Practical Computing

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SKILLS OUT OF SCHOOL

Reviews:

Enterprise, Ericsson PC
Framework, Symphony, Sony MSX
Secrets of the BBC's ROM

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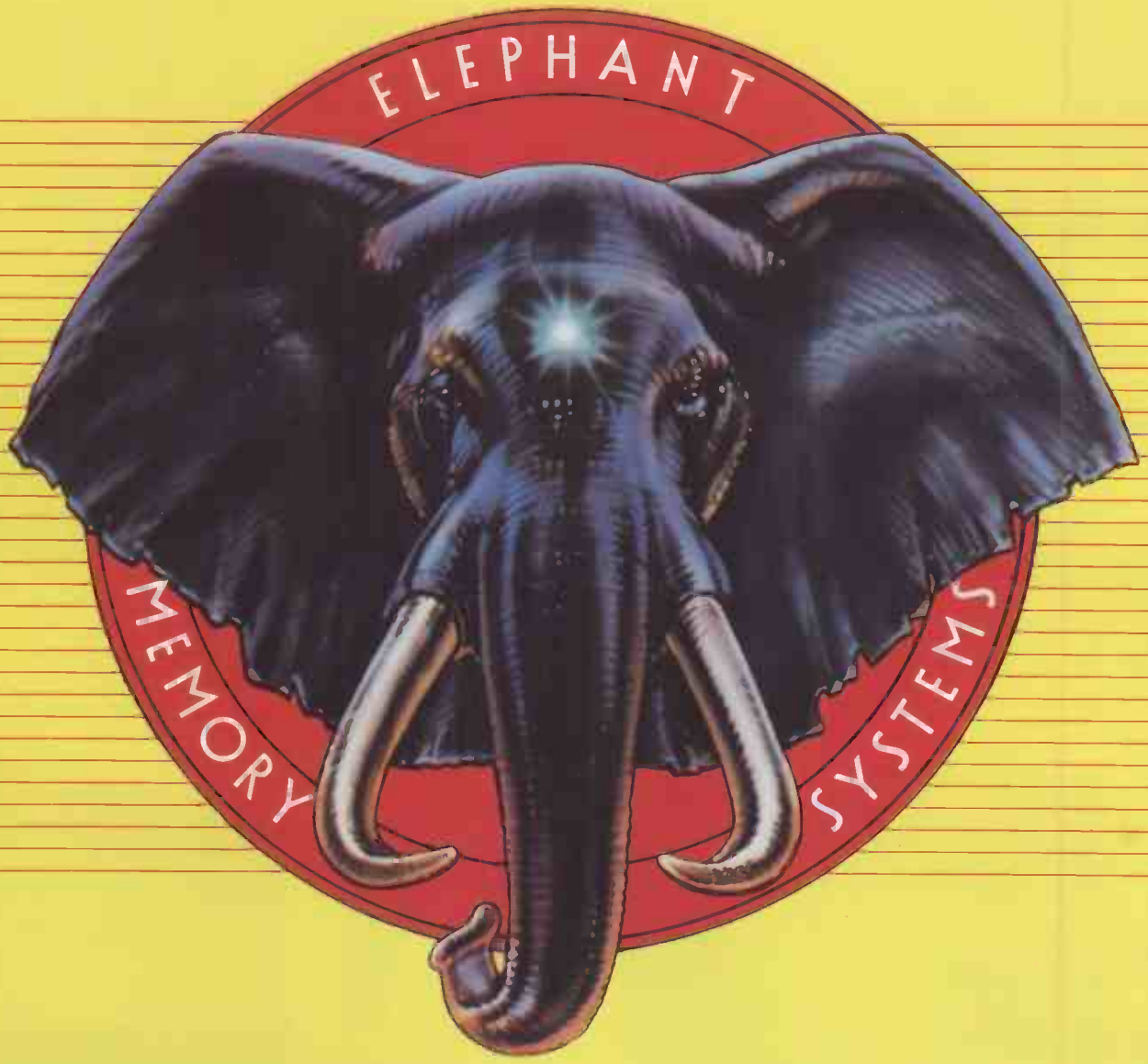

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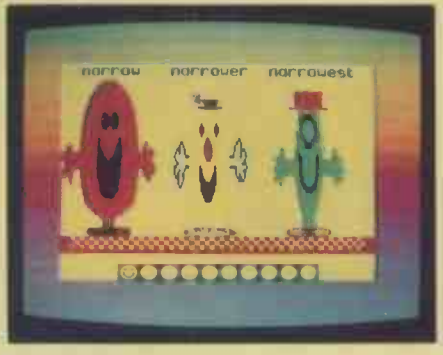

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PUBLISHING DIRECTOR
Chris Hipwell

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Old faithfuls

COMPUTERS are supposed to be subject to rapid technical advance. Announced on Monday, delivered on Wednesday, out of date by Friday. The truth is rather different. Today's best buys in micros were not launched last week, or even last year, but somewhere back in the mists of time.

Two of America's best sellers over the recent Christmas period were the Apple IIe, at about $1,000, and the Atari 800XL, at around $120. Yet there is a high degree of compatibility between today's IIe and the Apple first marketed in 1977. The 800XL is largely compatible with the original Atari 800, which arrived more than five years ago for the 1979 Christmas market.

Similarly the IBM Personal Computer and Acorn BBC B have changed little since they were launched over three years ago in autumn 1981. There are very good reasons why these ancient micros continue to outsell most rivals: compatibility, software, and the lack of real competition.

In a market where machines can come and go with alarming speed — the Dragon, the Newbrain and the Commodore Vic-20 are examples — companies that keep faith with their existing users deserve and get support. And the best way to keep faith is to ensure that new micros, and new versions of old micros, remain compatible with previous models in the range.

This not only helps users, it also helps software writers. It takes about 12 to 18 months to build up a reasonable software base for a new micro. Software houses therefore cannot afford to invest in machines that have a two-year life span. When a machine is around for five or six years, however, the situation changes radically because software that sells steadily for years is generally more profitable than heavily promoted but short-lived hit games.

Hardware without software is worthless. Old-fashioned hardware is more useful than "the latest thing" if there is more good software available for it. But that said, the Apple II, Atari 800XL, Acorn BBC B and IBM PC are not really that much out of date in hardware terms. The Atari and BBC B certainly represent more sophisticated and more advanced designs than the more recent Sinclair Spectrum, Commodore 64 and Amstrad micros. While the IBM may not feature the latest in cpu technology this mainly makes it slower than many rivals rather than inherently less capable.

The reason is simple. When these machines were designed, each of them offered a new level of performance for the price. The Apple II was the first micro with built-in high-resolution colour graphics and sound, and established a new level for memory with its use of 16K RAM chips. The Atari was the first micro with really advanced graphics and sound, through the use of the expensive custom-designed dedicated chips Antic, Pokey and CTIA. The BBC B offered the first really fast, powerful Basic on a low-cost computer, plus a new level of expandability through its many interfaces and the Tube. The IBM PC was, of course, the first mass-market 16-bit micro in using the Intel 8088 chip, even though it used eight-bit support chips to bring the price down.

By contrast, most recent micros have been built down to a price, rather than up to a level of performance. This is not to say there have been no technical advances in the last three to five years. There have — especially the arrival of affordable machines using Motorola's powerful 68000 chip.

But neither the Sinclair QL nor the Apple Macintosh yet offers a level of performance superior to that of established models. In another year or two, when the storage limitations have been sorted out and the software arrives, perhaps they will.

Until then, the message for 1985 is "roll out the old". New 128K models of both the Apple II and Atari must, logically, be on the way to bring new life to these long-running marques. We'd also like a 128K BBC with 32K of video RAM and 64K free to Basic, please. We don't even care if you call it an ABC. M

5 Years ago...

Video Genie is the cheapest get-up-and-go microcomputer completely packaged with full facilities and adequate memory so far offered in the U.K. It is fully compatible with one of the three most popular existing micros in its class.

Essentially it is an all-in-one improvement of the Tandy TRS-80 Level II 16K. The Genie case includes the keyboard, integral cassette player, and both video and UHF modulator outputs. The price is £425 including VAT, compared to the official Tandy recently discounted offering at nearly £600 which, however, includes a video monitor.

At this price, should one be criticising at all? I think so. The micro is no longer a novelty and while the earliest models on the market were entitled to a tolerant reception, each new entrant has to offer better value than its predecessors.

In many respects the Video Genie is an improvement on the TRS-80 but a number of irritating features remain. It is also not entirely clear for whom it is intended — small business, education, hobbyist; the Tandy answer to that is 'All three' and the manufacturers of the Video Genie say the same.

PC Volume 3 Issue 2

The best thing next to a BBC micro.

The BBC Model B Microcomputer is widely recognised as an impressive first computer for the home or the school, but its capabilities are restricted by its lack of data storage and the limitations of Basic for serious programming. For the user who needs more from this computer the Torch Z80 Disc Pack is a gateway to the world of advanced computing.

Model B's fitted with disc interface can be upgraded to full business machines by the Torch Z80 Disc Pack thereby offering the use of more powerful and flexible languages such as Fortran, Pascal, BCPL and Cobol while twin 400K disc drives provide a massive storehouse for information and rapid data transfer from disc to processor.

Torch Z80 Disc Pack

The Torch Z80 Disc Pack is the proven upgrade for the BBC Model B microcomputer. It provides 800K of disc storage plus a Z80 second processor with 64K RAM running TORCH's own CP/M® compatible operating system based in ROM.

This advanced design means that almost all of the 64K RAM provided by the Z80 board is available for programming use – an advantage no other BBC micro upgrade can offer.

If your BBC micro has the Econet® option, there is a further benefit the Torch Z80 Disc Pack can offer. TORCHNET can link together up to 254 upgraded Model B's on a local area network, so for enthusiasts, clubs, schools and businesses it is a simple and low-cost way to achieve networking facilities.

The discs can be used for storage under the Acorn DFS system or for CP/M® programs and data.

A comprehensive software package is provided which includes word and data processing and a spreadsheet program, along with utility programs and manuals.

The Torch Z80 Disc Pack is recommended by the CCTA for government use.

At £699 the Torch Z80 Disc Pack is exceptionally good value.

Torch Z80 Extension Processor (ZEP100)

When fitted to a BBC system which already has compatible high quality twin 400K disc drives, the ZEP100 provides a complete business or scientific computer.

Alternatively, a ZEP100 may be fitted to a BBC system to enable it to be used as a Torchnet station.

The ZEP100, priced at £299, comes complete with full software support. There are already over 10,000 users of Torch computer systems.

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Other Operating Systems Available – UCSD p-System
Torch Z80 Disc Pack. As for ZEP100 but includes 2 x 400K 5¼" floppy disc drives with separate power supply unit.
Unicorn. These products are part of the best selling range of add-ons to the BBC Micro by Torch Computers Ltd.

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Prices quoted are ex-VAT. CP/M is a registered trademark of Digital Research Inc. Econet is a registered trademark of Acorn Computers Ltd. Perfect Software is a registered trademark of Perfect Software Inc. Text, graphics and keyboard provided by BBC Model B.

Indemnity insurance

RECENT ARTICLES in the computer press have centred upon the growing concern shown by computer-buying members of the business community with regard to the inadequacy of certain computer systems when their capabilities are compared to the tasks for which they were originally purchased.

While we do not believe that any dealer deliberately sets out to market a product to clients which is inadequate or insufficient for their requirements, it is a sad fact of life that all too often systems fail to carry out the jobs for which they were purchased. It is becoming more obvious that executives are now prepared to take legal action in respect of shortfalls of the computer equipment with regard to performance. Recent court judgments have shown that computer dealers are not in a particularly favoured position. Even the initial encounter with a legal claim can involve a computer company with very considerable legal costs for the preparation of a defence or a counterclaim.

In order that both clients and dealers alike may be protected against the consequences of a lengthy dispute or expensive court judgment, we feel that it is now essential that the trade bodies for computer dealers and consultants insist upon a minimum trade standard for their members. This should take the form of compulsory professional indemnity insurance linked to a well-defined code of conduct for the sale of computers. We are well aware that the general reaction of computer sales companies to professional indemnity insurance is that "We will never need professional indemnity insurance as we do not make mistakes".

But we would strongly advise dealers and customers alike to consider the possible consequences of a claim involving their company.

P J Walters,
Halsey and Company,
Bristol.

Was Compaq the first?

I WOULD like to take you up on a few of your comments regarding our new Compaq Deskpro range that were printed in the December issue news.

Compaq's claim is not that the Deskpro was the first 8086-based machine to run IBM PC software, but that it was the first to offer total compatibility — that is to provide a slow 8088 speed mode as well as a higher speed mode. This allows it to run virtually any PC software, including communications tools, tutorial packages and the like which require the slower 8088 processing speed. Of the other machines you reference, none, to the best of my knowledge, offer a slow-speed alternative mode with the exception of the Eagle Turbo XL. Was the Turbo XL released and available in the U.K. on 18 September 1984 when we launched the Deskpro? I don't know, but only if it was can our claim be fairly contested.

You also compare the ITT Xtra 130 with the Deskpro Model 3, noting that they are "about equivalent" but with the ITT product over £900 cheaper. The ITT product is an 8088-based system without any of the processing speed advantages of the Deskpro — how can you say they are equivalent?

Also, why would anyone with £6,000 to spend "surely go" for the IBM PC/AT? If they do, they would be spending over £400 more without getting the Deskpro Model 4's useful built-in 10Mbyte tape streamer. The IBM PC/AT doesn't offer one even as an option, but it is one of the most useful features that could be offered to the typical business desk-top user.

J McNally,
Compaq Computer Ltd,
Richmond,
Surrey.

● **The editor replies:** "We were first" claims are hard to verify in the computer business. The first dual-speed IBM-compatible we tried was the Sperry PC, last summer. We did not mention it at the time as it was not then on the market. Whether the extra facilities of the Deskpro range are worth the extra cost will no doubt be decided by the customers who, even when they are wrong, are always right.

Turbo-DOS virtues

IN YOUR Hot 100 Buyers Guide to Top Micros, you listed Minstrel 2 under the S-100 category. While we would agree with the description of the hardware given, we were horrified to read your comment that the Turbo-DOS operating system is "non-standard."

A major virtue of Turbo-DOS is that it can run programs written to run under CP/M-80, CP/M-86, MP/M-11 MP/M-86, without modification, and incorporates a PC-DOS emulation in its latest version, which Minstrel 2 uses. Turbo-DOS also has the added advantage of being multi-circuit, which means that networks can themsevles be networked.

Turbo-DOS is running on IBM, Philips, NCR, Televideo and other hardware besides the Minstrel. However, HM Systems are sole U.K. OEM licensees.

Tony Harris,
HM Systems Ltd,
London NW8.

RML prices

WE WERE pleased to see the small note on RML price cuts on page 15 of your December issue. Sadly, the price data on the RML 480Z that appeared under Specialised Systems in your Hot 100 list is somewhat out of date. A specialist purchaser of the RML 480Z would typically pay £585 for a high-resolution colour 480Z, plus a further £847 for both twin double-density drives and a colour monitor. Perhaps with this latest data we could get rid of the "expensive" tag?

Also, it does seem to us a pity that the numerous categories could not find room for the RML Chain Network which is installed in 900 sites and is by far the most complete of all educational systems.

David Jay,
Research Machines Ltd,
Oxford.

Worthy Electron

I AM becoming more and more disgusted by your magazine's attitude to the Acorn Electron. Every point I read about the machine is always a bad point with the exception that the moron who is bringing it down is always stating something like, "Its only good point is its Basic", or to that effect. The thing that aggravates me more is the fact that you always compare it to the BBC Micro. My only question is: how do you expect a computer to be as fast, have as good a sound, expandability, etc., as one that costs twice as much?

I would like to point out that many owners, like myself, have an Electron purely and simply because we believe it is worth

(continued on next page)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)

every penny. Not everybody buys a computer so that they can expand it with umpteen gadgets just to keep up with everyone else. I have an Electron because I enjoy writing programs, both in assembly language and Basic, and enjoy the pleasure of either the results of my program or having got a stage further on my favourite game, which just happens to be the Elite which in your December edition you said was available for the BBC and not for the Electron.

If I should wish to expand my system then I am willing to spend £60 on the expansion unit because I know that it is well worth the money and I can then buy what few accessories I would want.

Patrick Bray,
Kirkby-in-Ashfield,
Nottingham.

● **The editor replies:** An Acorn Electron with expansion box offers similar facilities to an Atari 800XL. However, the Electron has one-quarter of the number of sound channels, fewer than half the graphics modes, a fraction of the software, half the RAM — 32K against 64K — and yet it costs twice as much: £260 against £130 for the Atari. The Electron Basic is better, and perhaps to you this is worth £130, but we do not think most readers will share your view.

Apple disc controllers

EICON DISC CONTROLLERS for the Apple will work with Shugart-compatible 8in. drives with a head-load time of 35ms. to 50ms. and a track-to-track access time of 3ms. The SDC1 single-density controller costs £295, and the DDC2 double-density controller costs £365, both plus VAT. Possibly a better alternative is the Terradrive, which comes as a controller card with a single or dual 5.25in. slimline drive, in a unit only 2in. high. It is powered from the Apple, stores 1 Mbyte on each disc, and costs £649 or £1,095 for the single or dual units respectively.

S R Hodge,
Eicon Research Ltd,
Cambridge.

● **John and Timothy Lee reply:** Thank you for the additional information. We believe that high-density floppies holding one or two megabytes provide an excellent solution and that they will become common on many computers in the future.

The new IBM PC/AT may optionally store 1.2Mbyte on a floppy.

Floppy discs have security advantages as they can be backed up very easily. What then of the future of hard discs? We can see little long-term prospect for small Winchesters with a capacity of 5Mbyte or even 10Mbyte because of difficulties over backup, but the larger capacity ones are a different matter. For speed, silicon discs and cache buffering will become common as chips get cheaper, and are much faster than hard discs.

dBase II user group

I HAVE contacted Ashton-Tate about a dBase II user group and there isn't one in the U.K. So if there is anyone out there who programs in dBase II and would like to share tips and hints, then contact me.

For example, there is a very serious omission in the manual. It does not tell you that Quite does not clear the secondary file. So immediately before that statement you should have a Clear statement.

I use the Cannon AS-100 computer but tips and hints are not machine dependent.

Richard Bourne,
10, Longfield View,
Normanby,
Middlesbrough,
Cleveland TS6 0SL.

Telecom Gold gateway

I READ Chris Bidmead's article on bulletin boards and electronic mail in the December issue with great interest.

However, in one respect his facts are incorrect: Telecom Gold has a gateway facility into British Telecom's Radiopaging service which can alert mailbox holders to the arrival of incoming messages if required.

I hope you will be able to advise your readers of this additional benefit of the Telecom Gold service.

Christine Ott,
Telecom Gold.

Universal calendar

I REGRET that there is an error in the last line of the Universal Calendar program, published in the December issue. In line 1160, Goto line 20 should read Goto line 10.

I should also point out that after entry, the program should be initialised by Goto 1100. It can then be saved with these variables, using

SAVE"xxx"LINE 10

If it is not autorun, then use Goto 10, not Run.

A M Tucker,
Dorchester,
Dorset.

Compaq prize

PRACTICAL COMPUTING held a competition at Compec, with the prize of a Compaq transportable micro kindly donated by Compaq Computers.

The winner was Ivor Rogers, computer manager at building contracts and property developer G E Wallis & Sons of Bromley, Kent. With an IBM System 36 and two IBM PCs already in the office, the Compaq is an ideal extra for a building contractor with several branch offices. Not only is it transportable, it is tough enough to be hauled from site to site on a daily basis.

The photograph shows Joe McNally, managing director of Compaq Computer Ltd, presenting Ivor Rogers (seated) with his prize.

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CPC 464 green screen VDU (GT64)

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It has a typewriter-style keyboard and numeric keypad. 64K of RAM, 32K of ROM and a very fast extended BASIC with real time features.

And it costs a great deal less than the price of a comparable system.

The CPC 464 can handle the trickiest computer games (if you can), revision for exams, cataloguing and budgeting.

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And with the free software pack, we think that's pretty good for starters.

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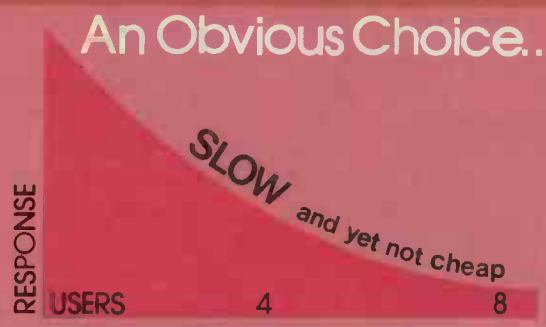
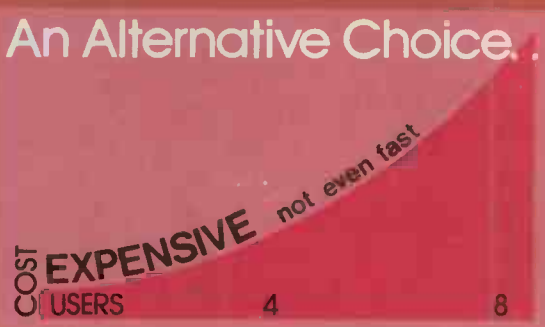


Time Sharing Micros

Typical multi-user micro machine are doomed by CPU degredation being based on time-sharing principles. Altos, Fortune and IBM PC/AT are in this class.

An Alternative Choice...



Networked PC's

Networks are too expensive and tedious. They do not offer a truly integrated multi-user system or speed. Networked IBM PC's and Apricot are such examples.

The Wise Choice...

Multi-Processing

The choice you didn't know you had . .

In Multi-processor SuperStar, each user has its own dedicated processor with up to 1Mbyte of RAM each, working at full CPU speed regardless of the number of terminals. The tremendous increase in power resulting from having up to sixteen 16-bit processors compared with time-sharing a single processor must be plain. Because it is a network on an internal bus, it is very much faster than conventional serial networks — yet it is much less expensive because all the processors are integrated into one desk- top unit instead of being distributed among the various PCs

SuperStar is a genuine multi-user system with record/file locking and with printer spooling. All MS-DOS and CP/M (all variants) programs run without modification. It is ideal for a cost-effective Office Automation system for any or all of the following functions in any combination.

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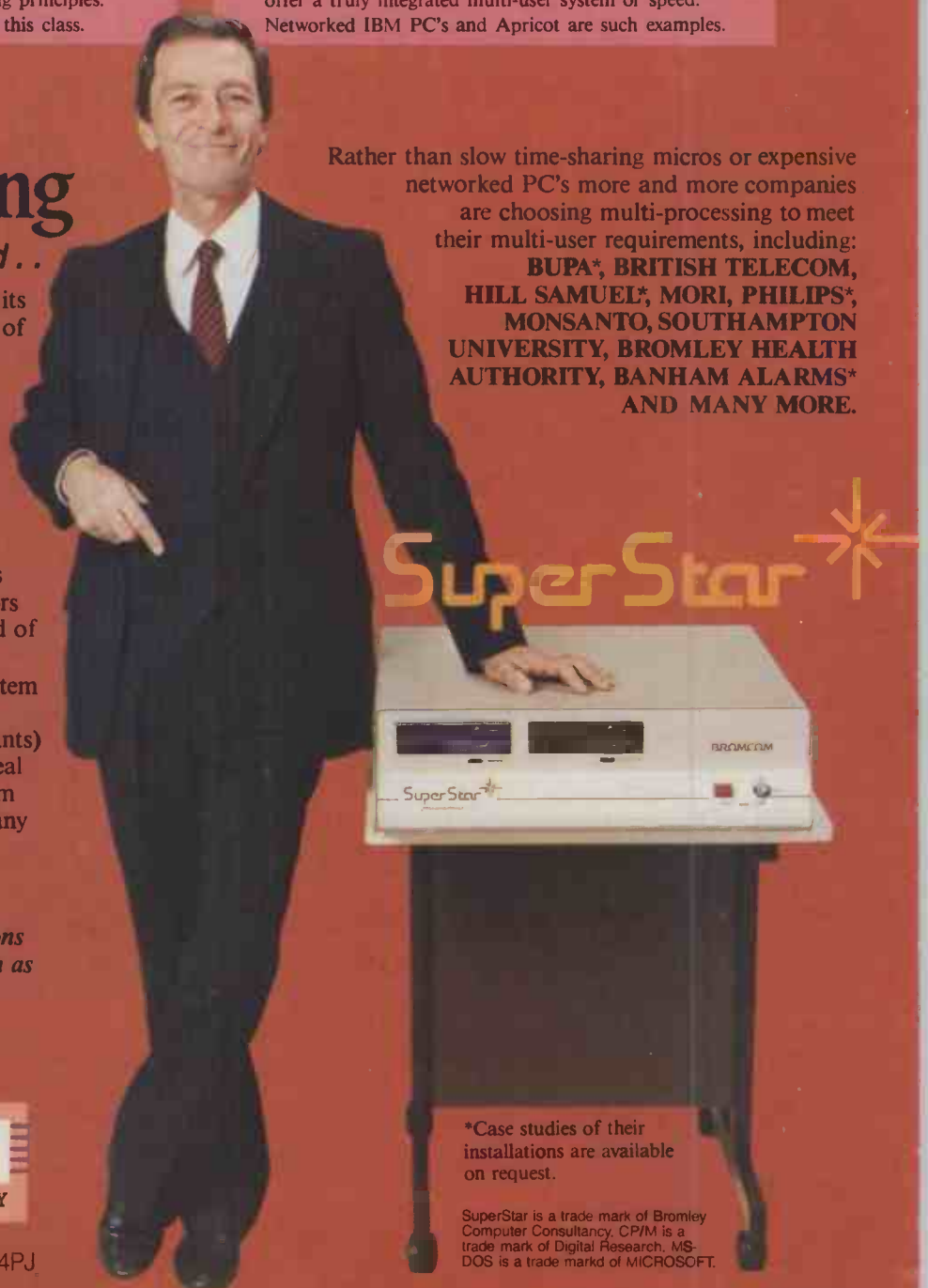

Rather than slow time-sharing micros or expensive networked PC's more and more companies are choosing multi-processing to meet their multi-user requirements, including: **BUPA*, BRITISH TELECOM, HILL SAMUEL*, MORI, PHILIPS*, MONSANTO, SOUTHAMPTON UNIVERSITY, BROMLEY HEALTH AUTHORITY, BANHAM ALARMS* AND MANY MORE.**

*Case studies of their installations are available on request.

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SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system). IMPOS supports CP/M, MS-DOS and shortly Xenix in slave processors in any combination and it is fully upward compatable with ACTION DPC/OS, Televideo MmmOST and TurboDOS.

News: hardware

Tramiel's Atari strikes back

JACK TRAMIEL, the new owner of Atari, recently visited the U.K. He cut the price of the 64K Atari 800XL to £130 — it is $120 in the U.S. — and announced plans to launch several new micros in 1985.

The standard 6502-based 800XL will be revamped again, and become even cheaper to manufacture. A 128K version will be introduced, along with two further new models. One will probably include a built-in disc drive, but all will be compatible with the existing software. First showing will be at the Las Vegas show in January.

A new range of 16-bit micros and peripherals will be introduced at the Hanover trade show in April. They will be based on the Motorola 68000. Prices will be from around £300. Also planned is a 32-bit graphics micro built using the National Semiconductor 32032 chip. The price is expected to be around $1,000.

Tramiel has signed a deal with Digital Research for the Gem software that uses the desk-top metaphor, like the Apple Macintosh. Atari's 1985 business plan is to sell 10 million units and achieve a turnover of $1 billion — less than half the company's sales at its peak. This implies less than $100 per unit, which means most of them will have to be 800s and video-games machines.

Contact Atari Corp., (U.K.) Ltd, Atari House, Railway Terrace, Slough, Berkshire SL2 5BZ. Telephone: (0753) 33344.

Penman plotter-printer

THE PENMAN is claimed to be a plotter, printer, robot, desk-top turtle and mouse. It uses two small powered wheels and a third free wheel housed in a small unit connected to the main control box by a ribbon cable. This in turn is connected to the RS-232 port of a micro.

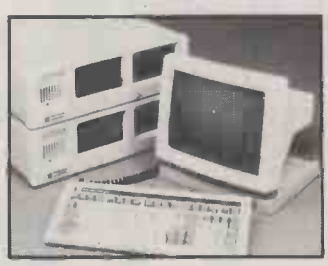
Software in the control box sets the relative speeds of the two wheels. This allows straight lines and circles to be plotted without unsightly zig-zags. There are three pen slots, and pens can be changed in mid-plot.

Penman can be programmed in Logo, and can be linked into business-graphics packages like Lotus 1-2-3. A utility pack for use with the BBC Micro and Apple II incorporates a mouse-driven menu as well as Logo drivers.

The cost of the unit varies from £239 to £299, depending on the machine. Details from Penman on (0903) 209081.

Multi-user Molecular

MOLECULAR COMPUTER LTD is offering an unusual dual-processor multi-user machine that combines two of the newest chips around. The Intel 80286 is used as the main processor, while the 80186 handles I/O functions.



RAM starts at 512K and is expandable up to 1Mbyte. Two serial ports and a parallel port are supplied as standard. A further 11 serial ports can be added to allow 11 more users to be connected.

Disc options range from a standard 10Mbyte Winchester to an optional 120Mbyte. There is also a 5.25in. 800K floppy.

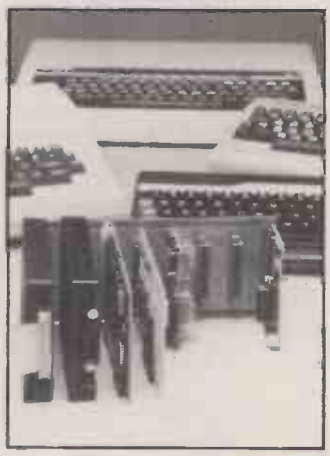
The system is built by Durango and sold in the U.K. by Molecular Computer Ltd for prices starting at about £5,000. Details on (0753) 44113.

Multi-machine interface

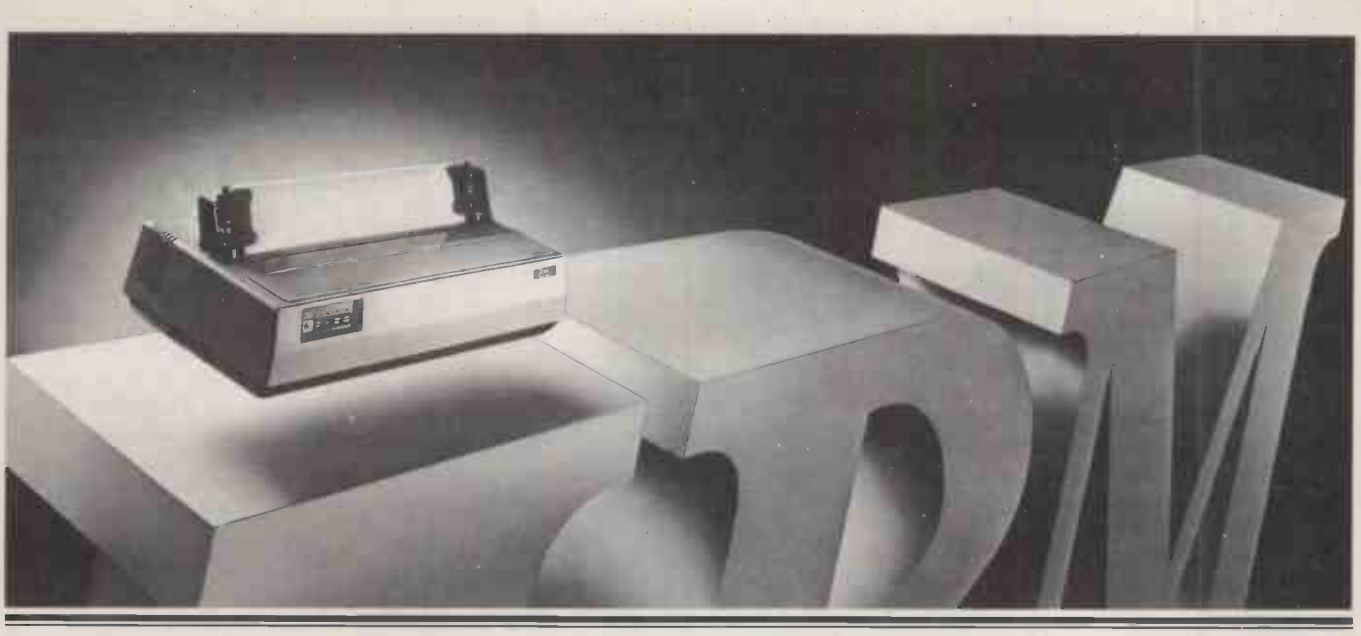
THE WSX Mk 1 is designed to allow peripheral equipment to be used on a range of micros, rather than tied to specific hardware. It does this by adding a so-called "personality module" to the basic expansion unit, which is tailored to a particular machine. The micro can then use any peripherals that work with the unit. Furthermore, if a different module is connected, a different machine can be used.

At present modules are under development for the BBC Micro, Dragon, Tandy Color Computer and Amstrad. Initially peripherals are likely to be in control and education fields, and to be home-grown. The manufacturer, Wessex Microcomputers, hopes that later third-party suppliers will take advantage of the portability.

Prices have not yet been finalised, but will probably work out at about £300 for a system complete with module. More information from Wessex Microcomputers, Bennet's Field Trading Estate, Wincanton, Somerset. Telephone: (0963) 33509.



(more news on page 15)



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MSX cracks

THE FIRST breakaway from the solid front of MSXers has occurred. Toshiba has announced that it is reducing the price of its HX-10 to £239.95, a drop of £40. This places it at the level of the Korean Goldstar machine that has hitherto undercut the Japanese models by £30 to £40. Details on (0276) 62222.

Meanwhile, Panasonic has launched its CF-2700. This has

64K RAM and everything that you would expect an MSX machine to have. Its price stays firmly in the upper regions at £311.50 including VAT. More on (0753) 34522.

The Philips MSX machine, so far the only European variant in the family, has also appeared. It is made in France, has 48K RAM, and an optional 3.5in. floppy. No price has been announced for the U.K.

BT's Tonto

BRITISH TELECOM's Merlin division has announced that it is selling a repackaging of ICL's One Per Desk — which itself is a QL in a box with extra goodies like a telephone bolted on. For some reason best known to itself, Merlin has dubbed the unit Tonto, which happens to be Spanish for "stupid".

The unit offers slightly more in the way of data communications than the straight OPD. Thus it offers a standard

RS-423 interface with VT-100 emulation, which allows Tonto to be connected to a local mainframe or LAN. As with the ICL system, the whole idea is spoilt by the Microdrives, which are far too slow and have yet to be proved reliable enough for business purposes. It will be interesting to see what happens when the much rumoured new version of the Sinclair QL with a microfloppy appears.

The basic unit costs £1,245, and a version with Psion's Xchange bundled software costs £1,375. More information can be obtained by dialling 100 and asking for Freephone Merlin.

DEC Professional 380

THE PROFESSIONAL 380 is designed to be the top-of-the-range machine of the 300 series. It is virtually a desk-top implementation of DEC's 16-bit mini, the PDP-11/70.

It offers up to 1Mbyte of RAM, a 10Mbyte Winchester as standard, upgradable to 33Mbyte, and a range of operating systems including MS-DOS, CP/M-80, UCSD p-system and P/OS.

A new high-resolution display offers twice the vertical

resolution of other members of the 300 series, and there is four-page bit-map storage. Up to eight colours can be viewed simultaneously.

Prices start from around £7,500. The 33Mbyte Winchester costs about £3,500. Details on (0734) 868711.

BBC mouse

AMX has introduced a mouse for the BBC. A ROM chip contains machine code for creating on-screen windows, icons and pointers. The 64

icons can be supplemented by using an icon-designer program.

The AMX mouse can be used with any BBC Micro fitted with version 1.2 or later of the operating system, and is compatible with the second-processor and disc-filing systems. It plugs into the user port underneath the computer.

The mouse comes with an art program with various Mac-paint-like facilities. Second processors need to be switched off to run this software. The hardware and software together cost £89.95 including VAT. More information on (0925) 62907.

Battle of the year carries on

A CHALLENGER has emerged to TDI's claim to be the hottest micro under the sun. Last month's review showed that running under the p-system the Pinnacle outperformed all previously Benchmarked micros.

Now Jarogate has claimed that its 80286-based Sprite, described in last month's *Practical Computing*, is even faster. In tests at November's Compec show, the Sprite took on the Pinnacle and won. However, TDI points out that the Sprite was unable to run the original test. The modified test was also run on different versions of Cobol, which TDI claims gave the Sprite an advantage.

So the battle still rages. It is hoped to stage a rematch sometime this year. Watch this space.

Hardware shorts

- The Advance 86B has been reduced from £1,250 to £1,086, both prices excluding VAT. An additional 128K RAM costs £70. The Advance is distributed by W H Smith and Ferranti; Ferranti is currently setting up a dealer network. More on 061-428 0771.
- Servicon has launched a range of 3in. discs for the BBC Micro. The 500K 40/80-track unit costs £129.95, and £199 for a double-headed version. Details from (0242) 528213.
- Acorn is scaling down its operations in the U.S. by about 80 percent. This follows disappointing sales of the BBC Micro there. The partial withdrawal is expected to cost the company about £5 million.
- A 6502 second processor unit for the BBC Micro costs £199 plus £79 for interface and cable from CMS on (0223) 324141.
- Sharp has produced a 360K 3.5in. floppy for the PC-5000 portable computer. Cost is £449. More from 061-205 2333.
- Up to six screens can be linked to a micro with KGB's display multiplexer. Prices range from about £300 to £500 depending on the cable runs required. More information on Windsor 50111.
- The Panda 20/64 allows Commodore 64 programs to be saved or loaded from most ordinary domestic cassette recorders. The cost is £17.99, and details are on (0733) 233600.
- Disc-drive manufacturer Shugart has announced that it has produced an optical mouse — that is, one without moving parts. It is available now to OEMs, and should filter through to the end-user in due course.
- Alpha Micros has access to Telecom Gold through the communications package Dialog — not to be confused with the on-line information service of the same name. The cost is £550. More on (0753) 821922.

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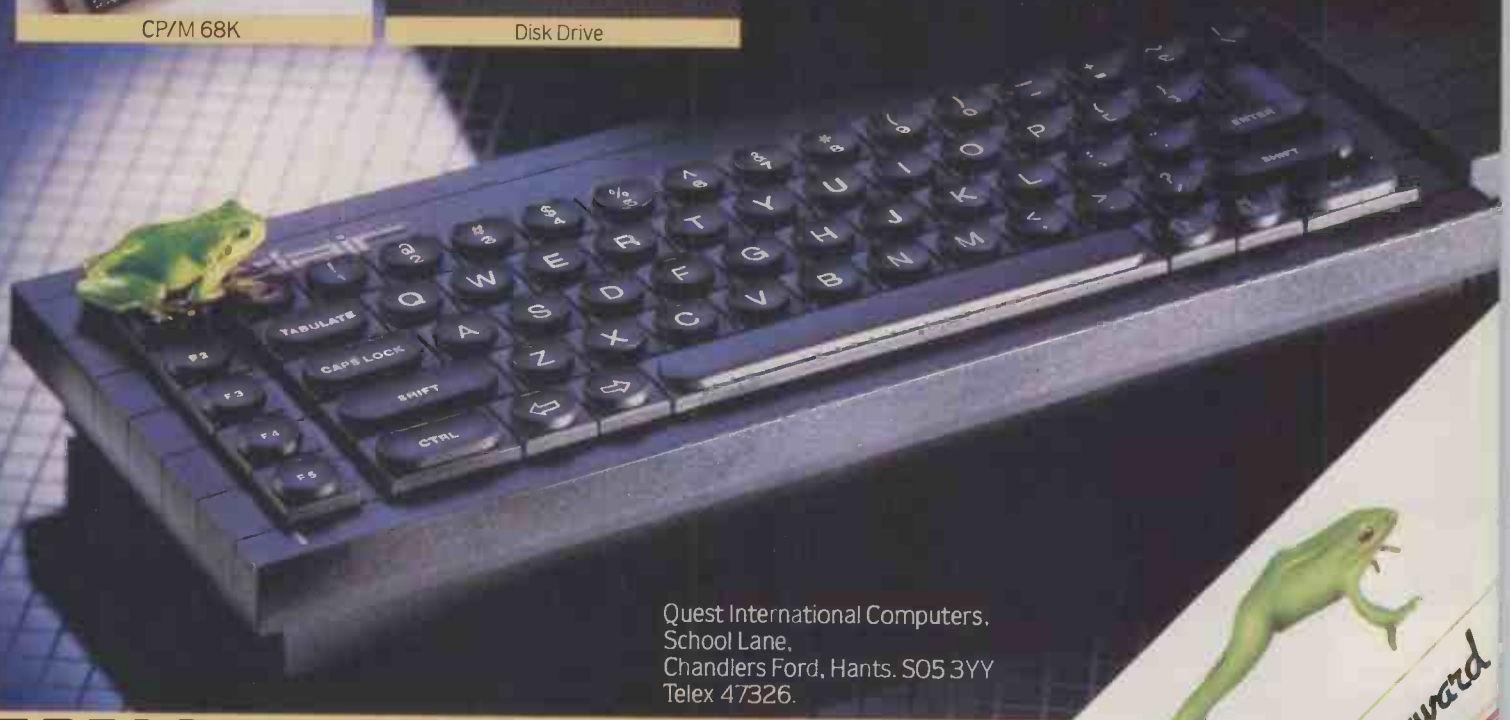

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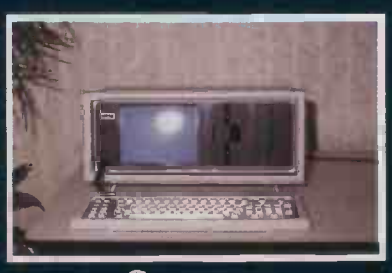

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20

MICROWARE

Canon's A-200 IBMulator

CANON'S new A-200 micro is an IBM-compatible that uses the full 16-bit 8086. It comes with 256K of RAM, two 360K floppy-disc drives and monochrome screen for £1,875 plus VAT — which is quite competitive as it includes graphics and an RS-232C port. A colour monitor is also available.

As you would expect from Canon the A-200 looks smart and well made. But it's still hard to see it as more than just one more desk-top IBMulator. Contact Canon on 01-773 3173.

More compatibles

ABM, a British company, is launching a range of five 8088-based IBM look-alikes, including three transportables and a leather-covered desk-top model. Prices are aggressive, being from £1,295 to £2,195 for machines built in the U.K.

The Director model has 256K of RAM, graphics, a colour monitor and two 320K discs for £1,995. One of the transportables, The Commando, is ruggedised.

Contact Ash Row Electronics, Holder Road, Aldershot, Hampshire GU12 4RH. Telephone: (0252) 315475.

Tandy is showing the Model 1000 — claimed to be a complete IBM clone — at the Which Computer? show. Telephone: (0922) 648181.

Ceedata is importing the Copam 8088-based IBM-compatible micro made in Taiwan. Prices start at £2,100 for a twin-floppy version with 256K of RAM, colour-graphics facility and monochrome screen. Telephone: 01-783 0502.

Coquin Software is importing the Sam-2001 look-alike — origin unknown, but probably Taiwan. Telephone: 01-646 3493.

PC Paintbrush

IF YOU FANCY an Apple Macintosh but have got an IBM PC then what you need is PC Paintbrush. This mouse-driven drawing program offers a selection of icons and pull-down menus just like the Mac, but can handle colour too. Obviously you need a graphics adaptor. The maximum resolution is 720 by 704 pixels. If you haven't got a mouse, the program also works with a joystick.

PC Paintbrush comes from IMSI in San Rafael, California — the company responsible for the excellent 4-Point Graphics program. It costs £119 plus VAT from Pete & Pam, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

Wyse enters PC market

OVER THE LAST YEAR, Wyse has made a name for itself in the U.K. with its excellent terminals, and many are attached to British multi-user micros. Now Wyse has launched the WysePC range of IBM PC- and XT-compatible personal computers, which are being manufactured by the Wyse Taiwan subsidiary. Like the terminals, most Wyse PCs will be sold on an OEM basis to other companies for resale to end-users.

Contact Wyse Technology, 3040 North First Street, San Jose, California 95134, U.S.A. Telephone: (U.S. area code 408) 946-3705.

Oli-mouse

OLIVETTI can now supply a mouse for its M-24 micro. It plugs directly into the keyboard, and duplicates the cursor-control keys. This means the mouse does not require any extra software and works with most standard IBM packages. Also, the mouse uses neither an expansion slot nor an RS-232C port. However, it does cost £147, which hardly squeaks into the cheap category.

Olivetti has also launched versions of the M-24 with quadruple-density disc drives, which takes the capacity to 720K per disc.

Contact British Olivetti Ltd, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Software shorts

- Control Data has announced an IBM PC version of its Plato computer-based training system. It includes software and an add-on board to double the IBM's graphics resolution. Telephone: 01-240 3400.
- Topic, run by the Stock Exchange, is one of the world's largest private viewdata systems. It can now be accessed using an IBM PC. Telephone: 01-588 2355.
- IBM has launched Arabic versions of the PC and PC/XT. Contact your local IBM dealer.
- Chartstar is a new graphics program from Micropro. It will read and graph data from Infostar. Calcstar, Planstar and many other packages, and it costs £325. Telephone: 01-879 1122.
- PC Mailbox is an electronic-mail package for the IBM PC, designed to work with Geisco's Quik-Comm Email system. Telephone: 01-546 1077.
- Macscope-T is claimed to be the first "truly user-friendly" package for linear and integer programming on an IBM PC. It will handle up to 200 variables and up to 100 constraints, and comes with a tutorial disc. The price is $75 — or less to academic institutions. Management Analytic Support Inc., 6826 McLean, Va 22101, U.S.A. Telephone: (U.S. area code 202) 293-1624.

Deskpro range enhanced

COMPAQ has already added some bells and whistles to its new Deskpro range of IBM compatibles. These are a 30Mbyte hard disc, and a second 10Mbyte disc for the models 3 and 4. An Intel 8087-2 maths co-processor can also be installed. Finally, Compaq has announced the availability of PC Xenix, the Unix operating system from Logica.

(continued on page 23)

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EPSON

(continued from page 21)

Contact Compaq Computer Ltd, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860.

Email manager

ELECTRONIC MAIL can be tedious if you have to stop what you are doing to load the comms software, phone Telecom Gold and log on manually to read your mail. Braid's Mail Manager provides a solution, because it collects your mail automatically, and does it in background mode.

The Mail Manager is menu-driven and can be used for internal as well as public message systems. The package price is £875, which includes software, documentation, all cables, autodial/auto-answer modem and registration on Telecom Gold, EasyLink and One to One. The software is available separately for £550.

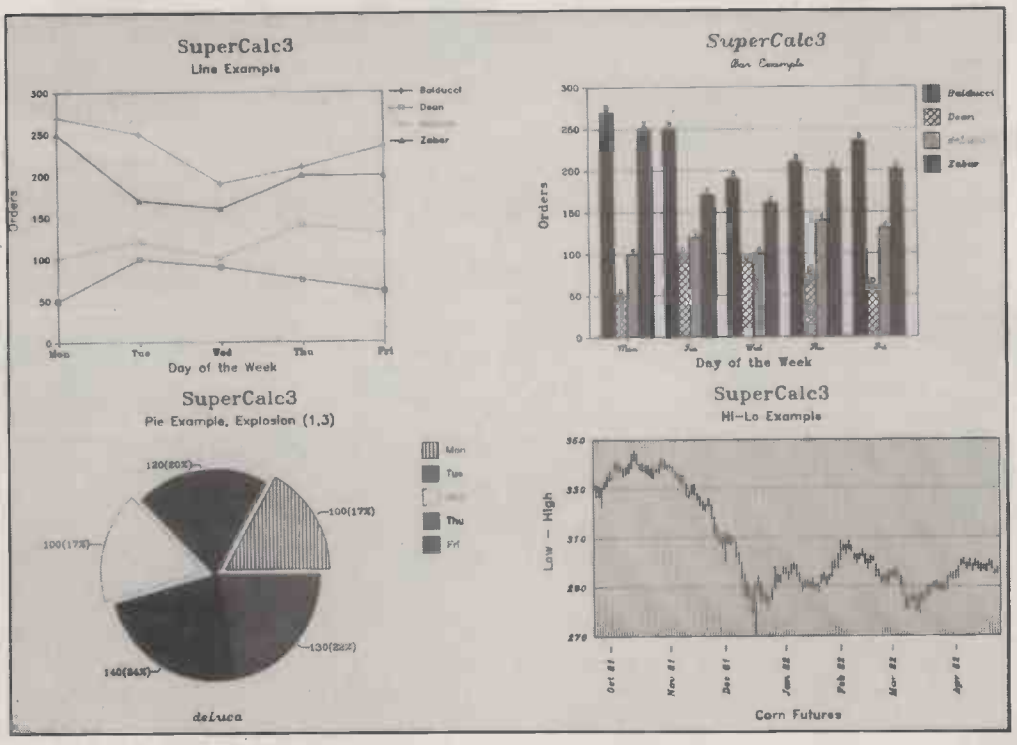
Contact Braid Systems, 130 Buckingham Palace Road, London SW1W 9SA. Telephone: 01-730 0736.

Victor Technologies returns

AT THE END of 1984 ACT relinquished the distributorship of the ACT Sirius, with which it had been so successful. Victor Technologies, the manufacturer, is opening a U.K. subsidiary office to take over.

Victor will be distributing three products: the Victor Sirius 1, the Vicki portable and the Plus PC. The Vicki is a 25lb. transportable version of the Sirius with a built-in 9in. monochrome screen. The price with 256K of RAM is £2,495 plus VAT.

The Plus PC is an add-on which provides a Sirius 1 with IBM PC compatibility, dual-format disc drives and the facility to switch between Sirius and IBM modes. The price is £1,125 plus VAT. Victor Technologies can be contacted via Taylor Rea Associates on 01-222 2883.



Supercalc 3

SORCIM'S new version 2 of Supercalc 3 has enough extras to claim it offers more than Lotus 1-2-3. For example, it can now handle up to 9,999 rows, do iterations automatically, and is hard-disc compatible and supports PC-DOS file paths. It now includes the best-selling Sideways program, too, for turning wide spreadsheets through 90 degrees on the printer.

The established Supercalc 3 selling point — that unlike Lotus 1-2-3, it does graphics on the standard IBM screen — has of course been retained. And at £295 it is £80 cheaper than Lotus.

For further information contact Sorcim/IUS, 10 Station Road, Watford, Hertfordshire WD1 1EG. Telephone: (0923) 46255.

Colour cards

NOW there are three more IBM-compatible alternatives to the IBM Colour/Graphics Monitor Adaptor, with the launch of boards from Hercules, Comway and Persyst.

● Hercules became rich and famous by offering a single card to display both text and graphics on the IBM's monochrome screen, where IBM offered a separate graphics card which meant buying a colour monitor to do the same job. The Hercules colour card replaces the IBM graphics adaptor and offers the same facilities plus a parallel printer interface, light-pen port and RF modulator . . . but it's about half the price. The Hercules Colour Card costs only £220 plus VAT. Contact Pete & Pam, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

● The Comtronics board offers the same facilities as the Hercules card but with enhanced colour capabilities. That is, it will display 640 by 200 resolution in four colours instead of two, and 16 colours at 320 by 200, instead of the four available with the Hercules board. It costs £395. Contact Ferrari Software, Ferrari House, Station Road, Egham, Surrey TW20 9LB. Telephone: (0784) 38811.

● The Persyst board offers a high-resolution 10- by 16-character cell, instead of the eight by eight cell of the Hercules card. It supports 800- by 400-pixel resolution in the alphanumeric mode. This provides a high-resolution text image, claimed to be superior to the IBM monochrome display adaptor even in colour. It runs Lotus 1-2-3, and doesn't flicker either! The board is called Bob, for "best of both" worlds. It costs £395 plus VAT. Contact Micro Technology, 51 The Pantiles, Tunbridge Wells, Kent TN2 5TE. Telephone: (0892) 45433.

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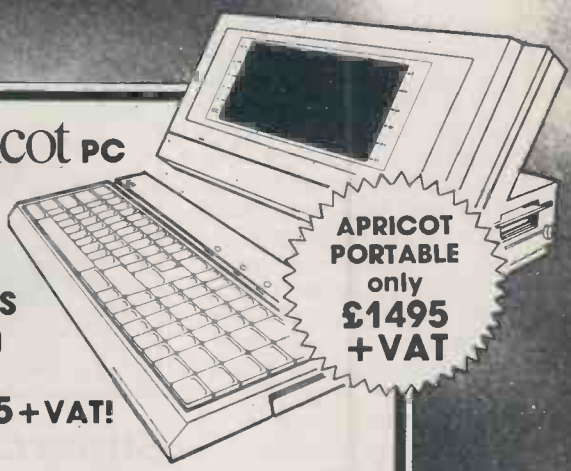

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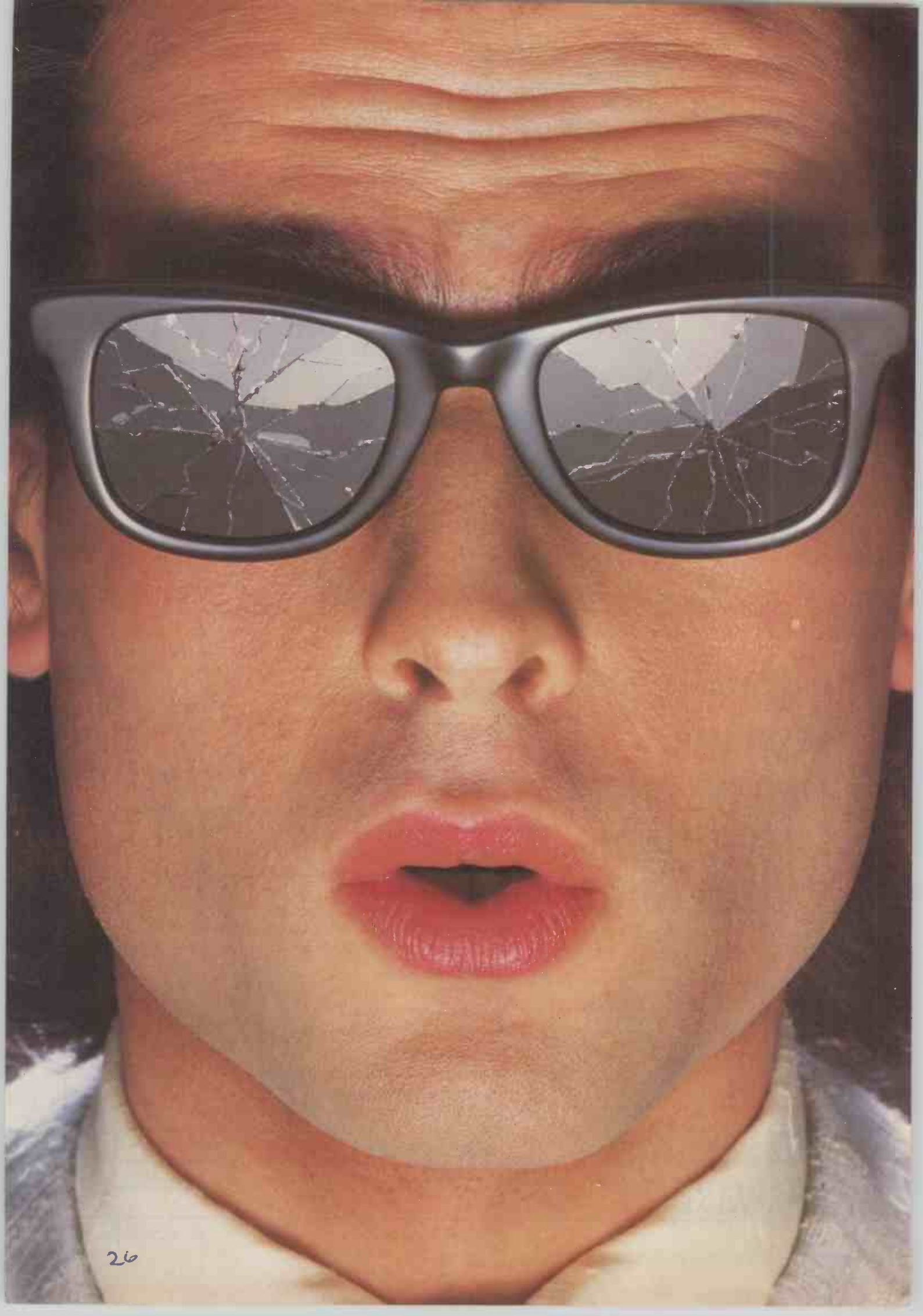

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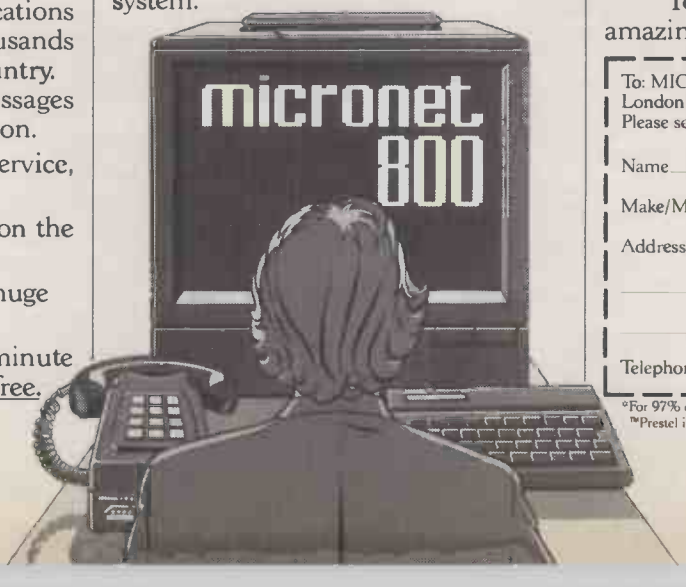

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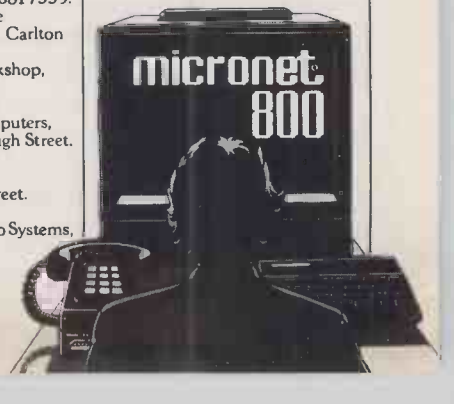
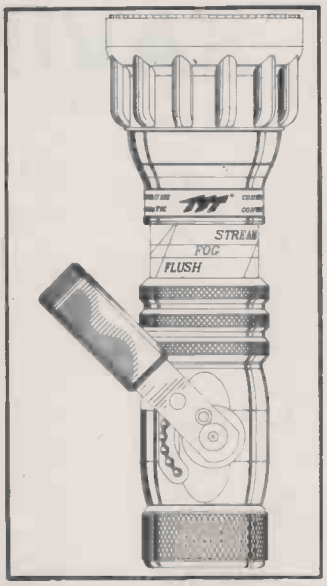


Autocad upgrade

A NEW much faster version of the prize-winning Autocad drafting and drawing program is now available for the Apricot, IBM and other MS-DOS machines. The previous version of Autocad was voted 1984's scientific/technical program of the year in the Computer of the Year awards sponsored by *Practical Computing* and Germany's *Chip* magazine.

