impact on standards of living;

Based on a talk before the Town Hall of California, Los Angeles, CA, January 1980.

— The decline of the two-party system and the rise of special-interest groups; and
— The rise of working women and the two-income family.

There is probably a single, common thread linking these trends. I believe it is the shift from a value system of conformity to a variety of competing systems. We have been moving towards a multiple-choice society. That can be a healthy trend indeed. Already, the old liberal-conservative issues are being superseded by others concerning the appropriateness of scale, fiscal responsibility, the accountability of leadership, and greater participation in decisions that affect our lives. We can thank California for a lot of this momentum. Ultimately, nothing will better protect us from Orwell's vision of Big Brother than the natural forces of competition within an environment of less central regulation.

Less Commitment to Thrift

The implications of this value shift to a multi-choice society will have a profound effect on business. It will mean, among other things, that the private sector will have to cope with a society that is even more highly segmented by market. The tastes and values of the consumer will reflect great diversity. And diversity will represent new opportunities for those with the capacity to respond and to deliver.

Let me comment on some observations about the market place. In the eighties, the baby-boom children will become one-third of the adult population. With incomes estimated at over $35,000, they will dominate consumer spending. This generation is less committed to thrift, investing in material possessions and building future security than previous generations. Many value immediate pleasures, living well in the present and exploring a variety of personal experiences now. For instance, they feel entitled to such "intangible experiences" as travel and all forms of entertainment. They feel entitled to personal career options that will enable them to afford these experiences.

In the society of entitlement, everyone from conservationists to minority groups, from the young to the old, will feel it is their right to be heard, and the duty of business and government to respond. Increasingly, consumer wants will become needs, and needs will become demands. Quality-of-life expectations will continue to rise. Value will be of utmost importance. In that environment, responsiveness to the consumer will become paramount to business success.

The image of America as a homogeneous market is declining. The image of America as a marketplace of diversity is ascending. Just as mass magazines have given way to special-interest publications, and network TV will face increasing competition from special-interest networks, like cable, so other businesses will experience the impact of this profound change.

New Banking Relationships

Needless to say, the financial services industry is influenced and will continue to be influenced by these changing consumer trends. The way in which people live is immediately reflected in how they spend, borrow and invest their earnings. Accordingly, a higher sensitivity to the needs, realistic expectations, and desires of consumers must be developed. All of us must learn to listen more carefully to the marketplace. I believe it is going through a period of great change. Now is the time to develop keen antennae.

Just a short while ago, for example, the average person had two banking relationships and knew exactly what each was for. Commercial banks were for checking accounts, and savings banks for just that — savings.

In the past few years, of course, everything has changed. There has been a blurring of distinctions among such diverse financial institutions as commercial banks, thrifts, mutual funds, brokerage houses, credit unions and insurance companies.

Today, mutual fund managers offer low-threshold money market funds with check-writing features. Insurance companies are experimenting with sophisticated financial planning services. Brokerage houses are offering bank card services to access free credit balances, and thrifts are offering interest-bearing checking accounts. Billpaying by phone is growing. Also cable networks, with two-way communication capacity, may one day offer important innovations in the delivery of financial and marketing services direct from the home.

What, then, lies ahead?

Fishing in New Waters

Although forecasting is a dangerous business, especially in such a rapidly changing environment, let me share with you some guesses, and where I believe the future challenges and opportunities lie for the financial services industry. Without a doubt, American Express has an important vested interest in these developments, since we are an active participant and a partner with the banking community.

To begin with, it seems clear that the inflationary and earnings pressures which propelled financial institutions to fish in each other's waters will not abate. In addition, the regulatory agencies will continue to relax some of the traditional constraints on financial services. Thus, the trend towards increasing competition between traditional and non-traditional financial institutions will accelerate in the eighties. This will bring less distinction between type of institution and greater diversity of choice for the consumer.

Specifically, it seems likely on the legislative front, that Congress will authorize nationwide NOW accounts, which are a form of interest-bearing checking account. There probably will be a gradual phase-out within the next five years, perhaps sooner, of interest rate ceilings payable by banks and savings institutions.

Tougher Competitions

The McFadden Act, which limits major financial institutions to a presence in only one state, may well be liberalized to permit electronic terminals, such as Automated Teller Machines, to span state lines. (Incidentally, California has already spawned a generation tied to ATMs.) However, despite the current mood which favors

deregulation, true national branching is highly doubtful, although bi-lateral branching between states may occur, as you in California well know.

What is obvious, however, is that the banking environment will be characterized by tough competition and an escalating use of new marketing techniques to lure the increasingly bewildered and inflation-conscious consumer. Financial institutions will have to become more sophisticated in the uses of market analysis, better able to communicate in a straight-forward fashion, and above all, they must learn to offer what the consumer needs and wants rather than what is simply technologically more efficient.

While increased competition may produce sleepless nights for some within the industry, I believe it will not only benefit the consumer, but will force the industry to respond more flexibly to the multi-optioned society of the eighties. The race will be on for more cost-effective, convenient, and reliable products and services. Technology holds many promises, provided it is applied wisely.

Refinements of Applications

Many of the great technological leaps envisioned for the eighties are already here. So, as far as financial institutions are concerned in this decade, I foresee a period of innovation through application refinement rather than through technological discovery. These refinements will often perform the same functions that exist today, but they will be faster, better and more tailored to serving real consumer wants. Indeed technology can be used to offer new product features, which are then differentiated in the marketplace by highly reliable standards of service and consumer responsiveness, like Travelers Cheque refunds.

In the area of charge cards, technology will probably not change significantly, although new applications are on the horizon. For example, plastic cards are now being used as a "key" to hotel rooms and businesses. Telephones or cars could also be accessed by plastic. We and others are experimenting with marrying microprocessor chips to plastic. This, of course, could transform the card instrument into a personal traveling data-base or true electronic money.

Upgrading of Applications

Often, however, the pragmatic approach will not lead to the elimination of established, working payment systems, but to their improvement and upgrading through new technologies. For example, the Travelers Cheque, invented by American Express in 1891, is just as useful to travelers today as it was 90 years ago. The product is unchanged, but the global infrastructure that services it is infinitely superior because of electronic technology. While 20 years ago experts told us that the charge card would doom the travelers cheque to extinction, they were wrong. Business has never been better and is growing. It is our experience that new payments systems supplement existing systems. Each has its unique place: each serves different consumer needs. Each represents a discrete choice for the marketplace.

One of the reasons technology has not transformed the financial services industry and brought about the long-heralded cashless society, is because consumer habits change slowly unless there are real advantages. The consumer has been highly resistant to and suspicious of technology. And in my opinion, rightly so.

Fear of Loss of Financial Privacy

Consumers fear many aspects of Electronic Funds Transfer Systems. They fear the lack of permanent paper records, and the potential of fraud. They often object to the immediacy of the funds transfer, which denies them their "float". They prefer the human interaction to the impersonal one. Above all, of course, they fear the invasion of their financial privacy.

The growth of electronic technology during the eighties will only intensify concern over these issues. So, key questions facing members of the industry will be, how can business and government work with the consumer to make certain the rights and choices of the individual are protected? How can industry make certain that the consumer understands his rights, his options and the personal implications of using the services, such as revolving credit?

Quite frankly, we've come dangerously close, in recent years, to letting technology govern us. We have not paid enough attention to the issue of privacy, for instance. And certainly, a high-technology society can't be allowed to be a low-security society. Business is partly responsible for this concern because it failed to focus adequately on the possible dangers of technology.

A Debt of Gratitude

We owe a debt of gratitude to those consumer activitists who raised our consciousness and forced us to confront the issues.

Today, a tremendous challenge business and government face is to resist being totally beguiled by the apparent attractions of technology. Members of the financial industry can make a serious and costly mistake by prematurely committing themselves to systems which may not be acceptable to the consumer. Harnessing technology to the service and security needs of the consumer should be our goal. That will prove far tougher than refining the technology itself.

We believe some consumer fears about EFTS have merit. We also believe the implications of EFTS go far beyond our narrow interests as a company or even the interest of those in the payment systems business. We are talking about the individual's right to flexibility and choice, the right to access computer information about oneself and to correct misinformation. In short: the rights of an individual, as an individual, and the right to have an equal voice with the computer if problems arise.

That is why, in the past, we endorsed the general principles of laws enacted in 1978 which supported protection of consumers in EFTS transactions. And that is why we were a leader in promulgating a strict Privacy Code within our company, which we believe is a model within the industry.

An Evolutionary Process

Basically, it is the position of American Express that an evolutionary rather than a revolu-

(Please turn to page 22)

Computer Technology:

Directions in Investment Management

Gerald J. Moran, CFA
Vice President – Research
Scudder, Stevens and Clark
345 Park Ave.
New York, NY 10022

"The issue is finding a common language, to bridge the gap between the two professional jargons. In my experience the language that works best is not FORTRAN, BASIC, or APL. It is not any proprietary high-level language such as IDC's XSIM or the like. The language that works best is English."

Using all Kinds of Computers

We are a large investment counseling firm with ten offices across the country, and we have need for all kinds of computers. The mainframe or central data processing facility is primarily geared toward an extensive and centralized record-keeping operation. But mini, micro, and time sharing facilities focus more (but not exclusively) on analytical applications on-site in the various offices.

