computers and people

May–June, 1980
Vol. 29, Nos. 5–6
formerly *Computers and Automation*

PREPARATION OF COMPUTER-TRANSMITTED MEDICAL FORMULAS

ANNOUNCEMENT

18TH ANNUAL COMPUTER ART EXPOSITION IN "COMPUTERS AND PEOPLE" TO BE PUBLISHED IN THE ISSUE OF SEPT. - OCT. 1980

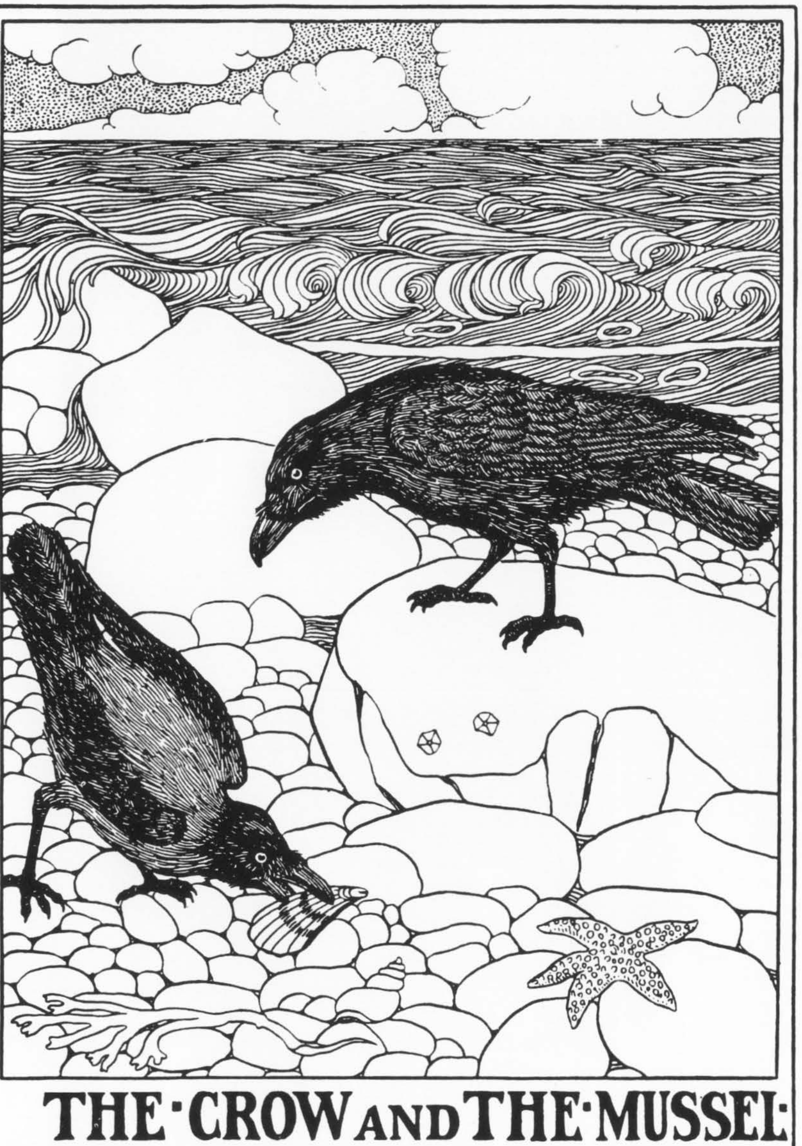
CLOSING DATE FOR ENTRIES: JULY 15, 1980

We plan to publish the 18th annual exposition of computer art in the Sept.-Oct. 1980 issue of "Computers and People."

For this year, the following are the rules:

CONTENT

1. Each submitted drawing should be interesting and artistic.
2. 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.
3. The forms should appear in various sizes, perspectives, and orientations.
4. 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.



THE·CROW AND THE·MUSSEL:

TECHNICAL DETAILS

1. Entries should be submitted on opaque white paper in black ink for best reproduction. Color entries are acceptable; however, they will be published in black and white.
2. The preferred size of entry is 8½ x 11 inches (or smaller); the maximum acceptable size is 9 x 12 inches.
3. Each entry should be accompanied by an explanation in three to five sentences of how the drawing was programmed for a computer, the type of computer used, and how the art was produced by the computer.
4. There are no formal entry blanks; any letter submitting and describing the entry is acceptable.
5. We CANNOT UNDERTAKE to return artwork; and we urge that you NOT send us originals.
6. Entries should be addressed to Computer Art Editor, "Computers and People," Berkeley Enterprises Inc., 815 Washington St., Newtonville, Mass. 02160.

DEADLINE FOR RECEIPT OF ENTRIES IS TUES., JULY 15, 1980.

See the following excerpt from last year's editorial:

Much computer art, considering the 17 years of its existence, lacks (1) the impression of solidity in representing three dimensions, (2) the presence of familiar themes to evoke mood, (3) the depiction of time, history, fate, by implications, and more besides. It is a pity that computer artists are not seeking to bring their art into a more powerful and emotional appeal to human beings. After all, it is human beings and not computers who wish to be stirred by art, and who pay for the machines by the income that humans earn.

Take for example the picture "The Crow and the Mussel" drawn by Percy J. Billinghurst, in "A Hundred Fables of Aesop", published by John Lane, The Bodley Head, London, 1903. How rich it is in representation of an environment, stones, seaweed, waves, sky, action, conflict! Let us hope that computer art will go much farther.

Forum

DELIVERY OF THE COMPUTER DIRECTORY AND BUYERS' GUIDE

1. From Gerard Guyod, Sr. Ptnr., March 1980
Market Ventures
1000 Quail S/290
Newport Beach, CA 92560

For over one year, I have been waiting to receive the directory I was alleged to get. You're nothing but a chiseler.

2. From the Editor

We have fallen behind in the delivery of the directory, and I am sorry. For the last couple of years, expenses have risen, income has fallen, and we have had a rough time. But "The Computer Directory and Buyers' Guide," 1978-79 issue, is now typeset and should go to the printer in April. We will, of course, send you the copy to which you are entitled by your *D subscription ending May 1979. I do not think that then we can be classified as "chiselers."

One of our big mistakes was believing a smooth-tongued computer salesman who promised us a micro-computer system for producing "The Computer Directory and Buyers' Guide" by computer; and it took us 10 months from Jan. 1979 to October to stop believing him.

The next (1979-80) issue of the computer directory is already being compiled, without benefit of computer, and should be out later this year.

Thank you for your strongly worded note.

3. From the Editor, April 4, 1980

The 1978-79 issue of "The Computer Directory and Buyers' Guide" has been sent to the printer. We expect that it will be begun to be mailed about April 18.

COMPUTERIZED MAIL FORWARDING SYSTEM – BUG

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

To the Editor:

This is in reference to the Data General Computerized Mail Forwarding System that you discussed in the March-April 1980 issue of "Computers and People" (page 34), and according to which the Postal Service is saving $20,000,000.

In my experience of this system, a letter addressed to me (with my correct address), when received at my local post office, was thrown (by mistake) into the "undeliverable" bin. Whereupon the CFS produced a label "unable to forward — not deliverable as addressed," and the letter was returned when it should not have been. This irritates me.

My local post office has informed me that one of the faults with the CFS is that it does not give any indication that an inquiry into it (e.g., by entering the name and former address code) does not find any matching master record in the system. This happened in my case, since I have not moved and the mail was correctly addressed to me, but it got inadvertently pitched into the "undeliverable" bin locally and was forwarded to the CFS system in the Sectional Center of the Postal Service. Since I had not moved, and therefore had not filed a change of address card, the Data General computer's program erroneously marked the letter "unable to forward — not deliverable as addressed" (both of which were incorrect statements), when it should have said "no forwarding record found," leaving open the possibility (in this case true) that the letter should be rechecked for delivery. This Data General CFS system needs programming improvements.

SUBSCRIPTION RENEWAL – AND MAILING LIST DIFFICULTIES

*1. To: 5106231 * 01 * D P 7412 205600*
R HANSBERRY APPL TECH
BOEING COMPUTER SERV 018
5603 30TH AVE SW
SEATTLE WA 98126

Dear Former Subscriber,⟶ MISSING ISSUE NOTICE ⟵

According to our records you have been a subscriber to "Computers and People" for some time ... but some of the issues recently published

HAVE NOT BEEN SENT TO YOU

because our records show that your subscription has expired. If this is not so, please tell us ... and it this is so, won't you please renew? for at least two good reasons: ....

2. From RUSSELL HANSBERRY
6527 35TH AVE SW
SEATTLE WA 98126

You have in the past presented comment on errors in billing systems and the ability to correct them. I would like to call attention to an error in a mailing list system and see if you can correct it.

(please turn to page 19)

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NOTE: The above rates do not include our publication, "The Computer Directory and Buyers' Guide." To receive this, please add $15.00 per year to your subscription rate in the U.S., and $18.00 elsewhere.

NOTE: No organization in Switzerland or Morocco is authorized or permitted by us to solicit subscriptions for, or receive payment for, "Computers and People" or "The Computer Directory and Buyers' Guide." Such subscriptions and payments should be sent directly to us.

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Change of address: If your address changes, please send us both your new address and your old address (as it appears on the magazine address imprint), and allow three weeks for the change to be made.

computers and people

formerly *Computers and Automation*

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

Front Cover Picture

Assistant Chief Pharmacist Karen Fisher, of Ralph K. Davies Medical Center's Franklin Hospital in San Francisco, prepares a computer-transmitted formula for intravenous solution prior to sending it directly to the appropriate nursing station. A new hospital-wide medical information system now permits such intravenous medications to be prepared in the pharmacy instead of at the nursing station. See more information on page 25.

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 APRIL 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 was sent to the printer about April 4, and should be mailed out before the end of April.

Editorial

Distraction, Camouflage, and Deception

Edmund C. Berkeley
Editor

The practice of distraction, camouflage, and deception is widely found in the world of nature. This fact proves that it has survival value in the struggle to live, the contest of evolution.

A certain fly has circular bands of orange and black like a wasp, and buzzes like a wasp; I have to look closely several times to make sure that it is a fly and not a wasp. The praying mantis looks very much like a set of small twigs. There is a large green caterpillar, the tomato horn worm, which is extremely hard for me to see, because its tint of green and its protuberances are so much like the tomato vine. None of these species of life would be as successful as they are if they had not evolved to deceive.

In human society there are countless examples of distraction and deception. The desire for privacy has for part of its motive your and my desire to have not all the truth about us known, and therefore we desire to appear different from what we know or feel we really are. The purpose of much advertising by most organizations is the construction of a desirable "image" or reputation instead of a natural or undesirable one.

Imagine the manufacturer of a computer product or package saying "We have just been beaten in competition by a new product, which does twice what ours does for half the price. Don't spend your money with us."

Or "We have just found out that our software product has about six bad bugs in it; it will take us the next six weeks to remove them. We can't in honesty take your money."

Or "We have announced a new product and are taking orders for it. But truthfully, there are 13 unsolved technical problems at this moment, and our promised delivery date, a year from now, is far more likely to be 3 years."

In order to prevent mistakes from distraction, camouflage, and deception, it is worth noting that:

- camouflage as shown in animals and plants cannot imply intent to deceive, because evolution does not work that way, does not imply morals;

- observation and perception — attentive, focused, thoughtful, trained, and critical — is most necessary.

Here is one of the reasons why an establishment in a nation finds it important to control the press, radio, and television — the media: thus they condition what the great majority of people who live in that nation are able to perceive. In the time of the Roman Empire this principle was expressed as "Divide et impera", meaning "Divide and rule." But in modern times it would be more precise to say "Distract and rule."

