Personal Computer World

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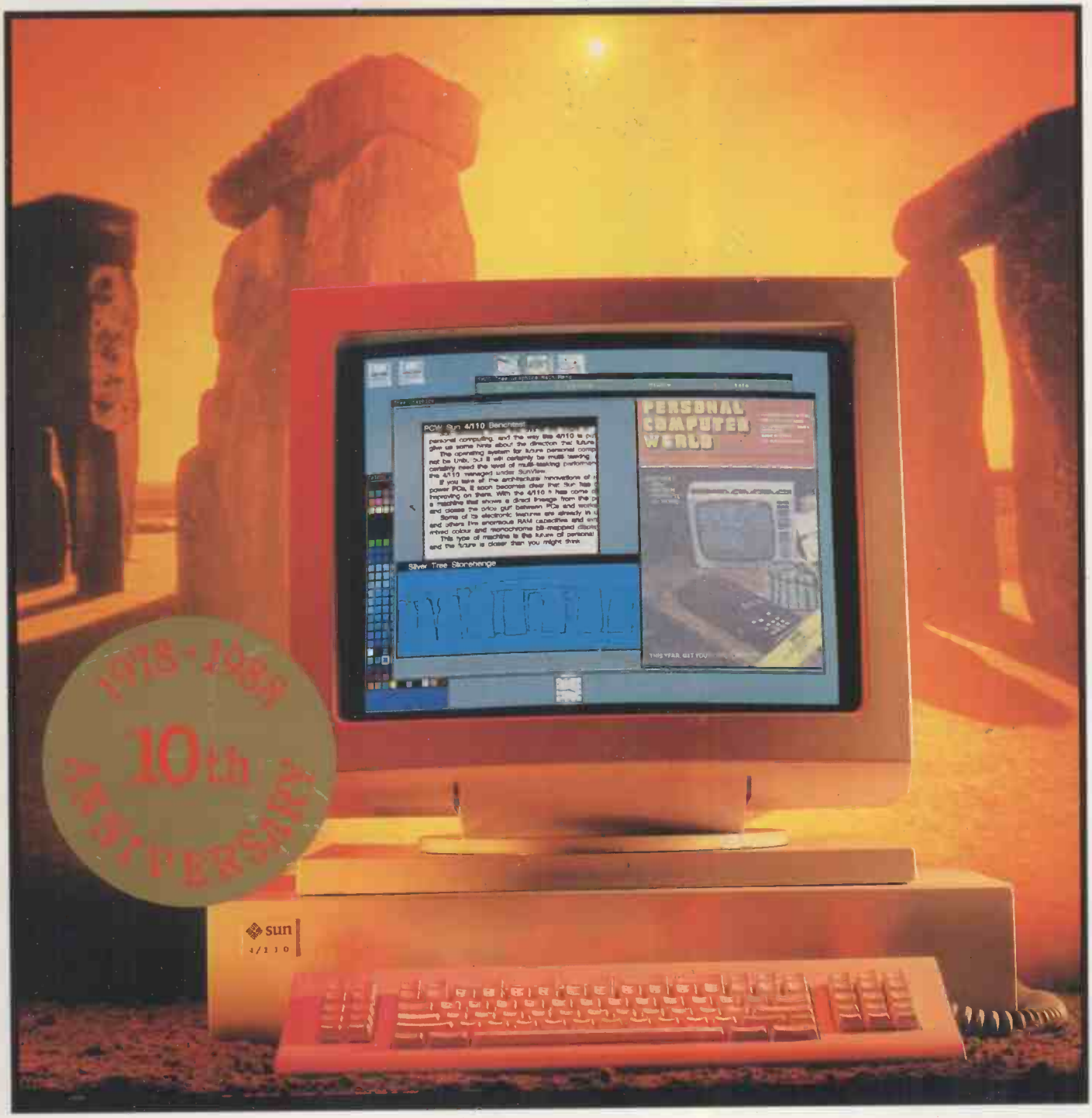

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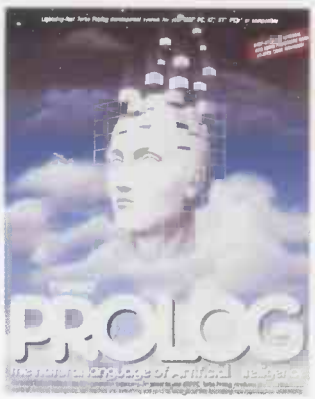
Takes Programming into a New Dimension



Turbo Prolog is a fifth-generation computer language that takes programming into a new dimension. It brings supercomputer power to your IBM PC, and introduces you step-by-step to the fascinating new world of artificial intelligence. Because of its natural, logical approach, both people new to programming and professional programmers can build powerful applications with Turbo Prolog — such as expert systems, customised knowledge bases, natural language interfaces, and smart information-management systems.

Voted Top Programming Language Year.
What Micro, February 1988

Turbo Prolog Provides a Fully Integrated Programming Environment

Turbo Prolog is a declarative language — given the necessary facts and rules, Turbo Prolog uses deductive reasoning to solve programming problems. Like Borland's Turbo Pascal, the de facto worldwide Pascal standard, Turbo Prolog provides a fully integrated programming environment. A full-screen text editor works with the compiler to produce flawless source code.

Prolog Technical Features:

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- has the ability to handle new EGA text modes
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"Turbo Prolog is more than just a language compiler. It is a complete development environment and at about £70 is very good value."
Phil Manchester, PC, September 1986

TURBO PROLOG TOOLBOX
Our new Turbo Prolog Toolbox enhances Turbo Prolog — with more than 80 tools and over 8,000 lines of source code that can easily be incorporated into your programs. It includes about 40 example programs that show you how to use and incorporate your new tools.

"It is the first compiler to bring this fascinating 'artificial intelligence' language within the range of the smaller users.
It has a faster and neater programming environment than many of the expensive Prolog systems. Moreover, the compiled programs execute at a surprisingly fast speed."
What Micro? Top Ten, February 1988

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Practical Computing, August 1987

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"It should be quite clear by now that I am impressed, this system (Turbo C) is very, very good indeed — I've used it every working day since it was available."
Doug Kaye, Personal Computing With the Amstrad, December 1987

NEW VERSION 1.5 WITH 100 NEW FUNCTIONS

Turbo C 1.5 Offers Spectacular Graphics

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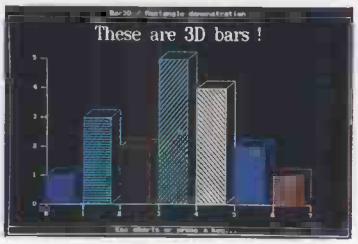

professional graphics in a short time, without purchasing any additional libraries.

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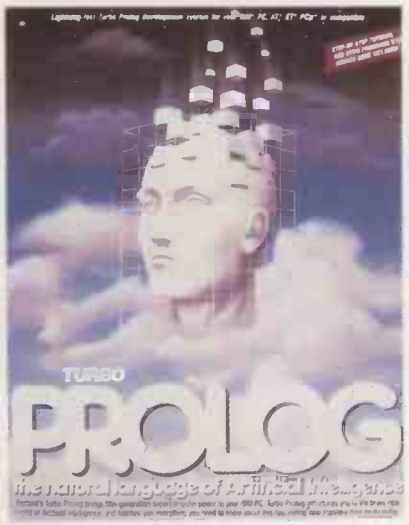
- File search utility (GREP).

"Turbo C also lived up to its 'Turbo' label when running the PCW Benchmarks. In all tests bar one (Textscrn), the Borland product came out on top."
Nick Walker, Personal Computer World, September 1987.

World leaders in their own right

❝There are no prizes for guessing which is the computer language that revolutionised programming at the serious end of the microcomputer world — it's Turbo Pascal . . .❞

Owen Linderholm, PCW, December 1987



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Owen Linderholm, PCW, December 1987

4.0's Cursor Automatically Lands On Any Trouble Spot

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Turbo Pascal 4.0 Toolboxes Help You Get Along

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Personal Computer World

SUN 4/110 96

In this our tenth anniversary issue we speculate on what the next ten years might contain for the personal computer user. As a foundation stone, we Benchtest the Sun 4/110 workstation, perhaps the most sophisticated microcomputer available today. Taking each of the following features in turn we look into the future of: image processing, user interfaces, mass storage, processors and connectivity. What machine will be sitting on your desk in 1998? Turn to page 96 to find out.

Cover photography by Chris Bell

FEATURES AND REVIEWS

HUSKY HAWK 8/16 106

Is this the world's first pocket MS-DOS compatible? The Husky Hawk 8/16 is both CP/M and MS-DOS compatible, has 640k of RAM for MS-DOS, and a 280k RAM disk, all within a footprint of an A5 pad. Martin Wren-Hilton Benchtests this ingenious and expensive little machine.

LASER PRINTERS 110

Owen Linderholm takes delivery of four new laser printers from Toshiba, Apple, SBC and Kyocera. After a slight mishap he emerged from behind the boxes, covered in toner, to declare his verdict.

PIXELPAINT 116

After receiving a Mac II, Ian McKinnell was disappointed that so few products actually used its colour graphics. PixelPaint rectifies this, giving 4096 colours to choose from in an enhanced Mac-Paint competitor.

SPECIALIX 386 122

Envious of the new breed of powerful 386 PCs but unwilling to scrap your existing investment in PC hardware? The Specialix 386 internal PX card may be your solution. Derek Cohen checks out this plug-in-and-go expansion card.

DRAFIX 126

The dividing line between 'cheap and cheerful' CAD packages and full-blown CAD packages is no longer so obvious. Drafix is one of a new generation of CAD packages — cheap and easily expanded into a professional system.

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CONTENTS

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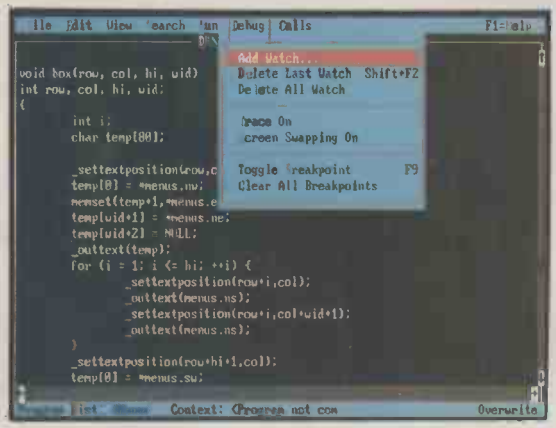

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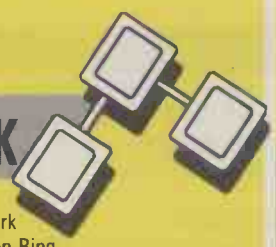

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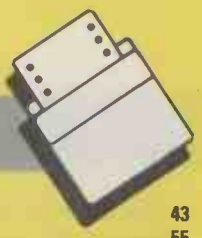

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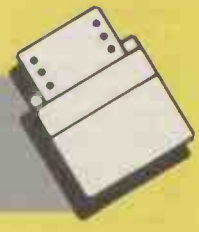

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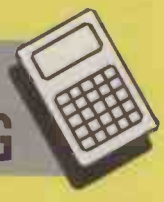

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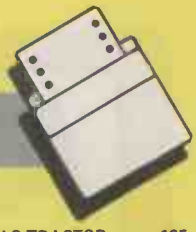

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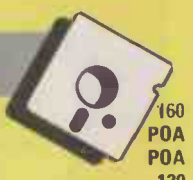

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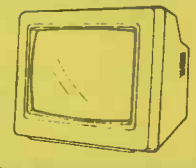

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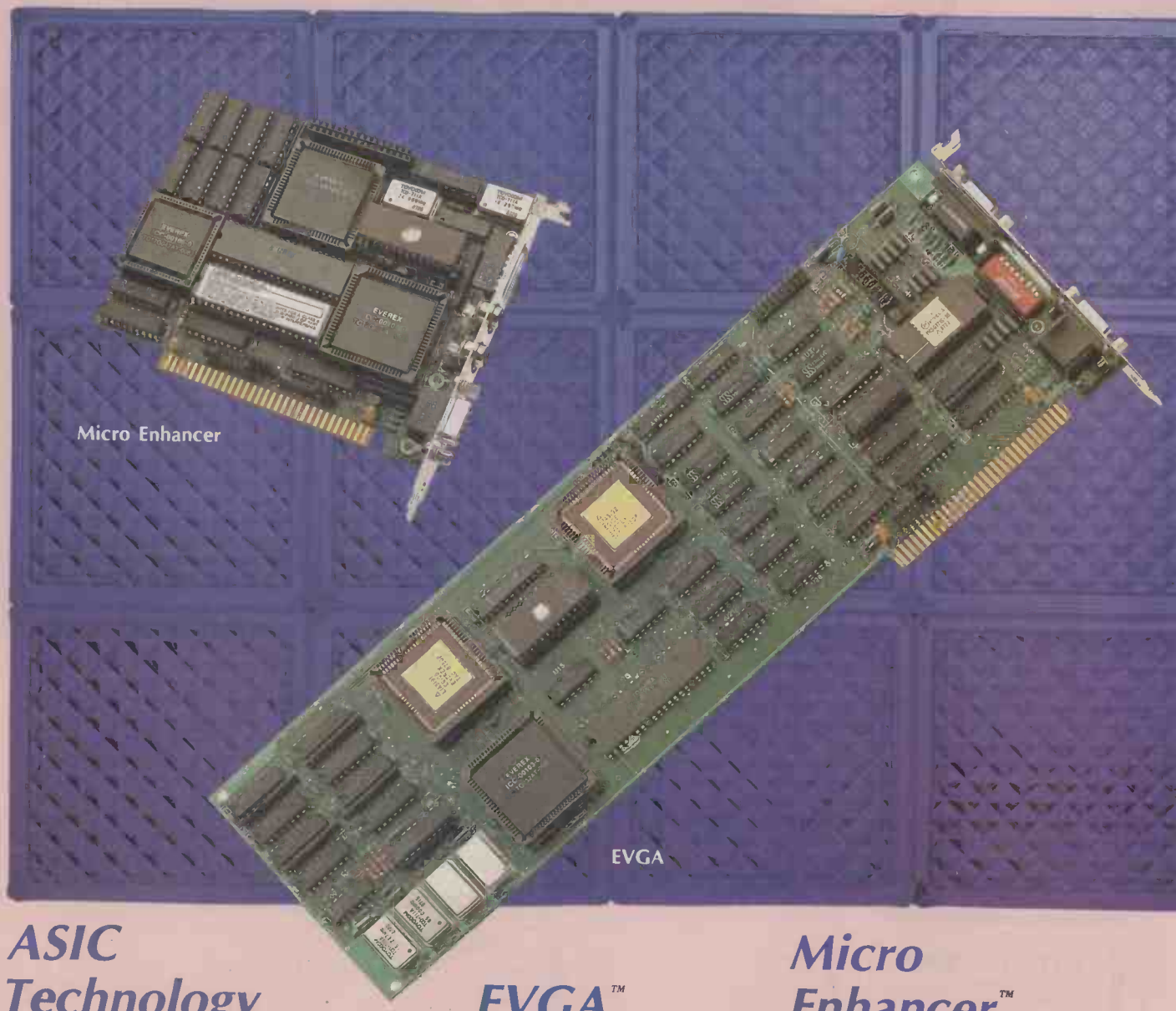

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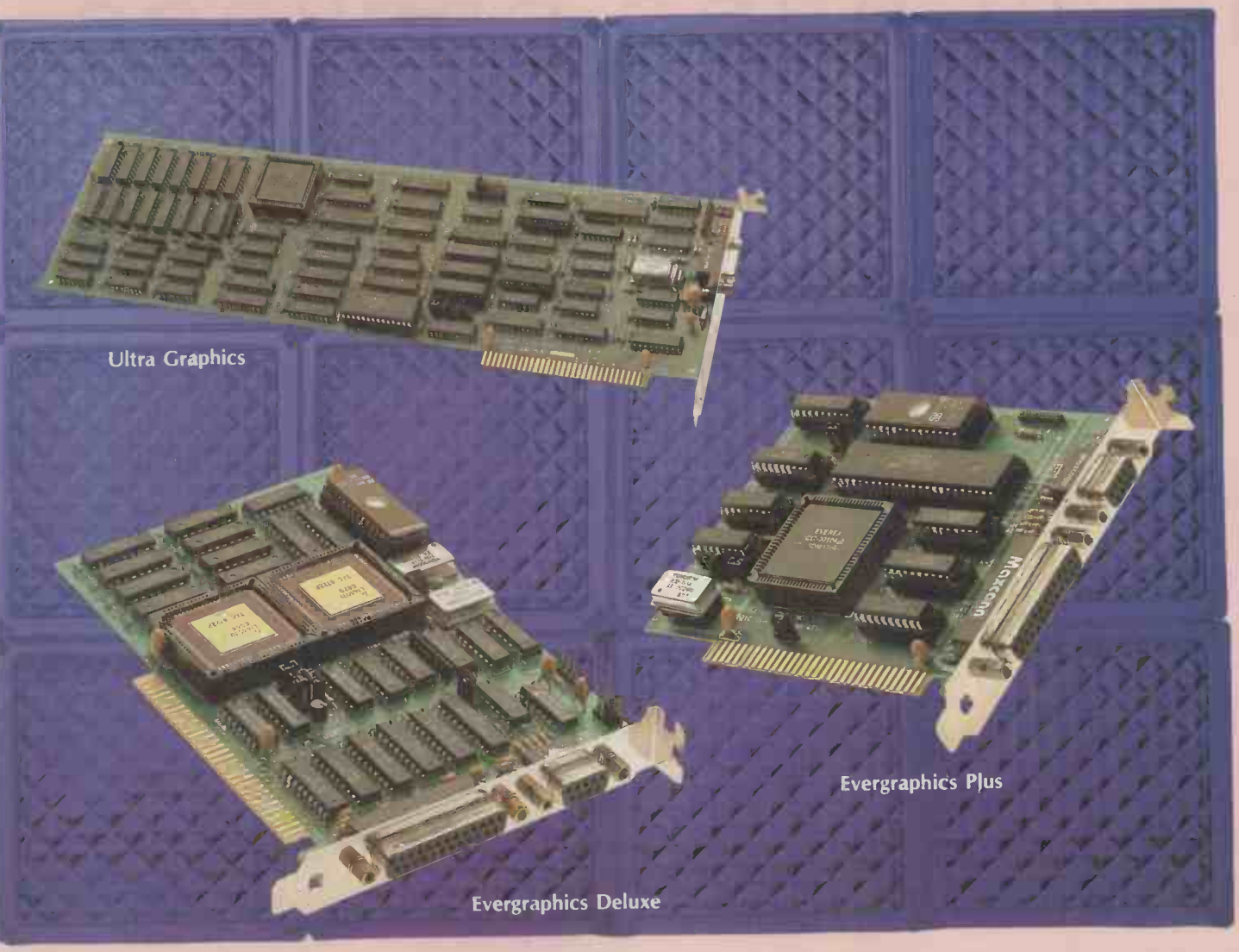

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- PRINT GROUPS OF LABELS SPECIFYING THE NUMBER TO PRINT FOR EACH LABEL
- PRINT ACCORDING TO SEARCH CRITERIA ANY NUMBER OF TIMES
- PRINT ANY LINES OF THE LABELS IN ANY ORDER
- IGNORE ANY LINES OF THE LABEL
- PRINT ONTO VIRTUALLY ANY SIZE LABEL
- ANY NUMBER ACROSS THE WEB
- ANY MARGIN SPACE AND GAP SETTINGS
- ANY TYPESTYLE YOUR PRINTER IS CAPABLE OF (INCLUDING COLOUR)
- PAUSE PRINTING BETWEEN EACH LABEL
- DIFFERENT TYPESTYLES AND BARCODES MAY BE MIXED ON THE SAME LINE WITHOUT EFFECTING ACROSS THE WEB PRINTING
- PRINTOUTS CAN BE AS LABELS, A COLUMNISED LIST OR COMPRESSED (SCRUNCHED) FORMAT USING ANY LINES OF THE LABEL IN ANY ORDER.
- OUTPUT CAN BE SENT TO A FILE, ANY PRINTER OR SCREEN.

A UNIQUE feature to SUPER LABELLER is the REQUEST command. This allows text to be merged into a label or text file "LIVE" from the keyboard while printing.

MAIL MERGE

As well as addressing your envelopes, SUPER LABELLER incorporates a comprehensive MAIL MERGE facility which will accept ANY standard text file. You can merge in:

ANY LINES OF A LABEL, ANY NUMBER OF TIMES IN ANY ORDER.

DAYS, DATES AND TIMES.

PRE-SET MESSAGES (16).

SERIAL NUMBERS (2).

PRINTER CONTROL CODES (UNLIMITED).

BAR CODES (UNLIMITED).

In fact ALL the advanced features available for use on a label are also available to use with MAIL MERGE.

ANY number of copies of the text file can be specified and output can be sent to the SCREEN, PRINTER or FILE.

Labels for merging can be selected by "WILDCARDS", INDIVIDUALLY or by GROUP allowing for UNLIMITED CATEGORISATION.

Furthermore the advanced SEARCHING FACILITIES allow selected data to be found and merged according to virtually UNLIMITED criteria.

BAR CODES

BAR CODES are offered as an option and once again offers TOTAL FLEXIBILITY.

BAR CODE formats can be defined EASILY in a FEW MINUTES and stored on disc for use at any time. An UNLIMITED number of different BAR CODE standards can be created or indeed your own system can be designed.

BAR CODES are printed using the graphic capabilities of your printer and may be positioned anywhere on the label freely mixed in with normal text, WITHOUT effecting across the web printing.

The BAR CODE RATIO is user definable, to give a magnification effect.

SERIAL NUMBERING

SERIAL NUMBERING is an important feature of SUPER LABELLER and this facility is TOTALLY CONFIGURABLE.

There are TWO INDEPENDENT SERIAL NUMBERS associated with each label file and each can individually be set to have its own characteristics.

- START AT ANY NUMBER
- ANY NUMBER BASE
- ANY INCREMENT (+ or —)
- ANY NUMBER OF LABELS WITH THE SAME NUMBER
- FORMATTED TO ANY NUMBER OF DIGITS BETWEEN 2 AND 12
- LAST NUMBERS SAVED WITH FILE

0012345 ABC00001 00ABC11

FILES

Each group of labels are stored together in a common file and there may be as many files as will fit on your disc.

ANY file can hold up to TEN THOUSAND labels, all held automatically in SORTED ORDER by name.

Typically, even with TEN THOUSAND labels in a file, SEARCHING and SORTING takes no more than a FEW SECONDS.

A new file can be set up in SECONDS and requires NO COMPLEX CONFIGURATION. Indeed you only need to specify the maximum characters required per label and the name you wish to call your file.

All these options are available:

- CREATE FILE
- DELETE FILE
- LIST FILES
- SELECT FILE
- ADD A LABEL
- ADD LABELS IN BATCHES FOR SUPER FAST DATA ENTRY
- CHANGE LABEL DETAILS
- DELETE LABELS
- RENAME LABEL
- RECATEGORISE LABELS

SEARCHING

SUPER LABELLER incorporates an ADVANCED ENGLISH TEXT SEARCH feature allowing for multiple AND OR and NOT (AVOID) operations. Below is an ACTUAL EXAMPLE of this facility to demonstrate the power.

IGNORE CASE
PLEASE FIND HOUSE ON LINES 1, 2
OR FIND BUNGALOW ON LINE 1
BUT AVOID FLAT ON ALL-LINES
AND FIND LONDON ON LINES 1, 6, 8
BUT AVOID CHELSEA AND AVOID ISLINGTON

This can be used both for SELECTIVE PRINTING of labels and MAILMERGE. Furthermore this can be combined with the "WILDCARD" feature to allow UNLIMITED CATEGORISING.

LABEL EDITING

A BARRAGE of editing facilities are available to SUPER LABELLER to ease data entry and modification. It includes features that would compare favourably with many word processors as well as DEDICATED FUNCTIONS designed specifically for use with labels. The list includes:

VISIT A LABEL — Allows you, while editing, to quickly visit another label (for example to view the contents or to cut and paste) and then return to the original.
COPY CURSER — AN EXTREMELY USEFUL aid to editing which allows a secondry curser to move freely anywhere on the screen and "pick-up" characters as though they had been typed. This keeps TYPING TO A MINIMUM by avoiding the need to retype duplicated words or sentences.
It is also used to pick up graphic characters to be used for drawing.
FIND AND REPLACE TEXT — This can be performed by scanning both FORWARD and BACKWARD through the labels.
CHANGE SIZE OF LABEL — The size of the label can be changed at ANY TIME from within the editor at a key stroke.
EXPANSION KEYS — The ten function keys can be set so a single keypress "EXPANDS" into a WORD or SENTENCE again to minimise typing.
QUICK SHOT — Allows the current label being edited to be printed to see instant results.

EMBEDDED COMMANDS

SUPER LABELLER offers many special features by allowing COMMANDS to be embedded within a label or text file. This offers print time facilities of UNRIVALLED FLEXIBILITY. For instance:

- TWO INDIVIDUAL SERIAL NUMBERS
- DATE AND DAY STAMPING
- TIME STAMPING
- REQUEST TEXT FROM KEYBOARD DURING PRINTING
- BAR CODES
- MERGE PRE-DEFINED TEXT
- PRINTER CONTROL CODES

COMPLETE control over the printer is allowed by USER DEFINABLE PRINT CODES. Furthermore, the COMMANDS for each printer function can have any name you choose. This allows customisation of any special facilities your printer provides. If your printer supports colour you could create COMMANDS such as RED, GREEN, BLUE and so on.

IMPORTANT

SUPER LABELLER is the culmination of TWO AND A HALF YEARS of producing FAST, EASY TO USE, SPECIALIST LABELLING SOFTWARE.

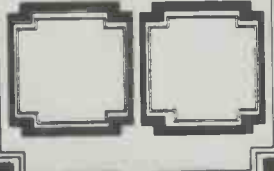
First time users are guided through the program with PULL DOWN MENUS and EXTENSIVE HELP.

Experienced operators have the UNPRECEDENTED opportunity to leave the menu system and PROGRAM DIRECTLY using the powerful MASS-FORTH operating system, allowing new commands to be created at will.

DRAWING UTILITY

All printable characters are available for use on a label and selection of the required graphics character comes from an EASY TO USE PULL DOWN GRAPHICS CHARACTER WINDOW.

The curser keys are used to "DRAW" your designs. This feature can also be used to obtain FOREIGN CHARACTERS that are not normally available from the keyboard.



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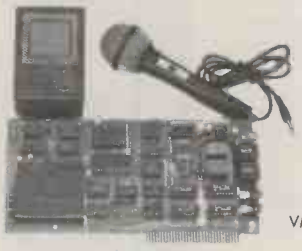

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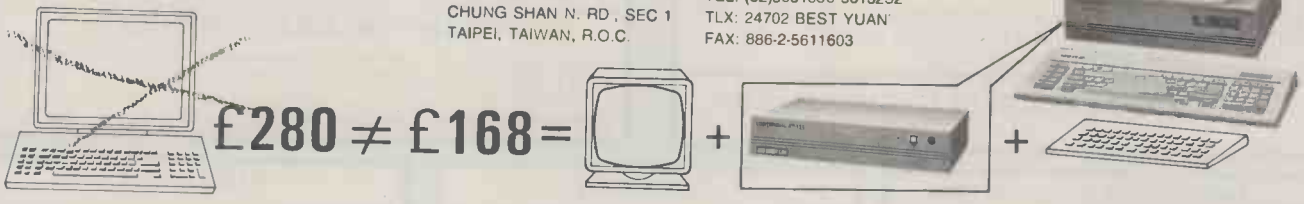

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LQ1050	(220/73cps)	£597
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SQ2500	(270/90cps) P/S	£962
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193	(240/33cps)S	£417
292	(300/100cps)Col	£446
293	(300/100cps)Col	£595
294	(400/100cps)Col	£816
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Star ND15, 136 col, 180 cps, 45 nlq	£354.00
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Epson EX1000, 136 col, 300 cps, 50 nlq	£539.00
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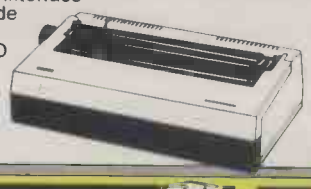

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Full Warranty.

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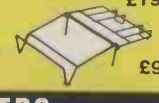

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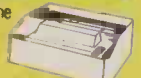

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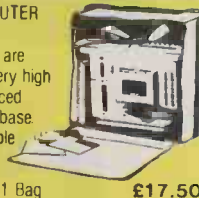

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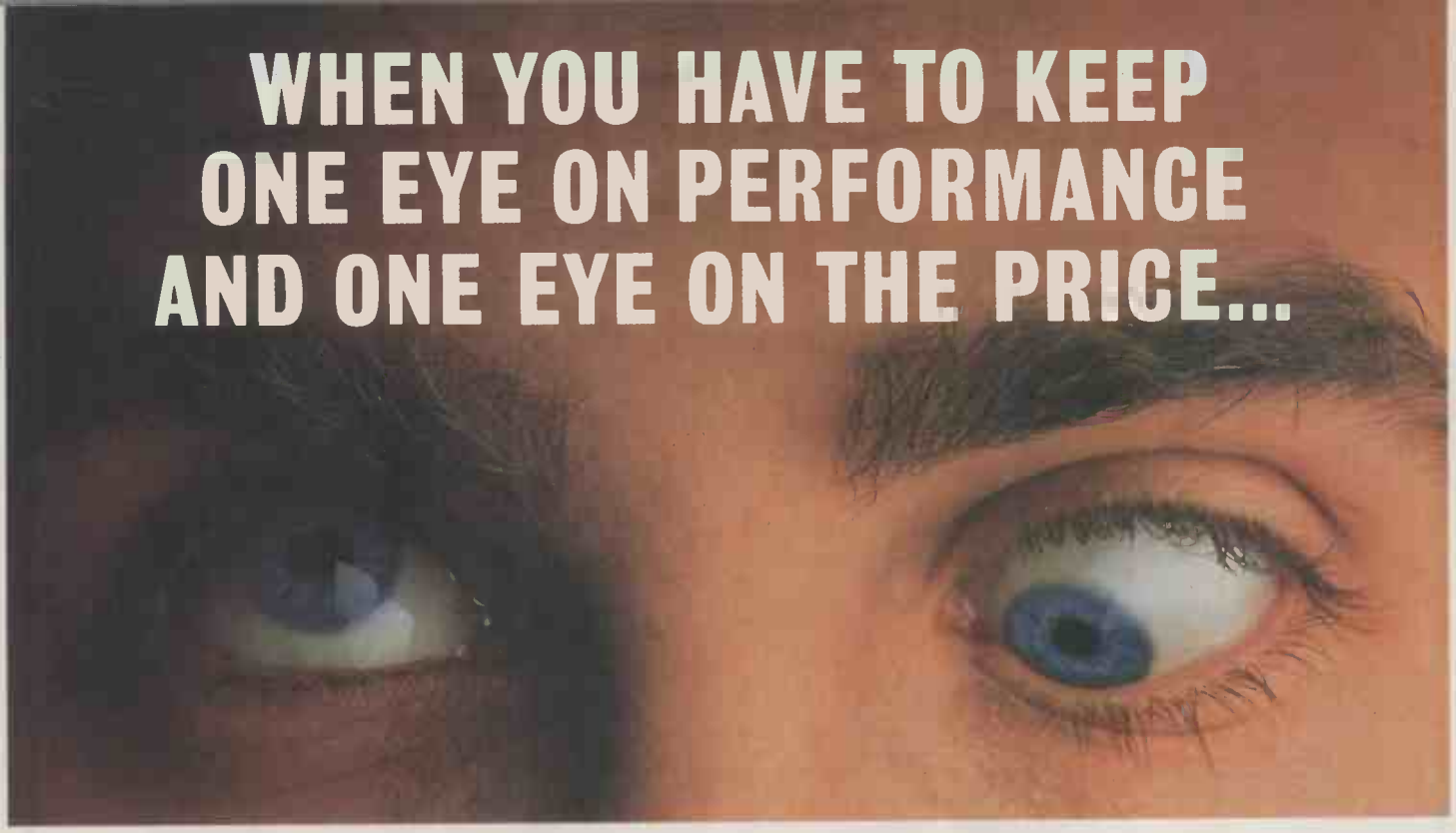

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LEVEL 3 SYSTEM	**£7599**	Mission 386 (2Mb Ram). Viking 1 (1280 x 960 non-interlaced) 19" monitor, optical mouse, Ventura DTP, PC Paintbrush, Superfast Laser Canon IX12 Scanner

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Epson LQ500	£279
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Epson LQ850/1050	£459/£619
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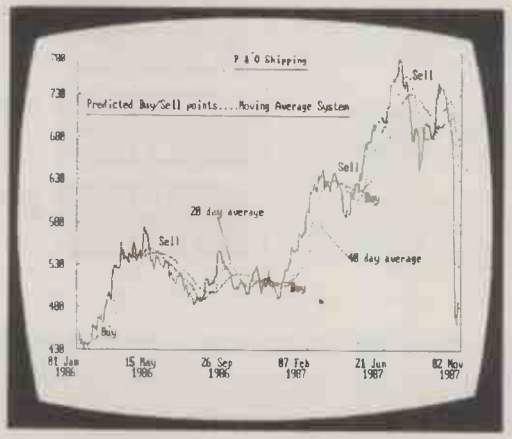

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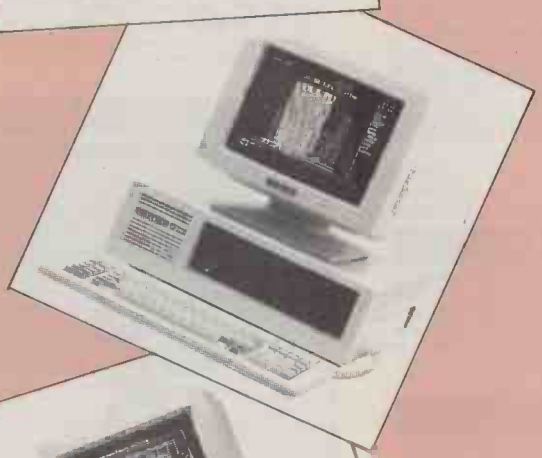

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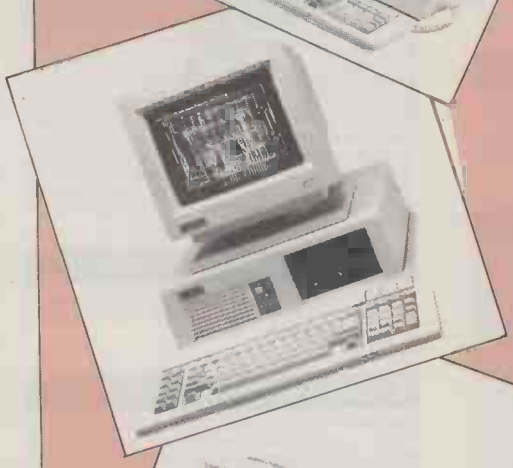

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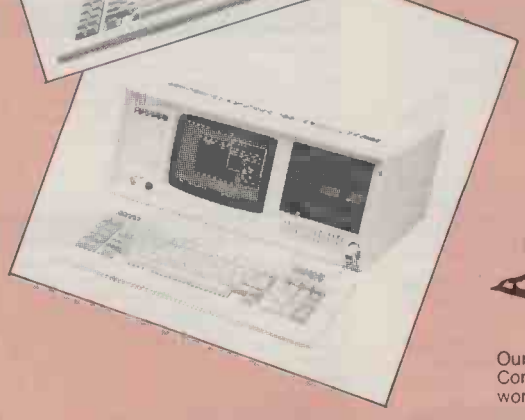

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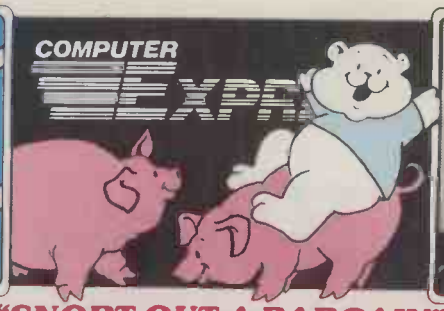

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At last! Amstrad is attacking the portable market, where until now the over-priced Japanese have romped. This sturdy little beast comes in four versions. Take it anywhere. The modem versions are especially good value.
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PPC Double Floppy 512k.....£475.00
PPC Single Floppy 640k Internal Modem £475.00
PPC Double Floppy 640k Internal Modem £569.00

PANASONIC 1081

This 120cps draft/30cps NLQ little beast is a surprising winner. It continues to sell very well, no doubt helped by the fact that everybody (led by us!) discounts it so massively! But it has excellent 9-pin quality, is Epson and IBM compatible, comes with a tractor feed, is 80 columns wide and amazingly cheap! Has helped to up Panasonics' U.K. market share greatly!
£142.00

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This special value added service which includes delivery, installation, training, hot-line support and on-site maintenance is now available. Ask for details when placing your order.

MIRACLE WS4000 V21/V23 Modem

This is the most popular Modem in the country today because it is cheap, reliable, looks good and does the job, which is really quite a simple one, after all. You can use it to access Telecom Gold, One-to-One, EasyLink, Prestel and all the bulletin boards that keep sprouting up. You also need a serial cable (£15.00) and software. We recommend Sagesoft ChitChat (£69.00) because that package also allows you to access Prestel. Most others don't.
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The trouble with integrated packages is that they tend to do one thing at most very well, and all the others not so well as a dedicated package. Smart is the only integrated system in which all of its components (WP, Spreadsheet, Database, Graphics, Communications, Diary) are competent to stand on their own against the competition. The best-selling integrated package. It retails at £695, but we sell it at nearly half that!
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Statistics show that more Word Processing software is sold than any other kind. Word Perfect is the best selling WP package in the world today – full stop. It is also, in the view of most trade people, the best. Strongly recommended. In software terms, only Lotus outsells it.
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NEC P7 PINWRITER

Heavy duty 24-pin dot-matrix prints draft at 180cps and Letter Quality (LQ) at 72cps. A very successful product in the corporate sector. 132 column.
£447.00

EXPRESS AT

Manufactured by Supercom of Taiwan, this 8MHz 80286 comes with a choice of classic or mini box with plenty of slots, parallel and serial ports, Real Time clock, MS-DOS 3.2, Hercules style monochrome graphics and monitor, AT keyboard. With this machine we break the psychological £1200 barrier on hard disk AT's (though not by much!)
32mb Express Mini AT.....£1250.00
32mb Express AT.....£1299.00

AMSTRAD 1640

No listing would be complete without mention of this machine. The shortcomings of the 1512 have been rectified and the 1640 is excellent value for money, coming as it does with an 8086 8MHz chip, 640k RAM, mouse, Gem, MS-DOS and choice of hercules mono, full colour or EGA screen. The old 1512 was selling massively in this country, and the successor 1640 is having similar success. For real value buy the single drive version and add a 32mb FileCard!
Single Floppy ECD.....£749.00
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EPSON PC RANGE

This range is robust and sets the standard for design and style, while remaining easy on the pocketbook. The PCe is a turbo 8088 which comes complete with AT-style keyboard, DOS and monitor. The AT-style AX range comes with keyboard and MS-DOS, but you need to pay extra for the monitor and graphics adaptor board of your choice. The AX is a popular item for power users on a budget, such as local authorities!
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MP 201 - 132 column 200cps	£273
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NOTE: The minimum quantity for ribbon orders is three (3) units.

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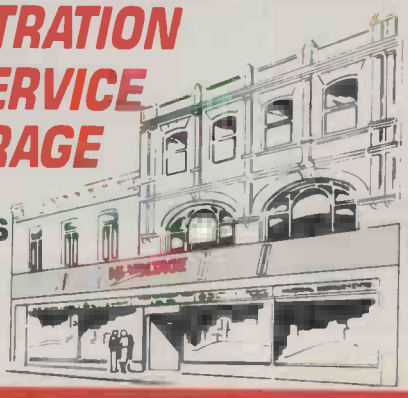

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AMSTRAD PC1512

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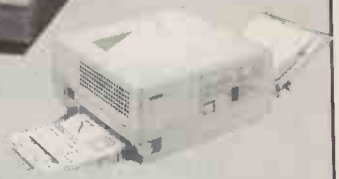
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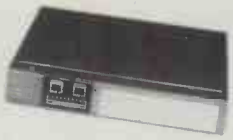

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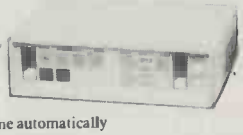

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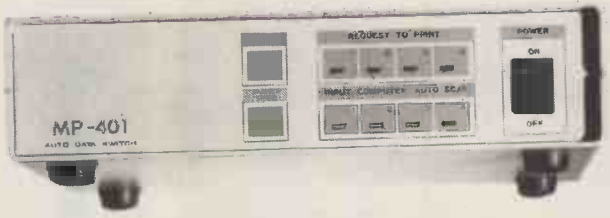

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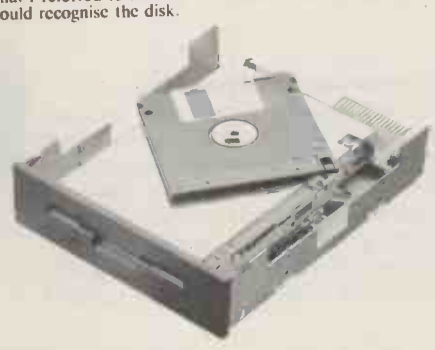
Fitting the drive into my AT-compatible proved to be no problem. Getting the machine to format disks correctly proved more difficult. Although DOS said that there was 720k of available space on a newly-formatted disk placed in what I referred to as drive B: no other 3½in disk drive would recognise the disk.



To the rescue came Citadel, who gave the following explanation:

When you format a disk under DOS, the program looks in the BIOS to see what format the disk should be. Even altering the CMOS set-up on an AT doesn't affect this process. The default for drive B: is 360k and this is what it happily does.

Using a program like PC Tools to format disks shows what is really going on as, for my newly-installed drive, it only gave 160k, 180k, 320k and 360k as possible capacities.

The trick is to use DRIVER.SYS which is supplied with DOS versions 3.2 onwards. This installs extra 'logical' drives whose parameters can be specified in your CONFIG.SYS file.

Inserting the line 'DEVICE=DRIVER.SYS/D:1' into my CONFIG.SYS produced a message at boot-up time to the effect that external drive E: had been installed. I then loaded up PC Tools and it informed me that drive E: can be formatted in just one way — to 720k. As long as I access the 31/2in drive as E: rather than B: I now have no problems with any DOS operation.

D. COHEN

(Reprinted from PCW December 1987)

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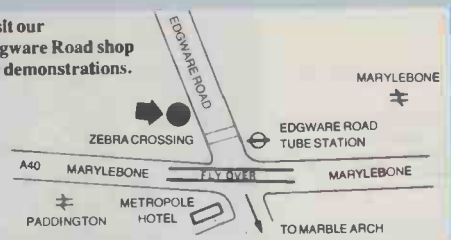

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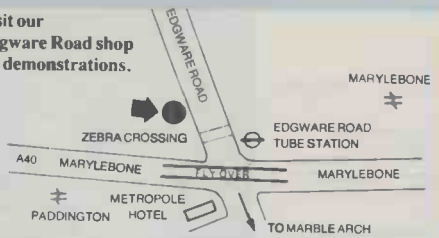

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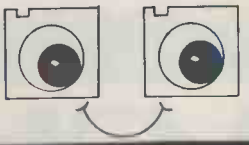

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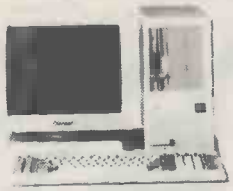

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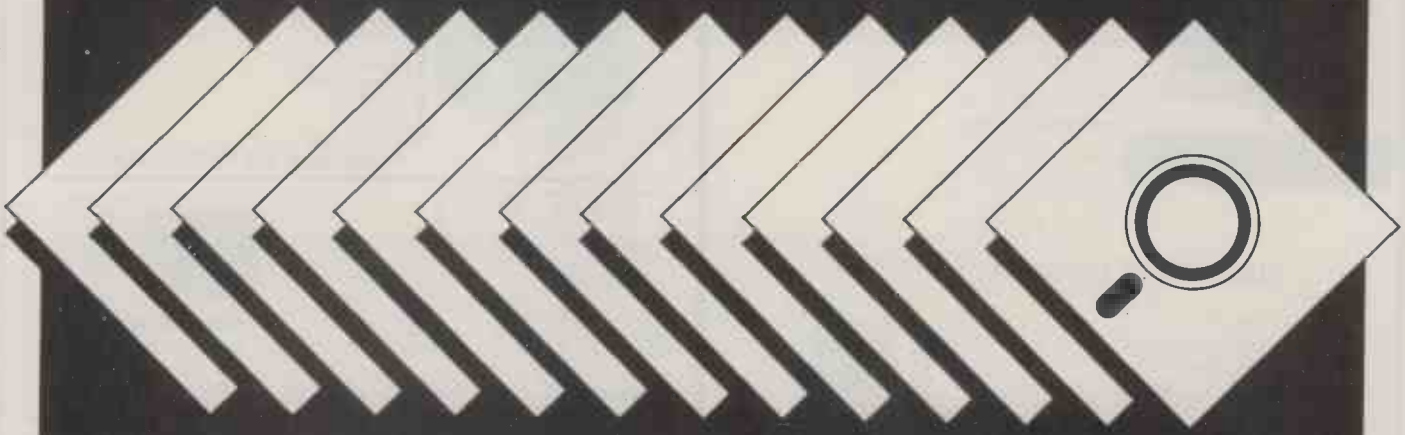

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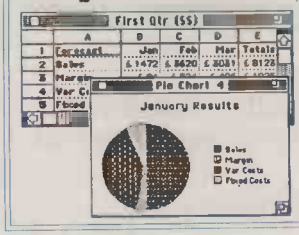

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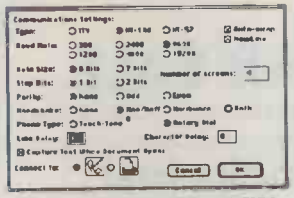

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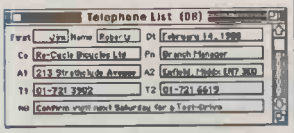

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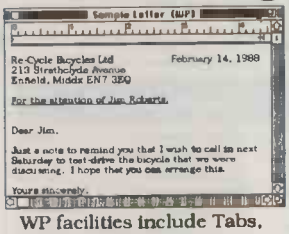

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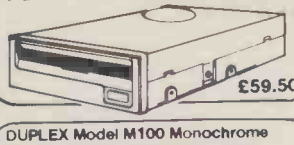

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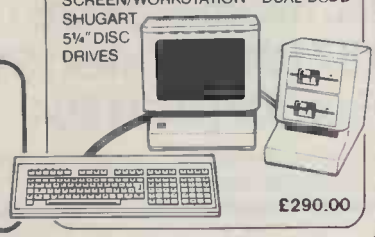

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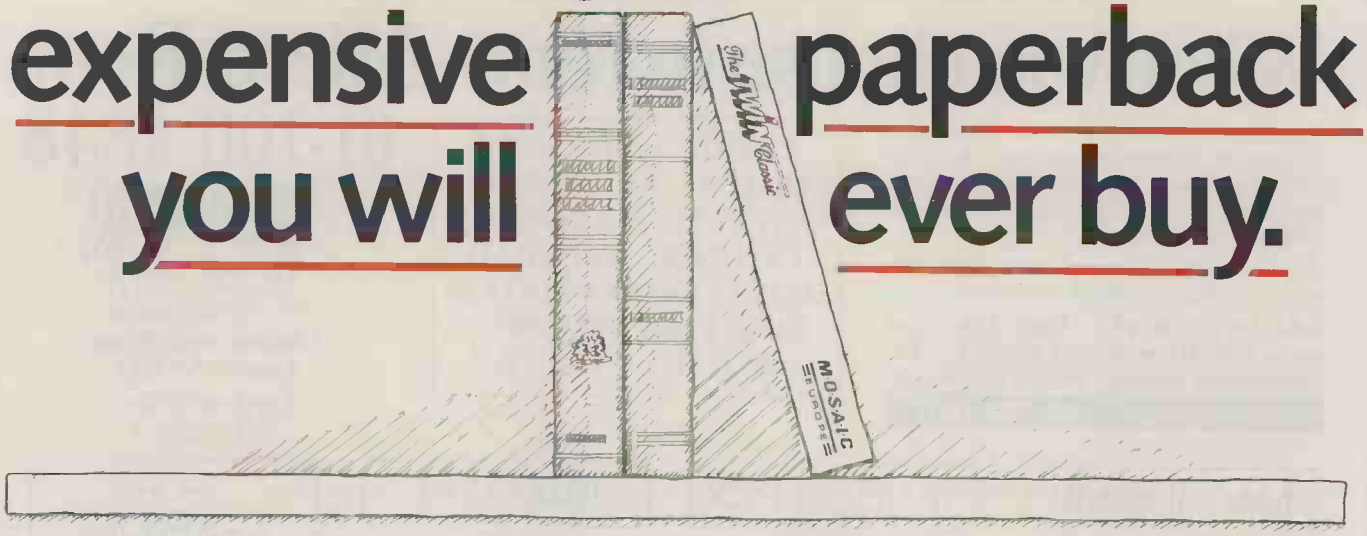

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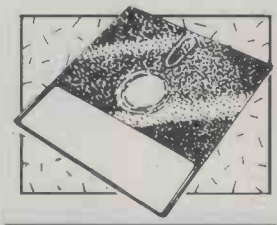

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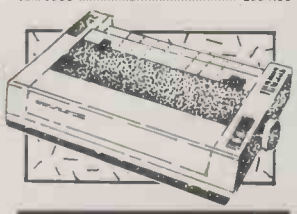

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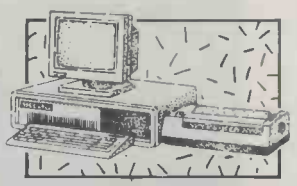

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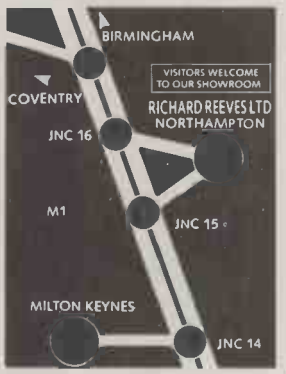

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Care in design make this and other products easily usable by individuals, schools, clubs and companies by combining friendly on-screen layout with very fast code. A cut down product was not rushed through in order to meet a marketing deadline.

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- COMMODORE AMIGA **'AMIGAMAGIC'** (Design and programming). Amiga Dealer Demonstration Disk. Commodore Business Machines (UK) Ltd, Maidenhead, Berkshire
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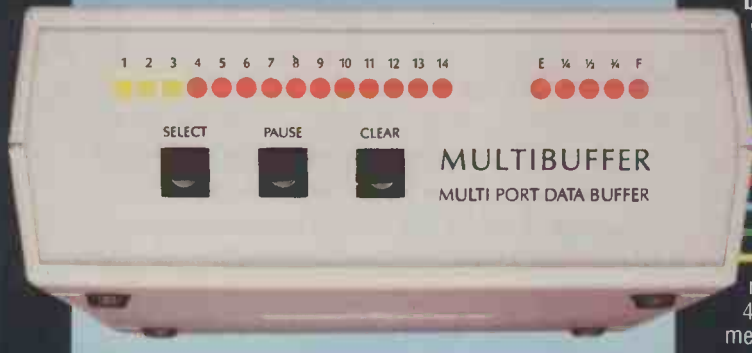
MULTIBUFFER: THE ULTIMATE PRINTER • PLOTTER SHARER

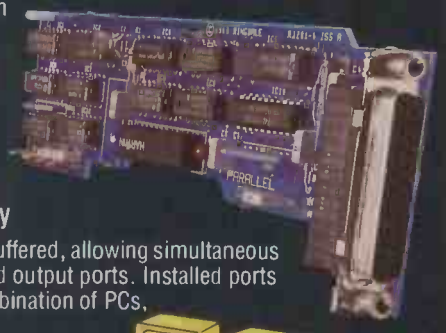


New British-made universal buffered printer/plotter sharer and data switch

- Up to 14 user-installable serial and/or parallel ports.
- ALL INPUT/OUTPUT PORTS CAN BE ACTIVE SIMULTANEOUSLY.
- Up to 4 MEGABYTES of common memory, automatically allocated and deallocated as required on each active port.
- SEVERAL PCs CAN SHARE ONE OR MORE PRINTERS OR PLOTTERS.
- ANY PC CAN ACCESS ANY PRINTER OR PLOTTER.

User-configurable for future requirements

The MULTIBUFFER can be factory- or user-configured with 1-7 plug-in interface cards for up to 7 parallel ports or 14 serial ports, or a combination of parallel and serial. Each serial card provides **two** data ports. Data direction (input/output) of each port is selectable and all common baud rates and handshakes are supported.



All users can send data simultaneously

Each port is separately buffered, allowing simultaneous data flow on all input and output ports. Installed ports can be used for any combination of PCs, printers and plotters.

Up to FOUR MEGABYTES buffer memory

With advanced high-speed algorithms, buffer memory is automatically allocated and deallocated to each user in real time from a common 'pool' of up to 4MB. A limit can be set on maximum memory per user.

Simple but powerful menu-driven set-up

All user-configurable features of the MULTIBUFFER are accessed via a user-friendly menu-driven program running on a PC. No fiddly switches are used. Also, when the MULTIBUFFER is driven from several PCs, each PC user can activate a RAM-resident pop-down menu for printer selection and other useful functions. Setups can be stored in non-volatile memory.

Highest-ever data throughput

State-of the art high speed 16-bit CMOS technology allows up to 13 input ports to receive data simultaneously at a full 9600 baud without slowing-down the PCs – much faster than other printer sharers. Data rates up to 38400 baud (serial) and 30000 bytes/sec (parallel) are possible – ideal for laser printers and DTP systems such as Ventura or Pagemaker. The MULTIBUFFER can often eliminate a much more costly printer-sharing network.

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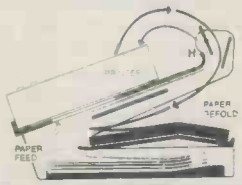

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Centronics GLP	3.65	3.45	3.15
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MX/FX/RX 80 FX 800	3.35	3.20	3.05
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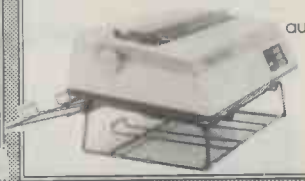

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Amstrad's chip caught speeding

A friend of mine already has an Amstrad Portable Personal Computer PPC640, complete with disks and modem — and complains that it runs too fast.

Other people will be experiencing this 'problem' soon — the next shipments were due to start floating into Britain around mid-March.

The explanation is that these too-fast systems almost certainly have a chip inside them which is not the 8086 chip originally advertised. It isn't even the low-power 80C86 chip you would normally expect to find, instead, on a battery-powered portable.

The number of the chip is V30, and the manufacturer is NEC. The chip is very nearly identical to the 8086, except for the fact that it is faster, and that it runs cooler and uses less power, and that it also runs Z80 code if you ask it nicely.

My friends inside Amstrad assure me that almost all PPCs will have this chip inside, but that it isn't guaranteed, because — who knows? — the 80C86 may at some stage become cheaper.

Well, possibly, possibly. What I hear in the background, however, is not the murmur of learned technical debate and the heated market horse-trading of dealers in chip futures, but the unmistakable bellow of Alan Sugar, head of Amstrad, backing a horse both ways.

The single most important thing about the NEC V20 and V30 chips is not the fact that they totally imitate (or nearly) the 8088 and 8086 chips from Intel. It is the fact that Intel thinks that the imitation is illegal, and is suing NEC for millions and millions of dollars.

My own bet: a week after NEC wins the lawsuit, Amstrad announces that it has 'standardised' on the V30.

Alternatively, a week after Intel wins an injunction against NEC, Amstrad announces that it has plentiful supplies of 80C86 chips and is a valued customer of Intel.

Or that it has done a deal to pay a certain sum of money in royalties to Intel, and will switch over to the 80C86 as soon as stocks of the V30 finally run out.

Friends report that they have put the V30 into the Amstrad 1640, and it works fine. There is one test I still have to do before I confirm this: I have to get a PPC640 and try running Microsoft Word. I do know that when I substituted a V20 for the 8088 in my old Zenith, it wouldn't run Word 3.0. But I must admit, it's an esoteric sort of test. I wouldn't lose sleep over the thought of a machine refusing to run that today.

Designer Stubble cleans up the print

Designer Stubble is the excellent name for a piece of software which can teach you how to do desktop publishing on an Amstrad PCW. The word 'Stubble' derives from the fact that the thing prints out on the standard grotty matrix printer that comes with the machine.

John Evans of Bath produced Designer Stubble 'as an attempt to turn back the tide of badly designed rubbish which is now flooding out of desktop publishing systems — and also to demonstrate that people don't need to spend a fortune to produce a modest publication on a computer.'

With a PCW machine, Desktop Publisher software and Evans's Guide, the total bill comes to £346, he observes. 'Compare that with the cost of a couple of toner cartridges for a laser printer.'

It's true that, in DTP, the technology no longer lags: the skills do. People are producing 'magazines' which look exactly as if a beginner has been let loose inside a print shop — there are even serious awards given for rotten DTP design.

The Designer Stubble disks cover five main subject headings including a survey of established professional publishing techniques (like how to launch a title!), basic typesetting conventions, a guide to the program features of DTP, and practical advice on newsletter design and production.

Evans makes no claims that the learning process will be easy — he insists that just to work through his disks will take 'several hours'. But he does make it sound worth trying.

At a price of £17 for two A-format disks or £13.50 for one B-format disk for the PCW, it has to come highly recommended.

Details from 20 Grosvenor Place, London Road, Bath, or on (0225) 315131.

This NEC laptop was available for nearly a year in America before it was released in the UK, by which time its unlit screen was looking tatty next to the Zenith 181. Now the Amstrad PPC has arrived, making it look expensive, so NEC has cut the price to 'only' £1000 plus VAT — more than twice the Amstrad price, and no modem included.

The announcement of this price cut (from £1600 plus VAT) refers to the company's intention to 'maintain this position in the portable marketplace' — what position? 'When first launched, the MultiSpeed was the most competitively priced product on the market, £400 below its closest rival.' Well, one of us doesn't know what's going on. I'm starting to think it must be NEC.

Clock shock

I'm a little shocked at the claims made by Applied Microsystems Technology, which says (quite incorrectly) that it is shipping a 32MHz PC based on the 80386 chip.

The speed of the clock which drives a processor chip is related to the amount of work you get it to do, in exactly the same way that the speed of a car is related to its engine revs.

The clock in the AMT system runs at 20MHz or 25MHz, depending on model number. If the company put standard 150-nanosecond memory chips in the system, the 25MHz machine would have to slow down amazingly to wait for the data to emerge from the chips. Instead, AMT put 80-nanosecond memory chips in, so it isn't slowed down.

But to claim that this makes it 'equivalent to' a 32MHz clock speed is simple nonsense. You might as well say that most cars in London never use top gear, therefore a car with five gears doing 30mph is 'equivalent to' a four-gear car doing 40mph.

The AMT machine does have ultra-fast memory, so it may be faster than most, or it may not be. How about an independent test?

Any computer expert will tell you that there's no easy or foolproof way to test the absolute speed of a machine. However, there are tests which can be run.

The *PCW* Index tests are far from fault-free, but they are widely used. AMT chose not to run those. Review machines aren't available yet, so nobody else can challenge AMT's own 'tests' which show '32MHz performance'.

There's no such thing as '32MHz performance'. Anybody who can make a claim of this sort is either a fool or a rogue. If they then fail to run a recognised test to back it up, they must be warned that some people will doubt their honesty,

So far, the company's only response to this kind of criticism has been to say that it didn't *really* claim 32MHz speed. Since I very clearly remember someone at the company saying that they *did* have 32MHz, I interpret this as the sound of back-pedalling.

And since AMT, in its press announcement, refers to the 'complementary chips' that support the CPU, at least the evidence so far suggests they aren't rogues. But more evidence is needed — and fast. Faster than 32MHz.

The Wizards of Transputerdom

The first 50 Atari Abaq machines have been built — complete with ultra-fast Inmos Transputer chips — and several are already in the hands of developers writing software.

Initial response of these wizards to the new Helios operating system is sufficiently confused to make it seem likely that some months will go by before we see any interesting applications.

In the mean time, other Transputer suppliers are moving prices down in anticipation.

The pioneer of Transputerdom on the Atari ST is Tim Moore of Kuma. His K-Max development system is down to £700 plus VAT, roughly half of what it cost when first launched.

Inmos itself has announced a new board family called Trams (Transputer Modules) — the idea looking strangley similar to Leon Heller's design, with a low-cost motherboard, into which you plug modules.

The Transputer really is catching on. I took a day out of the schedule to visit the Micro Development Systems show at Wembley, where normally you can get to play with strange machines that will never grace an office — machines with control interfaces for machinery, machines with VME bus or STE bus or Futurebus connections, and operating systems like OS/9.

Amidst the normal crowd of 68000 and 32032 and Z80-based systems (oh, and 8086 as well!) the common factor was Transputer development systems.

Cambridge Risc Machines was showing a system running Helios, with a PC (Amstrad-built) as the keyboard, disk and screen interface. They said Helios was still 'more flaky than usable' but better than nothing.

There was the enormously powerful 32-transputer module for the Sun — built by Niche Technology. A four-player flight simulator was being demonstrated on 64 Transputers (gross waste of processing power!) on Rapid Recall's exhibit. And a new company — 3L of Livingston — was offering an alternative 'C' language compiler for parallel systems, parallel C.

GUY KEWNEY

Newsprint Index

No Miracle cure for errors

If the modem 'Maximiser' is a miracle, the time is overdue for the end of the age of miracles. The device looks like a Miracle Technology modem, and is in fact a device to prevent the standard Miracle from transmitting errors.

The only possible reason I can think of for buying a pair at £324 each would be to do encrypted data.

Testing it, I found it to be a pig, with literally the worst documentation ever on a modem-style device. It sends data either in X-modem format or in a private own-technology MPAD error correction standard. Originally it was meant to do Epad, a Prestel-style error detection system which has now been all but abandoned even by Prestel — but it seems not to do this.

Miracle's new managing director made no attempt to pull the wool over my eyes about it, when I asked why it didn't include the *de facto* Microcom Network Protocol error correction standard: 'It was started so long ago that we didn't know about MNP,' he said.

He also made it clear that Miracle would be producing a real system in the near future — sources tell me that a deal is being negotiated with US Robotics. That, I suspect, will be a stopgap product while Miracle's technical staff are prodded into the year 1988.

For those who are still interested because of the taste of the word 'encryption' the Maximiser sets between computer and modem, and converts the data that the modem will send. With the encryption chip added, it converts it into something that nobody else, bugging the line could decypher without very substantial resources indeed.

In that market, it's pretty well unique, which makes it worth a mention — but for anybody just fed up with errors, forget it.

If it were easy to use, in my opinion it would still be a waste of effort.

The Modem Maximiser from Miracle Technology is claimed to prevent the standard Miracle from transmitting errors

Desklink removes the strain

When a new Tandy 80386 PC compatible arrived in the office, I decided it was perhaps time to upgrade from my old 80286 machine.

After opening the 80386 packaging and finding the machine only had a 1.44Mbyte 3½in floppy drive, I decided the aggravation of copying all my data from one format to another wasn't worth it. Fortunately, at this point a copy of Desklink arrived and I realised that perhaps it wouldn't be so hard after all.

Desklink is the latest product from the US software house Traveling Software and is really an upgrade of its laptop computer file transfer program, Lap-Link.

Within half an hour I had the 80286 machine working as file server for the 80386 machine and suddenly MS-DOS had three new virtual drives E, F and G, which were physically A, B and C on the file server. Then with some judicious use of the DOS XCOPY command my 80386 had its full complement of software and only a single 3½ inch disk used — the one Desklink arrived on.

Desklink actually works through the RS 232 port of both machines and achieves a bit transfer rate of 115,200 baud. The server software is simple to use and allows the sharing of printers and disk drives on either machine.

The machines can be up to 30 metres apart and support a chat mode, so both users can interactively communicate. The package comes with 3½in and 5¼in disks and the necessary RS 232 transfer cable. Also included is a free copy of Lap-Link. Desklink is distributed in the UK by Tempest computers on 021 233 3100.

Taking a bite of the big Apple

The good news may be — only may be — that Apple is, at last, starting to fight its prices down in the UK. Just in time too — because enterprising renegades like Aidan Powlesland are starting to fight back.

Aidan Powlesland is not, nor does he pretend to be, a genuine approved Apple Mac dealer. His company — Historic Engineering — is a source of cut-price machines, Mac II or Mac SE.

He gets the cheapo Macs by the simple expedient of getting a friend in New York to go into a store there, and buy the machine you want. The difference in price between the US and the UK does the rest.

The figures aren't as clear-cut as I'd like them to be, and not only because Apple did just reduce its UK prices. Different disks, different monitors make exact comparisons misleading.

However, at the time the first Historic Mac was advertised, the dollar price in US — discounted at normal levels to a customer going in off the street — was $5300 for a Mac II. That's £3000, roughly. Powlesland was able to sell this for £4376, and a comparable machine — hard disk, monitor, etc — would have cost £5635 from an authorised UK dealer.

This fact has caused a highly secret punch-up between Apple and one of the magazines specialising in the Mac, because Powlesland was advertising this deal — and the UK official dealers complained that they were not pleased at seeing some fly-by-night operator undercutting them.

Pressure from Apple followed, and Powlesland was informed that his advertising was no longer acceptable.

On the face of things, Apple needs a good excuse — and the one it offers is: 'We have to have a European facility (factory) and it doesn't sell in the same volume as the American one in Fremont, California. Also, each machine we make is for a smaller market — we make a few Arabic Macs, and a few Swedish Macs, and so on.'

This is, of course, pure rabbit pucky. If Apple UK can't separate cause from effect, I can. The reason the Cork, Eire 'facility' makes so few machines is simple — they are overpriced.

The company didn't offer an excuse for pressuring the magazine. Loftily, an executive informed me that the question was 'confidential' between Apple and its dealers, and Apple and the magazine.

However, contacts on the staff of the magazine concerned have explained why they didn't fight the pressure: 'On a point of editorial independence, it would be worth standing up to Apple', said one staff member, 'but not on behalf of somebody who takes the money and imports a single machine with no intention of supporting it. If it was MBS, shipping over a thousand Mac IIs and buying them at trade discounts, then we might take a different view — because they would be a legitimate trader.' I'll actually buy a bit of that.

But the good news does seem to be that gradually, carefully, and with due attention to the needs of keeping the boat stable, leaving the muck unstirred and not waking the sleeping dog, Apple is working to bring Macintosh prices down.

The latest round of prices look enormous when you say 10% (which they are) — less impressive, though, when you realise that a 40% cut would still leave an awful lot of fat on the joint.

As an example, a perfectly ordinary tape drive, capable of backing up 40Mbytes of data, sells for £1200. In the PC market, an equivalent product sells for £300.

So there's a long way to go — but I do, honestly, get the feeling that the new management has started on the journey.

Until computers are the size and weight of a Filofax wallet (or imitation) the dream of keeping all your appointments and phone numbers in electronic form remains just a dream. But Kempston is not the first company to realise that the two can be married (electronics and Filofax) to make life easier to organise.

The Kempston product, Datafax, costs £39.95 for the low-cost Amstrad PCW word processor. With a 'binder' and some special-purpose pre-perforated paper for the PCW printer, the price goes up to £49.95 (including VAT).

The classic program for printing out your personal diary in Filofax format is Portex. I have just spent a couple of weeks trying to learn to live with this method of becoming efficient, and am searching for alternatives.

The only two sensible alternatives I've met are Time Manager on the Macintosh (now old, out of date, and still not cleaned up from its bugs) and Prime Time.

At the end of the tests, I have to admit that, although Portex fails to meet any of my pre-determined check points for what a computer-based organiser should do, I'd still recommend it. That's because it does meet just one: it can print perfectly on both sides of Filofax paper.

Prime Time meets all the others. It is RAM-resident in my PC, so I can get at it for any phone call. It allows me to switch instantly from diary to phone book to calendar, and it is really intuitive. The only thing it doesn't do is print on both sides of Filofax paper.

This turns out to be the crucial factor.

I honestly hated Portex. In order to use it, you need a machine with no other application running. You load Portex, and you then are faced with a screen and no menu. Before you can load your diary, you have to press the right function key (no help until you hit the help key!) and select the right diary file. Same for a phone book.

Portex started out purely as a little print utility. It took an address list, and worked out where the page breaks should go on double-sided Filofax paper. All the rest has been bolted on to the top, producing a structure that puts me in mind of the Eiffel Tower standing on its head.

But, tedious though it is to set up and use Portex, that core ability remains the one thing that you simply can't do without. You have to have a computer work out the print format for you.

If you have 20 pages of text, you have to print page one on the left-hand side of the first computer sheet, and page two on the underneath right-hand side of the same sheet. Now, quickly: where does page ten go?

You try using block moves and column shifts on a word processor, and all you will get is grey hair. Portex just does it.

Kempston's package isn't one we got a chance to test by press time, but it is of the 'I do the printing' variety. I therefore recommend it to PCW owners whatever its other strengths and drawbacks may be, with the added comment that it is roughly a quarter of the price of Portex, so be grateful.

Full details from Kempston on (0908) 690018. Portex is from Showerings on (01) 922 8821. Time Manager is currently being re-written for the PC (and I hope, being corrected for the Macintosh) and we'll let you have details as soon as possible.

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Getting to know the Amiga DOS manual

This month's informed comment: the Amiga 2000 is a nice pig. Taking their corporate courage by the scruff of the neck, the folks at Commodore finally decided that the Amiga 2000 was in solid enough shape to risk letting me have one to play with.

At the end of a couple of months living with the beast, I can't honestly think of anything to say that would prevent anybody buying one. But I can think of an awful lot of warnings.

First, you will definitely need the manual. No, strangely enough, you don't get the manual with the machine. You get a slim volume called a user guide, which frankly you can do without. If you aren't clever enough to work out what to do with an Amiga just by plugging in the Workbench (startup) disk when it says 'please put the Workbench disk in' then you won't be bright enough to understand this 'extract from' the AmigaDOS manual.

But without the full manual, you're virtually stuck. You need it, for example, if you have a hard disk and want to persuade the machine to look on the hard disk for ordinary AmigaDOS commands.

Take a simple command like "dir" to find the directory of files on a disk: before the Amiga can do this, it has to look in a special directory to find out what the "dir" command is.

That directory is on the floppy 'workbench' disk. What that means is awesome: every time you try to use a command, like copy, or makedir, or run, or execute, or rename, or delete, or type, or list — and several other essential instructions — you have to have the 'Workbench' disk in the floppy drive.

This is a poor idea, even allowing for the fact that the Amiga has one of the slowest floppy disks I know. You end up with 'Macintosh elbow' from putting new disks in and out of the drive.

Oh, of course you can change this! But not without the manual.

And as for persuading the machine to change this itself, by writing your own startup sequence, well, you really need to be a programmer. The AmigaDOS manual explains how, and you will get there in a couple of weeks.

And the AmigaDOS manual is sold separately, published by Bantam Amiga Library and usually costing around £23. Clever, eh?

You will also need the Gold Fish disks.

The Fish disks cover an enormous amount of free, public domain, and shareware software, much of which is a torment to understand and use. The Gold disks contain the essential extra programs that you can't use an Amiga without.

To get them, you join the Commodore user group, ICPUG, which will solve several of the other problems you will have. For example, you can download 'shareware programs' from bulletin boards. But they will arrive on your system with an extra few bytes on the end, because the Xmodem protocol downloads blocks of 128k.

Try to run a file which is longer than it ought to be, and the Amiga will inform you that this 'is not an object file.' You need a shareware program, called fixobj, to chop off the extra bytes.

There are other surprises. For example, for somebody accustomed to the Atari ST or the Mac, it seems obvious that if you have a file on the disk, you can point to it with the mouse.

Not on the Amiga. A file can be there, but it will only have an icon if you know how to make one. Without an icon, there's nothing to point to — not even the silly list of filenames that Microsoft Windows gives you. I'm told that one of the Fish disks has a program that will make icons . . . haven't found it yet.

Now, what is nice about the Amiga 2000 is the fact that it has a multi-tasking operating system. You really can run two tasks at the same time.

And one of these can be a straightforward IBM PC-DOS task, because Commodore does sell the Bridge board — a complete PC clone on a card — which fits inside the Amiga.

With the bridge board, you get only an ordinary 8088 chip running at 4.77MHz. That's very, very slow — slower than an Apple II. As a way of giving somebody a PC, it stinks.

However, I don't use it as a PC. I use it as a way of getting PC information into the Amiga (and back). Also, quite importantly, it can be a way of plugging cheap IBM accessories into your Amiga.

I have a Tandon Businesscard disk drive — 20Mbytes on a PC expansion card. Inside the Amiga, 10Mbytes of that are formatted as a PC drive, the other ten as an Amiga drive. I couldn't help noticing that it took ten times longer to format the Amiga portion than the PC bit, but that's by the way.

The idea is pretty good. It would be even better if the engineers who designed the internal PC card had found a way of leaving it free to use the bottom couple of hundred interrupts, so that you could plug more accessories into the system.

For example, it's impossible to run Transputer chips that work quite happily in a normal PC bus system. And other programs behave oddly at times.

The Amiga's main reputation is a games machine. As a games machine, the 2000 suffers by comparison with the cheaper 500 model.

For a start, the 2000 is a business machine, and tends to come with 3Mbytes of RAM. Wonderful, but when you run many games, you have to turn this off, because the games must talk to the bottom half on megabyte — the area which those super-chip video and sound controllers can access.

Some programs won't stand for that, because (for copy protection reasons) they won't let you run the program that turns off fast memory. You have to put the game disk in the drive and turn the machine on. Crash!

There are other differences between the 2000 and the 500, which have resulted in frustrating calls to software suppliers. 'Why won't *Time Bandit* read the keyboard?' I asked Microdeal. 'Are you using a model 2000?' came the reply.

They're working on it. So are many others.

The claim that 'there's no good business software for the Amiga' won't stand up. There is lots.

I can recommend Word Perfect as a word processor (after serious misgivings over initial delays) and Diga! from Precision Software in this country, is a good comms package

But still, after all this time, I have to say I do worry about Commodore itself.

What is it doing for money? Can it really afford to sponsor Chelsea football club? What is it doing about a successor to the Amiga? What about a truly high-resolution screen driver for the current model? Will the company really be around in a year's time?

I suppose we ought to be more optimistic. After all, it's already a couple of years since I felt sure the company would die inside six months. Maybe it can carry on working the same survival trick. I hope so.

This AMS Microscan is rather more generally useful for getting pictures into a computer than the trick of mounting a scan head on a priner — and is equally low-priced at around £250 plus VAT. Don't be too scornful of its 'only 200' dots per inch resolution, because anybody doing desktop typesetting with dot matrix printer output will be working at that resolution. So, by the way, will facsimile machines. AMS says this is meant to work with its Finesse DTP package, but software will be available for GEM (so that Ventura users can use the images) and Microsoft Windows (which will make them accessible to PageMaker.

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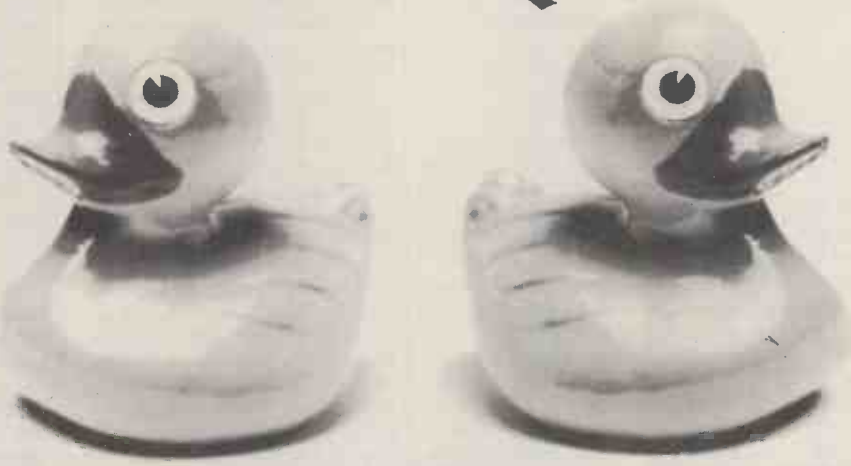

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Lawsuits the Avant-Garde way

The ability to run IBM PC programs on an Atari ST is what attracted buyers to pc-ditto, not the prospect of being caught up in a nasty lawsuit. But the lawsuit is what looms today.

The dispute is between Avant-Garde Systems of Jacksonville, Florida, and several UK importers of the product, and it isn't simple.

There are now at least three versions of pc-ditto.

The first version worked on US models of the Atari ST, and fell short of perfection in two ways. It didn't work properly on European versions; it didn't understand the ST's monochrome display

In the UK, a company called Robtek began selling pc-ditto in a version that would talk to the ST's mono screen. This was called version 2.03, and exactly where it came from remains a mystery. Robtek says it came from Avant-Garde. Avant-Garde says it didn't. Either way, we tested it here at *PCW* and found it didn't work properly — it was a lot worse with a lot of software, but it did run on a mono screen.

There is now a version 3.0 which comes in two flavours, American and European. Why, I hesitate to say for certain. I suspect that Avant-Garde could well have made a single version, but chose not to because it very much wanted to prevent Robtek from selling it.

Here we start getting into the stuff of the lawsuit. Avant-Garde has written to UK journalists, pointing out that version 2.03 is not an official, nor a reliable, product, and that Robtek is not entitled to sell it.

Words are not minced in the letter I received from Avant-Garde's founder, William Teal. He describes the Robtek version as 'a pirate version, distributed illegally.'

Robtek claims that it has a licence to sell pc-ditto, and that Avant-Garde's letter is 'an attempt to cash in on our success with the product, and the advertising we have invested in building up the market.' It has agreed to stop selling pc-ditto pending the lawsuit — but all other Avant-Garde claims are 'not true'.

This goes further than I can swallow.

The question of whether or not Robtek was officially licensed by Avant-Garde is one which the court will have to decide.

The question of where version 2.03 came from may never be answered — it's quite conceivable that a programmer in Avant-Garde did send a doctored version for someone at Robtek to try out, without official sanction from Bill Teal.

I spoke with a senior executive at Robtek who 'unofficially' explained that company's point of view in some detail.

I pointed out that a simple equally unofficial glance at the contract he swears they have with Avant-Garde would settle the matter very quickly. He refused.

Bill Teal is very clear on what happened: he was negotiating with Robtek to give the company a licence to produce pc-ditto, and the only document that changed hands was a long and detailed letter of intent.

'That letter states very clearly that only the exchange of written contracts would make it valid,' he said. 'Robtek is claiming that we phoned up and told them it was OK, go ahead, and that simply isn't possible under the terms of that letter. And even if it were possible, that isn't the way we do business.'

It certainly isn't the way he does business. He was also involved in negotiations with John Symes of Microdeal, who speaks with awe of protracted phone conversations with Teal, who was expounding the need for care in drawing up contracts. 'He'd talk for fifteen minutes at a time on the phrasing of one paragraph, in an imaginary document,' said Symes.

Teal says he broke off negotiations because he simply doesn't trust Robtek, and one part of the reason is that his is not the only software on the Robtek disk. 'It contains a directory with programs from another US company which they have no licence to distribute,' said Teal. 'I've been in touch with this company and they've never even heard of Robtek, much less given them a licence.'

Robtek directors Paul Share and his partner Robert Zysblat have made other enemies. Dieter Eckhardt of Golden Games in Germany accuses them of failing to pay anything for a game called Hollywood Poker which he developed, and of failing to pay programmers who work for a new company, Diamond Games, which was meant to be a joint venture.

He too is currently engaged in action against Robtek in the UK courts.

The name of Paul Share is not one to quote if you wish to gain entry into high places in Apple either.

Apple's grudge against him involves his distribution of Magic Sac, an emulator of the Macintosh for Atari ST users.

The only 'illegal' part of selling Magic Sac (in Apple's eyes) is the fact that you have to have the Macintosh ROMs to run it. Robtek didn't offer to sell us Mac ROMs with our copy, but it did give us a phone number of an unnamed associate who could.

Avant-Garde has also set its lawyers against two other UK software publishers — John Symes at Michtron/Microdeal is one, and Bill Browning at Eidersoft is another.

Browning believes that Teal has spoiled the market for pc-ditto by his insistence on launching two versions — one for US and one for Euoropean machines — and attempting to restrict imports of the US version to the UK.

I'm inclined to agree.

I'm also inclined to think that Avant-Garde has not a leg to stand on, in its insistence that it can prevent Michtron from distributing the US version 2.0 in this country. And the lawyers, unofficially, seemed receptive to the suggestion that there was no point in trying to prevent this — all they were concerned with was to eliminate the pirate version, 2.03.

The product remains useful to ST owners:

You can take an IBM PC disk with Lotus data on it and actually run Lotus (slowly) to extract information and print it out, or display it.

You can take a WordStar text file and use a PC conversion utility (there are plenty of those to turn it into an editable form for the ST. All for under $60.)

Users who want the European version 3.0 which works on both colour and monochrome Atari ST models can buy it direct from Avant-Garde in the US. Version 2.03 (which Robtek told me has not caused one single complaint from customers) definitely should be avoided as faulty, according to our tests in this office.

Avant-Garde is at 381 Pablo Point Drive, Jacksonville, Florida 32225, on (904) 2212904.

Sophos' Vaccine cure for killer virus

A data virus is a program which poisons your own programs, and spreads itself throughout your system. One has been discovered which was benign — on a certain date, it printed a message of peace and love and destroyed itself. Most, however, are designed maliciously, simply to destroy the data on somebody's computer.

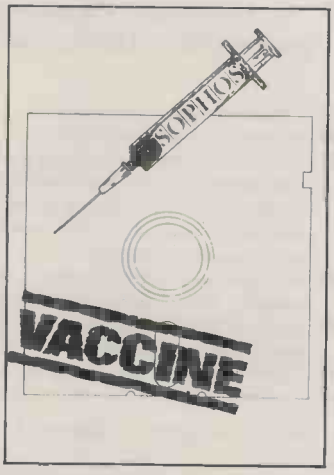
Sophos reckons it has found a cure. It calls its product Vaccine. Naturally, in fact, it's more of a leprosy vigilance campaign.

It runs on a system known to be clean, and notices the 'fingerprints' of data and programs. If they change subsequently, you get a warning.

At £195 plus VAT, you have to be sure you need it and I suppose most people will doubt it. Theoretically, you can guard against it by doing backups. But you have to keep them all, because the typical 'virus' program does nothing at first, and only starts misbehaving when it has been on your disk so long that it has infested all the backups too.

I had a strange insight into the mind behind this sort of program recently on CIX, where a lunatic praised the people who produced them as 'discouraging software piracy.' His idea was that if it became unsafe to copy programs for fear they were infected, people would only use software they had bought in a store, with the cellophane wrapper still on.