The new version costs from £800 and has other enhancements apart from the speed gain, including the ability to link to dBase II and III. Existing users can upgrade for £200. Details from KGB Micros Ltd. Telephone: Windsor 50111.



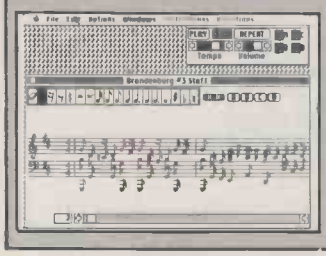
Month of the Mac

SOFTWARE for the Apple Macintosh is arriving thick and fast now. Titles include a mixture of established packages converted for the machine and completely original programs it would be difficult to imagine running on anything other than the Mac.

TK!Solver is in the first category — this equation solving tool is well known

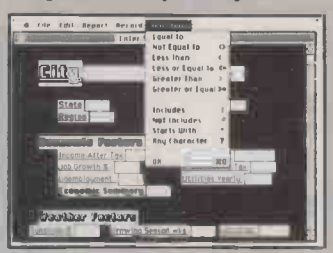
on the IBM PC and Apple II machines. The Mac version costs around £190 plus VAT from P&P or Softsel.

Musicworks is one of three packages from da Vinci software it would be difficult to imagine running on anything but a Mac. Musicwork lets you compose music on screen, which you can output through the Mac's speaker or headphone socket if you like and, most importantly, you can print realistic-looking music. The price is £70 from Softsel.



Interiors and **Landscapes** are the other da Vinci packages. Both are simply files of images which work with Macpaint. Interiors, probably the more useful, is for designing room and house layouts, but the Landscapes images are more beautiful. Landscapes and Interiors cost £42.75 each from Softsel.

DB Master from Stoneware is well known to many Apple II users as a simple record-keeping database. The Mac version does not differ much from the original concept except in



the externals common to virtually all Mac programs — flashy graphics on-screen, a variety of printer type founts, mice, icons and pull-down menus. Softsel is bringing it in for £162.20.

Macproject, a project scheduling and costing package, has been announced by Apple itself. As well as letting you analyse critical paths and keep track of project costs, Macproject also lets you transfer costing data to Multiplan for more detailed analysis. The price is £99 from any Apple dealer.

Hippo C is an interactive version of the increasingly popular C high-level systems programming language. Like Mac-Pascal, this compiler has many of the virtues of an interpreter in that it is

easy to edit and run programs. In debugging mode you can actually see results output in one window while viewing the code in another. No U.K. price is available yet on this product but P & P hopes to bring it in.

Suppliers: P & P Micro Distributors Ltd, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

Softsel Computer Products Ltd, Softsel House, Central Way, North Feltham Trading Estate, Feltham, Middlesex TW14 0XQ. Telephone: 01-844 2040.

Go problem cracked

VERSIONS of go, the Japanese strategy board game, are now available for the BBC, Electron and Commodore 64. Go is much more difficult to program than chess and has been seen as the ultimate programming challenge.

Microgo 1 from Edge Computers is available on cassette for all three of these machines, price £9.95. Spectrum and MSX versions are promised shortly. Play takes place on a nine by nine board. The full-size traditional go board is 19 by 19, but smaller ones are often employed for quicker games.

Acornsoft Go costs £9.95 on cassette or £12.95 on 40/80-track disc. It plays on a 13 by 13 board and is slightly the stronger of the two until you get used to it, when Microgo's greater strategic grasp and more variable human way of playing begins to pay off. Both programs play at good beginner level and are an ideal introduction to the game of go.

Contact Edge Computers Ltd, 3 Junction Road, Reading, Berkshire RG1 5SA; telephone (0734) 65852. Acornsoft Ltd, Betjeman House, 104 Hills Road, Cambridge CB2 1LQ; telephone (0223) 316039.

Software Arts

THE PHONE NUMBER of Software Arts, the company responsible for developing both TK!Solver and VisiCalc, was printed wrongly on page 24 of our January issue. It should be Ipswich (0473) 221551.

Micro courses

THE Microsystems Training Directory is a monthly listing of training courses and self-instruction packages — 1,353 in the last issue. It is published by the National Computing Centre, price £25 per issue. Contact: NCC, Oxford Road, Manchester M1 7ED. Telephone: 061-228 6333.

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ASK PC

Q On the strength of articles I have read on the Advance 86 I ordered an 86A, which was delivered without any instructions or documentation. *Practical Computing's* review states 128K RAM as standard, with colour and graphics built in, but I have not been able to demonstrate either. I have also written to Microsoft because some arithmetic has bugs. Try:

```
I# = 2^53 + 1234567
PRINT I#
```

and

```
II#.= 2^53
PRINT I#
```

Although I# has enough precision to exactly represent integers with values around 2^53, the term 1234567 is ignored.

J M Hughes

A The machine really does hold 128K RAM as stated. The architecture of the 8088 processor in the IBM PC and the 8086 processor in the Advance can only address 64K of memory in one bank, so the maximum possible Basic workspace would be 64K. Slightly less is actually available, and it is reported as 62,570 bytes. The remaining memory is used for the operating system.

My Advance 86B has 256K of RAM, but disc Basica only gives 61K free. Some of the remaining memory is used for the operating system, and if you are clever you can use the rest for a print spool buffer, a cache memory or a silicon disc.

I have had no difficulty with colour using a Microvitec medium-resolution RGB monitor. Friends tell me that ordinary colour TVs such as the Sony 14in. portable work extremely well but that some of the more expensive colour sets seem to give trouble.

The behaviour you have experienced with Microsoft Basica is not a bug. The # after the I in your examples declares it as double precision, or 16 significant figures. However, you are performing a line of mixed-mode arithmetic, in that you have both single-precision and double-precision terms on the same line.

The term 2^53 is worked out in single precision, or seven significant figures. This answer is a large number, approximately 9E+15, so only the seven most significant figures are kept. To this answer is added the relatively small number 1,234,567, again in single precision. This number is too small to change the seven most significant figures retained from the first sum.

Having kept seven significant figures, you store the answer in I#, a double precision term. With mixed-mode arithmetic, each part of the calculation is carried out using the highest precision of the two numbers involved. Thus you would get the accurate answer by either

```
I# = 2^53#
PRINT I#
PRINT I# + 1234567
```

or

```
PRINT 2# ^53# + 1234567#
```

Both give the expected answer of 9,007,199,255,975,559, which is indeed 1,234,567 larger than the answer from 2^53.

You must always be careful when combining numbers of different types. People who learned to program in Fortran are more familiar with the problems of mixed-mode arithmetic, because all versions of Fortran have integers, reals and double-precision reals. In many floating-point versions of Basic, there are only real numbers, and problems with mixed-mode arithmetic cannot occur.

Another occasion when difficulties can occur with mixed-mode arithmetic is in integer division. In the following in Basic and Fortran I and J have have been declared as an integers, while R is a real by default.

Basic	Fortran
10 DEFINT I,J	INTEGER I,J
20 I = 3	I = 3
30 J = 2	J = 2
40 R = I/J	R = I/J
50 PRINT R	PRINT *,R
1.5	1.0

Both the programs set the integer variables I and J to 3 and 2 respectively, then divide I by J and assign the value to the real R. In the Fortran program

I/J = 3/2 = 1

since both the variables are integers, and so the real R is assigned the value 1.0. By contrast, in Basic the division operator / always means real division, so 3/2 is calculated as a real and equals 1.5, so R is set to 1.5.

If you want to make Microsoft Basic perform integer division you must use the integer division operator which is a backslash rather than the usual division operator which is a slash /. If line 40 read

```
40 R = I \ J
```

the answer would be given as 1.0.

The rule in Basic is that each step in the calculation is performed with the highest precision found in either the two operands or in the operator. In Fortran the calculation is performed with the highest precision found in either of the operators.

CP/M on Tandy

Q I have a TRS-80 model III and would like advice on the problems and feasibility of upgrading it to use CP/M.

F Stokes

A The TRS-80 model III has a Z-80 cpu running at 2.5MHz, its own operating system TRS-DOS, and a 64-character by 16-line screen display. It has now been replaced by the model 4, which has an 80-character by 25-line screen and a Z-80A cpu running at 4MHz, and can either run its own operating system TRS-DOS version 6.1 or CP/M version 3.0. The model III normally has 48K memory, and the model 4 has 64K or 128K.

The problem boils down to upgrading the model III to the model 4 at minimum cost. The main problems are

1. The memory maps of model III and model 4 differ significantly. The model III uses the first 14K of memory for ROM. On the model 4 CP/M expects to use the space below 100hex for a jump table, and the memory beyond this is used as normal working space for the transient program area. The conflict is resolved by a hardware modification to the model III. Given a suitable kit, this is straightforward. Remove the case, the heat shield over the cpu board, and then the Z-80 cpu chip. An extra circuit board is plugged in to the empty Z-80 socket, and the Z-80 is plugged in to a socket on the new board.
2. Additional memory — usually 16K, but optionally a further 64K as well — is located on the new board. A chip which contains the memory addresses may need changing, or in some cases it is removed and a plug to the new board inserted in the empty socket.
3. The model III keyboard lacks keys for some of the ASCII characters such as a Control key and brackets. The CP/M modifications must reconfigure the keyboard to give them.
4. New circuitry is required, on the new board, to produce an 80 by 24 screen display instead of the old 64 by 16 display.

The best but most expensive solution is to buy a model III to model 4 upgrade kit from your nearest Tandy shop. It costs £499 including VAT, and comprises a new board with a 4MHz cpu, an additional 16K memory, a new operating system TRS-DOS 6.1 as on the model 4 and an 80 by 24 display.

Version 3.0 of CP/M supports the use of more than 64K of memory and costs £79.95. An additional 64K costing £99.95 may be used as a cache buffer, a silicon disc or a print spool buffer.

Ariolasoft's chart busters

ARIOLASOFT has put together a superb range of American games for the Commodore 64, has slashed the prices, and is distributing them in volume to British dealers.

The games are drawn from Electronic Arts, which is like America's Ultimate Play the Game, and Broderbund. Titles include Broderbund's Choplifter, Lode Runner, David's Midnight Magic and the sequel to Choplifter, Raid on Bungeling Bay. From Electronic Arts comes Archon, Mule, the basketball simulation One on One, the platform game Hard Hat Mack, Murder on the Zinderneuf and Realm of Impossibility.

The presentation, packaging and marketing of the new range is excellent, if slightly naughty in places. For example, Choplifter is presented as a "Commodore 64 U.S. No. 1 Hit", though it was a hit on the Apple and Atari micros before the Commodore 64 was even invented. In fact, a Vic-20 version appeared some time ago too.

Choplifter fans will be pleased to hear that the 64 conversion offers more legible tanks than any of the others, though the little men you rescue are not quite as well defined.

When you buy a program it comes with a voucher which provides entry to a monthly prize draw. Collect several vouchers and you can get discounts off peripherals: 10 vouchers earn a £50 reduction on a 1541 disc drive.

The range includes standard games costing £9.95 on cassette and £12.95 on disc, plus deluxe games, including Archon and Mule, which cost £11.95 on cassette and £14.95. This is roughly half the current prices for imports of these titles for the Apple and Atari micros.

Ariolasoft is looking to offer programs for other machines, if the Commodore 64 versions are successful. This should include the Atari ones, and possibly Spectrum conversions, with the Amstrad a possibility for the future. However, Apple owners will probably lose out.

Raid on Bungeling Bay (top) and One on One.

Commodore 64 shorts

- Castle of Terror is a new adventure game from Melbourne House. Phone 01-940 6064.
- All six Level 9 adventures are now available on disc for the 64, as well as the BBC. Phone (0494) 26871.
- BMX fanatics will love the new PSS game Hyper Kiker, described as "the most realistic and exciting simulation of BMX riding you can get" by the U.K.'s number one rider Craig Schofield. It costs £7.95 on cassette. Phone (0203) 667556.
- Psion has launched the excellent tennis simulation Match Point for the 64. It costs £7.95 on tape. Phone 01-723 9408.
- Durrell has brought out a 64 version of its helicopter battle simulation Combat Lynx, which uses joysticks making it easier to play than the Spectrum original. A BBC conversion is on the way. Phone (0823) 54489.
- A German student from Heidelberg University has written a "full blooded" graphics adventure on Tristan and Isolde. CRL is marketing the English translation for £8.95, but for musical accompaniment you have to buy your own Wagner records. Phone 01-533 2918.

Psion's QL Chess

PSION has finally launched its three-dimensional chess program on Microdrive for the Sinclair QL. The three-dimensional graphics are absolutely superb, and the program plays an excellent game of chess. It thumps White Knight II on the BBC — no slouch itself — in about a fifth of the time.

In terms of graphics, ease of use and playing strength, this could well be the best chess program now on the market. It must be an essential buy for all QL owners.

Apricot Adventure

QUEST — THE ADVENTURE is an adventure game from Quest International that requires an ACT Apricot with at least 128K of RAM. The theme is pirates and desert islands, and the ultimate aim is to plunder Bluebeard's treasure. Operation is by 17 single keystrokes. The game costs £29.95 including VAT, and to buy it you have to phone (04215) 66488.

Century's bigger things

IF SOFTWARE is judged by the size of the box it comes in, then Century Software should do well with its two latest offerings, each of which includes a full-length fantasy novel.

The Horse Lord is an arcade game by the author of Snapper. It is on cassette for the BBC Micro and comes with a 254-page novel of the same name written by Peter Morwood. It costs £12.95.

Legend comes on cassette for the Sinclair Spectrum and comes with a map, a booklet and a 384-page novel by David Gemmell. The game itself is claimed to have 150K of text in Part 1, which is an adventure; Part 2 is a war game.

CAD/CAM Warrior

TASKSET'S new Commodore 64 game has an original scenario in using CAD/CAM ideas, but the game itself is an arcade/adventure. Its novelty element is that the screen shows both the top and bottom of a plate, and you can pop through the holes from one to the other.

The game has 8,192 screens, and costs £9.95 on cassette and £12.95 on disc.

Spiderman

IF YOU HAVE completed The Hulk, you can move on to Spiderman, the second in the series of comic-book adventures from Adventure International. It is available on tape for the Spectrum, Commodore 64, Atari, BBC and Electron, but only the first two machines have the graphics.

Spiderman also features a new full-sentence interpreter — a first for a game by Scott Adams.

Space Shuttle

ACTIVISION has released Space Shuttle on tape for the Spectrum and Commodore 64. This simulator comes with a 32-page colour Flight Manual containing many interesting and authentic details.

The Spectrum version costs £7.99 and the Commodore version £9.99.

Another Space Shuttle simulator is already available from Microdeal for the Dragon and BBC Micro.

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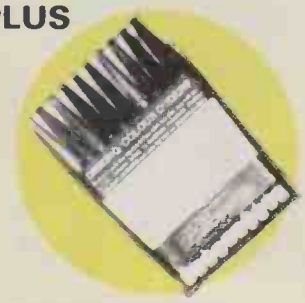

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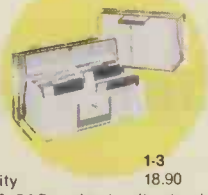

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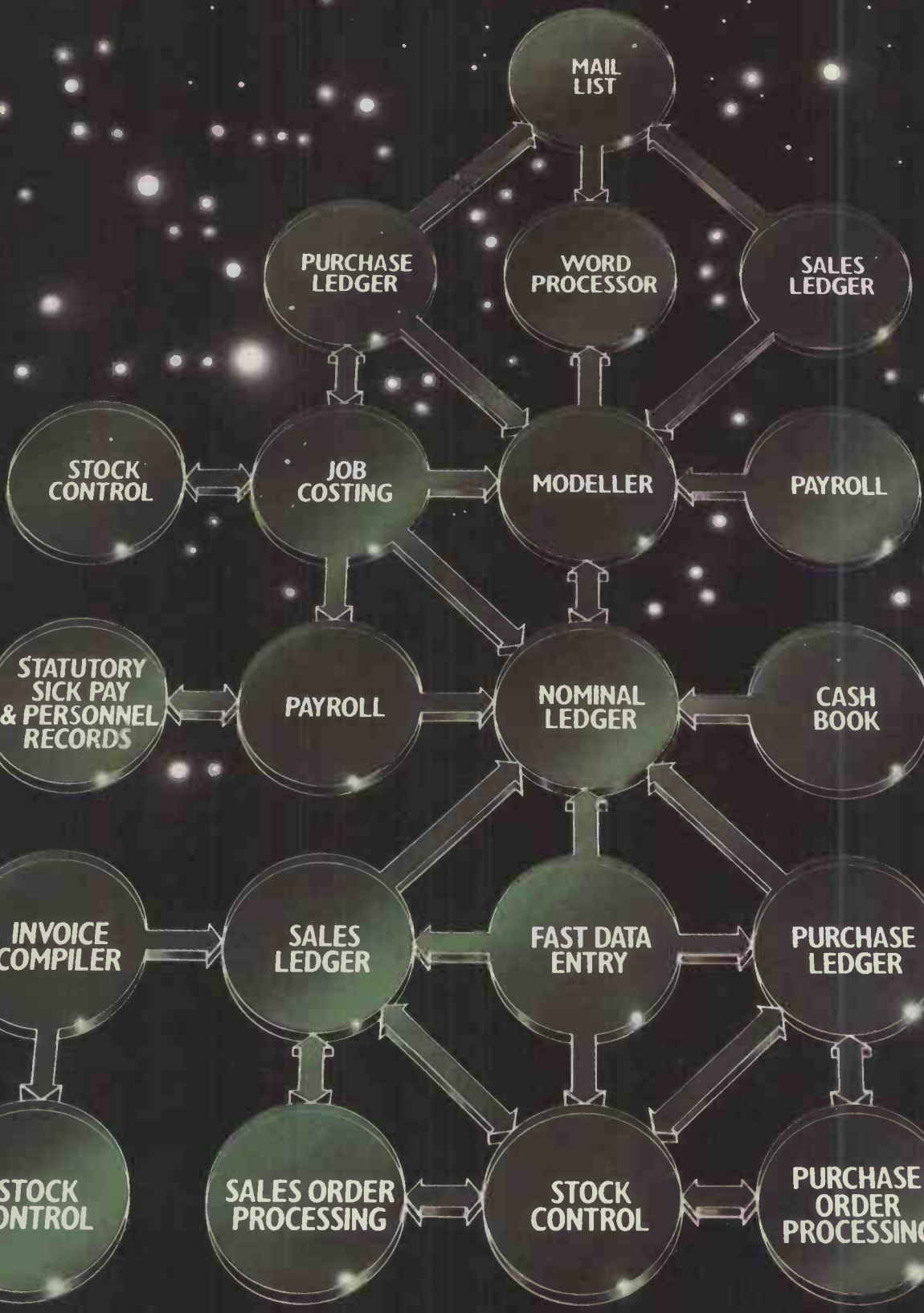

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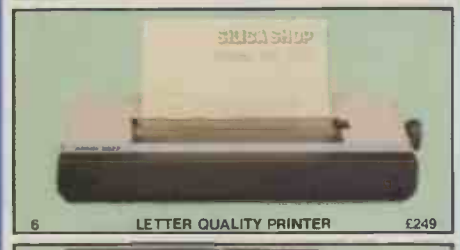
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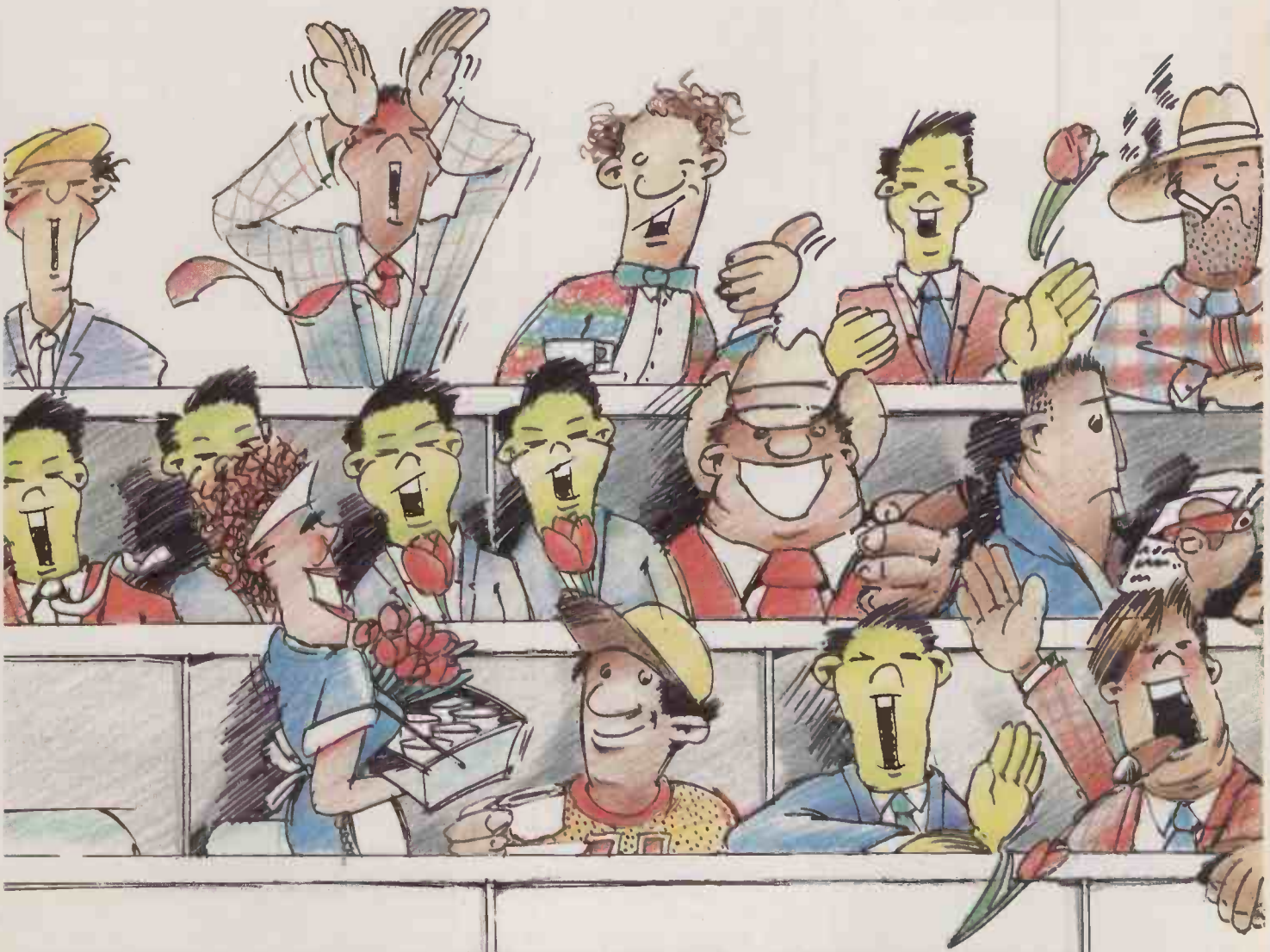

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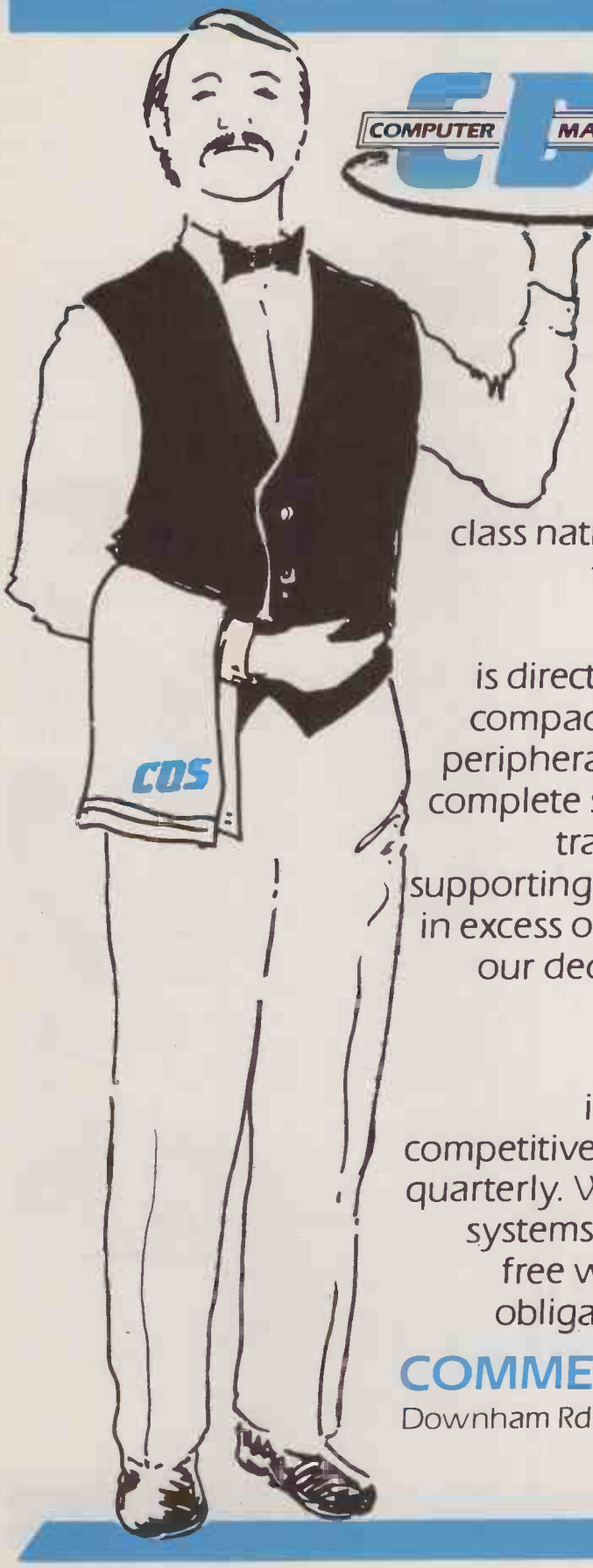

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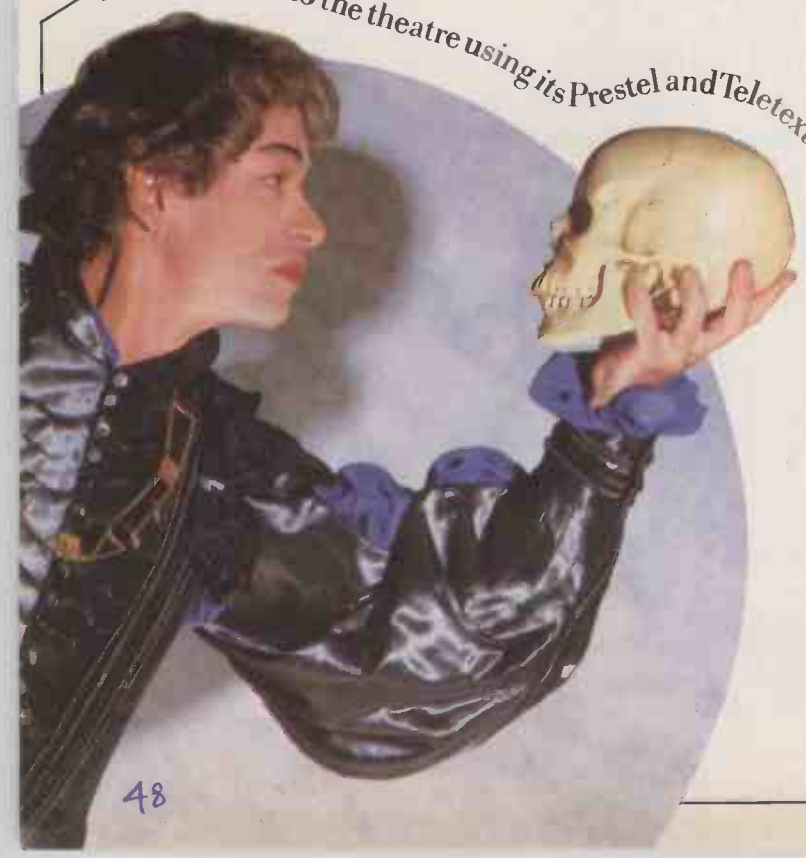

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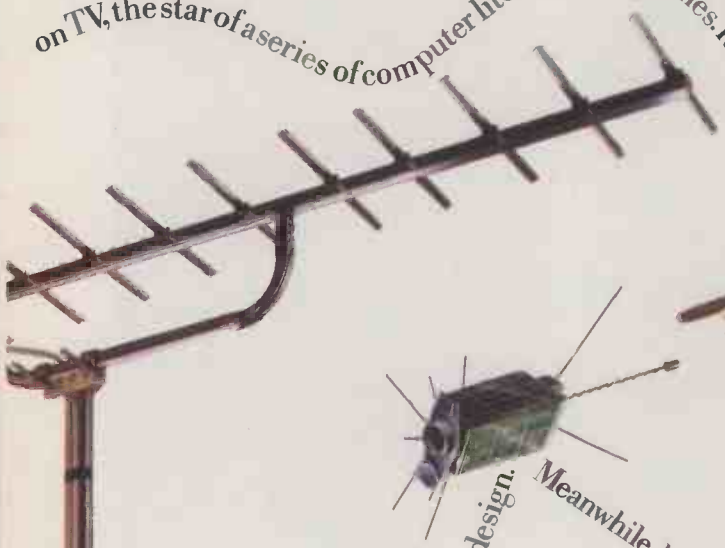

working in space, tracking a satellite it also helped design. Meanwhile, back on Earth at 49 Acacia Avenue, Kingsmead, Middlesex.

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by Ray Coles

Whatever next?

The fast-moving microelectronics industry is as full of surprises as ever.

IN SEPTEMBER I was wringing my hands, along with the rest of the electronics industry, over the microprocessor chip famine which seemed certain to choke the life out of many a skinny start-up company. I told terrible tales of prices rocketing, of orders being turned away by semiconductor firms who obviously felt that they had enough business to last them well into 1985, and of frantic equipment manufacturers turning in desperation to the black market to obtain the devices they needed to feed their faltering production lines.

That was back in the summer, five short months ago, but in the semiconductor industry five months can be a very long time indeed, and today the picture is changing rapidly. My concluding paragraph in the September Chip-Chat was headed "Glut looming" and I went on to predict that in two or three years time the situation would be reversed after extra capacity had been brought on stream by the chip manufacturers.

Well, I was right about a glut coming, but I could not have been much further out with my timing, because it now looks as though the famine is over and the pendulum is swinging rapidly in the other direction. The most sensitive barometer of semiconductor industry fortune is the so-called book-to-bill ratio, which is very closely monitored in Silicon Valley. When chips are hard to get and demand outstrips supply, equipment manufacturers place advance orders with several chip suppliers in the hope that at least one will ultimately deliver in time to meet production schedules. As a result, the semiconductor manufacturers build up order books which considerably exceed their ability to deliver, and therefore to bill their customers. In other words, orders arrive faster than deliveries can be made.

Groaning shelves

At the height of the boom period about a year ago the average book-to-bill ratio reached 1.66. Now it is sinking rapidly and has dropped well below the break-even 1:1 ratio, which means that parts are now leaving the factories faster than new orders are arriving. All this is very good news for those long-suffering small equipment manufacturers who managed to survive the famine. Before long the distributors of microprocessor and memory devices will have shelves groaning with chips, and not long after that prices are bound to fall. Unfortunately, when they fall demand will increase, and the whole crazy cycle will start all over again.

Anyone watching all this from orbit would probably deduce that these oscillations are due to the birth pangs of a new industry, and that things will soon settle down as the technology matures. But, as someone whose name for the moment escapes me is fond of saying: "You ain't seen nothing yet!"

In most industries it is the mature products that form the bulk of sales, and innovation occurs only on the fringes. Not so the semiconductor industry. It thrives on the constant introduction of radically new technology, which quickly replaces earlier products before maturity in the normal sense of the word is ever achieved. Thus by 1987 the just-off-the-drawing-bard 256K dynamic RAM will be shipped in similar quantities to that of its predecessor, the 64K DRAM, with about 800 million of each finding their way into the world's greedy memory sockets.

Indecent haste

In the same way, there has been an almost indecent haste in introducing 32-bit microprocessor chips such as the Motorola 68020 and the National 32032. The equipment industry has hardly had time to get to grips with 16-bit technology, yet semiconductor companies feel obliged to continually render their own best-selling products obsolete just to remain in the forefront of technology and retain their competitive edge.

Despite the high rate of innovation so far, there are still no signs of the pace slackening. One of the most important new techniques already starting to affect the chip makes' output involves the use of so-called "silicon compiler" computer-aided engineering systems. This technique formalises and simplifies the fully-custom design and layout of new VLSI chips to such an extent that the whole process can be safely devolved to a customer, leaving a semiconductor manufacturer to act in the role of a "silicon foundry."

According to IPI, the respected Danish consultancy group, by 1988 50 percent of all integrated circuits used will be customised rather than selected of the peg from a standard range, and 68 percent of those will be based on semi-custom gate array and standard-cell designs. The gate-array technique is already widely used in low-cost home micros such as the Spectrum and the Oric, which use a gate array to collect together all the random interface logic which would otherwise require multiple packages. Like masked ROMs, gate arrays are manufactured unprogrammed and then "wired up" by the application of a final metallisation layer. The process is normally regarded as being semi-custom because the basic gate array is a standard part until it is programmed.

The standard cell technique simply automates the design process traditionally used by skilled IC designers so that an ordinary circuit designer can sit at a CAD terminal and create a new IC by calling up, positioning and interconnecting standard functional blocks which are eventually output as a set of photo masks ready for manufacture. Initially these standard cells consisted of just gates, flip-flops and registers, but now a designer can call up complete memory and microprocessor cells to build a one-chip system suited exactly to their individual requirement. Today's circuit boards will become tomorrow's custom chips.

Just around the corner — or so some optimists say — is wafer-scale integration, a process which could stand the computer world as we know it right on its head. It would allow the direct interconnection of hundreds of VLSI chips on the silicon wafer from which they are normally sawn for separate packaging. This sounds an obvious step, but silicon processing is such that defects are common and yields low. When a whole wafer is interconnected to form a functional unit, the chances of it ever working are slim indeed.

Huge rewards

Undeterred, no less an innovator than Sir Clive Sinclair is actively funding development work at his new Metalab, leaping in where Texas Instruments, IBM and most recently Trilogy have already had their fingers badly burned. If Sinclair pulls it off, the rewards will be huge and available computing power will eventually be increased by several orders of magnitude. Thinking machines and intelligent robots will become useful everyday objects rather than the dull factory workhorses they are today.

If that is not enough to make your imagination boggle, there is plenty more lurking in the fertile minds of the chip designers. What comes next? Don't ask me, anything can happen in this high-speed roller-coaster of an industry, and I am too busy hanging on.

by Mike Lewis

Those were the days

Mike Lewis looks back to the heyday of punched cards and decides some of the old sorting methods used might be worth adapting for a micro.

RECENTLY I MARKED a small landmark in my career: the 20th anniversary of my first job in computing. One of my first duties was to operate an IBM 1401, easily the most popular computer of its day. Our system, which was run by eight operators working in two shifts, fully occupied a 600 square foot computer room. It was somewhat less powerful than the Olivetti M-10 that I now carry in my briefcase.

Our biggest problem was sorting. The difficulty was not so much how to sort, since many of the techniques discussed in this column were well known in the mid-1960s. It was that we could not afford the considerable time that the 1401 needed to sequence, for instance, our file of 2,000 customers.

Tape storage

The machine had an 8K core — what we would now call RAM — and was considered large by the standards of the day. We had four model 7330 tape decks, which could read at a respectable 7,200 characters per second but which took the best part of three minutes to rewind. Disc drives were on the market but they were still too new and too expensive for our installation. All this meant that sorting was painfully slow.

Instead, we used to sort our input data externally, using a model 83 card sorter. We had two of these workhorses and they were the most heavily used items of hardware in the computer room. Each machine stood about 3½ft. high and was about 5ft. in length, with a flat top that doubled as a work surface.

At the right-hand end there was an input hopper which fed the punched cards on to a conveyor belt running the length of the machine. The cards travelled under a read head called a brush, and above a series of output bins. Each card was deflected into one of the bins, according to the data punched on it.

The 80-column punched card was easily the most universally accepted medium for data storage and transfer ever devised. It was completely interchangeable between all the major manufacturers' computers and peripherals, and could even be read by humans. Those were indeed the days.

Each column had 12 punch positions, divided into two regions: the numeric portion being the digits 0 to 9, and three zone punches. Alphanumeric characters were represented by a combination of zone and numeric, or you could use a single punch to store base-12 numbers. These were very handy for shillings and pence, month numbers, and the like.

Input hopper: 478 690 123 298 588 317 245 403 701 357 145 129 989

Bin number	Pass 1	Pass 2	Final pass
0	690	701	
		403	
1	701	317	123
			129
			145
2		123	245
		129	298
3	123		317
	403		357
4		245	403
		145	478
5	245	357	588
	145		
6			690
7	317	478	701
	357		
8	478	588	
	298	989	
	588		
9	129	690	989
	989	298	

Figure 1. A simulation of the card sorter, using three-digit base-10 numbers.

Numeric sort

To sort on a single numeric column, either base 10 or base 12, we would load the cards into the input hopper, position the brush to read the column in question, and set the sorter going. The machine would stack each card into one of 12 output bins, corresponding to the position of the punched hole. There was a 13th bin which was where the machine sent mispunched cards. Alpha sorting was also possible but the procedure was complicated and we always tried to avoid it.

To sort on a multi-column field, we had to start with the least significant column, then pick the cards from the bins and reassemble the deck in such a way that all cards with a 0 punch were at the front, followed by all the 1s, and so on. This procedure was repeated for each digit — that is, each column — in the field. This type of sorting is sometimes known as radix sorting, and the example shown in figure 1 illustrates how it works.

I have often thought of writing a program for a modern microcomputer that would mimic the sorting technique of our trusty model 83. But if you followed the analogy faithfully, the program would need a one-dimensional table to hold the data to be sorted, this being equivalent to the input hopper. You would also need an array of n,y elements to represent the output bins, where n is the number of items to be sorted and y is the base, or radix, of the numbering system used. Not

(continued on next page)

Original list	Pass 1	Pass 2	Pass 3	Pass 4	Final Pass
5 00101	20 10100	20 10100	8 01000	2 00010	2 00010
20 10100	2 00010	8 01000	25 11001	20 10100	5 00101
31 11111	8 01000	12 01100	2 00010	5 00101	8 01000
2 00010	12 01100	5 00101	11 01011	8 01000	11 01011
15 01111	5 00101	25 11001	20 10100	25 11001	12 01100
11 01011	31 11111	2 00010	12 01100	11 01011	15 01111
25 11001	15 01111	31 11111	5 00101	12 01100	20 10100
8 01000	11 01011	15 01111	31 11111	31 11111	25 11001
12 01100	25 11001	11 01011	15 01111	15 01111	31 11111

Figure 2. A radix sort of five-bit binary numbers.

(continued from previous page)

only would this require prodigious amounts of memory, but there would also be a heavy overhead for moving the contents of the output bins back to the input hopper after each pass.

The latter of these snags can be avoided by replacing the input list by a second n,y array, and flipping between the two. The output from one pass thus becomes the input to the next. The large storage requirements can be reduced by using a radix of 2, which is the obvious system for a micro since all types of data can be represented as binary numbers. An extract from a program that uses these principles is shown in the listing.

Arrays

In this program, the two n,y arrays have been merged into a single three-dimensional table. This has dimensions n,x,y, where x is the one of two values indicating either the input bins or the output bins. Notice that the Dim statement specifies dimensions of n,1,1 rather than n,2,2 because the lowest entry in an array in Microsoft Basic defaults to position 0 rather than 1. To help avoid confusion, the array is subscripted by symbolic constants like Zero and One rather than by actual numbers.

It is fairly easy to modify the program to use a different number base. First, adjust the number of entries in the third dimension of the array to reflect the value of the radix. Then alter the mechanism by which the program tests the value of the current digit. This is localised in the function FNbits, which returns the value of the jth bit from bit-string i. This function could be generalised to return the value of k bits from i, starting at bit j.

Trade-off

Changing the radix in this way demonstrates the classic programming trade-off between time and space. If you increase the number base, say from binary to octal or hexadecimal, the sort would need fewer passes and so would run faster. If you tested a full byte on each pass instead of a single bit, you could sort any number of 32-bit values in just four passes. On the other hand, you would need 256 input and output bins, so sorting 1,000 items would consume 512K of RAM.

Whatever radix you choose, it clearly makes sense to ensure that it is a power of 2. Also, it might be possible to use a simple transformation to reduce the radix. For example, if you knew that the values to be sorted consisted entirely of capital letters, you could convert the letters to five-bit numbers — A=0, B=1, etc. — thus speeding things up considerably.

How does the radix sort compare with other sorting algorithms? The main point in its favour is that it is an order-n sort, that is, the time needed to sort n items is roughly proportional to n. By contrast, most elementary exchange sorts are of order n^2. If you double the number of items to be sorted, you must quadruple the time taken. Even the highly efficient Quicksort is usually considered to be of order n log(n). So, in theory, there must be some value of n where the radix sort becomes faster than any of these other methods.

On the other hand, the time needed for a radix sort also increases with the number of digits in the key, using the chosen number base. For most purposes I doubt that this method would be preferable to the better-known techniques. But if you need to sort a very large number of values, and either the values are all quite small or you have ample memory available, then the method used by the venerable model 83 card sorter might just be worth reviving.

Binary radix sort program.

```
500 'BINARY RADIX SORT. This simulates a card sorter, but using a list
    of binary numbers in place of a deck of cards. The "sorter" has four
    bins: two input and two output; and two bins for zero-bits and two
    for one-bits.
520  'This is represented as a 3-dimensional array:
       TABLE(<element no.>,<input/output bin>,<zero/one bin>)
540 'Other arrays hold pointers and maximum values:
       POINTER(<input/output bin>,<zero/one bin>)
          MAX(<input/output bin>,<zero/one bin>)
560 'All variables are defined as integers.
580 '



600 'Some constants used:
620     BITMAX=12                   'No. of bits to be sorted on
640     N=1000                      'No. of elements to be sorted
660     ZERO=0: ONE=1               'Zero/one flags



680 'Other definitions:
700     DIM TABLE(N,1,1), POINTER(1,1), MAX(1,1)
720     DEF FNBITS(I,J)=(I AND 2^J)\2^J
                                    'A function to extract the Jth bit from I



740 'Various initial settings:
760     INBIN=0: OUTBIN=1: MAX(INBIN,ZERO)=N: MAX(INBIN,ONE)=0:
        MAX(OUTBIN,ZERO)=0: MAX(OUTBIN,ONE)=0
820 '



840 'Sorting starts here.
860     FOR BITPOINT=0 TO BITMAX-1      'Do this for each bit in turn
880             POINTER(INBIN,ZERO)=1: POINTER(INBIN,ONE)=1:
                POINTER(OUTBIN,ZERO)=1: POINTER(OUTBIN,ONE)=1
                                        'Point to first entry in each bin
900             CURRENT=ZERO            'Start with input bin zero
920             WHILE POINTER(INBIN,CURRENT)<=MAX(INBIN,CURRENT)
                                        'Do this for each entry in turn
940                     ELEMENT=TABLE(POINTER(INBIN,CURRENT),INBIN,CURRENT)
                                        'Extract element to be sorted
960                     BITVAL=FNBITS(ELEMENT,BITPOINT)
                                        'and the value of its current bit
980                     TABLE(POINTER(OUTBIN,BITVAL),OUTBIN,BITVAL)=ELEMENT
                                        'Store it in the relevant output bin
1000                    POINTER(OUTBIN,BITVAL)=POINTER(OUTBIN,BITVAL)+1:
                        POINTER(INBIN,CURRENT)=POINTER(INBIN,CURRENT)+1
                                        'Increment pointers
1020                    IF POINTER(INBIN,CURRENT)>MAX(INBIN,CURRENT)
                        AND CURRENT=ZERO THEN
                                CURRENT=ONE
                                        'When input bin zero is finished,
                                         switch to input bin one
1060            WEND                    'End of pass for current bit
1080            MAX(OUTBIN,ZERO)=POINTER(OUTBIN,ZERO)-1:
                MAX(OUTBIN,ONE)=POINTER(OUTBIN,ONE)-1: SWAP INBIN, OUTBIN
                                        'Switch input and output bins
1100    NEXT BITPOINT                   'Repeat for next bit
1120 '



1140 'The sorting has now finished, with the sorted list in the two
      current input bins.
```

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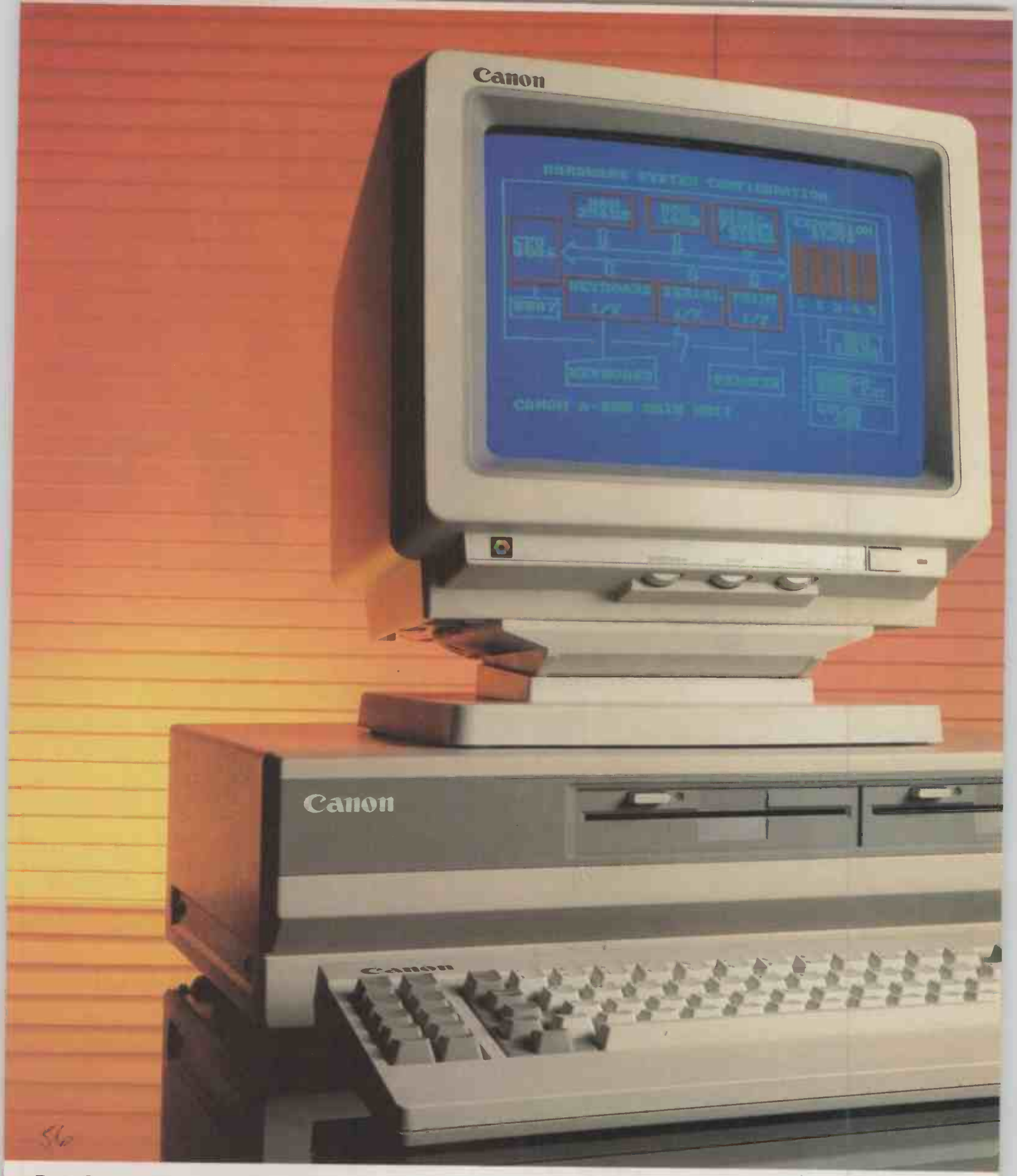

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by Ben Knox

A textbook case

Schools can now subscribe to a tailor-made electronic information source.

IT IS ONLY after they have been adopted in schools that new technologies gain their rightful attention and respect from the general public. So let's hope that this pattern of events will follow the launch last November of a new on-line information system for use by schools.

The Times Network for Schools, TTNS, is run by The Times Network Systems Limited, a subsidiary of Rupert Murdoch's News International empire. TTNS aims to provide a large database of information which will be useful to schoolchildren and their teachers, covering both formal and extra-curricular subjects and activities. The system is fully supported by local education authorities throughout Britain.

April start

Initially, the service is residing on the computers which run Telecom Gold, British Telecom's electronic mail system. The TTNS database is accessed via specially set up Telecom Gold mailboxes. After logging on, users have the option of using the normal electronic mail facilities of Telecom Gold or entering the TTNS database. The system will move to its own computers in April.

For schools, two of the main deterrents to entering the communications field are the high equipment costs and connection charges for commercial systems. To get over these problems, TTNS is subsidising the purchase of modems, and Telecom Gold is supplying low-cost mailboxes. Schools or colleges who want to participate in the scheme will be charged only £152 for a multi-speed, autodial auto-answer modem made by Dacom; it normally costs about £400. The special mailboxes will cost only £69 per term for unlimited use. The normal Telecom Gold registration fee is £100, plus connection charges of about 10p a minute at peak time.

Included with the modem is software to enable a BBC or RML 480Z microcomputer to communicate with Telecom Gold. There is also training software which simulates an on-line session with TTNS. Students and teachers can use it to get to grips with the system without having to run up enormous telephone bills.

The initial steps which you need to go through to access the system — dialling and logging on to Telecom Gold — are carried out automatically by the software. Once on the system you can either type Mail to use electronic mail, or Menu to go into TTNS. In the TTNS database you are presented with a menu of 12 subject areas.

The first item on the TTNS menu, called Competitions, gives details of inter-school, national, international and company-sponsored competitions. Some of them can be submitted using electronic mail. Curriculum, the second heading, provides information on 26 subjects.

Abstracts from relevant reports are available in the Educational Reports section. Many are from government departments, and have been chosen to be of interest to teachers or pupils.

Users having problems with their equipment can turn to the Hardware option for information on new computers and peripherals, and new uses for the system. The Leisure option gives information on holidays and extra-curricular activities, while News/Noticeboard offers the latest news about TTNS.

Schools may order equipment, information, stationery and other supplies through the Order Forms option, and by using a Swap Shop can exchange books, computer hardware and software, furniture and other equipment.

Probably one of the most useful options, known as Software, provides downloading facilities for educational software. Specially designed protocols aim to make the process error-free. It is also possible for users to load software into the system.

Inter-school sports competitions and local club fixtures and results can be networked using the Sports option. Careers information on the Careers Database is currently expected to include details of the army, public service and medicine, University scholarship schemes and rates of pay.

The final option, Profiling, allows teachers to keep information about various important aspects of a pupil's education and background. In this section of TTNS teachers and researchers may compare notes and argue points.

The TTNS system is fairly easy to use, if a little clumsy. The menu system requires the entry of more codes than is necessary to access a particular area. For example, to get information about Science, from the main menu you have to type B, followed by Return to get the menu for Curriculum. From here you have to type B again to signify that you still want something from the Curriculum area, followed by 23 and then Return. The only advantage of this method is that you can go straight to your choice from anywhere in the system.

Although the system is relatively new, there are already a number of large companies and organisations sponsoring some of the sections. The Stock Exchange, for example, has provided an itinerary of interesting places for a class to visit while on a field trip to the City of London.

Career decisions

British Gas has put details of its scholarship schemes on the Careers Database. Plenty of background information is provided to the uses of gas and the structure of the company. Also on the Careers Database are lengthy details of ranks and rates of pay in the army. If TTNS can encourage organisations from other areas of commerce and industry to put similarly extensive information on the system, perhaps with details of university and polytechnic courses and vacancies, the service could become invaluable to fifth- and sixth-form pupils making decisions about their career direction.

An interesting feature, due to be added when the system has been transferred to its own computers, is an international gateway to The Source. This large American information system contains tens of millions of pages of information covering different subjects.

For further information on TTNS contact Sue Stride, The Times Network for Schools, News International plc, PO Box 7, 200 Grays Inn Road, London WC1X 8EZ.

