Computer Age

APRIL 1980 ISSUE 5 60p

‘This periodical can be highly recommended on the evidence of its first two issues. It contains for the businessman, professional firm, teacher and individual a reliable guide almost equivalent to a computer Which on the ins-and-outs of buying and using computers.’

The Times Monday February 18

LETTER FROM AMERICA

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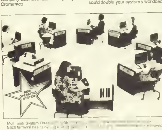

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Cover The American Connection
by S L Sant

Editorial

Toy computing

Readers will notice a letter in this issue with the same title. Tempting as it was to have left the letter in without comment, the importance of to what use computers are put means that we should remember that no computer is a toy until it is treated as one. Megabytes of main memory mean very little if the application is badly implemented or trivial. In contrast, a single board computer with a few thousand bytes of memory can control a machine tool or help a disabled person. So I do not regard our competitors as being stuck in the toy market. We can be proud that, in addition to **Computer Age**, *Britain has three good computer magazines.*

Contributors and readers

The importance of Computer Age deliberately scaling and taking the commanding heights of computing has been underlined by **The Times**. *But a magazine such as ours would be nothing without its contributors and readers. A truism perhaps, but when a play is commended for excellence its producers should bring the actors, not themselves, forward for a bow.*

When a reader writes a letter, he or she may not realise that an opinion expressed, or a piece of advice given, is taken seriously, though not necessarily acted upon. The only real concern I have is that the flow of letters continues.

■ *Readers ring up or write in for advice. We do our best, and welcome these requests, but cannot always help. What we would like is for professional programmers, analysts and software houses to write in to us giving in great detail machines and software they specialise in. This way, they can help us to help our readers.*

Meyer N. Solomon

Patrick Poon

Peter Krass

APRIL
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DIAL FREE ON A CORDLESS MOBILE EXTENSION TELEPHONE

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The Parliament of The British Isles, Rovafone and a new telephone breakthrough open the door to new consumer savings.

Britain's phone system is the world's greatest. No country can compare. But what has made our phone system even greater is the recent parliamentary decision to allow consumers to buy their own phone – phones they can buy themselves.

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words and forwards getting in a tizz.

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We Now Take A Big Risk!! That's right! But we're so confident about Rovafone measuring up to what you've been told and that you'll be 100% pleased with it that we are prepared to take the risk ... so this is what we propose.

You send us a cheque for £364.95 and for thirty days from the date you receive the complete Rovafone System you can check it all out thoroughly in everyway at no risk whatever. That's a promise. And remember the 30 days only start from when you receive the system. Not before.

If you're not totally convinced after this 30-day period (which will give you a chance to put Rovafone completely through its paces) simply return the complete system to us and we'll in return refund your £364.95 in full plus a cheque of our own to cover your postage costs insured on returning the system to us.

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THE MECHANIZATION OF MYSTERY:

WORK IN THE COMPUTER AGE

What will work in the computer age be like? This is an important but neglected question. The current debate on microelectronics applications is concerned mainly with the number of jobs that will be available, and not with their nature. But patterns of work and leisure are unlikely to change dramatically in the foreseeable future. Employment patterns will shift as some occupations decline and become obsolete, other occupations grow and new ones emerge. Levels of unemployment are determined more by the complexities of world economics than by local technological innovations. The fear that microprocessors alone will lengthen British dole queues is unfounded.

Work, as a way of spending about half of our waking lives, is therefore not going out of fashion. The quality of working life for many people will, however, be affected by the ubiquitous chip. The objective of this article is to examine the characteristics of this new technology and to look at how it could change our experience of work.

The following conversation takes place towards the end of George Bernard Shaw's play *Saint Joan*. The year is 1431 and the Maid of Orleans has just been burned at the stake for heresy, witchcraft and sorcery. The executioner returns to the castle hall where Joan was tried, to tell the Earl of Warwick that her body has been completely burned.

Warwick Well, fellow, who are you?

The Executioner (with dignity) I am not addressed as fellow, my lord. I am the Master Executioner of Rouen: it is a highly skilled mystery. I am come to tell your lordship that your orders have been obeyed.

Warwick I crave your pardon, Master Executioner, and I will see that you lose nothing by having no relics to sell.

Shaw published the play in 1924. The sense of this particular piece of dialogue relies on the now obsolete use of the word *mystery*. At one time, it meant trade or skill. Shaw's lines illustrate the way in which occupational knowledge and skill confer status on their possessor. The title of Master Executioner thus carries meaning and social recognition. Hence the Executioner's retort at being called fellow, and Warwick's apologetic reply.

Western industrial societies have since the turn of this century been witness to a process in which human knowledge and skill have been transferred to machines. The mystery of many occupations has become mechanized. Advances in electronics appear to be increasing both the pace and extent of this transference.

'We are preoccupied with Britain's economic problems.'

Is microelectronics good for us?

There appears to be widespread agreement that British industry and commerce must use this new technology. If we do not, we may be unable to improve productivity to a degree that will allow us to compete in world markets.[2] It is also widely believed that applications of microprocessors will enhance the experience of work in several ways. Robots and automated machines will take over jobs that are dangerous, unhealthy, dirty, unpleasant and boring. Computing and control devices that are cheap, reliable and powerful will reduce unit costs and improve the quality of many goods and services. Believing that we must use this technology and that it will be beneficial to do so, debate has passed beyond the 'if' and 'why' stages and is now concerned with when and how it will be used.

The British government and trade union movement broadly support these developments. Critics promise higher unemployment, and resistance to these inno

nent technological changes is based on threats to job security The critics case is strengthened by the accusation that however desirable these changes are happening too quickly Society is unable to make the appropriate adjustments by creating new industries, and by relocating the retraining sectors of the working population that become redundant These adaptive processes take time

Features of the new technology

Little detailed consideration has been given to the content of jobs and the nature of work in the computer age Change is a normal characteristic of modern industrial society and we should not be surprised when it happens What then is special or different about the technological promises of microelectronics?

The outstanding features of the new technology can be highlighted in comparison with older technology The table contrasts the abacus, a type of calculator that is still in everyday use in eastern countries with the programmable calculator These devices are useful for comparison purposes because they can both be held in the human hand and have been designed for similar purposes What is said here about the calculator applies to all computers (see below)

Calculators and computers are more useful but more complex devices than the humble abacus Microprocessor based devices in general are able greatly to extend human abilities but they are mysterious machines Although fairly easy to operate, compared with the abacus users have little or no understanding of what goes on inside and have no means of repairing them when they break down Building one s own calculator other than from a special kit of parts, is out of the question

Microprocessors thus widen the *psychological distance* between the user and the machine The abacus and most mechanical devices, are technologically transparent Their mode of construction and functioning can easily be understood by observation Electromechanical devices such as the programme control switches on modern washing machines are technologically translucent, and for most of us an intuitive understanding of their functioning is possible But microprocessors are technologically opaque They are forever beyond the comprehension of those who do not have the necessary specialized knowledge Opening up a calculator or a microcomputer gives the uninitiated no idea at all of how the thing works

Professor Donald Michie of the Machine Intelligence Unit at the University of Edinburgh has recently warned about the existence of technological black holes ' in self programming computers whose reasoning and decisions cannot be understood by even their human creators The tendency of technology to become more opaque and to incorporate more knowledge and skill previously held in human minds is not new Our world has been filling up with mysterious machines since the turn of the century Few people for example, know how their radio and television work

Microprocessors, however will suddenly and dramatically widen the psychological distance between most of us and the devices that we use and see around us This will be a commonplace feature of life in the computer age and will not be restricted to the workplace Microprocessors can already be found in factories offices cars homes shops and toys

The new Technocratic Elite

A major social consequence of technological capacity will be the rise of a professional elite comprising those who understand, design and develop microelectronics applications As the efficiency of our industry and commerce increasingly relies on these applications society will become increasingly dependent on the expertise of the ' technocrats a label used by the economist John Kenneth Galbraith [2] Other commentators have predicted this trend According to the sociologist Daniel Bell " In the post industrial society technical skill becomes the base of and education the mode of access to power " [3] And Sir Ieuan Maddock Chairman of the British Advisory Council for Applied Research and Development has predicted that ' ... there is the real likelihood that the workforce will become polarized into a relatively small technological elite able to move with, and enjoy the advancing technologies and to adapt to the changing circumstances and a much larger proportion of workpeople whose skills have become outmoded and who lack the education or the mental attitudes to adapt to change" [4]

Because of the level of education required membership of the technocracy will be limited, and tough to achieve That group will control key social decision making processes and will have much political influence and power This concentration of social control will create new pressures on the education system Those seeking access to the technocracy will demand more appropriate primary and secondary education more vocational further and higher education and more opportunities for re-education and for topping up individual qualifications There will also be pressure for more public participation in political decision making, particularly on technologically controversial issues Psychological distance between users and technology widens the social distance between technocrats and everyone else

The quality of working life

Technology is important but is not the only factor that influences the quality of working life The ways in which organizations are structured and in which work systems and jobs are designed, also determine the experience of work The precise impact of microelectronics in this respect is therefore not certain Research has shown that if work is to be psychologically satisfying, it must provide at least the following nine characteristics [5]

- 1 variety
- 2 autonomy
- 3 use of capacities and challenge
- 4 achievement and growth in competence
- 5 intrinsically meaningful work
- 6 socially meaningful work
- 7 interaction with others
- 8 recognition and feedback of results
- 9 responsibility

Robots automation and computers can replace human labour in undesirable jobs and bad working conditions But this technology can also be used in ways that make less use of human knowledge and skills and that provide fewer opportunities for human learning and development Robots may reduce the need for manual skills and physical effort in work, and create more need for perceptual and conceptual skills They may give human operators more control and scope for initiative in production processes or less Automation of simple tasks may create other routine jobs, or may make more demands on humans for problem solving and decision-making

	ABACUS VERSUS CALCULATOR	
	ABACUS	PROGRAMMABLE CALCULATOR
ORIGIN	Obscure, at least 500 years old	Recent; 1970s
MATERIALS OF CONSTRUCTION	Simple, natural, few	Complex man-made, many
MANUFACTURE	Simple, few cheap tools, few technologies involved	Complex sophisticated and expensive production equipment, many technologies involved
CAPABILITIES	Four arithmetic functions	Potentially unlimited range of mathematical routines
SPEED IN OPERATION	Fast on simple arithmetic, otherwise slow	Very fast.
USER SKILL REQUIRED	High much practice needed to develop expertise and speed	Low but high for sophisticated applications
USER REPAIR AND MAINTENANCE	Simple	Impossible (components are usually usually non repairable and have to be replaced when faulty)

skills

Operators in fully automated chemical processing plants for example have a high degree of autonomy, responsibility and control over the production process But they often find their jobs boring for long periods stressful when things go wrong and they are often socially isolated from their workmates The degree of control that they exercise is small because when things really do go wrong qualified engineers and technicians have to be brought in

Electronics in the office will eliminate repetitive clerical and secretarial tasks What will happen to those currently employed in these jobs? They may be made redundant or their jobs may be made even more routine, or they may be freed to do more interesting and challenging work. The copy typist could become either a mere word processor key puncher or an office information centre with a job function much broader than the conventional secretary

The future quality of working life will therefore depend on how work is organized around the new technology and not directly on the technology itself Microelectronics applications however do appear to have a unique potential to remove from work the nine components listed above Research has also shown that when these components are absent indifference and job dissatisfaction result This may lead to job induced stress deterioration in mental health and absenteeism Dissatisfaction with monotonous meaningless

Employment

work can lead to acts of sabotage which make the work temporarily more interesting and give employees the opportunity to express their humanity, when that opportunity is denied by the work process

Promise, threat and challenge

Promises and fears about automated factories and offices have appeared in print regularly since the last world war We are now beginning to build an electronic society What is clear is that automation through microprocessors will not automatically enhance the experience of work Much depends on how the new technology is introduced and on how organizations and work processes are designed to accommodate it There is always a good deal of choice on these issues and we have yet to discover how much freedom of choice there is and how to make the best use of the available opportunities

This places on those who design and apply this technology a responsibility to consider the social and psychological consequences At the moment, we are preoccupied with Britain's economic problems The microelectronics revolution that sweeps through the 1980s will not solve these problems unless it is handled with care and consideration for the human beings caught in its path This is the challenge of the computer age ■

REFERENCES

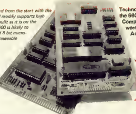
1 See *Joining and Assembly The Impact of Robots and Automation* Advisory Council for Applied Research and Development HMSO London 1979 **2** *The New Industrial State* John Kenneth Galbraith Penguin Books Harmondsworth, 1967 **3** *The Coming of Post Industrial Society* Daniel Bell Heinemann Educational Books London 1974 p 358 **4** Beyond the Protestant Ethic Sir Ieuan Maddock *New Scientist* 23rd November 1978 p 595 **5** *The Development of Job Design Theories and Techniques* David A Buchanan Saxon House Farnborough 1979 p 139

See page 96

Maintain the lead with Acorn 6809

the 6809 designed from the start with the programmer in mind readily supports high level languages and built as it is on the experience of the 6800 is likely to become the standard 8 bit microprocessor for the foreseeable future

Technology leader in microprocessors the 6809 is now available from Acorn Computer with full supporting hardware on a eurocard paired with the Acorn VDU interface at a special introductory price.



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Acorn is offering their two most powerful modules as the basis for a 6809 development system requiring the addition of keyboard, power supply and monitor For existing owners of Acorn Systems, the 6809 CPU card is a direct plug-in replacement for the 6502 CPU and can be used with all the supporting cards presently consisting of 8K memory, tape interface, VDU interface, Floppy disc drive Analogue to digital/digital to analogue and Universal Interface

For newcomers to Acorn the two card system can readily be linked to terminals printers, etc , the operating system firmware is designed for modularity and has disc bootstrap

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- Fully buffered address and data bus
- 2K operating system with
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  - VDU routine
  - Cassette load and save
  - Disc bootstrap
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  - All usual debug facilities

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- RGB & Sync output
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- Single 5v rail

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"Ooh said a visiting colleague He worked in Fleet Street You ve got one of Those! He picked up the remote control for the TV and stared wistfully at the back for a moment before turning it over 'I thought it was a calculator' he said But it isn t is it it s one of those things for the telly How does it work?

He blotted out *Ryan's Daughter* and *Dallas* in two easy moves

' And you ve got a recorder How posh! Oh look it gets those word things as well! How do you do that?" I showed him The Oracle glowed fretfully across the room I sensed that I was going to have to mutter the usual apologies

"What do you use it for?" he asked It was an embarrassing question

"Well I said You can find out what s on at your local cinema and then you can get a potted criticism of the film It saves you going out

Isn t it very expensive?

'Well it s all rented We work in telly, so we get a bit off tax too I suppose But really it s not much use at all You get the

'At first all went swimmingly in the typing pool.'

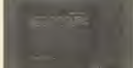
News headlines four hours out of date of course it s not as good as Prestel — but if you re lucky it ll tell you how much Sainsbury s are asking for a bottle of British sherry in Coulsdon "

It was at that point that I realised the Communications Revolution was falling apart at the seams We re never going to be ready for it I launched into the following tirade approximately

'The problem with it all ' I said nervously, in case he was in the pay of ITC — Is that we hardly ever use it I ve got a miniature tape recorder upstairs with a miniature Sony lapel mic Why, I don t know It s not broadcast quality — none of those things are But I just can t bring myself to talk to it I feel like an idiot Any writing I want to do I do on the typewriter It saves you going through two processes I ve used it in a real interview twice in the eighteen months I ve had it

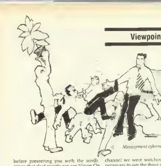
"As for the typewriter, it s an IBM golfball with a correcting ribbon that lifts half the mistake off the page The registration s no more accurate than on a portable worse in fact My typing speed is slower, because if you hit the keys too hard you get a double letter and if you hit them too soft you get a hyphen which you have to go back and erase Because that damned corrector key is there, you tend to use it That cuts your speed by about half

"The TV, as you observe, has a remote control panel It offers you twelve different ways of getting the set to tell you which channel you re watching You can also use it to mix Teledata over the picture, allowing you to see neither clearly If the set's tuned to BBC 1 you can t get Oracle If it s on ITV you can t get Ceefax Though Ceefax is quicker, that s because it only has a hundred pages to browse through



GEC Prestel set

Prestel for Apple II



Management cybernetics

Viewpoint

before presenting you with the intelligence that deaf people can see Vision On with subtitles next Thursday on the page the Index said would give you the latest Market report

Oracle has nine hundred pages though it doesn t use the first two hundred unless you want one of the other seven hundred at the time If it s more than a hundred pages from your programmed destination, it may make a quantum leap for you — otherwise you have to wait for the seven hundred little numbers to come up including the pages it sticks on

Eventually you arrive at the page you require only to discover it s in four parts You want part 1, but it's already on part 2 You have no control over these page subdivisions which occur because the system has no way of getting all the information you want on to one page despite the little twerker that gives you either the top or the bottom of the page in what looks like unstretched Panavision You have to wait for the slow readers to catch up

"Then having discovered that only half the information you want is on page 476 you have to go back and comb through the various Indices in order to find the rest of the information you want It would be far quicker if they issued a printed Index but that would be admitting the deficiencies of the system So you give up and phone the Daily Telegraph Information Service, or get in the car and go out and buy the local paper

"It s all irrelevant anyway since Oracle tends to present its information in dark red letters on a burgundy background Adjusting the Brightness only brings up the background as well — while the Contrast control is seemingly a device relegated to the previous generation of TV receiver

Last week I summarised the calculator battery in the control unit started to flatten dramatically It only works up to about eight feet at the best of times — but there we were having to get closer and closer to the set in order to find out which channel we were watching until it was necessary to jam the thing right up against the magic eye in order to get it to work It was at that point we realised we could actually see the little red lights on the channel selectors, telling us which channel we were watching

And that, in short sums up our life with the Domestic Communications Revolution If as has been said Information is Power and the access to computerised information is going to restore to the individual the power the State and other users of valve computers have in the recent past usurped, then God and Robespierre help us all But what of the Corporate user? Surely in the world of Critical Path Analysis and Flow Chart Forecasts there must be some cogent use for all this tasteful matt black hardware?

Not a bit of it Two tales from the Revolution will suffice

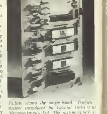
The first concerns my father who manages a large firm heavily into the lucrative field of Business Communications This from time to time involves typing lots of scripts for expensive multimedia presentations including vast conferences for firms like IBM and ICL Consequently the firm is under some pressure to present an upmarket updated micro chip image to its gold chip clients Under this pressure they spent fifteen thousand pounds to bring in a word processor which would eliminate script errors and justify type as well as all the other miracles like collating copying making the tea and forecasting the 2 30 at Newmarket It was also supposed to unleash the full creative potential of a highly involved management motivated decision taking and participating Sitz bathful of secretaries In short my father s firm were investing in a piece of the 21st century every bit as ingenious and necessary as the Hewlett Packard wrist calculator he bought himself one birthday and swapped six months later for a watch

Well At first all went swimmingly in the typing pool copies of scripts were appearing clean tidy and fully justified from the bowels of the machine And then within a few days the management noticed something odd Only half as much work was being done The machine had come to dominate the office completely There were queues to get on it because golfballing scripts was now secretarially passe and definitely infra dig Scripts were piling up and it still took just as long to proofread and correct them Somebody had to do the proofreading just as before True copying and collating were quicker But they had hired an extra girl to operate the thing In the end they had to order a second machine to try to cope with the chaos the first one had caused Parkinson s Law applies equally to Man and Machine it seems The actual product was no better than it had been before

I wonder how many firms are investing in the Electronic Office only to find they re exchanging a flexible form of tyranny for an inflexible one?

The second story concerns a friend of mine who used to manage his own Film and TV facilities hotshop His big break through came when he won the world distribution franchise for a piece of Silicon Valley Ca technology that was going to knock TV s eye out It was an EFP (Electronic Film Production) tool of remarkable complexity and miraculous miniaturisation There, in a box the size of a briefcase were two roomsful of VTR editing equipment The heart of it a digital computer Hooked up between two video cassette recorders working from either U Matic or 1 Ampex standards this little baby would On or Off line edit any programme you wanted to make It even gave you wipes dissolves fades and wobblies right on cue and had automatic sequencing and high speed search facilities To overdub a sequence was simplicity itself — it would stretch automatically to fit the voiceover and was accurate to less than half a frame It was also cheap

In other words he had a professional



Picture shows the single board Tex... system introduced by General Instrument Microelectronics Ltd The system which is controlled using a single chip microcomputer will enable a normal TV set to receive both telephone line based (Prestel) and TV transmission based (Ceefax and Oracle) information systems toy that had Communications Revolution written all over it, and sold hundreds overseas (British television of course still works on 2" VTR standard and uses film for gathering News)

In this country the main market has been industrial and educational. At the heart of a lightweight low cost record — edit — distribute TV system this little box of tricks has helped wake our industry up to the myriad possibilities the electron can afford to the information process Training functions for instance Recording the movements of a traditional craftsmen for posterity Monitoring production lines for systems analysis And the secondary marketing uses — producing low cost

Viewpoint

Sales visuals for example Secondary conferencing Dummy runs for advertising campaigns Training and informing distributors And giving the company front men some dry media experience Almost anything you can imagine

I say 'You can imagine' but it seems industry can't Because once they've bought the stuff my friend reports, they can't find any long term use for it Once you've made your training film, it's made You get the odd Chairman who likes to record his Christmas speech but that's about all Just as we hardly ever use Teledata in our own home because as workers in the information industry when we need to find out anything we have our direct sources without having to consult a tertiary information network like Ceefax and Oracle so firms who invest in electronic media do so for reasons other than business need Keeping up with the Joneses Bad marketing advice Fear of being left behind in the New Technology ratrace

A major multinational chemicals concern keeps a fully-equipped TV studio in Milton Keynes Although it cost thousands to set up the only part of the system that is regularly used is the A/V recording studio The TV equipment is lying idle because the firm has no ongoing use for it

A major redbrick and modernist university has built a TV studio complex for its Communications course It has a fifteen camera setup It's hardly ever used because it's not a Media course

And my friend reports getting a call one day from another multinational giant, inquiring about setting up a studio "What do you want to do in your studio?" inquired my friend politely After all, his marketing policy consists of offering the right system for the job in hand, a unique philosophy it seems, in the videobiz "I don't know" said the anguished voice at the other end. But they've told me to spend £90 000!"

Paul Ingrams is a freelance broadcast journalist and short story writer

Block diagram showing how GIM's "Televiev" system is connected into a standard TV circuit and interfaced to the viewer's keypad The single board system is shown in white

COMMUNICATION FOR THE DISABLED

The author met the editor at the Microsystems 80 exhibition and this article was commissioned then

There is a revolution in this country which I want to tell you about. It is a struggle in which the ammunition is supplied by comrades engaged in the nearby Microchip Revolution and ultimate victory brings ultimate independence.

In Britain, there are 1½ million people who suffer from some form of handicap. About 30 000 babies are born every year permanently damaged. They belong to one of the most stigmatised sections of our so-called compassionate society. Handicap seldom comes singly and seldom has a single cause. It may be the result of congenital abnormalities, progressive neuromuscular diseases such as multiple sclerosis, or industrial accidents. There is also an enormous variation in the types of handicap, needs, and the residual physical or mental abilities these people have.

Let us concentrate on one specific group — those who suffer from cerebral palsy, more commonly known as spasticity. Cerebral palsy manifests itself as a loss of voluntary muscle control which ranges over a broad spectrum from slight hand tremor to very severe cases where control of virtually all parts of the body is grossly accentuated or absent altogether. Cerebral palsied individuals experience difficulty in walking, swallowing and communicating, and everyday survival sometimes depends on someone being on hand to cater for the basic physical necessities of day-to-day life which we take so much for granted.

In the more severe cases, the victims often retain full intellectual ability but speech and limb mobility are lost, making communication extremely difficult and frustrating. For example I know a bright-eyed twelve year old girl who can only communicate by a painfully slow nod or shake of the head in response to yes no questions posed to her. Therefore there exists a need for these non vocal people to be able to communicate not only their basic needs but also to express their thoughts and ideas creatively and to become independent and valued members of our community.

At present these needs are not being fully met. Existing communication devices such as the POSSUM equipment supplied by the Health and Education services, although innovations of their time, are now considered by many schools and individuals who use them as being too slow in operation, inflexible and bulky.

Research is in progress in the Electrical and Electronic Engineering Department of King's College, University of London to investigate methods of increasing the rate at which severely physically handicapped people can communicate by utilising available technology in the form of the microprocessor.

The Microcomputer Assisted Communicator (M A C) has been developed as a basis for evaluating various techniques to speed up communication rate. It is based on the standard NASCOM 1 microcomputer board and packaged into a briefcase for transportability. Sockets on the side of the case allow direct connection to the aerial socket of a domestic television set and to one or more user switches.

The prototype M A C has been developed in association with a London school for pupils with motor and communication handicap. It has been used by a 15 year old boy who is cerebral palsied and relies on a POSSUM communication aid operated by two foot operated switches for classwork. POSSUM uses a matrix selection method and thus was duplicated on the television screen to reduce the amount of new learning involved and resulted in a rapid transfer to the new equipment. Features and improvements suggested by the pupil and teachers involved included full editing facilities for producing error free text not previously attainable using conventional communication aids and a special matrix containing digits and arithmetic symbols to allow column arithmetic to be performed easily without repeated back and forward spacing.

The screen of the television is divided into two sections, namely the matrix and the text areas. Letters of the alphabet as well as punctuation and special characters arranged in a matrix in the lower half can be transferred to the top portion comprising the text area. A sequence of switch depressions first selects the row in which the character appears and then scanning along the row to select the desired character. The type and number of switches used will depend on the specific and/or residual physical capabilities of the user. For example someone with gross movements of one foot will make use of a switch which will activate when the foot is raised or lowered while a person with good hand control but limited range of movement may be able to use a proportional device such as a joystick to steer a cursor around the matrix.

The NASCOM 1 was chosen for its availability, versatility and cost. As very few communication equipment outside the POSSUM range have been approved by the Department of Health, it was envisaged that M A C could be constructed by an enthusiastic volunteer since the NASCOM is supplied in kit form. The arrival of the NASCOM 2 is a blessing in disguise. While it is much more flexible than its little brother and has a larger on board memory capability, there are as yet unresolved hardware problems requiring inelegant solutions which makes it unsuitable for construction by an amateur without proper test equipment. However once debugged and running the

Continued on page 54 ▶

The King's College microprocessor communicator (M A C)

MICROTEK

The Microtek MT 80. A versatile alphanumeric line printer. Totally self contained with three distinct applications. At home for personal computing to fulfill your hobby or leisure needs. In small business to promote efficiency. In industry and research serving a vital need.

The MT-80 is quietly functional and remarkably reliable. So reliable that we can offer a full ONE YEAR warranty. Feature for feature the MT 80 is miles ahead of the competition with dependable performance, fast factory service, and an incredibly low price.

The MT 80 printer has innovative features usually found in printers two or three times the cost.

INTERFACE SPECIFICATIONS
(specify interface type with order)

The MT 80 series printer is available with three types of interface each implemented on a different field exchangeable logic board.

• PARALLEL INTERFACE (MT 80P)
The MT 80P accepts data in a bit parallel character serial form. Data can be entered into the printer's buffer at rates in excess of 1 000 characters per second with the application of an externally applied DATA STROBE signal. An internally generated ACKNOWLEDGE signal from the printer indicates that the character has been accepted. A BUSY signal from the printer is generated when the data buffer is full, or when further reception of characters must be inhibited for other reasons. PAPER EMPTY, SELECT, FAULT signal ground, chassis ground and logic + 5 VDC are also provided at the interface connector. A low signal presented on the INPUT PRIME pin will clear the printer's buffer and re-initialize the logic. All input data and interface control signals are TTL compatible, and are designed to be the same in timing and sense as the standard Centronics interface signals.

• SERIAL INTERFACE (MT 80S)
Serial interface signal levels conform to the RS 232C specification. The interface accepts asynchronous serial ASCII input at switch selectable rates of 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud. An input character code of 1 start bit, 7 data bits, 1 parity bit, 1 stop bit or 1 start bit, 8 data bits, no parity bit and 1 stop bit is assumed. The parity bit, if used, is ignored by the printer. A busy indication appears on the Data Terminal Ready (DTR) and Clear to Send (CTS) pins when for any reason the printer must inhibit the transmission of data.

• IEEE 488 INTERFACE (MT 80G)
The IEEE 488 interface conforms to the GPIB international standard for acceptor handshaking and listener functions, and consists of 16 parallel lines divided functionally into three groups. One group of eight lines carries data bytes and interface control messages in a parallel fashion. The second group consists of three lines (DAV, NRFD and NDAC) used as a control handshake for the transfer of data between devices. The last group consists of a five signal management bus (ATN, IFC, SRQ, REN, and EOI) used for the control of the entire interface system. All signals are available through a standard IEEE 488 connector.

CHARACTER FORMAT
The MT 80 Series Printer contains three complete character fonts — a 9 × 7 font printable at 10 characters per inch (80 characters per line), a 10 × 7 font printable at 5 characters per inch (40 characters per line) and a 7 × 7 font printable at 15 characters per inch (120 characters per line). Each column can print any of the 96 character standard ASCII set, and fonts can be intermixed on the same line.

PRINT CYCLE
An ASCII CR/LF pair (or CR only if the auto line feed switch is on) is normally transmitted at the end of each data line and initiates the print and line feed cycle.

PAPER FEED
The non-printing paper feed rate (slew speed) is 10 lines per second. Paper feeds can be initiated by any of the following methods:

ASCII LF CODE (LINE FEED) — Paper will be advanced one line for each LF code received.

L F PUSHBUTTON — Each depression of this front panel pushbutton will cause the paper to advance one line.

ASCII FF CODE (FORM FEED) — Receipt of the ASCII Form Feed (FF) code will cause the printer to automatically feed paper to the next top of form position.

T O F PUSHBUTTON — Depression of this front panel pushbutton will cause the printer to automatically feed paper to the next top of form position.

ASCII VT CODE (VERTICAL TAB) — Receipt of the ASCII Vertical Tab (VT) code will cause the printer to feed to the next available vertical tab position or to the next top of form position, whichever comes first.

PAPER EMPTY DETECTOR
When the paper supply has been exhausted, printing is inhibited, the red P E light on the front panel is illuminated and the green SEL light on the front panel is turned off. The paper empty function may be over ridden by depressing the SEL switch on the front panel.

CHARACTER BUFFER STORAGE
220 bytes of FIFO data storage are provided in the standard MT 80 printer. Optional data storage up to 4K in 1K increments is available. Data can be received and stored in the buffer simultaneously with the printing operation.

CONTROL CODES
In addition to the previously mentioned CR, LF, VT, and FF codes, the MT 80 series printer recognizes the following control codes:

- DC1 — Selects the printer to receive data and control characters from the interface.
- DC2 — Begins the skip-over perforation setting sequence.
- DC3 — De selects the printer from the interface.
- DC4 — Begins the forms length setting sequence.
- STX — Begins vertical tab setting sequence.
- ETX — Ends vertical tab setting sequence.
- FS — Selects the 5 character per inch type size.
- GS — Selects the 10 character per inch type size.
- RS — Selects the 15 character per inch type size.