Sophos is in Oxford on (0865) 853668.



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Apple comes of age with Claris

Time was when Apple, like a little boy with a bullying father, was far too scared of the consequences to dream of challenging Microsoft in the software business. You may recall that when Apple launched the Mac, it quoted Microsoft (with Software Publishing and with Lotus) as the software house which would make some enormous part of its revenues from this new machine. And it has depended on Microsoft in many ways since — the spreadsheet, Excel, for example, sold thousands of Macs into the business community.

But Apple is a big boy now, and dream it can, with the launch of a new software brand name — Claris. This is a new 'independent subsidiary' of Apple, a software publishing company.

The software itself isn't that new. Claris has rights to all the old Macintosh favourites, and a few old Apple II favouries. For example, it can sell MacWrite and MacDraw. Two new titles are the obviously mega products, SmartForm Designer and SmartForm Manager.

First challenge to Microsoft went the way you might expect. Microsoft's biggest (only) distributor of Mac products in the UK is P&P Micro. Claris had the brilliant idea of sponsoring P&P to start up a new Macintosh divison which would eventually become Claris UK. A brilliant idea, until it reached Microsoft.

Splat! Blood all over the little tyke's nose, and an official statement from P&P that it wouldn't distribute Claris products.

I'll offer my opinion, that it's a little short-sighted of Microsoft to try this way of preventing Claris from succeeding. For a start, it's annoyed P&P; it's given another distributor the chance to run with the Claris label, it's annoyed Apple and — perhaps a trivial point, really — it won't work.

Microsoft UK has a new boss, who is (my sources say) examining every aspect of how the UK subsidiary is run. I hope *this* wasn't his idea.

● Despite the laid-back Californian lilt to their voice, these Claris chaps are pure bureaucrats at heart. The SmartForm products form part of Claris and Apple's strategy to link into the mainframe and mini world. 'We grow up filling forms, so we're all familiar with them' is their theory. So when you want to access a mainframe database from your Mac-based terminal, you just fill in a form. When the Government decides to privatise the DHSS, don't be surprised to find Claris at the front of the queue.

Claris also wants to develop the idea of software slots. Just as you can plug in peripherals to hardware, they want to encourage developers to produce add-ins to their products in a fashion similar to products such as What's Best for Lotus 1-2-3. An example is an add-in for an architectural application based on MacDraw. You just point at the various objects, specify what they are made from and, hey presto! — a bill of materials.

Plug into a Dell

Dell has followed up its launch of the new model 200 (an IBM clone with an 80286 chip reviewed last month) with the launch of an equally new model 300.

It is barely different from the previous 386-based machine, judging by the specs — but it is cheaper by some £400.

The machine is sold as 'ideal for OS/2' — the new IBM attempt at setting an operating system standard. By 'ideal' they mean OS/2 will use lots of memory.

Since you can plug 4½Mbytes worth of memory chips into the main 32bit system board, that makes it fast, because you don't have to use the 16bit system bus which you would use with plug-in memory boards.

I had lunch with Michael Dell just before the last issue of *PCW* hit the streets, and so I missed his reaction to last month's review.

In our review, my colleague Peter Jackson remarked that the machine was 'nothing special, but good value' — which obviously fell short of what the company was hoping for.

I don't know why — you'd have to go a long way to get more praise out of my colleague, especially for a PC clone.

For those who read the review, and took it the same way the Dell people did, consider the strengths of Dell.

They are simple, reliable machines that imitate the IBM range, look expensive, and aren't.

After some six months of playing with the 12MHz 286 model (essentially the same beast that Peter Jackson reviewed) I have to say that it was a real pleasure to have such a well-behaved animal in the office, after some of the too-clever clones I've played with.

This is an occupational hazard of testing a wide range of hardware. All too often I find I'm testing a memory card, or a mouse, or some special disk software — and it crashes. It doesn't crash because the thing I'm testing is faulty, but because the machine I am playing with is somehow 'improved' on the original IBM spec.

When I get a piece of add-in hardware these days, it's the Dell I plug it into — because it will work there. So far, when I have had a new piece of software and it misbehaves in the Dell, it's always turned out to be the software at fault.

The same was true when I tested Windows 386 and Dell lent me a 386 machine for the purpose. On many 386 machines, it just doesn't run — but on this machine, it worked.

Rave reviews are never going to be printed by serious journalists, not about a workhorse machine like this. Journalists like exciting, new, innovative hardware — not a JACK — Just Another Clone, Kids — of all trades.

Users, however, probably do want Just Another Clone, Kids — with perhaps a faster clock, and a good screen, and a big disk, and at a nice price, and no problems. They don't want to find that you can't run a big Viking screen. They don't want to find out, a year later, that the hard disk controller isn't replaceable because it has a special shape. Or that the onboard serial port can't be addressed as Com 2.

At our lunch, Michael Dell did promise a block-buster announcement for April, of the sort that does interest journalists. (Do I know what? No, sorry — no idea!)

But more impressively, he also reported that the first nine months of Dell in the UK have been outrageously successful, with 10% of the company's annual revenue coming from outside America — which means here.

This news has come as a serious shock to most other computer builders. Why not? — it came as a shock to Dell himself. When he first came over last summer, I warned him that his 'revolutionary' concept of computers-through-the-mail might be slow to take off, and that he could expect to make a thumping loss for the first nine months or so.

No marks for prescience for me! But he agreed with me at the time, so he doesn't score high, either.

But the success isn't hard to explain. What most corporate buyers want when they buy IBM is solid, reliable hardware which won't embarrass them in a year's time when somebody asks 'whose idea was this heap of junk, anyway?'.

Dell's service backup is prompt, its phone helpline is helpful, and its hardware works. And it's good value.

So what I say is: here's to a boring life, and long may it last. Eventually, inevitably, somebody at Dell will discover I've got the thing, and come and take it away. I won't be pleased.

Have you got what it takes?

PCW is on the hunt for two new members of staff. One will be a staff writer, the other will fill a more senior post.

Both positions require someone with a broad interest in and experience of personal computer hardware and software. You should also be able to write articles and reviews which meet the exacting standards of *PCW*'s editor. Applicants for the senior post should be currently employed as a computer journalist and have a technical or business computing background.

Needless to say, you'll already be a dedicated *PCW* reader and be yearning to get your hands on the up-to-the-minute products that fill our pages. You'll also be expected to research and write features.

If you think you're up to the challenge, this is what you need to send us as your application:

1. A summary of your education and work experience.
2. A description of the computer hardware and software you own/regularly use.
3. A 1000-word review of a piece of business hardware or software in the PCW style.
4. A short critique of this issue of *PCW*.

Applications should be sent to the editor, Derek Cohen, at Personal Computer World, VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive by 14 April 1988.

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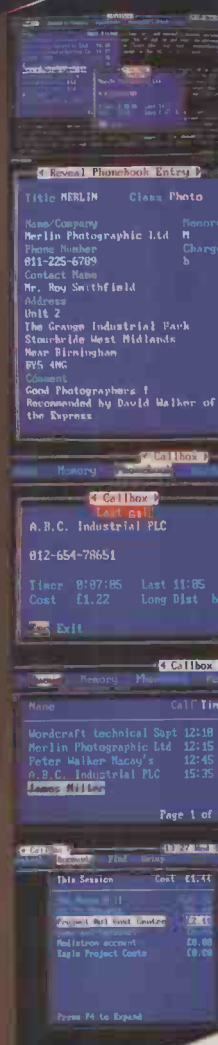

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‘Unbeatable...’

‘A considerable bargain...’

(Don’t you believe it!)

When reviewers use words like 'bargain' and 'unbeatable' about your computers, you could just rest on your laurels.

At Dell, we accept quotes like those opposite as a challenge. (They come from reviews of the 286^{12} and 386^{16} in 'Personal Computer World', July '87 and 'Which Computer', October '87.)

So we're pleased to announce that we've actually improved on the specification of the 286^{12}. Our new System 200 offers even better value in 12MHz computing.

And we're equally delighted to tell you that our 386^{16} is renamed the Dell System 300 – and is down in price. With its new VGA and 3½" drive options, it now represents yet more value in speed and power computing.

The new System 200

The new Dell System 200 surpasses the performance of the Dell 286^{12} – and costs less.

We have taken your needs into account when designing it. We've combined the highest standards of AT architecture with the very latest technological developments to give you OS/2 compatibility, 3½" disk support, and VGA monitors. Plus it's simple and inexpensive to upgrade memory on the motherboard to 4·6MB.

Higher speeds and all-round performance make the System 200 the finest available 286 technology. Add to all that an incredibly low price and the inclusive package of direct service and support from Dell, and we've clearly beaten the 'unbeatable'.

The System 300

Innovative design allows the Dell System 300 to maximise the performance of its 16MHz 80386 microprocessor. So if your applications require both power and speed this is the machine for you.

It will actually deliver advanced computing power more usually associated with minicomputers. And because thousands of American users have found this to be the case, we've been able to reduce its price by £400 in this country. Making it an even more cost-effective alternative to the mini ... and a yet more 'considerable bargain'.

How a direct relationship benefits you

These changes reflect Dell's philosophy of dealing direct ... to give you precisely the computer you need for a price you want to pay. Our machines are designed and built in Texas and configured for your needs in the UK.

And as the manufacturer we're proud to accept responsibility for them. We cut out the middleman and his margin – so bringing prices down – but we also provide better support than a dealer could.

When you buy Dell you not only get fast, powerful and compatible pc's but you get as much technical support as you want. And it won't cost you a penny.

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Our direct approach has proved popular with the end user. After just three years, we are one of the seven largest manufacturers in the USA. In less than a year in Britain, companies of the calibre of BP Oil International are already standardising with Dell.

Order your Dell computer now

If you'd like to take advantage of an even better Dell package, get in touch today. Write to us at Dell Computer Corporation, FREEPOST (RG 1462), Bracknell, Berkshire RG12 1BR. Better still, 'phone us to discuss your computer needs in detail with our expert staff on

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Intel 80286 running at 12·5 or 6·25 MHz; 640K of RAM expandable to 16MB; 1·2MB, or 1·44MB 3·5" floppy disk drive; Floppy and hard drive controller; Enhanced 102 key keyboard; 200 watt power supply; Six expansion slots; Real-time clock; the Dell System Analyser.

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High resolution monochrome monitor; Hercules compatible Monochrome Graphics card; 2 Serial and 1 Parallel Ports.

System 200	with	20MB, 65MS hard drive	£1,299
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Dell System 300

STANDARD FEATURES
Intel 80386 running at 16MHz; One megabyte of Static RAM on the system board; 1·2MB, or 1·44MB 3.5" floppy disk drive; Floppy and hard drive controller; Enhanced 102 key keyboard; 200 watt power supply; Eight expansion slots; Real-time clock; the Dell System Analyser.

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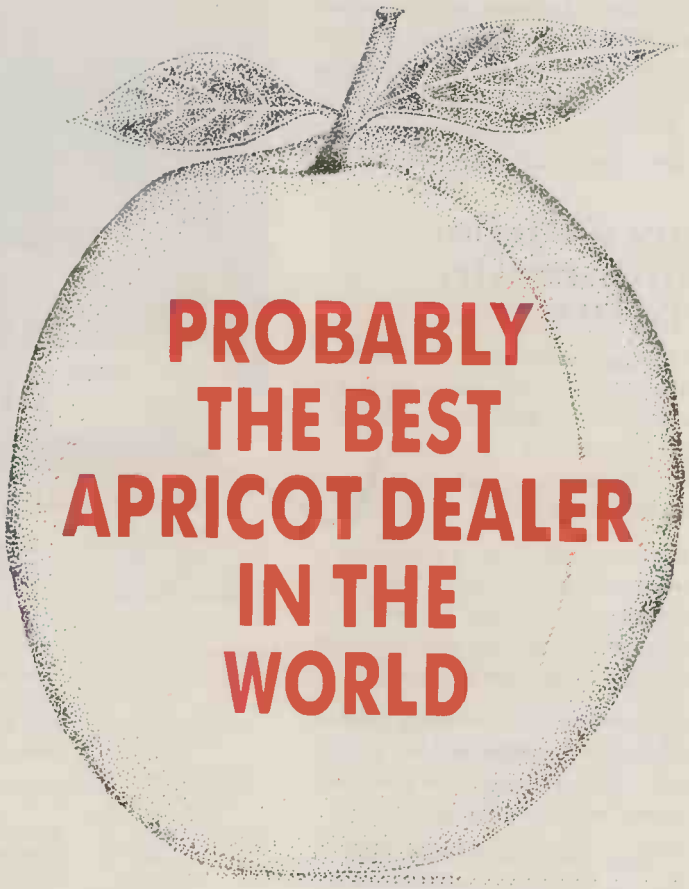
Prices do not include VAT. Microsoft is a registered trade mark. All system prices and specifications are subject to change without notice. All orders are subject to Dell's standard terms and conditions of sale which are available on request.

PCW10



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Dispelling the fog surrounding a hypertext

I have just emerged from a nightmare world where everybody else knew exactly what was going on and I alone was blundering around in a fog — with the discovery that it wasn't as bad as I thought. That's hypertext.

The fog of confusion and incomprehension was caused by the arrival of Hypercard from Apple.

It was dispelled when I re-discovered a program (for the Mac, but now available also under Windows for the PC) called Guide.

I can now explain hypertext to you in one easy sentence: but to understand it, you have to know that Hypercard is *not* hypertext.

It would, theoretically, be possible to produce a genuine hypertext package — like Guide, which is hypertext.— with Hypercard, but you'd have to be one hell of a programmer.

The problem with explaining hypertext is analogous to trying to describe a rabbit to somebody who'd never seen the countryside, by projecting the shadows of your fingers onto a wall.

The only way to examine a Hypercard stack is with the hypercard program. However, I can describe hypertext — one form of hypercard stack — by analogy.

If text is the text of a book, an outline is analogous to its list of chapter headings. But the hypertext version would be more like the index — and not the index itself, but the process of using the index.

To understand this, all you have to do is work with genuine hypertext. Then it does become clear.

The way to do this is to use Guide, from Office Workstations Ltd (OWL) of Edinburgh.

Then if you are me, you have to wait for your brain to catch up. With me, the process took two years (it came out in 1986) and during that time I learned to use outliners, and play with Hypercard — and suddenly I realised what was going on.

It would be nice to produce a Guide version of Newsprint.

A reference to Amiga, for example, would show up by changing your cursor to a different shape and you'd know that by clicking, you'd be pressing a 'reference button' which would take you to the next related point, which might be in another news item altogether. That might have similar references — and so, whatever order the text was created in, you'd read all the references to Amiga.

That is, you would if the writer had made the connections.

What is wanted of course, is some artificial intelligence. This would go through your text as you created it, and note words that matched, and words that nearly matched, and link them. Ian Ritchie head of OWL says that this is what everybody in the trade is working on.

David Tebbutt author of Brainstorm was trying for something like this when he originated that program. It fell short in two ways: first, it insisted that the linked words matched exactly, and second, it wasn't interested in 'text' only in 'headings' and it didn't really like you trying to edit it. Nonetheless, it was an important step in the development of hypertext and remains excellent value for organising thoughts.

Brainstorm by the way, is now available for £5 in demo form, upgraded and only slightly abbreviated.

David Tebbutt has been working frantically on it since he re-acquired the rights to the program from its publishers and he has evolved a new distribution method which is not quite shareware but comes close.

The main improvements of the new version are that it is now a pop-up program, it has a wide variety of fast colour options (early colour versions were very slow) and the memory allocated can be adjusted to suiit.

For anybody who has the original version, the new version costs only £15 — send the old Master disk along for upgrade. This applies only to the IBM PC family not CP/M or Apricot versions. You upgrade them to PC!

Brainstorm Software is on (08956) 77845 and at 18, Courtlands Close, Ruislip, Middlesex HA4 8AX.

Apology

We would like to draw our readers' attention to a mistake in an advertisment in the March issue of *PCW*. The correct telephone number for COMPUTER PRECISION is (01) 226 3043, and the telephone number of PRECISION SOFTWARE is (01) 330 7166. Our apologies for any inconvenience caused.

Grapevine

Walters has done a bit of price-cutting on its already low-cost micros, while launching one or two new machines in the last month or so. Surprisingly, while things like the Turbo XT portable drop by only £100 (to £550) and the LCD AT (also Portable) drops by £275 to £1025 for the biggest percentage cut is in the add-in hard disk — a 40Mbyte drive which drops £205 to £525, showing that disks were (relatively) high priced on the Walters list.

The new machines include a new 386 model, the 'Jumbo 386' at £2700 for a 2Mbyte monochrome system; and also a new AT-technology LCD portable — laptop style, illustrated here. It looks astonishingly like a ★★★★★★★★★ ? and costs £1270. Details on (0494) 32751.

Now you see it!: The reason you can't see the connecting cables in the Tech-Nel local area network is because they aren't there. The Powernet uses the mains cables to link up to 32 users together at 9600 bits per second. That is pretty slow by comparison with the megabits that most local area networks can handle, but you have to ask yourself: 'Could I really install the cabling for a genuine network in my office?' Tech-Nel can be contacted at 8 Haslemere Way, Banbury OX16 8TY or on (0295) 65781.

Timeworks Desktop Publisher, at £99 is aimed squarely at users of the Atari ST, even without laser printers. It is now upgraded to include features that users said it needed. These features as listed by Electric Distribution, which handles the product, include 'cursor tracking, plus frame size and location specification to make the package even faster and more accurate to use.'

The package will drive several varieties of laser printer, from Atari to Postscript, but I feel sure that the thing which will interest most users is the fact that the package will now run on a single drive Atari 520ST as well as the bigger 1040 and mega machines.

A 3-D computer-aided design system (for PC micros) has been launched by **SK Micro Systems** at £375 — the price alone making it worth a mention. Features listed in the announcement: said to be the first 3-D CAD system which gives shading on ordinary displays such as the EGA, with 16 colours (it would normally require 256) by using dithering techniques; able to work with IGEWS format drawings, or HP-plotter files, and working with more than 200 dot matrix printers and 80 plotters. Details on (0462) 679331.

Torch sea-change: while the Unix running world waits anxiously for X-Windows to make their machines look like a Macintosh, Cambridge survivor Torch has designed its own friendly wimp, and is now hurrying to make it a standard with serious new software. Latest is Sea-Change, an application generator. From the sound of it you can guess it generates 'C' code, and the claim is that even totally non-expert programmers can produce quite sophisticated code with it. Written by Thomson Computers, of York, this is now available on the Torch triple-X machine — details on (0223) 841000.

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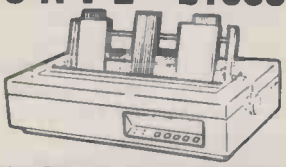

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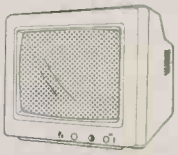

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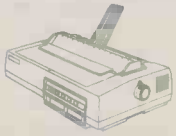

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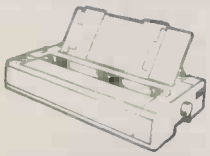

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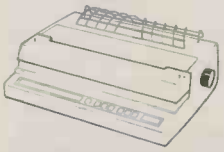

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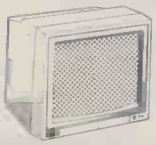

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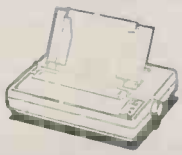

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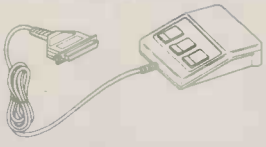

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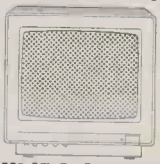

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NeXT killers line up

TIM BAJARIN

In this month's news showcase our West Coast correspondent, Tim Bajarin, looks at the NeXT generation of killer computers and analyses Apple's recent investment in Mirus.

For Atari and Commodore 1987 was a difficult year. Although Atari succeeded in making a profit, it had little success in getting the ST accepted by serious computer dealers. The company just cannot shake off its games computer image.

Atari also went through three vice presidents of marketing. This is still holding the company back, even when there seems a chance of its advancing.

Commodore also had a turbulent year: there was a major management shake-up in which the president was fired and the company started 1988 with almost totally new management.

But 1988 will be particularly important for Commodore, and perhaps even Atari. This year the personal graphics workstation will be born. And its father will be none other than Steven P Jobs, the computer visionary who has already given us two computer standards — the Apple II and the Macintosh.

His NeXT machine will be a personal computer that can also function as a graphics workstation. For lack of a better term, I call it a personal graphical workstation. Although few details are known about the machine, it does seem clear that it will be truly graphical, and will fit into an office automation environment. Consequently, this machine could set the technical standards for desktop computing for years to come, especially if it is priced $5000-$7000.

Those close to the company say this machine will be Unix-based with a custom-built windowing environment. It will be multi-tasking and have very sophisticated graphics chips, probably a subset of the Pixar chips used in the Pixar commercial graphic workstations.

But, there is an astonishing irony in this. Commodore's Amiga is a windows-based system that is multi-tasking. It also has sophisticated graphics chips. And the Amiga 2000, priced at under $2000, has already achieved its own unique position as a graphics workstation in many money-conscience firms.

The Atari machine, although less graphically sophisticated, can also claim to be part of this next generation. In fact, Silicon Valley sources say that Atari has developed a new set of graphics chips that are even more powerful than the new generation of Amiga chips. The story has it that there are four key developers who defected there from the original Amiga chip program at Commodore.

Consequently, Atari is rumoured to be releasing its own 'NeXT Killer' soon. This will be a 68030-based machine with the new graphics chips and 4Mbytes of RAM, with a 1280×960 colour monitor and an 80Mbyte hard disk for about $5000. Although this may be just vapourware like so many other things Atari has talked about, it's clear the company has its sights set on the emerging workstation market. Whatever the final specification of Steve Jobs' NeXT machine, it will have a dramatic impact on many vendors, especially Atari and Commodore. What is significant is whether or not Commodore and Atari use their new generation machines to make their presence known in the market.

Of the two, Commodore could be in the stronger position. Under Max Toy, former Compaq super salesman and most recently executive vice president of ITT's PC division, Commodore has gone out to find strong industry talent with a lot of connections.

The entire Commodore team is now filled with seasoned veterans who know the distribution channels and can manoeuvre the company to make the most of these market developments. On the other hand, Atari still has its original staff, headed by Jack Tramiel and his offspring.

And while they are also seasoned veterans, they still have to cope with the stigma of Tramiel's war with the dealers in his Commodore days.

And Commodore has made some serious strides in the business market channels, while Atari is still floundering in the consumer markets.

The answer to all your 'connection' prayers: LapLink from Traveling Software hooks laptops, Macs and PCs together

Phone wire break-through

Many offices now use two or three computers and would like an easy way of connecting them together. In the past, most people have tried to make machines communicate through sophisticated local area networks.

But now there is a system that uses ordinary telephone cables and, at very low cost, makes multiple PCs work together.

Traveling Software has introduced a product called DeskLink. It connects any two computers with ordinary RJ11 phone wires over distances of 75-100 feet and allows complete sharing of disk drives and printers.

Desklink can be installed in minutes and will transfer data at 115,000bps using a single serial port.

It can also connect 3½in and 5¼in disk drive computers together and handle the conversion to each format.

For $169 you get software and universal cables to hook any two IBM PCs or compatibles together. This is cheaper than even the low cost local networks like SageNet, LANLink and D-Link.

Traveling Software also has a product called LapLink that is designed to hook laptops and PCs together in the same way. It costs $139 and there is a version for the Mac, which allows a Mac and a PC to share files, drives, printers, and so on. Each package gives you software in both disk formats and cables that work in any configuration.

Traveling Software was originally set up to market products for the laptop computer world, but has branched out into a category it calls accessibility software. It means that multiple PCs and Macs work together quite cheaply, instead of against each other.

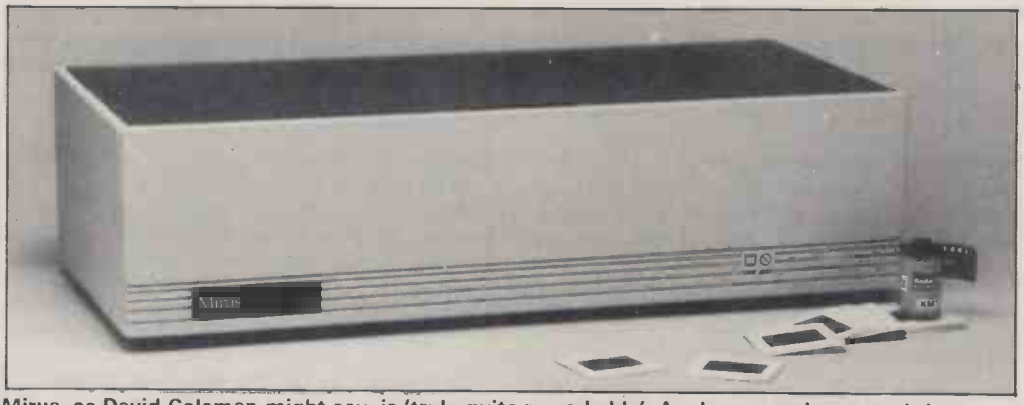
Traveling Software is at North Creek Corporate Center, 19310 North Creek Parkway, Bothell, Washington 98011 on 206 483 8088. ▶

Apple goes for presentation techniques

One of the companies in which Apple invested recently is Mirus. 'Mirus' is the Latin word for 'remarkable': the company has a digital imaging system that Apple believes is a critical part of its desktop presentation range. Computer-aided slides have come a long way. Computer-generated slide-making is still a very open market.

Polaroid's Palette video imaging system could be likened to the dot matrix printer of the normal printing world. Presentation Technologies' Imagemaker uses opto-mechanical technology and could be likened to the daisy wheel printers of our day. But the Mirus film recorder is digital imaging technology and is much more like the increasingly popular laser printers.

The heart of the Mirus system is its Precision Digital Technology. Similar digital imaging techniques can be found in larger ($15,000-$100,000) film printers typically used by 35mm slide service bureaux. The Mirus device sells for less than $6000 and is a true desktop unit. An average slide from a service bureau can cost at least $10.00 but a slide made on the Mirus machine costs an average of only 50 cents.



Mirus, as David Coleman might say, is 'truly quite remarkable'. Apple was so impressed that it invested in the company. The system offers superb digital technology for less than $6000 and it is a true desktop unit. Mirus, which actually does mean 'remarkable' in Latin, is destined to become another Silicon Valley success story

One of the main attractions of the machine is that its resolution (from 512 to 8000 lines per inch resolution) is software switchable. And 2000-line resolution is about all you need for most presentation slides.

The one drawback is speed. At 2000-line resolution, each slide can take anything from two to eight minutes to produce, depending on the complexity of the graphics. But considering you get the control and flexibility of doing it in-house, this can be well-justified. The Apple Mac version will be shipped in the second quarter, and the PC version should be close behind. Apple will go all out for desktop presentations this year, and the Mirus machine will be the equivalent of the laser printer in this strategy. Although Apple owns only 20% of this company, Mirus can't lose; it is destined to become another Silicon Valley success story.

Mirus is at 445 South San Antonio Road, Los Altos, California 94022, telephone 415 949 5544.

Drive disk

A recent magazine advertisement for Ford motor cars proclaimed that for $4.95 the company would send you a PC disk holding a simulation program.

The program contains a driving game that supposedly mirrors the driving capabilities of several 1988 model Ford, Lincoln and Mercury cars. It also contains a handy program that lets you figure out how much you'd have to pay for one of these cars if it were equipped the way you want it. You can even print out a price sticker and use a mini spreadsheet to help you find out how much your monthly payments would be.

The simulation uses animated graphics to explain basic automotive engineering concepts. These screens cover rack and pinion steering, front wheel drive, air bags and anti-locking brake systems.

Although Ford is just testing this idea and placing the ad in a few PC-related magazines, the company hopes its demos will develop into a full blown ad campaign some day.

The company behind the design of these ads is the Soft Ad Group Inc, of Sausalito, California. It has also produced disk advertisements for Chase Manhattan Bank's home banking service and is just finishing a two-disk project for Buick.

Even though the Ford disk costs $4.95, it is expected to end up on bulletin boards and be copied generously. As PCs find their way into more and more homes, this concept of disk-based advertising might really catch on. END

Live wires

Later this year, IBM and Sears will roll out their videotext online service — to be known as Prodigy. Together, Sears, IBM and CBS set up Trintex, the company behind Prodigy, although CBS pulled out late last year to concentrate on a major business reorganisation.

Although Trintex is more than two years old, it is only just getting off the ground. It spent those two years doing the background research and setting up the system — no small task. In fact, when Prodigy arrives this summer, its market will be limited and it will be perhaps late 1990 before it covers the rest of the US market.

While very similar to Britain's Prestel service, this new service will be totally consumer-orientated. The cost for accessing Prodigy will be about $10 a month with unlimited log-on time. You can use a standard PC, Mac or Apple II with 256k of memory.

Most of Trintex' actual revenues will come from the advertising that is displayed at the bottom of the screen. The service will have the traditional information such as Associated Press and USA Today wire services, as well as financial news from Dow Jones. You can also have online access to brokers Dean Witter and Donaldson, Lufkin and Jenrette for instant trading of stocks. Through the shopping feature, you can buy directly from more than 70 retailers, advertisers and direct marketers who have already signed up to use Prodigy to market their products.

An agreement with American Airlines allows the user to have direct access to its EAASY Sabbre system to book air tickets, hotels and hire cars. A unique feature called 'ask the experts' allows the user to ask questions of Jane Fonda on fitness, Sylvia Porter on finance and Howard Cosell on sports, and they will get an answer from these experts in 72 hours. A consumer reports section gives the user information on products and evaluates almost anything you could want to buy.

It will also feature educational programs and games for anyone to play, and you can even order your groceries through the system. There is an extra charge for only one service — home banking, connected to local banks all over the country.

The interface to the software is the same throughout the system, which makes it very easy to use. And you can even buy a pocket-sized 1200-baud modem for it for less than $100.

Most video text systems, particularly the one from Knight-Ridder, failed miserably, but they were much harder to use and more business-orientated. The Prodigy system has some tough hurdles ahead, but if its target market (the baby boomers with discretionary incomes) understand its true value, and see that it is actually easy to use, IBM and Sears could have a real winner on their hands.

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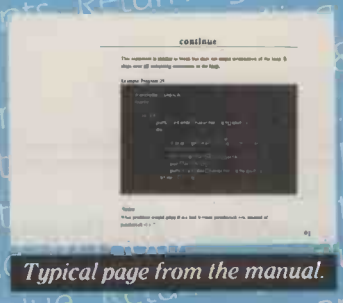

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Dreams do come true

I have just been trying out the most wonderful word processor: its central feature being a two-screen display. One is a normal VDU, while the other is an A4-size scratchpad that sits on the desk or in your lap. The text on it looks like a standard laser printout.

Attached to the scratchpad is a stylus, which you use for messing around with the text. You can delete from whole blocks down to individual characters just by striking through them and saying, 'Kill'.

You can transpose on a similar scale by putting the stylus on the appropriate spots and saying, 'Move Here'. To get synonyms you touch a word and say, 'Thesaurus'. To add text, you just say, 'Insert' and type away. You can insert individual letters or short words by handwriting them carefully in the margin of the scratchpad and touching the insertion point. And in a shared environment you can even use function keys on the scratchpad instead of voice commands.

The wonderful thing is that all these changes occur only on the scratchpad: the VDU goes on showing the original text. Only when you say, 'Paste' does it carry out a block delete of the relevant area on the VDU and a block insert of the scratchpad text. If, on the other handy you prefer a bit of your original — one sentence, say — you touch the beginning and end on the scratchpad and order, 'Restore'. The passage is deleted from the scratchpad and the corresponding original is block copied from the VDU.

'Really', I remarked to the woman who was demonstrating it to me, 'it's exactly what we all *thought* a word processor would be in our days of innocence — before we'd even seen a microcomputer and came to realise how anti-human they really are.'

I didn't hear her reply because the Teasmade went off at that point.

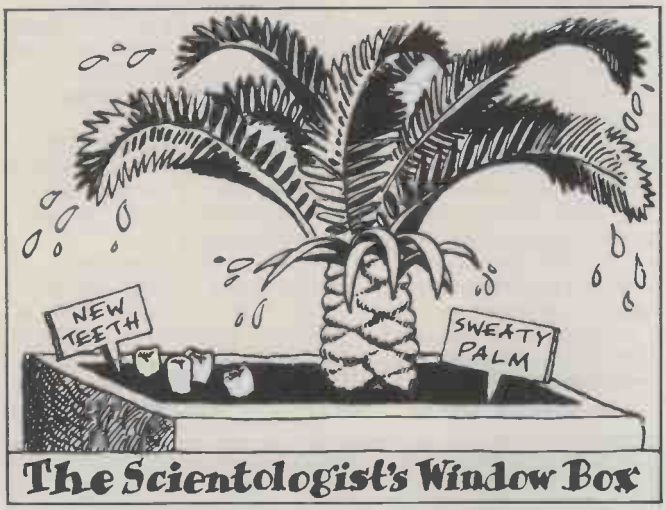
However, I know this is a dream shared by tens of thousands of non-secretarial writers.

I also know there are people out there who make fortunes by turning today's dreams into tomorrow's systems. I only hope they read *PCW*.

Malcolm Macdonald, Banagher, Co Offaly, Ireland

Send your letters to Derek Cohen, 'Letters', *Personal Computer World*, VNU House, 32-34 Broadwick Street, London W1A 2HG or contact us on Telecom Gold 83:VNU200.

Scientology — no science



I note that you have printed an advertisement for a 'dianetics' book in your February 1988 issue. Your readers should be aware that dianetics is the creed of the scientology cult and the purchasers of this book may well be approached by proselytising members of the cult.

At the Amstrad Computer Show last June a stand bearing the name 'The Croydon Effective Education Association' was lined with Ron Hubbard's many books on scientology and the techniques of dianetics. The personnel present demonstrated the use of the cult's 'E-meter' on youngsters while their parents watched.

The 'E-meter' is a kind of primitive lie detector that measures galvanic skin response, the sweaty palm effect, and it is used by scientologists during 'auditing' sessions to identify a line of questioning which gives rise to stress or unease. This can be very impressive to the naive.

The claims originally made for dianetics were fantastic — godlike psionic powers, immunity to disease, the ability to grow new teeth — though these have been toned down considerably in recent times.

Recent media reports have highlighted the lengths to which the cult will go, including lawbreaking, to silence critics and cover up their activities.

I suggest that your readers think twice about sending their home address to any organisation connected with dianetics.

Iolo Davidson, Gloucestershire

Error trap

Lotus 1-2-3 and Symphony Releases which use the 8087/80287 chip exhibit an arithmetic error which could lead to serious errors.

If a number X is raised to the power Y, X^Y (in Basic or Pascal), or X**Y (in Fortran), where Y is a very small number, the result should approach the limiting value of 1. This sort of calculation arises in many technical problems: for example, EXP(Y), as well as in commercial calculations. The Lotus packages perform correctly when the arithmetic is carried out by software — that is, early releases and/or when no 8087/287 chip is fitted. If the 8087/287 hardware is fitted and used, the packages can give the result 0.5 — that is, a 100% error!

If Y = approximately 0: for example, small rounding errors have accumulated to move the value into a range: $-1.0E-16<Y<+1.E-16$, X^Y can become 0.5 exactly. The explanation is complex and the circumstances best investigated numerically.

Set up a table of X^Y to be calculated for $0.1 < X < 10$ and $-1.0E-10 < Y < -1.0E-30$ and $1.0E-30 < Y < 1.0E-10$.

The moral is this: double check important results by using any of the other spreadsheets which read .WKS format files and understand 1-2-3 syntax in formulae and addresses. Only in this way can you reproduce final important results.

John R Flower, Leeds

Being charitable with computing

Since becoming involved in using computers to run our small charitable community care project, we have discovered that many other non-profit making concerns are also buying computers but finding it difficult to get consultancy help at prices they can afford.

We are fortunate in having a software development expert on our support committee as well as other experienced friends who give advice as we need it.

We would like to share knowledge freely with other charitable bodies and we aim to set up a small 'Help' bulletin board based on TBBS software, where enquirers could leave questions which could be answered in a short time, and a databank of small files covering the sort of problems your readers often come up with.

Miracle has given us a V22bis modem, and Kaypro has donated a 20MByte PC.

Obviously, other offers of help would be very welcome.

Arthur and Susie McBryan, The Poynders Project, 252 Poynders Gardens, London SW4

With the level of profits that many computer hardware and software companies make, and the financial problems many charities face, how about a campaign to encourage computer companies to donate a standard percentage of these profits to charity, either in money, or in free goods and service?

Throwing some light on DTP

I would like to offer some hints, to any of your readers who are using, or thinking of using, Xerox Ventura Publisher, and a word of warning about choosing a laser printer for desktop publishing use.

We started using Ventura about four months ago and found it to be every bit as good as the reviews claimed. However, we encountered a number of problems, some of which were to do with Ventura and some to do with the printer. We have got around most of these problems by talking to knowledgeable DTP dealers, but no thanks to Xerox, who ignore our telexes and deny all knowledge of a Ventura Publisher Division if we telephone the number given in the Ventura instruction manual.

The first problem was that Ventura crashed with monotonous regularity. We discovered that this was partly due to the hard disk manager program that partitions our 40Mbyte drive into two logical drives so that DOS can manage them. Ventura apparently fights with any memory-resident program. Removing the hard disk manager reduced the problem, but did not eliminate it completely. Ventura now crashes about once a day.

The second problem was that when a previously saved chapter was opened, there would be spurious characters embedded in the text. These proved to be control codes for paragraph tags and text attributes, which Ventura inserts into the original WP file. If one of these codes gets split by a page break, Ventura interprets it as text instead of a code.

Laser printers have given various problems, mainly with graphics. The first machine we tried was a Kyocera F1010. When we imported drawings from GEM Draw Plus, we found several problems:
(a) When drawings were scaled down, the text would not scale down below a minimum size, due to font size limitations in the printer.
(b) Text rotated through 90° did not print out.
(c) White text on a black background did not print out.

The answer appeared to be a Postscript printer, so we tried an AST Turbolaser/PS. This is a well-specified machine, with 35 resident Postscript typefaces, including Dingbats. Unfortunately, it has one fatal flaw. There is a bug in the Postscript software, which means that it won't print circles. I tackled AST about this at the *Which Computer? Show*, with not very satisfactory results. The conversation went something like this:
Me: 'Good morning, I'm interested in your Turbolaser/PS, but I'd like to know if you are going to fix the bug in it?'
Assistant: 'What bug?'
Me: 'It won't print circles from GEM or Ventura.'
Assistant: 'Yes it does, it just doesn't print the line around the outside.' [This means it prints any fill pattern, but not the border.]
Me: 'That's not much use if I want to print an unfilled circle, or one with a white fill pattern.'
Assistant: 'The problem is not in the printer, it's in the software. Xerox and Digital Research will be bringing out upgrades that get around it.'
Me: 'But the problem is not in GEM or Ventura; it's in version 47 of Postscript, which is resident in your printer. I've just bought GEM and Ventura. Are you saying that I've got to get an upgrade because of a bug in your software?'
Assistant: 'That's right.'
Me: 'So you won't be fixing the problem in the printer?'
Assistant: 'No.'
Me: 'But I can buy a laser printer with a different version of Postscript, from another manufacturer, that works perfectly with the current versions of GEM and Ventura. If I bought your printer it would not work with these programs until an upgrade becomes available. I also don't know if this printer will work with other graphics programs I might want to buy. Doesn't this bother you?'
Assistant: 'I can't say any more than what I've already said.'

At this point I walked away.

The moral of this story is, if you are buying a laser printer for DTP, make sure it does everything you want it to. Try to get hold of a demo model for at least a week and really put it through its paces.

Trevor Emmens, Analog Devices, Limerick, Ireland

We feel *so* small

With growing enthusiasm I was following your series on Smalltalk written by Carl Phillips. Finally, I decided to order a copy of Smalltalk/V. Your 'special deal' quoted a price of £135 — hardly a small amount of money for a private programming enthusiast like me.

Having made the decision about what from my point of view can only be described as a risky investment — I do not know how useful Smalltalk will turn out for my purposes — I was more than astonished to receive a letter from Smalltalk Express in response to my order apologising that the prices in PCW were 'slightly incorrect' and that in addition to the quoted £135 a further £31.75 is charged for package and VAT. However, your magazine *explicitly* stated that all prices would include package and VAT. Furthermore, this has now been published for the third time and obviously neither Smalltalk nor *PCW* felt obliged to correct it. I can only say that I am quite disappointed.

Thomas Wolfmaier, Lancs

Thank you for drawing this to our attention. Until your letter arrived we, too, were under the impression that £135 was an all-inclusive price. Apologies to yourself and anyone else who fell foul of this mistake. However, even at £166.75, Smalltalk/V is still a bargain when compared with any other commercially available Smalltalk.

Z88 fan club meets here

PCW *has received very many letters from readers praising the Cambridge Computer ZX88. Here are extracts from some of them.*

MS-DOS portability means disks and the power to drive them which adds extra weight and acts as a disincentive. With the Z88 I have achieved near perfection in portability — the machine is a keyboard and virtually nothing more . . .

There has been a market niche for years waiting for an effective compatible laptop which did not require busy executives to add extra rivets to their briefcase handles. It's now called Z88 . . .

Using the Z88 I frequently start a report in my London office, continue on route, and complete it in a hotel room in America or Europe. My standard reports and expense forms are kept in EPROM, requiring only simple additions before printing out and submitting them. My only criticism is the paucity of supportive material in the manual. I am still unable to catalogue files properly . . .

What is particularly good is the instantaneous boot-up which takes you back to where you last switched off. This makes it realistic for note-taking. I can jot thoughts into the correct files as they come to me . . .

As an architect I find the Z88 gives me all the computing power I need from day to day in a ridiculously convenient form. XT compared to Z88 — no contest. I do have some niggles. A Mac-style clipboard for transferring data between live jobs would be handy. A few more functions built into the calculator would be nice . . .

I use the machine with 256k extra RAM almost only for word processing where it serves me well. The manual is often too sketchy and I need to use an amplifier to drive my Juki daisywheel printer. The real problem is storage. The EPROMs are unreasonably expensive for storing something like a book. Maybe Amstrad could be persuaded to market a disk drive . . .

I use the Z88 for writing letters at home and aboard ship. After answering Cambridge's questionnaire on the machine I received a natty soft plastic carrying case. Unfortunately, when in the case, it is very easy for pressure to be applied simultaneously to both Shift keys leading to continuous operation, flat batteries and total amnesia in the RAM area.

Last month I reported problems with the keyboard and stability of the Z88. I am happy to report that the latest model we have received has put in sterling service. The keyboard easily keeps up with my extremely fast and idiosyncratic typing style, and it hasn't locked me out once. There is certainly room for some developments. How about a software product that did incremental back-ups to EPROM of a text file as it was edited? How about some add-ons, too?

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Panic station

Was Martin Banks a Boy Scout? It seems not, if his experiences with a keyboard are anything to go by. Luckily, a Derby dealer, 'Tebbo' and standards came to the rescue

MARTIN BANKS

Lots of people hate standards, and lots of others hate Christmas. Sometimes, they are even the same people. Yet both have a place in the great panoply of life. Both, for example, can be appallingly restrictive of what you do, how you do it and, most important of all, *when*.

Yet, sometimes, they have their place. Christmas is OK if you like that sort of thing, and it can have the peculiar effect of pulling together people in a friendship and *camaraderie* which never exists at any other time of the year. It would, of course, be worth all the brouhaha of commercialism if some of that friendship extended beyond Boxing Day.

Standards can be a pain as well. You can read many a word against them written by any number of individuals and small companies with better ideas than the current standard. Very often they are right. We all know that the IBM PC standard is something of a turkey and that any systems designer could come up with something better while lying fast asleep in the bath.

That, as I discovered the other day, is not the point. Regular readers will no doubt remember that I am not the world's worst denigrator of standards in computing. I have some negative views on how they restrict innovation and development, but appreciate how we have to live — and interact — in the real world. My discovery is all about this last matter.

The intuitive may have detected that Christmas is not my all-time favourite period in the year. It is a time which can have some side benefits, however, especially if you work as a writer and have a large writing job to complete. Christmas is then ideal, for that implement of torture, the telephone, stops ringing.

That week between Christmas and New Year was, therefore, set aside for a clear run at a particular job I had to do. No phone meant no interruptions, because no one else was working; no keyboard meant no output.

Yes, there came upon me the one thing I hadn't expected (one never does). The keyboard on my PC crapped out, failed, deceased, declined to respond to my urgent probings (*Ed: careful, this is a family magazine*). In a word, I was stuck.

Without thinking, I picked up the phone and dialled my local dealer (who had expertly fixed the beast in the past). No answer, came the firm reply. Of course, no-one works between Christmas and New Year, do they? So why should the dealer have service engineers sitting around twiddling their thumbs. I thought it was damned inconsiderate, but I had to accept it was sensible.

There then came upon me one of those feelings. I expect you know the sort: I believe it is called 'panic'. There I was with a large writing job to complete by the end of the month, and no computer to do it on. After a small, therapeutic scream, I realised I did actually have a solution to hand. So I picked it up.

Having written about a third of the job, some 5000 words, I turned to a review machine I had in the office: the Z88. What! I here you cry, Uncle Sir Clive's latest doorstop!?!

Yes, I'm not afraid to admit it. The little thing saved the day.

Now, like many journalists, I have had a good go with Cambridge Computers' gizmo and have to admit that I find it extremely useful. But then, journos have an odd lifestyle (no comments, please) and the ability to do things like write while travelling on trains and planes is great for us, but possibly a trifle odd for many others.

Nevertheless, the thing has worked and worked well. It is also tough. Mine has been to the States and back, sharing a shoulder bag with cameras and tape-recorders, surviving X-ray machines and all. It has also had the great advantage of PC-Link, the software comms package which lets you squirt files back and forth between the Z88 and an IBM-compatible PC. This also works. (If that sounds snide, I apologise, but so often these good ideas don't in practice.)

Here was my salvation. I multi-tasked myself by writing furiously into the Z88 (some 6000 words all told) while at the same time phoning round trying to borrow a PC from someone. This was still needed because the work had to be delivered as an ASCII file on a PC-formatted disk. I found a dealer I know up in Derby — National Computer Supplies — open, and as the boss was coming past my way the next day, yes, he would drop something off.

A Tandon PCX20 duly arrived, but it was a brand new one so there was no serial port. As my invalid Olivetti has an integral port, there was no board to swap out. So, there I sat with a machine that could finish the job, a machine with half the job already on it, and no means of connecting them.

Like a knight in shining armour, handsome and leonine David Tebbutt came to my rescue. Being a hack of no mean proportions himself, he understood the problem I faced, offered a loan of his own PC, his office, and his hospitality for a very pleasant evening that combined the minimum of work with the maximum in temporary hedonism. The result was satisfactory; the files were ported from the Z88 to the appropriate disk.

It is also worth considering a couple of points about how it was achieved. The disk which carried the original files that made up the job started life with work done on an Olivetti M21 PC compatible (old, hard-driven and forgiven for its lapse). Further files were created on a Cambridge Computers Z88 and ported to the disk via Tebbo's PC (the make of which I admit I do not know). The job was then finished and knocked into shape on a Tandon.

Four different computers had a hand in that job, and I got away with it because they all worked to the same standard. Compared with that ability, the detailed nature of the standard is secondary.

The other point worth considering, particularly if you ever do anything on a PC that smacks of work and has a timescale attached, is that a fall-back position is essential. Without that Z88 being available, I would have been dead in the water. We all get 'conned' by the real reliability of modern PCs. We all think they may just go on forever. They don't, they can't. So if you need to be, be prepared. END

BANKS' STATEMENT

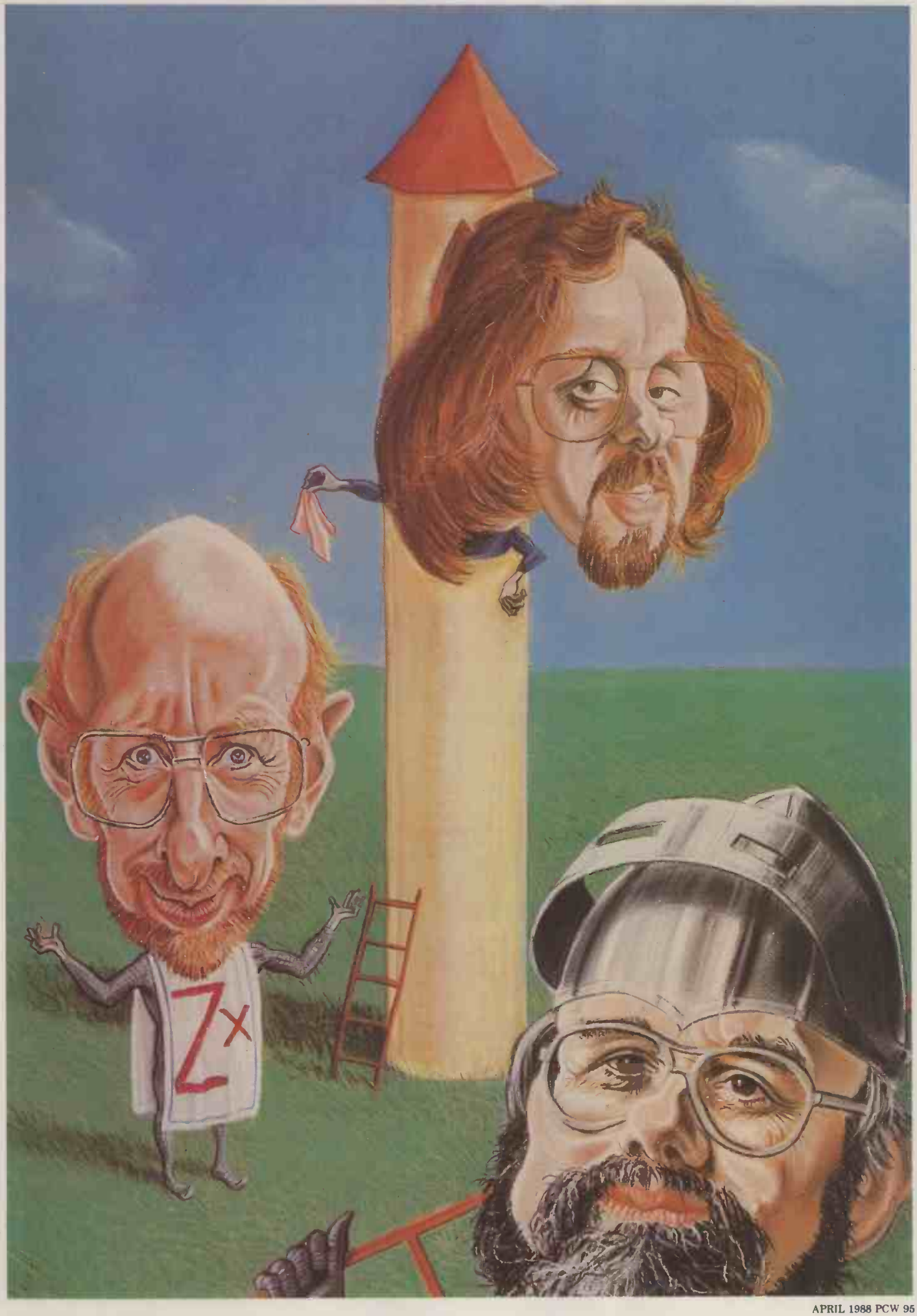
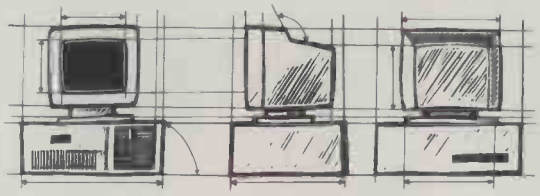


Illustration by Christopher Sharrock



Sun 4/110

The march of technology has narrowed the gap between the micro and the minicomputer, and with the Sun 4/110, Sun has pioneered the development of a micro-architecture machine which offers substantially more than PC performance. Peter Jackson gives an overall assessment, while individual facets are scrutinised by a team of *PCW* regulars.

Historically speaking, increasing processor power and bigger mass storage capacities have been used to support larger numbers of users but with roughly the same computer power per user. And then came the workstation, to prove Henry Ford's dictum that history is bunk.

The thinking behind the development of workstations was that users in particular sectors needed the processing power of minicomputers and mainframes, but also needed to put that power in the hands of individuals rather than reserving it for large groups of casual users.

But those power-hungry users in the fields of CAD and artificial intelligence could not afford a minicomputer each, so the workstation originators — young companies like Sun Microsystems and Apollo — adapted microcomputer hardware into mainframe-style architectures, using every possible design trick to wring the last milliMIPS out of relatively cheap processor and RAM technology.

Then they gave users a machine each, and put big and fast hard disks on a network for shared access and a lower overall system cost.

But now the workstation makers are starting to feel the squeeze. Microcomputers like the Compaq DeskPro 386/20 and the Macintosh II either have or promise near-workstation performance at much cheaper prices, and there are limits to the performance enhancements that the workstation makers can include to keep ahead, given the declining number of customers who would need that performance and the prices that would have to be charged for it.

Hence, finally, the Sun 4/110. What Sun has done is to cut down its top-end Sun 4 workstation, taking out some of the architectural speed enhancements and reducing the disk access speed to simplify the system and make it cheaper to build, while maintaining a performance premium over the high-end PC competition. In a very real sense the Sun 4/110 is a personal computer as we all understand it, using techniques and components that are becoming familiar in today's high-speed 80386 and 68020 machines but keeping the distinctive workstation features that have made Sun so popular.

Sun obviously thinks that this is the future of personal computing, and the way the 4/110 is put together may well give us some hints about the direction that future will take.

Hardware

Externally, the most obvious feature of any Sun system is the big bit-mapped monitor that gives CAD users the scale and resolution they need. And that is even more so for the 4/110. The electronics of the system are contained in a slim system unit, about the same size as an IBM AT case but a third the height, while the disk and tape backup units are built into an external case that Sun accurately describes as a 'shoebox'.

In a normal configuration the whole system fits easily on a desktop, with the big 19in monitor on top of the system unit and the disk shoebox either on the desk or under it.

The system unit is actually a three-slot card cage, and is common to all low-end Sun systems. The slots meet the VME bus standard, a 32-bit design much used in high-speed systems based on the Motorola 68000 family of processors; and, in Sun 3 workstations, all three slots are filled with processor, video, and memory boards. In the Sun 4/110, however, greater integration of electronic hardware on a single board means that only one slot of the three is officially occupied. But, in practice, two slots are used since the video circuitry is built on to a daughterboard that actually obscures the centre slot.

Indeed, the entire Sun 4/110 system can be removed from the system unit simply by pulling out the main board/daughterboard combination, and the review system was in fact a Sun 3 that had had its normal three-board complement removed and the Sun 4 board combination inserted.

The main board itself is deceptively simple. The most obvious feature is the enormous amount of RAM on the board, made up of the now-usual single-in-line memory modules (SIMMs). There are 32 SIMM slots, and the default configuration is to have them all filled with SIMMs each holding 256k of parity-checked RAM, for a RAM capacity of 8 Mbytes. Sun is cagey about further expansion, but it does not take a genius to work out

Sun 4/110 Mass Storage

Perhaps the most notable feature of the mass storage fitted to the Sun 4/110 workstation is its sheer orthodoxy. To be sure, the Winchester disk drives are bigger and faster than any offered before, but Winchesters they remain, and that fact in itself speaks volumes. For the 4/110, Sun has just introduced a 327Mbyte SCSI drive with an 18ms seek time and 1.2Mbytes per second transfer rate. The SCSI bus allows overlapping access to several drives, which means that to the user they appear to be accessed simultaneously. To give you a handle on this level of performance, it's 15 times the capacity and 5 times the speed of the hard drive on the PC that I'm writing this on. What this means is that improvements in Winchester drive performance are broadly keeping up with increases in processor speed.

Machines like the Sun 4/110 point to the future requirements for personal computer mass storage. Ever greater bit-mapped screen resolution means huge volumes of data have to be manipulated; a 256 colour screen image at 1024x1024 pixel resolution fills 8Mbytes of store. It's not enough for mass storage just to keep up in capacity; it needs to get proportionally faster too to keep response times within the acceptable range. It seems likely that the tried-and-tested magnetic disk will still be the best bet for some time to come. Vertical recording, a new technique in which the oxide grains are orientated perpendicular to the disk surface for closer packing, promises to raise capacities by an order of magnitude, and 3½in floppies holding 10Mbytes have been seen working in several Japanese laboratories.

Many times over the past decade we have been treated to prophesies of new mass storage technologies that were going to overthrow the rule of the magnetic disk drive. First, there was the non-volatile magnetic bubble memory. That proved too slow and too costly to fabricate and bubble memory is now almost unheard of outside exotic industrial environments.

More recently the betting has been on some form of optical disk storage. It is quite clear that laser-driven optical media can provide very much larger capacities than magnetic media; drives holding more than a gigabyte are already in production. Optical disks have two problems, though. First, no one can currently make a commercial optical disk that is erasable; the WORM (Write Once — Read Many Times) drives you can buy now are useful only for archival storage as they can never be re-used. Various Japanese and US manufacturers are close to launching erasable optical media, as they have been for the past five years.

Second, optical media are still an order of magnitude slower than the best Winchester disks. It seems likely that the optical disk will find its niche as long-term archival store, and for CD-ROM style reference works.

Another mass storage technology which looks likely to advance is plain old RAM. As RAM gets cheaper and computers with multi-megabyte memory become commonplace, it makes more and more sense to cache whole tracks of data for speed; for example, a 4Mbyte Mac II can use up to 1Mbyte of memory as a disk cache. Portable computers like the Tandy 100, the Psion Organiser and the Z88 show that non-volatile RAM or EPROM is a perfectly good mass storage medium for lower-volume applications, and Anamartic's wafer-scale 'disk' memories could add a new dimension to non-volatile memory. The mass storage system of the future might well be a 4Gbyte erasable optical disk, cached into 100Mbytes of wafer RAM, cached into 1Mbyte of fast static RAM.

Dick Pountain

that using 1Mbit chips rather than 256kbit chips would take the RAM capacity up to 32 Mbytes on the main board.

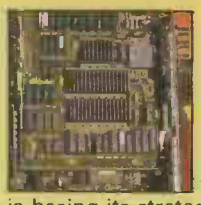
This amount of RAM may seem excessive to those crammed beneath the 640k limit of MS-DOS on a PC, but large RAM capacities are crucial in the type of jobs that workstations do, and will become increasingly important in the personal computer market too. When large amounts of data are being handled, and complex graphical images are being displayed and manipulated on a big screen, the easiest way to get high perceived speed is to use a lot of fast RAM and keep as much data stored there as possible.

Naturally, the 4/110 RAM is 32 bits wide, and it also uses static column access techniques to cut down memory wait states. This technique, which first came to mass-market attention in the Compaq DeskPro 386, uses the fact that whenever a memory cell in a RAM chip is specified by its row and column addresses, the contents of the entire column are read into a column buffer in the chip.

So, if a system monitors RAM accesses and finds out that successive acesses are in the same column of the chip, then only the new row address needs to be sent. To put it another way, accessing successive memory locations in a single page of RAM takes half the time in a static column RAM architecture than it would in a conventional architecture.

Of course, this does not work for

Sun 4/110 Connectivity



Connectivity is a very important issue for computing in the future. As computers permeate the business environment it becomes more and more necessary for them to work well together. Even with the IBM standard in the PC market, networking can be a nightmare, particularly when connecting different types of computer. In addition, applications are ever hungry for more power and memory. Increased connectivity and communications can deliver this power to the desktop. Sun is basing its strategy on the need for the desktop computer to be a graphically powerful workstation which effectively presents powerful applications and large amounts of information.

Sun has a very comprehensive networking system and overall strategy to back it up. The company refers to this as its Open Network Computing (ONC) Environment. Physically, Sun workstations are connected to other machines (Suns, Sun Servers, VAXs, and so on) by Ethernet for local access, or via numerous other connections using standard communications protocols like X.25 and SNA to a wide range of other computers. All of this interconnection is treated by ONC as if it were local, so Sun's networking strategy could be described as local area networking on a grand scale.

The network architecture Sun uses is based on Ethernet for physical and data connections; the Internetwork Protocol (IP) at the network level; Transmission Control Protocol (TCP) at the transport (or long-distance inter-network connection); and User Datagram Protocol (UDP) at the same level for controlling the interchange of data formats. All these protocols are used to ensure that the two connected systems understand what and why they are communicating, and also that they transmit the data itself correctly.

The exchange of information over the network is controlled by SunLink which is the family of data communication products provided as part of OSN. The other parts of OSN are the Open Network Computing (ONC) environment which allows different networks to connect together; the Network extensible Window System (NeWS), merged with the X-Window System so that windows will operate across the network; and the Catalyst third-party family of communications products (rivals to the Sun part of OSN).

SunLink is used to allow as many as possible of the rival and competing communications standards — such as X.25, the Manufacturing Automation Protocol (MAP), Technical and Office Protocol (TOP), IBM's SNA and BSC protocols and DECnet — to talk to each other. You could regard SunLink as a translator between all these different competing protocols. This strategy is an interesting one. Instead of creating yet another 'standard' in this area, Sun has chosen to connect all the other standards together like a web. The advantage is obvious; they work with everything else. The disadvantage is that they have to keep adding new sections to deal with new 'standards' as they come along.

Another way Sun has chosen to increase the number of systems it can communicate with is via its Network File System. A significant product for the PC

Sun 4/110 Image Processing

The Sun Microsystems machines are setting a standard in the field of workstations and, as the technology becomes cheaper, this will have significant implications for the PC market in general. The most striking feature of any of Sun Microsystems' range of workstations, compared with any similar machines, is the dominant 19in screen needed to display the two million pixels it uses. The general concepts of the WIMP user interface and object-orientated programming need a screen with the appropriate resolution, simply to make the user environment practical. Sun has led the field in providing the user with an appropriate screen for the WIMP operating environment and for the standard workstation applications of computer-aided engineering design (CAED), artificial intelligence (AI), fluid dynamics and molecular modelling. To provide this detailed screen resolution, Sun has developed some revolutionary ideas in both display software and hardware.

The original concept behind the Sun workstation was to use a main processor with a range of support processors, including a video co-processor. Due to chip design and production difficulties, a software solution had been implemented and put into production before a hardware solution could be finalised.

It was later proven that, for monochrome machines, a hardware raster operations chip provided no significant increase in performance. When the colour machines were launched, the monochrome raster operations chip was extended and was extensively used to provide the support required for the complex raster operations needed in a typical windowing environment. This chip, alongside the proprietary memory management unit (MMU), provides the backbone to powerful screen graphics.

The MMU provides the mapping for up to 256Mbytes of memory and supports virtual memory access, allowing programs requiring vast amounts of memory to run in a limited amount of RAM. It also supports Direct Virtual Memory Access (DVMA) which allows the graphics co-processor also to use MMU chip and virtual memory access. This specialist interfacing of the SPARC chips allows for greater speed of operation and safer software control because all the complex transfer functions are achieved in hardware.

The raster operations chip, or 'blitter' chip, enables memory to frame buffer, frame buffer to memory or frame buffer to frame buffer data transfer to take place. During the transfer process, this chip can perform various logical operations at bit level and allows windows to be moved around the screen with little main processor intervention. In a typical windowing environment like GEM or Microsoft Windows, the processor would be relieved of what at present is a time-consuming duty. This provides a simple method for implementing processes like mouse manipulation, where a series of AND and OR functions are used to prevent data loss during mouse control.

The current Sun 4 series of workstations provide a 19in monitor with a screen resolution of 1600x1280 pixels. This generates a video bandwidth of 200MHz, where the video bandwidth is the product of the pixel count, the number of colours or grey levels and the video refresh rate. As the screen resolution increases, so obviously either the video bandwidth must increase or the refresh rate slow down to

market is the company's PC-NFS, a Network File System for IBM PCs and compatibles. This allows PCs to access files on Sun workstations, share printers, act as a terminal on a Sun network, access other systems via Sun gateways and even distribute applications over a Sun network.

ONC is transparent to the hardware using it because it uses standard Unix system administration procedures which have been modified for use across a network. Besides these, Sun has developed applications for use with networks. These are mostly used to display information on network performance and to test connections between specific nodes on the network. All these tools are used to keep the network operating at full speed and full efficiency. Much of ONC is in the public domain so that as many manufacturers as possible support it.

Connectivity on Sun systems does not extend beyond networks. At present they have made no provision for very closely-coupled information exchange — such as sharing instructions between processors. Sun could introduce this in the future, but to do so would require a new bus control/link chip designed for parallel or inter-processor communication. Instead, Sun has concentrated on making as wide a range of services and systems available to, and on, ONC as possible.

ONC may be a long way ahead of simple local area networks, but it can still be considered only as a form of data sharing. The only way that the processing of a difficult task can be shared is by running independent processes on different systems and transferring data between them. This allows heavy number-crunching processes to be passed off to a processor like a Cray and graphics manipulations on the resultant data to be done by the Sun itself.

This leaves us with two views of the future of computer connectivity for the moment. According to Sun, the future user will be confronted by a desktop workstation of great power (at least we'd consider it great power at the moment). This workstation will be either standalone or part of a local area network. The machine or network will in turn be connected via a server to a much larger and more distributed network. Through this the user will have access to a large number and variety of systems, from little PCs right up to huge supercomputers. This distributed network will operate transparently. The user can say 'send a piece of mail to Sonya in California' and it will, or he/she can instruct the workstation to farm off a real-time neural network simulation to a new Japanese neural computer.

This contrasts sharply with the distributed processing point of view which is a lot less well defined. This again sees a workstation on the user's desk but this time the workstation is acting as a front end to a node of a giant distributed computer. If this node can handle the users' commands, it will. If it needs to send messages, they are 'broadcast' across the distributed computer until they reach their destination. If more processing power is required, the processor instructions are also 'broadcast' across the computer and performed by any free node they encounter. Results are transmitted back in a similar manner.

The latter vision is more unlikely to ever be completed but is potentially more powerful. The former will soon arrive and is almost certain to succeed. It is interesting to note how much both visions rely on fast and accurate communications.

Owen Linderholm

every RAM access. In most applications data is stored well away from program code, meaning that static column access gives no benefits whenever that data is required. However, using this technique means that slower RAM chips can be used with a processor of a given speed without losing throughput and, indeed, the 4/110's RAM chips are not particularly quick 120ns parts. Static column RAM will increasingly be used in personal computers, as will the more complex interleaved memory architecture now appearing on some 20MHz 80386 machines. Here, memory accesses are made alternately to two separate banks of RAM, with the second bank available for access while the first 'recovers' from its own last access.

Whatever the technique used, the speed of the CPU/memory architecture is crucial to getting top performance out of a high-speed processor. And tricks such as these will be increasingly used in the future.

As it turns out, the 4/110's central processor does not place any major speed demands on the RAM chips; it runs at a respectable but not blazing 14.28MHz, slower than the 16.67MHz 68020 in the Macintosh II, for example. But this central processor is the SF9010IU Integer Unit — the SPARC chip — which is a Sun-designed and Fujitsu-built RISC processor implemented as a gate array. The SPARC's RISC-derived advantages are described elsewhere, but it can deliver a claimed 7 VAX MIPS while the 80386 at a faster 16MHz can de-

allow the extra data to be displayed. Unfortunately, at present, 200MHz is close to the current maximum possible on a desktop-sized and priced monitor.

The screen has a very stable, non-flickering display due to the screen refresh being non-interlaced and operating at a frequency of 66Hz. For the colour screen, the pixel resolution has been reduced to enable 256 colours to be displayed at the same time. The 256 colours can be chosen from the 16.7 million possible colour combinations provided by a Sun's own look-up table (LUT).

For those who find that the standard configuration described above is not sufficient, Sun has developed two even more specialised video co-processors, the GP Plus and the GP2. The GP Plus is aimed specifically at 2-D wire-frame applications such as computer-aided design. It provides a typical drawing performance of 65,000 2-D vectors per second. For those requiring 3-D vectorisation, the GP2 will provide more than 150,000 3-D vectors per second or 20,000 shaded polygons per second. Both these chips provide the power needed for such applications, but they are both very expensive and organise the machine into a very specialist, small area of powerful performance.

A specialist real-time application currently requiring very expensive equipment is the enhancement and reconstruction of satellite-transmitted television pictures. This is apparently only because of a fiftieth of a second delay that is added to enable the picture to be enhanced. As the blitter and SPARC technology improve these enhancers will inevitably start appearing in televisions and videos, and will provide the facilities for the real-time image improvement necessary to remove transmission noise from the video signal. With the video system Sun provides, its workstation is becoming an important platform in the research and development of such technology.

Sun has also pioneered what is now being referred to as 'Display PostScript'. Sun's Network/extensible Window System (NeWS) is the only production version of 'Display PostScript' available at present and allows for true WYSIWYG, especially as the screen resolution of the Sun monochrome monitor provides a display of approximately 115 dots per inch.

NeWS is different from Adobe's announced version of Display PostScript because it is both a read and write language. It allows the user both to view a PostScript image description, and also to alter and rewrite it back as a PostScript file. NeWS is also a PostScript interpreter, so application developers can add new features and functions dynamically to the NeWS system itself. But its biggest advantage is the fact that it is completely device, media and resolution independent, and any NeWS application will run on any NeWS-supporting machine without modification.

In the future, the devolution of processing power will be more clearly defined, with video co-processors or 'blitters' taking on more responsibility for the video interface. This will free the main processor from the usual time-consuming memory transfer operations and will provide more raw processing power for the useful operating code.

Ten years ago, when the research team at Xerox's Palo Alto Research Centre was developing the WIMP interface, the machine they used cost more than $150,000. Implementing their research fully in a production machine has taken 10 years of technological advance and innovation, and only now are such systems becoming a marketable reality.

Andy Redfern

liver only 3 to 4 MIPS under optimum conditions.

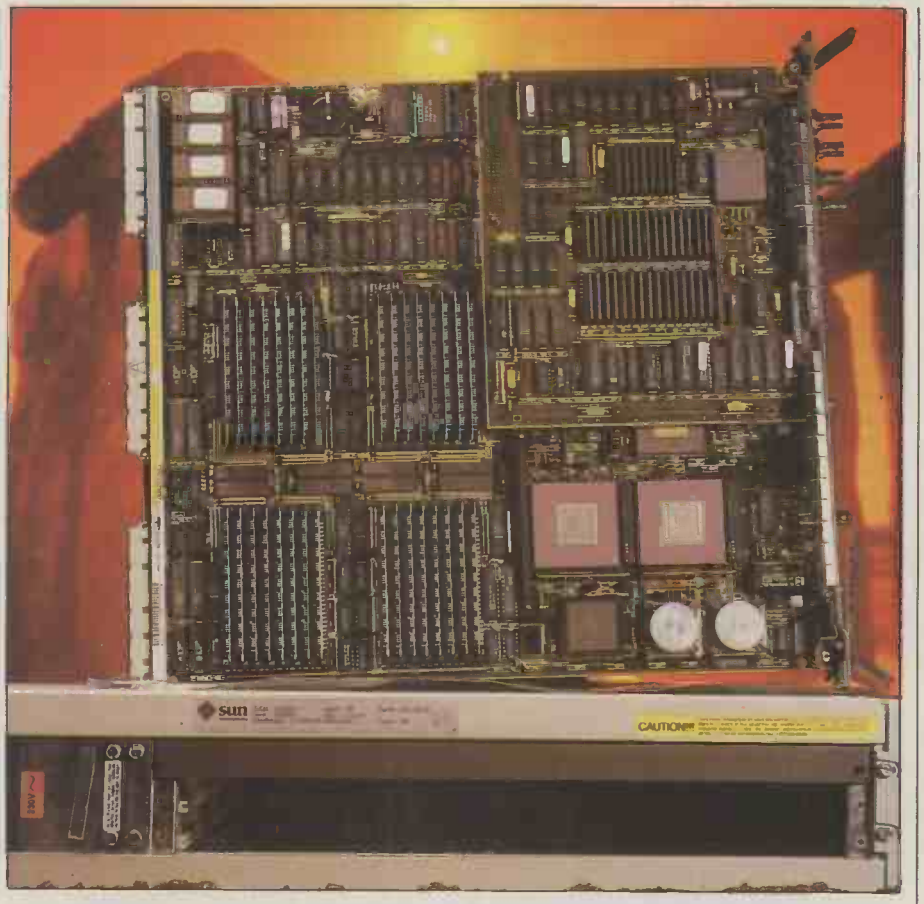
In the high-end Sun 4 system, the integer-only SPARC chip is linked with a sibling floating-point controller gate array and the Weitek 1164 and 1165 floating-point co-processor chips for faster mathematical calculation. On the 4/110 these chips are optional, although the sockets are on the board and fitting them would take just seconds.

Again, this co-processor configuration is filtering through into the power PC market. The Compaq DeskPro 386/20 has a socket for a Microway Weitek co-processor board built around the 1164 and 1165 and collectively called the Weitek 1167 accelerator. The Portable 386 has a similar socket that cannot be used only because the Microway board is physically too big to fit in the case.

The Weitek processors outperform by large margins the 80387 and 68881 maths co-processors for the 80386 and 68020, and users are becoming more conscious of the real benefits that can be gained by using maths chips in number-intensive applications such as CAD. Weitek must be rubbing its hands at the suddenly-increasing market for its products.

The other major features of the 4/110 board, apart from the boot EPROMs and real-time clock, are a SCSI controller that hooks up to the mass storage shoebox, an Ethernet interface, and two expansion buses.

The use of a SCSI controller may mislead some observers into thinking that the disk drives on the 4/110 are slow, but that is not the case. The SCSI port on the main board is simply used as a bus, and the disk and tape drive controllers sit on this bus and use their own communications standards to the drive hardware. The hard disk is a 141Mbyte drive with an ESDI controller, giving an average access time of 18ms and a data transfer rate of 1.2Mbytes per second into the SCSI port; while the tape controller uses the QIC-36 standard to handle a 60Mbyte streaming tape cartridge.



The main board of the 4/110 slides out on rails from the casing. The SPARC chipset is on the lower right. The chips with large heatsinks are the Weitek co-processor chips, and a frame-buffer daughterboard is at the top right

Sun 4/110 SPARC Processor

The Sun 4 series workstations are all powered by a new proprietory 32-bit processor called the SPARC (short for Scalable Processor ARChitecture). SPARC is a Reduced Instruction Set Computer, or RISC, of formidable processing power. Sun claims that SPARC can perform seven times as many integer operations per second as a VAX 11/780 minicomputer, and five times as many floating operations when its floating point co-processor is used (in acronymic jargon, that's 7 VAX MIPS and 1.1 Linpack MFLOPS).

The acceptance of the RISC design philosophy for high-performance computing applications has been one of the more remarkable stories of the past decade. Three years ago there were no commercially available RISC chips, and the idea was considered to be somewhat academic and highly controversial.

Now it is hard to imagine any new processor design that does not at least pay lip-service to RISC principles. As well as Sun's SPARC, we have seen the Acorn ARM which powers the Archimedes, IBM's RT processor, Hewlett-Packard's Precision Architecture, the MIPS processor, and more. Though not a 'pure' RISC design, the Inmos Transputer has been influenced by a similar philosophy, while Motorola's new 78000 family will be true RISCs. Only Intel seems still committed to the rococo style of processor design.

A Reduced Instruction Set Computer is one which employs very few fast primitive instructions rather than many complex powerful ones. In the early days of the microprocessor, the architecture was decided mainly by what the silicon technology could handle, and what would fit was what you got. Then, as new generations of processor emerged, the tendency was to incorporate all the instructions of the previous generation (for software compatibility) and then add some new ones. These new instructions were often more powerful or high-level to make life easier for Assembler programmers, and would do quite complicated things to data in main memory, like block-moving bytes or searching for a particular byte value.

Consider the Intel 8080 chip used in the very first personal computers, which had about 80 basic instructions: it was displaced by the upwardly compatible Zilog Z80 which has 256 instructions. Efficient memory usage was another design goal. A complex block-move instruction might occupy only a couple of program bytes, while it replaces a loop that takes dozens of bytes.

The first RISC design was the 801 minicomputer developed by IBM research labs in 1975. The researchers noticed that most computers, regardless of their instruction sets, spent most of their time executing a handful of relatively simple instructions. Thus, if these were made very efficient, overall throughput would increase. The 801 was never marketed but the work lives on in the current PC/RT. Then, in 1980, student projects at Berkeley and Stanford universities produced RISC microprocessor designs with startling performance. The second Berkeley chip (RISC II) with an 8MHz clock ran integer C programs faster than a 12MHz 68000. From 1983 onward

The Ethernet controller drives two back-panel ports: one thin Ethernet for cheaper cabling systems and one full Ethernet for co-axial cabling. And of the other two expansion buses, the first is simply the VME bus connection to the system unit backplace, while the second, called the P4 bus, is the fast 32-bit connection to the video daughterboard.

There is a choice of video boards, both giving the normal Sun screen resolution of 1152×900. The monochrome board can also provide a 1600×1280 display on one of the three 19in monochrome Sun monitors, the other two offering 1152×900 resolution either in standard monochrome format or with 256 grey scales. This board comes with 256k of video RAM, and drives the screen at a fast 66Hz non-interlaced refresh rate. There is a choice of 16in or 19in RGB colour monitors to go with the colour video board, which can display 256 colours simultaneously — eight bits per pixel — from a palette of more than 16 million, again at the standard Sun resolution, and can also limit itself to one bit per pixel to give faster monochrome operation.

Unlike larger Sun systems, there is no graphics accelerator hardware on these boards. The speed of the displays comes from the performance of the 32-bit P4 bus and the high overall processor throughput, and this should give encouragement to those PC graphics board makers toying with the idea of building 32-bit MicroChannel boards using graphics co-processors like the TMS34010 and Intel 82786. We are already beginning to see 16-bit VGA-compatible boards from companies like Paradise Systems, giving display performance superior to that of conventional 8-bit VGA and EGA boards, and 32-bit boards are only a matter of time.

It is obvious that Sun has stripped some features from the main board to cut the price of the system and get everything on a single board. There is no dedicated cache RAM, for instance, although Sun calls the static-column RAM architecture 'cache without the cost', and the monochrome graphics hardware normally included on Sun processor boards is missing. The processor board can only act as a VME master rather than a master or slave, so the implementation is really only a subset of standard VME. The SCSI hardware on the board is new, but is a downgrading from Sun's normal ESMD controller which transfers data at 2.4Mbytes per second and comes on a separate VME board in larger systems.

In fact there is nothing on the board that has not already been included on existing high-end PC and Macintosh systems, apart from the fast RISC processor made possible by the fact that Sun does not have to be MS-DOS or Macintosh Toolbox compatible.

It is interesting to see the personal computer manufacturers adopting as many of Sun's workstation techniques as they can afford to build in, and equally interesting to watch Sun giving way a little on performance and moving back towards personal computer standards and prices.

System software

All workstations use Unix, and the 4/110 is no exception. Sun's SunOS is what the company calls 'Converged Unix', and is built up from AT&T Unix System V with the Berkeley 4.2BSD extensions to facilitate network connectivity and software development. On top of that — literally — Sun offers three windowing front-ends, SunView, X-Windows and NeWS, which are fully discussed on page 102.

For hard-core Unix users with their own software using their own user interfaces will find no surprises here, and will be able to run their packages using all the familiar Unix commands and file structures after recompilation.

Programs can be recompiled using the 'cc' command in normal Unix style, and Sun also offers 680x0-to-SPARC and SPARC-to-680x0 cross-compilers. Apart from the inevitable C, compilers are on offer for VMS Fortran, Pascal, Sun Common Lisp, and Modula-2.

As usual, it is striking to find that raw Unix is not as unfriendly as it is made out to be for those familiar with MS-DOS versions 2.0 and above. The hierarchical directory structure in MS-DOS, for example, and the way it is controlled with MD, CD, and RD, was taken directly from Microsoft's Xenix implementation of Unix. The only difference is that ordinary forward slashes are used to separate directory path names in Unix, and backslashes in MS-DOS.

In normal use the 4/110 user is shielded from Unix by SunView and

Sun Microsystems sponsored the Berkeley group under Dr David Patterson and SPARC is directly descended from the RISC II chip.

The RISC philosophy involves several trade-offs. RISC programs must use more of the simpler instructions, and the instructions themselves tend to be bigger since they contain a lot of the control information that would be stored in microcode ROM in a conventional processor.

SPARC architecture is typical of modern RISC thinking. It has only 50 integer instructions, most of which execute in a single clock cycle and work on data held in registers. It employs 32-bit data paths throughout and a high degree of pipelining (overlapping execution of successive instructions). Branches and jumps are delayed until after the next instruction has executed to avoid pipeline breaks.

SPARC has its Floating Point Unit on a separate chip in the current implementation, but in future versions all may be put on to one chip. The CPU extracts all floating point instructions from its instruction stream and puts them into a queue for processing by the FPU, which runs fully concurrently. It's possible to add extra FPUs in a pipeline to increase floating point performance.

SPARC is a 'load/store' architecture which means that load and store instructions are the only ones which may access external memory, all arithmetic and logical instructions being confined to the contents of registers.

The current SPARC chip has 120 registers organised into 'windows' of 24 registers each (future chips may have even more windows). These windows are addressed as if they were arranged in a circle and only one window is active at any given time. Each window consists of three kinds of register: eight IN registers, eight LOCAL registers and eight OUT registers. Successive windows overlap so that the OUT registers of window 1 are the same physical locations as the IN registers of window 2, and so on. So, values can be 'passed' from window 1 to window 2 by simply switching windows, with no actual movement of data. These register windows correspond to the parameters used in procedure calls in high-level languages like Pascal and C, and so procedure call and return becomes very efficient.

The significance of the 'Scalable' in 'Scalable Processor ARChitecture' is that the simplicity and low device count of RISC designs means that they can be reduced in size without a major redesign and the possible introduction of more bugs, which is not typically true of complex designs like the 80386.

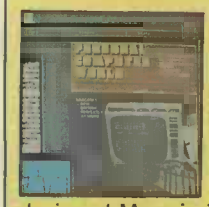
Sun hopes that its new architecture can be given a long life (and so become an industry standard) by implementing it in new high-speed technologies, such as gallium arsenide, as they become commercially viable.

Sun quotes the following performance figures for different manufacturing techniques. Fujitsu, using 1.5 micron silicon, achieves 7-10 VAX MIPS. These are the chips in the 4/110. Cypress Semiconductor, using custom CMOS technology, can extract 20 MIPS; and Bipolar, using its own ECL integrated technology, can expect 40 MIPS.

In addition, Sun jokingly refers to the 'SPARCinTOSH' and 'SPARCinCRAY' to emphasise that, by changing the levels of implementation and integration of its architecture, it can beat the price/performance of machines at both ends of the computing scale.