Personal Computers are Not the Answer

Within the context of having all these facilities available, I will now risk breaking the Code of the Range — that is, to speak what is seldom heard, a discouraging word:

PERSONAL COMPUTERS ARE NOT THE ANSWER.

Personal computers represent only a logical step in the technological evolution of the past quarter century. As such, their use is subject to many of the influences (positive and negative) that affect all traditional forms of computing in the investment business.

Lack of Easy-to-Use Programs

A recent article in the "New York Times" lamented that the advances in hardware and microprocessors have not been matched by the development of software or easy-to-use programs. Most investment professionals do not want to learn programming. Our experience in this has been that most of the pioneers in "personal computing" have had previous computer experience. For someone without any experience at all, we estimate that it takes about one month to get used to the hardware and general procedures and six to eight months to become comfortable with Apple or Tandy BASIC. I would contend moreover that this situation has been largely the case for a very long time in the general field of computer technology. What we are seeing with "personal computers" or microprocessors is in many ways merely a reflection or echo of the history of data processing itself.

Based on a talk at the Annual Financial Analyst Conference Federation Conference in Houston, Texas, April 1980

Exhibit 1

Prism Diverse

Source: Wilshire Associates

SECURITY	NO. OF SHARES (M)	PRICE	MARKET VALUE (M)	PERCENT OF PORT. MARKET VALUE
FOOD & BEVERAGE INDUSTRY:				
1/ Anheuser Busch Inc.	52	25.25	1,313	5.68
2/ Coca Cola Co.	28.5	42.38	1,208	5.22
3/ General Mills Inc.	40	26.50	1,060	4.58
4/ Pepsico Inc.	52	24.25	1,261	5.45
INDUSTRY TOTAL			4,842	20.93

SECURITY	FUNDAMENTAL SHORT BETA	PERCENT OF PORT. MARKET RISK	CONTRIB. TO S.E. OF 1% PURCHASE	CONTRIB. TO NON-MARKET RISK	PERCENT OF NON-MARKET RISK
1/	1.05	6.04	0.0894	1.34	14.85
2/	0.74	3.88	0.0506	0.70	7.78
3/	0.84	3.90	0.0343	0.41	4.52
4/	0.93	5.10	0.0708	1.03	11.46
I.T.	0.90	18.92		3.48	38.60

Lack of Imagination or Will

Since the advent of the IBM 360 series in the mid 1960's, the revolution in miniaturization, and the dramatic expansion of computing capacity, the challenge to the investment community has been that the technological capacity to do things is running far ahead of the investment community's will or imagination to do them.

It can be argued, however, that this gap is justified. After all, the real topic today is not "using personal computers" but attacking "investment problems in the most cost-effective and intelligent way possible." In many cases, this involves the use of a computer. I think that the main benefit of personal computers in the investment business today is that they are finally open-

ing up vistas to the investment professional that indeed had already been available to him for a long time.

Why not Take Advantage?

A fair question to raise is this: Why have we, as investment professionals, not taken greater advantage of what the computer has to offer up till this time? One of the reasons lies in one of the fundamentals of advancing technology itself — the tendency for greater and greater, narrower and narrower specialization.

The Tower of Babel Again

The problem is common to all businesses and professions. It is illustrated by the following conversation:

Portfolio Manager: "How can I get the analysts' latest available estimate for those companies in a specific portfolio?"

EDP Expert: "This can be done easily using 9600 bps multipoint digital line and synchronous data link control (SDLC) protocol under IBM's SNA using statistical multiplexers interfaced to front end processors operating under NCP and utilizing VTAM software on the mainframe."

Portfolio Manager: "Oh."

Some of you may have had a similar experience in listening to a hardware sales talk where, ostensibly, the purpose of the meeting was to talk about YOUR business needs.

Or the portfolio manager, not to be outdone, could counter with the following conversation:

Portfolio Manager: "What I am looking for is for the computer to isolate good growth stocks with improving ROA and stable real earnings not affected by FASB8 or FIFO related earnings overstatement."

EDP Expert: "Oh!"

To be fair to the EDP specialist, there are of course good reasons for his inability to understand what a "good growth stock" is, and the other technical terms used.

Failure in Communication

In any event what we have here is "a failure to communicate".

The issue is finding a common language, to bridge the gap between the two professional jargons. In my experience the language that works best is not FORTRAN, BASIC, or APL. It is not any proprietary high level language such as IDC's XSIM or the like.

The language that works best is English.

The Language that Should be Used is English

The problems endemic to the interrelation of investment professionals and data processing professionals can be greatly alleviated by mutual identification of the problem in the mother tongue. This should happen before each side lurches off into the jargon of his own respective trade. This problem may in one way be on the borderline of resolution with the advent of the personal computer. The user (the investment professional) and the program creator are one person. Thus, we hope, no more communication gap!

Unfortunately, there is a very real danger that we may not go in this direction. The dangers will lie not in the failures of personal computing, but in its successes — when the application is good enough to advance beyond the "personal" stage. Personal computing, as it grows, may exacerbate all the existing communications problems that plague users of more established computing vehicles. After all, there is nothing one can do on a personal computer that can't be done on other computers.

Portfolio Construction Techniques

Rather than dwell on potential problems, however, I think it would be appropriate now to look at the direction that computer technology is taking in the investment community.

Three areas, to me, have particular promise. They are (1) portfolio construction techniques, (2) graphics, and (3) data base access. See exhibit 1.

This is a sophisticated program (Wilshire) using modern portfolio theory. It shows the portfolio manager where he is making his bets — note the last column. That is, his portfolio is expected to perform like the S & P 500 adjusted for the portfolio Beta except for the effect of the "overweighting" in these stocks.

From a technical viewpoint, this and many reports like it are available using prepackaged programs that are called up with less than ten lines of instructions on a time sharing terminal. Instructions are all in English. An investment professional, who knows modern portfolio theory (MPT), can become conversant with the "language" in an hour's time. Report generation is either overnight or "real time" (loosely translated as "right away"), which costs four times as much. Typical of such reports are relatively high variable costs but low user time costs (compared to high speed batch processing on internal mainframes). There may or may not be a subscription fee.

Modern Portfolio Theory

This is just one example of a modern portfolio theory application. Because of the substantial computations that MPT requires, it is always associated with the use of computers. Unfortunately, the converse is often the case as well. That is, the use of computers for investment purposes is often associated with MPT among those investment professionals who have little use for that particular theory (reflecting conclusions that this theory prompted back in its more naive days),

an unfortunate confusion that has impeded the professional use of the computer on all levels.

Large, number-crunching programs do not always have MPT theories supporting them. See exhibit 2.

This is part of page two of four summary pages in a program developed at Scudder that entails over hundreds of thousands of calculations per portfolio. It is designed to show the fundamental characteristics of a portfolio in much the same way that an analyst would like to dissect a conglomerate into its component parts. This is the S & P 500 portfolio.

Another example is exhibit 3. It enables one to see, for example, the price to book ratio for a stock, an industry and a group of industries, within a portfolio as well as for the portfolio as a whole. Similarly with return on equity and the historical variablilty of return on equity.

Graphics

An area that is literally exploding is the matter of computer graphics. The examples of the next few exhibits come from a Time Sharing Resources presentation at a New York Society five-part seminar, "Computerized Tools Available for Investment Analysis."

Exhibit 4 cites the advantages of computerized graphics over manual. Many are willing to concede these advantages; it's just that they don't know where to start. In addition, investment professionals typically don't use a lot of graphic material primarily because it's so time consuming, often involves one or two people (thereby opening the way for communications breakdowns), and because it takes so long and cannot be changed easily, it is not particularly helpful in formulating one's own ideas.

Exhibit 2

Portfolio Characteristics

Source: Scudder, Stevens, and Clark

	% OF EARNS. GROWTH IN YRS. 5	10	% OF RET. ON EQUITY	STD. DEV. 10 YRS.	% OF REINVEST. RATE
CONSUMER					
Cosmetics & Toiletries	11.1	9.2	19.1	2.0	48.5
Drugs, Hospital Supplies	12.1	13.0	18.2	.6	60.9
Food, Beverage	10.7	10.4	14.9	.7	59.7
(28 lines omitted)					
UTILITIES & TRANSPORTATION					
Public Util.: Communicat.	8.9	7.1	11.4	1.2	40.2
Public Util.: Electric	2.7	2.7	10.9	.4	31.0
Public Util.: Gas	8.5	8.7	14.2	1.2	54.9
Transportation	18.0	12.8	8.8	2.7	67.2
TOTAL	7.9	6.3	11.1	1.0	42.8
GRAND TOTAL	9.1	9.5	13.0	1.4	58.4

% OF IMPLIED GROWTH	% OF IND. TOT. RETURN	HIST. REL. P/E HIGH	LOW	REL. P/E 1979	10% PV TERM. YIELD REC.
9.2	15.6	208	165	110	8.0
11.0	14.9	200	171	155	4.1
8.8	15.2	118	102	96	7.1
(28 lines omitted)					
4.5	14.9	85	84	83	11.4
3.3	16.4	83	77	77	16.9
7.8	14.4	74	67	99	7.5
5.9	11.0	111	86	96	4.2
4.7	14.3	85	79	85	10.5
7.5	13.5	108	91	95	6.1

Exhibit 3

Portfolio Characteristics

	PRICE 2/80	BOOK VALUE	% OF RET. ON EQUITY	STD. DEV. 10 YRS.
CONSUMER				
Cosmetics & Toiletries	800	394	20.9	2.0
Drugs, Hospital Supplies	5,620	2,374	17.9	.6
Food, Beverage	4,230	3,044	15.7	.7
Household Products	1,450	1,141	14.2	.8
Merchandising	2,640	2,823	13.0	1.0
Recreation & Service	2,820	1,758	15.4	1.0
TOTAL	17,560	11,533	15.4	.6

Presentation, Analysis, Hardware

Because computer graphics are quick and accurate, they are appropriate for both presentation and analysis.