DESIGNED FOR RELIABILITY

LOADED WITH INNOVATIONS

- 9X7 Dot Matrix
- 80 or 120 columns per line plus double width printing
- 125 characters per second, 70 lines per minute bi directional throughput
- Complete 96 character ASCII set (upper case and lower case) in 3 software or hardware selectable fonts
- Pin Feed paper handling system
- Sophisticated vertical format unit
- Forms width continuously adjustable from 4 5 inches to 9 5 inches
- Paper entry through bottom or rear
- Highly reliable print mechanism (100 000 000 characters print head life 1 000 000 lines MTBF)
- Comprehensive self diagnostic software
- Prints original plus three carbons
- 1K to 4K data buffer option available
- Three popular interfaces available (parallel serial IEEE 488)

SWITCHES AND INDICATORS

In addition to the power on/off select line feed and form feed switches and their associated in dicators the following internal selector switches are provided

CHARACTER WIDTH — Two switches determine whether character size is software selectable (using the FS GS RS codes) or fixed at 5 10 or 15 characters per inch

AUTO LINE FEED ON OFF — If this switch is on a line feed will automatically be appended to every CR code received

TRUNCATE/WRAPAROUND — When the line buffer contains more data than can be printed on a single line the extra characters will either be truncated or printed on the next line depending upon the position of this switch

BAUD RATE (serial interface only) — Three switches will select the in coming baud rate to 110 150 300 600 1200 2400 4800 or 9600 baud

BI DIRECTIONAL/UNI DIRECTIONAL PRINTING — All print speed specifications given assume this switch set at the bi directional position For extremely precise vertical alignment of columns where throughput rate is of secondary importance uni directional printing may be desirable

SELF-TEST FEATURES

Each time the MT 80 series printer is powered up a comprehensive self test program is automatically ex ecuted The microprocessor the con tents of the ROM memory and the RAM memory are exercised If a non fatal error is detected the red P E light on the front panel will begin flashing When the SEL but ton is depressed an attempt will be made to print a message indicating the nature of the problem If the L F switch is held depressed during power up the printer will when selected print one line feed and a continuous series of HHHHHHHHH HHHHHHH lines across the entire printable area A trimmer potentiometer is provided for obtaining vertical print alignment between left to right and right to left printing lines The HHHHHHHHH HHHHHHHHH pattern is very useful for this align ment procedure If the 'T O F switch is held depressed during power up the printer will when selected con tinuously repeat a sequence that prints all three character sets

Parallel interface @ £495
Serial interface @ £525
IEEE 488 interface @ £550

Kingston Computers Limited

Scarborough House Scarborough Road Bridlington YO16 5NS Telephone (0262) 73036

A MEMBER OF THE DALE GROUP OF COMPANIES

A MODERN MENTOR

The use of the computer as a teaching [illegible] on a scale comparable with its bu[illegible] lications A sure sign of this is [illegible] bureaus offer teaching packages

Scarcity of skills, and of teachers to impart them, is one of the factors that hampers the growth of many British companies It is therefore surprising that as yet the potential of the computer as instructor has been little exploited For training courses whose subjects may range from the servicing of machine tools to the installation of washing machines the operating routines for a computer terminal or the latest legislation on employment can all be very successfully administered through a computer

A service called MENTOR has recently been launched by a Yorkshire based computer bureau PMSL Computer Services Available throughout Britain via terminals and the public telephone network it provides on-demand access to instruction progress of all kinds These may be specially written for customers by PMSL or devised by the users themselves

Those who decry computer aided instruction seldom appreciate that this is a tool for training not education in the true sense of that word CAI does not claim to supplant the human teacher On the other hand by translating his or her knowledge into the form of computer programs, it disseminates this far more widely and thoroughly than is possible by conventional methods It also, as experience (particularly in the USA) has demonstrated has a number of inherent virtues

The Sperry Univac BC/7

Instruction on tap

Instruction is for instance on tap at any time that happens to suit the individual and wherever a terminal is available As far as the PMSL service is concerned this is any place to which a portable terminal can be carried and there is a telephone that can link it to the central computer through a little device known as an acoustic coupler

The pace at which a lesson is administered is determined entirely by the individual trainee and the system with limitless patience will repeat a point as often as he commands it to The slow learner need not therefore be embarrassed or the fast one held back

MENTOR tests each student frequently not permitting him to move forward until he has demonstrated his thorough understanding of the lesson presented thus far It can also measure each student's performance Statistics collected in this way not only provide an impartial assessment of progress but may reveal any weakness in the presentation which the writer of the course can then remedy

PMSL Computer Services the computer bureau that is providing this new service is well established and well financed It is a wholly owned subsidiary of the Provident Financial Group which began its life in 1880 as the Clothing & Supply Company and is today the largest check trader in Europe if not the world with 1¼ million customers 500 branch offices 12 000 agents and 50 000 retail outlets to redeem its checks Group activities now also embrace estate agencies insurance banking and the provision of a range of credit facilities for the public

Developing market

Why I asked David Holroyd Marketing Director of PMSL had the bureau chosen computer aided instruction as the subject of its latest service? There were two excellent reasons. First we see a very rapidly developing market — I'll enlarge on that in a moment. Second because our computer is a Sperry Univac 1100 series (which incidentally handles terminal based applications very efficiently) we have been able to base MENTOR on the Sperry Univac's own ASET computer aided leasing software.

This in our opinion is an exceptionally good all round computer aided instruction system with many years of user experience behind it.

In keeping with their overall product policy PMSL have added value to the ASET software package by enhancing its basic facilities. Their MENTOR service incorporates ASET but also gives greater terminal flexibility so that users may use their own existing networks if they wish. Another feature is the input of graphical data in a most simple but effective manner. This enables users whose training requirements need graphical displays to incorporate the most sophisticated diagrams into their lessons without the normal complexity involved in this process. The other part of ASET that has been enhanced within the PMSL MENTOR service is the record keeping and reports section. This is because PMSL believe that the management assessment element of computers in education and training will always be an important feature of an organisation's choice of such a system.

When you consider that as well as all this PMSL have dedicated one of their four Sperry Univac 1100 computers to the MENTOR service and designed a simplified but secure sign in for authors and students then you can see why I feel that MENTOR is one of the most interesting services to come on to the market recently.

Price-performance ratio

One of its virtues is that it uses a minimum of computing capacity. In consequence cost per student hour to the user is very reasonable. Another advantage is that its author language is both simple and powerful. In this context 'powerful' means that the user is not restricted by technical constraints in what he can do. Even a person totally unfamiliar with computing will find it easy to develop

Bureau Package

his own program of instruction. He will also be able to do this interactively, in conversation with the computer through a TV type terminal. PMSL therefore expects that many customers will want to write their own programs — with guidance from bureau specialists if and when they need it.

Many people who consciously or not are somewhat unnerved by computers are completely won over when they begin to use a terminal. For in conjunction with a good lesson this method of operation makes the machine seem both friendly and responsive. An approach known as the tutorial mode guides the user step by step and if he makes an error indicates the nature of this and how it can be remedied.

'We expect company training departments to be among our biggest users, on the grounds both of economy and convenience.'

Appreciating that hands on experience is the best salesman PMSL is offering prospective users a six months trial period that will allow them to evaluate computer aided instruction within the context of their own requirements. The bureau charge for this service including rental of one terminal and an acoustic coupler will be around £3,000. To this must be added whatever the user must pay for Post Office line time which typically works out to between £1.00 and £1.25 per student hour.

Sales or company training

'We expect company training departments to be among our biggest users on the grounds both of economy and convenience.' David Holroyd asserted. 'Many will find for instance that it is no longer necessary to call people into head quarters for training. One customer company who used to send technicians on a three months course in France now trains them here. Since the computer is always available departmental managers can stagger training times so that perhaps only one person is absent at a time and in this way disruption is minimised.'

The PMSL computer aided instruction service may also solve the post sales support problem for many companies. Computer manufacturers are a case in point. In the old days there were fewer computers and these sold for hundreds of thousands of pounds. It was therefore possible to absorb the cost of support services. But this situation has changed. More and more low-cost minis are being sold, many to first time users. Support people are getting more expensive and harder to find. It can be a real headache to provide economically the level of service such customers need.

The system in use

A customer company is now evaluating a scheme which will allow its own customers to use the PMSL system to train operators in new company routines. When I accepted the invitation to try this system for myself I found that guided by the program I was effortlessly learning a routine for entering accounting information into the computer through a visual display terminal.

This same PMSL customer I learned is investigating the use of computer aided instruction for teaching COBOL to computer programmers. Another customer finds it an effective way to teach the use of a radar simulation system. Estate agents who are buying PMSL's own estate agency computer and software find the service provides an efficient and acceptable method of training their own office staff and of course PMSL itself and other Provident Financial Group companies use MENTOR in house to instruct sales and other staff. "There is no doubt at all in my mind that computer aided instruction will soon be indispensable in all kinds of organisations." David Holroyd concluded. "It is cheap. It is flexible. It is totally acceptable to students. And of course it is always available so that anyone who feels he needs a refresher can just sign on to our computer and re-learn anything on which he is rusty." ■

This Is ITMA

ITMA stands for Investigations on Teaching with Microcomputers as an Aid. This is the first article in a three-part series on the development of the ITMA project. Rosemary Fraser teaches at the College of St Mark and St John, Foundation, Derriford Road, Plymouth PL6 8BH.

How can a microcomputer become an effective aid to teachers in the classroom? This is the question that the ITMA team is concentrating on. From early experiments in the classroom we are convinced that a large display under computer control can offer the teacher an extra dimension in the classroom. This article introduces the work of the ITMA Project.

The full time staff of the project is based at the College of St Mark and St John, Plymouth. The team depends very much on its local schools and teachers' efforts and also on liaison with other research groups. The four areas of investigation being undertaken are:

- 1 Classroom observations — classification of interactions
- 2 Evaluation of materials — classification of the use of materials
- 3 Exploitation of the microcomputer's potential — providing good user/machine interface and offering varied assistance to the learning process
- 4 Production of flexible teaching material

One of the most difficult tasks of work in this area is communicating to people exactly what we are trying to do! An interactive computer program is a very different type of teaching aid to those we have become accustomed to. Blackboards, chalk, textbooks, workcards can be used by the teacher to add to the lesson and to the variety of presentation and discussion in that lesson. With programs that are flexible in design and suited to the teacher's style, the microcomputer can be used in the same fashion. However the microcomputer can play a much more compelling role than the usual aids and can indeed control part of the lesson.

We are observing teachers in the classroom both with and without computers. With the teachers' help, we are beginning

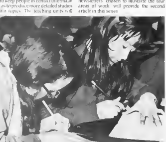
Teachers

to build up experience both of computer use and classroom observation. In the classroom observation we are concerned with detailed interactions. For the mathematics classroom we have developed, in collaboration with Nottingham University, a system called SCAN(1) to help us capture detailed feedback. The photographs that accompany this article show how motivating using a computer can be. It must surely be well worth while exploring and reporting on the possibilities.

ITMA is very much concerned in writing programs that provide an environment for discussion and investigation in the classroom. The teacher is responsible for the teaching, using the controlled display and the facility of interacting with the program when and how it is required. We are *not* in any way producing programmed learning sequences. The work of the project is to be published in the form of teaching units, research papers and regular termly newsletters (2). This gives us the opportunity to keep people in contact informally as well as to produce more detailed studies in certain topics. The teaching units will provide descriptions of classroom activities and full teaching notes as well as the computer program.

The ITMA team is primarily concerned with the art of teaching and learning. During the Project's short existence of just over 12 months, we have become convinced that through the study of how to use a microcomputer in the classroom we shall learn better how to teach both with and without the aid of a machine. The Project is structured with curriculum development groups which at present include Geography, Economics, Mathematics, Computer Studies, Physics and Primary groups. These are to be supported by a programmers group and an observers group. Our major problem is to support the enthusiastic response from the classroom.

Selected papers from the Project's newsletters, chosen to illustrate the four areas of work, will provide the second article in this series.



Finally, we include a selection of comments from children involved in a lesson with the computer. This lesson was held in the studio at the college and is one of several lessons that we have recorded on video.

I think the computer was a very good idea. It was fantastic working with it because you could argue and disagree back at the computer but you could hardly argue and disagree with your teacher because he or she is boss! I would very much like to work with the computer again. It is super.

Kevin House

I quite enjoyed it really but I have to say at times I could of fallen asleep for example when we were talking about angles and we went all things that we already knew.

But of course there were good parts for example when we were taught how to use a computer which was very interesting, also I think more children should be taught how to use a computer so that it could help them get a job.

John James

It was too hot and stuffy. The computer didn't quite know what it was doing. It gave the co-ordinates out on the wrong line. The desks were too close together and it was all crammed up and because it was hot my eyes started to run. The computer was good to use and I missed two lessons. It beat the routine.

Mark Summers

It was really a good exercise. I would like to go there again. I thought it was very exciting before we went because we didn't know what was going to happen. It helped me a lot on the old items which I didn't really understand properly. In fact I enjoyed it very much.

P. Feast 3L

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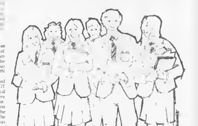
College of St. Mark and St. John, Plymouth

This third article is a highly [illegible] introduction to the version of PILOT [illegible] written by the authors. It is [illegible] with the eclectic nature of [illegible] computing that the original [illegible] was written at a medical centre. [illegible] vious articles appeared in Issues 3 & 4



COMMON PILOT

In part one we discussed the need for an author language as a key part of the systems software for a classroom computer system. Now we describe the author language we have created for this purpose, a language we call COMMON PILOT.

COMMON PILOT is actually the third generation of the PILOT language. PILOT originated at the San Francisco Medical Center where it was designed for delivery of CAI on one of the first intelligent terminals, the Datapoint. The original version of PILOT is still in circulation under the names Core PILOT and PILOT 73. The second generation of PILOT dialects was started when one of us (LK) realized that with the addition of certain features Core PILOT could become a fully fledged author language. That extended PILOT became part of the Western Terminal System at Western Washington University, and a number of other institutions followed our general approach in creating other versions of extended PILOT. The advent of the microcomputer led to increasing interest in author languages for small machines and, given its origin, PILOT was an obvious candidate.

Preliminary efforts at standardization indicated that there were two PILOT camps: one which wanted to preserve the simplicity of Core PILOT, and one which wanted to develop PILOT into an author language competitive with those used on the largest computers.

Although we were firmly in the second camp, we saw no conflict between our goals and those of the first camp. That is, we felt it should be possible to implement the powerful version on the simplest microcomputers and to preserve Core PILOT syntax as a subset of the powerful version. To prove this point we set out to implement a powerful version of PILOT on the SWTPC 6800. While doing this we consulted with the significant users of extended versions of PILOT, and we attempted to combine the best of their ideas into a consistent syntax. The result of this effort was so successful that we went commercial with the product, and now COMMON PILOT is available on the 6800, 6809, 8080 — Z80 under CP/M, Helios and North Star DOS, the TRS-80, TERAKTERC, Alpha Microsystems, Perkin-Elmer, and on any system which runs standard versions of PASCAL. A number of additional implementations are in progress.

Before we discuss the details of COMMON PILOT we should mention some of the assumptions that underlie its design. For reasons we have discussed in part I of

'There were two PILOT camps'

this article, we decided that COMMON PILOT must be a disc based interpreter. We also discussed our reasons for preferring a language with explicit structure, that is, a language in which each instruction leads to a single high level hardware action.

Core PILOT was chosen by a number of groups as the basis for extension because of a number of excellent design features and we wanted to preserve them. We wanted to hold the number of instructions to a minimum: new instructions were added only if they provided an essential instructional function. Instructions which would shorten coding were included only if they would be heavily used in coding instructional material. One of the important features of Core PILOT was its complete elimination of automated record keeping. While it is often desirable to keep records during delivery of CAI, automated record keeping is almost always overkill. Computer resources are consumed keeping data far more voluminous than any author can process. This is one of the prime reasons for the great expense of CAI on large computers; efficiency does not sell bigger mainframes.

Perhaps the most controversial decision we had to make was [illegible] computation. Core PILOT [illegible] limited integer arithmetic. We [illegible] stay with BASIC syntax and [illegible] the variable names to single letters followed optionally by single digits. As [illegible] becomes cheaper this restriction on variable names probably will have to be removed.

COMMON PILOT programs consist of a series of instructions, one to a line. Each instruction consists of

- a one or two letter op code
- one or more optional modifiers and conditionals
- a colon,
- and a text field

The most heavily used op code is the type code T. This code instructs the computer to display the text field following the colon at the terminal. Thus the instruction

T This is an example

will cause the message "This is an example" to appear on the screen of the CRT. Variables can be embedded in the text field of the type instruction. The computer will substitute the current value of the variable in the text at run time.

Obviously the computer must be able to distinguish variables from text, and we did not want to reserve any special characters for this purpose which then could not be used in regular text. This was accomplished by the following syntax rule. A variable must be preceded by a flag (for numbers and $ for strings) and followed by a space which will not be displayed For example if the current value of the string variable N$ is Mary and the current value of the numeric variable S3 is 13 then the instruction

T Well SN$, your score is S3

will display the text

Well Mary your score is 13

Subscripted variables cannot be imbedded in the text field The type instruction is the only instruction which is used to display text at the terminal, so it is used for the presentation of explanations for the asking of questions, and for the presentation of responses Often the program will require a number of type instructions in a row for multiple line messages To simplify the coding only the colon (and of course the text field) need be included on the second and succeeding lines

The **accept** op code, A:, instructs the computer accept input from the terminal and to store that input in a answer buffer Input characters will be accepted until a RETURN in sensed Numeric and string variables can be placed in the text field of the accept instruction using the same syntax and restrictions as apply for the type instruction A copy of the user response will be loaded into any string variable in the text field and the first encountered number will be loaded into the numeric variable. For example if the current instruction is

A SN$ A

and the user response is

My name is Mary, and I'm 14 years old

After execution the answer buffer and the string variable N$ will contain the complete answer and the numeric variable A will contain the number 14

A major problem in programming the computer to carry on a dialogue is to cope with the immense variety of possible user responses One component of this is the unpredictable use of spaces and cases COMMON PILOT automatically compresses multiple spaces to single spaces upon input The **problem** op code **PR** can be used to set additional editing features for example, removal of all spaces and conversion to all upper or all lower case If our previous example of an accept was under the control of the instruction

PR LS

the L in the text field would cause conversion to lower case and the S would cause removal of all spaces Therefore the contents of the answer buffer and of the variable N$ would be

mynameismary andi'm14yearsold

The **match** op code M – instructs the computer to compare the text field of the match instruction with the contents of the answer buffer The match is a window string match That is the match will be successful if the sequence of characters in the text field of the match instrution are found anywhere within the answer buffer Again using the same example the instruction

M year

would give a successful match with the

Language

answer buffer

mynameismary andi'm14yearsoM
year

but the instruction

M iam

would not Again the main programming challenge is to deal with the great variety of possible answers To assist in this programming, there are a number of special operators which can be used in the text field of a match instruction Alternatives can be listed by use of the OR operator !

Trafalgar , or 'Trafalgr

Occasionally the window string search is too general especially when searching for short words like no which might be components of a large number of longer words The percent sign % can be used in the text field of a match instruction to reduce this generality The percent sign matches the **beginning or end** of an answer, or a space The only limitations on the use of these characters in match instructions are the line length and the ingenuity of the programmer Notice that it is essential to keep track of the operative auto edit options when programming the text field of the match

Larry Kheriaty [illegible] programmer at Western Washington University at the control terminals of the [illegible] terminal system Each of the computers in the background (Interdata Perkin Elmer [illegible]) drives 24 terminals

Thus we could write

M yes!again!ofcourse!sure!right!yeah! ok!please

to process possible affirmative answers to a query about repeating something

The ampersand, **&**, is used as the AND operator in the text field of a match instruction It is useful to think of the effect of the ampersand in two ways one as a connective between multiple elements on a list and the other as a wild card element which matches an unspecified number of unspecified characters Examples are

elements of a list — M red&white&blue
wild card characters — M psy&h&g&t

where the second example is a match looking for the word psychologist in the answer — but it is making allowance for a variety of spelling errors Many of the most common spelling errors consist of single letter substitutions We allow for those by the use of the asterisk, * which matches any single character Thus the instruction

M Trafalg*r

will match the responses "Trafalger",

Remember that COMMON PILOT is an explicit language therefore **all branches must be programmed explicitly**

The **jump** op code **J** , instructs the computer to transfer control to the line indicated in the text field of the jump instruction The text field can be a label of up to six characters or one of three special locations Every new label occupies space in a label table thus reducing the amount of space available for arrays etc Therefore three special symbols are used for the most common destinations for jumps the next question (the next PR code) the last used accept (the last A) and the next match (the next M) These destinations which float through the program with the user can be referred to without use of new labels thus saving storage space and speeding table searches The symbols for these three are **P, A,** and **M**

Before describing the remaining op codes let us see how these four could be combined into a simple program

The instructional strategy is introduced by the sequence of instructions and by making the execution of any particular instruction dependent on prior conditions The only condition we have covered thus far is created by the match instruction a match either succeeds (a Y condition) or it fails (an N condition) The Y or N conditioner can be appended to any op code An instruction with a Y conditioner will execute only if the last match attempted was successful otherwise the instruction will be skipped With that information you should be able to understand the following sequence of instructions

```
T    Are you a male or a female?
A
M    male!female!
TN   It's a pity you can't tell, but make a
     guess
JN   A
M    male
TY   OK I'll send you to the male section of
     the program
JY   P
TN   OK, I'll send you to the female section
     of the program
JN   FEMALE
PR
```

Incidentally the spaces after the colons are not essential, but they do seem to add to the legibility of the programs Notice also that somewhere else in the program there must be a line starting with the label FEMALE

The **compute** op code C. instructs the computer to carry out the numeric or string of operations specified in the text field As mentioned earlier the syntax of these instructions is the same as BASIC syntax The text field of the compute instruction is usually an assignment the keyword LET is not used A full range of floating point and scientific operations and functions are allowed for numeric calculations, and one and two dimensional arrays of maximum dimension 999 are allowed The range and accuracy for floating point operations differ from implementation to implementation in some implementations floating point arithmetic is done using hardware, in others using software String operations are also allowed The maximum dimension of a string is 999, a length which effectively precludes the need for string arrays This in turn allows the simple notation for substrings

String variable (starting position, length)

Pseudo-variables are allowed so that instructions of the following type are legal

C A$ (5,8)="AbCdEfGh"

That instruction would convert the string "xxxxxxxxxxxxxxx" into "xxxxAbCdEfGhxxx" We will not attempt to give a complete description of the compute instruction capabilities herein They are essentially what anyone who is familiar with an extended version of BASIC would expect

The compute op code also is used to cause the editing of strings The syntax for this purpose is

C: /A$ option list

where / indicates that we want the edit operation and A$ represents the string variable to be edited The option list can include a C (capitalize the string) a U (translate the string to upper case /xy (replace all occurences of character x with

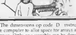
Language

character y), and x/ (remove all occurences of character x) This is one case where we have added an instruction to save coding All these operations could be done using the assignment form of the compute code with string operators but it would require much more code It is difficult to give a true indication of the usefulness of this instruction without including lengthy sections of programs The following may give some idea

Suppose we had asked the user to give a list as an answer The computer should be able to handle a variety of delimiters which could be used to separate elements in the list This could be done by listing a number of alternatives on each match instruction but only with significant effort The programming can be simplified by converting all the delimiters to commas by the following instructions

```
C  A$ = %A
C  /A$ / , ; , : , /+,
C: %A = A$
```

The answer buffer (%A) cannot be edited directly, so the first and third instructions are needed to transfer from and back to that buffer The second instruction converts spaces semicolons colons and plus signs to commas After restoration of the edited result to the answer buffer the match instructions need only look for commas



The dimensions op code D instructs the computer to allot space for arrays and strings Only one variable can be dimensioned per dimension instruction The syntax is standard BASIC syntax the maximum dimension is 999

The **use subroutine** op code U , instructs the computer to call a subroutine The text field is the name of the subroutine, a label All variables in COMMON PILOT are global so there is no variable list on a subroutine call The end op code, E , instructs the computer to return control to the instruction following the last U instruction If no U instruction is in force then the E: instruction ends the program The test field of the E instruction may contain a destination if the return point is not to be the instruction following the U. The syntax for the destinations is the same as that for the jump instruction The utility of this capability will be illustrated in part IV

The **graphic** op code G , instructs the computer to treat the screen of the terminal as a piece of graph paper The text field of the instruction may contain a variety of instructions including move, draw point erase and move origin Each of the preceding operations requires coordinates

Coordinates in [illegible] on the assumption that the screen is [illegible] grid of 512x512 points with the origin at 0,0 in the lower left corner Draw and erase operate from the current cursor position to the specified coordinates In any particular implementation the screen resolution may be less than 512x512, so the coordinates are divided by whatever integer will make maximum use of the screen without loss of information In this way graphics created for one implementation will function (at best in distorted form) on another terminal The G instruction can be used to send any of the 256 ASCII codes to the terminal so this gives the author access to the full range of control characters for any specific terminal The following graphic instruction will cause a box to appear on the screen

G M100 200 D400,200 D400 400, D100 400 D100,200

and the following sequence will start a message in the center of the screen

G M256 256
T A message

The coordinates can be either numbers or numeric variables but not subscripted variables Obviously the effect of the graphic instruction is very dependent on the terminal hardware For this reason not all of the implementations of COMMON PILOT include the graphic instruction

Two **file access** op codes are included file input, FI , and file output FO The text field of both of these instructions must contain a record number and a string variable Transfer is between the file record indicated and the string variable a complete sector is transferred The compute instruction is used to pull out or to extract records from this sector when it is in the string variable The actual file must be created external to the COMMON PILOT language using whatever high level computational language is available

Only one file can be used in a COMMON PILOT program but since that one file can occupy a complete disk in a dual drive system that is really no serious limitation The first FO instruction encountered in a program is a file open instruction Its text field must contain the drive number and the file name

The **remark** op code R , is used for documentation It is ignored by the computer at run time The text field of the instruction is the remark

The **execute indirect** op code XI , is perhaps the most unusual instruction in COMMON PILOT The text field of this instruction is a single string variable This instruction causes the computer to execute the contents of the designated instruction as a COMMON PILOT instruction This allows the author to include user-generated or randomly generated parameters as part of COMMON PILOT instructions While this instruction is infrequently used the instructional strategy of many of the most complex programs is dependent on one or two applications of this instruction

One of its simpler applications is to implement a directory Say we had a list of nine problems each of which started with a label PROB1 PROB2 etc The following code would give user-control of access to these

```
T    Which problem do you want?
A      X
C    I$ = "J   PROB" !!STR(X)
XI   I$
```

Note that the compute instruction concats the string version of the user supplied number onto the incomplete jump instruction in I$ Then the XI causes execution of the jump Other, more impressive examples of the use of this instruction will be given later

Additional Conditions

We have already mentioned two of the conditioners which can be appended to op codes the Y and N conditioners Three additional conditioners are included The E conditioner will allow execution of instructions to which it is appended only when an error condition is operative Errors which give rise to an error condition are errors in compute expressions and failure to find a number in a response when a numeric variable was included This latter is the most frequent use

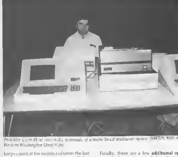
```
A     X
TE    You must use some digits Try again
JE    A
```

The error condition is cleared by a proper response or by a correct expression A digit between 1 and 9 can be appended to an op code as a conditioner The computer keeps count of the number of times the last A has been executed in sequence If that count matches the digit conditioner then the instruction executes This can be used to give a series of hints of increasing specificity for repetitions of the same user mistake An expression can be appended to an op code as a conditioner For example

```
T(C-2=A+4)    A message
```

The instruction will execute only if the expression is true Since the expression can contain any of the operators or functions legal in the compute instruction as well as the connectives =, , , , =, =, and the operators AND (&) OR (!), and NOT ( ), this is an extremely powerful feature The expressions can be either numeric or alphanumeric Because the expressions can be rather long we allow the C conditioner to be appended to an op code This will cause the instruction to execute only if the last evaluated conditional expression was true

A number of **modifiers** can be appended to specific op codes to alter some details of their execution The hang modifier **H**, can be appended to the **T** op code (TH) to suppress the carriage return and line feed at the end of the line The **J** modifier can be appended to the **M** op code to cause an automatic jump to the next **M** instruction if the current match fails The **S** modifier on the **M** op code allows for some additional latitude in spelling errors when appended to the **A** op code it becomes the accept single character instruction The **X** modifier when appended to the **A** op code suppresses all automatic editing that is it becomes an accept exact



Professor Gerhold at [illegible] terminals of a micro based multiuser system (SWTPC 6809) at Western Washington University

Finally, there are a few **additional options** which can be included in the text field of the **PR** instruction (We have already mentioned the case and space editing options L U and S) The **W** option clears the label table thus allowing program segmenting with duplicate labels The **G** option allows the user to insert GOTO commands from the terminal whenever this option is set This allows the user to deviate from the planned program sequence, it is useful in debugging programs and in programming simulation games where there is no way of knowing in advance when an exit should occur

The escape option, **E**, causes an immediate subroutine call to a subroutine named **SYSX** whenever a user response starts with the character The author has complete freedom in programming the subroutine it can be used for a number of useful routines for example a dictionary, for debugging, or to provide a calculator capability The following sequence will provide the latter

```
*SYSX C   A$ = %A
(copy answer for editing)
C      A$ U
(force to upper case remove )
C    B$ = "C   X5 = "!!A$
(build assignment instruction)
XI   B$
(execute assignment)
T       X5
(type result)
E      A
(return to last accept)
```

Notice that the edit version of the compute instruction and the execute indirect instruction are needed for this sequence If the escape option were on when the user typed " SQR(100) + LOG(100) the computer would type 12 and then give the user another opportunity to answer the original question

Obviously it is possible to make coding errors in COMMON PILOT When a coding error is encountered the offending line is typed out with an error code and control passes to the next line In this way it is often possible to locate a number of errors in a single testing pass and more important, the user who typically knows nothing of programming can continue with the program (perhaps by typing GOTO P in the case of serious errors)

This completes our introduction to COMMON PILOT No single article can adequately describe all the possibilities offered by a high level language but we hope that this at least gives some idea of the capabilities of a good author language and an idea of how those capabilities differ from those of the typical computational language For readers who are interested in additional information an author manual is available from

Micropi
2445 N Nugent
Lummi Island WA. 98262
USA

The cost of the manual is $6 00, please include an additional $2 00 for airmail postage

See appendix overleaf

• *Text continued*

George Gerhold is Professor of Chemistry and Larry Kheriaty is Chief Systems Programmer at Western Washington University Bellingham Wa U S A

Appendix

APPL PROGRAMS [illegible]

[illegible]

EXAMPLE 1 — [illegible]

This is [illegible] poor problem [illegible] answers [illegible] digit numbers [illegible]

[illegible]

1, 3	Variable [illegible]
[illegible]	[illegible] random number [illegible]
130	Clear screen [illegible] is ignored
140–150	[illegible]
160	When [illegible] The [illegible] backspace [illegible] blanks [illegible] as a line feed [illegible] after execution the screen will show
210	[illegible] line feed [illegible] and g
220	[illegible] line feed and return [illegible]
230	[illegible] expression used [illegible]

[illegible]

SAMPLE PROGRAM 1

```
[illegible]
```

EXAMPLE 2 — Alphanumeric Answers

Beginning authors sometimes assume that random generation of parameters to allow multiple uses of a section of code is possible only with numerical problems. The following example shows use of random generation in a verb use drill. Notice that the parameters are selected by taking sections of strings contained in a string variable and that the use of the S1 allows utilization of the full range of features of the match instruction.

	B=1 (yesterday)	B=2 (right now)	B=3 (next week)
A=1 (Bill and I)	went	are going	will go
A=2 (We)	"		
A=3 (They)			
A=4 (He)	"	is going	
A=5 (Mary)			
A=6 (Dad)	"	is going	
A=7 (I)			

The student is going to be asked to supply a verb which makes sense in a sentence. The example is incomplete.