Dick Pountain

Sun 4/110 Unix Operating System



The choice of Unix as the operating system for workstations has some good technological reasons behind it as well as marketing reasons. First, it is a portable operating system that can be ported to any processor that the workstation manufacturer happens to use — from the 68020 to the SPARC in Sun's case, or to the Xerox-designed Mesa in its 6085 workstation, say — without affecting applications software compatibility. Second, Unix is well-suited to the 32-bit 68020 architecture used in the majority of workstation designs. The 680x0 family uses a linear memory-addressing architecture, regarding memory as a single enormous lump of storage, rather than the segmented memory-addressing scheme of the Intel 80x86 family. This in turn means that a multi-tasking operating system like Unix does not need to keep track of multiple memory segments when manipulating concurrent 'processes'. And third, the lack of memory management functions in the 680x0 chips means that the operating system needs to control the context-switching between multi-tasking processes — and Unix does that handily.

Of course, the marketing considerations helped too. Unix is particularly strong in the engineering and academic markets, usually on DEC hardware, and the workstation makers had a good story to tell if they could offer Unix compatibility on a single-user machine at sub-DEC prices. Even now, the main markets for workstations are engineering CAD and academic artificial intelligence research.

The version of Unix used on the Sun 4/110 is a 'Converged Unix' called SunOS, which is actually the Berkeley 4.2BSD version with enhancements from 4.3BSD and the addition of AT&T System V compatibility in the kernel, libraries and utilities. In most cases the 4.2BSD and System V functions can be combined, but when incompatibilities do arise, Sun provides separate System V functions in separate libraries so that programs can be written compatible with Berkeley, System V, or use functions from both to work with the converged Unix. Now though, Sun and AT&T have jointly announced a new Unix version, a unification of SunOS and System V, that will include an Application Binary Interface (ABI) to hook Unix applications into the operating system. This should work in the same way as the Application Program Interfaces (APIs) for network operating systems like Novell's NetWare, which allow developers to write software adhering to the interface and leave the operating system to handle the low-level technicalities of particular hardware cofigurations.

Perhaps the ABI will help to standardise the confusing world of workstation Unix implementation. So far, the differences between the different flavours of Unix led the workstation originators to adapt, modify and merge the flavours to produce their own proprietary operating systems. SunOS is one example; a more extreme one is Apollo's Aegis. However, there now seem to be moves towards standardisation based around AT&T's Unix System V 3.2, with Apollo announcing that its new operating system will merge Aegis, 4.3BSD, and the new System V so that software written for any or all of these flavours will run simultaneously on the same workstation.

There is no doubt that the next generation of personal computer hardware will need a flexible and portable 32-bit multi-tasking operating system that can handle the wide variety of processors, system architectures, and input and output devices that will be used. And Unix proponents will say that that is exactly what Unix is. But, for Unix to succeed in the mass market, it needs to provide assurances that every Unix application will run on every Unix system, and also needs a simpler command-line interface and a standardised graphics-based front-end to let users handle a Unix system without ever seeing Unix unless they want to.

The application compatibility seems to be coming, thanks to the improved communication between AT&T and other Unix suppliers about standards, and the promise of unified versions such as Posix. But the chances of altering the command-line interface are slim, given the strength of the Unix hackers' devotion to 'grep', 'ls', and the rest of the cryptic Unix command lexicon, so the graphical user interface is the most important need at present.

Fortunately, there are signs that Unix-based windowing systems are also heading towards standardisation. The Sun 4/110 comes with three such systems: Sun's own SunView, MIT's X-Windows, and NeWS, an implementation of Adobe's Display PostScript design. And Sun is planning a merged system combining NeWS and X-Windows for launch later this year.

The advantage of NeWS and X-Windows is that they are standards available to all. Display PostScript, which makes graphics output independent of the hardware used to display it, is being offered around the computing business and has already been signed up by Steve Jobs' NeXT workstation

the SunTools system command options, but it is nice to know that there is a fully-compatible underlying structure.

The SunLink connectivity options can link to IBM, DEC and other systems using SNA 3270, BSC 3270, X.25, BSC RJE, LU6.2, Channel Adaptor, OSI, DNI, and TE100 standards; while the Open System Network environment combines Sun's NFS network system, Yellow Pages, REX Remote Execution, SunLink, X-Windows and NeWS.

In use

Setting up the 4/110 for single-user operation is as simple as setting up a PC. The thick RGB cable, with separate RGB and Sync BNC connectors, hooks the monitor to the system unit while a simple SCSI cable connects the system unit to a storage shoebox. The shoebox is powered from the system unit, while the monitor requires a separate power cable of its own.

The keyboard, with a three-button Mouse Systems optical mouse coming out of the back of it, goes into its own socket. Then, turning on the power boots the system, either over Ethernet or from the local shoebox, depending on the configuration, and produces a big, blank, white screen with — on the review system — a 'cobra£' prompt. (Cobra was the 4/110's internal codename.) After the usual Unix login procedure, raw Unix is ready and waiting for use.

Typing 'suntools' starts the SunView user interface, described in detail on page, which for most users will be all they see.

The black-on-white monochrome display of the 19in RGB monitor is impressive, with none of the graininess that often goes with displaying monochrome graphics on colour PC screens. In pure text mode outside SunView the display actually looks sluggish in putting text up on the screen, since each character of the default system font is drawn pixel by pixel and there are a lot of pixels involved. But SunView itself snaps windows open and resizes and moves them with a certain amount of vim, at around the speed of a Macintosh SE and slower than a Macintosh II. That difference is understandable, since SunView sits on top of the operating system, like Microsoft Windows, rather than acting as a fundamental part of the system software.

The startup options that can be used with SunView allow the user to choose which Tool programs should be loaded as defaults, set the foreground and background colours using any of the 16 million-plus available colours, and select a custom desktop pattern rather than the normal 50 per cent grey tone. These are the kinds of options that are available from the Control Panel in Macintosh systems, and allow users to customise their desktop machines as they wish.

Other features of SunView are also now appearing in the personal computer market. SunView can run using several monitors at once, giving a much larger effective desktop, just as the Macintosh II can — but not quite as effectively, since windows cannot extend across screen boundaries and items cannot be dragged from one screen to another. However, one

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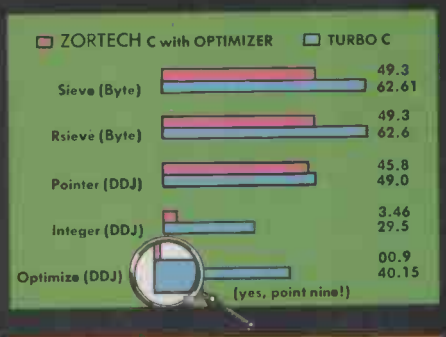

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company as well as by DEC. And X-Windows, originally developed at MIT as part of its Project Athena plan to network various bit-mapped workstations, is now in revision 11 and is available from just about every workstation manufacturer.

All three windowing systems on the Sun range are so-called 'client/server' types rather than kernel-based systems like Apple's Macintosh Toolbox. The window manager software runs as just another Unix process, and other running processes send requests to the window manager server to get access to the display and input devices of the hardware. This method is ideal for network use, where programs running on a remote machine can get access to the window manager running on another. As far as the user is concerned, the program is running in a window on the local screen, even though it may physically be running on a machine a continent away. Doing it this way means that a user can distribute processing tasks to the network machines that best run them: for example, with Sun 4/110 systems, mathematics-intensive applications would be best run on a machine with the Weitek co-processor set installed. With a client/server window manager, only one machine in a network would need to have this set for all other users to be able to run those applications on it and display the results on their own screens.

But whatever the networking standard employed, the user interface on Sun systems resembles the original Xerox PARC windowing techniques more closely than the Macintosh and Microsoft Windows do. Some of the features are the same, notably the use of overlapping windows that can be moved and resized at will, and the use of a 'desktop metaphor' with icons representing applications and files. But some are very different.

Taking the standard SunView environment as an example, the most obvious difference is the way menus are implemented. Instead of having a menu bar at the top of the screen or in every onscreen window with pull-down menus attached, SunView implements the original Xerox scheme of pop-up menus at the mouse pointer position. Pressing the right-most of the three mouse buttons pops up a menu dependent on that mouse position: if the pointer is in a window, the menu refers to the application running in that window, while on the desktop it refers to the system-level tools.

Another feature is what Sun calls 'walking menus', where small arrows next to a menu item indicate that sub-menus exist, and selecting an arrowed item pops the sub-menu up to the right of its parent.

Interestingly, Apple has implemented this walking menu scheme in its latest Macintosh system software versions, and there are even public-domain software packages that implement mouse-position pop-up menus on the machine. However, with MultiFinder it looks as though Apple will not implement this officially.

Other SunView features are more familiar. For example, clicking and holding down the left mouse button while pointing at a window's title bar allows that window to be dragged to a new position; and, as with the Macintosh, the re-positioned window remains empty while the system figures out what information needs to be re-written to the new position. But closing a window, resizing it or zooming it to full-screen size must be done by popping up a control menu associated with the title bar and choosing the appropriate command from it; there are no close, zoom, or resizing icons attached to windows. Starting an application from the desktop is done either by typing a command into the command-line interface in a Unix shell window, or by specifying the applications to load automatically at start-up time. If an application is loaded it can be reduced to an icon on the desktop, and re-opened into a window by a single click of the left mouse button.

In general, the SunView system is simple to learn and use, although the use of a three-button mouse is sometimes confusing to those used to the single-button control provided by the Macintosh and now by Microsoft Windows. But there are things that Sun could learn from the personal computer windowing implementations, notably simple cut-and-paste of text and graphics between windows, a non-menu-based window size control, and the ability to activate a window simply by clicking on it rather than by selecting an implicit 'Unhide Window' command from a menu.

And again, the windowing system looks slow compared with the personal computer competition, particularly when it comes to updating resized or repositioned windows. However, SunView scores heavily over the competition when it comes to configurability, as anything in the user interface can be changed at will.

What the personal computer business has to learn from windowing environments like SunView is the method of windowing applications running over a network with interprocess communication between windows, and the superior configuration options provided as standard. There is no doubt that client/server windowing systems running on big, fast bit-mapped screens on top of a networked multi-tasking operating system that may or may not be Unix, are on the way in the personal computer market. **Peter Jackson**

thing SunView *can* do that the Macintosh can't is divide a single screen into separate monochrome and colour regions, each capable of being used independently.

Another interesting feature is that colour windows can be overlaid on the monochrome desktop, using the full 256 colours available for simultaneous display. But if one colour window uses 256 colours, and then a second colour window is opened, the colours will be 'false' in the second window, like an astronomical photograph or some flashy video effect. However, moving the mouse pointer into the new window corrects its colour display, sending the original window into false colour mode. This is a visually disturbing but neat solution to the limited choice of simultaneous colours available for display.

The real power of the 4/110 is not really apparent when a single task is being run under SunView, since it does appear slower than a Macintosh II, for example. But, when several processor-intensive tasks are loaded and run in different onscreen windows, it is easy to see what the system can do. With several copies of a single graphics image redrawing continuously in their windows, it was still possible to bang away on the keyboard, putting text into an editor window, with hardly any visible slowdown. If OS/2 can deliver this level of multi-tasking performance, it will be surprising.

The Sun keyboard is odd, with a total of 34 function keys arranged at the left end, right end, and across the top. The top row of function keys is squashed right down on top of the numeric row, making for typing errors, and the positioning of keys like Del, backspace, and backslash is unhappy and unfamiliar. Four of the right-hand function keys can operate as a cursor control diamond, but there is no separate cursor pad and no numeric paid either. But in use there was little problem, since the mouse control is extensive and the Mouse Systems mouse is accurate and light to the touch.

Indeed, the whole machine feels powerful and can be used without worrying about memory or storage limits. The benefits of big RAM capacities and big hard disks, combined with a lot of processor power, become obvious in true multi-tasking environments.

Conclusion

If you take all the architectural innovations of recent high-power PCs, it soon becomes clear that Sun has been using them and improving on them throughout its history. With the 4/110, however, it has come closer to producing a machine that shows a direct lineage from the personal computer and closes the price gulf between PCs and workstations. Some of its electronic features are already in use in PCs, and others, like enormous RAM capacities and extra-high-resolution mixed colour and monochrome bit-mapped displays, soon will be.

This type of machine is the future of personal computing — and the future is closer than you might think.

Sun is on (0276) 62111. END

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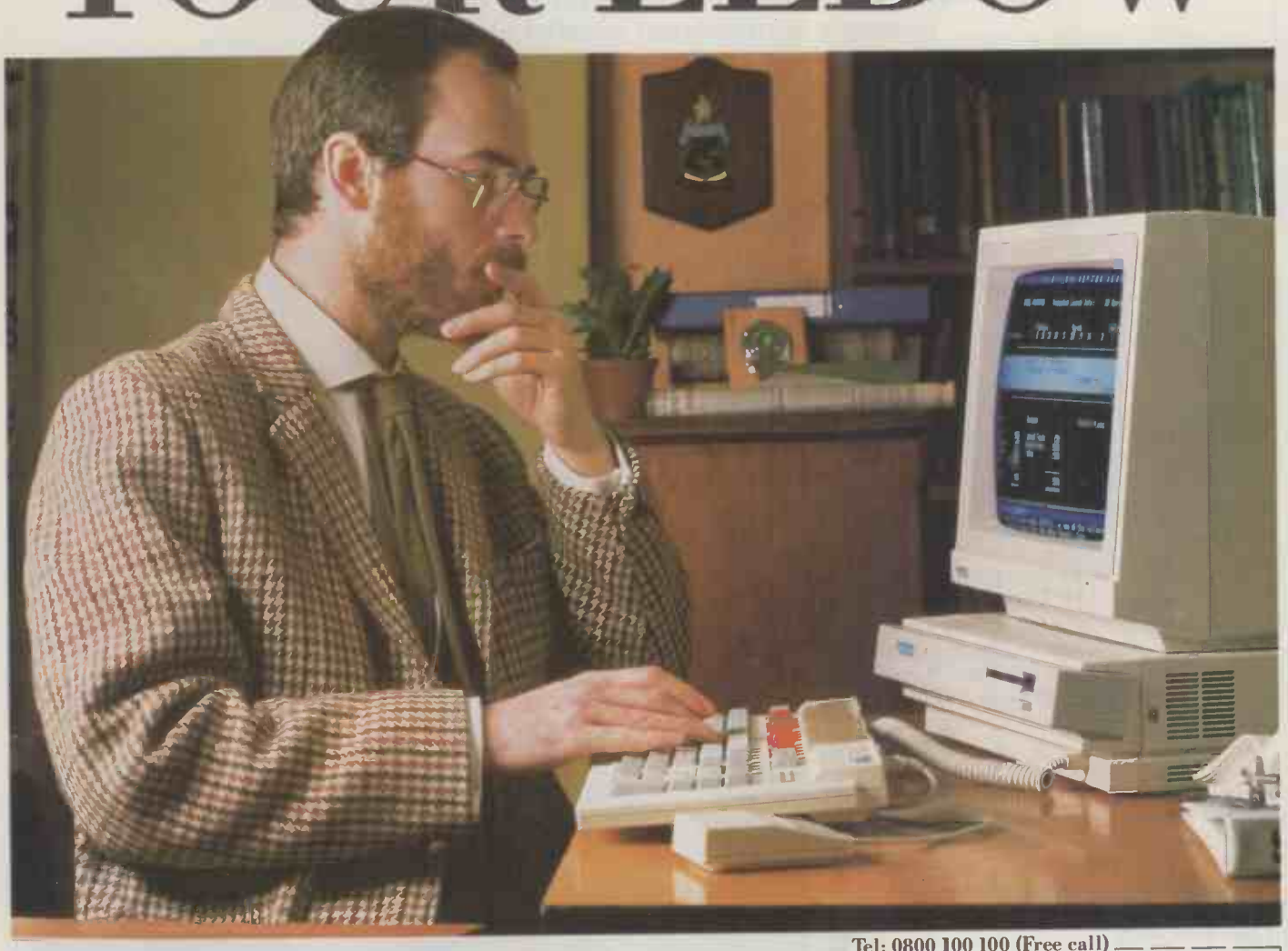

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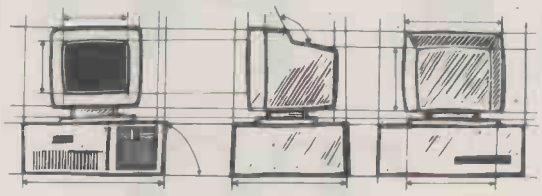


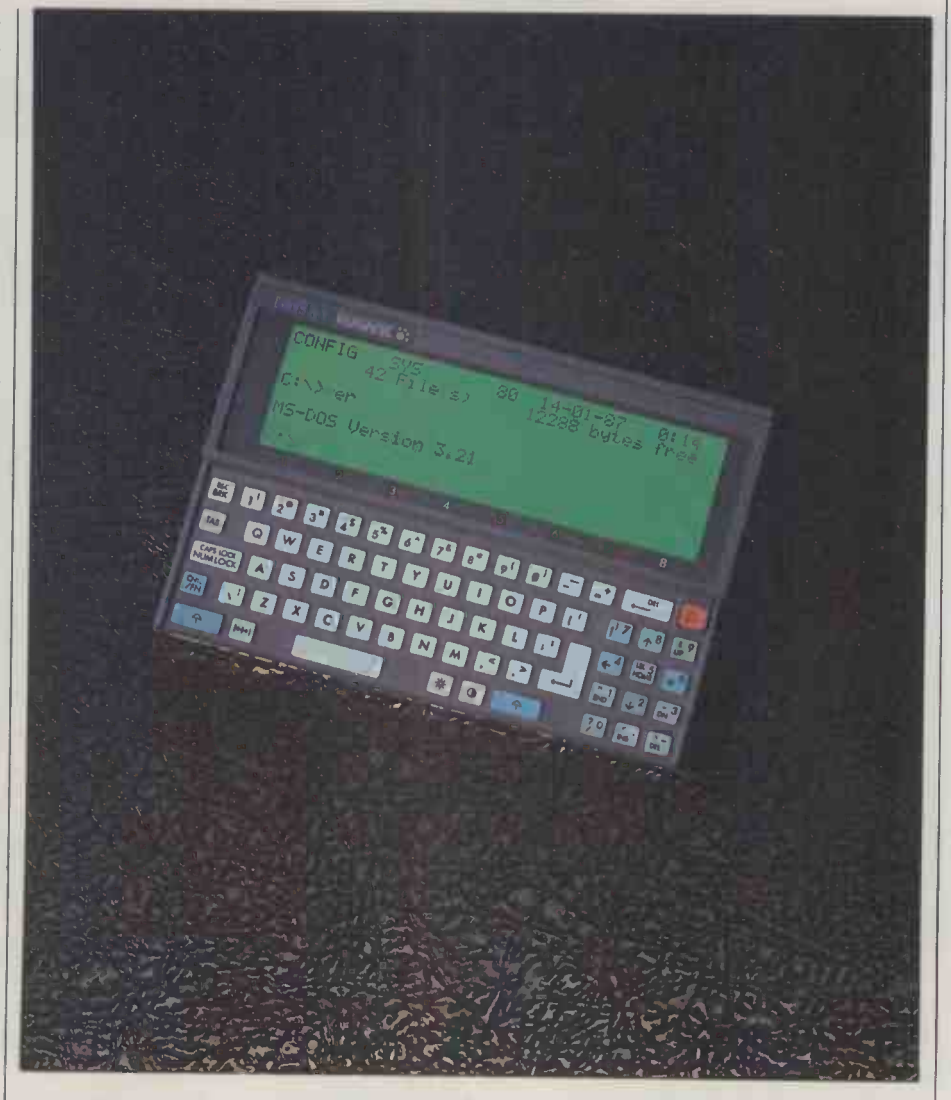
Husky Hawk

Small may be beautiful, but it's not necessarily cheap. Marvelling at how so much hardware can be packed into such a small box, Martin Wren-Hilton also swoops on the handheld Hawk for having a complicated parallel architecture.

In April 1987 we looked at the Husky Hawk, a tiny handheld computer with full CP/M compatibility. One year on, we consider the latest member of the Husky family of diskless portables, the Hawk 8/16. It is probably the smallest PC in the world.

Husky has built itself a reputation for selling rugged machines, designed for rigorous outdoor use. The Hunter is rain-proof, the Special Performance is hurricane-proof and the military specification M208 is virtually bomb-proof. The original Husky Hawk was the first 'executive-proof' product, designed to be carried around in a briefcase. All four of these machines run Husky's own DEMOS (Disk EMulation Operating System), which emulates CP/M 2.2.

Like its CP/M brothers the Hawk 8/16 — which runs MS-DOS 3.21 — is destined to be used in specialist vertical applications involving data entry. Although it is capable of running some well-behaved, off-the-shelf programs, it is most likely that custom programs will be developed for users of the Hawk 8/16. Indeed. Husky claims that the prime reason for making the machine was to allow developers to use a broad range of development tools such as Turbo Pascal and Microsoft C.



Hardware

Physically the Hawk 8/16 looks identical to the original Hawk. Not too surprising, because it *is* an original Hawk — with a second processor and an interesting parallel processor architecture. Heath Robinson would be proud.

Weighing just 1lb 12oz, the diminutive grey ABS box is a credit to the Husky engineers. It may not be quite as rugged as its outward-bound brothers, but it has certainly inherited enough strength to make it as bash-proof as necessary.

The front profile of the case is A5 size. To get an idea of what that looks like, take a look at a horizontal half page advert in this magazine. The Hawk 8/16 redefines the term 'portable', but it isn't a laptop. On the back of the case are two recesses, for your thumb and fingers. A thick elasticated band goes behind your hand to keep the machine attached to your mitt.

This arrangement feels both comfortable and secure, but leaves you with just one hand for the keyboard. That's no great loss because (a) the keyboard has not been designed for extended periods of typing and (b) most applications for the Hawk 8/16 will involve only occasional data entry.

To the right of the case is a flap covering two RS232 serial ports. COM1: features a DB25 connector for attaching an external modem, printer or other asynchronous device. COM2: has an 8-pin mini-DIN con-

nector, which is where the optional Husky bar-code reader attaches. In future, Husky wil be making available an external disk drive which connects to this port but at the moment the only way of importing programs is via an RS232 cable.

On the left of the case is another flap, this time covering an expansion port that accommodates the Husky Sidebox range of peripherals. These include a compact modem and a thermal printer. The Sidebox modem supports V23 communications and has auto-dial and auto-answer facilities. For unattended operation, the computer can be programmed to switch on when the phone is answered, which is a useful feature.

Once attached, the Sidebox peripherals are meant to be left there, rather than being repeatedly connected and disconnected. A metal bar across the top of the case adds rigidity and only one of the two devices may be attached at once. Power for the Sidebox peripherals is drawn through the expansion port from the computer's rechargeable battery pack.

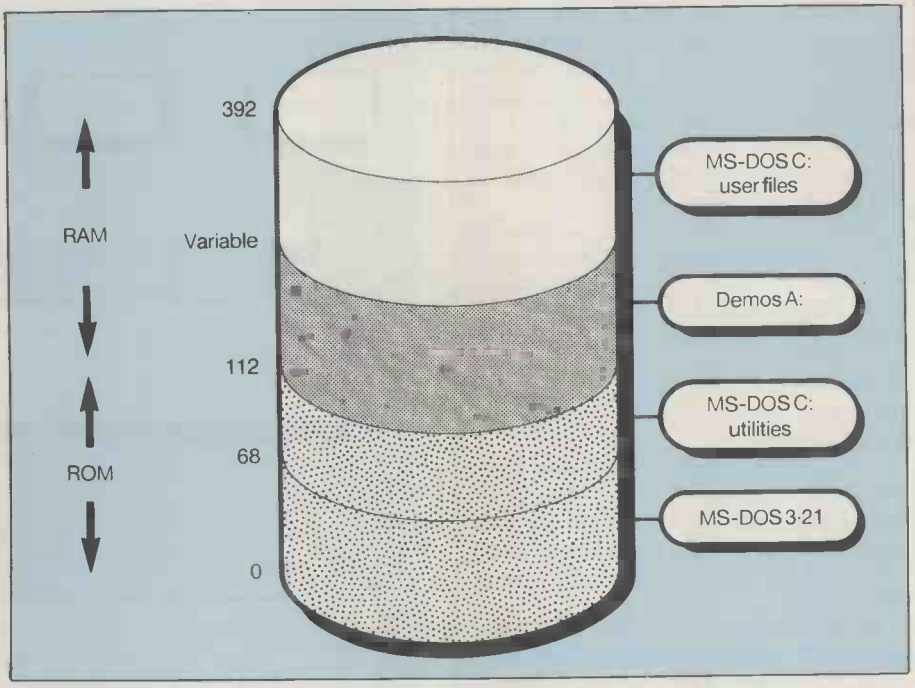
Underneath the case are four infrared opto-couplers which, operating at up to 9600 baud, connect the Hawk 8/16 to an optional 'Homebase' unit. The Husky Homebase is a combined intelligent modem/recharger which is typically meant for sending data back to the office which has been collected during the day. Data integrity between the computer and the Homebase is ensured by the use of a cyclic redundancy check (CRC) error-correcting protocol.

Homebase has its own processor and memory, so can answer the phone and accept data, even when the Hawk 8/16 is not attached. Moreover, Homebase can accommodate two credit card memory modules, although, as these are still under development, they were not available for review.

Occupying 30% of the front is a 40×8 character supertwist LCD. Through emulation software, this is mapped on to an 80×24 virtual screen which is equivalent to the IBM Monochrome Display and adapter. Pressing SHIFT and a cursor key moves the 40×8 window up, down and sideways over the virtual screen. Toggling 40 characters at a time from side to side is also possible using a key to the left of the space bar. With it, you can see the full 80 columns quite easily.

Graphics can also be displayed directly on the 240×64 pixel screen through extended BIOS calls, although it is not possible to scroll graphics because the display data is not stored in a virtual screen buffer.

Character generator data is stored in RAM and can be modified as necessary to support any unusual symbols.



The Husky Hawk 8/16 virtual disk. Note that the 280k of RAM is shared between MS-DOS drive C: and DEMOS drive A:

An electroluminescent back panel is activated by pressing a key to the immediate right of the space bar. The back panel is lit only momentarily by pressing it, so to switch the back panel on for longer, press the key with SHIFT. The back panel now stays lit until you switch it off by pressing the key once more. Of course, using the electroluminescent panel helps to eat away at the battery power.

In an office lit only by daylight, I found no need for back light, as the large characters and supertwist display made the screen clearly legible. To the right of the light key is one for adjusting the contrast. Pressing it repeatedly, you can select one of four possible contrast levels.

Interestingly, the display is not a standard module bought off the shelf, but is hand-assembled by Husky with components manufactured to its own specifications.

Under the display is a 68-key keyboard, laid out in five rows. The review model came with a semi-IBM-compatible keyboard, which is meant for use during software development. The real end users of the machine, who will have no contact with messy things like MS-DOS command prompts, will get a simplified 'user' keyboard with 10 function keys across the top and a dedicated numeric keypad. For really big orders, Husky will manufacture customised keyboards for specific applications.

The most unusual feature of the keyboard on the review machine was the lack of an ALT key. I was assured by the Hawk 8/16's designer that it was possible to emulate any IBM key codes in software.

As the Hawk will seldom be used with standard MS-DOS applications, however, the lack of an ALT key may not be too important.

Another unusual feature is the combined CNTL/FN key. Pressing this with a numeric key on the top row generates a function key, but pressing it with an alphabetic key gives a control code.

Memories of the Sinclair ZX family of computers came flooding back when I started playing with the numeric keypad — each key has three functions. Pressing the combined CAPS LOCK/NUM LOCK key engages both at the same time. With NUM LOCK on, you get numbers from the numeric keypad. With it off, you get cursor control. And with SHIFT pressed, either the display moves around the virtual screen, or you get characters like " and ?. Like the Sinclair computers, it is quite easy to get used to.

Opening the case is as simple as removing four Philips screws. Packed inside, there are two printed circuit boards (PCBs), a loudspeaker and the rechargeable battery pack.

As you would expect from a diskless machine, plenty of memory is supplied — well over one megabyte including RAM and ROM.

The PCB at the bottom of the case accommodates an HD64B180 processor (a superset of the Z80), 352k of RAM, 48k of ROM and a few other bits and bobs. This is almost ident-

ical to the original Hawk, and is used as a subsystem to control all I/O operations (see Fig 2). Using custom hardware, the address bus has been expanded from 16 bits to 19 bits, to allow for a 512k address space. Three 128kbit EPROMs are used to make up the 48k of ROM.

Under the keyboard lives a smaller PCB with the 80C88, 640k of RAM and 128k of ROM. The ROM is actually a single 1Mbit EPROM. A ribbon cable connects this PCB to the HD64B180 subsystem, through a ROM socket on the larger PCB. Husky calls this the Parallel Interface Processor Exchange.

Also on the smaller PCB is an 8259 Interrupt Controller and an 8253 Programmable Timer, as found in the true blue IBM PC, and some logic 'glue' chips which hold everything together.

Both PCBs are manufactured using advanced surface mount technology (SMT), on both sides of each board. All components (except the ROMs) are 'flat pack' devices, and unlike those in many portable computers, all chips are cool-running, low-power CMOS.

A real time clock-calendar not only provides timing information to programs, but can also be set to switch the machine on and off at certain times. This is particularly useful with the Homebase option, so that the machine can be programmed to call head office at, say, midnight, to upload all the data that has been collected during the day. It could then download software updates or anything else from headquarters.

With this much squeezed in, there is no room for any internal expansion. Husky has no plans to bring out an external expansion box for IBM PC compatible expansion cards, as the architecture would not be able to support them.

Running at 6.144MHz, this portable is hardly a speed demon, but it still turns in a Norton SI Computing Index of 1.7 and a Benchtest figure of [1.15].

Even when the machine is switched 'off', the CMOS RAM keeps its contents. When switched on, the Hawk 8/16 does not boot from cold, but just returns the user to where he was when the machine was last used. The register contents of both microprocessors are saved in RAM. By switching the machine on with CTRL-C pressed, then entering a 5-digit password, it is possible to boot the little machine from cold. Another method involves using a pin to prod a tiny recessed switch in the base of the computer.

Amazingly, when it is waiting for a key depression (while entering commands at the MOS-DOS C> prompt, for example), the 80C88 can be switched off. Obviously, the contents of all the registers are preserved, so that when the 80C88 restarts, it can pick up from where it was when it was switched off. It is funny to think that when using the typematic feature — pressing a key and holding it down — that the 80C88 is rapidly being switched on and off by the HD64B180!

Of course, Husky did this to save energy, and that it certainly does. Under 'normal' conditions, the battery life is rated at 30 hours from a rapid one hour charge. Even with the electroluminescent back panel in use, you can expect 12 hours or so. Unfortunately, I did not have an opportunity to test out the life expectancy of the battery, but a small utility called POWER, which displays in percentage terms how charged the battery is, indicated that the nickel-cadmiums held their charge well.

When the amount left approaches 30%, the Hawk 8/16 switches off to keep the contents of RAM intact. In this state, data and programs are retained for up to one month. Application programs can read this percentage amount by using extended BIOS calls to warn the user when it is time to recharge.

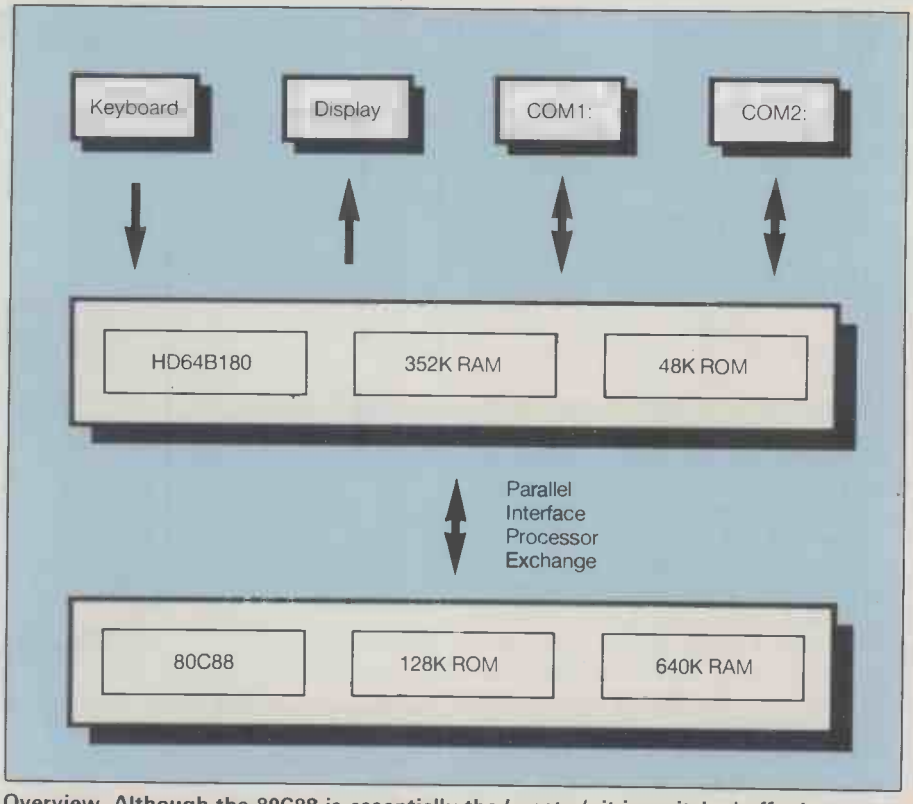
A 'pregnant plug' power supply comes with the Hawk 8/16, as does a car lead for recharging the nickel-cadmium pack. The ability to recharge from flat in one hour is amazing. After this time, the batteries are trickle charged, to keep them topped. Even while being charged, the Hawk 8/16 can be used.

In days gone by, fast-charge batteries had short life-spans — perhaps 10 or 20 charges before the ability to hold charge deteriorated. Husky says that this is not the case with the Hawk 8/16, which can be fast charged hundreds of times.

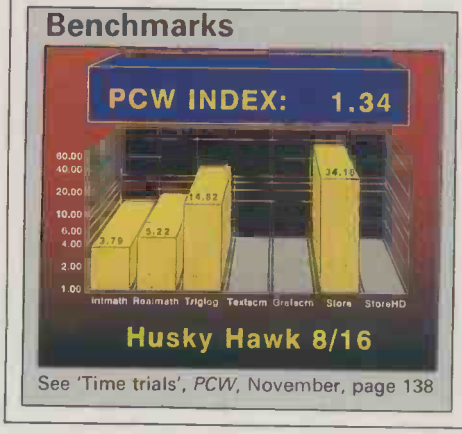
Software

As standard, the Hawk 8/16 comes with two lots of software — one for each processor. DEMOS, Locomotive Basic and HASM (Husky Support Module) are for the HD64B180 support subsystem, and MS-DOS 3.21 and a 16k PC BIOS run on the 80C88.

When the machine boots for the first time, or when reset, MS-DOS is loaded and the C> command prompt appears, ready for you to run an MS-DOS program. But you can (if you



Overview. Although the 80C88 is essentially the 'master', it is switched off when MS-DOS or an applications program is waiting for a key to be pressed



See 'Time trials', *PCW*, November, page 138

really feel so inclined) run CP/M software by entering DEMOS. The A> prompt then appears and you can run your CP/M application. In fact, HASM — the support module that handles I/O for MS/DOS — is a CP/M application! So returning to MS-DOS is as simple as typing MSDOS. Application programs, too, can switch from MS-DOS to CP/M and back, although the usefulness of this is questionable.

Husky's DEMOS is fully compatible with Digital Research's CP/M 2.2, right down to the low-level BDOS calls. Locomotive Basic, although present, is not likely to be used by anyone, and is a remnant from the days of the first Hawk.

Of the 352k of RAM available to the HD64B180, 280k is assigned as a virtual drive that is shared between DEMOS and MS-DOS (see Fig 1), 64k is the Transient Program Area (TPA), 4k is used to simulate the directory usually found on track 0 of a CP/M disk and the final 4k holds the character generator matrices, the virtual screen and the real graphics map.

The virtual drive in Fig 1 shows 280k divided between the MS-DOS C: drive and the DEMOS A: drive. Both operating systems think that they own the whole 280k of space, so when one operating system writes data to its RAM drive, the area in the other file allocation table (FAT) is marked as 'bad sectors', to prevent one file overwriting another.

MS-DOS Drive C: includes MS-DOS utilities, some of which are in RAM, some in ROM. I ran a program to check the attributes of the files in C: and found that the ones in ROM were marked as 'read only', as you would expect.

The 16k PC BIOS itself is of Husky's own design. I/O requests are passed to HASM, which does what has to be done.

At its simplest level, the Hawk 8/16 runs some well-behaved MS-DOS applications. What it won't run are programs that attempt to write directly to the screen.

In order to write to the screen, a program must use standard BIOS interrupts and Ansi escape sequences. It is also the case that reads from the keyboard must be done through the BIOS.

Under DEMOS, screen emulation uses the Televideo TV950 standard that comes from the world of CP/M.

A number of extra extended call functions have been added to INT 15H for the Hawk 8/16. Functions 10H on now include open DEMOS file, close DEMOS file, read DEMOS file, write DEMOS file, delete DEMOS file, search DEMOS file, execute Hawk escape codes, display string, switch off 80C88 and return to DEMOS, display COM port setup menu, get DEMOS error code and switch off 80C88 until a key is pressed.

When a particular task has finished executing, the Hawk 8/16 can switch itself completely off through an extended BIOS call. If required, the internal clock can be set to switch it back on again later.

Technical specifications

Main processor:	80C88, 6.144MHz
RAM:	640k CMOS
ROM:	128k CMOS, including: — 16k Husky BIOS — 68k MS-DOS 3.21 — 44k MS-DOS utilities
Auxiliary processor:	HD64B180, Z80 compatible, 6.144MHz
RAM::	352k CMOS, including: — 280k virtual disk — 64k TPA — 4k DEMOS directory (drive B:) — 4k video memory
ROM:	48k CMOS, including: — DEMOS — Locomotive BASIC — HASM (Husky Support Module)
Mass storage:	None
Display:	Supertwist LCD with electroluminescent back panel, 240×64 pixel resolution
Keyboard:	Semi-IBM-compatible, 68 key (simplified end user keyboard optional)
Expansion:	Sidebox modem, V23 auto dial, auto answer Sidebox thermal printer, 42 chars per line Homebase intelligent modem and recharger Optical bar code reader
Size:	8.5×6×0.8 ins
Weight:	1lb 12oz
I/O:	DB25 RS232 serial port, 8-pin mini-DIN RS232 serial port, four proprietary infra-red opto-couplers, 37 way D type expansion port
Bundled software:	Locomotive BASIC
Main operating system:	MS-DOS 3.21
2nd operating system:	Husky DEMOS, CP/M 2.2 compatible.

Documentation

Four manuals describe the hardware and software in some detail. The *MS-DOS User Guide* and the *MS-DOS Reference* are to be found in a single binder. A standard *Husky Hawk Manual* describes the basic machine and a *Hawk 8/16 Manual* provides information that is specific to the 16-bit processor extension.

Prices

The Husky Hawk 8/16 with wrist strap, one keyboard overlay and soft carrying pouch costs £1345. The Sidebox Modem is £195 and the Sidebox Thermal Printer will set you back £175. For £395, you get the Homebase combined modem/charger with 16k of RAM. These are one-off unit costs, exclusive of VAT.

Conclusion

It would be unfair to compare the Hawk 8/16 with conventional portable PCs, because the only reason Husky chose to make it PC compatible was to make it reasonably fast and easy to program with all the powerful tools that are available for PC software development. Most companies will choose to develop software for this Lilliputian machine using conventional desktop PCs.

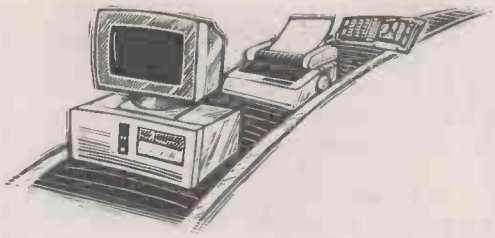
In positioning this product between the 'electronic bricks' that are used primarily for stocktaking, the laptop personal computers that are used to run word processors and spreadsheets, Husky is attacking a large market of sales reps, field engineers and researchers for whom it is well worth considering.

During the review, I couldn't help thinking that Husky has used an unnecessarily complex architecture in the Hawk 8/16. Why use two main processors when only one is really needed?

Husky assured me that adding some components to its existing Hawk model cut down development time. Unfortunately, it sacrificed the better compatibility that is found in most laptop PCs. I also believe that the company's decision to go with the parallel architecture made the Hawk 8/16 unnecessarily complicated. Of course, none of the internal complications will be apparent to end users.

At £1345, the Hawk 8/16 is no bargain basement toy. It is a respectable performer, and packs a hell of a lot of hardware into a pygmy-sized case. Get one if you have a unique application to which it seems suited, but don't buy it if you want to run Lotus 1-2-3.

Husky is on (0203) 668181. END



Laser printers

As ever, evaluating a group of printers is a matter of priorities — and a question of how much you want to spend. Owen Linderholm throws some light on a range of lasers from Apple, Toshiba, SBC and Kyocera.

Laser printers are really used only in a business environment. Even though prices are falling continually, the cheapest laser printers, at just under £1500, are far beyond all but business budgets. I decided to test the printers in general use and to perform specific tests for print quality and speed. Another important consideration was installation and maintenance.

Since this review is essentially to test Hewlett-Packard LaserJet Plus compatible printers, I set them all up in their HP emulation modes and then took a brief look at their other facilities. Most laser printers have at least one form of emulation for another printer — typically, emulation from an IBM printer and for a standard daisywheel printer. These allow the printers to operate as replacements for standard word-processing printing. A laser printer in HP emulation mode is still acting as a daisywheel printer but can also receive and print graphics and fonts as bit images.

To test speed and quality of print on ordinary text operations and on graphics and desktop publishing, I used five tests. First, I used all the printers with Ventura DeskTop Publisher, printing four tests. The first two were standard: printing the 'Scoop' pages and the 'Capability' page. The next two tests involved printing a more ordinary Ventura document, created for the review. This was almost all text, with some customised styles, and used a new Bitstream font which must be downloaded to the printer. One test was to print a single page and the other to print all nine pages of the document. The fifth test was to print a long WordStar text document correctly with the laser printer acting as a text printer.

Warning: the toner in laser printers can be very dangerous. If the powder is inhaled it can cause severe respiratory problems. With most laser printers this isn't a problem, but I have encountered some which have toner cartridges with loose tops. I hate to think of the consequences of dropping one of these while putting it in the printer. Most printers use the technique of covering the toner cartridge with a plastic seal which is removed after the cartridge has been safely installed.

Other problems with installation stem from the connections to the computer and installation of driver software.

The Apple LaserWriter NT/X

The LaserWriter NT/X is part of a new range of laser printers from Apple — the LaserWriter II SC, II NT and II NT/X. They all use the same casing and Canon engine, and have space for a large plug-in board to control the printer. In the basic model this is a small and sparse board which is driven using the QuickDraw routines in the Macintosh — it can *only* be used with a Macintosh. The NT is the LaserWriter Plus replacement and is PostScript-driven with 35 resident PostScript fonts.

The top model, the NT/X, is very similar to the NT except that it uses a 68020, can have more internal memory attached and has a SCSI port to attach a dedicated hard disk to the printer. This hard disk is used to store recently and commonly used bitmaps of PostScript output to speed up the process of printing. In addition, the NT/X claims to include HP LaserJet Plus emulation.

The LaserWriter NT/X is a small and compact printer with the new Apple light grey livery. The printer looks a bit like a square box with half a cylinder sticking off one side. A paper tray slots into the opposite side. Visible controls and indicator lights are minimal.

The NT/X has 1Mbyte of ROM (holding fonts) expandable to 2Mbytes, and 2Mbytes of RAM expandable to 12Mbytes. The available interfaces are AppleTalk, RS423 and RS232, and a SCSI interface to attach an external SCSI hard disk for the printer's exclusive use. In addition, there is an Apple Desktop Bus port for future expansion. The printing protocols supported are PostScript, HP LaserJet Plus and a subset of the Diablo 630.

Before I catalogue the problems I had with the Apple LaserWriter NT/X, I should make clear that it is not primarily designed to be HP compatible, nor is it really meant to work best with an IBM PC. Apple LaserWriters are intended to be driven by Apple Macintosh computers using PostScript.

The LaserWriter II NT/X was very straightforward to install in an AppleTalk network. All you have to do is plug it in and let the network software recognise it and use it when needed. Unfortunately, hooking a PC into AppleTalk involves adding in an AppleShare PC card and driver software, neither of which were available. Alternatively, you can attach the LaserWriter to the serial port.

The NT/X model is claimed to be the only LaserWriter that can perform HP emulation, and I'm not at all sure that even this claim is accurate. Printing the Scoop page from Ventura to an HP LaserJet Plus with the NT/X set to HP mode resulted in incorrect output. The headline was printed in 10 point (rather than 36 point which is the best that HP emulation can manage). In many places in the text, letters were run together and over-printed. In addition, here and there letters were missing. Graphics, however, were printed correctly.

The Capability page gave even greater problems. Most of the text was run together and overprinted.

Clockwise from top left: the Toshiba PageLaser 12, the SBC SpeedLaser 6, the Apple LaserWriter NT/X and the Kyocera F1200

The point size display managed only up to 18 point type correctly. Once again, graphics were accurately printed and the mysterious vertical-line problem was evident.

The test to print the first page of the other Ventura test got all the text right apart from the two capital letters on the headline but the vertical-line problem appeared again. Printing ordinary text was better, although the printer occasionally hiccoughed, missing pages or getting confused with bits of text.

It is only fair to point out that the Apple printers are meant to be used as PostScript printers, and they functioned very well in this capacity even over the serial link.

I also used the LaserWriter NT briefly with an Apple Macintosh, and was impressed by the output.

Documentation

The user manual for the LaserWriter NT/X is very informative, covering installation for the various models (changing DIP switches at the back of the printer) and installing the printer on AppleShare, as well as extensive maintenance and troubleshooting sections. It even has a rather neat diagram showing how to lift the printer with the least strain to one's back.

Toshiba PageLaser 12

The Toshiba PageLaser 12 is claimed to be the laser printer with the lowest cost per page of output. This is because of the long life of replaceable parts within the printer. It is also extremely fast, printing text at up to 12 pages per minute.

The proprietary Toshiba engine is brand new and has not yet been fully tested in the market-place, so it is impossible to know if the claims for long life are true. Toshiba says the printer will be able to cope with printing 25,000 pages per month and that the whole printer should last for about 1.2 million pages. These figures may not seem very remarkable to the novice laser printer user, but many parts of a laser printer wear out fairly rapidly. In addition, consumables like toner need to be replaced frequently.

Compared with many laser printers, these are very good figures. Other laser printers have similar or worse figures for toner use (1500 to 5000 pages), worse figures for drum life (20,000 to 30,000) and much lower figures for the number of pages. The typical 'life' of a laser printer is 180,000-400,000 pages.

The printer itself is a very large, almost square, box, reasonably styled. It has minimal connections but does have an LCD display to give information about the state of the printer and a set of touch controls to change these. A paper tray fits neatly all the way into the front of the printer. There is a standard Centronics parallel port and an RS232C serial port. At the top left of the printer are three slots for plug-in IC cards. One of these is for printer emulation and the other two are for additional fonts. 500k of memory can be expanded to 2Mbytes with an additional board. Toshiba P351, IBM Graphics printer and Diablo 630 emulations are built-in.

The Toshiba was an ideal printer to use. I had no problems setting it up and getting it to work in HP emulation mode. It does not have HP emulation built-in but has a slot for a plug-in IC card. One of these, for the HP LaserJet 500+, is supplied as standard. This was already plugged in — I just had to switch the printer to cartridge emulation.

The Scoop page printed perfectly, exactly as an HP *should* print it. Solid blacks are very dark and smooth, although the edges seem to break up just a little. Straight lines are ex-

tremely good and solid, but fonts look a little ragged. The Capability page was also very good and the edges of solid black areas printed slightly better.

My own test page was also dealt with perfectly apart from the reversed sub-head, which HP printers cannot deal with. Font edges were relatively smooth.

The Toshiba was also remarkably fast. It should be pointed out that I used it with only the 500k of memory that comes as standard with the printer. If the extra 1.5Mbyte cartridge were added, speed would improve considerably, particularly for those pages with a lot of graphs.

The Toshiba was also excellent at printing ordinary text files from WordStar, and was very quick.

Documentation

The Toshiba manual was a little short on technical background information but had the usual full installation and maintenance sections. In addition, it had a very handy tear-out reference card showing everything you would need for day-to-day use very clearly.

The SBC SpeedLaser 6

The SpeedLaser has a number of unusual features. Firstly, it is the cheapest of the three printers tested. Secondly, it uses an unusual interface, a plug-in card which buffers the information and transfers it to the printer. In addition, fonts can easily be downloaded to the printer for use, rather than using more expensive font cartridges which plug into the printer. The SBC comes with 14 fonts on disk ready to be downloaded.

The engine in the SBC is a Ricoh engine and is rather less robust than the Toshiba and slower than the Canon, but is considerably cheaper.

The printer itself is very small and light, coloured one of the usual shades of light grey. A slightly strange paper tray slots in, slanting downward. The front panel of the printer shows the origins of the laser printer very well. It is exactly the same as some photocopier front panels with little iconic coloured lights. On the top of the printer is a symbol translation table showing what the lights mean. Some of these are obviously laser-printer specific, like 'Data in Controller Buffer', but others could be straight off a photocopier, like 'Call Service/Engine Error'.

The printer is fairly easy to open up, but the construction is a bit poorer than the other printers here.

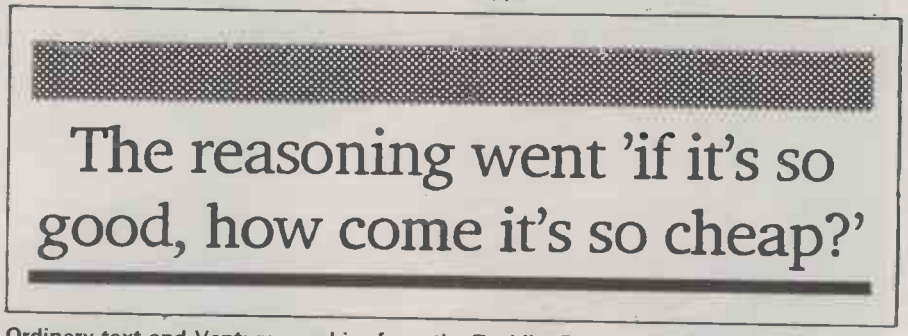
The interface to the card from the printer looks like a standard Centronics port, but the other end of the cable is a 50-pin D cable which plugs into the controller card. The controller card is a full-length PC card with lots of I/O and control circuits which converts a high-speed video-type signal to the sort of signal the printer can understand.

The SBC controller card has 1Mbyte of RAM for use as a bit image buffer and also takes up to 64k of the computer's memory for a printer driver, emulation and resident fonts. SBC supplies 14 downloadable fonts, any of which can be installed.

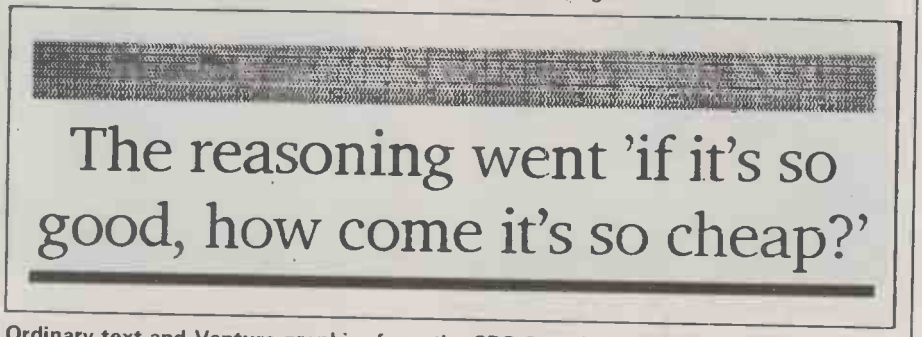
The SBC also includes a printer programming language to control emulations, fonts, sizes and graphics. Macros can be set up in this language, and it can be used to control the printer fully from the computer and to add simple graphics and fancy fonts to ordinary text printing.

The SBC arrived fully set up and at last my pessimism was rewarded. It told me it was out of toner, so I opened the printer up to take a look. The toner cartridge fell apart in my hands (well, that's the simplest description of what happened), depositing a large pile of toner all over the workings of the printer. I eventually got it cleaned up and SBC was extremely efficient about getting a replacement printer to me. (I ought to point out that none of this was the company's fault. The original printer had been sent on from somewhere else and had been badly packed.)

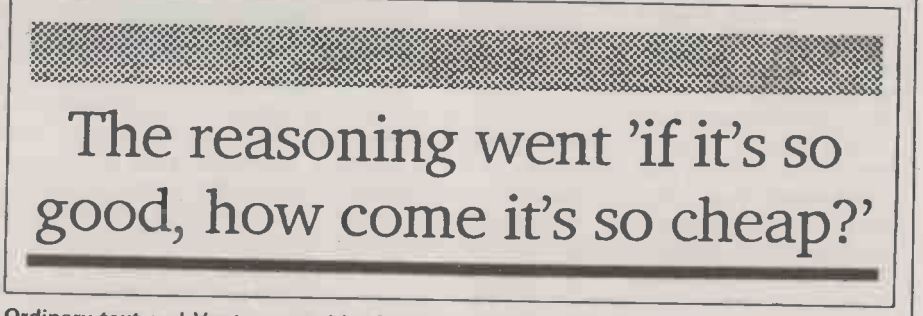
Ordinary text and Ventura graphics from the Apple LaserWriter NT/X



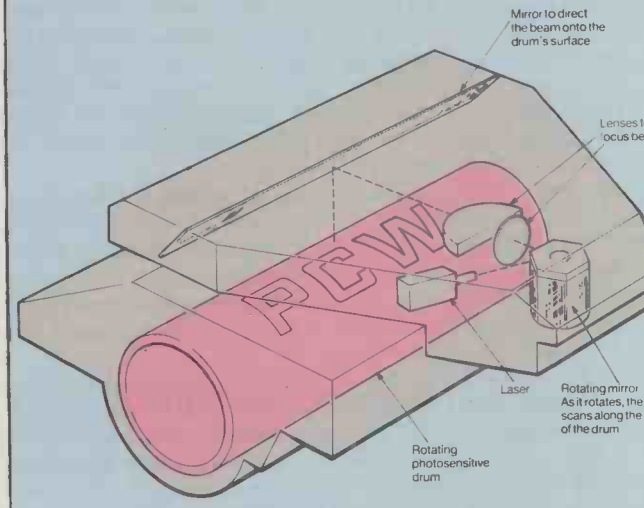
Ordinary text and Ventura graphics from the Toshiba PageLaser 12



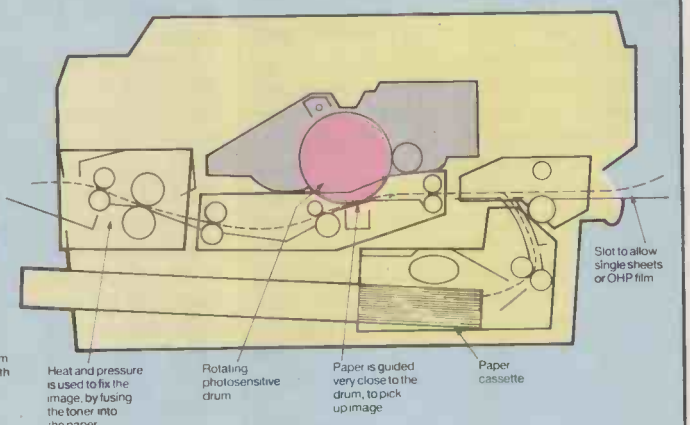
Ordinary text and Ventura graphics from the SBC SpeedLaser LP6



Ordinary text and Ventura graphics from the Kyocera F1200



Expanded view of the drum and laser



Side view of a laser printer showing the complete paper path

Technical specifications

The Apple LaserWriter NT/X

Price:	£4495
Paper sizes:	A4, B5, US letter, US legal, envelope — each needs a special cassette
Size:	22cms x 51.3cms x 47.5cmcms
Weight:	20.5kg
Expected life:	300,000 pages minimum
Standard memory:	1Mbyte ROM, 2Mbytes RAM
Printing modes/ emulations:	PostScript, Diablo 630 and HP LaserJet Plus
Supplied fonts:	Courier, Helvetica, Helvetica Narrow, ITC Avant Garde, ITC Bookman, ITC Zapf Chancery, ITC Zapf Dingbats, New Century Schoolbook, Palatino, Symbol, Times

Toshiba PageLaser 12

Price:	£2995
Paper sizes:	A5, 5½ins x 8½ins, B5, A4, US letter all standard; US legal optional cassette
Size:	32cms x 48.3cms x 49.5cms
Weight:	39kg
Expected life:	1.2 million pages (600,000 before first service)
Standard memory:	500k expandable to 2Mbytes
Printing modes/ emulations:	HP LaserJet Plus, Toshiba P351, IBM Graphics, Diablo 630
Supplied fonts:	Line Printer, Prestige Elite, Courier

SBC SpeedLaser SB6

Price:	£1795
Paper sizes:	Half US letter, A5, B5, A4, US letter, US legal
Size:	20.6cms x 42.2cms x 41cms deep
Weight:	17kg
Expected life:	At least 180,000 pages.
Standard memory:	1Mbyte (on controller card)
Printing modes/ emulations:	HP LaserJet Plus, Epson FX100
Supplied fonts:	Fonts downloadable from disk — 14 supplied

Kyocera F1200

Price:	£3460
Paper sizes:	Cassette fed — B5, A4, US letter, US legal. Other sizes can be manually fed
Size:	32cms x 42.8cms x 45cms
Weight:	26kg
Expected life:	500,000 pages minimum
Standard memory:	1.5Mbytes
Printing modes/ emulations:	HP LaserJet Plus, IBM Graphics, Diablo 630, Qume Sprint II, NEC Spinwriter, Epson FX80 and Line Printer
Supplied fonts:	Courier, Times Roman, Prestige Elite, Letter Gothic, Helvetica Bold, Helvetica and Line Printer — all in different sizes and pitches

The SpeedLaser acted rather oddly in HP emulation mode. It printed Scoop correctly but was a bit light overall. Solid black areas were not perfectly filled in — there were slight grey shaded areas. Edges and straight lines were *very* good and letters would have been good except that they also suffered from faint areas and fading. The same was true of the Capability page which was also printed correctly.

Unfortunately, I was not able to get my own test working correctly. The SBC was able to do the first page correctly but not the full nine pages. Some pages were skipped or overprinted. All other multi-page Ventura documents were spoiled in the same way. SBC was able to print out multi-page documents correctly at its offices, so I can only assume that there was some problem with the controller card I received.

Ordinary text suffered from the same problems but the text quality itself was very good, and it was easy to switch fonts with SBC's downloadable fonts.

Documentation

The manuals supplied with the SBC were pretty dreadful — written somewhere in the Far East and showing it. They did, however, hold the relevant technical information; it just took a little longer to fathom it out. SBC is currently rewriting the manual for the UK market and it will undoubtedly improve. SBC was also happy to provide advice and support over the phone, even if it wasn't a lot of help with a faulty controller card.

The Kyocera F1200

The Kyocera range of laser printers is distributed in this country by Mekom.

The printing engine in the F1200 is made by Kyocera itself. It has been around for a while and is solid and reliable.

The printer itself is very stylish and professional-looking. It is fairly large and heavy and coloured in contrasting greys. A paper tray slots in on the left and paper can be fed straight through or out of the top. The front panel holds an LCD text display for messages and has an extensive range of controls and indicator lights. Opening up the printer is straightforward, as is installing new toner, and so on. There are two slots for additional IC cards at the bottom of the front of the printer, which hold additional fonts, and so on.

The F1200 comes with 1.5Mbytes of memory as standard which can be expanded by a further 2Mbytes. It has HP LaserJet+, IBM Graphics printer, Diablo 630, Qume Sprint II, Line Printer, NEC Spinwriter and Epson FX80 emulations built-in.

The Kyocera was as straightforward as the Toshiba to set up and has in fact been running happily in the *PCW* office for several months: the only problem is that occasionally we need to replace the toner cartridge.

Printouts from the F1200 were excellent. Everything worked first time and the quality was extremely good. Scoop printed perfectly and had good, solid black areas. The edges of black areas tend to bleed slightly, but straight lines are very good. Letters in fonts are clear but slightly ragged.

The Capability page was again a standard HP emulation print but was also very clear. It had very good black areas and graphic shading, but again there was a little bleeding, or smudging.

My own test was printed perfectly with very good clean edges to font letters. Grey-scale shading was a bit obvious, however. Ordinary text was also very good, very dark and clear, and was quickly printed.

One interesting feature of the Kyocera is the built-in programming language. This is similar to the SBC's but even more extensive. You can change font orientation, alter and check the printer status, change text spacing, alter fonts mid-word, draw graphics and bar codes, and create macros and debug programs. New fonts and characters can even be created.

The quality of support offered by Mekom was variable. The company proved to be rather unhelpful when answering questions on the telephone, but it is very good at sending a service engineer round to sort out problems.

Documentation

The Kyocera manuals are again clear and cover practically every eventuality, including exotic problems like precise Centronics interfacing and handshaking. The programmer's manual is excellent and includes programs to control the printer.

Conclusion

The most expensive printer I looked at, the Apple LaserWriter NT/X, is also the most powerful. Unfortunately, most of its advanced features were outside the scope of this review. For Apple Macintosh users, it will be impossible to find a better printer. For PC users who want a HP compatible, I would suggest that they look elsewhere — the incompatibility problems are too great.

By contrast, the cheapest printer, the SBC SpeedLaser LP6, was a *lot* cheaper than the others. Although I had problems with it, I'm sure that, given SBC's cooperation and helpfulness, I would have sorted them out eventually. It has obviously been more cheaply produced than the others and wouldn't be the choice of those with considerably more money to spend. It does, however, perform fairly well as a budget-priced laser printer with reasonable performance.

The Toshiba PageLaser 12 and the Kyocera F1200 are a lot closer in specification than the other two. Both are excellent-quality printers. The Kyocera has performed well over a long period of time and the Toshiba has not caused a single problem.

The advantages of the Toshiba are that it is slightly cheaper and is very rugged, with a long life and high-quality output. It is also faster. The Kyocera also has high-quality output but isn't so long-lasting. It does come, however with many more emulations, more fonts and more memory — all as standard. It is also programmable and quick.

Apple Computers is on (0442) 60244. **Toshiba Information Systems** is on (0932) 785666. **SBC** is the business division of Spectrum Group and is on (0582) 402545. **Kyocera** printers are supplied by **Mekom** on (01) 454 2288. END

Speed Tests

Apple LaserWriter NT/X over serial port at 9600 baud.

Scoop	579 secs
Capability	1014 secs
PCW test first page	331 secs

The following times were for the LaserWriter as a PostScript printer:

PCW test first page	122 secs

I was unable to time the Apple LaserWriter as a text printer in HP mode correctly because the word-processing software kept timing out due to the slow speed of the RS232.

Toshiba PageLaser 12

Scoop	307 secs
Capability	355 secs
PCW test first page	99 secs
PCW test all pages (9)	202 secs
Text document (15 pages)	91 secs

Note that the times for graphics-intensive pages (Scoop and Capability) would improve if more memory were added.

SBC SpeedLaser LP6

Scoop	167 secs
Capability	202 secs
PCW test first page	81 secs
PCW test all pages (9)	Unable to do it
Text file (15 pages)	246 secs

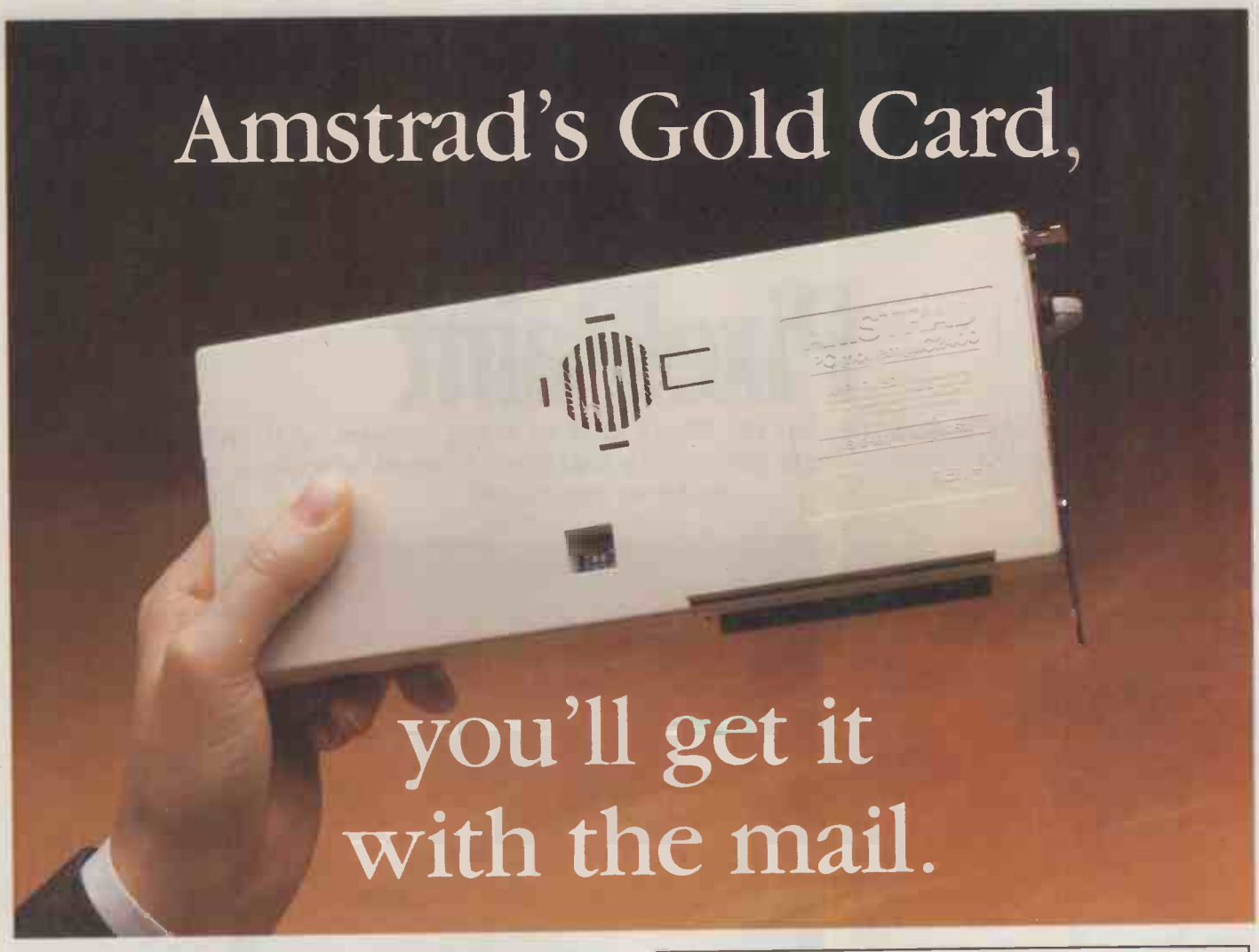
Kyocera F1200

Scoop	136 secs
Capability	166 secs
PCW test first page	110 secs
PCW test all pages (9)	211 secs
Text file (15 pages)	98 secs

How laser printers work

Laser printers work by building up a pattern of electrical charge on a rotating drum. This charge is then used to pick up particles of toner (a particular form of black plastic). These are then transferred to the paper by earthing it and passing it over the surface of the drum as it rotates. The result is that the particles of toner are then transferred to the paper in the same pattern as they were on the drum. Finally, the pattern of toner is sealed on to the paper by melting it on — and noo, the laser doesn't do the melting; it is used to impart charge to the drum. See the diagram on page 113 for a better idea of how this all works, or for a definitive explanation see the article 'Colour by numbers' in the June 1987 issue of *PCW*.

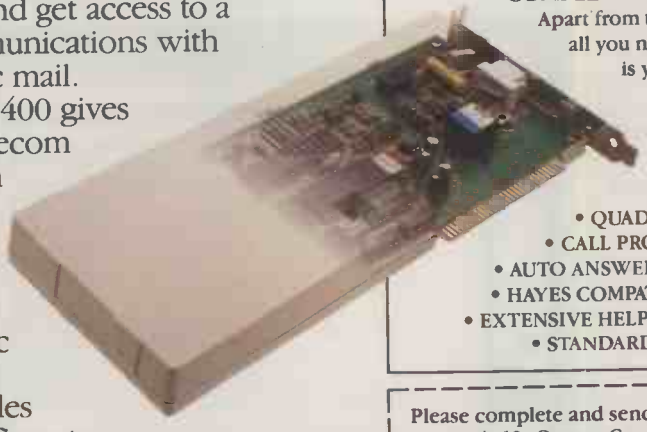
Amstrad's Gold Card,



you'll get it with the mail.

When you buy Amstrad's new MC 2400 modem card at just £199+VAT* you break through yet another price barrier – and get access to a world of business communications with Telecom Gold electronic mail.

Using Amstrad's MC 2400 gives you instant access to Telecom Gold – the system which combines all the speed of a telephone call with the accuracy of the written word.



You can use electronic mail on your Amstrad MC 2400 to control a sales force, link up Branch offices, to keep in touch with key executives, and much more. There is rapid access to Telex and a world of business information on-line through financial, commercial and marketing databases.

Choosing Amstrad's MC 2400 makes best sense to get onto Telecom Gold – and not just because of its price. It's a quad standard (V21, V22, V22bis, V23) auto dial, auto answer card modem that is ideal for access to electronic services and gives accurate high speed transfer of data.

You'll find that business works better, together with Amstrad and Telecom Gold.

MC 2400 SPECIFICATION

COMPLETE WITH MIRROR II SOFTWARE

Apart from the Amstrad MC 2400 card modem, all you need to get on-line to Telecom Gold is your existing PC and a telephone line. A Telecom Gold application form is included with each modem.

AMSTRAD'S MC 2400 OFFERS THE FOLLOWING:-

• QUAD STANDARD (V21, V22, V22bis, V23) •
• CALL PROGRESS MONITORING • AUTO DIAL •
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• HAYES COMPATIBLE • PULSE OR TONE DIALLING •
• EXTENSIVE HELP FACILITIES • B.A.B.T. APPROVED •
• STANDARD B.T. PLUG CONNECTION •

Please complete and send to: Telecom Gold Direct Response Unit
Unit 10, Oxgate Centre, Oxgate Lane, London NW2 3YP

Name _____ Position _____

Company _____

Address _____

_____ Tel. No: _____

PCW 4/88

Tick appropriate box.

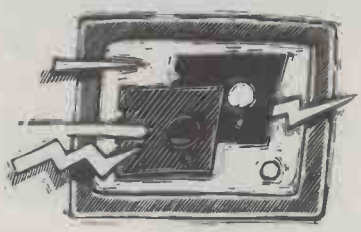
☐ I would like to sign on for Telecom Gold Electronic Mail, please send me an application form.

☐ I would like more details about Telecom Gold Electronic Mail – what it is and what it does.

☐ I would like more details about Amstrad's MC 2400 card modem.

AMSTRAD TELECOM GOLD

*RECOMMENDED RETAIL PRICE, INCLUDING VAT, £288.85. PRICE CORRECT AT 1/3/88 BUT MAY CHANGE WITHOUT NOTICE.



PixelPaint

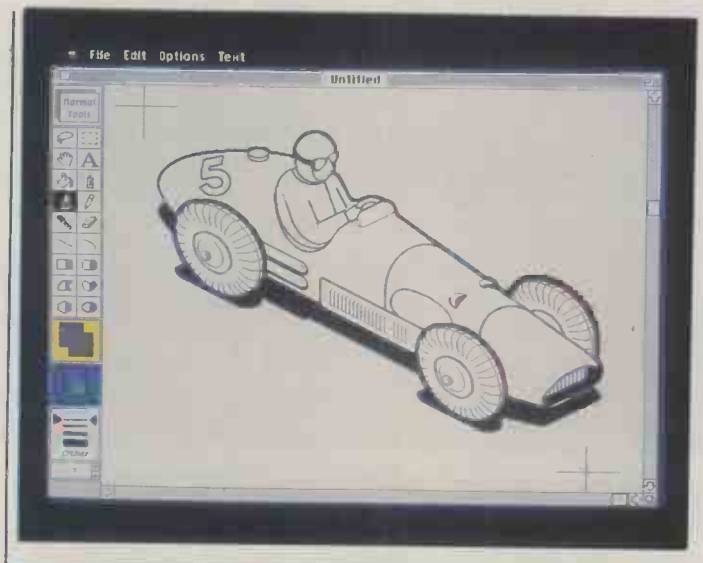
Ian McKinnell tries on the Mac's coat of many colours — 16 million at the last count — feels the quality and finds himself wishing it weren't quite so expensive.

In the Macintosh community, each new machine is eagerly anticipated. For months before the strenuously-denied launch, rumours abound: the intimate details of the new machine (which change every week) are discussed in the minutest detail. Until now, the biggest question has been: is this finally going to be the *colour* Mac?

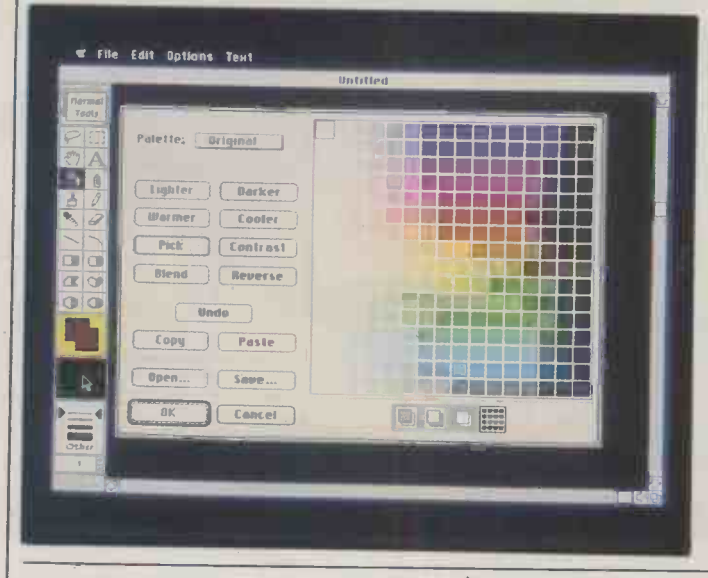
This time it was. There was colour — and lots of it, as demonstrated by the hackneyed images of 'balls in space' used in all the early photographs of the ugly new machine. No longer did Macintosh owners have to salivate over an Amiga, salvation was here — if (a very big if) you could afford it.

I was fortunate in having a Macintosh II in my studio not long after the machine was launched. It was both an exciting and desperately frustrating experience. There was the Apple in the top left corner of the screen, resplendent in its coat of many colours — but initially that was about the only evidence I had that this was a colour machine. Only two programs worked in colour (CricketDraw and Graphicworks), but they used only a miserable total of eight colours and made a Sinclair Spectrum's use of colour look positively sophisticated. It was like having the first 128 Macintosh all over again. Here was an incredibly sophisticated colour machine with only black and white software.

It took a long time for the first program to appear which started to take advantage of the Macintosh II's potential: that program was an early beta release version of what was then 'SuperMacPaint' (every new beta-release had another new name). Even now, when the program, now christened PixelPaint, is finally released, it's still virtually the only kid on the block, though there's a positive stampede of colour programs just around the corner. As the first major colour program, PixelPaint, made and distributed by Supermac, has a lot weighing on its shoulders for there is no precedent as far as the Macintosh is concerned, and SuperMac is having to draw its own guidelines.



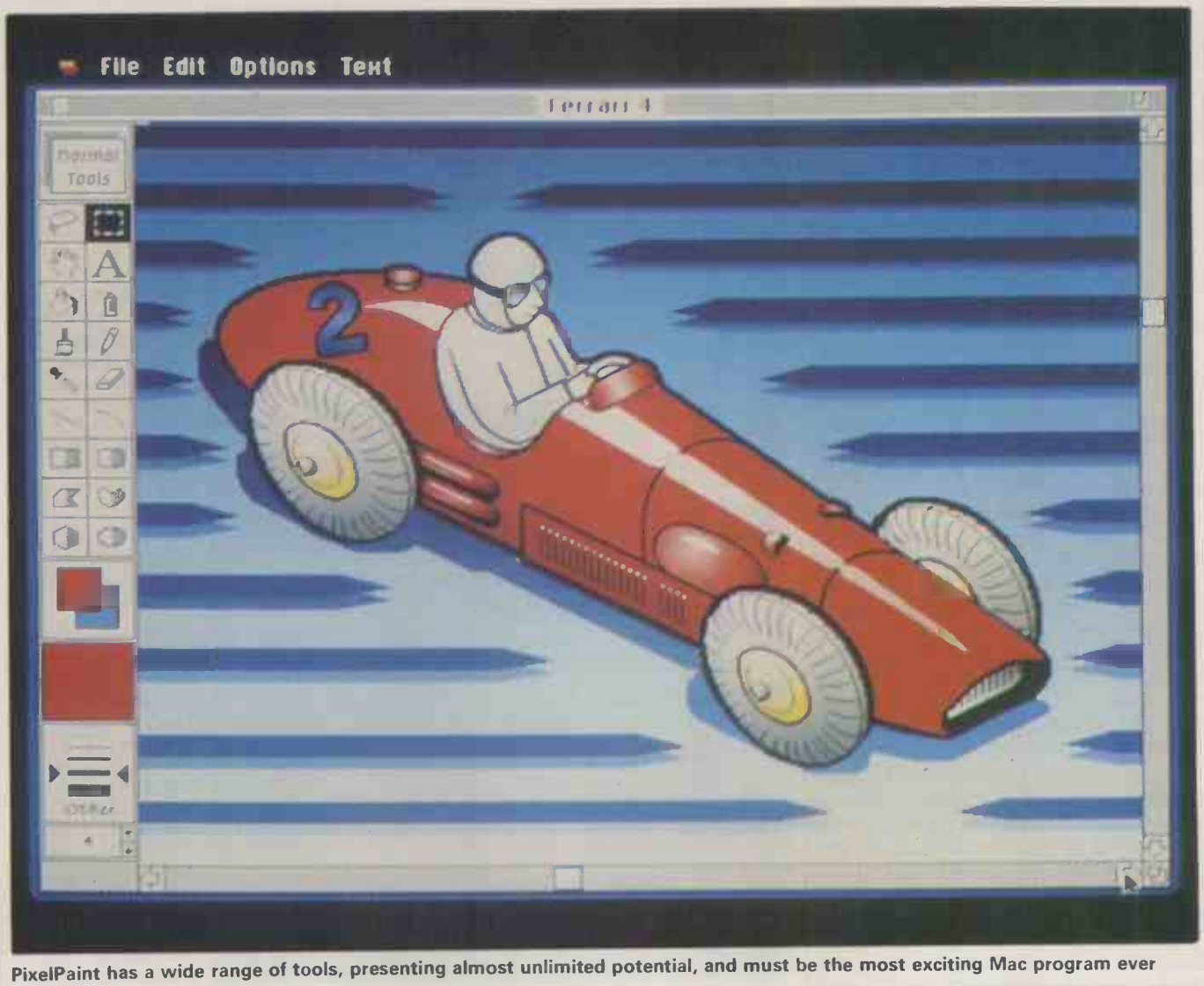
PixelPaint not only looks like the original MacPaint — in most cases it works like MacPaint too, so most Macintosh users will feel immediately at home



PixelPaint uses all of the 256 colours available with an 8-bit video board. The heart of PixelPaint is its system of palettes, where colours can be mixed and altered almost *ad infinitum*

Big numbers

Being able to use PixelPaint involves a very heavy financial commitment. PixelPaint will run only on a Macintosh **II** — and it has to be a Macintosh II with an expanded (8-bit) video card. It *will* run with 1Mbyte of memory — just, but in reality 2Mbytes is a minimum, and the amount of memory available determines not only the speed of the program, but also the size of a document. With 1Mbyte it's possible to have a window of just 512×512 pixels (approximately 19cm×19cm or 7½ins square). With 2Mbytes that can be extended to



PixelPaint has a wide range of tools, presenting almost unlimited potential, and must be the most exciting Mac program ever

720×576 pixels — about the size of a normal MacPaint page. With 5Mbytes on board and a big monitor it's possible to go to a maximum of 1024×1024 pixels — approximately 38cms (15ins) square.

It may be possible to run PixelPaint without a hard disk, but as the program itself is 438k, and a complex drawing could easily exceed 300k, I wouldn't like to try it. For the same amount of money you could buy a decent family car and we haven't talked about output devices yet.

PixelPaint is a bitmapped, or paint, program, just like the original MacPaint of four years ago, but in colour. Despite that major difference, there are a surprising number of similarities between the two programs, and the screen of PixelPaint will be immediately familiar: all of MacPaint's tools are here and all work in exactly the same way, with only three new icons — eye-dropper, arc and regular polygon, and a new line choice, 'other' (it's now possible to select any line width, up to 100 pixels). Gone, however, is the patterns box at the bottom of the window, replaced by a simple set of four squares displaying the currently selected colours and pattern. The biggest portent of what is to come is the box at the top of the tools with the legend 'Normal Tools'. Click on this box and it changes to read 'Special Effects'. Houston, we have lift off.

The simplicity of this interface is a great testament to its originator, Bill Atkinson, and it presents a very friendly face to any Macintosh user. It's a wise choice, for it means that PixelPaint can be used instantly: I had been using the program (in various beta test forms) for a number of months before I finally saw the manual, and there was little I hadn't managed to discover, although PixelPaint is perhaps the most complex and powerful program I have ever used on a Macintosh.

Most of PixelPaint's power lurks beneath the surface, and a brief glance at the menu options reveals an intimidating number of choices — particularly as many of the menus are hierarchical, or nested (as indicated by an arrow which sits to the right of an item).

For example, passing the mouse over 'Visual Effects' in the Edit menu reveals another menu, with a further 21 items. The jack-in-the-box effect abounds in PixelPaint: many items simply reveal yet more choices. To change the foreground colour, you click on the foreground colour box in the tool box which reveals a palette of all the 256 colours currently available: passing the mouse over one of the colours and then releasing selects that new colour. It's far simpler than it sounds, and a much, much quicker and more intuitive system than using an endless array of dialogue boxes, a clumsy approach taken by programs such as CricketDraw.

An innovative aspect of PixelPaint is its pop-up menus in the special effects mode, where pressing the command key and the mouse button instantly brings up a menu below the cursor, wherever it is on the screen, making selections simple and very fast. A lot of thought has obviously gone into PixelPaint, and this shows in features which, although small in

themselves, can save a great deal of work. For example, clicking with the lasso tool while the command key is held down will automatically select all the contiguous area of the colour connected to the pixel you clicked on. So if you command-click on a text character, it will instantly be selected, an example that I hope other programmers will follow. PixelPaint offers perhaps more choices than any other Macintosh program, yet due to its design it remains fairly easy and logical to use.