If you have discovered a new bulletin board or information system which you think would interest other readers, write to me with the details either here at *Practical Computing*, or via Electronic Mail on TBBS London, Telecom Gold 84:TCC051, or Prestel Mailbox 919993567. *Practical Computing* is on Telecom Gold 81:JET727.

Encounters of the APL kind

Boris Allan reports on a recent conference for Logo and APL users.

IN THE FIRST ISSUE of *Vector*, the journal of the British APL Association, there is the editorial comment: "Once you become committed to APL, it seems that you are rarely lured away from it. This kind of loyalty is praiseworthy indeed but also has dangerous tendency to promote insularity. Events might just be passing APL by."

This attitude seems to be common amongst APL supporters, and at the 1984 British Logo User Group, David Weatherby gave a very informative paper on Logo and APL as two complementary approaches to the use of computers in education.

Weatherby's position was not that APL was the best programming language in the world or the only language you should use, but that the advantages of APL were underemphasised.

Notation

On the one hand, APL is a language which is closest to standard mathematical notation, and so is particularly suited to allow people to explore the world of symbolic mathematics. On the other hand, Logo is well suited to allow people to explore the world of concrete mathematics.

The upshot of the talk was that a select band of Logo users went to meet a select band of APL users for a weekend at I P Sharp. The course was organised by David Weatherby and Chris Beatty, formerly head of computing at Westminster City School and now an APL consultant. Chris Beatty had instigated the teaching of computing at Westminster City School, using APL as the main programming language. The school's APL consultancy work had become so successful that he felt it was not possible to remain in teaching.

The biggest problem for children in moving from Logo to APL, or for adults moving the other way, would be changing from the use of recursion as a control mechanism to the use of pattern matching and operations on vectors. This is not to say that APL does not allow recursion, but its style is such that recursion is conceptually, as well as computationally, inefficient in many circumstances.

With its AI background, Logo encourages the use of recursion, although it is often a difficult concept to teach. Logo teaches recursion from the way it is designed, and the idea of trying to teach explicitly about recursion contravenes the Logo ideal. If you try to teach recursion rather than actually doing recursion, it easily becomes relegated to the status of useless, pointless knowledge.

Just as Fortran taught the importance of modularity and the avoidance of side effects, by the lack of global variables other than the Common block, so any language encourages certain modes of thought. APL encourages you to think compactly, to think in terms of the form of your data structures and to think in parallel. APL seems to have a great potential for parallel processing because so many APL functions are effectively parallel processors. You can enquire

```
234 + 333
```

to be told

```
567
```

or you can enquire

```
234 + 3
```

to be also told

```
567
```

By the second morning of the course programs were being written to produce all the necessary statistics for bivariate correlation and regression, and simulations of Gödel's theorem. APL is not difficult to learn, apart from one aspect which, as with other programming languages, is the symbolism used. With APL you cannot use most of the APL symbols if you have a conventional keyboard, though with soft keyboards this becomes less of a problem. The QL system gets over the keyboard problem by turning most of the strange symbols such as the Greek lower-case to strange words such as Size, which use the standard ASCII character set — see page 74 for a review of an APL version on the QL.

Logo's virtues

If you ignore the turtle graphics, the most powerful aspects of Logo are list processing, recursion and the encouragement of systematic modes of thought. Turtle graphics should not be ignored but Logo also offers much more. Of the weaker aspects, many Logos are very poor when you consider the status of numbers on a conceptual as well as a pragmatic level. There are many confusions in Logo concerning numbers, due to Logo's background in list processing.

APL offers a form of list processing, but as yet is too rudimentary. APL emphasises parallelism and encourages systematic modes of thought, and is only equalled by Fortran for numerical applications, which is where Logo tends to be weaker. Logo has its own symbolism, which is readily accessible, whereas APL has a notation which has much in common with mathematics.

It seems clear that APL should appear in education, particularly at higher and more mathematical levels. This was a conclusion most of the Logoers had reached by the end of their exposure.

In a final meeting at the course's conclusion it was decided that the dialogue should be continued, and that there must be people who were interested in computer languages, and the implications of these languages. I am to be the post box for any interested in such a loose grouping. Given that its original members are from Logo and APL as well as from Forth, we already have a variety of viewpoints. Any interested parties please contact me c/o *Practical Computing*. Those in mathematics education may care to contact John Wood at Micros in Schools, Open University, Milton Keynes MK7 6AA.

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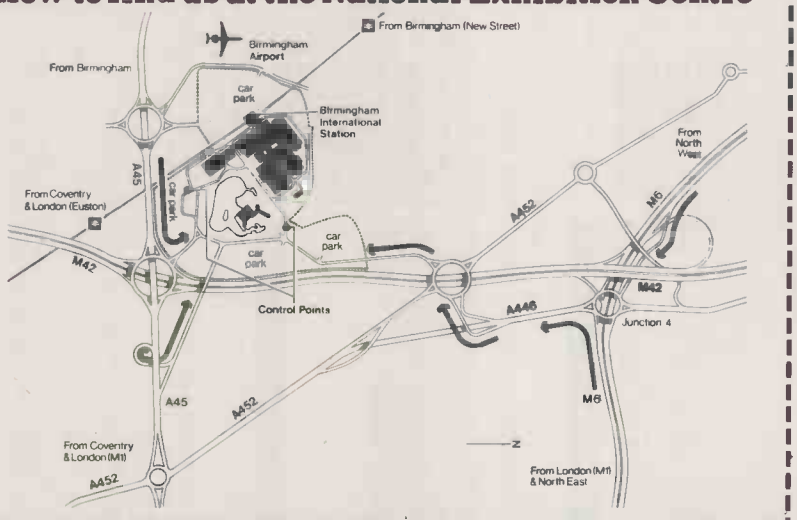

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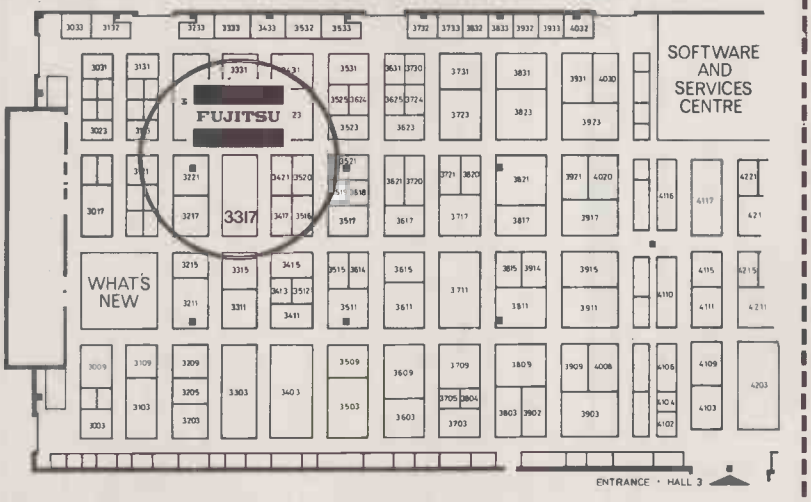

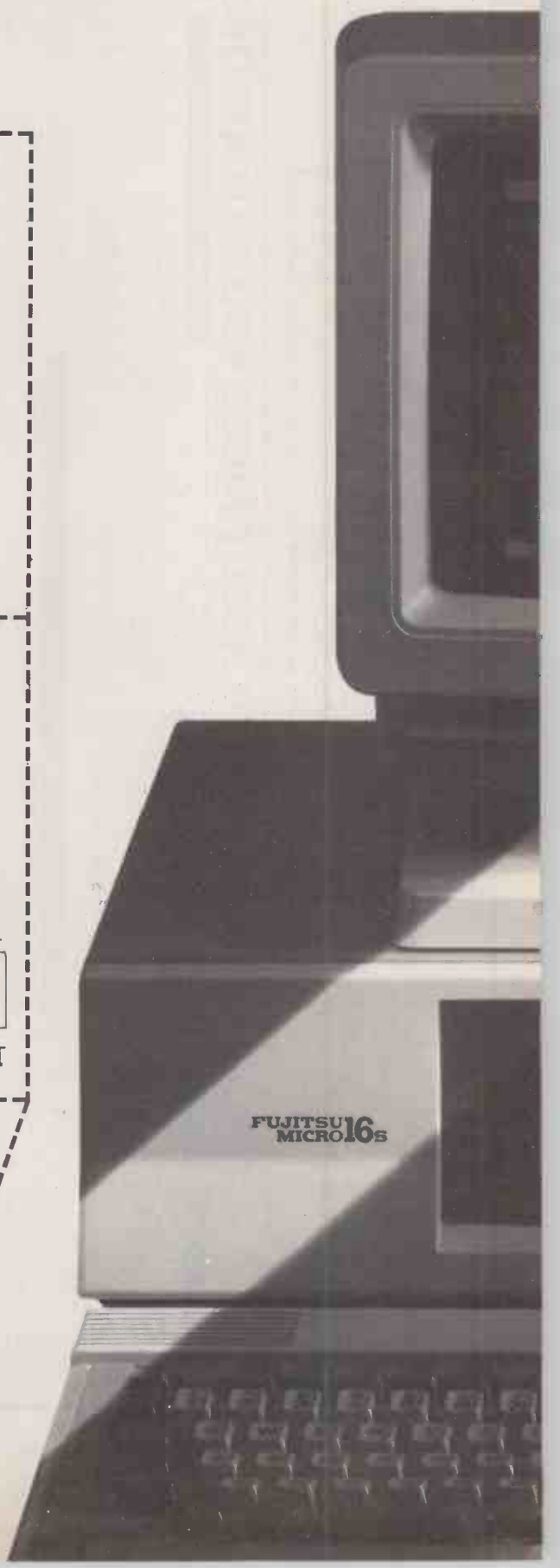

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SONY HIT-BIT

The Sony MSX micro and peripherals seem to have been designed with serious home use very much in mind. Ian Stobie investigates how they match up to the non-MSX opposition.

ALL MSX home computers are essentially alike. The problem for the companies which make them such as Sony, Toshiba, and Canon is how to make their particular product stand out.

Sony's approach with its Hit-Bit computer is to include some extra software in ROM and offer a good range of optional peripherals, including a neat A4 printer/plotter and a disc drive. Despite its rather frivolous name, Sony's £299 machine is therefore one of the most serious of the MSX computers, aimed at the keener home user.

The initials MSX derive originally from Microsoft Extended Basic. MSX is a detailed hardware and software specification worked out between a number of Japanese consumer-electronics companies and a local subsidiary of the American software house Microsoft. All MSX micros are built around the Z-80A processor with a 9918A display controller and the AY-3-8910 sound chip. They all use the same cassette storage format and have identical cartridge slots; they also all come with the same Basic in ROM.

The point of all this standardisation is to allow machines from competing manufacturers to run the same software. The original intention seems to have been to make MSX on micros what VHS is to video recorders. But unlike VHS video cassettes, MSX software is not yet in very plentiful supply.

The Sony Hit-Bit and its peripherals.

Mainly Japanese

Apart from Spectravideo, Philips and the Korean Goldstar, only Japanese companies have shown much enthusiasm for the MSX concept. All the established home-computer manufacturers such as Commodore, Atari and Acorn are sticking to their own independent architectures. MSX taken as a whole is in effect just another machine in a crowded marketplace of incompatible standards.

Sony's Hit-Bit MSX computer is, like most products from the company, nice looking and well designed. Judging by the construction it is probably reliable too. It is inevitably very similar in appearance to other machines observing the MSX home-computer specification.

It has a full-size QWERTY-layout keyboard, with five function keys above the main block of keys and four cursor-control keys laid out in a sensible pattern to the right. The keys are well made and feel quite good in use, though I did find when typing at high speed that keyboard bounce could make some keys repeat — like thisss.

One MSX-compatible cartridge slot is located above the keyboard. We had no problem getting cartridge-based software to run on both the Canon MSX machine and the Sony, so in this respect at least MSX is a technical success. The Hit-Bit has a second cartridge slot hidden away behind a panel at the back of the machine, to which the optional disc conveniently connects.

When you first turn the machine on it goes straight into playing any game you have loaded in the cartridge slot. If the slot is empty the Hit-Bit displays a colourful menu. From it you can choose Basic or any of the three simple programs in Sony's built-in ROM, called Address, Schedule and Memo.

Address, Schedule and Memo are really just three different input screens put up by the simple database program contained in the ROM. Each screen lets you enter records consisting of a one-line header followed by a nine-line free-text field. The lines are 26 characters long, so you are limited to having simple card-index type data in your "personal databank", as Sony rather too grandly describes this piece of software. You can delete or amend existing records, sort the records by header or search for a particular record containing a specified word. If you have a printer you can print out records in permanent form.

CMOS RAM pack

When you turn the machine off you obviously lose all your data unless you save it to cassette — the Sony has a cassette interface as well as the two cartridge slots. This slow process is obviously inappropriate for things like looking up telephone numbers or appointments, so Sony also offers a battery-packed CMOS RAM pack which fits like a software cartridge in the cartridge slot. It costs £39.95 and has a capacity of 4K, so with it you could hold about 20 fully packed screenfuls in your personal databank. At these prices the makers of paper notebooks and record cards have little to fear.

MSX Basic is well suited both to writing

(continued on next page)

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games and to more practical use. Numbers are calculated and displayed to 14 digits. Such high precision can slow things down a lot, leading some reviewers to think MSX Basic inherently slow. However, you can declare your variables as integers or as six-digit single-precision numbers, which usually improves performance significantly, especially when using the graphics commands.

Straightforward commands are provided for line, circle and box drawing, and for plotting, area-filling and block copying. Special commands control up to 32 sprites for fast-action graphics. Interrupt-driven commands such as On Sprite Gosub, On Key Gosub and On Interval Gosub help you to write fast-executing code.

Sound commands resemble those of the IBM PC Basica, where you place parameters in strings activated by a Play command. I find this approach far the simplest way of controlling the many facilities provided by the AY-3-8910 sound chip, which can produce three-note chords over eight octaves in a variety of different sound envelopes. The Hit-Bit outputs the sound through the TV set.

The only problem with the Basic is the amount of memory it occupies. Of the 64K theoretically available to you only 28K can be used for program lines and workspace. Fortunately none of this is needed for mapping graphics as a separate 16K area is dedicated to the display. Even so, for most applications even a 48K Spectrum gives you more memory to play with at the end of the day.

Two manuals

The Sony normally comes with two manuals to describe this very powerful Basic. One is an introductory manual apparently aimed at children. Despite frequent use of a cartoon dog called Fido, it adopts a laborious, condescending style, and receives an early nomination from us as Most Dreadful Manual of 1985. On the subject of For-Next loops: "If Prince FOR can't find Princess NEXT the computer will be so unhappy that it will display an error message. . . ." The other manual is a 192-page MSX Basic Reference Manual, which we did not see.

The Hit-Bit also comes with a 24-page booklet about the built-in personal databank software, and each peripheral such as printer, disc drive and joystick also has its own manuals. Judging by the books we saw, Sony documentation is lengthy but not very informative.

Sony is offering a very neat printer which plugs into the parallel interface in the back of the Hit-Bit. What appears to be the same unit is also sold by Toshiba for its MSX machine. Sakata manufactures a very similar printer, aimed at the general home-computer market, equipped with both parallel and serial interfaces.

Good-quality Japanese arcade games like Antarctic Adventure are available for MSX.

These machines are all really small flat-bed plotters, based around a well-established four-pen head mechanism. The head has four small inch-long ballpoint pens mounted in a rotating holder. The same mechanism has been used in other makers' printers but Sony puts it to the best use we have yet seen.

What makes the difference is the Sony paper-transport mechanism. It seems to be very accurate and can accept ordinary A4 typing paper as well as roll paper. As you feed the paper in from the front, face up, two wheels positioned on each side grip it very tightly and pull it under the print head. When you start printing, characters are formed by these wheels moving the paper up and down while the print head moves a pen of the appropriate colour horizontally against the paper.

Different-width papers are accommodated very simply by repositioning the right-hand paper-transport wheel. This automatically causes the printer's control software to terminate the line in the appropriate place — for example on A4 paper the printer will turn a text line at the 80-character position, on 4.5in. roll paper at around the 40th.

Output quality is surprisingly good, with none of the inky splodges we have found on other similar printers. This may be simply because the Sony-supplied ballpoint pens are of very good quality. The construction of the whole unit is very neat, and comes with a roll holder.

You can print complicated graphics by including appropriate control codes in Print statements in a Basic program. The printer recognises a range of control codes which do things like draw from a line between two points, which can be specified either absolutely or relative to the current position. The only real problem with the Sony plotter is speed. Printing at about six characters per second normal size, it is at least 10 times slower than a dot-matrix printer of equivalent price, and so is not worth buying if you do not need colour graphics.

An infrared sensor attaches to the computer so that you can use the joystick from across the room.

The Sony disc drive uses the company's own 3.5in. microfloppy discs. They have a high reputation for reliability and are used by companies such as ACT and Hewlett-Packard. The Hit-Bit's drive comes in a black metal box with a lot of large cooling holes cut in the top. A connecting cable terminates in a very large plug which fits into either of the Hit-Bit's cartridge plugs. The drive unit is single-sided, and provides you with 360K of usable storage space per disc.

The disc operating system, MSX-DOS, is integrated into an extended MSX Basic which comes on a ROM inside the disc-connector cartridge. It switches out the usual resident ROM Basic, but appears to resemble it closely and even runs the Benchmarks at the same speed.

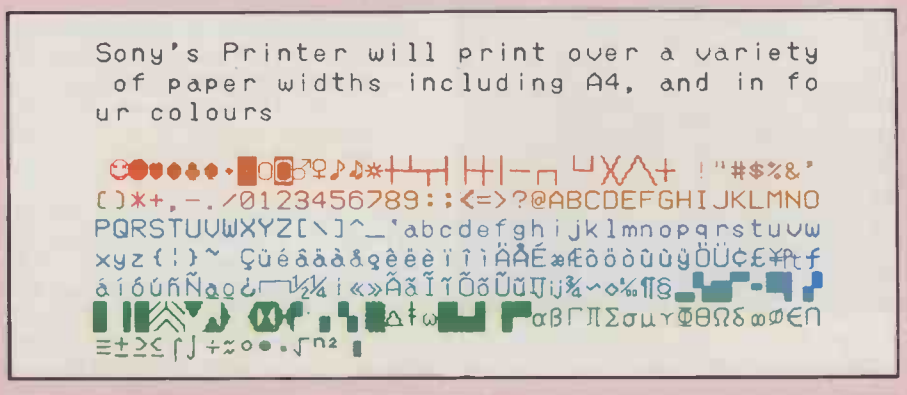
The disc Basic has extra instructions, such as Format, Get, Put and Kill, and leaves you 4K less memory free for your programs. Rather surprisingly, the commands do not resemble MS-DOS, the operating system which brought Microsoft into the big time when IBM adopted it for the PC.

I could find no mention in the 92-page MSX disc manual of the rumoured file

The Canon MSX machine looks similar to the Sony and runs the same software.

Specification

CPU: eight-bit Z-80A
RAM: 64K plus 16K screen RAM
ROM: 48K containing Microsoft MSX Basic, operating system, and Address List, Memo and Schedule programs
Display: plugs into domestic TV or RGB monitor; 24 lines of 32 characters, 24 lines of 40 characters, or 256- by 192-dot graphics; both text and graphics can be in 16 colours
Keyboard: full-size QWERTY layout with separate cursor- and control-key blocks and five programmable function keys; keys generate upper and lower case and graphic characters
Sound: outputs through TV; Basic supports three-note chords across eight octaves
Interfaces: two MSX cartridge slots, cassette I/O, parallel printer port, two joystick ports, system expansion edge connector
Size: 407mm. (16in.) by 254mm. (10in.); weighs about 3kg. (6lb.)
Discs: optional 360K single-sided disc-drive unit, £349.95 including VAT; uses Sony 3.5in. microfloppy discs, which cost £30 per box of 10
Printer: optional four-pen printer/plotter, £249.95; prints text or graphics in four colours on to standard single-sheet A4 paper or 4.5in. roll paper; text printing speed is about 6cps
U.K. price: £299 including VAT for the HB-75B computer itself
U.K. distribution: available now; Sony (U.K.) Ltd, Sony House, South Street, Staines, Middlesex TW18 4PF. Telephone: Staines 61688



Benchmarks

The table shows the time in seconds to run the eight standard Basic routines — see *Practical Computing*, January 1984, page 102. Sony's HB-75B performs identically to other MSX machines such as the Canon and Yamaha offerings, which also use MSX Basic version 1.0. The disc version of Basic on the Sony also executes the Benchmark routines at identical speed. Compared to other home micros the MSX machines appear slow, but this is partly compensated for by the 14-digit precision of numeric variables.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Sony MSX — Z-80A	2.0	6.0	16.6	18.4	19.0	31.4	44.8	216	44.3
Amstrad CPC·464 — 6502	1.2	3.4	9.3	9.7	10.3	19.2	30.4	34	14.8
BBC Model B — 6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52	14.8
Yamaha MSX — Z-80A	2.1	6.0	16.6	18.4	19.0	31.7	44.9	216	44.3
Spectrum — Z-80A	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253	58.5

compatibility with IBM data files. Obviously we couldn't check as our IBM, like all the rest, has 5.25in. drives, so whatever logical disc format MSX-DOS uses there is a goss physical incompatibility to overcome.

MSX-DOS appears to be a rather simple operating system which falls short of CP/M in the facilities it offers. But it does support random-access as well as sequential files, and much of the manual is devoted to explaining how to write Basic programs using them.

We had no applications software on disc to look at. Sony is not bundling anything with the disc and there does not yet seem to be any commercial MSX disc software available in the U.K. More worrying, however, is the general state of the MSX software on tape and cartridge, which is far from abundant.

Kuma seems to have the greatest commitment to MSX, with most of its existing catalogue, including several serious products, transferred across to MSX. Its offerings include Forth, a Z-80 assembler, a ca£sette-based word processor, and a Prestel package and serial car to go with it.

We looked at a dozen Japanese-written Konami cartridges, available here from Micro Peripherals Ltd. All were arcade games except for one educational games program, Monkey Academy. Though they are all programmed to a very high standard, with good graphics and sound, playing them becomes boring. The price of £15.99 each including VAT also seems steep.

Conclusions

● The basic Sony Hit-Bit computer is unquestionably overpriced at £299. For this you could get an Amstrad CPC-464 complete with monochrome monitor and built-in cassette drive, and keep £50 change, or you could buy two Atari 800XLs at £130 each plus some good Atari games. Other strong rivals are the Commodore 64 and BBC computers, which have more potential for serious use and much more software available.

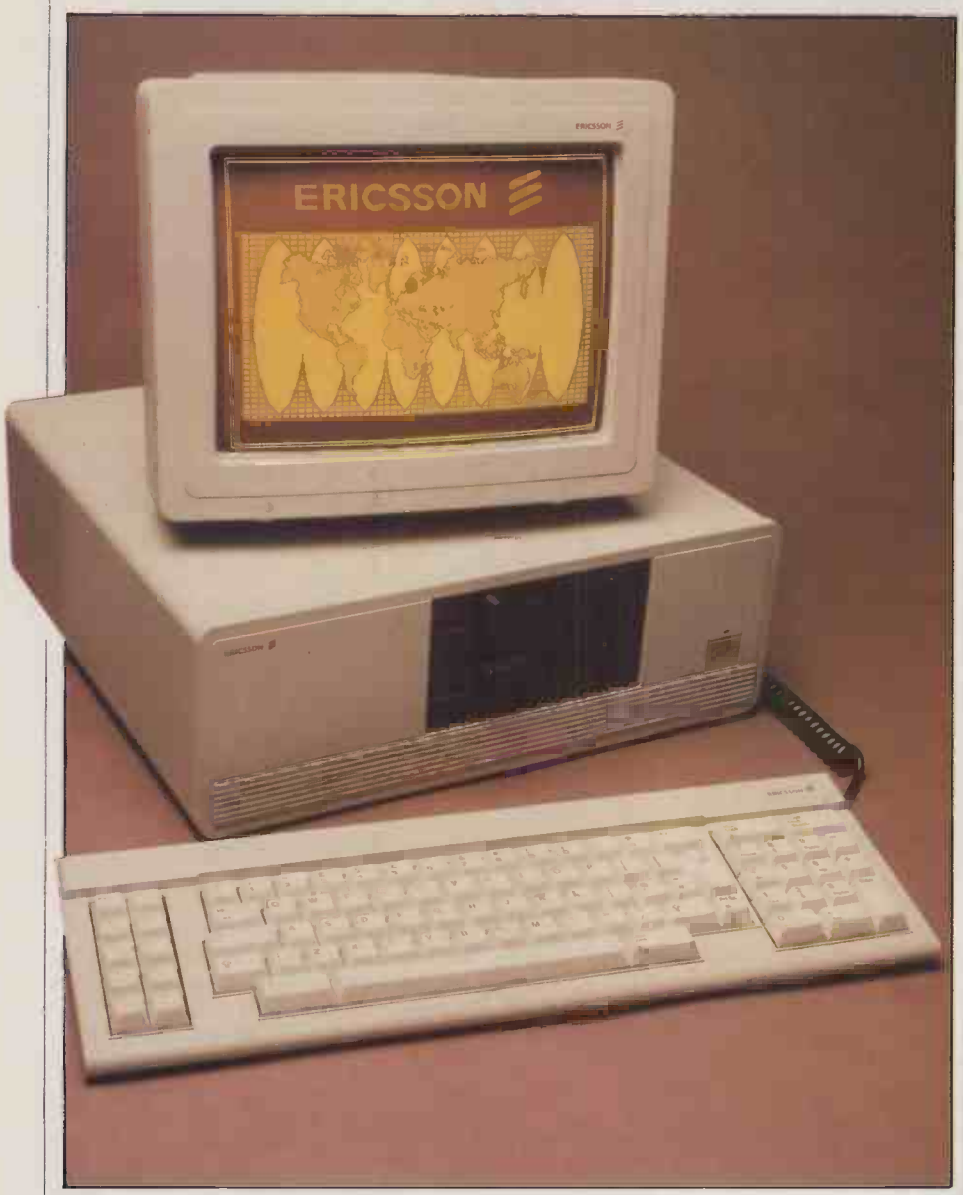
● The Sony printer is beautifully made and fun to watch at work. Again the pricing — almost £250 — can hardly be described as aggressive. For many people a conventional dot-matrix printer such as the Shinwa CPA-80, available for less, would be a better buy.

● Sony's 3.5in. microfloppy discs are very tough and have a great reputation for reliability. However, £349.95 is far too expensive for a 360K single-sided disc drive with a new, unestablished and very simple operating system.

● With the Hit-Bit, Sony has produced a good-looking and probably reliable home computer, but it costs too much. It is hard to think of a good reason for buying it as several of its non-MSX competitors have far more software available for them.

ERICSSON PC

It seems that no self-respecting electronics company is happy without an IBM compatible in its catalogue. Robert Piper investigates Ericsson's offering.



ERICSSON is taking the launch of its new IBM-compatible PC very seriously. The "helping hand" baby commercials that have been shown on TV are testimony to that fact, although viewers may be forgiven for thinking it is nappies that are being promoted rather than a computer as the latter only makes the briefest of appearances.

The sale of personal computers is a new departure for the Swedish telecommunications giant and is intended to widen its range of office-automation products. Ericsson already has a useful grounding in computers through the wide range of computer terminals it produces for use with mainframe equipment.

The Ericsson PC is technically very similar to the IBM model, but the external design has some useful improvements on the PC's ergonomics. Its price, however, reflects the policies adopted by other multi-nationals breaking into this market, and it is only marginally cheaper than an equivalent IBM PC.

Ergonomics

Ericsson's interest in ergonomics is first exemplified by the PC's impressively small footprint. At 15.5in. wide by 15in. deep the processor box's footprint is almost one-third smaller than the IBM's, and the space-saving theme is continued by the keyboard and monitor. All three units are manufactured by Ericsson and consequently the overall beige and brown colour scheme is well co-ordinated with the unusual amber/brown of the monitor.

The front of the main unit houses the disc drives. Either twin 5.25in. 360K floppies or a single floppy and a 10Mbyte hard disc are fitted, depending on the model. Early machines were supplied with two rather noisy Shugart floppies but more recent models have been modified in this respect.

To the right of the drives are the On/Off pilot and switch. They have been effectively camouflaged to keep the front uncluttered, but it does seem unecessary — even potentially disastrous — that the switch should be on the front at all. It only has to be used once or twice a day so the rear panel would be a far more sensible and safe location.

Built-in RS-232

The rear panel houses a Centronics-type parallel port to drive printers and an RS-232C serial port — which is an extra on the IBM — to drive serial printers or communications devices. The monitor derives its power from the processor via a special cable so only a single mains supply is needed.

Internally the PC is well constructed. The motherboard is located across the base of the machine and the large power supply, cooled by a pleasantly quiet fan, occupies a 4in. section on the left of the machine.

The 4.77MHz Intel 8088 processor is located on the motherboard and there is a spare socket for an 8087 co-processor if you want one. Speed is not one of the Ericsson's strong points — it runs at a similar pace to the IBM PC. There is an 8K ROM containing the system boot routines and start-up diagnostics, but no IBM-style ROM-based Basic interpreter.

The standard Ericsson PC is supplied with a modest 128K RAM but you can expand it to 256K by adding a plug-in board, which occupies space in one of the machine's six slots. The standard mono graphics-display adaptor occupies another slot, leaving a healthy four and a half slots. Ericsson markets its own range of boards, including multi-function and high-resolution graphics units, but the PC should be able to accept standard PC hardware. As usual though, users are advised to confirm suitability before buying.

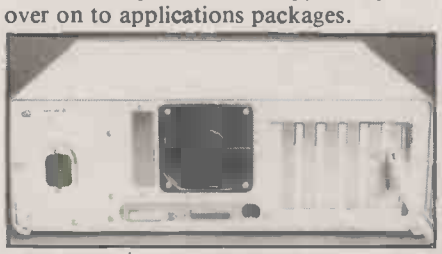
The monochrome monitor is an attractive, compact unit. Brightness and contrast are controlled by thumbwheels located under the front of the 12in. anti-glare screen. In an attempt to reduce bulk a conventional tilt/swivel base has not been included. The screen can be tilted by adjusting the length of a rear support leg, and swivelled by simply moving the monitor around. Ericsson offers a trendy Wang-style flexible monitor support arm as an optional extra.

The screen displays 80 by 25 characters in amber on a brown background. The stability of the display is excellent, and both characters and graphics are very crisp. Standard graphics resolution is 640 by 200. It can be increased to 640 by 400 with an optional expansion board, though there is not yet a great deal of software to take advantage of this feature.

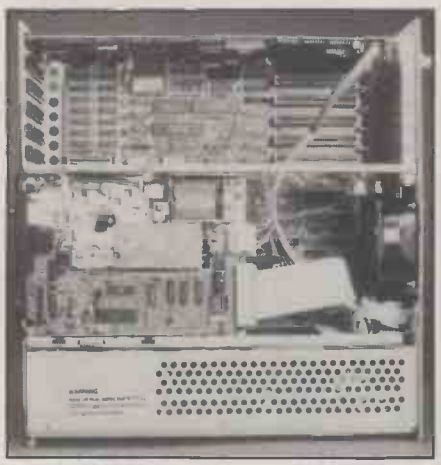
Keyboard

The keyboard is considerably smaller than many of its competitors. Key pitch and layout are fairly standard, but Ericsson has pared off some of the wasted plastic around the outside of the keypads. You may miss the area below the keypads if you are used to supporting your palms on it while typing. Status LEDs are included on the Num Lock and Cap Lock keys and a separate Enter key is provided for the numeric pad. Both £ and $ signs are in evidence.

The Ericsson PC is supplied with MS-DOS version 2.11. It contains no surprises whatsoever, except maybe the U.K. keyboard-configuration utility and several batch files which instruct users on how to create backup discs and copy the system over on to applications packages.



Both Centronics and RS-232 ports are fitted as standard.



One of the six slots is usually occupied by a graphics card.

Microsoft's GWBasic interpreter is included as standard on the system disc for those who wish to write their own programs. After the Basic interpreter has been loaded only around 32K is left for user programs instead of the 62K we have come to expect from the IBM PC and its compatibles. Ericsson says later versions have over 61K free.

Compatibility

The Ericsson machine is up with the top few as far as IBM compatibility is concerned. Its normal-speed 8088 processor and ultra-conventional design all help it in this respect. Although not quite on a par with the Compaq, the new Swedish entrant offers similar levels of compatibility to the ITT Xtra — and that is excellent judged by any standards. Software selection should be no problem. Virtually any of the thousands of programs intended for the IBM should perform equally well on the Ericsson.

Ericsson itself will be offering many of the most popular general-purpose packages under its own name and with its own brand of support. This applies to packages like Open Access and dBaseII which will be supplied with Ericsson's own special Getting Started pack. This includes a written tutorial to be used in conjunction with an example data disc, a function-key template and access to the Dial an Expert hotline service. Ericsson's expertise in the terminal market pays dividends here as it is offering communications hardware and software to enable links with IBM 3270/3770/2780/3780 mainframes. Also supported via asynchronous communications are VT-100, TTY, PC-to-PC links and videotex services.

It is in the area of customer support that Ericsson intends to make its particular mark. The Dial an Expert service is open during working hours for hardware and operating-system problems as well as application software. Ericsson now runs its own PC training centre to teach first-time users the basics of the PC, its operating system and application software. Courses last from one to four days and currently cover 24 different subjects.

Documentation also reflects Ericsson's approach to customer support, and the user manuals are well written and especially suitable for first-time users. The DOS manuals, however, are too similar to the standard Microsoft documentation and consequently rather clinical and unfriendly. Handy reference guides are also provided which outline the purpose and syntax of each command, and at no time is a user left in mid-air with no idea on how to proceed to the next step.

Specification

CPU: Intel 8088 running at 4.77 MHz
RAM: 128K RAM, expandable to 640K
ROM: 8K bootstrap and diagnostics
Dimensions: systems unit 390mm. (15.4in.) x 370mm. (14.6in.) x 140mm. (5.4in.)
Keyboard: 84-key IBM layout, 10 function keys, LED on Num Lock and Caps Lock
Mass storage: two 5.25in. 360K floppies, or 10Mbyte hard and 360K floppy
Interfaces: RS-232C serial and Centronics-style parallel
Software in price: MS-DOS version 2.11
Peripherals: 128K RAM board £254, colour £530
Price: single-floppy, monochrome, 128K RAM £1,667; dual-floppy, monochrome, 256K RAM £2,129; dual-floppy, colour, 256K RAM £2,417; hard disc, monochrome, 256K RAM £3,284; all prices exclude VAT
Supplier: Ericsson Information Systems Ltd, Maidstone Road, Rochester, Kent ME1 3QN. Telephone: (0634) 401721

Conclusions

● The Ericsson PC is an attractive, compact machine with above-average attention to detail in the increasingly important area of ergonomics.

● The amber display is outstanding; the remainder of the hardware is unexceptional with few distinguishing features.

● Processing speed, on a par with the IBM PC, lets the machine down somewhat. The competition increasingly uses the full 16-bit 8086 processor running at a higher clock speed.

● Compatibility with the IBM PC is excellent, and software should not prove to be a problem.

● The claimed levels of support set the machine apart from much of the competition and must be both encouraging and reassuring to potential customers.

● Such hand-holding has to be paid for: at a purchase price around 90 percent of equivalent IBM hardware it is questionable whether the Ericsson is sufficiently enticing, despite those hidden extras.

Benchmarks

The standard Benharks were run with GWBasic running under MS-DOS version 2.11. All times are in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Ericsson PC — 8088	1.1	4.4	9.9	10.3	11.2	20.3	31.8	33.6	15.3
IBM PC — 8088	1.3	4.8	11.8	12.2	13.4	23.6	37.6	36.6	17.7
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2

ENTERPRISE

Fifteen months have passed since the Enterprise was announced but at last it has arrived. Bill Bennett reports on whether it was worth waiting for.

ON THE SURFACE, the Enterprise looks like another toy computer, but behind those deceiving toyish looks lies a brain of considerable power. Scratch that surface and there is a micro whose specification beats that of the MSX micros, the Commodore 64 and the Sinclair Spectrum soundly. It holds up pretty well against more powerful opposition, like that of the BBC Micro and the Commodore Plus-4 too.

At a price of £250, the Enterprise is pitched firmly in the new middle ground of home computing, occupying more or less the same territory as the MSX machines. Its paper specification is fairly similar: Z-80 processor, 64K RAM, decent keyboard, powerful Basic, high-resolution graphics, and sound. But on almost every feature, the capabilities of the Enterprise are better than those of run-of-the-mill MSX machines.

What lifts the Enterprise above the morass of cheap home computers is the built-in word processor. As professional word processors go, the Enterprise is somewhat lacking. As a home word-processing package it is wonderful. Elsewhere on the software front, the Enterprise is blessed with an implementation of the Basic language every bit as extended and structured as that on the BBC Micro. This makes the Enterprise an ideal machine for learning about computers.

The Enterprise is one of the flattest computers around. Its dark grey plastic case measures about an inch at its thickest. Shapewise, it is a bit odd. Most micros are variations on a theme of squarish box shapes, but the Enterprise has very unconventional lines. How this shapes up ergonomically to long-term use is anybody's guess, but over a few days' reviewing it seemed to fit the bill admirably.

It's a pity the same cannot be said about the keyboard. As a trained touch-typist, I find the keys are are not sprung enough for really fast entry of text. However, compared to the keyboard of the Spectrum Plus, the QL and other low-cost machines, the Enterprise keyboard is adequate. I particularly like the clear, uncluttered markings on the keys in a crisp typeface. No excuses here for bashing the wrong key. There is even a degree of colour coding: function keys in blue — there are eight of them — Stop key in red, special keys in green, and the standard character keys in grey.

Placed next to the keyboard of an IBM PC or an Apricot, the Enterprise looks surpisingly good. A great deal of attention has been paid to the positioning and size of the various keys. To the right of the keyboard is a green joystick, in a similar position and fulfilling a similar function to the cursor keys on MSX computers. No doubt it will break off with clumsy use, but I found myself taking to it as easily as I adapted to the Macintosh mouse.

Just above the function keys is a Perspex strip which covers a strip of paper showing the keywords associated with the function keys, both shifted and unshifted. The review machine had a double-sided paper strip; on one side is the set of functions available in IS-Basic, on the other are those functions usable from the word processor.

Cartridge Basic

Like every other home computer, bar only the moribund Jupiter Ace, the Enterprise uses a version of the Basic programming language. Unlike most other machines, the Enterprise Basic comes on a cartridge which slots into the ROM port on the left-hand side of the machine. However, the word processor lives in a ROM inside the main body of the machine.

You do not need anything in the ROM socket to use the word processor. Switch the machine on minus the Basic cartridge, and after the system-checking procedure you are in the word processor. Connect a printer to the machine via the printer socket on the rear and you have a fairly respectable system. Needless to say, the port is non-standard, though wiring a cable from it to Centronics-type interface is not a difficult matter. Enterprise Computers supplies the necessary leads.

Ideally a software package requires no more documentation than instructions on how to load it. The Enterprise word processor's documentation takes up no more than four pages of the manual. I suspect that this is not really enough to allow novices to make the most of the package, though operation is fairly straightforward.

Entering the word processor from Basic destroys anything currently in memory. The same applies when you change the word processor mode from the 40-column to the 80-column option. The first memory wash is acceptable, but not allowing a change of screen width in the middle of a document can be very annoying.

Although the 80-column display works perfectly well with a television, anybody seriously considering doing a lot of 80-column word processing ought to consider buying a colour monitor. The software automatically performs word-wrap on entered text, and the functions are triggered by a combination of one of the function keys together with the Control or Alternate key, or maybe just a function key on its own. For the most part the functions act on a paragraph.

Copy can be altered in what amounts to

The joystick is used like the cursor keys on MSX machines.

a Screen Editor mode. You simply move the cursor to the position required using the joystick. Once there, you type over the offending text or delete it, or use the Insert key to add some more. Nowhere are you given any indication of the size of your document, nor are there any clues as to how much memory you have left. However, the 64K memory is clearly capable of storing a sizeable amount of text: I expect you could have a document of up to 9,000 words, which is a lot for a word processor that does not use discs.

Although there will be an Enterprise disc option, there is no indication that the word-processor software might support discs. It can save to tape, but a tape-based word processor is no use to anyone requiring a serious writing tool. There are none of the sopisticated word-processor features like block move, block delete or even search and replace. There doesn't even seem to be any recognition of the fact that documents need to be organised in pages when they are printed out.

Despite the shortcomings, the word processor is far superior to the offering included with the Commodore Plus-4. As a professional system it does not stand much comparison with the likes of Microsoft Word or Word Perfect, and does not even come up to the much maligned standards of WordStar. Yet those packages alone cost more than the complete Enterprise system.

On the hardware front the Enterprise scores a number of points over its eight-bit rivals. I am slightly dubious about the bold claim that the Enterprise is a computer "with obsolescence built out". Over a year ago when the machine was first launched that didn't sound so silly, but in the interim a number of innovative products like the Sinclair QL and the Apple Macintosh have arrived to make the eight-bit micros look distinctly old hat.

This claim must be more of a reference to the expansion capability of the computer. It can in theory address up to 4Mbyte of ROM or RAM, though the memory expansion sets are not available yet. Elsewhere, the Enterprise is well endowed with expansion possibilities. To the right of the machine is a hooded slot which hides the expansion socket. It is in fact no more than one side of the pcb with a number of tracks extending to the edge in the time-honoured manner.

Along the rear of the main case is the power socket, TV output and a distinctly non-standard monitor port. The Enterprise does not possess an on/off switch, though there is a Reset button. The printer port is again non-standard, but is easily connected to a Centronics interface. There are two control ports. Also on the back is a serial port and a very interesting cassette port.

Non-standard

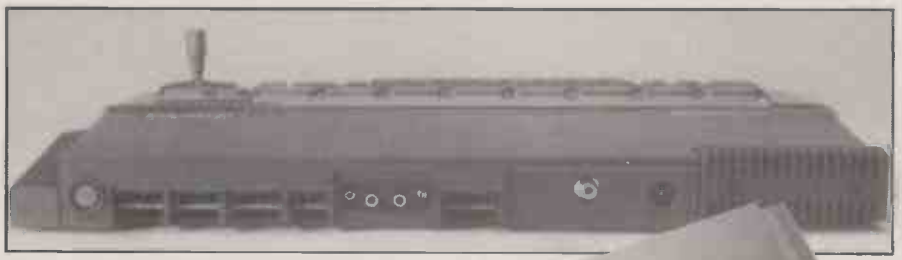
The twin control ports will initially be used as little more than joystick ports. As such they are non-standard — they don't take Atari joysticks, which is a great pity as that was one area at least where different manufacturers had standardised. The serial port is again non-standard. Enterprise Computers clearly decided to cut costs by leaving everything as edge connectors rather than supplying proper sockets.

In addition to the RS-423 interface — which connects with relative ease to a variety of modems, printers and plotters — the same port also is used for the network. This allows up to 32 Enterprises to link together and will be useful if the machine ever makes it into a classroom. Sockets are included so that you can connect two cassette recorders up to an Enterprise, both of which can have their motors under computer control. This sounds like a good idea, especially for file handling. However, with the constantly falling real cost of disc units, I feel that it is unneccessary. How many people own two cassette recorders anyway?

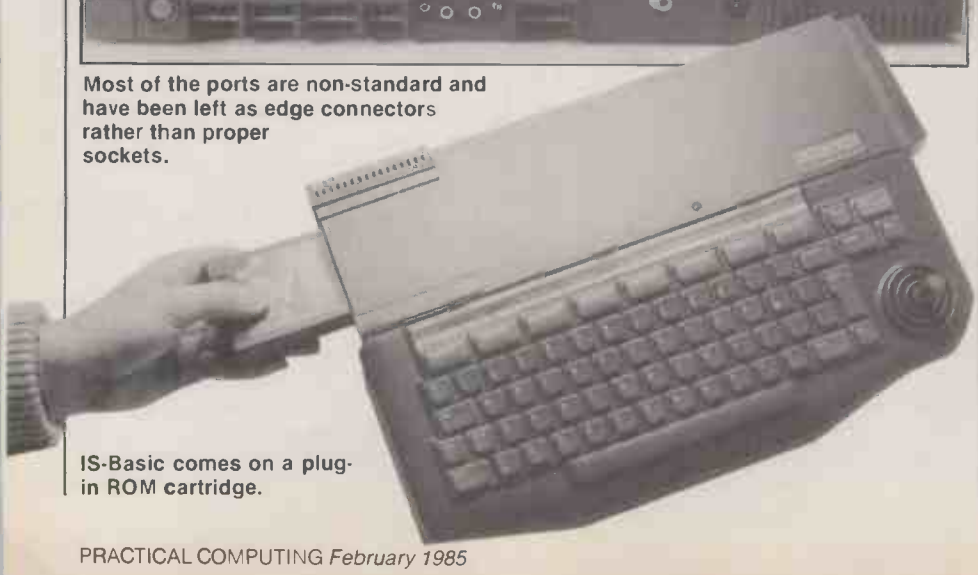
Stereo music — or rather sound — is output through the cassette interface, and it is possible to listen to it if you have Walkman-type headphones. Again, what initially seems to be a good idea is not so impressive in practice. Because the socket is at the rear of the machine, and most Walkmans only have a couple of feet of headphone lead, you have to sit in an uncomfortable crouched position to be able to hear the sounds. What you can hear is impressive, but even Paul McCartney would have difficulty getting listeners if you had to contract backache to hear him.

Inside the case are two rather special custom-built chips called Nick and Dave. They sound more like presenters from breakfast television than sophisticated slices or silicon. Yet this pair are the real heart of the Enterprise. A modern home computer is a little like a medieval court: to the outside world it doesn't matter so much who is sitting on the throne; what really counts is who gets to interperet the instructions. In the land of Enterprise the Z-80A may be king, but Nick and Dave are in charge of implementing policy.

Nick and Dave control the video output and the stereo sound of the micro. In many ways, these two facilities as implemented on the Enterprise represent some kind of peak in the development of the eight-bit home computer. Next month I shall be looking at both the sound and the graphics, together with the highly impressive IS-Basic.



Most of the ports are non-standard and have been left as edge connectors rather than proper sockets.



IS-Basic comes on a plug-in ROM cartridge.

Specification

CPU: Z-80A running at 4MHz
RAM: 64K
ROM: 32K operating system internally, Basic comes on a separate 16K cartridge
Keyboard: standard QWERTY layout, 69 keys plus eight function keys and a joystick cursor control
Display: text modes 40 by 24 and 80 by 24; graphics up to 672 by 256, though higher with interlacing software; maximum of 256 colours at a time on screen
Sound: four channels, including one of noise; can be output in stereo
Interfaces: ROM port, expansion socket, twin joystick ports, monitor output, Centronics printer driver, RS-423 and network output, two cassette ports
Software in price: word processor on ROM; IS-Basic cartridge
Dimensions: 38mm. (1.5in.) by 393mm. (15.5in.) by 254mm. (10in.)
Price: £249.95 including VAT
Manufacturer: Enterprise Computers, 31-37 Hoxton Street, London N1 6NJ. Telephone: 01-739 4282

APL for the QL

Glyn Moody tests out a new version of this high-powered programming language, and discovers that now it is easy for anyone to learn.

THE INITIALS APL stand simply for A Programming Language. Since its first implementation on an IBM mainframe in the late sixties, it has gained a small but fiercely loyal following among programmers. It is therefore rather surprising to learn that it was originally developed as a purely mathematical language. Its inventor, K E Iverson, published his book *A Programming Language* in 1962, as the result of work he had done as a professor at Harvard University on ways of studying algorithms more formally.

This formal mathematical background is both APL's greatest strength and its greatest weakness. It means that you can write powerful programs in very few lines of code. Unfortunately, until recently, you needed to use weird and wonderful symbols to do this, which in turn usually meant an expensive special keyboard. This, together with the fact the APL listings look like hieroglyphics, have limited the appeal and spread of an otherwise attractive language.

MicroAPL's new version for the QL may well change that. Apart from making the language available for less than £100 on a home micro, MicroAPL has made one of those great leaps forward that are simply doing the obvious. Instead of the numerous special characters required to unlock the mysteries of APL, short and self-explanatory keywords are used throughout. No additional symbols are needed, and the resulting output has a comfortingly Basic-like look to it — see listing 1.

```
<1>  !NUMERIC INPUT UTILITY
<2>  !A<;1 2 3> ARE NUMBER, MIN AND MAX OF SUCCESSIVE FIELDS
<3>   R is #ERX ERR
<4>   goto 0*index 0 eq 1 take size A is(!-2 take 1,size C)size C is(A,
      -10000000),10000000)<;1 2,3+2 eq -1 take 1,size A>
<5>  L1:goto L3*index 0 eq size R is,prompt,0 size prompt is B,' ? : '
<6>   goto L3*index not and on R in'-+./ 0123456789'
<7>   goto L4*index(+on A<;1>)ne size C is,exec(R ne'/')over(R ne'/')on R
<8>   R is 0 size N is 1
<9>  L2:goto L5*index or on 0 is(A<N;2>gt A<N;1>take C)or A<N;3>lt A<N;1>take C
<10>  goto L2**size C is A<-1+N is N+1;1>drop C,0 size R is R,A<N;1>take C   *
<11> L3:goto L1,0 size# is #AV<14 136>,'*** INPUT NOT NUMERIC - PLEASE RETYPE **
      *',#AV<14>
<12> L4:goto L1,0 size# is #AV<14 136>,'*** ',(,2 0 fmt+on A<;1>),' NUMBERS NEED
      ED - PLEASE RETYPE ***',#AV<14>
<13> L5:#AV<14 136>,'*** ';D on A<N;1>take C;' IS OUTSIDE THE RANGE : ';A<N;2>;'
       TO ';A<N;3>;' - PLEASE RETYPE ***',#AV<14>
<14>  goto L1
<15> ERR:goto L3*index 13 ne 1 take #LER & goto 0
      defn
<16>  defn
```

Listing 1. Sample MicroAPL keyword listing.

```
[1]  ⍝NUMERIC INPUT UTILITY
[2]  ⍝A[;1 2 3] ARE NUMBER, MIN AND MAX OF SUCCESSIVE FIELDS
[3]   R←⎕ERX ERR
[4]   →0×ι0=1↑ρA←{(¯2↑1,ρC)ρC←(A,¯10000000),10000000)[;1 2,3+2=¯1↑1,ρA]
[5]  L1:→L3×ι0=ρR←,⍞,0ρ⎕←B,' ? : '
[6]   →L3×ι~∧/R∈'¯+./ 0123456789'
[7]   →L4×ι(+/A[;1])≠ρC←,⍉(R≠'/')\(R≠'/')/R
[8]   R←0ρN←1
[9]  L2:→L5×ιV/D←(A[N;2]>A[N;1]↑C)∨A[N;3]<A[N;1]↑C
[10]  →L2××ρC←A[¯1+N←N+1;1]↓C,0ρR←R,A[N;1]↑C
[11] L3:→L1,0ρ⎕←⎕AV[14 136],'*** INPUT NOT NUMERIC - PLEASE RETYPE ***',⎕AV[14]
[12] L4:→L1,0ρ⎕←⎕AV[14 136],'*** ',(,2 0⍕+/A[;1]),' NUMBERS NEEDED - PLEASE RETY
      PE ***',⎕AV[14]
[13] L5:⎕AV[14 136],'*** ';D/A[N;1]↑C;' IS OUTSIDE THE RANGE : ';A[N;2];' TO ';
      A[N;3];' - PLEASE RETYPE ***',⎕AV[14]
[14]  →L1
[15] ERR:→L3×ι13≠1↑⎕LER ◇ →0
      ∇
[16]  ∇
```

Listing 2. The same program in standard APL.

Basic's strengths

The end result is an interpreted and interactive language that offers practically all the advantages of Basic, with many more individual features, not to mention fundamental advantages of design. And all this with no loss of speed. For example, APL on the QL can invert a 20 by 20 matrix in about 50 seconds, and using just one line of code.

MicroAPL's interpreter for its implementation of the language requires about 100K. If all of this were downloaded from Microdrive, there would be precious little available for the workspace. So the routines are split, with 30K resident on ROM and the remainder on cartridge. Once the interpreter is fully loaded, there are no further accesses to Microdrives except for saving and loading APL programs. Hence response times are very fast.

Like Basic, APL is interactive. So typing

```
3+4
```

and pressing Enter produces

```
7
```

Output is differentiated from input by colour and the fact that input is indented.

The ordinary arithmetic operators +, −, * and / function as in Basic; they are calculated to 18 significant figures and displayed to a maximum of 15. But there are a couple of important differences. First, they can apply to lists of numbers as well. Thus the odd-looking

```
2 4 34 6 + 3 27 4 1
```

is perfectly legal and produces

```
5 31 38 7
```

You can even divide lists:

```
4 8 6/2
```

gives

```
2 4 3
```

The last example also indicates another important difference between APL and Basic: arithmetic operations are carried out from the right. So

```
2 3 1+8/2 2 2
```

gives

```
6 7 5
```

The standard arithmetic operators can also stand on their own. Thus /4 is equivalent to the inverse function, and produces 0.25. The operator * gives 1 if the number that follows it is positive, 0 if zero, and −1 if it is negative.

Various operators can act on single numbers or lists. For example, the operator Max will round up a decimal. Max 32.4563 gives 33. Similarly Min 32.4563 gives 32. Like the arithmetic operators, Max and Min can stand between two numbers, in which case they return the greater and lesser of the two.

More powerful is the operator On. It

allows operations to be performed iteratively: in some respects it is a one-word version of a Basic For loop. For example,

```
+ on 2 4 5 3
```

would produce 14, which is

```
2+4+5+3
```

General operators like Max and On play a key role in APL. One of the most important is the operator Is. This is used to assign numbers, lists and tables to variables. It is the main verb of APL. After a variable has been assigned a value, typing that variable causes its contents to be printed. Once again, the interactive nature of the language is apparent.

Tables are set up using the Size command. For example a 10 by 10 table of random numbers is generated by

```
a is 10 10 Size 100 rand 100
```

Like lists, tables can be manipulated directly in APL. If a and b are two tables of similar shape, then a + b calculates the element by element sum. Tables can also be multiplied by a scalar directly: 3*a will give a table whose elements are each three times the elements of a.

To multiply tables together using the rules of matrix multiplication, there is a special symbol: +.*. The operator MatDiv will produce the inverse of a matrix. The single line

```
+ matdiv 20 20 size 400 rand 400
```

will invert a 20 by 20 matrix of random numbers. The + sign at the front is another example of the single-argument form of an operator. In this case it displays whatever is to the right of it.

Decode

Matrices can be up to eight-dimensional. A three-dimensional matrix can be regarded as a cube of numbers; it is displayed on the screen as three slices through the cube of two-dimensional matrices. Higher-dimensional versions are less easy to visualise.

There are a host of other operators, some familiar like logs, trig functions and logic operators, and others peculiar to APL. These include things like Decode, which allows you to convert from mixed number bases, such as those found with years, months, days and so on. So

```
1 52 7 24 60 60 decode 25 41 2 8 34 5
```

converts 25 years 41 weeks 2 days 8 hours 34 minutes and 5 seconds to seconds. Although such operators may seem of limited use, they do allow you to access a wide range of features in a compact way.

Such manipulative power would be little use without the ability to use it in extended programs. These are called functions in APL, which reflects the fact that they work just like the built-in operators provided by APL. Once defined, the functions can be called and linked together in other function definitions. In some respects they are like procedures in highly structured Basics, or the functions that can be defined in Forth.

You leave the directly interactive mode using the command Defn. Thereafter, all lines are numbered, and their contents are not executed. Defn is followed by the name of the new function — for example, Defn Func. If the new function is to have arguments they must be signalled in the Defn statement: Defn Func x. The definition that follows will use the same variable x in its statements. Similarly, if you wish the result of a function to be put into a specified variable, this can be done in the same way, as in

```
defn z is func x
```

which puts the output of Func x in z. The function definitions use lines of APL written in the ordinary way. A second Defn is used to terminate the definition. Listing 1 shows a typical function listing.