Comments

[illegible]	Force all answers to upper case, allow up to [illegible] spaces
[illegible]	[illegible] spaces for various lists
[illegible]	Load the possible subjects into S0. Notice that because the longest subject (They) has four characters all the subjects are allotted four characters whether they require that many or not
[illegible]	Three destinations [illegible] characters long [illegible] in S0
[illegible]	The answer field portion of the match instructions are loaded into S3. Each answer field is four characters long. [illegible] there is a one-to-one correspondence between the subjects in S0 and the answer fields in S3 (e.g. the second subject (We) and the second answer field [illegible] correspond)
[illegible]	The text field portion for match instructions for answers [illegible]. Again note the correspondence with the subject [illegible]. Also notice that [illegible] the lengths of the individual [illegible] fields are the same as the lengths of the subject spaces in S0 and in S5 they are not
[illegible]	Load L5 with a series of flags for each combination of subject and destination. These flags will be turned off when a combination is used once
100	Make X one of the integers 0, 1, 2, 3 or 4 [illegible] X will be used to pick the subject
[illegible]	Make Y one of the integers 0, 1 or 2 [illegible] Y will be used to pick the destination
[illegible]	[illegible] is the position in the list of flags (L5) for the selected values of X and Y. The flags are in the following order: three destinations with the first subject, three destinations with the second subject, etc.
[illegible]	If this combination has been used already (i.e. the flag is off) then pick another
[illegible]	Turn off the flag for this combination
[illegible]	[illegible]

	That [illegible] 4) be the starting point for this subject in two [illegible] 3) and P9
250	[illegible] 300 [illegible] is the starting point in M$
290	[illegible] the starting point in M$
300	Load the selected subject into S1$ This line is needed as [illegible] calculated variables cannot be used in type lines [illegible]
400	Load the destination
410-430	Load the appropriate match instructions into the string variables [illegible] and M10 In this way the match instructions correspond to the randomly selected subjects
440-450	Ask the question
460	Get the response
470-490	Head [illegible] an missing error
500	Match for the correct answer
510-550	If match [illegible] 500 is successful send message [illegible] and [illegible] go to another problem
[illegible]	[illegible]
570	Check for wrong form [illegible]
580 [illegible]	[illegible] send appropriate message and give another chance
[illegible]	Check for singular-plural error
600	[illegible] from problem statement
[illegible]	[illegible] with unrecognised responses

Finally [illegible] the program should be viewed as an example of use of the [illegible] as an example of English instruction Whether or not this example is based [illegible] strategy how many sentences a student should [illegible] and who [illegible] language used in the responses [illegible] the student is phrased [illegible] suitable for the students as well as the validity of the [illegible] are all questions which should be addressed by [illegible] who are experienced at the appropriate level

APPLE PROGRAM 3

[illegible]

SAMPLE OUTPUT [illegible]

[illegible]

THE PERSONAL COMPUTER MARKET PLACE

The American scene by arrangement with Technology News of America, publishers of Computer and Communications Buyer

American financial experts predict explosive growth in the small-computer retailing business. The industry's success during the next few years, they say, will be impressive. There is one problem, however: the personal computer market is still being defined. As a result, many retailers will by left by the wayside. In fact, some experts now say that as many as one third of all U.S. computer stores will go under during the next two to three years.

Since 1975, when the first computer store opened in the U.S., computer retailing has become a business where, as one consultant put it, nothing stays true for too long. Marketing strategies that worked last year, or even last month, may not work today. The direction personal computer use will take is uncertain. One thing, however, is clear: computer stores, in order to survive, must keep up with the changing market. Thus, industry observers say, a dominant style among successful computer stores is likely to emerge.

According to Stephan Seidman, successful computer stores will be divided into two major types — those which sell to small business, and those which sell to consumers. Seidman is an independent consultant and has researched the U.S. computer retail market for Strategic Business Services, a San Jose, California consulting group. Seidman also says that hobby stores will not play an important role in the retail arena during the next few years.

"Many of the hobby stores opened at a time when all the markets seemed available," Seidman says. "Now," he adds, "stores have to decide between only the business and the consumer markets."

According to a computer magazine editor, the hobby market has become unattractive to retailers because it is quickly reaching a saturation point. Growth in the hobby market, he says, is only about 2 per cent each year. Sales growth in the small-business market, however, is about 30 per cent each year, he explains. For this reason, selling computers to hobbyists has become unappealing and relatively unprofitable. As a result, new stores are catering to the more lucrative markets, while older hobby stores are making the difficult transition into the small business market place.

Seidman says that computer stores wishing to sell to small businesses must take on the characteristics of a systems company. This means that they will offer highly skilled sales help, service and software preparation, he explains. In addition, he says these retailers will need a comprehensive understanding of their clients' business practices in order to better meet their computer needs.

In increasing numbers, small businesses are considering buying computer systems. At the same time, competition between computer stores is growing. Particularly in the cities, this competition is already intense. Reflecting the opinion of other industry observers, Seidman says that the experienced retailers will prevail as competition between stores continues increasing.

While experts expect big growth in the small-business market, opinions are divided on the sales potential of the consumer market. Despite the success of companies which primarily sell to consumers, such as Tandy's Radio Shack, there is question whether this market will increase over time. Some experts say that consumer sales have already peaked, while others foresee unlimited growth.

Adding to problems stemming from an uncertain market, some computer stores are creating their own problems. Two common dilemmas which computer stores inflict upon themselves are under-capitalization and over-extending.

Under-capitalization is a common problem of small businesses in general. But in the computer retail business, it is particularly troublesome. Without sufficient capital, stores are not capable of giving quality service. Store owners are frequently unable to acquire enough funding from the banks and other financial sources. In other cases, store owners underestimate the amount of money needed to operate a successful store. As a result, in both cases the store is poorly run. In time, the business dies.

Under-capitalization has been especially severe among the hobby stores, many of which are run by hobbyists themselves. The business gets off to a bad start, and is never able to recover.

The other problem, over-extending, is more common among larger scale stores. Simply stated, over-extending is the imprudent use of money. A store tries to provide more different services than it can afford. Naturally, none of the services are competently provided. Customer satisfaction sinks, and the store soon follows suit.

Seemingly in response to these problems, several large companies with plenty of capital have entered, albeit tentatively, the computer retailing business. Computer vendors, including Digital Equipment Corporation (DEC) and International Business Machines Corporation (IBM) have a number of computer stores in the United States. In addition, a few large department store companies, including Sears, Montgomery Ward, Macy's and Bloomingdales, are toying with the idea of selling personal computers in their stores.

So far, however, neither the computer vendor stores nor the large department stores have given the smaller independents a great deal of competition. The department stores seem extremely cautious and appear to be waiting for a more clearly defined market before they step in. The vendor owned stores, on the other hand, are not selling many computers.

One independent shop owner says that DEC's stores are not, in his words, "earning their keep." "The stores do bring in a lot of business to DEC's OEMs, however, and this in turn brings money to DEC," he adds.

The DEC stores also function as education centers. Classes are offered to the curious but ignorant shopper. DEC spends time educating people on the benefits and uses of the computer (for a price, of course), hoping to later sell them a computer system.

In addition, several computer vendors are eyeing the personal computer market place. General Electric, Honeywell, Control Data Corporation, Atari and AT&T have joined Tandy Corporation and Apple Computer Inc. in the process of affecting U.S. government regulations concerning personal computers. According to one computer expert, the move signals these companies' eagerness to join what they see as a potentially huge market. "Although these companies have not run any personal computers up their flagpoles," he says, "they are nonetheless setting up flagpoles. The rest is just a matter of time."

It seems likely that the larger companies will hold off entering the personal computer market until they feel that the smaller companies have completed the task of defining the market's weak and strong points. Once that happens, it is likely that they will move quickly.

In the meantime, experts say, the struggle to define the personal computer market will continue. Small companies and stores, they say, will come and go. Eventually, the evolutionary process will slow down to the point where the bigger companies feel comfortable. Then, the experts say, the personal computer retail business will take on those characteristics now associated with the lage computer industry.

Technology News of America, ... 26 Broadway, New York, NY 1004, USA

PACKING IT IN

Microprocessors are becoming micro universes. Does VLSI mean our Very Large Scale Inability to use everything they offer?

Very Large Scale Integration — VLSI. It all sounds rather boring, doesn't it? But this is going to be the next development of importance from the semiconductor industry, and its impact is going to be far reaching. So it is perhaps somewhat surprising that the semiconductor business, which has in the past been a world leader in that major growth industry — jargon — should come up with such a poor name for the subject. Just adding a "Very" to the existing "Large Scale Integration" seems somehow to be a little on the feeble side.

But maybe the obvious restriction in its jargon-generation-capability has been the result of *force majeure*. The application of intense thought and effort elsewhere has squeezed imagination dry. Certainly the results of VLSI that you and I will be able to take advantage of will have been bought dearly, in terms of brain power, by the semiconductor industry's designers and engineers.

In essence, VLSI means the ability to pack on to a circuit, approximately the same size as those currently available, many times the functional complexity that is possible today. This will be achieved, at its simplest level, by reducing the geometries of the individual circuit elements within an integrated circuit. This reduction is often defined by the criterion of the width of line that can be etched into the circuit. A fairly standard width at the moment is 5 microns, or thousandths of a millimetre. State-of-the-art is represented by 3 micron widths — a 40% size reduction. With the new VLSI circuits this will be taken down to widths between 1 and 2 microns, a reduction of up to 60% on current state of the art.

This however is by no means the limit. Using silicon as a substrate it has been estimated that the theoretical limit to this development is around 0.3 microns. At this point the fundamental laws of physics start getting in the way. From there on other substrate materials will take over. The obvious point is that by reducing to a tenth of a single linear dimension the actual increase in theoretical circuit densities that can be achieved (and therefore the complexity of the circuits) is 100 times greater than that possible today. But, this is only in theory.

There are one or two practical problems that such development poses. The major one concerns the semiconductor manufacturers themselves, at least those that operate in the merchant market, selling their wares to all-comers. Another concerns the end-users, and what they will end up with as available products and components from which to construct their systems.

The semiconductor industry's problem has already received two possible solutions, both of which are diametrically opposed, and both are liable to have a significant effect on the end-user in different ways.

> *'One or other will come out on top'*

But first the problem. Several years ago Gordon Moore, one of the founding fathers of the leading US semiconductors manufacturer Intel, produced a statement that became known as 'Moore's Law'. In effect this said that it could be shown that circuit densities doubled every year. Basically this also meant that the functional capability of circuits doubled. Up until the advent of VLSI processing capabilities this law has been fine and dandy, and the marketplace has been ready, willing and able to absorb all the *functions* the semiconductor industry has been able to throw at it.

This is now changing, however. Last year, Gordon Moore introduced a new 'law' that was very much a codicil of the original. He said that the functional complexities that are now becoming possible mean that it will become increasingly difficult for the semiconductor industry to actually design and develop products that a) make use of that complexity, and b) sell in sufficient volume to be a viable commercial proposition. This is of fundamental importance to the industry which by the very nature of the production processes employed has to sell at high volumes to a large number of individual users.

Also, the design and development costs of these high complexity circuits has risen alarmingly. Intel's 8086 16-bit microprocessor cost around $20 million to develop. The 8080 cost around $1 million. These days, to develop a chip of the highest complexity, the semiconductor industry almost needs to *guarantee* itself a reasonable market for the part.

The point of Moore's revised version of his law is that, now the industry can put very complex functions onto a chip, it doesn't necessarily follow that manufacturers will. If they do, it inevitably will reduce the breadth of available market for the part, and make it a dubious commercial venture from the start. The alternative is to increase complexity no higher than it is today.

Moore sees only a few avenues open to the semiconductor industry where this problem will not operate. The main one is memory devices, where the demand is insatiable, and the complexity of semiconductor technology can be exploited to the full. But any device using *logic* functions is a different matter. He summed it up at the time by saying 'the semiconductor industry may well be left saying 'thanks for the memory'.

The push for complexity would not stop, however. Moore sees that role being taken over more and more by the systems manufacturers using in-house manufacturing facilities. Custom design would become very much the order of the day. This is already the case in much of the mainframe computer industry, where most of the major companies have their own facilities. In fact IBM is often reckoned to be the biggest semiconductor manufacturer in the world, bar none.

The logic behind this suggestion is that it will only be these companies that can afford the development costs of new complex circuits. This will not be because of their general financial clout, but because they will be able to afford to manufacture the devices actually at a loss on paper, because of the overall added value the circuits will provide at the system level (a good unique selling point, engineered in silicon can be worth a lot in the marketplace)

It is interesting to note that, in the small systems field, Commodore already owns a semiconductor company, MOS Technology, the makers of the 6502 microprocessor used in the PET Atari is bidding to purchase at least a share in a small West Coast manufacturer, Maruman

The diametrically opposed view has been recently proposed by US market research company, *Frost and Sullivan* It is their opinion that the introduction of VLSI circuits will lead not to more custom design, but less Instead, they see the introduction of much larger and more complex general-purpose circuits particularly microprocessors The logic behind this suggestion is that a powerful micro, possibly of 32-bit word length, could be manufactured to be general enough to satisfy a wide range of applications This could be possible because it would be powerful enough to use often complex software routines to dedicate it to any specific application

This has obvious attractions for the semiconductor companies, who after investing many millions of dollars in the development of the part would have the huge potential return from a very large market

The potential of this market does however seem to ignore one point Software is now often more expensive to produce than hardware, and this is a trend that is much more liable to get worse than better

Viewpoint

A general-purpose processor, no matter how powerful is likely to have several specific drawbacks when an individual application or system is being considered so the software overhead in developing that system could well be large The way software costs are going, it may well prove more economical for systems manufacturers to produce or have produced for them *hardware* capable of providing the specific functions required rather than try to software engineer' them

Whichever route the semiconductor industry eventually follows or indeed whether it is a mixture of the two it will undoubtedly result in changes for the small computer business For some time, the most likely outcome is that the two opposite routes will co-exist, they may even survive side by side There is however a chance that one or other will come out on top and in large measure, the winner will be determined not by its capabilities, but by the way those capabilities are exploited by the system manufacturers

At face value, it would appear more likely that those systems companies either with an in-house semiconductor plant or very close ties with one will be in a better position to engineer new unique selling points and facilities into their equipment than the others that have to use 'big general-purpose processors, and software engineer the facilities they require

However there is one thing that strongly militates in favour of software engineering This Industry has shown a remarkable propensity for self-help, especially in the software field. If someone — the ubiquitous Arnold Scroggins working in his back bedroom for example — develops some new software for a microsystem that looks even half reasonable then do the manufacturers say, 'How dare you! Keep your hands off '? Nope They tend rather to say "well done", and offer to market the software for him

This is likely to be the case here which will mean that the systems houses could well end up producing what might be termed very complicated components

If things do go this way then it is time to invest in high-level language training for soon there will be plenty of work to do ■

THE BYTE SHOP & COMPUTERLAND
Still the biggest 6 in the country
London
Birmingham
Nottingham
Ilford
Manchester
Glasgow
&
6

THE IMPERATIVE INTERFACE

This reference article is an attempt to categorise and describe the small computer market

Imagine this You possess marvellous machines that can process information easily and quickly, that can in many ways make life easier for people in business, industry and education What's more you can make a good profit selling these machines

The only trouble is that between you and the bulk of people there's a screen It's a transparent screen You can see the people on the other side and they can see you But you cannot communicate the benefits of your machine to them and they cannot express their exact needs to you

That is the small computer scene today True there is no end of discussion and

'The future cannot be postponed, especially if it's about to become yesterday'

publicity — chiefly of the wrong kind, with the word microprocessor (seldom defined) figuring like a magical utterance in a spell There are constant reports of an impending revolution — one which has been about to happen for the past year or so and can't you sense the vague dissatisfaction of people who have been kept waiting for something momentous? The truth of course is that the revolution has been happening and its rate is accelerating by the day The time will come within the next decade when its speed will unbalance not only individuals but whole nations — if they are not prepared

Japan and the US are well advanced in the usage of small computers, they are information societies in the making In the US alone about a quarter million personal computers have been sold In Europe, in spite of deep anxiety about the future, labour and management implicitly agree that it is essential to integrate the small computer with society

But in Britain there is a time lag between acceptance and implementation which if it is drawn out too long, will have serious effects on the country's competitiveness in world markets Tied in with this is the problem of not just informing people about, but also educating them to buy and use, small computers

Everyone agrees that the market is there But because no reliable research on a sufficiently large scale has been undertaken, the market remains as shapeless as it is tantalising

The screen seperating vendor from customer cannot be torn down But it must somehow be transformed into an interface

The interface allows communication between the two groups But what should it comprise?

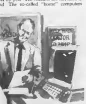
Just as an interface has many lines, each component of the general question has a separate answer but the totality, the interface, will turn out to be surprisingly simple

We start by viewing the problem as a whole Then we break up the whole into parts, dealing with each in as complete a way as possible, ignoring any overlap between parts

The whole is the assertion that there is a huge market in small computers Then we identify — using experience and some arbitrariness — the sectors of the market

- 1 Computers in the home
- 2 Computers in schools
- 3 Computers in higher education and research
- 4 Computers in industry
- 5 Computers in the professions
- 6 Computers in departments of big and medium-sized business
- 7 Computers in small business

This has been a big market in the States But it has reached a plateau there and its percentage of the total market is shrinking year by year The reasons are not hard to find The so-called "home" computers



were in a sense a leap-frog over the type just beginning to appear what I call the true home computer The 'home' computers are now after some upgrading, being presented as suitable for school, university and small business use! American sales methods emphasised the plug-in-and go angle leading many people to half expect the computer to program itself It's said that hardly two in three 'home' computers are in actual use The true home computer is a different animal

The 'different animal' which is a true home computer is the home video computer system with plug-in modules for games elementary programs and a simplified instruction set This in turn, may be displaced by flat screen television sets which incorporate — almost as an after thought — microprocessors — and which have the ability to plug into any public database like Prestel Once these intelligent TVs are priced under £200 and available in the High Street, there will be a sales boom, quickly followed by a market glut, as happened with electronic calculators But the survivors of the inevitable shake-down will still be doing good business

In competition with the intelligent TV set as consumer durables will be language translators, "revision notes for exams intelligent dictionaries and tutors all very compact and with single line displays, sold through outlets such as W H Smith Menzies, NSS, Dixons and naturally Harrods and Selfridges Also available will be microprocessor based toys with speech abilities

Marketing

This electronic stationery market once established, will depend heavily on new products coming out at strategic times like Christmas

Computers in schools

It's an open secret that there is a desperate shortage of programmers one that can only grow more acute with the increasing numbers of small computers

Opposed to this is a body of opinion amounting almost to belief that says future generations of computers will hardly need programming (the American sales pitch come true) The necessary programs will already be resident in the computer and the computer will in any case tolerate instructions that are 'fuzzy' by today's standards That is, instructions will correspond far more closely to natural language The belief is based on the fact that computers are becoming immensely faster, and that improvements in memory density will be in two to five orders of magnitude

But for the foreseeable future the programmer shortage will continue The obvious place to alleviate the shortage is the school

Computers in schools can not only be used for acquiring programming techniques but as teaching aids A computer in every classroom translates into a lot of computers But the bottleneck in sales is the education authority that is constrained by a tight budget coupled with an unnerving amount of ignorance about small computers It goes back to the fact that the (undefined) microprocessor looms large but the microcomputer is hardly familiar as a word let alone as a tangible object

A major effort is needed to educate authorities about small computers their cheapness versatility and utility

The market is well-defined but the purse strings are tightly controlled The opening and shutting of the purse depends very much on government policy

The great advantage of selling to schools is that a lot of applications software can be left to the schools themselves to develop The schools market is worth persisting with Sooner rather than later as has happened in France, the government of the day will admit the future cannot be postponed, especially if it's about to become yesterday It will be obliged to undertake a massive purchasing exercise for schools spread out over a five year period And this will have to happen by the middle of this decade

Universities perhaps the best established market in Britain and currently the most accessible It holds and is fulfilling the promise of fruitful interaction between customer and vendor It is in research establishments and university departments of all disciplines that invaluable developments in hardware and software take place I say this fully aware of the massive efforts of IBM, RCA, Texas Instruments, GEC ICL Plessey, Intel, Zilog Motorola and a host of other companies and military establishments But I stress the word interaction. University developments range over process control pattern recognition artificial intelligence systems analysis and applications software It is most often here that the customer in turn becomes a supplier to or a designer for the vendor Symbiosis is a good word to use to describe the relationship

The strength of the universities lies partly in the computer use in faculties as disparate as computer science and literature The more faculties are encouraged to use computers, the more they can cross fertilise each other and increase the impact of computing in all walks of life both through teaching and in cooperation with the vendor

Of course there are a limited number of centres of higher education and research. But increasing numbers of students in different disciplines are exposed to small computer usage They graduate, enter employment, carrying with them the ability, interest and will to use small computers The graduates of this decade will in the next couple of decades add yet another powerful impetus to the proliferation of small computers

Modular software can be developed by university and company personnel and incorporated by manufacturers into hardware, then mass produced and sold cheaply

It is vital that vendor links with universities are strengthened even more Vendors should regularly commission research and adopt a benevolent policy of employing students from all kinds of disciplines or if this is not possible allow them to handle and use systems

Universities are the obvious places for the development of error-free software and efficient algorithms Much software now sold for small computers is of dubious quality It is trial-and-error software with the trial not quite extensive and the error not quite eliminated

Industry is another strong well-established market ranging across process control to data logging to modelling and the more mundane stock control and data processing in factory offices. It is in many respects a highly specialised market with computers being sold to specialist companies that in turn sell packages for specific applications.

One section of this market is of course, the microprocessor in dedicated applications such as monitoring the state of sensors, but this does not concern us here. This market will be amongst the most stable of the seven, but has as yet scarcely been touched.

More than any other sector this one will expand in response to the availability of cheap computers. That is, increased production of the product will actually stimulate increased demand, rather than the other way round.

Doctors, dentists, lawyers, accountants, consultants of one sort or another, architects, surveyors, estate agents just a small list that could be expanded five-fold.

Each profession can be catered for by a special hardware-software package, its needs more easily pin pointed than those of a small business.

Professionals are always on the look-out for labour-saving devices. They are more capable of grasping both the rudiments of computing and its cost benefits. The computer can also be emphasised as a kind of intelligent typewriter with word processing capability.

Professionals are receptive to new technology if it means less drudgery and greater rewards. But they will give short shrift to products that do not come up to their expectations. Any vendor who wants to offer a professional package had better work closely with professionals to develop it. Professionals are not shy of telling others of their pleasure or displeasure with a product.

The professional market is large now, and its growth will be steady though not spectacular. Market penetration is very shallow as yet. the opportunities are immense. Servicing this market is an unparative for the small systems vendor. Apart from its size it has the outstanding virtue of being identifiable, with each profession having fairly standardised requirements. These lend themselves to easy reproduction with a consequent lower price per package, in turn leading to a large volume of sales.

Computers in departments

Here is a fat, lusciously profitable market: big business already well acquainted with computing through mainframes and minicomputers, aware of small computers, and wishing to use them 'locally' stand alone or tied to mainframes.

It is up to the vendor to push his small machine as a word processor, a part of the electronic office, an intelligent terminal, a local processor of information which will later be used as data for another, larger computer.

Marketing

This market is practically ready-made, but big business remains to be convinced, and stay convinced, that microcomputers are "man enough" for the job. Part of the convincing can be done by extensive advertising, participation at exhibitions and the holding of seminars. There does still remain a credibility gap, chiefly in the region of software. The only convincing bridge across the gap that I can think of is described at the end of this article.

Computers in the small business

One of the greatest difficulties with this market is a satisfactory definition of what a small business is. This is scarcely surprising since they are thick on the ground and differ from each other almost as much as twins resemble each other.

This market is the biggest potentially, and so the most tempting of all. It is the least definable, full of individual varied needs and quirks, the combination is enough to give a software house nightmares.

If the reader has noticed a strong futuristic element in what has gone before he will not be wrong. But in discussing the present state of the market one must pin one's hopes on the near future, for the astonishing fact is that right now the market is fragmented because the selling structure is fragmented, without cohesion or cooperation among vendors.

There is a piece meal approach to that most vital and most elementary rule of marketing, market research, a piece meal approach to the products offered, the services, the packages. If any thorough research has been done on the extent and needs of the sectors of the market, it is being kept a close secret without apparently benefiting the initiator or initiators of that research.

There is no standardisation of hardware and software. There is a tendency (thankfully now diminishing) to charge all that the market can bear, with no thought for the effect this has on future sales. There are at least five bus structures and a corresponding number of languages, each with numerous dialects, available on small computers. In short, a chaotic assemblage of feudal baronies.

It's too late now to talk about imposing a discipline that will apply right across the board, and anyway, rigidity presents its own perils.

But there are urgent needs. The main need is to combat the danger that a (fundamentally unjustified) disillusionment with small computers will set in, delaying progress and leaving Britain at a severe disadvantage.

Establishing cooperation and communication with the potential customer is being tried in many ways, but these ways are being followed in different directions and by different travellers.

Without the lines of communication being brought together and coordinated in one interface, there will be no change in the current situation. The vendors of small systems are like men who have struck a lode of solid gold but who are trying to mine it with tooth picks.

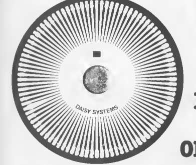
There can be only one interface that will do the job of educating the customer, coordinating market effort, lowering prices through increased volume of sales, lobbying government, maintaining standards of ethics and product quality, representing Britain's export efforts, ensuring cooperation between originator, vendor and customer. That interface is a Small Computer Marketing Association, empowered to do all these things and funded by a membership levy.

It would be only too easy for the Marketing Association to become a self perpetuating, bureaucratic sluggard, but it would surely not be beyond the wit of its members to build in safeguards. To agree, for instance, that it would not stay in existence beyond the next critical decade, and that its main job is to spread the use of small computers. No doubt, the very idea, not to say the actuality will be the subject of lively, even bitter (and healthy) criticism. But it is essential. In no other way can a massive well-directed effort be made in Britain.

Do you know the answers?

How many microcomputers are there in universities? In Government departments? In businesses? What are they being used for? What do small businessmen want? What are their problems? Is the small business market really as big as people say it is? If so, just how big? Should the industry as a whole produce a flood of give-away books and pamphlets for the public? Shouldn't there be a massive professional advertising campaign embracing the media and extending over three months every year, apart from weekly and monthly advertising? Should the government be pressed into giving special tax concessions for purchasing of small systems?

So the article ends with many questions, many more unasked, no concrete answers available to any, but with answers urgently necessary and only forthcoming if *all* the people in the small computer scene come rapidly together (without colliding) to create the Small Computer Market Association. ■



MAKING MARKS ON PAPER

[illegible] Data Recording Equipment [illegible] responsibilities [illegible] equipment

When VDUs first became readily available it was said that they would reduce the amount of paper consumed in an office environment, a statement which has turned out to be a fallacy.

Printers reproduce words, pictures etc by pressing inked types on blocks to paper. Printers are found in every computer room, or wherever there is a requirement for a computer system to output its data for immediate information or filing away for future reference.

Therefore the principal output medium of information processing systems is hardcopy printed paper produced by a computer output printer. There are many types of printers for a variety of applications each differing in:

- price
- performance
- control electronics, and
- the method in which a character is formed on to the paper

There are two basic methods of printing: impact and non impact.

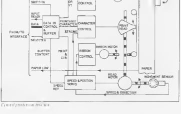
Impact printers utilize mechanical pressure to transfer the character image from an inked ribbon to the paper.

On the other hand non impact printing makes use of other techniques such as laser, ink jet, thermal and electrographics.

Laser printers are beyond the reach of many system users as they cost several thousand pounds, are complex devices and are mainly intended for very large mainframe computer systems.

As modern engineering techniques have improved so have the concepts of ink jet printing, which fall into two categories. One is known as drop on demand and the other as continuous ink.

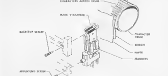
Drop on demand uses tiny piezo electric crystals to pump ink onto paper, which forms the necessary dot matrix



General printer structure

characters

The continuous method of ink jet printing can be described as a stream of ink droplets where the droplets required to form a character are deflected onto the paper and the excess diverted to an ink gutter which is recycled The major advantage which the ink jet printer has over its rivals is that it is extremely quiet in operation thus making it very practical in certain appli-



Drum printer mechanism

cations

Thermal printers too are quiet and do not require ribbons inks or any chemicals However they do need special thermally sensitive paper A thermal printer as the name suggests uses thermal energy rather than mechanical impact energy It basically consists of a matrix of heating elements, which are electrically isolated from one another these elements are electro resistance heated up to 260°C and produce well-defined dots on thermally sensitive paper Thus by selecting and heating various elements sharp images of alphanumeric characters can be printed The main drawback for both ink jet and thermal printers is the lack of multiple copies Most modern offices demand two or three part documents

Printing is performed either a character at a time, in a serial format by a *character printer*, or a line at a time in a parallel format by a *line printer* Character images are printed either as shaped fully formed characters or as a set of dots representing the character formed by a dot matrix Thus we can classify printers by three characteristics impact or non impact, character or a line printer, fully formed, or dot matrix character printers

Printer units can be dissected into four modules the paper feed mechanism ribbon movement mechanism control electronics, and print head or print element drive mechanism The paper feed mechanism can be one of several types, for example, it can be front feed unit, single or multi sheet feeder etc Ribbons can be either cartridge, or spool type Character life varies from one to several million characters

Let's briefly examine the concept of line printers and the various print methods us-

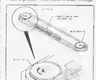
Peripherals

ed drum chain and comb techniques

A few years ago line printers were expensive adding substantially to the cost of owning a medium sized computer system. However in line with most computer peripherals prices have tumbled, while performance and reliability have increased significantly Today s 200/300 line a minute printer has a special attraction to medium sized minicomputer system users, hence filling an obvious gap between serial and fast line printers

There are two basic methods of impacting the character One method is to impact the ribbon and paper with the character to be printed, as is done with an ordinary typewriter This is known as a front striking character impact mechanism The other method is to place the character to be printed behind the ribbon with the paper in front of the ribbon The character image is formed when the hammer impacts the paper, causing pressure on the ribbon and forming the character The characters are scanned past the hammers and are moving when impact occurs This basic technique is the one employed in all drum, chain and train printers

The everyday steel comb is the basis for a comb printer The comb is wide enough


Train printer mechanism

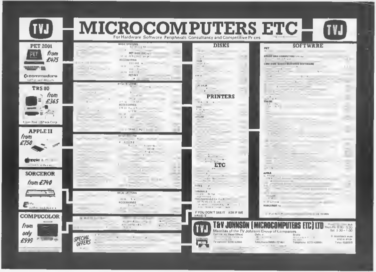
to cover 132 print positions (columns) On each tooth of the comb is a tiny steel ball Behind the teeth (and the steel ball) are a row of electromagnets in front the paper platen and an inked ribbon The electromagnetic pulse pulls the tooth away from the paper When de-energised it springs forward to flick a matrix dot impression onto the paper via the ribbon Every character in a line is generated simultaneously, the comb moves one dot space and the next dot of teeth are fired When each dot in the first line has been produced, the paper advances one dot row and the comb moves back to produce the next set of dots Thus it requires seven passes to produce a complete line of print The sideways shuffle of the comb is achieved by a rotary stepping motor with flexible linkage to give precise dot placement

Whenever letter quality print is required, and here word processing is the prime example then a fully formed character printer will be found The commonly known daisy printer was pioneered by Qume, and closely followed and improved by Diablo The reason it is called a daisy printer is due to the construction of the print element It is circular with 96 petals. This circular disc has characters mounted on flexible pivots (petals) at the outer perimeter and attains a print speed of around 55 characters per second Daisy wheel printers offer a maximum of 96 character set, and the wheels are made of either plastic or metal which affords a long life


NEC spinwriter print element

NEC have introduced into the word processing market a printer which uses a slightly different technique This printer called the Spinwriter uses what can best be described as a folded daisy wheel or a cup with flexible pivots The main advantage over the daisy wheel is that the NEC offers (a maximum of) a 128 character set This is achieved by mounting two characters on each of the 64 flexible pivots The print element is constructed of plastic reinforced with glass fibre to yield a long life Apart from one or two most of the daisy printers use a ribbon cartridge (unfortunately they are not interchangeable) and they all offer facilities for use of single strike carbon ribbon for ultimate in quality print Once again all daisy printers offer a variety of paper feed options forms units which can handle normal computer stationery to single and multi sheet (A4) front feeders ■

To be continued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ACCOUNTANTS' GUIDE TO MICROCOMPUTERS

In this concluding article [illegible] microcomputer to work

Use of computers in the accountant's office

In my previous two articles (Issues 2 and 3) I have dealt with the type of equipment a practising accountant might buy for himself or for his clients, and the various matters he should consider when recommending the purchase of a system or programs by his clients

In this article I will give you some ideas to consider for the cost-effective use of a microcomputer in your own practice both to increase efficiency and profitability and to increase the practice potential

The two fields I am most often approached on by accountants for advice are

- Incomplete Records
- Time Recording and Job Costing

In the case of incomplete records there are a number of systems available ranging in sophistication and priced between £3 000 and £15 000 Basically I would recommend that you look at systems that provide

- a clear audit trail
- a clear set of working papers
- a set of accounts (draft) that can be modified after discussion with the client

If the facility to print final accounts with full schedules and notes is available, this is a worthwhile extra but the cost of providing it on some systems may exceed your budget

Any system chosen should permit the free formatting of accounts to your own requirements It is a waste of money to buy any system that does not give you this flexibility

In choosing a system do not be influenced purely by the end reports Remember that your secretaries or audit assistants will have to key in data, and they will need to have an easily readable screen with clear input instructions

It is also important to remember that data being entered will be printed out rapidly on edit and printers in the range of 120 to 180 characters per second should ideally be chosen Anything slower can clog up the system although if you want quality reports you will need a daisy-wheel printer in addition

The same considerations apply to choosing a time-recording system

Here you want to check on the number of staff the number of clients and the number of transactions with which the system can cope if the system cannot cope with your requirements with all the data discs mounted it is too small

The system chosen should show you clearly

- how much time was spent on each client and evaluate it
- how each staff member is spending his time
- work-in process
- expense analysis

'Anything slower can clog up the system'

Costs for a system will vary dependent on the number of staff and clients with whom you are dealing, as different sizes of practice may require different sizes and types of media It is important to consider the potential growth of your own practice and to see whether the equipment you are studying is capable of upward expansion

If you have a system to deal with your own time recording requirements, you might consider offering a service to some of your clients such as solicitors surveyors etc

Other accounting/bookkeeping services that might be offered either to clients or through an Insitute approved bureau service to the public include Sales Ledger Purchase Ledger and Payroll Many small towns have a lot of scope for this type of bureau service

In selecting the right type of system a thorough review of your potential client requirements should be made so that you are not caught short with a machine that will not cope with potential volumes

Once you have a microcomputer system you can use it as a basis for training staff not only in the problems that they will encounter when auditing clients systems (and on present forecasts there will be tens of thousands in the commercial field by the middle of the 1980s), but also in programming In this sphere the development of programs for dealing with tax matters and tax planning should be considered

In management departments the microcomputer can be used to prepare statistical and analytical reports The word processing facilities that are being attached to more and more systems (such as the one on which I am preparing this article) can be used for report writing These facilities enable one to correct or amend a report and retype at speeds of about 500 words per minute

Use of the same word-processing facilities can increase the efficiency in the accounts typing pool A copy of last year's accounts can be easily amended (possibly by the audit assistant when he completes his draft of the final accounts) and retyped at great speeds thus eliminating any backlog that may normally arise

In these three articles I have sought to give a general picture of the microcomputer world as it might affect the practising accountant The editor of Computer Age would be pleased to hear how accountants are using microcomputers or what problems they or their clients are encountering ■

Concluded Mike Kusmirak is the Managing Director of Equinox Computer Systems Limited Next Issue *Alex Harrison* FCCA FCIS *writes for* Computer Age

The author is a managing consultant with ICFC Consultants the largest firm of management consultants advising medium sized and private companies in the UK. ICFC Consultants is part of the Finance for Industry group a wholly private enterprise institution. ICFC (Industrial and Commercial Finance Corporation) was set up in 1945 and is the prime UK source of medium and long term funds for small and medium sized companies

COMPUTERS FOR THE SMALLER FIRM

Part 2: Should we be using a computer?