Like most programs, many of the actions of the tools are modified when combined with the keyboard functions 'tab', 'shift', 'option', 'command' and 'escape' (being used for the first time on a Macintosh, perhaps) — it's just more complicated because there are lots more of them. Where there is a precedent (such as 'shift' constraining ovals to circles and rectangles to squares) this has been followed, simplifying matters greatly, though there has been one glaring omission. It's now the norm in graphics programs for the space bar to change whatever tool is currently selected into the grabber, so that moving around a page is quick and simple. It's so useful that using the space bar is now a habit — one that has to be unlearned in PixelPaint, for this feature is noticeably absent and sorely missed.

Any colour . . .

The most important element of PixelPaint is, of course, colour. Using an 8-bit video board restricts the Macintosh II to using just 256 colours on screen at any one time, from a choice of a (theoretical) 16 million. A total of 256 may seem a lot but, as soon as you begin using PixelPaint it can rapidly seem very little. PixelPaint uses a system of 'palettes' which, like a conventional painter's palette, is where colours are mixed, altered, and created.

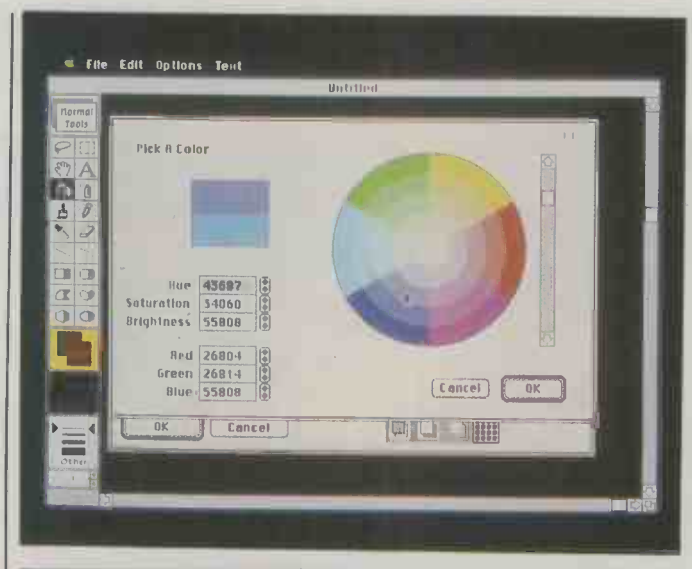
PixelPaint has 14 different palettes built in, including a greyscale palette. There are palettes restricted to 8, 16 or 32 hues, each ranging from dark to light, as well as more bizarre palettes, and one called 'system'. Any or almost all of the colours in a palette can be changed at any time, and any number of new palettes can be created and saved independently.

In all palettes, the top right corner is reserved for white, the bottom left for black — these can't be altered as the system needs them to draw its menus. Any of the other colours can be edited by a number of methods. The 'color' dialogue box shows all the 256 colours available. These can be changed by using one of the buttons in the window (lighter, warmer, and so on). Dragging the mouse selects a number of colours, and if 'blend' is clicked afterwards these are transformed into a range of colours equally shaded between the first and last colours selected. The more squares selected, the smoother is the transition — it looks much more magical than it sounds. Choosing 'pick' brings up the (now) standard system colour wheel, offering a number of other ways of changing a colour. Clicking on the up and down arrows at the right hand side changes the brightness of a colour. Moving the pointer anywhere in the wheel automatically 'picks up' that colour. Alternatively, the colours can be altered by changing the numbers in the red/green/blue (RGB) and/or Hue Saturation and Brightness boxes to the left (red has a Hue value of 0, green is 21,845, blue is 43,690).

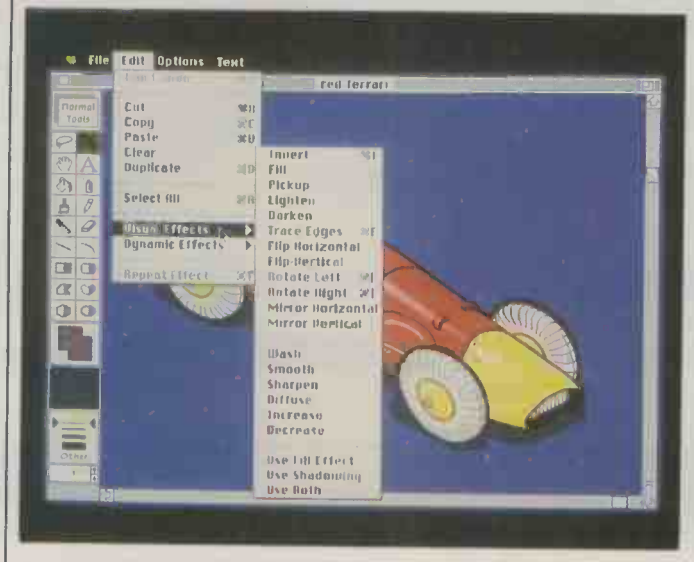
PixelPaint deals with light so colours are 'additive': that is, mixing colours together makes them brighter, the opposite of mixing real paint. Colour introduces a whole new layer of decision-making to Macintosh graphics: in other words, it takes even longer because, as anybody who has tried to decide what colour to paint their bedroom will testify, making decisions about colour can be far from easy and having a choice of 16 million does not simplify matters. Alternatives are easily tried, however, for the colours in an existing image are easily changed, either wholesale, by selecting a new palette, or one colour at a time.

One of the most important palettes is 'system', the standard Apple colours; a seemingly random mess of various colours with some obvious deficiencies (a decent orange, for example). It is important to use this palette (unedited) if any drawings are to be exported to other applications, for although the system will attempt to 'remap' the colours, to replace a non-standard colour in the original palette with the nearest one it can find in the system palette, an image can still arrive in very weird shape. If necessary, it is possible to edit the system palette (more properly called the CLUT (Colour Look-Up Table)) using a desk accessory, 'Klutz', although this should be a last resort.

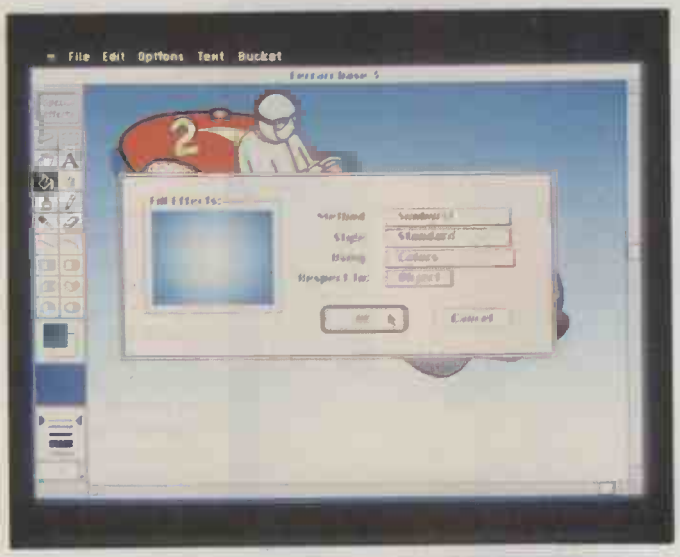
The palettes are best exploited us-



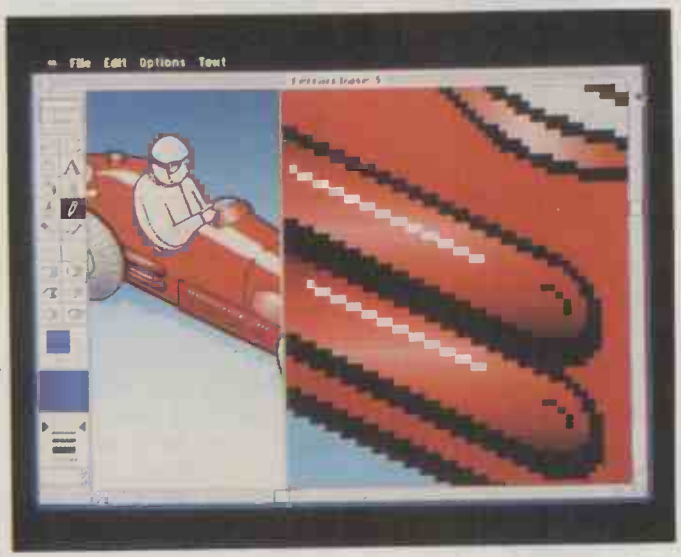
The colour wheel is now a part of the Macintosh II system. Using it gives access to a potential 16 million colours, but only 256 can be displayed at any one time



Much of the power of PixelPaint lurks beneath the menus, many of which are now 'hierarchical', where one menu choice brings up another. If you find decision-making difficult, PixelPaint is definitely a program to avoid



PixelPaint's most powerful, useful and fascinating facility is that it can not only create a smooth transition from one colour to another, but also apply the blends with great versatility



No paint program would be complete without 'FatBits'. This close-up view also shows the subtle effects that can be created using the blend facility

ing one of PixelPaint's most powerful and attractive features, 'Fill Effects'. When normal tools are activated, clicking the paint bucket in an area causes it to be filled with the currently selected foreground colour. Using 'Special Effects' however, it is possible to fill an area with a blend of any or all of the colours from a palette, the range of this blend being determined by the foreground colour and the blend colour selected. This could be a subtle graduation from black to dark blue, a rainbow, or a psychedelic riot. There are many ways in which the blend can be applied: left to right; top to bottom; in a sunburst pattern emanating from the point the mouse is clicked; 'shapeburst' where the blend follows the contours of an area to be filled; or any direction of your choosing. The blend can be a simple transition of one colour to another — it can also be mirrored or repeated. Using Fill Effects it is simple and quick to give impressive three-dimensionality and depth to an illustration in a sophisticated fashion that would be virtually impossible — or at least hugely time-consuming — if attempted any other way.

It would have been very easy for Fill Effects to have been a mere gimmick — instead, it is a tool so controllable and versatile that it is impossible to consider the future life of an illustrator without it. Fill Effects is also far quicker than it would be reasonable to have expected — it's almost instantaneous.

Blends can also be used in other ways — for example, the paintbrush can cycle through the colours in the palettes as the line is drawn. It can even be used with the airbrush, producing a multi-coloured splatter that will doubtless prove to be the background for many an image. It is also possible to produce instant drop-shadows or blended shadows for any object.

If the Macintosh II and PixelPaint had been invented in the Sixties their inventor would have been a millionaire overnight. Groovy, mind-blowing effects can be easily achieved in seconds, and PixelPaint's trick (to be used sparingly) of cycling every colour on the screen through every colour of the palette is a convincing substitute for LSD.

There are 132 patterns available in PixelPaint (chosen, of course, from a pop-up menu), and any or all of the existing patterns can be modified to your own needs. The patterns use the currently selected background and foreground colours, although pressing the command key reverses this combination and pressing the option key makes the background colour transparent.

Patterns are a vital part of a black and white graphics program, but their value in PixelPaint is very limited as tone can be applied in much more subtle and fascinating ways. Much more interesting patterns can be achieved — and in full colour, using PixelPaint's 'tile' facility — whereby an image from the clipboard can be repeated *ad infinitum*, producing rich and complex patterns. The image repeats every 16, 32, 64 or 128 pixels, and the image can be taken from any part of the clipboard image. Fabric designers would, I'm sure, gladly kill for a facility such as this.

In fact, every paint facility you could imagine is to be found in PixelPaint somewhere, plus some you never thought of (such as a facility for drawing random lines). There are also many new tools which could never have existed before, such as 'smooth', which helps disguise the jagged lines around an object, and 'charcoal', 'watercolour' and 'smear'.

Unfortunately there is no room here even to mention all of these features, let alone cover them in any detail. However, there is one vital facility missing — a draw layer, such as that found in SuperPaint. The only way around the problem is to create the basic outlines of a drawing in another program, such as MacDraw, and carry it over to PixelPaint for colouring; or to use the desk accessory version of Canvas from within PixelPaint.

PixelPaint can open existing documents created by a number of programs, provided they are stored in MacPaint format: PICT (used by most draw programs), the new PICT2 format, Encapsulated Postscript (EPSF) documents, such as those created by Illustrator, Colour Startupscreen documents (which replace the 'Welcome to Macintosh' screen), and finally, of course, PixelPaint's own document format. PixelPaint can also save a document in any of these formats, thus working as a document translator.

The speed of PixelPaint depends entirely on what it is doing. Using the paint brush, pencil or most of the tools, the effect is instantaneous.

Some of the more complex special

effects, however, particularly the dynamic effects, such as free rotate, are painfully show — thankfully they can be stopped by pressing command period. Opening or saving a drawing, even from a hard disk, can take up to 30 seconds. Generally, though, PixelPaint is as fast in most cases, and sometimes faster, than its black and white predecessors working on an old Macintosh, a tribute both to the programmers of PixelPaint and to the processing power of the Macintosh II.

There are a number of sample images included with the package, unusual in that some of them, particularly the images of a frog and another of a tropical fish, are of an incredibly high quality. The manual is comprehensive and fairly easy to follow, but the most interesting aspect of PixelPaint's manual is that it is entirely in black and white, with most of the screen shots being muddy black and white photographs.

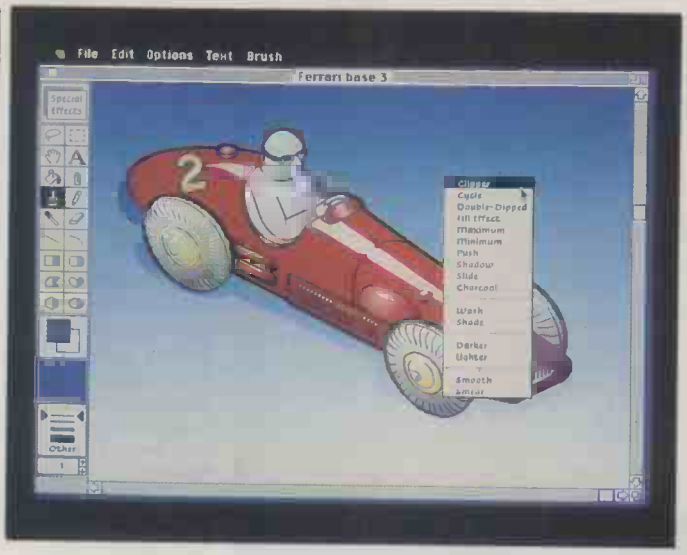
. . . as long as it's black

That the manual should be presented in this way highlights the major, overriding, virtually crippling problem with colour programs in general, and PixelPaint in particular — getting the images out. PixelPaint does have some print facilities — it can print to the Laserwriter for example, although the results are translated into shades of grey and look, well, awful — but it claims to be ready to use colour Postscript when the machines become available.

PixelPaint can also output its images to the few available, incredibly expensive, colour printers — an example of a page printed on a 300 dpi Tektronix 4693D Color Image Printer is included with the package. The example looks much like a good colour photocopy: good enough for internal use, but not good enough for publication. There is no facility for PixelPaint to produce colour separations — that is, to print the image out in black and white, either in process colours (yellow, magenta, cyan and black) or as solid, spot colours.

Another method of reproducing PixelPaint images is through photography. The crudest method, used for the screenshots illustrating this article, is simply to photograph the monitor; though the results, no matter how much care is taken over them, cannot begin to match the intensity and contrast of the colours as they appear on screen.

A much more sophisticated version of this method is using a film-recorder such as those made by Dunn Instruments and Honeywell. Essentially these are black boxes containing very special black and white monitors which are photographed on to either 35mm (5in×4in) photographic film through a series of colour filters. This film can then be reproduced conventionally, as with any other photograph. The results can be outstanding, but the machines are expensive — £3000 to £11,000 or more, depending on the resolution. There are a number of such film recorders made specifically for the Macintosh II in the pipeline, so someone could well be setting up a bureaux service with one soon. One problem with the photographic approach is that, surprisingly, PixelPaint has no facility for filling the screen with an image — even if sufficient memory is available, so all photographs of the screen will still have menus and scroll bars visible, which will make any presentations very confusing.



PixelPaint uses 'pop-up' menus extensively. In this case, when using any of the special effects tools, pressing the command key and the mouse together brings up menus beneath the cursor, making choices simple and quick

'. . . it's still virtually the only kid on the block, though there's a positive stampede of colour programs just around the corner.'

A third alternative is to output images as video, and there are already a number of boards being developed that will produce a broadcast quality video output from the Macintosh II. Television graphics is a big and a very rich industry, where there is a huge market for the Macintoch II if its output is of a sufficiently high quality. These television video boards will doubtless be 24-bit, however, capable of handling far more than PixelPaint's current 256 colours, and PixelPaint will obviously need some adaptation to be really useful in this environment.

The manual claims that 'PixelPaint's design anticipates direct video output devices'. We'll have to wait and see. At the moment, as far as output is concerned, PixelPaint is ahead of its time, and it is very frustrating to produce images that look great displayed on the monitor . . .

Conclusion

So who is likely to use PixelPaint? Well, if the price had been around that of conventional paint programs (about £100), everybody with a Macintosh II would doubtless have bought it just for the way it shows off the machine, if nothing else. After all, people in their tens of thousands have bought existing programs such as MacPaint and SuperPaint. However, at a price in the region of £500, PixelPaint is far more expensive and thus limited to a more specialised audience. That audience is further limited by the lack of output devices available: there is little value in including full colour artwork in a presentation onscreen if it cannot be printed.

PixelPaint will be of great value in producing presentation artwork, however — in packaging design, for example, it would be possible to produce a package in a wide range of experimental colourways far more cheaply than by any other means. It will also make a great teaching tool. In the long term, as the possibilities of outputting the images increase, so will PixelPaint's potential value.

Despite these serious problems, however, and despite any cynicism that inevitably may have crept into this article, my ultimate conclusion is that PixelPaint is simply wonderful.

PixelPaint is distributed in the UK by **SuperMac**, a division of Scientific Microsystems, on (0753) 49553.

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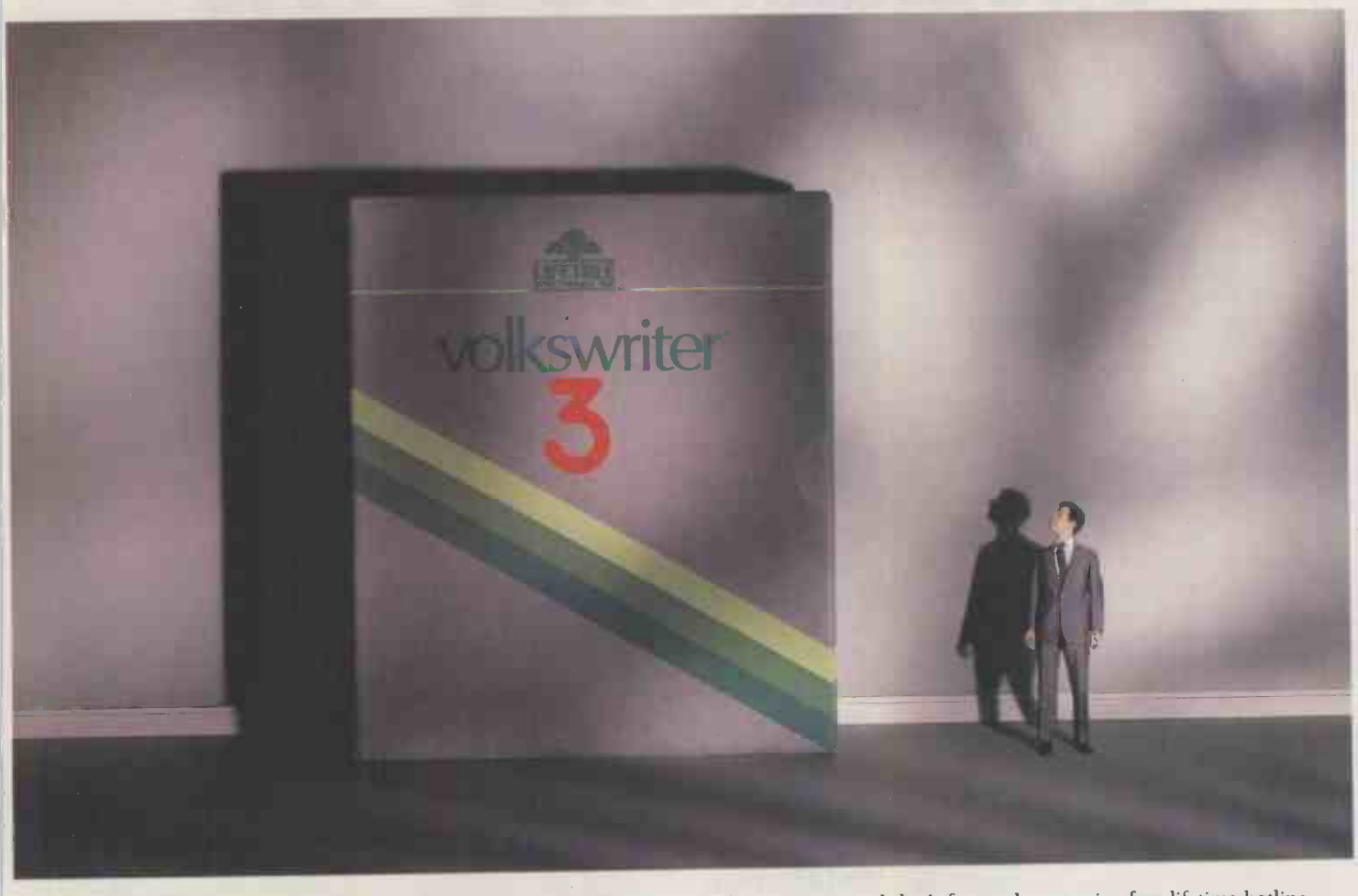

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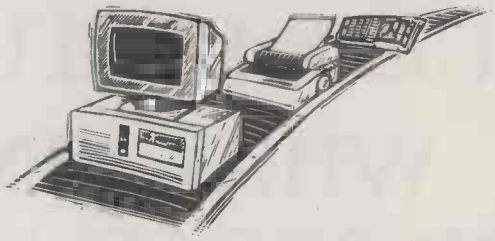


Specialix 386 C-PAC

Derek Cohen gets out of breath chasing performance from a co-processor board that looks just a bit too universal, and then wonders what the advantages are over a whole machine.

For owners of ordinary PC and AT-compatibles it must be particularly frustrating to see machine after machine being launched with better specifications. With the second-hand computer market being somewhat underdeveloped, the prospect of throwing away an investment of some thousands of pounds is not one to be relished. And many PC or AT owners will be looking for ways of harnessing 386 power while retaining their existing hardware.

Earlier this year Intel announced its Inboard 386/PC which shares one major failing with its 386/AT predecessor and the Orchid co-processor card. All these cards require the user to remove his/her CPU and link the plug-in card and the computer's motherboard using a ribbon cable.

Even experienced computer hardware hackers can easily bend or damage chips when installing or removing them. So, any product which requires novices to remove the many-legged chips that drive their system must be viewed with caution. An 8088 has 40 legs, an 80286 has 68, and removing these chips and inserting a similarly legged cable into the vacant socket is no task for those with faint hearts or unsteady fingers. And having a serviceable CPU is pretty essential should you decide eventually to either sell the basic machine or run it without the co-processor board.

A new solution has arrived from Specialix which requires no such chip contortions and will work, it is claimed, in *any* PC or AT. The 386 C-Pac is a full-length plug-in card which requires no connection to the host PC or AT other than an 8-bit bus slot. This means that it will work not only in standard ATs and PCs but also in Amstrads which use the 8086 chip, and Olivettis and similar machines where the bus and the CPU are on opposite sides of the motherboard, making any ribbon connection impossible. For other machines, disk drive controllers may already be hogging the slots closest to the CPU, or the CPU may lie under a disk cradle that is difficult to use.

Installation

The 386 C-PAC board is fairly tightly packed with an 80386 processor, a socket for an optional 80387 co-processor (supplied with the review model), 1Mbyte of 100ns 32-bit RAM and an array of support chips. In the centre is a 96-hole expansion socket for adding 4Mbyte RAM expansion daughterboards.

There is only one set of DIP switches. These are located at the top of the board which makes it easy to change them after the board has been installed in the machine. There are no jumpers or other hardware switches.

Installing the board is a combined software and hardware process. Before slotting the card into the machine, it is necessary to run the Setup program supplied on a floppy disk. This disk contains system tracks as well as a number of files and, as the installation process modifies some of these files, Specialix recommends that DISKCOPY is used to make a working disk.

With the floppy disk in drive A: you type SETUP and watch the program take over your computer. Well, it felt like that, for the first thing that the program does is reboot the computer. 'Setup is rebooting your computer', it says. It does this to follow your CONFIG.SYS file in action and so take note of which hardware drivers you have installed on your machine. From this information it makes its own drivers which it copies, along with other files, into a sub-directory of your choice.

Once your machine has been rebooted using Specialix' own 'Quick Boot' operating system, you have to re-run Setup and select the menu option 'Setup has just rebooted my PC'. Throughout its operation Setup is menu-driven, with the default option highlighted in green.

Hardware installation involves specifying what type of computer the

card will be installed in, what type of graphics adaptor, whether the computer uses an expansion chassis outside the main computer case, and how much memory there is on the Specialix card. Clearly, Specialix is aiming to trap any possible sort of incompatibility in so-called compatibles. Thus there are separate entries for genuine IBM PCs or ATs and compatibles, with several of the latter, such as Compaq, Hewlett-Packard, Olivetti and Zenith, warranting entries of their own. EGA and CGA-compatible graphics cards are specified separately from their IBM mentors but there is no entry for VGA cards. I found, however, that choosing 'other' produced adequate results.

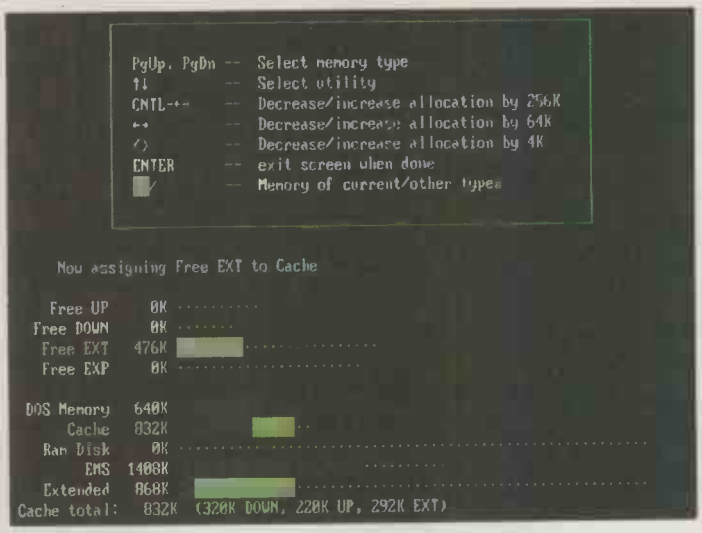
Once the hardware has been correctly specified, the Setup program displays a picture of the correct positions for the four DIP switches on the card. The Setup program can be re-run whenever the hardware has been changed. It then requires its floppy disk to boot the PC and will eventually show you whether any of the DIP switches need changing.

Setup then runs a memory utility that allows you to specify how you want to use the memory available in your PC. I ran the card in an Inter-Orient AT with 1Mbyte of main memory, 1Mbyte of extended memory on an Interquadram MightyMeg card and 1Mbyte of memory on the Specialix card. The Interquadram extended (linear) memory is configured as expanded (paged) memory using a software driver.

At this point I must introduce the neat metaphor that Specialix uses to describe the PC when it is running on the 80386 or its original processor. When the 80386 is the main processor, Specialix refers to the PC as running 'Upstairs'; when in its original slow state, as 'Downstairs'. In fact, to switch between fast and slow modes you run one of two programs called UP and DOWN.

The memory utility uses a graphics display to show you how all the memory in your computer can be allocated. Four types of memory are available for allocation: UP and DOWN main memory, extended memory and expanded memory, and the display shows how much of this is not allocated. Using the cursor keys it is possible to allocate the memory to one of five tasks: Upstairs DOS memory, disk cache, RAM disk, extended memory and expanded memory.

PgUp and PgDn move between the different types of memory installed, and the Up and Down cursor keys move you between the various tasks to which the installed memory can be allocated. Left and Right keys increase or decrease the memory allocated to any particular purpose. The memory belonging to a particular source is highlighted in green so it is possible to see, for example, that 512k of extended memory has been designated as DiskCache and 512k as extended memory.



The graphic display of the set-up program shows the user the different ways that available memory can be assigned to a number of tasks. Some extended memory (in green) has been allocated to the disk cache

Specialix recommends that the maximum of 640k of the 32-bit RAM is allocated to DOS memory and the balance to the disk cache. Because the 80386 can process data much faster than the hard disks likely to be installed in PCs and ATs, a disk cache will make some contribution to removing this bottleneck.

This process may sound rather complex, but in fact it is easy to re-run the memory utility from the hard disk at any time and change the allocations to suit particular purposes. Initially, this Setup program adds two extra lines to your CONFIG-.SYS file, one for the 80386 driver, the other for the RAM disk. Subsequent modifications do not affect these two lines, but change the contents of the drivers themselves.

Once the Setup program has been completed, the board can be simply slotted in and the computer rebooted.

It was while running DESQView that I discovered that the memory allocation I had chosen wasn't reflected in what DESQView found. It seems that my version of the Setup program put the driver calls in the wrong place in my CONFIG.SYS file. The UPDEV.SYS line had been placed at the start of the file rather than after the drivers to call DESQView's own extended memory manager (QEXT.SYS) and the expanded memory driver I use with the Interquadram card. Specialix was very helpful and easily diagnosed the problem.

In use

The first thing I did was to switch into fast mode (or Upstairs, as it is quaintly called) and run the PCW Benchmarks. A *PCW* Index of 6.77 rates alongside Mitac and Apricot 386 machines but noticeably below Mission and Compaq.

The reasons for the disparity are easy to find. The Specialix 386 C-PAC uses the host PC as an I/O driver to access screen, keyboard, ports and disk drives. Yet, despite being a 32-bit processor, its access to these peripherals is through an 8-bit bottleneck. By producing only one card to fit both PCs and ATs, Specialix must restrict itself to an 8-bit bus connector.

The disk cache facility is one attempt to remove some of this problem since some or all of the disk cache can be located in the board's own 32-bit memory. However, this has a maximum size of 220k and, for large programs, the 'hit' rate (when the data the processor needs is actually in the cache) can be quite small. The cache is a 'write through' cache which means that disk writes are written immediately.

Despite the above comments about I/O, the PCW StoreHD Benchmark ran twice as fast Upstairs as Downstairs. Strangely, the StoreFD timing was marginally slower.

I also noticed that the screen handling was distinctly slow. Running the Xtree file manager, it was possible to watch the different areas of the screen being written one by one rather than appearing apparently in an instant. Changing the display adaptor description using the Setup program seemed to have little effect, nor did changing from a rather old Paradise EGA card to a spanking new VEGA VGA card. Graphics-based programs such as Microsoft Windows showed similar effects.

Despite being relatively slow at I/O, there is no doubt that the 386 C-PAC does considerably speed up most processing operations. A database batch file operation to count up and

sort records ran very noticeably faster. The *PCW* office has been experimenting with Bitstream Fontware. These fonts come as Bezier curve outlines and have to be compiled for specific sizes. Producing a set of sizes in one font took 25 minutes 'Upstairs' and 105 minutes 'Downstairs'. Admittedly, Bitstream's compiler makes use of the maths co-processor, but, nonetheless, if you have many computational tasks to do, the card will make a significant difference.

I also tested out Ventura Publisher. Despite the strange slowing down of the screen handling, Ventura is markedly faster running on an 80386; and, with hard-disk access times being halved, loading fonts and files is speeded up as well as hyphenation and graphics drawing.

I stated earlier that it was possible to allocate the host computer's base memory for use by the card. If this memory is not in fact allocated in this way, it is possible to work as if your box housed two separate computers. The following rather tortuous path explains how I did it.

First, I ran UP to put the 80386 in control. The first time you run UP it reboots the machine on the 80386, but subsequent moves up and downstairs do not involve any rebooting as long as no host motherboard memory has been allocated for use by the 80386.

Upstairs, I ran Procomm within which I ran a DOS shell, and ran the DOWN program. Now Downstairs, I ran PC-Write, opened a document and then a DOS shell. In this shell I ran UP, and was instantly back in Procomm's shell from which I could EXIT into my Upstairs application. This was no review for anyone with vertigo.

Because the two processors were each working with their own main DOS memory, I had two separate PCs. However, there is no multi-tasking involved. Throughout this manoeuvre, the 80386 is supervising the whole process. Upstairs it is the main CPU, and uses the host CPU for I/O. Downstairs, the host CPU runs the application. In neither case can the two CPU work independently.

With the two processors running their own version of DOS, some care is needed when writing batch files which incorporate calls to the UP and DOWN programs. I wrote two batch files which would change from Downstairs to Upstairs (or vice versa) and change my DOS prompt to reflect which area I was in. Specialix provides a program called LEVEL which reports whether you are Upstairs or Downstairs, and also returns an ERRORLEVEL of 0 or 3 which can be acted upon in a batch file.

All seemed to go smoothly except that my DOS prompt always reflected the wrong area. When I ran my 'go upstairs' batch file, control would pass to the 80386 but my prompt said I was Downstairs. Batch-filing it Downstairs, my prompt would change to say I was Upstairs. The reason is that, once the UP.EXE program is run, control leaves the Downstairs processor and so the Downstairs batch file is suspended at that point. Running DOWN, control returns to the batch file where it was exited, and the next command, which says, 'PROMPT UP' is dutifully executed.

Benchmarks

	Downstairs	Upstairs
Intmath	1.79	0.67
Realmath	2.42	0.88
Triglog	6.57	2.82
Textscrn	36.08	40.02
Grafscrn	9.72	4.47
StoreFD	9.26	9.46
StoreHD	5.75	2.56
PCW Index	3.65	6.77

See 'Time Trials', *PCW*, November 1987.

One of the attractions of an 80386-based machine is its ability to manage memory and multi-task DOS applications. Both DESQView and Windows 386 make use of the 80386 to run multiple 640k DOS shells. Unfortunately, neither Windows 386 nor DESQView's 386 memory manager (QEMM.SYS) will currently work with the 386 C-PAC. Nor will the card run OS/2, although Specialix has a version of Xenix that runs on the 386 C-PAC. To be fair to Specialix, other 286 and 386 speed-up cards experience the same problems, and it is rumoured that even Microsoft's own Mach20 80286-based PC enhancer card has been delayed because of its difficulties running OS/2.

Specialix says that it is working on these problems — which are the result of conflicts over memory windowing — but it is not clear whether the fix will be in the hardware or the software or both. So if running 386-specific software is important to you, check it out with Specialix first.

The final cautionary tale concerns communications programs. Both Procomm and Hayes Smartcom III experienced hiccoughs when running Upstairs (it must be all those stairs). Procomm's file transfers often timed out very early, and Smartcom invariably reported a 'Data speed over-run — possible loss of data' when connecting to Prestel at 2400 baud. Neither program exhibits these problems when running on a full 80386-based computer. However, there is no advantage usually in running communications processors on faster machines and it is very easy to switch Downstairs when necessary.

Documentation

The slim, comb-bound manual goes into great detail on how to install the card and make copies of the software. It even makes a valiant effort at explaining the different types of memory a PC can use, and warns against possible problems with some sorts of memory drivers such as VDISK. It is possible to run conventional DOS VDISK rather than Specialix' own RAM disk, but the manual warns: 'Note that you will have different VDISK drives upstairs and downstairs, with identical drive letters but possibly different contents.'

Fortunately, installation and configuration are quite simple so most users will not need more than a quick read through the manual.

Conclusion

At £1695 for a 386 C-PAC with 1Mbyte of memory, you need to have some good reasons for wanting to keep but upgrade your old PC or AT with one of these cards. The 8-bit bus connector makes the card universal in its application, but can also be its failing. Most 386-based PCs use much faster hard disks than PCs or ATs and are beginning to use 32-bit disk controllers.

Speed improvements are certainly there, with PCs obviously showing greater differences in performance than ATs. Installation of the card is very simple, and owners of Amstrads or Olivettis who have been unable to install most of the existing 386-based co-processor cards will certainly want to think about this product. But the most expensive parts of any 80386-based device are the 80386 itself and the fast RAM it needs to work at full speed. Those components are as much a part of the cost of this board as they are of a full 80386-based machine, and just a few hundred pounds more will buy a full machine with 32-bit expansion potential.

Those users who will be attracted by the card are likely to be owners of specialised hardware installations where their PC or AT is no longer standard in its configuration, and perhaps connectivity. For them, the faster processing power produced by any co-processor will extend the life of what may have been an expensive PC to configure. The price of this card has fallen once already since its launch, and the price of 80386s and fast RAM can only fall too. This card will get cheaper, but so will full 80386 machines.

Specialix is on (01) 398 9422. **END**

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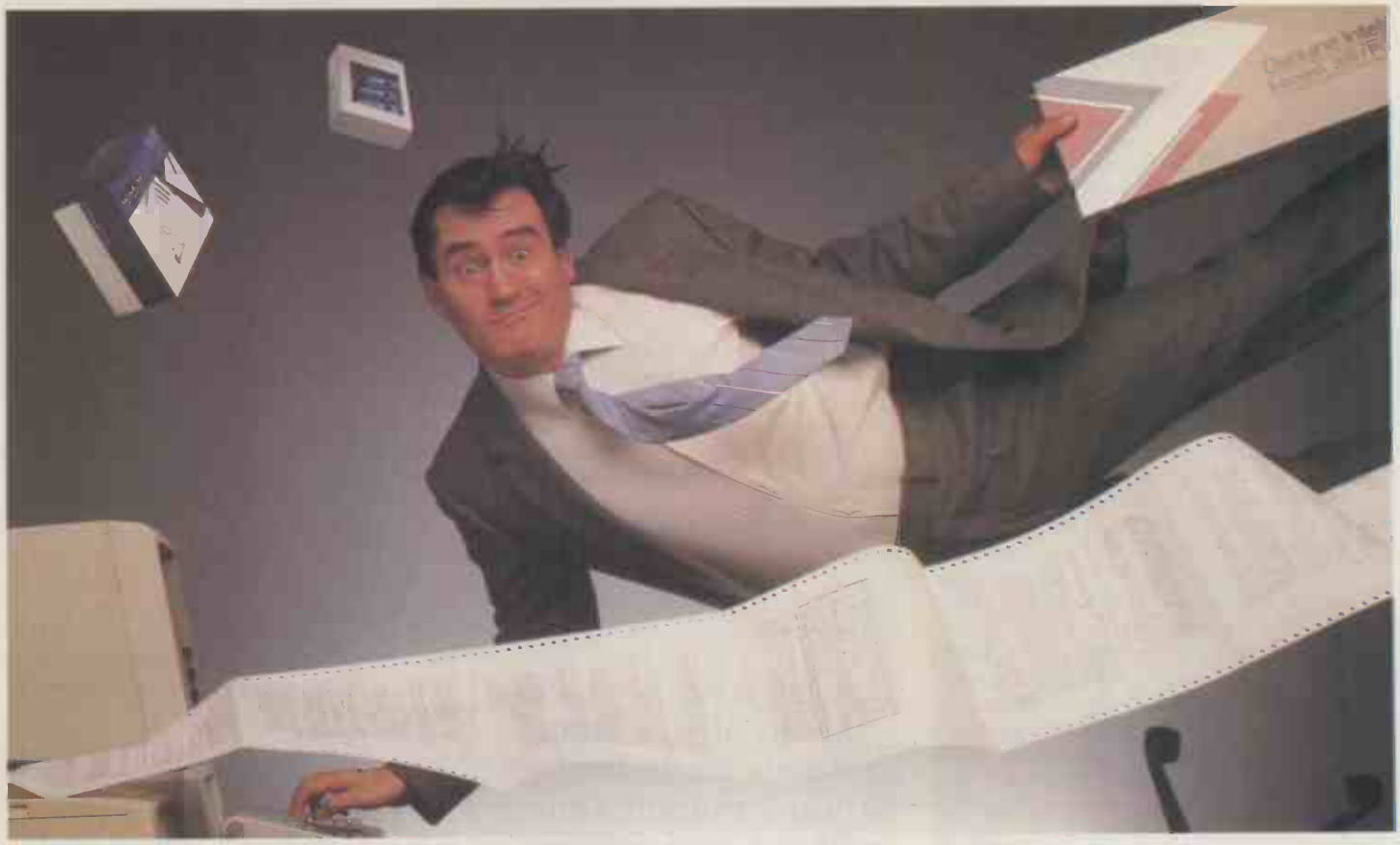

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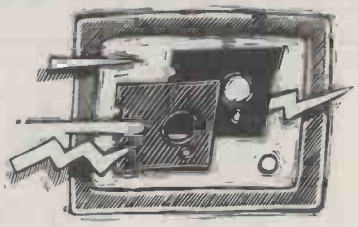


Drafix

With its updated version, Drafix 1 Plus, and its add-on module, the 3D Modeler, Drafix could now be the front runner in the low-cost PC CAD stakes. Dr Roland Newman judges whether Drafix meets this claim.

Any designer looking for a suitable PC CAD program could be forgiven for being bewildered by the large number of packages that are now available. Let us clarify the situation by breaking the existing CAD software into three groups: **Group** 1, costing typically less than £100, includes Autosketch and Generic (the basic package at any rate); **Group 3**, costing in the region of £2500 and over, includes the industry standard Autocad (with its new package Release 9), the most impressive 2-D and true 3-D Versacad and packages like Cadvance. In between, in **Group 2**, are packages such as TurboCad, Prodesign II (now called DesignCAD) and Drafix, with its latest version, Drafix 1 Plus.

The differences between these three groups is a complicated matter, largely to do with 2-D, 2½-D or 3-D, speed, memory expansion, attribute listing, file exchange facilities, symbol libraries, output facilities, programming facilities, inter-relationship with database packages (for bills of materials, for example) and, to a much lesser extent, the user may be surprised to learn, the drawing, editing and display facilities. The situation is even more confusing because many of the Group 2 producers are continuing to issue updates incorporating drawing and editing facilities which formerly were incorporated only in the much more expensive Group 3 packages.

Overview

Drafix is a Group 2 package which in its recent release, Drafix 1 Plus, now incorporates function key macros, freehand sketch mode, curve fitting, a pop-up text editor and the ability to save default settings of current drawing environments. It is a good example of how relatively low-cost packages are continuing to eat away at the differences with Group 3. In addition, Drafix has now made available the MegaCADD true 3-D Modeler which, in terms of 3-D, puts it well ahead of all its rivals in Group 2 and, to some extent, provides a capability which many of the much more expensive Group 3 packages do not yet provide.

Both Drafix 1 Plus and the 3-D Modeler can be purchased separately and can be used as standalones, so I'll examine each of them in turn. The software was evaluated on an AT compatible, EGA, 640k, 40Mbyte hard disk, 80287 maths co-processor, Everex Extended Memory Card (though Drafix does not support extended memory), and on an Intel 386, Sigma 480 EGA, with an 80287 maths co-processor. Output was by Roland DXY 880A (emulating a Hewlett-Packard 7475) and two 24-pin dot matrix colour printers: the JDL 750 (supplied by Pro-Vector on (0908) 617721) and the NEC P5XL (supplied by NEC on (01) 993 8111).

'. . . you have a package which at this stage stands alone in the Group 2 market almost without competition.'

Drafix 1 Plus

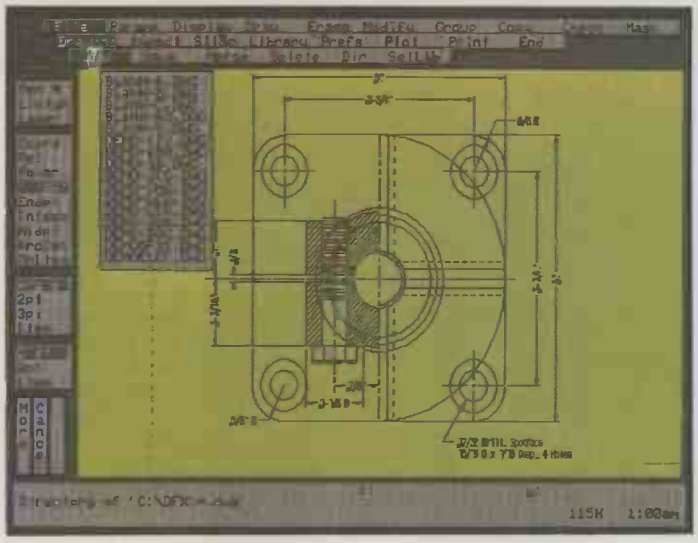
The program is supplied in the form of four non-copy-protected 360k disks with two additional disks of 450 general symbols (structural and electronics, machine design and architectural). For hard-disk users the installation procedure is automatic, by logging in on Drive A and running an Install program. The program DFXSETUP must be run to configure Drafix to operate with your graphics card, input device, printer and plotter. For a floppy disk system only the configuration program needs to be run, though for floppy disk users a good strong right arm will be necessary in order to use Drafix because of the continual disk swapping that is required.

A word of warning, though: like most of the Group 2 CAD programs, Drafix does not support many plotters (and many of those supported will operate only with the add-on Large Plot module which must be separately purchased) so do check before you buy. Worse still, all the plotters supported are serial-only so be ready to spend many hours investigating baud rates, parity and data bits — quite unnecessary if the plotters are parallel.

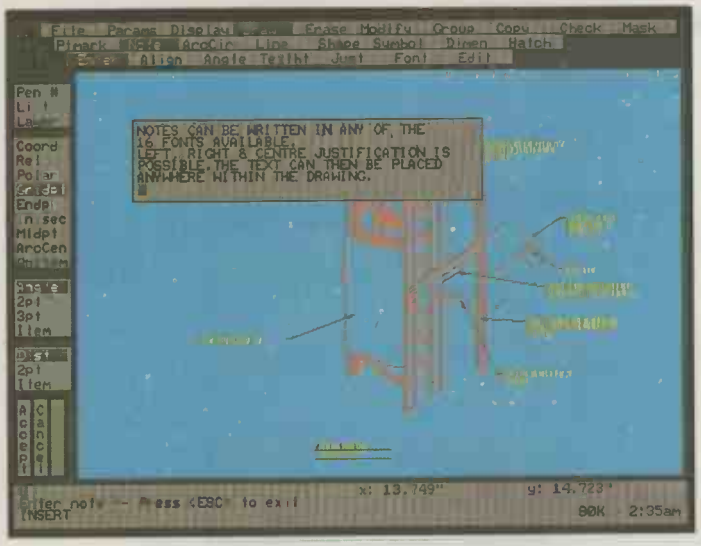
In use

The great attraction of Drafix 1 Plus is its ease of use. The opening menu is presented as a horizontal line across the top of the screen and the sub-commands can then be selected by mouse or digitiser to appear as a second series of options on the next horizontal menu line. Again, as an option is selected from the second line, it appears as a series of logical and related options across the final horizontal third line. Further options, when selected, appear as a roll-down menu listing a series of choices which, after selection, then disappear. This compares with the columnar menu arrangements used by Versacad, Autocad (until recently, that is: Release 9 now uses pull-down menus to supplement its command menu), but not Cadvance which provides a series of sub-menus, all of which remain on the screen.

The advantage of the Drafix menu system is that the menu and menu



Drafix 1 Plus uses a series of horizontal bar menus. As an item is selected on the top menu level, a second-level menu bar appears beneath it. These bars keep appearing until the item required is arrived at



Text can be added to the drawings in any of the 16 available fonts. Note the mouse-button reminder icon in the bottom left-hand corner which indicates what each of the mouse buttons does at that particular menu level

prompts remain available on the screen, and the need to memorise chains of commands is drastically reduced. In addition, if you get confused at any stage, you can jump right back to the first command menu (which remains on the screen) and start again. On the left side of the screen are permanently displayed lists of what are called 'interrupts' — commands which can be used in the middle of drawing or editing routines without having to track back through the main menu command system.

An additional and very useful screen prompt is the representation of a three-button mouse below the lists of interrupts. As each command or sub-command is implemented the 'button' label changes to offer you a choice of confirmation, cancellation or variation. Pressing the relevant mouse or digitiser button implements your decision.

What you cannot do with Drafix is to action commands through the keyboard. Though you are required to enter coordinates, angle locks and grid-spacing, and so on, through the keyboard, the program does not allow command entry directly. This is disappointing because although most beginners to CAD like mouse/digitiser entry, more experienced users prefer the much faster entry possible by single letter command input through the keyboard.

Macros (chained lists of pre-set drawing or editing commands) are pre-set through the 10 function keys and these function key macros can be changed as required. However, do note that these are primitive macros in that the chained lists will include commands only and cannot incorporate coordinates or radii for any set drawing requirements.

Drawing

As is to be expected with the Group 2 of CAD packages, Drafix 1 Plus offers all the basic construction elements. For example, the DRAW command, when selected, offers point-markers, text entry, arcs, circles, lines, shapes, symbols, dimensioning and hatch patterning. Again, each of these will offer a series of related commands with, for example, LINE, prompting a choice of single, double, tangent to (arc or circle), perpendicular to, parallel to, offset to and angle to. It is worth noting that the parallel line command fixes corners as it draws, and parallel line intersections can be cleaned up through the 'modify' command.

Again, as is now common in this range of CAD packages, drawing elements can be placed in any of 255 drawing layers or assigned any colour (with a CGA or EGA monitor, of course) and moved between or assigned to different layers. The most notable drawing enhancement in this latest release of Drafix is the true free-form sketching freehand facility which, though drawn as a connected series of separate lines, can then be manipulated as a polyline — that is, as if it were one single line. (Take care using the sketch facility for it takes up a great deal of the limited memory available.) The package includes most grids, except rotated and isometric, and you can snap to these grids with all the usual facilities of being able to snap to mid-points, intersections, centre of arc and circle. Coordinate entry by absolute (x, y), relative (x, y relative to your current point) and polar (distance and angle relative to current point) is also available through keyboard entry.

Perhaps the most important pointer to the future development of CAD is the provision of 450 pre-drawn symbols. In my view, draughting may well become largely the assembling of pre-drawn symbols, particularly as CAD moves more and more into 3-D, with symbols having a 'Z' dimension and incorporating standards and specifications. Take care to check your scale when first incorporating symbols into a drawing, otherwise you will find your cogwheel may appear larger than your machine drawing. Also note that if you have set up a white background screen, as I did, you will spend some time wondering why the (white) symbol does not appear!

You can also create, save and recall your own symbols, though remember that they will be treated as grouped entities so have to be exploded before you can edit them.

Drawing size is limited to about 230k or about 8000 entities since Drafix stores drawings in RAM as you create them. In the test drawings, Drafix's 45 seconds load time of 500 lines and 500 circles showed it to be one of the fastest packages in this Group. For a real increase in speed, readers might consider creating a RAM drive and running Drafix there (save your drawings back to the main drive before switching off).

Editing

Drafix Plus 1's editing facilities are nearly, but not completely, comprehensive. You can scale, rotate, move, mirror, stretch, copy and trim objects, but not drag them. You can bevel, trim, break and round objects (a point worth noting here is that when you try out these commands you must zoom in close to the object, otherwise you will not see any effect) but you cannot carry out automatic rectangular or circular arrays (say, placing teeth on the gear): you have to repeat the entry for each part of the array, though this only requires pressing the input device button.

There is also no general 'undo' command (except on symbols) but the requirement to confirm each command on entry perhaps makes up for this. There is, to be fair, an 'Erase –> Last' command on the top level of the menu. Sometimes when editing, some lines are inverted and sometimes trailing edges are left, but the later releases of Drafix should cure these minor bugs.

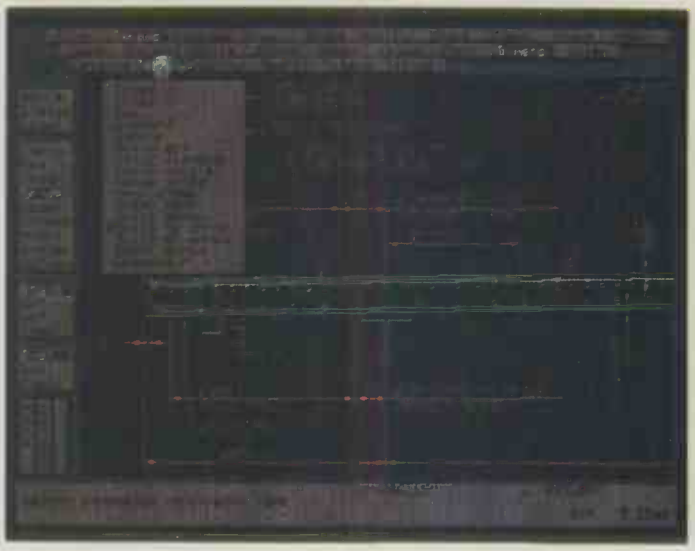
Grouping of objects for editing, saving or moving is possible. Objects can be grouped individually or by region — the latter is particularly useful as you select the region by a window and can then choose to include or exclude objects partially in the window or by type, layer, line type or pen colour.

The 'Zoom' command is unusual in that rather than select a corner to commence definition of a windowed area, you locate a view centre and then expand the window accordingly. Panning is carried out by the normal 'from/to' technique: that is, you define the point you want to move from and then indicate your destination point.

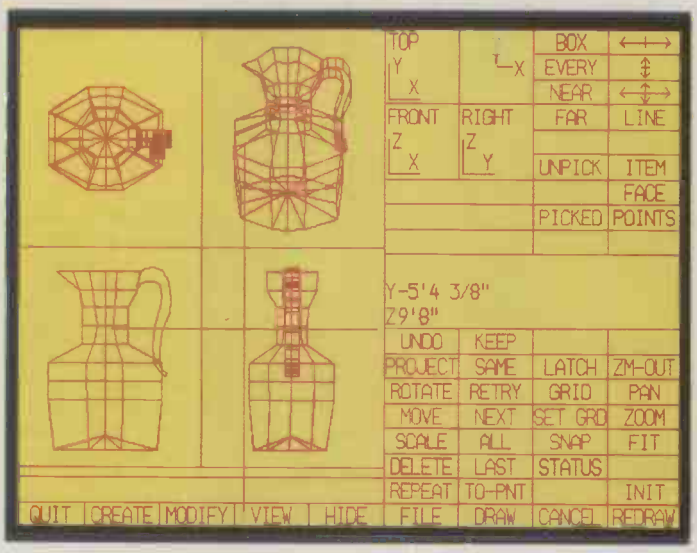
Drafix 1 Plus provides 15 standard hatch patterns. These you insert by setting into the group the boundaries of the perimeter area required, although it was a while before I could find a way of erasing the hatch pattern without erasing the boundaries. The solution provided by the HOTLINE service was to treat each line in the hatch pattern as a separate drawing object. The patterns, however, are not user-definable, though you can control the spacing and angle of the hatch.

Text entry

The package provides 16 standard fonts which can be adjusted by size and angle of orientation, plus right, left, centre and parallel (to a reference line) justification. The new release includes a text editor that appears on the screen as a pop-up window in which you can enter and polish your text entry before placing it in your drawing.



As is now common in most CAD packages, Drafix 1 Plus allows drawing elements to be placed on any of 255 possible levels. Each level is distinguished by a different user-selectable colour, to help remove the confusion that could arise



One of the more interesting Drafix 1 Plus add-ons is the 3-D modeling package. It can be used to create true 3-D models and then allows the user to view the object from any angle, from both outside and within the object itself

Dimensioning

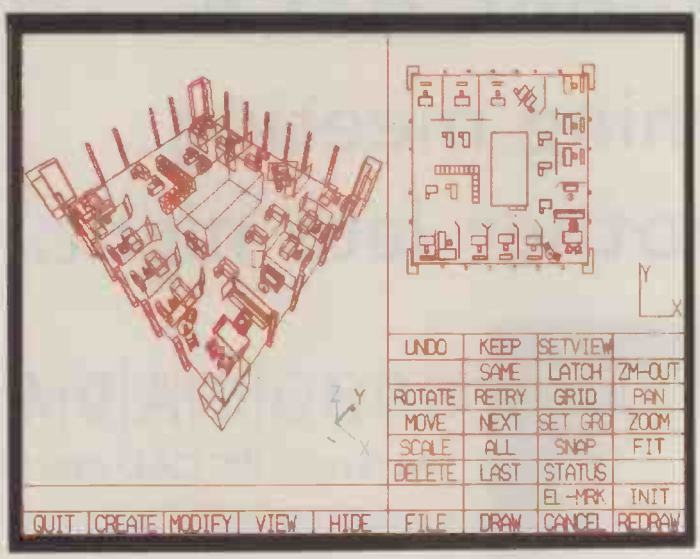
All the common dimensioning facilities and units are provided and, surprisingly, Drafix 1 Plus offers a large number of alternative line terminators including crosses, arrows and slashes. Baseline, chain, centreline as well as the normal horizontal, vertical, angular and radial dimensions are provided. However, 'associative dimensioning' (where the dimensions of the object change automatically as you change its size) is not included.

Output

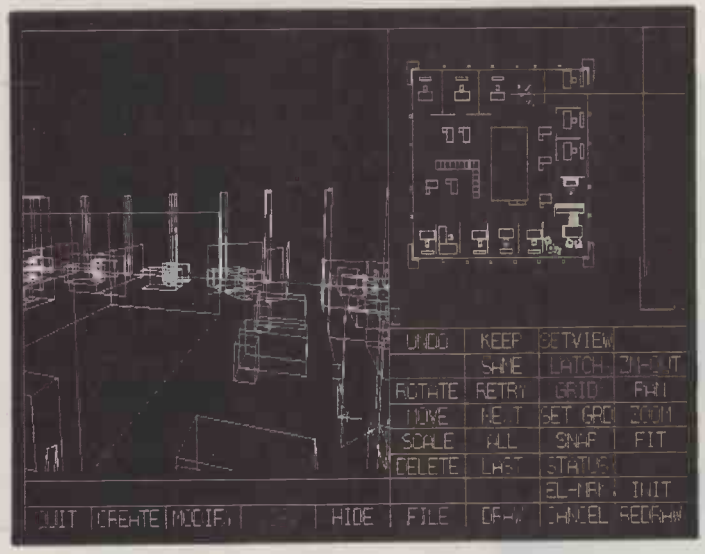
The basic Drafix 1 package supports a reasonable but small number of plotters, and once you have configured the plotter the procedure is quite straightforward. Remember that most plotters can emulate the Hewlett-Packard, though you may run into difficulty in setting the DIP switches to suit the emulation. For large-scale drawings (D and E size), the Drafix Large Plot module is essential. However, many users will be expected to output their drawings on to a dot-matrix printer, thus avoiding the expense of a plotter.

The basic package enables you to print only the view that is currently on the screen. This may well not be the whole drawing but only that part of the drawing appearing on the screen. To overcome this limitation, the DotPlotter module is included with Drafix 1 Plus. This module, for dot-matrix and laser graphics printers, is a reasonably capable system, but compared with the rest of the package is complex and cumbersome.

It is possible — and instructions are provided — to edit the default configuration file to enhance the output for various printers. However, as the DotPlotter manual rightly warns, this is for the *more experienced* user! Still, although the quality of output is inferior to most plotters, high-quality dot matrix printers such as the 24-pin NEC P5XL and the JDL 750 used in the evaluation showed they could provide a reasonable standard of black and white pre-



The main use of 3-D modeling is to create and visualise design ideas before 2-D drafting. This screen display shows a small 2-D design window and a larger 3-D visualisation window



Perhaps the most impressive Drafix feature is that the View option allows you to 'walk through' the 3-D line representation. Simply select a window and a target point, and the Modeler generates the required view in the large output window

sentation suitable for most clients of small businesses and practices. The colour output of these two printers is superb, but a great deal of patience is required for colour output. Drafix will, I am sure, include some form of buffer facility soon for its plotting and printing output.

A tip that readers might find useful is that if you cannot find your printer on the list of devices supported, then use the 'Frieze' command in PC Paint or Publisher's Paintbrush (supplied by Ctrl-Alt-Deli on (0908) 662759) to transfer your drawing from Drafix, and then use the editing and printing program in the Paint software to enhance your drawing. The list of printers supported and the print system in Publisher's Paintbrush can hardly be bettered. Drafix will undoubtedly be looking at print programs in packages like DesignCAD, and thinking again about its own product.

Documentation

Unlike most of the Group 2 middle-price CAD packages, Drafix 1 Plus comes with excellent documentation. Four manuals are provided: the *Installation and Set Up* guide; the *Getting Started* guide; the *Technical Reference Manual* and the *General Symbols — User's Guide*. Given that any potential user is aware that any form of CAD package of any reasonable capability requires an extensive learning effort which can be shortened only by attending an intensive course, these manuals provide all the necessary information. The *Getting Started* manual is written in the style of explaining each separate command independently of the other commands, a style which is unnecessarily boring. I am sure that future issues will be written in an accretional style where each command learnt will be built up and interlinked to previous drawing commands, as is increasingly becoming the case with publications associated with the more expensive CAD programs. In case of difficulty, the HOTLINE support (on (01) 858 6016) is most helpful and informative.

Further add-on modules that are available are Drafix symbol libraries: Mechanical; Electrical; Architectural, each retailing for £150. A file exchange module OTTO is available at £95 and, in my view, is essential for businesses with clients who will be using other CAD packages such as Versacad or Release 9 (Autocad). This module was not supplied for the evaluation, so no opinion can be given of its effectiveness.

Finally, the most important of all is the Drafix 3D Modeler to which we can now turn our attention. One further note is that Drafix is now supplied, I understand, through Frafix Europe (located in Holland) but there may be delays in supplying customers' orders.

Drafix 3D Modeler

The most interesting and impressive of the Drafix add-on modules is the Modeler, which can be used on the PC, XT or AT. At £295 it is easily the best of the 3-D programs available at this end of the market. You can use it to create a true 3-D model and then have unlimited views both from outside and within the object.

It's debatable whether it's the right package for serious CAD applications, but for any engineer or architect wishing to view his design in accurately calculated three-dimensional perspectives, it could be a very useful tool, avoiding the freehand guesswork so often used in design work. Its other main use is to create and visualise design ideas before 2-D drafting. Still, if you have visions of the Modeler producing coloured renderings from your computer, then think again. The program shows your drawn 3-D object in black and white wire frame view, though it can remove hidden lines (if you can afford the redraw time). If you want more sophisticated coloured renderings, then you will have to start thinking in terms of software costing a great deal more.

On first evaluating the system it looked strangely familiar, and then I realised it was a cut-down version of MegaCADD's primary product Design Board Professional, which costs about £2000. The Modeler consists of the selection of several major features of the MegaCADD product redesigned to be used in conjunction with Drafix 1 Plus.

Installation

The Modeler, like Drafix 1 Plus, requires 512k RAM (640k recommended), two disk drives (a hard disk is recommended) and a maths co-processor, though the installation section of the manual includes a command SET NO87 = 3D if no co-processor is installed. The software comes in the form of non-copy-protected 360k disks which are copied into the Drafix sub-directory if

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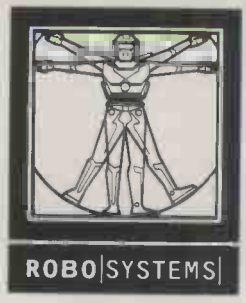

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Fax: 01-881 0771

using the system with Drafix, or into a sub-directory of your own choice if the Modeler is being run as a standalone system.

The system, whether on disks or hard drive, is then installed by running a simple configuration program; and the alternatives offered require you to know the graphics card in your computer, whether you are using a mouse and whether you wish to grab screen images. The graphics cards supplied are the same as those supported by Drafix 1 Plus and, if a mouse is not being used, the pointing device you configured in setting up Drafix will automatically be transferred to the Modeler.

One other interesting alternative offered in the configuration program is the possibility of running an informative automatic demonstration program. You will then need to rerun the configuration program to revert to an interactive mode. On the whole, a very straightforward installation program.

In use

The Modeler is easy to use, for the menus under each main option — selected by a mouse from the opening screen — remain on the screen at all times. As you select various functions the program leads you, by the use of help indicator (and error) messages, through the input procedure necessary for each function.

To create a 3-D object the screen offers two windows: one large, and one small. The menu then offers you a choice of shapes — square, rectangle, circle, or a multi-sided straight line shape for you to input on to a two-dimensional plane or plan. Walls of different thicknesses and curved surfaces such as domes can also be drawn. You are then prompted to enter the bottom and top of the required 3-D object on to the same plan elevation (snaps to the object or to a changeable grid are available) and a three-dimensional extension of the object appears in the other smaller screen. Thus, a square becomes a cube, a circle a cylinder, and so on. For designers used to drawing in 2-D and inputting the 'z' dimension, and transferring the plan into another sub-program for the 3-D object to be created, the Modeler will be a revelation.

The 'View' option reverses the views in the sense that the larger window then shows a (selected) perspective 3-D view while the smaller shows the plan or xy-plane. In turn, the 'Modify' option offers four windows, xy, xz, yz and perspective, and any of these can be used as a basis for modification or change. Perhaps the most impressive is that the View option allows you unlimited perspective, including 'walk through' views. You are required to select a view and target point at selected heights in the smaller window, and the program generates the required view in the larger window. A selected set of editing features are available for changing any drawn 3-D objects: you can stretch and scale items, bend surfaces, change cylinders into cones, rotate items about a point, merge models, and place exactly lines or walls or adjacent models. Similarly, pan and zoom facilities are also available.

Nevertheless, and as one must expect at this price, the Modeler lacks many of the typical CAD features. No layering system is available, nor hatching, nor text entry nor dimensioning, nor distance calculations; but, of course, all these are available once the drawing has been transferred to Drafix. The Modeler has no facilities for hard-copy output, for any required views must be transferred to the Drafix program for printer or plotter output. However, the transfer procedure is extremely straightforward and simple and, once transferred, all the editing and output facilities of Drafix become available for use: an ingenious solution to utilising the best features of both packages. Note, however, that you cannot transfer drawings from Drafix to the Modeler.

'. . . for any engineer or architect wishing to view his design in accurately calculated three-dimensional perspectives, it could be a very useful tool, avoiding the guesswork so often used in design work.'

Remember also that all the views are wireframe views: that is, you can see all the lines on all sides of the drawn object. A facility to hide the lines theoretically not viewable from the selected viewpoint is available but, like the 'HIDE' commands on all CAD packages, this takes a very long time indeed. In redrawing test diagrams the Modeler was very slow, and I would not recommend that anyone attempts any really complicated diagrams without an AT, a hard disk and a co-processor. In addition, Modeler does not support any expanded memory cards.

Documentation

Only the *User Guide* is supplied and this has a reasonable Index and a good Glossary. The manual is clearly a cut-down version of the full Mega-CADD manual for there is a reference in the Index to Appendix G, though the final one in the manual is Appendix E. Accepting that any form of 3-D CAD requires an extensive learning effort, the manual is successful in teaching the basic concepts involved and takes the reader through each of the main input commands of Create, Modify and View. There are plenty of excellent diagrams at every stage, and the reader will find very useful the concept of the 2-D xy screen of the monitor falling backwards to the horizontal so that the monitor screen, in turn, becomes the 'z' dimension for the input of the top and bottom dimensions.

As with Drafix, the 'HELP' line number is (01) 858 6016.

Conclusion

Given the low cost of the 3-D system and given the limitations outlined above, the Modeler, particularly if used with the Drafix editing and plotting facilities, offers a very good deal for the designer whose work could benefit from 3-D wireframe drawings.

In desktop publishing there is the well-known acronym WYSIWYG (What You See Is What You Get). For CAD programs another acronym is appropriate — YGWYPF (You Get What You Pay For). It's easy enough to point out deficiencies in what is a Group 2 low-cost CAD package, but you have to be careful that you are not comparing it with packages like Release 9, Versacad or Cadvance which cost eight times as much.

Given the basic set-up and concepts that underlie Drafix 1 Plus and assuming that its designers continue to upgrade it so that the future releases overcome existing deficiencies — its limited drawing-size memory, its lack of a programming language, database facilities, memory expansion, more expansive macros and direct keyboard entry, and all this at a relatively low cost — then Drafix may be able to take on the Group 3 packages. Add to its present capabilities, though, the possibilities inherent in the 3-D Modeler, and you have a package which at this stage stands alone in the Group 2 market almost without competition.

Software supplied by R Manhattan & Associates on (01) 630 8322.

Dr Roland Newman is a Reader in architecture at Oxford Polytechnic.

END

ANNIVERSARY RETROSPECTIVE

Nostalgia runs riot as *Personal Computer World* celebrates its tenth anniversary this month. To mark the event, Nick Walker has compiled a selection of key articles, from the very first issue in 1977 through to 1984. There's also a quiz to test your knowledge of the industry and of the magazine.

Ten years ago this month, the first copy of *Personal Computer World* hit the streets. In the following eleven pages, we present some of the more interesting articles from the early days of the magazine.

'Personal Power' from Volume 1, Number 1 gives a general overview of the personal computer business as it was in 1978. This introductory article explains how, in 1978, you could build a hobbyist computer for around £500, and how around £5000 could purchase a business micro complete with VDU, printer, punched tapes and even, if you were very lucky, floppy disk drives.

Lurking quietly within the pages of Volume 1, Number 1 were rumours of fully built and cased micros soon to hit our shores from America. Tandy and Commodore were the first to arrive, quickly followed by the biggest success of them all, the Apple II. Competition from the UK was lead by Research Machines and its 380Z.

However, the years 1980–1982 saw a new wave of home and small business computers which attracted a whole new collection of personal computer users. The two leading lights of this era were Sinclair and Acorn. Clive Sinclair's presence was with us even in Volume 1, Number 1. Two products advertised in this issue owe their origins to Sir Clive; one for programmable calculators, the other for his low-cost hex-programmed computer, the Science of Cambridge MK14. This came complete with 256 bytes of memory, a hex keypad and two hex LEDs — I remember playing Pontoon with hex A-E representing the cards 10 to Ace.

Perhaps Sir Clive's most influential machine was the ZX81 (£49.95 in kit form, £69.95 built). This physically tiny, 1k machine complete with spillproof keyboard brought affordable computing to a whole new audience.

The endorsement of Acorn's micro by the BBC proved very fruitful for Acorn and attracted a lot of new users. For many people, the BBC Model B offered more facilities than an Apple II at a fraction of the price. *PCW* readers took to the BBC Micro in droves and it still remains a very popular second machine today. Despite our support for this machine, we managed to upset Acorn by publishing details of how to transfer programs from tape to disk. Very useful and, according to Acorn, highly illegal.

For the business micro owner, *PCW* has always stressed the importance of selecting the right software before buying a machine. Such classics as Lotus 1-2-3, WordStar and dBase were reviewed in early issues.

It was during 1982 that IBM announced its intention to produce a personal computer. The 64k, cassette-based, Basic-programmed system looked expensive (at around £2600) even with an IBM label attached. Few people predicted the impact of this machine, but today the IBM PC and its many clones are the most popular micros in the world.

Guy Kewney has been giving us his usual off-beat views on the industry since the first issue, and his 'Newsprint' section continues to be the most popular part of the magazine. Two of his columns, from January 1983 and February 1983 have been combined to form a 'Guy Kewney view' of the industry in 1983.

Martin Banks continues to wax lyrically about the PC business and has, for the last two years, won awards for his work. However, he does run the biggest risk as his articles are often the most forward-looking. For this feature we've selected his September 1981 column on the changes he perceived in computer purchasers. Comparing his description with today's 'consumer product' approach makes interesting reading. One of Martin's favourite topics over the years has been the threat from Japan, and our 'News from Japan' on page 135 shows just how seriously the Japs were taking the UK market in 1984.

Dick Pountain's 'Calculator Corner' had an enormous following: for many people, a programmable calculator was all they could afford while they anxiously waited for the price of real computers to fall.

Looking through past issues of *PCW* also makes you realise just how many products didn't make it: the Enterprise 64/128; the Oric Atmos; The Last One; the NewBrain; IBM's PC Junior; MSX; the Lynx; Mattell's Aquarius, and the Orb.

Try the accompanying quiz. No prizes, but you can count yourself better informed than any of the current editorial staff and a number of past editors if you get 50% right.

PCW Anniversary Quiz

1) In 1978, the Intel 4004 chip — a cut-down 8008 — was to be found in action in every High Street. What was it running?

2) At the Home Microcomputer Symposium at Wembley (26 January 1977) lunch cost an 'exorbitant' £4.50. How much RAM did the writer lament he could have bought for the same price?

3) 'I have tried very hard to obtain information about their product without any success. This seems very bad public relations since they have publicly displayed the machine on more than one occasion (for example, in May 1977). This is not a good sign for the future.' Which still-trading computer company and which product?

4) Science of Cambridge advertised the MK14 for £39.95 (plus VAT), claiming it to be the only 'low-cost keyboard-addressable microprocessor' available. It had a hexadecimal keyboard, 8-digit LED, machine code monitor including 512-byte PROM, and 256 bytes of RAM. Sir Clive Sinclair and which other famous UK computer person were behind this 'working component of larger electronic systems'?

5) Which piece of common office equipment was originally designed as an input/output device for IBM Series 360 computers?

6) Many early personal computers came with a CUTS interface. What did CUTS stand for?

7) What was the occupation of *PCW*'s founder, Angelo Zgorelec?

8) The Heath H11 computer kit has 4k RAM, LSI-11 CPU, power supply and case for $1295. What was its claim to fame in software compatibility? Under what name is Heath now trading?

9) What was considered a suitable throughput for a high-speed business computer printer?

10) The £7000 Super C business computer had an optional extra feature in its operating system which was thought useful for engineers, managers and operating clerks. What was it?

Answers on page 139.

NEWSPRINT

Guy Kewney provides the latest micro news.

Raising the standard

'With the appearance of the IBM standard, the obsolescence of 8-bit systems will take place even more rapidly than previously predicted,' remarked Dr Robert Harp, previously boss of Vector Graphic, now boss of Corona Data Systems.

Harp was building up to announce a machine which was the same as the IBM, yet better than the IBM (for many obvious reasons) and yet was also portable, comparable in size and weight with the Osborne — but with a bigger screen and smaller disks. And the price was $2,395 (with one disk).

It was quite an announcement, spoilt only by the fact that the machine isn't going to be available until April in America, and who knows when in this country.

Actually, Harp was releasing a whole family of IBM-compatible machines. The first was a desk-top machine, like the original IBM but costing $2,600 (compare that with the £3,000 or so asked for the IBM in this country today by 'grey' importers).

Because this machine has half-height floppies, you can get four, or two and a hard disk, in the desk-top box.

However the main improvements are not just how the floppies fit in the box, but more substantial — the power supply, the memory, and the graphics are all enhanced over the standard specification.

In the words of Bob Harp: 'In the past, most systems like this have been priced far too high, and too many features have been "optional" which ran the price even higher. Having so many components optional also meant that serious users had to be quite knowledgeable in order to configure a system.'

In the Corona — unlike the IBM — video controller, disk controller, extra memory, printer ports and graphics are all included in the price. Memory can be expanded from the normal 128 kbytes to 512 kbytes without expansion slots. And the power supply is 110 watts, compared with IBM's 60 watts, which will be sufficient, says Harp, to power several extra expansion boards — and the IBM's power supply, he adds, is not.

Corona offers graphics to a 640 dot by 325 dot resolution (IBM's is 640 by 200) and stores the graphics image in main memory, not on an add-on card — which makes its graphics a lot quicker and cleverer. But IBM graphics can be run on the normal IBM graphics expansion card if you like.

The portable version, with two disks, will cost $2,795. Included in that price will be 128 kbytes of memory, the display monitor, input and output ports, graphics, MS-DOS, Basic, and a spreadsheet package.

Legal matters

Atari says it is suing Commodore for ripping off the Pac-Man game, and selling it as Jelly Monsters. Commodore says that Atari has lost a similar lawsuit in Hong Kong, and as a result has withdrawn from this one. Atari says no, it hasn't withdrawn, it has just 'stood over its application for a temporary injunction, but obtained an order for a speedy trial'. Commodore says it will be pressing for costs.

When we know more, we'll tell you. I can't help feeling a touch ironical about the wording of Atari's press release, however.

The release itself refers to the 'substantial commitment to the development and marketing of new and original software' — which is very true and valid —and says that it will 'continue to enforce its rights against those who would seek to misappropriate the fruits of Atari's labours,' which is a matter for the courts to settle.

The irony of this case is the fact that Pac-Man is not a program which Atari wrote. It happens to be one they bought from a Japanese company.

Assorted op-systems

Anybody planning to sell you an imitation IBM Personal Computer with MS-DOS, the operating system which Microsoft produced for IBM, can plan on paying a mere $19 per copy, providing they plan to sell more than 5000 machines.

Microsoft has announced new prices to go with its new version of the operating system, which is expected 'soon'.

MS-DOS 2.0 'offers a number of new and enhanced features,' the company says.

User friendliness is provided by a 'visual shell, and help facility' — that's to say, a menu of common commands and an explanation of them if you panic and type a question mark.

The new software should run a bit faster, too, because Microsoft has taken a little of the computer's main memory over and uses it to store data coming off disk. The assumption is that you are very likely, having read one sector, to want the next, so MS-DOS 2.0 reads in the whole track and your second access comes direct from memory.

Most interesting, however, is the sign of a response to Digital Research's Concurrent CP/M-86. So far, DR has offered this on the IBM PC and very few other systems. There are several reasons for the slowness of the response: first and foremost, people don't understand what it is.

Once you have understood that Concurrent CP/M-86 lets you switch happily between Supercalc and Wordstar and your electronic mail system without loading and unloading files, you tend to want it. At that point, you find that it takes up an extra 91 kbytes on the Sirius 1.

Novel printer

Olivetti has found a new way to become newsworthy — by producing a new printer with a completely new way of printing. It involves shooting black sparks at white paper.

Most printers hit a piece of paper with an inky ribbon, pressed onto it either by a lump of metal in the shape of a letter, or else with sharp needles which repeatedly slam into it.

Some printers use the needle method but instead of hitting the paper in the right place, they burn the paper. To work properly, this method needs heat-sensitive paper. Don't leave it in the sun after printing ...

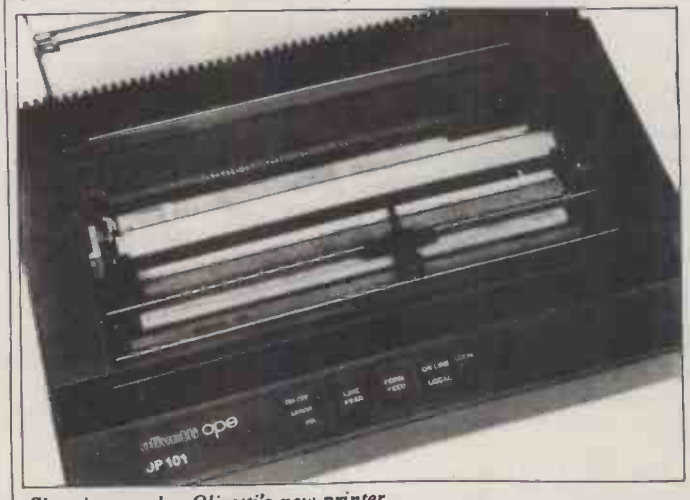
Olivetti has hit upon the idea of using a graphite electrode and instead of writing on the paper (as with a pencil) it electrifies it. A spark flies between electrode and paper and a particle of carbon flies with it, onto the paper. The idea is exciting enough and, at £400 plus VAT (£14 more than the Epson), the price isn't badly wrong.

Olivetti claims that the printer has fewer moving parts, which is true enough, but omits the fact that it only has one electrode. So where your impact matrix (those needles) with seven or nine moving parts has to travel down a line of print once, the carbon head has to travel seven (or so) times. It has to shake about a bit. The drawback is that the carbon used in the printer is all too clearly carbon.

There is a printer which uses laser techniques, which is so fast that it does carbon copies by printing the same page twice and you don't notice the difference. 'Every copy a top copy,' somebody said once. The Olivetti has every copy a carbon copy.

One of the first companies to adopt the new printer is Acorn.

Olivetti is on 01-785 6666.



Shooting sparks: Olivetti's new printer.

Fast Future

Britain's own response to the IBM Personal Computer is a lot cheaper than the original.

A new company called Future Computing, selling through distributor Encotel, has launched a machine costing £1,500 which runs all IBM software but runs it some 60 percent faster.

At press time, we had so few details that it was hardly worth running the item — but this is pretty unusual, so a quick mention will do no harm.

The machine will have a very comprehensive local area networking ability, says Brian Jackson, the managing director of the new company.

And to set it right apart from most IBM look-alikes, this one will be able to have an add-on processor more powerful than its own chip.

Where most users of the 8088 chip eventually plug in an ordinary Z80 to provide standard CP/M, Future Computing will offer the much beefier Motorola 68000, a favourite of those who want to write programs in C under Unix.

And in 1984, promises Jackson, there will be a 'true 32-bit processor', but he didn't want to give details

Arise, 'Sir' Clive...

Around the middle of December, I was frequently distracted by people telling me that it would not just be Clive Sinclair OBE, but Sir Clive Sinclair, KCG or whatever, instead of merely Uncle Clive.

By the time you read this, of course, all the speculation will be probably wasted — until the next Honours List — because the honours will have been announced — or not.

Naturally, before attempting to print this rumour, I rang Sir Clive up, and told him what I'd heard. He laughed immoderately, and agreed at once that if such a thing were in the wind, 'They' would probably have told him of it.

But I couldn't help noticing how he signally failed to say that 'They' hadn't.

If by some strange chance the powers that be do manage to confer official approval on Clive, it will come as less surprise to a lot more people than you would think possible.

At Government dinners recently, Ministers have been hinting at 'recognition' for various micro-industry people and their 'contribution to Britain's position in the world in this area'. And, in rooms where Sinclair has been standing, Ministers have used the phrase 'for people in this room at the moment'.

Ever since Clive first pointed out that the Civil Service and the BBC (not altogether the same thing, since some Civil Servants didn't go to Oxford or Cambridge) didn't approve of him, there has been some sort of chorus of official disagreement.

There was the amusing episode you may remember, of the educational 'approved' list, where the Spectrum (its virtue is its low cost) was included together with the RML 480Z and the BBC micro as a suitable machine for young children — providing they also bought an expensive colour video monitor.

'Proves we have nothing against him, doesn't it?' enquired one well-placed gentleman, who seemed astonished when I suggested that Sir Clive might not agree.

So, I suppose, since Sir Clive always wanted to prove to the Establishment that he was real and since the Establishment always wanted to seem fair-minded and even handed, you could say that a deal is a deal, and everybody's happy.

As long as it is really 'Sir' Clive, and not some Minor Bloody Eminence.

Free micros!

You presumably want to know how the world's first hard-disk portable computer ended up being sold through Rymans office shops? Read on.

Rymans used to sell an American-built overpriced system called Dynabyte, imported by Metrotech. Then Rymans and Metrotech and Dynabyte all split up.

Rymans has thought a bit about this and has returned to the market with a British product range — the extraordinary Andromeda family from ITCS in Staines.

This is the family of 'free' microcomputers which has attracted both controversy ('he can't do it!') and enthusiasm ('we've done £2.5 million worth of business in less than six weeks from startup') because the machines are not only free, but come complete with some cheap software.

The idea is simple enough: ITCS will lend a machine suitable for running the software it sells and maintain it for a reasonable fee, for three years.