Hardware is not a problem: see exhibit 5. Terminals lease for less than $150/month; alternatively, there are systems offering multicolor pen plotters in either the users' office or in that of the software supplier. High speed cathode ray tubes (a TV set, for instance) can display multicolor graphic displays.

Exhibit 4

A Comparison of

Manual vs. Computer Graphics

MANUAL GRAPHICS

- — Time consuming
- — Error prone
- — Appropriate for presentation only — not analysis

COMPUTER GRAPHICS

- — Quick, procedural
- — Accurate
- — Appropriate for both presentation and analysis

Exhibit 5

Hardware is Not a Problem

- — "Diablo" wheel terminals — serve a dual purpose
- — Reasonably priced pen plotters — extensive capabilities
- — High speed CRT's — multi-colored graphic displays
- — Local pen plotting service

In exhibit 6 is a simple example. The approach to answering the question noted is probably a direct function of a computer graphics capability that is quick and simple. See exhibit 7.

This shows just how quick and simple it is. The mode is conversational; the underlined areas indicate the answers.

Exhibit 8 carries out a similar set of instructions. It takes a few hours to get comfortable with the system but answering the questions takes a few minutes.

The result is that Lilly and Merck stand out as spending much more on R & D per dollar of sales. Conversely, American Home Products and Warner Lambert stand out as spending much less on R & D than others. The same presentation can be produced on a pen plotter.

Pen plotters are available on-site and off-site via time sharing services linked to large systems, and on-site as attachments to very small computers.

Data Bases

The third area I would like to talk about is data bases or accessing information on file in computer-readable form. See exhibit 9.

A substantial data collection job is involved in building these data banks or files of information. It is questionable wisdom to try to replicate them in-house. Typically, syndicated data banks are quite good for frequently traded equities; their applicability to less frequently traded items such as preferred stocks and some bonds depends on the specific program usage.

Exhibit 6

A Question and Answer

QUESTION: In 1978, were expenditures for R & D by the top 7 drug companies consistent with their relative shares of the market?

APPROACH: Produce two side-by-side pie charts: one showing the breakdown of R & D; the other, the breakdown in net sales.

Exhibit 7

Solution

```
Graph, bar chart, or pie chart (GBP)? P
What is fixed? Time, company, or variable (TCV)?
                                        T
Enter time period: 78

*Pie specifications*

What is fixed for pie no. 1? (VC)?      V
Enter variable: RANDD
Enter ticker symbols: AHP:BMY:LLY:MRK:PFE:SQB:WLA::
Show value or PCT of total (VP)?        P

*Enter pie title (end when complete)*
Enter: RESEARCH AND DEVELOPMENT:INDUSTRY BREAK-
       DOWN:

What is fixed for pie no. 2? (VC)?      V
Enter variable: SALES
Enter ticker symbols:  S
Show value or PCT of total (VP)?        P
*Enter pie title (end when complete)*
Enter: NET SALES:INDUSTRY BREAKDOWN:
```

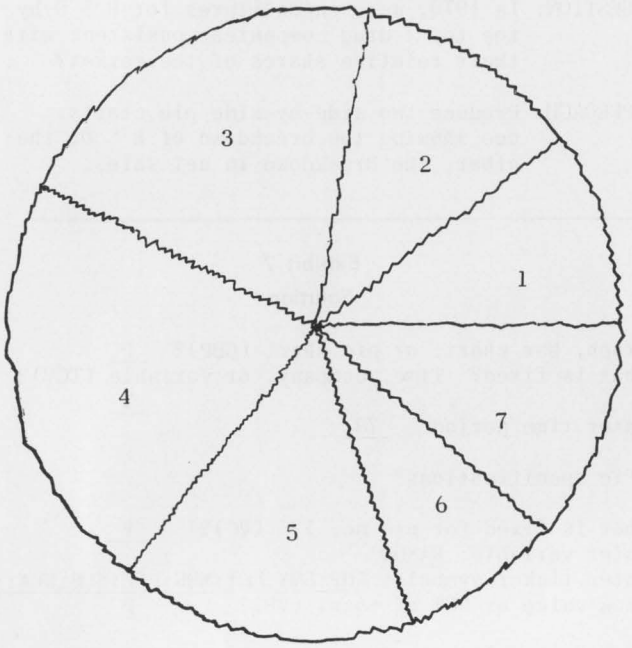
In exhibit 10 we look at the volume of data available to the investment professional on a selective basis. We have to be impressed at its sheer size. Value Line and Compustat are essentially competitive services. FDIC refers to information on 14,000 banks; IBES refers to a systematic array of current brokerage earnings estimates.

This is an Interactive Data Corporation chart; IDC is a large, multi-purpose time sharing operation. Data Resources, Automatic Data Processing and Service Bureau Corporation are also firms in the major league in this area. There are many others.

What is of particular interest today, I think, is the proliferation of very specific data bases maintained by others that are accessible to us in the investment business. For example, I.P. Sharpe offers the "Form 41 Data Base," which is constructed from Form 41 reports submitted to the Civil Aeronautics Board — the data is comprised of balance sheet, expense, revenues, and traffic statistics by aircraft type, type of service, and by airport for over 60 carrier entities. In all, there are about one million time series associated with the data base. Of course, using this little known base of information is not everyone's cup

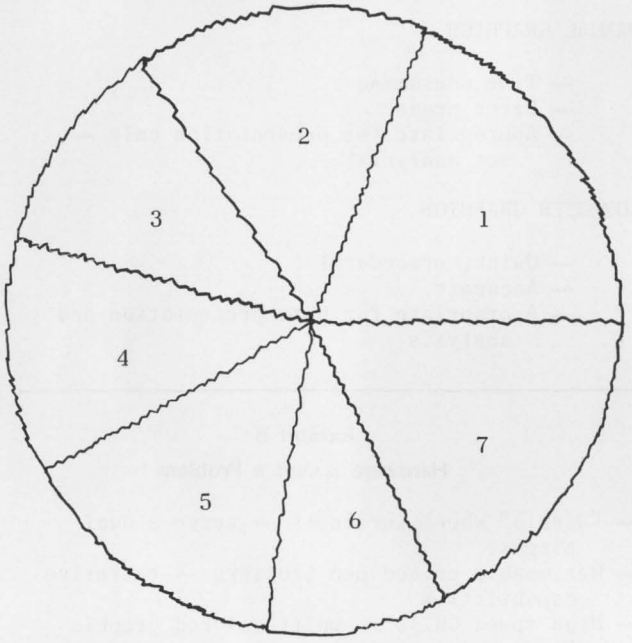
Exhibit 8

Research and Development
Industry Breakdown



1.	American Home Products Corp.	10%
2.	Bristol-Myers Co.	12%
3.	Lilly (Eli) & Co.	20%
4.	Merck & Co.	22%
5.	Pfizer, Inc.	15%
6.	Squibb Corp.	8%
7.	Warner-Lambert Co.	12%

Net Sales
Industry Breakdown



1.	American Home Products Corp.	19%
2.	Bristol-Myers Co.	15%
3.	Lilly (Eli) & Co.	12%
4.	Merck & Co.	12%
5.	Pfizer, Inc.	15%
6.	Squibb Corp.	9%
7.	Warner-Lambert Co.	18%

Exhibit 9

Interactive Data Corporation
Databases

TECHNICAL

Security Master	— Descriptive items for 42,000 securities, indices, options, interest rate futures
Prices	— Daily price, earnings, dividend items for 12,000 securities
Split & Dividend	— Stock split, cash and stock dividends for 12,000 equities
Monthly/ Quarterly	— EPS, short interest, inside transactions on NYSE and AMEX equities, rights, warrants, REITS
Masterpiece	— Weekly price and dividend items for 22,500 unlisted equities, bonds, municipals
Municipal Bond	— Daily valuations and descriptive information for more than 1.1 million municipals
International Securities	— Descriptive, dividend, and capital items for 14,000 securities in U.K., Europe, Asia, South America, and Australia

Exhibit 10

Data Base Sources

FUNDAMENTAL

Value Line
- — Industrial
- — Financial
- — Business line

Exstat
- — Descriptive items for 2,000 international firms

FDIC

Compustat
- — Industrial
- — Utility
- — Business line

I/B/E/S

ECONOMIC

Chase Econometric Associates, Inc.
- — U.S. Financial
- — U.S. Macro
- — WPI, CPI
- — Industry models and databases

Dynamics Associates
- — Corporate planning
- — Software support

(please turn to page 21)

Sand, Glass, Quartz, and Silicon

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"Doorways keep opening for new and awesome uses for silicon — uses that seem to grow like sand dunes in the desert."