The media in the United States diligently distract the people in this country from thoughtful, fair, well-rounded consideration of many serious problems. Among these are the horror of nuclear war, the disastrous record of nuclear waste disposal, the great challenges in conservation of energy, and much more.

Three feasible steps to break oneself away from the distraction and diversion are:

- to conclude there is distraction;
- to stop looking at it and listening to it;
- to find sources of information (there are some) that can actually be trusted.

Humanized Computers: The Need for Them and the Substantial Pay-Off

Tom Gilb
Independent Consultant
Iver Holters vei 2
N-1410 Kolbotn
Norway (42) 80 16 97

"If codes were engineered in the direction of easy-to-remember codes, related to what they stood for, people demonstrated a marked degree of improvement in their ability to learn, remember, and reproduce them correctly."

Data Pollution

High-ranking officials publicly admit that the identification numbers which are a by-product of mass data processing systems, are a 'burden and nuisance' in the eyes of the public. Postmaster General William Bolger, was reported as saying on September 15, 1978: 'We're not unmindful of the burden and nuisance numbers are looked upon by the public - our social security number, bank account numbers, and everything else'. In the same breath, these executives regretfully announce an added burden, in the name of cost-cutting.

Somehow, I feel that we have heard these arguments once before: industrial pollution was a necessary evil to provide places of work for people who would otherwise be unemployed.

Now that we have established a sense of priorities regarding the physical pollution of our human environment, it is perhaps time to cast our attention towards the new industrial data pollution; a function of the increase in the new data processing industry.

We are no longer mainly concerned with direct threats to our physical health, but the frustrations of computer systems which are inadequately designed for ease of human use can certainly cause severe psychological distress, when people at the grass roots somehow feel that they are to blame for the errors and delays which often result. And this distress will certainly result in physical ill health symptoms in some. I'd like to stress that I am not merely talking about a hypothetical abstraction, but of a number of pathetic cases with which I have personal contact; people whose work situation in connection with computer systems is considered highly frustrating and negative.

Bell Labs Found that Humanised Codes Pay Off

As early as about 1970, Bell Labs in New Jersey conducted extensive research into a narrow but important aspect of the work situation of their many employees in the Bell Corporation (the US dominant telephone company). They conducted 40 experiments using 350 Bell System personnel (of varying backgrounds). The employees were presented 60 codes and asked to rate them according to difficulty, where 1 was the most difficult and 9 was the easiest. Each experiment was designed to get facts about the ease with which their typical employees could handle the most common codes which they had to report many times daily, primarily geographical locations and telephone equipment parts.

The results showed in all respects that the typical abstract numeric codes which were in common use as a result of early data processing traditions, dating back to electromechanical machines before the Second World War (001,002), were a substantial barrier to employee productivity. Meaningful mnemonic codes were considerd the easiest to work with, while alpha-numeric and numeric codes were found to be more difficult (see Figure 1).

Humanised Codes – Easier to Learn and Remember Correctly

The results showed that if the codes were 'human engineered' in the direction of easy-to-remember codes which were related to whatever they stood for, then people demonstrated a marked degree of improvement in their ability to learn, to remember, and to reproduce them correctly.

Bell's Common Coding Policy

The results were so dramatic, and Bell knew it could trust the research of its own famous research labs, that it became clear that the Corporation could not continue to trust the design abilities of computer specialists. They would continue to design according to their traditions and their personal convenience, without due regard to the much larger questions of giant scale employee productivity, customer service and accuracy.

A Corporate policy was formulated and implemented in 25 points and each point was backed up by at least one of the research results mentioned earlier (see Appendix). Each policy point was designed to pay off in increased productivity and accuracy, if implemented (007,008).

Next, teeth were put into the Policy by the establishment of a Common Coding Office, which I visited in the summer of 1977 in New Jersey. It was then staffed by 60 people, who served to advise the various US Bell Companies on how to make human engineered systems according to the policy. This group acted when systems were going to be changed anyway; they didn't insist that everything be changed overnight. But they made sure that every change through the years was a change in the direction of a greater degree of human engineering of the codes used by the personnel.

T. Gilb is an independent consultant in Norway, and has been in computing since 1958, and specializing in highly humanised systems since 1968. He consults and teaches regularly in several countries, and is the author of a number of books.

Bell is probably no different from any company or institution where a large amount of employee labour is concerned with data processing and contact with computer systems. The people are basically the same, in Bell or elsewhere, in their ability to relate to abstract codes and procedures, or to more natural systems of human communication. If abstract numbers were such a good idea for people, then we should go over to speaking that way. As it is today, pure abstract numbers are mainly used as cryptographic codes in order to make it difficult for people to learn the meaning of the message.

I suggest that we are all in need of policies and organisational advisors similar to Bell's. But we don't all realise it yet. The purpose of this article is to increase awareness on the part of influential levels of people as to the nature of this problem and to propose some solutions.

The Cost of the Human Element as Opposed to the Machine Element of Work

Montgomery Phister, in his remarkable collection "Data Processing Technology and Economics," has painstakingly collected and massaged several decades of data on the cost of the human and machine element in data processing systems (010).

Using his data as a departure point, I estimate that by 1980 the direct data processing department personnel costs will be more than six times the cost of the computer hardware in the USA (see Figure 2). This is a 300% increase in the relative costs since the childhood of computers 30 to 35 years ago. Clearly traditions and priorities developed in bygone years must be changed to reflect this fact.

In spite of the fact that many people are of the opinion that great changes have been wrought by the computer, I have observed that there has been remarkably little change since before World War II in the way in which codes, forms and reports are designed, and the procedures for getting data into computers. I have compared, for example, IBM Corporation texts on how to design data processing codes, written in 1936, 1956 and recently, and find that the degree of change is insignificant (001,002). This is even clearer when I observe a large number of varied data processing systems all over the world. The methods for human communication to the computers are essentially the same primitive ones developed many decades ago. This fact is only lightly disguised by transferring the obsolete and abstract codes and procedures to electronic on-line interactive computer terminals.

Not only have we failed to consider the rapidly increasing human cost component adequately, but we have largely neglected to make use of the available speed and capacity actually available in current computers. We still act as though the speed of a mechanical relay was the limiting factor. The potential for human engineering of data processing codes and procedures to make fuller use of available equipment is documented in detail in (003) and (004). I stress this is not to plug the books, but to ensure that you have a specific body of knowledge with which you can confront your computer specialists when you have decided on a course of action. You can expect most of them to deny much of what will be asserted in this paper, because they have been brainwashed differently for so long, and have not been given sufficient motivation (by you) to break out of that mould.

The long-term reversal of cost priorities, where it now pays off more and more to design systems for people, rather than to teach people to adapt to systems, is dramatically illustrated in another prognosis based on Phister's data, which indicate that by 1980 about 70% of the data processing department costs will be the human component, as opposed to 40% in 1955 (see Figure 3).

We should add to this the important fact that these costs relate only to the very narrow economics of the data processing department. In many companies, the true economics of interest in relation to the impact of data processing is in other areas of the company, which can easily be 20 to 100 times greater, when we remember that the data processing department budget is often about 1 to 5% of the company budget.

Still other institutions must consider the economics of the large public which they serve, either for national, ethical or market force economics reasons. These may far outweigh even total internal company or institution economics.

Finally we should not ignore the fact that in many human engineering situations, the critical aspect is security, safety or utilisation of scarce human resources (such as doctors or engineers) and that human engineering of the computer system is often a vital contribution to these aspects as well.

Future Threats

We are already on the path involving both the misuse of human beings and the under-utilisation of opportunity in computer automation. This 'bad architecture' increases the pressure on the institutions which create data-Frankensteins. The following is a list of potential events and trends which will result. Indeed, some, if not most, are already happening.

1 Loss of business - Your customers and the public will turn to your competitors where they can get more convenient, rapid and reliable service.

2 Loss of service potential - Government and local authorities will be unable to offer the services which are intended. They will have too small a productive capacity to do so as a result of heavy-handed procedures, forms to fill out, delays and errors. This has already happened to doctors and National Health authorities in the author's country, for example.

3 Loss of market for products - Many businesses develop products which could have substantially improved their competitiveness on the national and international marketplace by increased ease of use and reliability through use of better computer logic. Companies who are last to implement highly appealing human interfaces will quite naturally lose out on the marketplace.

4 Employee resistance to futher automation - Many employees have already been hurt severely by computer system implementations which had other priorities than the employee ability to learn, use and effect the system. These employees will naturally resist attempts at further automation. In one extreme case an employee in the USA went to prison for consciously sabotaging his system dozens of times during 18 months before he was caught at it. Management will also contribute substantially to

the resistance, as they learn that their computer specialists cannot be relied on to provide simple and useful systems.

5 Exaggerated union control - Unions will quite naturally seek to defend their members against frustrating, unsafe systems or systems which cannot make use of their present skills and background. They have the power and motivation to delay and destroy the profitability of systems which are not tuned in to their member's present capabilities and interests.

Environmental Opportunity as a Result of Humanised Computers

The traditional approach towards computer system development has already alienated the public, the employee and the Unions. Indeed I have frequently seen top and middle management act with varying degrees of scepticism towards further computerisation, because they equate unreasonably designed computer systems with computer systems in general.

Computer systems, and the abstract codes, detailed forms, unreadable reports and documents which they produce too often, are clearly a form of environmental pollution.

They reduce the quality of life for many of us in annoying and frustrating ways, on a daily basis (005,009,012).

Computer systems which were devoted to helping humans accomplish their tasks with a minimum of distraction and a maximum of politeness, tolerance and helpfulness would increase the quality of our common environment. We can make them that way if we decide to do so, but upper management, in league with employee representatives, and watched and chided by the press, must create the change.

We must laugh at our early pollution of the data environment, and at any continued attempts to continue in that style. We must show that we expect a superior quality of aid from our tool. Computers are the tools we make them. If they pollute our lives, we are getting what we have accepted.

Economic Opportunities for Human Engineering of Computerised Systems

Human engineering may be motivated by security considerations, employee relations, public relations, productivity or pure good economic investment reasons. This section looks at some of the economic factors which are affected by increased human engineering of computerised systems.

Saving the General Public Time and Effort

This consideration should be made by any large organisations such as government, utilities, or public transportation which interface with the general public. In some cases, such as a National Health Insurance, interfacing with medical staff, the same consideration applies.

It is unethical, we could call it social data pollution, to design forms, codes and reports so that large numbers of users must expend more effort than necessary to handle the data.

The cost of design, programming and computer machine time to save substantial effort on the part of the user public is in most of these cases less than one thousandth of the effort, time, cost and talent which it is capable of saving.

Since it is unrealistic to expect a computer specialist to consider these 'national' economics, it becomes the responsibility of higher management to ensure that this consideration is given priority, and to see that it is carried out to the reasonable limit of the technology. The BBC Radio/TV licence number of about thirty-eight (38!) digits for the general public is a prime example of the ridiculous lengths technologists will go to (and defend in the Times!), when management does not pull the strings properly. The burden many medical people have in filling out forms for other authorities is another example of unacceptable misuse of scarce and critical human effort which can be stemmed only when management and the profession affected decide to stop these outrages. They are only tolerated today because too few people realise that they are to a large degree unnecessary with present and future economics and technology.

Saving Your Own Employees Time and Effort

A deep application of human engineering (I mean using all tricks of the human engineering trade) in certain areas of data processing can, as a rule of thumb, increase human productivity by a substantial amount. I use as a rule of thumb that in re-designing a data processing application using the Humanised Input principles, we can always expect an easily measurable reduction in work operations of a factor of three to ten (003,006).