All the machines (over 20 different combinations from six basic designs, including an Osborne-like portable) run CP/M on an identical central processor.

The difference between the systems is the size of the keyboard, the size of the screen, the density of the disks, and so on.

The systems have now been enhanced with the launch of what proprietor David Lewis-Pryce reckons is the 'first winchester-disk portable' in the world.

This is no light-weight: the basic Zita portable requires you to lift 36lb weight and the hard disk version is even heavier. However it does pack away into a single case, small enough to put in front of you on the tube, and compact enough to hold in one hand long enough to push open the door with the other.

Its advantages over the Osborne — apart from its UK origins — are the bigger screen (nine inches) with 80 columns display and much bigger disk capacity. It can be cheaper, too, but not for the same amount of software.

The more observant of our readers may have noticed something different about this month's PCW. *What we've done is to change over to phototypesetting, in the form of a brand-new, computerised Itek machine. Our dear old IBM golfball machines have been put out to pasture on a much less onerous task of setting* Private Eye.

This doesn't mean, of course, that we'll now see fewer errors in PCW *— it's just that they'll be* high technology *errors. Pic shows our typesetter, the glamorous Ms Jane Hamnell, trying to get Space Invaders running on the Itek.*

Home computer sales

In 1982 an astonishing 509,000 people bought home computers in Britain. It was the year the home computer really arrived.

What's more, home computing seems to be one area where Britain is taking a lead.

A set of startling figures come from micro-analyst Robin Bradbeer who's just completed a report on the subject.

'Per head of population we have twice as many machines in the UK as the US and one and half times as many as Japan,' said Bradbeer.

'Over two-thirds of all pcs sold in Europe are sold in the UK. We also have more manufacturing than anybody else and are producing more machines. And our distribution chain is more efficient than those in the US and Japan.'

In fact over half of them come from Sinclair. In retail and mail order last year Sinclair sold 220,000 ZX81s (£50) and 75,000 Spectrums (£125 and £175). Sinclair has reached the people through a number of High Street stores including WH Smith, John Menzies, Greens, Wigfalls, Currys and Rank Xerox. Mail order has declined sharply to 10 per cent of total UK sales.

Price has a lot to do with Sinclair's success. Home computers are getting cheaper and cheaper. We have already seen this with the ZX81, which went down from £70 to £50 at the beginning of August, and several other machines are expected to follow suit early in 1983 having shipped large volumes for Christmas.

Another machine which might have been expected to be overshadowed by a bigger brother is the VIC-20 from Commodore, 00,000 were sold in 1982, again through a wide range of retail outlets. When the Commodore Max and Commodore 64 were launched at the Hanover Fair last April the company fully expected the 20 to fade gently into obscurity. 'But in October it was decided to increase the sales of the VIC-20 and we have now sold over one million units internationally,' said Commodore.

Despite all this blue sky talk from the pundits there is scepticism in the field about how successful home computers will be, especially when sold as a brain for the home. 'A diary or a thermostat will do better than their computer counterparts,' said one doubter.

Home Computers sold in the UK in 1982

Sinclair ZX81	220,000
Commodore VIC-20	100,000
Sinclair Spectrum	75,000
BBC Computer	40,000
Dragon 32	25,000
TI 99/4A	20,000
Atari 400	12,000
Video Genie	10,000
Colour Genie	2,000
Others	5,000
TOTAL	509,000

NEWS FROM JAPAN

CP/M-80 and CP/M-86 software to run under MS-DOS . . . a pocket computer for car insurance salesmen . . . the Japanese equivalent of the IBM PC . . . Shinichiro Kakizawa brings you the latest news from the Japanese hot-line.

Shinichiro Kakizawa is a computer technology and applications consultant, and a freelance journalist. He has worked in the computer industry for twenty years, originally on mainframes, and for the last five years on micros. Fujitsu and NEC are among the companies he has worked for in Japan, Singapore, the Netherlands, and the UK. He has been involved in policy setting for the Japanese fifth generation project and in Britain he participates in SPL's fifth generation project, Insight.

Multi O/S software

Megasoft is selling a package which allows CP/M-80 and CP/M-86 software to run under MS-DOS. This interesting approach comes in the form of interface software which will run immediately below MS-DOS (versions 1.25 and 2.0). Data can be shared between MS-DOS and CP/M, exchanged, and stored on the same disk. The package is called the EM/3 O/S Integration Adaptor and costs around £190. Manuals are unfortunately only available in Japanese at the moment.

1Mb, 1.6Mb in one floppy drive

There is good news for micro users who have difficulty knowing what to do with ever-increasing piles of diskettes in different capacities and densities for a variety of systems.

The majority of the machines on display in shops in the electronics bazaar, Akihabara, Tokyo are now equipped with a standard 1.6Mb floppy disk drive. Only a year ago, the standard was more like 1Mb. As elsewhere in the world, micro users in Japan are facing difficulties with stacks of incompatible floppy disks.

Matsushita (also known as Panasonic) has come up with a decent solution for this problem. Its new drive, called 'Super mini FDD JU591', can read/write two different capacity disks with a single drive by automatically changing the rotation speed of 5¼in disks between 300rpm (1Mb) and 360rpm (1.6Mb). Diskette type can be identified automatically within one second of insertion. Matsushita's plan is to produce 200,000 units this year at its Hananomaki factory in Northern Japan, and it has been talking to a number of micro assembly makers around the world. You may see new micros with this drive before Christmas in the UK. The price (note that it's only for OEM sale) is £200.

From black/white to colour in the classroom

Panaboard is a little expensive but a very useful tool for classroom training. What you have written on a black/white board can be hardcopied in colour, transferred to VDU or large video projector, or stored on disks.

Panaboard is from Matsushita, manufacturer of the IBM 5550; price is a little over £10,000. Last year Oki developed a black and white hard board copier, and this new machine is certainly a welcome addition to the micro classroom.

Let your watch do the walking

A watch capable of memorising telephone numbers for 10 people is being sold in Japan by Casio. The watch has a one-chip CMOS CPU, stores 10 sets of four alphabetic characters and 10 numeric digits, and provides a calculator function as well. The idea is similar to the Seiko wrist computer, but unlike the Seiko, this watch does not require a separate keyboard for input. How it will sell is yet to be seen, but my feeling is that watch computers have now established themselves firmly in the market.

Many more with a wide variety of features will soon follow, including offerings from Sanyo, Citizen, Ricoh and Seiko.

Calculating the premium

Sharp and Unix Ltd (a Tokyo system house) have developed a special purpose pocket computer for helping car insurance policy salesmen to calculate the premium quickly. The machine is based on the popular CE-1253H with 24k RAM. It has special function keys needed for car insurance, and cannot be used for any other purpose. This trend of developing more dedicated pocket computers suitable for only one task is a forerunner of future pocket expert systems. Sharp expects to sell a lot — over 20,000 — this year.

Fuji diskette drives

Fuji Film Company, best known for films and cameras, has begun shipping 1.6Mb 5.25in diskette drives in limited quantity. IBM has said that it will make 1.6Mb drives its next standard device. Fuji is the fourth Japanese manufacturer to produce a 1.6Mb drive after Y-E data, Matsushita and Hitachi. It seems that anyone in this market who offers a diskette of less than 1.6Mb per sheet will be regarded as a failure.

Industry overview

In the business microcomputer market, the biggest difference between Japan and the rest of the world is probably the non-existence of the IBM PC (I daresay you can buy it somewhere in Tokyo if you really want it). Instead, IBM Japan sells the 5550, something similar to the PC/XT in terms of horse power. The machine has been reasonably successful and large mainframe users are buying it, but unlike the PC, you can't buy the 5550 in the high street micro shops in Japan.

The major supplier of microcomputers in Japan is, of course, NEC. It has sold over half a million systems, including the ever-popular 8-bit PC8000, PC6000 series, and 16-bit PC9000 machines. NEC has now firmly established itself as the leader in Japanese micros, mainly because it had the right machine at the right time when the micro took off in Japan four years ago.

NEC enjoys the same privileged position that the IBM PC has in other markets. Every software house writes packages primarily for NEC.

MSX arrival

There is no clear distinction between machines to be used by home users and business users, unlike the UK where the Spectrum, ZX81, and BBC Micro are clearly for home and educational use.

In Japan, everyone has been using NEC, Sharp, Fujitsu, Hitachi, OKI, Mitsubishi, and Toshiba machines whether it's for home or business.

The only difference is the money spent on peripherals. Home and hobby users spend less, but the CPUs are usually the same. However, this situation is rapidly changing as more and more MSX machines are joining the force. MSX machines are cheap — current offerings are around £150 for an 8-bit 64k average machine. It will be interesting to see if the MSX standard is accepted worldwide.

Among the major suppliers, Sord is one of the first and has a lot of enthusiastic followers mainly among large business users. Sord's PIPS spreadsheet package has been as popular as VisiCalc.

It's rather sad that we don't see many world popular brands like Apple, Tandy, and Commodore. You can get hold of them if you wish but, except at the beginning of the micro fever, they haven't sold well.

Wrong pricing, inadequate advertising budgets and lack of decent support networks were the reasons.

It's very sad indeed that major companies of this stature let themselves down in this way. END

PCW IN THE PAST

BANKS' STATEMENT

THE SKULKING MORON

More musings from the Banks biro.

Software, if you'll pardon the pun, is a soft touch for anyone with a yen for making barbed comments about the computer industry. It is, in fact the moron that skulks inside the snazzy boxes of hardware that look so terribly clever.

See, its easy to have a go at software, especially in the microcomputer business. It rarely is what most people seem to think it might be, or hoped it should have been given luck and God's good grace. Software producers certainly over-step the mark at times, broadly alluding to the wondrous power of the XYZ suite of integrated packages in their advertising. Systems manufacturers often more than broadly allude to the infinite capabilities of their ticky-tacky boxes. . . '*You* could run all of GEC's accounts on this wrist-watch-styled gizmo, costing just 27 pee'.

Yes, the poor bemused punter is often oversold on the joys and wonders of the microcomputer. Sometimes, they are even oversold — dare I say it — deliberately. Well, a sucker is a sucker is a sucker, I suppose.

Many times, however, it would seem that the punters oversell themselves on the whole idea. Often, it is only with great difficulty that they are dragged, kicking and screaming, back to the world of reality, and other boring things like file sizes, field lengths and suchlike.

This self-abusive overselling is probably more prevalent in software than hardware. Since the heady days of the late seventies, when that nasty thing called the microprocessor came to national prominence, there has been a slow but steady awakening in people's perceptions about hardware. They now yawn — through knowledge rather than disinterest — at the old chestnut about 'this box' holding the equivalent power to a computer that used to fill a house.

But the same cannot be said of software. To many people, and certainly to many potential users of microcomputers, the subject of software tends to elicit one of three different and distinct responses. The first is the blank stare, occasionally accompanied by a querulous 'eh?' The second is the dubious enquiry as to whether it is illegal or should be mentioned in polite company. The third response follows the pattern: 'Ah yes, I know about that. I've seen adverts for complete accounts packages for £40.'

Now I know that there are many, many happy and contented users of microcomputers running much good software and achieving exactly what they set out to do. I also know that there are many individuals writing that software, both for themselves and other people. But at the same time, I also know that there are many, many discontented users who feel they have bought a pig in a poke, and many, many more who haven't bought anything yet but run the risk of one hell of a surprise when they do.

Now, as I have also said (back at the top of the page, remember?) it is easy for someone to sit complacently at a typewriter and have a good whinge and whine about software. Therefore, from this point on I shall try to avoid that. Instead, I will make a suggestion.

It is a suggestion that has been borne out of a story that concerned a user, a particular computer system, and a software supplier. In this context the names don't really matter.

Now the user purchased the computer, because he liked it and then shopped around for some software that would run the applications he had in mind (mainly accounts and job-costing work). This, he now freely admits, was a mistake. He acknowledges that he should have found the applications packages he needed, and then found a machine that would run them. That, unfortunately, is the way that many first time buyers are liable to start.

Now, he found some software that could do the job, at least on paper, but in practice it didn't seem to work out that way. The implementation of the software involved work, correction and bug-hunting, accompanied by much burning of the midnight oil by all concerned. 'It doesn't work,' cried the user, 'and it can't be got to work.'

From that user's point of view that statement was true, and very self-evident, but there was a *but* (isn't there always?).

The *but* in question came from the supplier of the software package, who said, in effect, that he was hardly surprised it didn't work. This was not to say there was anything wrong with the package. In theory it would meet the application nicely. On a bigger machine it would have coped well. 'You see,' said the software man, 'that application, the volume of work to be processed, really needed a minicomputer, though some of the biggest micros could have handled it.'

Therein lies the rub. The user had a good idea — to use a micro computer to run the business accounts — but its implementation was a different matter. The simple (at least in theory) task of gaining a rough quantitative guide to the job, that could be gauged against the known capabilities of a range of machines and software packages, seems to have been missing.

In old style computing (mainframes etc), this exercise is sometimes called systems analysis and is a job for the crème de la creme of the brotherhood. Needless to say, that makes it very expensive and takes it beyond the financial pale for the majority of potential micro buyers.

But there is scope for cheaper variations on that theme and, while not so accurate (and even in the mainframe business that is a very relative word), user requirements could be rapidly quantified at the dealer level and matched to software and hardware.

It occurs to me that there ought to be some way of grading both hardware and software, and also the user's application. Software, in particular, would benefit from this, for it could help both the potential user and dealer. Both would have a common frame of reference around which to discuss an application and its implications.

Hardware would be relatively easy to grade, for it could simply be based on a system's capabilities. For example, on a scale of one to ten, in ascending order of 'power', you could have a Sinclair ZX81 without add-on memory as grade one; grade five might be an Apple/Tandy/Commodore machine running two mini-floppies and a printer; then, at the top (purely for the sake of argument), machines like the Onyx 8000 running over 20 Mbytes of hard disk.

Software would be more difficult to grade, but not impossible. Simple games and educational programs would be grade one, while a fully integrated accounting package with bells and whistles would be grade ten. It would, of course, have to be usable on grade ten hardware. Intermediate gradings of software would be difficult: there would no doubt be a need for further subdivisions into different applications areas, such as engineering, accounting, medical, etc. The gradings should, however, be matched to what the packages can actually do. For example, there could be a very fine general ledger package that does not integrate with any other accounting package. This would have a lower grade than a similar, text integrating package (unless, of course, that integrating package was a bummer).

By the same token, it should be possible for a dealer to have some form of checklist for the user. This could be a series of questions that would allow the dealer to quantify the application, and thus give it a grading that is relative to those for hardware and software, ie, a grade ten application will need a grade ten computer running grade ten software. As a side benefit, such an exercise would help the user gain a better understanding of just what he is trying to achieve, and why. He might end up realising that he doesn't need a computer at all.

I really don't know if such a system of grading is workable, or whether it is economically viable to establish. Ideally, all this would be done by some independent body with no vested interests to protect. The chances of that are remote, to say the least.

But there is scope for enterprising companies, or groups of companies, maybe even the Computer Retailers Association, to have a go. Even if the grading structure was not of the best, it could well be better than nothing at all. I am reminded of the CP/M operating system, which is certainly not the best there is in operating systems, but has succeeded primarily by being there. A poor grading system could succeed by the same token.

A poor grading system that at least gives some quantitive comparison for dealers and users to work on does, however, seem infinitely better than the current state of the oversold wing and a prayer.

Taken from PCW September 1981

BENCH TEST

SINCLAIR ZX81

Just as we get used to more computing power for the same money, along comes Clive Sinclair offering much more for much less! David Tebbutt reports.

Right from the start, I had better explain that the ZX81 costs £50 in kit form and £70 ready-built and, as such, represents absolutely amazing value for money. Whatever shortcomings are highlighted in this Benchtest must be weighed against this fact.

Like the ZX80, its predecessor, the ZX81 will be available by mail-order and, by the time you read this, deliveries should be coming through. Clive Sinclair tells me that he plans to up production to 10,000 units per month starting in April and that he'll be producing 10,000 ZX80s to satisfy overseas demand, so, providing that 10,000 or fewer of you order the new machine per month, delivery should be swift.

Sinclair has been a bit cheeky in his advertisements. Under a column entitled 'New, improved features', he proceeds to mention three things that were included in the ZX80 when it was launched over a year ago!

For the benefit of those unfamiliar with the ZX80, it was the first ready-built computer to break the psychological £100 price barrier. It was well-made but looked slightly cheap in its lightweight plastic case and with its shiny keyplate. The 'keys' were printed on a plastic membrane with a metallised back; when each 'key' was pressed, the metallic back came in contact with PCB tracks, shorting them to complete the appropriate circuit. The system plugged into the domestic television to give an extremely clear display, and program storage could be made onto the home cassette recorder. The ZX80 came with 1k of user memory (RAM) and a 4k operating system/Basic language chip.

The main limitations of the ZX80 were the fact that it could not handle floating point numbers or cassette files.

So what in the ZX81 is new, compared with the ZX80? First, an extra 4k of ROM is provided, which allows 30-odd additional functions to be incorporated. This will also drive the printer (expected in the summer). I couldn't test this, but I have seen it working. It is an electrosensitive printer requiring aluminised paper, the surface of which is burnt off by an electrical discharge to reveal the black paper underneath. Don't study the photos too closely, because they show a model, not the real thing. The ZX81 costs an amazing £30 less than the ZX80, thanks to some neat design consolidation in a Ferranti chip custom-built to Sinclair's requirements. The total number of chips in the basic system is four, against the ZX80's 21. The ZX81 and its peripheral products are all cased in sturdy black ABS plastic. And very nice it looks, too.

Hardware

Although physically smaller than the ZX80, the new machine weighs in at 13oz, about 2oz heavier than its predecessor. The system needs a UHF television, a cassette recorder and a power supply to make it usable.

On my colour television the screen is a pleasant green and all characters are displayed in black. The machine offers no colour facilities and my guess is that you shouldn't hold your breath waiting for them. I suspect that a projection system based on three of Uncle Clive's miniature TV tubes might appear one day but, then again, I also suspect that he'd introduce another computer to take advantage of this. The display is 24 lines of 32 characters of which two lines are reserved for system messages and commands. Low resolution graphics are provided to give 64 by 44 plotting points. As with the ZX80, the display is very clear and rock-steady.

I'm pleased to see that the new power supply has its own flying lead for the attachment of a normal mains plug. (The ZX80 was awkwardly designed with an integral plug which often needed an additional socket or extension lead.) This power supply must give 600 mA at 9V but, since the ZX81 draws close to this, the standard power supplies actually give 700 mA and I would recommend that readers using their own supplies go for the higher rating, too.

Once again, the keyboard is formed by an underprinted plastic membrane which is everything-proof (water, chemicals, Coca-Cola, cigarette ash, monkeys, editors, etc). The keyboard layout is different from the ZX80's so, if you're upgrading, prepare to make a few mistakes at first. At the same time it is an improvement, since each keyword is frequently placed at or near its initial letter. (All you have to do now is learn the qwerty layout!)

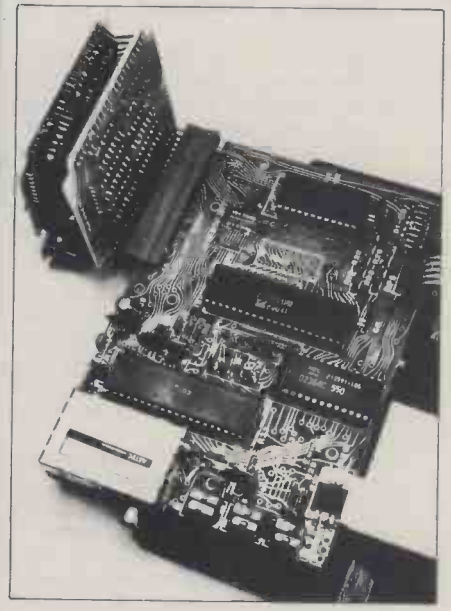
Here are a few ideas for Uncle Clive: a plug-in battery pack, a plug-in single-line LCD display and a remote (infra-red or ultrasonic) facility so that you can sit in your armchair beaming the display information at an aerial adaptor on the television.

Compared with the ZX80, the ZX81 looks very smart indeed — one could almost say tasteful. It has a nice shape and texture and the keyboard is made of a non-reflective material, a definite improvement.

The plug-in 16k RAM pack fits to the edge of the PCB where it protrudes from the rear of the casing. The cursor takes a while to appear at switch-on, because the system is checking to see how much memory is present in order to set certain system variables. If you're a machine code freak you can reset the RAMTOP variables in order to give you somewhere safe to tuck your precious program.

Five screws hold the ZX81 together; three of them are hidden under the pads on which the machine stands (footpads? — surely not). You know what I mean — those non-skid things. There's a substantial heat sink for the regulator under the rear of the keyboard — it's a good place to warm your hands on a chilly morning. The PCB is held into the casing by two screws. The keyboard is separate from the main PCB and is connected to it by a couple of flat printed cables. The main PCB is well designed and neatly made. Assembly of the ZX81 is done very professionally by the Timex Corporation in Scotland (the same people that are making Sinclair's latest miniature television).

The basic ZX81 contains four chips — ROM, 3.5 MHz Z80A CPU, 1k memory and the Ferranti custom-made chip — plus a limited assortment of bits and pieces. It's very, very simple — I think even I could build it. A few spare positions on the board give the manufacturer a certain amount of flexibility to tweak the machine to the requirements of different television systems and to be prepared in case a memory chip famine occurs. The Ferranti chip handles all the I/O and control signals between the various elements of the machine. Nosing around inside, I notice that it has a very cosmopolitan flavour, with memory from Malaysia, the CPU



and ROM from Japan, a UHF modulator from the Philippines, a regulator from El Salvador and the custom chip from Britain. The edge connector is not gold-plated (what do you expect for £70?); it's just the PCB printing taken out to the edge. The 16k RAM pack contains two boards connected at the edge. One board contains eight 4116s which are driven by the other board's assortment of seven chips which handle the memory addressing and refreshing.

Software

The ZX81 syntax-checking is excellent because, unlike the ZX80's, instead of operating on each character as it's entered, the system waits until NEWLINE is hit. Finding your way around the keyboard at first is a real hoot — some of the keys have five functions. As before, the single stroke keyboard entry is a joy to use and the automatic spacing inserted by the system makes program listings clearly legible. For example, if you tried to enter 10FORN=1TO10, it would appear as 10 FOR N=1 TO 10. Pretty neat, huh?

Editing is very simple. You position the cursor on the line to be modified, hit the EDIT key and then make your corrections. Additional characters and functions are automatically inserted at the cursor position within the line while RUBOUT deletes the character or function to the cursor's left. A touch on the NEWLINE key confirms the changes.

An enormous number of functions have been crammed onto this rather small keyboard. This has been achieved by using two special keys: graphics, which allows the user to key all the graphic characters as well as the normal characters as white on black; and function, which allows the user access to (surprise, surprise!) special functions. A normal mode of operation also exists. In addition to all this, the keyboard has a bog-standard shift key, thus increasing the range of options for each key still further.

The character set is a one-off — it's not ASCII or anything I recognise. I think we'd be safe if we called it Clive code. The TV display isn't exactly memory-mapped — it tends to move around and change its size depending on what's going on. It is, however, possible to find the start of the screen area and then to access the screen by PEEKing and POKEing the screen locations in the buffer.

Basic

All but one of the ZX80's Basic functions, plus a substantial number of additions, have been incorporated into the 8k ROM which drives the ZX81. The following commands and statements are provided over and above the old ZX80 repertoire: ASN, ACS, ATN, COS, EXP, INKEY$, PI, SGN, SIN, SQR, INT, LEN, LN, TAN, VAL, <=, >=, <>, COPY, DIM A$, FAST, FOR... TO... STEP, LLIST, LLIST n, LPRINT, PAUSE, PLOT, PRINT AT, PRINT TAB, SCROLL, SLOW, UNPLOT.

The machine can be operated in two modes — SLOW (sometimes called 'compute and display'), and FAST. FAST mode offers the world famous screen flicker every time you hit a key, while SLOW mode keeps the screen refreshed at all times, resulting in a nicer display, moving graphics and a lot of irritating delays: see the Benchmarks for comparisons. If you need to see the screen continuously then SLOW mode is a boon. If you don't, say if you were doing lots of calculations, then it's better to use the FAST mode. The two can be called from within a program, thus offering the best of both worlds. The SCROLL feature removes the top line from the screen and moves each line up, leaving a blank bottom line. Without SCROLL, the display freezes when the bottom line is reached. A PAUSE instruction is provided which suspends a program's operation for a user-defined period or until a key is depressed. The screen is visible when in PAUSE mode, regardless of whether the program is running FAST or SLOW. In SLOW mode the screen flickers slightly when the PAUSE takes effect but in FAST mode it has to come on altogether. This means that you'll have to be careful not to have your PAUSEs too close together, unless you actually enjoy watching the screen going absolutely bananas. The INKEY$ function is welcome since it can be tested to see if a key is being depressed and, if so, which key it is. This feature is great for fast-moving games since you need only hit the key you're interested in — there's no need to hit NEWLINE.

There are no DATA or READ instructions but this can be circumvented by saving a program with all its associated variables and then using a GOTO to kick the program off when it's reloaded. (RUN automatically clears any variables.) Pressing CONT, not surprisingly, allows you to continue the program. PLOT and UNPLOT functions (0,0 is in the bottom left-hand corner) are provided, giving a graphics capability of 44 by 64 points. Each point, or pixel (picture element), is a quarter the size of a normal character. Hardly high resolution but better than a poke in the eye with a sharp stick!

The cassette needs either 35mm sockets or an appropriate adaptor. SAVE is offered but no VERIFY, so saving a long program can be a bit worrying. I suggest you first save a few short programs, just to make sure the controls are set properly. When loading a program, the pattern on the screen shows you when data is being recognised. The theory of cassette adjustment is that you play a data tape, gradually turning the volume up until the pattern appears. Then you turn it up a little more and it should be ready for use.

The printer, when it arrives, will allow you to LPRINT and LLIST data and programs respectively. Even better, it will allow you to dump the screen contents to the printer using the COPY command either within the program or as an immediate instruction. Such a screen copy takes about 12 seconds to produce.

The only function to disappear is the TL$ command mentioned earlier. The same thing can be accomplished using the LEN and TO instructions. All trigonometric stuff is in radians and PI is provided to help you unravel the results. SGN = signum which can possess

one of three values: −1, 0 and +1. At one stage the new ROM (for the ZX80 and, subsequently, for the ZX81) was expected to offer DRAW, UNDRAW, DATA, READ and RESTORE features. Instead I think the idea of adding printing facilities became more important. After all, these features can be realised using the existing range of commands.

A character string of any length may be used as a numeric variable name, providing it starts with a letter. String variable names are restricted to A$ to Z$. String and numeric arrays may be any number of dimensions — the limit is dictated by the amount of free memory available. String arrays are character arrays really, with the last entry in a DIM statement being the number of characters per array element. With a full 16k RAM and a small program (it fitted on the screen) I set up a string array 100 x 6 x 25 characters long. I used this since each element would be about the size of a name and address record, allowing extra information like telephone number and birthday, for example. Substrings are handled using the TO function. LET A$=B$ (3 TO 5) would make A$ a three character string comprising the third to fifth characters of string B$. This open up possibilities for giant strings and the use of string slicing to extract variable length fields.

Documentation

A programming book is provided with the system: *ZX81 Basic Programming* by Steven Vickers. The cover is a very odd photo (montage?) of what appears to be a couple of model delta-wing jets on top of a solitary skyscraper at night. Two red windows peer at you from the upper floors. It must be full of deep meaning which totally escapes me. Sinclair Research specially commissioned it. Can any psychologist readers tell us what it's all about, please?

The book is written for the novice, and it does a pretty reasonable job. It is infinitely better than the book given out with the ZX80. What a pity, then, that just as the reader is about to key something in for the first time, he encounters the most off-putting (and unnecessary) paragraph in the whole book: 'A message like this, telling the computer to do something straight away, is a command; this particular one is a PRINT command, but also a PRINT statement. Calling it a PRINT statement just specifies its form without referring to how the computer is going to use it. Thus every command takes the form of a statement, but so do some other things — program lines do, as we shall see in Chapter 8.'

The style of the book isn't really to my taste although Steven reveals a lot about himself with his talk of dead tax collectors and expressions like 'Lor', love a duck'. *Eye* fans will be delighted with his reference to *Talbot?* on page 38 (I find the question-mark rather becoming, don't you?). Oddly, error codes are referred to as report codes. Perhaps the idea of associating errors with the machine was just too abhorrent, even if they do happen and even if they are usually the user's fault. Ho hum — more psychologist fodder. There are the usual typographical errors which didn't get cleared up but I couldn't find too many.

Technical Specification

CPU:	NEC Z80A, 3.5 MHz
Memory:	1k RAM expandable to 16k
Keyboard:	Plastic membrane under-surface printed
Screen:	Domestic UHF television
Cassette:	Domestic audio recorder
Firmware:	8k ROM containing Basic and operating system

Potential use

Who would use this machine? Kids will love it (so will Dads) and, at this price, I can't think of a better way of introducing them to the subject. Most courses on computers and especially on Basic programming cost more than the ZX81. In my view you can buy a ZX81, have a lot of fun, learn a bit about computers and Basic programming and decide whether you like it or not. If you don't like it or if you decide to move on to bigger and better things, you can always sell the machine (or give it to ComputerTown). The 16k RAM pack is a must for anyone doing anything remotely serious. The printer, when it arrives, will give you the chance to keep a record of all that interesting stuff you've got locked in the machine. The floating point arithmetic certainly makes the ZX81 a far more useful machine than the ZX80 and I suspect that many people will give it serious consideration as a result. You must bear in mind the sort of limitations imposed by the ZX81's inability to handle files. You can save a program with all its variables on tape, which gives you 16k for both programs and data. In my earlier example, I managed to get 100 records of 150 characters each into memory with a short program of 20 lines or so. There's no reason why you shouldn't record the program again with another 100 records, which would overcome this particular limitation. The only problem you'd be left with, then, is the fact that other programs cannot access the same data. I think that if you're really worrying about this sort of thing then maybe you require a more substantial system.

Expansion possibilities for the ZX81 are limited at the moment to the printer and the 16k RAM pack. I asked Clive Sinclair if there was any chance of disks being developed and he gave the same enigmatic answer he gave a year ago when I asked the same question about the ZX80: 'We're working on it.' Draw your own conclusions.

Conclusions

He's done it again. Uncle Clive has come up with a lovely product which will have enormous appeal to people wanting to find out more about computers, but without it costing them an arm and a leg. The idea of producing a superior machine to the ZX80 and selling it for a lower price is absolutely wonderful. I'm full of admiration for the man. Most people would have upped the spec and held the price ('It really hurts me to do this') or even increased it slightly. The product is clearly aimed at the home market and I'm sure that it will do extremely well there, far better in fact than the ZX80. And *that's* rapidly becoming the biggest selling micro in the world!

People who are wondering about its relevance to business or serious work at home ought to sit down and do a few calculations on just how much information they need to hold and how they wish to access it. You could hold 100 or so names and addresses or keep track of around 600 financial transactions in one load of the 16k memory. These figures allow for a fairly simple entry and enquiry program in each case. By abbreviating information you can clearly cram more in. By splitting your information across several tapes you can build a substantial file of information but each tape would have to be managed by a separate version of the program.

If you know nothing about computers and you want to enjoy finding out about them, then this machine offers a value for money way of doing just that. Children will love the ZX81, there can be no question about that, and I suspect that more than a few people who are already familiar with computers will buy one, just to have a bit of fun.

Prices

Kit	£49.95
Built	£69.95
Mains adaptor	£8.95
16k byte RAM	£49.95
Post & Packing	£2.95

Answers to PCW Anniversary Quiz

1) Ping pong video games.
2) 256 *bytes*. You can now buy 32k for the same price. As for the current equivalent of £4.50, that would buy you 128k.
3) Commodore Business Machines had failed to deliver its Pet 2001 almost a year after first announcing it.
4) Clive Sinclair and one of Acorn's founders, Chris Curry.
5) The IBM Selectric typewriter. The first issue of *PCW* contained an article on how to link one to a personal computer.
6) Computer User's Tape Standard.
7) A newsagent.
8) It ran PDP-11 software. Heath is now part of Zenith.
9) 70cps.
10) The ability to call up a directory of a disk. As standard, it was only possible to get a directory of programs in memory.

BENCHTEST SOFTWARE

dBASE II

Kathy Lang continues her series of database reviews

dBaseII gives users of CP/M systems the ability to store, process and access data in a wide variety of ways. It has a clean, well-constructed user image, making it unusually easy to learn and use even its most powerful facilities. The authors call it a relational data base management system but, strictly speaking, it is a 'file management system with data base connections'. While the term 'data base' is increasingly being used to mean the same as 'file of data', I don't find this a very helpful trend, so I shall stick to the word 'file' when I'm talking about a single file of information which need not be connected with any other data file. 'Data Base' will in these articles continue to be reserved for a system in which the data is stored in one or more files which are interconnected in such a way that the end user (as distinct from the data base administrator) does not need to know which physical file contains the data he needs to access.

dBaseII stores data in sequential fixed record length files, and must be given information about the record structure for the file. This information is stored in the first physical record of the file, so there is no need for a separate record definition file, and hence no danger of getting the two out of step (for instance by deleting the record definition file by mistake). dBaseII can handle two files of data at once, but not more. Each data file may have one or more indexes for fast access and for updating; these indexes are of equal status, that is, dBaseII regards as the primary index which ever index is invoked first on a particular access of the file. If the user wishes it, he can arrange for all indexes to a particular file to be kept up to date automatically when data is being updated, a distinct improvement on other data management packages.

dBaseII has a variety of ways of updating, accessing and displaying the data, making it one of the most flexible packages on the market. It originates in America and is distributed and supported in this country by Encotel Systems Ltd of Croydon, who supplied my review copy.

Constraints

Records stored in dBaseII files must all have the same structure and be of fixed length, with the maximum length 1000 characters. No record may contain more than 32 fields, which could be a serious limitation in some applications; a field may contain up to 254 characters. Data items may be numbers, character strings or logical variables (ie, taking the value True or False); no special 'date' type exists, so dates must be stored as numbers in year/month/day order to sort correctly. Arithmetic in dBaseII is performed to an accuracy of 10 digits; numeric values may be treated as integers or real numbers, but for length calculations each digit occupies the same space as a character.

Index keys may be constructed from several data fields, but may not be more than 100 characters long altogether. When defining the record structure, data items must be named; these names may be up to 10 characters long. Commands may be invoked from the keyboard, or stored in files and called in with one instruction; command files may include statements invoking other command files, and you may have up to 16 command files open at a time. One or two data files may be in use together. When calculating dBaseII allows the user to store, in memory or on file, up to 64 variables for intermediate results; these may be up to 254 characters long, provided the total space used for temporary variables does not exceed 1536 characters.

Data input and editing

Creating a data file is a two part process: the CREATE command allows the user to specify the structure of each record and then to input the data using this structure. Records are displayed with a named field on each line, with the type shown and a delimiter used to show how long the field may be. Formatted screens to allow more sophisticated displays can be set up using a set of commands giving full control over the screen format.

Once created, data may be edited using an EDIT command; this involves specifying the record to be edited by a variety of methods and then using simple screen editing to amend the record displayed. The screen editing uses the same conventions as the popular word processing package Wordstar — CTRL-E for moving up a line, CTRL-D for moving right a character and so on. It would be nicer to be able to use the terminal's own cursor keys, but at least the Wordstar convention will already be familiar to many dBaseII users. Records may be deleted in EDIT mode but not added; addition is done with INSERT within the data file and APPEND at the end.

Multiple changes are possible too: the REPLACE command lets you, for instance, increase by 10 percent all prices which have not been changed for at least six months, while CHANGE allows you to display each record in a group turn, to allow fields named in the command to be modified without having to specify a record key each time.

Until a file has data in it, the data structure can be edited without hindrance. Once the file contains data, editing the structure would destroy the data. So dBaseII makes it possible to set up a new, modified data structure and copy data into it. The data may be from an existing dBaseII file, or from an external file in a variety of formats. This makes it possible to add fields to an existing data file which can have data added later, or to create a data file which is a subset of another, as well as to import data files written by other software. In each case, the operation takes just three or four simple commands, which use the standard dBaseII structure.

It is also possible to use two dBaseII data files in conjunction to modify data. One file may be updated by another, with the user specifying the key to be used to match the files. Or, using a similar technique, two data files can be merged to form a third.

Displaying data

Two kinds of command are used to show data on the screen. The user can either choose which record to show and display it all in one command, or locate the chosen record(s) and then display them. This gives greater control over location and display. Using these commands, you can display a set of records matching particular criteria, either as a list or one at a time, move around in the file using the range specifiers or such position identifiers as Top, Bottom or Skip. You can display a whole record, or just selected fields.

The 'selection only' commands can either use the index currently selected for the file, or use fields for which you haven't created an index, although the latter is, of course, slower. Where several records match a specification, dBaseII displays the first and permits you to 'continue' through the rest one at a time. The command which is normally used for printing reports can also display on the screen, so that you can show summaries on the screen too. Some of the commands used to display data

Taken from PCW May 1982

from files can also be used to display information from memory, so you can carry out calculations on the current data file and display the results.

Reporting

The REPORT command allows the user to create layout specifications for summaries on either screen or printer. These specifications are stored for subsequent use but cannot be edited. Reports are laid out with fields listed across the page. Column and row headings are allowed but all specification of rows and columns is, as with all the packages I've reviewed so far, in absolute terms — line 3, column 42 etc — so you have to do a lot of counting to make sure the spacing is all right and a lot more each time you change the layout. Records may be selected according to specified criteria and there are some powerful calculating facilities. There is no provision for letting column headings take their names from the field names used in the record definition and the calculation facilities fall short of creating sub-totals when specified fields change. More sophisticated reporting features, such as formatted field display using pictures — a bit like the PRINT USING command in Basic — and subtotalling when fields change, are available through the use of command files (ie, rather than through the REPORT command in its standard form). I wasn't able to make a full test of the report feature, as it didn't work properly on my version of the package.

Selection sets

Nearly all the commands for file access can be modified with a selection parameter. For instance, if you want to select only people over 40 years old from a file containing age as a field, and show on the screen the name, age and sex of people in those records on the screen, you can give the command 'DISPLAY FOR AGE 40 NAME, AGE, SEX' and the relevant records will be listed, 15 at a time. So you don't have to decide in advance which fields you will want to select on, and set up a selection criteria file; you just add a FOR parameter to the display, location, reporting and other commands. Brackets can be used in conditions to ensure the correct order of evaluation and you can use the logical operators AND, OR and NOT as well as the usual comparison operators. Comparisons involving strings may also use an operator which searches within strings as well as comparing complete fields.

Sorting records

In dBaseII, indexing is used to carry out the kinds of operation which in other packages often involve both indexing and sorting, and I was able to do all my tests without using SORT except as a straight benchmark. So it is little hardship that sorting is a rather cumbersome difficult operation in dBaseII; you can sort on only one field at a time, so sorts on multiple fields involve sorting on each field in turn, starting with the least significant. You can sort on parts of fields and in ascending or descending order. I couldn't discover how to get dBaseII to ask the user to change disks, so I was limited also to sorting within a single disk, as dBaseII takes up most of one disk. However, this isn't really a problem, since when a file is opened in conjunction with an index, it is accessed in the order indicated by that index. So if you wanted a file displayed in a particular order, you would index it using the desired ordering fields as keys.

Any field or combination of fields can be used in an index up to a total length of 100 characters. The only other limitation is that this access technique must use the order in which the index was constructed. For instance, if a file was indexed by age, years of education and salary, records could be found by specifying age, age and years of education or all three, but not by years of education and salary alone. A slightly irritating feature of INDEX is that you can only index on character variables, so numeric items must be converted with the STR function. This is specified in the INDEX command, but the specification must include the length of the numeric item, even if you want to use the full length of the field as given in the record definition.

Tailoring

Any command which can be executed from the keyboard may instead be put in a command file for later execution. Other commands, particularly looping instructions, may only be used from command files. The instructions look Basic-like at first but have more structure than is common in Basic. For instance, the IF statement must have a matching ENDIF, so you are allowed to nest these pairs. There is a limited form of GOTO, but only to jump to the end of a DO . . . WHILE loop — so it's basically 'no GOTO' programming without being obsessive about it, which I personally feel is about the right balance. There are also commands to allow flexible input from and display to the terminal, and fancy layout on the printer; one form of the input commands makes it easy to build menus. I found the command files easy to construct and use, and flexible in their application, though not quite as powerful as those of FMS-80. One helpful feature typical of the consistency found almost everywhere in dBaseII is that throughout, the commands fields are referred to by the names they are given in the record definition.

Stability and reliability

dBaseII has been in use for some time in this country and in the States. The previous release reportedly had some bugs in it; the latest release, which I tested, had a couple of glitches that I discovered. I didn't lose any data, or come close to it, but I did have trouble using the REPORT feature, nor could I get the command for editing command files to work properly. Encotel assures me, however, that a revised version with the REPORT bugs corrected is on its way from the States and will be forwarded to end users.

User image

As distributed, dBaseII is not a menu-driven package, which means that the user must know the form of at least the simplest commands before he can get, started. To some extent, it is a matter of taste whether you prefer menu-driven or user-initiated systems. Personally, I like to have the choice and in dBaseII you only have the option to construct menus — they aren't provided. However, the format of the commands was almost entirely internally consistent, and most operations only required two or three commands. For instance, to find particular records you simply issue one command to tell dBaseII which file to use, and another to specify the keys, and to limit the scope of the search and the display of variables. So I would expect a user with some motivation to find it pretty easy to use. This is largely confirmed by reports from two users, one who had a particular application in mind and became a fluent user in a few days, largely self-taught, and another who got hold of it 'to try it out' and never got very far.

The documentation comes in two parts. The first was written by an experienced user and provides a good, well-paced introduction yet goes right through to the most complex commands. The second part is a reference manual written by the software designer, but is of a much higher standard than usual. I thought the two-level approach a good idea which worked well but it's a pity there is no index for either part, only a list of commands and the pages on which they are described.

There are of course some sillies, though I had to work harder to find some than with previous packages I've seen. I don't like the use of the word QUIT to indicate normal ending of a session, especially when the keys CTRL-Q are used to abort in an EDIT command. Even the tutorial manual starts with 'how to install dBaseII for your terminal', including prompts such as 'are you going to use hex or decimal to specify . . .' at a stage when the user is hardly likely to know the difference. I feel that installation information should be in an appendix and no user should buy software from a dealer who is unable or unwilling to install it, unless the user is experienced enough to find and make sense of the appendix. And please, when are software writers going to make it easy to specify dates in the format preferred by the user, which is not necessarily that of the country of origin of the software?

dBaseII costs £375 for the complete package, and it needs a standard CP/M system with a minimum of 48k to run it.

Conclusions

dBaseII is a powerful and flexible data management system, with a well-designed and consistent user interface. Its strengths and weaknesses reflect an approach typical of good software engineers. Among its strengths are the clear command design, which makes it possible to deduce the formats of commands you haven't used before from the familiar ones, which avoids the hierarchy problems of menu systems while remaining easy to use, and which uses the same format for the 'programming' commands so that the user's growth path is smooth and logical. The selection facilities are good and the feature which allows you to request automatic updating of all indexes is invaluable.

PCW IN THE PAST

PERSONAL POWER IS HERE

J. H. Miller-Kirkpatrick

Personal Computers in 1978

First of all let us try and define the term Personal Computing. Many years ago when I was working on large IBM mainframe computers, the cost of an installation to handle simple accounting and stock routines for a medium sized company was discussed in terms of millions of pounds and parts thereof. The advent of Mini Computers a few years ago brought the installation cost down to the £100,000 area and was thus a feasible proposition for more and more small companies and research establishments. With the advent of LSI technology and finally the first Microprocessor chips the cost of a computing machine has dropped to prices measured in thousands of pounds and promises to drop to hundreds of pounds in 1978.

A computing machine capable of interaction with a human being comprises basically only four units — a human operated input device such as switches or keyboard; an output device such as LED display, TV, printer; a central processing unit and a memory. The cost prices of items in the first two categories are reasonably static due to the use of these devices in many other applications. The cost of the items in the last two categories have dropped considerably during the last couple of years and although prices have not reached rock bottom the curve of price changes has flattened and there should be no major price changes during 1978. However, the prices of components to manufacturers currently promises several simple computing systems at under £500 during 1978 with prices dropping towards £250 by this time next year.

What is a computer?

Basically a computer is a machine capable of doing the same job repetitively and accurately with the ability to react to programmed decisions and thus alter the job that it is doing.

The job that it is doing can be anything from running an On-Line banking system for the big banks to controlling a very simple switching system for central heating or model trains.

I realised a few years ago that my hobby was 'Logic', that seemed to be the only way to integrate my fascination for programming computers with that of playing with electronic circuits. I became involved with the measurement of time, a subject which has produced some very fine pieces of art/workmanship/logic called clocks, simply because I was interested in the complex logic of cogs and wheels. The Microprocessor is the latest extension of this hobby and my main interest in Personal Computing is in the development of generalised computing machines so that one box is capable of doing several different jobs. Other 'Logic' hobbyists such as games players, crossword designers or solvers, statisticians, etc will be interested in Personal Computing from the point of view of using the equipment to further their own particular branch of the hobby. Another area of Personal Computing covers the use of the equipment

Taken from PCW March 1978

simply to make life easier: a complex diary, a personal accounting system for home or small office, mailing lists, etc.

For the designers

For the designer who wants to design his own personal computer with his own software and never-ending hardware, modifications systems start as low as £50 for a simple MPU, switches, lamps and minimum memory. Ideal for electronics hobbyists or engineers as a first step in the use of an MPU, such a system can be used as a development tool in many MPU or non-MPU applications.

The next group of products in general centre at about £250 for a system with a simple keyboard and calculator-style display. At this level your MPU has a little more memory: usually some in RAM for your use and some in PROM or ROM to control the keyboard/display routines. At this level some of the optional extras that make life easier still can be added, examples of these are TTY keyboard/Printers, VDU interfaces, Cassette interfaces and software. As an example the Motorola kit at £200 includes a cassette interface so that programs/data can be stored on tape; the National LCDS at £300 has an optional TTY interface, cassette interface and versions of Assembler and Basic programs in PROM or paper tape form. Beware, at the level of the £200 kit the extras are not optional and you need £500 of TTY before you can do anything. Before you buy make sure what else you need; like buying HiFi, an amplifier is no good without speakers and a tuner or record deck; these non-optional extras can add considerably to the cost of your system.

Of course you can opt to build your system out of parts, like buying a HiFi system from different manufacturers rather than buying a 'Music Centre'. Several suppliers will be supplying on this basis but you will need about £1000 to buy yourself a decent system off-the-shelf. Most of the suppliers are enthusiasts themselves and will not mind offering advice to buyers who have money to spend. Tell your supplier what you want to do and let him advise you which parts you need immediately and which parts you can add later. Most people buying at this level will not be interested in the mechanics of the system but more in what it will do and what software is available. Software engineers will use this type of system for designing simple 'packages' to sell to other users of similar systems, who, in turn, will use the packages for entertainment and/or business.

At the upper level of personal computing your system will cost you up to £5000-£6000 and will include VDU, printer, tapes, disks, etc. At this level most systems sold will be primarily for small business use, not just small manufacturing or service businesses but also the small shopkeeper and one-man business. The system becomes the master filing system with sales ledgers, stock, mailing lists, diary, and multitudinous other applications all being handled by one machine.

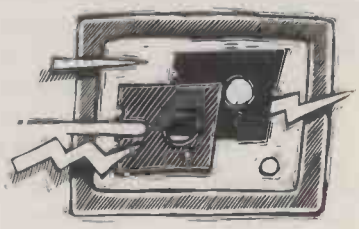
Also using this type of equipment is the software consultant who will design and implement your requirements on your system for a small fee. For the full small-company business package this could add another £5000 to the installation price, but if you can modify your manual system to fit into the requirements of a standard software package then the design cost is spread over several users with the same basic requirements and thus could add only a few hundreds of pounds to the cost.

The current situation at the beginning of 1978 is more or less as I have just described. During 1978 we will see a new product come onto the market which is typically a system with output to a TV, interface to a cassette recorder and an optional interface for printers, etc. Prices for these 'music centre' type of systems are likely to be between £250 and £1000 depending on their facilities and country of origin. On systems such as these imported units can include freight, insurance and currency charges as a large percentage of the cost. Some American manufacturers have now set up facilities in Europe and even in the UK. Several UK companies have designed their own equipment which is just coming onto the market at present at prices of about £200 to £500 for a suitable kit of parts. Ready built the units are a little more expensive. By April or May 1978 several such systems will be available but still from specialised shops and mail order companies. Perhaps by Christmas they may be available in most areas of the country.

Simple versions of this type of system will be used for training, simple repetitive message handling such as shop window advertising, a design unit for 'one-off specials' or to handle one simple job in the home or office such as a diary or mailing lister. More complex versions will include graphics facilities and the ability to use BASIC or a similar English-based programming language, a full typewriter style keyboard and 80 x 24 character output to a TV. Unlike HiFi the higher cost of this equipment does not relate to its quality but more to its facilities and thus capabilities. If you do not need all of the facilities offered by the more expensive equipment at present then buy one of the lower cost systems. The prices of the higher cost systems will probably drop in time for Christmas '78, by which time you may know which facilities will suit you best. In the meantime, you can exercise your new hobby with the lower-cost devices.

Hobby computing in the home can involve all of the family (if you intend to take over the family TV it *has* to involve all of the family). A home computer for TV games, accounts, diary, recipes, homework, etc. could become more important than the colour TV or even the car in the average household before 1980. Computing machines are going to affect most people's lives over the next few years — it makes sense to make friends with them now: next time the Gas Board's computer sends you a stupid bill you can send back a reply from your own computer!

Welcome to the World of Personal Computing.



Microsoft C

Low-priced, turbo-charged rivals gave Microsoft good reason to update its C compiler. Adam Denning looks at Version 5 and its companion, Quick C.

If you develop software for the IBM PC, AT and/or PS/2 families and their clones, the chances are you'll program some of your applications in C. More and more software houses are starting to use C for all development. This has meant a flood of compilers, third-party libraries and general add-on goodies for the professional C programmer, with a bewildering array of choices across a vast range of prices.

The 'which to use?' question has been examined in almost every technical computer publication in the world, but the answer is always out of date in a couple of months. One of the reasons for this is that just when we all think the market is stabilising, one or two companies release revolutionary products which stun the programming world into overnight changes of loyalty.

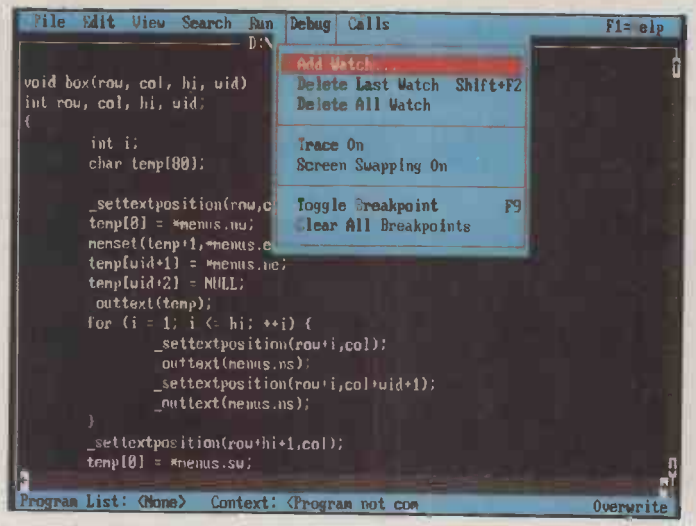
The initial launch of Microsoft C (version 3.00) was one such event, causing Lattice to lose a substantial portion of the market. Then Microsoft itself was hit by Borland's Turbo C and Zorland's C compiler. Turbo C, with Borland's advertising skills behind it, quickly became popular. It offers an integrated environment for editing, compiling, linking and debugging programs, as well as providing an extensive library of standard, DOS and PC-specific functions. Turbo C is also, of course, very cheap.

Immediately before this, Microsoft launched version 4.00 of its compiler, which offered (basically) greater optimisation and the *truly* revolutionary (which is, after all, an over-used word!) CodeView debugger. CodeView makes the C programmer's life much easier than it ever was before. Not just symbolic debugging, but source-level debugging with full expression evaluation, variable alteration, windowing and watch/tracepoints. A joy to use.

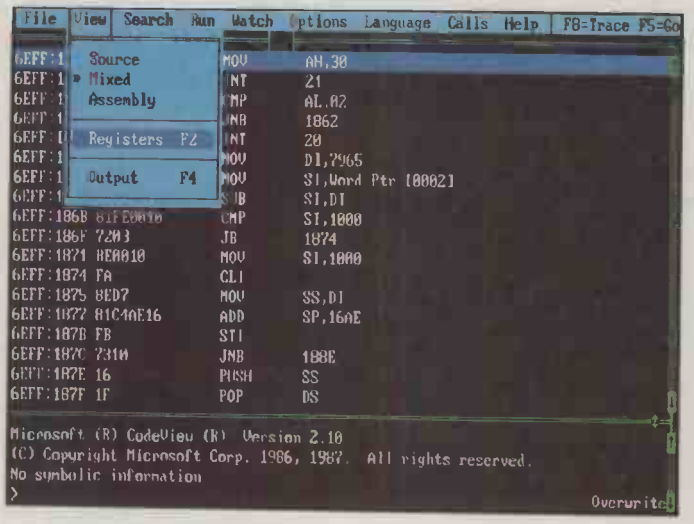
In the UK, a company called Zorland launched its own C compiler, at the ridiculous price of £29.95. Not surprisingly, it captured a lot of the amateur market as well as a fair chunk of the professional market. When Zorland released Version 2.00 of this system, sales rocketed because the price didn't go up but the speed and functionality did — a lot.

Microsoft, due to the sheer professionalism of its version 4.00 compiler, has never lost out, but it knows when it has to do something. So it came up with Microsoft C Version 5.00 and QuickC.

The easiest way to describe the new compiler is to say that everything Version 4.00 has, Version 5.00 has even better. Better manuals, better libraries, better code — even better CodeView. Quick C, which is

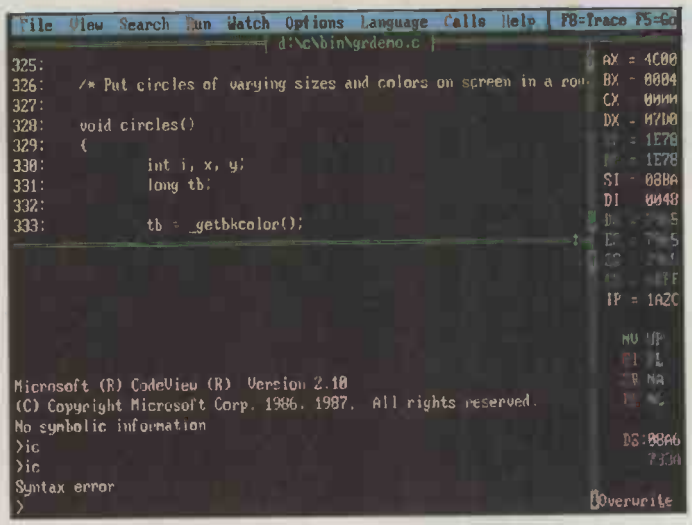


The Microsoft Quick C integrated environment offers an excellent prototyping tool before committing a program to the full-blown C compiler. Quick C can compile either directly into memory or to an object file



CodeView, the run-time debugger supplied with Microsoft C, can be used with later versions of Microsoft Basic, Pascal and Assembler. CodeView output can be viewed on a second screen while watching your program output on the main screen

The onscreen help available within Quick C goes beyond that needed to use the program, and explains such things as BIOS calls, library functions, memory models and even C language syntax



A multitude of windows can be displayed while using CodeView, including source code, assembly code, command-line processor dialogue, register status, and 'watch windows' showing the current status of specified variables or expressions

available as a product in its own right for about £65, is shipped with C Version 5.00 so that program prototyping is rather quicker than before. Let's take a closer look at what you get for your money.

In use

Microsoft C Version 5.00 is supplied as nine 360k disks, three ring-bound manuals, a perfect-bound Quick C manual, an 80-odd page reference 'card' and two keyboard templates for CodeView. For those owning Version 4.00 already, all this costs a mere £50 (excluding VAT) while Microsoft continues its friendly upgrade policy. Owners of earlier versions of Microsoft C can get the upgrade for £100. People who don't have the Microsoft C compiler at all yet will have to pay an immense £495.

The compiler is put on your hard disk by running the supplied SETUP program. This moves the executable and include files to specified or defaulted directories and then proceeds to build the libraries. You can choose which memory models you want installed when you run SETUP and at the same time you can decide whether you want to use the Emulator maths library, the 8087 maths library or the 'alternate' maths library. If you're like me, you'll want all memory models and all maths options — SETUP does this in one fell swoop and took about half an hour on my ageing 4.77MHz machine.

This building of libraries is a new step — previous versions of the compiler didn't do it. The libraries are built using the library manager, LIB (a new version of which is supplied with the compiler), to merge the standard library for a given memory model with all the option libraries chosen by the user. This means that each library ends up being huge (around 250k on average), but it does mean that linking is rather faster.

No serious compiler user is without a hard disk, but just in case you don't have one, it is just possible to use Microsoft C with two floppies.

The executable programs supplied with Microsoft C include new versions of LIB and LINK, the linker. LIB seems to have undergone no functional changes since the version supplied with C Version 4.00, but there are quite a few alterations to LINK, one of which is the provision for Quick libraries. These will be discussed when we look closer at Quick C.

Other executables are the compiler itself, supplied as a number of separate parts, the compiler program, CL, the Quick C package (QC is the compiler and QCL is the command-line driver), the CodeView debugger, CV, and a variety of utility programs such as MAKE, EXEMOD and EXEPACK.

None of the major programs is exactly small, but this is unlikely to cause concern, considering the performance of the software. Quick C, for example, is some 325k but its usefulness soon makes you forget this.

The compiler supports the most modern dialect of the C language, that defined in the draft Ansi standard. This allows for enumerated types, const and volatile modifiers and functions which return structures. There's more to Ansi than this, of course, and the whole package reflects Microsoft's determination to be one of the front-line compiler vendors. Ansi-compatibility is everywhere.

One of the most useful features of an Ansi compiler such as Microsoft C is the introduction of the function prototype. A function prototype is a declaration of a function before its use (or definition). It includes the type of the function itself as well as the number and type of each of its arguments. For example, the Kernighan & Ritchie declaration of the standard function 'malloc' might be

```
char *malloc ( );
```

which tells us (or the compiler) very little except that malloc is a function which returns a pointer to a character. The Ansi-standard definition

```
void *malloc ( unsigned int );
```

tells us a bit more. It says that malloc is a function which returns a pointer to any type (which was true even in Kernighan and Ritchie's days — it's just that they had no way of specifying that) and that it takes one parameter — an unsigned integer. These 'prototypes' allow the compiler to perform argument type-checking, ensuring that we have passed to a given function the correct number of arguments and that each is of the correct (or convertible) type.

Of course, one of the most powerful features of C is that it allows functions to have varying numbers of parameters, and it also allows the programmer to take a number of liberties with types. Hence, if a function's usage goes against its prototype, the compiler generates only a warning, not an error. A special form of the prototype exists for functions which take varying numbers of parameters:

```
int fprintf ( FILE *, char *, . . . );
```

This prototype declares fprintf as a

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function returning an integer which takes at least two parameters, the first of which is a pointer to type FILE and the second of which is a character pointer. Other arguments, if present, are of unspecified types and therefore are not checked during compilation.

Microsoft C does in fact provide a number of warning levels, which allow the programmer to determine just how many warning messages will actually be shown. Error messages will always be generated, of course, but warnings can be all but switched off. Alternatively, and most usefully, the highest warning level can be used. This makes the compiler perform a number of 'lint-like' checks, including warnings about data conversions, dodgy constructs and unused variables. It is definitely recommended (by me) that the highest warning level is used at all times.

The compiler is invoked with the CL command, which can compile and link at the same time. Versions 3.00 and 4.00 of the compiler also had a driver program called MSC, which had a slightly more friendly front end. With the addition of Quick C, Microsoft has obviously decided that this is no longer required as it is not included with Version 5.00.

CL can cope with C source files, object files and library files. It can compile a number of files at a time, optionally linking them all into an executable program at the end, or it can stop after compilation so that the object files may be added to libraries. CL takes a vast number of options, some of which go to the linker and some of which are used by the individual passes of the compiler. These compiler options fall into a number of classes, some of which are examined below.

Memory models

Options introduced with the characters -A select the memory model the compiler will use during the compilation. Memory models determine the maximum size of the code and data within programs: they are a consequence of the segmented architecture that Intel uses on the 8086 family of microprocessors. Items within a segment may be accessed with 16-bit pointers (often called near pointers): this feature produces faster and smaller code than using 32-bit (far) pointers, which is necessary if an item lies outside the current segment. A segment may be no larger than 64k, though.

To achieve the best compromise between program speed/size and accessible data, most compiler vendors support a number of memory models in which 16-bit pointers or 32-bit pointers may be chosen for code and data items, in any combination. Code items are functions; a near pointer to a function is just its offset within the code segment; a far pointer is the function's segment address as well as its offset. Data items are variables used by a program, including arrays and structures. Near pointers to data reference the data using just an offset, while far pointers use both the segment address and the offset.

The situation in which code and data pointers are 16-bit is called the small model, and by its nature it limits programs to a maximum 64k of code and a maximum 64k of data. This is often sufficient — luckily, because small model programs are smaller and faster than other models. The compact model uses near (16-bit) code pointers and far (32-bit) data pointers, allowing up to 64k of code and any amount of data (subject to physical memory constraints, of course). The medium model uses far code but near data, allowing as much code as you need but only 64k of data. The large model uses far pointers for both code and data, allowing unlimited code and unlimited data. As you would surmise, the largest model produces the slowest and largest code of each of these memory models.

Benchmarks

Intmath	0.0067
Realmath	0.0067
Triglog	0.0067
TextScrn	31.28
GrafScrn	10.24
Store (h/d)	3.68
Store (f/d)	10.24

These Benchmarks were run on an Amstrad PC1640 with a 20Mbyte hard disk and an EGA screen

Microsoft C also supports another memory model, called the huge model. Huge-model programs use far pointers for both code and data items, just like large-model programs, but allow individual data items to be any size. Large-model data items cannot exceed 64k each, although there can be any number of them. This is because each data item is assumed to lie wholly within a given segment, allowing pointer arithmetic to be performed only on the offset portion of a far pointer, which is naturally faster and smaller. Huge-model data items are not assumed to lie wholly within one segment, which means that pointer arithmetic is performed using both the segment and offset portions of a pointer. This gives maximum flexibility but less efficient code. The programmer has to choose which model to use for a given application.

Microsoft C makes the programmer's life considerably easier in this respect, by allowing a much larger range of memory models than the five described above. 'Custom' memory models may be specified to the compiler, allowing such things as small code with huge data. Note that code is accessed only with near or far pointers, never with huge pointers. This is because a function is assumed to lie wholly within a segment (if it didn't, it would be over 64k long!).

Furthermore, the language supported by Microsoft C provides the extra keywords 'near', 'far' and 'huge'. These keywords may be applied to data, functions and pointers to modify just that item. This is extremely powerful if you consider the situation in which you have a fairly small program which needs to manipulate a 100k array. It seems that you would need to use the huge-model process for this, but in fact you can declare the array as huge and compile the program with the small-model process. This means that everything except accesses to that array uses near pointers, resulting in the most compact and fastest program possible!

And there's more: those models with far/huge data pointers allocate initialised global and static data to the 'default data segment' if possible, allowing access to those items by near pointer. So-called compiler pragmas tell the compiler to make other assumptions. For example:

```
#pragma same_seg ( myvar1, myvar2 )
```

tells the compiler that the external variables myvar1 and myvar2 are in the same segment, which allows the compiler to generate more efficient code by using near pointers if possible when accessing these items.

Optimisation

Microsoft calls this version of the compiler the 'optimising compiler', and optimising is certainly something it seems to do rather well. Optimisation involves looking again at code produced by naive translation to see if it can be made faster and/or smaller. Most programmers (or rather, most customers of programmers!) are more impressed by speed than by code size.

Microsoft C performs some quite remarkable optimisations. Take the first five Benchmark results, for example (see above). They were unmeasurable because the compiler had optimised away the loops in them completely. It had worked out that they were doing nothing useful, so it removed all the code. You need to watch this, of course, if you're foolish enough to write simple time-delay loops in software.

One of the most spectacular optimisations Microsoft C can perform is that it can convert certain function calls into in-line assembler instead. Take the 'strcpy' function, for example, which is used heavily by most programs. Each time this function is called, both its parameters must be pushed on to the stack and the call must be made. Then on return, the stack pointer needs to be adjusted to remove the previously-pushed parameters. It is far more time-efficient to encode a strcpy call as the requisite 'rep movsb' and supporting instructions. Microsoft C can do this for quite a number of functions, making 'calls' to them considerably faster.

The compiler can generate code using special 80186 and 80286 instructions if required, making programs run faster on machines based on these processors.

To enhance program speed further, the special keywords 'pascal', 'fortran' and 'cdecl' are supported. Pascal and fortran are synonyms and, when applied to functions, cause those functions to use the Pascal/FORTRAN calling conventions. Cdecl is used to revert to the standard C calling conventions in a module being compiled, so that all its function calls are interpreted as being of type pascal. Pascal's calling convention is faster and smaller than C's, but is less flexible.

The −Ox option to CL tells the compiler to perform maximum optimisation, while −Od disables optimisations altogether. The latter is useful during debugging, as optimised code can be a lot harder to follow than non-optimised code. Various stages of optimisation between these two extremes are available through a mixture of command-line parameters to CL and the use of '#pragmas' in the source code.

Compiler performance

All these optimisation strategies obviously take time to execute. The table of compile-and-link times compares the times taken by all variants of the Microsoft C compiler to compile a typical program. XPAGE is about 700 lines long and uses every C construct, particularly loops. It includes about another 800 lines of include files, so the figures represent the time taken to compile about 1500 lines of text. From these figures, we can see that CL with no optimisation (cl −Od . . .) is about 1.5 times faster than compilation with full optimisation (cl −Ox . . .) once the link time is subtracted from the total time. The variants of Quick C are of course even faster — they are examined later on.

If you think these times are depressingly slow, remember that they were performed on the slowest machine possible. An 8MHz PC/AT compiles this program in considerably less than a minute.

The fastest version of XPAGE produced by this process was then run on simple data. As the Benchmark results show, the output from Microsoft C Version 5.00 is considerably faster than the output from Borland Turbo C Version 1.00.

CodeView

The CodeView debugger has been much discussed because it so improved programming in C on the PC. CodeView offers source-level debugging with breakpoints, watchpoints and tracepoints, online help, complete variable and expression control, assembly-language symbolic debugging and much more. This version is better than earlier versions in that it can handle much larger programs (and overlaid programs, too) and in that it is multi-language. This means that this version of CodeView may be used to debug programs written in assembler, Fortran and QuickBASIC (Version 4.00) as well as in C.

The program detects which language is in use, if possible, and selects the appropriate expression evaluator. If you decide that you would like to change this during debugging, you can select a different expression evaluator on the fly.

Quick C

Quick C is one of the major reasons for upgrading your C compiler. Everyone knows just how tedious it is going through the seemingly endless edit-compile-link-debug cycle and, although CodeView makes the latter part of this cycle considerably less painful, it is very hard to be patient while your program compiles just this once more. By using Quick C, you get an integrated environment in the true sense of the word. It comprises a full-screen editor, a compiler and a debugger.

You may say that this is no more than Turbo C — well, there is a difference. In fact, there are several differences. First of all, programs can be compiled in memory — that is, the resulting executable program is left in memory rather than having to be written to disk before it can be run. This makes compilation faster. Also, the link stage (for single-module programs, anyway) is not required with Quick C during development because linkage is performed at compile-time to memory-resident library routines.

The programmer may enhance the standard libraries by loading his/her quick libraries with Quick C. A quick library is a special-format object file which contains library functions in a format usable by both Quick C and QuickBASIC (Version 4.00) in-memory programs.

Another, major, difference between Quick C and Turbo C is the debugger. Although the integrated debugger within Quick C is not as powerful as CodeView, it does offer single-stepping of source statements, variable interrogation, watchpoints and breakpoints. Development of a program is therefore straightforward and fast. The one edge which Basic had over C — that its development cycle is that much faster because interpreters are available — is no longer valid.

Newcomers to C particularly will benefit from Quick C (in fact, they'd be better off buying Quick C alone first of all, and then moving up to the full system when they are proficient in that), because it offers superlative online help facilities. Suppose, for example, you want to know the syntax of the C switch statement. You can find out in two ways — either press F1 and select the relevant topic, or place the cursor anywhere in the word 'switch' inside your program and press SHIFT-F1. Either way, the requisite help message pops up. Library functions also can be used in this way, so if you're unsure of quite how 'printf' works, or you've temporarily forgotten just how to use 'fread', you can press SHIFT-F1 once you've typed the function name and the program will tell you how to use it. I must confess that I find this feature rather more useful than having to go back to the runtime library reference manual.

Quick C can also be used as a command-line-driven compiler in the same way as the full compiler, using the compiler-driven program QCL. It takes the same command-line options as CL and can compile and link at the same time. It can produce code in all memory models except huge, and although its optimisations are not as powerful as those provided with the full compiler, it produces perfectly respectable code in about half the time it takes CL. Because it can produce CodeView-compatible debugging information, it can be used to prototype programs in circumstances where the Quick C environment is not suitable.

The libraries

The libraries supplied with Microsoft C cater for just about all requirements. A major advance over the libraries in Version 4.00 is the inclusion of specialist PC-specific graphics and BIOS functions, as well as slightly more general-purpose low-level DOS functions. The graphics functions provide support for line-drawing, cursor positioning, ellipse and arc draw-

Compile-and-link times for a typical source file

Microsoft C

cl −Ox −W3 −F 2000 x page.c −link sadams /noe	181.7
cl −Od −W3 −F 2000 xpage.c −link sadams /noe	132.2
qc1 −Ox −W3 −F 2000 xpage.c −link sadams /noe	100.0
qc1 −Od −W3 −F 2000 xpage.c −link sadams /noe	66.0

These times incorporate a link time of approximately 20.8 seconds.

QuickC in-memory compilation with optimisation	58.0
Quick C in-memory compilation with no optimisation	34.0

Size and execution speed of fastest XPAGE.EXE: 15701 bytes, 148 seconds.

Turbo C V1.00

tcc −Z −G −O −k −w xpage.c	43.33
tcc −k −w xpage.c	42.90

Size and execution speed of fastest XPAGE.EXEC: 14032 bytes, 202 seconds.

Note: All compilations were performed on a 4.77MHz 8088-based IBM PC clone running IBM PC-DOS 3.30. An 8087 was used in tests 7, 8 and 15 (see text).

ing and flood-filling. Also provided are routines to perform BIOS-level text output and manipulation. The graphics library is a great bonus for those who want to achieve the sort of graphics that are so easy in languages like QuickBASIC.

The BIOS-level routines provide functions to talk to the comms ports (setting up the baud rates, parity and so forth, as well as sending and receiving characters), talking to the parallel port, reading and writing absolute disk sectors and so forth. The DOS-level functions perform such things as ambiguous filename searches, low-level file-handling and memory allocation and setting the default drive.

Apart from all this, of course, there is the large Unix/Ansi library, with all the usual functions for string-handling, memory allocation, file-handling and so on. A large set of standard header files complements the library and makes it easy to use. Various Microsoft additions to the standard functions are also provided to stop you re-inventing the wheel.

Bugs

Two bugs have come to light since I started using the compiler in earnest. The first concerns the runtime library; specifically, the 'halloc' function. This is very similar to malloc, which allocates heap memory and returns to the program a pointer to the allocated chunk.

Halloc is the Microsoft-special version. It is used to allocate 'huge' chunks of memory (that is to say, typically over 64k) and the documentation states that arrays allocated with halloc must, if over 128k, have elements which are powers of two in size. This is fair enough and quite understandable. It's also the way the earlier version of halloc works — the one provided with Version 4.00. A program I have which uses an array of between 64k and 128k works perfectly with Version 4.00 but refuses to work with Version 5.00. Investigation showed that it was halloc which was failing. After examining the disassembled version of halloc, it became clear that it was failing because the memory I was allocating was not in power-of-two-sized chunks. It seems that the new version of halloc requires elements of arrays to be powers of two in size if the array is greater than 64k, not the 128k limit of earlier versions. The documentation does not reflect this.

The other bug is less frustrating. Using the Quick C compiler to prototype rapidly a program I was developing, I got the message:

> qcbug.c (146) : fatal error C1001: Internal Compiler Error (compiler file 'gencode.c', line 390) Contact Microsoft Technical Support

This message was caused by a very dubious line of code that I used because I wanted to test something quickly. The line involved was an IF statement which called the 'mkdir' function up to 17 times and, if one of the calls failed, the IF-controlled statement was executed. Each mkdir call was separated by a logical-OR operator, !!, so the expression was quite complex. The full compiler (CL) handled this expression with absolutely no problems, but obviously Quick C wasn't prepared for Denning code!

Neither bug is serious in that once they are known about, they are easily avoided, and they're the sort of thing you expect to find in any new product. Nevertheless, it's worth making public very quickly all known bugs, so that other programmers can avoid having to find them all by themselves. Microsoft has been advised of the bugs and no doubt will change something.

Documentation

The documentation supplied with the package is of the highest quality. It is, unequivocally, the best I have seen for a compiler system. Apart from the 400-page *Quick C Manual*, there are three main manuals. The first is a *User's Guide* and this describes, in careful, readable detail, how to use the compiler and its subsidiary programs, and what each of the options does. An adjunct to this manual is the *Microsoft Mixed-Language Programming Guide*, which is supplied with Microsoft's macro assembler, C, Fortran, Pascal and QuickBASIC (Version 4.00) packages. It describes how to call modules written in any of these languages from any of the others.

The second manual contains the *Language Reference* manual and the *CodeView* and *Utilities* manuals. *Language Reference* details precisely the dialect of C accepted by the compiler and is, therefore, much more useful to the modern-day programmer than the C reference manual at the back of Kernighan & Ritchie. The third is the *Runtime Library Reference* manual which describes each function in the libraries provided with the system, with examples for each. Microsoft seems to have found the one true documentation style.

Conclusion

Microsoft C Version 5.00 is undoubtedly excellent. It is probably the most professional C compiler system available for MS-DOS systems, and its combination of superlative documentation, excellent performance, fast, convenient prototyping in Quick C, and the productivity-enhancing debugging powers of CodeView make this compiler system just about the only real choice for a company developing software in C for PCs and PS/2s.

There is nothing this compiler lacks, except perhaps a multi-file lint facility. The programmer who needs to write code for ROM-based systems is also catered for now, so you no longer have to buy something like Aztec C for ROMming.

If you're not a professional programmer, though, you may wonder whether the price difference between this system and Turbo C or Zorland (sorry, Zortech!) C is worth it. If that's what you're thinking, buy Quick C first. If you like what you see and have the money to spare, the odds are you'll find yourself justifying the purchase of the full system before long. It really is that good!

It remains to be seen just how good the new release of Turbo C, Version 1.5, is; but, knowing Borland, it will probably get Microsoft wondering about Version 6.00 — or at least Version 2.00 of Quick C. It is unlikely to be good enough, though, to turn the professional programmer away from Microsoft's truly professional C compiler system.

Microsoft is on (0734) 391123. END

Birthday presents

Completing this year's Reader Survey could be well worth your while — it's our tenth birthday and there's prizes to be won.

In a fit of unparalleled generosity, *Personal Computer World* is giving you the opportunity of having a say in what the magazine publishes over the next year, *and* winning one of a list of prizes totalling over £6000 in value.

By filling in the Reader Survey opposite, you will help us make sure that Britain's Biggest (and we think best) Computer Magazine accurately reflects your present and future computer interests and activities. The questions won't take very long to answer and, to thank you for filling in and returning the survey, we are offering two bribes — sorry — benefits.

First, you will be eligible to win one of the many valuable prizes which are described on this page. They have all been donated by generous manufacturers and distributors, and any one will enhance your computing power.

Second, when you complete and return your form, we will donate 10p to the charity you have nominated at the end of the survey.

Because the prizes are quite valuable, we don't want to make it too easy for you to win one; so, we have also included a skill question. The prizes go to the first readers' replies pulled out of the heap whose answer comes closest to the correct one.

And, you don't need a stamp. Just pop your completed questionnaire in an envelope and send it to: PCW Survey, Freepost 25, VNU Publishing, VNU House, 32-34 Broadwick Street, London W1E 6EZ, by 21 April 1988.

The Prizes

Epson LQ500 (£385)
This new entry-level 24-pin printer comes with two built-in letter-quality fonts which it reproduces at 50cps. It has an 8k buffer, tractor and friction feed as standard and a slot for plug-in extra fonts. **Donated by Epson UK on (01) 902 8892**

Acorn Archimedes (£1200)
The Archimedes is a very worthy successor to Acorn's BBC series. It holds the honour of being the fastest micro to run *PCW*'s Benchmarks with an index of over 15. The 310 comes with 1Mbyte of memory and a colour monitor. As well as running programs designed for the BBC, Archimedes-specific programs are now available as well as a pretty robust PC emulator for MS-DOS programs. **Donated by Acorn Computers on (0223) 245200**

Borland Quattro (£195)
This Lotus-compatible PC spreadsheet features the now standard Borland user-configurable menu system. It has more functions than 1-2-3 and performs many operations much faster. Ten customisable graph types are included with eleven fonts. Macros can be 'learned' and a debug window aids their development.
Donated by Borland International on (0734) 320100

Fontasy Publisher (£600)
Fontasy is one of the most popular fancy font programs available. Using a PC's graphics mode, it is possible to create very elaborate pages of text and graphics using any of a wide range of fonts from simple Alpine and Roman to the exotic New York, Skyline and Xmas. The package on offer includes a font designer, expanded memory driver, borders, clip art and over 600 different fonts. **Donated by Ctrl-Alt-Deli on (0908) 662759**

Cameron Scanner (£250)
This hand-held scanner unit can be used to import graphics directly into a wide range of packages including GEM-based paint programs, Fontasy, and PC Paintbrush. The PC version of the scanner works in CGA, Hercules and EGA modes, and comes with a plug-in interface card and memory-resident software. The ST version connects directly to the DMA port.
Donated by Lighting Distribution on (01) 965 5555

Cambridge Computer Z88 (£250)
Sir Clive Sinclair's little black number is scoring a big hit with *PCW*'s readers. Weighing only 2lbs yet offering a full-size keyboard, the Z88 includes word processor, spreadsheet, alarm, calculator, diary and terminal emulation. Storage is on separately-purchaseable RAM and EPROM cartridges.
Donated by Cambridge Computers on (0223) 312216

WordPerfect (approx £250)
Now the leading word processor, this product is perhaps most famous for its speed, printer handling and clutter-free screen. The winner can choose either WordPerfect Executive for the PC, or the ST or Amiga versions.
Donated by Sentinel Software on (0932) 231164

Amiga Small Business Package (£600)
A newly-released package from Commodore comprising an Amiga 500, colour monitor, printer, word processor, database and spreadsheet. A plug-in-and-go kit which also opens up access to many professional graphics, sound and video programs.
Donated by Commodore on (0628) 770088

Micro Midget (£750)
Probably the smallest-footprint PC-compatible available, this machine is being supplied with two 3½in disk drives, a mono monitor, 640k RAM and the Logotron range of budget word processor, spreadsheet and database. This minute box even contains room for a PC expansion card or two.
Donated by ACPM on (0227) 712882

Mac Bumper Bundle (£1000+)
A host of programs for the Apple Macintosh. Comment — electronic pop-up notes; Spelling Coach — interactive spelling checker; Canvas — a combined paint and draw program with a 9ft×9ft work area that can be installed as a desk accessory; FileMaker Plus — a database with built-in forms manager; CAT (Contacts/Activities/Time) — a relational database for managing people and events; plus QuickKeys, DeskTop and Calendar Maker.
Donated by Computers Unlimited on (01) 200 8282

NEC Multisync II (£649)
This successor to the pioneering original 14in Multisync monitor now boasts increased vertical auto-scanning range, automatic picture sizing, compatibility with more machines and a smaller footprint.
Donated by NEC on (01) 993 8111

READER SURVEY 1988

1 Are you a PCW subscriber? ☐ 01

2 If not, how often do you purchase/read PCW?

Every month	☐ 01
Once every two months	☐ 02
Once every three months	☐ 03
Less often	☐ 04

3 If you read PCW less than once every two months, what influences whether you read it or not?

Specific hardware reviews	☐ 01
Specific software reviews	☐ 02
Specific features	☐ 03
Other contents	☐ 04
(please specify) _____	
None of the above	☐ 05

4 How many other people read your copy of PCW?

1-2 ☐ 01 3-5 ☐ 02 6-10 ☐ 03 11-15 ☐ 04 15+ ☐ 05

5 For how many years have you read PCW?

1 ☐ 01 2 ☐ 02 3 ☐ 03 4 ☐ 04 5 ☐ 05 more than 5 ☐ 06

6 Many PCW items appear every month. Please show how often you read them:

	Always	Often	Sometimes	Never
Adverts	☐ 01	☐ 02	☐ 03	☐ 04
Banks' Statement	☐ 05	☐ 06	☐ 07	☐ 08
Bibliofile	☐ 09	☐ 10	☐ 11	☐ 12
Checkouts	☐ 13	☐ 14	☐ 15	☐ 16
ChipChat	☐ 17	☐ 18	☐ 19	☐ 20
Computer Answers	☐ 21	☐ 22	☐ 23	☐ 24
End Zone	☐ 25	☐ 26	☐ 27	☐ 28
Hardware Benchtests	☐ 29	☐ 30	☐ 31	☐ 32
Letters	☐ 33	☐ 34	☐ 35	☐ 36
Mailbox	☐ 37	☐ 38	☐ 39	☐ 40
Musical Interlude	☐ 41	☐ 42	☐ 43	☐ 44
Newsprint	☐ 45	☐ 46	☐ 47	☐ 48
Program File	☐ 49	☐ 50	☐ 51	☐ 52
Screenplay	☐ 53	☐ 54	☐ 55	☐ 56
Software Screentests	☐ 57	☐ 58	☐ 59	☐ 60
SubSet	☐ 61	☐ 62	☐ 63	☐ 64
West Coast Connection	☐ 65	☐ 66	☐ 67	☐ 68

7 If you read Program File, how often do you key in complete program listings?

Often ☐ 01 Sometimes ☐ 02 Never ☐ 03

How often do you use parts of the published listings in your own programs?