Spectacular advances in electronics have added new luster to silicon — one of nature's most commonplace elements. To meet today's needs, technology crafts silicon into forms that, for purity and precision, far outshine their lowly forebears.

In 1927, anyone with 40 cents could purchase from the U.S. Government Printing Office its 204-page Bulletin 266 entitled "Technology and Uses of Silica and Sand."

The publication noted, more prophetically than its author could have imagined, "probably no other nonmetallic mineral has more diversified uses and more value in the industry ... than silica in its numerous forms."

Abundance

One of Earth's most abundant elements, silicon is inexpensive and available almost anywhere. A principal constituent of sand, it was first used by man to make glass as far back as 6000 years ago. Actually, nature predated that breakthrough billions of years earlier by firing up volcanic furnaces to fuse sand and soda into obsidian, a natural glass.

However, the technology referred to when Bulletin 266 was issued did not begin until 1824, when a Swedish scientist first isolated silicon. At the time of the 1927 bulletin, silicon was of growing value in the chemical and construction industries, in pyrometallurgy and other sectors which drew on its particular qualities: hardness, refractoriness, and resistance to heat, weather and ordinary chemical action.

In those days no one could have foreseen that an infant industry - electronics - would elevate silicon to technological preeminence almost a quarter of a century later.

Skyrocketing Importance

Since the advent of the semiconductor, in fact, silicon has skyrocketed in importance. Today, it is the dominant substance in the production of microelectronic circuits. When using it as the base material in the manufacture of transistors, diodes and integrated circuits, the industry employs a silicon of low resistivity - a material essentially requiring moderate control of relatively large concentrations of impurities within it.

Based on an article in "Vectors" for Fall 1979, published by Hughes Aircraft Co., address above.

At the other end of the spectrum are the electro-optical grade silicons that give optical sensors the ability to detect that which is invisible to the naked eye. These substances have high resistivity and are of the highest purity consistently attainable in volume production for sensors. Such applications require materials of enormous sensitivity - even to invisible laser and infrared radiation.

"Intrinsic" Silicon

For instance, to detect radiation from lasers emitting in the near-infrared, the greater the silicon purity, the greater its sensitivity. The substance used in this application is called intrinsic silicon. For detector arrays sensing thermal radiation in the far-infrared, extrinsic silicon is utilized. Here, precise amounts of other materials, or dopants, are intermingled with the high purity silicon.

Both types of optical detector grade silicon, because of the rigorous demands for purity and precision, are related only in fundamental origin to their native mineralogical family, quartz and quartz minerals. Not surprisingly, the expertise for producing the quality and volume of silicon currently required for electro-optical, microwave and particle detecting devices didn't develop overnight.

The two most widely used processes are the Czochralski method for making, or growing, extrinsic silicon for infrared detectors and the so-called float zone method for growing the single-crystal, ultra-high purity intrinsic silicon used in production of laser detectors.

Float Zone Process

In the float zone process, a rod of high grade polycrystalline silicon - generally derived from quartzite - is placed in a vacuum chamber and positioned within a radio frequency heating coil. The lower end is heated to produce a hanging droplet of molten silicon.

Then a seed crystal is brought up from below and fused with the molten silicon. As seed and silicon rod are slowly lowered through the coil, a zone of molten silicon about 2 centimeters long is formed at the center of the coil. The polycrystalline silicon rod is fed into the molten zone from above, and the pure silicon crystal is formed below the zone as the seed is rotated and lowered. Most of the impurities are either retained in the molten zone or evaporated into the vacuum and removed.

(please turn to page 22)

The Automatic Prevention of Errors in Computer Applications: Algorithms

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"The knowledge of a trained, sensible, experienced clerk can be put into a computer."

Outline

Let us consider a business environment and examine the methods and precedures of a good trained clerk which he will use for preventing errors — errors in the calculations, reports, and records which he uses or produces.

The technique and the know-how to prevent errors comes from education, training, and experience. The kind of clerk whom we are contemplating has had:

a high school education
some ten years of experience in the operations of the business
a lot of practical knowledge of the real world
good judgment

How shall we imitate this paragon of virtue and talent in a computer program?

1. The Talents of a Good Clerk

The first ingredient is a gentle skepticism. Every piece of information, every item of data, which he takes in, reads, or considers bears a mental questionmark:

Is this correct?
How does it compare with what I would have expected?
What grounds do I have to believe it?

An innate capacity of every thinking animal, man, dog, cat, horse, tiger, ... is to compare what he (or she) perceives around him with some mental model (model inside the brain) of the environment, situation, and problem: is it food and shall I eat it? is it danger and shall I run or fight? ... For more than 600 million years evolution has been equipping animals with processing ability for solving the problems of survival. Most of the solving comes from instincts. Some of the solving comes from learned behavior. A few animals (man, chimpanzee, dolphin ...) add on a capacity for language and logic (we might call it the "new brain"). But it is the "old brain" which estimates and predicts from the mental model to such an extent that surviving becomes a good bet. And a good clerk makes use of his estimating and predicting capacity.

The second ingredient of a good clerk is a degree of patience. Perhaps not a very large amount of patience, because that interferes with getting the work out promptly. But enough patience to resist excessive speed and excessive pressure: "Haste makes waste."

The third ingredient of a good clerk is pride. He takes pride in his work. It saddens him to allow a mistake to get out to the outside world. When that happens, he thinks and thinks about how that blemish on the record and reputation of Old Siwash Company could have been avoided, and is to be avoided in the future.

The fourth ingredient is carefulness. He is as a human being automatically careful. His habits produce that invariably. When he writes down a telephone number, he looks again to make sure that he has copied it correctly. He believes that no one can copy ten digits correctly the first time, in 100 cases out of 100. He believes that everyone, himself included, needs to look once more to verify the choice and sequence of the ten digits.

2. Estimating

Probably the most important of all the resources of a good clerk is estimating.

Estimating, according to the dictionary, means forming an idea of quantities without actually counting or measuring. It means fixing roughly or approximately the size or the cost or the worth or the magnitude or some other attribute of something or other.

We can extend the idea of estimating from numerical information to nonnumerical information, as for example when we see "hte" and guess that it means "the"; or we read "periodically", and realize from the context that it must mean "aperiodically" ("from time to time") based on on the logic of what is being said.

3. The Importance of Estimating

Estimating is an important process, for over and over again, the result of estimating is essential for answering questions, making decisions, and correcting information that looks peculiar, odd, unreasonable. The trained, sensible, experienced clerk forms a guess in his mind, with which to compare the reported figure or answer which he is offered, either by another clerk or by a computer.

4. How to Estimate

Estimating is regularly made up of two processes, separate and distinct:

1. Gathering at least some information or data to base the estimate on: observations, facts, statistics, reasonable assumptions, etc.
2. Combining that information (using reasoning, arithmetic, logic, probability, etc.) so as to construct the estimated value that can be compared with the value provided by input, file, computing, etc.

5. Reference to Tables

The knowledge of a trained, sensible, experienced clerk can be put into a computer, into a database (new name), files and tables (old name). Rapid access methods devised by quantities of hard programming work are becoming widely available; this enables rapid associative memory to be realized with a good computer, not only with a good clerk.

So the items of information such as the speed of a fast train and the existence of the word "Washington" can be practically stored within a computer and referred to in tables (old name), databases (new name).

What then are some of the algorithms which we can list and illustrate for the automatic prevention of errors?

6. Algorithms That Will Prevent Errors

Some of the algorithms that will prevent errors automatically, given databases to refer to, are listed in Table 1.

Table 1

SOME ALGORITHMS THAT WILL PREVENT ERRORS

Number	Name
1	Comparison with an Estimate
2	Comparison with Two or More Sources
3	Comparison from Tables
4	Checking to Exclude Duplication
5	Checking for Outside of Range
6	Checking for Incorrect Spelling
7	Checking for Mathematical Inconsistency
8	Checking for Great Improbability
9	Checking for Incomplete Classification
10	Checking for Conflicting Classification

I'VE COMPUTED THE GROSS NATIONAL PRODUCT AND IT'S EITHER PLUS THREE TRILLION OR MINUS 600 BILLION GIVE OR TAKE A BILLION.

Naturally, for a number of these algorithms, some calculations will also be necessary.

Both these processes are shown in the following problem:

How far is it from New York to Boston?

And some friend says: Oh, it takes about four hours on a fast train. We find out or we remember or we already know that a fast train travels about 50 miles an hour. So with two items of information, and one multiplication (4 times 50) we have an estimate, 200 miles. Checking in an almanac, we find the airline distance is 188 miles, and checking with a road map, we find the motoring distance is 209 miles. The estimate is very satisfactory: many kinds of decisions can be made using the estimate.

Again, both these processes are shown in the following problem:

Is the address "815 Washigton St." correct?