Once a function has been defined, it enters the workspace, and remains available during the current computing session. The workspace is another key concept in APL. Any functions or variables that are defined remain in the workspace until the machine is switched off. In this way functions can call each other and also use sets of data stored as variables. Rather than file individual functions, it is the whole workspace with its set of associated functions and variables that is saved. New workspaces can be set up for different sets of functions. In this way a complete program can be built up from a series of small units. Each of these can be written and tested before moving on to the next section that calls them. The editing facilities of APL are also geared to program development.

Errors in a newly defined function throw up a variety of error messages, some more intelligible than others. More usefully, the first offending line is highlighted, and an arrow indicates the spot where the function failed. You can then list the function and proceed to edit that line. Functions are run, just as variables are displayed, simply by typing their name. But APL also allows you to run from a particular line in a function. In this way you can progressively debug a function without constantly having to rerun all of it.

Workspaces are saved and loaded using the system commands)Save and)Load. This family of commands, which all begin with), is used for general management. For example)Vars will give a listing of current variables in the workspace, and)Fns gives the functions.

Another class of system functions provides various standard lists and options for setting parameters. All of them begin with the hash symbol #. Thus #A stores a list of upper-case letters; #M the months of the year; #PP sets the print precision, that is the number of digits, in numeric output. One very useful command is #WA, which displays the number of bytes remaining in the work area. For a standard QL, on power-up, it is about 29K.

The # symbol also plays an important role in the APL language itself. It is used to get keyboard input. Thus

```
a is #
```

will display a query mark on the screen. If a number is then entered at the keyboard, it will be placed in the variable a.

Generally APL lacks some of the display facilities of more recent languages. But MicroAPL has again sought to get round some of these limitations by introducing hash commands that draw on the QL's screen handling. For example a range of commands of the form #CC –n, where n is an integer from 1 to 9, allows ink, strip and paper colours to be set. This part of MicroAPL's software is still under development.

Documentation

The manuals used for this review were final drafts, rather than actual copies that will go out to users. As such, they were full and well written. As well as a beginners' guide to APL, which include examples together with problems and solutions, there are various reference sections.

There is no doubt that freed from the shackles of an impenetrable notation, APL emerges as a very powerful and usable language. MicroAPL seems to have done a good job in replacing the standard APL symbols by keywords. Furthermore, MicroAPL's implementation of a keyword APL is such that programs written in it can still be run by standard APL packages, including those on mainframes, and vice versa. This is because there is a keyword translator that sits on top of the main interpreter.

MicroAPL will also be launching a version of APL for the QL that uses the special character set, together with stick-on labels for the keyboard. The price will be £129.95 against the keyword version price of £99.95.

APL represents one of the first products simultaneously to use something like the real power of the QL as well as offering the serious user or professional the possibility of advanced programming on a home micro.

Conclusions

- **MicroAPL's keyword version of APL is sensibly implemented. Printouts are no longer indecipherable reams of obscure symbols.**
- **The language that emerges is fast and almost indecently powerful. Anyone wanting a step beyond Basic could well find that APL is the answer.**
- **It is unfortunate that you need to use Microdrive cartridges. However, MicroAPL is confident that its implementation will be compatible with both floppies and hard discs.**
- **The documentation is full, and well suited to beginners and old hands alike.**

SYMPHONY

While 1-2-3 remains a top seller, why should Lotus Developments want to launch a second integrated business package? Paul Myerscough reports on the features of the new super-spreadsheet program.

HOLLYWOOD came to Heathrow as the U.K. micro world was introduced to Lotus Development's Symphony in a burst of American-style product promotion. A bank of computer co-ordinated slide projectors beamed images of success, invention, style and sophistication on to a wall that eventually dissolved into a stage with a live 40-piece orchestra. The canapés and wine that followed merely provided a breathing space before the audience transferred to adjoining rooms where more than 50 IBM and Compaq computers were available for hands-on trials.

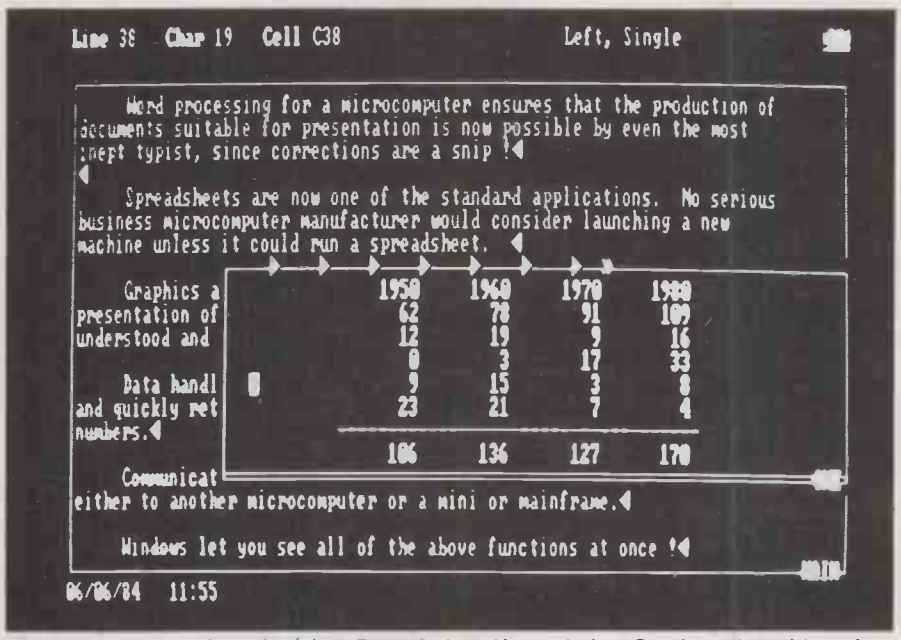
Market driven

What is so special that demands a £150,000 British launch and a £500,000 national advertising campaign? It is not technical innovation, nor is Symphony a brilliantly different software tool that demands this exposure. Rather it is the marketplace: Symphony is targeted squarely at the spreadsheet market, said to be currently worth $100 million.

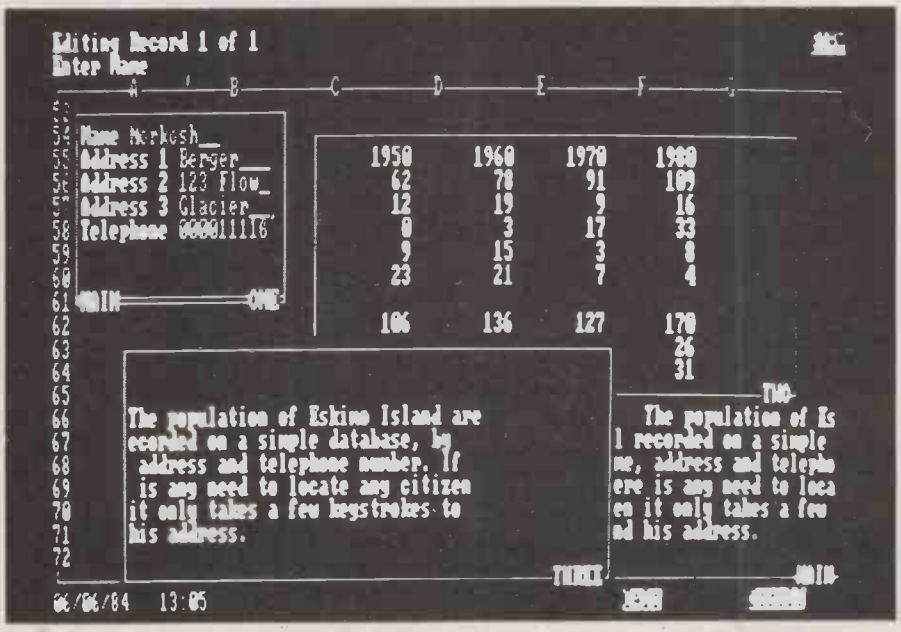
A computer enthusiast may never meet a spreadsheet, but for many business users this piece of software is the only reason for owning a micro. Combining functions analogous to file manipulation, programming and summary reporting all in a giant data matrix, these programs are used for storing simple figures or for presenting complex data. Their uses include simple book-keeping, engineering project costing, scheduling, building abstract models of the real world, and making What If projections.

Apple's success in selling computers is attributed to the business community's need for VisiCalc, the first well-known spreadsheet program. In January 1983 Lotus 1-2-3 was launched for use on the IBM PC. It was praised for its ease of use, a wider spread of functions that included graphics output, a large matrix and fast calculation. Within two months it became the best-selling software package in the U.S., a position it has more or less maintained ever since.

Such obvious success has attracted much well-funded competition. The result has been a series of product announcements for software that integrates a super-spreadsheet with other business functions. With users' needs well identified, the successor to 1-2-3 will be determined mostly by market presentation, not by any software innovation.



Word processing takes place in a Doc window. Here window One is active; although showing spreadsheet-type data it is also a Doc window.



Here the same text is shown in Sheet window Main and Doc window three. Window One is an active Form window for database work.

To provide an integrated product that is both clever and fast, programs and data must all reside in memory at the same time. Symphony requires around 290K of memory for programs, so the minimum 320K configuration leaves little more than 30K for data. In Symphony's case, integration is not the combination of separate programs, but rather the extension of conventional spreadsheet functions to include word-processor-like text manipulation, file-system-like screen masks, and commands associated with

graph generation and communications.

The package comes in a hard moulded plastic container with three well-produced manuals which together provide some 850 pages of information. One of the six discs is a copy-protected program disc which must be used at start-up time, but can subsequently be replaced by a Help disc or data disc. There are also two installation discs, a Help disc, a tutorial disc and one containing programs for printing graphs.

Access

Symphony's outer layer takes the form of a program called Access, which provides a menu allowing it to appear integrated with two separate programs Printgraph and Translate. Once the system is loaded the screen becomes a window on to an empty spreadsheet into which data may be typed or transferred from disc.

There is a single working environment, known as the worksheet, but you have four ways of looking at any area. Thus a window is given one of the types Doc for word-processor activities, Spread for spreadsheet, Graph, and Form for a formatted data entry and enquiry screen. Comm provides a blank screen for terminal emulation.

There are some restrictions on the handling of different types of data, but the method of operation makes it simple to place tables, text and graphs next to each other on the screen and to manipulate them together in one worksheet. Printing can be a little more complicated, as a separate program is used for printing graphs.

A plastic function-key overlay shows 23 key combinations usable in many parts of the system. Help is context sensitive and loads information from disc as required. Services provides a global menu controlling disc and printer interfacing, and general configuration and window management. Menu displays a list of options that relates to the type of work in hand.

Window management provides almost everything you might need. Any number of windows can be placed on the worksheet. Their size, shape and position on the screen can be selected by the user, and any number of them displayed or hidden. Transferring material from one window to another is easy. The only feature I missed — one that is offered by Open Access — is the ability to lock two windows together so that scrolling one causes scrolling in the other.

The tutorials cover the basic operation of each function area. The 16 15-minute lessons all show an example worksheet in the top half of the screen, with explanatory text in a window below. Students are forced to enter specific keystrokes to activate the functions discussed, which is a simple and effective method of reinforcing the lessons.

Extra capability

1-2-3 made its mark for user-friendliness and powerful functions. Symphony adds to this by improving the operating environment through global setting sheets. For printing the worksheet Symphony provides defaults for more than 20 characteristics like page length, margin positions and line length. These values can be overwritten on a setting sheet screen. The whole setting sheet is given a name and saved, and a catalogue of sheets is built-up to print a memo, a spreadsheet or a letter.

Four types of setting sheet — graph, database, print and communication — can be catalogued and called up by name in this way. A further five — configuration, document, sheet, services and window — are set or changed for a session, and all are saved with the worksheet to disc.

Symphony includes all the spreadsheet functions of 1-2-3. It extends some of the cell-range manipulating functions and adds a few others. As with many new releases the maximum matrix size of 256 by 8,192 cells is beyond most normal requirements, but unlike Open Access the sheet cannot overflow on to disc. Even with a fully configured IBM PC and a mostly empty worksheet, row 8,192 column 256 is unusable.

Translate

Data may be transferred from existing files through the Translate utility, which converts Symphony files to and from Dif and dBase II format. It is not a completely reliable procedure, and sometimes requires a Reset to recover system operation. This is a common fault, but it is disappointing that a piece of software designed to interface with outside files does not check the format of the data being read and terminate gracefully with a useful message when a problem is detected.

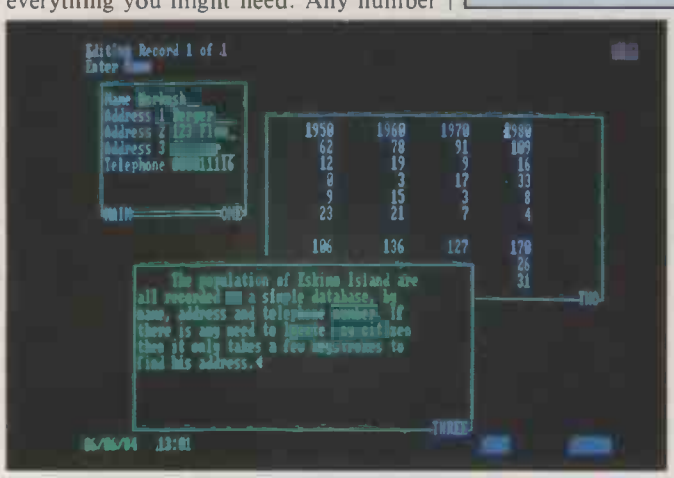
Getting around the worksheet is easy using Symphony's full range of Tab, Page, Scroll and Goto options. Windowing helps too, as a window can be associated with a particular range of cells and can be called up by name. Cell ranges may be given names, the name and cell-range relationships being managed as a separate table. This leads to some interesting anomalies in the adjustment of formulae when named ranges are changed, although Lotus deserves some credit for warning users about this.

The range of in-built functions for relating cell values is fairly wide. There are 17 maths functions, seven logic operations, 16 string functions, five business functions, seven statistical functions, 11 to do with date and time. A further 17 are concerned with table look-ups and database functions. What If analysis is achieved by setting up a table of substitution values for one or two

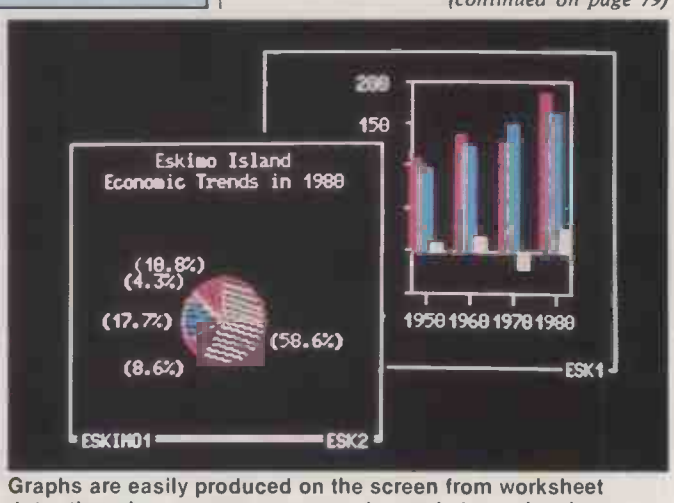
(continued on page 79)

System details

Symphony runs on all IBM PC micros and compatibles with at least 320K of memory. A version for the Apricot is due to appear early this year. Symphony costs £550 plus VAT and is distributed by Lotus Develpments, Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone (0753) 840281.



Here the window Main has been hidden using one of Symphony's simple commands.



Graphs are easily produced on the screen from worksheet data, though a separate program is needed to print them.

(continued from page 77)

variables involved in a master formula. On request, the system uses each of the entries or entry pairs, recalculates the model and places the solution to the formula in the pre-allocated cell in the What If table.

Recalculation may be invoked automatically or controlled manually. Where circular references are detected it is possible to request a maximum of 50 iterations of recalculation. Word processing on Symphony is smooth and efficient. Typing in a Doc window on the worksheet provides immediate access to a menu of commands, including Copy, Erase, Move, Search, Replace, Justify, Format, Page-break and Line-marker. Format masks may be introduced anywhere in the text to control tab and margin settings, and justification and wordwrap characteristics of subsequent lines.

Combinations

Key combinations can be used instead of the cursor-control keys to find the next/previous word, start/end of a line, paragraph, or document. A Goto command will reach a particular line or label in the text. Typing usually takes place in Insert mode; overtyping is possible, but without wordwrap.

Special characters are designated by Symphony for accessing printing features. They are embedded in the text and are interpreted by the software at print time to match the specified printer's requirements. The software uses a set of 256 international characters, and on printing does its best to reproduce what is required. For example, the £ sign is held internally by the code 163 and may be entered by the sequence Command key, 1, —; and if it is not represented by the printer, it will print as L, backspace, =.

Storing text to disc and printing it is controlled from the main services menu. The print option has its own setting window where margins, start/stop page numbers, page length, a single-line header and footer, and destination may be set up.

These features are adequate for most basic needs and pleasantly easy to use. Any that are missing from this part of Symphony may be noticed by the professional wordsmith but not by the typical spreadsheet user. Personalised form letters are created easily by embedding formulae to pull in data from elsewhere in the worksheet and by printing through a database printing option.

Colour display

With appropriate non-IBM hardware Symphony can display up to seven colours on one graph. To create a graph you store numeric data to be represented as cell entries in a sheet, prepare a graph setting sheet, preview the image on the screen and attach it to a named window. You then have to store it in a format suitable for printed output from the Printgraph program.

Ranges of cell are used for supplying numeric values, labels and display characteristics of a graph, which may be a pie, bar or stacked bar, line (discrete or XY), or a high/low open/close chart as used to show stock-market prices. Integration enables spreadsheet entries changed in one window to immediately affect a dependent graph displayed in another window.

A Symphony database is simply part of a worksheet where each row is considered a record and each cell in a row a data field. Columns in the worksheet are given names which become the names for fields held in that position in each record. The Form window, used in database processing, provides a formatted display of one record for adding, enquiring, changing or deleting data.

As the database is actually a worksheet the standard spreadsheet facilities are available for field formatting and calculations. Similarly, records may be sorted and selected, fields may be analysed statistically and data may be reported. More than one database file may be used at a time, but the restriction that all data must exist in memory in the worksheet seriously restrains the use of Symphony for file-based systems.

Communications software is integrated in the same manner as other features. In mid-session you can call up a communications sheet with preset data about modem protocol and a dial-up number, and initiate a communications session with a remote computer. In the same way the session can be interrupted by an incoming call. Received data is displayed and optionally sent to a printer. Any saving must take place within the worksheet, where it can immediately be manipulated by Symphony.

The macro facility offered by 1-2-3 was regarded as a powerful bonus over competing spreadsheets. Symphony expands this facility by providing the now common Learn feature. It records a set of keystrokes entered by the user and stores them in a special named area of the worksheet.

Once a repetitive task is learned in this way it can be repeated over and over just by calling up the name of the macro. The macro is stored in part of the sheet so it is quite possible to review what has been recorded and make corrections by editing. The macro may even be input manually, using the encoding scheme as a sort of programming language; Symphony has some 30 keywords for this purpose.

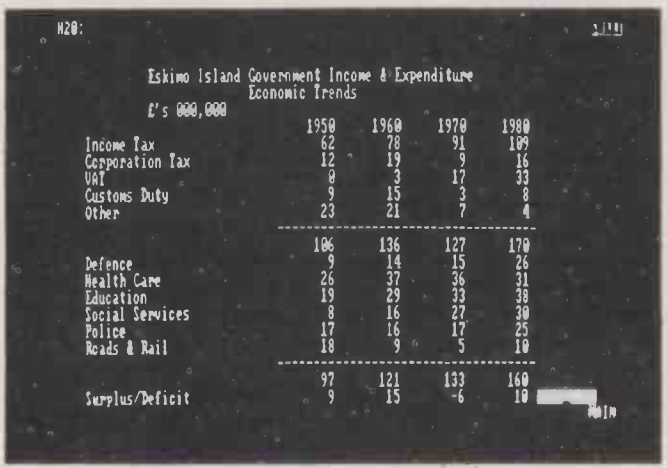
Conclusions

● After the fanfare of publicity, the biggest surprise about Symphony is that it is just another spreadsheet program.

● Symphony is not the world's most sophisticated spreadsheet, it provides only average word-processing power and the database function is a little exaggerated; some users regard the extra functions as an obstacle in learning to use the package.

● The support and training provided by Lotus are a strong point in Symphony's favour.

● According to the distributor Softsel, 1-2-3 is still the top-selling piece of software and Symphony is now number 3 — so why should Lotus worry?



H20:

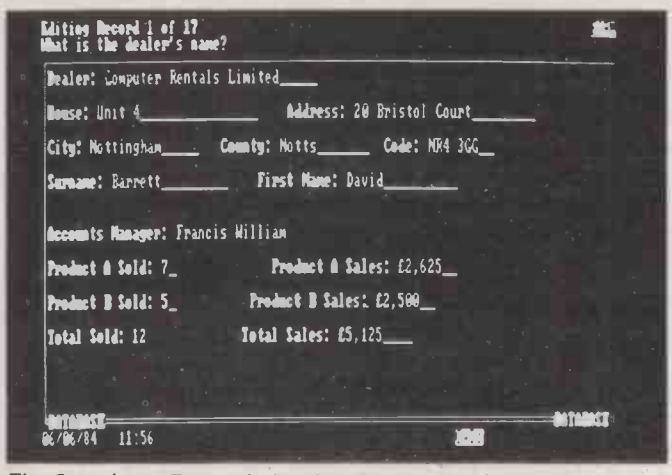
Eskimo Island Government Income & Expenditure
Economic Trends

£'s 000,000

	1950	1960	1970	1980
Income Tax	62	78	91	109
Corporation Tax	12	19	9	16
VAT	0	3	17	33
Customs Duty	9	15	3	8
Other	23	21	7	4
	106	136	127	170
Defence	9	14	15	26
Health Care	26	37	36	31
Education	19	29	33	38
Social Services	8	16	27	30
Police	17	16	17	25
Roads & Rail	18	9	5	10
	97	121	133	160
Surplus/Deficit	9	15	-6	10

MAIN

Symphony's Sheet window with a conventional matrix of spreadsheet cells identified by letter/number pairs.



Editing Record 1 of 17
What is the dealer's name?

Dealer: Computer Rentals Limited

House: Unit 4 Address: 20 Bristol Court

City: Nottingham County: Notts Code: NR4 3GG

Surname: Barrett First Name: David

Accounts Manager: Francis William

Product A Sold: 7 Product A Sales: £2,625

Product B Sold: 5 Product B Sales: £2,500

Total Sold: 12 Total Sales: £5,125

06/06/84 11:56

The Symphony Form window is a conventional database formatted input and enquiry screen.

FRAMEWORK

Chris Bidmead uncovers the hidden virtues of Ashton-Tate's program.

WITH ITS pull-down menus, movable windows, and zoom-ins and zoom-outs, the Framework environment bears a superficial likeness to the operating system of the Mac. That can hardly be a coincidence as both draw inspiration from Smalltalk, developed by Xerox during the 1970s. But while Macintosh windows are just segments of screen, in Framework they have hidden depths.

All activity in Framework is carried out in and around frames. Physically a frame is an area of screen with a literal picture frame drawn round it. It is adjustable in size and movable across the territory it lies on, using the Drag and Size keys. This territory can be another frame, creating a nest of Chinese boxes or frames within frames. Of course it can also be the desk top — the neutral area of screen that forms the top level of the nesting.

Frames come in several flavours, depending upon the work you expect to be doing in and around them. There are word-processing frames, spreadsheet frames, database frames and graphics frames, plus another one which we'll come to in a moment. I say work is done "in and around frames" because data can be written into the inside of the frames, and also on to the edge of the frame itself, for instance in the form of a label that gives the frame a name and identifies it to other frames on the desk top.

But as well as a label — and this is the real genius of Framework — the outside edge of every frame is allowed to have its own engine, in the shape of a formula hidden behind the frame label. The formula, which can be an entire Fred program, drives the frame. In the case of a graphics frame, for instance, it defines where the data to draw the graph is to come from and how it is to be used.

Frames can be strung together in a structure called an outline, which is itself a special kind of frame. Outlines define the way the Chinese boxes will nest together. Empty outlines are created at the touch of a couple of keys, and frames can either be slotted on to them, like presents hanging on a Christmas tree, or the individual branches can be nurtured and made to bear their own fruit. The two keys to the right of the PC keyboard marked – and + are used to move up and down between the levels, and you can move between frames on the same level by using the cursor keys.

Outlining is an example of Framework's powerful information-hiding concept. To imagine this feature in use picture the Christmas tree being able to fold instantly like an umbrella, with only its ribs showing, or with equal speed shrink to invisibility as one of its frames unwraps itself to fill the whole screen.

Better off

Powering-up Framework on the hard-disc 256K Olivetti left only about 23.5K available for data. I was actually slightly better off using the dual-floppy version of the same machine, as the disc driver is smaller, and with Framework on board leaves some 30K of user memory. If you are using Framework to run a business this certainly would not be enough. Besides limiting word processing to about 4,000 words, with 256K you can't load the Mite comms package into Framework, or even access all the built-in help sheets properly. The limitation was not a serious hindrance to exploring the essential features of Framework as long as unwanted frames were regularly deleted from the desk top.

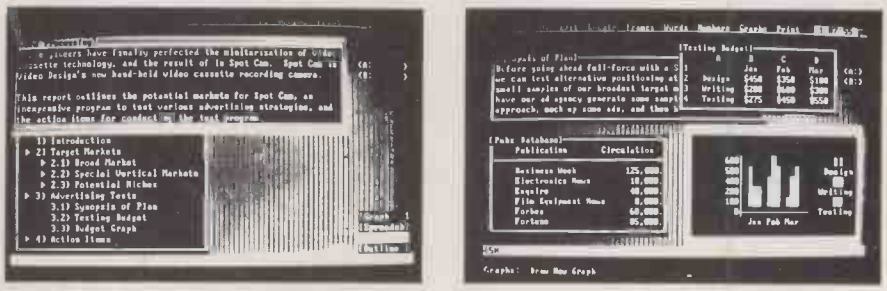
From inside Framework even the directory of disc files appears as a frame. Logically enough, the MS-DOS nested sub-directories are treated as sub-frames. The standard MS-DOS directory makes no visible distinction between files and directories, but when seen through the eyes of Framework the directories appear in angle brackets and are marked on the left-hand side with an arrow indicator, the standard Framework sign of the presence of a sub-frame.

You can enter into or exit from sub-directories very easily by using the – and + keys in the usual way, and you can fold or unfold a directory by positioning the cursor key over its name and hitting Return. Another Return folds it up again.

To open up a new frame you simply pull down the Create menu, select the kind of frame you want and watch it spring to life on the desk top. To open a frame that already exists as a disc file is even easier. Just put the cursor over the directory file name and hit the Return key.

Framework's command structure is designed to give you maximum help at the beginning without obstructing you with unwanted menus when you get going. The commonest functions like dragging, moving, copying and editing are permanently assigned to the 10 function keys, leaving the others to be accessed by way of the pop-up menus keyed along the top bar of the screen. At all levels, options always available during the run are permanently displayed here, and can be pulled down into Mac-like menus by hitting the Ins or Insert key, which has ingeniously been reinterpreted by the Framework designers as Instruct.

All these menu options can be short-circuited by using the Control key in association with the first letter of the menu name. Thus instead of having to hit the Ins key and moving the cursor along the menu bar to pull down the Numbers menu, you can get to it directly with Control-N.



The outline frame specifies the relationship of the other frames, which may be for word processing, spreadsheets, databases or graphics.

If you want right-hand justification in the spreadsheet, for example — you can go straight into operation with the Control-N followed by R. I would have preferred the pop-up menus to appear after a slight delay so that you could avoid them showing up at all if the whole command sequence is given quickly, but there seemed to be no way of beating the menus to the screen.

A spreadsheet frame is created from scratch by pulling down the Create menu and hitting the S key. Sensibly, the size of spreadsheets when first created by Framework is limited to 14 rows by 14 columns, but you can change this default or expand the spreadsheet as you work on it.

Lotus 1-2-3, Perfect Calc, Supercalc and Abacus users will be instantly at home with the way Framework's spreadsheeting works. Formulae are built up from standard functions, identified by a preceding @ sign, and text can be more or less freely interspersed among the numbers.

Fred

Fred, the Frame Editing Language, is a powerful extension of the 1-2-3 style of formulae into a complete programming language. It allows reiterative structures, nested procedures with parameter passing, local variables and the full panoply of string, graphing, numeric and sound functions. Sound functions? Oh yes, in Framework you can write a spreadsheet that plays tunes.

There is even a function called @run( ) which executes external non-Fred programs direct from the disc. Framework can therefore be used as an integrating environment that blends Fred programs with other routines written in more conventional languages, the technique used in integrating the Mite communications package.

Zooming the formula-editing line to full screen allows over 32,000 characters to be used in writing out each procedure. As each procedure can call others it is not difficult to build long and powerful programs. One shortcoming, which can be patched round, is that the elements of Fred are all functions rather than procedures — using the Pascal distinction.

Every keyword in the language begins with @ and is terminated by a pair of function brackets, within which all the relevant operators, variables and constants must nestle. Everything has to be disguised as a function, even structuring identifiers. For example, compound statements, built from simple statements bracketed together in languages like Pascal with Begin . . . End, in Fred have to be constructed by wrapping them up as parameters to a pseudo-function called @list( ).

As a further discouragement to using the language, Ashton-Tate has covered it only lightly in the two-volume manual supplied with the software. Programmers who want to explore it in depth are going to have to buy *Framework, A Programmers' Reference* at a hefty $25.

But Fred has its compensations. Debugging programs is greatly simplified by the way the system highlights the element in a formula that has caused the error. And if your Fred program calls a second frame that is correctly formulated but passes it the wrong parameters, examination of the second frame will often show up the offending parameter. Like dBase II, Fred gives the feeling that everything is within your reach, even though kludges are sometimes required.

As with Psion's Abacus and others, English-language cell addressing is allowed: instead of calling a cell B5, you can refer to it as

Jan.Distribution Costs.

Unlike Abacus, though, this facility has to be explicitly turned on with the ! command, and while it is enabled the ordinary short co-ordinate form cannot be used.

Hiding concept

The information-hiding concept goes deep. When you place the cursor over a cell with a formula in it and hit the Formula Edit key to pull it down into the edit line, you are doing no more than is now standard in spreadsheets. But try hitting the Zoom key at this point. The screen clears, leaving only the formula depicted in the top right-hand corner. You can now use the whole screen to extend the formula, add comments or perhaps extend it to a complete program. Using the convention derived from assemblers, a comment is marked off from the rest of the line by preceding it with a semicolon.

Formulae can refer to cells outside the current spreadsheet, provided the external spreadsheet is present on the desk top at the same time. If a spreadsheet at desk-top level wants one of its cells to display the average of a column of figures in a second spreadsheet — called, say, Summer Sales — it is a simple matter of writing in a function along the lines of

@avg(Summer Sales.B2:Summer Sales.B5)

The title of the spreadsheet has to be repeated like this because the same syntax allows you to define a region that lies across a number of different spreadsheets.

This cross-referencing between spreadsheets is a very powerful feature of Framework, although the mechanism can be a little long-winded when the second spreadsheet has been tucked away in an outline. The full path name down through the outline is required at each end of the reference. If the outline looks like this

3 Income
  3.1 Sales
    3.1.1 Spring
    3.1.2 Summer
    3.1.3 Autumn
    3.1.4 Winter
. . . . etc

the averaging function will have to be written out as:

@avg(Income.Sales.Spring.B2:Income.Sales.Spring.B5)

The Search and Replace functions accessed from the permanent top-line menu can be applied to the creation of formulae as well as to straightforward word processing, so complicated formulae do not necessarily require a lot of typing.

The so-called database section of Framework amounts to little more than the in-memory flat-file handling familiar from Lotus 1-2-3. It lays out a table of records in rows and fields in columns, and lets you sort and filter the data according to various criteria.

The filtering is much simpler and more consistent than the 1-2-3 method of creating a separate Criterion Area, and fits in naturally with the idea of frames. The database is a frame, and the filter — all

(continued on next page)

```
;@timer(@item1,@item2) => @item1-@item2

; timer takes two items both must be time strings hh:mm:ss.ss
; returns a time string which is the difference in hh:mm:ss.ss
; djh 7/84

@local(hr,min,sec,delta),
@set(hr,@value(@mid(@item1,1,2))-@value(@mid(@item2,1,2))),
@set(min,@value(@mid(@item1,4,2))-@value(@mid(@item2,4,2))),
@set(sec,@value(@mid(@item1,7,5))-@value(@mid(@item2,7,5))),
@if(sec<0, @list(@set(min,min-1),@set(sec,sec+60))),
@if(min<0, @list(@set(hr,hr-1),@set(min,min+60))),
@if(hr<0,@set(hr,hr+24)),
@set(delta,
     @if(hr<10,"0","")&@integer(hr)&
     @if(min<10,":0",":")&@integer(min)&
     @if(sec = 0, ":00.00",
     @if(sec<1,":00",
     @if(sec<10,":0",":"))&@decimal(sec,2))),
@return(delta)
```

Like dBase III, Framework is rich in date and time functions. They include a function @diffdate( ) to return the difference between two dates, but although a spreadsheet can keep an eye on the clock with the function @time( ), raw Fred is not able to return the difference between two times. However, one of the Fred function libraries supplied on the utilities disc includes a program called @timer, which will serve as an example of Fred source code.

Fred's @ timer.

Mite

Mite, from Mycroft Labs Inc., is a last-minute add-on to Framework and Ashton-Tate's answer to the Lotus Corporation's inclusion of a communications package in Symphony. It is a menu-driven package giving a choice of protocols to meet many needs, though not all. It understands XOn/XOff handshaking of text files and can transmit and receive binary files using the XModem Ward Christiansen protocol, and one or two others. It is not compatible with my own favourite, Move It, and neither will it communicate with BSTAM, the old-style comms package that is still widely used in the U.K.

Like Ascom, which it closely resembles, Mite can be driven from command files, and provides copious on-screen help. Some of the Help pages seem to think the package is still running under CP/M, and there is even a command to set the user number — quite out of place on an MS-DOS system.

The confusion between the two operating systems is at its worst in the system command section, which according to the Help screen allows you to call up the directory, copy files and so forth. The Dir facility is flakey, and one command is confusingly described in the Help screen as

Copy <source> = <destination>

although MS-DOS uses no =, and CP/M reverses the order of the source and destination files. It appears to have been removed from the software and from the hard-copy documentation. It is all evidence of hasty integration into the Framework package, but I came across no bugs that seriously affected the functioning of the system.

The documentation is top-notch, and includes a very full discussion of the ins and outs of serial communications, written in a non-folksy style that makes good reading for the intelligent beginner, and offers a quick refresher course to the old hand.

(continued from previous page)

salespeople called Jones who live in Sutton, perhaps — is to be applied to all of it. Go up-level to the frame title with the – key and hide a formula behind it by hitting the Formula Edit key and writing in the command line

```
@and(Salesp = "Jones", Locale =
  "Sutton")
```

Recalculate the frame, and when you next enter the frame with the down-level + key you will only see the filtered subset. The whole file is still there, and you can look at it again by evoking the Open All command in the Frames menu.

The filtering mechanism can also be applied to dBase files pulled in from the disc, being used to convert the records to Framework format and peel off the particular subset of the file you want to work with. But apart from reading and writing entire files, Framework is not able to handle disc-based data, so it does not begin to approach the sophistication of a true database-management system like dBase II or Superfile.

A graph frame can be dragged and sized like the other kind of frame, and takes instructions from a formula embedded in behind the title. A typical graph formula might be something like

```
@drawgraph(StoresSales.D2:StoreSales.
  D5, #Column, #Bar,,"Product Types",,)
```

This particular formula means: go to a spreadsheet called Storesales and get the data that lies in the cells ranging between D2 and D5; use the column tiles as labels for the x-axis, draw a bar graph, use Product Types as the title of the x-axis.

It is complicated, but the beginner does not have to bother about any of this because the graph-drawing menu pulled down from the main menu line writes these formulae automatically in response to some simple switch settings. The graph created in the frame is a low-resolution representation, but can be blown up to full colour if the hardware allows simply by hitting the Zoom button. Graph frames cannot be adjusted manually. You have to change the formula or go back to the graph-creation menu and start afresh.

A graph can be linked to a spreadsheet or database so that changes in the figures are immediately reflected in the graph. Just enter the name of the graph into any vacant cell of the spreadsheet. Of course, both spreadsheet and graph will have to be on the desk top at the same time. If you want the changes in the spreadsheet or database to be reflected in more than one graph, you simply include the name of more than one graph in the frame containing the original data.

Framework's word processor is not unlike a sensible subset of Microsoft's Word, except that the zoom facility gives you more room to see what you are doing, with fewer fixed menu lines cluttering up the screen. Screen editing works in a straightforward way, but for print formatting and features like headers and footers you need to resort to Fred formulae.

The comparison with Word is prompted by the way both word processors can dart about between quite different chunks of text laid on the desk top. I far prefer Framework's approach to word processing as it is easier to understand and more consistent, quite apart from the flexibility you can introduce with Fred.

One tiny feature illustrates this. When you switch the text-entry mode from Insert to Overtype, Framework is one of the few word processors that fulfils your intuitive expectation that the destructive backspace should overwrite characters with spaces as it moves to the left. Some word processors simply delete characters at this juncture, dragging the text to the left to fill the gap, which makes sense in Insert mode but not in Overwrite mode. Microsoft's Word locks out the destructive backspace as an illegal key when in Overwrite mode.

WordStar users are in for a pleasant surprise. The cursor remembers its column when you move it vertically over the screen. It hugs the text, moving to the left when short lines are encountered, but unlike WordStar reverts to its original column when longer lines permit.

The big feature of word processing with Framework is the use you can make of the Outline facility. Anything from some sketchy ideas for a short report to the grand design of your next novel can be laid out in outline form and developed holistically. The patchwork stays firmly together while you shift the patches around as you please. The patches need not all be text. In building a report you can use outlining to hold together a motley collection of graphs, spreadsheets databases and written commentary.

System details

Ashton-Tate, Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. Telephone: (0908) 568866.

Framework costs £495 plus VAT. It runs on IBM PC and PC/XT systems with at least 256K RAM. A 384K system is recommended, and is essential for running the tutorial and comms packages. A version for the PC/AT is expected in the U.K. soon.

Conclusions

- **Framework is a powerful, revolutionary way of tackling the problem of handling a variety of different processes and data types on an IBM-style micro. To call it merely an integrated package sells it short, but Ashton-Tate marketeers are wary of frightening you off.**
- **Framework aims to blur the distinction between using an application package and writing programs, and provides a smooth upward path for casual users who wants to take more power into their hands.**
- **Because it is memory-bound Framework really needs a machine with beefed-up RAM to use its full talents. It will come into its own on the next generation of virtual-memory micros.**
- **The manuals look good, but there are a number of irritating and sometimes misleading misprints.**
- **At around £500 Framework is very good value for money.**

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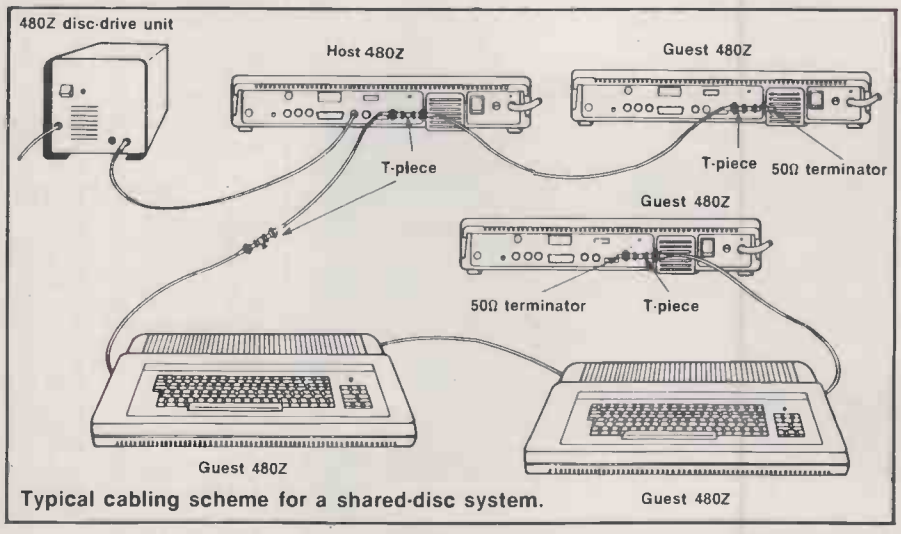
Talk amongst yourselves

Roger Cullis samples comms in the classroom.

THERE ARE two main reasons for networking microcomputers: users may wish to communicate with one another or they may wish to share common resources. In schools, while funds raised by parent-teacher associations and the local education authority usually provide an adequate number of computers to meet the needs of a class, they definitely will not stretch to supply a disc drive and a printer for each work station. So the need to economise provides the main motivation for linking computers together. The ability to download software from a remote computer is also becoming increasingly important with the advent of free bulletin boards or centralised resources.

Research Machines was the first British computer company to serve the education market. As part of a planned upgrade path which leads the user from a single computer to a full network system, it has designed a system to link a group of up to 16 of its 480Z microcomputers to a shared disc system. In this arrangement the host computer has the disc unit connected normally while the other computers are guests and are linked to the host machine by way of a coaxial cable.

The key to the system's operation is a transceiver interface which connects each computer to the coaxial cable by way of an optical isolator. The transceiver copes with multiple access by providing carrier sensing with collision detection. It is a high-speed system in which serial data transmission takes place at approximately 0.8 Mbits per second.



Typical cabling scheme for a shared-disc system.

RML Chain

The Chain network is a high-speed LAN developed from the Zilog Z-Net. Research Machines has developed an operating system by configuring the multi-user and networking versions of CP/M. This approach provides a processor-independent multi-drop bus network with a layered architecture that permits centralised resource sharing. The hardware is the same as the hardware used in the shared-disc system, and it is expected that a shared-disc system, SDS, will be upgraded to Chain when the extra resources required become available.

A typical network may include up to 16 480Z computers, a hard-disc unit, twin floppy drives and a printer. In addition, each computer on the network may have its own individual silicon disc in the form of a block of RAM configured to behave like a floppy disc and capable of giving extremely rapid storage and retrieval, or a local floppy-disc drive.

In the Chain network, each computer has a network interface of the type required for the SDS. The computers are joined together by means of 50 ohm coaxial cable. With standard cable the maximum length of the network is 300m. while low-loss cable permits this to be extended to 1.2km. The run consists of individual cables looped from computer to computer. They are coupled using standard BNC connectors and T-pieces. Terminators are attached to the ends.

The heart of the system is a network server. There are three options: twin double-density minifloppies, twin quad-density minifloppies and twin double-density 8in. floppies, each offering successively greater storage capacity. The network server also supports up to four 20Mbyte hard-disc units, giving ample program space for a typical educational establishment.

The network server runs MP/M 2.1 which is interfaced with CP/Net. It provides a true multi-tasking environment through with the users gain disc and spooled printer access. The system permits up to 16 users to have simultaneous read and write access to the same physical file by providing physical record locking. Each user can have access to up to 32 separate files, subject to the constraint that a maximum of 255 files may be open at any time on the network as a whole.

Booting the network is a simple operation. The system is powered up and Reset pressed. Stations may be logged on individually by typing N at each computer, or the network server may download a common program to a group of users.

Since Chain is a CP/M-based system, it follows the well-established CP/M file structure and uses familiar utilities like Stat and Pip. An additional feature provided by the network is a sysem of up to 16 user numbers for grouping files. Thus all the files used by the physics department might be classified user 8 and those used for school administration user 3. Communal files are held under user 0.

A great strength of CP/M is the wealth of business software which runs under the system. Research Machines has recognised this and has ported a large number of major packages over to the 480Z system. It also appreciates that the pockets of educational users are not as deep as those of business users and has negotiated

special prices so that its customers are able to take advantage of these resources. For example, WordStar, Multiplan, Cis Cobol and Fortran 80 are among the packages supplied bundled with a Chain Network, while special educational versions of Sage Accounts and dBase II are available at a fraction of the price of their commerical counterparts.

RML has also extended its system to satisfy a variety of specialist technical requirements. Typical of these is the Superdraft VI professional drafting software and the Pluto high-resolution graphics board with a palette of over 16 million colours. In combination with the Chain network, packages like this permit very sophisticated teaching to be carried out at a realistic cost.

Econet

Acorn's answer to sharing peripherals and linking computers is Econet. Each BBC Micro requires a suitable interface for which provision is made on the motherboard although this is not supplied as a standard item. The interface is based on the Motorola 68B54 advanced data-link controller chip and each computer possesses a block of links which can be pre-set to its own unique binary-coded station-identity code. One computer is designated at the file server and is connected to a disc system which acts as a backup store. Another computer is designated as printer server, although in larger networks there may be more than one.

Computers on the network are linked together with simple twisted-pair cable having four conductors and an earthed shield. Up to 254 computers can be linked on each Econet. The network is in the form of a single unbranched bus with a terminator box at each end. Five-pin DIN sockets are used at the computer connecting nodes and a short connecting cable is supplied with each Econet-equipped computer.

A clock box is attached to the bus at a convenient point, usually at the mid-point to minimise the distance to the remotest station. To simplify the task of wiring, Acorn supplies ready-wired harnesses for small installations, although for the classroom environment it is advisable to have a more permanent installation. The clock rate for the network, which is selected by means of links on the clock box printed circuit board, depends on the length of the connecting cables. The maximum length is 500m. corresponding to a clock rate of 76kHz. For a length of less than 100m. the clock rate can be increased to 300kHz. Speed of communication is directly dependent on the clock rate.

Two levels of Econet have been available for some time and two further enhancements have recently been announced. Level 1 is intended for small groups of computers, ideally not more than four. Level 2 is for larger groups and requires a 6502 second processor at the file server. Level 3 is a hard-disc based system and is intended for networks requiring a large amount of storage capacity. Econet Bridge permits a number of Econets to be connected together.

On the individual microcomputers, Econet is set up as a filing system with the software in paged ROM. There are two supported versions in circulation. The original version was an 8K NFS 3.34, which has recently been superseded by a combined disc and network filing system which incorporates DGS 1.0 and NFS 3.4.

Felsted School in Essex provides an excellent example of how the power of networking may be harnessed to integrate computing with all of the school's activities. The school is a collection of buildings occupying a large rural site within a village. The main computer installation is in a small outbuilding with two rooms, one of which houses the file servers and servicing facilities.

There are two main networks linked by an Econet Bridge. One network is served by an Acorn hard-disc system with standard Acorn software, and the other is supported by a Nascom 20Mbyte hard disc with file server software. The computer-studies classroom houses about 20 linked BBC Micros.

The teacher's work station can monitor and display a list of the files most recently

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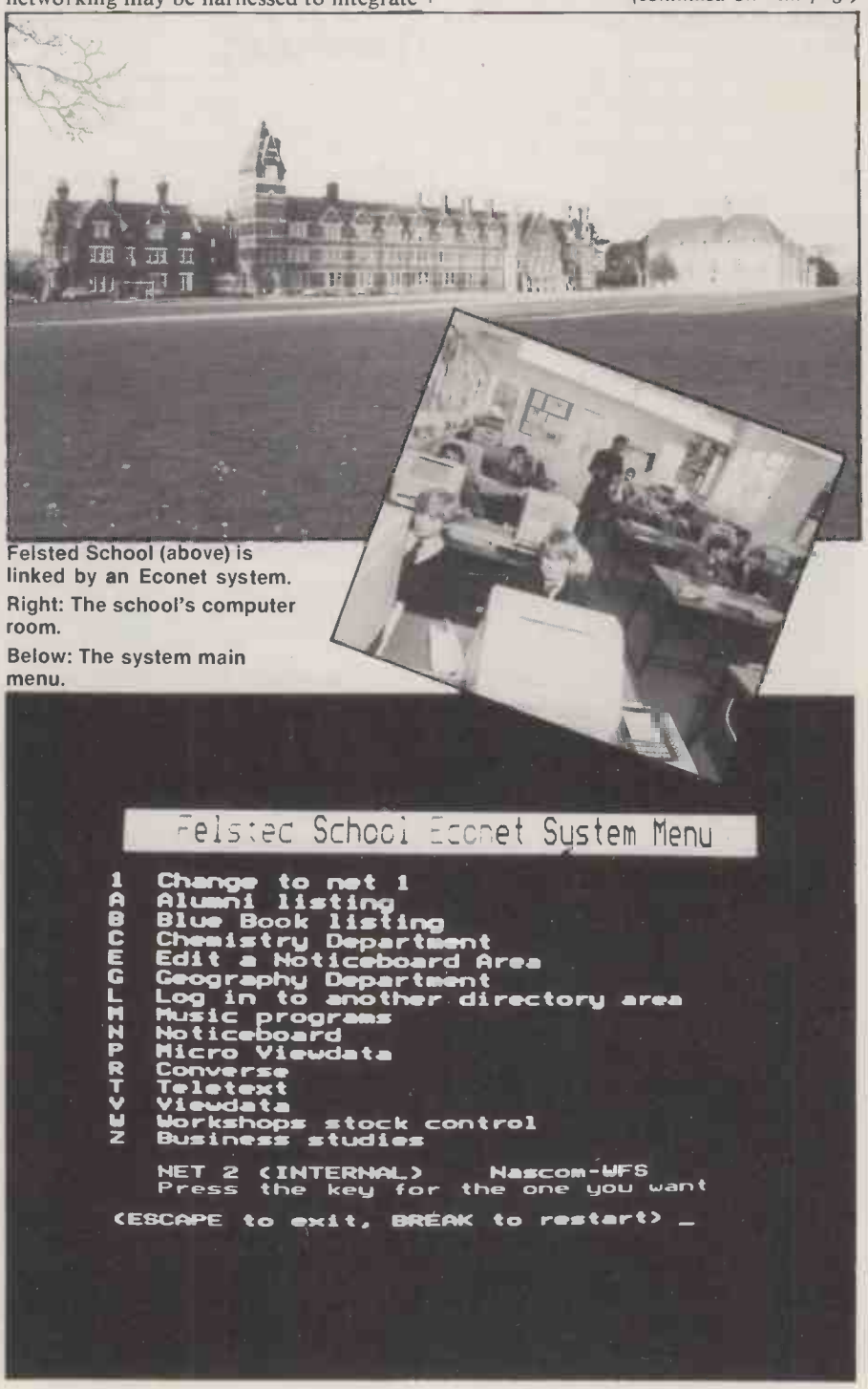


Felsted School (above) is linked by an Econet system.

Right: The school's computer room.

Below: The system main menu.

(continued from previous page)

accessed by each of the pupils' work stations so the teacher knows what program each student is working on. The teacher can break into the program or transfer it to their own machine for modification or correction. The entire class may be working on the same program or they may be working individually on any file to which the file server permits them access.

Network wiring extends over most of the school site. There are a further 20 or so computers in different locations although in other classrooms there are usually no more than two computers. Some computers are on trolleys and can be plugged in as required. One remote building which has not yet been linked into the main system has its own network of three computers served by a floppy-disc drive. Another building which is isolated by a public road is about to be integrated by either an infrared optical link or a British Telecom dedicated line.

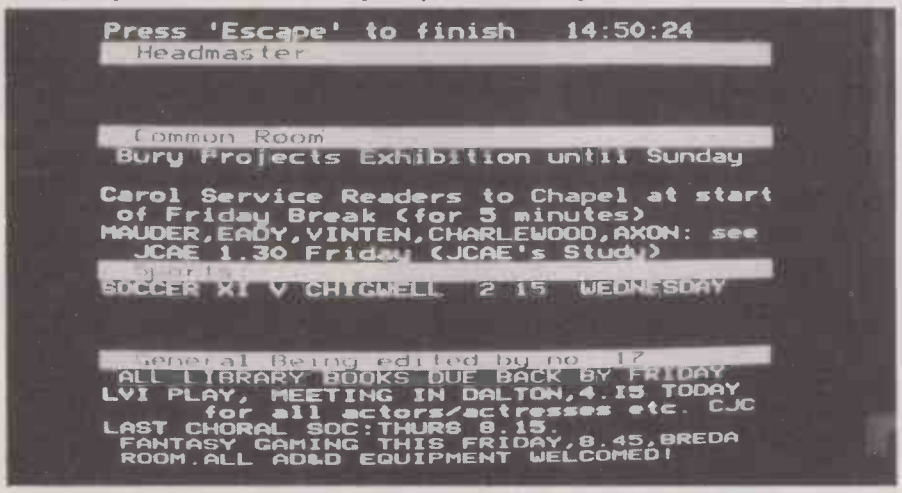
In other subject areas computers are used for group teaching with a single BBC Micro driving a large monitor display in each classroom. The geography and chemistry departments, in particular, have large suites of programs stored on the file servers.

The computer system also serves the school in other ways. Monitors located in strategic places serve as frequently updated bulletin boards and have replaced the traditional noticeboard. A time-clock display in the top line helps to ensure that they are frequently consulted, while the messages are abbreviated to permit them to be read while walking past.

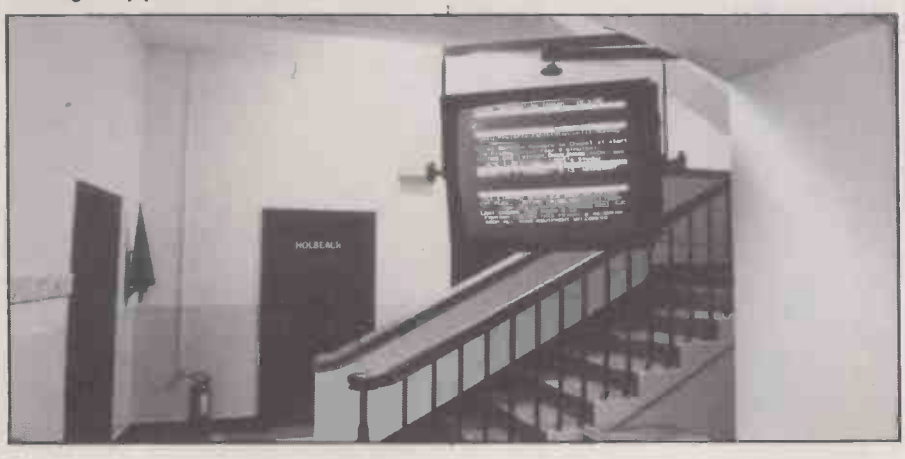
A teletext expansion unit is linked into one of the networks making available a wide range of broadcast news and software. Electronic mail messages can be sent from each work station to the file server for subsequent retrieval. Large databases contain lists of former and current pupils. The technology department has computerised its stock control. Word-processing facilities — Wordwise and/or View — are available on selected computers but they are ROM-based.

Torchnet

Torchnet is a variant of Econet and is an integral feature of all Torch computers and BBC expansion units from the ZEP-80 Z-80 second-processor card upwards. It requires the presence of a standard Econet interface on each machine and a clock and terminators on the network wiring. Unlike the Acorn Z-80 version of Econet, which treats the network as if it were an additional CP/M drive, Torchnet possesses all the commands and facilities of Econet. However, it does not require dedicated file servers or printer drivers. The firmware built into the MCP filing-system ROM permits any work station to carry out these functions.



At Felsted, electronic noticeboard displays (above) are networked to monitors strategically placed around the school.



E-Net

The Amcon E-Net is a hard-disc based system which uses Econet interfaces and protocols. Many of the commands are identical to Econet commands, such as *I Am and *Access; others have Econet analogues such as *Tell instead of *Notify, while the remainder such as *Park are unique to E-Net.

E-Net is under the control of a system manager who performs housekeeping functions such as assigning new users to the system and altering the disc allocation of current users. It permits the sharing of a disc system by a large number of users. Those who need to save programs are allocated disc space and a user number.