We have now reviewed some of the classes of machines that are available. Could we benefit from using such machines and if so should we be purchasing our own equipment or paying for external services or a bit of both?

Any decision to computerise should be justified by establishing that there will be a cost benefit. Such an assessment is not always easy — how do you evaluate the worth of better sales analyses? What price is to be placed on the goodwill generated by a better service to customers?

ASSESSING THE NEED

The first task is to expose any need for change then to assess whether the change should involve computerisation or not.

Here are some of the questions we might try answering:-

•Accounts

a are we coping adequately with the daily accounting requirements of the company — or are we giving overlong credit or failing to take advantage of purchasing discounts or getting into a panic at the month or year end?

b do we know at all times who owes us money and how much or to whom we owe money — can we predict our cash-flow position and so avoid a liquidity crisis?

c can we analyse our sales in terms of how much and to whom and more importantly, by the profitability of each product?

d does paperwork get generated unnecessarily or merely for reasons of appearance, or is there a lack of essential paperwork due to inadequate systems or staff shortage?

•Production

e are our inventory levels matched to needs, is money unnecessarily locked up in stock or does customer service suffer from our running out of finished products?

f are we planning our material purchases sensibly with due regard to production needs suppliers performance and economic order quantities?

•Management

g does management have information of the true and current position of the company or is it working on figures that relate to some previous period — are we driving by looking into the rear view mirror only?

h have we the data to help us to plan the future with reasonable confidence are we able to establish budgets in support of our goals and then to monitor performance against such budgets?

•Marketing

i What do we really know of our market - what data do we have of our own transactions to show the trends in demand or to show the changes occurring in the market?

j are we able to prepare figures in such a way that we can compare them with national figures to determine our strength in the market and our possible future prospects?

k can we monitor the true development of our market share?

When a list has been made of areas needing change we can weigh up the possibility of computerisation against the alternative solutions. Judgement must now be made on the basis of benefits and costs. At this point it can be helpful to call on independent specialist assistance from outside the company.

What computer system will be best for our needs and what will it cost?

Let us assume that we have identified a possible need for computerised data processing. What type of equipment should we use and how much is it likely to cost?

There is no single solution to most problems. The best solution for one company may not be right for another appearing to have the same problems — due to the geographical availability of services quality of staff or other considerations.

Let us look at some typical solutions where the company relies entirely on outside services, where it combines some in house equipment with outside services, or where it is completely self-reliant.

BUREAUX SERVICES

•Batch Processing

With this type of service the user sends his data to the bureau where it is processed and the results returned to him.

The original data may be in its raw state as documents or in some computer legible medium such as punched paper tape,

Big system: Claude [illegible], Director of Personnel and Computing at Tesco Stores (Holdings) Limited pictured with the Company's [illegible] computer in the background punched cards computer legible tally roll, etc If the bureau requires the data to be prepared for computer input it will be necessary to use a Data Preparation Service or to have relevant equipment available in-house Such equipment can cost from as little as £300 up to several thousands of pounds

Batch processing is appropriate to most applications where two or more days delay is acceptable between the despatch of data and receipt of the results It is sometimes possible to reduce the turn-round to a matter of hours or even less by arranging for hand delivery and collection or by transmitting the data over telephone lines

The advantages of a bureau service are that the company does not need skilled computer processing staff, is able to relate the cost of processing with the volume of processing required and does not incur any major capital outlay The main disadvantage is that within the bureau computer system company records are only updated periodically and between computer runs it may be difficult to ascertain the up-to-date position

The cost of data preparation will range upwards from about 50p per thousand characters encoded and can represent as much as half or more of the cost of a small project, such as an analysis of sales The proportion will reduce very considerably as more of the company's processing is entrusted to the bureau becoming negligible when related to the savings once the books of original entry have been transferred to the computer

Big System ICL 2900

It is possible for a company to maintain all its accounting operations and to produce analyses of management information, financial and otherwise by using the services of a bureau

Processing fees with a bureau for the small to medium sized company will range from less than a £100 per month to perhaps £25 000 per annum A typical figure for maintaining the sales purchases and

Guidelines

nominal ledgers for stock recording and for some management analyses might be £8 000 a year

Time sharing

The use of time-sharing will usually involve the company in having its own terminal through which it transmits data by telephone link to the bureau computer The terminal will probably have a facility for receiving certain responses from the computer, and may well be able to receive all the processed results Otherwise the results will be despatched by post or similar means

The advantages of time-sharing over batch processing lie in the greater control the user has when scheduling and arranging his processing runs together with the speed of processing responses, which can be immediate Time sharing provides a company with all the benefits of in house facilities including access to records as and when required without incurring high capital outlay The user only pays for the amount of computer power he requires — his share the remaining power is available to other users

The disadvantages of time-sharing may be the high cost of conversation with the computer via the terminal, over the telephone network, and the tendency for such services to be non-competitive for the smaller application However the approach can offer many small and medium sized businesses an ideal solution and will do so increasingly as terminals become less expensive and telecommunication services improve

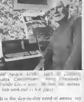
The cost of a single terminal can be less than £1 000 if purchased or £100 per month if rented although typical commercial applications often involve terminals costing several thousand pounds Processing charges vary enormously, depending on geographical location and other factors and will in the main tend to be more expensive than other bureau systems for the smaller processing requirement

PARTIAL SYSTEMS

When data is processed partly on in house computer equipment and partly through an outside computer service, we have a partial system

Broadly speaking a company's data processing may be divided into two areas of activity

a the day to day maintenance of various records and the processing of transactions against these records
b the periodic extraction of various trading analyses and statements and the preparation of schedules for management information



Small System ... Chromax Computer ... Granville Green ... motives We hate work and ...

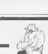
It is the day-to-day need of access say to its book keeping records that makes a company reluctant to transfer them to an outside service The result is that the use of a bureau for the company's period reports involves the additional cost of collating and preparing the data a second time prior to entry into the outside computer The second time handling cost can be avoided however, by installing a small in house computer (such as a VRC or a mini computer) Not only will day to day processing now have all the advantages of being computerised but the computer will store data needed for the period processes while dealing with the day to day needs of the company This data can then be transferred directly to the more powerful outside computer for preparation of the period reports Such an arrangement can be less expensive than installing in house equipment capable of meeting both requirements

This approach means that larger volumes of data may be handled by a given number of staff whilst a very high standard of accuracy is assured In addition, with the continued accessibility to live records, staff are able to operate more effectively by responding to the exceptions revealed by the computer's pro

Continued on P55 ▶

BRAND NEWs 5

compiled by Microspy



This middle section may either be pulled out or photocopied then filed for reference It will be comprehensive and range over the whole field of products services, events and courses **PU** stands for Personal User **SB** stands for small base – that is, small budget or small business **MB** – medium base medium budget or medium business **BB** – big base big budget or big business Addresses are to be found at the end of **Brand News.**

Systems

ABACUS COMPUTERS LTD
WORD PROCESSOR system/stand alone computer Magic Wand Hardware TEI PT208 Integral twin double-density floppy disc drives Green phosphor VDU 24 lines of 80 characters Special keyboard NEC Spinwriter Printer bidirectional 55 chs per sec CP/M(tm) op system Software for Magic Wand Edit Print Edit creates text Print control shape of text margin justification paragraph indentation character spacing other standard features Commands enable flexible document creation Full configurations start from £4990 off the shelf package for existing users £262 50 (TEI) **SB**, **MB**

C.A.R BUSINESS SYSTEMS LTD
TRI NOVUM computer Vendor states "not cheap but best buy" Triple 16 bit processor mini computer Cycle time 160 ns Disc controller million bits per second error checking "Sophisticated" system software IOS operating system FORTRAN 7 user language COBOL Extended BASIC User software includes 1) ADMIN system building system. User can sit down build application for department screen management data management and data retrieval from user implemented database reporting and word processing Written by LMR Computer Services 2) FINANCIAL MODELLING SYSTEM Management tool enables budgeting financial planning strategic planning Written by The P E Consulting Group **MB** (Tri Novum)

CPT (UK) LTD
1) CPT 8000 Patented CRT display 54 lines wide 240 characters horizontal width Twin floppies Supports up to 3 printers Qume or Diablo) Multilingual User friendly 2) CPT 6000 Less powerful version of 8000 Single floppy 160 ch horizontal scroll Four machines support one printer WORD PROCESSOR SYSTEMS with Workpak shared resources package due for launch shortly **SB**

THE DACOLL GROUP
DACOLL VDT system Multitask intelligent terminal system Basic configuration 1) Dacoll microcomputer 2) VDU 3) Floppy disc controller single floppy IBM compatible Serial interface (sync async program select) 4) Desk unit 5) Software enter data to specified file area list data from specified area append data to previously written file communicate externally in tty or 2471 mode set up directory of files Hardware and software enhancements 2 further VDUs keybd or line printer up to 3 more floppies single or double density VDUs with editing XY cursor addressing special peripherals Software enhancements SPEL compiler interpreter disc file editing data entry verification 2780 emulation customer built software disc reformatting to allow IBM 3741 format compatability **MB** (Dacoll)

DATA APPLICATON (UK) LTD
DAI Personal Computer Well received in **Personal Computer World** exhibition launch Can connect directly to existing range of Industrial Control Interface cards without need of custom interfaces Up to 48K RAM 24K fast BASIC Colour graphics (variable to 255 by 335 resolution) PAL output to TV Upper lower case QWERTY RS232 Optional floating point hardware Machine code utility Scrolling screen editor 3 programmable oscillators with volume control 60 ch screen width dual cassette interface 6 Game paddle inputs **PU Industrial** Fiercely competitive £500 to £1000 Discounts for 5 or more (DAI)

GENERAL INSTRUMENT MICROELECTRONICS LTD (GIM)
TELEVIEW system for Teletext & Viewdata connects to domestic TV Uses standard mask programmed 8 bit micro chip (PIC 1650) modular system expandable to full facility using remote control keyboard Vendor claims "low cost advantages over other systems" Has 1) interface extracts data from TV modem for telephone line 2) Full QWERTY keyboard or small keypad infrared remote control available 3) Data store memory for at least one data page 4) Data Acquisition chip takes processes data from TV or phone line loads into store 5) Video generator chip converts store data into signals for driving TV **OEMs**, add-on & TV manufacturers (Teleview)

HONEYWELL INFORMATION SYSTEMS
LEVEL 61/60 small business computer CPU 2 disc storage units card reader paper tape reader line printer communications controller able to support remote VDUs **MB**

INTELLIGENT ARTEFACTS LTD
Zenith S-100 computer North Star double density disc system runs all North Star Software 2 serial ports Z80 processor 32K RAM plus one disc £1000 extra disc £200 extra 16K £200 Also available as complete business system with VDU printer full accounts package plus PAYE £2500 Schools version with speech output same price **SB** (ZENITH)

INTERTEX SUPERBRAIN COMPUTER
Manufacturer claims bold performance at a modest price Hardware Twin Z80A cpus 4MHz Host processor for processor & screen functions second processor for disc I/O usable for other processor related functions 8 bit 64K dynamic RAM 256 bytes static RAM ROM 1Kbytes standard 2708 compatible CRT 12 P4 phosphor 25 lines by 80chs 8 by 8 character matrix line drawing characters cursor Floppy disc store 320 Kbytes two double density drives Optional

A generous gift Honeywell Level 61 computer presented [illegible] hard disc through S100 bus adaptor Standard functions keyboard N-key rollover numeric pad user defined functions cursor control Software System utilities — CP/M(tm) 8080 disc assembler debugger text editor file handling User languages FORTRAN COBOL BASIC Applications packages for standard business uses available **SB** Price approx £2000 sac VAT (Superbrain)

LOGITEK
GENERAL ACCOUNTING SYSTEM based on ALTOS Sun Series complete systems (see Brand News Issue two) 1) Nominal Ledger 'heart of system' Trial balance balance sheet profit & loss account etc 2) Sales Ledger complete invoicing and monthly statement-generating package — keeps track of current aged debtors Customer file maintained including credit information account status Current details of active customer accounts available immediately 3) Purchase ledger Tracks current aged creditors optional cheque writing feature Maintains complete supplier file information on purchase orders discount terms active account status 4) Payroll Hourly salaried commissioned employees tax return info Employee masterfile accumulated earnings deductions for current tax year 5) Stock control Pattern trends of turn over priced reports include detailed inventory list Mailing list & WORD PROCESSOR packages also available **SB MB** (ALTOS)

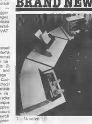
MICRO MEDIA SYSTEMS
NEPTUNE system Multiuser multitasking operating 16 bit micro 128K RAM BASIC and Pascal user languages Two text editors text formatter Storage Cartridge disc drive 10 Mbyte (optional 90 Mbyte) 3 VDUs text matrix printer daisy wheel KSR terminal Vendor states powerful versatile yet nexpensive system **SB MB** (Neptune)

MONOTYPE COMMUNICATIONS LTD
WORD PROCESSING system Monotype 150 Two intelligent terminals 64K per terminal Two double sided double density mini discettes total store 200 pages of text Diablo DIASY WHEEL printer (model 1355) proportional spacing Scientific foreign characters produceable Field proven word processing software Options inc telex punch & document transmission to other Monotype 150s Data processing packages also available stock control costing personnel records payroll address list, invoicing sales purchase & nominal ledgers Vendor states all software thoroughly tested designed for simplicity of operation Ergonomic design £11 964 for two system **SB, MB** (Monotype)

NASCOM-1
Price reduced to £140 exc VAT See BRAND NEWS Issue 1 **PU**

PERSONAL COMPUTERS LTD
WORD PROCESSOR system based on APPLE II computer (see Brand News Issue Two) 48K Apple II £858 disc drive £398 printer £1600 Interface £110 monitor £132 software package £150 Capabilities 1) enter mode for use of keyboard 2) format mode for editing 3) disc mode storage 4) print mode output Format mode permits page manipulation centring text left and right justifying cursor based Document definition specified in print mode Text compilable from both disc and memory Mike Sterland Managing Director Same machine will also run the VISICALC financial modelling package **SB** (Apple)

BRAND NEWs



T Monotype

PHONE AIDS
Programmable Electronic Notebook Nixdorf LK-3000 Modules plug in to give choice of eleven language translators calculator filing system Special modules can be tailored by Nixdorf **PU SB MB, BB** £115 for basic machine Extra for modules Ex stock (NIXDORF Computer)

PRIME COMPUTERS LTD
PRIME 250 512 Kbytes error checking & correcting MOS main memory operating system (PRIMOS) floating pt. instructions 2 Kbyte 80 ns access cache business instruction set virtual control panel 32 Mbyte cartridge disc CRT console 8-line async multiline controller cabinet chassis power supply cables Compatible with all Prime peripherals controller I/O CPU 32 bit architectural integer arithmetic unit, 128 32 bit hardware registers stack architecture Priced from £38 000 **MB** (PRIME)

SINCLAIR RESEARCH LTD
Sinclair ZX80 personal computer Z80A mpu Basic 1Kbyte RAM equivalent to 4Kbytes of other computers Expansion boards connected via backplane connectors 3Kbytes each BASIC in ROM Single stroke keyword entry replaces full strokes Edit facilities Statement lines syntax checked String handling up to max of 26 string variables strings of any length Nesting for loops up to max of 26 Built in functions such as PEEK, RND Timer available under program control Touch sensitive keyboard. 24 standard graphics symbols Display 24 lines of 32 chs £99 95 Inc VAT assembled available March Kit £77 95 **PU Learners, Control applications** (Sinclair ZX80)

SUPERTYPER (UK) LTD
WORD PROCESSING System Micro processor floppies printer keyboard optional VDU Disc capacity 260 000 chs Qume printer standard keyboard

ZILOG
THE MCZ RANGE Multi purpose computer systems comprising 1) Z80 CPU 2) 64Kbyte memory 3) Terminal interface 4) Printer interface 5) Floppy or Hard Disc mass storage 6) Expandable configurations "600K to 1 2 Mbyte floppy disc 10Mbyte to 80 Mbyte hard disc 1 to 5 terminal interface optional boards for specialised input/output Vendor claims an easy growth path System SOFTWARE & Operating system (RIO) 5 High level languages The range 1) MCZ 1/20A Desk-top micro dual floppies 2) MCZ 1/50 Desk top micro dual floppy VDU multiterminal COBOL run time package 3) MCZ 1/25A Rack mounted multiterminal COBOL runtime package 3) MCZ 1/25A Rack mounted floppy or hard disc drive 4) MCZ 1/10 Rack mounted with floppy or hard disc drive VDU multiterminal COBOL runtime package 8000 hrs MTBF (mean time between failure Support field service qualified distributors documentation training **SB MB BB** DISTRIBUTORS 1) MEMEC SYSTEMS LTD 2) MICROPOWER LTD (ZILOG)

Applications

ADDA COMPUTERS
INCOMPLETE RECORD ACCOUNTING SYSTEM PET based 32K Pet dual mini floppy printer incorporates numeric kbd £3500 for full configuration Simple to operate Standard accountancy applications include ledger VAT Bank Fixed asset depreciation Cash time saving of over 50 per cent compared with manual methods **SB** (PET)

CINCOM SYSTEMS
T-ASK online query facility for use with vendor's database management system TOTAL For DEC PDP 11 users English-like retrieval language queries database extracts information Operates with DAC TOTAL version 2 0 runs as separate disc overlay uses 24 KB memory works under RSC11M RSTS/E **OEMS, MB** (DEC PDP 11/34

GRAFFCOM
Integrated small business software — ISBS Set of packages designed to run in suite or on individual basis Stock control Order entry and invoicing Name and Address system Company Purchases system General Accounting Payroll Supplied on floppy disc full details instructions User friendly Also time recording systems finance control Vendor can write special applications supply turnkey systems (NORTH STAR HORIZON RAIR BLACK BOX other Systems supporting CP/M (tm) **SB** Dealer enquiries invited

KPG COMPUTER SYSTEMS
WORD PROCESSING package TAC WPS for Data General equipment Single or multi user Business BASIC Hard disc based Range of features include text correction deletion insert (from single character to block) underlining search replace using defined character string right hand margin justification page length control paragraph assembly from stored stock direct access to data processing files (Hard disc Data General MICRONOVA NOVA or ECLIPSE) £2000 — £3000 **MB, BB**

LANGSLER SOFTWARE
HOTEL SYSTEM 1) Room availability immediate viewing and blocking for up to 12 blocks of rooms 400 days ahead 99 rooms per block Room blocks initially defined named by user Entering a date gives screen display of availability of all blocks for date & following 6 days Leap years dealt with automatic call-up calendar 2) Guest billing Caters for approx 200 rooms invoicing of customers Final accounts include service

BRAND NEWs

charge VAT Printer output Integrated but available separately (PET 32K plus disc) SB

MERCATOR MANAGEMENT CONSULTANTS
WORD PROCESSING computer Minerva Mks 1 2 & 3 Configurations 1) Mk1 16Kbytes single disc drive stores 68 pages of text 2) 32Kbytes two disc drives store 150 pages 3) Mk3 48Kbytes 4 disc drives store 320 pages Qume Sprint 5 DIASYWHEEL printer Different typefaces Desk included BASIC user language Upper lower case characters Insertion deletion correction left & right justification print widths up to 120 characters and other standard features Business packages available Programs also written to order for clients £1900 4425 4950 respectively SB (TANDY TRS80)

MICROPOWER
MCBS Integrated PRODUCTION CONTROL suite suitable for beginners For manufacturing environments forecasting and costing of all stock requirements Suite works either stand alone or as extension of the MBCS system covering all ledgers order entry stock control & payroll Also special packages for SOLICITORS and JEWELLERS Based on Zilog MCZ series of microcomputers hardcopy printer VDU MB (ZILOG MCZ range) See systems this issue

MICRO SCOPE LTD
RESERVATION SYSTEM Reservation deposit processing booking documents to both customer and business reminder letters balances due general enquiry facilities printed reports audit trail mailing lists Outputs full documentation set on preprinted form Based on modular hardware concept up to 7 VDUs 2 Mbyte floppy disc storage hard disc option Starting price £10 000 includes training 1 year hardware maintenance SB (CROMEMCO) Vendor also a Systems builder specialist consultancy design and development own micro development centre education services Offers training courses hand-on experience States prepared to enter into joint development projects to help defray start up costs of a project SB MB

SAFE COMPUTING LTD
FIXED ASSET Inflation Accounting Package Creates maintains computerised register of fixed assets flexible depreciation parameters choice of methods of assessing depreciation further options for allocation of depreciation in first and last years Reports on individual assets analyses assets by group division company or cost centre with depreciation calculated on proportional basis by company calendar Financial reports at selectable intervals (either historic or inflation accounting) Vendor states popular answer to complexity of accounting work BB BUREAU Service system based on not mentioned

SIAEngineers design package for structural reinforced concrete to standard CP110 (1972) DECIDE handles provisions for ultimate load check serviceability loading shear stress check Engineer controls design Interactive Documented Seminars for use BUREAU SERVICE by SIA (CYBER)

STAGE ONE COMPUTERS
Random access for both Commodore and Compu/Think Disc Drives Screen and file create and management system PETAID V2 Allows immediate retrieval of individual records Indexed sequential version due shortly BUSINESS PACKAGES 1) Estate Agents 2) Accountants (Incomplete records) 3) JOB CONTROL (for printers (PET)

STAGE ONE SOFTWARE
Set up 1979 Partners have over twenty years experience in systems software design 1) Database file create and management package 2) Utilities 3) Software tools 4) Commercial packages PETAID Version 1 for tape or sequential disc Version 2 disc random access General accounting package Stage One word processor stock control insurance brokers package Incomplete records Insurance renewals mailing system (PETAID program) appointments planner (PETAID program) SB (PET)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
INFORMATION RETRIEVAL system from National Centre of Systems Reliability (NCSR) "LexiBOSS" Combines the functions and facilities of both main categories of information handling viz Structured database management systems textual storage systems Principal features of LexBOSS Storage of source documents documents of any size contents from full text to highly structured data large inputs with a minimum of labour and expertise search routines and questions user facilities & output formats many levels of access security Claims unique features dynamic definition of file structures enter new multiple-field data values in on line mode concurrently search retrieve both text & data with user facility to define own units for engineering technical scientific terms Can store 200 000 documents BB (DEC PDP11 RSTS/E operating system)

PITNEY BOWES LTD
SPECIALIST APPLICATION COMPUTERISED TERMINAL Photo shows an operator at the keyboard of 7700 embossing terminal manufactured by Pitney Bowes This high-volume computerised machine produces data carriers in the form of plastic cards or metal plates It is particularly suitable for hospital medical data and in the motor ind

plete computer kit.
£79.95
Including VAT.
Including post and packing.
Including all leads and components
Fewer chips, compact design, volume production – more power per pound!
The Sinclair ZX80 Kit £79.95
Assembled £99.95 Complete!
sinclair ZX80
Science of Cambridge Ltd
Tel. 0223 311488
Order Form
To: Science of Cambridge Ltd, 6 Kings Parade, Cambridge, Cambs., CB2 1SN
Please send me
Quantity
Item
Item price
Total
79.95
99.95
8.95
12.00
16.00
5.00
TOTAL
Address

ustry for chassis and engine part number identification **BB**

UNILEVER COMPUTER SERVICES LTD (UCSL)
CORPORATE MODELLING SYSTEM "STRATEGY" Developed from experience of financialmanagement in Unilever Group English like statements enable system operation by Managers with no expertise System now enhanced by 1) Graphing facility 2) Automatic link complementa graphics facility by linking to vendor s SPEAKEASY System Includes colour access to statistical analysis **BB**

Disks

ALMARC DATA SYSTEMS LTD
MICROPOLIS range of quad density disc drives fully compatible with all S100 systems 315 Kbytes per single 51/4 drive 630 Kbytes per double drive unit Vendor now appointed agent **SB OEM**

BURROUGHS
New Model MD122 FLOPPY disc drive vendor claims world s first 6 Mbyte twin 8 inch drive built in microprocessor controller (AMC) Voice coil actuator gives average time to date 158 ms 3 Mbytes formatted store on each disc AMC controller performs CRC generation error handling sector relocation file search confidence/ diagnostic media wear monitoring leaves host system controller or cpu less burdened **OEM** (Burroughs)

DATA GENERAL
New DG DISC subsystems Three models 1) 25 Mbyte disc and 1 26 Mbyte discette 2) 25 Mbyte discette only 3) 12 5 Mbyte disc and 1 26 Mbyte discette a) 25 Mbyte permanent disc Formatted in sectors of 512 bytes each 384 tracks per surface divided into 2 by 192 track bands on each of four surfaces each band accessed by separate read/write head Each 8 track disc has 132 072 bytes in 256 sectors b) 12 5 Mbyte disc Formatted same way but 4 tracks per cylinder c) Discette 77 tracks 16 sectors each 512 bytes Transfer 62 500 bytes per sec Head positioning inc seek settling 25 msec track-to-track 100 msec random avg 253 msec max Rotational at 360 rpm 83 3 msec Winchester technology Software support **MB** (NOVA/ Eclipse and microNOVA proprietary DATA GENERAL)

EQUINOX COMPUTER SYSTEMS LTD
CARTRIDGE disc drive model KB10 Industry standard S100 systems 5 Mbyte

Flexfile 21

BRAND NEWs

fixed platter 5 Mbyte removable cartridge Runs approximately 10 times faster than floppies on seek operations needs no additional back-up one of the most reliable types KB10 supports CP/M 2 0 MP/M FAMOS OMNIX op systems Unlimited off line storage controller operates with up to four 2200 BPI 2400 RPM drives Data transfers up to 3 10 Kbytes a sec may be overlapped with seek ops on other drives Controller has been in field use for 2 years £4950 ex VAT **OEM MB**

WESSEX ELECTRONICS LTD
New TRI DATA Flex file 21 microprocessor controlled MINIDISC system Dual drive capability comprehensive text editing using Text Formatter RS232 IEEE compatible **OEM**

Printers

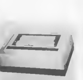
ANADEX
DP-8000 & DP 9500 Printers See Brand News Issue 3

DATA DYNAMICS
TWO Colour printing now available on ZIP range of vendor s printers See Brand News 3 for Zip 30

IBM
IBM ELECTRONIC TYPEWRITER Two models Vendor claims elegant new style Compact stationary carriage units interchangeable typing elements Full line error correction character or entire line deletion by keystroke pushbutton reduction of calculations for column layouts centring can store sets of margins tabs for common formats Ergonomic light touch keybds Quick reference cards integral with front of machines remind user of steps in operation Model 50 12 or 12 chs/in or proportionally spaced type Two sets of margins tabs storedle Reposition Model 60 736 chs storage combined use of memory and format storage enables pre program layouts Allows full speed typing without pause at line ends £1250 **MB BI 3** (IBM)

INTEGREX LTD
Type 454C COLOUR MATRIX PRINTER Micro controlled bidirectional 250 chs per sec single print head 9 by 9 matrix Max line length 155 chs Principal application is in colour VDU dumping Graphics areas may be colour mixed 3 colour ribbon shifts vertically for max throughput Ribbons available for most colour combinations Serial parallel interfaces available inc IEEE 488 **MB**

INTELLIGENT ARTEFACTS LTD
BASE 2 DOT MATRIX printer Micro processor controlled Vendor claims unique features All standard interfaces incorporated with printer — RS232 20 mA, Centronics parallel IEEE 488 so making it suitable for all computers including Pet Serial baud rates 75 to 19200 two line buffer Paper feed by stepping motor enables ejection at 15 inches/sec step sizes small enough for continuous plotting Three character sets 1) Standard 2) APL 3) Down loadable ROM can be programmed for Pet graphics Arabic etc Programmable hori



Integrex 3-colour printer

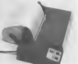
zontal vertical density horizontal vertical tabulator many other features also included Retails £475 **SB OEM**

LogAbax
Model 80 high speed DOT MATRIX printer LogAbax developed interface 180 chs/sec No further details except interface allows connection to Burroughs 2815 computer and single card interface under development for other mainframes **BB**

MEMOREX
Model 3476 LINE Printer (identical to vendor s MRX/780 but with changed interface to allow attachment to IBM System/34) 760 lines per min Attaches to System/34 via Work Station Controller avoiding CPU requirements allows user to have 2 printers £8000 vendor states another example of policy to protect computers user s investment **BB** (IBM)

MICROMEDIA SYSTEMS
MICROLINE 80 printer DOT MATRIX Vendor states low cost high quality rugged reliability built in Head life of 2 hundred million characters Features include program selectable fonts graphics printing 40 80 and 132 col printing 6 or 8 lines per inch friction pin and tractor feeds Serial parallel or Pet IEEE 488 interfaces **SB MB OEM**

NASCOM
IMP Impact MATRIX printer 7 by 7 dot matrix 80 chs per sec Bidirectional 10 line print buffer 96 ch ASCII set Automatic carriage return/line feed 81/2 paper (pressure feed) 91/2 paper (tractor feed) Baud rate 110 to 9600 External signal for optional synchronisation of baud rate RS232 interface Vendor compact low priced £325 exc VAT Ex stock **PU, Schools, Labs**



Nascom IMP

WESTREX
Model TX80 Printer 80 col 6 by 7 DOT

MATRIX Unidirectional 150 characters per sec Upper & lower case character set, special ch sets option Friction or tractor paper feed friction feed utilises standard teletype roll Basic interface 8 bit parallel Centronics compatible RS232 current loop & interface boards for popular micros available Vendor claims unique jewelled micro head good for at least 100 million characters mean character between failure time of 5 million lines £500 end user OEM reseller discounts Ex-stock **PU SB OEM**

Bureaux, Consultancies, Services, Shops

ANAGRAM SYSTEMS
Recently formed Software House Aims to provide sophisticated business packages for the micro market Works closely with Brighton company Amplicon Micro Systems Ltd first package is Anagram stock control system for PET Six founder members all with mainframe experience **SB**

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Now launching eighth annual comparison with the help of CSA (Computer Services Association) Compares computer service BUREAUX Aspects of performance include employee costs productivity marketing performance machine utilisation administration costs staff turnover income per head etc Detailed results confidential **MB BB**

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Templeman Software ...