The word "Washington" occurs 98 times per million words according to a standard reference of word frequency /1/. The word "Washigton" does not exist. With great probability in our favor, we "correct" the spelling of the street name to read "Washington". As for the "815", we have at

this moment no information, beyond that it is a reasonable number for a street address; but if the number were 657342 instead, it would be close to unbelievable as a street number.

7. Comparison with an Estimate

An effective calculating procedure (algorithm) for dealing with a great many proffered results from a computer or from a clerk, from a doctor's bill or a real estate tax bill, is the following:

1. Look at the figure.
2. Compute or guess an estimate of it.
3. If they agree within 10%, accept the figure.
4. If not, challenge the figure.

There are a number of good ways to produce an estimate using only arithmetic of one significant figure (or at most two). For example, to add a large number of figures, count them and multiply by the typical or average figure. To integrate a function y in the interval from x = a to x = b, choose a typical value of y and multiply by b-a. To find the derivative of y at a point x, choose a small number h, and find the result of dividing (y at x + h minus y at x - h) by 2h. There are many good formulas which can give rough approximations. They can be used by a clerk or by a computer. Why not put them in the data base, and use them when desirable?

8. Comparison with Two or More Sources

Another algorithm for preventing errors is:

1. Look at the figure produced by the computer.
2. Find the value of that figure shown in one or more tables.
3. Determine a tolerance.
4. If they agree within the specified tolerance, accept the figure.
5. If not, challenge the figure.

9. Comparison with Tables

A limited but probably useful way of correlating zip codes with states is shown in Table 2, "First Digit of Zip Code". A quick comparison of the first digit of the zip code with the information in this table might well cut down materially delays in mail delivery from wrong zip codes.

Table 2

FIRST DIGIT OF ZIP CODES

First Digit	State
0	CT ME MA NH NJ PR RI VT VI
1	DE NY PA
2	DC MD NC SC VA WV
3	AL FL GA MS TN
4	IN KY MI OH
5	IA MN MT ND SD WI
6	IL KS MO NE
7	AR LA OK TX
8	AZ CO ID NV NM UT WY
9	AK CA HI OR WA

This illustrates a partial check of a quite elementary situation in the real world, so as to prevent errors automatically. There could be a 100 (perhaps even 500) checks, partially or completely, of the information contained in an item of data. In terms of computer operations, with a million per second, it should not be very difficult to compute a character which reported "this is verified" and attach that to a figure or a string. This is simply a computer equivalent of the centered dot, which I used for a dozen years in the manual actuarial calculations that I performed year after year in the life insurance companies where I worked 1930 to 1944. The set of checks of information input from the real world might even change the reputation of computing, from giving wrong results often to giving wrong results never.

10. Checking to Exclude Duplication

Probably one of the most irritating wastes of advertising through the mail is the mail addressed by computer which duplicates other mail. I wish I had the money including the postage for the cost of the "junk mail" for each of the pieces I received during the past year, which was a duplication. I think I would be $200 ahead.

To exclude duplication of the records of individuals in a mailing list or a prospect list is a problem for which software packages have been offered. What I have seen is an offer to pass a list of names and addresses through the package at so many cents per name and address; the cost has seemed high. But it ought to be possible to eliminate a great many duplications at quite a low cost, using a simple algorithm, such as the following:

1. Are the zip codes the same? If no, stop.
2. Are the last names the same?
   If yes, continue.
   If almost the same, continue.
   If no, stop.
3. Are the first and middle names or initials the same?
   If yes, delete one record.
   If almost the same, continue.
   If no, stop.
4. Is the street address the same?
   If yes, delete one record.
   If almost the same, delete one record.
   If no, stop.

How is a computer to apply "almost the same"? In the same way as a trained, sensible, experienced clerk does!

For example, consider two names and addresses:

Lawrence M. Clark, 835 Edmands Rd, Framingham, MA, 01701
Laurence Clarke, 833 Edmunds Road, Framingham Centre, MA 01701

The clerk will look at these two names and addresses, and he will decide at once that they are the same person, who should be in the mailing list exactly once. Which of the records will he choose? He will lean towards accepting

the first one and throwing out the second, because: "Lawrence" is commoner than "Laurence"; the middle initial "M" suggests a bit more accuracy; and since the zip code is exactly the same, "Framingham" is adequate even if "Framingham Centre" might be more correct.

The knowledge of the "trained, sensible, and experienced" clerk can be embodied in tables, databases, rules, and algorithms. It is not magic nor supernatural.

11. Checking for Outside of Range

It is remarkable how much general knowledge a trained, sensible, and experienced clerk gathers about the possible values of variables which he deals with in business and clerical operations.

In Table 3 are some samples of impossible values of variables.

Table 3

SOME IMPOSSIBLE VALUES OF VARIABLES

John Jones walked 9 miles in the next half hour.
The airplane crashed 3 times in April and twice in May.
Sam Smith died on March 18 and again on August 2.
The tallest skyscraper in New York has 150 floors, and the smallest has 3.
The airline distance between Tokyo and Osaka is 5100 miles.
The supertanker Ave Maria is 200 feet long.
The mass circulation magazine Hottest Lines has an annual subscription price of $1300.

Although it may appear as if the knowledge of the extremes of variables is too vast to put into a computer, this is not true. Every application of a computer deals with a limited context, and this implies a limited number of variables. Practically, many business problems will deal with 150 up to 600 variables at the most. If these variables are numerical, maximum and minimum values can be rather easily determined from general knowledge and common sense. If these variables are conditions, usually only 2 values, yes or no, true or false, etc., are likely to be needed. Sometimes three values may be needed, like "the same, almost the same, different". If these variables are strings, then general knowledge and common sense can often set minimum and maximum numbers of characters for these strings, and often set other conditions as well that may help to prevent "outside of range" errors.

The algorithm is simple:

1. Is it less than the maximum?
   If yes, continue.
   If no, report error.
2. Is it greater than the minimum?
   If yes, accept.
   If no, report error.

12. Checking for Incorrect Spelling

With the development of word processing, the decline of spelling contests, and the production of more and more poor spellers from the school system for various causes, it becomes easier and more "modern" to produce accurately spelled words from a computer. Even many good secretaries cannot spell nowadays, using recorded dictation, especially when two words sound alike and can both be used in the same context. I remember having an excellent transcriber of my dictation, who always replaced "in lieu of" by the phrase "in view of". (Perhaps it was my fault for not pronouncing the phrase well enough in dictating to the machine.)

There are two main situations. One occurs when there is no doubt of the word even if spelled in many different ways. Examples which I have seen in print (because they escaped the proofreader) are "vocabularly" for "vocabulary", "commerical" for "commercial", "recieve" for "receive", "neccessary" for "necessary", and so on.

This algorithm can be handled by lookup in a table in which an incorrect spelling X is paired with a correct spelling Y. A table of 2000 "spelling demons" could make a striking percentage improvement in the text finally typed by computerized word processing machines.

The second situation is where a designation of meaning or of syntax or both is required in order that the correct spelling be produced. Examples are: "forward" confused with "foreword" which leads to a hybrid spelling "foreward" (I have seen this misspelling often in the writing of the head of a certain computer network); "affect" confused with "effect"; "better" confused with "beta"; "picture" confused with "pitcher"; and so on.

This situation cannot be handled without tags placed on words so that they can be selected by a computer algorithm that pays attention to the tag of meaning or syntax or both. The person typing on a word processing machine would be able to write if he wishes "foreward (meaning preface)" or "foreward (meaning advance)"; then the computer could take over, look up the word X1 and tag X2, and find in the table the appropriate Y.

13. Checking for Mathematical Consistency

What do we mean by mathematical inconsistency as it relates to computation and procedures in business and in industry? And how is this different from some topics that we have already treated, under the headings of: comparison with estimates; comparison with tables; checking for outside of range?

These topics of course are cases of mathematical inconsistency. But there are other kinds of cases besides.

Example: A life insurance company often issues a "rate book", consisting of many tables, one for each age from 20 to 65 of an insured, and showing for each age the guaranteed values of an insurance policy (cash value, paid up insurance value, and period of term insurance) for each duration from 3 years to 20 years, and thereafter at five year intervals. These tables are presented for each of the plans, ordinary

life, endowment, term, etc. The rate book is fat and heavy even when printed on excellent thin paper. Problem: Are those values correct?

The values may have been correct when they went to the printer. But they may not be now: accidents happen; figures may be illegible; etc. One of my jobs in the years 1930 to 1934 was proofreading ratebooks. My instructions were: read down the columns; subtract mentally the upper figure from the lower one; did the differences progress smoothly? About once every two hours I caught an error. Did I catch all the errors? I hope so.

This is an interesting example of what the mathematicians call monotonic functions, variables that change always in one direction, always increasing or always decreasing.

In order to put this process into a computer program, let us assume that we have an optical character reader which can read the figures in the columns of the ratebook. Clearly the human clerk will be inaccurate but the optical character reader should be accurate. Then the algorithm to be used is simple:

1. Read the figure
2. Read the next figure
3. Subtract item 1 from item 2, obtaining a difference, item 3.
4. Pick up the last difference, the previous item 3.
5. Is item 3 close to item 4?
   If yes, continue
   If no, report error
6. Repeat for the next figure down the column.