Control of the network itself is under the control of a file server, Eddie. However, since Eddie is preconfigured, it is feasible to place the disc system in a locked cupboard so that the system manager is not required to be physically present at all times that the network is in operation. Typically Eddie will be configured for up to 2,047 users with a largest single-user space of 1Mbyte. The upper limits cannot easily be altered once the system is running, but higher values can be allocated before any users are assigned.

There is a need to communicate with other computer systems of types which may not support the specialised protocols developed for use within the networks. Commstar is an example of communications software which converts a computer into an intelligent terminal to exchange data with other computers by way of an RS-232 serial interface. As it is intended for the BBC Micro, it is ROM-based.

Commstar

Commstar operates in two alternative modes. In terminal mode it can be configured in a variety of ways either by menu-driven commands from the keyboard or by specific emulations loaded from disc. There is also a Prestel mode using the teletext character set and Prestel communications protocols.

In terminal mode, data may be transferred byte by byte in chat format, or whole files may be sent in 128-byte blocks using Ward Christiensen protocols and handshaking. This permits Commstar to form the basis of simple shared resource system as files can be received from or transmitted to a remote computer for printing or saving to disc.

A Commstar-equipped computer can communicate with others either by means of a direct connection or by way of a modem and the public telephone network. It provides a cost-effective way to access free bulletin boards and Prestel.

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Speed freaks

Boris Allan argues that the standard Benchmarks bear little relation to a machine's real performance, and suggests some alternatives.

A SET OF eight Benchmarks is used in many microcomputer magazines, including *Practical Computing*. Benchmarks 1 to 7 originally appeared in the American magazine *Kilobaud,* while Benchmark 8 was devised by John Coll and first appeared in *Personal Computer World*. These Benchmarks are written in Basic, a language rarely used nowadays in serious applications. Speed is the only criterion they use, so other important aspects such as numerical accuracy are ignored.

Table 1 shows examples of Benchmarks 7 and 8 of the standard set. The third timing, labelled BM8/2, is produced by taking 1/10th of the eighth Benchmark, and corresponds to the original form of Benchmark 8. The numbers in parentheses are the rankings of the values for the Benchmarks BM7 and BM8.

From these two sets of figures, different averages can be computed. M1 is the arithmetic mean of BM7 and BM8/1; M2 is the arithmetic mean of BM7 and BM8/2. G1 and G2 are the corresponding geometric means, and Av. is the overall average or arithmetic mean calculated over all eight Benchmarks in the standard set. The numbers in parentheses give the rankings of the various values.

The Spearman rank correlation between BM7 and BM8 is approximately −0.8, indicating substantial disparity between the rankings on the two Benchmarks for this small selection. This disparity is shown clearly by computers C and F, at opposing ends of the two Benchmarks.

The means M1 and M2 show the effects of the negative correlation of the two Benchmarks. The rank correlation between M1 and M2 is about 0.1, which is rather suspicious because the means are composed of the same two elements, albeit with slightly differing weightings. The fact that the second mean, M2, is rank correlated at about 0.8 with the average of all Benchmarks, Av., suggests that Av. de-emphasises BM8 and accentuates the BM7 type of Benchmark.

The geometric means G1 and G2 correlate perfectly with each other since scaling has no effect on geometric means. It is the relative speeds and times which are of most interest, so the geometric mean is the one to choose, even when averaging all eight tests. However, it is not clear that it is necessarily useful to take an average of all eight.

Computer F is slowest of the six machines tested, as measured by the geometric mean, but is the fourth slowest as measured by the arithmetic mean. What has happened to F is almost the opposite to the experience of C, which is third on the geometric mean, but fifth on the overall average.

The correlation between the orderings G1/G2 and Av. is about 0.7, which is high but not perfect; a perfect correlation would be 1.0. So the question arises whether the use of a greater number of tests assist in the validity of the mean Benchmarks.

Given that you are interested in relative sizes, you could use the logarithms on the Benchmark times. In a preliminary investigation of the Benchmarks I calculated the standard Pearson interval correlations between the logarithms of the timings for the eight Benchmarks taken over a sample of 10 computers.

Using the standard correlation measure, the result of the correlation analysis showed clearly that Benchmarks 2 to 7 were strongly intercorrelated, with all correlations being 0.97 or greater. BM1 was less highly correlated with the other

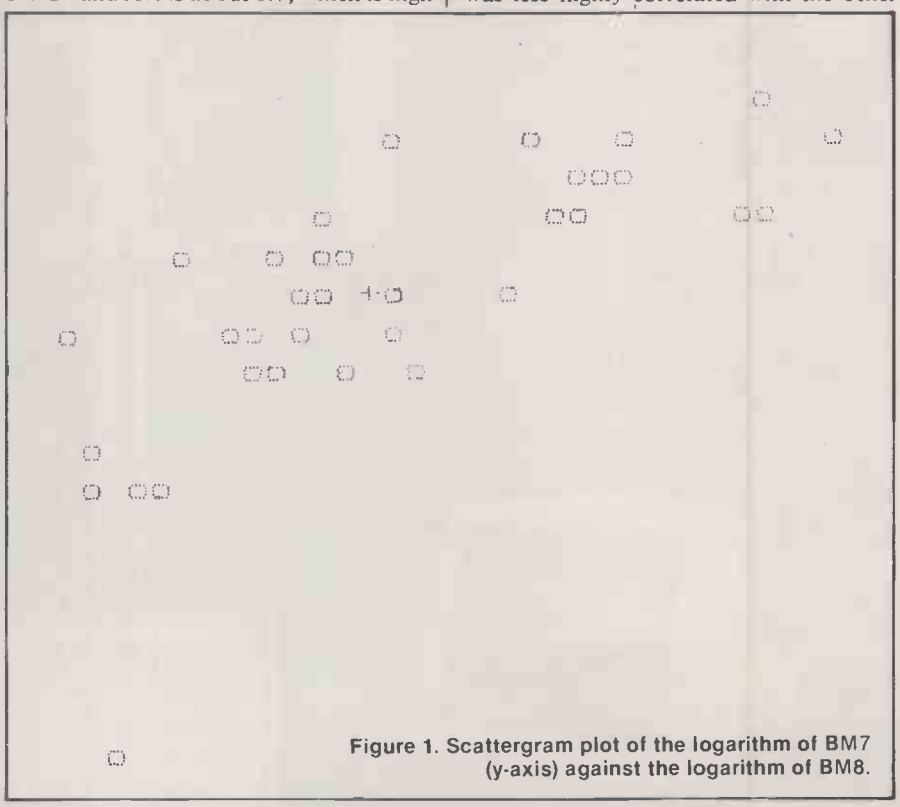

Figure 1. Scattergram plot of the logarithm of BM7 (y-axis) against the logarithm of BM8.

Computer	BM7	BM8/1	BM8/2	M1	M2	G1	G2	Av.
A	28.0(3)	27.0(2)	2.7	27.5(1)	15.4(3)	27.5(1)	8.7(1)	13.3(2)
B	21.9(1=)	38.5(5)	3.9	30.2(2)	12.9(1)	29.0(2)	9.2(2)	12.5(1)
C	42.4(6)	20.7(1)	2.1	31.6(3)	22.3(6)	29.6(3)	9.4(3)	15.6(5)
D	30.4(4)	34.3(4)	3.4	32.3(4)	16.9(4)	32.3(4)	10.2(4)	14.7(3)
E	37.4(5)	30.0(3)	3.0	33.7(5)	20.2(5)	33.5(5)	10.6(5)	16.8(6)
F	21.9(1=)	52.0(6)	5.2	37.0(6)	13.6(2)	33.7(6)	10.7(6)	14.8(4)

Table 1.

Benchmark 7.

```
300  PRINT "S"
400  K = 0
430  DIM M(5)
500  K = K + 1
510  A = K/2*3 + 4 - 5
520  GOSUB 820
530  FOR L=1 TO 5
535  M(L) = A
540  NEXT L
600  IF K < 1000 THEN 500
700  PRINT "E"
800  END
820  RETURN
```

Benchmark 8.

```
300  PRINT "S"
400  K = 0
500  K = K + 1
530  A = X^2
540  B = LOG(X)
550  C = SIN(K)
600  IF K < 1000 THEN 500
700  PRINT "E"
800  END
```

Benchmarks from 2 to 7, but even then the smallest correlation was 0.87. BM1 happens to be the shortest in execution time and so is more susceptible to errors in timing.

The remaining Benchmark, BM8, was most highly correlated with Benchmarks 1, 3 and 4, but this correlation was no more than 0.81. Thus there seem to be two groups of Benchmarks: the first consists of Benchmarks 1 to 7 and the second group contains only Benchmark 8.

So, effectively, using Benchmarks 1 to 7 is a waste of time. Of course, there are slight variations, but they are trivial. Averaging all eight Benchmarks in effect adds seven examples of one type of Benchmark to only one example of the other type. The effects of such changes in weightings are shown in the differences between M1 and M2.

If you wish to discriminate between computers, you do not need to measure almost the same thing in seven different ways, once is enough. To discriminate you need to examine BM8 and one of the other seven Benchmarks. I chose BM7 because it is slower and therefore more accurately measured, and of all the Benchmarks is least correlated with BM8.

I took 42 sets of Benchmarks, noted the calculated overall average where one was given, and calculated the average where there was none. The two values for Benchmarks 7 and 8 were entered on my list. The next stage was to convert the timings to logarithms, and to plot the resulting bivariate distribution.

Figure 1 shows the scattergram that is produced by a very approximate procedure which consisted of plotting lower case os at about the correct row and column position as given by the logarithm of the timing. BM7 is plotted on the y-axis and BM8 on the x-axis. Some of the computers were so close in timing that the os were superimposed. The o at the bottom left is the HP Series 200 Model 16, a very fast machine.

The Pearson correlation between the logarithms of the two Benchmarks is 0.73, which is a middling but not high figure for two measures of performance. The arithmetic means of the logarithms of the Benchmarks are indicated by a + on the graph, and correspond to the geometric means of the raw timings.

The geometric mean of BM7 is 33.8s. and for BM8 is 46.8s. so on average BM8 takes 1.384 times longer than BM7. As BM8 is inherently longer, to compare BM7 and BM8 you need to divide the BM8 timings by 1.384, to see which takes longer for any particular computer. To calculate one value to sum up the two Benchmarks, you use the geometric mean because you need not bother with any rescaling, since relativities are preserved.

Table 2 gives the results for the computers investigated. The six computers used were chosen because they are consecutive machines from the list of medium-speed computers. When the six

(continued on next page)

Benchmark results

	BM7	BM8	L7	L8	LM	L.Av.
VERY FAST						
HP 200/16	4.3+	15.0	1.46	2.71	2.08	1.25
FAST						
IBM PC/AT	15.0	13.9	2.71	2.63	2.67	1.96
OEM Orion	16.7	13.0	2.82	2.56	2.69	1.99
Olivetti M-24	14.8	15.9	2.69	2.77	2.73	1.96
Olivetti M-21	14.8	16.1	2.69	2.78	2.74	1.97
Wang PC	14.3	18.0	2.66	2.89	2.78	2.00
Olivetti M-20	26.5	12.0	3.28	2.48	2.88	2.38
MEDIUM						
Advance 86	23.9	26.0	3.17	3.26	3.22	2.43
Seiko 8600 (S)	29.7	23.7	3.39	3.17	3.28	2.58
Zenith Z-110	25.5	29.0	3.24	3.37	3.30	2.71
HP 150	28.0	27.0	3.33	3.30	3.31	2.59
LSI Octopus	21.9+	38.5	3.09	3.65	3.37	2.53
Sinclair QL	42.4	20.7	3.75	3.03	3.39	2.75
Amstrad CPC-464	30.4	34.3	3.41	3.54	3.47	2.69
IBM PC	37.4	30.0	3.62	3.40	3.51	2.82
Acorn BBC B	21.9+	52.0	3.09	3.95	3.52	2.69
DEC Rainbow	38.8	29.8	3.66	3.39	3.53	2.84
ACT Sirius	40.1	29.0	3.69	3.37	3.53	2.85
ACT Apricot	34.5	35.0	3.54	3.56	3.55	2.80
Canon AS-100C	35.5	34.0	3.57	3.53	3.55	2.82
Compaq	37.6	36.9	3.63	3.61	3.62	2.87
IBM PPC	37.6	36.9	3.63	3.61	3.62	2.87
Kaypro 10	29.5+	51.0	3.38	3.93	3.66	2.83
Apricot F1	39.5	38.5	3.68	3.65	3.66	2.91
DG The One	39.5	39.1	3.68	3.67	3.67	2.93
Logica Vitesse	44.9	35.0	3.80	3.56	3.68	2.99
RML 480Z	33.1+	50.7	3.50	3.93	3.71	2.98
Tatung Einstein	34.5+	49.5	3.54	3.90	3.72	2.93
SLOW						
Sharp MZ-700	32.0+	82.0	3.47	4.41	3.94	3.00
Seiko 8600 (T)	60.5	47.8	4.10	3.87	3.98	3.29
Apple IIe	45.6+	100.6	3.82	4.61	4.22	3.47
Epson PX-8	45.7+	105.3	3.82	4.66	4.24	3.47
Commodore 16/Plus-4	61.0+	88.0	4.11	4.48	4.29	3.47
Commodore 64	51.6+	116.0	3.94	4.75	4.35	3.53
Sharp MZ-5600	53.8+	115.2	3.99	4.75	4.37	3.53
Tandy Color	51.1+	132.6	3.93	4.89	4.41	3.61
VERY SLOW						
Yamaha YIS-503	44.9+	216.0	3.80	5.38	4.59	3.80
Oric Atmos	69.2+	140.0	4.24	4.94	4.59	3.79
Spectravideo	45.2+	236.0	3.81	5.46	4.64	3.82
Epson HX-20	101.0+	132.0	4.62	4.88	4.75	3.94
ZX Spectrum	80.7+	253.0	4.39	5.53	4.96	4.07
Tandy 100	63.6+	323.0	4.15	5.78	4.97	4.21

(continued from previous page)

are examined within the context of the surrounding machines it is clear that both the Octopus and the BBC model B are extremely fast compared to their neighbours on BM7, but both are rather slow on BM8.

If the relative orderings of the two computers on L.Av. is studied, it can be seen that their relative ranking is higher than that from LM. In fact, the Octopus becomes the second fastest computer in the medium group on L.Av. as compared to fifth fastest on LM, and the BBC model B moves from ninth fastest on LM to fifth fastest on L.Av. The reason for this disparity is that the machine is faster on BM7 than on BM8, indicated by the + appended to the BM7 timing. Generally the Benchmarks are biased towards the kinds of features tested by BM7, and so the Benchmarks as a whole are biased in favour of the slower machines, which do relatively badly on BM8.

The timing for BM8 is so strange for the HP Series 200 Model 16 that I suspect that it should be 1.5s. rather than 15s. The microprocessor for the HP is the Motorola 68000, and the Sinclair QL runs BM8 in 20.7s. on a 68008; consequently the time for the HP 200/16 must almost certainly be wrong.

Discounting the HP, only two machines in the top half of the table are relatively faster at executing BM7. Substituting the value of 1.5s. for BM8 on the HP 200/16 gives a value of 0.93 for LM, and 0.57 for L.Av.

The next interesting question concerns the way in which BM7 and BM8 differ in style. Given two computers using the same or equivalent microprocessors, say the Intel 8086 on the OEM Orion or the Sharp MZ-5600, it is possible for there to be a wide disparity in the way in which a language translator is organised.

Basic variants

It is often difficult to compare two versions of the same language because of the difference in facilities provided, and often such aspects are not touched by standard Benchmarks treated as a whole. However, one version of Basic might be faster than the other because of differences related to the efficiency of the organisation of the system in general, and of the language translator in particular. This is probably reason why the timings of the Orion and the MZ-5600 differ so.

The efficiency of BBC Basic is well known, and this has enabled the BBC model B to outperform its microprocessor. All other computers using the 6502 are counted either as slow or as very slow. In the early days of microcomputers with roughly equivalent processors and a heavy reliance on Basic the original *Kilobaud* Benchmarks made sense because they were designed to investigate the efficiency of the organisation of the Basic translator. Most of the slower computers, for which BM7 was relatively speedy in execution, are in the older mould. The very slow group contains two CMOS computers, the Epson HX-20 and Tandy 100, the 6502-based Oric Atmos, and the Z-80A Yamaha YIS-503 and Spectravideo MSX machines and the Z-80A Spectrum. Given the variations in the forms of Basic now being provided, even the concept of BM7 is out of place: new Basics are increasingly procedural.

BM8 seems to be more important for the faster computers. Most of the work in the routine is taken up with the evaluation of series, processor-intensive work which optimises on hardware arithmetic. There are two main aspects to this Benchmark: the speed of the processor and the quality of the coding of the series evaluations.

Apart from that most superior of chips the 68000, there are those who argue that the Zilog Z-8000 series of chips are very fast in operation. In the list of computers there is only one Z-8000 computer, the Olivetti M-20, which uses the Z-8001. Ignoring the suspect time for the HP 200/16, the M-20 is the fastest computer on BM8, so it is difficult to understand why it is so slow on BM7.

It seems that BM8, which is sadly de-emphasised by the standard Benchmarks, is the relevant Benchmark for modern computers whereas the other Benchmarks are best fitted for older styles of computer such as MSX.

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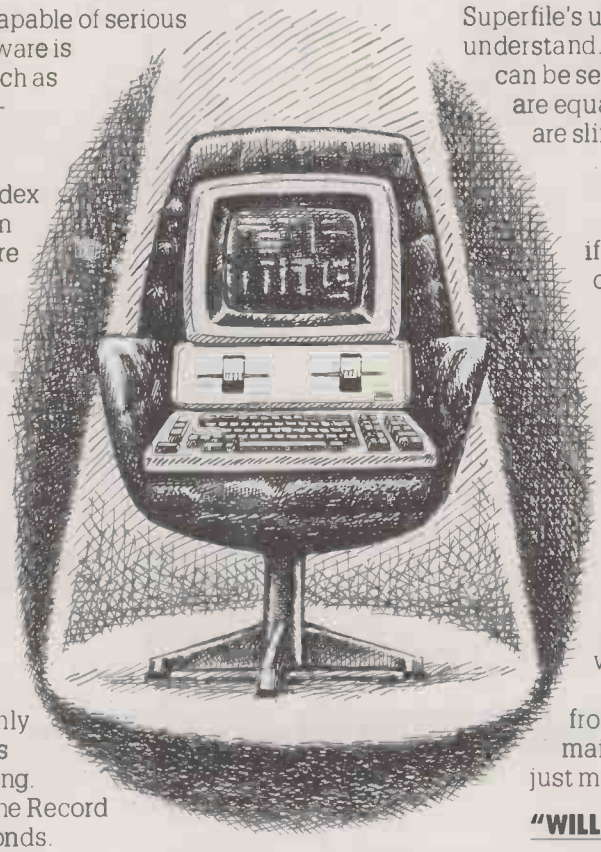

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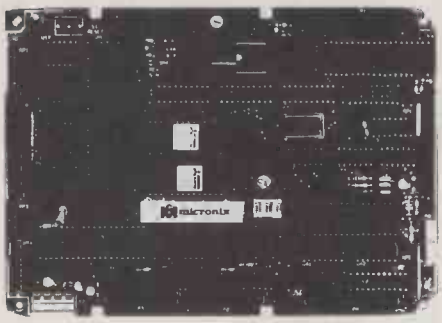

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Skills out of school

Jack Schofield sees how far and in what ways computers can be used as educational tools by adults.

COMPUTERS are supposed to be educational, but what does this mean in practice? If you take away the computer programs that teach you about computing, there is very little left, and most of that is for the under-eights. So what about the after-eights? The educational value of computers to adults tends to get caught in a circular argument. You have to buy a computer to learn about computers. You have to learn about computers because you have bought a computer. But can any skills be inculcated along with learning how to hit Return?

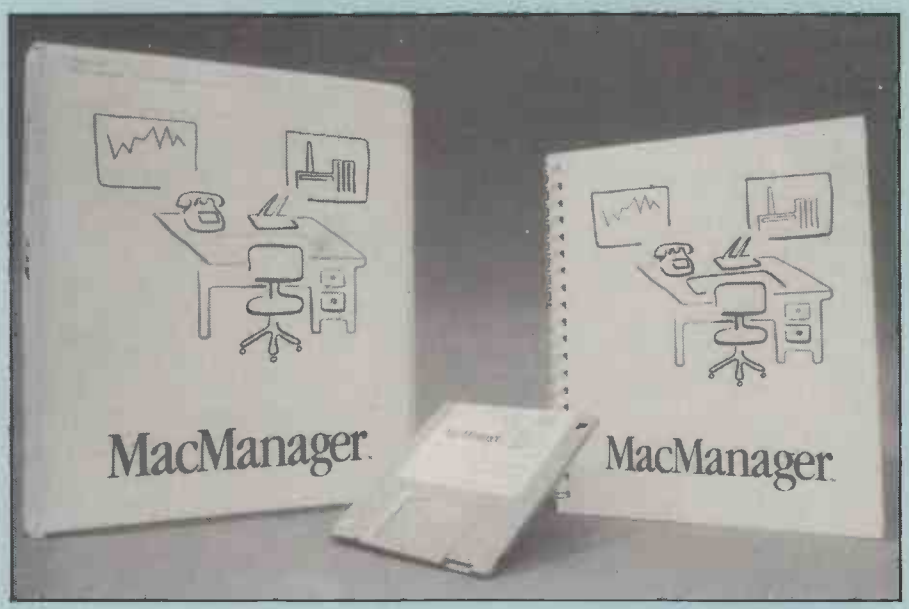
One thing the computer is good at is drill — teaching by repetition — because it neither hesitates nor tires. Two areas where drill can help you to acquire a skill are touch-typing and foreign languages. In both these areas the micro is now relatively well established. Both topics are covered in separate articles in this special section, along with programs for children.

The problem with drill is that it requires motivation. The way to get motivation is to turn the task into a game. This is widely accepted with regard to children's programs, but for some reason less readily embraced by adults.

Obviously there is a game element in learning, say, touch-typing. The computer program measures and reports your score in terms of words per minute and the number of errors made and you resolve to try harder and do better next tme. The motivation is similar to that of the Space Invaders addict who continually strives to get a higher score. It is not quite the same, because the object of using the touch-typing program is to learn typing. The real reward comes later, in the form of additional speed and efficiency when typing letters or whatever. With Space Invaders, the reward is playing the game.

A simulation involves a computer pretending to be something else, such as an aircraft or a business. The aim of the simulation is to mirror, in some essential points, real life. For example, in a flight simulator turning off the engines should result in the simulated plane plunging to the simulated ground. In a business simulation, firing all the production staff should result in zero production and,

(continued on next page)



Macmanager is a management simulation program for the Apple Macintosh.

Mule

One of the best educational business games is Mule, from Electronic Arts, where up to four players construct an alien planet. Three players can be played by the computer, but without the human interaction it is not such a good game.

While Mule sounds like another version of Hamurabi, it is a lot more complex than that. Mule stands for "multiple use labour elements". When you have got one you can opt to produce energy, or food, or mine a plot of land. You place your production symbol on the plot and you're in business.

After several rounds of production, with breaks to visit the pub, there is a market phase. You can buy or sell things to the company store or to other players. Everyone sets his or her own price. Trading takes place when a buyer's price meets a seller's price. This interaction takes place against the clock, which leads to cut-throat competition bordering on frenzy.

The game also demands co-operation between players, because you cannot get rich if no one can afford to buy what you have to sell. Also, the colony is subject to occasional attacks by pirates and various natural disasters, and if the colony's net worth falls below a certain level then everyone has lost. Mule is, in fact, a superb model of the free-market economy, where prices are set by supply and demand but tempered by enlightened self interest.

Mule is a joystick-operated graphics game and childishly simple — at least at the lowest of the three levels of play. However, it has greater depth, and the manual brings out some of the finer points. These include production benefits as you climb the learning curve, the law of diminishing returns, and "the Prisoner's Dilemma", which penalises those who are too selfish.

(continued from previous page)
eventually, zero sales. Of course, no one needs a computer to establish such elementary points. Computer simulations are useful only when the number of variables involved, or the complexity of those variables, makes the realities difficult to grasp intuitively.

Navigation is an area where even quite simple flight simulators can perform a genuine teaching role. The understanding of radio beacons, distance-measuring equipment and the rest of the gadgetry of modern flight systems can be developed by a simulator. So can an understanding of aerodynamics and the working of flaps and ailerons. All these are covered in the Sublogic program Flight Simulator II, by Bruce Artwick, which accurately simulates flight in a Piper 181 Cherokee Archer. The major limitation of such programs is that they utilise the computer keyboard or, slightly better, a joystick, which are a far cry from flying the real thing.

Driving

It would seem logical to suppose that if flight can be simulated, so can driving a car. However, there do not seem to be any serious driving simulations available. There are Grand Prix games, generally based on the arcade game Pole Position, and it is even possible to buy a joystick which is actually a small steering wheel. Nevertheless, the resemblance of all these games to real driving is very, very slight. It is doubtful whether anyone could learn much from them.

Trading and management simulations were among the first games to appear on computers. Star Trader and Hamurabi both appeared on mainframes, and are still popular today. Acornsoft's Elite is a variant of Star Trader, notwithstanding the exciting graphics and arcade aspects. Hamurabi derivatives include such popular games as Dictator, from DK'tronics, where you govern a banana republic.

Both Hamurabi and Sumer — virtually the same game — are still supplied by ITT Dialcom for use on Prime superminis, and can thus be played on the Telecom Gold computers. A popular modern version is Atari's Kingdom. The game action involves deciding how many acres of land to plant with seed, and success comes from maintaining the kingdom's population without too many people starving.

The attraction of Hamurabi is that it does not require graphics, and is fairly simple to program. It does require complex calculations, which the computer handles easily. The problem with Hamurabi is that it does not resemble real life very closely. The economy of a country is sufficiently complex as to be not reducible to a few mathematical formulae.

One of the largest and most complex games of Hamurabi is called the Treasury Model of the Economy. Cabinet ministers, Treasury officials and sometimes members of the Opposition front bench are invited to play. Various fiscal policies are fed into the model, and the Treasury computer produces a result. The accuracy of the model is perhaps indicated by the fact that the actions of all recent British governments have frequently produced exactly the opposite of the intended result.

Slightly less complex simulations are provided by Incentive Software's 1984, and Simon Hessel's Great Britain Ltd. Incentive's game involves you in maintaining the government's balance sheet. Factors include setting the minimum lending rate, negotiating wage rounds, and raiding industry for profits. You also have to maintain reasonable expenditure on everything from defence to housing.

Of course, even if the model is accurate, relatively few people are given a turn at running a country. The value of games like Hamurabi and 1984 is therefore educational rather than practical.

Company management simulations obviously have more to offer, but are relatively rare for two reasons. First, managing a small company is much less grandiose than running a country, and it is therefore less appealing. Second, much more is known about how companies work, and including all the factors in a computer model makes simulations time consuming and complex to run.

Examples of management games are Corplan from Understanding Ltd, Woodstock from Hama, Flexi-Game from the Ulster Management Centre, and Comanex, from Sapphire Systems. A more complex version of Corplan is available from Longman under the name of Plan It. As this is a "dynamic business simulation" rather than a game it costs around £600.

Corplan has a management structure of four people, though one person can play all the parts. There are 11 major decisions to be made. The managing director is responsible for issuing shares and bonds, paying dividends and ordering the plant. The production manager is responsible for ordering machines, hiring and firing workers, ordering materials and setting overtime. The sales director is responsible for hiring and firing

```
                                play hmrabi
TRY YOUR HAND AT GOVERNING ANCIENT SUMERIA
SUCCESSFULLY FOR A 10 YEAR TERM OF OFFICE.
HAMURABI:  I BEG TO REPORT TO YOU,
IN YEAR 1 , 0 PEOPLE STARVED, 5 CAME TO THE CITY.
POPULATION IS NOW 100
THE CITY NOW OWNS 1000 ACRES.
YOU HARVESTED 3 BUSHELS PER ACRE.
RATS ATE 200 BUSHELS.
YOU NOW HAVE 2800 BUSHELS IN STORE.

LAND IS TRADING AT 21 BUSHELS PER ACRE.
HOW MANY ACRES DO YOU WISH TO BUY: ? 0
HOW MANY ACRES DO YOU WISH TO SELL ? 0

HOW MANY BUSHELS DO YOU WISH TO FEED YOUR PEOPLE ? 2000

HOW MANY ACRES DO YOU WISH TO PLANT WITH SEED ? 700
HAMURABI:  I BEG TO REPORT TO YOU,
IN YEAR 2 , 0 PEOPLE STARVED, 7 CAME TO THE CITY.
POPULATION IS NOW 107
THE CITY NOW OWNS 1000 ACRES.
YOU HARVESTED 1 BUSHELS PER ACRE.
RATS ATE 0 BUSHELS.
YOU NOW HAVE 1150 BUSHELS IN STORE.

LAND IS TRADING AT 26 BUSHELS PER ACRE.
HOW MANY ACRES DO YOU WISH TO BUY: ? 0
HOW MANY ACRES DO YOU WISH TO SELL ? 100

HOW MANY BUSHELS DO YOU WISH TO FEED YOUR PEOPLE ? 2000

HOW MANY ACRES DO YOU WISH TO PLANT WITH SEED ? 800
HAMURABI:  I BEG TO REPORT TO YOU,
IN YEAR 3 , 7 PEOPLE STARVED, 8 CAME TO THE CITY.
POPULATION IS NOW 108
THE CITY NOW OWNS 900 ACRES.
YOU HARVESTED 1 BUSHELS PER ACRE.
RATS ATE 337 BUSHELS.
YOU NOW HAVE 1813 BUSHELS IN STORE.

LAND IS TRADING AT 17 BUSHELS PER ACRE.
HOW MANY ACRES DO YOU WISH TO BUY: ? 0
HOW MANY ACRES DO YOU WISH TO SELL ? 0

HOW MANY BUSHELS DO YOU WISH TO FEED YOUR PEOPLE ? 1813

HOW MANY ACRES DO YOU WISH TO PLANT WITH SEED ? 900
HAMURABI:  THINK AGAIN. YOU HAVE ONLY
0 BUSHELS OF GRAIN.  NOW THEN,
HOW MANY ACRES DO YOU WISH TO PLANT WITH SEED ? 0
HAMURABI:  I BEG TO REPORT TO YOU,
IN YEAR 4 , 18 PEOPLE STARVED, 2 CAME TO THE CITY.
A HORRIBLE PLAGUE STRUCK!  HALF THE PEOPLE DIED.
POPULATION IS NOW 46
THE CITY NOW OWNS 900 ACRES.
YOU HARVESTED 3 BUSHELS PER ACRE.
RATS ATE 0 BUSHELS.
YOU NOW HAVE 0 BUSHELS IN STORE.

LAND IS TRADING AT 20 BUSHELS PER ACRE.
HOW MANY ACRES DO YOU WISH TO BUY: ? 0
HAMURABI:  THINK AGAIN. YOU HAVE ONLY
0 BUSHELS OF GRAIN.  NOW THEN,
HOW MANY ACRES DO YOU WISH TO BUY: ? 0
HAMURABI:  THINK AGAIN. YOU HAVE ONLY
0 BUSHELS OF GRAIN.  NOW THEN,
HOW MANY ACRES DO YOU WISH TO BUY: ? 1
HAMURABI:  THINK AGAIN. YOU HAVE ONLY
0 BUSHELS OF GRAIN.  NOW THEN,
HOW MANY ACRES DO YOU WISH TO BUY: ? .a
INPUT data error AT LINE  0
```

In Hamurabi you try to prevent your people from starving.

salespeople, setting the selling price of the product, Corples, and buying advertising. You get a quarterly report on your progress as you try to maximise profits over both the short and long term.

Corplan is hard work to play, but a sufficiently complex simulation to be of practical use, particularly for anyone new to running a company. This is not to say that being able to win at Corplan means you will be able to run a company, simply that you will be aware of many of the practical difficulties involved.

Some management games simulate specific industries, rather than being generalised business games. Perhaps the leading software house in the field is Cases Computer Simulations, CCS, which has produced a range of titles such as Airline, Auto Chef, Brewery, British Lowland, Dallas, Corn Cropper, Manager, Print Shop and Oligopoly. The Commodore range also includes an airline management simulation, High Flyer.

Football management is an area where there are several simulations to choose from. Addictive's Football Manager is the leading example, with CCS's United a recent addition. Millionaire, from Incentive, simulates running a micro-computer software company. Your chances of becoming a millionaire are extremely remote — just like real life.

Some people think the stock market is a game already; certainly it is a traditional computer simulation. There is an amusing version called Stocks on Telecom Gold. You can buy and sell shares in such unfamiliar companies as Tensi-Wensi Airplanes, TWA; American Bankrupt Co., ABC; and Idiotic Bumbling Morons, IBM.

Software summary

	Micro	Format	Publisher
Acquire	A,T	C,D	Avalon Hill
Airline	At,T	C,D	Adventure International
Airline	B,E,S	C	CCS
Auto Chef	S	C	CCS
Baron	I	D	Blue Chip
Boardroom	S	C	Wessexsoft
Cartels & Cut-throats	A	D	Startech
Champions	B,S	C	Peaksoft
Comanex	CP/M,I	D	Sapphire Systems
Company Director	T	C	Molimerx
Corn Cropper	B,E,S	C	CCS
Corplan	A,B,S	C,D	Understanding Ltd
Dallas	B,E,S	C	CCS
Dictator	B,C,S	C	DK'tronics
Energy Czar	At	C	Atari
Flexi-Game	B	C,D	Ulster Management Centre
Football Manager	B,C,S	C	Addictive
Galactic Empire	At	C,D	Adventure International
Great Britain Ltd	S	C	Simon Hessell
High Flyer	C	C,D	Commodore
Hotel	B	C	Pitmansoft
Kingdon	At	C	Atari
MacManager	M	D	Harvard Associates
Manage	S	C	CCS
Millionaire	A,At,C,I,M	D	Blue Chip
Millionaire	S	C	Incentive
Mule	A,At	C,D	Electronic Arts
Mule	C	C,D	Ariolasoft
Oligopoly	S	C	CCS
Plan It	I	D	Longman
Print Shop	S	C	CSS
Ship of the Line	S	C	Richard Sheppherd
Stockmarket	At,C,S	C	Argus
Stockmarket	S	C	CCS
Stockmarket	C	C	Kuma
Stockmarket	B	C	Micro-Aid
Stocks & Bonds	At	C,D	Avalon Hill
Taipan	S	C	Jaysoft
Tycoon	I	D	Blue Chip
United	S	C	CCS
Woodstock	B,C	C	Hama
1984	B,S	C	Incentive

Micros: A, Apple; At, Atari; B, BBC Model B; C, Commodore 64; E, Electron; I, IBM; M, Macintosh; S, Spectrum; T, Tandy
Format: C, cassette; D, disc

Microcomputer stock-market simulations are available from Kuma and CCS, among others. By far the most sophisticated is Millionaire from Blue Chip. This is a large and expensive program which is very expensively packaged and normally found running on IBM PCs. Apparently it is a very accurate simulation of the American stock market, and popular among people who work there.

Like flight simulators, stock-market games are useful for introducing new concepts and the unusual jargon used in an unfamiliar field. They can also be of real educational value, but it probably requires a tutor to bring this out. Unless the game is backed up with economic and historical analysis, there is a danger that techniques developed to suit the simulation might be thought directly applicable in real life. As far as I know, none of these programs is sufficiently accurate to make that a wise approach.

Psychology

A new generation of management aids is just coming on to the market, which are based not on economic theory but on psychology and sociology. Examples include the Edge series — The Negotiation Edge and The Management Edge.

Corplan is based on the view that management is a matter of technique: that is, you have to buy materials and hire workers at the right time, price your product correctly, etc. It is production orientated. By contrast, the newer programs are based on the view that management is about handling and motivating people. It is about organising and motivating groups, establishing goals and rewarding good behaviour.

The Management Edge is fairly typical of the new genre. The idea is to observe your co-workers, and analyse your own feelings, whereupon the program advises you what to do next. Assessing your subordinates involves agreeing or disagreeing with statement such as that they are talkative, methodical, concerned, ambitious, sarcastic, friendly and so on.

The assessments produced by the program seem, in general, to be quite acute. Also they seem more accurate when you know someone well, so the output is not purely random. Whether you can actually manage people using such techniques remains a moot point. Some would consider it calculating almost to the point of dishonesty. I do not think it is practical.

At the moment, psychological software is being treated as something of a game. Leading Edge's The Negotiation Edge has been applied to the Scargill/Macgregor battle, and Mind Prober to politicians such as Ronald Reagan. In the future, as small micros become more powerful, this kind of software is likely to be developed further and taken more seriously.

Ten-finger exercises

With a keyboard just like a typewriter's, a micro is an obvious tool for teaching people to type. Carol Hammond assesses some of the software produced for this purpose.

USING A MICRO to learn to touch-type serves two purposes. First you are using the computer as a tool to help you acquire a skill. Secondly, at the same time you are learning to use the computer itself more efficiently as your typing proficiency and keyboard familiarity increase.

However, as much as it seems a good opportunity to kill two birds with one stone, this double purpose does have its effect on how different software packages approach the task of teaching you to type. Some seem more concerned to get you to type with speed and accuracy on any keyboard, and merely use the computer as a means to this end. Others are aimed at you becoming more familiar with your computer.

The packages are a mixed bag not only in their aims but also in their origins and quality. Pitman Publishing's package relies on well-tried methods of drill and practice. Some packages from other companies appear eager to extol the merits of touch-typing as a part of word processing, and are not necessarily as well structured as those on offer from the old hands.

Pitman Publishing's Keyboard Skills is directed at anyone who wants to learn to type or refresh their skills using a home computer. A piece of card is all that accompanies the program disc. On one side of the card is a diagram of the QWERTY keyboard indicating which keys should be pressed by the fingers of which hand. On the other side is a progress chart on which you fill in your accuracy and speed after each of the 50 exercises. The on-screen instructions are so clear and concise that no further documentation is needed. The instructions tell you how to use the course to its best effect by repeating exercises if your accuracy is below standard.

The course consists of drill and practice exercises. Drills are completed before beginning a practice. A diagram of the keyboard appears on-screen with the key to be typed highlighted. You cannot go on until you have struck the correct key. You start off with the home keys, ASDF and JKL; and progress on to more difficult areas such as typing capital letters and numerals. The drills emphasise the need to keep your fingers on the home keys rather than slip into two-finger typing. This is made clear as you amble through the exercises: when you have to hit one of the home keys, as you are repeatedly asked to do, you find that you cannot do so as quickly as you should because your fingers are lazing on the keys you hit last.

Each time you hit the wrong key a bleep sounds. You carry on typing until you hit the right one — there are no other ways to turn it off. Although this is certainly an effective deterrent to making mistakes, it can become irritating.

Accuracy

Once you have completed the drills you go on to practice exercises. Each consists of six lines of type, most of which are sentences using all the keys known at that stage. At the end of each exercise your speed and accuracy appear on the screen. Speed is given in words per minute and accuracy as a percentage. You are told to aim for speeds of at least 20wpm. Accuracy is particularly stressed: you have to achieve a rate of up to 95 percent before you can proceed in certain exercises.

Despite my efforts to cut corners after getting a 92 percent score the program flung me back to type "sad lass" yet again. This strict treatment is accompanied by the school-teacherly reminder of "You need some extra practice on some words", which is probably very good for the soul as well as the fingers.

However, teaching with a rod of iron did have some effect as my speeds and accuracy did improve. Being given your results straight away also encourages you to improve, and appeals to the competitive urge. It will certainly do something for those hooked on arcade games which consist of repeatedly trying to improve your score. Such immediacy of results is also one advantage of using a computer to touch-type rather than count through what you could have typed on a typewriter.

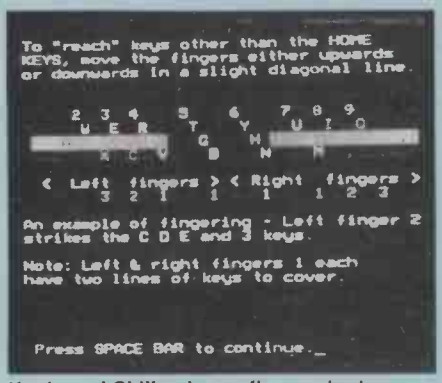
Microguide's Snowball Domestic Keyboard Course takes a different tack. Its emphasis is on keyboard training as a foundation for further computer training. The accompanying booklet even gives a brief summary of computer terms.

The course for the BBC model B consists of 24 training units, three of which are consolidation texts in which you go over what you have learnt. You begin by learning the home keys, and a colourful display of two robotic-looking hands indicates which fingers should hit which keys. You progress onwards until you encounter the numeric block, special characters including the mysterious "amphrosand", and how to get upper-case letters using the Caps Lock and Shift keys.

In Snowball you are required to type small groups of letters, such as ASDF, a number of times. Once you have completed one group successfully you can go on to another. This is the equivalent of Keyboard Skills' drills but is not as successful. It is much more tedious to be shown a group of letters and know you will have to plough through them, rather than being prompted to hit random letters one at a time. You are told of any mistakes after you have completed a line, so you have to go back to the beginning and type the whole lot all over again before you can carry on to the next exercise. If anything, I tended to make more mistakes through boredom.

A particularly irritating habit of the program shows up when you have to type groups of letters followed by a space. If you reach the end of a line and press the space bar before you press Return the extra space, which you obviously cannot see on-screen, counts as a mistake. You can then waste a lot of time wondering what you have done wrong.

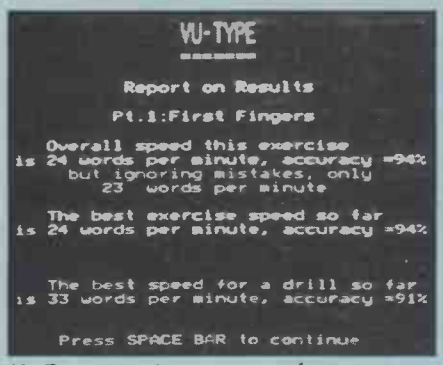
The speed tests are disappointing too. If you have trudged through 24 units with little firm idea of your powers and progress, the speed tests do little to clarify the situation. The first consists of having to type a passage from the inside back cover of the booklet. The passage is printed inside what is presumably supposed to represent a monitor screen,



Keyboard Skills shows finger placings.

Fingers move in All Fingers Go.

Mastertype makes a game of learning.



Vu-Type reports on your performance.

Vu-Type's cursor.

but equally resembles a shoe box. The type is tiny and is printed in a pale orange on a cream background. Squinting at the barely legible text consumed a lot of valuable typing time. Maybe this is intended as a simulation of real life, when you may be expected to read all kinds of illegible scrawl, but it does not do your eyes or ego any good at the end of the course.

My wpm rate came out as −47 on this program, since mistakes count against the overall result. If you make a mistake halfway through the exercise which puts the rest of the text out by one space, every character is counted as a mistake, although they may have been otherwise correct. The second speed-test text is almost as bad to read as the first, but the thorn this time is the content, which extols the merits of Snowball Self Teach Systems, sentiments I did not concur with by this stage.

Unconventional

One package that stands out thanks to its unconventional approach is Softsel's Mastertype, which is based firmly on the idea of learning by game playing. When the program is loaded a pair of chimp-like hands appears on the screen to show where to rest your fingers, followed by brief demonstration of how to play the game. Letters appear in the four corners of the screen; they are the enemy and shoot missiles at your base, which resembles a spaceship. You have to type the letters in the corners as quickly as they appear in order to blow up the missiles, which are zapped by a wizard who teeters along the roof of the spaceship.

The letters you type appear in the spaceship window. You can use the Del key to backspace over a mistake and retype it, or you can hit the space bar and try again. After you have completed the game your score and average wpm appears. At the end of a lesson, which consists of a number of games, a table shows you score, average speed, final speed, number of words typed/destroyed, number of mistakes and the highest score so far. It will also say whether your score is good or needs some improvement.

You then go to the main menu, which offers Demonstration and Beginner modes. The latter is an easy version of the game where each word that has to be typed is only one letter long. Option C takes you to another menu where you have the opportunity to change your current speed goal. Your speed goal dictates how quickly the missiles attack the spaceship and thus how quickly you have to type. You can reduce or increase the speed to alter the level of difficulty of the game.

The C menu also offers the opportunity to redisplay your score, change to another lesson, change the letters from upper to lower case and vice versa, catalogue the disc or create a new lesson. Cataloguing what is on disc simply allows you to see what is on disc, including any new lessons created. The booklet and program advise you to create lessons in which you can practise changing from upper to lower case, which you get little chance to do of elsewhere, and to brush up on any weak areas. You create a lesson by pressing option 6 from the C menu. You can write a short introduction to the lesson, then type the 40 words you want to use in the lesson, with a maximum of 12 characters per word. Several lessons can be saved if required.

Mastertype's approach is radically different, and refreshing as a result. Its graphics are colourful and fun, and it is good to get away from the usual keyboard diagrams. However, you do not have the opportunity to practise sentences and paragraphs as on other programs. Even if the lessons you create are based on full sentences it is very disconcerting to type words in random order as they pop up in the corners of the screen. The main priority of the game is to keep your base intact, and from that point of view it may be good tactics to ignore the words or letters which appear in one corner of the screen, sacrifice one quarter of your ship and concentrate on the rest.

Our review package was for the Commodore 64 and consisted of a tutorial disc and accompanying 46-page booklet — though since the booklet contains information for Apple, Atari and IBM PC users too, it is not as substantial as it might first appear. However, it is comprehensive enough and kept in tune with the fun nature of the software with jolly diagrams and cartoons.

Mastertype is really for those who want to brush up their speeds for typing in programs and the like. The final two lessons consist of typing maths-like expressions and words commonly found in Basic, such as Sys, Save and Load. The results chart is very good in its breakdown of your performance, but does not tell you exactly how accurate you are. Again it is similar to a games performance chart. Definitely one for the kids and games freaks, but not for anybody hoping to take typing exams.

Dorling Kindersley's Tiny Touch'N'Go is a fairly standard package which comes with a disc, loading instructions and a certificate that reveals its makers' sense of humour. It says: "The undernamed . . . has successfully completed the lessons in Tiny Touch'N'go and should be afforded all the rights and privileges concomitant with such an achievement." This vein of dry humour is continued in the lessons where you tackle Christmas-cracker type quasi-religious sentences. For example, "Being in a ship is like being in jail, with the chance of being drowned. A man in jail has more room and better food," and "The question is this, is man an ape or an angel? My Lord, I am on the side of the

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angels." If you don't mind such soul searching while you flounder over the keyboard, the package is otherwise sound.

It starts off with the obligatory home keys and progresses through 62 lessons on to the 1,000 most commonly used English words, before introducing paragraphs. The number of mistakes you make and your speed are given after each exercise. Tiny Touch'N'Go is particularly helpful by saying how the wpm rate is calculated — as if five letters or spaces are one word. You are given targets of 25wpm and 100 percent accuracy to meet on repetitive exercises, 95 percent accuracy for variegated ones and 40wpm for lessons beyond number 57. If you meet the exercise targets you move on to the next exercise, otherwise you are invited to repeat the exercise until you master it.

Errors are indicated by a ! which appears beside the mistake; if you miss out a letter a ? appears. If you key an extra space at the end of the line, this is indicated by a ! too, together with the useful message "line too long".

Software summary

	Micro	Format	Price	Publisher
All Fingers Go	B,E	C,D	£14.95*	National Extension College
Atari Touch Typing	At	C	£12.99*	Atari
Iankey Keyboard	eight-bit CP/M	D	£39	Iansyst
Skills Trainer	16-bit CP/M	D	£49	Iansyst
Keyboard Skills	B,C	C,D	£9.95*	Pitman Publishing
Mastertype	A,At,C,I	C,Ca,D	£33.20	Softsel
Snowball Domestic Keyboard Course	Ap,B,O	C,D	£24.95	Microguide
Snowball Executive Keyboard Course	CP/M, MS-DOS	D	£59	Microguide
The Typing Master	CP/M	D	£50‡	Anthony Ashpitel
Tiny Touch'N'Go	B,C,D,S	C	£9.95*	DorlKindersley
Touch'N'Go	CP/M, MS-DOS,I	D	£30	Caxton Software
Type Attack	V	Ca	£29.90	Sirius
Typing Tutor	I	D	£27	IBM
Typing Tutor II	A	D	£25	Microsoft
Vu-Type	B	C	£16.10*	BBC Soft

Micros: A, Apple; Ap, ACT Apricot; At, Atari; B, BBC model B; C, IBM, Commodore 64 D, Dragon 32; E, Electron; I, IBM; O, Osborne; S, Spectrum
Format: C, Cassette; Ca, Cartridge; D, Disc
Prices given are for the cheapest version; those marked with an* include VAT.
‡ A business version of The Typing Master is also available at £125 + VAT.

Fingers move

The main claim to fame of Microtrust Software's All Fingers Go is its keyboard diagrams. The program shows hands on a keyboard, with the appropriate fingers resting on the home keys. The fingers appear to move as they lengthen and shorten to press other keys. This is a good way of showing which fingers should go where and is a hefty reminder to type properly. However, when you try to type quickly the graphics prove a problem as the labels on the keys you have to press become more difficult to read as they are covered by the image of a finger.

You work through the home keys and onwards to sentences. Towards the end of the course the emphasis is on retyping particular words you have got wrong. The program offers the usual speed reports, error counts and analysis. Its main distinguishing feature is that it shows you the mean time to type each letter. You are also given the option to change the volume of the bleep which acts as an error signal and to change the colours of the background, keyboard and fingers, none of which are in fact terribly good.

All Fingers Go comes with two tapes and an eight-page booklet which is fairly clear and helpful. You have to read the manual carefully to progress with the program, since it tells you to keep the Caps Lock key on for the first lesson and then to switch it off. Without doing so you may generate mistakes when hitting the ; key, without knowing why. One strong black mark against All Fingers Go is that the manual tells you to enter Load AFG10 when trying to load the second tape, which contains lessons 10 to 18. This did not work, but using Load AFGA did.

BBC Soft's Vu-Type comes with the most thorough manual. At 56 pages long it details every step of the course and the ins and outs of using the program which itself offers a lot of extra goodies. You are shown a colourful diagram of the BBC Micro keyboard complete with Esc, Tab and Ctrl keys, together with the Caps Lock, Shift and function keys, as well as the Up, Down and Right and Left Arrow keys.

An arrow points to the key you must hit. A beep sounds if you hit the wrong key and you cannot continue until you hit the right one. If you do not hit any key a beep sounds three times to prompt you. Vu-Type is produced in association with Pitman Books and keeps close to the Pitman method of teaching, consisting of drills beginning with the home keys, graded exercises, followed by work on the numerals and Shift keys, then on to sentences.

You are given the usual results reports telling you your error percentage, overall speed in wpm, accuracy percentage, your best speed for a drill and your best exercise so far. The Pitman emphasis on accuracy is also paramount and you are given messages such as "take more care," "well done" and "try to beat this", according to the level of accuracy achieved.

An advantage of Vu-Type is the possibility of further practice offered by the freestyle exercise option. With this you can type in any text you choose, which not only provides some variety but is also good for morale. You will always be marked 100 percent accurate, since Vu-Type assumes that what you have typed in is what you intended to type!

Other options available are more gimmicky. You can use a beep to emphasise errors if you want, and adjust its volume as you wish. Using the Sound command you can give each key a different note — though this will only be useful for the few, and perhaps amusing on first hearing for others. Much is made in the manual of the ability to alter the display options so that you can have keys flashing on error or flashing all the time. Target keys can be highlighted.

Such options, together with the facility to change the colours of the main screen, main keys, control keys, function keys, solid-key edges, text window, text, target and home keys mean that the screen can look as attractive or as lurid as you like. For those who want to mess around it may be useful in highlighting keys to be hit and such like. If you just want a straightforward crash course in typing you can manage quite well without it.

Conclusions

● Using a micro to learn to type is a good idea. The colour and sound available with a computer make the process more interesting and fun.

● If you are trying to learn to type on your own, using a program that will not let you pass over your mistakes means you are more likely to tackle any areas of weakness. Also, if you use a package that allows you to monitor your progress you can see how you are getting on and can have targets to beat and to aim for.

● What package you choose depends on your aim in learning to type. Mastertype is probably the best if you just want to brush up your typing to cope with a computer keyboard, whereas Keyboard Skills provides a straightforward, no-nonsense approach to learning to touch-type for any purpose.

RAMROM 15

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- All socket positions are software selectable.
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RAMROM 15	£129.95 inc VAT	(P&P £3.50 inc VAT)
EXTERNAL PSU	£5.75 inc VAT	(P&P £1.73 inc VAT
ZIFSOCKETS	£9.00 inc VAT	Free P&P with RAMROM)

Trade and local authority enquiries welcome.
Prices correct at time of going to press.

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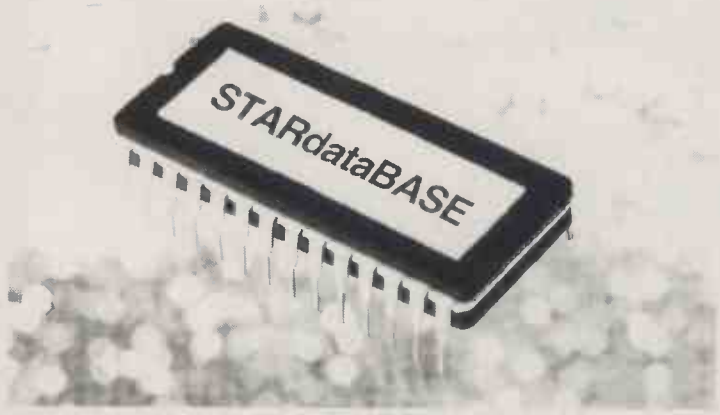
STARdataBASE . . .

The database



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● Circle No. 189

Foreign talk

Theodora Wood searches for innovation in the current batch of language-learning software.

LANGUAGE STUDY in the home has until now been the province of Linguaphone courses and television programmes. Both have a large oral element combined with excercises in workbooks to help students to listen to and write a foreign language.

Computers offer something extra. They contain an interactive element, though at the moment it is confined to text. Most language programs available combine one or more of these features.

Wida Software specialises in language programs for the school, college and home markets. Wida wrote the Linguaphone German course, and its Apfeldeutsch is a complete course which includes seven discs of teaching and testing routines, six audio cassettes, a textbook and a workbook. Apfeldeutsch is designed to take beginners to O-level standard.

A course of this type is thorough, but is also rather expensive at £120. Though it is most suited to seriously motivated learners, it does show the main advantages of a computer-based system. Students can go back and forth through the excercises with ease, and repeat wherever necessary. Marking is immediate so mistakes are quickly corrected without the time lag inherent in most written work.

Wida shows an interesting approach to vocabulary learning in its Vocab programs, which avoid the pitfalls of parrot-fashion rote learning of single words in isolation. In Vocab French, German or Spanish there is the possibility of building up word lists and a sentence which gives the context. The basic word list and gapped sentences then form the basis for six games, including Anagram and Word Order. Keeping vocabulary within its context is not only an aid to learning individual words but also helps to familiarise the user with other words and phrases.

The Storyboard range of programs covering French, German, Spanish, Dutch and Welsh, also from Wida, grew out of the original English Storyboard verson. Text is entered using the Writer program, which features automatic wrap-around and a line-by-line checker. Text used in this manner can be scaled for difficulty, from early learners through to college level. As the text is filled in the story becomes clearer, and contextual clues help to finish the exercise. Like Vocab this offers more than the ritual learning of word lists.

Unfortunately, many children learn languages in schools at the textual level and so learning word lists still plays an appreciable part. Another aspect of language learning is the memorisation of word tenses with all their irregularities.