Hedge against Inflation and Variable Work Force Supply

Increased human engineering is the same thing as increased automation. We make a current investment in design, programming and computer machinery, in order to save human effort of a repetitive nature for many years to come. An increased part of our work force is automated, and can be 'hired and fired' without human consequences, on an as-needed basis. This avoids human, union, social and legal problems of hiring optimistically during boom times, and later having to shed it (or worse, keep it on until reserve capital is drained to the point of threatening the livelihood of the core of the employees, as we have recently seen in the Norwegian Tandberg company demise).

Increased Market Share Due to More Competitive Services or Products

Deep human engineering of computerised systems is so rare at the moment, that any company which takes the opportunity to do so now will naturally become a leader in this area within their industry or service. Human convenience is known to be a major factor in many areas for determining buying of products, and continued use of repetitive services. There is every reason to expect a successful assault on this area to result in an increased market share, although this applies only to the leaders, since in the long run everybody must join in to compete. I wish my banks and insurance companies, for example, understood this to a far greater degree than they seem to do. They are moving in that direction, clearly, but they have missed many present opportunities for many years, because of a lack of management guidance in this area.

Technical Opportunities for Human Engineering of Computerised Systems

The following list is a partial sample of specific technical possibilities which can realistically be considered by most non-trivial computer system designs in order to improve the human productivity related to the system. In many cases these things can be accomplished by suitable additions to current systems. Supporting technical detail is available in the references, particularly (003).

1. Reduction or elimination of forms to fill out. In many cases the computer input form is no longer technically necessary. It is a relic of earlier and more limited data processing technologies or economics. It often represents an extra work step, with delays, additional work and additional error possibilities. In most cases a far more direct approach is possible between the source of the data and the computer. Most computer professionals are not as yet trained to handle this design problem, but there is nothing particularly difficult about doing it once they are given the motivation to accomplish improvements here.

2. Simplification of codes presently used in connection with computers. Most of the currently favoured long numeric codes, like the ones on your credit card or bank account, are primarily a result of technological limitations which are not, or will not be, valid in the future. These codes primarily serve narrow machine-to-machine communication needs, and might perhaps have some limited use within machines in the future. But at the interface between humans and machines we can use the codes people naturally prefer such as names and addresses, even when these are varied in content and correctness. The job of finding the correct record in computer files can be left to the machine, or to a dialogue between people and machines.

3. Processing 'partial' information and doing so in 'varied' sequences. Due to technical limitations of early data processing technology there arose a strong tradition of insisting on a complete set of information ('filling out the entire form'), and making sure it always came in the system in a predetermined sequence. This is no longer necessary, since the logical ability of the computers coupled with the ability to retrieve or deduce missing information based on computer database information, allows humans to communicate in the natural incompletenesses which occur (often because outsiders correctly believe we already have that information stored in our files). The computer is fully capable of determining what information it really needs to solve present tasks, and will help us to keep our information gathering to a necessary minimum.

4. Tailoring computer output page content to the recipient. Again, based on early computer limitations in storage for logic and texts, we have accepted as routine a high degree of standardisation of forms printed out by computers. Too much information is often pre-printed, to save the computer doing that job. This can confuse the reader. The reader is expected to interpret codes (such as '65' on an invoice meaning Value Added Tax) hopefully printed on the back of the form, but which could better be spelled out directly. Small business computers have many of the limitations of early computers from the 1960s, and this increases the temptation to continue with these traditions, although even the smallest computers of the 1980s are capable of a much higher degree of human engineering than is presently being practised by most systems of any size.

The opportunity is there to design printed matter with an extremely high degree of orientation to the parameters of the user (type of customer, geographical district, previous buying history, special requests for certain types of data) (011). This in turn will do much to ensure a smooth, error-free connection with the recipient. The necessary investment in more highly tailored programs should not exceed one to five percent of the project cost of not doing this tailoring.

5. Letting the computer observe 'normal behaviour' and adapt to it. Before computers, humans quite naturally observed and recorded certain patterns of the environment which they were serving. They couldn't avoid doing so. In most present computer programs, this power of observation is not programmed, or if the data is collected, the system is not programmed to make use of it. As an example of simple things which can be done, if a customer or user has normally requested some special service, such as a few extra copies of an invoice, and an order comes from that customer without explicitly asking for that service, the computer could have been programmed to give it to him anyway on the grounds that he probably wants it. A message could even indicate that the computer has guessed that he wants it, and if he doesn't he can say so next time. Another example would be keeping track of normal patterns of amounts of money recorded in a financial accounting system, both with regard to the highest amounts normally deposited or recorded in particular accounts, and even the nature of the amount (even numbers, numbers divisible by 5, last 2 digits 95, 98, or 99). These patterns can be recorded individually and can be used to check future amounts and to give 'suspicious' warnings to clerks, professionals or auditors depending on needs.

The System User's Bill of Rights.

Both your own employees, and outsiders affected by your system, the general public and employees of other institutions and companies, should have certain rights to expect a reasonable standard of human engineering in computer systems. The humanisation of the system is normally of benefit to the system-creator institution, so the main function of the bill of rights is to remind the system architects of the duty they are expected to perform, and to give them support in humanising the systems. The form of this 'bill of rights' is as follows:

1. System forms, instructions, and outputs should be easily, immediately and reliably understandable to all people who must make use of the system.

2. When the users of a computerised system, or any extension of it such as a form to fill out, or codes to write down, are in doubt as to the correct actions, they should have access to immediate advice, if possible from the computer itself.

3. Computer systems should be programmed to understand most of the commonly-used formats of data. It should not be a requirement that people learn the exact arbitrary method which the computer programmer finds convenient. The computer should be required to learn most forms that people commonly find convenient for expressing themselves.

4. The sequence of giving data or instructions to the computer should be capable of being varied to suit the environment of the user of the system.

5. The system should be adapted to people, their environment, their habits, their traditions and their human error tendency.

6. Codes should be the ones preferred by the users of the codes, since these will be the most reliable and efficient codes in terms of total system economics.

7. Systems should be designed for successful use with the least skilled people within the expected group of users.

8. When users show signs of error, non-cooperation, dissatisfaction or lack of productivity in using a system, all parties should put the responsibility for this failure on the design of the system, never on the users; and expect satisfactory changes to be made in the design of the system.

9. Wherever and whenever the machine can take a burden from human minds or shoulders, we have a right to expect it to be seriously considered.

10. The user is always right.

Management Guidelines for Humanised Computer Systems

Here are some possible courses of action for your consideration.

1. Commission a study of the potential for increased automation degree in present computerised systems. Who is affected, by how much, and what would changes cost?

2. Develop a company policy to increase the degree of automated help to employees and the public you serve, to the furthest extent presently practical.

3. Initiate a short-term small-scale change in present system, in order to get a feel for the potential offered. Record the productivity and reliability increase, and employee or public opinion regarding this change. This is a pilot study to give your people experience and confidence.

4. Ask your data processing management to ensure that all computer professionals are reasonably conversant with the new humanised technical design methods, and that at least one is thoroughly trained as a specialist.

5. Involve employee representatives in the picture. Get them to voice the changes which will make their work environment more productive, reliable and comfortable.

6. Insist that all new projects have specific measurable goals regarding the human productivity factors in the data processing systems. These include work production, error-freedom, training degree and personal opinion of satisfactory work environment. The management and employee representatives who will effect the system design must be trained in the method for expressing their needs in this area.

7. Make sure that all major and long-term projects have planned both automated and organisational feedback mechanisms, so that signals for necessary change are captured and acted upon. The computerised system must be continually evolving and adapting to current real world events.

8. Survey external and public aspects of your present systems. How do your customers and members of the general public react to your computer outputs and to the forms they have to fill out? Identify at least one area which could be substantially improved by means of a new 'interface' to the old system. Make at least one such change and measure the effects of the change.

9. Continue to give signals and questions to your managers to impress upon them the priority you give to making the best use of human and computer resources. With a view towards the long-term future of systems being developed now, encourage them to overdo humanisation, rather than take a chance on missing these opportunities.

10. If the experts you now listen to cannot speak your language; get ones who can.

APPENDIX

Code Design Principles

General

1. Codes should be designed for the least skilled workers within the expected population of code users.

2. The preferences of code users should be taken into consideration.

3. The total set of code systems in use by intended users of a new system should be taken into consideration.

4. Each code should be unique.

5. In defining size of vocabulary from which the code system is to be drawn, room must be allowed for anticipated growth of the code system.

6. Numeric characters should be given preference in codes designed for simple tasks.

7. Since it is easier to convey meaning with alpha characters than with numerics, tasks requiring complex internal processing of the code should use alpha to the extent possible.

8. Meaningfulness should be built into codes by whatever means and in as many ways as possible.

9. Where meaning cannot be equally provided for all codes within the code system, preference should be given to those codes which will have the highest use frequency.

10. The length of codes for a given system should be optimised in terms of the code user's capabilities.

Code Length

11. The code designer should take advantage of common English usage practices in physically dividing or connecting long code phrases.

12. Techniques for psychologically shortening long codes or code phrases should be capitalised upon wherever possible.

13. Tradeoffs in costs of artificially lengthening codes and code phrases should be carefully considered.

14. Codes should be made up of characters already in the worker's repertoire.

15. The vocabulary from which a code system is drawn should be kept as small as possible consistent with unique coding and anticipated growth.

16. The vocabulary for a given code system should contain the fewest possible character classes.

17. Rules for the design of codes for any given system should be clearly defined and consistently followed.

18. Symbols should be used consistently for the same meaning or function.

19. Where size of vocabulary permits, characters which are likely to be confused visually or acoustically should be avoided.

20. Special techniques to aid in discrimination of perceptually similar characters should be consistently employed.

21. Where options are available, simple characters should be given preference over complex characters.

22. Where options are available, the effects of the serial position of characters should be used to enhance performance.

Formatting

23. Code elements and phrases should be formatted in terms of the user's order of needs for information.

24. Decisions on formatting messages or on arrangements of codes within a phrase should be coordinated among system users.

25. The length of the coded message should be kept to the minimum information required by prospective users.

26. Formatting of coded messages should be such as to facilitate ease of scanning for accuracy and completeness.

(Source: Bell Laboratories Record (007))

References

001 IBM Preparation and Use of Codes Handbook code AM-5 Series Machine Methods of Accounting (1936) / The significance of this publication is that this pre-computer set of methods is still widely taught and used.

002 IBM Modern Coding Methods IBM form 32-3793-6 (1956) / The unique numeric codes method, codes for machines, not for people, still dominates the teachings, largely unchanged from 1936. Practices which dominate most computerised systems as we enter the 1980s are largely derived from this set of techniques.

003 GILB T and WEINBERG G M Humanised input: Techniques for Reliable Keyed Input Winthrop Publishers Inc. Cambridge MA ISBN 0- 87626-345-7 (1977)/ This textbook collects a simple, but rarely written about set of techniques for adapting computer systems to human beings. It is limited to alphanumeric keyed data techniques. (Note: Scandinavian Publisher is Studentlitteratur, Lund). An extensive bibliography is included with annotations on each entry.

004 GILB T Data Engineering Studentlitteratur Lund Sweden ISBN 91-44-12621-2 (1976) / In addition to a summary coverage of the humanised input techniques, some case studies are given, and user motivation is covered.

005 STERLING T D Guidelines for Humanising Computerised Information Systems CACM pp 609-613 (Nov 1974) / Conference report recommendations. 'Politeness' is one interesting recommendation.

006 GILB T New Generation of Input Technology in Data Processing (UK) Part I (June 1978) and Part II (July/Aug 1978) / This is a Data Processing management level overview of the humanised input technology.

007 SONNTAG L Designing Human-Oriented Codes Bell Laboratories Record pp 43-49 (Feb 1971) / This is the original report on the research at Bell mentioned in this paper and the code design principles developed from it.