And in general, wherever a trained, sensible, experienced clerk can perform an operation of checking on the consistency of mathematical operations, so can a computer.

14. Checking for Great Improbability

There is a difference between impossibility and great improbability, although sometimes the borderland in between is obscure. We may believe for example that certain last names of individuals are impossible, like 1101; recently however a man went to court to ask the judge to change his name to 1101 (if I remember that figure), and the judge refused. But hunting in the New York Manhattan directory for 1979-80 I found the following last names of individuals:

No	Wrong	Void
May	Hurry	Fatal
But	By	From

But I did not find any individual whose last name was either And or Or.

Whenever the value of a variable (such as the last name of an individual) may appear to be so unusual and odd that it obviously can be questioned, there should be a character in the regular computer designation of the value, which in effect notifies the observer "sic", meaning "this is the way it is; it has been verified a second time".

15. Checking for Incomplete Classification

Suppose that there are 4 classifications or conditions, a, b, c, and d. Then there is a total of 16 possibilities, as shown in Table 4.

Table 4

FOUR CLASSIFICATIONS

a	b	c	d	a	b	c	d
0	0	0	0	1	0	0	0
0	0	0	1	1	0	0	1
0	0	1	0	1	0	1	0
0	0	1	1	1	0	1	1
0	1	0	0	1	1	0	0
0	1	0	1	1	1	0	1
0	1	1	0	1	1	1	0
0	1	1	1	1	1	1	1

In this table 0 represents the condition absent or false and 1 represents the condition present or true.

Regularly every statement regarding conditions that occurs in procedures or rules covering cases or instances is a statement in which "all" or "no" occurs or is implied. Such a statement can be checked off using Table 4 of all possible cases to determine its effect. For example, "There are no cases both b and c." Then the last two lines (four cases) of Table 4 designate an empty class, and only 12 cases to be covered remain.

A graphic way of showing the same situation is shown in Diagram 1. And "there are no cases both b and c" is depicted by shading the area that is common to both b and c.

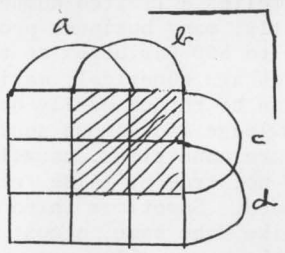

Diagram 1 – Four conditions; a, b, c, d

All this is simple algebra of logic or Boolean Algebra, and there are many algorithms for making sure systematically that all the cases that ought to be covered are covered. But it remains simple only when the number of conditions is small: 4 producing 16 cases; 5 producing 32 cases; 6 producing 64 cases. A few more conditions, such as 10, produce 1024 cases; that is not simple.

Some of the errors in computer applications come from insufficient analysis of situations. In a famous lawsuit Willie and Mary Craft in Memphis, Tennessee, sued the Memphis Light,

Gas, and Water Division, for lack of recognition by the computer system as programmed for their situation. They had bought the other half of their building and the city had physically combined their meters; but the computer program repeatedly cut off their services and could not take into account the joining of the meters. The case went to the Supreme Court, and the Court required a city owned public utility to provide human listeners to complaints from persons serviced, and human adjustments.

Checking for conflicting classifications is almost the same as checking for incomplete classification. In both cases Boolean Algebra provides methods and procedures.

16. Conclusions

Two conclusions are I believe demonstrated from the discussion in this article. These are that:

1. The knowledge and the procedures of a trained, sensible, and experienced clerk are very largely programmable.

2. Many algorithms can be applied to the variables of business and industry so as to obtain to a large degree automatic prevention of errors.

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Moran - *Continued from page 14*

of tea. But I mention it as illustrative of the concept — if a need exists for quantifiable information, there is probably a time sharing data bank around that is accessible to you.

Perhaps as interesting as the matter of data banks are the nonquantitative types, such as the Information Bank. In this service, 50 people write summaries of 900 articles daily. Articles can be accessed by subject matter and date. There are 23,000 key words for cross-referencing. Thus, a user can inquire about everything Carter or Khomeini has said about energy from January 1, 1978 through May 5, 1980. Fifty-three publications are screened and there are 900,000 articles on file. The emphasis of this type of service has reoriented itself in the past few years away from the universities, for which they were originally designed, to business and finance because of the money crunch in our higher education system. Costs appear high at $110/hour, but its sponsors talk about 15 minutes in a skilled researcher's hands as being worth five to six days of conventional research in a library.

Integrating Available Resources

The real payoff in the effective use of computing power by the investment professional is combining the strengths of the various sources available — outside data banks, graphic peripherals, in-house mainframes, minis and micros — to bring an investment firm's proprietary information together with information that is maintained by others.

This is the same problem that is being faced by personal computing, and it is spawning an entire industry which is developing software packages in order to make the personal computing environment more "user friendly." You will hear that term being used by EDP personnel in the future. I think significant strides have already been taken toward this goal in the time sharing mode, and I hope that, as in industry, we don't spend a lot of time reinventing the wheel with the new low-priced computers.

This type of integration is available now on many time sharing systems. One might say that most future developments in personal computing will move toward selective adaptation of what is already available, but will involve customizing and economizing — that is, making things more accessible and feasible.

Conclusions

In closing, three points should be emphasized:

1. Personal computers are not brand new, but a logical extension of technological trends of the past two decades. Their usage will face many of the same problems and opportunities that we have come to know in traditional data processing.

2. Substantial computer resources are available to the investment professional now. We probably don't sufficiently take advantage of them.

3. Personal computing, however one defines it, is either here or is definitely coming for the investment professional. I foresee that its major contribution will not be that it provides a "better Beta" or pretty histograms, but that its ease of use and general availability will help the investment manager to crystallize his own thinking and get more involved in defining how this revolution in technology can better serve his needs for information.

Our situation now is analogous to the story of the aging Justice Holmes on a train between New York and Washington. The conductor came up and asked for his ticket. The elderly gentleman fumbled around in his pockets. The conductor recognized him and reassured him that he know he had purchased the ticket and not to trouble himself. The Justice looked up and said "I know that; I need the ticket to find out what direction I'm heading!" According to one of the Peter principles, If you don't know where you are heading, you may wind up someplace else. □

Kristinat - *Continued from page 15*

This zone refining process may be repeated up to seven times in order to grow dislocation-free crystals so pure they contain only 10 to 20 boron atoms for each trillion silicon atoms.

The resulting cylindrical bars, or boules, then can be sliced, lapped, etched and polished into double-sided wafers up to 3 inches in diameter and with tolerances as precise as 0.00025 inch.

The high resistivity of this intrinsic silicon, up to 30,000 ohm-cm, is derived by bona fide purity - rather than by compensation, in which impurities carrying a positive electrical charge are evenly balanced against those carrying a negative charge. Hence, there is less redistribution of impurities during vacuum float zone processing and greater consistency from boule to boule.

"Extrinsic" Silicon: Czochralski Process

In the Czochralski method of growing single-crystal extrinsic silicon, precise numbers of indium or gallium atoms are mixed with high purity polycrystalline silicon and then melted by resistance heating in a crucible placed within a protective argon atmosphere.

A seed crystal is dipped into the molten silicon. The seed and the melt usually are rotated in opposite directions. When the seed has grown to the desired diameter - a factor regulated by precision control of temperature - it is withdrawn from the melt, using carefully controlled pulling rates.

The resulting extrinsic silicon crystals are then sliced and used in manufacture of detector arrays so sensitive to thermal radiation that they require no illumination to "paint" a visible image of a scene enveloped in darkness or haze or smoke.

Hughes Aircraft Company possesses the only facility in the U.S. that is volume producing electro-optical grade silicon for detectors; it has also pioneered such silicon advances as ion implantation, complex monolithic structures and high resolution projection mask alignment. The Hughes uncompensated, high resistivity silicons contain as little as 0.001 percent of the impurities found in silicon used to fabricate typical integrated circuits. The company's intrinsic silicon diode detectors, single-element devices and multi-element arrays are used in missile guidance and fiber optic communications, laser range finders and laser-designated target tracking systems, optical fuses, star sensors and satellite mapping systems.

Uses of Silicon Spread and Spread

One October day in 1919, some eight years before Bulletin 266 was published, Dr. Rudolf Wegscheider scored an academic "first" when he introduced the physiochemistry of silicon as a lecture topic at the University of Vienna. Dr. Wegscheider no doubt sensed the far-reaching potential for silicon. But he told his class he did not wish to be remembered as having opened a new doorway for the scientific community but rather as having offered further proof of the biblical observation, "There is no new thing under the sun."

Perhaps Dr. Wegscheider's perspective was on target. But the doorways keep opening on new and awesome uses for this abundant and widespread element - uses that seem to grow like sand dunes in the desert. □

Robinson - *Continued from page 9*

tionary EFTS-development process will lead to the greatest benefit for the consumer and those industries which employ it.

At this moment, the Carter Administration and various members of Congress are sending to Congress legislative proposals which deal with various aspects of privacy. We endorse privacy legislation for financial institutions and will support whichever bill balances the legitimate rights of people to privacy with the needs of companies to do business.

In summary, I do not believe the cashless society is immediately at hand because it does not reflect the public's deepest wish. Instead, in terms of payment systems, individuals will want more options, not less.