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Remote DIAGNOSIS for DEC systems users Field service software support and maintenance

Exhibitions, Courses, Events

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26 March Microprocessors in Products & Production 27 March Word Processing systems and people Also inhouse courses The Office of the Future How to Buy & Use a Microcomputer

PORTSMOUTH POLYTECHNIC
(Dept of Elect Eng)
2nd April Second Steps in Microprocessors course 29 April Micros briefing for Directors and Managers One-day awareness course Portsmouth

COMMODORE
1) April 2 Basic for Beginners Course Sky way Hotel Heathrow 2) April 4 Micros and the Businessman Excelsior Hotel Manchester 3) April 15 Micros in Control systems Excelsior Hotel Manchester 1) £250 ex VAT 2) £50 ex VAT 3) £50 ex Vat

ICFC MANAGEMENT CONSULTANTS
6 April Seminar on Word Processing Half day For managing directors financial directors of medium sized companies professionals London Chamber of Commerce London

DATA COMMUNICATIONS
8 9 April European Data Communications Standards Conference Royal Garden Hotel London

TEKTRONIX
14-18 April Microprocessor Workshops Workshop One for engineers new to micros Two suitable for engineers with experience

April 15-18 Communications 80 **Exhibition** National Exhibition Centre Birmingham

BRITISH COMPUTER SOCIETY
15 April **Forum** for Users at Communications 80 combined computer and communications Grand Hotel Birmingham £23 members of BCS £30 non members
23 24 April Process Control specialist group a two day conference Waldorf Hotel London £90 members £115 non-members £60 BCS students
25 April Seminar on Participative Design — A constructive appraisal In-depth evaluation of a new methodology £55 Bloomsbury Centre Hotel London

INFOTECH
16 18 April Computer Appreciation for **Businessmen** London Ref KC82

INFOTECH
16 18 April Conference Expert Systems based on knowledge processing techniques of Artificial Intelligence Conference Chairman Donald Michie University of Edinburgh Cavendish Conference Centre London Code C69

LOUGHTON COLLEGE OF FURTHER EDUCATION
18 April The Application of Microcomputers in production systems 24 April Application of micros in business and management teaching One day conferences Loughton Essex

CPE COURSES LTD
29-30 April 2 3rd July Course Buying a computer London

ONLINE
30 April-2 May MERSEY MICRO SHOW Exhibition and Seminars Adelphi Hotel Liverpool

UNIVERSITY OF EDINBURGH
18 22 AUGUST (Specially announced ahead of time by request — takes place during Edinburgh Festival) COMPSTAT Symposium on Computational Statistics Edinburgh

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MSS
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DSGENE Tel [illegible]

Arnm[illegible] Data Systems Ltd
906 Woodborough Road
Nottingham
NG3 5QS Tel 060[illegible]

Anagram Systems
9 M[illegible] Close
Horsham
West Sussex
RH12 1JT Tel (0403) 68601

The British Computer Society
13 Mansfield Street
London W1M 0BP
Mero Rel 1828
Tlx 262284 Tel 01 [illegible]

Burroughs Machines Ltd
OEM Division
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Langwood House
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Tel Rickmansworth [illegible]545

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London W14

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Berks

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Slough Trading Estate
Slough
Berkshire Tel [illegible]

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Tlx 271[illegible]
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Shepperton
Middlesex TW[illegible] JB
Tlx 8954324 Tel [illegible]

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Bangwick
[illegible]

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[illegible]
[illegible]
Stevenage
Hertfordshire

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London SW1[illegible] Tel [illegible]

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[illegible] House
[illegible]
New [illegible]
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[illegible]
[illegible]
[illegible] Avenue
[illegible] Tel [illegible] 734 [illegible]

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[illegible]
[illegible]
[illegible]
[illegible]
[illegible] Tel 0[illegible] 305

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[illegible] House
[illegible]
[illegible] LU

[illegible] Ltd
[illegible] Industrial Estate
[illegible]
Burton on Trent
Staffordshire DE11 [illegible]
Tlx [illegible] Tel Burton on Trent (0283) 21[illegible]

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Swindon SN3 3TB
Tlx 44444[illegible] Tel Swindon (0793) [illegible]

Intelligent Artefacts Ltd
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Orwell
nr Royston
Herts Tel Arrington (02207) [illegible]

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[illegible]A [illegible]worth Park Road
Surbiton
Surrey

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Shirley House
[illegible] Camden Road
London NW1 9NR
Tlx 23820 Tel 01 267 3262

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[illegible] Street
[illegible]
Lancs

Mcmec Systems Ltd
[illegible] Park Industrial Estate
Thame
[illegible] OX9 3RS
Tlx 837508 Tel (084 421) 5471

Memorex UK Ltd
Memorex House
96/104 Church Street
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Middlesex
TW18 4XU Tel Staines (81) [illegible]

Mercator Management Consultants Ltd
6 Vyvyan Terrace
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Bristol
BS8 3DF Tel (0272) 37636

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[illegible] Chepstow Road
Newport Gwent
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for Micro Media [illegible]

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Basingstoke
Hampshire R[illegible] LG
Tlx 85872 Tel (0256) [illegible]

Micro Scope Ltd
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Taplow
Maidenhead
Berks

Monotype Communications Ltd
14-16 Cockspur Street
London SW1Y 5BL
Tlx 917125 Tel 01 [illegible]

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[illegible] Chapel Road
Worthing
West Sussex BN11 1EG

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42 B[illegible] Street
Chesham
Bucks Tel [illegible]

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[illegible] Road
[illegible]
[illegible]
[illegible]
Tel [illegible]

[illegible] Computer Ltd
[illegible] Bishopsgate
London EC2M 4NR
Tlx [illegible]
Tel 01 62[illegible] [illegible]

Midland North
Phone[illegible]
B[illegible] House
Broad Lane
Everley
Brackley
Northants

Prime Computer (UK) Ltd
The Hounslow Centre
1 Lampton Road
Hounslow
Middlesex TW3 1SB
Tlx 938471 Tel [illegible]

Head Office
The Sales Manager
SIA Ltd
Ebury Gate
23 Lower Belgrave Street
London SW1W 0NW
Tlx 916635 Tel [illegible] 1144

Sale Computers Ltd
Bristol Street House
Bristol Street
Birmingham
B5 7AZ Tel [illegible] 1331

Solidisk KPF
[illegible] Chiswick High Road
London W1 5RP
Tlx 41832[illegible] Tel 01 [illegible]

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Old Christchurch Road
Bournemouth
Dorset

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1[illegible] [illegible] Drive
P[illegible]
Middlesex HA5 [illegible]

Tek[illegible] (UK) Ltd
PO Box [illegible]
[illegible]
Harpenden
Herts AL5 4UF

Tempe[illegible] Software [illegible]
PO Box
[illegible] Street
[illegible]
W[illegible]
[illegible] Tel [illegible]

U[illegible] Computer Services Ltd
[illegible] House
[illegible] Road
Wembley Tel [illegible] 1414

United Kingdom Atomic
Energy Authority
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London
SW1Y 4QP Tel 01 930 5454
[illegible]

Western [illegible] Ltd
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Dewsbury
[illegible] 5SE
Tlx [illegible] Tel [illegible]

Westrex Company Ltd
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[illegible]
N[illegible] Tel 01 45[illegible]

from p 12

NASCOM 2 is a powerful unit which is ideally suited to this application Initial trials indicate that it can be used successfully as a communication aid and negotiations are underway with Portable Microsystems Ltd Brackley, with a view to developing pre production models However funding for this venture has still to be found

Of course, the inherent flexibility of the microcomputer means that M A C is not restricted to the matrix selection method It is possible to tailor the selection method the number of switches and the sophistication of the device to the individual user

The reluctance of top administrators to recognise the importance of microelectronics permeates even through to the caring profession At grassroots level I have found considerable dissatisfaction amongst the professionals who are in daily contact with handicapped people relating to the inefficient and seemingly uncaring attitude of the present service provided by the ONLY government approved manufacturer of communication equipment It is these professionals rather than the Department of Health (the largest agency responsible for supplying communication equipment to the disabled community) who are aware of the limitations of the traditional communication aids and the potential of microcomputers in this field Yet many are unable to voice their feelings or upset the status quo for fear of transgressing their professional code of conduct

Project

I am well aware that the Department of Health had their fingers badly burnt when a contract with a stable manufacturer fell through and left a number of unserviceable devices in the field However eight years have since passed and it is about time that the unofficial monopoly is broken and small but competent firms such as the manufacturer of the Electraid communicator (much sought after by schools in preference to POSSUM) are encouraged to expand It is interesting to note that the same firm is developing an innovative user — programmable communication aid despite an earlier

[illegible]

unsuccessful application for funding to the NRDC and vain attempts to gain Department of Health approval for its other equipment

There is an urgent need for immediate government action to coordinate developments in the research laboratory and to widen the number of devices available to disabled people Regional Resource Centres should be established where handicapped individuals can be assessed and emphasis placed on the matching of the user s capabilities to a wide range of aids not just the one or two as at present There must also be adequate provision for making available one-off aids and to encourage closer links between researchers and manufacturers

While the abortion amendment bill which is certain to increase the number of handicapped babies born makes a triumphant return to the floor of the House of Commons the disabled community is expected to bear up to a reduction in the number of aids supplied as well as services such as home help in addition to the cuts which affect us all

A conference workshop is being held on Friday March 21st at King s College London to bring together all interested parties to review new aids and to plan further action to ensure that policy makers at national and local level know about these developments and make financial provision for them All are welcome — details are available from Peter J Deakin at 17 Taylors Mews Neath Hill Milton Keynes BUCKS MK14 6HL

▶ from p 42

cessing routines

There are no special skills required by the staff using the in house equipment Although the operator will generally have typing skill, this is not essential as most data is entered through a compact numeric key cluster

The potential disadvantage particularly with VRCs, is that data is entered generally through a single station only which restricts the volume of work that can be handled Also the capacity for work is limited by the somewhat slower methods of processing involved

IN-HOUSE SYSTEMS

Small business computers such as the VRCs and micro or mini computers may well meet all the processing needs of the smaller business

The *total* cost of such an in house system for a small to medium sized business is unlikely to be less than about £10 000 and more probably in the region of £20 000 to £25 000 Turnover in such companies is unlikely to be less than about £800 000 although such generalisations are always subject to exceptions

Some of the more expensive mini-computers can be expanded considerably

Guidelines

as applications are developed and introduced, and it may be advantageous to employ in-house a data processing professional Although the day to day operation of a mini-computer does not call for a data processing expert, the development of programs and systems certainly will and the very high cost of using external services can often be avoided by employing one

SUPPORTING SERVICES

Most suppliers of computers (*hardware*) will be able to offer program suites (*software*) for many of the common business and scientific functions These are called *packages* and their costs can vary enormously They are typically about one tenth of the cost of equivalent systems designed from scratch for an individual user

The main suppliers of software apart from equipment suppliers, are the *Software Houses*

It is very difficult to give a good guide to software costs However, applications on a VRC might be in the region of £300 to £500 for each application package and

Medium system for word processing Monotype 1 0 with two intelligent terminals

and will support several data entry points A number will also offer *real time* working which means that data may be processed or records displayed, in time step with the relevant business activity

Such mini computers with ever improving power-to cost ratios are beginning to replace the traditional main frame computers in all but the largest businesses The price for basic configurations of this class of mini computer can start from under £20 000 with the average installation comprising machinery and some initial software probably being in the range of £40 000 to £60 000

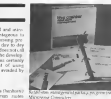
The proportion of total cost represented by systems and programs continually rises

£1 200 to £1,500 for equivalent software that is specially designed These figures would increase on a mini computer to perhaps £1 000 for a package and anything from £8 000 to £30,000 for the bespoke equivalent

It is important to appreciate that there is no fixed relationship between the cost of a computer and the cost of software required for the company's systems During a computer's lifetime expenditure on software may well exceed the original cost of the computer

NEW DEVELOPMENTS

There is now much talk of the Electronic Office or Office of the



Retail store management package program from Microsense Computers

Future These are general terms for the use of a range of devices all with some form of computer at the centre The most widely used of these is the word processor, which handles the entry storage retrieval and editing and allows a great deal of automation of repetitive typing tasks as well Booklets dealing with this and the wide aspects of the office of the future, will be available later in the year From *ICFC Consultants 5 Victoria Street Windsor Berks SL4 1EZ*

Consultancy assistance

Within the scope of this article an attempt has been made at giving some kind of answer to the questions

'What sort of equipment are we talking about?' and "What is the order of cost? This has been done in the certain knowledge that not everyone would find the figuces familiar — although they are all drawn from examples of the author s first hand experience during 1979

The process of selecting the right data processing solution is akin to selecting the best means of travel Whether we use snow shoes or a plane walk or drive or a combination of means will depend on the goals we wish to achieve, the environment in which we must operate and the budget available to us

A very large range of equipment is available in the market The developing technologies which make computers respond to the spoken word and which herald powerful data transmission facilities by the use of laser beams are steadily increasing the options available to us

Already it is possible to communicate with a mini computer in our own style of handwriting, already we may enter data through a simple push button telephone hand set and receive prompts from the computer in the spoken word Already we can sit in our armchairs and use our television set as an information terminal using the facilities being offered by the B B C the I B A or the Post Office (Oracle Ceefax and Prestel)

As progress continues and despite inflation the cost of data processing will come within the reach of more companies and will eventually be as familiar as the photo copying machine

How then can a company make a sound judgement on what form of data processing it should have now, or should be preparing for in the future?

Already the reader may have become bewildered by the plethora of products and services offered to him by courting salesmen who speak in a learned language of megabytes and words of cycle-times and virtual storage. Surely any one of these salesmen as the representative of a reputable supplier will be able to offer a competitive and sound solution?

We would not be calling into question the ethics of a salesman, to suggest that it is no part of his job to draw attention to certain drawbacks in his proposals, or to advise us of a cheaper and better solution which is available from a competitor. It is also unlikely that he could afford to spend, on every occasion sufficient time to appreciate fully the needs of our company — even if he were qualified to do so. The wisest approach for any company about to embark on computerised data processing or merely wishing to establish whether or not it is appropriate is to seek the advice of professional consultants.

There are a number of well established software houses which are able to offer excellent technical advice on the application of computers to business problems. Although such bodies are primarily in the business of installing and implementing systems they will also supply objective evaluations.

Many firms of management consultants also have this ability to hand with the added advantage of a breadth of discipline, which equips them to see the data processing needs of a company in the right perspective.

Nowhere is the need to relate computer solutions to the scale of a company more necessary than in the small to medium sized business. The data processing skills of ICFC Consultants have been developed over the last 15 years specifically to complement the main consultancy activity which specialises in assisting the management of smaller companies. In recent years we have provided professional advice on computer and data processing problems to firms ranging in size from 25 employees to 5 000 employees.

Consultancy fees are a prudent expense in the search for the right solution and will most often be repaid amply by the savings in the time of the company's management and by the benefits realised.

An ill chosen or badly planned data processing system can cost a company its very existence!

Appendix

Glossary of terms

a d p — Automatic data processing

Backing Store — A store of much larger capacity than the working store but requiring longer access time. Data may be transferred in blocks between the two stores.

Batch Processing — Execution of programs serially such that each is completed before the next is started or the processing of data in a similar serial fashion

Guidelines

Computer — A device capable of automatically accepting data, applying a sequence of processes to the data and supplying the results of these processes

Data — All or any selection of the operands and results involved in any operation or set of operations

Note 1 The word data although plural in form is commonly used as a collective noun and may therefore be used with a singular verb

Note [illegible] The use of the word information to mean data is deprecated. In its ordinary sense the information associated with data is what the data conveys to the person receiving it

Data Processing — A systematic sequence of operations performed on data e g merging, sorting, computing, manipulation of files with the object of extracting information or of revising it.

Disc — A magnetic store in which the magnetic medium is on the surface of a rotatable disc

Edge Punched Card — A card in which holes similar to those for paper tape are punched near to one edge

Field — A zone, a grouping of characters or their equivalent representation on a record or form to which some meaning has been ascribed. Fields may combine to form a larger field and conversely a field may have sub fields

Hardware — Physical equipment as opposed to the computer program or method of use

Input — The process of transferring data from an external store or peripheral equipment to an internal store. The data so transferred

Intelligent Terminal — A terminal which is programmed to apply logical and discriminatory rules on data it is processing

Interface — A shared boundary, for example the boundary between two sub systems or two devices

Magnetic Card — A card with a magnetic surface on which data can be stored by selective magnetisation of portions of the flat surface

Magnetic Disc — A flat circular plate with a magnetic surface or surfaces on which data can be stored by selective magnetisation of portions of the flat surface

Magnetic Striped Ledger Card — A card used on visible record computers where data is not only printed on the card but is also able to be encoded on a ribbon running vertically down the card; this stripe has a magnetic surface which can be read or written by the computer

Memory — Loosely any device that can store data; more often refers to the main store of the computer where data is processed and where programs operate

On Line — Pertaining to equipment or devices under control of the central processing unit or to a user's ability to interact with the computer

Output — The process of transferring data from an internal store to an external store or to a peripheral equipment or the data so transferred

Peripheral — Any unit of equipment distinct from the computer's central processor which may provide the system with outside communication

P O S — Point of Sale pertaining to data collection or processing at the moment of selling goods

Program — A set of instructions, expression and any other necessary data for controlling a computer run. The spelling has been adopted to distinguish it from other types of programme such as a production programme or a programme of work

Pulling — The process of withdrawing selected cards or records from a physical filing system

R A M — Random Access Memory: a store in which records may be directly addressed

Real Time — In time step with events being simulated or at sufficient speed to analyse or control external events happening concurrently

R J E — In time step with events being simulated or at sufficient speed to analyse or control external events happening concurrently

Software — A set of programs, procedures and possibly associated documentation concerned with the operation of a data processing system

Store — See memory

Terminal — A point at which information can enter or leave a communication network. A device usually equipped with a keyboard and some kind of display capable of sending and receiving data over a communication channel

Time Sharing — A method of using a computer system that allows a number of users to execute programs concurrently and to interact with the programs during execution

V D U — Visual Display Unit: a display of data on a television type device or by light emitting diodes in a viewing window

V R C — Visible Record Computer: a computer where ledger cards are maintained in order that records continue to be physically discrete and legible to [illegible]

Word Processor — A machine used to facilitate the composition, editing and production of text

■**Concluded** *This article [illegible] adapted from a booklet published by ICFC Management Consultants.* **Computer Age** *thanks the author and his company for [illegible] to use ICFC material [illegible] a future issue.*

The first part of this article appeared in the March issue.

TOPICS IN ARTIFICIAL INTELLIGENCE

Part 4: Computer Vision

Figure 1

Previous articles in this series dealt with representation in problem solving, planning a strategy and pattern recognition. Readers with problems may write to the author care of Computer Age

A framework for machine perception

In humans the sense of sight is perhaps the most powerful and important of all the senses. Not surprisingly, therefore, an immense amount of research effort has been expended over the years in attempting to imitate the visual process by means of machine — to enable, for example, a computer to "see" its surroundings. The subject of machine vision certainly falls within the orbit of Artificial Intelligence studies.

At the very outset it is useful to point out that in this context "seeing" is inextricably bound up with questions of interpretation and understanding. For example a television camera might crudely be said to "see" its surroundings in the sense that it can electronically reproduce and transmit a replica of its visual environment. In artificial intelligence terms, however, in talking about machine vision we are much more concerned with the problem of operating on such an image so as to derive an *understanding* of its content, either by attaching a label to it, adding information to currently stored environmental knowledge in some way or by initiating some action which confirms that understanding.

Vision can appear deceptively simple. Figure 1 shows a popular form of toy in which a child can build a small car by connecting together interlocking pieces in the correct configuration. Although we can readily grasp the potential difficulties of matching together the pieces in the right order and relative orientation, we might be tempted to take for granted the processes involved in perceiving the pieces — which might be jumbled upside down, partially obscured from view, and so on — in the first place, processes which must occur before the problems of assembly can even begin. If a machine is to be used in an assembly task — and it is self-evident that such a machine would have enormous potential, particularly in an industrial environment — such problems must be faced.

In this article we shall explore the basic procedures of machine vision and indicate at least some of the potential difficulties

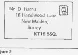


Figure 2

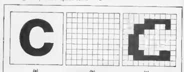


Figure 3

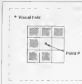


Figure 4

which confront the designer of a perceiving machine

We can identify perhaps three criteria which must be satisfied for an effective perceiving machine

- (a) **It is necessary to extract information about the real world and encode it in the form of an image in such a way as to preserve the essential characteristics and relationships of the original**
- (b) **The image produced must be processed so as to isolate or emphasise its important features and de-emphasise irrelevant or unimportant information thereby maximising the probability of correct interpretation**
- (c) **The content of the image must be recognised or interpreted and appropriate action initiated**

Machine perception of simple patterns

Let us illustrate and expand these ideas by means of a simplified example Figure 2 shows an envelope the last line of whose address carries the postcode — a group of letters and numbers which give a representation in much compressed form of the geographical location of the envelope s intended destination Let us now consider how the problem of reading such a postal code by machine might fit into our generalised framework outlined above

If we ignore the details of how to isolate the postcode from the other information on the envelope and of how to select one character at a time then the visual environment to be perceived in this case reduces to two-dimensional representations of alphanumeric characters

First, then the form of the character in the field of view must be extracted and an image produced for subsequent processing There are many ways in which this might be done For example a flying spot scanner is a simple device which can project a narrow beam of light at successive points on the visual field so as to scan the entire field point by point By measuring the amount of light reflected at each point an image can be produced in the form of a matrix of points each corresponding to the intensity of reflected light at that point In this particular example we should find that only two levels of intensity are significant these levels corresponding to black points (where ink has been applied to the envelope surface) and white points (where the envelope surface is unmarked) The image produced therefore will take the form of a matrix of black and white points which should approximate to the shape of the original character

This process is summarised in Figure 3 Figure 3(a) shows a typical character which might fall into the field of view and Figure 3(b) a grid of points which might be tested by the scanner By superimposing the grid over the character and distinguishing those elements on the grid which are predominantly black from those which are predominantly white the digitised character — our extracted image — of Figure 3(c) is obtained A *binarised* (two level) image of this form is particularly suited to computer processing of course since its representation inside the machine is so straightforward What would you say is the principal factor which determines how accurate a representation of the original character is the image?

We are now ready to move on to the second stage of processing, where we wish to operate on the extracted image so as to maximise the probability of correct interpretation at the final stage A typical problem which may occur with the type of data extraction described above arises because of our attempt to transform a real-world image formed from continuous and unbroken line segments into a representation in the form of a finite number of discrete black and white points We say that the binarisation process is susceptible to *quantisation error* and the extracted image will not have exactly the same shape and form as the original except in certain limited cases The example of Figure 3 for instance, shows how the original character is approximated by the binarised image

Equally important is the fact that for a variety of reasons — dirty marks on the envelope dirty or worn type heads poor quality paper and so on — the image produced may contain a certain amount of *noise* in the form of spurious black points on the image matrix or white points appearing where black points should be Figure 5(a) shows an example of this

(a) Before smoothing

(b) After smoothing

Figure 5

A technique commonly used to minimise the effect of noise and quantisation error is a process called smoothing, one instance of which operates as follows

Consider a small square or "window" of dimensions 3 by 3 image points and superimpose this on the image matrix centred on some point of interest which we shall call P (see for example Figure 4) Now count the total number (N) of black points in the window A new (transformed or *preprocessed*) image is formed by making the point at position P on a new matrix a black point if N is equal to or greater than some threshold value, or a white point otherwise If we choose say a threshold of 4 in our example of Figure 4 for instance, then the point at position P on the new matrix would be changed to a black point

If we now apply this procedure by moving the window so as to centre on every point of the image in turn then we produce a transformed matrix with the same dimensions as the original, but if the process has been effective, with spurious noise eliminated and any sharp variations caused by quantisation errors smoothed out Figure 5 shows a typical image before and after the application of the smoothing procedure when the threshold was set at 4 Can you predict in general terms the likely effect of selecting a higher or a lower value for this threshold?

There are, of course many other preprocessing techniques which might be applied — for example the centreing of the image on the grid or its rotation to an upright position (position normalisation), the reduction of the image to its basic outline (skeletonisation) or the expansion of the image so as to utilise the full area of the grid (size normalisation) — but algorithms for these procedures will not be considered here

The final stage of processing in machine vision when an interpretation or recognition of the image is carried out is largely then a matter of applying some kind of pattern recognition technique to the image produced by the first two stages Since this was the subject of the previous article there is no need to repeat the basic principles introduced there (See issue 4)

We now have an idea of the fundamental processes involved in machine perception However the situation we have considered so far is rather restricted It is only necessary to contemplate the perceptual ability required by an automatic assembly machine such as that described earlier to see the restricted nature of our approach so far In such a case and in a whole host of applications where we might want to make use of a machine which can see we need to interpret a three-dimensional *scene* rather than a two-dimensional drawing In the following section, however, we shall see that although new techniques are necessary to deal with this new type of probem, the same basic framework is applicable

Although a procedure for interpreting

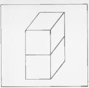


Figure 8

real world scenes is not very different in principle from the previous scheme for two-dimensional figures of necessity it is more sophisticated in detail

We begin by noting that in practical terms three dimensional scenes can only conveniently be handled by machine as their two dimensional projections, although these differ from the previous simple alphanumeric characters in that their lines enclose regions corresponding to the faces and surfaces of solid bodies (think for example of a photograph of a cube) Let us restrict ourselves for the present to a discussion of scenes whose two-dimensional projections consist of just straight lines

The *first stage* of processing is as before to extract the information from the visual field and produce a machine-oriented representation The added sophistication of a typical real world three dimensional scene suggests that a television camera might be an obvious candidate as the artificial "eye" here To convey the subtleties of the scene we may then store the image so produced by means of a matrix of points as before but now storing any one of a

Series

number of brightness levels at each point rather than our previous black/white simplification

In the *second stage* of processing if we are to keep our computations simple we need to take some fairly drastic action to reduce the very large amount of information produced at the first stage A sensible way of doing this is to reduce the scene to a line drawing This preserves the essential characteristics of the image and yet still as we shall shortly see, allows the possibility of interpretation of the scene it represents This process requires an algorithm which can detect the edges and vertices of objects in the scene a task which can quite successfully be achieved by looking for sharp changes in brightness levels as the original stored image data is scanned Figure 6 shows an image in this processed form of a scene depicting two solid boxes stacked one on top of the other

Figure 6 also illustrates another major feature of scene perception and leads neatly to a consideration of the *third stage* of processing the interpretation of the real world scene It will be noticed that in the line drawing representation of our three dimensional scene an interpretation of the scene will have to be made without a complete view of the objects contained within it For example since we view the boxes from just one angle certain faces of the boxes are partially or completely removed from the field of vision Further if — as in this case — the scene is made up of a number of distinct objects then there is a high probability that the presence of one object will obscure part of another Thus before we can recognise the objects of the scene we must analyse the image for information about the different regions (areas totally enclosed by boundary lines) present in the scene and which regions belong to which object

One method for carrying out such an analysis has been developed by Guzman The principles of the method are readily understood and rely on the observation that a great deal of information about the regions of an image and their most likely patterns of connection can be obtained by observing only the vertices of a line image — the points at which there is a junction between the straight line segments

For example a junction which takes the form of Figure 7(a) — the FORK junction — gives strong evidence that it is a point at which three connected surfaces meet This is illustrated in the figure by drawing in the links between those surfaces An example of this kind of junction is easy to find if you look again at Figure 6

Alternatively consider the ARROW junction shown in Figure 7(b) Reference back to Figure 6 once more will show that this type of junction generally provides evidence of *two* surfaces which are connected Again this connection pattern is indicated by drawing in appropriate links A few moments of study will reveal that Figures 7(a) to 7(e) illustrate the five different vertex types which can be found in the image of Figure 6 As an exercise identify all the vertices for yourself and check that they allow a valid analysis of the objects in the scene

In fact it turns out that only about eight different vertex types are required to allow the analysis of almost all scenes represented as straight line drawings One further type of interest which is not found in the example given is the MATCHED TEE shown in Figure 7(f) This shows that a pair of TEE junctions whose axes are on the same straight line will tend to link together regions on the opposite sides of their two shafts Can you think of an example where such a junction might occur?

Although not universally applicable methods based on this simple principle have been remarkably successful in analysing images based upon line drawings of real world scenes The result of applying this type of analysis is to produce a list of distinct objects in a scene and to catalogue just which regions of the scene make up each Objects of characteristic shape may thus be identified and the whole scene interpreted by looking for the spatial relationships among them

Perception is a human faculty which we as humans have a tendency to take for granted Perhaps only when we seek to imitate that faculty by means of a machine do we really appreciate the complexity and subtlety of the mechanisms of vision This article has attempted to identify the main problems to be tackled if machine vision is to be realised Finally it should be stated quite firmly that despite the considerable progress made in recent years current machine vision is still at a relatively crude stage with many difficulties still to be overcome ■

Dr Fairhurst is at the Electronics Laboratories, The University of Kent at Canterbury

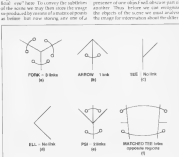


Figure 7

IMPLEMENTING THE FUNCTIONS

Continuing the series for the absolute beginner

So far we have encountered three methods for describing a switching or logic function, using electric switches, algebraic functions and truth tables Now we shall introduce another method which is most commonly used by designers of electronic logic circuits

In this method a special graphical symbol, known as a gate, is used to describe the logical functions we have encountered so far and others which we shall meet later on In the electronic and computer literature there are many different sets of graphic symbols to describe these functions We shall use the symbols used by most electronic component and computer manufacturers Here the AND OR, NOT (negation) and Exclusive OR gates are as in Fig 9 (a), (b) (c), and (d) respectively

Using these symbols we can illustrate (6)* as in Fig 10,

and the EX OR function in equation (8)* and Fig 9 (d) as in Fig 11

In this system the NOT gate is sometimes omitted and replaced by a 'blob' as in Fig 12 (a) and (b)

Two very extensively used gates are the NAND and NOR gates The NAND gate (derived from the abbreviation NOT AND) and NOR (NOT OR) gate are as in Fig 13 (a) and (b)

These gates are sometimes drawn as in Fig 14 (a) and (b) respectively

The equivalence of the gates in Figs 13 (a) and 14 (a) and those in Fig 13 (b) and 14 (b) is a direct consequence of De Morgan's equations (See Issue 4) The symbol in Fig 13 (a) is used if S depends on both A and B, i e S is false if both A and B are true, while the symbol in Fig 14 (a) is used if S depends on either A or B i e S is true if A is false or B is false A similar distinction is made in the choice between the symbols in Figs 13 (b) and 14 (b)

Now these gates are implemented by electronic circuits The distinction between the two states (true and false) of the input(s) and output of a particular gate (or other logic devices we shall meet in the following article) is made by assigning a particular voltage level to each of the true and false states Let us call these voltage levels High and Low Thus if A B or S is true then the voltage on the pin to which it is connected will be High and if it is false — Low In TTL these voltage levels +5V and OV On the other hand if A, B or S is true then the voltage level will be Low and if it is false — High ■

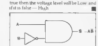


Fig 10

*See Issue 4

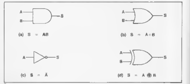


Fig 9

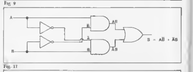


Fig. 17

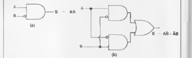


Fig 12

Fig 13

Fig 14

THE GREAT STRUCTURE DEBATE

Pascal v. BASIC (yet again)

Professor A. H. J. Sale [illegible] Information Science [illegible] Tasmania

Shadow boxing

In the January 1980 issue of *Computer Age* an article by Darrel Ince attempted a comparison between Pascal and BASIC. In the author's own words the article illustrated "why Pascal has become a serious contender for the programming crown previously held by BASIC".