Eiffel Tower

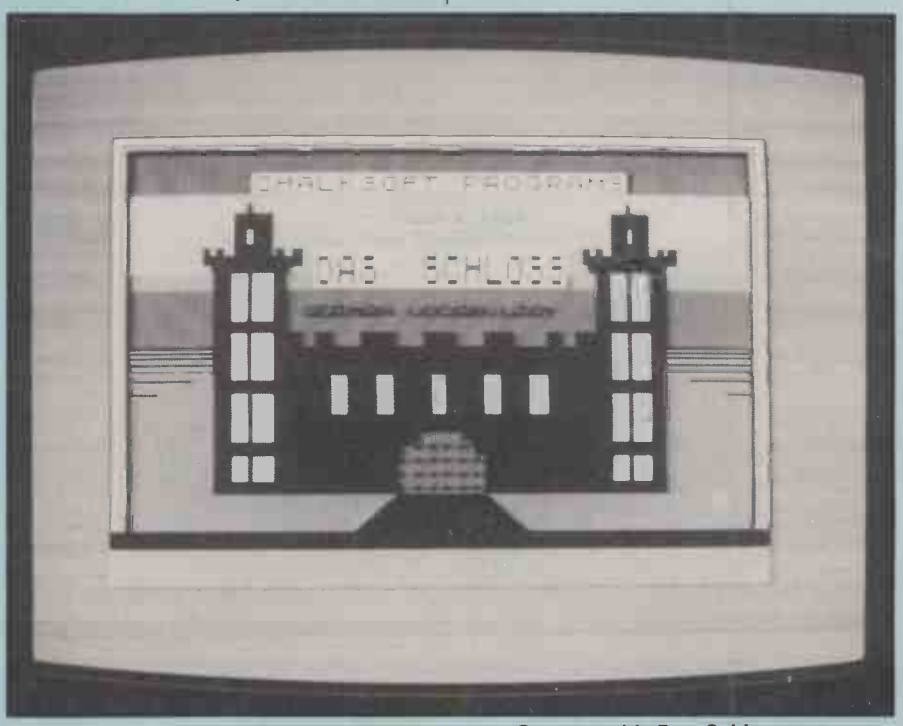
Chalksoft's Eiffel Tower is typical of many programs to test vocabulary. It includes 10 word lists which can be chosen from a menu. You guess the correct word with the help of a clue in English. Each time a word is guessed correctly part of the tower is built up; the testing session is over when the building is complete. A Help section on the screen reminds you how to enter any accents necessary. If you wish, you can make up new word lists and save them for later use. Any number of words can be learnt using this general format. Das Schloss is the German version of the same activity.

Tense French by Sulis Software is confined to learning all the tenses of both regular and irregular verbs. You can choose to test yourself on a particular verb and tense. This is done by simply entering all the forms of the tense while a score out of eight is built up at the side of the screen. At the end of the exercise an Analysis option highlights mistakes in a different colour, and shows the correct forms. This is useful for identifying problem areas which require revision. Tests can also be done on the meanings of all the verbs used — 20 in all — either English to French or vice versa. Tense French is thorough in its testing phase, but does not have much of a game element to provide motivation.

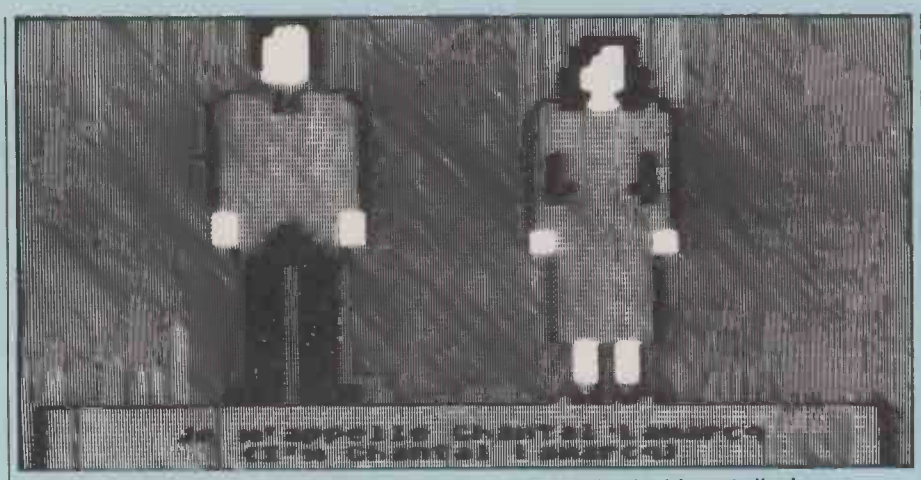
Both these elements are combined over two programs by Kosmos Software with French Mistress A and B. Program A is a vocabulary testing program covering familiar nouns, while B covers grammar, verbs and their tenses and adverbs. The programs are designed to take you to O-level standard. There are problems with the more advanced vocabularly in that meanings can be more ambiguous, so your answer may be marked as incorrect when it is a correct alternative meaning. Similar packages are available for German and Spanish, and all can be used for other words.

Longman's new French revision program combines elements of vocabulary and verb testing, together with texts to be memorised and tested. User-defined word lists are not catered for, but the two Lexis programs include up to 2,000 words, which should be sufficient for most users.

Conversational French, Spanish, German or Italian for the Atari



You try to build up the tower and improve your German with Das Schloss.



In Conversational French the oral element is synchronised with text displays.

concentrate on the look, listen and learn approach, with pictures and text appearing on the screen. The oral element is synchronised with these displays so that you can hear the language being spoken. Constant repetition is what is required here to learn the words and phrases in ascending order of difficulty. Each course consists of five cassettes and a workbook.

Conventional

All these approaches are based on what might be termed as the conventional approach to language learning. They require a certain amount of effort and persistence on the part of the participant, and there is no guarantee of quick results. The Linkword system is founded on a rather different way of learning languages with a computer. Gone is the emphasis on the precise nature of particular verb forms and placing of accents. Instead, the emphasis in these packages is to get the user going fluently as soon as possible, at the expense of rigid adherence to rules.

The theory behind the courses rests on the belief that memory can be aided with the use of imagery. There are 10 sections providing up to 350 words for use in everyday situations such as travelling, on the beach, illness and business. The first parts of each section are involved with the acquisition of new vocabulary. Thus in the business section of the Spanish program, the screen message is "The Spanish for job is empleo", followed by "Imagine being employed to do a job".

You are asked to spend some time visualising the clue so that it is fixed in your memory before moving on to the next word. Some of the clues are positively bizarre, such as "The Spanish for accountant is contador, (kontador) . . . imagine an accountant sitting in his office counting doors instead of money." These sometimes comic clues all aid the visualisation process and help to fix the word in the user's memory.

Each section also contains some grammar, though none of it is particularly serious. Testing routines are included to check progress in translation both ways. At the end of each section there are some sentences for you to translate, containing the words in commonly used phrases. For pronunciation there is an audio cassette to listen to after you have worked your way through a section.

No pretence

The Linkword programs do not pretend to offer a complete language course. What they are is a quick and relatively painless way of acquiring sufficient skill to be understood by foreign listeners. Training schemes using the method have reported increased learning speeds and higher motivation. A basic vocabulary of 350 words together with some grammar could be learnt in 10 hours. Linkword is an interesting alternative to other programs available, and one worth considering if your aims are modest.

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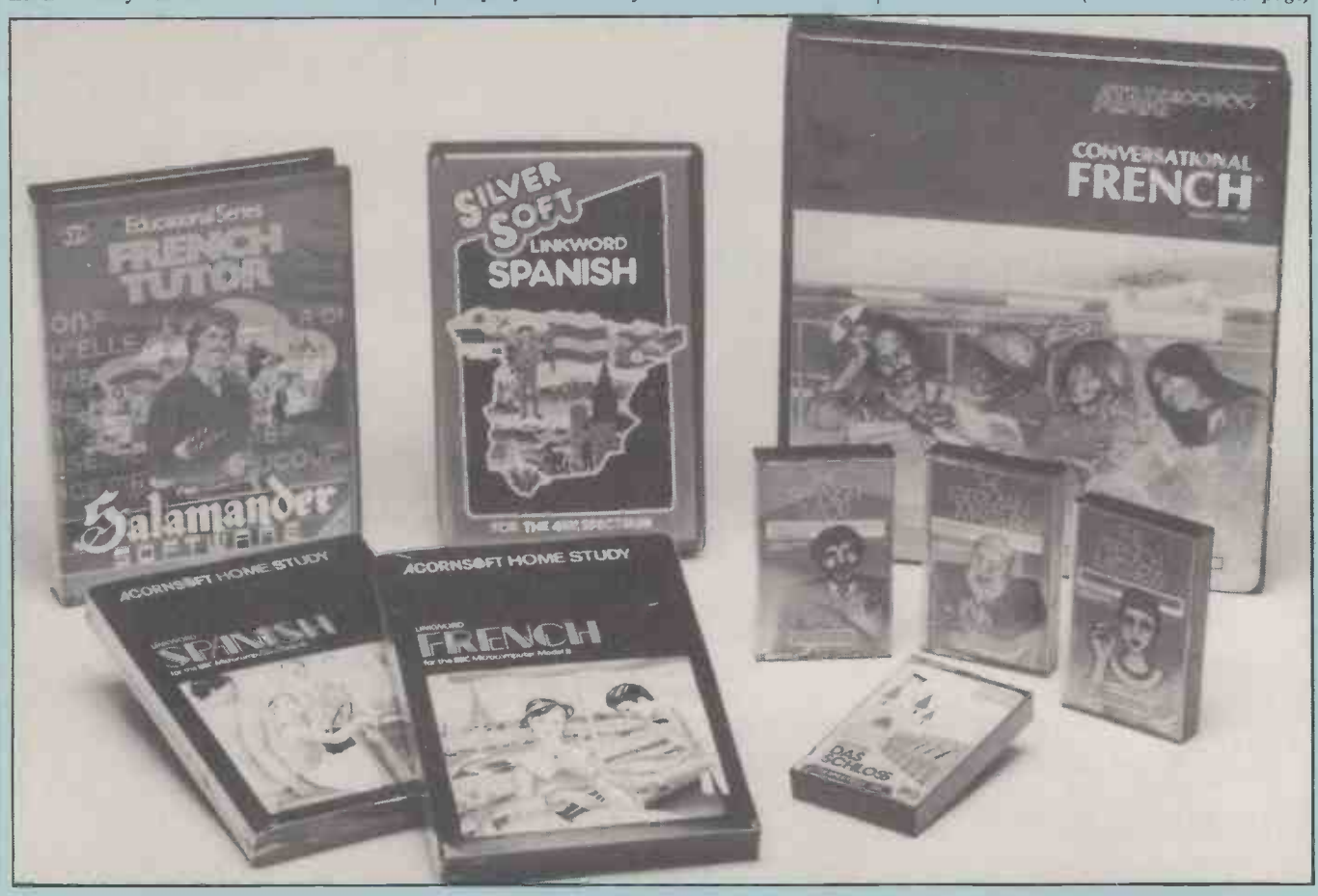

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Silversoft produced the Spectrum version of the Linkword programs and has recently released another alternative language-learning scheme. French on the Run is based on the adventure format. You are a British wartime pilot, shot down over enemy territory, and your aim is to make your way back to England. There is a choice of four routes to choose from, of increasing difficulty, and you must answer questions and act on orders.

The question section is in the form of multiple choice, and you are tested on vocabulary, grammar and idiomatic phrases. This form is favoured by the examining boards at CSE and O-level; students who have done well with the program have had correspondingly high exam results. French of the Run provides practice in the language in a simulated real-life situation.

Conclusions

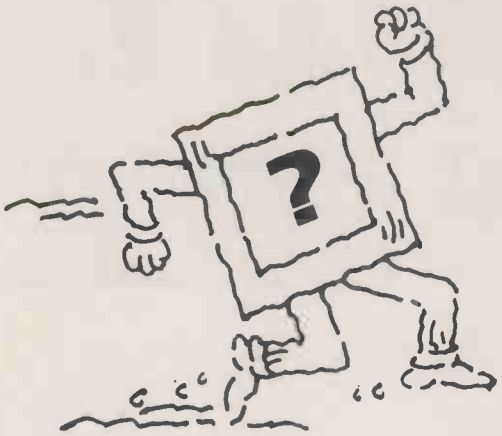
● None of the programs discussed, with the possible exception of Apfeldeutsch, would go very far in preparing anyone to understand speech and speak fluently in a foreign country.

● Although computers have not yet altered the main thrust of language learning, this may change. Interactive video could use computer power to integrate the various elements of language learning with sound and visuals.

Software summary

	Micro	Format	Price	Publisher
Vocab French	B,E	C,D	£25	Wida
Vocab German	B,E	C,D	£25	Wida
Vocab Spanish	B,E	C,D	£25	Wida
Apfeldeutsch	A	D	£120	Wida
Storyboard French	A,B,E	C,D	£25	Wida
Storyboard German	A,B,E	C,D	£25	Wida
Storyboard Dutch	B,E	C,D	£25	Wida
Storyboard Welsh	B,E	C,D	£25	Wida
Eiffel Tower	B,S	C	£9.25	Chalksoft
Das Schloss	B,S	C	£9.25	Chalksoft
Tense French	B,S	C	£9.25	Sulis
French Mistress A	B,E,C,S	C	£8.95	Kosmos
French Mistress B	B,E,C,S	C	£8.95	Kosmos
German Master A	B,E,C,S	C	£8.95	Kosmos
German Master B	B,E,C,S	C	£8.95	Kosmos
Spanish Tutor A	B,E,C,S	C	£8.95	Kosmos
Spanish Tutor B	B,E,C,S	C	£8.95	Kosmos
French Revision	C,S	C	£7.95	Longman
Conversational Spanish	At	C	£22.99	Atarisoft
Conversational French	At	C	£22.99	Atarisoft
Conversational Italian	At	C	£22.99	Atarisoft
Linkword Spanish	A,B,E,C,S,At	C,D	£12.95	Various
Linkword German	A,B,E,C,S,At	C,D	£12.95	Various
Linkword French	A,B,E,C,S,At	C,D	£12.95	Various
Linkword Italian	A,B,E,C,S,At	C,D	£12.95	Various
Linkword Greek	A,B,E,C,S,At	C,D	£12.95	Various
Linkword Portuguese	A,B,E,C,S,At	C,D	£12.95	Various
French on the Run	B,E	C	£9.95	Silversoft

Micros: A, Apple; B, BBC; C, Commodore 64; E, Electron; S, Spectrum; At, Atari



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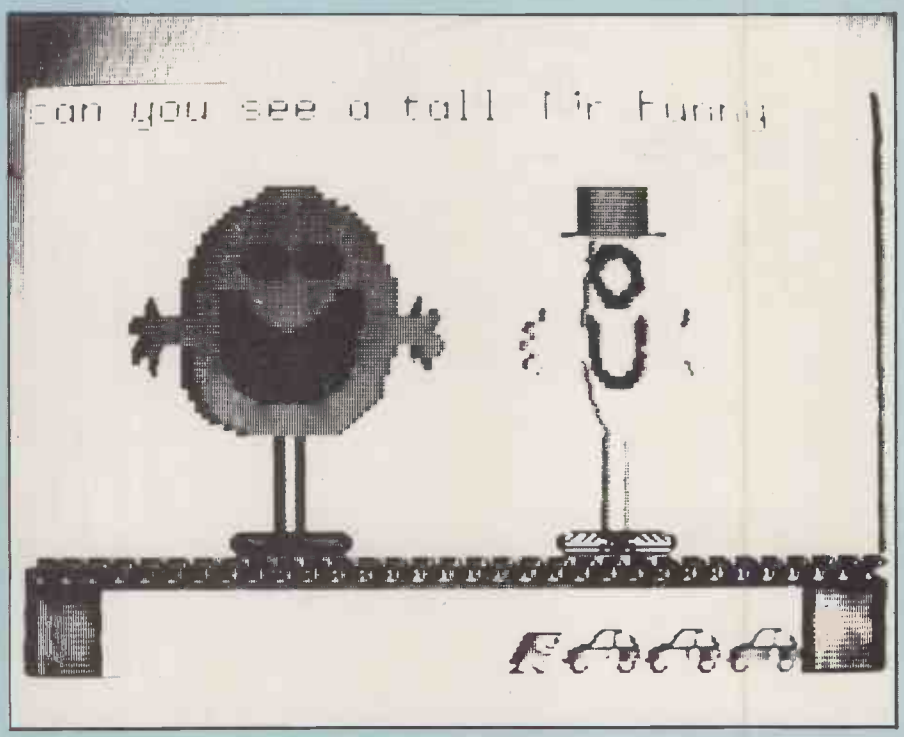
Kids' stuff

Theodora Wood looks at some of the programs available for children which aim to both entertain and educate.

EDUCATIONAL PROGRAMS for use in the home have to interest not only the child but also the parent, as bored adults tend to communicate their lack of interest to children. Latest releases tend to confirm the move in the market to educational software which incorporates a games element in its format to attract attention. Also for preschool-age children especially, difficulties in operating any program or reading on-screen text mean that the features of the best programs have to include ease of operation.

Children from the age of about two are perhaps the most difficult group of all. Longman has produced three programs for the BBC model B based on traditional nursery rhymes. Nursery Rhymes 1 illustrates features appropriate to this age group. The program operates like an animated book, and rhymes can be chosen from a menu of five well-known songs such as *Hickory Dickory Dock*. All the child has to do is press a number and the animated rhyme will appear. Pressing the space bar will repeat the tune and the scrolling of the text. Pressing Escape returns to the menu. Toddlers can learn to operate the program very easily and will enjoy seeing their favourite nursery rhymes animated on the screen under their control.



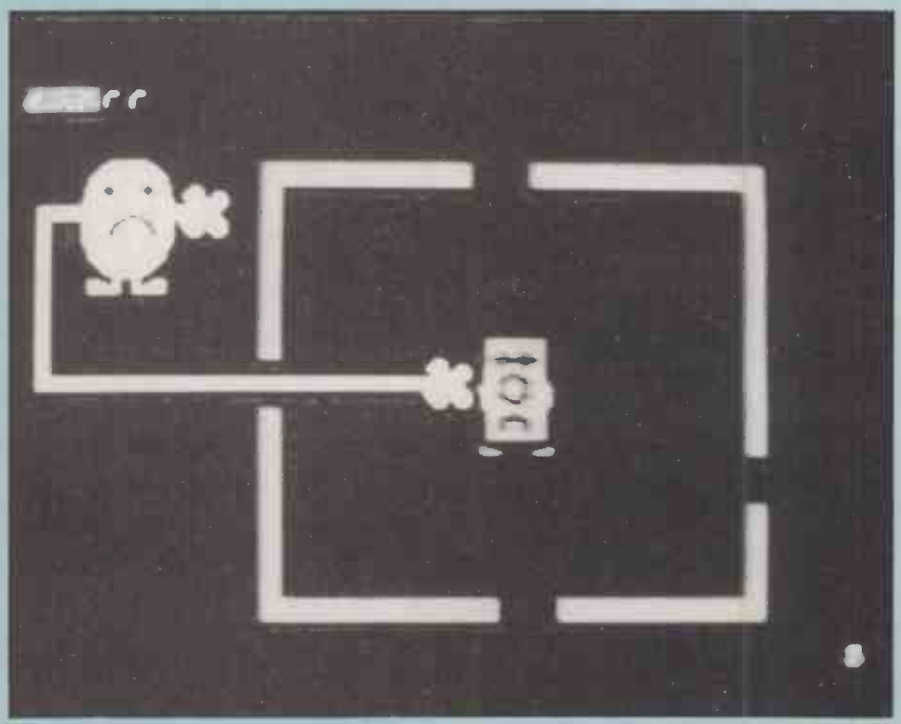
Mr Funny features in one of four programs from Mirrorsoft's Here and There with the Mr Men.

Preschool

The preschool age group is well catered for by a variety of software houses. Numerous programs teach first steps in counting and letter recognition. It is necessary to look at the programs carefully and decide whether they are actually offering activities which could just as easily be encountered in other ways.

Software publisher Ebury produces a range of programs suitable for this age group which are carefully designed and graphically interesting. Keyboard activity is restricted to a minimum to enable young children to use them. Booklets come as part of the package to help parents with learning strategies. The emphasis is on parental involvement, not only in the use of the programs but in other suggested activities which add to the effectiveness of their use.

Mr T Tells the Time helps children to become familiar with the clock face. First it illustrates the clock and then asks the



Using Logo-like Up, Down, Left and Right commands Mr Tickle is made to touch Mr Grumpy on the arm.

child to press the space bar when Mr T is pointing to a missing number which is indicated by a flashing square. Matching Hours operates on three levels, from the hours to halves and quarters, and the player has to match the clock faces. Similar programs from Ebury/Good Housekeeping cover early stages of letter recognition and writing, shapes, measuring and numbers.

Here and There with the Mr Men by Mirrorsoft is an excellent example of the computer being used to maximum effect. Based on the easily recognisable characters from the popular Mr Men books the program reinforces concepts of left/right and up/down. Four separate programs can be chosen from a main menu. A particular favourite has been Mr Tickle and Mr Grumpy. The object of the game is to program Mr Tickle's arm to move until it tickles Mr Grumpy. First the child has to align the doorways in Mr Grumpy's house and then move Mr Tickle's arm. This can either be done step by step, seeing the result of each movement as the keys are pressed, or by typing in a complete program and then seeing if it is correct. As the game proceeds Mr Grumpy makes it more difficult by putting chairs in front of the doors.

Stimulating

These games could be described as promoting pre-Logo activities which are set in such a simple and motivating format that children from four to eight could work together, or with a parent, without any hint of a drill situation. The programs also stimulate discussion, a feature increasingly seen as perhaps the most important gain to be made when using computers in an educational context. Also they introduce the concept of a program as well as reinforcing directional skills. Mirrorsoft's other programs for this age group, Count with Oliver and First Steps with the Mr Men, cover more conventional counting and first steps with reading.

Acornsoft's new program, Workshop, is likely to appeal to four-year-olds upwards. The program is billed as the electronic equivalent of Plasticine and shapes can be manipulated in various different ways. They can be cut, drilled and rotated, complete with noisy sound effects. Each action is stored in the Look section where a program is built up which can be Run.

Apple and Atari users are not so well catered for in the open market for this age group. This is mainly because whatever its hardware merits, neither machine has been introduced in large numbers in schools, and the home market for educational software has not been large. Of course there is a wealth of American programs which can be ordered from dealers and stores. However, they can present difficulties to younger learners, especially in word-recognition programs, where American usage of English can be a problem.

IO Software produces Apple programs for use in schools which could be used at home, such as Odd Man Out and Colour Sequences which test visual discrimination. Older Apple users may have to use similar programs designed for schools. Atarisoft's My First Alphabet teaches first letters and numbers with the use of animated graphics and musical rewards.

For children from about six upwards the choice is much greater as their ability to read and enter text is increased. Spelling and arithmetic are two areas which have received a lot of attention, but the actual programs produced vary considerably in quality. The most basic concentrate on drill situations. Such a program is Educational 1 from Golem for the BBC and Electron. For the price of one tape, arithmetic can be tested as well as spelling and time. The arithmetic section covers the four standard operations and is limited to a reward for the correct answer.

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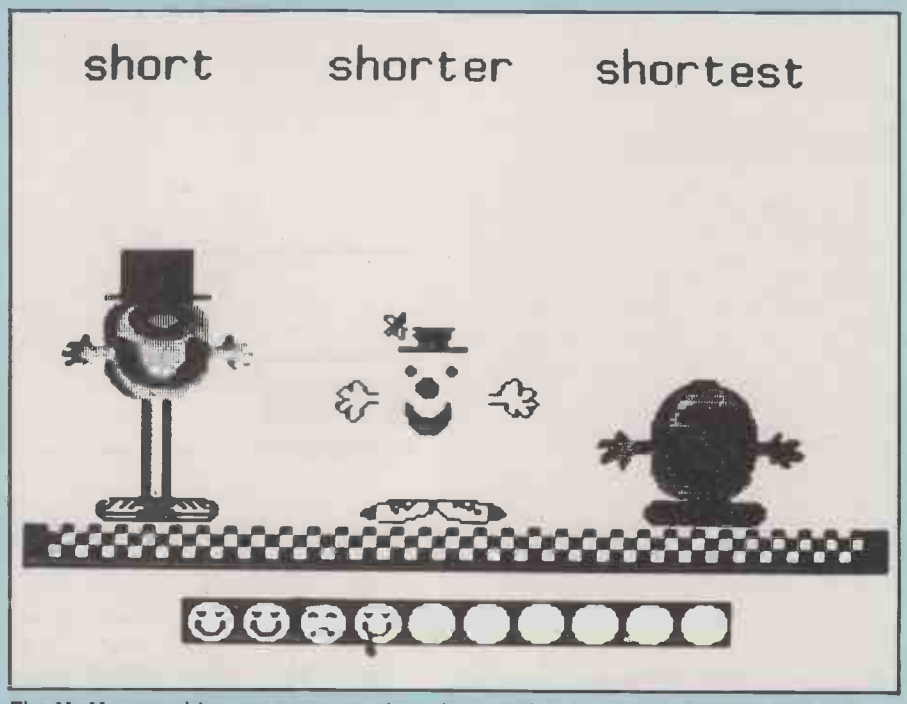

The Mr Men graphics are put to good use in a word games program which part of the Here and There suite.

Guessing the correct word makes Acornsoft's Podd go through his repertoire of 120 actions.

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Spelling is taught by the look, cover, write syndrome which has always been one of the traditional approaches.

In contrast, Acornsoft's Podd is a minor masterpiece. Podd is a loveable character who appears on screen at the beginning of the program. The object of the program is to find out what Podd can do. The words "Podd can . . ." appear, and the child has to enter an activity. If an appropriate word is entered Podd will perform the activity, such as crying, sneezing, running and leaping. As there are 120 actions to guess the program not only tests spelling but increases vocabulary, since the search is on for new actions for Podd to perform.

Board games

Other types of game can be seen as descendants of board games such as Scrabble where combinations of letters can be used to build up words. Longman has a new range which develops this approach. Snaffle, Riddle of the Sphinx and Word Wizard can all be played by up to four players and are aimed at family participation.

Mental arithmetic has been seen as rather old-fashioned in a computerised society. Certainly calculators remove the need for absolute accuracy, but the need to be aware of the rough answer is still important. Arithmetic lends itself to amalgamation with arcade action, and Mirrorsoft's Quick Thinking even enjoyed a spell in 1984's software charts. In Sumvaders, robots drop down from the sky and the object of the game is to answer a question correctly before the robot lands. Addition or subtraction are both options and two players can play at different levels, so a child can play against an adult and still win.

Such a combination of mental gymnastics and arcade action can be seen in Psion/Ask's new program for the Spectrum. In Estimator Racer, the player has to drive a racing car into the lane labelled with the answer nearest to the mathematical sum which is being asked.

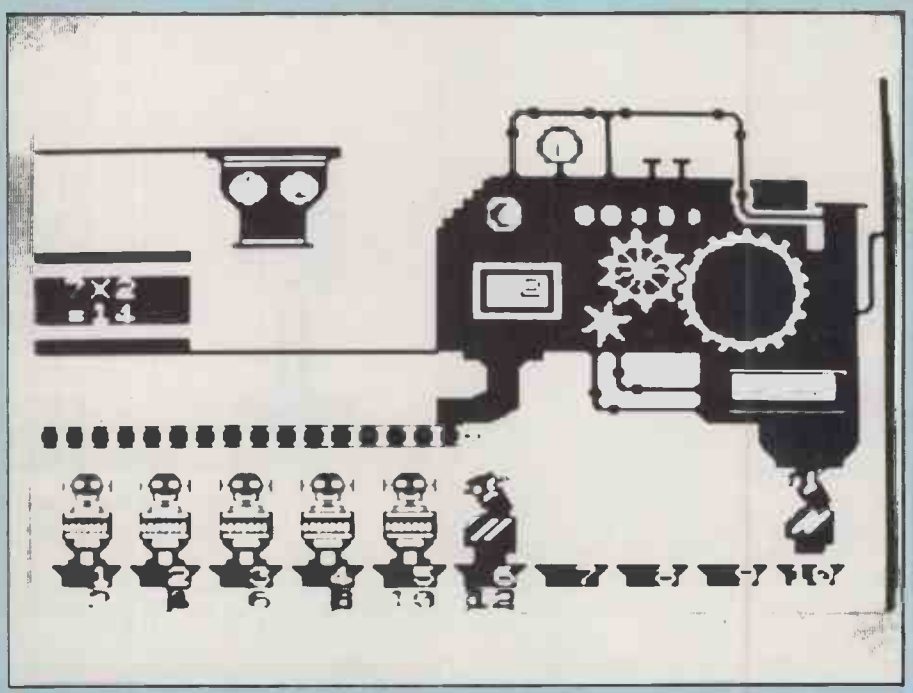
Frac Attack by Shards is a concerted assault on the understanding and testing of fractions which again provides the entertaining mixture of the arcade and arithmetic. Over a series of six games the user has a chance to move from the most elementary fractions to those taxing enough for an adult. Unfortunately, Frac Attack shows one of the negative features of this type of game because bombing routines are incorporated into the structure of one of the games. This aspect is also illustrated by offerings such as Tablesums by Griffin Software.

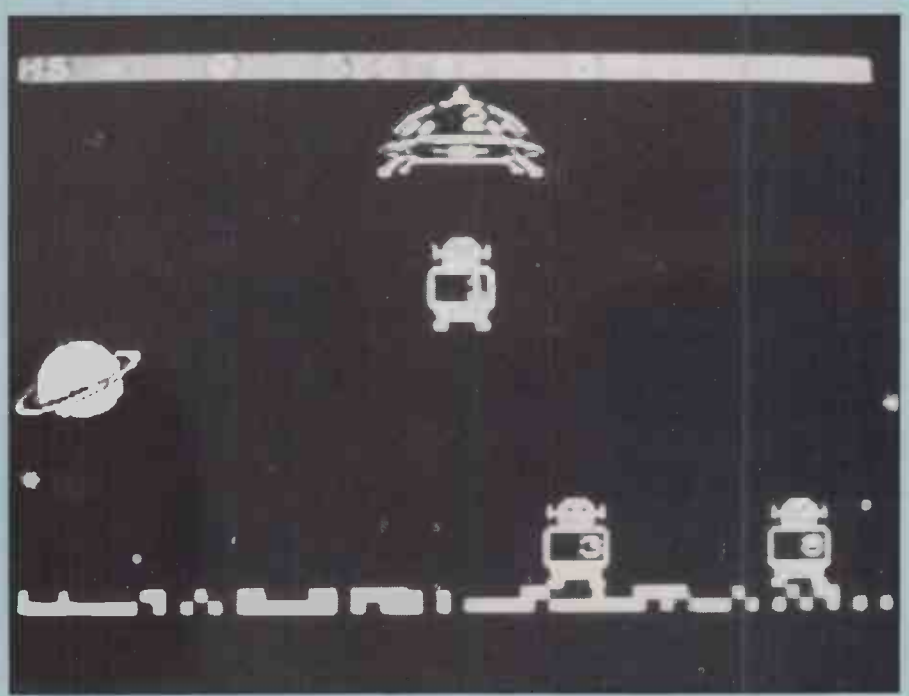
Arithmetic and spelling are two of the more traditional aspects dealt with by educational software. Other approaches take specific areas of learning and exploit them in unusual ways. Look Sharp by Mirrorsoft concentrates on visual discrimination. Old Macdonald's Farm can be used by the younger members of a family, testing odd-one-out and memory skills. Sort is a selection test for space cadets. The activities are the same as Old Macdonald but at a greatly enhanced difficulty level, and visual skills have to be used to the full.

Other programs exploit the adventure format to encourage reading, visualisation and logic. Chalksoft's Pirate is a tale of adventuring on the high seas. Another new program by Acornsoft, Spooky Manor, is specifically designed for group use, and four people can play at once; maps are also included. Quinkey owners can use the system.

Rupert James Pettigrew is a secret agent who makes his appearance in the Pettigrew programs produced by Shards. Again based on the adventure format, the tales of Pettigrew combine adventures with puzzles, word skills, keyboard control and problem solving. Atarisoft's Walt Disney series offers a similar format, where Mickey Mouse embarks on adventures and in the process helps children with arithmetic and word recognition.

Simulations is another area of games playing which grasps the imagination of the user and increases knowledge in specific areas, while requiring traditional skills to execute various actions. Hill McGibbon is a new educational software





Mental arithmetic combines with arcade in Mirrorsoft's Quick Thinking programs Robot Tables (top) and Sumvaders.

house, set up by former directors of Heinemann, which markets three former Heinemann programs: Ballooning, Car Journey and Special Agent. All three programs show the special graphics ability of the Five Ways Software group. Ballooning requires the user to operate a hot-air balloon at three different skill levels, from operating the controls to stay in the air to carrying out particular tasks such as delivering medicines to a farmer. Completing the tasks develops a working knowledge of the relationship between air pressure and the atmosphere.

Simulation

Sinclair Research markets Oil Strike, which simulates the search for oil by surveying regions seismically. Sinclair's Weathermaster develops weather-forecasting skills using a simulation of Atlantic charts. Adventures and simulations encourage reading and writing as well as developing powers of logic, memory and problem solving.

Strategy games require careful thought and are well suited to conversion to computers. Chess is perhaps the most complicated strategy game of all and Longman's new package, First Moves, provides a structured tutorial to take a beginner through the moves of all the pieces as well as playing games against the computer. Other games such as Reversi have been published as computer titles. These types of programs have to compete with the original versions and have the advantage of enabling the user to play alone.

Programs such as Ega Beva's Sliding Block Puzzle and Acornsoft's Juggle Puzzle use the computer to present problems of a different sort. Both present jumbled picture puzzles on screen, and the object of the activity is to reorganise the pictures into their correct form. Sliding Block Puzzle uses the same method as in all plastic puzzles where the pieces have to be moved round to the correct place. Juggle Puzzle operates like a Rubik cube, where sections of the puzzle have to be twisted to their correct orientation. Both are fiendishly difficult at the most advanced levels, requiring concentration and persistence beyond the range of most adults.

Graphics expertise

Gaining command over the graphics capabilities of a computer can be a formidable exercise. The success of Logo in this field has been well documented, and simplified subsets of the language can be used with younger children, such as Acornsoft's Turtle Graphics. Logo devotees are prone to idolatry but an activity which is preferred to more traditional activities in a school context is not necessarily an instant hit with younger children at home. This is especially true if no robot turtle is used, and at nearly £200 for a turtle not many homes have one. Also a language based on Lisp may well be superseded by languages such as Prolog.

One way forward may be the approach adopted by Interactive Story Books in its Tales of Tillie the Turtle. Initially developed for the Atari, the package makes full use of the sprite facility and the software includes five programs of Logo work space to be used within the story.

Electronic sketchbooks exploit the graphics capability of computers and the best adopt an icon approach to promote ease of use. Rolf Harris's Picture Builder can be controlled by a joystick, and shows shapes and colours outside the drawing area which can be chosen. Text can also be added and pictures Saved on to disc or tape.

Hill McGibbon's Picture Builder operates in a similar way, but instead of gradually building a picture out of a combination of shapes, the user can manipulate a shape by stretching, squeezing and turning. Consequently complicated three-dimensional pictures can be built up and coloured in. They can then be printed on an Epson printer.

Programs to assist music learning come in two forms: those which test knowledge of notes and those which aid the user to compose using the computer. Note Invaders by Chalksoft combines arcade action with note recognition on the bass and treble clefs and has proved useful with children preparing for Grade 1 in piano. Commodore's new program, Music Maker, is a powerful package that has eight built-in voices which simulate instruments such as guitar, piano and synthesiser. Rhythms can be created to form the background to tunes composed on the Commodore.

The production of home-educational programs is likely to increase as parents who are worried about cuts in the education system will want to help their children at home. Improvements in this type of software have continued over the last year, coupled with an increased emphasis on more open-ended creative activities. However, using a computer must be kept in perspective, and tactile and practical experiences must not be ignored. Computers add variety and motivation and so are a valuable addition but not the complete answer.

Software summary

	Micro	Format	Price	Publisher
Nursery Rhymes	B	C	£9.95	Longman
Mr T Tells The Time	B,C,S	C,D	£9.95	Ebury
Mr T's Number Games	B,C,S	C,D	£9.95	Ebury
Mr T's Measuring	B,C,S	C,D	£9.95	Ebury
Here and There	B,E,S	C	£7.95	Mirrorsoft
Workshop	B,E	C,D	£9.95	Acornsoft
Odd Man Out	A	C,D	£8.05	IO Software
Colour Sequences	A	C,D	£8.05	IO Software
My First Alphabet	At	D	£30	Atarisoft
Educational 1	B,E	C	£7.95	Golem
Podd	B	C,D	£9.95	Acornsoft
Snaffle	C,S	C	£9.95	Longman
Word Wizard	C,S	C	£7.95	Longman
Riddle of Sphinx	C,S	C	£7.95	Longman
Quick Thinking	B,E,C,S	C	£6.95	Mirrorsoft
Estimator Racer	S	C	£4.95	Pslon/Ask
Frac Attack	B	C	£6.95	Shards
Tablesums	B,E,C,S	C	£7.95	Griffin
Look Sharp	B,E,C,S	C	£7.95	Mirrorsoft
Pirate	B,S	C,D	£9.25	Chalksoft
Spooky Manor	B,E	C,D	£9.95	Acornsoft
Pettigrew's Diary	B,E,C,S	C,D	£7.95	Shards
Ballooning	C,S	C	£9.95	Hill McGibbon
Oil Strike	S	C	£9.95	Sinclair
Weathermaster	S	C	£9.95	Sinclair
First Moves	C,S	C	£7.95	Longman
Sliding Block Puzzle	B	C	£7.95	Ega Beva
Juggle Puzzle	B	C,D	£9.95	Acornsoft
Rolf Harris Picture Builder	C	C	£9.95	Commodore
Picture Builder	B	C,D	£9.95	Hill McGibbon
Note Invaders	B,E,S	C,D	£9.95	Chalksoft
Music Maker	C	C,D	£30.0	Commodore
Music System	B	C,D	£25.0	System

Micros: A, Apple; At, Atari; B, BBC model B; C, Commodore 64; E, Electron; S, Spectrum
Format: C, cassette; D, disc

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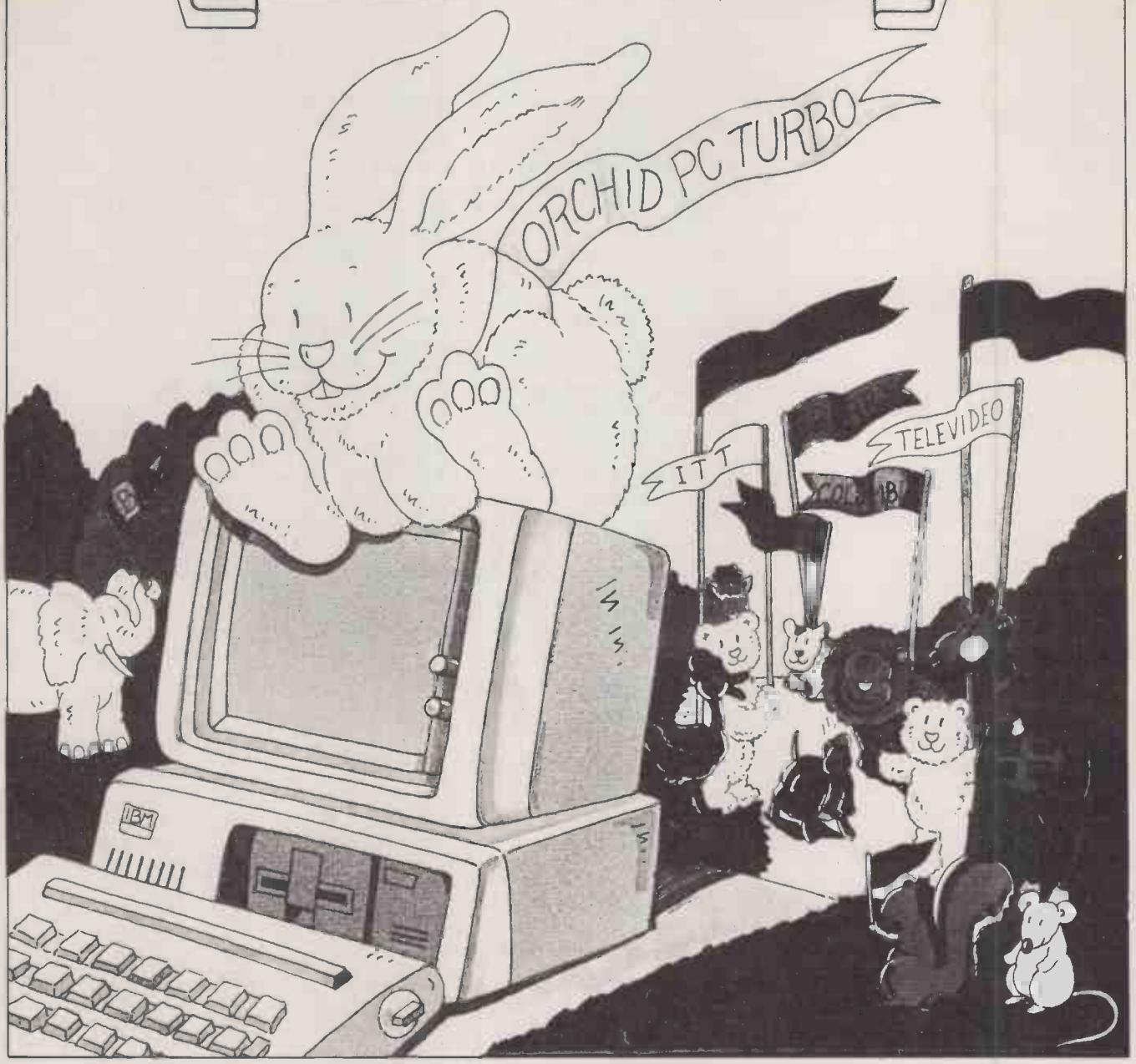

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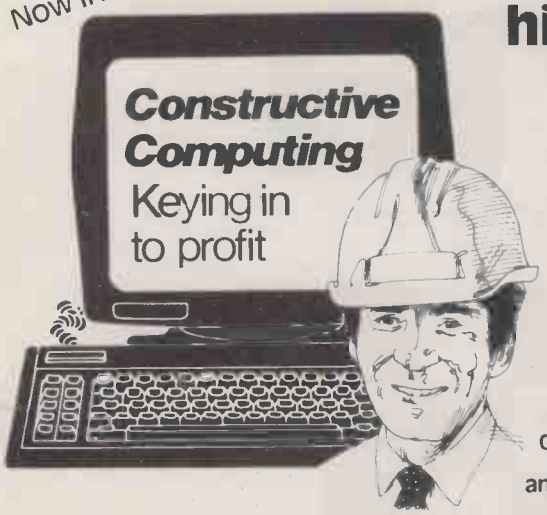

A practical conference highlighting computer benefits to construction managers

Thursday 21st February 1985, Bloomsbury Crest Hotel, Coram Street, London WC1N 1HT.

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The day promises to be of real practical value to construction managers and directors – a day to build your confidence in computers.

Programme

8.45 Registration of delegates and coffee.

Chairman (morning session) Dennis A Neale, chief executive, Chartered Institute of Building.

Session one. Getting programmed.

9.30-10.00 Selecting the right system Gavin Whichello, managing director, National Training Systems, explains how to evaluate your computer requirements and discusses the evaluation of benefits versus price; custom and standard software.

10.00-10.30 Latest systems for contractors Brian Harrison, senior consultant with the Building Advisory Service, assesses what's new on the market. Who makes it, what it does, how much it costs – and how best to use it.

10.30-10.50 Coffee – and a chance to see the exhibition.

Session two. Profiting from your office computer

10.50-11.20 Spreadsheets and financial modelling Julie Colberg, a management consultant with accountants Peat Marwick, explains how to use the power of the computer to produce a whole range of budgetary and financial forecasting systems.

11.20-11.50 Drawing on the computer Mervyn Richards, manager of Laing's computer graphics production and development unit, explains the mysteries of computer aided design, and why contractors, who are becoming more and more drawn into design, should look more closely at CAD.

11.50-12.00 Discussion

12.00- 2.00 Lunch. The working displays of hardware and software systems will be open during this especially extended interval.

Chairman (afternoon session) Rob Howard, general manager of the Construction Industry Computing Association.

Session three. Planning for Success

2.00- 2.30 Surveying the scene. Dr Martin Barnes. As a director of a project software house and one of the country's leading project managers Martin Barnes is uniquely qualified to give an overview of the latest developments in computing for planners, and quantity surveyors.

2.30- 3.00 A system described. Jeff Reiss, of Abtex software, shows how a planning software programme can benefit the smooth running of a construction project.

3.00- 3.15 Questions on afternoon session.

Session four

3.15- 5.00 Computer Clinic and Exhibition Conference speakers will be on hand to answer individual problems and give delegates independent advice on computer problems. During this time the computer exhibition will remain open to delegates wishing to get hands-on experience of manufacturers' products.

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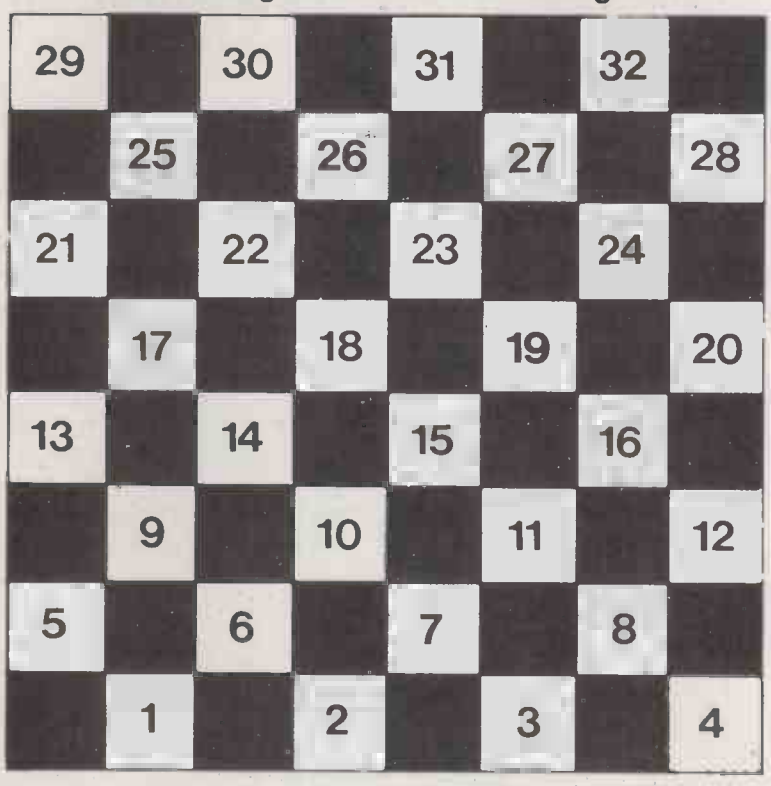
Dama

David Levy proposes some algorithms for an interesting alternative to draughts.



THE GAME OF Dama is played on the same eight-by-eight board as draughts, with the same type of pieces. Dama is popular in Central Europe, though for some reason it appears to have been neglected by British games enthusiasts. Its rules are simple, yet like so many other strategy games this simplicity belies the true nature of the struggle.

The two players sit on opposite sides of the board, each with an army of eight pieces. White's pieces initially occupy the squares numbered 1 to 8, while Black's occupy squares 25 to 32. The players move alternately, and a move consists of either a single, forward diagonal step with one piece; or a single, double or triple jump, all in a forward direction, by one piece over one or more pieces, which might belong to the same side or to the opposing side. So in the initial position, White can move one step with any of the pieces on squares 5 to 8, or could make a single jump with any of the pieces on squares 1 to 4.

The aim is to be the first to manoeuvre all of one's own pieces on to the squares initially occupied by the opposing army, so in this sense Dama is similar to the game of Halma which was the subject of last month's article. In Dama, however, it is possible to create a situation in which your opponent cannot move any of their own pieces, and if you make a move that creates such a position you immediately lose the game. The rules originally designated such blocked positions as draws, but the game is made much more interesting by this rule change.

Findler's work

I first came across the game in a paper by Professor Nicholas Findler on a program, written in Australia, that played Dama. Professor Findler is one of the world's leading experts on computer games, and has written prolifically on many related subjects, including computer poker. This article relies heavily on Findler's work.

The fact that the game is not trivial for a computer program can be seen from the number of possible ways of moving one's own pieces from their starting squares to the opponent's starting squares, in single steps. This number is in the region of 10^9, and to cater for the possible move orderings it must be multiplied by 56 factorial — itself a number of the order 10^{74}.

Clearly the game lends itself well to a tree-searching approach, and so it is necessary to analyse the nature of the game in order to derive the most suitable features for the evaluation function. Findler's own program had to be small, since his computer had the equivalent of only 5K of memory — this was in 1959 — and so he employed only one feature in his evaluation function. He did, however, describe other important features which would have been included in the program had space permitted.

The most important of these is Development. It measures how much progress up the board has been made by each of the players. The measure of a player's development is simply

$$\text{rank}_{\text{piece 1}} + \text{rank}_{\text{piece 2}} + \text{rank}_{\text{piece 3}} + \ldots\ldots + \text{rank}_{\text{piece 8}}$$

and the overall development measure is

White's development − Black's development

The feature known as Potential is based on the concept that it is generally more advantageous to jump over one of your opponent's pieces in the next half move than it is to jump over one of your own. The reason is that your opponent has the right to move his piece in order to prevent

you from making an advantageous jump, whereas you can decide to leave your own piece where it is.

To measure this feature for any particular sequence of k ply it is necessary to define a number of variables

P_j — the game position which has arisen j ply after the start of the game

k — the number of ply ahead that the program thinks

Own_i — the number of possible jumps over the program's own pieces in position P_i

Opp_i — the number of possible jumps over the opponent's pieces in position P_i

then potential in position P_j is measured by

$$(Opp_j - Own_j) - A \times (Opp_{j+1} - Own_{j+1} + Opp_{j+2} - Own_{j+2} + \ldots\ldots + Opp_{j+k} - Own_{j+k})$$

where A is a constant.

Negative potential

The previous feature measures the merit of potential jumps during a sequence of moves that extends for the next k ply from the root position. This measure does not take into account the fact that the importance of potential for a particular player varies according to whether or not it is that player's turn to move. In order to allow for this the program must also consider the potential one ply further on. The measure of negative potential is therefore simply

$$Own_{j+k+1} - Opp_{j+k+1}$$

The Spread of a player's pieces is the extent to which they are spread out across the board from left to right. If they are well spread out it will be easier for them to block the opponent's jumps, and the pieces themselves will have more flexibility of choice in their paths to the far end of the board. Findler suggested the following measure for the Spread of one's pieces

$$8 \times (rank_{piece\ 1}{}^2 + rank_{piece\ 2}{}^2 + \ldots\ldots + rank_{piece\ 8}{}^2) - (rank_{piece\ 1} + rank_{piece\ 2} + \ldots\ldots + rank_{piece\ 8})^2$$

The smaller this number, the better spread are one's own pieces.

Since the object of the game is to march one's pieces into the two far ranks, it is obviously sensible to include in the evaluation function some indication of whether a move ends on one of the eight key squares. This Home feature scores 1 if a move does end on one of the far eight squares, and 0 otherwise.

Findler suggests the interesting concept of measuring the Mobility for each square of the board, rather than for each piece as in chess, draughts and many other games. His idea is similar to the concept of degrees of freedom which I have discussed elsewhere in connection with Gomoku and Connect-4.

Consider how a piece from square 1 might eventually arrive on square 25. You can see that using single steps the piece must make six moves in order to arrive; three of these moves will be forwards and to the left, and three of them will be forwards and to the right. The number of left moves can be denoted by l, the number of right moves by r, and the total number of moves by m.

The quantity $P_m(r,l)$ in the fifth column of the mobility table is the number of different ways, on an empty and infinite board, that a piece could move from square 1 to square 25 in single steps. It is simply

$$m!/((m-r)! \times r!)$$

But the board is not infinite, it has edges, and so some of the paths from square 1 to square 25, which would exist on an infinitely wide board, do not exist in the real world. The number of such routes to be subtracted is denoted by d, and this number subtracted from $P_m(l,r)$ gives the number of feasible paths from square 1 to square 25, as indicated by the value in the g column.

From	To	m	r	l	$P_m(r,l)$	d	g	Mob
1	25	6	3	3	20	6	14	104
	26	6	4	2	15	1	14	
	27	6	5	1	6	0	6	
	28	6	6	0	1	0	1	
	29	7	3	4	35	21	14	
	30	7	4	3	35	7	28	
	31	7	5	2	21	1	20	
	32	7	6	1	7	0	7	

Mobility table for a piece or square 1.

The Mobility value assigned to square 1 is then determined by adding together all the g values for square 1. It is indicated by Mob. From the table you can see that square 1 has a Mobility value of 104. Squares nearer the left and right edges of the board will have lower mobility values than those nearer the centre, and so the mobility feature will encourage moves away from the left and right edges. This is logical, since pieces on the edges have fewer ways to advance than those on more central squares.

By studying the table and the way in which it has been created you should be able to generate similar tables for every square. It will then be possible to measure the change in Mobility for each move, simply by determining the difference between the Mobility values of the origin and destination squares.

Weighting

The six evaluation features can be combined into a linear evaluation function in the usual way. The weightings for each feature will probably be determined by trial and error, though it is always interesting to program some sort of learning device to encourage the program to improve the weightings in its own function. A method for accomplishing this was described in my book *Computer Gamesmanship*.

Another method could also be used. In the Dama program there are six features. Start with two features, and play a series of games between two versions of the program until a reasonably good relationship exists between the weightings of these two features. Then add a third feature, and play another series of games between two programs using evaluation functions that differ only in their weighting for the newly added feature. This series of games will provide a reasonable idea of the correct weighting for the third feature. Then continue the process, adding the remaining features one by one.

Now create 2^6 different evaluation functions. For each feature examine the established weighting, W, and use the two values $1.1 \times W$ and $0.9 \times W$. The two possible weightings for each of the six features will provide the 64 different evaluation functions, and your program can now play a tournament, matching in turn every possible pair of sets of weightings. You will need to put the programs on a shallow-depth of look-ahead — say three ply or four ply — otherwise the tournament will take forever.

Best score

Choose the set that scores best in the tournament. Each version of the evaluation function will have played 63 games, or better still 126 — once with White and once with Black against each opponent. The winning set of ratings is now used as the reference point, and the process is repeated.

When the weighting for a particular feature moves, say, up after one tournament of games and up again after the next set, continue to iterate by using values 10 percent above and below each of the current weightings. But when you find that a weighting goes up after one tournament and down after the next, reduce the window for this weighting from 10 percent to 5 percent. This hill-climbing process is repeated until the windows are all, say, 2.5 percent or less, whereupon you have reached a local optimum in your search of the six-dimensional space that is represented by the evaluation function.

Bibliography

"Some Remarks on the Game 'Dama' which can be played on a Digital Computer", by N V Findler, *Computer Journal*, 3 (1960) p.40.

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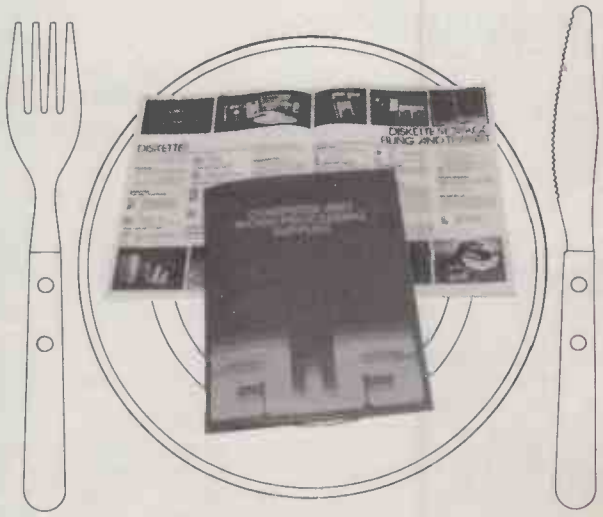

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Inside OS

Roger Cullis dissects the BBC Micro's operating-system ROM routines.