People Want to Control Their Money

It is perfectly clear that people want to control their money, their float, their choice, and that no single system or payment instrument will satisfy their multiple activities and lifestyles. The consumer is smarter about money than ever before and growing more sophisticated. He or she wants the best of both worlds — the advantages of technology coupled with a variety of personalized services. It is our duty to provide it.

Total automation and dehumanization of financial services will not occur in the eighties. Perhaps it never will. However, the coming decade will bring, to all of us, the opportunity to seize control of our electronic destiny. Let us blindfold "Big Brother" in this electronic age. Let us protect the individual's right to privacy, and embrace the multiple-choice society. Let us do so, promptly and wisely. □

CACBOL - *Continued from page 3*

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(Source: prior issues of "Computers and People" formerly "Computers and Automation," published by Berkeley Enterprises, Inc., 815 Washington St., Newtonville, Mass. 02160, (617) 332-5453) □

Computing and Data Processing Newsletter

COMPUTERIZED WAREHOUSING SAVES ENERGY, LABOR, LAND, AND INCREASES PRODUCTIVITY

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Automating and computerizing a five-story warehouse is saving energy, labor and land for Hoechst-Roussel Pharmaceuticals, Inc., a subsidiary of American Hoechst Corporation. In addition, the automated warehouse provides better inventory control, improved security and a faster retrieval system.

Energy is saved because little or no heat, air conditioning or lighting are needed since employees seldom have to work inside the structure. The costs of controlling temperatures in the 3.38 million cubic foot space represent significant savings, particularly as energy costs continue rising. One operator controls the entire operation through the computer. Materials enter the

Figure 2 - "Virtuoso of the Pallets Single-Handedly Operates 5-Story Warehouse" At the computerized warehouse in Somerville, NJ, a single operator controls over 10,000 pallets from this control station. Pallet loads move on a conveyor. (See the right side of this photo.) A computer cathode ray tube display (in front of the operator) provides immediate information on pallets. A TV screen (to left of the CRT) shows the operator various views of the entire automated warehouse. Figure 1 is the front cover of this issue of "Computers and People."

warehouse, are stored, and retrieved automatically. The technology here eliminates the need for forklift trucks.

Land is saved by using height to provide more space. The warehouse is 52,000 feet square, but 65 feet high. Computer-controlled stacker cranes lift pallets to the top racks which are 60 feet high. Since forklifts are not used, the aisles are narrower than usual. The warehouse uses one-third less land than a conventional warehouse. The computer "never forgets," and inventories are more efficiently controlled. Security is improved because workers seldom enter the storage area. Similarly, the computer sends the stacker cranes to the exact bin to retrieve materials more rapidly than possible in a conventional warehouse.

Because the company produces pharmaceuticals, storage of all materials must follow U.S. Food and Drug Administration regulations. They require that products awaiting Quality Control release be segregated from material approved by Quality Control. Usually this is done by using several separate areas, one for each category of product, requiring much space that is often unused. However, the FDA has approved the Hoechst-Roussel computerized system of random storage for all materials. This is believed to be the first random storage system allowed in the pharmaceutical industry. Approval was based on the extremely tight controls possible with the computer. Materials that have not been approved by the Quality Control Department cannot be removed from the system. Each pallet that enters the system is identified by a card produced by the computer. These cards are kept under lock and key by Quality Control personnel. Once the material is approved, Quality Control releases the card to the warehouse controller. Without the card, the pallet cannot be removed from its rack.

Raw materials and packaging materials enter the computerized system via the receiving area of the main production building. Each pallet moves along a roller conveyor. It is first inspected by a set of photo-electronic eyes that check all dimensions of the load. Then the pallet moves alongside the control center. There the operator types information identifying the load into the computer. The computer takes this identification and sends the pallet into the adjacent warehouse. Here the computer moves the pallet onto one of two computer-controlled stacker cranes. Following the computer's orders, the crane's microprocessor then places the pallet into the bin selected by the computer.

At this point, the crane's microprocessor reports to the computer that the pallet has been placed into the proper bin. Then the computer punches that information into the card and delivers the card through a slot to the operator. The same information is printed for Quality Control review. If the material has not been approved by Quality Control, the card is removed until approval. Only then is the card returned to the control operator. When the material is needed for production, the controller feeds the card into the computer. The computer sends the crane to retrieve the pallet and send it out to production. The same sequence applies to pharmaceutical products in bulk and to finished packages. Quality Control also governs the release of all untested products of this nature.

The control operator monitors the entire procedure through closed-circuit television, status lights, and printed messages from the computer. The computer itself constantly monitors the activity. It checks to make sure materials are not misplaced. If the computer "suspects" something is wrong, it stops all movements within the system and alerts the operator. The warehouse has eight storage aisles with eleven levels of racks capable of storing over 10,000 pallets. In the future, it is planned to add more racks to increase capacity to 14,500 pallets. Two computer-controlled stacker cranes now operate within the eight aisles. When the additional racks are added, one more crane will be used.

THE UNIFIED COMPUTER SYSTEM OF THE SOCIALIST COUNTRIES: STATUS

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Last July a jubilee exhibition of computer engineering was held in Moscow. The exhibitors came from countries participating in Comecon's Unified Computer System (UCS), including Hungary's Videoton Computer Engineering Works, which presented its latest products made under an international specialization scheme, such as the UCS second-generation RJ-10/M and R-11 computer systems, the sophisticated versions of R-10 and R-12.

About 30 different types of electronic computers were made in the Comecon countries before 1970. Each type required different programs, set of spare parts and experts with special qualifications. UCS was established aiming at avoiding the drawbacks resulting from the multitude of different (non-compatible) computer stocks which — in addition to being extremely expensive — excluded the possibility of applying the most expedient uniform methods.

Fifteen computer types, some 200 peripheric devices and remote data processing systems as well as numerous programs have evolved during the ten years of existence of UCS, with four computers and about 40 peripheries made in Hungary. In 1976 the member-countries started with the serial production on second-generation models, capable of higher performance and input capacity than the former types. These were the machines that were put on display in Moscow.

Hungary is engaged in the development of both hardware and software.

Under the international division of labour scheme, Hungary has been given the smallest-size computer, which — together with its sophisticated versions — is produced by Videoton and other companies. Likewise, several companies and institutions are engaged in the software business.

Videoton, formerly turning out mainly radio and television sets and tape recorders, started to produce in large series computers and peripheries in 1971. Since then, a total of 800 complete computer systems have left the factory, with 200 completed last year. Eighty per cent of the computers has been exported, mostly to socialist countries. The biggest buyer of Videoton computers is the Soviet Union, whose imports amounted to about 55 million roubles last year.

Exports to dollar-account markets began only a few years ago. The deliveries to western firms were worth 4.5 million dollars in 1978 and are expected to reach 8 million dollars this year. The principal buyers of Hungarian-made computers and peripheries — line printers, card-readers, and displays — are France, Yugoslavia, the United States and West Germany.

In order to improve its product structure, Videoton has bought a few licences, including SEMS of France for small computer systems, the U.S. Data Product for line printers, and the U.S. CADO licence for VT-30 small office computers.

The self-designed computer systems of Videoton include R-10/M, a more reliable and faster version of R-10, and R-11, a sophisticated version of R-12, whose prototype has just been completed. The serial production is scheduled to start in 1981. Both systems are equipped with microprocessors and are attachable to various peripheries. To these products belongs the VIDEOPLEX-16 industrial data-recording device which — in addition to replacing imports — has become a sought-after export article.

Apart from the basic UCS activities set originally and based on cooperation and specialization in 1971, the Comecon countries began with the serial production of minicomputers (Mini Computer System). According to the relevant agreements, magnetic tapes and discs are made in Bulgaria, printers in Hungary and memory units in the GDR and Poland. The Soviet Union provides devices used to create contact between the computers and the processes controlled by them as well as the so-called intelligent display systems. Czechoslovakia specializes in the production of plotters and flexible magnetic memory discs, Romania in that of individual memory units and program stocks, and Cuba in that of processors. The manufacture of the first four mini-machine models was launched in 1977.

CHINESE LAG IN COMPUTERS AND SEEK WESTERN TECHNOLOGY ACCORDING TO STEPHEN S. YAU

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A Northwestern University professor who recently returned from the People's Republic of China (PRC) says that Chinese computer development lags at least 10 years behind that of the West and believes that the Chinese can't catch up without outside help. Stephen S. Yau, chairman and professor of electrical engineering and computer science at the Technological Institute, Northwestern's engineering school, headed the Institute of Electrical and Electronic Engineers (IEEE) delegation to the PRC this fall. The trip, the third consecutive yearly tour by an IEEE group and the first since normalization of relations between the PRC and the United States, focused on integrated circuit technology and computers. The Chinese Institute of Electronics held briefings, tours of labs, and industrial sites and talks at major universities for the visiting scientists and engineers.