I hope to show that the comparison of Pascal and BASIC yields a hopeless mismatch, and that indeed to compare the two languages is somewhat like shadow boxing: the opponent isn't really there. In this case, few computer scientists would dispute that BASIC is simply not intended for writing complex programs, and there is no doubt that Pascal is far superior.

Control structures

The Darrel Ince article rested its comparison entirely on what I call "structured code" — the ways of structuring executable statements in two languages. This is not surprising, for it is the only aspect of the two languages in which they are even roughly on the same footing. Such a comparison is interesting, and yields a number of facts. Firstly, Pascal was designed to have a small set of well designed constructs which conform to the idea of structured programming, whereas BASIC has only much more primitive constructs. Secondly, because Pascal's constructs are easier to put together (its building blocks fit together in more manageable, modular ways) programs can be written with much greater assurance of being correct. Indeed the evidence seems to show that Pascal programmers can be 5-10 times more productive than programmers in other languages once they know and use it as the fine tool it is.

However, this comparison is persuasive only because BASIC does not have good control structures. "Add them," say the BASIC adherents, "and the two languages are level-pegging once again. And look," they say, "there are some structured BASIC systems around to see and use."

This argument has two flaws. One of them relates to standardization. Pascal has almost reached the stage of being an International Standard, whereas the structured BASIC concept is just on a possible horizon. In addition, of course, BASIC compilers vary very widely between systems in the language they implement, hardly a firm foundation for doing anything but the most trivial of tasks. The second fatal flaw in the argument is much more important. It assumes that this is the major point of difference between the languages — it is not. In fact it is the least important difference! To illustrate the problem, I should like to introduce the pedal-car analogy.

The pedal-car analogy

Consider the humble pedal-car, well known to children. It represents to a child an important step up in transport, and much longing can be invested in waiting for one. When it arrives, the task of learning to steer it, how to operate the motive drivers, how to survive crashes, and a myriad other activities fascinate the child. Yet the pedal-car can be learned almost immediately. It has a simple interface, and if you crash it you seldom do much damage. Indeed, children derive much fun from driving pedal cars into other pedal-cars, a delight which persists to the dodgems of funfairs. Of course, if a pedal-car gets into trouble, you can simply stop, pick it up and turn it around and get in again and off you go.

Compared with a real car, a pedal-car is theoretically no more limited. Theoretically you can drive a pedal-car over the Alps or from John o'Groats to Lands End. It may even be possible to drive it in places where a real car cannot go, such as down the [illegible] or on the streets of [illegible]. But [illegible] would deny that a real car is a much more powerful vehicle than a pedal-car. When we grow up and want to do more adventurous things, we invest time in learning how to drive properly and we invest money in a real car.

BASIC is very similar to that pedal-car. It is easy to learn, easy to play with, and not difficult to get yourself out of trouble spots you have created for yourself. But it remains a pedal car, and using it to tackle bigger tasks that it was not designed for remains something which should only be done under duress. BASIC is *meant* to be basic: that was precisely its aim.

Adding structured control to BASIC can be likened to adding headlights and trafficators to the pedal-car. You can now see where you are going, and others can see where you want to go. But it remains a pedal-car. To graduate, you might start adding an engine. Then you need better steering than pedal car standard, and brakes for certain. Not too far down the development line you find yourself needing instruments, gears, and better road-holding abilities, which leads to pneumatic tyres and suspensions. If we pursue this too far, the result will no longer be a pedal-car even vaguely.

Structured data

Pascal has a rich set of data structuring methods and a rich set of fundamental data types. In comparing it with BASIC it is difficult to even get started because BASIC lacks almost all the techniques that Pascal programmers find useful. Its data must be structured in rigid and definite ways, and only a very few possibilities exist. To be fair, those possibilities are very well chosen and a lot can be done with numbers, tables, and strings of characters.

Pascal has not only all the fundamental types that BASIC has and more, but it has the facility to be able to define new types of objects. An example is the facility to be able to handle a type which has values which are the names of pets, thus

```
type
    pet = (dog, cat, tortoise, budgie, fish
    canary, other)
```

In addition it has five structuring rules by means of which components can be built up into composites: the array rule (a mapping from one value to another), the product rule and the union rule (for forming agglomerates and incorporated into the record structure), the sequence rule (called a file), and the set rule (familiar to kindergarten schoolchildren). These can be mixed so that you can have an array of records, each of which contains a further array and a sequence, and the components of the second level arrays contain records which are either a simple type or a set.

The basic idea is again to provide building blocks for constructing complex structures. Well-chosen blocks facilitate accurate construction.

Theoretic foundations

It may not be of great appeal to some but the fact is that Pascal was designed around sound theoretical concepts. There exist formal definitions of the constructs of Pascal which set out what axioms (or rules if you prefer) Pascal compilers must comply with, and defining the meaning of the constructs. By contrast BASIC is composed of the things that were thought to be useful some 20 years ago. It has no firm theoretical foundation.

The consequence of this difference is that it is possible to write far larger and more complex Pascal programs than can be envisaged in BASIC. If the rules are defined, then we can reason our way around them, and satisfy ourselves that the program is indeed correct. To illustrate the point, recently I wrote a program of slightly over 1000 lines of Pascal in 4 man-days (250 lines/day average). At the end of this period it was released, and no-one has yet found a bug in it by the process of testing. There are three bugs in it as released, but each of these was found solely by the subsequent process of writing down the assertions about what the program was doing and why. Comparing the assertions and the program revealed logical errors.

This is the sort of correctness we expect from washing machine controllers, oven timers, telephone exchanges, and the like. It is the sort of thing Pascal does better than any other language available today and at which BASIC is a non-starter.

The patriarch of old

Pascal is a *patriarchal* programming language as opposed to anarchic systems such as BASIC. This means it was carefully designed to make it harder to get the program to execute because it has to conform to rules. The Pascal compiler thus enforces the rules when it compiles the program and makes it much harder to write wrong programs. (It remains possible, of course.) The name has been bestowed on this by analogy with the patriarch of a tribe who laid down the rules of behaviour and woe betide those that transgressed!

The consequences are easy to see: some people object to being told that there are rules, and rebel. Others find the rules are easy to live under and allow for a life of greater certainty. Certainly there are fewer surprises when Pascal programs execute because more errors are picked up before this very late phase. This aspect of Pascal's design is one of the least noticed by experts but one of its most useful features. It enables the clever programmer to actually behave like a craftsman wielding his or her tools (compilers, analysers, etc) according to personal skills.

Validation

There does exist a set of procedures whereby the correctness of a Pascal compiler can be tested. Would you buy a real car without an MoT certificate? Why should you buy a Pascal system without a similar guarantee that the system has at least been looked over by an expert? (Of course an MoT certificate does not guarantee that the car you buy is perfect! Neither does a validation test.)

I have never heard of MoT tests for pedal cars, perhaps they exist. Certainly the validation of BASIC compilers is not available; their very diversity will demonstrate that beyond a shadow of doubt.

The consequences of this are important. A Pascal compiler must demonstrate *quality* in order to sell; a BASIC system often sells not because of quality but because of features. Have a look through the advertisements to see the sort of promotion of 'features' that goes on. Such a perversion does no one any good.

Real microprocessor programming

Some people actually try to work with the microprocessor underneath, whereas so far I have confined myself to the general programming problem. Here again Pascal scores, because its structuring rules allow it to describe what registers (for example) are really like. It is possible to define a microprocessor program status word (PSW) for example as being a packed record consisting of a three-bit priority field and a five-bit condition-code field. The condition codes are a set of named bits. Well, the Pascal for this is

```
type
    CCodeNames = (N, Z, V, C, T);
    Register =
        packed record
            Priority: 0..7;
            CCode: set of CCodeNames
        end;
```

By associating a variable of this kind with an address (perhaps as some BASICs do with their PEEKs and POKEs) one can drive devices with greater conceptual control. Further, the set construction method removes almost all the temptation to lapse into assembly code to pick at bits. Thus if OurRegister is the name of an actual register of the type given above, the following code will test whether the N-bit is set:

```
if N in OurRegister.CCode then
```

Perhaps you instead want to ask if both of the N and Z bits are clear, then the set operations allow you to strip off all the rest by the set-intersection operator "*" and then to test if the result is the empty set "[ ]", thus

```
if ([N,Z] * OurRegister.CCode) = [ ] then
```

Enough has been written to show that Pascal's facilities far outstrip anything in BASIC. Many Pascal users do not need ever to learn assembly code, a mind-numbing task at the best of times. (Some people enjoy it, there is no denying the fact. Some people also enjoy stripping cars down and putting them together and learning the difference between a half-shaft and a stub-axle.)

Real-time programs

When it comes to writing complex real-time programs, Pascal and BASIC are on a par. Neither has the slightest facility for real-time activity. However, writing real-time programs is one of the most complex tasks a computer scientist can undertake and it makes sense to graft good real-time facilities onto the best ordinary programming language you have. That must be Pascal, and it accounts for much of the interest in Pascal in recent years amongst the Silicon Valley fraternity.

It is simply not true to assume that programs for microprocessors are small and simple. Where it is true it is usually an artefact of the limitations of BASIC or of some small system used for playing. In fact, assuring that real-time programs interact correctly is a most demanding task, and even small problems can generate quite substantial size. In one example I wrote last year, a program to provide a simple heat and timing control on a stove assembly generated about 2000 assembler instructions. In Pascal it took two man-days to write (correctly and maintainably) and about 500 lines including comments. The problem is small, but to write 2000 instructions correctly, even at the BASIC level, is not a trivial task.

What debate?

I hope I have shown that there really is no Great Structure Debate. BASIC remains what it always was in the big computer world, a good little language for playing with, for taking the first fumbling steps, and for writing programs of 3 screenfuls or so. Pascal is intended for those who want their systems to work reliably and efficiently, and is a carefully designed programming language incorporating most of our insights of the past decades. They are not really even in competition for anything other than a few fringe applications.

To those that worry about the cost of Pascal compilers, or their size, it is only necessary to say "wait and see". The $2000 Pascal system of today will rapidly become the $1000 Pascal system a year hence, and the $500 system the year after. No great predictive ability is needed for this: the designs are already on the drawing-boards. ■

Comparison

READY-REFERENCE FOR UCSD PASCAL ON APPLE II

(This handy reference complements Dr Martin Beer's article in issue 2.)

SPECIAL KEYBOARD COMBINATIONS

To get	Press
move-up	CTRL O *
move-down	CTRL L *
	CTRL K *
	SHIFT M *
swap-split-scrn	CTRL A *
auto-follow	CTRL Z
stop-display	CTRL S
flush-output	CTRL F
EOF	CTRL C
ETX (accept)	CTRL C *
DEL	CTRL X
TAB	CTRL I
LF	CTRL J
DC1	CTRL Q

* especially important

OPERATING SYSTEM COMMANDS

C — call the Pascal compiler
E — call the Editor
F — call the File Manager
R — run the workfile
X — execute a code file.

(For A, H, I, L & U see Manual)

EDITOR COMMANDS

A — adjust indentation *
C — copy either from internal buffer or from file
D — delete *
F — find
I — insert *
J — jump to beginning/end/marker
M — adjust to margins
P — look at next page
Q — quit editor *
R — replace
S — set environment/markers
V — verify that screen is text
X — exchange characters.
Z — zap = strange delete

* — useful when starting at a minimal set

OTHER EDITOR FEATURES

repeat factor permitted before commands
"<" changes direction to backward
">" changes direction to forward
"/" means repeat until eof
"=" means move to last change
ETX (CTRL C) usually accepts
ESC usually rejects change

FILE MANAGER COMMANDS

B — look for bad blocks
C — change name (=)
D — set date
E — extended directory list * (=)
G — get into workfile *
K — crunch spaces
L — list directory * (=)
M — make directory entry
N — clear workfile to new *
P — set volume prefix
Q — quit file manager *
R — remove files * (=)
S — save workfile with name * (=)
T — transfer files * (=)
W — what is state of workfile
V — what is volumes online
X — attempt to repair bad blocks
Z — Zero the directory on a formatted disk.

* means useful when starting at a minimal set
(=) means either "=" or "?" allowed as wild matches. "?" stops for confirmation

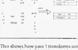
Compiled by
A H J Sale
University of Tasmania

WRITE IT YOURSELF

Part 3

This is the last article on the construction of assemblers. The previous two appeared in issues 3 & 4. Readers may write to the author direct or care of Computer Age

My previous article (CA March) described how pass 1 of a two pass assembler builds up the symbol table thus can be shown by the diagram below



This shows how pass 1 transforms some segments of an Intel 8080 assembler program into symbol table entries. There is no need to worry about what the program segments actually do, the main point to understand is that pass 1 takes symbols from the program that is to be assembled and builds up the symbol table. Pass 2 then uses this table and also the operation and pseudo operation tables to produce a machine language program. The last two tables which never change during the execution of pass 1 and pass 2 are set up by the procedure called *initialise* which is executed in pass 1.

The algorithm for pass 2, which again I have expressed in Pascal is shown below. Its structure resembles that of pass 1. It does however differ considerably in detail.

```
[illegible]
```

```
[illegible]
```

Pass 2, like pass 1 uses a number of subsidiary procedures. Some of these procedures are also used in pass 1 and have been described in the previous article of this series.

A class of procedures that are used in pass 2 and which I have only partially described are those concerned with the searching of the various tables looking for symbols or operation names. Examples of these procedures which are used in pass 2 are:

- look for operation
- search pseudo op table
- look for symbol

They are essentially similar and involve scanning down a table looking for a match

Since I have described the search pseudo op table previously and also because of their similarity I shall only describe one more namely the procedure called *look for operation*.

This procedure has four parameters: the first parameter is the operation name that is to be searched for, the second parameter is a boolean variable which is set true if the operation is found in the operation table, the third parameter is an integer variable which is set to contain the value of the operation and the fourth parameter is of the operation in the operation table.

```
[illegible]
```

The procedure called *translate operation* takes the value of an operation name and places it in the file used for storing the machine language instructions. Similarly, the procedure called *translate symbol* takes the value of a symbol and places it in the same file. Thus if pass 2 is currently assembling the Intel 8080 instruction

JNZ TOP

where JNZ has a value C2 (hexadecimal) and where the symbolic name TOP is located at address 40 (hexadecimal) then the effect of these procedures is

The procedure called *read a line* pass 2 reads a line of assembler program and places the operation name from the instruction in the variable called operation name. If a symbolic name exists on the line then the procedure called *extract symbol* will place it in the variable called sym setting the boolean variable that is called exists to be true.

The procedure that is called *output line* prints the assembler instruction that has just been read on an output peripheral together with its translated machine language equivalent and the address at which the instruction is located. The format of this on the output peripheral is usually left up to the constructor of the assembler e.g. he may choose to display the assembler instruction and its equivalent machine language instruction on the same line, separated by forty spaces separating them from the address at which the instruction is located by five spaces

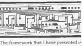
OA 5 spaces JNZ TOP 40 spaces C24000

Finally the procedure called *terminate* which is executed at the end of pass 2 closes all the files that are in use then usually prints the symbol table out Some assemblers use a procedure like terminate to print out a cross reference table This is a table which lists all the symbolic names used in the program together with the addresses of the instructions that reference them This can be very useful in debugging

I have delayed describing fully the processing or errors until this article the reason for this being the fact that pass 2 embodies a degree of error handling: this is handled by calls to the procedure *notify error* Since I have not been too concerned over detail I have only dealt with a small subset of errors that can occur e g I have not included the handling of symbol table overflow This is where the assembler program contains more than the number of symbolic names that the symbol table can hold The detection of these errors is more a matter of detail, how these errors are communicated to the user is quite an important matter of principle

In describing both passes I have taken the philosophy that the error messages should occur at the end of the program The large majority of assemblers indicate programming errors by printing a message either directly underneath or by the side of the instructions in error *Notify error* places the error message on a file along with the line number at which the error occurs When passes one and two have finished the file is sorted by line number and then printed out this is achieved by the procedure *terminate*

Assemblers



The framework that I have presented is fairly general in that I have concentrated on broad principles without becoming over detailed The algorithms that I have presented need modification to handle practical assembler languages this even includes the assembler for the Intel 8080, the microprocessor that I have used to illustrate the principles of assembler construction I shall therefore conclude my articles by pointing out some of the ways that real assemblers may differ

- 1 Some assemblers usually those associated with mainframe computers may have more than one data or address fields which may contain more than one symbolic name e g the IBM 370 has an instruction called MVC which can take two symbolic names in its data or address field
- 2 Some assemblers again usually those associated with mainframe computers have a whole variety of instruction formats which occupy different word lengths The PDP 11 has thirteen different formats
- 3 Some assemblers have operation codes which depend on the contents of the data or address fields This occurs in the Intel 8080 assembler where for example the operation code for INX in

  INX H

  is different from the operation code for INX in

  INX C

I have now presented the main principles of assembler construction and perhaps have given you an insight into non-numeric programming I shall finish with one small word of warning don't put spaces in your identifiers if you are going to construct an assembler using Pascal I have done it for legibility but it isn t strict Pascal ■

• Concluded

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THE DEFACTO STANDARD

A Disk Operating System for Micros

CP/M (tm) has been rapidly taken up by users of micros and is now so widespread that Computer Age presents a definitive article to help all present or potential users.

This review is extracted from Microcomputers in Distributed Data Processing by Martin Healey and David Hebditch to be published early in 1980 by Winthrop.

Editor's note: *Professor Healey's next article to appear in Issue 6 will discuss the desirable features of software packages.*

In general minicomputers have followed the conventional trend in computing whereby the major software systems are developed by the hardware vendors exclusively for their own products. Alternative software products such as compilers and [illegible] monitors are offered by software houses for the leading machines but usually utilising a standard operating system. Examples of total foreign system software packages such as the Bell Labs UNIX operating system for PDP 11s and the BLIS COBOL system for Data General machines come to mind but these are rare exceptions.

With microcomputers while there are a variety of microprocessors available the earlier dominant systems all featured the INTEL 8080 and later the ZILOG Z80 which will execute 8080 code. The PET and APPLE feature the 6502 but these are later products. Thus there exists a large number of suppliers of hardware systems incorporating a similar processor e.g. ALTAIR IMSAI NORTH STAR CROMEMCO RAIR TANDY. To this list can be added a number of names outside the personal computer sphere e.g. INTEL EX

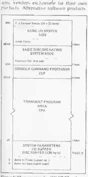

Figure 1 Memory map for 48K CP/M system

Function	Number	Information	Result
0	System Reset		
1	Read Console		ASCII character
2	Write Console	ASCII character	
3	Read Reader		ASCII character
4	Write Punch	ASCII character	
5	Write List	ASCII character	
6	(not used)		
7	Interrogate I/O Status		I/O Status Byte
8	Alter I/O Status	I/O Status Byte	
9	Print Console Buffer	Buffer Address	
10	Read Console Buffer	Buffer Address	
11	Check Console Status		True if character Ready
12	Lift Disk Head		
13	Reset Disk System		
14	Select Disk	Disk number	
15	Open File	FCB Address	Completion Code
16	Close File	"	"
17	Search First	"	"
18	Search Next	"	"
19	Delete File	"	"
20	Read Record	"	"
21	Write Record	"	"
22	Create File	"	"
23	Rename File	"	"
24	Interrogate Login		Login Vector
25	Interrogate Disk		Selected Disk Number
26	Set DMA Address	DMA Address	
27	Interrogate Allocation		Address of Allocation Vector

Figure 2 BDOS functions in CP/M version 1.4

CONST	– return console status in reg A
CONIN	– return console character in reg.A
CONOUT	– output character in reg C to console port
LIST	– output character in reg.C to printer port
PUNCH	– output character in reg C to punch port
READER	– return reader character in reg.A
HOME	– move to track 00
SELDSK	– select disk given in reg C
SETTRK	– set track given in reg C (0-76 for IBM compatible)
SETSEC	– set sector given in reg C (1-26 for IBM compatible)
SETDMA	– set memory address for buffer initialised to 128
READ	– read defined sector to memory buffer
WRITE	– write to defined sector from memory buffer

Figure 3 BIOS Primitive Routines

TEL ADDS who are also using similar microprocessors in specific products

With all these systems now supporting floppy disks, the requirement for disk operating systems is paramount and with the commonality of CPU one software house DIGITAL RESEARCH INC won the race hands down with its CP/M (Control Program Monitor) operating system. Probably the cleverest feature of Digital Research's system was the implementation *flexibility* It was important if one software system was to be adopted by many hardware vendors to realise that while the CPU's were similar the I/O and disk controllers weren't Thus as explained later the I/O routines are supplied as a separate module in *source* code form! Thus the basic CP/M system can be tailored to any hardware system

Versions of CP/M are now available for both 8080/Z80 and 6502 systems

The Structure of CP/M

CP/M (Version 1) is a single-user single tasking disk operating system Essentially it provides a user interface to a diskette file system and simple I O routines It does not provide any form of real time executive e g no scheduler or task manager and is thus very different from the minicomputer operating systems such as DEC's RT 11 Data General's RDOS etc Intel's ISIS comes from the same stable therefore is somewhat similar in concept although *not* compatible

CP/M itself consists of four sections plus the user's program as shown in figure 1 The I/O and diskette controller handlers (primitives) are called BASIC I O SYSTEM (BIOS) and are supplied in source code form to any user if required although, say PERTEC provide a specific tailored version for their ALTAIR machines The file handler is included in the BASIC DISK OPERATING SYSTEM (BDOS) This supports up to four IBM compatible floppies in the normal form although expanded versions for double density diskettes etc are available

The console commands are processed by the Console Command Processor (CCP) which utilises the BIOS routines and principally creates calls to BDOS to load programs etc User programs are loaded into the Transient Program Area (TPA) Using standard CP/M utilities all programs are loaded and saved only from files and not from any user specified locations within TPA CCP is itself a transient program and can be overlaid as could BDOS if the user program specifically accessed I/O directly via BIOS

Most microcomputer systems use a power on reset circuit to cause a jump to a specific memory location This contains the start of a ROM based routine which loads the first sector of the CP/M disk into memory This contains a routine to load the rest of CCP BDOS and BIOS from the first few sectors of the sytem disk A routine in BIOS then sets up certain system parameters in page zero, these include a jump instruction for the warm start procedure (typing control C which is trapped by the BIOS) and the jump to BDOS for entering the call processor Also included are the remaining 8080 interrupt vectors, some used by CP M utilities but not CP/M Buffers are also provided for default disk transfers plus a default file control block Since CCP and BDOS (if the user program doesn't use files) can be overlaid the warm start routine reloads CCP and BDOS from disk before returning control to CCP

Facilities of CP/M

The functions provided by CP M are split into two groups input output and the file operations Figure 2 lists the functions provided in version 1 4

All functions are accessed by first writing the function number into register C and any input address in register pair D E Single-byte results are returned in register A and for two byte results (addresses) the high order byte in register B A jump to sub routine is then executed via absolute location 5 which stores a jump to the location (fbase + 6) in BDOS where the function is analysed and executed

The BDOS system functions are supported by the I O primitive routines in BIOS A list of these functions is shown in Figure 3

In addition BIOS includes two routines to handle the cold and warm boot procedures

It must be noted that BDOS is hardware independent To tailor CP/M to any hardware environment *only* BIOS must be modified By convention the BIOS routines are accessed by a jump vector at the beginning of the BIOS Since these are at known memory locations the BIOS routines can be directly accessed by user programs rather than the preferred access via BDOS

File Handler

CP/M files are maintained by name in a directory on each diskette A file can be any size from no sectors to a full diskette organised as a logically contiguous sequence of 128 byte records Physical sectors are not necessarily contiguous and can be dynamically allocated to change the size of a file A 33 byte file control block is maintained for each 16 KB of each file the user writes file name etc parameters into a temporary FCB in page 0 and executes an OPEN function which causes the full FCB to be read into a location at the very top of BIOS There are 16 FCB slots to allow multiple files to be opened at once The FCB is updated in memory and written back to disk when the CLOSE function is executed The form of the FCB is shown in Figure 4

The NR field is initialised to zero and sequential access is maintained by incrementing For a file exceeding 128 records (16KB) the EX field is incremented and the data for that extent loaded into the FCB Random access in sectors is simply achieved by precomputing and overwriting NR A maximum of 16 extents (256 KB) is imposed in version 1 4

CP/M handles data files in 128-byte units with a corresponding buffer in page 0 which cannot be increased Many diskettes are formatted with bigger sectors Thus the double density North Star version with 512-byte sectors has BIOS tailored to transfer a sector to an intermediate

FIELD	FCB POSITIONS	PURPOSE
ET	0	Entry type (currently not used but assumed zero)
FN	1 – 8	File name padded with ASCII blanks
FT	9 – 11	File type padded with ASCII blanks
EX	12	File extent, normally set to zero
	13 – 14	Not used but assumed zero
RC	15	Record count in current extent Size (0 to 128 records)
DM	16 – 31	Disk allocation map filled in and used by CP/M
NR	32	Next record numeir to read or write

Figure 4 File control block format

buffer just below the FCB area at the top of BIOS. The appropriate 128-byte sector is then moved from this buffer to the target buffer in user memory on page 0. For a write the whole sector is read into the buffer, 128-bytes modified in memory and the whole written back. Only one transient buffer is thus required independent of the number of concurrently open files.

CP/M Utilities

The user accesses CP/M via the console terminal communicating with CCP. CCP itself contains 5 built-in functions.

ERA	– erase named file from diskette
DIR	– display directory of specified diskette
REN	– rename file
SAVE	– save 'n' 256-byte blocks of memory starting at location 256 (100 Hex) onto diskette
TYPE	– display the contents of an ASCII file on the console

Any other command issued to CCP is assumed to be the name of a disk file which is loaded from 256 upwards and executed. The user can thus define any transient command. CP/M is supplied as standard with 9 utilities initiated by the following commands.

STAT	– list statistical details of files on disk, alter and display device assignments
ASM	– load 8080 Assembler and assemble a specified file, produce object file in INTEL hex format
LOAD	– create disk file in executeable code from INTEL hex format file. The file created can then be loaded and run by a CCP transient command of the same name
DDT	– load and execute CP/M Dynamic Debugging Tool
PIP	– load the Peripheral Interchange Program for control of disk file and peripheral interchanges.
ED	– load and execute the Text Editor. Used to create new source programs and modify existing source files.
SYSGEN	– create new CP/M system diskette
SUBMIT	– submit a file of commands for sequential batch processing
DUMP	– dump the contents of a file in hex format.
MOVCPM	– regenerate CP/M system for a given memory size.

Further Software under CP/M

Because of the acceptance of CP/M on a wide variety of hardware, a standard O.S. interface is in existence on many thousands of systems. The attraction is very obvious therefore for any other system software house to produce utilities which utilise the CP/M functions. Leading amongst such utilities are the language processors developed by Microsoft Corp.

Digital Research produce their own optional utilities, namely:

MAC	– an 8080 macro assembler
SID	– a symbolic debugger
TEX	– a text formatter
DESPOOL	– a simple non-interrupt driven routine for simultaneous support of console and printer

Microsoft produce the following language processors and software development aids.

EDIT 80	– a text editor
MACRO-80	– a 8080 and Z80 Macro Assembler which generates relocatable code modules. Linker, Loader, Library manager and Cross reference list utilities are included.
BASIC	– a simple 4K, an extended memory resident and a full disk-extended BASIC Interpreter (MBASIC) are all available. MBASIC approaches DEC's BASIC PLUS in standard
BASIC compiler	– language compatible with version 5 MBASIC
FORTRAN-80	– ANSI '66 compiler except for COMPLEX
COBOL-80	– ANSI '74 precompiler/interpreter with ISAM, COPY and EXTEND. Interactive with ACCEPT/DISPLAY
PASCAL-80	– compiler

All compilers generate relocateable code compatible with the MACRO-80 code and linker etc. PASCAL is not the common UCSD interpreter and, since it can be used to generate code modules, it could well become a standard system software development language competing with INTEL's PL/M, ZILOG's PL/Z etc.

An alternative COBOL compiler known as CIS-COBOL produced by Microfocus includes a screen formatting utility.

A most surprising omission is that of the ready availability of data communications products. Some good ones are available however, including a special purpose CP/M machine-to-machine file transfer package and a generator system which will produce IBM protocols based on Bi-synch up to a full HASP emulation.*

Enhancements to CP/M

With the increasing availability of higher performance microprocessors and cheap disks, particularly 8" Winchester drives, there is a need to enhance CP/M. CP/M version 2.0, released in the last quarter of 1979, is the first step forward. The major enhancements are support for large capacity disks and improved file attributes. This has been achieved by moving *all* disk dependent parameters into a "disk parameter block" (DPB) in BIOS. Thus features such as number of tracks, number of sectors/track, maximum number of sectors, etc. can be defined. A DPB is used for each different disk drive type supported. An optional sector "stagger" translation vector is also included.

With version 1.4 the maximum file size is 16 x 16KB extents (256KB); with version 2.0 physical sectors can be grouped (clustered) by parameter selection into multiples of 1 to 8, which, coupled with an increase to 64 extents, gives a maximum file size of 64 x 16 x 8 = 8MB. Using a grouping factor of 1 creates a version 1.4 compatible file. At the same time, a new random access facility has been introduced into BDOS allowing physical disk blocks to be allocated dynamically when written.

The directory system has been enhanced so that read, write and user-number attributes can be appended by file; most diskette systems are protected only by a physical tag on the diskette itself, so that this is a major advancement.

In addition to version 2.0 of CP/M a new system, MP/M, has been released. MP/M is compatible with CP/M but supports a multi-programming nucleus with support for "bank-switched" memory (e.g. 2 or more memory boards with the same 64KB address space, one of which is selected as active by an I/O instruction). A real-time clock is required and interrupt driven I/O is preferred. Since the hardware dependency is now becoming severe, MP/M cannot have the universal appeal of CP/M. Since sharing of a cheap 8 bit micro is also somewhat restricting, this system is obviously a precursor for a system based on 16-bit micros.

Summary of CP/M

CP/M presents an excellent single user operating system for program development and single program execution. With FORTRAN, BASIC and COBOL a CP/M system forms an excellent scientific or small business computer. With the excellent Editors, Debuggers, Assemblers and probably PASCAL, such a system also forms a cost effective Microprocessor Development System (MDS) *but* as yet there are no equivalents to the In-circuit emulators (ICE) available on the microprocessor manufacturers' own MDS products. INTEL, on their own MDS, also provide a real-time executive, RMX-80. There are few equivalents commonly supported under CP/M; STOIC is available in the CP/M users' library (whole hosts of programs are available for the cost of diskettes) and Systems and Software Inc. offer RMX-80 for $1 500.

In using CP/M we have found few bugs. We wrote one program which used the CCP area for a stack which was corrupted by BDOS calls. Using PIP to transfer data at faster than 1200 baud can lose bytes without warning. Because the File Control block is updated in memory, turning the power off without closing files will leave the directory corrupted if any sectors have been added or deleted from files.

Finally the worst feature of CP/M is the documentation. It is acceptable at the user level, e.g. Assembler, DDT etc, but for instance the rules quoted for creating a new BIOS are frankly worse than useless

* Any professionally interested reader can contact the author on (0727) 44211

ACTIVITIES AND INTERRUPTS

In this series, Paul Martin is introducing readers to the modern theories of concurrent operating systems, and then illustrating the practical use of these theories with examples in assembler and Pascal. Finally, he will be describing some of the new concurrent languages such as Concurrent Pascal, Modula and ADA. The articles are based on practical experience in designing and implementing real time and multi user systems. The author's own company, Micro Task, will be offering a multi tasking executive to systems houses for use on the Z80 and Z8000 chips in about the middle of 1980.