008 BELL LABORATORIES INC Common Language Coding Guide Bell Laboratories internal publication (1970)/ This publication explains in about 27 pages the detailed rules and procedures for development of humanised codes. It was obtained on request from Supervisor, Standard and Code Development, Common Language Dept, Bell Labs, Piscataway NJ USA-08854.

009 STERLING T D and LAUDON K Humanising Information Systems Datamation pp 53-59 (Dec 1976)/ Includes 25 'Criteria for humanising management information systems'.

010 PHISTER M Data Processing Technology and Economics Santa Monica Publ Co PO Box 3543 Santa Monica CA 90403 USA ISBN 0-917640-01-2 (1976) / This extraordinary book contains well organised and indexed hard facts about the economic relationship of people and computer technology.

011 FEENEY W R and HOOD J / Adaptive Man/Computer Interfaces: Information Systems Which Take Account of User Style / In Computer Personnel SIGCPR of ACM vol. 6 nos. 3-4 San Diego State University pp. 4-11 (summer 1977) / These initial experimental findings indicate that computer data presentation can be more effectively used if it is formatted and structured in a manner best suited to the psychological characteristics of the recipient.

012 TOMESKI E A Building Human Factors into Computer Applications Management Datamatics IFIP-Adm Gr Amsterdam vol 4 no 4 pp 115-120 (1975) / Prof. Tomeski of University of Minnesota has many articles and books on this subject.

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Small Business and the Transfer of Technology

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"At our present rate of tax burden, about 24 billion dollars are used to finance government research and development."

Technology Transfer? None to Small Business

Ninety-six percent of all industry is classified as "small business" by the U.S. Department of Commerce. Small business as such is not participating under contract to the Department of Defense (DOD), National Bureau of Standards (NBS), National Science Foundation (NSF), etc., in existing programs to enhance national productivity. Technology transfer at the level of small business in the United States is almost non-existent. The big government bureaucracy seemingly does not consider little business capable of contributing to big improvements. The big industry bureaucracy doesn't want to share its wealth.

This leads to Sobczak's First Law of National Mediocrity: "Those in power will tend to stay in power by controlling and reducing the methods by which others can achieve or share in power."

Technical Innovations

Since 1945 the United States and Great Britain have received 70% of the Nobel Prizes for Science. Further, the United States is credited with producing 60% of all world wide technical innovations during the past 25 years. The National Technical Information Service (NTIS) has a library of 300,000 reports with a projected growth of 70,000 per year. Technology is growing by leaps and bounds.

The Japanese and German industrial communities have developed the skills necessary to take American technology and convert it to commerical use at the expense of American small business. In both countries, government sponsors technological application to new product development. In the United States, small business is penalized when it tries to grow.

Sobczak's Second Law of National Mediocrity states, "Apathy towards national purpose begins at the top. Americans are taught early to follow the leader and refrain from rocking the boat."

Penalization for Innovation

The majority of governmental research and development is concentrated on military or space applications. The military patent portfolio represents two thirds of all patents (technology) held by the federal government. A potential estimated to be worth $200 to $300 billion is not being utilized. A small businessman would be insane to accept a government non-exclusive license. The license is royalty free and continues for the life of the patent for as long as the licensee makes the benefits of the invention reasonably available to the public.

This logic leads to the Third Law of National Mediocrity: "When a small business stumbles upon a profitable technological transfer, big government allows American capitalism to exercise the non-exclusiveness of a license."

Entrepreneurs Should Be Aware of Technical Innovations

This introduction is not colored against "big" everything; it serves to point out that:

1. Entrepreneurs, if they exist, are not aware of the potential technology available for utilization.
2. Government is doing too little to make anyone aware of technology.
3. There is too little risk capital available or put to use.

It would seem our first concern would be making entrepreneurs aware of technology. Naturally, and significantly, I recommend the Little People's Productivity Center, Inc.

But for those who want to transfer technology themselves, the list is as follows:

List of Resources

1. NASA is authorized by the National Aeronautics and Space Administration of 1958 as amended, Section 203 (a) (3), Public Law 85-568; U.S.C. 2473, to transfer technology. Their objectives are to insure that developments resulting from government sponsored civilian aerospace research and development are made available to the widest extent practical and appropriate for the nation's benefit. Contact: Technology Transfer Division Code ET-6, NASA Headquarters, Washington, DC 20546

2. The National Technical Information Service, U.S. Department of Commerce, is authorized by the Research and Technical Services Act; Public Law 81-776; 15 U.S.C. 1151-1157, to make federally sponsored technical information readily available to government, business and industry. Contact: Melvin S. Day, Director, NTIS, 5285 Port Royal Road, Room 1008, Springfield, VA 22161

3. The National Bureau of Standards, U.S. Department of Commerce, is authorized by Standard Reference Data Act; Public Law 95-322; 15 U.S.C. 290 and National Bureau of Standards Organic Act, as amended; Public Law 56-177, as

amended; 15 U.S.C. 271 et seq., to make critically evaluated scientific and technical reference data readily available to scientists, engineers and the general public. Contact: Office of Standard Reference Data, National Bureau of Standards, U.S. Department of Commerce, Washington D.C. 20234

4. The Patent and Trademark Office, U. S. Department of Commerce, is authorized by 35 U.S.C. 1-42 to promote the continued growth of American technology and business through the utilization of technical information available through patents, dissemination of patent information, and maintenance of a public search center containing applied technical information in the form of patents. Contact: Oscar G. Mastin, U.S. Patent and Trademark Office, Department of Commerce, Washington D.C. 20231

5. The Office of Water Research and Technology, Department of the Interior, is authorized by the Water Research and Development Act of 1978, Sections 301 and 302; Public Law 95-467, 42 U.S.C. 7851, to be responsive to technical and scientific information needs and to provide communication and coordination among all those engaged in federally sponsored water resources research and development. Contact: Office of Water Research and Technology, Department of the Interior, Washington D.C. 20240

6. The General Services Administration is authorized by Public Law 90-620, October 22, 1968; 82 Stat 1287; 44 U.S.C. 21, to provide reference services to the general public and the federal government on records of the federal government, and on historical materials in Presidential libraries. Contact: Director, Central Reference Division, National Archives and Record Services, G.S.A., Washington D.C. 20408

7. The General Services Administration is authorized by Presidential Memoranda of November 27, 1965 and October 27, 1969 to provide a single point in each metropolitan area for the public to address questions about federal agencies and receive the desired information, or an accurate referral to the office which can best assist you. Contact: Federal Information Center Coordinating Staff, G.S.A., Washington D.C. 20405

8. The Government Printing Office is authorized by 44 U.S.C., Chapter 17, to make U. S. Government publications available for purchase. Contact: Superintendent of Documents, Government Printing Office, Washington D.C. 20402

9. The Library of Congress is authorized by 2 U.S.C. 136; 20 U.S.C. 91, to render general and specialized reference and bibliographic services. Contact: Ellen Z. Hahn, Chief, General Reading Rooms Division, Library of Congress, Washington D.C. 20540

10. The Library of Congress is authorized by 2 U.S.C. 136, to provide (1) general and specialized reference and bibliographic service based on library holdings in science and technology that includes more than 3,000,000 books, 36,000 serial titles, plus 2,000,000 technical reports; and (2) referral services based on an indexed inventory of some 12,000 information resources. Contact: National Referral Center, Science and Technology Division, Library of Congress, Washington D.C. 20540 Attn: John A. Feulner (Referral), Constance Carter (Reference)

11. The National Science Foundation is authorized by the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-1975, Public Law 81-507); and miscellaneous other laws codified at 42 U.S.C. 1876-1884, to promote the progress of science and thereby insure the continued scientific strength of the nation. Contact: 1) Experimental Technology Incentives Program, National Science Foundation, 1800 G Street N.W., Washington D.C. 20550 2) Program Manager for Small Business, Applied Science and Research Applications, National Science Foundation, Washington D.C. 20550

12. The Smithsonian Institution is authorized by Acts of Congress, approved July 1, 1836 and August 10, 1846; 20 U.S.C. 41 et seq., to make available to qualified investigators at various levels of educational accomplishment, the facilities, collection, and professional staff of the institution. Contact: Gretchen Gayle Ellsworth, Director, Office of Fellowships and Grants - Room 3300, 955 L'Enfant Plaza, Smithsonian Institution, Washington D.C. 20560

13. The Smithsonian Institution under its general authority (see 12 above), created the Smithsonian Science Information Exchange as a D.C. non-profit corporation under 29 D.C. code ss 29-1001 et seq., to be a clearinghouse for information about ongoing or recently terminated scientific research projects. Contact: Dr. David F. Hersey, President, Smithsonian Science Information Exchange, Room 300, 1730 M Street N.W., Washington D.C. 20036 (Note: SSIE will be transferred to the Department of Commerce in 1980)

14. The Department of Energy is authorized by the Atomic Energy Act of 1954 as amended, Sections 156 and 161 (g); Public Law 83-703; 68 Stat 919; 42 U.S.C. 2186 and 2201, et al, to encourage widespread utilization of inventions covered by DOE-owned patents. Contact: Assistant General Counsel for Patents, DOE, Washington D.C. 20545

15. The Maritime Administration is authorized by Section 101, Merchant Marine Act of 1936 as amended, Public Law 91-469; 46 U.S.C. 1101, to operate the National Shipbuilding Research Program. Contact: Wallace T. Samsone, Dep. Ass't. Admin. for Maritime Aids, Maritime Administration, Department of Commerce, Washington D.C. 20230

Department of Defense and Office of Naval Research

Strange as it may seem, there is very little being accomplished by DOD to transfer technology. Realize that technological transfer planning must consider the regulated limits of the government's right to transfer. The government is subject to private ownership developed under contract, export licensing requirements, and restrictive agreements with other countries. The Office of Naval Research has had responsibility for Navy patent (technology) transfer since 1976. They advertise via the Patents and Trademark Office, Official Gazette, and the NTIS. They offer the potential of an exclusive license. Unfortunately, unless a small business does a great deal of research, it would never find ONR.

Government Policy of Technology Transfer

Despite decades of debate, there is no uniform government patent (technology transfer) policy today. The executive branch essentially allows flexibility. That flexibility has resulted in some twenty different patent policies now being used by the agencies of the federal government in its ongoing research and development contract relationships. It is appropriate to ask what kind of success the government has had in getting inventions and technology released to the public, and what kind of return the public gets for its investment. At a DOD seminar in 1976, it was stated that 14,000 inventions (government financed) were patented in the last ten years. Only one in ten was brought to the market place.

Small Business Ignored

At our present rate of tax burden, about 24 billion dollars are used to finance government research and development. Small business is never mentioned in discussions of technology transfer. As you have read the sources of information concerning the dissemination of information concerning technology, note that the type of technology transfer we consider in this article is an afterthought. The idea of considering small business is only now becoming popular. Government, by its bigness, ignores small business.

Other than firms like LPPC, no one is developing a program for the little guy. Once again 96% of business is ignored. They do not see a return on their investment in government. Those in power are investing resources where the public can see a quick return. The logic is simple when one considers the Bread and Circus during the decline of Rome.

The new buzz word programs ignore small business. ICAM (Integrated Computer Aided Manufacturing), IPAD (Integrated Programs for Aerospace Vehicle Design), Cooperative Technology, etc., do not have a small business contractor, have done no more than give lip service to small business technology transfer, and continue to keep technology transfer in the power structure among the power brokers. One wonders where the Small Business Administration stands in active support of technology transfer for the little people. It could be that we need a Very Small Business Administration, unbeset by the bureaucracy, to do our bidding.