Often ☐ 01 Sometimes ☐ 02 Never ☐ 03

8 How interesting do you find articles in the following categories?

	Very	Quite interested	Mildly	Not
Animation/Video	☐ 01	☐ 02	☐ 03	☐ 04
Chip/hardware development	☐ 05	☐ 06	☐ 07	☐ 08
Computers in Action	☐ 09	☐ 10	☐ 11	☐ 12
Desktop publishing	☐ 13	☐ 14	☐ 15	☐ 16
Education	☐ 17	☐ 18	☐ 19	☐ 20
Engineering/Scientific	☐ 21	☐ 22	☐ 23	☐ 24
Game playing	☐ 25	☐ 26	☐ 27	☐ 28
Graphics	☐ 29	☐ 30	☐ 31	☐ 32
Hardware – how it works	☐ 33	☐ 34	☐ 35	☐ 36
High-powered computing	☐ 37	☐ 38	☐ 39	☐ 40
Multi-user systems	☐ 41	☐ 42	☐ 43	☐ 44
Networks	☐ 45	☐ 46	☐ 47	☐ 48
Programming	☐ 49	☐ 50	☐ 51	☐ 52
Software – how it works	☐ 53	☐ 54	☐ 55	☐ 56

9 Which article that we published in the past twelve months did you like most?

_____

10 What feature/review would you like to have seen in PCW in the past twelve months that we did not publish?

_____

11 How many personal computers do you own?

None	☐ 01
1	☐ 02
2	☐ 03
3	☐ 04
4	☐ 05
5 or more	☐ 06

12 How many personal computers do you regularly use but not own?

None	☐ 01
1	☐ 02
2	☐ 03
3	☐ 04
4	☐ 05
5 or more	☐ 06

13 If you replied yes to either of the above, which of the following categories apply?

	Own/ regularly use	Plan to buy
80386-based IBM or compatible	☐ 01	☐ 02
80286-based IBM or compatible	☐ 03	☐ 04
Hard disk C compatible	☐ 05	☐ 06
Amstrad PC/PPC 1512/1640	☐ 07	☐ 08
Single/twin floppy PC	☐ 09	☐ 10
Apricot/Sirius/generic MS-DOS	☐ 11	☐ 12
Laptop PC compatible	☐ 13	☐ 14
Cambridge Computer Z88	☐ 15	☐ 16
Other laptop computer	☐ 17	☐ 18
Apple Macintosh/Plus/SE/II	☐ 19	☐ 20
Atari ST	☐ 21	☐ 22
Commodore Amiga	☐ 23	☐ 24
Acorn Archimedes	☐ 25	☐ 26
Amstrad PCW	☐ 27	☐ 28
Other CP/M	☐ 29	☐ 30
Amstrad CPC	☐ 31	☐ 32
BBC	☐ 33	☐ 34
Commodore 64/128	☐ 35	☐ 36
Apple II	☐ 37	☐ 38
Sinclair Spectrum	☐ 39	☐ 40
Sinclair QL	☐ 41	☐ 42
Atari 400/800/130	☐ 43	☐ 44
Pocket computer (for example, Psion)	☐ 45	☐ 46
Other (state which)	☐ 47	☐ 48

14 Do you regularly use any of the following?

	Yes	No
Personal computer networks	☐ 01	☐ 02
Multi-user micros	☐ 03	☐ 04
Workstations	☐ 05	☐ 06
Minicomputers	☐ 07	☐ 08
Mainframe computers	☐ 09	☐ 10

15 If money were no object, which computer would you buy for yourself?

_____

16 What peripherals do you own/use? And which are you planning to buy in the next twelve months?

	Own/Use	Plan to buy
Mono monitor	☐ 01	☐ 02
Colour monitor	☐ 03	☐ 04
Multi-scan monitor	☐ 05	☐ 06
Dot-matrix printer	☐ 07	☐ 08
Daisywheel printer	☐ 09	☐ 10
Ink-jet printer	☐ 11	☐ 12
Laser printer	☐ 13	☐ 14
Desktop publishing system	☐ 15	☐ 16
Other printer	☐ 17	☐ 18
Plotter	☐ 19	☐ 20
Disk drive	☐ 21	☐ 22
Expansion/add-on boards	☐ 23	☐ 24
Co-processor board	☐ 25	☐ 26
Graphics tablet	☐ 27	☐ 28
Joystick	☐ 29	☐ 30
Lightpens	☐ 31	☐ 32
Modem	☐ 33	☐ 34
Mouse	☐ 35	☐ 36
Sound/music add-ons	☐ 37	☐ 38
Scanner/image input device	☐ 39	☐ 40

READER SURVEY 1988

17 How much do you expect to spend on hardware in the next twelve months?

	Personal use at home	To use at work
Up to £100	☐ 01	☐ 02
Up to £250	☐ 03	☐ 04
Up to £500	☐ 05	☐ 06
Up to £1000	☐ 07	☐ 08
Up to £2000	☐ 09	☐ 10
Up to £5000	☐ 11	☐ 12
£5000 +	☐ 13	☐ 14

18 How much do you expect to spend on software in the next twelve months?

	at home	work
Up to £100	☐ 01	☐ 02
Up to £250	☐ 03	☐ 04
Up to £500	☐ 05	☐ 06
Up to £1000	☐ 07	☐ 08
Up to £2000	☐ 09	☐ 10
Up to £5000	☐ 11	☐ 12
£5000.+	☐ 13	☐ 14

19 If you use an online service like Telecom Gold, Prestel or MercuryLink 7500, how much do you spend on it each month?

Up to £10 ☐ 01 Up to £20 ☐ 02 Up to £50 ☐ 03 Up to £100 ☐ 04 £100 + ☐ 05

20 How many computer books did you buy/read in the past twelve months?

None ☐ 01 1-2 ☐ 02 3-4 ☐ 03 5-6 ☐ 04 7-10 ☐ 05 10-15 ☐ 06 15+ ☐ 07

21 Could you supply some details about yourself? These will be kept confidential.

Name _____

Address _____

_____

_____

Postcode/Country _____

22 Age

Under 20 ☐ 01 20-25 ☐ 02 26-35 ☐ 03 36-45 ☐ 04 46-55 ☐ 05 56-65 ☐ 06 Over 65 ☐ 07

23 Sex

Female ☐ 01 Male ☐ 02

Are you in full-time education?

Yes ☐ 01 No ☐ 02

Are you in employment?

Full-time ☐ 01 Part-time ☐ 02 Not employed ☐ 03

26 If you are employed, select the category letter which best describes your job title

A. MD/owner/partner/chair(wo)man
B. Financial director
C. Other director
D. Office management
E. Sales and marketing management
F. DP management
G. Doctor/lawyer/broker/professional
H. Education
I. Scientist/technologist/researcher
J. Programmer/analyst
K. Other

Now choose the number next to the industry sector you work in:

1 Insurance/banking/finance
2 Government/national/local
3 Transport/communications/utilities
4 Computer manufacturing
5 Other manufacturing
6 Computer distribution/retailing
7 Other wholesale/retail distribution
8 Mining/construction/oil/chemicals
9 Media/advertising/publishing
10 Education
11 Computer services/consultancy
12 Other services/consultancy
13 Other industry

Write the letter/number combination here _____

27 Number of employees in your company

Up to 10 ☐ 01 11-25 ☐ 02 26-50 ☐ 03 51-100 ☐ 04 101-150 ☐ 05 151-250 ☐ 06 251-500 ☐ 07 501-1000 ☐ 08 1-2000 ☐ 09 2000+ ☐ 10

Turnover of the company where you work

Up to £100k ☐ 01 £100k-£500k ☐ 02 £500k-£1m ☐ 03 £1m-£2m ☐ 04 Over £2m ☐ 05

29 Do you authorise expenditure on computer products and services for your department/company?

Yes ☐ 01 No ☐ 02

30 Please indicate your income bracket

Up to £8,000 ☐ 01 £8-£12,000 ☐ 02 £12-£15,000 ☐ 03 £15-£20,000 ☐ 04 £20-£30,000 ☐ 05 £30,000 + ☐ 06

31 What do you mainly use your computer(s) for? (Tick up to three)

Accounting	☐ 01
CAD/scientific/engineering	☐ 02
Communications	☐ 03
Database	☐ 04
Desktop publishing	☐ 05
Education	☐ 06
Financial planning	☐ 07
Games	☐ 08
Graphics/presentations	☐ 09
Programming	☐ 10
Spreadsheet	☐ 11
Word processing	☐ 12
Other (please specify)	

32 Which other computer publications do you regularly read?

Byte ☐ 01 Mac User ☐ 02 PC Plus ☐ 03 PC User ☐ 04 Personal Computer Mag. ☐ 05 Practical Computing ☐ 06 ST World ☐ 07 What Micro ☐ 08 Which Computer ☐ 09 .EXE ☐ 10 Other _____

33 Which of the following magazines do you regularly read?

What Car ☐ 01 Car ☐ 02 What Hi-Fi ☐ 03 The Economist ☐ 04 Office Equipment News ☐ 05 Practical Photography ☐ 06 Amateur Photographer ☐ 07 New Scientist ☐ 08 Business ☐ 09

34 List your top three magazines apart from Personal Computer World

_____

_____

_____

35 If you would like to make any further comments about Personal Computer World, please feel free to write them down on a separate piece of paper.

36 The charity I would like you to support on my behalf is

Childline	☐ 01
Enterprise Technology	☐ 02
Imperial Cancer Research	☐ 03
Oxfam	☐ 04
Terrence Higgins Trust (AIDS)	☐ 05

37 On 16 February, what was the size of the largest single file on any hard disk in the PCW editorial office?

38 The prize I would like to win, should my answer above be correct, is:

Amiga 500	☐ 01
Archimedes 310	☐ 02
Borland Quattro	☐ 03
Cambridge Computer Z88	☐ 04
Cameron Handy Scanner	☐ 05
Epson LQ500	☐ 06
Fontasy Publisher	☐ 07
Macintosh software bundle	☐ 08
Micro Midget	☐ 09
NEC Multisync II	☐ 10
Pace Linnet modem	☐ 11
WordPerfect Executive/ST/Amiga	☐ 12

This completed questionnaire should be sent to: PCW Survey, Freepost 25, VNU Publishing, VNU House, 32-34 Broadwick Street, London W1E 6EZ, by 21 April 1988.

"It's so simple to use"

"How are you getting on with that spreadsheet?"

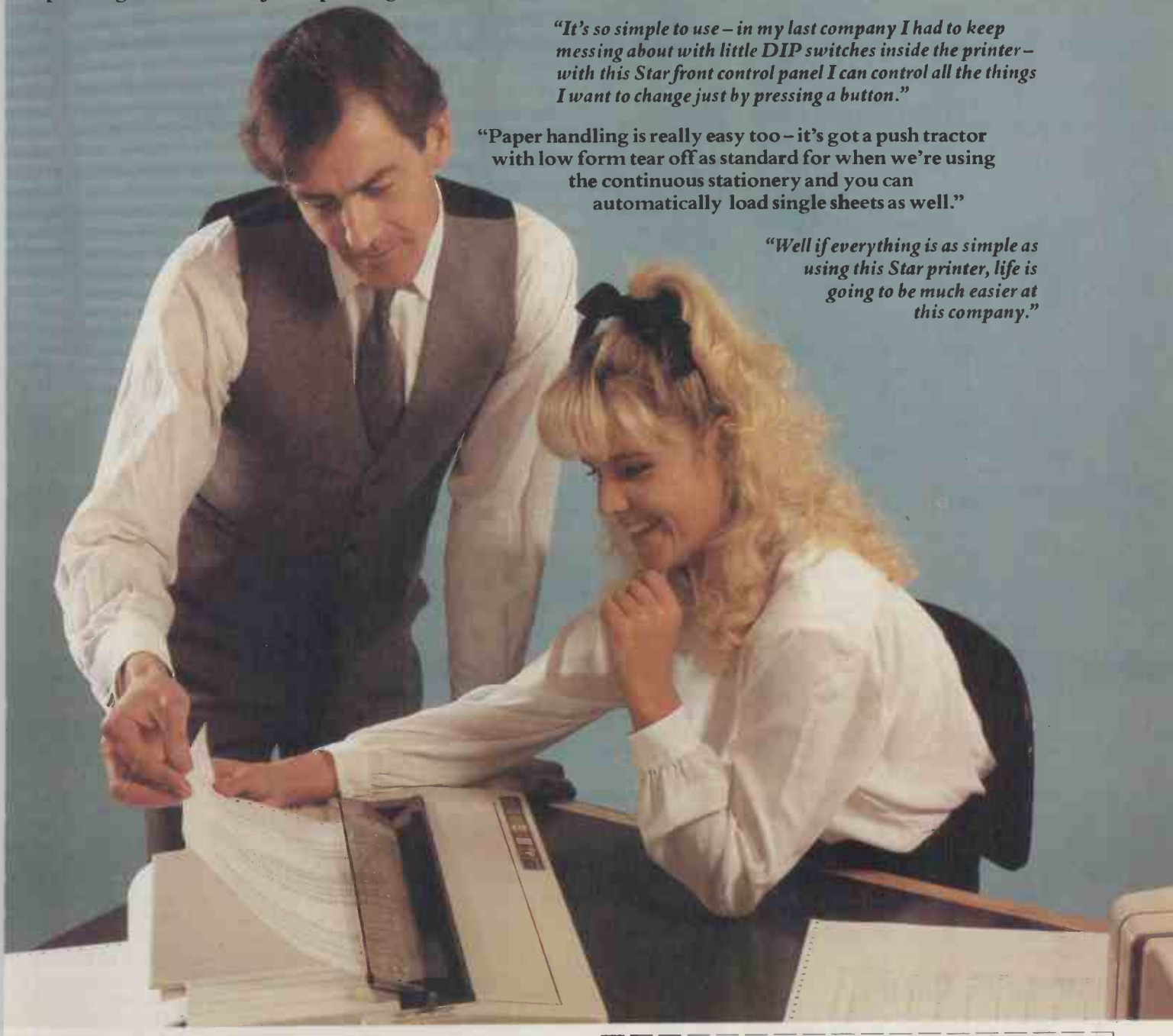
"It's just printing out now, I can't believe it's really that easy, I just did what you said and this NR-15 printer has done the rest."

"Yes, since we've had this Star Printer, it's made things a lot easier, it's fast – 240 characters per second in draft, it's got excellent Near Letter Quality at 60cps, so I can use it for my letter writing too, it has a large memory – 12K – so you can carry on using the system while the printer gets on with the job of printing."

"It's so simple to use – in my last company I had to keep messing about with little DIP switches inside the printer – with this Star front control panel I can control all the things I want to change just by pressing a button."

"Paper handling is really easy too – it's got a push tractor with low form tear off as standard for when we're using the continuous stationery and you can automatically load single sheets as well."

"Well if everything is as simple as using this Star printer, life is going to be much easier at this company."



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Star Micronics U.K. Ltd.,
Craven House, 40 Uxbridge Road,
Ealing, London W5 2BS.
Telephone: 01-840 1800.

A division of
Star Micronics Co., Ltd., Japan.

I'd like an easier life. Please send me details of the Star range of 24-pin and 9-pin dot matrix printers ☐ Please send me details of the Star LaserPrinter 8 ☐ Or just call Belinda on 01-840 1829.

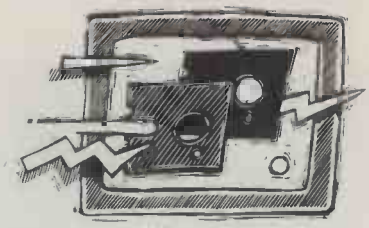
Name _____ Company _____

Address _____

_____ Postcode _____

Telephone _____

9 PCW 4



Byline

Ashton Tate seems to have missed when it tried to board the DTP bandwagon. A hurriedly-prepared product, alarmingly simple in design and seriously lacking in sophistication, does not make for good presentation. Graham Jones despairs.

Massive growth in desktop publishing has seen a large number of newcomers to the software scene in the past couple of years. For the most part, top software houses have remained remarkably silent about desktop publishing, reflecting sadly, perhaps, that they did not discover the market themselves. However, there have been rumours in the computer trade press that some of the big firms were developing desktop publishing packages. One of these rumours has at last come to fruition with the launch of Ashton Tate's desktop publishing product, Byline.

Byline is branded by Ashton Tate as 'PC desktop publishing for PC users'. The promotional blurb that accompanied the review copy makes it clear that this is a product which does not need a mouse, or an operating environment such as Microsoft Windows. Implicit in Ashton Tate's promotion is the idea that real PC users don't need a WIMP environment.

While it is undoubtedly true that the vast majority of PC users do not use mice, and run software happily under MS-DOS without Windows or GEM, it is skating on thin ice to imply that desktop publishing can be done without such enhancements. And, as you will see, the Byline product proves this to be the case.

What, no WIMP?

Desktop publishing is a graphic activity. Page layout requires a combination of artistic skill and typographical precision, and the WIMP environment provides publishers with both of these. Running a program under MS-DOS must surely limit the creative process either of picking items up and shoving them around the page until it looks right, or of managing your publication through a series of windows. In the US, Ashton Tate has already been heavily criticised for its anti-WIMP attitude, with one commentator pointing out, quite rightly, that dBase Mac utilises the environment admirably.

So why has Ashton Tate opted for a non-WIMP desktop publishing program? Probably it is due to the simple fact that most PC users do not use this form of operating environment, but may well wish to gain the benefits of desktop publishing. But can Byline deliver the goods?

The answer to that question depends very much on the sort of publishing you want to do. If you are a publishing professional, you can safely ignore Byline. You would too easily become frustrated with its cumbersome way of design and its overall slowness. However, if you are in business and want a program to produce professional documentation, you could consider Byline.

The reason professional publishers will not like Byline is the fact that it does not allow you to design pages following traditional principles, unlike PageMaker, Ventura or **X**Press. With these packages you can, using the WIMP environment, place items on a page 'freehand' and then deal with the precision layout once the page looks right.

In use

Byline does not allow you to place items on a page freehand. Instead you must manipulate them either with the cursor arrow keys, or by typing in the precise positioning of the item into a dialogue box.

Byline comes on five standard floppy disks (the 3½in format is expected to be produced in the near future). One of the floppy disks contains a number of clip art items, another has the tutorial publications upon it, so the actual program itself only takes up three disks. To load Byline you need an IBM PC or 100% compatible with at least 384k of RAM. You will need a display adaptor providing at least CGA standard, and you will also require MS-DOS 2.0 or higher.

Byline is best used with a hard disk since more than 100 files are used and these take up about 1Mbyte. If you use a floppy system, you will be involved in a great deal of time-consuming disk swapping.

Once you have Byline up and running, you are presented with a split screen. On one side is the 'spec sheet' and on the other is a representation of the whole page. The blurb with Byline suggests that it is WYSIWYG. It is not. Byline produces a *representation* of what will be printed and not the sort of WYSIWYG you get on something like a Macintosh.

However, for many office publishing purposes true WYSIWYG may not be necessary, so the limitation of Byline might not be important. Professional publishers, however, would find it a distraction.

The spec sheet is the area in which you type information relating to the items you position on the page. Before you enter any material you must position a box to receive it. Boxes will either take 'text' or 'photos'. Quite why the word 'photo' has been chosen by Ashton Tate is a mystery. Professional publishers do not refer to graphic items as photos, and the bit-mapped graphics supplied as examples by Ashton Tate could hardly be described as such.

However, when you decide what type of item box you require, Byline automatically places a two-inch square box at the top left of the page. If you want it somewhere else, you can move it using the arrow keys, and you can resize it using a

combination of tabs and arrows. Alternatively, you can type the position and size of the box directly into the spec sheet. Every single item on the page has its own spec sheet, which is automatically generated by the program when you add an item to a page. Each page also has its own spec sheet. In this way, you can build up your own style sheets and supply them whenever necessary.

Whichever way you position boxes in Byline, it is cumbersome. Using the arrow keys is slow. Even with the added enhancement of using Shift-Arrow which speeds up the movement 10 times, it is slower than using a mouse to lift it and move it. If you decide to describe the size and position of the box on the page accurately, you will need to have designed your page on paper first to a reasonable degree of accuracy, which destroys much of the point of buying a DTP package in the first place!

You can measure your item, or 'element' boxes, as Byline refers to them, in inches, centimetres, picas and points. The default setting according to the manual is inches. The version of Byline used for this review had a default of millimetres, and the manual does not reveal how to change this default to the more professional system of picas and points.

Once your boxes are in place you can begin to import material into them. Byline accepts a wide range of word processor and graphics formats, as well as ASCII files. However, there is one glaring error in that it cannot import directly from Microsoft Word, which is one of the most popular word processors.

Style matters

When material is imported, it will take on the styles incorporated into the spec sheet for the box in question. Each text box, for example, can have three levels of heading as well as the body text described in the spec sheet. However, Byline comes with only five typefaces — Courier, Times, Bookman, dBase Elite, and Swiss — so if you are looking at serious publishing you will need to buy additional typefaces. Indeed, in terms of professional publishing only Bookman and Times actually rate at all, so Byline is seriously limited in typographical choice.

The text box spec sheet also allows you to choose the method of justification, and the amount of leading (spacing between lines of text). However, you can adjust the leading only within single-point increments (a point is 1/72nd of an inch). For good typographical results this is not good enough, and a much finer degree of control is required.

The spec sheet also allows you to decide how many columns there should be, whether or not there should be rules between columns and how thick these should be, and also the size of any borders. The gutter between the columns (called the 'column gap' by Byline despite the fact that no professional publisher ever refers to the gutter as this) is not controllable by the user. This is preset in the spec sheet for the page and means that all gutters on a given page must be the same. This is typographically incorrect, especially in newsletters and magazines, and is a serious flaw in Byline.

Spec sheets for the photo boxes allow you to define the size of the box, any cropping of the graphics contained within them, and the size of any borders or boxes required around the material.

Making up is hard to do

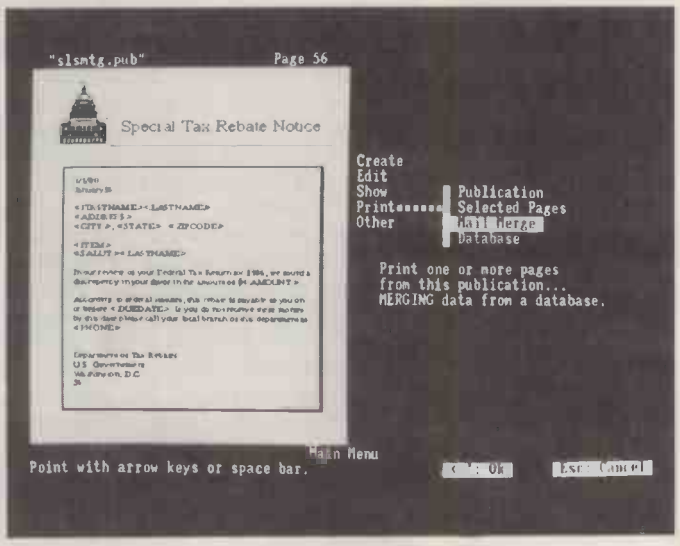
When your material has been loaded into the relevant boxes, and the spec sheets have been tidied up to produce the effect you want, you can move material around the page to get the best look. With a WIMP environment this is easy. You just use the mouse to point to the item you want to move and literally move it. With Byline, shifting items around the page is awkward and slow. You have to use either the arrow keys, or alter the spec sheets. It means that you must have a very precise design in advance if you are to use Byline with any kind of speed.

This reveals that Byline is not really a sophisticated desktop publishing program at all. It is a fairly basic page make-up application that combines text files with graphics files. But you can do that quite easily with Microsoft Word, for example. Sophisticated desktop publishing programs, in the true sense, allow you to do much more than just mixing text and graphics. They allow you to emulate the traditional publishing process, merely providing a tool by which publications are produced. Byline does not emulate traditional publishing, but takes a completely different approach to document design. Sophisticated desktop publishing programs also allow you to manufacture your own simple graphics, and even new word processors such as FullWrite Professional give you a complete drawing package as a menu-selection.

Byline professes a simple graphics capability, but this is limited to rules and boxes. Byline does not, for example, produce tints, nor does it support white text reversed out of a black background — both commonly used in publishing.

However, Byline does have a reasonably good text editor. This is a fairly fast but basic word processor which allows you to write your text directly into the publication instead of importing it from a word processor file. The advantage of using the Byline text processor is the fact that you do not have to quit the application to write articles for your publication. In addition, Byline saves all your text files in an ASCII format so that they can easily be exported back to your main word-processor application if required.

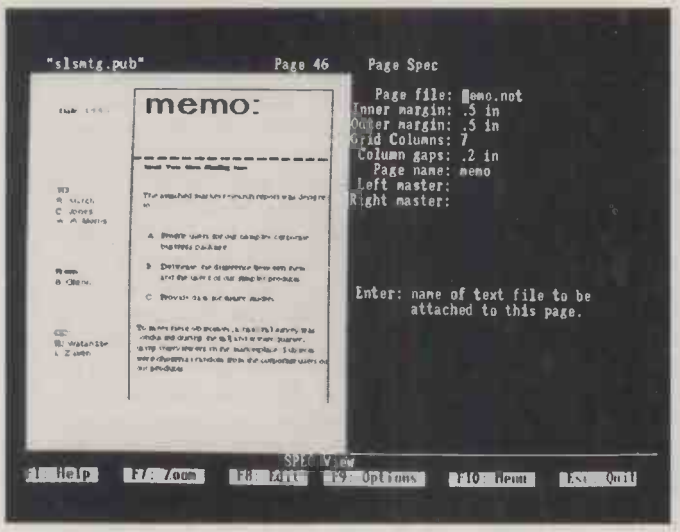
The text editor in Byline can use either half of the screen, replacing the spec sheet, or the whole screen. It has all the usual basic word processing facilities such as cut and paste, which are accessed through function keys, as well as type styling and formatting. The text processor also includes search and replace facilities, but does not have a spelling checker. Once you save your text, it automatically appears in its box on the mini page representation. However, Byline cannot let you write unless you give it a filename first. You need to remember the names of



Byline includes a unique dBase merge facility that enables users to import dBase III+ databases into pre-styled formats for mail-merge letters, database-driven directories, invoices and other similar reports

your text files before you start writing so that you do not double up. If you do type in the name of an existing text file, Byline will load this into memory. The result would be a waste of your time while you closed this file and renamed a fresh one.

When you are happy with your text and graphics, you can enhance the pages if you wish to. Byline allows you to produce both left- and right-hand master pages, and you can generate automatic headers, as well as automatic page numbering. You can also experiment with various 'looks' by adjusting the number of columns in each text box, the justification of text, the size of headlines and so on. Byline supports all fonts from eight point to 144 point.



Byline contains 23 sample templates that enable fast and easy construction of reports requiring a standardised format, such as memos, agendas and other business communication applications. This allows a new user to produce documents quickly and with little effort or knowledge of the system

In print

Printing the output of Byline should be easy for most PC users. The program supports a wide range of printers including PostScript compatibles such as the Apple LaserWriter, as well as other laser printers like the popular Hewlett-Packard LaserJet series. Byline also supports 9- and 24-pin dot matrix printers including those from Epson, IBM and Okidata. If the printer you are using does not have the typeface specified in a particular spec sheet, Byline automatically substitutes one which is available from your chosen printer. (When you install Byline, you have to specify which printer you will be using so that the correct driver can be loaded.)

To enhance your printing Byline also allows you to kern characters. Kerning is the typographical process whereby letters are moved closer together to improve their appearance on the page. Kerning in Byline is automatic, although you can alter the degree of kerning by changing the kerning tables using the text editor. Kerning tables are descriptions of the space taken up by particular pairs of characters. For example, an A and a V need to be moved closer together, so a kerning table may describe this pair of characters as taking up only 75% of the actual space required for them. This moves them closer together. For the same letters in some other typefaces 75% may be too close and you would need to alter the kerning table to say, 85%. This is time-consuming, however, and much more cumbersome than the simple keyboard manual kerning supported by the likes of PageMaker. But it is a mystery why Byline allows for the typographical precision of kerning at all, while removing the more important control over gutters and having so few typefaces. In addition, you can select type sizes only in single point increments, which is not accurate enough for many publishing activities. Another typographical problem with Byline is the fact that you cannot change the method of justification or of letter spacing to improve the look of text, as you can with PageMaker or XPress.

Of interest to many PC users, however, will be Byline's ability to import directly from Lotus 1-2-3 and Symphony. This means that Byline could be very useful in the publication of management information and in spreadsheet publishing. In addition, Byline has the unique capability of using dBase III files in mail-merge letters, directories, and so on. Because of this fact, Byline could become very useful in basic directory and database publishing.

It is hard, however, to believe that Byline will become anything more than a useful tool for a minority of individuals. It does not offer the degree of sophistication provided by other PC desktop publishing packages. Even Finesse, at less than £100, is more refined. Byline also falls down in terms of typographical control: someone who wants to produce top-class material will not get the level of precision required from Byline. Byline also lacks sufficient established typefaces. Businesses which need to produce smart documentation may find a home for Byline, but they too will become frustrated, as I did, with the cumbersome way of doing things and the appalling lack of speed.

The whole problem revolves around the entire concept of Byline. It has been designed with the WIMP environment an absent, seemingly unwanted, item. It is this factor alone which dramatically reduces the capabilities of the package. The product has been designed to use the capabilities of the basic IBM PC or clone, without any enhancements — save that of improved screen handling. The IBM PC was never designed with the graphic work of publishing in mind. To produce a program like Byline to take advantage of the lack of features of the PC is a retrograde step.

Byline is not, like DTP packages which use the WIMP environment, intuitive. It does take time to learn. However, it is very difficult to use comfortably. While the idea of a spec sheet for every item is useful, though not new since Ventura uses style sheets (much more effectively), their constant overbearing presence on the screen tends to take your mind off the real work in hand — designing a page. Also, the slowness of the program, due to its awkward way of working, is frustrating and not conducive to effective publishing.

Documentation

Like many computer manuals, the one included with Byline is incomplete. It has a poor index, for example, so finding the answers to your inevitable questions at the beginning is not easy.

Conclusion

Byline is a simple page make-up application which may benefit those people who want to produce fairly basic page layouts as might be required in the production of business documentation; it is not a good tool for the production of newsletters or magazines. If your needs are simple and you do not want the level of sophistication offered by the larger, more expensive packages like PageMaker, then it's worth a look.

However, the lack of typographical choice and precision found in Byline is a serious problem, and one which should be considered carefully. This looks like a product rushed out to claim some part of the desktop publishing market. From a company with the reputation of Ashton Tate, this is something of a surprise.

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The new alchemy

Gone are the images of chemists drooling over phials and test-tubes: many of them are now at the forefront of research into AI and computer simulations. Nick Hampshire examines the invaluable role of computers in the advancement of molecular biology.

Most people's image of a research chemist lies somewhere between the medieval alchemist surrounded by foul-smelling components and explosive reactions, and the man or woman in a white coat with a cluttered laboratory full of odd-shaped glassware — images which owe their origin to the Industrial Revolution and the creative minds of Hollywood scriptwriters.

Chemistry was one of the core foundations upon which 19th century industry was built, a position which this branch of science still occupies. The discoveries of chemists have, to a very large degree, been the basis upon which our current lifestyle is founded. Thanks to chemistry we have synthetic fibres for the textile industry, plastics for virtually every use under the sun, medicines capable of conquering virtually every disease, plus a thousand and one other products ranging from foodstuffs to the manufacture of silicon chips.

Foundations

In the two hundred year history of modern chemistry, more than seven million different chemical compounds have been identified, and this list is being added to at the rate of about 30,000 per year. It is not surprising, therefore, that one of the earliest applications for computers in chemistry was simply to provide chemists with a database of information on all these compounds and on new discoveries.

There are now a whole range of online and private databases; in fact, they probably include some of the largest public access databases in existence. These databases cover a whole range of different aspects of chemical science, from molecular coding which makes up the genetic blueprint for life itself. Not only is such information available as online databases, some of it is now also available on optical discs in the form of CD ROMs.

As with any science the information about the nature, structure, properties and methods of synthesis of chemicals is of vital importance. Computers have made accessing this enormous quantity of data far quicker and far easier. In addition, applications such as molecular modelling, computerised synthesis and computerised analysis are leading chemists into a vast new world of possibilities.

Virtually every application of computers to chemistry is built upon our knowledge of the mathematics of the behaviour of atomic and sub-atomic particles. These mathematical models are a blend of standard physics and the more recent quantum mechanics first proposed at the begining of this century. From these basic principles, mathematicians and theoretical physicists have developed a whole series of equations which have subsequently been experimentally verified as accurately modelling atomic and molecular structures.

This mathematical modelling of atomic and molecular structures has given rise to a branch of chemistry known as 'quantum chemistry'. It is in this branch of chemistry that computers have had their biggest impact, since most of the equations involved are horrendously complex. Indeed, in 1933, the Nobel prize-winning physicist Paul Dirac, who with Erwin Schrödinger was one of the founders of quantum chemistry, wrote:

'The underlying physical laws necessary for the mathematical theory of a large part of physics and the whole of chemistry are completely known, and the difficulty is only that the exact application of these laws leads to equations much too complicated to be solved.'

By the middle of the 1960s, computers had already been used to overcome the limitation caused by the complexity of the formulae.

The ability to solve such complex formulae using computers has allowed theoretical chemists to build models of chemical reactions at an atomic level and sub-atomic level. It also allows them to build models of molecular systems such as gases, liquids, solids and crystals. In this way they can predict the properties and behaviour of substances which have not yet been created, or examine the reason why a particular phenomenon exists such as superconductivity or organic metals.

Molecular modelling

For those of you who may have forgotten your school chemistry and physics, an atom is the fundamental unit of all matter. Atoms are very small, there are literally billions of them in an object as small as a pinhead, each of which is built up from a number of elementary sub-atomic particles. There is a small, dense core of protons and neutrons which give the atom its mass, and spinning round this core is a cloud of electrons which give the atom its electrical properties. The negative charge of these electrons is ideally balanced by the positive charge of the protons.

Electrons are, however, fairly loosely attached to the atom, which means that it is quite easy for an atom to gain or lose one or more electrons, thereby giving it an overall positive or negative charge. Most atoms also have a slight natural electrical imbalance due to their structure, and it is this electrical imbalance which causes atoms to combine together as molecules. In a molecule consisting of two or more atoms, the electrical equilibrium is generally more stable than in individual molecules. It is, broadly speaking, the amount of electrical imbalance within an atom or molecule which determines its chemical reactivity.

The coming together of two or more atoms to form a molecule means that they share one or more electrons at the point where they touch. This in turn means that the spherical cloud of electrons around a simple atom no longer exists in a molecule, but is replaced by an electron field which often has an exceedingly complex shape.

The shape of molecules is important; it can determine many of their chemical and physical properties as well as indicating how they will react with other molecules or atoms. In the past, chemists built models of molecules using little coloured wooden balls to represent the different atoms, and these were joined by rods.

These rod-and-ball models had

Illustration by Kate Charlesworth

their limitations; not only were they difficult to build, they were also fundamentally innaccurate. They failed to show the wide variation in atomic sizes and the distance between attached atoms but, most importantly, they were unable to show the shape of the electron field surrounding the molecule. The result was that chemists had to build more than one model for a particular molecule, and with the large molecules being investigated by biochemists, this model-building task started to become very onerous.

By using a computer with a graphics display screen to model molecular structure, all these limitations are overcome. The computer display is far more flexible in its use than a solid model. The chemist can traverse the molecular structure and examine every component in detail in much the same way that an architect can use a CAD program to explore a building design. The use of a computer to model a molecular structure is a fairly processor-intensive operation, particularly if the molecule is both large and complex. Many chemists, therefore, use special graphics terminals attached to large and very powerful mainframe computer systems. However, simple displays are well within the capabilities of current popular PCs. In fact, molecular modelling programs have been written for machines such as the IBM PC (see the 'MBasic Molecular Graphics Suite' program in 'Program File', October 1987).

An example of a chemical structure display program designed for the PC is intriguingly called 'The Egg'. It is produced by Elsevere Scientific Software. This program is basically a scientific word processor system but, when used in conjunction with a database of chemical structures called ChemLibrary, it is able to show the structural skeletons of a whole range of organic, inorganic and biochemicals. It costs just over £300.

The computer with a graphics display was a natural solution to this problem. A molecular model could be built within the modelling program's database which could be viewed in three dimensions. The chemist could rotate the molecular model to any desired position; he could even move through the molecule to view parts which would otherwise be hidden. By building into the program a database of atomic structures as well as the mathematics of quantum chemistry, it is possible to expand such models so that the computer display can show the electron field shape, relative atomic sizes, and so on.

The use of computer graphics displays for showing molecular models has also had the effect of showing scientists the limitations of some of their existing conceptions of molecular structure. One major misconception was that the structure of a molecule was static; this is true at temperatures of absolute zero, but at all other temperatures every atom within a molecule is vibrating. Far from being static, a molecule wobbles, rather like an almost infinitely small blancmange.

The traditional method of determining the 3-D shape of a molecule, such as a protein, is to use X-ray crystallography. In this technique, a crystal composed of a regular array of millions of identical molecules is exposed to a narrow beam of X-rays which are scattered in a pattern. This pattern is dependent upon the shape and structure of the constituent molecules. By using computerised analysis, this data can be converted into a 3-D map of the electron densities of the molecule.

With this technique the 3-D structure of a whole range of very complex biochemicals has been determined — substances such as haemoglobin, insulin, and DNA. But they all suffer from one drawback which is that the molecules being investigated are all moving. What is obtained is not the true shape but the average shape of all the molecules in the sample. Scientists who noted this problem also realised that the constant motion of a molecule also plays a very important part in determining its chemical properties.

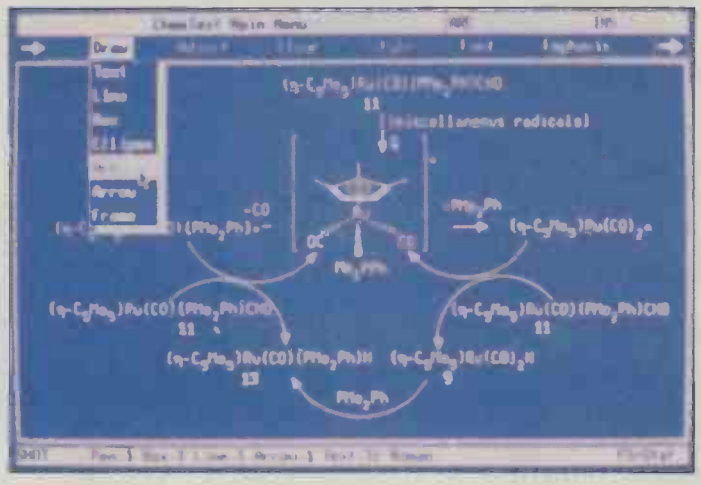
By using computer simulations of molecular movement, scientists such as the team at Harvard University under Professors Karplus and McCammon were able to show how molecular dynamics affects the behaviour of a molecule. They have used high-resolution graphics displays to create animated sequences of the movement within a molecule, movement calculated by means of the standard physical laws of motion. The timescale for this molecular movement would normally be incredibly small, probably no more than a trillionth of a second.

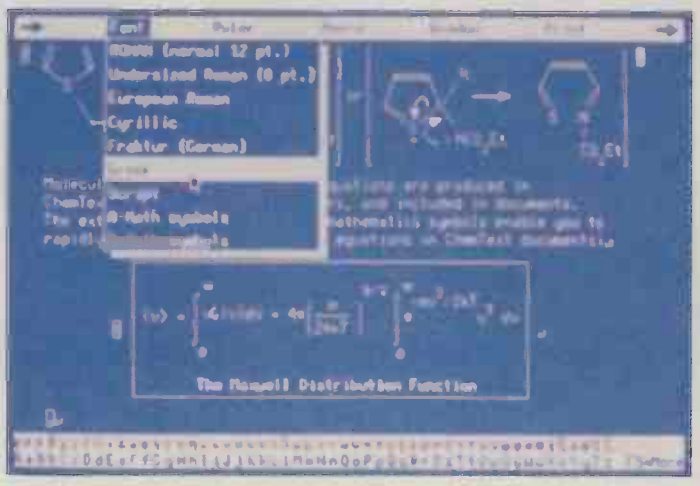
The computer simulation is displayed in full colour using a program called 'Hydra', and is able to show the entire sequence of movement by all the atoms within the molecule under investigation. Using such systems, molecular biologists have already discovered that the key to a great many biochemical reactions lies in molecular dynamics, a form of molecular modelling impossible without the aid of computers.

Computerised molecular modelling has allowed chemists to determine the structures of increasingly larger and more complex molecules. This has led to enormous advances in our understanding of chemical processes, especially those which take place within living organisms. Scientists have realised that in most biochemical reactions it is the shape of the molecule which is important: reactions take place where the shape of two molecules is such that they fit together. This is the way in which many enzymes work; it is also the way in which many pharmaceutical products work.

Many of the new generation of bacteriacides, anti-cancer drugs and anti-viral agents are designed to latch on to a specific part of the target cell or organism. Initially, these compounds were located by simple trial and error. Pharmaceutical companies scoured the animal and plant world for potential drugs. These chemicals would then undergo lengthy screening procedures to test their potential and also look out for any undesirable side-effects. This was not just a very expensive process — it was also a totally hit-and-miss process.

The discovery that the shape of molecules, as well as their chemical reactivity, is vital, is now leading scientists towards the design of molecules with the correct shape. Molecules of this form will only latch on to the specified target chemical or organism; everything else will be ignored. In this way, dangerous side-effects can be eliminated and the medical profession will have the type of armoury it has long desired.





The screenshots on this page were supplied by ECS Chemical Systems, one of the leading suppliers of computer software to the chemical industry

Just as computers can be used to display the structure of existing molecules, so they can also be used to design new molecules: a form of molecular CAD. However, designing a molecule with the correct shape and reactivity is in itself simply an interesting academic exercise. In order for that molecule to become a physical reality, this design process needs to include instructions on how to synthesise the designed chemical. This is an area where, once again, computers are an essential aid. Already, artificial intelligence programs have been designed which can offer the chemist this kind of advice.

Chemical analysis

In order to determine the atomic constituents and shape of an unknown chemical, chemists use a whole array of different techniques — many of which extensively rely on the use of computers. These are techniques such as nuclear magnetic resonance spectroscopy, UV and IR spectroscopy, mass spectroscopy and X-ray crystallography. In some of these techniques, the data output needs to be matched against vast libraries of reference data from *known* substances. In others, such as X-ray crystallography, the output needs very extensive mathematical manipulation in order to convert it into usable information. In short, most of these techniques would be impossible without computers.

The complexity of much of this analytical data has meant that manual techniques for using this information to determine the structure and shape of a molecule are exceedingly time-consuming and laborious. It is little wonder, therefore, that chemists have been at the forefront of developments in artificial intelligence, as techniques involving the use of 'knowledge bases' are required in order to take over much of the very tedious manual interpretation work.

The term 'expert system' has recently become very fashionable, and is used to denote computer programs which use knowledge in the form of rules to interpret data and produce a 'knowledgeable' conclusion about the data even when the data is incomplete. This is just the type of program which the chemist

needs, and, in fact, one of the prime developers of expert system technology was a chemist, Professor Josiah Lederberg of Stanford University.

Professor Lederberg's program, called Dendral, is now one of the classics of expert system development and was designed to infer the molecular structure of an unknown compound from mass spectral and nuclear magnetic resonance data. Written in Lisp, it uses a special algorithm from which the program's name is derived, the dendritic algorithm. This algorithm systematically enumerates all the possible molecular structures and uses its chemical expertise to reduce this list to a manageable size.

By using artificial intelligence techniques Dendral was able to eliminate all impossible structures, and could, therefore, focus the chemists' attention on just a small handful of potential structures. It was then up to the chemists to use their far greater expertise to determine exactly which was the correct one from this shortlist. This enormously improved the productivity of analytical chemists.

Since Dendral was first developed in the late 1970s it has been joined by a whole family of other expert systems, mostly developed at Stanford University and nearly all written in Lisp. Congen uses spectroscopic and chemical data to determine the structure of a protein from an electron density map by interpreting X-ray diffraction data composed of the position and intensity of diffracted waves. With this data and a knowledge-base containing information about the nature of proteins and X-ray crystallography, the expert system builds up a hypothetical 3-D structure of the protein under examination. Capable of handling even more complex molecules is an expert system called GA1 which helps biochemists and geneticists determine the structure of large sections of DNA, the chemical code for life itself, using a range of different analytical data.

Artificial intelligence programs have already become a very powerful tool in the analytical chemist's armoury. This use of expert systems becomes even more powerful when combined with the increasing sophistication of analytical instruments which make extensive use of computers to interpret and process vast quantities of sensor data.

Molecular synthesis

Once the properties' atomic composition and structure of a chemical compound have all been determined, the next great challenge facing the chemist is to attempt to synthesise it. This is particularly important in the pharmaceutical industry where a great many drugs are still derived from natural sources. Some are derived from plants, others from bactera or fungi, but they all have the drawback that collection, extraction and purification of the desired chemical can be a very expensive operation. Being able to synthesise the substance from cheap and readily available chemicals would be a far more economical alternative.

The synthesis of a large, complex molecule from a number of small, simple molecules is a process of adding the small molecules to the larger molecule one at a time and attaching them to the correct position and in the correct orientation. It is a construction process on an atomic scale. In order to attach these molecular building blocks correctly, a large number of different synthesis techniques have been developed, of which there are about 3000 in organic chemistry.

Thus, the synthesis technique consists of attaching a building block molecule to the base molecule using the correct synthesis technique, which ensures that it is attached to the correct position and in the correct orientation. This process is then repeated using a different building block molecule and a different synthesis technique until the required molecule has been assembled. Each step also involves the practical problem of separating the correctly-assembled molecules from the unused building block molecules and any remaining base molecules which have not been joined to the building block molecule. It should be noted that the choice of synthesis technique not only involves ensuring that the two molecules are assembled correctly, but also involves ensuring that the yield of correctly assembled molecules is sufficiently high; it would be useless if only one in 10 were correctly assembled.

The process of devising a synthesis sequence for creating a particular target molecule is a long and time-consuming task involving a great deal of searching through reference material. This is an area where, once again, expert systems have proved themselves to be very useful. A typical example of such a system is Synchem2 which was developed at the State University of New York in 1984.

Synchem2 is written in PL/1 and uses knowledge about chemical reactions in order to discover a plausible sequence of organic synthetic reactions which will turn a set of available starting materials into the desired target molecule. The system attempts to find an optimal synthesis route from the starting materials to the target by applying heuristics which limit the search pathways to those which satisfy the limiting constraints, such as quality and yield of the desired product.

The use of an expert system to determine the sequence and nature of the synthesis reactions has considerably reduced the amount of time it takes to develop a procedure for synthesising a desired compound. However, chemists are taking this process one step further and are now using automated robot systems to perform the actual synthesis. The step-by-step nature of organic molecular synthesis makes it an ideal candidate for automation.

This use of robots in the laboratory has been the subject of a considerable amount of work in many research centres, one of which is Purdue University in Indiana where the Chemistry Department has constructed an organic synthesis robot. This device is based around a standard robot arm which is able to move objects between a series of different workstations. The robot arm, together with the workstations, is able to perform all the tasks normally associated with synthesis — weighing, mixing, diluting, pipetting, and extracting — together with techniques for cleaning any glassware and equipment used in the synthesis procedure in order to avoid contaminating subsequent procedures.

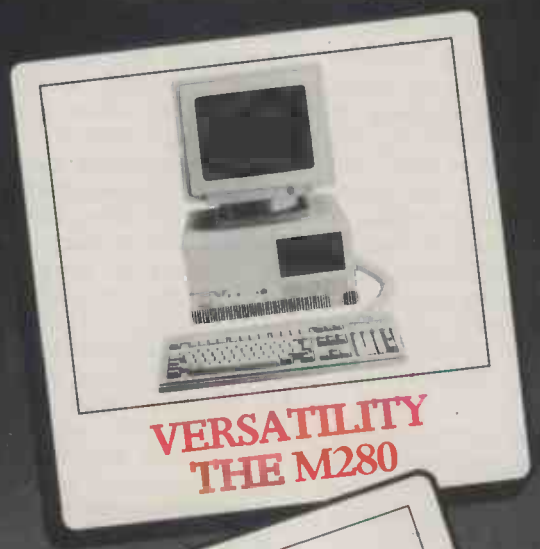
The Purdue robot synthesis system involved the scientists in creating a whole new range of instrumentation. But, the final system, which is controlled by a network of 8-bit processors running under CP/M, has shown that such techniques are practical. Indeed, such automated systems have allowed chemists to concentrate on improving sections of the synthesis procedure where yield was low or the reaction rate unduly slow.

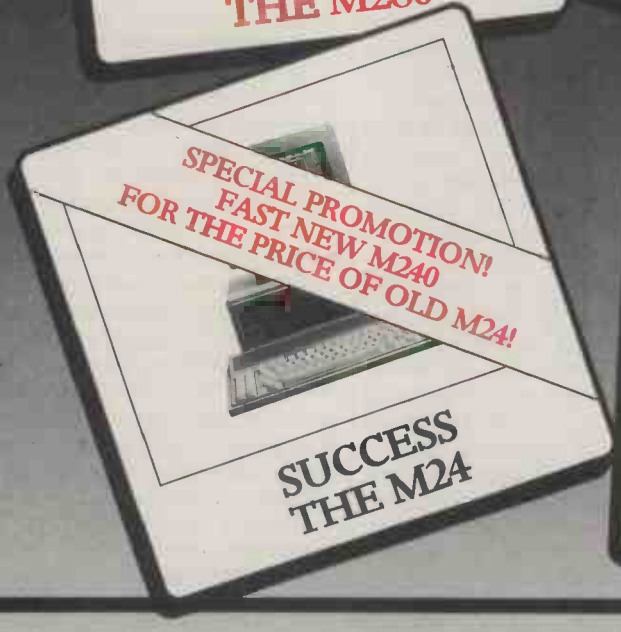
Computing and the molecular biologist

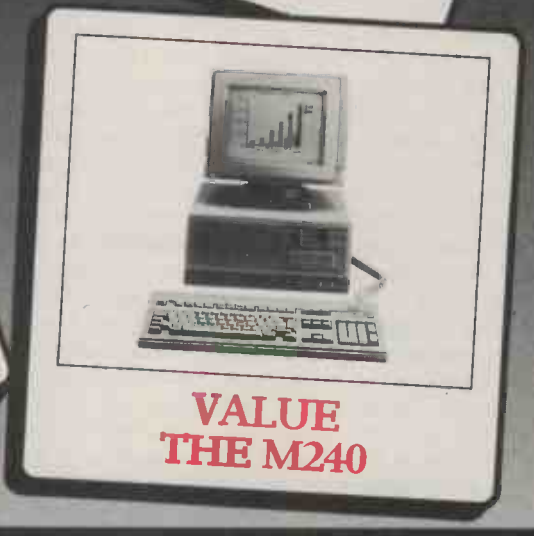
Molecular biology is a new science; in fact, it is about the same age as computer science. Molecular biologists seek to explain biological processes by looking at the molecular level, and, as such, it bridges the two scientific disciplines of chemistry and biology. Already, molecular biologists have acquired a very deep understanding of the structure of proteins, the mechanism of muscle contraction, the process of memory, the structure of DNA and thus the very basis of life itself. But despite these considerable advances, molecular biologists are still a long way from their ultimate goal, which is the complete description of a living organism at a molecular level.

Biological systems at a molecular

The Olivetti collection







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level are enormously complex. It was, therefore, natural that computers have from the very early days played an invaluable role in the advancement of molecular biology. They have employed all the computational tools used in chemistry, molecular modelling on a computer screen, computer-aided analysis and computer-aided synthesis, as well as the more mundane applications such as databases of nucleic acid sequences. They have, however, differed from conventional chemical applications since molecular biologists are primarily interested in molecules which are infinitely larger and more complex than those dealt with by the organic chemist.

So far, molecular biologists have used X-ray crystallography and other analytical techniques to build computer models of just under two hundred different biological super molecules, a list which even includes a couple of viruses (the smallest known 'living' organism). As in conventional organic chemistry, the shape of a biological molecule is enormously important — it is its shape which determines its function and role within a living organism.

By far the majority of biological molecules are proteins. These are very interesting substances since they are all constructed from a limited set of 20 building-block chemicals known as amino acids. Each protein consists of a chain of hundreds or even thousands of amino acid units arranged in a unique order. It is this sequence of amino acids which determines the shape and, therefore, the function of a protein.

There are potentially an enormous number of different proteins: indeed, with 20 different amino acid bases, there would be over 20 ^100 different proteins having a length of 100 amino acid units. Given this enormous potential it is, therefore, surprising that an organism like the bacteria E Coli which is built up from over one million molecules contains only 3000 different molecules. The reason is that proteins are not randomly produced; they are, in fact, assembled to order by the cell's genetic code, a code which is stored on a special molecule, DNA.

The DNA molecule is assembled from four different amino acid subunits to form a long string which is twisted to form the famous double helix. DNA is essentially a molecular equivalent of a computer program. It is a program which produces protein molecules; it is also a program capable of producing replicates of itself. The long DNA strand contains a series of coded sequences, each relating to the synthesis of a particular protein. These coded sequences are referred to as genes.

The fact that virtually all biologically-active molecules are built up from a very small number of building blocks, and the fact that DNA is a molecular synthesis code, has led molecular biologists to investigate techniques of adapting these processes in order to synthesise biologically active substances artificially. This would have particular application in medicine where theoretical pharmacologists have already used computer-generated molecular graphics displays to design new forms of drugs. This area of study has now become known as genetic engineering.

'. . . computers will play a very important part in the eventual conquest of such human ailments as cancer and AIDS.'

Genetic engineering would be impossible without the aid of computers. Not only are they required to help design the required gene, they are also essential in the process of gene synthesis. Basically, genetic engineering consists of creating a synthetic gene which is capable of producing a desired chemical; this is then inserted into the genetic code of a very simple organism such as a bacterium. Inside the bacterium this new gene will produce the desired chemical. By breeding the bacterium in large numbers, usable amounts of this chemical can then be extracted and purified.

Synthetic genes usually consist of 500 and 1000 amino acid base pairs which must be assembled in the correct order. This is an exceedingly complex and lengthy process; in fact, a gene with 124 amino acid pairs requires over 12,000 different operations in its synthesis. Because of this complexity, molecular biologists have developed a range of very sophisticated computer-controlled synthesis devices which have collectively become referred to as gene machines.

Most gene synthesis techniques are based on what is known as the Merrifield solid phase peptide synthesis method. This involves growing the gene molecule on a microscopic sphere of polystyrene. Millions of these tiny spheres are contained in a reaction vessel. The amino acids are added one by one to this reaction vessel and attach themselves to the end of the synthetic gene. This is not an unduly difficult procedure; it is just repetitive and requires constant attention to detail in order to avoid errors. For this reason, it is ideally suited to computerised control.

Once a gene has been synthesised, it needs to be inserted into a host living organism. Here again computers are an invaluable aid, this time in the form of an expert system. Stanford University has developed one such system called Molgen. This has an extensive knowledge base on both genetics and laboratory procedures, and can help the scientist splice the synthetic gene into the genetic material of a bacterium so that the bacterium will manufacture the desired protein.

The future

Probably the greatest advances lie in the field of molecular biology. Computers can be used to design and create new drugs: drugs which can target and destroy a single substance and *only* that substance. Using computer models of viruses, it is possible to design drugs which will latch on to the shape of the virus and then destroy it. Similarly, drugs can be designed which will target and destroy specific forms of cancerous cell. In fact, computers will play a very important part in the eventual conquest of such human ailments as cancer and AIDS. They will help design the drugs and they will help manufacture them for commercial use using genetic engineering.

A spin-off from this work on drug synthesis is directly of interest to computer users — this is the possibility of creating a molecular computer. Already, workers in this area have utilised some of the molecular biologists' discoveries to create simple molecular logic gates. They are now investigating the adaptation of the Merrifield synthesis technique to the construction of circuits containing large numbers of molecular logic gates. In fact, researchers at Carnegie Mellon University are confident that within two years they will have created assemblies with more than 1000 logic gates. This form of computer would be infinitely small: a one cc device would be more powerful than the largest current computer and also more than 100 times faster.

The future for computer-aided molecular design and synthesis is one of considerable promise. Indeed, one Russian researcher has gone so far as to say that with the aid of computers, man may one day be able to create life itself. END

Making the most of Ventura Publisher

The popular DTP software package, Ventura Publisher, boasts ease of use and powerful facilities, yet you may need a little help to get the most from your system. Edward Brown documents some of the package's salient features and outlines some useful and effective methods of presenting your text.

It is hard to believe that Xerox Ventura Publisher Version 1.0 was first launched into the IBM PC world only one year ago. With its launch, the second generation of desktop publishing software was made available on an IBM PC/XT providing facilities which were previously considered possible only on an Apple Macintosh. Since then Ventura Publisher has been further refined and improved and Version 1.1 has been released in several languages throughout the world.

Ventura Publisher provides a quick and easy method of producing documents ranging from one page to several hundred pages in length. To do this it utilises the concept of 'stylesheets' which store the details of the document layout, making it easy to experiment with different layouts for the same piece of text. The ease of use yet powerful facilities of Ventura Publisher are what makes it the most popular desktop publishing package for businesses today, but some people may still not be using Ventura Publisher to its full potential.

The purpose of this article is to show you some ways of making better use of Ventura Publisher. I shall do this by overviewing the configuration of the system followed by a brief look at the menus. Then I'll be looking at ways of using the menus to create a variety of effects.

Configuring the system

Ventura should be configured to gain the maximum from the system. The normal configuration for a system with Ventura Publisher is to place the BUFFERS=15 and FILES=15 statements in the CONFIG.SYS file. At the same time as doing this, check to see that there is no memory resident software loaded by the CONFIG.SYS file. For some mice it may be necessary to load a memory-resident program via the CONFIG.SYS file. Next check the AUTOEXEC.BAT file and remove any programs that would become memory-resident. Typically, these are programs such as SideKick or Superkey which are initiated from the keyboard by a special key sequence. Ventura Publisher will run on a 512k system, although when using Version 1.1 it is better to have a 640k system. Both memory and time can be saved by using the US hyphenation algorithm in place of the UK hyphenation algorithm. The fast US algorithm is not as accurate as the UK algorithm but the advantage is that it occupies only one third of the memory.

To install this algorithm, first rename the UKENGLSH.HY1 algorithm in the VENTURA sub-directory to UKENGLSH.OLD. Following this, copy the USENGLSH.HY2 algorithm off disk 1 onto the VENTURA sub-directory using the command:

```
COPY A:USENGLSH.HY2
  C:\VENTURA\USENGLSH.HY1.
```

Ventura Publisher will now use the faster US hyphenation algorithm to hyphenate the text. Although there is an increase in speed, this is only noticeable when the text is first loaded and hyphenated — as such the benefit of this change is limited. The prime advantage is for those with 512k systems who would benefit from the additional free memory. *Do remember* that if you have used this technique and then return to the other algorithm that the text file you are working on may no longer fit in memory; this may require it to be spooled out to disk which will greatly slow down performance.

If you have more memory available to you than the basic 640k, then a number of techniques can be employed to enhance the performance of Ventura Publisher. You can create a RAM disk and use this as the spool area if the limit of 640k is exceeded. To do this you must alter the VP.BAT file by adding /O=M: to the line beginning DRVRMRGR where M: is the RAM disk you have created. When doing this, it is also necessary to ensure that the SET LASTDRIVE= statement is used in the AUTOEXEC.BAT file to ensure that the M: drive can be accessed and to set up the RAM disk prior to use.

A better way of utilising the additional RAM is to install a disk cacheing program, such as FLASH, which will utilise the RAM provided by buffering the files as they are used. This cuts down on the number of disk reads which are required and speeds up the whole process. By using FLASH the disk is rarely accessed when changing between modes, and this greatly increases the overall performance of Ventura Publisher.

A la carte menus

Let's look first of all at ways of using Ventura Publisher's menus.

Desk menu At first glance the Desk menu appears to have nothing of interest to the user and this is how it is *intended* to look. However, if you move the mouse to the word Ventura located in the top of the bottom left-hand box and click on the mouse, another dialogue box will appear. This dialogue box gives useful information about the current state of Ventura. The most important value to look at is the 'amount' swapped out. If this value is not zero, it means that Ventura Publisher has started to utilise the disk for swapping data and the speed will be affected.

Files menu When dealing with files within Ventura, it must be remembered that several different files are used for each chapter. As a rule of thumb, if you are creating a one-chapter publication, then store all the files in one sub-directory; if you are creating a multi-chapter publication, store your files in several sub-directories under one main directory. The breakdown of the sub-directories should be based on those which Ventura uses for making a Multi Chapter Copy All.

Sub headline

This sub headline was created by first selecting the paragraph and creating a new tag called 'sub head'. Next the tag was set to 18 point Times Roman bold using the font entry of the paragraph menu. The 'Ruling Line Below' option was selected from the paragraph menu and custom width was selected from the top line of options. The custom indent on the right-hand side of the dialogue box was set at two and a half inches with the custom width set to one inch. Finally, the space above rule one was set to 0.04 inches and the height of rule one was set to 0.02 inches. Although the ruling line below can be placed anywhere across the page, it is best placed centrally under the text. To calculate the custom indent value, subtract the width of the ruling line from the width of the frame, take this value and halve it to give the custom indent value. If the custom width is to be the same as the text, it is better to use the option of setting the width to text wide. This avoids unnecessary manual work when the text changes.

sub headline

Drop capitals

Drop capitals, or big first characters as they are known in Ventura Publisher, are most often used to introduce the first paragraph of a chapter or article. They can be used to great artistic effect and it is for this reason that they were used so frequently in illustrated manuscripts. Typically the character is in a large font which is different to the main body text, and the characters within the body of the text flow round the letter in some way. The example here was created by typing the paragraph and then selecting the 'Special Effects' option from the paragraph menu. Within the special effects dialogue box, the 'Big First Characters' option was selected, the set font option was then selected and the size of the character was set to 38 points so that it lined up with the bottom of the second line. By experimenting with the size and font of the character, together with the space allowed for the big first character, many different effects can be achieved and it is worth spending a little time examining the combinations. One application which I have recently seen employed is a special symbol font to introduce individual paragraphs.

Other effects can be obtained by combining the big first character with the 'Reversed Effect' illustrated on page 166. The effect of a white character on a black background can be created by utilising a custom ruling line to highlight the individual character or by using the technique already described and creating the first character as a separate paragraph. If a custom ruling line is used, be aware that every time you alter the first character you will have to modify the ruling line setting. Creating the effect with two separate paragraphs requires a little more practice but is more flexible in the long run.

Example of big first character showing how the characters on following lines flow round the character which is dropped into the text.

Tables

Although tables can be created very easily using Ventura Publisher's built-in graphics, this can be time-consuming and inconvenient when the information is coming from a different package. Another way of creating tables is to use the paragraph and ruling box around features of Ventura. This method was used to produce the table shown here. First of all the text was typed in ensuring that there was a paragraph end after each entry so that column one, column two and column three are separate paragraphs. Once the paragraphs had been entered, three tags called col1 and col2 and col3 were created. The font for each of these tags was set to 12 point Times Roman and the ruling line around option was set with the height of rule 1 being 0.01 inches and the width being frame wide. Each tag was set to an indent of 0.08ins using the Alignment option. As the basic attributes of each tag are the same, you may find it easier to set up one tag and then use the Create New Tag box in the side bar to create the other two from the original. Once the basic configuration was set up, each tag in turn was assigned to a paragraph. The paragraph containing the text 'column one' was selected and the tag col1 was assigned to it. The spacing option from the paragraph menu was used to set the in from left space to 0 and the in from right space to be 0. Following this, the paragraph containing the text 'column two' was tagged with the col2 tag and the spacing option was used to set the in from left space to 1.5ins and the in from right space to be 0. The paragraph containing the text 'column three' was tagged col3 and the spacing option used to set the in from left space to 3.0ins and the in from right spacing to 0. The various columns were aligned in the shape of steps with each item of text on a separate line. All that remains is to get the three columns on the same line. This was done by selecting column three and using the spacing option of the paragraph menu to set the above space to 0, the below space to 0.19ins and the interline spacing to 0. Then the Breaks option was used to set the Paragraphs break to none, column breaks to none and the line breaks to after. Next both col1 and col2 were set so that the above, below and interline spacing was 0 and the paragraph break, column break and line breaks were set to none. Once this was done, all the columns were now on the same line in the form of a table. The rest of the table items were tagged, making sure to tag the right-most ones first as this makes the whole exercise a lot easier. Doing this, it is best to tag the right-most table paragraphs first as this makes it easier to tag the other paragraphs.

Column one	Column two	Column three
Item one	Item two	Item three

When starting a chapter, first load the stylesheet required and, before making any changes, use the 'Save As New Style' option to save it to the required sub-directory. Next use the 'Save As' option to save the chapter in the required sub-directory. By doing this, the danger of overwriting a stylesheet is greatly reduced and the chapter can be saved at regular intervals using the controls (^S) command sequence.

For several of the graphics options, when a file is loaded it is converted into a GEM format. By using these GEM files in place of the original files, the amount of disk space required can be reduced. To do this the original files need to be loaded into the chapter which will cause them to be converted. Next, load the GEM files created and replace the originals in the chapter. Now remove the originals from the file list by using the 'Remove Text/File' option in the edit menu and save the chapter. You can now exit Ventura and copy the original files onto a floppy for archive purposes and delete them from the hard disk.

Edit menu The 'File Type/Rename' option can be used to change the form of a text file so that it can be used by another word processor. This is achieved by selecting the option and then specifying the new format of the file. The next time the chapter is saved, the text file will be saved in the new format.

Page menu The 'Go to Page' option can be used to move to any page in the document rapidly. Use the keyboard shortcut ctrl-G (^G) to achieve this as it is more convenient. When selecting page numbering and chapter numbering, it is worth noting that the text options (for example, ONE, TWO, THREE) are not available in language versions apart from English and American English. When working on a chapter, remember to perform a renumber chapter at regular intervals to maintain the numbering in your chapters.

Frame menu A number of useful effects can be created with the ruling lines options from the frame and paragraph menus, and these are discussed below. The Anchors and Captions option is used in conjunction with the edit and page menus to tie graphics to a particular piece of text. In this way, text can refer to diagrams in a manner such as 'see diagram below', and the diagram can be maintained by anchoring it to the text and using the Frame re-anchor option in the pages menu.

Paragraph menu The Paragraph menu is used for creating a number of effects to enhance the appearance of your output. The most obvious of these is the special effect option which provides the facility to produce bullets and large first letters together with full positioning and size control. When used in moderation these can be quite dramatic. By using the Assign Function Keys, paragraph tag values can be assigned to the function keys and used during the paragraph tagging or text editing phase of document preparation.

Graphics menu When using the graphics menu use the 'Save To' and 'Load From' options for saving and restoring line and fill attributes.

Options menu Use the Options menu to set up the various facilities Ventura Publisher offers. For most uses turn on the rulers as they are useful for positioning columns and frames. Graphics should be turned off except when it is essential to see the graphics. This will considerably increase the speed at which the screen is redrawn. Use the Add/Remove Fonts option to reduce the fonts loaded to those which you are going to use.

Good design means that you should only be using two or three typefaces in two or three sizes for your document. This will reduce the size of the width table and increase the memory available for Ventura to perform other tasks.

Conclusion

Many useful and effective methods of presenting text can be developed using the facilities provided by Ventura Publisher. These effects only need to be created once and can then be used over and over again in your documents simply by tagging the text with the required tag. Some of these effects are illustrated in the boxes which accompany this article.

Reversed headline

The reversed headline shown here was created by first selecting the paragraph and then creating a new tag using the 'Create New Tag' button in the side bar. This new tag was called 'Reverse Head'. Next, the font was set to 24 point Times Roman bold and the colour was set to white using the font entry of the paragraph menu. The ruling line above entry of the paragraph menu was used to create a ruling line which was text wide with a rule one height of 30 points. The space below rule three was set to 30 points minus. The minus is selected by using the two boxes to the right of the space below rule 3 setting. The selection of a negative value causes the ruling line to drop down over the text providing the reversed headline. Now, wherever you want a reversed headline, you can tag the paragraph with the newly created reverse head tag. Other effects can be created in a similar way by using different colours of text and background, and it is worth spending some time experimenting with different combinations of shading to see what effects you can produce on your printer.

REVERSED HEADLINE

Change bars

When text is updated it is often desirable to place a change bar in the margin so that other readers can see which paragraph has changed. This can be achieved using the ruling box around effect of Ventura Publisher. First a new tag called 'Change Bar' was created by selecting the paragraph followed by 'Create New Tag'. This provided a tag with the same attributes as the base tag. Next, the ruling box around option was selected from the paragraph menu and the custom width was selected from the first line of the dialogue box. The height of rule one was set to 0.003ins, the custom indent was set to 3 points, the indent set to minus, and the custom width set to 0. This Change Bar can now be used, whenever required, by assigning it to one of the function keys by using the CTRL K shortcut; it can also be used when entering text within Ventura, thus providing a useful way of feeding back to the authors any changes that were made in the text.

> The ruling box around feature can be used to provide a change tag facility.

Call outs

Often in magazines a call out such as the one shown here is used to draw attention to a particular passage in the main text. This effect is a variation on the sub headline method of creating a tag. The call out was created by first selecting the paragraph and creating a new tag called 'Call Out'. Next the tag was set to 18 point Times Roman bold by using the font entry of the paragraph menu. The ruling line below option was selected and the frame wide option selected from the top line. The space above rule one was set to 0.04 inches and the height of rule one was set to 0.04 inches. Having completed the settings for the ruling line below, the ruling line above option was selected and the ruling line was again set to frame wide. This time the space above rule one was set to zero, the height of rule one was set to 0.20 inches and the space below rule one was set to 0.08 inches. Now the Call Out tag can be used wherever required.

Call out as in magazines

Small Caps

As shown in the example here, small caps are of an equivalent size to the lower-case letters of the font used and are used for such things as product names. The small caps in the example were created by selecting text mode and then positioning the text cursor at the beginning of Lotus 1-2-3. Next, the shift key was pressed and the cross bar cursor moved to the end of Lotus 1-2-3. The mouse button was depressed, which resulted in the text being highlighted. It is also possible to drag the cursor across the text in order to highlight it if this is preferable. With the phrase 'Lotus 1-2-3' highlighted, the option 'Upper Case' was selected from the side bar window followed by the option 'Small'; this resulted in the text being changed to small capitals. The same was then done for the other product names in the example. It is worth noting that the dBase example had to take into account the fact that dBase starts with a lower-case letter and that this also needs to be in the small mode to match up with the rest of the name.

A quick straw poll revealed that LOTUS 1–2–3, WORDSTAR, dBASE, and XEROX VENTURA PUBLISHER were the best known packages in their respective areas.

Additional information

The use of different fonts for several of the examples here shows what can be achieved with a little thought as to how to present information. The restriction on fonts is now changing, and there are a number of products available which enable the user to select the fonts he or she requires.

One of the most recent and interesting products on the market is the Fontware Package for Ventura Publisher which is available from Bitstream. This allows the user to select the fonts he requires for his printer, together with matching screen fonts for the screen he selects. Other products in this line which I have recently seen are available from Softcraft Inc, Weaver Graphics, The Laser Edge, and Graphic Displays.

Including graphics in your presentation is another way of drawing attention to your document and two useful things are screen images and clip art. Screen images are straightforward captures of what is on the screen and clip art is a collection of images from other sources. With regard to screen capture the most useful package I have so far come across is Hotshot from Symsoft, which allows the capture of both graphics and text screens. These can then be converted to PCX format or EPSF format, both of which can be loaded into Ventura Publisher. Other screen capture programs are available within many graphics programs and probably one of the most useful with Ventura Publisher is that supplied with Halo DPE from Media Cybernetics. With regard to clip art, the only examples I have seen are from PC-Quick Art Inc which keeps an extensive library.

Two further programs which have been specially designed to work with Ventura Publisher are worthy of mention. VP/Tabs and VP/Saddle are both written by The Laser Edge and are designed to enhance the use of Ventura Publisher. VP/Tabs is used as a pre-processor for Lotus spreadsheets so that they can be loaded into Ventura Publisher and processed correctly. This is done by replacing the spaces inserted by Lotus 1-2-3 with tabs which can then be set up in Ventura Publisher.

VP/Saddle is used to post process a PostScript file to produce pages in various formats which are suitable for the production of books and booklets.

Bullets

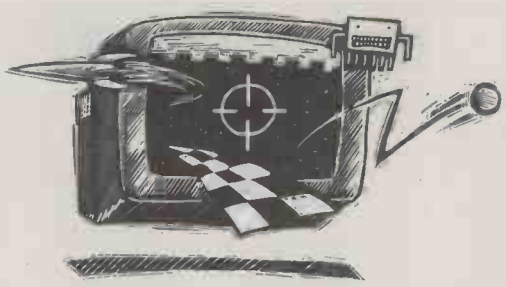
Bullets are used to introduce a list of items such as:

- Agenda items
- Action items
- Contents
- Enclosures

where each item is preceded by a distinguishing character. In the example here, the bullet used has been a dot placed in front of the text in a central position followed by an indent. Using Ventura Publisher it is easy to produce this type of bullet, by first selecting paragraph mode and creating a new tag called 'Bullet'. Then the 'Special Effects' option of the paragraph menu was selected, followed by the bullet box on the top right. The bullet options then became highlighted, the round bullet was selected and the ASCII code for this was displayed in the dialogue box as 195. Next, the set font attribute box was selected and the font was set to 12 point. The values were then accepted and the bullet was added to the font of the text. Great flexibility in bullet styles can be achieved by selecting the box which says 'Other' and selecting a different font such as the symbol font or a dingbats font (the latter font is only available if you have a postscript printer).

Example of a bullet list

- Type text
- select paragraph
- select "create new tag"
- call it bullet
- select special effects
- ✍ select bullet
- ✍ select dot
- ✍ select set font
- ✍ set to 12 point Times Roman Normal
- ✍ select OK
- select OK



How low — or high — can you go? Cloning creepie crawlies to mate with and hanging around seedy clubs to pick someone up is bad, but you can drastically change your habits with a trip in Apollo 18. Stephen Applebaum gets to grips with this month's top games.

Low life

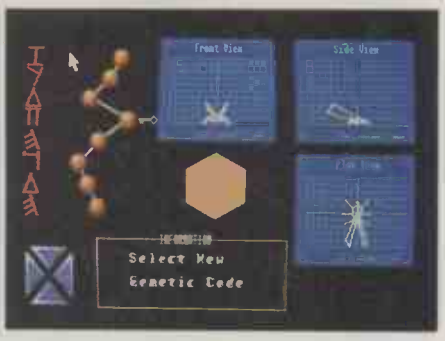
Title: Eco
Computer: Atari ST; Amiga
Supplier: Ocean
Format: Disk
Price: Atari, £19.95; Amiga, £24.95

The survival of our species is not something many of us have much cause to think about in our daily lives. With food and shelter available in abundance, we pass our days almost mechanically, worrying neither about where the next meal will come from nor about where we will stay after leaving the office.

Imagine, then, what it would be like to live in a world without all the material things we have surrounded ourselves with over the centuries. Imagine, in fact, what it would be like to be a creature fighting for survival in a world where animal life is divided simply between predator and prey. If you were one of the latter, would you be able to survive? Moreover, do you think you could survive long enough to evolve into the dominant species, hunter of all creatures and prey to none?

These rather intriguing, if inadequately hypothetical, questions are the basis for Eco, an intelligent, and brilliantly conceived and executed program from Ocean. Unlike anything you have seen before, Eco is a stunning, if highly stylised, simulation of a world inhabited by a large variety of fauna and flora representing almost every level of the food chain. Starting from the lowest form of life — say, a fly or a worm — you must eat, mate, and develop more complex offspring, with the aim being to develop so far that you are able to hunt *anything* without fear of being hunted yourself.

Eco opens with a beautifully-presented and thought-provoking extract from Darwin's *Origin of Species* that effectively galvanises one's imagination into overdrive. Having created the right atmosphere, the program then goes on to select randomly



an ecosphere based on one of several different worlds, each with its own climate.

The diversity of plant and animal life that subsists in a world depends entirely on the prevailing climatic conditions. For instance, only the likes of scorpions can live in arid desert conditions, while a lush equatorial region gives rise to a large variety of creatures, including simple insects and hominids.

During play, the display divides horizontally into two halves. The top half forms a window on to the world chosen by the computer; and the bottom half contains a number of icon controls to move your assigned creature along the ground in any one of eight directions — to send it on a search for food or, alternatively, for a mate — and, if it is a winged beastie, to make it take off and land.

A small radar feature tracks the movements of other creatures, allowing you to keep an eye out for possible sources of food and, rather more important, for predators who may be planning to make you their next meal.

In the top window, you can see not only your own creature but also any others in the vicinity. This part of the display is testimony to the skill of the programmers at Denton Designs, a name that disappeared from these pages a long time ago but has re-emerged triumphant.

All the creatures are depicted as fully-animated vector graphic figures which run, bound, scuttle, fly or wriggle across the screen without the hint of a flicker. The most impressive of all the animals is the seemingly indefatigable hominid, which runs and walks with immense grace and stops only to pick up a bite to eat, whether it be a hapless insect or a large quadruped.

Using the Atari's arrow, home and insert keys, you can pan around the landscape as though you were in control of a camera able to move in any direction. Via this option, you can move around your creature and examine it from virtually any angle. And, when another animal runs by, you can spin round so that you can watch it run towards you and then away in the opposite direction.

The most important thing to do when the game begins is to find food. Depending on the climate, this can be either super-abundant or scarce; but, no matter where you are, it is always in the form of stubbly grass.

Finding food is simple: all you do is move around the world until you come across a blade or two of green, and then click on the 'eat' icon to start your creature munching. Alternatively, you can click on the eat icon from the outset, in which case your creature will search for food of its own accord.

As your creature eats, a skull, with its jaws chomping, rises on a spine-like stalk in the bottom right-hand corner of the display. When it has risen to its full height, a fire, symbolising death, flickers at the spine's base. As your creature ages, the flames rise until,. at the point of

death, the skull is engulfed.

When you have successfully fed your creature, you can send it off to look for a mate. After it has found one, the display changes to reveal an ingenious little item called the 'gene designer'.

The gene designer allows you to play either God or Frankenstein, depending on how you look at it; for this is where new and, perhaps, better life is created. Down one side of the designer runs a line of eight hieroglyphs, beside which are eight corresponding orange balls representing the eight genes that make up your creature's DNA.

Each time your creature mates, you can 'unlock' one of the genes: you can drag the unlocked gene to various positions either left or right of its original one. Each time you move the gene a certain distance, its corresponding hieroglyph changes, indicating a change in the overall DNA structure. The effect this has on the physical characteristics of your creature are shown on a blueprint lying alongside the DNA filament. A gene unlocked in this way remains unlocked, and can be moved in combination with others whenever your creature mates.

Learning what each gene controls is a major part of the game. Sometimes you may unlock one and find that the only effect it has is to give your creature a bigger nose or longer arms. At other times, however, a single displacement can turn your animal from a hominid into a large chicken, or even a slug. But, being a slug is not as bad, believe it or not, as being a plant. Become one of these and your chances of survival are zilch.

When you return to the main screen from the gene designer, the first thing you notice is that your creature is much smaller than all the others roaming about. This is because it is but an infant and, therefore, must be fed to enable it to grow to maturity. Having fed, it can then look for a mate.

One thing you must avoid when creating a new species is making it too exotic. Although giving it wings, a massive proboscis and legs might have seemed a good idea at the time, you will soon find that it becomes extinct through not having another creature even nearly like itself to breed with.

Eco is one of the most unusual, and certainly inventive, games to have appeared on the scene in the past year or so. Its graphics and gameplay make it instantly appealing, though some people, particularly those who go in for shoot-'em-ups, will perhaps find it rather too pedestrian for their tastes.

One small step

Title: Apollo 18
Computer: Commodore 64/128
Supplier: Electronic Arts
Format: Disk; cassette
Price: Disk, £14.95; cassette, £9.95

If you are old enough to remember the Apollo space missions, you will no doubt remember the thrill of watching Man's first tentative steps on the moon. And, when Neil Armstrong spoke those immortal words: '... one small step for man, one giant leap for mankind', who but the most blasé could fail to feel a degree of pride at the enormity of the achievement.

Sadly, those pioneering days are gone, at least for now. Not even the Space Shuttle managed to affect the world's collective consciousness in the same way as the Apollo project.

If you yearn to relive the days of lunar landings and heart-stopping splash-downs, Electronic Arts' Apollo 18 is probably as close to the real thing that you can get without actually leaving your front room. It is not a precise simulation as such, but the atmosphere that it creates sure sends a shiver down your spine.

Apollo 18 puts you in the driver's seat, so to speak, of an Apollo rocket. Your mission is to blast off, dock with an orbiting space station, land on the moon, drive around the lunar surface, take off and re-dock with the command module, perform a spacewalk, capture a satellite, and then, finally, re-enter the earth's atmosphere and splash-down. Easy, huh?

The blast-off is viewed from inside what I suppose is meant to be the control room at Cape Canaveral. In front of you are a number of controls, beyond which are ranged various monitors manned by control staff members. In the distance, through a window on the far wall, you can see the rocket.

Prior to take-off, it is imperative that you make a number of pre-flight checks via what is called the 'telemetry screen'. There are a number of telemetry screens in the game, each corresponding to one of the mission phases. It is almost impossible to do anything without first of all programming something or other in the telemetry screen.

After making the necessary pre-flight checks, a very clear, very serious, extremely American voice advises you to begin the count-down by pressing the joystick fire button. From here on, success depends entirely on hand/eye coordination.

As the rocket rises from its pad the scene in the far window zooms in on the action, so that you get a view rather like that in the now famous film taken from a camera placed looking down the sleek body of an Apollo rocket as it pulls away from its moorings. Although not nearly as impressive, the game's graphics and roaring engine sound effects are good enough to evoke in one's mind the experience of watching the actual event on television.

To clear the first stage safely, you must watch a red strip which moves horizontally across the screen. When it gets to a specific point, you must press the fire button with the aim of stopping the strip as close to said point as possible. When you press the button, a time in 1000ths of a second appears in a small onscreen readout. If, after performing this procedure several times during the first phase, your cumulative time is 148 or greater, the mission is automatically aborted.

Okay, this doesn't sound too bad. But, as well as making sure that the red line does not overshoot the critical point, you must simultaneously keep the craft from over-rotating by moving the joystick left and right. Phew! If you think this sounds difficult, it is; or at least it is until you get the hang of it.

Once out of the earth's atmosphere, you go into a quick orbit before heading off for the moon. From now on, you see things through the eyes of the astronaut manning the craft.

On the way to the moon, a number of course corrections have to be made via the onboard telemetry system, as must a routine docking procedure with an orbiting space station. Once again, a steady hand is required to guide your craft into the docking section of the space station.

One of my favourite phases in the

game is the space walk, in which you practise capturing a satellite launched from your craft. The idea here is to guide an astronaut figure towards the satellite, hook it, and drag it back in. This section, like everything else in the game, is scored on the time/number of attempts taken for the satellite to be recovered.

My one gripe about the cassette version of Apollo 18 is that each phase has to be laboriously loaded in separately. If you fail halfway through a mission, this means having to rewind side A and then re-play the tape until the beginning of the load code is found.