IN ORDER to write software which makes full use of the facilities provided by a computer, it is vitally important to understand the computer's components and how they are controlled. The BBC Micro is a complex machine which not only drives a wide variety of peripheral devices through built-in interfaces but can also be connected to an increasing number of second processors to enhance its computing power. In many cases these resources can only be exploited by direct access to the utilities and routines which are an integral part of the languages and operating system provided in the machine's firmware.

The BBC Micro is built round the Mostek 6502 eight-bit microprocessor. In its standard form it has 32K of ROM and either 16K of RAM as the model A, or 32K as the model B. It was designed as an expandable system and so is primarily an I/O device. It can service a variety of peripheral devices such as serial and parallel printers, local area networks, disc drives and speech synthesisers. For this reason blocks of memory have to be reserved for specific applications. For example, in order to provide buffers for transfer of data between the computer and the floppy-disc controller, nearly 3K of read/write memory is required. Adding Econet takes another 0.5K, and speech synthesis a further 1K.

Memory map

The 6502 microprocessor has a 16-bit address bus, which means that it can access a 2^{16} or 64K memory bank. Of this, 32K is ROM and memory-mapped I/O and, on the model B, 32K is RAM — 16K on the model A. The arrangement of memory is shown in figure 1. RAM occupies the lower 32K addresses from &0000-7FFF and ROM occupies two 16K blocks from &8000-BFFF and &C000-FFFF. The lower ROM block is allocated to utilities, including Basic, the disc filing system, word processors such as View, or graphics extensions.

Up to 16 different 16K ROMs can be connected to this address space, although only one may be active at a given time. The machine operating system or a control program ensures that the appropriate page ROM is switched in when it is required. This operating system, which controls the running of the computer, occupies the upper ROM block, &C000-FFFF.

Most of the memory space contains operating code, but part of the address allocation is devoted to memory-mapped I/O. If an instruction is written to one of these addresses, it is not stored but passed directly to the peripheral device to which the address is allocated.

The OS, the paged ROMs and I/O devices all require read/write memory to store data during operation. This memory may be set aside exclusively for the purpose, as is the case with the soft-key buffer, &0B00-0BFF, which holds the strings called up by the user-definable keys. Alternatively, it may be shared among several chips, as with the paged ROMs' public workspace or the filing system zero-page locations, or it may be allocated dynamically during the operation of a program. An example of this dynamic allocation is found in the Basic stack, which acts as a temporary store, and expands and contracts according to the needs of the program.

The screen buffer where the computer stores what is currently displayed on the screen occupies the highest region of RAM. Its size depends on the mode which is being displayed. Mode 7, Teletext mode, occupies only 1K, whole mode 0 requires 20K.

Page 0, addresses &0000-00FF, is used for dynamic storage during operation, and page 1, &0100-01FF, is allocated to the 6502 stack. The operating system takes pages 2 and 3; pages 4 to 7 are given to the current language ROM, or to interfacing routines if a second processor is active. Pages 8 to C, addresses &0800-0CFF, are devoted to operating system buffers for input and output and for storage of soft-key definitions and sound envelopes. Page D, addresses &0D00-0DFF, contains the non-maskable interrupt routines and parameters such as the current paged ROM status and extended vectors.

The operating system ROM contains the routines to start up the computer when it is switched on or reset by pressing the Break key. It also supervises the chips which control the peripheral devices and handles the flow of data to and from them.

The BBC Micro can have a variety of different filing systems, such as disc, Econet and Telesoft, for data storage and retrieval. Mostly these are in the form of separate paged ROMs, but the two simplest are built into the OS ROM. They are the ROM filing system, which can be used for data retrieval only, and the cassette filing system, which only implements a limited subset of the full filing-system operations.

OS routines

There have been several versions of the OS, commencing with version 0.1. Each successive version has implemented more features, culminating in the current OS 1.2 which has remained unchanged for some time. The general layout of the operating system is shown in the memory map. There are several well-defined features which serve quite independent functions.

The computer is able to control a wide variety of peripheral devices by using dedicated peripheral controller chips. For instance, disc storage is controlled by an Intel 8271 floppy-disc controller chip, Econet by a Motorola 6854 advanced data link controller, and the VDU by a Motorola 6845 cathode-ray tube controller. These chips each have several registers which need to be initialised, and they expect instructions in a pre-defined format.

The look-up tables and control routines to meet these needs are stored in the operating-system ROM or, in the case of filing systems, in a separate paged ROM. The first part of the OS is devoted to look-up tables of parameters required to set up and run the visual display, starting with the character fount look-up table at &C000-C0BF.

Text characters are displayed on an eight by eight matrix. The fount for each character is stored in ascending ASCII order as an eight-byte block, each byte representing one line of the matrix. In each byte, a bit set to 1 represents a dot that is to be displayed. For example, the symbol +, ASCII code 2B, held in ROM at &C058-C05F, is displayed as shown in table 1.

&C300 contains an unconditional jump to VDU initialisation routines, and at &C303 there are the BRK embedded messages. &C31F-C332 contains the byte mask look-up tables used in processing pixels for graphics display.

&C333-C353 and &C354-C374 contain

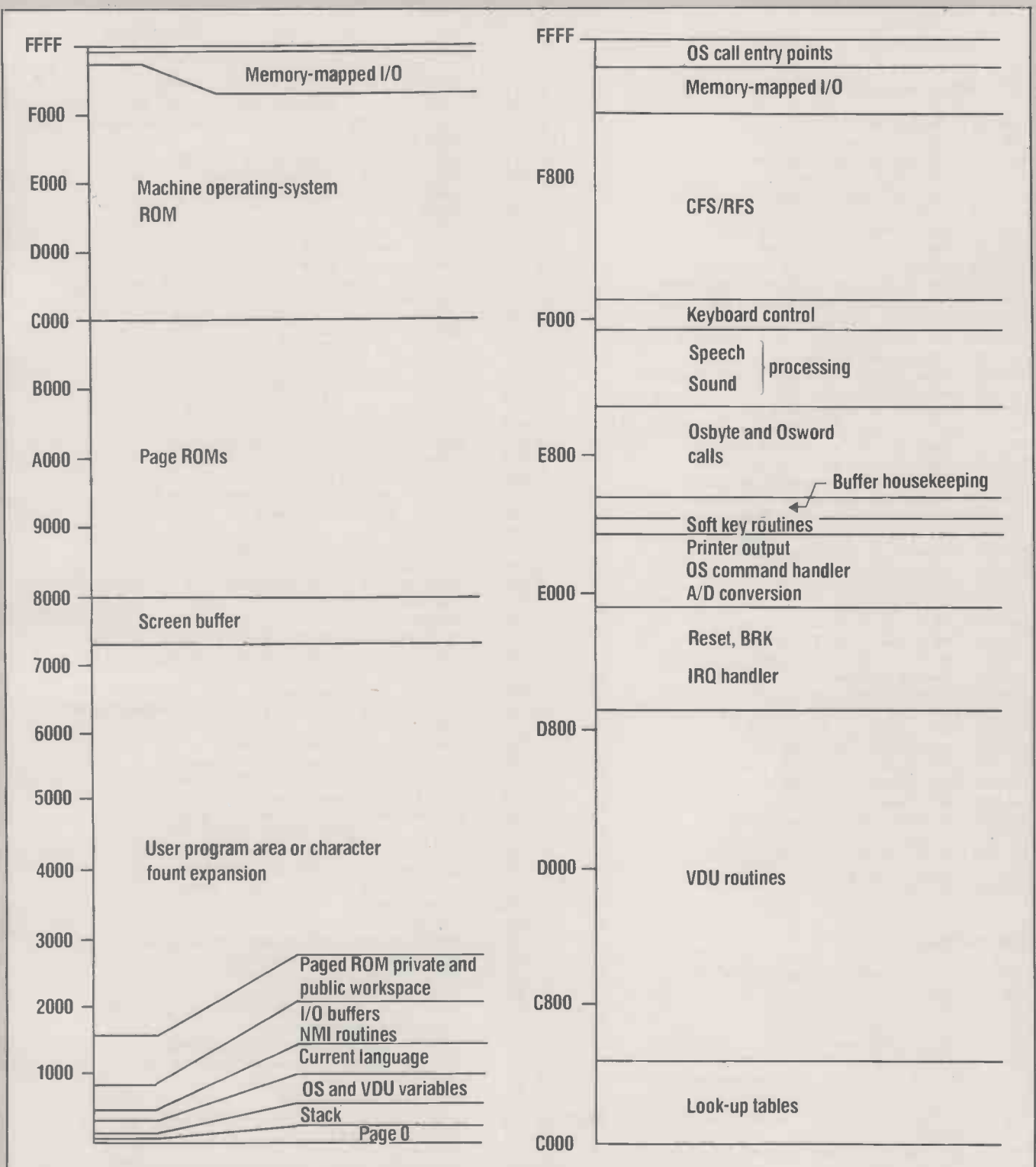

Figure 1. Memory map of the 6502 microprocessor (left) with details of the OS1.2 ROM (right).

L/U table address	byte	binary equiv.	visual display
C058	00	00000000	
C059	18	00011000	**
C05A	18	00011000	**
C05B	7E	01111110	******
C05C	18	00011000	**
C05D	18	00011000	**
C05E	00	00000000	
C05F	00	00000000	

Table 1. How a character is stored.

the two-byte address of the entry point of the VDU routines, indexed by VDU code. The high byte held in &C354-C374, is modified so that the number of associated parameters can be derived from it. The parameters are then assembled in a VDU queue. The low byte is held in &C333-&C353.

&C375-C3E6 holds the *640 and *40 multiplication tables, which determine the number of characters from the origin in text display modes. &C3E7-C3F6 holds look-up tables for default text window size, indexed by screen mode.

&C3F7-C447 contains look-up tables for various display parameters. Several of these tables overlap one another, and some serve a dual purpose. &C441-C444 holds the sound pitch offset. If more than one channel is programmed to output the same frequency, it is not possible to distinguish by ear that a second or third channel is active. To avoid this effect, the

(continued on page 125)

VDU display setup parameters and routines.

```
C000-C2FF  :character font lookup table
C300       :initialise system
C303       :"BBC Computer" embedded message
C312       :"16k + BELL" embedded message
C317       :"32K + BELL" embedded message
C31F-C32E  :4-colour MODE byte mask lookup table
C32F-C332  :16-colour MODE byte mask lookup table
C333-C353  :VDU entry point lo lookup table
C354-C374  :VDU entry point hi parameter lookup table
C375-C3B3  :*640 multiplication table (40-,80-column MODEs)
C3B5-C3E5  :*40 multiplication table (teletext MODE)
C3E7-C3EE  :text window - bottom row lookup table
C3EF-C3F6  :text window - right-hand column lookup table
C3F7-C3FE  :video ULA control register setting
C3FF-C406  :number of bytes per character for each display MODE
C407-C40B  :mask table for 2-colour MODEs
C409-C40C  :mask table for 4-colour MODEs
C40D-C414  :mask table for 2-colour MODEs, font flag mask table
C414-C41B  :number of colours minus one for each MODE
C41B-C425  :GCOL PLOT options processing lookup table
C424-C425  :2-colour MODE colour parameter lookup table
C426-C429  :4-colour MODE colour parameter lookup table
C42A-C439  :16-colour MODE colour parameter lookup table
C43A-C441  :display MODE pixels/byte -1 lookup table
C440-C447  :screen display memory index lookup table
C441-C444  :sound pitch offset by channel lookup table
C44B-C44E  :CRTC setup parameter
C44F-C453  :CRTC setup parameter
C447-C458  :VDU section control numbers
C459-C45D  :MSB of memory occupied by screen buffer
C45E-C462  :MSB of first location occupied by screen buffer
C463-C465  :number of bytes/row
C466-C468  :row multiplication table pointer lo lookup table
C469-C46D  :CRTC cursor end register setting lookup table
C46E-C479  :6845 registers 0-11 for MODEs 0-2
C47A-C485  :6845 registers 0-11 for MODE 3
C4B6-C491  :6845 registers 0-11 for MODEs 4-5
C492-C49D  :6845 registers 0-11 for MODE 6
C49E-C4A9  :6845 registers 0-11 for MODE 7
C4AA-C4AD  :VDU routine vector addresses
C4AE-C4B1  :VDU routine branch vector address lo
C4B2-C4B5  :VDU routine branch vector address hi
C4B6-C4B9  :teletext character conversion table
C4BA-C4BF  :soft character RAM allocation
```

VDU routines.

```
C4C0       :check VDU command, if normal character, PRINT it
C4ED       :RUBOUT
C511       :VDU 00 - do nothing
C511       :VDU 06 - enable VDU drivers
C511       :VDU 27 - do nothing
C53B       :VDU 01 - send next character to printer only
C55E       :confirm input, output cursors not separated ....
C565       :prepare cursor character for display ....
C56B       :interchange cursors, set CRTC address registers, toggle VDU screen
           :status
C588       :get graphics cursor printing status bit
C58D       :VDU 14 - paged mode on
C596       :VDU 02 - enable printer
C598       :VDU 21 - disable VDU drivers or delete current line
C59D       :set VDU status or, if zero, reset default
C5A1       :VDU 03 - disable printer
C5A6       :VDU 15 - paged mode off
C5A8       :reset specified VDU status bits
C5AD       :VDU 04 - write text at text cursor
C5B9       :VDU 05 - write text at graphics cursor
C5C5       :VDU 08 - backspace one character
C621       :move graphics cursor one position
C65B       :VDU 11 - move cursor up one line
C664       :VDU 09 - advance text cursor if enabled
C684       :set text cursor to new line, scrolling if required
C6AC       :clear text line to background, calculate offset, set CRTC address
C6AF       :calculate offsets of character row, set text cursor address register
C6B4       :paged mode scrolling
C6F0       :VDU 10 - move cursor down one line (line feed)
C6FA       :VDU 28 - define text window
C735       :OSWORD 09 - read pixel value
C74B       :OSWORD 0B - read palette
C759       :VDU 12 - clear text area
C779       :VDU 30 - home text cursor to top left
C7B7       :VDU 31 - move text cursor to X,Y
C7A8       :interchange current text cursor with value from general graphics
           :coordinate workspace
C7AF       :VDU 13 - move cursor to start of current line
C7C0       :VDU 16 - clear graphics area
C7F9       :VDU 17 - define text colour
C7FD       :VDU 18 - define graphics colour
C839       :VDU 20 - restore default logical colour
C88F       :save colour index and define logical colour
C892       :VDU 19 - define logical colour
C89E       :set logical/physical colour relationship
C8E0       :OSWORD 0C - write palette
C8EB       :VDU 22 - select screen MODE
C8F1       :VDU 23 - re-program display character or write to CRTC
C93B       :process unrecognised VDU command
C93F       :setup CRTC
C951       :set 6845 cursor register to previous value
C954       :set 6845 cursor parameters register = A-register
C958       :write parameter from VDU queue to specified CRTC register
C95E       :set specified CRTC register
C98C       :VDU 25 - PLOT k,X,Y
C994       :backspace one row, set CRTC screen start address registers
C9A4       :advance one row, set CRTC screen start address registers
C9B3       :set 6845 CRTC screen start address registers
C9BD       :VDU 26 - restore default windows
C9F6       :save 68465 text cursor position address, set corresponding 6845
           :registers
CA02       :set 6845 text cursor address registers
CA0E       :set 6845 CRTC registers indexed by Y-register
CA2B       :write two bytes to consecutive 6845 registers
CA39       :VDU 24 - define graphics window
CA8B       :set text window width according to character size
CAA2       :VDU 29 - define graphics origin
CAAC       :VDU 127 - backspace and delete
CAD4       :add number of bytes in row to display address
CAE0       :zero PRINT line counter and scroll if enabled
CAE3       :scroll if enabled
CB14       :zero page PRINT line counter
CB1D       :initialise video display parameters and workspace
CB33       :set up video display parameters table
CBC1       :initialise screen display parameters
CBF3       :OSWORD 0A - read character definition
CC02       :character font definition indirection vector lookup table
CCF5       :process unrecognised VDU command
CCFB       :scroll back one row, check if wrap-round needed
CD07       :OSBYTE 14 - explode soft character RAM allocation
CD3F       :move text cursor to next line
CD6A       :process character for display
CD77       :recover A-register, processor status from stack
CD7A       :process cursor character for display
CDA4       :soft scroll one line
CDCE       :set scan line address, scroll back until counter zero
CDDA       :interchange current text cursor with value from coordinate workspace
CDDE       :interchange two Page 3 bytes indexed by X,Y
CDE2       :interchange old and current graphics cursors
CDE4       :interchange old graphics cursor with value from coordinate workspace
CDE6       :interchange four-byte block indexed by X,Y in Page 3
CDFF       :scroll text one line
CE2A       :set scan line address = source line address
CE3B       :copy source line to scan line
CE5B       :determine text window height, if non-zero do CR
CE6E       :set text cursor X-coordinate to left-hand side of text window
CE73       :add character to scan line
CEAC       :clear text line to background colour
```

(continued from page 123)

pitch of channels 2 and 3 is offset slightly in the same way that piano strings are slightly detuned. &C447-C458 holds the screen buffer size and location look-up tables. &C463-C468 holds the character position determination look-up tables. &C469-C4A9 holds the initial register settings for 6845 CRTC chip.

&C4AA-C4B5 holds the look-up tables for alternative entry points and branch loops in VDU processing routines. &C4B6-C4B9 holds the character definitions for the non-standard ASCII codes used in mode 7. The soft-character RAM allocation is done by &C4BA-C4BF.

The VDU routines are held in &C4C0-&D93F, starting with the VDU command handler. Current VDU status is stored as a series of flag bits at zero-page location &D0. On input of a VDU command, permissible action is checked against VDU status and the entry point of the associated routine ascertained from a look-up table.

The value of the status bit may be determined with Osbyte 75. The significance of the bits is

0 — enable printer
1 — disable scrolling
2 — enable paged mode
3 — enable software scrolling
5 — enable text at graphics cursor
6 — enable cursor editing
7 — disable VDU

The command is processed and converted into instructions which are stored in corresponding registers of the 6845 CRTC to modify the display. Parameters associated with a VDU command, such as

VDU25,k,X,Y

are stored as a VDU queue and processed in sequence.

Graphics display is controlled by manipulation of graphics co-ordinates. A region of low RAM is set aside as graphics co-ordinate workspace. Values such as the previous position of the graphics cursor are stored here. It is also used, for example, as a co-ordinate store in the Plot and Fill routines.

Colour processing is controlled by a palette which stores the relationships between logical and physical colours. It is located in the video ULA chip.

The page 2 setup default values, held at &D940-D9CC, are copied by the Reset routine to page 2.

This article forms part of a book to be published by Losco Ltd, PO Box 4, Cranleigh, Surrey GU6 8BQ, price £11.95 plus £1.50 post and packing. A further instalment will appear in next month's *Practical Computing*.

```
CEE8    :confirm cursor in text window, calculate character row offset
CF06    :calculate address of text cursor
CF63    :PRINT character at graphics cursor
CFA6    :home graphics cursor
CFAD    :set graphics cursor X-coordinate to left-hand column
CFB7    :set up character definition and display character
CFBF    :display character
CFDC    :insert teletext character in scan line, convert if required
D03E    :set up character definition pointers
D060    :process PLOT command
D0B3    :set Page 0 colour processing bytes
D0D9    :move graphics cursor to absolute position
D0DC    :copy current graphics cursor coordinates from VDU queue
D0DE    :copy four bytes from VDU queue
D0E3    :set colour of point at current graphics cursor
D0EB    :omit last point in line
D0F0    :set colour of current graphics point, save to graphics scan line
D0F3    :process colour and save to graphics scan line
D104    :process colour of current graphics point
D10D    :check current graphics cursor position with respect to to window
        :boundaries
D10F    :check position of indexed graphics coordinates with respect to
        :window boundaries
D128    :check current graphics point position with respect to window
        :boundaries
D149    :adjust coordinates according to display MODE
D14D    :adjust PLOT coordinate according to display options
D176    :adjust coordinate for relative/absolute PLOT, divide it by 2
D1AD    :divide PLOT coordinate by 2
D1BB    :calculate graphics cursor offset according to display MODE
D1D5    :adjust cursor coordinates, calculate cursor offset
D1E3    :use graphics origin to calculate cursor offset
D1ED    :execute PLOT command
D214    :set up branch loops, PLOT parameters
D2E3    :set scan byte if appropriate, adjust coordinates and scan position
D3D3    :decrement graphics cell top line address by one row, set Y=7
D3ED    :set graphics mask = left-hand colour mask, increment graphics cell
        :by one line
D3FD    :set graphics mask = right-hand colour mask, decrement graphics cell
        :by one line
D40D    :calculate graphics cursor relative to graphics window
D411    :calculate graphics coordinates relative to specified point
D418    :calculate graphics coordinate offset
D42C    :if necessary, set up working coordinates, evaluate difference,
D42C    :make positive, divide Y by 2
D459    :take modulus of working coordinate, divide Y coordinate by 2
D467    :change sign of working coordinate, if negative
D47C    :copy 8 Page 3 bytes to new location (indexed by X,Y)
D480    :copy two Page 3 bytes to coordinate workspace
D482    :copy two Page 3 bytes to new location (indexed by X,Y)
D486    :copy current graphics cursor to coordinate workspace
D488    :copy current graphics cursor to new Page 3 location (indexed by Y)
D48A    :copy four Page 3 bytes to new location (indexed by X,Y)
D49B    :form 2s complement of number in Y-,A-registers
D4AA    :if byte legal, process colour, else, discard it and move cursor
D4BF    :omit last point in inverting actions
D506    :PLOT with dotted line
D545    :move graphics cursor and calculate offset for MODE
D54B    :get current graphics byte mask, set colour, save byte to scan line
D574    :reset graphics byte and save to scan line
D592    :check X coordinate from VDU queue against graphics window boundary
D5AC    :process working X coordinate, transfer to VDU queue
D5CC    :OSWORD 0D - read last two graphics cursor positions
D5DE    :OSWORD 0D - read old and current graphics position
D5D5    :transfer four bytes index by A-register to OS buffer
D5EA    :PLOT and fill triangle
D632    :if old graphics cursor greater than new PLOT point, interchange them
D636    :if source coordinate greater than destination coordinate,
        :interchange points
D647    :OSBYTE 86 - read text cursor position (POS and VPOS)
D65B    :process coordinates and PLOT points til target reached
D6A2    :set and arrange working coordinates, ....
D6A6    :arrange working coordinates, process colour mask, save to scan line
D70E    :recover target coordinates from stack
D774    :derive coordinates for next point in triangular PLOT
D7AC    :add stored value to working coordinate, increment counter if
        :necessary
D7C2    :OSBYTE 87 - read character at text cursor position
D808    :derive character definition from displayed character
D839    :determine logical colour of specified point
D85D    :get coordinates from VDU queue, set up graphics line address, colour
        :mask
D85F    :set coordinate source index, set up line address, colour mask
D864    :set up graphics line address
D8CE    :if enabled, PRINT at cursor position
D905    :if text cursor enabled, read character
D918    :reset CRTC cursor register, cursors together, enable screen, set
        :A-register to 0D
D923    :OSBYTE 85 - read HIMEM
D926    :OSBYTE 85 - read address of screen buffer for MODE
```

Page 2 setup — default values.

```
D940-D976  :Page 2 vectors default settings
D976-D9CC  :MOS variables default settings
```

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PC2/85

Two-column text from WordStar

John and Timothy Lee explain how to adapt your WordStar program to output text in multi-column format.

WITH A LITTLE effort WordStar can be coaxed into printing text in multiple columns. You start in the normal way, and type, edit and print the document in single-column format. With the text in its finished form it is ready to be reformatted into two columns. Keep a backup copy of the single-column version in case you want to alter the text later.

By default WordStar sets the length of a line of text to 65 characters. For two-column printing this space has to be shared between two columns of text, and you will also need a few spaces to separate the columns. Keeping to the 65-character default, and allowing three spaces between the columns, leaves 31 characters for each column.

It is best to type the text to the correct width to begin with, setting the right margin to 31 with a ^OR 31 command. If the text has already been typed in to a different width you will have to reset the margin and reformat every paragraph in the document by typing ^B on each paragraph. Of course, you can choose other column widths if you wish, as long as they fit on the paper.

The second step is to set the page length to twice the required length for the page. WordStar defaults to 66 lines per page, made up of 55 lines of text and 11 lines for a header, a footer or a page number, and margins at top and bottom. If you want to keep 55 lines of text per page use a .PL121 command to reset the page length to 121: twice 55 for the two columns of text plus 11 for the headers, footers and margins. If you use A4 paper, allowing a normal page length of 70 lines, reset the page length to 129.

Step 3 is to move the cursor to the beginning of the line where you wish to break the text into two columns; for a 55-line page this would be at the beginning of line 56. Then place as many reverse Linefeeds — 55 in this case — as are

(continued on next page)

Setting up the ^PE command

WordStar provides four commands ^PQ, ^PW, ^PE and ^PR, which are not normally used but may be installed by the user to perform any required function. To make your printer wind backwards you will have to patch your copy of WordStar, using the Install program, so that the ^PE, command sends the required ASCII characters to the printer. The codes required by some common printers are as follows.

	Command characters	Hex representation
Diablo 620, 630, 1650	Escape LF	02 1B 0A
IDS 560	Ctrl-Y Ctrl-Y	02 19 19
NEC 3500, 5500, 7700	Escape 9	02 1B 39
Qume 5, 9, 11	Escape LF	02 1B 0A
TEC Starwriter 25	Escape LF	02 1B 0A

Install shows you in turn the Terminal menu, the Printer menu, the Communications Protocol menu and the Driver menu. Type U in reply to each of these to make no changes. You will then be asked: "Are modifications to WordStar now complete?" Answer N to this question and it is followed by a message: "You may now modify any location described in the listing . . ." At this point you may change the contents of individual bytes in the program.

Type the address 06D3. The present contents of this address are displayed, and you must type the required command in hexadecimal. Thus for a Diablo printer, for example, you would type 02 and press Return. The contents of the next byte will be displayed, and you should replace these by typing 1B and pressing Return. Replace the contents of the next byte by 0A and press Return.

You have now made all the changes needed, and when asked for the location to be changed type 0 to leave the patching program. These alterations will be stored permanently in your working copy of WordStar, and each time you type ^PE, you will reverse line feed on a Diablo printer. Before patching your copy of WordStar, be sure to make a backup — just in case.

WordStar 3.3 has a new Install program that is much easier to use. It will certainly permit inexperienced users to modify their copy of WordStar easily, not only for the terminal and printer used, but also the Help level, page width, page length and other WordStar features. It does not show users how to patch individual bytes in the program as did the earlier version. If you type WInstall to run the installation program, you will be shown a menu. Instead of typing one of the letters from the menu, type + to access the patching program. Type 069D, the address of the ^PE command, and replace the contents in the way described for the earlier versions. Type X to leave the modification routine after you have made all the changes.

(continued from previous page)

needed to wind the paper back to the beginning of the two-column text. Though WordStar has no ready-made command to do this, you can patch the program to use the spare command ^PE — see panel.

The obvious way of printing the second column to the right of the first might seem to be to change the left margin of the page. Unfortunately WordStar will not allow you to do this in the middle of a document. Instead you have to insert a page offset command to make the second column print in the right-hand half of the page. WordStar defaults to a page offset of eight characters, so that printing normally starts eight characters in from the left-hand edge of the paper. To print two 31-character columns, with three spaces between the columns you have to reset the page offset for the second column with a .PO 42 command. Finally, move the cursor to the beginning of the first line after the page break and insert a page offset command to make printing resume in the normal position; this will normally require a .PO 8.

For multi-page articles you should repeat the procedure from step 3. However, it is probably quicker, easier and more reliable to create a file — called Newcol, for example — containing the 55 ^PE commands to wind the paper back and a .PO 42 command. You then only need to move the cursor to the place where you want to start a new column, and insert the contents of this file by typing

^KR NEWCOL

By default, WordStar numbers pages at the bottom under column 33 of the text. When printing in multiple columns WordStar puts page numbers 33 columns to the right of the current page offset, so it appears on the right-hand side of the page. The value of 33 can be changed with a .PC command, but the page number will always appear under the right-most column and cannot be central. Page numbering can be suppressed with a .OP command at the beginning of the file.

Numbers at top

It is still possible to get WordStar to number pages at the top by using a heading .HE command. If the .HE command includes a # character in a particular column, then the page number will be printed in that column. Books which are printed on one side of the paper only usually number pages at top right. This can be achieved by typing .OP followed by .HE, then 79 spaces and a #. Books that are printed on both sides of the paper put page numbers in the top right on odd-numbered pages, and at the top left on even-numbered pages. This can be achieved by typing .OP, followed by .HE ^P ^K, then 79 spaces and a #.

If your printer cannot wind the paper backwards, you cannot use the method described to print multiple columns. Multiple-column printing can still be obtained provided that you are using WordStar 3.0 or later. The procedure is as follows:

1. Type ^K^N to put WordStar into Column mode.
2. Perform the first two steps as before.
3. Move the cursor to the beginning of the line where you wish to break the text into two columns, and type ^K^B to mark the start of a block.
4. Move the cursor to the last line of the two-column section. Move the cursor to the right-hand edge of the column of text and type ^K^K to mark the end of a block. The entire column of text should become highlighted — or enclosed within the appropriate block markers if your WordStar does not use highlighting.
5. Move the cursor back to the first line of the first column of text, and move it right to the position where the second column of text should start. Type ^K^V and WordStar will move the second column so that it is on the right of the first column.
6. Repeat steps 3 to 5 for each page of text.

Until you become familiar with block moves in column mode it is easy to make mistakes, so copy the file before attempting this for the first time.

Double Height

THIS routine by J Humphreys of Swindon displays double-height characters in any mode other than mode 7.

Osword calls use a block of memory to read in values or output results. Basic uses the integers X% and Y% for addressing this block of memory when calling Osword. A% is also used and can have a value ranging from 0 to 13 that determines the nature of the call.

The integers held in A%, X% and Y% are passed to the accumulator, X register and Y register of the 6502 cpu respectively. The Osword routine resides at address &FFF1 in memory.

With A set to 10 the Osword routine reads eight bytes from the BBC's ROM to find the relevant dot patterns for the required ASCII characters. Osword puts these eight bytes into the block of memory pointed to by X and Y. To print the double character, two new characters are generated using VDU23 commands. Printing them one on top of the other produces double-height writing.

The routine can easily be incorporated into your own programs. To call the procedure, type:

PROCdouble(<string>,<X tab>,
<Y tab>,<col>)

For example

PROCdouble("Hello",2,4,3)

```
  10  REM **********************
  20  REM ***                  ***
  30  REM *** Double height ***
  40  REM *** Characters in ***
  50  REM ***   any  Mode   ***
  60  REM ***                  ***
  70  REM *** For Practical ***
  80  REM ***   Computing   ***
  90  REM ***                  ***
 100  REM ***  30/7/84  By  ***
 110  REM ***  J.Humphreys  ***
 120  REM ***                  ***
 130  REM **********************
 140  MODE 2:REM Also try MODE's 0,
1,2,3,4,5 & 6
 150  VDU 23;8202;0;0;0;0;
 160  CLS
 170  PROCdouble("** Practical **",
3,5,2)
 180  VDU5
 190  GCOL0,6
 200  MOVE400,700
 210  PRINT"Computing"
 220  GCOL0,3
 230  MOVE392,692
 240  PRINT"Computing"
 250  VDU 4
 260  COLOUR 1
 270  PRINTTAB(4,14);"Demonstrating
"
 280  PROCdouble("Double Height",4,
16,4)
 290  COLOUR 5:PRINTTAB(4,20);"By"
 300  FOR Z%=0 TO 6
 310  PROCdouble("J.Humphreys",6,20
,Z%)
 320  NEXT
 330  GOTO 300
 340  DEF PROCdouble(A$,b%,c%,col%)
 350  A%=&A:X%=&72:Y%=0:b=&72
 360  FOR d%=1TO LEN(A$)
 370  B$=MID$(A$,d%,1)
 380  ?b=ASC(B$):CALL &FFF1
 390  VDU23,224,b?1,b?1,b?2,b?2,b?3
,b?3,b?4,b?4
 400  VDU23,225,b?5,b?5,b?6,b?6,b?7
,b?7,b?8,b?8
 410  COLOUR col%
 420  PRINTTAB(b%-1+d%,c%);CHR$224;
TAB(b%-1+d%,c%+1);CHR$225
 430  NEXT
 440  ENDPROC
>
```

Editor

Philip Harriss of Feltham, Middlesex has submitted a character editor program that allows the user to define up to 32 characters in the range 224 to 255. The main options are:

1 — Erase character
2 — Edit character
3 — Load a character
4 — View all definable characters
5 — Summarise defining mode commands
6 — Exit program

Entering option 2 will present you with the character requested. You can move the cursor around the grid using either the cursor keys or the Z, X, : and / keys. When you are over a square that you want to alter, press the space bar to invert the current colour.

While editing the character, another set of commands is available. Most of them have some direct effect on the character.

Delete — deletes the line on which the cursor is positioned.

Flip — rotates the character through 180 degrees.

Inverse — invert the characters colours so that black becomes white and vice versa.

Line — fills in the correct boxes when you type in a value for the line that the cursor is on; it is used primarily for generating a known character.

Some less visually effective commands are:

Printout — sends to the printer a block print of any character which includes values of each line and any comments.

Save — saves any of the characters to tape; characters are saved in a special format, so if wanted must be loaded by the program.

Pressing Escape at any time will return you to the main options menu. Any special printer codes will need to be included in line 990. The actual program takes just over 4K of memory and uses modes 2 and 6.

Editor.

```
  10  *TAPE
  20  ON ERROR GOTO 1030
  30  DIM A%(8),B%(8),C%(8,8),D%(8
)
  40  MODE 6:*FX4,1
  50  PRINT'''"Character Editor"'"
      By P.Harriss."
  60  PRINT'"Do you wish to"'"1.Cr
eate a character"'"2.Edit a charact
er"'"3.Load a character"'"4.View ch
aracters"'"5.View instructions"'"6.
Leave this program"'''"Press option
 to continue (1 to 6)"
  70  A=GET:IF A>54 OR A<49 THEN 4
0
  80  IF A=52 THEN PROCSET:PROCKEY
:GOTO 40
  90  PRINTTAB(0,A-43);:PROCSPACE(
STR$(A-48))
 100  IF A=53 THEN VDU 19,0,7,0,0,
0:VDU 19,1,0,0,0,0:PROCINSTR:GOTO 4
0
 110  IF A=54 THEN 1010 ELSE PRINT
:IF A<>51 INPUTTAB(0,15) "Character
 Number..."A%(0) ELSE 690
 120  IF A%(0)>255 OR A%(0)<224 PR
INT"Range is 224 to 255";TAB(0,15)S
PC(40):GOTO110
 130  MODE 5
 140  GCOL 0,2:MOVE 50,998:DRAW 59
0,998:DRAW 590,730:DRAW 50,730:DRAW
 50,998
 150  IF A=49 VDU 23,A%(0),0,0,0,0
,0,0,0,0 ELSE PROCSHAPE(A%(0)):PROC
DISPLAY
 160  VDU 23;8202;0;0;0:X=1:Y=1:F%
=1:V=128
 170  PRINT'TAB(0,15);"(D)elete"'"(
E)nd"'"(F)lip"'"(I)nvert"'"(L)ine"'
"(P)rintout"'"(R)estart"'"(S)ave"'"
(V)iew";TAB(12,1);"CHR$ ";A%(0)
 180  COLOUR 133:PRINT TAB(0,12);"
Options VDU23 VALUES":COLOUR 132
 190  PRINTTAB(15,3);CHR$A%(0):PRI
NTTAB(X,Y);:IF C%(X,Y) THEN PROCSPA
CE("+") ELSE PRINT"+"
 200  *FX15,0
 210  A$=GET$:PRINTTAB(X,Y);:IF C%
(X,Y) THEN PROCSPACE(" ") ELSE PRIN
T" "
 220  REM KEYBOARD RESPONSES
 230  IF (A$="X" OR A$=CHR$137) AN
D X<8 X=X+1:V=V/2
 240  IF (A$="Z" OR A$=CHR$136) AN
D X>1 X=X-1:V=V*2
 250  IF (A$=":" OR A$=CHR$139) AN
D Y>1 Y=Y-1:F%=F%-1
 260  IF (A$="/" OR A$=CHR$138) AN
D Y<8 Y=Y+1:F%=F%+1
 270  IF A$="R" RUN
```

```
  280  IF A$="P" THEN MODE 6:PROCPR
INTER:GOTO 130
  290  IF (A$=" " OR A$=CHR$135) TH
EN 340
  300  IF A$="I" THEN 390 ELSE IF A
$="D" THEN 450 ELSE IF A$="S" THEN
610 ELSE IF A$="E" THEN 1010 ELSE I
F A$="F" PROCFLIP:GOTO 360
  310  IF A$="L" PROCLINE:GOTO 360
  320  IF A$="V" MODE 6:PROCSET:PRO
CKEY:GOTO 130
  330  GOTO 190
  340  IF C%(X,Y) THEN 380
  350  C%(X,Y)=1:A%(F%)=A%(F%)+V:PR
INT TAB(X,Y);:PROCSPACE(" ")
  360  VDU 23:FOR I=0 TO 8:VDU A%(I
):NEXT
  370  FOR I=1 TO 8:PRINT TAB(14,I+
12);A%(I);"  ":NEXT:GOTO 190
  380  C%(X,Y)=0:A%(F%)=A%(F%)-V:PR
INT TAB(X,Y);" ":GOTO 360
  390  FOR I=1 TO 8:A%(I)=255-A%(I)
:NEXT
  400  FOR G=1 TO 8:FOR I=1 TO 8:IF
 C%(G,I) C%(G,I)=0 ELSE C%(G,I)=1
  410  NEXT:NEXT
  420  FOR I=1 TO 8:FOR G=1 TO 8
  430  PRINTTAB(I,G);:IF C%(I,G) PR
OCSPACE(" ") ELSE PRINT" "
  440  NEXT:NEXT:GOTO 360
  450  A%(F%)=0:FOR I=1 TO 8:C%(I,F
%)=0:NEXT:PROCDISPLAY:GOTO 360
  460  REM FIND VALUES OF CHARACTER
  470  DEF PROCSHAPE(C%)
  480  ?&600=C%:A%=10:Y%=&06:X%=&00
:A%=USR(&FFF1)
  490  FOR A%=1 TO 8:D%(A%)=A%?&600
:A%(A%)=D%(A%):NEXT:ENDPROC
  500  DEF PROCDISPLAY
  510  FOR I=1 TO 8:B=A%(I):O=128:F
OR G=1 TO 8
  520  IF B-O<0 PRINT TAB(G,I);" "
ELSE B=B-O:PRINT TAB(G,I);:PROCSPAC
E(" "):C%(G,I)=1
  530  O=O/2
  540  NEXT:NEXT:ENDPROC
  550  DEF PROCFLIP
  560  FOR I=1 TO 8:B%(I)=A%(I):NEX
T
  570  FOR I=8 TO 1 STEP -1:A%(9-I)
=B%(I):NEXT
  580  FOR I=1 TO 8:FOR G=1 TO 8:C%
(G,I)=0:NEXT:NEXT
  590  PROCDISPLAY:ENDPROC
  600  REM SAVING CHARACTER
  610  MODE 6:VDU 19,0,1;0;0;0:PROC
SET
  620  PRINT:INPUT "Character to sa
ve..."A
  630  IF A>255 OR A<224 PRINT"Rang
e is 224 to 255":GOTO610
  640  PRINT"Insert data cassette"
  650  F1=OPENOUT("CHAR"):PRINT#F1,
A:CLOSE #F1:VDU 19,0,5;0;0;0
  660  PROCSHAPE(A):F1=OPENOUT("SET
"):FOR I=1 TO 8:PRINT#F1,A%(I):NEXT
  670  CLOSE #F1:GOTO 130
  680  REM LOADING CHARACTER
  690  CLS:VDU 19,0,4;0;0;0:PROCSET
:PRINT"Insert data cassette":PROCKE
Y
  700  F1=OPENIN("CHAR")
  710  REPEAT:INPUT #F1,A%(0):UNTIL
 EOF#(F1)
  720  PRINT "Character ";A%(0)
  730  CLOSE #F1
  740  INPUT "Character Number..."A
%(0)
  750  IF A%(0)>255 OR A%(0)<224 PR
INT"Range is 224 to 255":GOTO740
  760  PRINT"Loading Character ";A%
(0)
  770  VDU 23,A%(0)
  780  F1=OPENIN("SET")
  790  REPEAT:INPUT #F1,I:VDU I:UNT
IL EOF#(F1)
  800  CLOSE #F1
  810  PRINTCHR$11;"Load another ch
aracter ?";:A$=GET$:IF A$="Y" THEN
690 ELSE PROCSHAPE(A%(0)):GOTO 130
  820  DEF PROCLINE
  830  INPUTTAB(0,25);"Value of Lin
e ",A%(F%)
  840  IF A%(F%)>255 OR A%(F%)<0 OR
 INT(A%(F%))<>A%(F%) PRINTTAB(0,25)
;SPC(40):GOTO830
  850  FOR I=1 TO 8:C%(I,F%)=0:NEXT
:PROCDISPLAY:PRINT TAB(0,25);SPC(40
):ENDPROC
  860  PROCDISPLAY:PRINT TAB(0,23);
TAB(20):ENDPROC
  870  DEF PROCSET
  880  PRINT "                CHARACT
ER SET":PRINT:FOR I=224 TO 255:PRIN
T"      CHR$";I;" ";CHR$I;"   ";
  890  IF I/2<>INT(I/2) PRINT
  900  NEXT:PRINT:ENDPROC
  910  DEF PROCKEY:PRINT"Press any
key to continue":A=GET:ENDPROC
  920  DEF PROCSPACE(A$):COLOUR 0:C
OLOUR 131:PRINTA$:COLOUR 3:COLOUR 1
28:ENDPROC
  930  DEF PROCPRINTER:PROCSET
  940  INPUT '"Print which characte
r..."A:IF A>255 OR A<224 PRINT"Rang
e is 224 to 255":GOTO 940
  950  PRINT"Comment on ";A;"...";:
INPUT ""B$:PROCSHAPE(A):CLS
  960  VDU 2:REM INSERT PRINTER COD
ES HERE
  970  FOR I=1 TO 8:FOR G=1 TO 8
  980  IF C%(G,I) THEN PRINTTAB(G,I
);"*"; ELSE PRINT TAB(G,I);" ";
  990  NEXT:PRINT"    ";A%(I):NEXT:
IF B$<>"" THEN PRINT''B$
 1000  VDU 3:ENDPROC
 1010  *FX4,0
 1020  MODE 7:END
 1030  IF ERR=17 VDU 3:RUN
 1040  IF ERR=26 OR ERR=20 THEN PRI
NTTAB(0,25)SPC(40):GOTO 180
 1050  GOTO 1010
 1060  DEF PROCINSTR:CLS
 1070  PRINT"Character Editor by P.
Harriss"'''    Commands"'
 1080  PRINT"D - Deletes current li
ne"'"E - Exits program"'"F - Flips
 character through 180 degrees"'"I -
 Turns the character into its inver
se"'CHR$11;"L - Allows you to enter
 binary value of"'"      current lin
e"
 1090  PRINT"P - Prints character o
n printer"'"R - Returns you to begi
nning of program"'"S - Allows you t
o save a character to"'"      casset
te"'"V - Prints Character set"'"To
 move cursor up     - :"'"
     down  - /"
 1100  PRINT"                right -
 X"'"                left  - Z"'" C
ursor keys will also move cursor"':
PROCKEY:PRINTCHR$11;"To place or re
move a block use <space>"'"or <copy
>"'':PROCKEY:ENDPROC
>
```

Air Raid

There have been other programs like this one published before, but the compactness of Andrew Graham's code merits a look. His Air Raid game should run on model A or B machines.

The object of the game is to try and bomb as may of the buildings as possible before the plane reaches ground level. Do not be alarmed if some of the buildings defy the laws of gravity: it is only a game, after all.

When the plane has started its forward journey, pressing the space bar sends a bomb on its way to the city. Once you have completely eliminated all the buildings you are given another city to destroy, and so on. If you don't manage to destroy them all you die. Playing at the hardest skill level is no easy task.

Air Raid.

```
  10 REM BOMBER
  20 ON ERROR PROCerr
  30 REPEAT
  40  MODE 7
  50  *FX12,0
  60  *FX15,1
  80  PRINTTAB(12,8);CHR$141;CHR$1
31;"AIR RAID":PRINTTAB(12,9);CHR$14
1;CHR$131;"AIR RAID"
  90 PRINTTAB(12,14);CHR$134;"A=SL
OW";TAB(12,16);CHR$134;"S=FAST";TAB
(12,18);CHR$134;"RETURN=BOMB"

 100 REPEAT
 110 PRINTTAB(12,20);CHR$130;:INPU
T "SKILL LEVEL 1 to 6"S%
 120 UNTIL S%>0 AND S%<7
 130 PROCinit
 140 REPEAT
 150 MODE 2
 160 VDU 23,0,8202;0;0;0;
 170 PROCscreen
 180 V%=-64:X%=0:Y%=991:Z%=FALSE
 190 VDU5
 200 REPEAT
 210 PROCfly
 220 IF FNP(V%,W%)<>0 Z%=TRUE
 230 IF INKEY(-74) AND NOT G% PROC
drop
 240 IF G% PROCbomb
 250 UNTIL Z% OR Y%<64
 260 IF Z% PROCdead
 270  UNTIL MAN%=0
 280  VDU 4:PRINTTAB(0,5);"FINAL S
CORE:";SC%:"ANOTHER GAME Y/N":VDU5

 290 REPEAT G=GET:UNTIL G=78 OR G=
89
 300 IF G=78 PROCend
 310 UNTIL FALSE
 320 DEF PROCfly
 330 X%=X%+C%:IF X%>1216 Y%=Y%-32:
X%=0
 340 PROCplane(X%,Y%)
 350 K%=INKEY(0):IF K%=-1 ENDPROC
 360 IF K%=65 C%=C%-1:IF C%<=10 C%
=10
 370 IF K%=83 C%=C%+1:IF C%>=64 C%
=64
 380 ENDPROC
 390 DEF PROCplane(X%,Y%)
 400 GCOL3,7
 410 MOVE X%,Y%:VDU224
 420 MOVE V%,W%:VDU224
 430 V%=X%:W%=Y%
 440 ENDPROC
 450 DEF PROCdrop
 460 SOUND&11,1,200,60
```

(continued on next page)

(continued from previous page)

```
  470 A%=X%:B%=Y%-64:G%=TRUE
  480 ENDPROC
  490 DEF PROCbomb
  500  GCOL3,6:B%=B%-32:IF FNP(A%,B
%)<>0 SOUND&11,0,0,0:SOUND&10,-15,4
,3:MOVE D%,E%:VDU225:G%=FALSE:PROCh
ole:D%=-64:ENDPROC
  510 IF B%<32 SOUND&11,0,0,0:MOVE
D%,E%:VDU225:G%=FALSE:D%=-64:ENDPRO
C
  520 MOVE A%,B%:VDU225
  530 MOVE D%,E%:VDU225
  540 D%=A%:E%=B%
  550 ENDPROC
  560 DEF PROChole
  570 MOVE A%,B%:VDU9,9,127,127,127
,127,9,9,9,9,10,127,127,127,127
  580 VDU 4:SC%=SC%+20:PRINTTAB(11,
0);SC%:VDU5
  590 ENDPROC
  600 DEF PROCdead
  610 MAN%=MAN%-1:FORN= 1TO 100:VDU
19,0,RND(7);0;:SOUND&11,-15,RND(255
),1:NEXT:VDU19,0,0;0;
  620  ENDPROC
  630 DEF PROCscreen
  635  VDU19,0,4,0,0,0
  640 LOCAL X%,Y%
  650 FORX%=0 TO 18
  660 COLOUR RND(3)
  670 FORY%=31 TO 31-(S%*RND(3)) ST
EP -1
  680 PRINTTAB(X%,Y%);:VDU226;
  690 NEXT,
  700 PRINTTAB(5,0);"SCORE:"
  710 ENDPROC
  720 DEF FNP(X%,Y%)
  730 =POINT(X%+32,Y%)
  740 DEF PROCend
  750 *FX12,0
  760 CLS
  770  END
  780 DEF PROCinit
  790 *FX12,1
  800 *FX11,1
  810 A%=0:B%=0:X%=0:Y%=991
  820 MAN%=3:SC%=0
  830 C%=32:D%=0:E%=0:V%=-64:W%=102
3
  840 Z%=FALSE:G%=FALSE
  850 VDU 23,224,0,128,128,254,255,
126,0,0
  860 VDU 23,225,231,126,60,60,60,6
0,24,24
  870 VDU 23,226,255,169,171,253,17
1,253,171,255
  880 PROCplane(X%,Y%)
  890 ENVELOPE 1,128,-1,0,0,200,0,0
,127,0,0,0,126,0
  900 ENDPROC
  910 DEF PROCerr
  920 IF ERR=17 ENDPROC
  930  *FX12,0
  940 REPORT:PRINT"IN LINE "ERL
  950  VDU22,7
  960 END
>
```

Keytrap

This utility by Des Fisher of Harlow, Essex will selectively delete user key definitions until enough room is created for a new definition. It could be used when it is more important that a Bad Key error and resultant crash do not occur than that some key definitions are lost. One such program might be a disc !Boot file that sets up progamming aids in the user keys.

The user key memory is limited, and definitions to do such things as string search, Rem strip or append cannot all be resident at the same time. One way of tackling the problem is to delete all the current definitions with *FX18 before trying to redefine them, but this is not very helpful if you have a large development going on.

Des Fisher's solution is to adopt the simple protocol that List commands go in from right to left: that is, f9 then f8, etc. Programming aids go in from left to right. When Keytrap is used, it progressively deletes keys from left to right, so put the most important key definition in f9.

Most of the listed code provides a demonstration. The heart of the program is at lines 540 to 790. The main program should point errors to this area and set Key% to the key number from which to delete. Line 550 checks that the error is in fact Bad Key. If anything is to be gained by this, Keytrap sends execution back to the line that caused the error for another try.

One limitation of the utility is that it is not possible to return to the error line if it is in a loop, procedure, subroutine or function.

Keytrap.

```
   10 REM KEYTRAP   des fisher  Har
low(0279) 22450
   20
   30  MODE 7
   40  PRINT'"KEYTRAP";TAB(23);"de
s fisher   1983":A=INKEY(50)
   50  PRINT'"This program demonstr
ates a 'key trap'."
   60  PRINT"If when trying to defi
ne a user key in"
   70  PRINT"a prog the keys are al
ready full it"
   80  PRINT"will progressively cle
ar the user keys"
   90  PRINT"from 0 to 9 until ther
e is room.":A=INKEY(800)
  100
  110  PRINT'"First all the user ke
ys are cleared.":A=INKEY(150)
  120  *KEY 0
  130  *KEY 1
  140  *KEY 2
  150  *KEY 3
  160  *KEY 4
  170  *KEY 5
  180  *KEY 6
  190  *KEY 7
  200  *KEY 8
  210  *KEY 9
  220
  230  PRINT'"Now keys f1 to f4 are
 filled with 50"
  240  PRINT"characters each.":A=IN
KEY(150)
  250  *KEY 1"XXXXXXXXX0XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX0"
  260  *KEY 2"XXXXXXXXX0XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX0"
  270  *KEY 3"XXXXXXXXX0XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX0"
  280  *KEY 4"XXXXXXXXX0XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX0"
  290
  300  PRINT'"Now ERROR is turned o
n so when error"
  310  PRINT"251, Bad key, occurs t
he program goes"
  320  PRINT"to the key trap.":A=IN
KEY(200)
  330  ON ERROR GOTO 550
  340  key%=0
  350
  360  PRINT'"Now key f5 is defined
 with a very large"
  370  PRINT"string and the key tra
p goes into"
  380  PRINT"operation.'':A=INKEY(1
50)
  390  *KEY 5"XXXXXXXXX0XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX1XXXXXX
XXX0XXXXXXXXX0XXXXXXXXX0XXXXXXXXX0X
XXXXXXX2XXXXXXXXX0XXXXXXXXX0XXXXXX
XXX0XXXXXXXXX0XXXXXXXXX3XXXXXXXXX0X
XXXXXXX0XXXXXXXXX0XXXXXXXXX0XXXXXX
XXX4XXXXXXXXX0XXXXXXXXX0X"
  400  key%=0
  410
  420  PRINT'"f5 is now defined.":A
=INKEY(80)
  430
  440  PRINT'"A key definition must
 not occur"
  450  PRINT"inside a subroutine, a
 procedure, a"
  460  PRINT"FOR:NEXT loop or a REP
EAT:UNTIL loop.":A=INKEY(700)
  470
  480  PRINT'"Finally the prog trie
s to define f9"
  490  PRINT"more than 250 characte
rs.":A=INKEY(90)
  500  X$="RRRRRRRRR1RRRRRRRRR2RRRR
RRRRR3RRRRRRRRR3RRRRRRRRR3RRRRRRRRR
"
  510  *KEY 9 " "+X$+X$+X$+X$+X$+X$
  520  END
  530
  540 REM Bad key trap    Bad key E
RR=251
  550  IF ERR<>251 THEN PRINT'"Line
 ";ERL;:REPORT:STOP
  560  key%=key%+1
  570  IF key%>10 THEN PRINT'"Just
not enough key room at line ";ERL:S
TOP
  580  PRINT"User key f";key%-1;" c
leared"
  590  ON key% GOTO 600,620,640,660
,680,700,720,740,760,780
  600   *KEY 0
  610   GOTO 790
  620   *KEY 1
  630   GOTO 790
  640   *KEY 2
  650   GOTO 790
  660   *KEY 3
  670   GOTO 790
  680   *KEY 4
  690   GOTO 790
  700   *KEY 5
  710   GOTO 790
  720   *KEY 6
  730   GOTO 790
  740   *KEY 7
  750   GOTO 790
  760   *KEY 8
  770   GOTO 790
  780   *KEY 9
  790  GOTO ERL
>
```

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SALES LEDGER	Padmede	●		●	●
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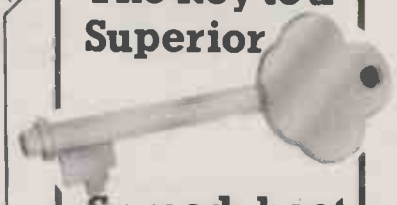

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Screen windows

THE COMMODORE 8000 series has a useful screen-window facility which allows a section of the screen to be scrolled independently. The facility does not exist on 4000 series Pets, but L V Turner from Colchester has written a utility to provide a form of screen windowing.

Lines 2000 to 3220 load the machine-code routines into the cassette buffer. They are accessed by Sys 634 to scroll down, and Sys 692 to scroll up.

The position of the window is specified by

Poke 84, top line (0 to 24)
Poke 85, left column (0 to 39)
Poke 86, number of lines (1 to 25)
Poke 87, number of columns (1 to 40)

The demonstration program shows the routines being used with the screen data held in array A$. The U and D keys are used to scroll up and down. Window details are set in line 110, and the routine at 300 prints the data in the window. The Sys in lines 320 and 360 positions the cursor at the position determined by locations 198 and 216.

The machine code and demonstration are written for Basic 4, but can be modified for Basic 2 Pets by changing the underlined values. The Sys should be 57949, and the values in line 3130 are 93,226.