Level of Sophistication

For government to get its act together, the first requirement is to determine the level of sophistication which small business can tolerate. LPPC has suggested this to government at several levels. The available technical resources (200 to 300 billion dollars) must be classified and the most cost effective offered to small business.

The method of dissemination must take complexity in terms of forms, formats, digests, etc., out of large systems and replace them with simple, bite-sized, digestible pieces of technology which fall within the comprehension of a small businessman. One needs only to review a government request for bid to know of what I speak.

Converting Bureaucratic Forms into Common Sense

Government must understand that after a hard day of surviving, a small industrialist has neither the stamina nor patience to convert bureaucracy into common sense. Further, he must have some assurance that economies of scale will not discriminate against his smallness. Little business does not expect the crutch given a Lockheed or a Chrysler. It does expect fair treatment with exclusive license. Too often we hear of the small business which invested risk capital and developed a new technology only to be outproduced and under-priced by large competitors with production economies of scale, extensive channels for distribution, and, of course, no investment to amortize.

Financing

Finally, small business needs financing. The ability to apply existing resources of the firm should be the collateral for an infusion of federal funds. Government contractors are allowed to apply a percentage of their R & D costs to the contract. Why not allow a portion of corporate taxes to apply to technology? The growth of small businesses will enhance the potential of future taxes.

Goals of Technology Transfer

The goals of technology transfer should be common to small business and government. These are:

1. To provide increased incentives for the most qualified companies without discrimination due to size
2. To increase standardization and interoperatability to provide new production sources to government
3. To improve the balance of trade by developing at home that which has been developed abroad in the past
4. Increased profitability for the small business
5. Increased competition and therefore reduced costs in development and acquisition in the national interest

In summary, we have available tremendous resources of technology which can be acted upon to produce new products and new profits. We have available a base of 300,000 small businesses capable of acting as the agents of transfer. What is missing is a concrete program, geared to the level of small business, which makes it worthwhile for a small business to consider the investment. I suggest that our leaders in government look at the structure of the Federal Republic of Germany and that of Japan. Perhaps if we use our cameras and copy what we see, small business will benefit in the United States.

References

For those interested in a further detailed study, the following are recommended:

1. "Socio-Economic Effects of Defense Programs," 1963, Industry Advisory Council, Office Secretary of Defense (I & L), Washington, DC

(please turn to page 19)

The Design and Implementation of Computer Systems for Small Manufacturing Companies

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"In this case we concentrate primarily on information which caused action and examined the points at which responsibilities were borne."

Manufacturing Companies

Microcomputers are increasingly being used effectively and economically in offices and commercial applications, but less so in manufacturing companies where potentially greater benefits can be derived from more timely and improved operational information. Yet for competitive and fundamental economic reasons, these benefits ought to be realised. Manufacturing companies are too important to be considered as merely an incidental sector of the microcomputer market.

This article considers the problems of applying microcomputers to manufacturing operations and explains the kind of "sales package" which will help to increase their rate of introduction and thereby release competitive and economic benefits.

Some Basic Observations

Main frame computers succeeded in large companies with centralised tasks like payroll, personnel and finance, mostly with the aid of service or computer departments to support them. They have had less success with operational information in manufacturing systems. Microcomputers now come to the smaller companies without service departments and to a fresh market of essentially naive customers. The computers may be cheaper and more flexible, thus overcoming some of the deficiencies of the centralised main frames, but the problems of deploying them are essentially unchanged. Are we set to repeat the mistakes of the first generation main frames with microcomputers and a new type of customer?

Unlike the fields of finance and possibly stock control, the information and style of any one manufacturing system tend to differ in important detail from another and the costs of analysing each system, programming it for a computer and finally getting all the information to a credible level of accuracy are high relative to the costs of the computers themselves.

Down to Earth, Pragmatic Attitudes

Production personnel in general and the first and second line managers in particular are selected for their down-to-earth, pragmatic attitudes. They are people who need to be impressed by demonstrations, since evidence and experience are the basis for many of their decisions and a certain amount of scepticism is a desirable skill in their job. It is both difficult and expensive to demonstrate a system in terms which meet the requirements of a production manager and allow reasonable evaluation, before any commitment to purchase and implement.

Attempted Sales

In practice, sales are attempted and made in this area on the basis of:

(a) Applications software packages which appear to be close to requirements.

(b) The buyer trusts that the package can be made to work in his case.

(c) A reputation; that this computer, company and support system have succeeded in similar applications.

(d) The computer costs appear small enough to risk (and lose!).

But the Method Does Not Work Well

This does not actually work very well. The applications packages tend to be "mechanically" sound and operationally tidy, but they have a number of significant weaknesses partly because of the "packaging" and partly due to the nature of the application:

(i) Relative to former manual systems, the users feel less in control of information; there appears to be less operational flexibility because "they" were not consulted in the design.

(ii) Packages do not focus on a particular manager's requirements and the benefits of decision support do not materialise.

(iii) There is a large effort required for implementation and the difficulties of a changeover are significant. The budget for the computer and software does not include these costs and the customer will probably not discern them initially, although they exist. Interference with operations as well as man hours is involved. The costs may be enormous and certainly exceed the anticipated "risk".

(iv) The trust element tends to be unfair to everyone since success depends on the synthesis of a system of hardware, software procedures and people. The selling company can have little understanding of the local procedures and people in the company of application, and the buyer little knowledge of the particular hardware and software.

(v) Reputations are difficult to assess, particularly among microcomputer companies where they are based more on technical competence, entrepreneural skills, and turnover than the ability to implement with minimal disturbances and costs and to provide reliable aftercare.

The Attractiveness of Microcomputers

The microcomputer is a tool which has barely been used for management information, although it is attractive if well-deployed. In comparison with a good manual system, there are potential benefits from improved:

— speed of access to information
— accuracy
— timeliness of reports
— consistency
— opportunities for simple procedures and a natural discipline because of the impartial machine.

These benefits should result in tangible benefits such as:

— better use of resources
— higher productivity with given resources
— more control
— more predictable performance
— less risk
— less stress for managers
— better customer service

Necessary to Tackle Marketing Thoroughly

The lack of widespread experience to confirm these points (or contradict them) emphasizes the need to tackle the marketing and implementation aspects more thoroughly through:

(1) Generalisable methods of organising information to reduce the costs of putting (existing) company systems onto a computer (see Reference 1).

(2) A wider and more profound understanding of the principles by which manufacturing systems are managed (controlled) so that software packages can be designed to support management functions coherently even by multiple computers on one site.

(3) More attention to the methods and sales pitch by which computers are introduced into the manufacturing context.

The Needs of the Small Manufacturing Company

The companies in which computers could bring most benefits are often the least well managed, although it is the weaker managers who need support. Small manufacturing companies are economically significant, particularly those making basic engineering components. The companies who might derive most benefit tend to be the most resistant.

An important distinction must be made at the outset between "what they want," which are aggregate, operational benefits like profitability and personal benefits like kudos, and "what they need". What they need is usually whole- or part-support for:

(i) Examining their existing information system.

(ii) Reviewing and analysing the strengths and weaknesses of their existing system.

(iii) A proposal in their terms to be discussed and revised in the light of requirements (both operational and computing) about what to do in the future.

Then, if a computer is considered as the future way of handling operational information, they need:

(iv) A feasibility study which does not interfere with production so that the system can be evaluated without introducing production overheads (or even direct costs!).

(v) A trial implementation to test procedures management support and unforeseen effects on personnel.

(vi) Full implementation.

Current Tendencies to Underestimate, Omit, and Insufficiently Support

The current tendency is to underestimate (i), to omit (ii), (iii), (iv) and (v), and to inadequately support (vi), because these activities are considered by the customer and supplier as an overhead cost on the computer, not as a service in their own right. It tends to concentrate attention on the computer and programming skills. Computer personnel are often involved where manufacturing management expertise is in fact more desirable. By identifying the needs and specifying how they can be met, it is possible to justify an inherently more rational approach and thereby:

— proceed in identifiable stages with intermediate targets
— obtain stage payments for services which need not necessarily proceed to computer purchase
— provide personnel appropriate to the work
— reduce the customer's liability at any stage
— reflect the customer's needs, which leads to confidence and trust.

In essence, it is possible to reconcile the needs of the customer with the desire of the computer supplier to allocate overheads to his direct cause rather than the computer. The nature of the service is explicit and can be well supported.

A Sample Case: An Electric Motor Manufacturer

The following technique has been applied successfully in four companies during the past two years and full implementation has been achieved in each. It may be illustrated with the case of a certain electric motor manufacturer: a company with principally mechanical engineering, machine shop and assembly work, a turnover of approximately 5 million £ and about 200 employees.

The managing Director was approached with a four-stage proposition which outlined the objectives, level of activity, involvement of the company, and possible outcomes from each stage under headings which reflected his probable needs (as discussed in Section 2).

Stage 1 Definition and Appraisal
Stage 2 Proposal for change and feasibility
Stage 3 Trial
Stage 4 Full implementation

There was a clear understanding that costs would be incurred at each stage, but that continuation from one stage to another would be an explicit decision. The costing was based on previous experience of allocating part of the time of one person to the project each week plus site visits by a principal at an average of three visits per month. The rate was a fixed rate per month. Progress was naturally determined by their ability to assimilate and respond so that it was important to relate costs to their efforts as well as our own, e.g., they paid for not trying!

Stage 1 – Definition and Appraisal

The first target was to understand current practice. Defining and writing out explicitly what happens "now" is an excellent starting point:

— it is an innocent and effective method of meeting people and familiarising oneself with the system;

— any future system will have to achieve "at least what they achieve now" and one must regard this initial definition as a minimum specification!

Appraisals and analyses are clearly skills based on a sound understanding of information and manufacturing systems, not just computers.

The Information Needed

In this case, we concentrated primarily on information which caused action and examined the points at which responsibilities were borne. For example, the sales order book of customer's products and delivery promises represents the company's responsibility to the customers. The list of parts issued to the machine shop represents one major commitment of resources by the company at a point in time. Various individuals and procedures were required to assemble the correct information; who and what were they? As well as responsibilities for current commitment, there were responsibilities for future commitments like: delivery promises for new orders; when to issue more parts to the machine shop; what to assemble next week; whether to invest in more capacity; etc. How was information extracted from the mass of detail to support these responsibilities, and which individuals were able to explain them?

In this example, we had to consider information relating to:

40 basic products with possible minor variations

600 current orders with schedules for up to 12 months

80 dispatches per month

8000 stock items

300 major machine shop parts

50 machine tools

5 assembly sections (rotor, stator, winding shop, complete assembly, test)

A manufacturing lead time of about three months from ordering a casting to final assembly

This stage took about four days on-site and two days off-site over a period of 4 to 6 weeks.

Stage 2 – Proposal and Feasibility

It was proposed to make a more detailed study of the point at which work was issued to the assembly and machine shops. The definition and appraisal revealed that work was simply placed in a queue and tackled by the foremen and operators as they completed a previous job. There was no planning of load, just one big bucket of capacity. This is a typical (weak) system, bottlenecks which move from one machine to another (unpredictably!) and arrears distinguish it. We did not fully understand it on the basis of our initial study. Short of direct involvement with those concerned for an extended period, it is unlikely that the precise requirements and best line of action can be discerned. This involvement was the purpose of the next stage of the exercise.

The further study and feasibility were proposed as an off-site exercise. By taking copies of the job tickets for work ready for the machine shop, issued and completed work, we gradually assembled a parts-orders-for-the-machine-shop order book. The core content and load on the various machines were assessed and we used a computer to reduce our own work and prepare the sort of system we felt would create benefits.