Electronic Arts could make this less tiresome by starting the code near the beginning of the tape instead of what seems nearly a quarter of the way through.

Apollo 18 is a fairly simple but extremely effective evocation of the ethos of the Apollo project. Its graphics are, on the whole, good, as are the sound effects. If you were, or are, fascinated by what was an historic achievement, Apollo 18 will certainly liven up your game-playing.

The butt of the joke

Title: Leisure Suit Larry in The Land of the Lounge Lizards
Computer: Atari ST; IBM PC; Amiga
Supplier: Activision
Format: Disk
Price: £19.99

Leisure Suit Larry in the Land of the Lounge Lizards is a picaresque tale about a rather seedy chap who scours the less glamorous clubs and bars of Lost Wages for a girl who will submit to his, er . . . charm. Larry has just turned 40 and has never been 'kissed', for want of a better word. Tonight could be the night, however, when his dreams finally come true. Then again, tonight could also be the night when he gets knocked down by a speeding car, or mugged and beaten up by an irate taxi driver, or urinated on by an errant hound or even crippled with some unspeakable disease.

Before anyone starts ranting about the corruption of the country's youth, it should be noted that Leisure Suit Larry is aimed specifically at adults. A printed warning, albeit one of almost microscopic proportions, on the outer packaging informs people that the game contains 'adult subject matter' and that 'parental guidance is suggested'.

After this first rather weak line of defence comes a series of 'adult'-oriented questions which must be answered before the computer will load the game proper. If you do not answer the requisite number of questions correctly, the program crashes and you have to re-boot the disk.

Larry Laffer is the hero of this rather wild 3-D animated adventure from the creators of the King's Quest series, and also the character you play. Despite his pretensions to being cool and irresistible to the opposite sex, Larry is actually a bit of a bozo.

He is the kind of character who goes to discos alone, dresses in a white suit like that worn by John Travolta in *Saturday Night Fever*, and reeks of after-shave. Apart from hovering round the edge of the dance floor leering at the ladies, he can usually be found carelessly leaning against the bar, sipping a 'Long-Slow Screw Against The Wall' cocktail or a Malibu and pineapple. Larry is the kind of guy, in other words, that female contestants on *Blind Date* have nightmares about choosing, or, equally bad, being chosen by. But whatever one may think of Larry, he is unfortunately the hero of the game, so I suppose we must sympathise with his plight.

The game opens with Larry standing outside the door of what the proprietors laughingly call a hotel, but is really a brothel. Inside, Larry can buy a drink at the bar, talk to a drunk, and do what you would normally expect to do at such a place. Getting into the hotel is easy, but unless Larry has a 'mate' with him, he will not survive long after his little rendezvous with the lady of the house. Those who go in, rarely come out.

The escapades of our would-be Don Juan are shown in colourful, fully-animated graphics, similar in style to those in Sierra's other 3-D adventures. Before you get too worried, though (or over-excited, depending on your temperament), the graphics, on the whole, are simple and lack detail. Larry, like the hero in King's Quest III, can be made to walk around the screen using the numeric keypad. (If anyone is wondering, actions of a lubricious nature are controlled by the computer.)

Although Larry can get to most locations on foot, there are times when he has to take a taxi. This, as far as I am concerned, makes for one of the game's most inventive screens. Once Larry has climbed into the rear seat of a cab, the display changes to a view from behind the vehicle. Looking through the rear window, you can see the back of Larry's head, the driver, and the oncoming buildings as they rush by on either side.

If Larry happens to be carrying a bottle of liquor in his pocket, the driver snatches it from him and knocks its contents back in a single blast. Consequently, he swerves the car from side to side and eventually crashes it. The effect is amusing and a little hair-raising.

A feature that Leisure Suit Larry has which other games of its genre do not are facial close-ups. When Larry meets a girl, typing 'Look At. . .' reveals a close-up of her face, complete with batting eyelashes and pouting lips. Depending on the chat-up line you use, she either smiles or frowns.

Taxi rides, drinks, discos, girls, all require money; and, in a town called Lost Wages, nothing comes cheap. When your finances begin to dry up, the only way to replenish them is to go to the town's casino and play blackjack or the slots (fruit machines). These, too, are shown in close-up. The blackjack sequence looks and plays as good as any card program on the market. The animated fruit machine is also excellent, though you should avoid it unless you can afford to lose the odd dollar.

Leisure Suit Larry in the Land of the Lounge Lizards is a great fun game. That said, however, its treatment of women is rather dubious — for the most part they are portrayed as sex objects and nothing else. One comment I find particularly distasteful is one made by a character who, giving Larry a knife, tells him he might need it because there 'are some kinky girls in this town'.

In the game's defence, it is the women who are the real heroes, not Larry. Although seemingly the victims, they outwit him every time. END

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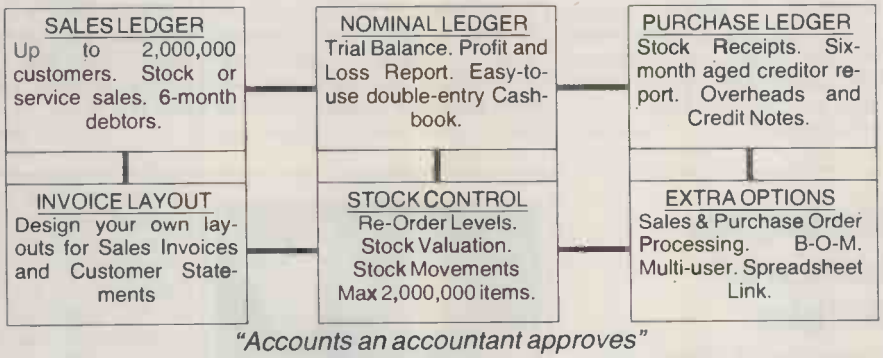

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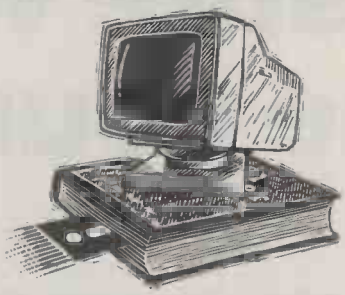
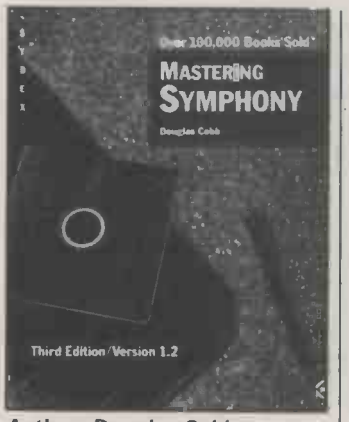


The application of microcomputers for financial planning, and alternative spreadsheet manuals, come under our reviewers' spotlight this month.

Mastering Symphony



Author: Douglas Cobb
Publisher: Sybex
ISBN: 0-89588-470-4
Price: £24.95

This is a megabook to match a megaprogram — my first impression of it was of a cross between hundreds of screenshots and an unedited version of the *Bible*. It contains eight sections, 31 chapters and over 800 pages. The section headings are 'Introduction', 'The Spreadsheet', 'Services', 'Graphics', 'Word Processing', 'Database Management', 'Communications' and 'Advanced Topics'. However, its size has certainly not dampened its popularity. It is now in its third edition and the cover claims that over 100,000 have been sold.

The author, Douglas Cobb, is a highly regarded spreadsheet writer and has provided an excellent combination of both tutorial and reference material which can be used by beginners and experienced users alike. For example, the section on Communications, although detailed, contains a primer chapter that explains among other things how a modem works and what the X-on X-off protocol is. As a reference book it is also very comprehensive. Each of the program's many spreadsheet functions, for example, is explained clearly and carefully, using examples where necessary. Throughout the book the author provides helpful, practical details and plenty of tips and advice — features which are sadly lacking in most software manuals. The author also sprinkles the book with useful and interesting background information which makes it easier and more pleasant to use — although it still wouldn't make light bedtime reading.

Overall, the book is well-organised and illustrated. However, because of its size, I did find it easy to get lost in the pages — some additional information at the head of each page — such as section and chapter number — would have been useful. In addition, I found the book physically bulky, and would have preferred to see it published as a set of two or three separate, smaller books. Some colour might have been useful to lighten it up and maybe index the page edges for easy reference.

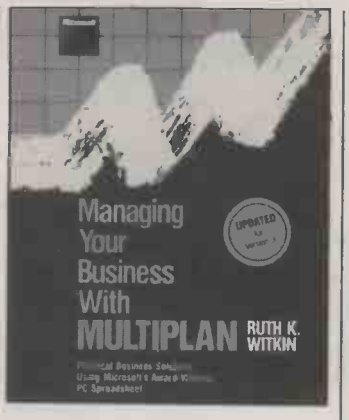
If you need a book on Symphony to complement the software manuals, however, I would strongly advise you to buy this one.

Anthony Meier

Managing your business with Multiplan

Author: Ruth K Witkin
Publisher: Microsoft Press
ISBN: 0-914845-94-2
Price: £17.95

I have to confess that I've never used Multiplan and, although I'm no stranger to budget and gross profit analysis, I'd be hard pushed to tell you what 'loan amortization' or 'five-in-one depreciation' analysis means. However, if I did need to work in this field and I was using a spreadsheet for the first time to do it, then on the strength of this book I would certainly use Multiplan.



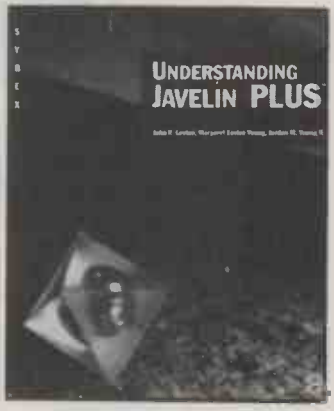
Geared specifically towards 'the small business user' (I find that an unfortunate phrase, as to me it always conjures up the image of a minute individual), the author presents a very friendly and helpful face to the first time (and also the experienced) user of Multiplan.

The heart of the book is really in Part Two where the author devotes individual chapters to setting up 12 financial spreadsheets and illustrates how to adapt them for your business. These spreadsheets range from the aforementioned loan appreciation and five-in-one analysis through price-volume analysis, project cost estimate, cash disbursements and cash flow analysis. The setting up of each spreadsheet is explained step-by-step and includes formatting cells, printing, using macros for speed and entering formulae. The remainder of the book deals with the obligatory introduction to Multiplan and how to create a general spreadsheet, and ends with how to use Multiplan to the fullest by explaining built-in commands, providing help and advice if your formula won't work, how to use the 'IF' and 'LOOKUP' facilities and, lastly, how to make macros work for you.

This book is very readable and it is very convincing in its praise of Multiplan (version 3) and how easily your own business needs could be matched to any of the presented spreadsheets. It is hard to fault Microsoft publications as they are all generally written to a very high standard; certainly, this book has done nothing to alter that opinion.

Lorna Kyle

Understanding Javelin Plus



Authors: John R Levine, Margaret Levine Young, Jordan M Young II
Publisher: Sybex
ISBN: 0-89588-358-9
Price: £19.95

The main author of this book, John Levine, is a software engineer and one of the creators of Javelin itself. (I wonder whether the program name was obtained from an anagram of his own name?) He certainly knows his subject and it shows in the book. It is not a replacement for the software manuals, which are excellent themselves, but a very useful addition.

The book's emphasis is on how to design and build models using Javelin Plus, making full use of the program's features and facilities. The book has a very practical bias and should ideally be used sitting in front of a machine running the program. The chapters take you through the design and creation of numerous actual models which are used to explain and illustrate Javelin's capabilities. The models cover a wide range of real-life applications such as business planning and mail list management. All aspects of model building are covered — there is a chapter that covers dealing with errors and diagnosing problems. There is a very useful section on good modelling practices like planning ahead and designing 'from the top down', and a section on good macro practices, like making your macros robust and readable.

Javelin Plus is a powerful and complex program that needs a book like this to help users get the most from it and use it to the full. The book covers both Javelin and Javelin Plus. The text is notably impersonal — factual and 'to the point' — but it is compensated for by being well-illustrated with diagrams, screenshots and tables. There are also handy notes scattered throughout the book for Lotus 1-2-3 users.

The book is a good buy if you want to learn more about modelling than the Javelin manuals can teach you. By covering a large range of example models in depth, the book condenses a considerable amount of knowledge and experience into its pages.

Anthony Meier

1·2·3 The Complete Reference

Author: Mary Campbell
Publisher: Osborne McGraw-Hill
ISBN: 0-07-881005-1
Price: $22.95

Lotus 1-2-3 is one of the success stories of the decade. Most micro users have used or seen it. My initial reaction to this book, therefore, was 'What else is there to say?'

The answer, of course, is in the title. This is 'the authoritative desktop companion of every Lotus 1-2-3 user.' New users may wish to start at page 1 and work through almost 900 pages of information, while more experienced users may dip and dive about as they wish. Mary Campbell, who regularly writes for *IBM PC Update*, *Absolute Reference* and *CPA Journal*, has performed a first-class feat in collating everything you ever wanted to know about 1-2-3, but were too afraid to ask.

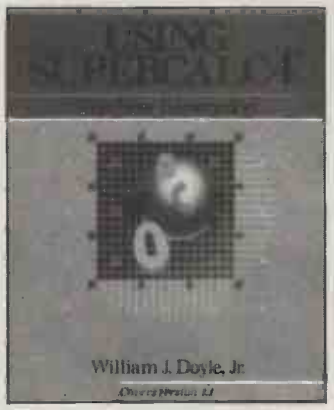
The book is divided into three main sections: Part One covers the worksheet and associated commands; Part Two deals with database and graphics commands; while Part Three 'expands the basic 1-2-3 features with the power of macros and add-on products.' No need to gnash your teeth either if you're sitting there with version 1A, which was superseded in the latter half of 1986 by version 2, as both versions are fully covered. I'd recommend that you update to version 2 though, with its 'greater memory capabilities, more sophisticated analytical techniques, new built-in calculating abilities and an expanded macro command language' or else you might find yourself excluded from the next office party.

The trouble with large softback volumes, and I mean *large*, is that the spine has a habit of breaking away from the contents after only a couple of uses. It would also have been nice if the production costs had run to a hint of colour and some kind of finger index; that aside, the author has made best use of the monochrome available by boxing off important points and interspersing the text with large, clear screen layouts. Copious worked examples are given to illustrate commands, and I was especially pleased to see good descriptions given to mathematical functions such as COS, TAN and EXP, as these are so often glossed over.

I'm sure every 1-2-3 user could find shelf space for this book; take it from me, you won't need to buy any other.

Lorna Kyle

Using SuperCalc4



Author: William J Doyle, Jr
Publisher: John Wiley & Sons
ISBN: 0-471-85992-3
Price: $24.95

I must admit that my heart sank when this book arrived for review: yet another guide for people who can't be bothered to read the manual. Although many pieces of software have documentation that appears to have been written by chimpanzees to be read by PhDs, SuperCalc4 users are fortunate in having a perfectly reasonable manual to work from. So why do books like this come onto the market?

Having said that, William Doyle has produced a good, comprehensive introduction to SuperCalc4 (Release 1.1), a spreadsheet in the mould of Lotus 1-2-3 and VisiCalc. He covers its features in the order that a beginner would be likely to need them, starting with moving around and data entry and working up through data manipulation, I/O, built-in functions and graphics to advanced capabilities such as macros and creating turnkey systems. The last chapter contains a couple of large examples, one of which enables those earning over $50,000pa to find their liability to US income tax; no doubt useful to someone.

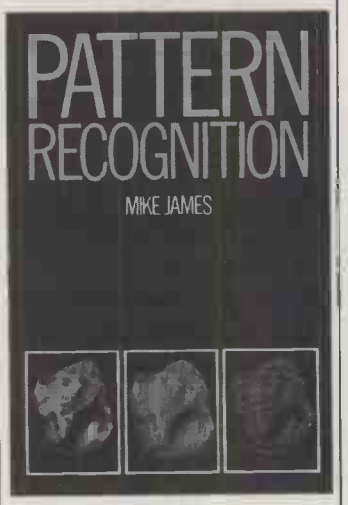
The book is written in an easy, tutorial style and explains the spreadsheet's facilities well. There are copious examples and exercises (with answers) throughout, each chapter building on the examples of its predecessor — a good incentive to work through and understand the system. It is sufficiently thorough and well-organised that advanced users could use it for reference purposes.

In conclusion, William Doyle has written an excellent introduction to SuperCalc4 which I would recommend to anyone who needs to learn how to use this particular spreadsheet and no longer has a manual.

Nicolas North

GENERAL

Pattern Recognition



Author: Mike James
Publisher: BSP Professional Books
ISBN: 0-632-01885-2
Price: £12

Pattern recognition is the central problem of computer vision. It is what puts the intelligence into seeing.

A favourite pastime of the MoD and the Pentagon, it is also the essence of OCR technology and has been used for activities as diverse as identifying cancer cells, classifying fingerprints and sorting the assortment into chocolates. Like so many areas of AI, it is now well within the grasp of modern micros, and the ready availability of cheap image digitisers makes it a distinctly practical possibility for many micro users. Books that might guide the newcomer are distinctly thin on the shelf, though.

Mike James' offering is designed to be used as part of an undergraduate course on image processing, though not necessarily by students of computer science. The bias is, therefore, towards practical techniques and this approach is supported by numerous Basic listings. These are clearly written and will run on most machines with little modification. The book is copiously, if rather primitively, illustrated and contains a bibliography and a list of suggested projects to help take things further.

All this is welcome, but I fear *Pattern Recognition* will be of limited use outside the confines of undergraduate

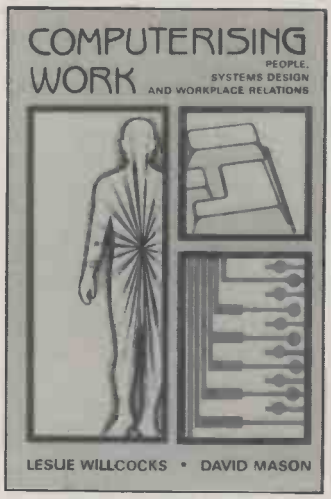
teaching. Unfortunately, the level of explanation fluctuates wildly. Boolean operators (familiar to many computer users) are carefully reinforced with the help of diagrams and truth tables — but if you don't know what a covariance matrix is or how to normalise a set of values, you're on your own.

This may be alright in the context of a university course that runs alongside a series of maths lectures, but non-students will have to fend for themselves. They will not be helped by occasional sloppiness. Several equations are given with not a hint about the variables and functions they contain. We are offered a subroutine to find the magnitude of a Fourier transform when it actually finds the power (magnitude squared). One diagram mysteriously has some co-ordinates in the form (x,y) and others (y,x). These might all be dismissed as minor quibbles but that would not be fair on the reader; anybody getting to grips with unfamiliar maths deserves clarity and a helping hand.

If Bayesian statistics, matrix algebra and Fourier transforms hold no terrors for you, then this book will be a good introduction to some simple practical techniques. Others will have to invest in some determination and a few maths textbooks to get through it.

Jack Weber

Computerising work: people, systems design and workplace relations



Authors: Leslie Willcocks & David Mason
Publisher: Paradigm
ISBN: 0-948825-65-0
Price: £9.95

Computer technology is so exciting that we often forget that these electronic devices are no more than tools to help people. *Computerising Work* takes a broad look at the human aspects of information technology in the workplace.

The book makes it clear that the users at the keyboard are not the only ones affected by the introduction of a computer system. Other interested parties, or 'stakeholders', include managers, programmers, shareholders, customers and the sales staff of the computer supplier. Some will see the use of computers as something to be welcomed, while others may be afraid of the consequences. To really understand the impact a new computer system can have, it is necessary to understand the politics of the organisation involved.

Having surveyed the basic issues, the book goes on to examine the problems of resistance to change. It contrasts the technocratic views of many systems analysts, who uphold the virtues and the inevitability of the new technology, with the views of a threatened workforce. Recent UK examples include a discussion of the newspaper industry.

Chapter 4, 'Design and the Systems Analyst', compares the traditional 'hard' systems design methodology with the more modern 'soft' approaches. Sensibly, it concentrates on the Checkland approach.

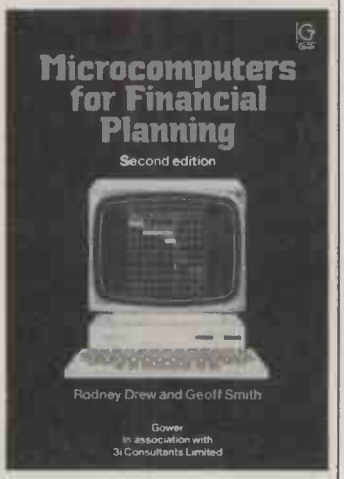
Two chapters deal directly with working with computers. The first relates to job design and the second to the environment and workstations. Industrial relations and managing implementation are covered, and there is a comprehensive reference list and guide to further reading.

Perhaps the most important feature of the book is that it brings together ideas from computer technology, organisational behaviour and management in a highly informative manner. As might be expected, individual topics can only be treated briefly within its 220 pages, but this is not a handicap for those who need an introduction to the subject. The examples are well-chosen and up to date, and include a discussion of the problems occasioned by the City's 'Big Bang'.

Computerising Work will make an excellent course book for both computer science and management students, and should appeal to trade union officials and managers who want to know more about the impact of computers. In fact, I have only one serious complaint — I did not discover this book in time to include it on the compulsory reading list for my own students!

Dr Chris Reynolds

Microcomputers for Financial Planning



Authors: Rodney Drew & Geoff Smith
Publisher: Gower
ISBN: 0-566-02579-5
Price: £25

Financial planning is a large, interesting and complex subject, as is the selection and implementation of packaged software. Each of these subjects could form the basis of a much weightier tome than this slim volume, *Microcomputers for Financial Planning*. It was, therefore, ambitious of the authors to attempt to distil their knowledge and experience into such a small vessel. The process has not been entirely successful and the resulting book has some shortcomings.

The book is divided into two sections: the first being concerned with financial planning in which the authors describe how planning systems operate; how they relate to accounting systems; the defects and difficulties of manual systems, and, finally, how computers can assist in overcoming these difficulties.

In this section the book addresses the novice financial planner, since it begins at a very basic level. However, such a novice could not hope to benefit fully from Chapter 3, which begins by describing simple budgeting techniques, and progresses to an airy passing mention of complex concepts such as 'margin mix' and 'product life cycle'. This illustrates a recurring problem in the book, which swings with confusing suddenness from addressing a total beginner to discussions which require a far greater understanding.

In describing how the computer can assist in the planning process, the authors feel it necessary to involve their novice in the minefield of communications and data transfer. Having presented a confusing and depressing picture of the unlikelihood of the user's needs being met, the reader is advised to seek professional help!

The chapter on financial planning software concentrates on 'Mastermodeller'. A detailed example is used to make a number of valid points about computer developments, which are relevant even on small-scale projects.

Chapter 6, which gives a detailed description of how to plan for a new business venture, is the one area where the authors maintain a consistent approach. The advice achieves the promised 'practical and down-to-earth' level and would benefit the novice reader.

The second section of the book explains microcomputers, the systems which run on them and how to select and implement them. Many of the terms which are explained in Part II have been used extensively in Part I, so readers may find it useful to begin at the end!

The issues of specification, implementation and project management are explained in a breathtakingly brief few pages. The value of such a short foray into these areas is highy questionable. While the authors have provided a number of useful checklists in the form of appendices, these are not sufficiently explained and must come into the category of 'a little knowledge . . .'

In summary, *Microcomputers for Financial Planning* attempts to do too much, and the useful messages it does contain are obscured in the process.

Karen Campbell

Jack Weber is a television producer.
Dr Chris Reynolds is a Reader in Computer Science at Brunel University, and author of the MicroCODIL educational language.
Karen Campbell is a chartered accountant who works for a major firm of consultants; she specialises in the selection and implementation of computer systems for financial management.
Anthony Meier is a chartered accountant and microcomputer consultant. **Lorna Kyle** is a systems analyst/programmer. **Nicolas North** is a computer science researcher at the National Physical Laboratory.
Next month: expert systems END

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```
MODULE Bench;
FROM IO IMPORT WrStr;
CONST NoOfIterations =   25;
      Size           = 8190;
VAR   I:CARDINAL;(* unsigned 16-bit intege

  PROCEDURE Sieve;
  VAR I,K,Prime,Count: CARDINAL;
      Flags: ARRAY [0..Size] OF BOOLEAN;
  BEGIN
    Count := 0;
    FOR I := 0 TO Size DO
      Flags[I] := TRUE;
    END;
    FOR I := 0 TO Size DO
      IF Flags[I] THEN
        Prime := I + I + 3;
        K := I + Prime;
        WHILE K <= Size DO
          Flags[K] := FALSE;
          K := K + Prime;
        END;
        INC( Count );
      END;
    END;
  END Sieve;

BEGIN
  WrStr("Start..");
  FOR I := 1 TO NoOfIterations DO
    Sieve;
  END;
  WrStr("..Stop");
END Bench.
```

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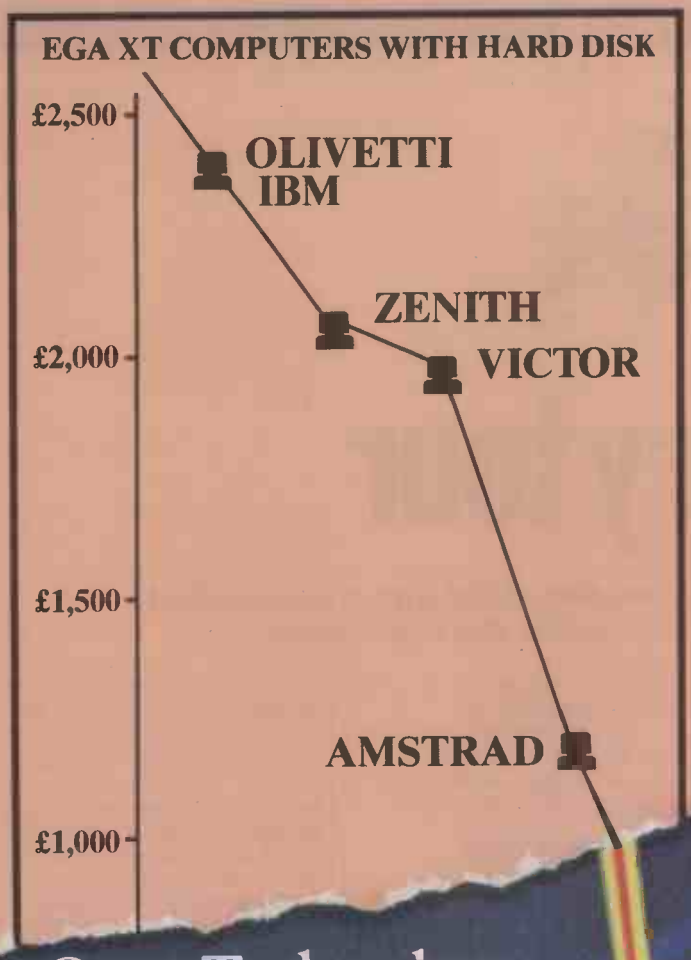
‡*25 iterations on Compaq 286 at 8MHz.*



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The PC IV Turbo's price of £99 monitor and advan graphi hard disk drive, A drive . . .

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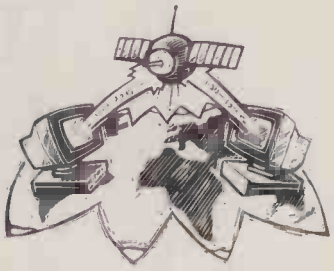

Mystery tour

The myriad mysteries of the many modem standards are unravelled this month, as Peter Tootill simplifies the main points.

There are two major hurdles to overcome in connecting a computer to a telephone line. The first is that computers use 'parallel data' — that is, data carried on a lot of wires (usually 16) simultaneously. Telephone lines have only two. Furthermore (and here's the second problem) it is 'digital data'. The signal is either on or off: 5 volts or 0 volts, there is nothing in between. Telephone systems use 'analogue data', which means that the signal is continuously variable. Many technical and computing books will explain the differences between parallel and serial, and digital and analogue data.

The first of the problems mentioned above is dealt with by the computer's serial interface. It takes the parallel data from the computer's data bus and converts it into serial data — that is, data where bit follows bit. The modem's job is to deal with the second problem. It converts (modulates) digital data into analogue data and back again (demodulates); hence the name MODulator/DEModulator.

The serial interface is often called an RS232 or V.24 interface after the two standards that specify it. The first is American in origin, but is widely used in the UK. The second is the international standard set out by the CCITT (the Consultative Committee on International Telegraphy and Telephony) which is part of the International Telecommunications Union, a UN body. The two standards are functionally the same.

Synchronous & asynchronous modems

When the computer's serial port is decoding incoming data, it needs timing information so that it can tell where one bit stops and the next one starts. With a synchronous modem, accurate timing circuits are used (these are usually built into the modems themselves, but may occasionally be provided externally — for example, by the computer itself). The modems synchronise their timings by means of occasional special characters called SYN characters.

Asynchronous modems, however, start and end every character with what are called start and stop bits. As these are 0 and 1 respectively, it means that the start of every character is identified by the transition from a 1 to a 0 bit. Thus, the modem only needs to work out timings for a relatively short period (one character length). No expensive timing circuits are needed, and synchronisation is automatic. It does mean that two extra bits are added to each 8-bit character, making 10 in all. That's why 300 bits/sec is only 30 chars/sec, and not 300 divided by 8 (37.5).

Modulation methods

The three basic methods of modulation are:

Amplitude modulation The strength (or amplitude) of the signal is changed to convey the information. This is used in AM radio (Fig 1).

Frequency modulation The frequency of the signal is changed to convey the information. This is the method used in FM radio, and the simplest version is used in 300-baud modems. Two frequencies are used: one to represent 0, and one to represent 1. In this context, it is usually called frequency shift keying (Fig 2).

Phase modulation The phase of the signal is changed. Usually referred to as phase shift keying (Fig 3).

Some modems combine two of the above methods, but I'll consider that when I look at higher-speed modems later.

Bits & bauds

Bits per second (bps) and bauds are both methods of measuring the speed of data transmission. Many people use the terms interchangeably, but there is a significant difference. I'll do my best to explain it.

As we have seen, the data being sent consists of a number of bits. So, the speed of transmission can be measured in bits per second. If you look up the word 'baud' in a data communications book, it will probably refer to modulation rates or some such thing. In fact, a baud is the unit used to measure the speed of change of the signal on the telephone wire itself, which is not necessarily the same as the speed of the data that is being sent.

This is where the difficulty arises. You have to divorce the two in your mind: the rate of change of the data signal on the phone line is not necessarily the same as the speed of the data it contains. Read on: it will become clearer.

Which Computer? Show news

Sadly, there wasn't much of interest in the comms line at January's Which Computer? Show in Birmingham. Apart from the Amstrad MC2400, Miracle was showing a new range of high-speed modems for use on leased lines. The company is obviously trying to move out of the consumer end of the market into the corporate sector. Who can blame it, with Amstrad pulling the rug out from under its feet?

The new range includes V.29 (9600 bps) and V.33 (144,000 bps) units. Prices start at £985 and £1295 respectively (excluding VAT). A 9600 bps Robotics HST compatible modem from the US is in the pipeline at a 'competitive price' — you can bet that is competitive with UK modem prices and not with the American ones.

Paxdata was showing its Ultimate 96 range, which, incidentally, includes both MNP and an LAP-based error correction protocol. This, the company claims, gives them a head start on other manufacturers, as the CCITT is expected to approve a LAP-based error correction scheme later this year. Most other manufacturers provide MNP or a proprietary system such as Dowty's SPAR.

Dowty itself was at the show demonstrating the Trailblazer (see under 'A new way?'), and the speed is impressive. An ordinary IBM XT or even AT screen can't keep up.

One interesting item that I saw was a UK version of Crosstalk 16 with viewdata emulation. This worked well, supporting dynamic frames and reveal. It is not yet ready for release, but should be available soon.

On the topic of Crosstalk, Mirror II, the not-quite-the-Crosstalk clone, will shortly be launched in its full UK version with standard scripts for calling UK systems such as Telecom Gold. It also includes viewdata emulation. Mirror I owners can upgrade for £15 plus the original master disk. (This price includes a supplement for the old manual. A new manual will set you back another £15.) Contact Softklone (UK) at PO Box 42, Fishponds, Bristol.

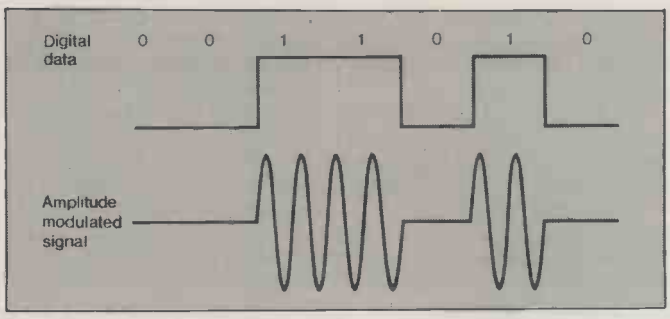

Fig 1 Amplitude modulation

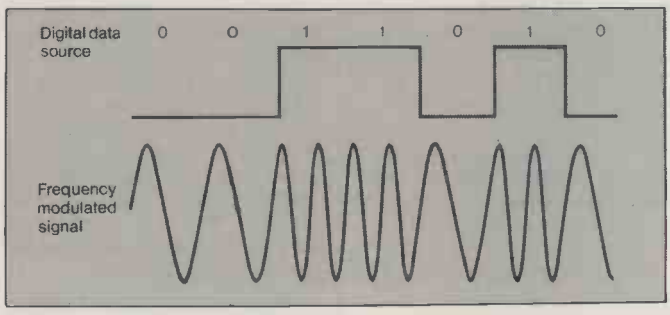

Fig 2 Frequency modulation

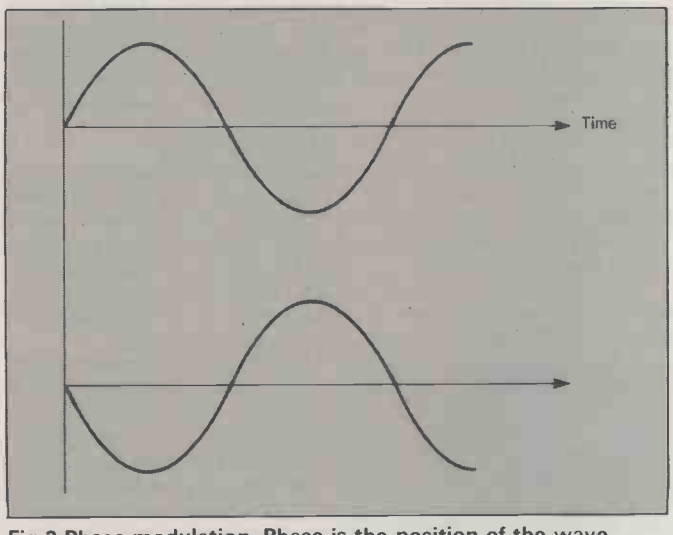

Fig 3 Phase modulation. Phase is the position of the wave form with respect to the origination of the carrier cycle. In this illustration, the bottom wave is 180 degrees out of phase with a normal sine wave illustrated at the top

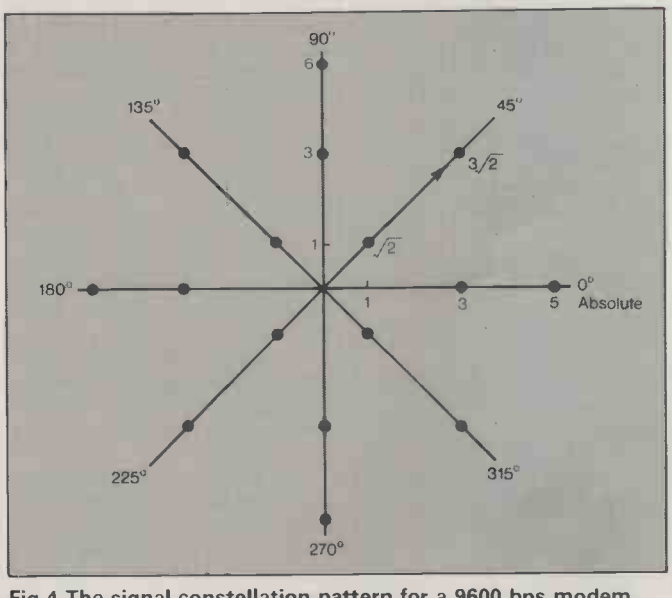

Fig 4 The signal constellation pattern for a 9600 bps modem contains phase and amplitude modulation (QAM)

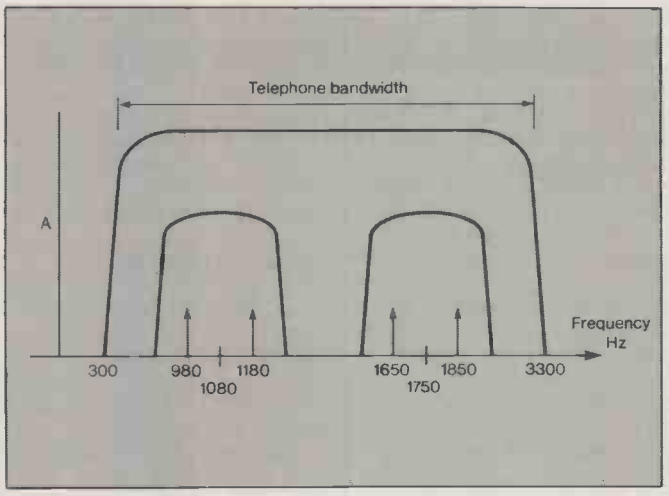

Fig 5 V.21 frequency spectrum showing both transmit and receive channels

Using a 300 bps modem, as we have seen, there are two different signals: one for 1 bits and one for 0 bits. Each signal level represents one bit so here the baud rate is 300, the same as the data rate. However, if we use a different signalling method — say, for example, we have four different signal levels — then each level can represent two bits (there are only four possible combinations of two bits: 00, 01, 10 and 11). If we keep the same baud rate (remember, baud measures the rate of change of the signal) we could send twice as much data — 600 bits per second at 300 baud.

As I'll describe later, the newer V.22 and V.22bis modems actually transmit and receive at 600 baud, but by encoding two and four bits respectively, the data is sent at 1200 and 2400 bits per second. A two-bit combination is called a 'dibit' and a four-bit one a 'quadbit'.

You may be wondering why we need these different signalling techniques. Why not just send data at 2400 baud if we want to transmit at 2400 bits per second — it sounds much simpler. Well, it would be, but the problem is with the telephone line. It can only handle frequencies between about 300Hz and 3300Hz, so we have a bandwidth of 3000Hz available which is fine for speech but not so good for data.

The theoretical limit for the baud rate on a phone line with a bandwidth of 3000Hz is 3000 baud (based on a formula derived by a gentleman called Nyquist in 1928, and which is sometimes called the Nyquist Limit). That sounds fine — 2400 is less than 3000, after all. True, but the problem is that we normally want full-duplex transmission transmitting data in both directions at once (see last month's 'Mailbox' column for an explanation of full and half duplex). That effectively halves our limit.

Furthermore, the closer we get to the limit, the more difficult it becomes to keep the signals clean and to avoid errors being introduced by line noise. Modern high-quality modems do use baud rates of 2400 and even slightly higher, but normally only in one direction at a time.

The most common modems available for use on the ordinary public switched telephone network, or PSTN (usually referred to as 'dial-up' lines) operate at speeds up to 600 baud full duplex. The main exception to this rule is the V.23 modem which works at 1200 baud (and 1200 bps) in one direction and 75 (bits and baud) in the other.

Which is which?

The most common modems found in the UK comply with a range of standards specified by the CCITT. These standards begin with the letter V — V.21, V.22, and so on. In the US, modem standards used to be set by the Bell telephone company, but now there is a move towards using the international CCITT standards.

Bell standards are not usually compatible with CCITT ones. In the high-speed area (above 2400 bps) there are also variants of CCITT standards. The 'Standards comparison' box on page 180 summarises the main modem standards commonly used on dial-up lines.

Medium-speed modems

Until recently, 300 bps was the normal operating speed for

modems. However, this is rather slow (around 30 chars/sec) and the introduction of IC technology has meant that modems operating at higher speeds can now be made at reasonable cost.

V.22 (1200 bps full duplex) looks like becoming the normal standard for UK users, for several reasons: it is often the highest speed that can be used on dial-up lines without error correction (such as MNP) being fitted to the modem itself; it is sufficiently compatible with Bell 212a to enable UK and US modems to communicate (handy for firms with international connections); and, it is the highest rate currently supported by PSS, Telecom Gold, and most of the other online systems. Prestel is a notable exception, with 2400 (V.22bis) access spreading across the UK. Most importantly, prices are falling to levels that make V.22 modems look quite attractive.

V.22bis is twice as fast (at 2400 bps full duplex) but needs good phone lines to work satisfactorily. However, it is, with one notable exception, still expensive — we will have to see what happens to prices in the wake of the Amstrad MC2400 launch. Even so, the MC2400 is still expensive compared to US prices. There, V.22bis modems can be bought for under $200 (£115).

High-speed modems

9600 bps modems are the latest thing to appear on the comms scene, but there are, unfortunately, several incompatible standards covering them (see the 'Standards comparison' box below).

The main CCITT standard (also used in the US) is V.32. This uses a complex modulation method with quadbits (4 bytes per baud) at 2400 baud, and a combination of amplitude and phase modulation called quadrature amplitude modulation (QAM) (Fig 4). It also transmits over the whole bandwidth in both directions at the same time for full duplex working. So, to avoid mixing up incoming transmissions with outgoing ones, sophisticated echo cancellation techniques are needed to filter out the outgoing transmissions and just leave the incoming signal for demodulation.

Error correction is built into the signal by adding extra bits in a pre-determined pattern (called trellis code modulation — TCM). The receiving modem knows what these bits should be, and that helps it to make allowances for line noise and sort out the original signal.

This system has the advantage of allowing the receiving system to correct most errors without having to ask for a block of data to be sent again (unlike other systems such as MNP) so there is no reduction in throughput. However, TCM is not perfect, and an ARQ (Automatic Repeat on reQuest) system such as MNP is still desirable.

V.32 modems are expensive, at around £2000 ($2500 in the US).

Another CCITT standard for 9600 bps is V.29. However, this was primarily designed for use on leased lines where there are four wires — two for the transmit and two for the receive channel. Hence, when it is used on ordinary telephone lines, it has to be used in half-duplex mode — alternatively transmitting and receiving data on the same frequency.

Hayes and US Robotics in the US, and Paxdata in the UK, produce 9600 bps dial-up modems using V.29 methods, and they get round the half-duplex problem by using FPPS. FPPS is a term that *PCW* contributor Steve Gold claims he invented, and which stands for 'fast ping-pong system' (personally, I'd have kept quiet about it). Basically, the modems bounce back and forth between transmit and receive modes. They do this with clever internal software, and present what appears to the computer to be a full-duplex system. This is good enough for most purposes and avoids the need for expensive echo cancellation.

The main problem is that Hayes and US Robotics modems don't work in quite the same way and they currently cannot 'talk' to each other, although the two companies are co-operating in an effort to sort this problem out.

Here we have another example of US prices being way below UK prices. The Robotics HST costs about $1000 and the Paxdata Ultimate 96 is listed at £1590. The HST includes TCM, while the Ultimate 96 doesn't.

A new way?

Until now, all modems have transmitted data on one basic frequency or channel. This is often referred to as a carrier. Even the V.32 modems use one basic frequency which is modulated in a complex manner to carry the data.

The people at Telebit (a US modem company) went back to square one and looked at the problem of achieving high-speed data transmission. They came up with the idea of using a number of carriers, each much narrower than previous ones and each carrying a part of the signal.

The Trailblazer uses 512 separate carriers and allows data transmission at speeds of up to 18,000 bps. It uses a form of QAM that Telebit has christened DAMQAM — dynamic adaptive multi-carrier quadrature amplitude modulation (no comment!). The adaptive bit is there because it monitors line conditions and gradually slows down if they are poor until it finds a speed they can support. CCITT standards also have what is called fall-back capabilities, but they tend to halve the transmission speed: 9600 falls back to 4800, and so on. The Trailblazer will wring every last bit out of the phone line.

The Trailblazer is available in a UK version from Dowty. The price of this technology? From Dowty — £1795; in the US, it costs $1200 (£690 at current rates). Doesn't it make you want to spit? END

Useful phone numbers

Dowty	(0635) 33009
Paxdata	(09277) 69554/69546
Crosstalk Communications	(0908) 669900
Miracle Technology	(0473) 216141
Softklone (UK)	(0272) 583534

Standards comparison

Modem type	Data rate (bps)	Transmission technique	Modulation technique	Transmission mode	Line use
Bell System					
103	300	asynchronous	FSK	Half, Full	PSTN[1]
202	1200	asynchronous	FSK	Half	PSTN[2]
212	0–300	asynchronous	FSK	Half, Full	PSTN
	1200	asynchronous/ synchronous	PSK	Half, Full	PSTN[3]
CCITT					
V.21	300	asynchronous	FSK	Half, Full	PSTN
V.22	600	asynchronous	PSK	Half, Full	PSTN/Leased
	1200	asynchronous/ synchronous	PSK	Half, Full	PSTN/ Leased
V.22 bis	2400	asynchronous	QAM	Half, Full	PSTN[4]
V.23	600	asynchronous/ synchronous	FSK	Half, Full	$PSTN_2$
	1200	asynchronous/ synchronous	FSK	Half, Full	PSTN
V.26	2400	synchronous	PSK	Half, Full	Leased[5]
	1200	synchronous	PSK	Half	PSTN[5]
V.26 bis	2400	synchronous	PSK	Half	PSTN[5]
V.26 ter	2400	synchronous	PSK	Half, Full	PSTN[5]
V.27	4800	synchronous	PSK		
V.29	9600	synchronous	QAM	Half, Full	Leased[6]
V.32	9600	synchronous	QAM	Half, Full	PSTN

Notes
PSTN — Public Switched Telephone Network
1 Not compatible with V.21
2 Rarely used
3 This mode compatible with V.22
4 Also used in North America
5 Rarely used with PSTN
6 Half-duplex variations for switched lines exist

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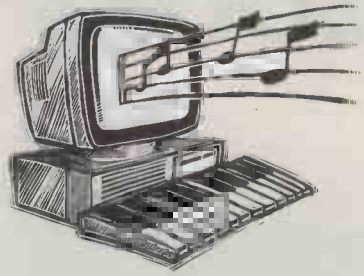

New music

This month's musical scrapbook features music add-ons for the trusty BBC Micro, Hybrid's marriage with Midi, and a combined sequence/sampler for the IBM PC.

BBC calling!

The BBC Micro in all its guises has sold around a million units in the UK, and consequently there's a wide range of musical add-on devices available, often at quite reasonable prices. In January's 'Musical Interlude' I listed some of the add-ons available for a range of popular computers, but apparently ignored the Beeb. Now is the time to redress the balance!

One of the older and more serious music add-ons for the Beeb is the Umi sequencing system that has been used by both professional and amateur alike. The strength of the Umi products lies in the marriage of excellent hardware with software that's easy to learn and powerful in use.

The Umi products are based around the Midi interface and are programmed in a similar way to most drum machines. This is quite different to most other sequencers, which try to operate more like 'Midi tape recorders'. Using the drum machine principle, a complex piece of music is first programmed in several short sections, known in Umi-speak as 'ideas', which are perhaps only a few bars long. The ideas are then linked together to form a complicated composition.

There are two versions of the Umi currently available: the Umi 3S, which features a single Midi port and both step and real-time sequencing software; and the Umi 4M, which is aimed at the professional user. The 4M is upwards-compatible with the 3S but features an extra three Midi ports and enhanced software.

The Umi 3S costs £230 including VAT. The 4M costs £322 for the basic version, or £460 with extra ROM-based micro-editing software.

Electromusic Research (EMR) is virtually the only company that can compete with Umi, and currently sells a Midi interface and two sequencing packages. The first of these is a six-track step-time recorder which is priced at £44.95; the other is an eight-track real-time recorder which is slightly dearer, at £49.95. The EMR Midi interface costs £79.90.

Hybrid systems

Hybrid Technology recently bowed to the mighty Midi and added the now industry-standard interface to its Music 5000 package. The new module will be called the Music 2000. It sports two discrete Midi outputs and retails for £161.

The Hybrid Technology music system was given a thorough Checkout in the February 1987 issue of *PCW*, but for the benefit of those without a copy of that noble tome, the system is based around a 16-voice synthesiser module (the Music 5000) and a ROM-based programming language called 'Ample'. The system can either be programmed directly from Ample, or via a series of user-friendly front-ends which are themselves written in Ample and loaded from disk.

These front-ends include a text-based 'note pad' for literally writing music into the system; a 'staff editor' for presenting the musical data in a more traditional form; and a 'mixing desk' which allows simple control of the Music 5000's voices including their relative volumes and stereo positioning. The Music 5000's stereo output can be connected either to your hi-fi or to another Hybrid module, the Music 1000, which provides the necessary amplification to drive small loudspeakers and headphones.

Since the system was reviewed, Hybrid has added a proper music keyboard, the Music 4000, and released an advanced manual for keen Ample programmers.

Ample as a language goes far beyond simply controlling the Music 5000 synthesiser. In a demonstration of its capabilities I was recently shown a short adventure game that had been written in Ample, which, although essentially text-based, used music to set the atmosphere of the game's locations and even to provide spectacular sound effects.

Two in one

I have recently received a letter asking if I knew of any products for IBM PCs or compatibles that were both Midi sequencers and samplers. No chance, I thought, until with the following day's post arrived a letter from Yam Educational Software informing me of just such a device. I immediately contacted Yam and put its staff through a gruelling interrogation.

The company couldn't provide me with a price in pounds sterling, but it has developed a package that provides a three-voice polyphonic sampler; and yes, it does feature graphic sample editing software tools and a Midi sequencer.

This is a most exciting breakthrough. Until now, sequencing and sampling have remained quite separate functions requiring quite separate interfaces; a state of affairs that is especially unsatisfactory to the home musician, who probably doesn't have these facilities provided by dedicated hardware.

The Yam package is called SoundBuster and is expected to be sold through mail order outlets for around £199. All sampling is done at the respectable rate of 32KHz and, although the hardware is limited to only three voices, up to five samples can be available in RAM at any time. The integral sequencer can handle both Midi and samples simultaneously, making this product unique.

Useful names & numbers

Music Quest Inc	1700 Alma Drive, Suite 260, Plano, Texas 75075, USA
Yam Educational Software	Daniel Webb on (01) 969 5822
U-Music	17 Parkfields, London SW15 6NH
ElectroMusic Research	(0702) 335747
Hybrid Technology	(0223) 316910
Casio	(01) 450 9131

Owning up

A few mistakes crept into the diagrams which accompanied February's 'Musical Interlude'. While some were purely cosmetic, I must thank Raymond Lesley from Lancing for drawing my attention to the Midi Command Table. This listed all the possible Midi commands in binary, decimal and English, but the list of decimal numbers which read 128, 129, 130, 131, 132, 133, 134 should have been 128, 144, 160, 176, 192, 208, 224. Sorry!

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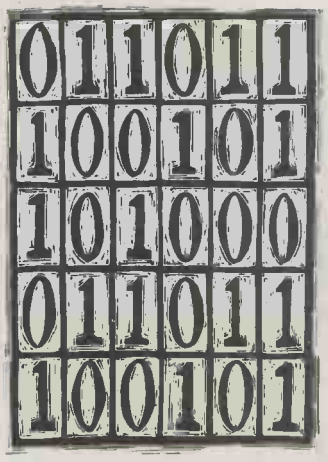


David Barrow presents more machine code routines and information for assembly language programmers. All helpful programming hints and short, useful new routines are welcome as are improvements to or conversions of those already printed. Submissions must be printed or typed clearly and must be documented to the SubSet standard, although documentation may be amended for publication. Send your contributions to SubSet, PCW; 32-34 Broadwick Street, London W1A 2HG.

Character graphics

This month we have two more generally useful graphics routines in 8086 code from John Hardman of Welling in Kent. These two routines are from a set which includes the line-drawing and area-filling routines published last month.

At the lowest level of operation, graphics routines must be designed for specific hardware configurations. The hardware must be specific with all but the highest level routines. Such generality may be useful, but at what cost? The first datasheet is an excellent example of the sacrifice you could have to make for the sake of portability.

Character matrix plotting

PLTCHR (Datasheet 1) deals with the eight bytes describing any character as a matrix of individual points. Each point is forwarded to a system-specific, point-plotting subroutine, SPOINT, along with co-ordinates and plotting colour.

John's intention is to enable a standard sized character to be written to any position on a high-resolution display, rather than to just one of the 200 positions allowed by the regular 25 lines by 80 columns text mode.

The PLTCHR routine is clearly written with a good structure to conform to the highest SubSet classification. It preserves all registers, may reside at any address in either RAM or ROM, and can be interrupted at any point and recalled without ill effect by the interrupting program. The only conceivable input errors would be an off-display position or invalid colour codes. Both are problems that should be dealt with by the point-plotting routine, SPOINT. Neither would cause PLTCHR to malfunction.

So PLTCHR is a good, generally applicable routine that could be used in any 8086/8088 computer system with a high-resolution graphics output device. Nevertheless, it is grossly inefficient.

The operation of PLTCHR takes between 5942 and 6582 clock cycles. To this must be added the time taken to plot 64 dots in high-resolution colour. Even at an optimistic estimate, this surely cannot be achieved

Datasheet 1

```
;=============================================================
;PLTCHR          Plot the individual bits of an eight by eight bit
;                character matrix to a graphics output device.
;=============================================================
;STRUCTURAL CONCEPTS
;DATA            CHARACTER MATRIX: Eight contiguous bytes
;                representing an alphanumeric or standard graphics
;                character such that,
;                 lowest addressed byte maps to character top row
;                 bit 7 of each byte maps to character left column
;                 set bits map to character foreground colour
;                 reset bits map to character background colour.
;PROGRAM         FOR bytes 0 to 7
;                {
;                  byte <-- (matrixpoint).
;                  FOR bit 7 to 0
;                  {
;                    IF bit SET
;                    [
;                      colour <-- foreground.
;                    ;
;                      colour <-- background.
;                    ]
;                    PLOT (rowpoint,colpoint,colour).
;                    colpoint <-- colpoint + 1.
;                  }
;                  colpoint <-- colpoint - 8.
;                  rowpoint <-- rowpoint + 1.
;                  matrixpoint <-- matrixpoint + 1.
;                }
;-------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR       8086/8088
;HARDWARE        Memory containing stored character matrix.
;                Screen or other graphics output device as
;                required by lower level routine.
;SOFTWARE        "SPOINT" - pixel (CX,DX) <-- colour in AL.
;                Must not change register contents.
;-------------------------------------------------------------
;PROGRAM DETAILS
;INPUT           AH = foreground colour.
;                AL = background colour.
;                DS:[BX] = stored matrix information.
;                CX = destination leftmost column.
;                DX = destination topmost row.
;OUTPUT          None.
;STATE CHANGES   Character output to graphics device.
;I/O ERRORS      None known.
;OPTIMISATION    None.
;INTERRUPTS      May be interrupted and re-entered.
;LOCATION NEED   Must reside in same Code Segment as calling
;                program and as called subroutine, otherwise ...
;                 Not specific. Relocatable. PROMable.
```

```
;PROGRAM BYTES 50
;STACK BYTES    20 + SPOINT stack use.
;TIMING         (8086 clock cycles)
;               5942 + (10 * no. of reset bits)
;               + (64 * SPOINT cycles)
;=============================================================
;
SPOINT                  ;System dependent set point routine. Must
;                        be in same segment as PLTCHR to use
;                        intrasegment displaced CALL, or
;                        re-assemble with other CALL form.
;
PLTCHR PUSHF            ;Save flags and registers used.   9C
       PUSH   BX        ;                                 53
       PUSH   CX        ;                                 51
       PUSH   DX        ;                                 52
       PUSH   BP        ;                                 55
       PUSH   AX        ;Save fore & back colour and      50
       MOV    BP,SP     ;index on stack.                  8BEC
;
       MOV    AL,8      ;AL <-- 8 bytes rows count.       B0   08
;
NXTROW PUSH   AX        ;Save rows count.                 50
       PUSH   CX        ;Save column pointer.             51
       MOV    AH,[BX]   ;Read next matrix byte (row).     8A27
       MOV    AL,8      ;AL <-- 8 bits columns count.     B0   08
;
NXTCOL SAL    AH,1      ;Next dot into Carry.             D0E4
       PUSH   AX        ;Save byte & cols count while     50
       MOV    AX,[BP]   ;getting colours from stack &     8B46 00
       JNC    PLTPNT    ;skip if bit=0: AL = b'ground,    73   02
       MOV    AL,AH     ;else bit set: AL <-- f'ground    8A
;
PLTPNT CALL   SPOINT    ;Plot (CX,DX,colour AL).          E8   lohi
;
       POP    AX        ;Restore byte & cols count.       58
       INC    CX        ;Next display column.             41
       DEC    AL        ;Repeat for 8 bits, columns,      FEC8
       JNZ    NXTCOL    ;in each byte, row.               75   ED
;
       POP    CX        ;Restore leftmost column point    59
       POP    AX        ;and rows count.                  58
       INC    DX        ;Next display row and             42
       INC    BX        ;Next matrix byte.                43
       DEC    AL        ;Repeat for 8 bytes, rows,        FEC8
       JNZ    NXTROW    ;in full matrix.                  75   DF
;
       POP    AX        ;Restore registers                58
       POP    BP        ;                                 5D
       POP    DX        ;                                 5A
       POP    CX        ;                                 59
       POP    BX        ;                                 5B
       POPF             ;and flags.                       9D
       RET              ;Exit in same code segment.       C3
;
;=============================================================
```

in fewer than 500 cycles for each dot. So, the time taken to write a single character to screen could easily exceed 38,000 clock cycles.

Of course, the routine could be recoded to work faster.

Reading the foreground and background colour codes from BP indexed stack for every bit of the matrix consumes 64 * 17 cycles. Stored in and read from the BP register directly, the read time would be reduced to 64 * 2 cycles. Similarly, saving AX to another register (SI or DI), instead of to stack inside the NXTCOL loop, would lop off another 64 * 14 cycles.

These two simple changes would cut PLTCHR's execution time by about 30%, yet this only nibbles away at the overall plotting operation time, still about 36,000 cycles.

The fundamental problem with PLTCHR is that each bit of the matrix is dealt with separately. For every one of the 64 pixels, the dot co-ordinates have to be converted into the address of the screen byte containing the indexed dot and the bit position of that dot. The byte has to be read and undergo a series of bit-masking operations before being written back to display RAM.

Where routines are written for a specific system, their operation can be tailored to fit the display format. Indeed, the configuration of display RAM may have been designed for speed of particular types of access.

Usually, the bytes affected by the display of one character are in close proximity or simple relationships, so that only one address need be calculated instead of the 64 that PLTCHR demands. Also, it is normally feasible to merge each intact byte of the character matrix into two display-adjacent bytes in very little more time than that taken to switch a single pixel.

Thus a system-specific routine, while not having the advantage of portability, may produce the same result as PLTCHR + SPOINT in one tenth of the time. Remember, in most graphics applications, speed is of overwhelming importance.

Mirror images

HFLIP (Datasheet 2) is a graphics routine of a somewhat different order to PLTCHR. It does not cause access of display memory and could not benefit from being directed toward any specific system. Yet, like PLTCHR, it is a clearly structured first-class routine that is extraordinarily slow in operation, taking 204 cycles to flip a single byte.

The problems with HFLIP are twofold. First, the fact that it is a subroutine and preserves all registers takes 52 cycles, or 25% of the overall time. Where speed is paramount, such niceties might be abandoned in favour of the 10-byte, 162-cycle sequence doing the actual flip.

But even 162 cycles is slow and this brings in the second problem. The bit manipulation is effected in only four cycles per iteration — a total of 32 cycles. Yet the loop mechanism amounts to 124 cycles, so 80% of the time is actually wasted on program control.

If speed really is important, the obvious solution is to unfold the loop and repeat the instructions, as in Fig 1. At a little over twice the length, QFLIP will flip six bytes for every one reversed by HFLIP.

Z80, 6502, 6809, 68000

The problem of reversing bit order in a single byte is similar in most machine codes. Fig 2 gives the quickest way to flip a byte in four common codes — or does it?

Datasheet 2

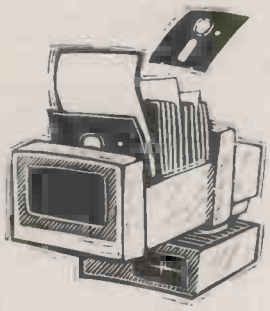
```
;=================================================================
;HFLIP          Reverse the bit order of the eight bits in a byte
;               length register (horizontal graphics flip).
;=================================================================
;STRUCTURAL CONCEPTS
;PROGRAM        workspacebyte <-- sourcebyte
;               FOR COUNT: 8
;               {
;                 carryflag, workspacebyte <-- workspacebyte * 2.
;                 sourcebyte <-- carryflag, sourcebyte \ 2.
;               }
;-----------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR      8086/8088
;HARDWARE       None.
;SOFTWARE       None.
;-----------------------------------------------------------------
;PROGRAM DETAILS
;INPUT          AL = byte to reverse.
;OUTPUT         AL = reversed byte.
;STATE CHANGES  None.
;I/O ERRORS     None known.
;OPTIMISATION   While low-byte CX is used as a loop count
;               register (for the quicker "LOOP" instruction),
;               CH is used as a temporary source byte register
;               becoming zero before CX is decremented to zero
;               after eight iterations.
;INTERRUPTS     May be interrupted and re-entered.
;LOCATION NEED  Must reside in same Code Segment as ca[illegible]
;               program, otherwise ...
;               Not specific. Relocatable. PROMable.
;PROGRAM BYTES 15
;STACK BYTES    4
;TIMING         (8086) 214 clock cycles.
;=================================================================
;                                              cycles    code
;
HFLIP  PUSHF          ;Save flags                10      9C
       PUSH   CX      ;and registers             10      51
;
       MOV    CL,8    ;CL <-- 8-bit count.        4      B1   08
       MOV    CH,AL   ;CH <-- 8-bit source.       2      8AE8
;
NXTBIT SAL    CH,1    ;Cy <-- next highest bit    2      D0E5
       RCR    AL,1    ;into AL's next lowest bit. 2      D0D8
       LOOP   NXTBIT  ;Do for 8 bits.           5/17     E2   FA
;
       POP    CX      ;Restore registers          8      59
       POPF           ;and flags.                 8      9D
       RET            ;Return in same CS.        16      C3
;
;=================================================================
```

Fig 1

```
;=================================================================
;
;8086                              c.cycles                  code
;
QFLIP  SAL    AL,1          ;  2   Source bit 7, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 0.     D0DC
       SAL    AL,1          ;  2   Source bit 6, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 1.     D0DC
       SAL    AL,1          ;  2   Source bit 5, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 2.     D0DC
       SAL    AL,1          ;  2   Source bit 4, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 3.     D0DC
       SAL    AL,1          ;  2   Source bit 3, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 4.     D0DC
       SAL    AL,1          ;  2   Source bit 2, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 5.     D0DC
       SAL    AL,1          ;  2   Source bit 1, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 6.     D0DC
       SAL    AL,1          ;  2   Source bit 0, through      D0E0
       RCR    AH,1          ;  2  carry, to result bit 7.     D0DC
;
       MOV    AL,AH         ;  2  Result back to I/O reg.     8AC4
;
;        total clock cycles: 34                 total bytes: 34
;        ---------------------                  -------------
;
;=================================================================
```

Fig 2

```
;=================================================================
;
;Z80                               c.cycles                  code
;
QFLIP  RLA                   ;  4                              17
       RR     C              ;  8                              CB19
;
;   (3-byte sequence repeated to total eight bits transferred.)
;
       LD     A,C            ;  4                              79
;
;        total clock cycles:100                 total bytes: 25
;        ----------------------                 -------------
;
;6502                              c.cycles                  code
;
QFLIP  ASL    A              ;  2 (one byte of page zero       0A
       ROR    M0             ;  5  has to be used)             66M0
;
;   (3-byte sequence repeated to total eight bits transferred.)
;
       LDA    M0             ;  3                              A5M0
;
;        total clock cycles: 59                 total bytes: 26
;        ----------------------                 -------------
;
;6809                              c.cycles                  code
;
QFLIP  ASLA                  ;  2                              48
       RORB                  ;  2                              56
;
;   (2-byte sequence repeated to total eight bits transferred.)
;
       TFR    B,A            ;  7                              1F98
;
;        total clock cycles: 39                 total bytes: 18
;        ----------------------                 -------------
;
;68000                             c.cycles                  code
;
QFLIP  ADD.B  D0,D0          ;  4 (ADD is 2 cycles quicker     D000
       ROXR.B 1,D1           ;  6  than ROXL)                  E211
;
;   (4-byte sequence repeated to total eight bits transferred.)
;
       MOVE.B D1,D0          ;  4                              1001
;
;        total clock cycles: 84                 total bytes: 34
;        ----------------------                 -------------
;
;=================================================================
```



A new broom

This month we say goodbye to the old and ring in the new, as Owen Linderholm departs and Andy Redfern arrives. The Program File takeover starts here.

When I arrived at the *PCW* office, I was greeted by a large number of programs to sort through (although Nick Walker and Owen Linderholm both assure me there were far more programs waiting for *them* when they started!), and hopefully by now you will all have received replies to your letters and suggestions from me as to the kind of programs we'll be looking for in the future.

At present, the actual content and format of Program File are under review and we'll be looking very closely at the comments we receive in the Readers' Survey in this issue. I personally feel we should be moving towards making better use of the Disk Library, which will benefit everyone concerned. It will make using the programs far easier, and it will allow us to put larger programs in the Disk Library which we would normally not be able to publish. I would appreciate readers' views on this, as it is a service intended for you, the personal computer user.

The current listing of programs in the Disk Library hasn't changed due to the recent shortage of staff, but by the time you read this there will have been a considerable number of additions, of which you will read more in the next issue of *PCW*.

New direction

Every couple of months I will be looking at a specific area of programming (see the 'Data compression' section for this month's topic) and asking you to send in your ideas and programs on the matter considered. Due to the long turn-around time on the Program File section of *PCW*, this will take a few months to filter through, but I hope it will be a success for us all.

Unfortunately, due to the limited amount of space available, the number of programs I'll be publishing for the older machines will fall. This is because the newer machines are receiving a lot of support, and I feel that the majority of our readers have moved on, even if they still have their old Spectrum lying around.

Sorry to disappoint anyone, and I would suggest that readers who are having trouble keeping in touch with users of machines similar to their own should contact one of the many user groups that now exist. (See the 'Directory' on page 223.)

Data compression techniques

Over the last 10 years, data compression has become an increasingly important subject within the telecommunications and image processing sections of the computer industries; and I'm sure we long for that little bit of extra space on our floppy or hard drive. Even with the advent of cheaper mass storage, data compression techniques are being used to increase their capacity even more. A good example of this is hardware technology: there is little difference between a 20Mbyte and a 32Mbyte hard disk, the extra storage being gained from using RLL data compression techniques.

Other techniques have been developed, many of which have been specially written to cater for the nature of the data involved. For example, run-length coding is not suitable for text data but is usually most suited to picture data.

I would like to hear from anyone about their experiences of using data compression, what techniques you

Guidelines for program listings

PCW is interested in pubishing quality programs written in any of the major programming languages for all popular home and business micros. When submitting your programs, include a disk or cassette version of your program, comprehensive documentation and a clear, dark listing on white paper.

The listing should be no more than 80 characters wide and, if possible, sample output from that program should be included. Ensure that you have marked the software, listing and documentation with your name and address, program title, machine (along with any minimum requirements) and a daytime telephone number.

We will be including some of the programs published in Program File in the *PCW* Disk Library. If you have any objections to your program being included, please indicate them, otherwise it will be assumed that the program can be included in the Disk Library. A total royalty of 50p is paid per disk sold. The sum is shared among the authors of the programs on the disk.

Here are some guidelines for submitting programs. Check through previous Program Files to see the sort of programs we prefer. Original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand and preferably not too long. All programs should be fully debugged and must be your own, original, unpublished work.

We will try to return submissions if they are accompanied by an appropriate stamped, addressed envelope, but please keep a copy of everything. Pograms are paid for at the rate of £50 per page of published listing, plus a £50 bonus for Program of the Month.

Send your contributions to Andy Redfern, Program File, *PCW*, VNU House, 32-34 Broadwick Street, London W1A 2HG.

actually use, and whether you feel that data compression has any useful purpose for the average personal computer user. I'm therefore interested in two things: either new techniques of data compression which you think you've invented or discovered; or very fast implementations of known methods. If you do use a previously published technique, *please* give references and acknowledgements both for ideas in general or routines you've actually lifted. This is an important point and applies to *all* programs submitted to Program File.

As most machines now have the standard languages (Pascal, C, and so on) available for them, it would be better if the programs were written more generally so that they are relevant to a larger number of people. Please don't feel you have to limit yourself to programs. If you have a great idea but are not sure how to code it, send it in and we'll try to use it somehow. Also, if you have any tips or useful ideas concerning data compression techniques in general, then send those in as well.

If you have submitted a data compression program in the last couple of months and have not heard from me, it's probably because it has been kept for future reference.

And, finally, if you have any ideas about programs you think ought to exist and don't, or new implementations of old ideas, send them in and perhaps we could do a small feature like this one on them.

This month's programs

The Program of the Month is an excellent Turbo Pascal terminal/viewdata emulation program written for use only on the PCW8256/8512 and, hopefully, the PCW9512, although this has not been tested. It requires the serial interface to be attached, but as you also need a modem you'll already have one. The program could be modified to run on an MS-DOS machine but it would take a lot of effort, as all the in-line codes would need to be altered and many parts of the code are machine-dependent.

As you will see in the listing, there is a very nasty hexadecimal overlay file to make. My advice is write out a cheque for £5 and send off for a copy from the PCW Disk Library. The disk program works; there's no debugging time and you'll save yourself a lot of heartache.

The rest of the programs are a fairly good mixture of machines and program types. The CPC Orbit Matching game is a simple but effective program, and I hope that any future games we publish will be of a similar quality and on a variety of machines.

PCW Disk Library details

- The disks cost £5 each, including VAT, postage and packing. Of this money, 50p goes to the author, being split evenly between them if there is more than one.
- The disks are *not* public domain and may *not* be copied at will. If you have one and friends want a copy, they must order their own.
- Programs are not immediately available in the Disk Library after being published in *PCW* — there will be some delay in sorting programs out. Programs intended for the Disk Library will carry the Disk Library symbol on the listing. As soon as a program is available, it will appear in the catalogue.
- No documentation is provided with the disks except that which is embedded in the programs themselves. Only order disks which you have copies of *PCW* for, unless a lack of documentation is not a problem. Back issues of *PCW* can be ordered from the Back Issues Department at VNU House, 32–34 Broadwick Street, London W1A 2HG, or by telephoning (01) 439 4242 and asking for the Back Issues Department.
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The *PCW* Disk Library catalogue is being revised and updated, and will next appear in the May issue.

Program of the Month
Amstrad PCW Terminal/ Viewdata Emulation Program

PCW DISK LIBRARY

by Phillip Wade

The Amstrad PCW comes with its own built-in terminal emulation program, but the one presented here knocks spots off most IBM PC viewdata programs. The main features of this program are:

- tty, VT52, control show and viewdata emulation
- reliable up to 4800 baud
- can generate a break signal

The viewdata emulation is especially well-implemented, with double height, flash and colour characters being supported, even though the PCW hardware doesn't support these advanced features.

The program is run by typing:

```
VDU [TTY | VT52 | CONTROL-
  SHOW | VIEWDATA | PRESTEL]
  [LOCALECHO]
```

the default being tty and remote echo.

The program unfortunately does not attempt to set up the serial interface, and this must be done before the program is run by using the CP/M SETSIO command. For example:

```
SETSIO R 1200 T 75 B 7 S 1 P EVEN I
  OFF X OFF H OFF
```

is the setup required for contacting Prestel on 1200/75; or

```
SETSIO 300 B 8 S 1 P NONE I OFF X
  OFF H OFF
```

is the setup required for communication with a 300/300 baud rate bulletin board. NOTE XON and Handshake should always be set to OFF with this program.

Of course, the above commands can be included in a SUBMIT file to save typing in the long command lines. For example, if you regularly contact Prestel over a 1200/75 modem, then make a file called PRESTEL.SUB which contains:

```
SETSIO R 1200 T 75 B 7 S 1 P EVEN I
  OFF X OFF H OFF VDU VIEWDATA
```

Then, to run the program, type SUBMIT PRESTEL.

The one drawback with this program is that there is no loader for the overlay file. This means a lot of hard work because errors can only be spotted at runtime. Perhaps it's time you sent off for the disk from the *PCW* Disk Library!

The images above are three sample screendumps of the Amstrad PCW Terminal/Viewdata Emulation Program program logged on to Micronet. Both the double-height characters and the graphics can be seen in the third picture

Jaded Programs Editor says goodbye

This month's Program File leaves me with rather mixed feelings. It is the last one over which I had any direct influence at all, and I feel like a part of my regular working life has vanished. But, at the same time, it is a great relief not to have to deal with the huge amounts of bureaucracy and paperwork involved in receiving, recording, sorting, returning and editing programs. I must also admit that after almost three years, I am feeling rather jaded. I'll miss the fun bits, though, like the excitement of receiving a really good program from an unknown contributor, and the people who write in or phone to thank you for publishing something.

Andy Redfern, *PCW*'s new Staff Writer, has now taken over Program File. He took to it like a hacker to Unix, and the whole of this month's listings section was put together by him with minimal supervision. So, from now on, please address all programs, hints, questions — and especially complaints — to him.

Owen Linderholm

The following keys have a special effect whilst you are using the program:

[EXTRA]+1	select 'tty' emulation mode. All control characters from the remote computer are filtered out, except for ↑G (bell), ↑H (backspace), ↑J (line feed), ↑M (carriage return), and DEL.
[EXTRA]+2	select 'vt52' emulation mode. No filtering of incoming characters takes place (except for DEL which is replaced by backspace/space/backspace), thus the PCW's inbuilt VT52 emulation will be operative.
[EXTRA]+3	select 'control show' emulation mode. Control characters received from the remote computer will be displayed explicitly rather than causing the corresponding screen operation (if any) to be performed. This is useful if you need to determine exactly what characters are being sent by the remote computer.
[EXTRA]+4	select 'viewdata' emulation mode. This is required for services such as Prestel and Micronet.
[EXTRA]+B	send a BREAK signal to the remote computer.
[EXTRA]+D	toggle local/remote echo. When local echo is selected, all characters typed are displayed on the screen as they are sent (RETURN is displayed as carriage return followed by line feed).
[EXTRA]+R	toggle the revealing of hidden information in viewdata emulation mode.
[EXTRA]+[PTR]	produce a copy of the screen on the built-in printer.
[EXTRA]+/	quit the program.

The ASCII character set (used in the tty, vt52, and control show emulations) uses codes from 0-127. Codes 32-126 represent printable characters, and codes 0-31 and 127 represent control characters (such as carriage return, bell, etc). The printable characters correspond to the PCW's inbuilt character set in that same range (as shown in Appendix I.4 of the Amstrad CP/M manual). The full range of ASCII characters can be typed on the keyboard, for example [ALT]+A will give control-A (code 1) and <-DEL will give DEL (code 127).

The differences between the printable characters in the ASCII and Viewdata character sets are shown below:

Code	ASCII		Viewdata	
	Character	Key	Character	Key
35	hash	#	pound sign	[SHIFT]+3
91	open square bracket	[	left pointing arrow	[
92	backslash	[EXTRA]+1/2	half	1/2
93	close square bracket	]	right pointing arrow	]
95	underline	_	hash	#
96	grave accent	[EXTRA]+8	wide hyphen	_
123	open curly bracket	{	one quarter	[ALT]+2
124	vertical bar	[EXTRA]+.	parallel vert. bars	[EXTRA]+.
125	close curly bracket	}	three quarters	[ALT]+6
126	tilde	[EXTRA]+-	divide	[EXTRA]+-
127	DEL	<-DEL	small filled box	<-DEL

For each code shown, the 'Character' column describes what is displayed on the screen, and the 'Key' column shows what you have to type to obtain that character. VDU performs all the necessary translations for the screen and keyboard when viewdata emulation is set. It also produces '#' when you press the key marked with the section symbol to make '##' easy to type, and produces the viewdata cursor movement codes when you press the cursor keys to help when editing mailboxes. Also, when you enter viewdata emulation, VDU sets a 24 row 80 column screen viewport. The original viewport is reinstated when you leave viewdata emulation or quit the program.

The four listings should be typed into separate files as shown. You then need to compile VDU.PAS into a .COM file, convert VDUOVL.HEX into VDUOVL.COM using the CP/M utility HEXCOM, and finally rename this latter file to VDU.OVL. The overlay file contains the character matrices used during viewdata emulation.

VDU1.PAS

```
PROGRAM vdu;

(written by Phillip Wade

CONST

   tty_ch = $af;                  { [EXTRA]+1 }
   vt52_ch = $b2;                 { [EXTRA]+2 }
   control_show_ch = $ad;         { [EXTRA]+3 }
   viewdata_ch = $b1;             { [EXTRA]+4 }
   reveal_info_ch = $be;          { [EXTRA]+R }
   local_echo_ch = $a7;           { [EXTRA]+D }
   break_ch = $ba;                { [EXTRA]+B }
   quit_ch = $ae;                 { [EXTRA]+/ }

   bell = 7;
   backspace = 8;
   line_feed = 10;
   carriage_return = 13;
   escape = 27;
   space = 32;
   delete = 127;

   sio_data = $e0;
   sio_control = $e1;
   tx_empty = $04;
   console = $06;
   kbd_status = $fe;
   kbd_transfer = $fd;
   ready = $ff;
```

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PROGRAM FILE

```
    sio_buf_size = 4095;      {must be a power of two less 1}
    kbd_buf_size = 15;        {must be a power of two less 1}

    mosaic_index: ARRAY [0..21, false..true] OF byte = (
                  ($c0, $c8), ($c1, $c9), (0, 0), (0, 0), ($c2, $ca), ($c3, $cb), (0, 0),
                  (0, 0), (0, 0), (0, 0), (0, 0), (0, 0), (0, 0), (0, 0), (0, 0), (0, 0),
                  ($c4, $cc), ($c5, $cd), (0, 0), (0, 0), ($c6, $ce), ($c7, $cf));

VAR

    ch, row, col, tx_mask, viewport_tr, viewport_lc, viewport_h, viewport_w,
       inactive_loops: byte;
    sio_buf_next, sio_buf_used, kbd_buf_next, kbd_buf_used, bios_interrupt: integer;
    emulation: (tty, vt52, control_show, viewdata);
    all_sent, reveal_info, local_echo, esc_just_recd: boolean;

    page_store: ARRAY [0..23, 0..39] OF byte;
    row_altered, row_contains_dh_chars: ARRAY [0..23] OF boolean;
    sio_buf: ARRAY [0..sio_buf_size] OF byte;
    kbd_buf: ARRAY [0..kbd_buf_size] OF byte;
    interrupt: ARRAY [1..59] OF byte;
    stretch_char: ARRAY [1..17] OF byte;
    original_matrix: ARRAY [1..48] OF byte;
    viewdata_matrix: ARRAY [0..$67f] OF byte;
    bios_30: ARRAY [1..3] OF byte;
    copy: RECORD
            ld_hl       : byte;
            source      : integer;
            ld_de       : byte;
            destination: integer;
            ld_bc       : byte;
            size        : integer;
            ldir        : integer;
            ret         : byte
          END;

PROCEDURE get_command_line_param (n: byte);

    BEGIN

       IF paramstr (n) = 'TTY' THEN
          emulation := tty
       ELSE IF paramstr (n) = 'VT52' THEN
          emulation := vt52
       ELSE IF paramstr (n) = 'CONTROLSHOW' THEN
          emulation := control_show
       ELSE IF (paramstr (n) = 'VIEWDATA') OR (paramstr (n) = 'PRESTEL') THEN
          emulation := viewdata
       ELSE IF paramstr (n) = 'LOCALECHO' THEN
          local_echo := true
       ELSE
          BEGIN
          writeln ('Unrecognised command line parameter ', paramstr (n),
                   ' - program stopping.');
          halt
          END

    END;

PROCEDURE clear_viewdata_screen;

    BEGIN

       bdos (console, escape);  bdos (console, ord ('E'));  {clear screen}
       bdos (console, escape);  bdos (console, ord ('e'));  {enable cursor blob}
       row := 0;
       col := 0;
       reveal_info := false;
       fillchar (page_store, sizeof (page_store), space);
       fillchar (row_altered, sizeof (row_altered), false);
       fillchar (row_contains_dh_chars, sizeof (row_contains_dh_chars), false)

    END;

PROCEDURE set_up_viewdata;

    BEGIN

       clear_viewdata_screen;
       esc_just_recd := false;
       inactive_loops := 0;
       bdos (console, escape);  bdos (console, ord('X'));  {set 25x81 viewport}
       bdos (console, 35);  bdos (console, 37);
       bdos (console, 56);  bdos (console, 112)
       {the viewport is 25 rows by 81 columns, to allow double height characters on row 24
        and to prevent wrapping when writing to column 80}

    END;

PROCEDURE leave_viewdata;

    BEGIN

       bdos (console, escape);  bdos (console, ord('E'));  {clear screen}
       bdos (console, escape);  bdos (console, ord('X'));  {restore original viewport}
       bdos (console, viewport_tr+32);  bdos (console, viewport_lc+32);
       bdos (console, viewport_h+32);  bdos (console, viewport_w+32);
       bdos (console, escape);  bdos (console, ord('H'));  {home cursor}
       bdos (console, escape);  bdos (console, ord('e'))   {enable cursor blob}

    END;

PROCEDURE copy_memory (source, destination, size: integer);

    BEGIN

       copy.source := source;
       copy.destination := destination;
       copy.size := size;
       inline ($01/copy/        { ld   bc,copy }
               $cd/bios_30/     { call bios_30 }
               $e9/$00)         { defw $00e9   }
```

```
    END;

PROCEDURE initialise;

    VAR

       bios_30_entry: integer;
       n: byte;
       ovl_file: FILE;

    BEGIN

       (set up a routine which jumps to BIOS function 30 (USERF))
       bios_30_entry := mem [$0001] + 256 * mem [$0002] + 87;
       bios_30 [1] := $c3;
       bios_30 [2] := lo (bios_30_entry);
       bios_30 [3] := hi (bios_30_entry);

       (check if a serial interface is fitted)
       inline ($cd/bios_30/                    { call bios_30 }
              $e6/$00/                         { defw $00e6   }
              $79/                             { ld   a,c     }
              $32/n);                          { ld   (n),a   }
       IF n <> $ff THEN
          BEGIN
          writeln ('Serial interface not fitted - program stopping.');
    halt
    END;