Machine-code loader.

```
10 REM ********************************
11 REM *                              *
12 REM *   SCROLL WINDOW UP OR DOWN   *
13 REM *                              *
14 REM ********************************
15 :
2000 S=634
2010 FORI=S TO S+182
2020 READ A
2030 POKE I,A:C=C+A
2040 NEXT
2050 READ A
2060 IFA<>C THEN PRINT"CHECKSUM ERROR"
2070 :
3000 DATA 32,5,3,24,165,84,101,86,170
3010 DATA 202,202,240,6,32,237,2,202
3020 DATA 208,250,32,14,3,198,87,32
3030 DATA 23,3,160,0,177,88,160,40.
3040 DATA 145,88,32,249,2,202,208,242,32
3050 DATA 38,3,16,234,165,84,133,216,165
3060 DATA 85,133,198,32,127,224,96,32
3070 DATA 5,3,166,84,240,6,32,237,2,202
3080 DATA 208,250,32,14,3,198,87,32
3090 DATA 23,3,160,40,177,88,160,0,145
3100 DATA 88,32,237,2,202,208,242,32
3110 DATA 38,3,16,234,24,165,84,101,86
3120 DATA 133,216,198,216,165,85,133
3130 DATA 198,32,127,224,96,24,165,88
3140 DATA 105,40,133,88,144,2,230,89,96
3150 DATA 56,165,88,233,40,133,88,176
3160 DATA 2,198,89,96,169,128,133,89
3170 DATA 165,85,133,88,96,165,88
3180 DATA 133,31,165,89,133,32,96,24,165
3190 DATA 88,101,87,133,88,144,2,230,89
3200 DATA 166,86,202,96,165,31,133,88
3210 DATA 165,32,133,89,198,87,96
3220 DATA 20167
```

Demonstration program.

```
10 REM ************************
20 REM *                      *
30 REM *   SCROLLING WINDOWS  *
40 REM *                      *
50 REM *    (C) L.V.TURNER    *
60 REM *                      *
70 REM ************************
80 :
90 PRINTCHR$(147)
95 :
100 REM ***** DEFINE WINDOW *****
105 :
110 TL=4:LH=10:NL=8:NC=20
120 :
130 :
200 REM ***** SETUP ARRAY *******
205 :
210 DIM A$(26)
220 FORA=1TO26
230 FORB=1TONC
240 B$=CHR$(64+A)
250 A$(A)=A$(A)+B$
260 NEXTB,A
270 :
280 :
300 REM **** SETUP WINDOW *******
305 :
310 FORM=0TONL
320 POKE198,LH:POKE216,TL+M:SYS57471
330 PRINTCHR$(145)A$(M)
340 NEXT
350 T=1:B=NL
360 POKE198,0:POKE216,23:SYS57471
370 PRINT"PRESS 'U','D' OR 'X'"
380 :
390 :
400 REM **** DETECT KEYS ********
405 :
410 GETD$:IFD$=""THEN410
420 IFD$="D"ANDT>1THENGOSUB500
430 IFD$="U"ANDB<26THENGOSUB600
440 IFD$="X"THENPRINTCHR$(147):END
450 GOTO410
460 :
470 :
500 REM ******** SCROLL DOWN *****
505 :
510 T=T-1
520 POKE84,TL:POKE85,LH
530 POKE86,NL:POKE87,NC
540 SYS634:PRINTA$(T)
550 B=B-1
560 RETURN
570 :
580 :
600 REM ******SCROLL UP **********
605 :
610 B=B+1
620 POKE84,TL:POKE85,LH
630 POKE86,NL:POKE87,NC
640 SYS692:PRINTA$(B)
650 T=T+1
660 RETURN
```

Data maker.

```
63961 MODEL=**
63963 X=40:IF MO=20 THEN C=3:N=0:B=527
      :Y=122:GOTO 63966
63964 IF MO=64 THEN C=19:N=198:B=631
      :Y=43:GOTO 63966
63965 C=16+2*(MO=30):N=158:B=623
      :X=X-40*(MO=80):Y=40
63966 POKE 900,N:POKE 901,B-500
      :POKE 902,X:POKE 903,Y
63967 PRINT"[CLEAR]***~[RVS]
      DATAMAKER~V2.0[RVOFF]~***[DOWN]"
      :POKE C,1
63968 INPUT"START~ADDRESS:~~~$";A$
      :PRINT:GOSUB 63973:S=A
63969 INPUT"END~ADDRESS:~~~~~$";A$
      :PRINT:GOSUB 63973:E=A
63970 INPUT"1ST~LINE~#:~~~~~~";L:PRINT
      :IF L<0 OR L>63959 OR L>INT(L)
      THEN RUN
63971 INPUT"STEP:~~~~~~~~~~~~";T:PRINT
      :IF T<1 OR T>63960 OR T>INT(T)
      THEN RUN
63972 POKE C,0:PRINT LEFT$("[DOWN5]",
      5+2*(X=80)):GOTO 63978
63973 A$=RIGHT$("0000"+A$,4):A=0
63974 FOR I=1 TO 4:C$=MID$(A$,I,1):D=0
63975 IF C$>="A"AND C$<="F"THEN D=ASC
      (C$)-55
63976 IF C$>="0"AND C$<="9"THEN D=ASC
      (C$)-48
63977 A=A*16+D:NEXT I:RETURN
63978 L$=STR$(L)+"~FORII="+MID$(STR$(
      S),2)+"TO"+MID$(STR$(E),2)
63979 L$=L$+":READJJ:POKEII,JJ
      :NEXTII~":GOTO 63984
63980 L$=STR$(L)+"~DATA~"
63981 IF L>63960 THEN PRINT"[DOWN]
      >>>~LINE~NUMBER~OUT~OF~RANGE"
      :END
63982 D$=MID$(STR$(PEEK(S)),2)
      :IF D$="0"THEN D$=""
63983 L$=L$+D$+",":S=S+1
      :IF LEN(L$)<76 AND S<=E THEN 6
      3982
63984 L$=LEFT$(L$,LEN(L$)-1):L=L+T
      :H=0+8*PEEK(902)
63985 FOR I=H TO H+159:POKE I,32:NEXT
      :PRINT LEFT$("[UP4]",
      4+2*(PEEK(902)=80))L$
63986 PRINT"S="S":E="E":L="L":T="T;
      :IF PEEK(902)=40 THEN PRINT TAB
      (39)
63987 PRINT LEFT$(":GOTO63990[UP6]",
      16+2*(PEEK(902)=80))
63988 H=PEEK(900):IF H=0 THEN H=525
63989 POKE H,2:POKE PEEK(901)+500,13
      :POKE PEEK(901)+501,13:END
63990 Q=32768+31744*(PEEK(903)=43)
      :IF S<=E THEN 63980
63991 H=0+7*PEEK(902):FOR I=H TO H +
      PEEK(902)+159:POKE I,32:NEXT I
63992 PRINT LEFT$("[UP7]",
      7+2*(PEEK(902)=80))
63993 A=PEEK(PEEK(903))+256*PEEK(PEEK
      (903)+1)
63994 B=PEEK(A)+256*PEEK(A+1)
      :IF PEEK(A+2)+256*PEEK(A+3)<639
      61 THEN A=B:GOTO 63994
63995 POKE A,0:POKE A+1,0
      :H=INT((A+2)/256):L=A+2-256*H
63996 POKE 904,H:POKE PEEK(903)+2,L
      :POKE PEEK(903)+3,PEEK(904):CLR
      :END
```

Data maker

It is often useful to be able to generate Data statements from areas of memory. Most often it is machine code that is being saved, but it could also be sprite or graphics data.

Thomas Gutekunst has written a universal data-maker program which will run on a 2001, 3032, 4032 or 8032 Pet, and the Commodore 64. Set the asterisks in line 63961 to 20, 30, 40, 80 or 64, according to the machine being used.

The program will ask for the start and end addresses of memory to be turned into Data statements. These values should be in hex. It will prompt for the starting line number and line increment, and then procede to generate a For-Next loop to Poke the values and the necessary Data statements.

When complete, the program will erase itself. If you do not want this omit lines 63993 onwards. Cursor controls are shown in square brackets and the appropriate cursor key should be used, not the literal characters.

Pet leader

In September Open File I gave a listing to allow Commodore 64 programs to be loaded into the Pet. Here is a quick and dirty solution to the same problem.

Before loading the 64 program, enter a dummy line

0 REM

and then load the 64 program. Now type

POKE 1025,1: POKE 1026,8

The 64 program can be listed but it still has the dummy line on the front, which should be removed.

Character generator.

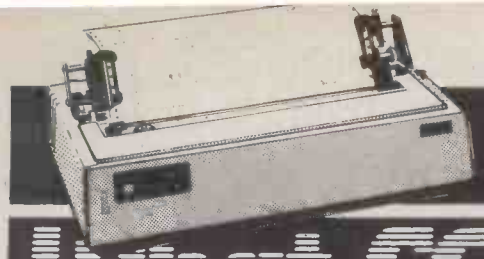
```
100 DATA 169,  0,133,251,169, 48,133,252
110 DATA 169,  0,133,253,169,208,133,254
120 DATA 162,  0,160,  0,177,253,145,251
130 DATA 200,208,249,230,252,230,254,232
140 DATA 224, 16,208,240, 96
150 POKE 52,48: POKE 56,48: CLR
160 POKE 56334,PEEK(56334) AND 254
170 POKE 1,PEEK(1) AND 251

180 FOR A = 0 TO 36
190 READ B: POKE 49152+A,B
200 NEXT

210 SYS49152

220 POKE 1,PEEK(1) OR 4
230 POKE 56334,PEEK(56334) OR 1
240 POKE 53272,(PEEK(53272) AND 240) OR 12

300 SC=47
310 FOR A = 0 TO 7
320 READ B: POKE 12288 + SC*8 + A,B
330 NEXT
340 DATA 0,16,0,124,0,16,0,0
```

Character generator

The character generator in the Commodore 64 is easily moved into RAM, where it can be modified to produce user-defined characters. In Basic this takes a long time, so Chris Landscheit has written some machine code to speed things up a bit.

Lines 100 to 130 hold the machine code as Data statements. Line 150 protects the character generator area from being overwritten by Basic; the Clr resets all Basic variables so the whole routine should be called at the very start of a program. Line 160 turns off the keyboard for safety and line 170 switches in the character generator. Lines 180 to 210 set up the machine code and then execute it. Lines 220 to 240 restore normal operation of the 64 except with the RAM character genertor selected. As an example, lines 300 to 340 change the / division sign to a conventional sign.

The routine transfers the character generator to $3000 (12288), but this could be modified by changing the 48 in line 100 and the Poke in line 240. The routine itself is at $C000 (49152) but could be moved if required.



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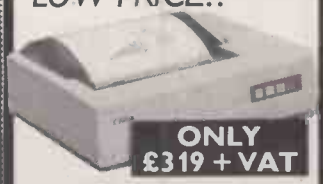

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● Circle No. 174

Space Storm

SPACE STORM is a game of dexterity and skill in Applesoft Basic by N J Patel. The instructions are included in the program but I will give them again:

W — sends the ship up
Z — sends the ship down
P — pauses the game to allow decisions to be made while flying.

The buildings go by underneath as you fly your ship above them, missing the oncoming asteroids. Pressing any one of the directions will continue your ship in that direction until a new command is given.

A machine-code routine which scrolls the entire screen is Poked into memory at the beginning of the program. It can be used in any program but will not scroll high-resolution graphics.

To save the scroll routine as a binary file, type the program in and save it. Stop the program with Ctrl-Reset and enter the monitor with Call −15. Type

BSAVEname,A$9000,L$A1

To call the routine type Call 36864.

```
5  REM   *** DONOT REMOVE 'REM'
     STATEMENTS FROM LINE 90
     ONWARDS
10  REM  *** SPACE STORM
20  REM  *** COMP. : APPLE II & I
     IE
30  REM  *** LANG. : APPLESOFT
40  REM  *** BY : NILESH PATEL (C
    )
50  REM  *** DATE : 27/07/84
60  REM  *** CONTROLS : W=UP
70  REM  ***             Z=DOWN
80  REM  ***             P=PAUSE
90  POKE  - 16368,0
100  POKE 36864,72: POKE 36865,13
     8: POKE 36866,72: POKE 36867
     ,162: POKE 36868,0: POKE 368
     69,189: POKE 36870,1: POKE 3
     6871,4: POKE 36872,157:
110  POKE 36873,0: POKE 36874,4: POKE
     36875,189: POKE 36876,129: POKE
     36877,4: POKE 36878,157: POKE
     36879,128: POKE 36880,4: POKE
     36881,189:
120  POKE 36882,1: POKE 36883,5: POKE
     36884,157: POKE 36885,0: POKE
     36886,5: POKE 36887,189: POKE
     36888,129: POKE 36889,5: POKE
     36890,157:
130  POKE 36891,128: POKE 36892,5
     : POKE 36893,189: POKE 36894
     ,1: POKE 36895,6: POKE 36896
     ,157: POKE 36897,0: POKE 368
     98,6: POKE 36899,189:
140  POKE 36900,129: POKE 36901,6
     : POKE 36902,157: POKE 36903
     ,128: POKE 36904,6: POKE 369
     05,189: POKE 36906,1: POKE 3
     6907,7: POKE 36908,157:
150  POKE 36909,0: POKE 36910,7: POKE
     36911,189: POKE 36912,129: POKE
     36913,7: POKE 36914,157: POKE
     36915,128: POKE 36916,7: POKE
     36917,189:
160  POKE 36918,41: POKE 36919,4:
      POKE 36920,157: POKE 36921,
     40: POKE 36922,4: POKE 36923
     ,189: POKE 36924,169: POKE 3
     6925,4: POKE 36926,157:
170  POKE 36927,168: POKE 36928,4
     : POKE 36929,189: POKE 36930
     ,41: POKE 36931,5: POKE 3693
     2,157: POKE 36933,40: POKE 3
     6934,5: POKE 36935,189:
180  POKE 36936,169: POKE 36937,5
     : POKE 36938,157: POKE 36939
     ,168: POKE 36940,5: POKE 369
     41,189: POKE 36942,41: POKE
     36943,6: POKE 36944,157:
190  POKE 36945,40: POKE 36946,6:
      POKE 36947,189: POKE 36948,
     169: POKE 36949,6: POKE 3695
     0,157: POKE 36951,168: POKE
     36952,6: POKE 36953,189:
200  POKE 36954,41: POKE 36955,7:
      POKE 36956,157: POKE 36957,
     40: POKE 36958,7: POKE 36959
     ,189: POKE 36960,169: POKE 3
     6961,7: POKE 36962,157:
210  POKE 36963,168: POKE 36964,7
     : POKE 36965,189: POKE 36966
     ,81: POKE 36967,4: POKE 3696
     8,157: POKE 36969,80: POKE 3
     6970,4: POKE 36971,189:
220  POKE 36972,209: POKE 36973,4
     : POKE 36974,157: POKE 36975
     ,208: POKE 36976,4: POKE 369
     77,189: POKE 36978,81: POKE
     36979,5: POKE 36980,157:
230  POKE 36981,80: POKE 36982,5:
      POKE 36983,189: POKE 36984,
     209: POKE 36985,5: POKE 3698
     6,157: POKE 36987,208: POKE
     36988,5: POKE 36989,189:
240  POKE 36990,81: POKE 36991,6:
      POKE 36992,157: POKE 36993,
     80: POKE 36994,6: POKE 36995
     ,189: POKE 36996,209: POKE 3
     6997,6: POKE 36998,157:
250  POKE 36999,208: POKE 37000,6
     : POKE 37001,189: POKE 37002
     ,81: POKE 37003,7: POKE 3700
     4,157: POKE 37005,80: POKE 3
     7006,7: POKE 37007,189:
260  POKE 37008,209: POKE 37009,7
     : POKE 37010,157: POKE 37011
     ,208: POKE 37012,7: POKE 370
     13,232: POKE 37014,224: POKE
     37015,39: POKE 37016,240:
270  POKE 37017,3: POKE 37018,76:
      POKE 37019,5: POKE 37020,14
     4: POKE 37021,104: POKE 3702
     2,170: POKE 37023,104:
280  POKE 37024,96
290  GOTO 620
300 L = 0
310  HOME : GR : COLOR= 1: FOR I =
     0 TO 39:Y =  INT ( RND (1) *
     25): VLIN Y + 6,39 AT I: NEXT

320  GOSUB 440
330  GOSUB 590
340  GOSUB 540
350  GOSUB 400
360  GOSUB 500
370  GOSUB 820
380  GOSUB 970
390  GOTO 320
400  REM  ** SCROLL
410  CALL 36864
420  COLOR= 0: VLIN 0,39 AT 39: COLOR=
     1:Y =  INT ( RND (1) * 25): VLIN
     Y + 6,39 AT 39
430  RETURN
440  REM   ** PLAYER
450 K =  PEEK (49152)
460  IF K = 213 AND L <  > 0 THEN
     L = L - 1
470  IF K = 216 AND L <  > 38 THEN
     L = L + 1
480  COLOR= 15: HLIN 0,0 AT L
490  RETURN
500  REM  ** HIT
510  IF  SCRN( 1,L) = 1 THEN 620
520  IF  SCRN( 1,L) = 5 THEN 620
530  RETURN
540  REM  ** ASTERIODS
550 YN =  INT ( RND (1) * 3)
560  IF YN = A1 OR YN = A2 OR YN =
     A3 THEN  RETURN
570 Y1 =  INT ( RND (1) * 6): COLOR=
     5: PLOT 39,Y1
580  RETURN
590  REM  ** SCORE
600 SC = SC + 1
610  RETURN
620  REM  ** INSTRUCTIONS
630  TEXT : HOME : INVERSE : HTAB
     13: VTAB 1: PRINT " SPACE ST
     ORM ": NORMAL
635  VTAB 3: HTAB 6: PRINT "W = U
     P  Z = DOWN  P = PAUSE"
640  FLASH
650  VTAB 5: HTAB 13: PRINT "< RE
     D ALERT >": NORMAL
660  VTAB 7: HTAB 2: PRINT "A SPA
     CE ASTERIOD STORM HAS FORCED
      YOUR"
670  VTAB 9: HTAB 2: PRINT "SPACE
      INTERCEPTOR TO FLY CLOSE TO
     THE"
680  VTAB 11: HTAB 2: PRINT "SURF
     ACE OF THE PLANET 'TYBON'."
690  VTAB 13: HTAB 1: PRINT "YOU
     MUST DODGE ASTERIODS THAT CR
     OSS YOUR"
700  VTAB 15: HTAB 1: PRINT "PATH
     .SURVIVING AS LONG AS POSSIB
     LE WILL"
710  VTAB 17: HTAB 1: PRINT "GAIN
      YOU MORE POINTS."
720  IF SC > HS THEN HS = SC
730  HTAB 1: VTAB 20: PRINT "LAST
      SCORE = > ";SC: HTAB 23: VTAB
     20: PRINT "HI-SCORE = > ";HS

740  VTAB 23: HTAB 11: INVERSE : PRINT
     "HIT RETURN TO PLAY": NORMAL
     :K =  PEEK (49152): IF K <  >
     141 THEN 740
750  VTAB 23: HTAB 1: CALL  - 958
     : VTAB 23: HTAB 1: PRINT "EN
     TER DIFFICULTY LEVEL (1-4) >
     ": VTAB 23: HTAB 35: GET LE$
     :LE =  VAL (LE$): IF LE$ = "
     " THEN 750
760  IF LE < 1 OR LE > 4 THEN 750

770  IF LE = 1 THEN A1 = 3:A2 = 2
     :A3 = 1
780  IF LE = 2 THEN A1 = 3:A2 = 2
     :A3 = 4
790  IF LE = 3 THEN A1 = 3:A2 = 4
     :A3 = 4
800  IF LE = 4 THEN A1 = 4:A2 = 4
     :A3 = 4
810 SC = 0: GOTO 300
820  REM  ** CHECK SCORE
830  IF SC > 1000 AND LE = 1 THEN
     LE = 2:A1 = 3:A2 = 2:A3 = 4:
     SC = SC + 1000: GOTO 880
840  IF SC > 4000 AND LE = 2 THEN
     LE = 3:A1 = 3:A2 = 4:A3 = 4:
     SC = SC + 2000: GOTO 880
850  IF SC > 8000 AND LE = 3 THEN
     LE = 4:A1 = 4:A2 = 4:A3 = 4:
     SC = SC + 4000: GOTO 880
860  IF SC > 10000 AND LE = 4 THEN
     LE = 4:A1 = 4:A2 = 4:A3 = 4:
     SC = SC + 6000: GOTO 1000
870  RETURN
880  REM  ** NEXT LEVEL
890  TEXT : HOME : VTAB 12: HTAB
     14: FLASH : PRINT "WELL DONE
      !!": NORMAL
900  VTAB 14: HTAB 4: PRINT "PREP
     ARE FOR MORE DODGING.LEVEL "
     ;LE
910  FOR T = 0 TO 30
920 S1 = 49200:DK =  PEEK (S1) +
      PEEK (S1) +  PEEK (S1) -  PEEK
     (S1) -  PEEK (S1) +  PEEK (S
     1) +  PEEK (S1)
930 DK =  PEEK (S1) +  PEEK (S1) +
      PEEK (S1) -  PEEK (S1) -  PEEK
     (S1) +  PEEK (S1) +  PEEK (S
     1)
940 DK =  PEEK (S1) +  PEEK (S1) +
      PEEK (S1) -  PEEK (S1) -  PEEK
     (S1) +  PEEK (S1) +  PEEK (S
     1)
950  NEXT : SPEED= 255
960  GR : GOTO 300
970  REM  ** SCAN FOR PAUSE
980 Y =  PEEK (49152): IF Y = 208
      THEN  COLOR= 15: HLIN 0,0 AT
     L: GOTO 980
990  RETURN
1000  REM  ** PASSED LEVEL 4
1010  TEXT : HOME : VTAB 12: HTAB
     1: PRINT "WELL DONE YOU HAVE
      PASSED LEVEL 4."
1020  HTAB 1: VTAB 14: PRINT "HIT
      RETURN...": HTAB  POS (0):
      GET A$: IF  ASC (A$) <  > 1
     3 THEN 1020
1030  GOTO 620
```

● Circle No. 171

● Circle No. 170

by Ian Stobie

Wordsquare

IF YOUR FRIENDS are fond of wordsquare puzzles then this program by D Lane and S Crick of Herne Bay, Kent is for you. From words you supply, it devises a wordsquare together with a key.

The size of the square can vary from 10 by 10 to 20 by 20. The list of words can be saved on a disc or a tape and loaded back when required.

```
10 REM Word-Square
20 REM Dave Lane   18/01/84
30 REM Converted for RML by Steve Crick
40 REM
50 CLEAR 2000
60 PUT 21
70 DIM W$(255),W(255),S$(20,20)
80 REM -------------Menu--------------------
90 PUT 31
100 PRINT "Is there a Printer connected (Y/N)"
110 ?:INPUT "Which-";PR$
120 IF PR$="Y" OR PR$="y" THEN LET PR=1:GOTO 150
130 IF PR$="N" OR PR$="n" THEN LET PR=0:GOTO 150
140 GOTO 90
150 PUT 31,22,32+2,32+13:PRINT"WORD-SQUARE"
160 PUT 22,32+3,32+13:PRINT"-----------"
170 PUT 22,32+6,32+5:PRINT"(1) Read words from disk/tape"
180 PUT 22,32+8,32+5:PRINT"(2) Prepare new word list"
190 PUT 22,32+10,32+5:PRINT"(3) Save word list on disk/tape"
200 PUT 22,32+12,32+5:PRINT"(4) Make / display word-square"
210 PUT 22,32+14,32+5:PRINT"(5) Display / edit list"
220 PUT 22,32+16,32+5:PRINT"(6) END PROGRAM"
230 PUT 22,32+20,32+5:INPUT"Option:";O$
240 LET O=VAL(O$):IF (O<1)+(O>6) THEN 90
250 PUT 31
260 ON O GOSUB 310,460,590,700,1360,290
270 GOTO 150
280 REM -------------End---------------------
290 PUT 22,32+23,32:END
300 REM -------------Read data---------------
310 INPUT"File name:";F$
320 IF LOOKUP(F$)=0 THEN 310:REM Use only with disk system
330 FOR I=1 TO 255
340 LET W$(I)="":LET W(I)=0
350 NEXT I
360 OPEN £10,F$
370 INPUT £10,N
380 FOR I=1 TO N
390 INPUT £10,W$(I)
400 PRINT TAB(12);I,W$(I)
410 NEXT I
420 CLOSE £10
430 PRINT
440 GOSUB 1520:RETURN
450 REM ------------New list----------------
460 FOR I=1 TO 255
470 LET W$(I)="":LET W(I)=0
480 NEXT I
490 LET N=1
500 PRINT"Enter words:"
510 PRINT"(* to stop)"
520 PRINT"(? to edit)"
530 PRINT TAB(8);N;:INPUT";W$(N)
540 IF W$(N)="*" THEN LET W$(N)="":LET N=N-1:RETURN
550 IF W$(N)="?" THEN INPUT"Number:";E:INPUT"Should be? ";
    W$(E) :N=N-1
560 LET   N+1
570 GOTO  530
580 REM  -----------Save data----------------
590 INP  "File name:";F$
600 CREATE £10,F$
610 PRINT
620 PRINT £10,N
630 FOR I=1 TO N
640 PRINT £10,W$(I):PRINT TAB(12);W$(I)
650 NEXT I
660 CLOSE £10
670 PRINT
680 GOSUB 1520:RETURN
690 REM ------------Make square-------------
700 INPUT"Size of square (10-20) :";S$
710 LET S=VAL(S$):IF S<10 OR S>20 THEN PRINT"Try again!":

720 FOR I=1 TO S
730 FOR J=1 TO S
740 LET S$(I,J)=".":REM a full-stop
750 NEXT J,I
760 PUT 31
770 FOR I=1 TO N
780 LET L=LEN(W$(I))
790 IF L>S THEN LET T=S*S/2:GOTO 1000
800 LET T=0
810 PUT 22,32+8,32+22:PRINT SPC(17);
820 PUT 22,32+8,32+22:PRINT W$(I);
830 PUT 22,32+10,32+22:PRINT"Attempt:";:PUT 22,32+10,32+30:
     PRINT SPC(5);
840 PUT 22,32+10,32+30:PRINT T+1;
850 LET RD=INT(RND(1)*4)
860 IF RD=0 THEN LET SX=INT(RND(1)*(S+1-L))+1:LET SY=INT(RND(1)*S+1)
870 IF RD=2 THEN LET SY=INT(RND(1)*(S+1-L))+1:LET SX=INT(RND(1)*S+1)
880 IF RD=1 THEN LET SX=INT(RND(1)*(S-L)+L):LET SY=INT(RND(1)*S+1)
890 IF RD=3 THEN LET SY=INT(RND(1)*(S-L)+L):LET SX=INT(RND(1)*S+1)
900 LET TX=SX:LET TY=SY
910 LET F=0
920 FOR J=1 TO L
930 IF S$(TX,TY)<>"." THEN LET F=1:LET T=T+1:LET J=L:GOTO 980
940 IF RD=0 THEN LET TX=TX+1
950 IF RD=2 THEN LET TY=TY+1
960 IF RD=1 THEN LET TX=TX-1
970 IF RD=3 THEN LET TY=TY-1
980 NEXT J
990 IF F=1 AND T<S*S/2 THEN 830
1000 IF T=S*S/2 THEN PUT 22,32+5,32+22:PRINT"Can't fit ";:
     PUT 22,32+6,32+22:PRINT SPC(17);:W(I)=1
1010 IF T=S*S/2 THEN PUT 22,32+6,32+22:PRINT W$(I);:GOTO 1130
1020 FOR J=1 TO L
1030 LET S$(SX,SY)=MID$(W$(I),J,1)
1040 IF RD=0 THEN LET SX=SX+1
1050 IF RD=2 THEN LET SY=SY+1
1060 IF RD=1 THEN LET SX=SX-1
1070 IF RD=3 THEN LET SY=SY-1
1080 NEXT J
1090 FOR P=1 TO S
1100 FOR Q=1 TO S
1110 PUT 22,32+Q,32+P:PRINT S$(P,Q);
1120 NEXT Q,P
1130 NEXT I
1140 GOSUB 1520
1150 GOSUB 1560
1160 IF PR=1 THEN FOR I=1 TO S:LPRINT:NEXT I
1170 PUT 31
1180 FOR I=1 TO S
1190 FOR J=1 TO S
1200 PUT 22,32+J,32+I
1210 IF S$(I,J)="." THEN LET S$(I,J)=CHR$(INT(RND(1)*26+65))
1220 PRINT S$(I,J);
1230 NEXT J,I
1240 GOSUB 1520
1250 GOSUB 1560
1260 IF PR=0 THEN RETURN
1265 IF O$="N" OR O$="n" THEN RETURN
1270 LPRINT
1280 FOR I=1 TO N STEP 3
1290 IF W(I)=0 THEN LPRINT W$(I);" ";
1300 IF W(I+1)=0 THEN LPRINT W$(I+1);" ";
1310 IF W(I+2)=0 THEN LPRINT W$(I+2)
1320 NEXT I
1330 LPRINT
1340 RETURN
1350 REM ------------editor--------------------
1360 LET D=20
1370 FOR I=D-19 TO D
1380 PRINT TAB(12);I;":";W$(I)
1390 NEXT I
1400 PRINT
1410 INPUT"Number to edit (or * to skip) :";E$:IF E$="*" THEN 1490
1420 LET E=VAL(E$)
1430 IF E<D-19 OR E>D THEN 1370
1440 IF W$(E)="" THEN LET N=N+1:LET E=N
1450 PRINT E;":";W$(E);"...change to:";:INPUT W$(E)
1460 INPUT"(C)ont.  (A)nother   (R)eturn :";C$
1470 IF C$="R" THEN RETURN
1480 IF C$<>"C" THEN 1370
1490 IF N>D THEN LET D=D+20:GOTO 1370
1500 RETURN
1510 REM ------------SPACEBAR to continue----
1520 PUT 22,32+23,32
1530 PRINT"Press SPACEBAR to continue..."
1540 SP$=GET$(0):IF SP$<>" " THEN 1540
1550 RETURN
1560 REM-------------Program to print screen--
1570 IF PR=0 THEN RETURN
1580 PUT 22,32+21,32:PRINT "Do you want a print of this screen (Y/N)"
1590 PUT 25:INPUT O$
1600 IF O$="Y" OR O$="y" THEN GOTO 1630
1610 IF O$="N" OR O$="n" THEN RETURN
1620 GOTO 1580
1630 PUT 11:PUT 11:PUT 25:PUT 10:PUT 25
1640 FOR J=59 TO 0 STEP -3
1650 FOR I=0 TO 40 STEP 2
1660 X=POINTS(I,J)
1670 IF X>191 THEN X=X-64
1680 IF X>127 THEN X=X+32
1690 PUT £2,X
1700 NEXT I
1710 PUT £2,13,10
1720 NEXT J
1730 RETURN
```

Gamescorer

WHEN Alison Berks goes to a friend for a quiet game of Black Maria, Scrabble or Rummy she takes along her PC-1500 hand-held computer and the Gamescorer program. While pencil and paper may be as convenient, and a lot less expensive, the computer adds interest to the proceedings and accuracy to the scores.

The program structure is straightforward, and plenty of meaningful labels have been used for Goto or Gosub target lines. Lines 40 to 60 dimension arrays and initialise the error messages. Lines 100 to 240 input the name of the game and the number of players and their names. Lines 250 to 290 set up a countdown clock, if required, and check that the players are ready. Lines 300 to 350 print out the preliminary details and set up columns for the players' scores.

Lines 400 to 500 input the scores, print the running totals, keep the individual highest scores and ask whether another round is required. Lines 550 to 700 sort the final total scores into order and print them out, print out the high scores, and ask if another game is to be played.

The use of For-Next loops throughout avoids unnecessary repetition of code. The use of labels and the general absence of spaghetti jumps back and forth aids readability, and error messages are chosen and displayed in a most effective way. Meaningful variable names such as Game$, Name$, Playernumber, and Highscore make it obvious what is going on, while Tabbing and printing with strings produces a tidy output.

```
10:REM  GAMESCORE
    R, by Alison B
    erks
20:CLEAR :WAIT 0
30:PRINT "GAMESCO
    RER":BEEP 10
40:DIM EM$(5),NAM
    E$(4),HS(4),TS
    (4)
50:EM$(1)=">10 le
    tters":EM$(2)=
    "<2 players"
60:EM$(3)=">4 pla
    yers":EM$(4)="
    >99":EM$(5)=">
    5 mins"
100:"GAME"INPUT "W
    hat game? ";GA
    ME$
110:IF LEN (GAME$)
    >10THEN LET EM
    =1:GOSUB "MESS
    AGE":GOTO "GAM
    E"
150:"PLAYERS"INPUT
    "How many play
    ers? ";NP
160:IF NP<2OR NP>4
    THEN LET EM=2*
    (NP<2)+3*(NP>4
    ):GOSUB "MESSA
    GE":GOTO "PLAY
    ERS"
200:BEEP 2:PAUSE "
    Input the play
    ers names":
    BEEP 2
210:FOR PN=1TO NP
220:"NAME"CLS :
    PRINT "Player"
    ;PN;:INPUT ":
    ";NAME$(PN)
230:IF LEN (NAME$(
    PN))>10THEN
    LET EM=1:GOSUB
    "MESSAGE":GOTO
    "NAME"
240:NEXT PN
250:"TIMED":CLS :C
    LCK=0:PRINT "A
    gainst the Clo
    ck (Y/N)?";
    GOSUB "Y/N":IF
    K$="N"THEN "RE
    ADY?"
260:"SECS":INPUT "
    How many secs
    a go? ";PT
270:CLCK=1:IF PT>3
    00THEN LET EM=
    5:GOSUB "MESSA
    GE":GOTO "SECS
    ?"
280:"READY?"PRINT
    "Are you ready
     (Y/N)?";:BEEP
    5:GOSUB "Y/N":
    IF K$="N"THEN
    "READY?"
290:FOR PN=1TO NP:
    TS(PN)=0:HS(PN
    )=0:NEXT PN
300:CLS :TEXT :
    COLOR 0:CSIZE
    2:LCURSOR 0
310:LPRINT GAME$+"
     GAME":LPRINT
    "BETWEEN"
320:FOR PN=1TO NP:
    LPRINT PN;":
    "+NAMES$(PN):
    NEXT PN:GOSUB
    "LINE"
350:FOR PN=1TO NP:
    LPRINT TAB 1+(
    PN-1)*18/NP;PN
    ;:NEXT PN:
    LPRINT :GOSUB
    "LINE"
400:"SCORE"FOR PN=
    1TO NP:IF CLCK
    GOSUB "CLOCK"
410:"SCOREIN"CLS :
    PRINT NAME$(PN
    )+"s score: ";
420:PS=100:INPUT P
    S:IF PS>99THEN
    LET EM=4:GOSUB
    "MESSAGE":GOTO
    "SCOREIN"
425:IF PS=100THEN
    "SCOREIN"
430:TS(PN)=TS(PN)+
    PS:IF PS>HS(PN
    )THEN LET HS(P
    N)=PS
440:TS$=STR$ TS(PN
    ):L=LEN TS$:
    LPRINT TAB 4-L
    +(PN-1)*18/NP;
    TS$;:BEEP 5
450:NEXT PN:LPRINT
500:CLS :PRINT "An
    other Round (Y
    /N)?";:GOSUB "
    Y/N":IF K$="Y"
    THEN "SCORE"
510:GOSUB "LINE"
550:PRINT "Sorting
      Please wait"
560:"SORT"SWAP=0:
    FOR PN=1TO NP-
    1:IF TS(PN)<TS
    (PN+1)THEN LET
    SWAP=1:GOSUB "
    SWAP"
570:NEXT PN:IF SWA
    PTHEN "SORT"
600:CLS :LPRINT "R
    esults":FOR PN
    =1TO NP:TS$=
    STR$ TS(PN):L=
    LEN TS$
610:LPRINT STR$ PN
    ;": "+NAME$(PN
    );TAB 18-L;TS$
    :NEXT PN:GOSUB
    "LINE"
620:LPRINT "Best S
    cores:";FOR PN
    =1TO NP:LPRINT
    NAME$(PN);TAB
```

```
    14;HS(PN):NEXT
    PN:GOSUB "LINE
    ":LF 5
700:PRINT "Another
    Game (Y/N)?";
    :GOSUB "Y/N":
    IF K$="Y"THEN
    "TIMED"
710:PRINT "Finishe
    d!":BEEP 5
999:END
1000:"MESSAGE"CLS
    :FOR M=1TO 3
    :BEEP 1:
    PAUSE EM$(EM
    )+" not allo
    wed":NEXT M:
    RETURN
1020:"Y/N"K$=
    INKEY$ :IF K
    $<>"Y"AND K$
    <>"N"THEN "Y
    /N"
1025:BEEP 1:CLS :
    RETURN
1040:"LINE"LPRINT
    "----------
    -------";
    RETURN
1060:"SWAP"BEEP 1
    :TS=TS(PN):T
    S(PN)=TS(PN+
    1):TS(PN+1)=
    TS
1065:HS=HS(PN):HS
    (PN)=HS(PN+1
    ):HS(PN+1)=H
    S
1070:NAME$=NAME$(
    PN):NAME$(PN
    )=NAME$(PN+1
    ):NAME$(PN+1
    )=NAME$
1075:RETURN
1090:"CLOCK"CLS :
    FOR A=1TO PT
    :PRINT NAME$
    (PN)+"s go:"
    ;PT-A+1;" <s
    pace>"
1095:FOR B=1TO 25
    :K$=INKEY$ :
    IF K$=" "
    THEN LET B=2
    5:A=PT
1100:NEXT B:IF PT
    -A<10THEN
    BEEP 1
1105:NEXT A:BEEP
    5:RETURN
```

MZ-700 Find

Geoffrey Childs, from Winchcombe, Gloucestershire, offers a program for the MZ-700 to add the keyword Find to S-Basic. After loading Basic you key in the program and then run it. You may now save the new version of Basic, using either the backup technique in the manual, or the variant in G P Ridley's *Peeking and Pokeing the Sharp MZ-700,* or you simply use the new keyword.

When using Find, the target word may be up to 20 characters long. It can be either a string, as in

FIND "OXFORD ROAD"

or it can be a tokenised Keyword as in

FIND FOR

or even be a line number, as in

FIND 1000

The program is in the form of a Basic loader for the machine code in the Poke statements. The blocks of code Poked into the various locations have the following effects

11283-6 — changes redundant keyword Kill into Find

12012-31 — target word buffer

12032-6 — latest relevant line number, in decimal

12040-59 — converts hex digits into decimal

12060-115 — converts line numbers into decimal

12118-23 — contains the start, length and number of the current line

12124-53 — stores the target word in the buffer

12154-225 — main loop for the search

12793-4 — changes the address for Kill to that for Find

MZ-700 Find.

```
1 REM MZ-700 Find
2 REM (C) G T Childs 1984
10 POKE 11283,70,73,78,196
20 POKE 12793,92,47
30 POKE 12040,213,22,48,175,237,66,56,3,20,24,248,237,74,43,122,209
40 POKE 12056,18,19,201
50 POKE 12060,229,42,90,47,17,0,47,1,16,39,205,8,47,1,232,3
60 POKE 12076,205,8,47,1,100,0,205,8,47,1,10,0,205,8,47,1
70 POKE 12092,1,0,205,8,47,17,0,47,26,214,48,32,3,19,24,248
80 POKE 12108,205,24,0,205,6,0,225,201
90 POKE 12124,213,229,17,236,46,205,20,84,126,254,34,32,1,35,126,254
100 POKE 12140,34,32,1,175,18,183,40,4,35,19,24,242,225,209
110 POKE 12154,217,33,207,107,34,86
120 POKE 12160,47,1,4,0,17,88,47,237,176,237,75,88,47,120,177,32
130 POKE 12176,4,217,195,251,24,42,86,47,17,236,46,0,26,237,177,120
140 POKE 12192,177,40,19,229,19,26,183,32,5,205,28,47,24,7,190,35
150 POKE 12208,40,242,225,24,227,225,42,86,47,237,75,88,47,175,237,74
160 POKE 12224,24,188
500 A=11283:B=11286:C=417:GOSUB 900
510 A=12793:B=12794:C=139:GOSUB 900
520 A=12040:B=12055:C=1797:GOSUB 900
530 A=12056:B=12059:C=238:GOSUB 900
540 A=12060:B=12075:C=1024:GOSUB 900
550 A=12076:B=12091:C=893:GOSUB 900
560 A=12092:B=12107:C=939:GOSUB 900
570 A=12108:B=12115:C=866:GOSUB 900
580 A=12124:B=12139:C=1912:GOSUB 900
590 A=12140:B=12153:C=1241:GOSUB 900
600 A=12154:B=12159:C=684:GOSUB 900
610 A=12160:B=12175:C=1393:GOSUB 900
620 A=12176:B=12191:C=1725:GOSUB 900
630 A=12192:B=12207:C=1266:GOSUB 900
640 A=12208:B=12223:C=2091:GOSUB 900
650 A=12224:B=12225:C=212:GOSUB 900
700 IF ER=0 THEN PRINT "No checksum errors."
710 END
900 K=0:FOR N=A TO B:K=K+PEEK(N):NEXT:S=S+1
910 IF K<>C THEN PRINT "Error line";S*10;" or";S*10+490:ER=1
920 RETURN
```

Print and Print/P

In April's Sharp Open File I gave J S Levett's tip for the MZ-80K using SP-5025 which gets Print to go to the printer, and Print/P to the screen. Geoffrey Childs has offered advice yet again. He has pointed out that the Pokes to make Print go to the printer result in a syntax error if a real Print/P is encountered.

He suggests using the single Poke to locations 7221 or 7236 instead of Mr Levett's three Pokes. It works by changing the defined word set up as the return address in a routine used by Basic to determine where it returns after trying to match the next character with a defined byte — in this case /. Whether the match is made or not, the changed address sends the interpreter on to where it would go if the command had been Print/P rather than Print.

Poke 7221,67 converts every Print to a Print/P. Poke 7236,00 converts each Print/P to Print. Poke 7221,69 and Poke 7236,128 put things back to normal.

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The 64 book question

Mike Todd assesses the literature available to help you get on familiar terms with your Commodore 64.

LEARNING Basic programming on the Commodore 64 is straightforward enough, but having a good book by your side is important. Since the 64 was introduced, a large number of such books have been published with the more recent ones adopting a lighter, more pictorial approach. So whatever your age or outlook, there is a book on the shelves for you.

Step by Step Programming by Phil Cornes comes in two volumes. Book 1 covers the principles of programming the 64 in a clear, colourful and practical way. Each of the main Basic commands is explored through simple examples. The book is full of off-screen photographs — many in colour — showing exactly what you should see as you work through the examples. The reader is introduced to many specialised aspects of the 64, such as keyboard graphics and animation, data handling, sprites and sound. Strangely, loading and saving programs comes near the end of the book, followed by a sprite designing grid and character charts.

Century has also produced two beginners' Basic books. *Very Basic Basic* is just what it says, covering the first 15 hours with your 64. It goes over most aspects of Basic, with many examples and useful hints. However, I must have doubts about a book that in its section on using the cassette machine insists that you should "make sure a program runs before saving it", which is surely the wrong way round.

Discover your Commodore 64 goes a stage further and describes program-writing techniques assuming a familiarity with Basic. It takes the beginner through the program-writing process, planning, flowcharting and coding, explaining many of the pitfalls the newcomer will encounter. There is also a section describing the peripherals of cassette, disc and printer.

Very Basic Basic and *Discover your Commodore 64* are presented in similar styles, with large paragraph headings in the margins and a chatty style, but the lack of illustrations makes them dry.

Book 2 builds on the techniques learnt in the first book, explaining high- and low-resolution graphics, point and line plotting, redefining characters, further sprite programming and sound generation. It too includes excellent off-screen photographs and well-produced illustrations. Both books contain useful programming ideas for almost anyone starting to program the 64, although they are expensive at £5.95 for only 64 pages.

If you prefer such an approach, then *Hands on Basic* from Byte Books will suit you well. Spiral bound, it is a chunky publication at a chunky price, which starts at the beginning and plods on tirelessly to the end. It is full of what it calls "discovery exercises", which are worked examples and problems. Despite its textbook feel, the book is thorough and covers some aspects of disc file handling, complete with program examples.

At the other extreme is *Your First Commodore 64 Program* by Rodnay Zaks. It is designed to be entertaining for all ages and is full of bright and witty cartoon drawings. Its coverage is reasonably thorough without covering unnecessary features, and each chapter has several exercises, for which sample solutions are provided.The final chapter does make brief reference to advanced features such as functions, subroutines, string operations, data structures and file handling, which it suggests may be pursued through more advanced books.

Larger and thicker, but in a similar vein is *The Really Easy guide to the Commodore 64* from Century. It, too, is liberally illustrated with cartoon characters, which in this case form an integral part of the text. This makes for a very light-hearted book, well suited to the young beginner.

Several of the 64's more advanced features are omitted but coverage is thorough, with many simple programming examples and helpful guides as to what can go wrong in the form of more cartoons at the end of the book. This would be a valuable resource book for anyone wishing to take their children down the programming path, and the monochrome line drawings are just crying out for coloured pencils.

Shiva's *Gateway to Computing* books would also form useful resource books. The two volumes adopt a light-hearted style, with many simple cartoon characters, program examples and problems with solutions. Book 1 is a simple introduction to the computer with only the most important commands described. Book 2 picks up where book 1 leaves off and delves into the realms of arrays, strings and simple logical operations.

Basic is Child's Play is a spiral-bound work book written for use in primary schools. There are many simple examples and self-checking tests throughout, which take the young programmer from an introduction to the keyboard, through simple commands and variables. Yet again, there is a sprinkling of cartoon characters.

All the books mentioned so far rely

(continued on next page)

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on the reader typing in the example programs, which is undoubtedly a useful learning aid. But there are a couple of Basic books which come complete with a cassette of all the programs. *Basic Adventures in Space Part 1: The Alien Planet* is in the Dr Watson series from Honeyfold and is pitched towards the 7- to 11-year-old. The book has a story line to it and the accompanying cassette contains the programs from the book, together with a couple of games designed to reinforce concepts such as line numbers, strings and how a Basic program runs.

Also in the Dr Watson series, complete with cassette, is *Beginners' Basic for the CBM 64*. It is much thicker than *The Alien Planet* and has a much more adult approach covering all aspects of the 64. It is a complete course on programming from first principles, and it bases much of its teaching on several useful projects which include graphics and sound.

All the software developed in the book is on the cassette, including utilities for designing character sets and sprites. In addition, it contains Honey-Aid, which is a utility package that adds 28 extra commands to Basic. They include some toolkit commands, such as Renumber, Find and so on; graphics commands which allow points to be plotted and lines to be drawn; and some sound commands. The program examples in the book do not assume that you have this utility loaded, but details of how to use it are included. The book is very thorough, and its price of £10.50 is value for money for Honey-Aid alone.

Once the art of Basic programming is mastered, it is time to start to use the Commodore 1541 disc drive. Unfortunately, Commodore's own documentation is appalling and beginners find handling discs extremely difficult. Although using discs to save and load programs is straightforward, writing programs to use them for data storage is rather more difficult and needs a good grounding in Basic programming. Despite this, a couple of the beginners' books mentioned do have brief accounts of how to use disc drives.

The Commodore 64 Disk Book from Century takes a rather hurried approach but does cover most aspects of disc handling, from the care of discs, through sequential and random-access files to checking the error channel. Unfortunately, like so many books, it attempts to go too deep too quickly, without giving much in the way of practical guidance.

Ian Sinclair combines a look at discs with printers in *Commodore 64 Disk Systems and Printers*. Most aspects of the disc drive are covered and some simple filing programs are described. It is one of the few books to examine some of the utility programs supplied with the 1541. It describes how to look after your drive, but its statement that "the head of the Commodore drive is above the disk not below" is totally incorrect and makes you wonder how much the author really does know about drives!

The printer side of the book is a brief look at four different printers describing how to use them and their control codes. This may be useful for those considering buying a printer. The appendices contain a discussion of word processors, random-access files, and a short list of suppliers.

Sunshine's *Commodore 64 Disk Companion* is rather more practical in its approach although it covers similar topics. It includes a brief description of how to use the so-called DOS Wedge on the utility disc supplied with the drive, and there are several useful program listings which are all well commented and worthy studying.

Once you have learnt how to program in Basic, the speed of its execution can often be a frustration. The answer is to program in machine code, or at least perform some of the more time-consuming tasks in machine code. In the Shiva Friendly Micro series comes *Commodore 64 Machine Code*. It is a fairly easy-to-read introduction to the subject, adequately explaining most aspects of machine-code programming with several example programs, some of which provide simple graphics utilities. It gets around the problem of the different types of asssembler available by describing a series of short Basic routines to assist in the process of generating machine code by hand. This is probably one of the best ways to learn, although only suitable for very short programs.

On the other hand, *Introducing Commodore 64 Machine Code* by Ian Sinclair assumes the reader has access to Mikro 64, one of the more popular assemblers readily available, although the code could easily be used with most of the other assemblers around. Coverage of all aspects of machine code is good, and there are several simple demonstration programs. Many of these have Basic programs which serve to Poke the numbers which form the machine code into memory.

Step by Step Programming — Book 1 by Phil Cornes. Published by Dorling Kindersely, 64 pages, £5.95. ISBN 0 86318 040 X

Step by Step Programming — Book 2 by Phil Cornes. Published by Dorling Kindersley, 64 pages, £5.95. ISBN 0 86318 041 8

Very Basic Basic by Derek Ellershaw and Peter Schofield. Published by Century Publishing, 119 pages, £2.95. ISBN 0 7126 0412 X

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Hands on Basic by Herbert Peckham, Wade Ellis Jr and Ed Lodi. Published by McGraw-Hill, 324 pages, £18.25 ISBN 0 07 049154 2

Your First Commodore 64 Program by Rodnay Zaks. Published by Sybex Computer Books, 189 pages, £7.95. ISBN 0 89588 172 1

The Really Easy guide to the Commodore 64 by Sue Beasley and Ruth Clark. Published by Century Publishing, 246 pages, £7.95. ISBN 0 7126 0374 3

Gateway to Computing with Commodore 64 — Book 1 by Ian Stewart. Published by Shiva Publishing, 104 pages, £4.95. ISBN 1 85014 017 0

Gateway to Computing with Commodore 64 — Book 2 by Ian Stewart. Published by Shiva Publishing, 115 pages, £4.95. ISBN 1 85014 035 9

Basic is Child's Play by Robert Grauer, Judy Gordon and Marsha Schemel. Published by Prentice-Hall, 164 pages, £16.45. ISBN 0 13 058819 9

Basic Adventures in Space Part 1: The Alien Planet, part of the Dr Watson Series. Published by Glentop Publishers, 114 pages and cassette £9.95. ISBN 0 907702 16 2

Beginners' Basic for the CBM 64 by Peter Holmes and Derek Bush, part of the Dr Watson Series. Published by Glentop Publishers, 348 pages and cassette £10.50. ISBN 0 907792 14 6

The Commodore 64 Disk Book by Tony Hetherington and Gordon Hamlett. Published by Century Publishing, 82 pages, £5.95. ISBN 0 7126 0543 6

Commodore 64 Disk Systems and Printers by Ian Sinclair. Published by Granada Publishing, 112 pages, £5.95. ISBN 0 246 12409 1

Commodore 64 Disk Companion by David Lawrence and Mark England. Published by Sunshine, 143 pages, £7.95. ISBN 0 946408 49 1

Commodore 64 Machine Code by Ian Stewart and Robin Jones. Published by Shiva Publishing, 162 pages, £6.95. ISBN 1 85014 025 1

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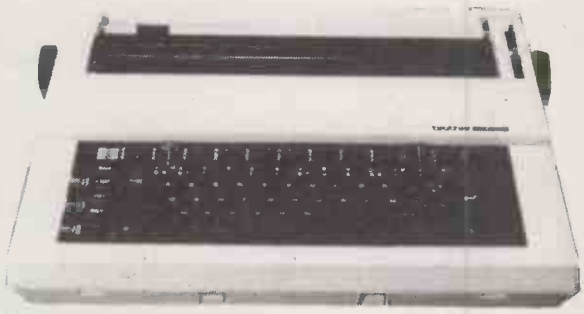

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Bill Bennett took a first look at the Enterprise in this issue. In March he excavates the Basic — is it as good as it looks? A new Research Machines micro has to be something of an event: Ian Stobie reports on RML's next offering. Plus there will be other reviews of special interest to BBC and Sinclair QL users.

>AND MUCH MORE

Next month, in our regular CP/M spot, David Dawe explains how to Submit from inside Basic. Roger Cullis continues his step-by-step analysis of the BBC ROM, while David Levy continues his games-programming series.

And there will be all the latest news — including the Which Computer? show launches — regular columns and reviews, not to mention the pages of free software in Open File.

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Why go a bundle on software for free?

Barry Miles believes that supplying a rag bag of applications programs with every computer may not be as good an idea as it once seemed.

THERE IS a modern trend to bundle software with hardware. Nowadays it is common to buy a microcomputer and perhaps find a word processor, spreadsheet or database within the package. On the face of it this is an attractive trend, for which users should be grateful, since they seem to gain greatly.

Economies of scale mean that software coming with the machine is produced at a considerably lower cost than software which has to be sold separately. Substantial packaging and marketing costs in the way of advertising and selling are avoided in particular. The savings are passed on to the consumer in the form of a low price for the combined package of computer and software. It is impossible to decide exactly how much you are paying for the software in such circumstances. The usual reaction is favourable in that you are getting an awful lot of capacity for the money you are paying.

Worthwhile?

Since you are presented with something without having to pay for it separately, you do not have to decide whether that particular item is a worthwhile purchase for you. On the other hand, as you have that particular piece of software, curiosity will probably mean that you will try it out.

Of course, everyone is subject to prejudice, and is inclined to think they know all about a particular item before they have tried it. The reality of using a word processor, spreadsheet or database may very well be far different from what you imagine before you first try one. There can be no doubt that being able to try these out and to decide whether they will be useful is a real advantage to the new user.

The conventional wisdom flowing from all this is that by bundling software with the hardware the software house does rather well because they have a guaranteed sale for their software. The customers also do rather well because they get an enormous enhancement to the capability of the machine, from the moment of purchase.

Attractive

Also it helps get over the problem of what you are going to use your computer for, a problem which often bedevils many a new purchaser faced with sceptical friends or relatives. At least you can say, "Well I can do some word processing like this", or "I can use the spreadsheet to do this calculation", and so on. Finally, the hardware manufacturers are pleased since the addition of software to the package makes the whole bundle more attractive and helps to enhance the sales of hardware.

However, despite the fact that this system seems to be the universal panacea, there are drawbacks. For example, any software house planning future products is likely to look at the potential market of the new machine. It will spy out the land to decide what it thinks the potential sales for its product will be before it invests time and money, and when faced with a bundling situation, important new considerations arise.

Improvements

A software producer may think along the lines that it would like to produce a word processor for the XYZ machine, and it could produce a really good one which could sell for £X. However, every user for the machine already has a word processor. So it must persuade potential customers that they should pay its price for a word processor, which at best might represent a 25 percent improvement over the facilities in the word processor that they already own. So why should it take the risk that very, very few people who already own a word processor will go to the expense of buying another and take the time and trouble to learn it? The software producer might think that it is better to stick to producing software for machines which do not come complete with the word processor.

The implication of this is that the advanced and enthusiastic user is likely to be denied progress in the form of steadily improving software for the machine. There is also another rather unfortunate consequence. The writers of the software which is bundled with the machine, being faced with no competition, will be inclined to be complacent about the quality of their product, and will not be inclined to improve it.

It is clear that the bundling of software gives a very considerable early gain to the average user and the beginner, at the expense of totally stagnating the development of better software of those particular types for certain machines. In an industry famed for its enormous rate of very rapid improvement, this new development may well stifle exactly that improvement. It is a case of the greatest good for the greatest number.

Software houses are likely to be stifled from producing other types of software to run on a particular machine, if they already feel defeated in the areas covered represented by the packages which come bundled with the machine. In general software houses find it attractive to be able to offer a range of products for a particular machine, so that their names can become established in relation to it and their advertising can be used to profitably cover a number of products for the computer. The likely result of this is that there is a shortage of software generally for the machines which are bundled in this way. Is this a good thing?

Beginners

A good way of minimising the problem is to make sure that the software which comes with the machine is really not the state of the art, but more a starter pack which may lead you on to more advanced software. However, so far only the Commodore Plus-4 seems to be following this route.

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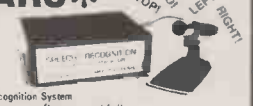

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