The elapsed time was nine calendar months (not full time on our part), but the rate at which information was assembled was limited by the manufacturing cycle times. It corresponds reasonably well with the rate at which the production controller could assimilate our aspirations and at which we could assimilate his and those of the managing Director. It enabled us to assemble the "data base" while we continuously re-examined motives and increased our understanding.

Stage 3 – Trial

The off-site duplication of the production control information had provided us with a working system for appraising the work content of maintaining the data base and experimenting with reports. The trial stage which moved the off-site computer version onto the site to test procedures and personal responses was preceded by some personnel training at the off-site facility. The company personnel, knowing that "amateurs" could do it, had few grounds for obstructing the system, although by this stage there was no hint of obstruction anyway.

Stage 4 – Implementation

The decision to move to stage 4 and purchase a computer was actually made at stage 3, although the distinction was an important one for the customer. Stage 4 is really the decision to buy a computer in addition to paying for the study. The empaasis at this stage was on tuning-up management reports. An additional 3 to 6 months was involved.

The Cost of the Work

The cost of the work was covered as it proceeded. The allocation of effort and the charges were evident to the company and the managing Director was able to identify progress with their efforts as well as our own. The off-

(please turn to page 19)

Rhodes – *Continued from page 18*

site duplication reduced interference with their operations until we were reasonably sure. We could also experiment without losing credibility because we were not performing in front of those whose confidence we needed to inspire.

The Computer Is Only a Part of the Product Being Sold

It may seem a long route towards selling a computer. The main point is that the computer is only a part of the "product" being sold.

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□

Sobczak – *Continued from page 15*

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□

Forum – *Continued from page 3*

Years ago I worked for Boeing Computer Services and subscribed to your publication. When times got bad I felt I could no longer afford the higher subscription price and did not renew. Times got better, I moved, and I became a subscriber again. You now keep sending me mail requesting that I become a subscriber again. From the mailing label, I can tell this is based upon the original subscription which has not been renewed. Can you remove or correct the old subscription record? My current subscription is to the return address on the envelope.

3. From the Editor

Thank you for your letter clarifying our failure many years ago to remove your old record of subscription. We shall delete that old address.

It is nice of you to write, and here is a 15¢ stamp replacing the one you made use of to help us.

□

Gilb – *Continued from page 12*

Codes and Difficulty

(1) Code	(2) Meaning	(3) Approx. Rated Difficulty
I. ALPHA CODES — EXAMPLES		
PCU	Program Channel Unit	9
PHILAD MK PA	Philadelphia, Market St., Pennsylvania	9
DLL CKT	Dial Long Lines Circuit	9
FTHUAC AZ	Fort Huachuca, Arizona	9
II. ALPHA-NUMERIC CODES — EXAMPLES		
BR2T52	2-Wire Talkback Bridge	6
2A4A83	22A Modulator for 4W-A Pilot Regulation	6
U4NA	U4 Mounting E/W 849A & B Networks	6
GE2	Attenuation Equaliser for Carrier Channel	6
III. NUMERIC CODES — EXAMPLES		
732681 8518	Canton, Ohio	2
2487 6021	Service Order Number	2
035	Bahama Island	2
29 29	New York, N.Y.	2

Figure 1: Preferred codes of Bell System personnel

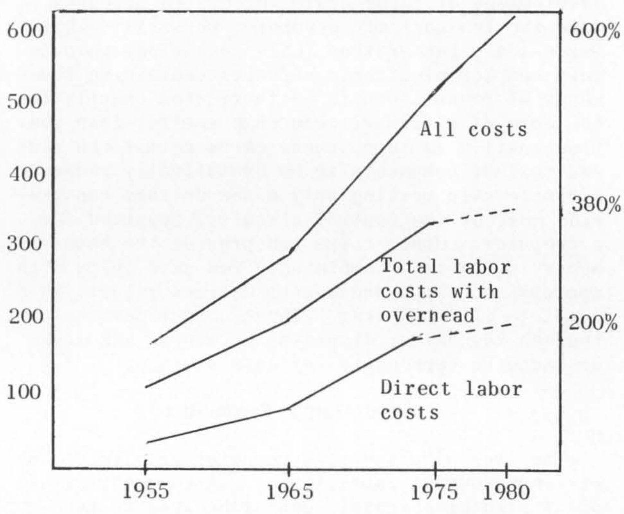

Figure 2: User operating costs

Various Costs as Percent of Total User Operating Costs

	Total Labor Costs Including Overhead	Hardware Costs	Supplies Costs
1955	38%	58%	4%
1965	55	35	10
1975	69	25	6
1980	72	14	14

Figure 3: Allocation of user operating costs

□

The Microcomputer Industry: An Introduction

Joe Weisbecker
Author of "Home Computers Can Make You Rich"
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"If you crossed a cowardly lion-tamer with a crossword puzzle solver, you would probably get a programmer."

A New Industry Is Born

Large computers costing hundreds of thousands of dollars have been around since the 1950s. Only big companies and government agencies could afford them then. Minicomputers costing $50,000 or less became available in the 1960s. Large numbers of medium-size companies could afford minicomputers. In the 1970s microcomputers costing several hundred to several thousand dollars started to appear. At these prices most small businesses and even individual homes could afford a computer. Low-cost, mass-produced microcomputers represent a major new industry. This rapidly growing industry provides many opportunities for new job, business, product, and spare-time income.

Just as the development of the internal combustion engine made the automobile possible, the development of large-scale integrated circuits made the low-cost microcomputer possible. This large-scale integration (LSI) technology permits very complex electronic circuits containing thousands of transistors to be fabricated cheaply in the form of a tiny silicon chip smaller than your fingernail. In turn, these chips permit the size and cost of computers to be dramatically reduced. A single chip costing only a few dollars can provide most of the control circuitry required for a computer. Other chips can provide the necessary memory circuits. Combining a few such chips with appropriate input and output devices results in a complete microcomputer. Input-output devices can include keyboards, displays, printers, and disc or magnetic tape units for data storage.

Input-Output Capabilities

The uses of a specific computer are limited by its input-output capabilities. A computer without a printer obviously cannot be used to type letters or paychecks. A computer without a disc storage device cannot be used effectively for many data-processing applications. Mechanical input-output devices can add significantly to the cost of a microcomputer.

Any computer can be programmed to perform a wide range of operations within the limitations imposed by its input-output capabilities. The uses of a specific computer are therefore limited by available programs as well as by the computer's physical capabilities. Growth of the microcomputer industry will depend on the continuing development of new techniques for low-cost input-output and data storage coupled with imaginative programming. These two areas represent major profit opportunities for companies and individuals.

Comparison with the Automotive Industry

When the automobile industry is mentioned, one immediately thinks of Ford, General Motors, and Chrysler. In the microcomputer industry most of the attention is focused on the companies that make small computers. Because it's unlikely that your spare-time road to riches will involve manufacturing computers, you'll need to take a broader view of the microcomputer industry.

The major car makers are only part of the entire automotive industry. The industry also includes thousands of other companies and individuals who prosper by filling needs not satisfied by the companies that produce cars. Among them are local car dealers, individual salesmen, used car lots, independent shopping guides, and consultants to fill the needs of car buyers. Potential car users can rent a car or a driver. Car customizing, painting, racing, and repairing provide full or part-time income for many people. Supplying parts, fuel, accessories, and disposal are other sources of income. Freelance writers and inventors derive income from the car industry. We've only scratched the surface, but you probably get the idea. To find spare-time money-making opportunities in the microcomputer industry you must look for needs not satisfied by the companies that make the microcomputers. This book will help you to identify these needs and show you how to satisfy them for fun and profit in your spare time.

Before proceeding with the mundane business of making money, you should become familiar with the four basic types of microcomputers.

The Four Types of Microcomputers

The microcomputer industry is comprised of two major segments. One segment involves computers for small businesses, and the other relates to small computers for home use. These two segments overlap to some extent. There is plenty of action in both areas for anyone interested in spare-time income opportunities. This book emphasizes the home computer segment with a few carefully selected excursions into the business segment.

Based on Chapter 1 (and a paragraph of Chapter 2) of "Home Computers Can Make You Rich" by Joe Weisbecker and published by Hayden Publishing Co., address above, reprinted with permission; 1980, 122pp; available at $5.95 from computer stores or from the publisher.

Microcomputers can also be classified as general purpose or special purpose computers. This gives us four basic types of microcomputers:

Type 1 - General purpose for business or industrial use.

Type 2 - Special purpose for business or industrial use.

Type 3 - General purpose for home or hobby use.

Type 4 - Special purpose for home or hobby use.

Let's look at the major differences among these four types of microcomputers. A general purpose computer can be programmed by its owner, which means that the owner of a general purpose computer can easily modify its operation to suit his changing needs. It also means that a manufacturer can mass produce one low-cost general purpose computer that will suit a variety of owner needs. Different programs tailor it to different owners. General purpose computers are generally designed with expansibility in mind. That is, you can easily add extra data storage capability or new input-output devices when they are needed.

Special purpose computers are designed for a limited set of operations. Their programs are built in by the manufacturer and are not easily modified by the owner. They usually have limited memory and specialized input-output capabilities that can't be easily expanded by the owner. There must be a large number of customers with the same application needs to justify producing a special purpose computer to satisfy these needs. Modern electronic calculators, video games, traffic light controllers, and cash registers are typical examples of special purpose microcomputers. General purpose computers tend to be more expensive than special purpose computers. The ability to change programs and expand input-output or storage capability adds to the cost of general purpose computers.

Business computers are usually more expensive than home computers for several reasons. First, the cost of a business computer is usually justified on the basis of tangible savings to the owner. For example, suppose the annual salary of a file clerk is $7,000 and the salary of a clerk who can operate a computer is $9,000. Over a two-year period two file clerks cost the business $28,000. If a computer operator and a microcomputer could replace the two file clerks, then it would cost the business $18,000 plus the price of the microcomputer over the same two-year period. The business would break even, or save money, if the microcomputer cost $10,000 or less. It is hard to set a similar tangible value on a home computer used for recreational, educational, or hobby purposes. As a result the market for home computers is apt to be much more price sensitive than the market for computers for small businesses.

Reliability

Another reason for the price difference between business and home computers is the quality of construction or reliability required. Business computers usually receive heavier use, and failures can be catastrophic to the business. Home use generally involves lighter use; failures are merely inconvenient. Higher quality and reliability requirements add to the cost of microcomputers designed primarily for business use.

A third cost factor involves the uses for home and business computers. Business use generally requires larger data storage capability, faster access to stored data, and printed output. Many home applications require only output on a TV screen and less demanding storage capability. Again, the added performance requirements add to the cost of the business microcomputer.

Some Typical Costs

The microcomputer industry is based on the four types of computers listed earlier. The general purpose, business-oriented microcomputer is usually the most expensive type, with current prices being in the $2,000 to $ 10,000 range. The special purpose microcomputer aimed at home use tends to be the least expensive type, with prices in the $10 to $500 range. Calculators and handheld electronic games fall in the lower end of this price range. At the top end are the elaborate video games and electronic home pinball machines. If you are going to use a microcomputer in your spare-time money-making activities, it will probably be a general purpose type.

Currently, a typical, minimum-cost, general purpose home computer costs $600 to $ 1,000. It has a keyboard with which to enter data and programs. Internal memory capacity is in the range of 4,000 to 16,000 bytes, or characters. Output is in the form of words, numbers, and pictures displayed on a TV screen. An audio cassette recorder lets you store data and programs for later use. The computer is probably programmed in a language called BASIC. In the future the price of a microcomputer system of this type might drop to the $200 to $600 range.

The minimum cost for a typical, general purpose, business-oriented microcomputer system is currently about $2,500. It has a keyboard for data entry and an internal memory capacity of 16,000 to 32,000 bytes, or characters. Both printed and TV screen outputs are provided. External data or program storage is provided by a magnetic disc device. Again, this system is programmed in BASIC. The future price for this type of system might drop to $1,500.