Yau, a specialist in computer systems reliability and maintainability and in software engineering, said that the basic problem with Chinese computer science is limited resources. Yau estimates that almost all of the computing machinery he saw in China was built there. China lacks the means to produce precision, high-quality items such as disk memories, and as a result the computers in the PRC that do have mass memories still rely on magnetic tape or drums, he said. The PRC could produce disks, although Yau doubts the result would be of sufficiently high quality. The Chinese, he said, find it difficult to import such hardware from elsewhere, in part because of the Chinese government's policy of restricting imports to encourage self-sufficiency and in part because of restrictions imposed by Western governments. The U.S., for example, won't sell sophisticated computing equipment to the PRC.

Despite those obstables, said Yau, "The Chinese government is now trying to promote scientific and engineering buildup. The most effective way to do this is to get outside help. They lag behind, especially after so many years in isolation. It's not that they don't have good people," said Yau. "But during the Cultural Revolution, none of the members of the scientific community was treated well. They lost a lot of time, and now they're trying to catch up." Yau and members of the delegation spoke with Wang Zhen, vice premier of the PRC. In response to a question from the U.S. visitors, the government official indicated his country's desire to import American technological know-how. "Ideally," said Yau, "the Chinese would like to develop their own computer industry in collaboration with industry from the West." Meanwhile, the Chinese are trying to develop computer hardware, software, and applications.

"Can they catch up on their own? I think it would be extremely difficult, if not impossible," said Yau. "The United States and the West aren't sitting idle." Yau led a 10-member delegation of IEEE representatives on a three-week trip throughout the PRC. An extensive formal program of tours, seminars, and presentations was supplemented by discussions with PRC scientists and engineers. "The most useful feature of our visit was informal discussion," said Yau, "sitting around in a conference room before and after a tour of an industrial site, for example." What was important was not an exchange of computer

lore — "They had nothing to offer us theoretically," he said. "Many of us (in the IEEE delegation) feared it would be a one-way street, with no exchange in terms of science and technology," Yau said. "But we gained a better understanding of the Chinese culture, society, and their progress in science and technology. Of course, the social and cultural aspects are not the primary function of the IEEE delegation, but we tried to understand their people. Many Chinese scientists are our former colleagues and have degrees from well-known universities such as Harvard, Berkeley, Stanford, MIT, and Northwestern."

Yau, 44, is a native of China. He received his M.S. and Ph.D. degrees in electrical engineering from the University of Illinois. He joined the Northwestern faculty in 1961 and has published more than 90 technical papers on computer systems reliability and maintainability, software engineering, real-time systems, pattern recognition, and other areas. A Life Fellow of the Franklin Institute, Yau received the organization's Louis E. Levy Medal in 1963. He was president of the IEEE Computer Society in 1974-75, Division V (Computer Society) director of the IEEE in 1976-77, and chairman of the IEEE Technical Activities Board Development Committees, 1979.

COMPUTER AND COMMUNICATIONS INDUSTRY ASSOCIATION (CCIA) FILES COURT CHALLENGE TO THE COMPUTER INQUIRY DECISION OF THE FEDERAL COMMUNICATIONS COMMISSION (FCC)

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The Computer & Communications Industry Association (CCIA) has filed a Petition for Review in the United States Court of Appeals for the District of Columbia Circuit challenging the Federal Communications Commission's "Final Decision" in the Second Computer Inquiry (FCC Docket No. 20828).

The FCC's decision, which was adopted April 7 and released May 5, essentially attempts to circumvent the provisions of the 1956 AT&T Consent Decree which bar the communications giant from activities in the unregulated data processing marketplace.

The 1956 decree was the result of negotiations between AT&T and the U.S. Department of Justice to end a federal antitrust suit brought against AT&T seven years earlier. In that suit, the government had charged AT&T with conspiracy to monopolize and monopolization of the telecommunications equipment market and had sought the divestiture of Western Electric, AT&T's wholly owned manufacturing subsidiary.

In exchange for maintaining their vertically integrated structure with Western Electric, the Bell System companies essentially agreed to restrict their public offerings to "common carrier communications services," defined in Section II(i) of the judgement to mean "communications services and facilities...the charges for which are subject to public regulation."

CCIA President A.G.W. Biddle said, "the FCC's Decision in the Second Computer Inquiry is an extraordinary attempt by a regulatory agency to modify an antitrust consent decree. As such, it poses a grave threat not only to the vigorously competitive data processing equipment and services industry, but also to the nation's underlying antitrust statutes."

Mr. Biddle went on to note that the Justice Department, in its own Comments in the Second Computer Inquiry, had advised the Commission that:

> ...we do not concur in the Commission's legally incorrect interpretation of the 1956 Western Electric consent decree....If the Commission believes that modifications in the decree are warranted, and can satisfy the standards for achieving such modification, the appropriate course of action is for the Commission to request a (judicial) modification in this final court order.

"At this state in the proceeding," said Philip S. Nyborg, CCIA's Vice President and General Counsel, "the Association believes that the Federal Appellate Court is the appropriate forum to decide the crucial issues of law raised by the Commission's decision. Early judicial resolution is in the interest of all concerned."

$100,000 PRIZE ESTABLISHED FOR THE FIRST COMPUTER WORLD CHESS CHAMPION - PART I

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A $100,000 prize has been established for the first computer program to become World Chess Champion and for annual computer-versus-human chess competitions. The prize, called the Fredkin Prize, has been established by the Fredkin Foundation of Cambridge, Massachusetts.

The competition will be monitored by the International Joint Conference on Artificial Intelligence (IJCAI) of Menlo Park, California. The IJCAI is a non-profit technical organization devoted to the advancement of the science of computer program construction with the end result of achieving intelligent action by computers. Carnegie Mellon University (CMU) will act as a trustee for the prize until it is awarded.

Dr. Hans Berliner of the CMU Computer Science Department, himself a former World Correspondence Chess Champion and author of the computer backgammon program that last year defeated the World Backgammon Champion in Monte Carlo, has been selected to head a committee that will formulate the precise rules under which the competition will be held.

(to be continued in the next issue)

□

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 programming 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"). 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 must display some kind of evident, systematic, rational order and completely remove some kind of randomness; the operation must be expressible in not more than four English words. (But Man can use more words to express the solution and still win.)

NAYMANDIJ 8007

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

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, plus a few more signs. To compress any extra letters into the set of signs, the encipherer may use puns, minor misspellings, equivalents (like CS or KS for X), etc. But the spaces between words are kept.

MAXIMDIJ 8007

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, ex-expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling may use puns, or deliberate (but evident) misspellings, or may be otherwise irregular, to discourage cryptanalytic methods of deciphering.

NUMBLE 8007

```
    I M A G I N A T I O N
+         G I V E S
  -------------------
=   I M A G I N E O Y I G
+           M A N Y
  -------------------
=   I M A G I N E A V A O
```

I = Y

9 9 3 2 7 1 8 6 6

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

SOLUTIONS

NAYMANDIJ 8005: Row 5: under 4.
MAXIMDIJ 8005: To make the world better, start with you.
NUMBLE 8005: Time brings roses.

Our thanks to the following people for sending us solutions: Roland Anderson, Stockholm, Sweden – Maximdij 8003, Naymandij 8003, and Numble 8003; T.P. Finn, Indianapolis, IN – Maximdij 8005 and Numble 8005; Steve Werdenschlag, Livingston, NJ – Maximdij 8005, Naymandij 8005, and Numble 8005.

The Frustrating World of Computers

by Harry Nelson
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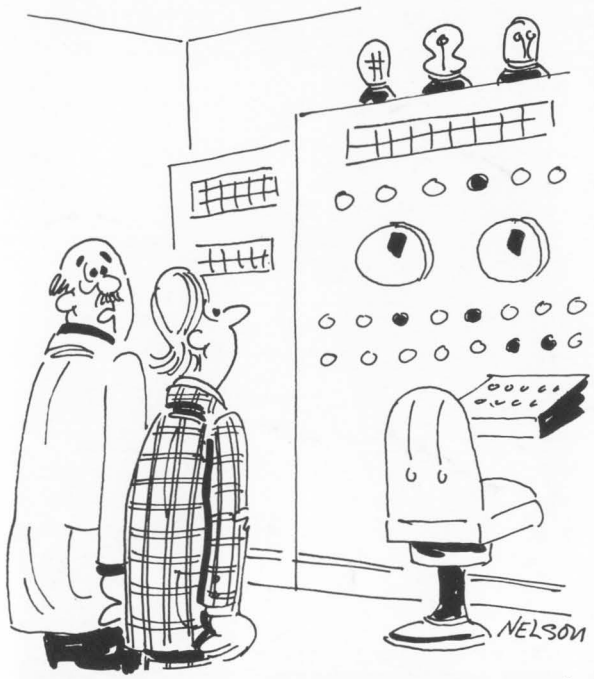

I HATE IT WHEN IT'S QUIET, — THAT'S WHEN IT'S THINKING UP WAYS TO DRIVE ME CRAZY ———

I DON'T UNDERSTAND IT, THE OPERATOR'S MANUAL SAID CORRECTING A MISTAKE WAS SIMPLE ———

I JUST GOT BACK THE COMPUTER ANALYSIS OF YOUR HUSBANDS CONDITION AND HE'S IN PERFECT HEALTH ———

IT STARTED WITH ONE LITTLE COMPUTER ERROR, THEN ANOTHER, THEN ANOTHER ———