Last month's article gave a simple introduction to some of the approaches taken to try and get more useful work out of your computer. This month we shall start our more detailed look at these techniques by examining the concepts of the Activity and Interrupt Routine, two ideas that should be understood before we progress to the more advanced control mechanisms used in programs. Yet although these concepts are very basic, an understanding of them will allow you to develop simple programs.

In order to understand how a computer can be doing many things at once, we must first grasp the difference between a *sequence* of instructions and its *execution*. To do this we must visualise the actual instructions and the data they act upon as being separate. Look at the following sequence of instructions:

```
LD   DE,(DATA1)   GET FIRST VALUE
LD   HL,(DATA2)   GET SECOND VALUE
ADD  HL,DE        ADD THEM TO GET
LD   (DATA2),HL   THIRD VALUE
```

The instructions contain the *addresses* of three locations DATA1/2/3 which *contain* the values used by this sequence. These locations would be defined in the source code and would be given addresses corresponding to actual memory locations by the assembler; these are termed ABSOLUTE addresses, e.g.

```
DATA1 refers to location C000
DATA2 refers to location C002
DATA2 refers to location C004
```

The fact that the addresses increase by two each time is because these data items each occupy one word (two bytes).

If you define all your data locations in the same place in your program, then they will be given consecutive addresses. These addresses can be considered as offsets from address zero. Let us next consider the above three data locations as having addresses that are offsets from the first data location.

```
DATA1 refers to an offset of 0000
DATA2 refers to an offset of 0002
DATA2 refers to an offset of 0004
```

It's all very well relating the data to the address of DATA1, but how does the program know where DATA1 is? Most micros provide a solution to this problem in the form of one or more INDEX registers; simply load the absolute address of DATA1 into the index register and refer to each data location as having an address formed by *adding* an offset value to the contents of the index register. The instruction sequence would now become:

```
  LD   DE,(INDEX+0)
  LD   HL,(INDEX+2)
- ADD  HL,DE
  LD   (INDEX+4),HL
```

The above sequence would not actually be allowed on the Z80, as only bytes can be accessed using offsets from an index register; each 16-bit load would have to be coded as two 8-bit loads. But why, you ask, should we want to use this method of addressing at all?

Well, we use it because it allows us to place our data anywhere in memory, regardless of where the instruction sequence is to reside. We can have the instruction sequence in read-only memory and have the data in an area of read/write memory (RAM).

The most important advantage gained from this *separation* of the *changeable* data from the instructions is that the instructions can be used to operate upon *more than one* copy of the data. We load the address of the first copy of the data into the index register and execute the instructions, then we load the address of the second copy into the index register and execute the instructions again. It is this sharing of code between more than one set of data that forms the basis of most real-time systems.

A sequence of instructions to perform a particular function we shall call a **procedure**. A procedure has no life of its own. When we bring it to life by setting a data address in the index register and then executing it, it becomes an ACTIVITY. So an Activity is a procedure operating upon

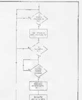

Fig. 1 *Single User version of example program*

some data (You may also find the term PROCESS being used to describe a program acting upon data)

When a subroutine is called the return address is automatically saved on the stack for use by the return instruction The stack is also used to save the contents of registers before entering sequences of code that might require temporary use of the registers in fact when writing subroutines it is safer to always save the contents of the registers on entry and to restore them on exit — except that is those registers that have the subroutine results passed back in them. To prevent the contents of the stack getting totally mixed up, it is usual to associate a different stack area with each copy of the data area

A simple program

Let us consider a simple program to accept input from a terminal and store it in a file on disc To avoid getting bogged down in details let us make a number of assumptions about the program

- **1 There are two input buffers for the device one is being written to disc as the other is being filled**
- **2 In order to write a buffer to disc the program has only to load the buffer address into one location and the disc address into another When the disc write is complete the disc handler will clear the disc address location Thus the program knows that if this location is not clear then there is a disc wrnd in progress**

Fig 2 *Multi-user version of example program*

Now look at the flowchart in Fig 1 to see what the program does It spends most of its time in a loop waiting for a character to be typed When a character is typed it is stored in the input buffer that is in use at that moment, then the program checks to see if it has filled the buffer If the buffer is not full then the program goes back and waits for another character to be typed If however the buffer is full then the program waits until the disc handler is available, starts off the disc-write sets its buffer pointer to point at its second buffer and then goes back to wait for the next input The initial setting up of the pointers and the opening of the disc file have been left out likewise the detection of the end of the input and the closing of the file

Fig 2 shows a version of this program that will serve more than one input device with each device having its input stored in a different disc file To do this we must make a number of changes to the program

- **1 There are two copies of the data area (Not forgetting that each input device requires two buffers)**
- **2 The disc handler is controlled in a different manner There is now a control-location for the handler which can contain one of three values '0' indicates that the handler is free '1' that the handler has been claimed by a user; while '2' shows that the handler is in the process of writing to disc**
- **3 The handler now requires three items of information to tell it what to do the buffer address the block in the file to write to plus the file number (this is because there are now two files to write to, one for each of the input devices)**
- **4 There is now a Control Routine. Each time it is entered the current stack and data area addresses are swapped for those of the other data area and stack Execution of the program then continues at the place indicated by Entry Pointer**
- **5 If the buffers are each of 256 characters in length then at normal typing speeds there should be no clashing of disc requests that stay unresolved long enough to cause the loss of an input character**
- **6 Again it is assumed that there is an initialise routine that sets up the data areas and the pointers correctly**

Let us now look at how this program works Entering at Entry Point A the input device is examined to see if a character has been typed Normally this test will fail and so an exit is taken back to the control routine which then swaps the data and stack pointers to point at the other copy of the data When a character has been typed it is input and stored in the buffer currently in use and the count of characters in the buffer updated Unless this count indicates that the buffer is full the exit is taken and the next entry is back at Entry Point A

A full buffer will cause the program to take the Y (yes) route from this buffer full test As you can see from the flowchart the first thing that is done is to set the entry-pointer used by the Control routine to point at Entry-Point B The result of this is that if the exit to control is taken because the Disc handler is not available then each time the code is activated with this copy of the data area it will immediately test to see if the handler is free and exit if it is not It will when the handler becomes free, start the disc write and change the buffer pointer to point at the other buffer Before exiting to the Control routine it will reset the entry pointer to point at Entry Point A again

The Entry Point mechanism is used in this example because it may be used in high level languages like FORTRAN If Entry-Point A is FORTRAN label 1000 and Entry-Point B is label 3000 with the entry pointer POINT being set to 1 to indicate A and 2 to indicate B the line

GOTO (1000 3000) POINT

at the start of the routine (procedure) will cause control 2921 to go to the right place

Bank Switching

An alternative to the use of an Index register to access multiple copies of data that is sometimes used in micros when a large program such as a BASIC interpreter is involved is to make use of Bank Switching hardware Bank Switching is the ability to change the physical location that the computer associates with an address used in a program With Bank Switching and its big brother Memory Management the addresses used in instructions are treated as logical addresses and when the instructions are executed the computer uses a look up table to convert them to physical addresses Privileged parts of the program will be allowed to change the entries in this table

An Interrupt Routine

The interrupt is a hardware facility that gives an external device the ability to capture the attention of the central processor (in our case the micro chip) This frees the main program from having to check the devices to see if any of them require to be serviced, it can instead concentrate on processing data

Interrupt routines consist of a number of parts that perform different functions

The *initialise* subroutine is the part that is called by the main program when it wants to use the device This routine sets up the buffer pointers and device addresses to those supplied by the calling routine

The *calling* routine will also supply either the address of a subroutine in the main program that is to be executed when the device has done whatever it was requested do (input a line/buffer transfer a block to/from disc) or the address of a flag to set when the request has been completed It will also switch on the interrupt facility on the device being used and set the interrupt vector to point at the part of the Interrupt routine that handles individual interrupts (The interrupt vector is the address to which execution is passed when the associated device succeeds in capturing the processor The address of the next instructions that would have been executed had the interrupt not occured is saved on the stack by the interrupt hardware)

This second part of the Interrupt routine is entered every time an interrupt happens In the case of a VDU terminal this subroutine would read the character that has just been typed on the keyboard display the character on the screen and store a copy of it in the buffer It would then execute a return – from – interrupt instruction to cause execution to return to the main program at the point at which it was interrupted (this is done by using the

Operating Systems

[illegible]

Fig 3 *Version of Example Program using Interrupt Routines*

Now let us look again at our example program this time looking at the version in Fig 3 In this version of the program the input devices each have an interrupt handler that is called to fill a buffer that is the size of a disc-block When they have filled their buffers they execute a subroutine that resets the buffer pointer to point at their other buffer areas sets a complete flag for the main routine to see and then calls the handler to input another buffer full You can have two copies of the interrupt handler or you can have just one copy but two entry points to each part — the code at the entry points setting up the address of the correct data area and stack for a particular device The disc handler works in a similar manner to the multi user version

This version of the program does not need a routine to swap the index and stack addresses instead it just has a simple program that loops round checking the availability of the disc handler When the disc handler is free it then looks to see if it can find a full input buffer to transfer to disc After starting the transfer it clears the buffer full flag and then goes back to the loop that waits for the disc handler to become free again

In this article we have the ways in which simple programs can be written to handle more than one device at the same time Next month we shall look at the more sophisticated mechanisms that are required if we are to be able to produce complex systems in which there are many independent users interacting and competing for the use of the computer ■


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DATA DICTIONARY & SYSTEM FILES

In previous articles (Issues 1 and 3) concepts of database and management information systems were introduced Brief mention was made of file structure data management and validation and report generation This article examines further aspects of a database system, data dictionary and systems files, run-time variables and levels of languages individual records editing

If a report is made to the management information system, how can it determine where to locate the information in the database and how to present it? Let us first address ourselves to the last part of the question

Referring back to the EMPLOYEE file already examined the fields held in it were EMPLOYEE CODE, NAME AND SALARY Somehow, somewhere in the system, apart form the actual information on each employee there ought to be some description of what the fields of the EMPLOYEE file are made up of Thus description is usually stored into a separate file call it the MASTER FILE This MASTER file should also store the description of all files in the system and, believe it or not, of itself

What information should the MASTER file store? In the simplest case, if all files in the system were sequential files then the MASTER file should store the names of the fields associated with any particular file That however is not enough to fully describe the data and more is needed The minimal information required, in addition to the name is that of the type and format of the stored data As most readers will be familiar with programming concepts it will be enough to mention that usual data types are integer (I) floating point (F) packed decimal (P) or double precision (D) for numbers, and otherwise textual or alphanumeric (A) data

The format is the size of the field that is, the number of digits or characters For example, I3 means an integer up to 999, while F6 2 means a floating point number with six characters one of which is the actual decimal point and two of which are on the left of the decimal point e g 123 45

The reader familiar with programming languages might wonder why the format is needed. Computers usually assume a particular storage structure for computational fields For instance an integer might occupy two bytes on one microcomputer, four bytes on a mainframe If the management information system is to be run on a particular computer the storage size associated with a particular data type should be known and the reader might wonder why it should then be stored for each field There are a number of reasons for this

First there are two aspects to the field size that under which it is stored and that under which it ought to appear in a report request Certainly the last aspect must be declared in the MASTER file even if the first aspect is implicit However a general purpose management information system ought to be given the facility of accessing data not stored into the usual storage structure handled by this system It ought to be able to access external data generated by a program outside the system In this instance, it will be highly desirable to specify the size of the externally stored field in addition to the size of this field needed for reporting purposes Having agreed that, for each field, the MASTER file should store the field name, type and size, we have now turned this MASTER file into what is called a data dictionary but only a rudimentary one How frustrating it could be to request a report and to type SALRU instead of SALARY! A useful addition to the data dictionary will be to have a synonym for a name For instance SAL instead of SALARY thence less typing mistakes Certain systems designers even advocate storing any possible synonym against the same field name for instance PAY as a synonym of SALARY This will ensure that the user does not have to remember whether the system expects him to type SALARY or PAY Some have even gone as far as getting the program to check for mis-spellings and correct them! One must draw the line somewhere

Other additions to the data dictionary are possible values or values range for a computational field, or states for a textual field e g from 0 130 (! !) for the age in years M (MALE) or F (FEMALE) for sex Moreover for good system design it will be useful to also know the probability distribution of these values As of course this distribution is hardly ever known, we might content ourselves with the average and most likely values The unit e g years in which the field is measured is a very useful feature to be included in a data dictionary Multinationals have in particular a problem of currency conversion and hence the unit of measurement of money the currency is needed I have come across a situation when a multinational was evaluating a deal the chairman in the States was thinking in dollars while the UK director was thinking in pounds sterling! It took them some time to realise the discrepancy

As yet another addition to the simple data dictionary it must be stated against each field whether it is a key for a record or part of a record moreover variations on the concept of a key may be included alternate key composite key

Up to now, all files were assumed to be sequential This is not the case in a data base where further structure is allowed The hierarchical structure ought to be familiar to the reader by now Against each field one must store the level onto which the field is held Further it will also be useful to store the level type for instance sorted unsorted or directly addressable level It gets quite complicated at this stage as for efficient system design one might want to know the probability distribution for each level under each parent level! I shall stop here at the data dictionary and mention that most existing systems only store subsets of a full data dictionary To summarise a structure has now emerged for the MASTER file as shown in figure 7

FILENAME
LEVEL NUMBER OR NAME
LEVEL TYPE
FIELD NAME
FIELD SYNONYM
FIELD TYPE
FIELD SIZE
FIELD VALUES OR RANGE
FIELD DISTRIBUTION
FIELD UNIT
KEY ?

Fig 7

This structure is valid only for a system in which fields have the kind of hierarchical structure described in earlier articles More general hierarchical or network structures are possible, in which case the description here given for the MASTER file may not suffice The MASTER file is of course only one instance of what one may call a ROUTINES file which stores system and user programs a STORAGE file which contains information on pointer addresses particularly to the start of each data file a STATISTICS file(s) which gather(s) information on system usage

It is essential that these files be stored in the same structure as other data files in the system In this manner the data management and report facilities of the management information system will be valid for the system file It will then be a simple matter to obtain a request for information from the MASTER file It will then be also easy to obtain information on programs in the system

For instance the user will be able to pull out a report on all programs in the system which contain a specified variable Much more can be said about system files as a guideline there is no reason why what is currently referred to as system specifications, usually a voluminous paper document should not be stored as part of the database This will allow the data processing manager to also become a *user of his own system* Computer professionals have often experienced the frustration of spending much time developing systems but never actually using them themselves

Well, they are the ones to blame! My message to them is. If you have a management information system use it

Run time variable and levels of languages

Referring back again to the employee file, it might be of interest to the employer to work out some level of income tax to be paid by each employee as is the case under the PAYE scheme Without going into any depth regarding tax structures I shall assume that a tax of 30% must be levied from each employee's salary The EMPLOYEE file only contains information on salaries The management information system should allow a facility for defining a run-time field call it TAX, in perhaps the following manner as shown in fig 8

Database

```
DEFINE
FILE EMPLOYEE
TAX = SALARY * 0 3
END
```

Fig 8

A report request might follow treating TAX as though it was a stored field, For example, see fig 9

```
TABLE
FILE EMPLOYEE
PRINT NAME AND SALARY AND TAX
END
```

Fig 9

Of course each time a record is retrieved the information on employee name and salary is presented to the reporting system which then computes the tax, and all three fields will appear in the final report The DEFINE command should also allow the user to specify the format and size of the computed field TAX In any system, difficult decisions are to be made on what should be actually stored in the data fields and what should be computed at run time One should try to balance the cost and volume of storage against the cost of run time computation

Further considerations arise in the context of database maintenance of the stored data in relation to preserving its integrity If tax was to be defined as a stored field and actually stored within the EMPLOYEE file this might have drawbacks SALARY and TAX are not independent, and the user must then check this dependence in any data management activity against these two fields Otherwise, if the tax amount was manually keyed in and mistyped or miscalculated the information in the database will not be consistent As a rule, unless in exceptional cases it will be undesirable to consider TAX as a stored field hence the usefulness of run-time variables The commands in fig 8 may be thought of as a program, separate from the program in fig 9

As a minor digression may I state that the program in fig 8 is rather a bad one What would happen if the rate of taxation was altered to 25%? Should one alter the program? It is easier to alter data than programs Hence, the factor 0 3 should not have been embedded in the program but passed on to it as a parameter Alternatively, this factor could have been stored into a separate file the program would have read this value 0 3 from this separate file and then carried on

The programs in Fig 8 and 9 may be thought of as part of the same language that of the *management information system* I would like however, the reader to think of them as belonging to different levels of this language, or maybe to different languages The reason will be clear shortly but before this happens, I shall need to introduce the concept of procedural versus non procedural languages

A programming language is said to be procedural if the user has to specify to the program the sequence in which the various program operations have to be performed otherwise it will be non procedural

Traditionally, languages such as BASIC FORTRAN or ALGOL will be considered procedural, while that of fig 9 will be non-procedural Indeed in a report request as seen in previous articles some sorting operation might need to be performed for the report to be brought about Sorting will however, be transparent to the user, who need not up to a point concern himself with the exact nature of these operations when making a request through a management information system The above definition of a procedural language is rather vague but it will do for our purposes here Suffice it to say that we would expect a non procedural language not to allow operations involving conditional or unconditional branching The traditional GOTO and IF THEN in BASIC or IF THEN ELSE in ALGOL

A non procedural language is easier to use, particularly by non computing professionals It, however restricts programming flexibility It is desirable that a general purpose management information system allows *two* languages one procedural one non-procedural to co-exist and to supplement each other One way of doing it is to allow the management information system to interface to a language such as BASIC or FORTRAN The other way is to extend the language introduced in fig 8 to allow it to also be a procedural language Both these two approaches should in fact be blended in a good management information system

As an example, assume that the tax on salary should only be levied if the slary exceeds 1000 Then instead of the commands in fig 8 one could use either of the commands in fig 10(a) or (b)

```
DEFINE
FILE EMPLOYEE
TAX    0
IF SALARY >1000 THEN TAX = SALARY * 0 3
END
```

Fig 10a

```
DEFINE
FILE EMPLOYEE
TAX    0
IF SALARY ≤1000 THEN
GOTO END
TAX = SALARY * 0 3
END
```

Fig 10b

The non-procedural report request in fig 9 might then follow The reader should by now be clear on the need for different *levels* of languages within the same management information system ▶

Individual records editing

Many readers will be familiar with the concept of an Editor. Those in particular who are keen machine code or assembler language programmers will have used some, perhaps rudimentary editors. I refer to some of these editors as being rudimentary in that those used in small micro computers usually only allow a limited number of functions. With the more powerful micro or larger computers much more flexibility can be achieved. My concern here is not with small machine language editors but with more general purpose text editors, such as those used in word processors, in database systems or stand alone.

For the uninitiated, baffled by the variety of word processors, the distinction between a word processor and an editor might not be all that clear. The distinction is not entirely clear to me, but I shall venture some thoughts which have helped me to slightly clarify it for myself. In a sense, a word processor is yet another aspect of a management information system. Indeed it is concerned with the storage, management and retrieval of data but in a biased manner as follows.

The thinking underlying a word processor relies on the concepts of characters, syllables, sentences, paragraphs, documents and, of course, delimiters such as commas, hyphens and full stops. The reporting facilities of a word processor, as opposed to the tabular reporting facilities of a traditional management information system, are concerned with indenting, right and left margins and text centering. Word processors input routines are concerned with easy creation of forms for data entry. Beyond this, the remaining features of a word processor fall roughly into two major classes: computer to computer communication, and text editing.

As far as the storage structures of data in word processors are concerned, these have been rather rudimentary to-date, falling into the classes of sequential or index sequential files. The reason is that word processors more or less came about from small micro computers, while management information systems were traditionally associated with larger mainframe computers. No doubt we will see more integration of word processors and management information systems in future, and indeed, many manufacturers are now offering both types of programs on their systems as supplements to each other. My concern next will not be with computer to computer communication, though this is a mounting field in database technology, but with text editing.

Text editors, if stand-alone systems or otherwise, usually allow creation and deletion of data. However, their main features follow the concept of updating or changing textual or numeric information. They allow such functions as locating a specified string of characters, either through its first occurrence in a file, or through all its occurrences, or perhaps through a limited number of such occurrences. Amendments to this string of characters are also part of the functions of an editor.

Database

Traditionally, text editors have been subdivided into line oriented and text oriented editors. If the storage of data is in a sequential file, the lines (or records) are numbered and the user can retrieve, replace or delete a line through its number. Contents oriented editors will retrieve a line through its content, by specifying a string of characters as mentioned above. Once a line is retrieved, content editing of this line is usually afforded by both systems. Moreover, both aspects tend to co-exist in the same program.

Recently, the emergence of yet other forms of text editing has been witnessed, with the usage of visual display units based on cathode ray tubes. These are those of page editing (a page being what is displayed on the screen), or cursor editing, whereby the cursor can be moved anywhere on the screen and text can be added, deleted or altered at the most recent cursor location.

Perhaps my expectations are high, but as far as stand-alone text editors on micro-computers are concerned, I was so disappointed by the limited number of functions offered by the various editors that I have decided to develop my own.

The situation has, however, much improved recently. Stand-alone editors are very useful for handling data files, particularly disc-based files. Some editors also allow handling of programs, a very interesting feature for the programmer.

'One must draw the line somewhere'

Now, what about editors in the context of a database? The reader might guess immediately that, beyond what has already been said, what remains to be said must relate to the structure of the stored data in the database. The text editor, as part of a management information system, should allow the user to navigate through the data. Hence it must be geared, in a hierarchical structure, toward the concepts of levels and fields, be able to follow pointers and make use of the data dictionary stored in the MASTER file.

In order to emphasise the difference between the text editor in a database, and the data management functions described in issue No. 3 of *Computer Age*, it is worth adding that the editor is geared towards retrieval of individual records in the hierarchy of a file, while other data management functions are oriented towards operations on whole files. This duality in a management information system is also present in the relational database approach, in which the equivalent concepts are termed relational calculus and relational algebra respectively. But more about that at a later date. ■

■ *The next art[illegible] series [illegible] appear [illegible]*

HARDWARE, SOFTWARE AND KNOWHERE

Yoshi Imamura

I was pleased to meet some readers of *Computer Age* at the Microsystems 80 show a few weeks ago While I was sitting in the splendour of the magazine s own stand I was greeted with jocular cries of 'What s all this then? and 'Where's the art? Some people asked 'What do you *do* at the Royal College of Art?' so I ll try and tell you

I'm encouraged to believe that not only is the way we teach computing at the RCA innovative and worthwhile, but it also directly maps onto something that is as yet little appreciated This is that the ways in which we use computing systems in the future must surely tend towards an *experience* of their output

We can accept this approach in terms of an airline pilot being presented with a stylised display of his aircraft s trim or election night t v graphics but both these systems are exotic and anyway use few of the possible sensory pathways to the brain

At the RCA there is, I think a growing awareness that it will be the business of the creative artist and designer to explore to the utmost ways in which human beings can interact with the increasingly sophisticated systems they make (And what a euphemism interact can be — it means of course, far more than merely to communicate change is expected, performance is required)

So groups of people — perhaps formally organised into working parties or more loosely tied by common interests — are endeavouring to translate the skills values, talents and energies of this unique, post-graduate, art university into strategies for this decade and beyond It could have been done earlier; it might have been done later Few have achieved the former and we are trying to help other people in other places, avoid the latter

I have organised, with help from colleagues two series of seminars It is a measure of the need in the art and design world for computer-knowledge that we ve often been heavily over subscribed To gain insights, practical experience and understanding, people have come from all parts of the College, and others have flown down from Scotland for the day, at their own expense

Yoshi Imamura

Sitting in the splendour of the magazine s own stand Vanessa Blackburn Kiddle talks to a prospective client Marian Reardon about to ensnare a subscriber

One course dealt with simple computer programming for artists and designers the other related more to the use and background of computing in art and design — a familiarisation exercise

I think we've been successful and I think that s because we ve concentrated on what I call Knowhere , as well as on hard- and soft-ware We manage to help people understand and use the concepts objects and processes designated by the words 'computer' and program *largely without using numbers* It seems to be the case that this approach might work elsewhere, too

We use colour form, patterns and words, and we are exploring sound, video, slides, displays in all sorts of media to illustrate things like sequences of instructions repetitions, conditional branches and so on It's obvious (now!) you can more clearly and effectively communicate the idea of for instance nested 'for-next loops , or 'Gosubs' but using graphics rather than by means of looking at the areas of circles or squares and roots of numbers

Computers, I suggest to anyone who ll listen, are not essentially about' numbers They are based on logic, and can symbolically represent almost any 'thing' ranging from colours to kindness, and of course *including* numbers

These are the titles of some seminars in the two series — I must emphasise that both have now finished though they will be repeated

Simple programming course

- **Computing in art & design – an introduction**
- **What is a program? What can be done?**
- **First steps in using a computer**
- **Introduction to the RCA computer studio**
- **Practical computing (1) – shapes and colours**
- **Practical computing (2) – words and numbers**

Computer familiarisation

- **Intro and background to computing**
- **Computers in art (1)**
- **Visual communication and computing**

- **Computers in art (2)**
- **Computers and applied art**
- **3-D design and computers**
- **Computing in design theory**
- **Information technology implications for design**
- **Information technology social issues**

Both courses include visiting speakers hands on experience of computers and our own television programmes in a small colour studio, and have for example a one-hour colour tape consisting of me talking and gesticulating on one side of a split screen with a close-up of the 380Z s video output on the other We shall end up with a complete series of such tapes for use by anyone in the RCA and perhaps outside

There are it seems three levels on which computers can be of use to artists and designers These are

- Roughly as a tool This includes the obvious examples of producing coloured diagrams, repetitive series, shapes and then too, the use of less predictable systems perhaps employing random numbers, where the minutiae of the product may not be defined but the overall pattern normally is Even here the 'emergent' properties of some apparently trivial set of rules can be quite counter intuitive
- As a creative partner' Here I place aspects of artificial intelligence, modelling and simulation, conversation and psychologically-helpful systems Examples a program that learns' to 'draw, one that converses about art, design and computers, a third that deals with value-judgements on designs
- The third level consists in almost any use of computers, and is characterised by the idea that, under certain conditions they, or their products processes or interactions with people can be seen as metaphors analogues paradigms I mean that an artist may be involved with computing in some way then go away and use some *understanding* (entailing notions of memory modelling reproducing in a new context) — an understanding gained from using the machine, but put into use in circumstances where the computer may no longer be necessary

Discourse

Let me expand on this last category

A person may use a series of recursive self-referential functions in order to produce some graphic output on a screen She may then take the *ideas* of 'function and recursion and apply them to other forms of image-making Now if she had only read or stumbled across those ideas the result would very likely be banal empty uninteresting It might just be saved by its creator's artistic skill but would otherwise be as useless as a portrait of a working miner executed by one who knew or cared little about people miners and so on

There is a lot — a great deal — of art and design which, though superficially of some concept thing or relation, is no more 'about' it or *aware* of it than is a xerox or a fish-finger packet about marine life

Our person, however has experienced, has under-stood what went on with the computer And can indeed only *avoid* a far richer set of mappings than the above superficiality by an act of cynical auto-lobotomy — itself interesting and not all that rare! (I wonder if I m using the word mapping in a comprehensible way? I suppose I mean that if the two things involved are visualised then there is some topological or other similarity between them — one may even model the other though that is a stricter case)

Readers who may have seen some of my pieces on computers and art in the last eight years or so will recall that I used to talk about a different set of categories than those above I used to have 1 — computers as a tool 2 — introducing randomicity, unpredictability, 3 — artificial intelligence

Now, I think that the second of those categories should be combined with the first, being only a variation of it, and perhaps reducing the prominence of and amount of attention given to a lot of rather silly meanderings My new third category, I reckon, cries out for use and recognition and for incorporation into various schemes

What are the schemes the plans and the contexts that we use and *refer* to at the RCA? For a start I try not to be too parochial about things There are clearly other groups and individuals doing work that may relate to ours, and we must be visible and communicate Places are kept for outside' people (staff students workers) and nearly all seminars including ones that cost us money to put on Until someone tells us to stop that seems a reasonable thing to do (In passing and analogously may I join in condemning the boorish nonsense spouted and legislated by the blue-bonnet plague that says we should charge the earth to foreign students attending places like the RCA)

Next we foster, use and expect to be used by contacts over a wide range of relevant subjects computing in general art and design in general communication education policy planning and so on

Finally, we recognise that what we do be it fundamental, theoretical research or severely practical application must be *for* something We are neither a silicon nor an ivory tower So we find that we can talk to people in industry, to researchers managers, workers and if we ve got our ideas right and can tell them honestly then they can sometimes help us and we them

We now have experience in many areas that I believe are pivotal in the structural development of our future environment (information and natural) We have looked at the very earliest stages of people conceiving and implementing ideas at many aspects of person-machine interaction at the nature of art and design at the education and training of those who will be using computer studies and information technology in their creative work and who will be designing those very objects processes and systems We are getting better at demystifying and explaining computing to people who may use their knowledge in ways as yet unknown

"Uhmm oh yes that's what I do at the RCA Well It's ok You know I think the main thing is that we're gonna get in a position where, you know, all sorts of information comes to us not just as columns of figures, but as things we can sense in more ways, and actually interact with and have an effect on I mean it s got to get more like that Everyone inside a world model (Laughs)

"It all sounds too nice and honest and (even though you try to have it both ways) *academic* Why don t you say what you re *really* on about? '

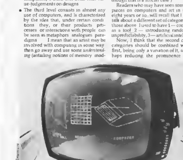
What, changing the world and stuff?'

Yeah

Well I couldn t really write that in a computing magazine could I? '

Why not? Why can t you just say it and if someone says it s silly just tell them to shut their mouth

'Dunno Spose so ■



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TRADE ENQUIRIES WELCOME

LEARNING FORTH

A miscellany

Concluding the series on the language invented by astronomer Charles H Moore

It is convenient but not essential to use a disc operating system (DOS) with FORTH The main advantage is that it may be used as virtual memory The second advantage is that the text file may be stored on disc (and subsequently edited and modified) since the text file is not retained in FORTH once the program has been compiled i e placed into the dictionary I have referred to the FORTH SCREENS (which are 1 K blocks of memory in my system) in a previous article You can save such screens on disc to be BLOADed into the memory block on another occasion and from there LOADed into the dictionary In the file name it is wise to include the screen number that it will BLOAD into so you know where to find it Also if a number of screens are to be loaded into the dictionary then the order is important so some reference to the order should also be included in the file name A FORTH word must also be defined to operate DOS e g

DOS 3D0 EXEC

The procedure is then

1. **BOOT DOS**
2. **BRUN FORTH (The core language stored on disc)**
3. **DOS**
4. **BLOAD the required screens**
5. **CALL 8192 (gets FORTH)**
6. **DECIMAL (FORTH BOOTS in HEX)**
7. **LOAD screens by number (e g 3 LOAD)**
8. **UPDATE (Dictionary entires will not be lost by accidental resets)**

Here is a CATALOG of one of my discs

```
DISK VOLUME 254

 B 002 HELLO
 B 077 FORTH
 B 006 FORTH ARRAY HANDLING 4
 B 003 FORTH ARITH 4
 B 006 FORTH M/C ROUTINES 2
 B 004 FORTH M & DIVIDE 4
 B 006 FORTH APPLEDEN M/C 3
 B 002 DOS HANDLING
 B 006 FORTH DIGITAL FILTERS A 5
 B 002 FORTH RANDOM CODE
 B 006 FORTH HIRES SETUP 3
 B 004 FORTH DIGITAL FILTERS B 4
 B 004 FORTH START
```

For any program requiring graphics the file FORTH HIRES SETUP 3 must be LOADED before any others

For some work with a digital filter it would go like this

DOS (if the system is already in FORTH
BLOAD FORTH DIGITAL FILTERS A 5
BLOAD FORTH DIGITAL FILTERS B 4
BLOAD FORTH HIRES SETUP 3
BLOAD FORTH M/C ROUTINES 2
CALL 8192
DECIMAL
3 LOAD
5 LOAD
4 LOAD
UPDATE

(The order of the above is important)

Note that M/C routines are not LOADed

The system is now ready to go

If you are using tape storage then probably the best procedure to save wasting time is to keep everything you define in the dictionary UPDATE it and put it all on tape when you ve finished

The equipment of the DOS Procedure takes rather long

Multi Dimensional Arrays

This is a way to handle multi dimensional arrays illustrated by matrices These are used, for example for translating rotating, and distorting shapes on the graphics screen I do no more here than show how to allocate space in the dictionary for matrices, how to address individual elements and how to carry out a simple operation such as matrix multiplication

```
ARRAY HANDLING COMMANDS

 ( VARIABLE X R C DIM  I J BIN  N X I J
 J PUT  N X FILLUP  X DISPLAY  X TRACE )

 0 VARIABLE COL 0 VARIABLE ROW
 : DIM SWAP 1 + 2 * ALLOT COL ! ROW ! ;
 : BIN SWAP COL @ * + 2 * + ;
 : PUT BIN ! ;
 : GET BIN @ ;
 : SHOW GET . ;
 : TRACE 0 COL @ 0 DO SWAP DUP I DUP
   GET ROT + LOOP ;
 : J R> R> R> I SWAP >R SWAP
   >R SWAP >R ;
 : FILLUP ROW @ 0 DO COL @ 0 DO DUP
   >R I J ROT J 1 PUT LOOP LOOP ;
 : DISPLAY ROW @ 0 DO COL @ 0 DO DUP
   I J SHOW LOOP LOOP
 : I R> R> R> J SWAP >R SWAP >R SWAP >R ;
```

Here is a screen of matrix commands The WORDS in brackets at the top are comments to remind the programmer how to use them The compiler ignores anything in brackets provided a space is left after the leftmost bracket Typing the bracketted words with numbers entered where appropriate will dimension a matrix fill it up and print it out The size of the row and column are stored as variables **X I J BIN** refers to an address into which the element whose row is I and whose column is J may be put by the command

N X I J PUT
X I J GET fetches the stored value to the stack
X I J SHOW prints it.