Several currently available microcomputers are described in Chapter 4. Just keep in mind that the microcomputer industry is based on the four types listed earlier. You should also remember that these four types of microcomputers reflect the different needs of various market segments.

Hardware Hackers and Programmers

The microcomputer industry includes products and people. To make money you should know something about both. Hardware hackers and programmers are two types of people you should become familiar with. They are potential customers, and you will eventually become one of them if you are serious about making money in the microcomputer industry.

Hardware hackers like to play with transistor circuits, build electronic gadgets, and learn how things work. They enjoy designing, modifying, or repairing computers. Hardware hackers build kits and find new uses for existing devices and parts. Electronic experimenters, engineers, technicians, and repairmen are hardware hackers. Most pioneers in home computers are hardware hackers. They read technical magazines and books. Companies such as Heath and Radio Shack cater to their needs.

Hardware hackers need books and articles that tell them how to build new electronic gadgets, how to fix or modify their computer, and how to control physical devices with a computer. They buy electronic construction kits, tools, test instruments, and parts. Articles, books, and information on inventing or how things work appeal to them. The number of hardware hackers is limited by the relatively high level of knowledge and skill required. Filling their specialized needs can be a financially rewarding spare-time activity with relatively little competition. You'll have to become a hardware hacker yourself to succeed in this area.

What Makes Programmers Happy

Programmers get their satisfaction from designing computer programs. In many cases they can't even use the programs they develop. The fun and challenge involve proving that they can make a computer do what they want it to. If you crossed a cowardly lion trainer with a crossword puzzle solver, you would probably get a programmer. The art of programming can provide a fascinating hobby or career. Programming provides the same mental challenge as playing chess. Many programmers are also mathematicians. Before the availability of low-cost home computers, most programmers were limited to playing with large computers owned by their school or employer. These professional programmers have been among the first people to buy inexpensive home computers. Because they have been "spoiled" by experience with large computers, they are the leaders in complaining about the limitations imposed on them by low-cost home computers. Programmers also like to argue about the merits of various programming languages. They spend large amounts of time designing operating systems, editing systems, and other programming tools just in case they want to write a useful application program some day. The ranks of programmers are growing more rapidly than hardware hackers because of the relative ease with which a beginner can learn programming.

Programmers need articles, books, and information on programming techniques, new computer languages, and new types of programs. They buy attachments to increase the capabilities of their computer and utility programs to make programming and debugging easier. Along with hardware hackers, they provide a market for computer-related gadgets, posters, and T-shirts. As new, lower-cost, easier-to-program computers become available, the number of programmers of home computers will grow rapidly. Learning to program will be necessary if you want to maximize your spare-time income opportunities.

Curiosity

Hardware hackers and programmers seem to have one thing in common - an avid curiosity about the other's specialty. Hardware hackers are anxious to learn about programming techniques, and programmers usually want to learn more about hardware. This provides you with an opportunity to write tutorial hardware articles aimed at programmers and software articles aimed at hardware hackers. You should keep in mind that your market will be comprised of people with interests and abilities in both areas. It is also helpful to divide hardware hackers and programmers into three skill levels - beginner, intermediate, and advanced. Beginning and intermediate programmers will comprise the largest group, whereas advanced hardware hackers will form the smallest group of potential customers for your products or services.

Identifying your market by specific interest and skill level will help you in designing and selling appropriate products or services. If you're aiming at advanced hardware hackers or programmers, you should stress newness, novelty, multiple options, or ability to customize for your product. If you're aiming at beginners, stress ease of use and low cost. There are magazines slanted toward beginning hardware hackers and others aimed at intermediate programmers. Knowing which group your customers belong in will tell you where to advertise your product or service.

Providing products and services that will appeal to hardware hackers and programmers is a proven, spare-time, money-making activity. Some larger markets for you to consider are discussed next.

Users and Nonowners

Many microcomputer owners or potential owners aren't interested in how computers work or how to program them. They are interested only in what the microcomputer will do for them. If they buy a general purpose computer, they want someone else to program it for them. These people represent a major market for special purpose computers and ready-to-use, general purpose computer programs. Most of the business market for microcomputers falls into the category of users. Lawyers, real estate agencies, doctors, or small stores don't buy microcomputers to play with or program. They buy them to save time or money in their businesses. Computer stores and software publishers satisfy this desire by providing microcomputer programs for standard bookkeeping and data-processing functions common to most businesses. Companies satisfy this need by providing special purpose microcomputers in the form of medical instruments and cash registers.

Although the business segment of the microcomputer market offers a variety of money-making opportunities, it is difficult for a beginner to take advantage of them. Business customers want immediate attention and may be reluctant to depend on a part-time hobbyist. Dealing with hard-nosed business clients isn't much fun and could make excessive demands on your time. Most computer stores, companies, and professional consultants are currently aiming their efforts at the small business market, and you will be faced with stiff competition. After due consideration, you will probably conclude that the best initial opportunities for spare-time income exist in the home computer segment of the market. After all, you'll have first-hand experience as a home computer owner yourself. Later on you may develop the skills required to compete in the small business area.

Market: Home Use

Large numbers of people will purchase general purpose microcomputers for home use. Some will be hardware hackers or programmers. Many more will be users who are interested only in what the computer will do for them. They want it for education, entertainment, saving time, making money, improving the quality of life, or impressing friends. They immediately discover that they need programs to satisfy these desires. Some will become programmers. Most will want to obtain a continuing supply of new programs for their computer without becoming programmers just because they make programming easier. They are popular because computer users can obtain programs for their computers without doing any programming at all. They can obtain these programs in the form of tape cassettes, books, or magazine articles. You can make money by designing new programs in your spare time. Of course, these programs should be those that a lot of people will want to use on their computers. Chapter 6 discusses writing and selling programs in more detail.

Potential microcomputer owners represent another large market segment. These people need to learn more about microcomputers and why they should own one. Writing articles that tell them about microcomputers can be a profitable spare-time activity. Giving lectures and demonstrations or teaching a microcomputer course at an evening school can put extra dollars in your pocket. People who are interested in buying a home computer but who can't justify the cost can often afford computer-related games, gadgets, and T-shirts. Many people won't realize that they want a computer until you develop the type of program that appeals to them. Computer companies are always looking for programs that will help them sell computers. Your new computer application might even be patentable in the form of a special purpose microcomputer. Somebody has to invent next year's hot new electronic game or toy - why not you?

With your own computer you can provide a variety of products and services for people who are not even interested in microcomputers. You might print their Christmas card labels, calculate their horoscopes, or provide entertainment at their parties. You can even use your computer to tutor their children. People who don't own general purpose microcomputers will outnumber those who do for a long time. Chapters 7 and 8 give you more ideas for profitable products and services aimed at non-owners.

Trend Watching for Fun and Profit

Keeping track of new developments and trends is part of any hobby or successful business. The microcomputer industry is evolving so rapidly that watching it closely is especially important if you want to find new spare-time money-making opportunities. To be successful you will have to learn to spot trends, recognize potential dead ends, and predict the popularity of new products.

There are all sorts of trends to watch. You should be aware of trends toward specific languages, microcomputers, and types of applications. Cost trends are particularly important. Demographic trends can tell you which age and income segments of the market are growing. Popular fads or trends such as biorhythm, astrology, or home security can give you ideas for articles, books, programs, or attachments that will be popular. Trends toward new input-output devices can open up new opportunities for you. Economic trends influence what people will buy. High rates of inflation should provide a large market for microcomputer programs to help people make or save money. A national trend toward gambling provides a market for computerized betting or handicapping systems.

The Programming Language BASIC

Early recognition of the trend toward BASIC as a popular microcomputer programming language would have provided the opportunity to write tutorial books and articles. There are now so many beginner BASIC books that your chances of interesting a publisher in another one are pretty small. Other languages may gain in popularity as programmers become bored with BASIC and new microcomputers appear. Early recognition of a new language trend will again open up the market for tutorial material.

The availability of new microcomputers will provide you with another set of opportunities, providing you can predict winners. Evaluate new microcomputers in terms of company, price, and function in order to predict winners. Is the company financially sound? Does it have adequate marketing, distribution, and customer-servicing capability? Can it manufacture in volume? Does the new computer have a significantly lower cost than other popular products in its class? Does it use the latest technology so that it won't become obsolete too soon? Does it provide obviously desirable new features at a low price? If the answer to these questions is yes, then you should consider buying the new microcomputer as well as stock in the company. New user groups, newsletters, programs, articles, and books will also be in demand.

Price Sensitiveness

In the area of small markets you have a major advantage over large companies. They can't afford to develop products or services for small, specialized, or local markets, but you can. Your overhead is low, and you don't have to make as much money to stay in business. Always be on the lookout for small markets that can provide you with a big spare-time income. Becoming an expert in several small specialized areas can give you a competitive edge.

Trends can help you in other ways. You should examine the markets that are left behind by a popular new trend. As new microcomputers appear, there is a rush to buy them, write about them, and develop uses or programs for them. Left behind temporarily are owners of older, less popular microcomputers. Because this group tends to shrink with time, it is often ignored. After all, who's interested in providing products and services for a shrinking market? The answer may be you. Owners of older microcomputers can still use new programs or attachments, and your competition in providing them will be minimal. Don't ignore this spare-time profit opportunity. At the same time be ready to move on to another area before your market disappears entirely.

In the next chapter we discuss some of the basic principles involved in making money. Armed with these principles and an understanding of the microcomputer industry, you'll be ready to start down the road toward financial freedom.

Chapter 2: Four Basic Ways to Make Money

To make money you can sell products, sell services, create new products, or gamble. The microcomputer industry provides opportunities for you to pick up extra money in any of these four ways. All the ideas in this book are based on these four approaches to making money. Let's take a brief look at each approach. ...

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The Computer Almanac and Computer Book of Lists — Instalment 13

Neil Macdonald
Assistant Editor

11 TECHNICAL SESSIONS ON "MAKING DATA BASES WORK" AT THE SECOND ACM GREATER NEW YORK REGIONAL CONFERENCE, NEW YORK, APRIL, 1980 (List 800501)

What to Look for in Database Management Software / Larry Welke, International Computer Programs Inc.
Impact of Coming Hardware and Software Technology / David Gable, "Electronic Engineering Times"
Contracting for a Database Software Product / Richard W. Thatcher Jr., Atlantic Software
Auditing Large Databases / Donald Adams, AICPA
Impact of Structured Design Techniques on Database Structure and Operation / Kenneth Orr, Langston, Kitch Associates
The Evolving Role of the Database Administrator / A. G. Brunettie, New York Telephone
Facing the Impact of Personnel Turnover on Database Maintenance / Joan Greenbaum, LaGuardia Community College
The Care and Feeding of Operating Databases: The CBS Experience / Myles Walsh, CBS, Inc.
Data Security in Database Operations / Robert Jacobson, International Security Technology
A Nontechnical Language for Nontechnical Users of Distributed Databases / Carol Brown, Winthrop and Brown
EFT (Electronic Funds Transfer): the Broadest Distributed Database / Christopher Gintz, Bunker Ramo International

(Source: announcement from the Association for Computing Machinery, 1133 Ave. of the Americas, New York, NY, 10036)

11 SHORT SUMMER COURSES ON COMPUTERS AND COMMUNICATION OFFERED AT GEORGE WASHINGTON UNIVERSITY (List 800502)

Modern Data Communications / Peter D. Bergstrom
PASCAL Computer Programming / Keith L. Doty, Stanley Y. W. Su
Computer Output Microfilm / William Saffady
Digital Transmission Systems Engineering / David R. Smith, John L. Osterholz
Software Design for Data Communications / William D. Skees
Computer Graphics Systems: Design and Applications / Robert L. Hellman
Configuration Management
Computer Assisted Make-up and Imaging Systems
Advanced Micrographics
Microcomputers in Control Systems
Microprocessors and Microcomputers

(Source: announcement from George Washington University, School of Engineering and Applied Science, Washington, DC 20052, (202) 676 6106, (800) 424 9773)

25 ENTRIES FROM THE PHONE BOOK AS A SAMPLE TO TEST RULES FOR SPELLING AND SEQUENCING IN MAILING LISTS (List 800503)

Petersen James D
Petit-Bateau Sari
Petchopiwong Sawad
Peter Sister Mary
Peteanu Ion

Peterson James D
Peters Lucy International Ltd
Peter's Bicycle Store
Pet Library Ltd The
Petelka Zofia

Petrino Carmela Delicatessen
Petri — See also Petrie, Petry
Petith Monica
Petricig James
Peterson Charles Theatrical Productions Inc

Peter & Charlie Hairstyles
Pessolano F John
Petrasovic E C
Peter Piper Clothes Co
Peter Pak Div of Consolidated Paper Corp

Pylyplw Hryhoris
Pzena Chas
Pyrpyris Vlassios Geo
Pyle David M Rev
Pyng Jou Her

(Source: New York Telephone Co., Manhattan telephone directory, alphabetical, 1979-80, pp 1074-1075, 1112)

6 LAWS OF GENERAL SCIENCE (List 800504)

Losing makes winning worthwhile.
- Dr. Reyer's Reflection

You can never tell which way the train went by looking at the track.
- Kramer's Law

If you can tell the difference between good advice and bad advice, you don't need advice.
- Van Roy's Truism

The graveyards are full of indispensable men.
- Charles de Gaulle's Postulate.

Logic is a systematic method of coming to the wrong conclusion with confidence.
- Manly's Maxim.

One and one does not necessarily make 11.
- Louis's Logic

(Source: "1001 Logical Laws ..." compiled by John Peers, published 1979 by Doubleday & Co., Inc., Garden City, NY, 189 pp) □

Computing and Data Processing Newsletter

QUALITY OF MEDICAL CARE RAISED BY COMPUTER INFORMATION SYSTEM IN A SAN FRANCISCO HOSPITAL

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When a patient is admitted to the Ralph K. Davies Medical Center's Franklin Hospital here, a sophisticated new computer information system virtually guarantees him a higher quality of overall medical care than he would have received several years ago. In fact, he has fewer worries about wrong medications, misinterpreted doctor's orders, or overlooked treatments than his counterpart in other hospitals.

Most mistakes made in patient hospital care are made in the administration of medications. 80% of those errors are in transcription and omission; but a new hospital-wide computerized system virtually eliminates this type of continual problem.

For example, when a doctor orders medications or intravenous fluids with medications for a patient, his orders are entered directly into a video terminal by light pen. These orders are immediately processed by the computer and displayed and printed at the appropriate nursing station and in the pharmacy, where medication is prepared.

Traditionally, a nurse would transcribe the doctors' orders onto a card, complete the appropriate color-coded medication card, send the information down to Pharmacy, note the completion of the orders, and then file the chart. The information is then passed along to the next shift, to the third shift, and so on throughout the patient's hospital stay.

Franklin Hospital, however, has installed a medical information system, which automatically handles the information and not only signals nurses when to administer the medication, but also insures that Pharmacy has prepared the medication exactly as the physician has ordered it. When the nurse records into the computer that she has administered a pill or injection, the patient is charged at that moment. No charges are made for drugs that a patient does not receive.

Approximately 75% of a nurse's time has traditionally been spent on paperwork processing; the new system has cut that time to less than 25%.

The new system also assures that a patient will not have to remain in the hospital longer than necessary because he has been poorly prepped. For example, if a patient gets fed at the wrong time, treatment can be delayed by 12 hours, which is another day's stay. Where dietary orders may have been lost in transmittal before, the new system guards against such misplacement, thus saving money for both patient and hospital. Lost or misplaced orders are a thing of the past.

Further, malpractice liabilities are significantly reduced by the new system. The system automatically signals Nursing when a medication has not been given, and also signals Pharmacy with audio and visual warnings. Thus, the chances that a malpractice situation would arise are a thing of the past.

229 COMPUTER SYSTEMS TO BE ACQUIRED BY THE U.S. AIR FORCE: FAILURE OF THE WORLD'S LARGEST COMPUTER PROCUREMENT PROGRAM

Jack Taub
Chairman of the Board
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" The history of the government's use of information technology is replete with examples of large failures at virtually every department and agency."

Is the Federal government, under current practices, capable of effectively applying information technology to Federal programs?

Exorbitant Costs

The history of the government's use of this technology is replete with examples of large-scale failures at virtually every department and agency. These failures have resulted in the government paying exorbitant costs for these resources, while at the same time reducing the effectiveness of the governmental process.

Industry Focusing on What the Government Needs

The information processing industry has the capability and resources to assist the government in solving this problem; however, two major changes must occur. First, the industry must refocus its attention toward providing the Federal government with what it needs — not what it wants. Second, the government must give the industry the flexibility to provide the most cost-effective solution to its problems.

I am aware that these objectives challenge the traditional relationship between industry and government, and appear to run contrary to the basic motivational drives of both groups. However, there is very little choice. If present practices continue, everybody loses. The recent failure of the Air Force's Phase IV project, the world's largest computer procurement, is a good illustration of this point.

Example: The Air Force's Phase IV Project

In April 1976, the Air Force initiated a project to replace computer systems at 118 Air Bases around the world. A total of 229 computer systems were to be acquired (approximately 2 per base) to support logistics, supply, and various other administrative functions which are carried out at the bases. After two years of preparation and several million dollars, the Air Force released a request for proposals (RFP) to industry in late 1978.

General Accounting Office: Review and Findings: Not Valid, Wasteful, etc.

The Government Operations Committee of the House of Representatives, which oversees the government's computer operations, received reports that the procurement was experiencing difficulties. The Committee commissioned the General Accounting Office (GAO) to conduct an investigation of the project. The GAO found that the Phase IV proposal was: (1) not based on valid workload requirements, (2) not preceded by an analysis of user needs, (3) not designed to achieve full and open competition, and (4) that it would result in the acquisition of twice as many computer systems as is necessary to meet the Air Force's requirements.

The GAO concluded that the present Air Force plan, if continued, could waste over $1 billion of the taxpayers' money and recommended that the present procurement be cancelled and the Air Force develop a simpler, more flexible and performance-oriented set of requirements which reflect actual base-level user needs.

The Air Force Said No

As could be expected, the Air Force refused to accept GAO's findings, and continued to proceed with its procurement plans.

The House of Representatives Government Operations Committee: Review and Findings: Questionable Statements of Need, Inadequate Provision for Competition, etc.

The Government Operations Committee held hearings on the Phase IV proposal. After hearing testimony from the GAO, the Air Force, and other witnesses, the Committee reported:

> A review of the Air Force's support for this position reveals that it has relied almost exclusively on broad generalizations of requirements and questionable statements of need. Further, the Air Force's cost analyses of these needs are incomplete and misleading. Also, the Air Force contradicts itself by admitting that it did not conduct an analysis of base-level user needs while at the same time asserting that the project cost effectively meets these needs. Finally, the Air Force's assertions that adequate competition will be achieved conflicts with the fact that only the two incumbent vendors have bid on this procurement.

Recommended that the Procurement be Cancelled

As a result of these deficiencies, the Committee recommended that the procurement be cancelled. A detailed account of the Committee's findings are contained in a report issued on December 10, 1979 (House Report No. 96-694). Each person reading this article has read that report. It will provide not only a complete history of the project, but also insight into the government's procurement process.

Both industry and government lose when a large-scale EDP project such as Phase IV fails. The government once again will fail to gain the benefits of modern technology, while the industry loses the opportunity to compete for substantial revenues.

What is the Solution?

The answer is simple. The government must give industry a chance to bid competitively its most innovative and cost-effective solutions, rather than remain constrained by some predetermined hardware solution.

Current Government Policy

This position is supported by current government policy: The Office of Management and Budget, through its Office of Federal Procurement Policy, issued Circular A-109 on April 5, 1976. The purpose of A-109 is to establish procedures to be followed by executive branch agencies in the acquisition of major systems.

Key provisions are to:

(1) Express needs and program objectives in mission terms and not equipment terms to encourage innovation and competition in developing alternative system design concepts;
(2) Ensure that each major system fulfills the mission needs;
(3) Accomplish system acquisition planning, built on analysis of agency missions resulting from clear articulation of mission needs; and
(4) Establish a program manager for each major system acquisition to provide continuity and accountability for the program.

The Air Force Disregards the Policy

The Air Force, of course, did not follow these criteria for its Phase IV proposal. Instead, the department issued a 1,200 page RFP, accompanied by 200 lbs. of attachments, outlining in great detail specific hardware specifications. Under these conditions, there is little wonder why the Air Force only received bids from the two incumbent vendors, UNIVAC and Burroughs. It is also understandable why the bids that were received consisted of nothing more than larger computers supporting obsolete programs and procedures, which have been in operation for up to 15 years.

Many Other Kinds of Solutions Available

Considering the geographic dispersion of the Air Force workload and the standardized nature of the administrative functions to be supported, one can visualize several more cost effective alternatives to satisfy the Air Force's base-level needs. A map provided by the Air Force illustrates the 118 locations which would have received new computer systems under the Phase IV RFP. Stars on it represent the number of computer systems which would be acquired through the Phase IV project and show their locations.

One alternative solution to the Phase IV project would be a distributive network, possibly in the form of an administrative utility that would not only support the current base-level functions, but would also provide additional capabilities. □

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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.)

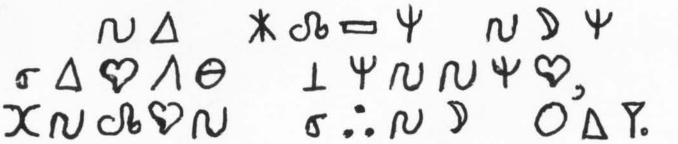
NAYMANDIJ 8005

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

MAXIMDIJ

In this kind of puzzle, a maxim (common saying, proverb, some good advice, etc.) using 14 or fewer different letters is enciphered (using a simple substitution cipher) into the 10 decimal digits or equivalent signs, 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 8005



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, 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 8005

```
                  T I M E
           *  B R I N G S
                R E O G O
              N B N I G
            E R S M I
          M G R B I
        B E G E R
      I N E R G
    = B M S T M O E S E O

      4405655
```

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

SOLUTIONS

NAYMANDIJ 8003: Make four plus signs.
MAXIMDIJ 8003: Try hard enough–and you can do anything.
NUMBLE 8003: Debt makes sad men.

Our thanks to Steve Werdenschlag, Livingston, NJ for sending us the following solutions: Naymandij 8003, Maximdij 8003, Numble 8003.

The Frustrating World of Computers

by Harry Nelson
1135 Jonesport Ct.
San Jose, CA 98131

I DON'T MIND SO MUCH THAT YOUR COMPUTER THINKS I OWE MORE THAN I DO BUT I RESENT IT TELLING OTHER COMPUTERS I'M A DEAD BEAT ——

THE COMPUTER BILLING IS CORRECT, YOU BOUGHT THE ITEM FOR $3.98 AND YOU OWE A BALANCE OF $1,367.88 ——

WELL, THEIR COMPUTER DID IT AGAIN, MADE OUT MY DRIVERS LICENSE TO MR. D. M. VEE ——

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