To write in all the elements of a fairly large matrix we get over the tedium of the PUT commands by FILLUP We type all the elements from last to first and the X FILLUP As follows

```
USE OF  FILLUP  AND  DISPLAY

9 8 7 6 5 4 3 2 1 X FILLUP  OK

X DISPLAY CR
1 2 3 4 5 6 7 8 9  OK

X 0 2 SHOW CR
3  OK

X 2 2 SHOW CR
9  OK

X TRACE CR
15 OK

( NOTE THAT X MATRIX GOES FROM X 0 0 TO
X 2 2 )
```

I have slipped in the word TRACE here which gives the sum of the diagonal elements It is only meaningful in square matrices and its particular property is that it remains unchanged in certain matrix operations The TRACE command in the listing gives

X 0 0 + X 1 1 + X 2 2

Try writing words for giving the sum of any in line elements as in a magic square

You will want to develop your own matrix handling routines and you have to make a choice between speed of operation and ease of programming (or rather the flexibility of programming) For speed you avoid defining variables as much as possible Fetching a number from an address to the stack is slow Constants are faster The disadvantage of constants is their local character as against the global character of a variable

For example **6 X !**

Stores 6 at the address X and all programs which get X by means of X@ unless this is changed subsequently by say

7 X !

However 6 CONSTANT X will make X= 6 for any program written subsequently until

7 CONSTANT X

changes the value But now earlier programs get 6 and later ones get 7

So programs for handling at the outset could well use constants for the ROW and COL words using XROW and XCOL, YROW and YCOL etc

```
4 BLOCK 12 LIST

      ( EXAMPLE

3 CONSTANT XROW     2 CONSTANT YROW
2 CONSTANT XCOL     3 CONSTANT YCOL

  : MATPROD CR XROW 0 DO XCOL 0 DO 0
  YROW 0 DO X J I GET Y I 1 GET *
  + LOOP . CR LOOP LOOP ;
```

Notice that you don t use @ to fetch a constant It is not an address In the MATPROD command I have used loop counters I J K These have to be defined and you can see how it is done in the array handling commands list

We use the two FORTH Words >R and R> The first of these passes a number from the normal stack (called the parameter stack) to the return stack This second stack which is less-used by the programmer is mainly for loop counters and loop limits Thus when you type :EX1 10 0 DO ----LOOP; The limits 10 and 0 go on the return stack and then the loop counter 'I' always refers to the top of the return stack even in an illegal use of 'I' as we can test later The return stack can also be used as a temporary store for a parameter but care must be exercised or the program will think it is a loop counter or something

>R means 'to the return stack
R< means 'from the return stack
Try this
6>R I PROTECT
You will find that 6 is printed followed by
CANT EXECUTE PROTECT?

(if you don't use protect you will exit to the monitor – you can get back by 2000 G)

What happened was that 6 was put on the normal stack, R transferred it to the return stack, I took it off and printed it Thus procedure is illegal -- all of this may only properly be done within a colon definition, but PROTECT wards off the evil consequences

6 >R R >

will, however, print 6

FORTH

In the MATPROD word our problem is that we need all three loop counters when in the inside loop In their own loops the counters are all fetched by 'I' but when in the inside loop you have to peel all the limits and counters like the layers of an onion This is all right provided you reassemble it promptly before the program tries to make use of the missing bits You can go on to K and L as well if you need them In summary, 'I' defines the loop counter you are in at the time of writing J defines the counter for the next outermost loop

So the next two examples

```
: EX1 3 0 DO 2 0 DO I . J . 4 0 DO
  LOOP LOOP LOOP ;

: EX2 3 0 DO 2 0 DO 4 0 DO I . J .
  LOOP LOOP LOOP ;
```

give very different results See if you can work out what these will be

GRAPHICS

We will now use FORTH with the Apple high resolution graphics The easiest way is to use the tape version which luckily is located in $ C00 FFF and exactly fills screen 2 in memory It is shown on my Disc Catalogue as FORTH M/C ROUTINES 2 It is *not* to be loaded into the dictionary since it would then be in the wrong area of memory and it is not relocatable I show here a list of the HIRE's SETUP 3

```
OK
7 BLOCK 12 PLIST
  WRITTEN BY ...
: ERASE 3 012 C
: HGR2 3 072 EXEC ;
  SETUP -1 + 130 + 302 C! 0 001 C!
 000 C! ;
  PLOT SETUP 3700 EXEC
  LINE PLOT SETUP 3790 EXEC ;
: AXES 0 130 0 0 LINE 0 0 255 0 LINE
 25 0 DO I 10 * 1 PLOT LOOP 15 0 DO
 1 I 10 * PLOT LOOP ;
  TEXT 3744 EXEC ; GRAPH 3751 EXEC ;
: CLEAR 3006 EXEC AXES
  MARKER 2DUP 2DUP 2 LINE 2DUP 2DUP
 2 + LINE 2DUP 2DUP SWAP 2 - SWAP LINE
 2DUP SWAP 2 + SWAP LINE ;
: HLINE 0 SWAP 250 OVER LINE ;
  VLINE 0 OVER 130 LINE ;
: POINTS 0 DO 2STACK PLOT LOOP ;
: AXES WHITEPLOT AXES ;
;S
OK
```

This is what they do

WHITEPLOT	selects white
ERASE	selects black
HGR2	cleans the screen
SETUP	formats the screen area for plotting
PLOT	uses SETUP and is used by means of X Y PLOT
LINE	needs both end points to be specified
AXES	sets up left and bottom axes with pips at 10 intervals
TEXT & GRAPH	pass back and forth without cleaning
MARKER	places a 5 by 5 cross on the by means of X Y MARKER
HLINE & VLINE	need only a single parameter
POINTS	enables the placing of experimental data by means of X1 Y1 X2 Y2 N POINTS PLOT where N is the number of points

Well, this article is the last of the present series I hope to be back with a FORTH program from time to time ■

●Starting soon. APL for micros

'Hello, I'm your floppy disc jockey'

SMALL SYSTEMS FOR BUSINESS

Putting the computing power where the people and the problems are seems to be the positive message today

The very first UK user of Hewlett Packard's small business system the HP 250 is *Dr Roeder*, Managing Director of *Supreme Plastics Ltd* who says "When the HP 3000 Series was released I just could not believe it because it was so superbly made to meet the requirements of the small businessman Then came the 300 and the 250 all carefully aimed at different potential users, providing just the facilities that were required "

Hewlett-Packard has throughout its history pursued definite marketing strategies and developed a classic marketing style "What makes us enthusiastic about working with them," says Roeder "is that they are very dependable They do not trade in futures and when they tell you something is going to happen on Tuesday, it will happen on Monday probably but certainly not later than Tuesday" According to Dr Roeder, HP has a reputation for bringing new products that reflect the future anticipated needs of the business user

"We practice management by objectives and attempt to have decisions made by the people who are closest to the problems, which goes hand in hand with the development of our products," says *Anthony Hill*, of Hewlett Packard

Supreme Plastics, a family-owned business, develop, manufacture and market re-sealable flexible plastic packaging A major subsidiary of Roeder Industrial Holdings, it was founded in 1934 by Dr Roeder's father who came to England from Germany and established a factory to make leather handbags The polythene bags which Supreme manufacture today are sold at the rate of five million a week to such diverse clients as Rolls Royce British Nuclear, EMI, jewellers and the general public All Supreme's packaging products are re-sealable either through the 'Minigrip' grooved fastening which can be split open and then pressed together again or through a plastic slider along one side of the bag, or through an adhesive strip which permits repeated opening and closing Products are manufactured at their two UK plants one in North London and the other in Whitby Yorkshire which has since expanded to double the manufacturing capacity of the 25,000 sq ft London plant

Up until January 1979, Supreme's accounting system had been a card-based manual system

Then Dr Roeder bought his first programmable pocket calculator the HP65 and the desktop HP92 to handle costings It was his experiments with the small HP 9845 scientific desk system which finally led him to the HP 250 soon after it was launched in the UK Before making the decision he and his Chief Accountant John Ford looked at IBM's System 32 and 34 the ICL 1500 and Burroughs B80 small business system

Hewlett Packard HP 250 flexible disc-based business computer

"I thought the HP 250 was the ideal machine for us because it is a very friendly machine and my problem was to get our staff to accept a computer after having worked for the past 30 years by hand" says Dr Roeder Moving from manual systems to their first computer staff both young and old showed tremendous enthusiasm and participated all the way "Before we had the computer we did a monthly analysis of all balances outstanding analysed up to three months, which took one of my lady clerks a whole week This same lady has come to accept the computer and I am surprised because she is not very young and had been working with manual systems for more than 10 years "

John Ford has assumed day to day responsibility for the computer which is used by Supreme's accounts clerks Staff had no need for any formal training, they simply worked from the HP manuals and at no point did they need to go to HP's support staff for assistance "You have to have one person who really knows quite well how to key in the data and we have a young girl who has had some previous experience on IBM equipment, but two of our other clerical staff who had no previous dp experience, found the computer very easy to understand and operate," says Dr Roeder

The HP 250 was designed by Hewlett-Packard to provide large computer system capabilities while minimising training time This entry-level, low-cost system offers the first time user a completely self contained computing facility with full database management capability Describing the system as simple and interactive, yet powerful and expandable, Dr Roeder cites some interesting features

"First of all, the L-shaped table top has plenty of space to put paper, the system has also got a normal uncluttered data entry keyboard and the 'soft key' labelling reduces the likelihood of errors "

Soft keys are eight user-defined function keys located along the bottom edge of the display screen and a changeable function message displayed above each soft key describes its present function "The programmer in generating programs can label dynamically the buttons to provide a choice of functions for the operator By pressing a button labelled say order processing, the buttons will immediately be relabelled with order entry, pricing, invoicing and so on" explains Dr Roeder

The system currently in use is a very comprehensive order processing system and an accounting system for sales purchase and nominal ledger which make full use of both the hardware and software facilities on the HP 250 "It is easy to implement, extremely attractive and the use of the soft keys mechanism really makes it extraordinarily easy to introduce people to computers," says Dr Roeder

Dr Roeder is also founder and Chairman

of Roeder Computer Systems & Consultants, a recently formed software and systems house that also offers a consultancy service free of charge. *Tom Houlihane* is the MD, who has directed a number of assignments evaluating technological and manufacturing trends for all Roeder clients. "I feel I have much more sympathy with the approach of those manufacturers like Hewlett-Packard and Texas Instruments, who deliberately take the stand that their role in life is to manufacture the best possible general-purpose tools and not to pretend to be all things to all men" says Tom Houlihane. This, he says, is an honest and realistic approach to the marketplace and there are relatively few companies who are prepared to recognise that they cannot do everything. "You don't have to con the businessman" says Houlihane. "Our consultancy is unbiased because we feel that if our advice to clients is not effective, then this will result in an installation that is not successful and will reflect badly on us." A great volume of their work is based either on the HP range, particularly the HP 250 and 300, or the Texas instruments DS990 range.

Currently, the relationship with Supreme Plastics is that Roeder Computer Systems, now with a technical staff of eight, is supplying support to them for the existing applications systems and are also supplying additional new systems, the most important being in the area of manufacturing systems, to be the next major area of expansion for Supreme.

Price is now about £14 500 for the systems that Dr Roeder purchased for Supreme, and this includes hardware and systems software. "The HP 250, we think, is unique and represents a conscious decision on HP's part to exploit their lead in hardware technology and to provide very sophisticated systems software which is spectacularly reliable. The lack of problems we have had is almost unnerving," he says.


Dr Ron Roeder, Managing Director of Supreme Plastics Ltd/Roeder Industrial Holdings Ltd and Chairman of Roeder Computer Systems Ltd

Tom Houlihane says that HP can supply processor store exploiting their SOS facility more cheaply than anybody else. "When you buy a HP 250, you get 128K of highly sophisticated systems software and that sums up the difference between the HP 250 and most other systems."

Two Users

Comparing the HP software with other systems, Tom Houlihane says "HP's software is uniquely comprehensive. From our experience, implementing original software on the 250 costs us about 60% of the effort of implementing original software on any other competitive machine and maintaining software on the 250 costs probably 30% of the effort that you could cost on any other machine."

The original system at Supreme Plastics covered order processing, sales ledger for over 3,500 accounts and nominal/purchase ledger for 500 suppliers. The company manufacture 70 standard products, so stock control is fairly simple.

The accounting system produces automatic pricing of products for a number of changing discount structures. The computer system has provided a means of transmitting management information, and marketing reports provide an analysis of customers and their requirements. It has improved the accuracy of administrative data, at the same time controlling costs. Dr Roeder has set up over 100 market categories using the Common Market Economic Activity classification.

"This is one thing which cannot be done by hand," he says. "We want to use the computer to give us a message when the customer is not re-ordering when he should. A complex task is the costing of products, because a plastic bag can be made in an infinity of sizes and every size has to have its correct costing. The EEC standard coding system (NACE) ranging over a thousand codes was put to use to provide a detailed analysis of sales."

Because the primary business applications are data intensive, the HP 250's database management software system (IMAGE) is considered a significant contribution in a low cost entry level system. This is further enhanced with the FORMS 250 data entry, and the reporting capability (REPORT WRITER). These facilities coupled with a powerful enquiry facility (QUERY) provide easy access to timely and consistent information to support the business user.

Supreme's Chief Accountant, John Ford, says: "We couldn't think fast enough of ways of using the machine. One advantage is that exploitation of programs like QUERY is genuinely possible for the non-professional. If the user is prepared to spend a maximum of three days learning about the machine then he could extract any reports which he wanted." To this Tom Houlihane adds: "In using Report Writer, Query or anything else, one is led through the system and prompted by the same soft key facilities that we use in our applications system. It is therefore very easy to use because, as long as you can get into the appropriate system software facility which one can do by picking up HP's manual, the system itself will lead you through it."

Supreme's manufacturing system is designed to interact with the order processing system on the level of stocks and actual orders. There are three major stages in Supreme's manufacturing process.

- **extrusion, in which the raw material, polythene, is drawn into 'tubes' of the appropriate dimension to fill an order**
- **printing, according to customer requirements on the 'tube'**
- **bag making/cutting the tube into the required size**

By integrating the manufacturing system into the order processing, the system will generate manufacturing and machine loading schedules. The computer will also produce workshop scheduling.

The HP 250 will support up to five terminals. Supreme have one terminal which handles the current accounting systems, but two more are on order — one will be dedicated to the manufacturing system and the other for enquiry use. All these terminals interact with the computer and support all the functions that the systems software will perform. The printer is a 180 cps bi-directional dot matrix printer.

The production plant produces both standard stock and special order, and the order processing system reflects demands on the finished product stocks. Inventory control for standard products is determined by sales or demand forecasting based on previous history. The manufacture of special products is based on actual orders received and the system produces a schedule for the special product orders which assists management in planning the manufacture of standard products. The system can reflect various stages of evolution of the company's products.

A weekly production planning module presents calculation of the ideal stock holding based on demand, so that the difference between actual requirements and actual stock can be automatically calculated. To formulate a plan for demand forecasting, the order file will trace current requirement for special orders to automatically produce a production and materials management plan. The production plan is analysed against the bill of materials processor to determine the material content of the production plan and finally the material requirement.

Roeder Computers Systems is now able to offer its expertise to the public on a turnkey key basis implemented on the HP 250 and 3000.

Tom Houlihane started his career 19 years ago intending to become a production engineer, but found himself attracted to the problems produced by a total lack of effective information processing systems to solve real business problems. Of this he says: "I was quite horrified at the discrepancy between the claims of most or many computer manufacturers and their reasonable hope of performance."

Dr Roeder says he first mastered Fortran many years ago on his college computer, the IBM 7090, using punched cards. On his desk he now has a Commodore PET and because the machine is so small he often takes it home so that his son of eight can start learning to use the computer. "My son loves it," he says, and adds, "Every businessman should have a computer because even if it only produces re ports it will pay for itself The Eighties he says, is the start of the true Computer Age

Two Users

Alex Lawrie Factors Ltd

Alex Lawrie Factors of Banbury finally found a way of bringing word processing productivity to its offices in a dedicated 'standalone' system that was not directly linked to their ICL 1901T mainframe computer We had to put it in a place where the people who are working with it feel in control and not oppressed by new technology they know nothing about says Cyril Roman Management Services Director at Alex Lawrie Factors 'The installation of the central processing unit on a different floor of the building remote from the typing area and the avoidance of complexity in systems design and operation have combined to give our typists this feeling of control I think it would have been a different story if we had surrounded them with too much hardware at the start '

The redesign of the office layout was important and in order to make the best use of the new word processing equipment Roman says he put up a partition so that his staff could feel part of the new environment, at the same time leaving the original (hopefully obsolescent) typewriters on extra desks alongside the processor to avoid any feeling of insecurity during the transition period We made sure that the layout was not in a typing pool area and we spread the equipment out on three separate floors We made sure that the operators or future operators were very much in the know about the negotiations and planning and we made sure that the authors were entirely responsible for setting out the system "

The story of Alex Lawrie Factors (ALF) is rooted in the early years of the development of factoring in the UK It was incorporated in 1962 as the financial arm of Alex Lawrie & Co an East India tea merchanting organisation founded in the 19th century In November 1975, the company became a wholly owned subsidiary of Lloyds & Scottish a major British finance house, and subsequently the First National Bank of Boston took up their previously agreed 25% shareholding A continued growth pattern brings ALF's annual turnover to £190 million with 240 employees and clients whose activities cover a diverse range of businesses

'We are expanding at the rate of 30% per annum, so we know that this year we will need 30% more computing word processing data entry and we hope to achieve this growth using much less than 30% more space and staff 'ALF is growing so fast that they are now setting up mini demonstration offices throughout the UK

Clients initially approach ALF when they have a cash flow problem in supporting their ever increasing values of sales ledger debtors ALF purchase the client s outstanding invoices so providing an immediate capital injection All new invoices are then purchased by ALF and as invoices become due for payment the factoring company collects from the client s customer It is therefore vital that ALF provide a highly efficient collection service

'The improved cash flow for our clients actually means improved cash flow for us if we get money in faster says Roman Our bad debt losses over the last few years has been virtually nil and our security has very much improved Increasing the productivity of the office is a major challenge for the management of Alex Lawrie Factors The company aims to achieve the same high level of performance with fewer resources 'The image that we want to project to our clients and customers and the world at large is one of efficiency We want to do the one thing for our clients that they want and that is collect their money very quickly without upsetting their customers says Roman

The Jacquard J100 Videocomputer

In addition to a computerised system of 450 sales ledgers routine statements, reminders and control reconciliations for all incoming cash, personalised letters must be sent to large numbers of customers These letters answer customer queries on price disputed delivery discount requirements copy invoices and payment terms Before word processing 35 credit controllers dictated letters word for word into a dictaphone, tapes were then transcribed by four audio typists and on average nearly 2 600 letters a month were typed As more letters were needed to achieve a higher standard of service and collection performance ALF realised that the volume of output should be higher with letters produced during the first two weeks of the month rather than spread throughout the month Now there is a tremendous increase in letters going out Mr Roman estimates that the number of letters produced will soon approach 8 000 per month and this in the first two weeks of the month

A high proportion of the total letter content is already stored on their mainframe computer, the ICL 1901T with tape and disc It is hoped that this information can be transferred from the mainframe to the Jacquard A primary and secondary file would be created holding this customer information It is anticipated that by the end of 1980 the two files will increase to combined total of 62 500 customer records

With a portfolio of something like 50 000 customers 10% of whom needed contact by letter ALF previously tried to contact customers through computer produced letters "We found like many other firms running sales ledgers that customers do not read computer produced letters We wanted firmly but politely to get a reply But our computer produced letters were going straight into the bin! says Roman If you produce a letter in upper case it is obviously printed by a computer People don t take so much notice of it as they would if it looks like a personal letter even though it may have been produced by a word processor "

ALF s total word processing system was carefully planned and systematically developed Roman realised that a 'standalone' installation away from their ICL mainframe computer would be more responsive to their office needs and soon began to decentralise the word processing system so that all functions were shared across a mix of departments Word processing operations were performed at more than one place but at the same time he made sure that the smooth continuity and steady improvement in the work flow remained consistent throughout the whole company We had no way-out ideas about a permanent on link to the computer using a lot of computer and development time in doing fancy things he says We knew exactly what wa wanted and we looked for a supplier that would provide both hardware and software near to our requirements with the capability of being tailored

In April 1978 ALF submitted a written

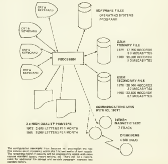
specification to a shortlist of seven manufacturers One of the manufacturers withdrew when it became clear that it could not solve the problem of integration of the dual requirements of word processing and data processing namely access to information from the central mainframe computer Jacquard came up with a well-proven word processing software package and hardware "With Jacquard we liked the situation where they offered us a spec and virtually stood back and said 'Take it or leave it!'" says Romain Romain insisted that the applications software should be wotten by their own in house staff with adequate technical training and support from the supplier

Hardware purchased from Jacquard is a J100 videocomputer 128K processor with Pertec 12 Mbyte cartridge disc drives (6 fixed and 6 removable) four J105 VDU satellite terminals two Diablo daisy wheel printers at speeds of 50 cps two discette drives 250 000 characters each with a communications package called SILA 1 and Type Rite at a capital expenditure of £43,000 Maintenance and technical in house support costs over five years, of £22 000 increase the total expenditure over the period to £65 000 However savings in additional staff and equipment of £50 000 are expected, leaving a net cost of £15,000 spread over five years 'A very worthwhile investment, says Romain, for a system that not only will keep pace with increasing volumes during this period of rapid expansion of the company, but also produce a higher standard of service for our clients

Two Users

Embarking on a pilot scheme in April 1979, Romain with the help of his consultants, Business Research Ltd, was able to complete a lot of test work on the J100 before actually signing a contract 'We never go full boot in on the first jump because every little part of our company is a duplicate of the next We take one department away and get them to test it out and we avoid costs by not buying the total equipment until we are sure it will work in that one department,' says Romain Two visual display units and a printer will be located on the third floor, and two with a printer on the fourth floor The manipulation of text will be handled by the audio typists on these screens and the letters will be produced on the printer The central processing unit with a VDU is in a separate location specifically for training and confidential work

Knowing that the true test of any word processing installation is whether it could stand up to the workload, Romain persuaded one of his most senior credit control managers to accept total responsibility for the first pilot scheme "We deliberately chose a guy with the street wisdom of how the company works, and he had a lady working under him who is the biggest volume producer of letters If his lady was unable to use the word processor for her large volumes of work, then no one else could "



Increasing the productivity of the office has always been a major challenge for Cyril Romain and his data processing team Once having made the big step he decided to educate his staff "You have got to allow staff to play with it because they are then self-motivated and accept the machine If they are directed to put work on the word processor then you are going to have unnecessary antagonism he says Romain believes that close personal involvement in group work will break through any communication barriers "We had one of our typists saying that she would never make it on the word processor but as soon as we got her into a group environment with the other girls, she changed, became more confident and is now very successful at it '

The Data Processing Manager at ALF is *Keith Myers* and working under him are five systems programming staff seven operators eight data entry clerks and two O & M analysts Together with one of his systems staff Myers has been responsible for installation acceptance and training

On maintenance the company has a draft contract with Jacquard but this is being delayed because Jacquard has not as yet established their maintenance with Addressograph Multigraph 'The machine is fairly resilient When the equipment has gone down we have got a reasonable response from Jacquard usually within 24 hours The hardware has ticked without a major fault and the software has gone even better, says Cyril Romain

Tiger Data, one of Jacquard's distributors, have developed the software that links the J100 to the ICL 1900 mainframe ALF have bought the software but are not using it as yet 'We are developing the software on the 1900 to extract names and address details and we have to finally establish the connection to the 1900 which we hope is going to happen this year The second stage will be to transfer names and addresses from the 1900 to the J100 once every month 'The J100 will operate as a stand alone system and we will link it up with the ICL mainframe but only when we want to It is possible, and we are quite happy to do it but we have not had all the support that we would ideally have wished for says Romain

Using the emulator software supplied by Tiger Data a link up with ALF's IGOIT will be tested and if successful will simply be used for the transfer of name and address information from the mainframe to the Jacquard ALF are now in the early stages of designing their new system for the 80s and there is no doubt that machine to machine communication and word processing will be a major influence on this design

Cyril Romain would like manufacturers to reduce the price of printers You have got to have a number of work stations within a reasonable distance of a printer says Romain We have a terminal on the first floor and we would love to have all our training down there but we just cannot do it because our staff have to run up three flights to look at the first printer The system has got to have cheap printers and they have to be pretty quiet too ■

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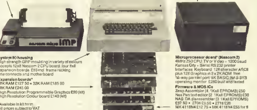

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FORTH

I would like to say how much I have enjoyed the first three parts of your (Gil Filbey's) series on the FORTH language in *Computer Age*. I have been very impressed by the clarity with which you have explained a language which is very different in concept from others available on main frames, minis and micros; the numerous examples are invaluable for understanding this potentially very powerful programming tool.

Having had my appetite whetted, I am now eager to follow up the references mentioned in the bibliography at the end of the first article. I would be grateful if you could let me have details of the availability of two of these publications. The two that I am particularly interested in are "FORTH High Level Programming Technique on Micros" and "FORTH, A New Way to Program a Minicomputer". As these are presumably American in origin I would be interested to know of any UK publisher that handles them. I enclose a stamped self addressed envelope for your reply. Thank you for your help. I look forward to reading the rest of the CA series.

Mark Webb, 101 Park Burn Drive, Guildford, Surrey, GU2 6FR

GF The papers you have asked for have been forwarded.

Relevance

I thought the articles by Clive Jenkins and John Braga (CA Issue 1) very relevant to the current situation. Clive Jenkins is right to warn people that the micro-processor will mean unemployment, but it is up to the public to find and generate the new business that the micro will bring. The various firms (INMOS etc) set up by the Labour Government when James Callaghan happened to wake up in the middle of a Horizon programme will provide work, but mainly in the already staff starved computer industry.

A large number of small businesses will welcome John Braga's guidelines on choosing a computer with open arms, especially with the cost of bringing in outside expertise now being about £200 per day. At the beginning of his guidelines John Braga cites the current data processing industry as one of the worst offenders in ignoring the micro. This is true, but for a good reason.

The place where micros are best suited is in small businesses which often means using packages written by outside organisations, ie software houses. The main product of a software house is it's employees' time, thus to divert this time to developing packages means lost revenue. With the low market price of micro packages, the estimated return from a package does not often outweigh the lost revenue.

These two articles, along with the other notable contributions make Computer Age a very interesting magazine.

Michael Bray, Computer Consultant, 29 Haseldine Meadows, Hatfield, Herts

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Toy computing

May I congratulate you on the first two issues of your magazine. But I think you are going to have to try hard to keep out of the toy market where most of your competitors have become trapped.

Keith Park, Micro Systems, Cotstone Bungalow, Brinkworth, Chippenham, Wilts

Micros and recursion

Excellent magazine, the article on Pascal was very good. Having grown up on main frame computers and been fascinated by recursion, perhaps "Micro's and recursion" would make a good feature for amateur programmers.

Pater Goodman, 35 Timbers Sq, Roath, Cardiff

Legal eagle

As a practising Solicitor presently involved in the development of a micro-computer package for the Legal profession based largely on programs written by myself, I was extremely interested in the article by Alistair Forsyth that appeared in your second issue. However, I would like to rap your knuckles a little bit in that, notwithstanding the fact that Mr Forsyth made three references to the Burroughs System and in fact prefaced one of the references with the phrase "an excellent example", nowhere in the article do you reveal the fact that Mr Forsyth is in the employ of that firm.

Having said that, I do like the magazine and wish you success.

G C Ross, 36 Hamilton Square, Birkenhead, Merseyside L41 5BP

Editor's note

We mentioned Alistair Forsyth's affiliation in the December issue (page 6). We ought to have mentioned it again in January and stand corrected. A further omission was not stating that Mike James, author of "SAM" (Issue 3), is at Research Resources.

Micro computers in the legal profession

A criticism of an otherwise useful article.

In the interest of unbiased reporting, I should like to point out to your readers that Mr Alistair Forsyth, in writing the above-titled article in your January edition, did not make it clear that he is an employee of Burroughs Machines Limited.

I think it was rather naughty for this not to have been pointed out in the introduction. Naturally, as a consequence, the article singled out Burroughs for praise, while choosing to ignore systems from LogAbax, Olivetti, Kienzle etc. Not that I think any particular manufacturer should have been mentioned.

I trust readers will now reflect on the article bearing this in mind.

Christopher Hodgson, LogAbax Ltd, Concourse House, 432 Dewsbury Road, Leeds, LS11 7LT

Reaping the whirlwind

I took exception to your footnote to "Newsflash" (issue 3): "Isn't it time women in computing were given a lot more recognition". Mrs Stephanie Shirley, the lady in question, has been honoured by THE TIMES because she runs a very successful business, *not* because she happens to be a woman. She is succesful in her own right, does not need anybody's patronage. Your footnote is a kind of inverted sexism.

Your Editorial is a further example of setting up dragons to slay. Let's have less moralising and more computer, or change your name to Don Quixote de la Mancha.

Janey Gould, 11 Harp Rd, London W7

Editor's note

The writer obviously wants a word

processor not an editor

Worthington's ailment *(a letter of solidarity addressed to Brian Reffin Smith)*

I was intrigued to learn of your appointment to Research Fellow in Computer Art, and later to come across your incisive article in Computer Age (issue 1 Dec 1979)

My own interest in this field stems from my experience as a conjuror (childrens parties and small shows) in which occupation apart from the routine prestidigitation I was wont to have recourse to a trained badger named Worthington. At the word of command he would spring onto a three-cornered stool and strike a small Chinese gong with a hammer attached to his left paw. Until that is the day that he stumbled spraining the paw and leaving me to claim either unemployment benefit or sickness benefit

I hope you will forgive this unconscionably prolonged and circumstantial prologue but the upshot of the matter is that neither of these potential sources of interim funding were deemed appropriate by the relevant authorities leaving me with no alternative but to take up psycholinguistic research using microcomputers

My work takes me to the metropolis on occasion and I wondered if it would be convenient at some juncture to discuss holophrenia some things new stars guitars something (Northstar Horizons with speech synthesis) blue If there's a war on I suppose you could call it a strategy co-ordination meeting Or you might call it Worthington Hoping to hear from you soon

Alan Stokes, Research Fellow, D E S Reading Project, The Open University, Milton Keynes

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