(check whether running on a CPC6128 or PCW8256/8512)
inline ($cd/bios_30/                           { call bios_30 }
        $e3/$00/                               { defw $00e3   }
        $32/n);                                { ld   (n),a   }
IF n <> 1 THEN
   BEGIN
   writeln ('This program only works on a PCW8256 or PCW8512.');
   halt
   END;

(check for traces of this being an unknown and unsuitable version of BIOS)
IF (mem [$0039] <> $a1) OR (mem [$003a] <> $fd) OR
   (mem [$fdcd] <> $a7) OR (mem [$fdce] <> $fe) THEN
   BEGIN
   writeln ('Cannot cope with this version of CP/M - program stopping.');
   halt
   END;

(make sure that the sio's tx buffer is empty)
IF (port [sio_control] AND tx_empty) = 0 THEN
   BEGIN
   writeln ('Serial interface not ready - program stopping.');
   halt
   END;

(get the command line parameters)
emulation := tty;
local_echo := false;
FOR n := 1 TO paramcount DO
   get_command_line_param (n);

(load the viewdata character matrices from VDU.OVL)
assign (ovl_file, 'vdu.ovl');
{$I-} reset (ovl_file) {$I+};
n := ioresult;
IF (n = $01) AND (mem [$0050] <> 0) THEN
   BEGIN
   (VDU.OVL does not exist on the default drive - try the drive from which the
    program was loaded)
   assign (ovl_file, chr(mem[$0050]-1+ord('A')) + ':vdu.ovl');
   {$I-} reset (ovl_file) {$I+};
   n := ioresult
   END;
IF n <> 0 THEN
   BEGIN
   IF n = $01 THEN
      writeln ('Cannot find VDU.OVL - program stopping.')
   ELSE
      writeln ('Error opening VDU.OVL - program stopping.');
   halt
   END;
{$I-} blockread (ovl_file, viewdata_matrix, 13) {$I+};
IF ioresult <> 0 THEN
   BEGIN
   writeln ('Error reading VDU.OVL - program stopping.');
   halt
   END;
close (ovl_file);

(happy with all checks - lets start)

(get the current viewport position and size)
inline ($cd/bios_30/          { call bios_30          }
        $bf/$00/              { defw $00bf            }
        $78/                  { ld   a,b              }
        $32/viewport_tr/      { ld   (viewport_tr),a  }
        $79/                  { ld   a,c              }
        $32/viewport_lc/      { ld   (viewport_lc),a  }
        $7a/                  { ld   a,d              }
        $32/viewport_h/       { ld   (viewport_h),a   }
        $7b/                  { ld   a,e              }
        $32/viewport_w);      { ld   (viewport_w),a   }

IF emulation = viewdata THEN
   BEGIN
   set_up_viewdata;
   row := 2
   END
ELSE
   BEGIN
   bdos (console, escape);  bdos (console, ord ('E'))  (clear screen)
   END;
bdos (console, escape);  bdos (console, ord ('H'));    (home cursor)
```

PROGRAM FILE

```
writeln ('VDU v2.2 by Phil Wade ', chr (164), '1988');
writeln ('Type [EXTRA]+/ to quit');

{a mask representing the number of data bits transmitted per character
 is required when sending BREAK}
inline ($cd/bios_30/          { call bios_30 }
        $bc/$00/              { defw $00bc   }
        $7d/                  { ld   a,l     }
        $32/n);               { ld   (n),a   }
CASE n OF
   5: tx_mask := $00;
   6: tx_mask := $40;
   7: tx_mask := $20;
   8: tx_mask := $60
END;

{set up a routine in common memory for producing double height characters, as
 it will be called with the screen environment in context.  The matrices for the
 viewdata character have already been copied to $f0 (left half) and $f1 (right
 half); stretch these and put into $f2..$f5 (upper left, lower left, upper right,
 lower right)}
stretch_char [ 1] := $21;   {     ld   hl,$bf80 }
stretch_char [ 2] := $80;
stretch_char [ 3] := $bf;
stretch_char [ 4] := $11;   {     ld   de,$bf90 }
stretch_char [ 5] := $90;
stretch_char [ 6] := $bf;
stretch_char [ 7] := $06;   {     ld   b,16     }
stretch_char [ 8] := $10;
stretch_char [ 9] := $7e;   {loop ld   a,(hl)   }
stretch_char [10] := $12;   {     ld   (de),a   }
stretch_char [11] := $13;   {     inc  de       }
stretch_char [12] := $12;   {     ld   (de),a   }
stretch_char [13] := $13;   {     inc  de       }
stretch_char [14] := $23;   {     inc  hl       }
stretch_char [15] := $10;   {     djnz loop     }
stretch_char [16] := $f8;
stretch_char [17] := $c9;   {     ret           }

{set up a routine in common memory for copying character matrices, as
 it will be called with the screen environment in context}
WITH copy DO
   BEGIN
   ld_hl := $21;
   ld_de := $11;
   ld_bc := $01;
   ldir := $b0ed;
   ret := $c9
   END;

{save a copy of the character matrices for characters $f0..$f5 as they will be
 corrupted during viewdata emulation}
copy_memory ($bf80, addr (original_matrix), 48);

sio_buf_next := 0;
sio_buf_used := 0;
kbd_buf_next := 0;
kbd_buf_used := 0;

{interrupts are made to call the following routine, which gets any received
 characters available on the sio.  The routine is placed in an array as it
 must be in the common area of memory, i.e. above $c000}
bios_interrupt := mem [$fea7] + 256 * mem [$fea8];
interrupt [ 1] := $f5;                          {       push af                 }
interrupt [ 2] := $db;                          {       in   a,(sio_control)    }
interrupt [ 3] := sio_control;
interrupt [ 4] := $e6;                          {       and  $01                }
interrupt [ 5] := $01;
interrupt [ 6] := $28;                          {       jr   z,nochrs           }
interrupt [ 7] := $30;
interrupt [ 8] := $c5;                          {       push bc                 }
interrupt [ 9] := $d5;                          {       push de                 }
interrupt [10] := $e5;                          {       push hl                 }
interrupt [11] := $2a;                          {loop   ld   hl,(sio_buf_used)  }
interrupt [12] := lo (addr (sio_buf_used));
interrupt [13] := hi (addr (sio_buf_used));
interrupt [14] := $11;                          {       ld   de,sio_buf_size    }
interrupt [15] := lo (sio_buf_size);
interrupt [16] := hi (sio_buf_size);
interrupt [17] := $ed;                          {       sbc  hl,de              }
interrupt [18] := $52;
interrupt [19] := $28;                          {       jr   z,bufful           }
interrupt [20] := $20;
interrupt [21] := $19;                          {       add  hl,de              }
interrupt [22] := $23;                          {       inc  hl                 }
interrupt [23] := $22;                          {       ld   (sio_buf_used),hl  }
interrupt [24] := lo (addr (sio_buf_used));
interrupt [25] := hi (addr (sio_buf_used));
interrupt [26] := $2b;                          {       dec  hl                 }
interrupt [27] := $ed;                          {       ld   bc,(sio_buf_next)  }
interrupt [28] := $4b;
interrupt [29] := lo (addr (sio_buf_next));
interrupt [30] := hi (addr (sio_buf_next));
interrupt [31] := $09;                          {       add  hl,bc              }
interrupt [32] := $7c;                          {       ld   a,h                }
interrupt [33] := $a2;                          {       and  d                  }
interrupt [34] := $47;                          {       ld   b,a                }
interrupt [35] := $7d;                          {       ld   a,l                }
interrupt [36] := $a3;                          {       and  e                  }
interrupt [37] := $4f;                          {       ld   c,a                }
interrupt [38] := $21;                          {       ld   hl,sio_buf         }
interrupt [39] := lo (addr (sio_buf));
interrupt [40] := hi (addr (sio_buf));
interrupt [41] := $09;                          {       add  hl,bc              }
interrupt [42] := $db;                          {       in   a,(sio_data)       }
interrupt [43] := sio_data;
interrupt [44] := $e6;                          {       and  $7f                }
interrupt [45] := $7f;
interrupt [46] := $77;                          {       ld   (hl),a             }
interrupt [47] := $db;                          {       in   a,(sio_control)    }
```

PROGRAM FILE

```
        interrupt [48] := sio_control;
        interrupt [49] := $e6;                          (       and  $01                )
        interrupt [50] := $01;
        interrupt [51] := $20;                          (       jr   nz,loop            )
        interrupt [52] := $d6;
        interrupt [53] := $e1;                          (bufful pop  hl                 )
        interrupt [54] := $d1;                          (       pop  de                 )
        interrupt [55] := $c1;                          (       pop  bc                 )
        interrupt [56] := $f1;                          (nochrs pop  af                 )
        interrupt [57] := $c3;                          (       jp   bios_interrupt     )
        interrupt [58] := lo (bios_interrupt);
        interrupt [59] := hi (bios_interrupt);
        inline ($f3);
        mem [$fea7] := lo (addr (interrupt));
        mem [$fea8] := hi (addr (interrupt));
        inline ($fb)

    END;

PROCEDURE update_viewdata_display (row: byte);

    (this routine redisplays a complete viewdata row from the page store (if there have
     been any changes), and also redisplays the following row if this row contains, or
     ceases to contain, double height characters.  The routine is always used before
     the cursor moves to a new row, and also about 1/100th of a second after all
     characters from the serial port have been dealt with)

    TYPE

       level_type = (upper, lower);

    VAR

       row_did_contain_dh_chars: boolean;
       col: byte;

    PROCEDURE output_viewdata_row (row: byte; level: level_type);

       TYPE

          colours = (black, red, green, yellow, blue, magenta, cyan, white);

       VAR

          foreground, background: colours;
          char_set: (alpha, mosaic);
          double_height, conceal, separated_mosaic, hold_mosaic: boolean;
          col, ch, last_graphics_ch: byte;

 PROCEDURE output_viewdata_ch (left, right: byte);

    BEGIN

       IF (foreground = background) OR
          (conceal AND NOT reveal_info) OR
          ((level = lower) AND NOT double_height) OR
          ((left IN [$00, $c0, $c8]) AND (right IN [$01, $c0, $c8])) THEN
          BEGIN
          bdos (console, space);
          bdos (console, space)
          END
       ELSE
          BEGIN
          (copy the matrices for this viewdata character into the system character
           matrix area for characters $f0 (left half) and $f1 (right half))
          IF left + 1 = right THEN
             copy_memory (addr (viewdata_matrix [left SHL 3]), $bf80, 16)
          ELSE
             BEGIN
             copy_memory (addr (viewdata_matrix [left SHL 3]), $bf80, 8);
             copy_memory (addr (viewdata_matrix [right SHL 3]), $bf88, 8)
             END;
          IF double_height THEN
             BEGIN
             inline ($01/stretch_char/    ( ld   bc,stretch_char )
                     $cd/bios_30/         ( call bios_30         )
                     $e9/$00);            ( defw $00e9           )
             IF level = upper THEN
                BEGIN
                bdos (console, $f2);
                bdos (console, $f4)
                END
             ELSE
                BEGIN
                bdos (console, $f3);
                bdos (console, $f5)
                END
             END
          ELSE
             BEGIN
             bdos (console, $f0);
             bdos (console, $f1)
             END
          END

    END (output_viewdata_ch);

 BEGIN (output_viewdata_row)

    (move the cursor to the start of the row)
    bdos (console, escape);  bdos (console, ord ('Y'));
    IF level = upper THEN
       bdos (console, row+32)
    ELSE
       bdos (console, row+33);
    bdos (console, 32);

    IF row > 0 THEN
       IF row_contains_dh_chars [row-1] THEN
          BEGIN
```

PROGRAM FILE

```
                (the display of this row is suppressed as the row above contains double
                 height characters)
                IF level = lower THEN
                   BEGIN
                   (this row also contains double height characters so clear the lower
                    half)
                   bdos (console, escape);  bdos (console, ord ('K'))
                   END;
                exit
                END;

          (set the default attributes for the start of the row)
          foreground := white;
          background := black;
          char_set := alpha;
          double_height := false;
          conceal := false;
          separated_mosaic := false;
          hold_mosaic := false;
          last_graphics_ch := 0;

          FOR col := 0 TO 39 DO
             BEGIN
             ch := page_store [row, col];
             IF ch IN [$00..$1f] THEN
                BEGIN
                (this is an attribute change)
                CASE ch OF
                   $1c: BEGIN
                        background := black;
                        (use normal video when the background is black)
                        bdos (console, escape);  bdos (console, ord ('q'))
                        END;
                   $1d: BEGIN
                        background := foreground;
                        (use reverse video when the background is not black)
                        bdos (console, escape);  bdos (console, ord ('p'))
                        END;
                   $1e: hold_mosaic := true
                END (case);
                IF (char_set = mosaic) AND hold_mosaic THEN
                   output_viewdata_ch (
                      mosaic_index [last_graphics_ch AND $15, separated_mosaic],
                      mosaic_index [last_graphics_ch SHR 1 AND $15, separated_mosaic])
                ELSE
                   BEGIN
                   output_viewdata_ch ($00, $01);
                   last_graphics_ch := 0
                   END;
                CASE ch OF
                   $01..$07: BEGIN
                             char_set := alpha;
                             foreground := colours (ch)
                             END;
                   $0c     : double_height := false;
                   $0d     : double_height := true;
                   $11..$17: BEGIN
                             char_set := mosaic;
                             foreground := colours (ch - $10)
                             END;
                   $18     : conceal := true;
                   $19     : separated_mosaic := false;
                   $1a     : separated_mosaic := true;
                   $1f     : hold_mosaic := false
                END (case)
                END
             ELSE IF (ch IN [$20..$3f, $60..$7f]) AND (char_set = mosaic) THEN
                BEGIN
                IF ch <= $3f THEN
                   last_graphics_ch := ch - $20
                ELSE
                   last_graphics_ch := ch - $40;
                output_viewdata_ch (
                   mosaic_index [last_graphics_ch AND $15, separated_mosaic],
                   mosaic_index [last_graphics_ch SHR 1 AND $15, separated_mosaic])
                END
             ELSE
                output_viewdata_ch (ch SHL 1 - $40, ch SHL 1 - $3f)
             END;

          IF background <> black THEN
             BEGIN
             bdos (console, escape);  bdos (console, ord ('q'))  (restore normal video)
             END

       END (output_viewdata_row);

    BEGIN (update_viewdata_display)

       IF NOT row_altered [row] THEN
          exit;

       row_did_contain_dh_chars := row_contains_dh_chars [row];
       row_contains_dh_chars [row] := false;
       FOR col := 0 TO 39 DO
          IF page_store [row, col] = $0d THEN
             row_contains_dh_chars [row] := true;

       output_viewdata_row (row, upper);
       IF row_contains_dh_chars [row] THEN
          output_viewdata_row (row, lower);

       IF row_contains_dh_chars [row] OR row_did_contain_dh_chars THEN
          IF row < 23 THEN
             BEGIN
             output_viewdata_row (row+1, upper);
             IF row_contains_dh_chars [row+1] THEN
                output_viewdata_row (row+1, lower)
             END
          ELSE IF NOT row_contains_dh_chars [row] THEN
             BEGIN
```

PROGRAM FILE

```
            (the bottom row used to contain double height chars - clear the lower half)
            bdos (console, escape);  bdos (console, ord ('Y'));
            bdos (console, 56);  bdos (console, 32);
            bdos (console, escape);  bdos (console, ord ('K'))
            END;

      row_altered [row] := false

   END (update_viewdata_display);

PROCEDURE add_to_sio_buf (ch: byte);
   (this procedure is just called for local echo - characters arriving on the sio are
    placed directly into the buffer by the interrupt routine)

   BEGIN

      inline ($f3);  (disable interrupts to prevent simultaneous access to variables)
      IF sio_buf_used < sio_buf_size THEN
         BEGIN
         sio_buf [(sio_buf_next + sio_buf_used) AND sio_buf_size] := ch;
         sio_buf_used := sio_buf_used + 1
         END;
      inline ($fb)

   END;

FUNCTION get_from_sio_buf: byte;

   BEGIN

      inline ($f3);  (disable interrupts to prevent simultaneous access to variables)
      get_from_sio_buf := sio_buf [sio_buf_next];
      sio_buf_next := (sio_buf_next + 1) AND sio_buf_size;
      sio_buf_used := sio_buf_used - 1;
      inline ($fb)

   END;

PROCEDURE add_to_kbd_buf (ch: byte);

   BEGIN

      IF kbd_buf_used < kbd_buf_size THEN
         BEGIN
         kbd_buf [(kbd_buf_next + kbd_buf_used) AND kbd_buf_size] := ch;
         kbd_buf_used := kbd_buf_used + 1;
         IF local_echo THEN
            BEGIN
            add_to_sio_buf (ch);
            IF ch = carriage_return THEN
               add_to_sio_buf (line_feed)
            END
         END
      ELSE
         bdos (console, bell)

   END;

FUNCTION get_from_kbd_buf: byte;

   BEGIN

      get_from_kbd_buf := kbd_buf [kbd_buf_next];
      kbd_buf_next := (kbd_buf_next + 1) AND kbd_buf_size;
      kbd_buf_used := kbd_buf_used - 1

   END;

-------------------------------------------------------------------------------

VDU2.PAS
--------
BEGIN  (main program)

   initialise;

   REPEAT

      (output one character on the serial port)
      IF (kbd_buf_used > 0) AND ((port [sio_control] AND tx_empty) <> 0) THEN
         port [sio_data] := get_from_kbd_buf;

      (get all characters waiting at keyboard)
      WHILE bdos (console, kbd_status) = ready DO
         BEGIN
         ch := bdos (console, kbd_transfer);
         IF emulation = viewdata THEN
            CASE ch OF          { key              viewdata character generated }
               1  : ch := 8;    { left cursor      cursor left     }
               6  : ch := 9;    { right cursor     cursor right    }
              30  : ch := 10;   { down cursor      cursor down     }
              31  : ch := 11;   { up cursor        cursor up       }
              35  : ch := 95;   { #                hash            }
              92  : ch := 255;  { [EXTRA]+1/2      none            }
              95  : ch := 96;   { _                wide hyphen     }
              96  : ch := 255;  { [EXTRA]+8        none            }
             123: ch := 255;  { open curly bkt   none            }
             125: ch := 255;  { close curly bkt  none            }
             163: ch := 35;   { [SHIFT]+3        pound sign      }
             166: ch := 42;   { section          star            }
             168: ch := 123;  { [ALT]+2          one quarter     }
             169: ch := 92;   { 1/2              half            }
             170: ch := 125   { [ALT]+6          three quarters  }
            END (case);
         CASE ch OF
            $00..$7f       : add_to_kbd_buf (ch);
            ^v_ch          : BEGIN
                             IF emulation = viewdata THEN
                                leave_viewdata;
                             emulation := tty
                             END;
```

PROGRAM FILE

```
                        END;
                     (restore the cursor position)
                     bdos (console, escape);  bdos (console, ord ('Y'));
                     bdos (console, row+32);  bdos (console, col+2+32)
                     END;
      local_echo_ch  : local_echo := NOT local_echo;
      break_ch       : BEGIN
                       i := 0;
                       REPEAT  (give the sio a chance to finish sending all
                                its characters)
                          i := i + 1;
                          inline ($f3);  (disable interrupts to prevent sio
                                         access between following two lines)
                          port [sio_control] := $01;
                          all_sent := (port [sio_control] AND $01) <> 0;
                          inline ($fb)
                       UNTIL (i = 1000) OR all_sent;
                       (start sending break)
                       inline ($f3);  (disable interrupts as above)
                       port [sio_control] := $05;
                       port [sio_control] := $9f OR tx_mask;
                       inline ($fb);
                       (hang around a while - recommended time for BREAK
                        is 0.2333 sec)
                       delay (150);
                       (stop sending break)
                       inline ($f3);  (disable interrupts again)
                       port [sio_control] := $05;
                       port [sio_control] := $8f OR tx_mask;
                       inline ($fb)
                       END;
      quit_ch        : BEGIN
                       IF emulation = viewdata THEN
                          leave_viewdata;
                       (restore the original character matrices for characters
                        $f0..$f5)
                       copy_memory (addr (original_matrix), $bf80, 48);
                       (stop interrupts being redirected to the sio routine)
                       inline ($f3);
                       mem [$fea7] := lo (bios_interrupt);
                       mem [$fea8] := hi (bios_interrupt);
                       inline ($fb);
                       halt
                       END
   END (case)
   END;

(put up to 5 characters to the screen)
i := 0;
WHILE (sio_buf_used > 0) AND (i < 5) DO
   BEGIN
   ch := get_from_sio_buf;
   CASE emulation OF
      tty          : IF ch = delete THEN
                        BEGIN
                        bdos (console, backspace);
                        bdos (console, space);
                        bdos (console, backspace)
                        END
                     ELSE IF ch <> escape THEN
                        bdos (console, ch);

      vt52         : IF ch = delete THEN
                        BEGIN
                        bdos (console, backspace);
                        bdos (console, space);
                        bdos (console, backspace)
                        END
                     ELSE
                        bdos (console, ch);
      control_show: IF ch = 10 THEN
                        BEGIN
                        bdos (console, escape);
                        bdos (console, 9);
                        bdos (console, 13);
                        bdos (console, 10)
                        END
                     ELSE IF ch = 13 THEN
                        BEGIN
                        bdos (console, escape);
                        bdos (console, 11)
                        END
                     ELSE IF ch < 32 THEN
                        BEGIN
                        bdos (console, 180);
                        bdos (console, $40+ch)
                        END
                     ELSE IF ch = 127 THEN
                        BEGIN
```

```
                        bdos (console, 180);
                        bdos (console, ord ('D'));
                        bdos (console, ord ('E'));
                        bdos (console, ord ('L'))
                        END
                     ELSE
                        bdos (console, ch);
            viewdata : BEGIN
                     IF esc_just_recd AND (ch IN [$40..$5f]) THEN
                        BEGIN
                        {this is an attribute change}
                        esc_just_recd := false;
                        page_store [row, col] := ch - $40;
                        row_altered [row] := true;
                        col := col + 1
                        END
                     ELSE
                        BEGIN
                        esc_just_recd := false;
                        CASE ch OF
                           $20..$7f: {printable character}
                                     BEGIN
                                     page_store [row, col] := ch;
                                     row_altered [row] := true;
                                     col := col + 1
                                     END;
                              $08  : {cursor left}
                                     IF col = 0 THEN
                                        BEGIN
                                        update_viewdata_display (row);
                                        col := 39;
                                        IF row = 0 THEN
                                           row := 23
                                        ELSE
                                     row := row - 1
                                  END
                               ELSE
                                  col := col - 1;
                           $09  : {cursor right}
                                  col := col + 1;
                           $0a  : {cursor down}
                                  BEGIN
                                  update_viewdata_display (row);
                                  row := (row + 1) MOD 24
                                  END;
                           $0b  : {cursor up}
                                  BEGIN
                                  update_viewdata_display (row);
                                  IF row = 0 THEN
                                     row := 23
                                  ELSE
                                     row := row - 1
                                  END;
                           $0c  : {clear screen}
                                  clear_viewdata_screen;
                           $0d  : {carriage return}
                                  col := 0;
                           $11  : {cursor on}
                                  BEGIN
                                  bdos (console, escape);
                                  bdos (console, ord('e'))  {enable cursor blob}
                                  END;
                           $14  : {cursor off}
                                  BEGIN
                                  bdos (console, escape);
                                  bdos (console, ord('f'))  {disable cursor blob}
                                  END;
                           $1b  : {attribute change follows}
                                  esc_just_recd := true;
                           $1e  : {home cursor}
                                  BEGIN
                                  update_viewdata_display (row);
                                  row := 0;
                                  col := 0
                                  END
                        END {case ch of}
                        END {if};
                     IF col = 40 THEN
                        BEGIN
                        update_viewdata_display (row);
                        col := 0;
                        row := (row + 1) MOD 24
                        END;
                     inactive_loops := 0
                     END {viewdata case label}
      END {case emulation of};
      i := i + 1
      END {while};

{update the viewdata display if all characters have been dealt with and they
 have stopped arriving on the serial port}
IF emulation = viewdata THEN
   IF inactive_loops = 15 THEN
      BEGIN
      update_viewdata_display (row);

            {move the cursor to its current position}
            bdos (console, escape);  bdos (console, ord ('Y'));
            bdos (console, row+32);  bdos (console, col#2+32);
            inactive_loops := $ff
            END
         ELSE IF inactive_loops <> $ff THEN
            inactive_loops := inactive_loops + 1

   UNTIL false

END.
```

VDUOVL. HEX

```
:200100000000000000000000000000000000000000303030303000300808080808000800CD
:200120000E0E0E0000000007070700000000000030E3E3E3E0E3F00F01C0080001CFC00E8
:20014000031F331F033F030080F880F098F080003C663D03070E1C0070E0C08078CC780097
:200160000F1C0E071E381F00E070E08CD870DC0003030300000000008080800000000061
:20018000003070707030000F0C0000000C0F0000F0300000030F0000C0E0E0E0C00000A0
:2001A000000E031F030E00000070C0F8C0700000000030 31F0303000000808 0F0808000008B
:2001C000000000000003030F000000000808000000001F0000000000000F000000000FB
:2001E000000000000003030000000000080800000000103070E1C0070E0C0800000000034
:200200000F1C38393B1E0F00E070F8B83870E000071F0303030303008080808080800009D
:200220000F3800031E383F00E03838E00000F8000F38000300380F00E03838E03838E000A6
:2002400003070E1C3F000000E0E0E0E0F8E0E0003F38383F00380F00F80000E03838E00096
:200260000F38383F38380F00E07800E03838E0003F000003070707 00F838E0800000000D2
:200280000F38380F38380F00E03838E03838E0000F38380F00380F00E03838F83838E00064
:2002A000000003030003030000008080008080000000030300030 30F000080800080800017
:2002C000000107 1C070100007 0C0000000C070000000 1F001F0000000000F000F000000074
:2002E0001C07010001071C000000C070C00000000F3800030300030 0E03838E08000800046
:200300000F38393939380F00E038F8F8F800F000003 0E1C383F38380080E07038F838380030
:200320003F38383F38383F00E03838E03838E000071E3838381E0700E07800000038E0003E
:200340003F38383838383F00C0F0383838F0C0003F38383F38383F00F80000C00000F800B2
:200360003F38383F38383800F80000C000000000071E3838381E0700E0780000F838F800BD
:2003800038383838F38383800383838F8383838001F0303030303 1F00F08080808080F000D9
:2003A0000F0101013939 1F00F8C0C0C0C0C0800038383B3F3B38380038E0800080E038009D
:2003C0003838383838383F000000000000F8003C3E3F3B3938380078F8F8B8383838 00031
:2003E0003C3E3F3B3938380038383B8F8F878000F38383838380F00E0383838383E0008A
:200400003F38383F38383800E03838E000000000F38383838380F00E038383898E0B80025
:200420003F38383F3B383800E03838E080E038000F38380F00380F00E03800E03838E0003E
:200440003F0303030303030 0F880808080808000383838383838 0F00383838383838E000C4
:2004600038383810C0E0703003838387 0E0C080003838393B3F3E3C00383838B8F8F8780003
:200480003C0E0703070E3C0078E0C080C0E078003838 1C0F0303030038387 0E08080800023
:2004A0003F0000030E383F00F838E0800000F80000030F3F0F030000000000F80000000092
:2004C0001838181818000000000078CC1870FC000001013F0101000000080E0F8E08000001
:2004E0000103070F030303000080C0E0808080000E0E1F0E1F0E0E007070F870F870700095
:200500000000000FF0000000000000FF000000000000F000F380F000000E038F838F80038
:2005200038383F3838383F000000E0383838E00000000F3838380F000000E0380038E000C7
:200540000000003838380F003838F8383838F80000000F383F380F000000E038F800E00010
:20056000030E0E3F0E0E0E00E03800E000000000000F38380F000F0000F83838F838E0E6
:200580003838 3F3838383800000E038383838000300030303030300800808080808000FA
:2005A000000000000038380F38003838383838E0383838383F3838000000 38E080E038004D
:2005C0000303030303030100808080808080E00000000E3F393938000000 70FC9C9C1C0071
:2005E00000003F3838383800000E0383838380000000F3838380F000000E0383838E000EE
:200600000000 3F38383F38380000E03838E0000000000F38380F00000000F83838F83838EE
:2006200000000393F3838380000000E038000000000000 1F381F001F000000F000F038F000E5
:200640000E0E3F0E0E0E03000000E0000038E000000038383838 0F0000003838383 8F80053
:2006600000003838380E030000003838 38E080000000 3839393F0E0000001C9C9CFC700002
:200680000000380E030E3800000038E080E038000000 3838380F001F0000 383838F838E08D
:2006A00000003F00030F3F000000F8F0C000F8001838181818000000000003878D8FC1800D6
:2006C0001C1C1C1C1C1C1C1C1C7070707070707070 3E031E033E0000000000 3878D8FC18007E
:2006E00000000 3001F0003000000 8000F0008000003F3F3F3F3F3F0000FCFCFCFCFCFC0083
:200700000000000000000000FFFFFF000000000000000FFFF000000FFFFFFFFFF000000E3
:20072000000000000FFFFFFFFFFFF00000FFFFFF000000FFFFFFFFFFFFFFFFFFFFFFFFFCF
:2007400000000000000000007E7E0000000000000000007E000000007E7E007E00000000A5
:200760000000000007E7E007E7E0000007E7E000000007E007E7E007E7E007E007E7E0095
:0000000000
```

Amstrad CPC/PCW Disk Reader

by Alan Potter

PCWDPB allows an Amstrad CPC6128, or a souped-up CPC464 or 664, running under CP/M Plus, to read disks formatted on the PCW8256 (or 8512, as long as they are single-sided disks produced in the top drive).

The routine sets up the logical B: drive to understand the PCW format, and then files can be PIPped from and to that disk. DISCKIT, however, will *not* work.

How it works

CP/M Plus stores a list of 'parameters' for each (logical) disk drive that it has; this is called the 'disk parameter block'. These parameters control information such as how many sectors the disk has per track, how many directory entries there may be, and so on.

The program has a copy of the PCW disk parameter block, and all it does is ask the operating system where that block is stored in memory. It then copies its block to that location, setting a flag which instructs the computer to use the new block rather than trying to match that block with one it already knows. When this has been done, that B: drive will *only* read PCW disks until the 'PCWOFF' command is executed. This returns the disk parameter block to its previous state.

Writing the program

The program has been written in 8080 assembly language. This was done because there is an 8080 assembler supplied with the computer: indeed, your CP/M Plus system disks contain all the software necessary to create this program. Here's how you do it:

Find a floppy disk which has at least 100k free — preferably one which is entirely blank. Enter CP/M and, using PIP, copy the following files onto it:

MAC.COM
HEXCOM.COM

(these files are both on side 2 of the system disks). Now, using a text editor or word processor, type the program PCWDPB. Save this text file onto the same disk, with the name

PCWDPB.ASM. You should now have three files:

```
A:MAC    COM : HEXCOM
   COM : PCWDPB ASM
```

Type:

A>MAC PCWDPB

The disk drives should whirr a little, and you will see:

```
CP/M MACRO ASSEM 2.0
01AA
000H USE FACTOR
END OF ASSEMBLY
```

If you see anything other than this, such as a line from the program, something has gone wrong. Edit the text file and compare the file carefully with the printed program; they should be exactly the same.

When you have done this, you will find a number of other files with filename PCWDPB on your disk. These contain files, and one of them, PCWDPB.HEX, can now be converted into machine code. Simply type:

A>HEXCOM PCWDPB

Once again, the disk drive will whirr and the following message should be displayed:

```
HEXCOM VERS: 3.00

FIRST ADDRESS 0100
LAST ADDRESS 01A9
BYTES READ 00AA
RECORDS WRITTEN 02
```

And now, when you take a directory, you should see a file PCWDPB.COM; this is the program which makes the B: drive read disks produced by the Amstrad PCW8256. This can be executed simply by typing 'PCWDPB', but it is probably best to create the other program in the set which allows you to turn off this facility.

This is done very much as before, only the program file should be called PCWOFF.ASM. The relevant commands to turn the text file into a program file are:

A>MAC PCWOFF

A>HEXCOM PCWOFF

Now you have two programs, PCWDPB and PCWOFF. These turn the PCW disk-reading on and off, respectively. They can be PIPped onto other disks, just like any other CP/M transient command.

```
; This program sets up the B: drive on an Amstrad CPC 6128 (& equivalents)
; to read disks formatted as single-density, single sided disks on the
; Amstrad PCW 8256 or 8512.
;
;  Assembler Directives First
;
        ORG     100H
BDOS:   EQU     5
;
;  Print a message to tell the user what's happening
;
        MVI     C,9
        LXI     D,MSG
        CALL    BDOS
;
;  Log in the A: drive as the current drive
;
        MVI     C,0EH
        MVI     E,0
        CALL    BDOS
;
;  Carry on if no error occurred
;
        ANA     A
        JZ      NOERR
;
;  An error has occurred
;  Tell the user, then finish the program
;
        MVI     C,9
        LXI     D,ERRMSG
        CALL    BDOS
        RET
;
;  If we get here, no error has occurred
;  So ask for the address of A:'s extended disk parameter block
;
NOERR:  MVI     C,1FH
        CALL    BDOS
;
;  And increase it by 27 to the start of the B: disk parameter block
;
        LXI     B,27
        DAD     B
;
;  Now start shoving our new data into that block
;
        LXI     D,NBLK                  ; Get the start of our block
        LXI     B,(BEND-NBLK+1)         ; And its length
LOOP:   XCHG
        MOV     A,M                     ; Get information from our table
        XCHG
        MOV     M,A                     ; & put it where the system wants it
        INX     D                       ; Increment the source address
        INX     H                       ; & the detination address.
        DCX     B                       ; Decrement the 'bytes left' count.
        MOV     A,B
        ORA     C                       ; Check how many left to do.
        JNZ     LOOP                    ; If some left, go round loop again.
        RET                             ; Otherwise return to system.
;
;  Disk Parameter Block for PCW computers
;
;     (Source: The Amstrad CP/M Plus, Powys-Lybbe & Clarke,
;      pub: MML Systems, pp431.)
;
NBLK:   DB      36,0                    ;  36 Records per track
        DB      3                       ;   3 Block shift
        DB      7                       ;   7 Block mask
        DB      0                       ;   0 Extent mask
        DB      174,0                   ; 175 Data Blocks
        DB      63,0                    ;  64 Directory Entries
        DB      0C0H,00H                ;   2 Directory Blocks
        DB      16,0                    ;  16 bit checksum vector
        DB      1,0                     ;   1 Reserved Track
        DB      2                       ;   2 Physical Sector Shift
```

PROGRAM FILE

```
            DB      3                       ;   3 Physical Sector Mask
;
            DB      0                       ;     Single sided
            DB      40                      ;  40 Tracks per side
            DB      9                       ;   9 Sectors per track
            DB      1                       ;     First sector number
            DB      0,2                     ; 512 Bytes per sector
            DB      42                      ;     Gap length (read/write)
            DB      82                      ;     Gap length (format)
            DB      60H                     ;     MFM, Skip deleted address mark
BEND:       DB      0FFH                    ;     Don't auto-select format
;
MSG:        DB      'PCW Disk Reader Installed.',13,10,'$'
ERRMSG:     DB      'Error Installing PCW Reader - will not read PCW disks.',7
            DB      13,10,'$'

; Program to undo the effects of PCWDPB.COM.
;
; Assembler Directives First
;
            ORG     100H
BDOS:       EQU     5
;
; Now select the A: drive as current drive.
;
            MVI     E,0
            MVI     C,0EH
            CALL    BDOS
;
; Find the address of the Disk Parameter Block
;
            MVI     C,1FH
            CALL    BDOS
;
; And now find the address of B:'s 'Freeze Flag'
;
            LXI     B,53
            DAD     B
;
; Reset the flag
;
            XRA     A
            MOV     M,A
;
; Give the user a message
;
            LXI     D,MSG
            MVI     C,9
            CALL    BDOS
;
; And return to CP/M+
;
            RET
;
; Here's our message
;
MSG:        DB      'PCW reader removed from memory.',13,10,'$'
```

Orbit Matching Game

by P Rendell

This is a simple game that should be easy to convert to other languages and other computers. It has been written in HiSoft Pascal. The object of the game is to manoeuvre a space rocket into the same orbit as a disabled spaceship. This may sound easy, but it is very difficult if both the orbits are eccentric.

The basic technique for simulating an object in orbit around a planet is to use Newton's Law of Gravity. Polar coordinates have been used, since this makes it easier to run the motor and perform the necessary calculations.

Variables used in the program are R for the distance from the planet to the object, O for the angular position of the object in radians. R1 and O1 are the rates of change of R and O with time, and R11 and O11 are the rates of change of R1 and O1. The program uses the RECORD BODY to hold data on both the rocket and the spaceship, so both have data to run a motor although the spaceship's is disabled. TESTKEY is used to control the rocket motor.

The test for matching orbits is a crude proximity check. The first set of procedures listed are graphics procedures, and these should be replaced by appropriate ones in other Pascals. The only other problem in transporting the program is to adjust the speed to give a consistent response; the constants TD and POWER can be altered to do this. MOVEBODY can also be modified.

```
100 PROGRAM ORBIT ; {*$C-,L-  P.RENDELL  ORBIT MATCHING GAME *}
110                 {*        26/09/87  11 Avon St. Coventy  *}
120 CONST
130   POWER=0.00025; TWOPI=6.2831853;
140
150 TYPE
160   BODY=RECORD                          {* ROCKET / SHIP DATA *}
170     X,Y,HPTR,PEN:INTEGER;
180     R,R1,O,ELLIP,ACCELR,ACCELT:REAL;
190     HISTX,HISTY:ARRAY [1..230] OF INTEGER;
200     R0:ARRAY [0..6] OF INTEGER;
210     MOTORON:BOOLEAN;
220   END;
230
240   BODYPTR=^BODY;
250
260 VAR
270   ACCEL:REAL;
280   TAIL,THRUST,AIR,FUAL,VISUAL:INTEGER;
290   LEVEL,TOPLEV,PTS,TOPPTS:INTEGER;
300   TAIL0:ARRAY [0..6] OF INTEGER;
310   O10:ARRAY [0..6] OF REAL;
```

```
320
330   BR,BS:BODYPTR;          (* BR => ROCKET, BS=> DISABLED SHIP *)
340
350 PROCEDURE SCRSETMODE(M:INTEGER);
360 BEGIN RA:=CHR(M); USER(£BC0E) END;
370
380 PROCEDURE SCRSETINK(INK,COL:INTEGER);
390 BEGIN RA:=CHR(INK); RB:=CHR(COL); RC:=RB; USER(£BC32) END;
400
410 PROCEDURE SETCURSOR(C,R:INTEGER);
420 BEGIN RH:=CHR(C); RL:=CHR(R); USER(£BB75) END;
430
440 PROCEDURE GRAMOVEA(X,Y:INTEGER);
450 BEGIN RDE:=X; RHL:=Y; USER(£BBC0) END;
460
470 PROCEDURE GRASETOR(X,Y:INTEGER);
480 BEGIN RDE:=X; RHL:=Y; USER(£BBC9) END;
490
500 PROCEDURE GRASETPEN(PEN:INTEGER);
510 BEGIN RA:=CHR(PEN); USER(£BBDE) END;
520
530 PROCEDURE GRAPLOTR(X,Y:INTEGER);
540 BEGIN RDE:=X; RHL:=Y; USER(£BBED) END;
550
560 PROCEDURE GRAPLOTA(X,Y:INTEGER);
570 BEGIN RDE:=X; RHL:=Y; USER(£BBEA) END;
580
590 PROCEDURE GRALINEA(X,Y:INTEGER);
600 BEGIN RDE:=X; RHL:=Y; USER(£BBF6) END;
610
620 FUNCTION TESTKEY(KEYNO:INTEGER):BOOLEAN;   (* KEY PRESSED? *)
630 BEGIN RA:=CHR(KEYNO); USER(£BB1E); TESTKEY:=ORD(RF)<64 END;
640
650 PROCEDURE INITSCR;                  (*  DRAW SCREEN FOR NEW GAME *)
660 VAR K:INTEGER;
670 BEGIN
680   SCRSETINK(2,2); SCRSETINK(3,3);
690   SETCURSOR(1,1);
700   WRITE('THRUST ',THRUST:1,'  RAD/TAN -');
710   WRITE('  FUAL ',FUAL:3,'   AIR ',AIR:4);
720   SETCURSOR(33, 3); WRITE('LEVEL ',LEVEL);
730   SETCURSOR( 1,25); WRITE('TOP LEVEL ',TOPLEV);
740   SETCURSOR(31,23); WRITE('SCORE ';PTS:4);
750   SETCURSOR(27,25); WRITE('TOP SCORE ',TOPPTS:4);
760   GRASETOR(320,200); GRASETPEN(2);
770   GRAMOVEA(-300,0); GRALINEA(-8,0); GRAMOVEA(8,0); GRALINEA(300,0);
780   GRAMOVEA(0,-200); GRALINEA(0,-8); GRAMOVEA(0,180); GRALINEA(0,8);
790   GRASETPEN(1); GRAMOVEA(8,0);
800   FOR K:=1 TO 32 DO
810     GRALINEA(TRUNC(8*COS(TWOPI*K/32)),TRUNC(8*SIN(TWOPI*K/32)));
820 END;
830
840 PROCEDURE INITBODY(OBJ:BODYPTR);   (*  INITIALISE DATA OF BR OR BS *)
850 VAR K:INTEGER;
860 BEGIN
870   WITH OBJ^ DO BEGIN
880     R:=R0[LEVEL]+TRUNC(20*RANDOM(0)/MAXINT); R1:=0;
890     O:=TWOPI*RANDOM(0)/MAXINT; ELLIP:=O10[LEVEL]*R/SQRT(R);
900     TAIL:=TAIL0[LEVEL]; HPTR:=1;
910     X:=TRUNC(R*COS(O)); Y:=TRUNC(R*SIN(O));
920     FOR K:=1 TO TAIL DO BEGIN HISTX[K]:=X; HISTY[K]:=Y END;
930     ACCELR:=0; ACCELT:=0; MOTORON:=FALSE;
940   END
950 END;
960
970 PROCEDURE MOVEBODY(OBJ:BODYPTR);   (*  EQUATIONS OF MOTION *)
980 CONST TD=10;  VAR O1:REAL;
990 BEGIN
1000   WITH OBJ^ DO BEGIN                (* 2 STEPS PER MOVEMENT *)
1010     R1:=R1+ACCELR+(SQR(ELLIP)/R-1)*TD/SQR(R);
1020     R:=R+R1*TD;
1030     O1:=(ACCELT+ELLIP/R)/R;
1040     O:=O+TD*O1;
1050     IF MOTORON THEN ELLIP:=O1*SQR(R);
1060                                    (* 2ND CALULATION WITHOUT MOTOR *)
1070     R1:=R1+(SQR(ELLIP)/R-1)*TD/SQR(R);
1080     R:=R+R1*TD;
1090     O:=O+TD*ELLIP/SQR(R);
1100     IF O>TWOPI THEN O:=O-TWOPI;
1110   END
1120 END;
1130
1140 PROCEDURE DRAWBODY(OBJ:BODYPTR);   (*  UPDATE SCREEN FOR MOVEMENT *)
1150 BEGIN
1160   WITH OBJ^ DO BEGIN                                  (* BODY HEAD *)
1170     GRAMOVEA(X,Y); GRASETPEN(PEN);
1180     X:=TRUNC(R*COS(O)); Y:=TRUNC(R*SIN(O));
1190     GRALINEA(X,Y); GRASETPEN(1); GRAPLOTR(0,0);
1200
1210     GRAMOVEA(HISTX[HPTR],HISTY[HPTR]);                (* BODY TAIL *)
1220     HISTX[HPTR]:=X; HISTY[HPTR]:=Y;
1230     HPTR:=HPTR+1; IF HPTR>TAIL THEN HPTR:=1;
1240     GRASETPEN(0); GRALINEA(HISTX[HPTR],HISTY[HPTR]);
1250   END
1260 END;
1270
1280 FUNCTION COMMAND:BOOLEAN;          (* GET COMMAND FROM KEYBOARD *)
1290 VAR KEY:CHAR;                     (* RETURN TRUE TO CONTINUE   *)
1300 BEGIN
1310   KEY:=INCH;
1320   IF KEY IN ['E','e'] THEN COMMAND:=FALSE ELSE
1330   WITH BR^ DO BEGIN
1340     ACCELT:=0; ACCELR:=0; MOTORON:=TRUE; COMMAND:=TRUE;
1350     IF KEY IN ['1'..'9'] THEN THRUST:=ORD(KEY)-ORD('0');
1360     IF THRUST > FUAL THEN THRUST:=FUAL;
1370     ACCEL:=POWER*THRUST;
1380     SETCURSOR(8,1); WRITE(THRUST:1); SETCURSOR(19,1);
1390     IF TESTKEY(1)       THEN BEGIN WRITE('R'); ACCELT:=-ACCEL END
1400     ELSE IF TESTKEY(8) THEN BEGIN WRITE('L'); ACCELT:= ACCEL END
1410     ELSE IF TESTKEY(0) THEN BEGIN WRITE('U'); ACCELR:= ACCEL END
1420     ELSE IF TESTKEY(2) THEN BEGIN WRITE('D'); ACCELR:=-ACCEL END
1430                        ELSE BEGIN WRITE('-'); MOTORON:=FALSE END;
1440   END
1450 END;
1460
1470 FUNCTION NOTEND:BOOLEAN;          (*  CHECK FOR END OF GAME  *)
1480 BEGIN
1490   AIR:=AIR-1;
1500   IF BR^.MOTORON THEN FUAL:=FUAL-THRUST;
1510   NOTEND:=COMMAND;
1520   SETCURSOR(27,1); WRITE(FUAL:3); SETCURSOR(36,1); WRITE(AIR:4);
1530   SETCURSOR(1,2);
1540   IF AIR<=0 THEN BEGIN WRITE('NO AIR   '); NOTEND:=FALSE END;
1550   IF FUAL<=0 THEN BEGIN FUAL:=0; WRITE('NO FUAL  ') END;
1560   IF BR^.R<15 THEN BEGIN WRITE('BURNT UP '); NOTEND:=FALSE END
1570   ELSE IF BR^.R>500 THEN BEGIN WRITE('LOST  '); NOTEND:=FALSE END;
1580   IF(ABS(BS^.R-BR^.R)<3)AND(BR^.R*ABS(BS^.O-BR^.O)<3)THEN
1590   BEGIN
1600     IF VISUAL>=20
1610       THEN BEGIN WRITE('** TRANSFER COMPLETE **'); NOTEND:=FALSE END
1620       ELSE BEGIN VISUAL:=VISUAL+1; WRITE('VISUAL ',VISUAL) END;
1630   END
```

PROGRAM FILE

```
1640   ELSE IF VISUAL<>0 THEN BEGIN VISUAL:=0; WRITE('MISSED   ') END;
1650 END;
1660
1670 PROCEDURE SPECIAL(SP1,SP2:INTEGER);  (*END OF GAME EFFECT *)
1680 BEGIN
1690   IF LEVEL=6 THEN
1700       BEGIN GRASETPEN(SP1); GRAMOVEA(192,150); GRALINEA(304,150) END;
1710   GRASETPEN(3); GRAPLOTA(BR^.HISTX[SP1],BR^.HISTY[SP1]);
1720   GRASETPEN(1); GRAPLOTA(BR^.HISTX[SP2],BR^.HISTY[SP2]);
1730   GRASETPEN(2); GRAPLOTA(BS^.HISTX[SP1],BS^.HISTY[SP1]);
1740   GRASETPEN(1); GRAPLOTA(BS^.HISTX[SP2],BS^.HISTY[SP2]);
1750 END;
1760
1770 FUNCTION DONE:BOOLEAN;              (*  PRINT RESULT, ANOTHER LEVEL ? *)
1780 VAR GOT:BOOLEAN;  SP1,SP2,DELAY:INTEGER;
1790 BEGIN
1800   IF VISUAL>=20 THEN PTS:=PTS+FUAL+LEVEL*100 ELSE PTS:=0;
1810   IF PTS>9999 THEN PTS:=9999;
1820   INITSCR; SETCURSOR(1,3); WRITE('ANOTHER GO (Y/N)? ');
1830   SP1:=BR^.HPTR; SP2:=SP1; DELAY:=1;
1840   REPEAT BEGIN
1850     GOT:=TRUE; DELAY:=DELAY-1;
1860     IF (VISUAL>=20) AND (DELAY<1) THEN
1870     BEGIN
1880       SPECIAL(SP1,SP2);
1890       SP1:=SP2; SP2:=SP2+1; IF SP2>=TAIL THEN SP2:=1;
1900       DELAY:=200; IF SP2=BR^.HPTR THEN BEGIN DELAY:=2500; SP1:=SP2 END;
1910     END;
1920     CASE INCH OF
1930       'Y','y':DONE:=FALSE;
1940       'N','n':DONE:=TRUE
1950     ELSE GOT:=FALSE;
1960   END UNTIL GOT;
1970   IF VISUAL>=20 THEN
1980   BEGIN
1990     IF LEVEL>TOPLEV THEN TOPLEV:=LEVEL;
2000     IF LEVEL<6 THEN LEVEL:=LEVEL+1;
2010     IF PTS>TOPPTS THEN TOPPTS:=PTS;
2020   END
2030   ELSE IF LEVEL>1 THEN LEVEL:=LEVEL-1;
2040 END;
2050
2060 PROCEDURE INITDATA;                 (*  SET UP DATA FOR 1ST GAME *)
2070 BEGIN
2080   LEVEL:=0; TOPLEV:=0; PTS:=0; TOPPTS:=0;
2090   NEW(BR); NEW(BS);
2100   BR^.PEN:=3; BS^.PEN:=2;
2110   BS^.R0[1]:= 90;  BR^.R0[1]:=140;  O10[1]:=1.0;  TAIL0[1]:=200;
2120   BS^.R0[2]:= 70;  BR^.R0[2]:=150;  O10[2]:=0.9;  TAIL0[2]:=100;
2130   BS^.R0[3]:=124;  BR^.R0[3]:= 80;  O10[3]:=0.8;  TAIL0[3]:=120;
2140   BS^.R0[4]:= 95;  BR^.R0[4]:=150;  O10[4]:=0.7;  TAIL0[4]:=110;
2150   BS^.R0[5]:= 90;  BR^.R0[5]:=100;  O10[5]:=0.6;  TAIL0[5]:= 90;
2160   BS^.R0[6]:=140;  BR^.R0[6]:=110;  O10[6]:=0.5;  TAIL0[6]:= 90;
2170   SCRSETMODE(1);
2180   WRITELN('                --- ORBIT GAME ---                ');WRITELN;
2190   WRITELN('YOU  ARE THE PILOT OF A ROCKET GOING TO');
2200   WRITELN('TO THE RESCUE OF A DISABLED SPACE SHIP.');
2210   WRITELN('MATCH ORBIT WITH THE SPACE SHIP SO THAT');
2220   WRITELN('VITAL SUPPILES CAN BE TRANSFERED.       ');WRITELN;
2230   WRITELN('* YOUR ROCKET HAS THE DARK TAIL.        ');
2240   WRITELN('* IT IS CONTROLLED BY THE CURSOR KEYS. ');WRITELN;
2250   WRITELN('NOTE: UP/DOWN ARE RELATIVE TO THE       ');
2260   WRITELN('      PLANET AND NOT THE SCREEN         ');
2270   WRITELN('      LEFT/RIGHT AFFECT THE ROCKET AT   ');
2280   WRITELN('      RIGHT ANGLES TO UP/DOWN           ');WRITELN;
2290   WRITELN('THE MOTOR THRUST CAN BE SET: VALUE 1-9 ');WRITELN;
2300   WRITELN('END THE CURRENT GAME BY KEYING "E".     ');WRITELN;
2310   WRITE('ENTER LEVEL 1-6 :');
2320   REPEAT LEVEL:=ORD(INCH)-ORD('0') UNTIL LEVEL IN [1..6];
2330 END;
2340
2350 (*****************    MAIN PROGRAM OF ORBIT GAME    *************)
2360 BEGIN
2370   INITDATA;
2380   REPEAT BEGIN                                (* NEW GAME LOOP *)
2390     FUAL:=500; AIR:=2000; THRUST:=5; VISUAL:=0;
2400     SCRSETMODE(1); INITSCR;
2410     INITBODY(BS); INITBODY(BR);
2420     WHILE NOTEND DO BEGIN                     (*  TIME LOOP  *)
2430       MOVEBODY(BS); MOVEBODY(BR);
2440       DRAWBODY(BS); DRAWBODY(BR);
2450     END
2460   END UNTIL DONE;
2470 END.
```

Turbo Prolog Universal Parser

PCW DISK LIBRARY

by Colin Walls

This program provides a way to create a parser for any language that can be expressed in slightly simplified Backus Naur form. Full details and instructions are included at the start of the listing.

```
/************   The Universal Parser   (in Turbo Prolog)   ****************/
/*                                                                         */
/*  This program parses (i.e. analyses into component parts of speech)    */
/*  sentences written in a language defined by a grammar (i.e. a set of    */
/*  rules that describe how sentences can be built up from words.)         */
/*                                                                         */
/*  It is, however, unusual in that not only the sentence to be parsed,    */
/*  but also the grammar to be used, are supplied as data. This means      */
/*  that it is truly universal, and can be used for any language that      */
/*  conforms to certain simple restrictions. The principle restriction    */
/*  is that the language must be definable in Backus Naur Form, which all */
/*  computer languages are, for example. A very simple example of          */
/*  Backus Naur Form (usually called BNF by its devotees) is:              */
/*                                                                         */
/*  <<noun_phrase>> ::= <<compound_noun_phrase>> | <<simple_noun_phrase>>  */
/*       (this means that a noun phrase consists of either a compound      */
/*        noun phrase, or a simple noun phrase. The "|" means "or")        */
/*                                                                         */
/*  <<compound_noun_phrase>> ::= <<adjective>> <<noun>>                    */
/*       (this means that a compound noun phrase consists of an adjective  */
/*        followed by a noun. Note the absence of the ";")                 */
/*                                                                         */
/*  <<simple_noun_phrase>> ::= <<noun>>                                    */
/*       (this means that a simple noun phrase consists of a noun on its   */
/*        own (well, we said it was simple))                               */
/*                                                                         */
/*  <<adjective>>   ::= big | small | hungry                               */
/*       (this means that an adjective is either big, or small, or hungry  */
```

```
/*                                                                      */
/*  <<noun>>          ::= cat | dog                                     */
/*        (this means that a noun is either cat or dog)                 */
/*                                                                      */
/*  Given this grammar TUP will parse the "sentence"      big cat       */
/*  as a noun-phrase made up from the adjective big, and the noun cat   */
/*                                                                      */
/*  It will parse much more complex sentences than this, using much more */
/*  complex grammars. You are restricted only by your ingenuity, and    */
/*  the computer memory available                                       */
/*                                                                      */
/*  To start off, simply go into Turbo Prolog and Load program TUP;     */
/*  then Run it. When asked for a Goal you must load up a grammar. The  */
/*  grammar above is given after the listing as GRAM1.TXT. To use it set */
/*  the goal:   load_db ("gram1.txt")                                   */
/*  make sure you have the dialog window set to full screen width       */
/*  then set:   parse (noun_phrase, [big, cat])                         */
/*                                                                      */
/*  If all goes well you will see the answer in a flash (Turbo Prolog is */
/*  very good at this sort of thing), and it should look like:          */
/*                                                                      */
/*  noun_phrase compound_noun_phrase adjective big                      */
/*  "           "                    noun cat                           */
/*  Successful parse                                                    */
/*                                                                      */
/*  The first line means that the word "big" is an adjective which is   */
/*  part of a compound_noun_phrase which is an example of a noun_phrase. */
/*  The second line means that the word "cat" is a noun, which is part of */
/*  the same compound_noun_phrase as "big" (note the " ditto mark), and */
/*  the same noun_phrase.                                               */
/*                                                                      */
/*  Is that too easy? Lets erase this trivial grammar, by setting a goal */
/*  zap_db                                                              */
/*  and load up a more complex one (by setting a goal of                */
/*  load_db ("gram2.txt") (the second example grammar after the listing) */
/*  then you can try a more complex sentence:                           */
/*  parse (sentence, [the, cat, sat, on, the, mat])                     */
/*  Impressed? Let's look at the grammar we are using by setting:       */
/*  print_db                                                            */
/*  You will notice that the grammar looks nothing like BNF. To keep the */
/*  program simple I have had to use a simple version of BNF. This uses */
/*  three different rule types:                                         */
/*                                                                      */
/*  def   defines words that will appear in actual sentences. So you will */
/*        use def to tell TUP that "cat" and "dog" are nouns            */
/*                                                                      */
/*  alt   defines alternative structures for a sentence component. So you */
/*        will use alt to tell TUP that a "noun_phrase" can consist of  */
/*        either a "simple_noun_phrase" or a "compound_noun_phrase"     */
/*                                                                      */

/*  str   defines the structure of a sentence component, that is, how it */
/*        is built up from simpler components. So you will use str to   */
/*        to tell TUP that a "compound_noun_phrase" is made up of an    */
/*        adjective followed by a noun                                  */
/*                                                                      */
/*  To add rules to the database we use  add_def, add_alt, and add_str  */
/*  So, to set up the original very simple grammar, first clear out the */
/*  current grammar, and then  enter the new grammar by hand, setting   */
/*  goals of:                                                           */
/*                                                                      */
/*  zap_db                                                              */
/*  add_def (noun, [cat, dog])                                          */
/*  add_def (adjective, [big, small, hungry])                           */
/*  add_str (simple_noun_phrase, [noun])                                */
/*  add_str (compound_noun_phrase, [adjective, noun])                   */
/*  add_alt (noun_phrase, [compound_noun_phrase, simple_noun_phrase])   */
/*                                                                      */
/*  To save the database we set a goal of:                              */
/*                                                                      */
/*  save_db (FILENAME)                                                  */
/*                                                                      */
/*  And to try it out, set a goal of:                                   */
/*                                                                      */
/*  parse (noun_phrase, [big, cat])                                     */
/*                                                                      */
/*  It should now print out the analysis and results as before.         */
/*                                                                      */
/*  What next? Well, you can add more words and more structures to this */
/*  very simple grammar;  and, if you're feeling really adventurous, add */
/*  facilities. How about permitting grammar input using Backus Naur Form */
/*  and handling incorrect sentences (by giving the best partial        */
/*  analysis) for starters. Good luck. The main predicates you will be  */
/*  using are:                                                          */
/*                                                                      */
/*  save_db   to save your new improved grammar with a different name   */
/*  zap_db    to clear out the active database from memory              */
/*  load_db   to add a grammar from file into the active database       */
/*  print_db  to print out the active grammar                           */
/*  parse     to parse a sentence                                       */
/*  add_def, add_alt, add_str to add definitions to the active database */
/*                                                                      */
/************************************************************************/
/*                                                                      */
/*  Technical Notes                                                     */
/*  ***************                                                     */
/*                                                                      */
/*  A. The parser handles right-recursive grammars, but not left-       */
/*     recursive, i.e.                                                  */
/*                                                                      */
/*     alt (adjective_list, [simple_al, compound_al]                    */
/*     str (compound_al, [adjective, adjective_list])                   */
/*                                                                      */
/*     is fine, but                                                     */
/*                                                                      */
/*     alt (adjective_list, [simple_al, compound_al])                   */
/*     str (compound_al, [adjective_list, adjective])                   */
/*                                                                      */
/*     could be dodgy.                                                  */
/*                                                                      */
/*                                                                      */
/*  B. The variables have short, but consistent names, built up from    */
/*     individual letters with defined meanings. For those who want to  */
/*     modify the code, the letters mean:                               */
/*                                                                      */
/*     T  is a target part of speech (e.g. "noun_phrase")               */
/*     S  is a sentence being analysed                                  */
/*     A  is an analysis                                                */
/*                                                                      */
/*     S may be:  GS (Given Sentence) the sentence given from above     */
/*                RS (Return Sentence) the sentence returned back up    */
/*                PS (Passed Sentence) the sentence passed on down      */
/*                                                                      */
/*     A (the analysis) may similarly be either GA, RA or PA            */
/*                                                                      */
/*     The lists are divided into the Head and the Tail (or car and cdr */
/*     for any LISPers reading this), denoted by H or T, so:            */
/*                                                                      */
/*     GSH  is the Given Sentence Head                                  */
```

PROGRAM FILE

```
/*      GAHT is the Given Analysis Head Tail                          */
/*      etc. etc.                                                     */
/*                                                                    */
/*  C. The grammar files can actually be edited as text using (for    */
/*     instance) the Turbo Prolog editor. This is quicker, but loses any */
/*     validation                                                     */
/*                                                                    */
/*  D. You can have multiple definitions for the same component. This */
/*     makes it easier to merge grammars                              */
/*                                                                    */
/*  E. Anyone fancying their hand at an interpreter should look at using */
/*     the fronttoken predicate. It works a treat on English as well as */
/*     Prolog.                                                        */
/*                                                                    */
/*  F. The program contains one known bug, namely that if you set a   */
/*     non-deterministic goal (such as parse (ANSWER, ....) ) which means */
/*     that you get the prompt to hit F10 if you will accept such a goal, */
/*     it loses any grammar in memory. I have no idea why this is so. */
/*     It is easy to recover; just load_db again (and preferably save_db */
/*     before setting a non-deterministic goal!)                      */
/*                                                                    */
/*  G. Why are there no comments in the code? Basically because this  */
/*     thing is long enough already, the code is very simple if you   */
/*     understand Prolog, and if you don't understand Prolog you don't */
/*     stand a chance anyway.                                         */
/*                                                                    */
/**********************************************************************/
/*                                                                    */
/*   Copyright Notice        10th December 1987                       */
/*                                                                    */
/*   This program may be freely used, modified, copied, or given away for */
/*   any non-commercial personal or charitable purposes. For commercial */
/*   use of any part please contact Colin Walls via Program File      */
/*                                                                    */
/**********************************************************************/

domains

  word = symbol
  wordl = word*
  wordll = wordl*

database

  alt (word, wordl)
  def (word, wordl)
  str (word, wordl)

predicates

  parse (word, wordl)

  add_alt (word, wordl)
  add_str (word, wordl)
  add_def (word, wordl)

  load_db (word)
  save_db (word)
  zap_db
  print_db

  print_alts
  print_strs
  print_defs
  write_l (wordl)
  write_ll (wordll)
  print_analysis (wordll)
  printa (wordll, wordl)
  print (wordl, word)
  same (word, wordl, wordl)
  inv_inv (wordll, wordll)
  app_app (wordll, wordll, wordll)
  invert (wordl, wordl)
  invert (wordll, wordll)
  append (wordl, wordl, wordl)
  append (wordll, wordll, wordll)
  included (word, wordl)
  check_alts (wordl, word, wordll, wordll, wordl)
  try_alts   (wordl, word, wordll, wordll)
  parse_alt  (wordl, word, wordll, wordll)
  parse_def  (wordl, word, wordll, wordll)
  parse_s    (wordl, word, wordll, wordll)
  build_s    (wordl, word, wordll, wordll, wordl, wordl)

clauses

  parse (T, GS) if
    parse_alt (GS, RS, [[T]], RA) and
    RS = [] and
    inv_inv (RA, AR) and
    print_analysis (AR) and
    write ("Successful parse\n").

    add_alt (W, L) if asserta (alt (W, L)).
    add_str (W, L) if asserta (str (W, L)).
    add_def (W, L) if asserta (def (W, L)).

    load_db (D) if consult (D).
    save_db (D) if save    (D).
    zap_db if retract(_) and zap_db.
    print_db if
      nl and
      print_alts or nl and
      print_strs or nl and
      print_defs.

    inv_inv (A, B) if
      app_app (A, [], B).

    app_app ([], A, A).
    app_app ([AH | AT], W, B) if
      invert (AH, HA) and
      app_app (AT, [HA | W], B).

    invert (A, B) if
      append (A, [], B).

    append ([], A, A).
    append ([AH | AT], W, B) if
      append (AT, [AH | W], B).

    print_analysis (A) if
      nl and
      printa (A, []).

    printa ([], _) if nl.
    printa ([AH | AT], P) if
      print (AH, P) and
      printa (AT, AH).
```

```
print ([], _) if nl.
print ([AHH | AHT], P) if
  same (AHH, P, PT) and
  print (AHT, PT).

same (AHH, [], []) if
  write (AHH, " ").

same (AHH, [AHH | PT], PT) if
  str_len (AHH, LA) and
  str_int (SLA, LA) and
  concat ("%-", SLA, F1) and
  concat (F1, "s", F2) and
  writef (F2, "").

same (AHH, [PH | PT], PT) if
  not (AHH = PH) and
  write (AHH, " ").

print_alts if alt (W, L) and
  write ("alt(", W, ",[") and
  write_l (L) and
  write ("]).\n") and fail.

print_strs if str (W, L) and
  write ("str(", W, ",[") and
  write_l (L) and
  write ("]).\n") and fail.

print_defs if def (W, L) and
  write ("def(", W, ",[") and
  write_l (L) and
  write ("]).\n") and fail.

write_ll ([LLH | []]) if
  write_l (LLH) and nl and !.
write_ll ([LLH | LLT]) if
  write_l (LLH) and nl and write_ll (LLT).

write_l ([LH | []]) if
  write (LH) and !.
write_l ([LH | LT]) if
  write (LH, ",") and write_l (LT).

included (A, [A |._]) if !.
included (A, [_ | BT]) if
   included (A, BT).

parse_def ([GSH | GST], RS, [[GAHH | GAHT] | GAT], RA) if
  def (GAHH, ALT) and
  included (GSH, ALT) and
  RS = GST and
  RA = [[GSH, GAHH | GAHT] | GAT].

parse_alt   (GS, RS, GA, RA) if
  parse_def (GS, RS, GA, RA).

parse_alt   (GS, RS, GA, RA) if
  try_alts  (GS, RS, GA, RA).

try_alts (GS, RS, GA, RA) if
  GA = [[GAHH | _] | _] and
  alt (GAHH, ALT) and
  check_alts (GS, RS, GA, RA, ALT).

check_alts (_, _, _, _, []) if fail.

check_alts (GS, RS, [GAH | GAT], RA, [ALTH | _]) if
  parse_s (GS, RS, [[ALTH | GAH] | GAT], RA).

check_alts.(GS, RS, GA, RA, [_ | ALTT]) if
  check_alts (GS, RS, GA, RA, ALTT).

parse_s (GS, RS, [GAH | GAT], RA) if
  GAH = [GAHH | GAHT] and
  str (GAHH, STR) and
  STR = [STRH | STRT] and
  CL = [STRH, GAHH | GAHT] and
  parse_alt (GS, PS, [CL | GAT], PA) and
  build_s (PS, RS, PA, RA, STRT, GAH).

build_s (GS, GS, GA, GA, [], _).

build_s (GS, RS, GA, RA, [STRH | STRT], CL) if
  parse_alt (GS, PS, [[STRH | CL] | GA], PA) and
  build_s (PS, RS, PA, RA, STRT, CL).
```

Acorn Archimedes Mouse Pointer Editor

PCW DISK LIBRARY

by E Taylor

These two listings allow the creation and use of any mouse shape on an Acorn Archimedes.

The first listing is a simple mouse shape editing program and is self-explanatory. It works best from the desktop, but will work from the ADFS prompt if lines 980, 1060 and 1070 are modified. It should also be noted that the program does not change the active area of the mouse pointer. To do this, consult the *Programmers' Reference Manual* for exact details or use the command POINT(x,y) to test the middle pixel of the mouse.

The second listing is the code that has to be added to each program to allow the mouse design saved in Program 1 to be called up. It is simplest to use if the listing is stored as a library routine, by saving it as LIBRARY.POINTINP. Then, any program can access the code with the inclusion of the following two lines near the start of the code:

```
LIBRARY "LIBRARY.POINTINP"
PROCpointer2 ("filename")
```

This will then load the mouse pointer design into memory for use with your application.

PROGRAM FILE

```
   10 REM >UTILITIES.POINTER
   20 ON ERROR PROCerror:CLS :GOTO 90
   30 MODE 12
   40 REM CHANGE MOUSE POINTER
   50 MOUSE ON 2
   60 DIM code% 100,Shape 500
   70 DIM CN(31)
   80 PROCchangecol
   90 P$="                              MOUSE POINTER SHAPE PROGRAM      E.Taylor 1988"
  100 PRINTP$
  110 INPUT "width of pointer  1 to 8 ";W%
  120 IF W%(1 OR W%)8 THEN 110
  130 INPUT "height of pointer  1 to 30 ";H%
  140 IF H%(1 OR H%)30 THEN 130
  150 width=W%*4 :height=H%
  160 REM
  170 REM
  180 FOR pass%= 0 TO 2 STEP 2
  190 PROCass
  200 NEXT pass%
  210 FOR I=0 TO W%*H%:?(Shape+I)=0:NEXT:CALL code%
  220 PROCscreen
  230 PROCinput
  240 GOTO 230
  250 DEFPROCass
  260 P%=code%
  270 [OPT pass%
  280 .pointer MOV R0,#2
  290          ADR R1,Shape
  300          MOV R2,#width
  310          MOV R3,#height
  320          MOV R4,#0
  330          MOV R5,#0
  340          SWI "Wimp_SetPointerShape"
  350          MOV PC,R14
  360 ]:ENDPROC
  370 DEFPROCscreen
  380 RESTORE 1220
  390 MOUSE TO 1000,512
  400 COLOUR 133:CLS:COLOUR 0
  410 PRINTP$
  420 VDU 23,255,255,255,255,255,255,255,255,255
  430 FOR Y=1 TO H%
  440 FOR X=28 TO width+27
  450 PRINT TAB(X,Y)CHR$255;
  460 NEXT:NEXT
  470 COLOUR 1
  480 FOR Y=1 TO 12
  490 READ COL$,CN(Y-1)
  500 PRINT TAB(0,Y)COL$;
  510 NEXT
  520 PRINT:PRINT"PRESS ESCAPE TO END"
  530PRINT:PRINT"USE CURSOR KEYS TO MOVE"
  540PRINT:PRINT"PRESS SPACE BAR TO ENTER"
  550 PRINTTAB(0,24)"colour nos f11/f12";
  560 X=28:Y=1:VDU 31,X,Y
  570 *FX 11,0
  580 VDU 23,1,0,0,0,0,0,0,0,0:PRINT TAB(0,0) " ";
  590 COLOUR 1:CP=1
  600 COLOUR 128
  610 ENDPROC
  620 DEFPROCinput
  630 A=INKEY(10)
  640 CASE A OF
  650    WHEN INKEY(-58):Y=Y-1:IF Y(1 THEN Y=1
  660    WHEN INKEY(-42):Y=Y+1:IF Y)H% THEN Y=H%
  670    WHEN INKEY(-26):X=X-4:IF X(28 THEN X=28
  680    WHEN INKEY(-122):X=X+4:IF X)width+27 THEN X=width+27
  690    WHEN INKEY(-114):CP=0
  700    WHEN INKEY(-115):CP=1
  710    WHEN INKEY(-116):CP=2
  720    WHEN INKEY(-21):CP=3
  730    WHEN INKEY(-117):CP=4
  740    WHEN INKEY(-118):CP=5
  750    WHEN INKEY(-23):CP=6
  760    WHEN INKEY(-119):CP=7
  770    WHEN INKEY(-120):CP=8
  780    WHEN INKEY(-31):CP=9
  790    WHEN INKEY(-29):CP=10:COLOUR 14:PRINTTAB(0,25)"      ";CHR$13; INPUT A:CN
(CP)=A
  800    WHEN INKEY(-30):CP=11:COLOUR 15:PRINTTAB(0,26)"      ";CHR$13;:INPUT A:CN
(CP)=A
  810 ENDCASE
  820 COLOUR CP
  830 IF INKEY(-99) THEN
  840 R=X MOD 4
  850 IF R()0 THEN X=X-R
  860 PRINT TAB(X,Y)CHR$255+CHR$255+CHR$255+CHR$255;
  870 pos=INT((Y-1)*W%+(X-27)/4)
  880 ?(Shape+pos)=CN(CP)
  890 ENDIF
  900 VDU 31,X,Y
  910 CALL pointer
  920 *FX 21,0
  930 ENDPROC
  940 DEFPROCerror
  950 COLOUR 1
  960 *FX 11,25
  970 *FX 4,0
  980 PRINT TAB(0,30) "DO YOU WISH TO SAVE YOUR DATA":A$=GET$:IF A$="Y" OR A$="
y" THEN 990 ELSE OSCLI "Desktop"
  990 INPUT "    SAVE PROGRAM NAME ";N$
 1000 CH=OPENOUT(N$)
 1010 PRINT# CH,width,height
 1020 FOR I=0 TO 500
 1030 N=?(Shape+I):PRINT# CH,N
 1040 NEXT:CLOSE# CH
 1050 PRINT TAB(0,30)SPC(70);
 1060 PRINT TAB(0,30)"Do you want to return to the Desktop y/n";
 1070A$=GET$:IF A$="Y" OR A$="y" THEN OSCLI "Desktop" ELSE END
 1080 ENDPROC
 1090DEFPROCchangecol
 1100 FOR I=0 TO 9
 1110 READ R%,G%,B%
 1120 R%=R% << 4
 1130 G%=G% << 4
 1140 B%=B% << 4
 1150COLOUR I,R%,G%,B%
 1160 NEXT
 1170 VDU 19,1,25,255,255,255
 1180 VDU 19,2,25,0,0,255
 1190 VDU 19,3,25,255,0,0
 1195 VDU 19,0,25,0,255,0,0
 1200 ENDPROC
 1210 DATA 0,0,0,15,15,15,15,0,0,0,0,15,0,13,15,0,0,8,8,8,8,0,0,8,8,8,0,0,15,5,5
 1220 DATA "F1 BLACK(background)",0,"F2 WHITE",85,"F3 RED",255,"F4 DARK BLUE",17
0,"F5 LIGHT BLUE ",102,"F6 PURPLE",187,"F7 GREY ",119,"F8 TURQUOISE transparent"
,68,"F9 SCARLET transparent",51,"F10 PINK transparent",59
 1230 DATA "F11 any number from 1 to 255",0,"F12 any number from 1 to 255",0
```

```
   10 REM MOUSE POINTER 2 DATA INPUT -see PROChelptext
   20 REM ************************************
   30 DEFPROChelptext
   40 REM print out details of library procedure
   50 PRINT "Use program POINTER to set up the pixels for the mouse pointer"
   60 PRINT "call this procedure early in your program by name PROCpointer2(file
name for data)"
   70 ENDPROC
   80 DEFPROCpointer2(filename$)
   90 DIM code% 100,Shape 500
  100 PROCfilein
  110 PROCcolour
  120 FOR pass%= 0 TO 2 STEP 2
  130 PROCass
  140 NEXT pass%
  150 MOUSE ON 2
  160 CALL pointer
  170 ENDPROC
  180 DEFPROCfilein
  190 CH=OPENIN(filename$)
  200 INPUT# CH,width,height
  210 FOR I=0 TO 500
  220 INPUT# CH,N
  230 ?(Shape+I)=N
  240 NEXT:CLOSE# CH
  250 ENDPROC
  260 DEFPROCass
  270 P%=code%
  280 COPT pass%
  290 .pointer MOV R0,#2
  300          ADR R1,Shape
  310          MOV R2,#width
  320          MOV R3,#height
  330          MOV R4,#0
  340          MOV R5,#0
  350          SWI "Wimp_SetPointerShape"
  360          MOV PC,R14
  370 ]:ENDPROC
  380 DEFPROCcolour
  390 VDU 19,1,25,255,255.255
  400 VDU 19,2,25.0,0,255
  410 VDU 19,3,25,255,0,0
  420 ENDPROC
```

Commodore Amiga Disk Sector Display

PCW DISK LIBRARY

by Anthony Birnie

This program allows you to examine disk sectors on Amiga disks at byte level. It also provides examples of the data structures involved — the key to accessing the disk at a low level. Additional technical information is included at the start of the program.

```
STRUCTURES
----------
Three memory structures are used within the program. Two to communicate with the

drive and one to get disk info.  Details of the user inserted info in the first

two and all of the last is shown below:

Item(C struct)  Address offset and content
--------------  --------------------------
1. MsgPort structure
mp_Node structure

  ln_Type       08 Byte indicating port or message etc.
  ln_Pri        09 Byte containing the priority; norm = 0
  ln_Name       10 A pointer to a null terminated string
mp_Flags        14 Byte, type of signal to give user if message
mp_SigBit       15 Bit for signal*
mp_SigTask      16 Pointer to task originating port*

*via AllocSignal() and FindTask() respectively.
Item(C struct)  Address offset and content
--------------  --------------------------
2. IOExtTD structure (Extended IO)

iotd_Req   structure
  io_Message structure
    mn_Node    structure

      ln_Type   08 Byte indicating port or message etc.
      ln_Pri    09 Byte containing the priority; norm = 0
      ln_Name   10 A pointer to a null terminated string
   mn_ReplyPort 14 Address to which a reply should be sent
   mn_Length    18 Length in bytes of the reply
  io_Device     20 Device address
  io_Unit       24 Unit number
  io_Command    28 The command you wish the device to process
  io_Flags      30 Command modifiers
  io_Error      31 Error number returned from request
  io_Actual     32 Mainly number of bytes actually dealt with
  io_Length     36 Number of bytes you wish it to deal with
  io_Data       40 Place to put or get the data (address)
  io_Offset     44 For Trackdisk this is a byte offset(see program)
iotd_Count      48 Disk change count for comparison
iotd_SecLabel   52 Place to put or get sector labels if used


3. InfoData structure (All of these items are returned by the Info function)

id_numsofterrs   00 Number of errors for disk
id_unitnumber    04 Unit number
id_diskstate     08 80 = write protected, 81 = validating and 82 = read/write
id_numblocks     12 Total blocks available
id_numblocksused 16 Total used
```

PROGRAM FILE

```
id_bytesperblock 20 This is usually 488 out of 512
id_disktype      24 -1    = no disk present.
                    BAD0  = Unreadable.
                    DOS0  = DOS disk
                    NDOS  = Not really DOS. That's what they say.
                    KICK  = KICKSTART, you won't see this either.
id_volumenode    28 (Help don't know what this is)
id_inuse         32 0 = no.

AmigaDOS BLOCKS
---------------
The disk block is 128 longwords (512 bytes) of data arranged as shown below:

Word    ROOT.  DIR    FILE HDR        FILE LIST       DATA
----    -----  ---    --------        ---------       ----
  0       2     2       2               16            0
  1       0     <----------Own key------------>       File header
  2       0     0       <---------# blocks------>     Sequence #
  3 Table size  0       # slots         # blocks       Bytes in block (488 max)
  4       0     0       <----First block key--->      Next block key
  5       <--------------------Checksum------------------------------>
 6-77     <-Hash-Table->  <------Block keys------>     Data
 78       BMAPflg < ---Spare----->        Not Used      Data
 79       BMAPblk < ---Spare----->        Not Used      Data
 80       <Spare> <---Protect---->        Not Used      Data
 81       <----Spare---> Byte size        Not Used      Data
82-104    <Spare> <---Comment---->        Not Used      Data
105       <--------Days---------->        Not Used      Data
106       <--------Mins---------->        Not Used      Data
107       <-------Ticks---------->        Not Used      Data
108       <----# Chrs in name---->        Not Used      Data
109-120   <--------Name---------->        Not Used      Data
121       Days*   <-----Name----->        Not Used      Data
122       Mins*   <-----Name----->        Not Used      Data
123       Ticks*  <-----Name----->        Not Used      Data
124       <Hash Chain Next Entry->        0             Data
125       0       <----------Parent----------->         Data
126       0       0       <------Extension------->      Data
127       1       2       <------&HFFFFFFFD------>      Data

* This is the created date for the disk.

A file list block is used when a file is so large that all the space in the key
table is used up. It is a file header extension block. Note that block keys are
stored in reverse, block #1 key stored at word #77 and so on.  Word 0 contains
the TYPE and word 127 is the SECONDARY TYPE.
```

```
wtitle$ = "TD-DISPLAY - DISK SECTOR DISPLAY.      (C) 1987 A. P. Birnie"
GOSUB InitializeStatus

REM  MEMORY REQUIREMENTS:  AmigaBASIC consumes 110kb aprox and the program has
REM  the use of a total of 120kb so 0.5Mb machine required. I haven't tried it
REM  but without REM statements 0.25Mb may just be possible.

REM  Disk sector display program for Amiga 3 1/2" disk drives with examples of
REM  opening,  closing and communicating with an Amiga device driver using the
REM  system library routines from Basic.  Note that access to the disk device
REM  using  DoIO()  is different from printer access as shown by CBM's Carolyn
REM  Scheppner in the file (A500)Extras:BasicDemos/ScreenPrint.

REM  .BMAP FILES: If you cannot find these in the  BasicDemos directory on the
REM  Extras disk refer to the program ConvertFD in the same directory, if that
REM  doesn't help you are an Amiga 1000 owner as I am and that leaves annoying
REM  your dealer for a copy of the latest Extras and Workbench disks.

REM  REFERENCES: For the drive see the ROM Kernel Reference Manual:Libraries &
REM  Devices where there is a complete section on it. Ports are covered in the
REM  :Exec volume where appendix B contains C listings of CreatePort(page B-5)
REM  and CreateExtIO(page B-8).  For the disk structure refer to 'The AmigaDOS
REM  Manual'.

REM  SAFETY: The program is fully debugged and will always fail safely.  Fatal
REM  errors are trapped and if they occur the program frees all memory  it has
REM  allocated and closes the device. Further since no facility for writing to
REM  the drive is provided disks cannot be corrupted.  If you wish to write to
REM  the drive,.....

REM  USER NOTES: Start up as a normal basic program from Workbench using mouse
REM  as usual. There is a short pause while the program establishes itself and
REM  after this a screen and 'status window' are displayed. In this window the
REM  upper two lines are concerned with program status and primary information
REM  and the lower three with the disk as follows:
REM  Line 1: (title) PROGRAM STATUS INFORMATION
REM  Line 2: STATUS - Initially an instruction to wait while initialization is
REM                   taking place and thereafter error messages and user info
REM                   on how the program is running.  YOU MUST keep an eye on
REM                   this field to know what is going on.
```

```
REM             DF*     - At first this shows that no unit has been selected. Unit
REM                       selection is via the lefthand menu.  It won't permit you
REM                       to select drives that are either not connected or not of
REM                       the standard type. Once a unit is selected the * changes
REM                       to the unit number. NB a unit will not initialize unless
REM                       a disk is present.  In this case if it was not the first
REM                       then the  last unit will be  re-initialized and its ROOT
REM                       block dumped(see below).
REM             BLOCK   - The currently selected block. On unit initialization one
REM                       block is immediately dumped this is the header block and
REM                       it is known as the ROOT (block number 880).  To read any
REM                       other block use the right hand menu  'Read Block' option
REM                       and a HEX/ASCII dump follows after keying in the block #
REM                       at the prompt in the small window which will appear.
REM     Line 3: (title) DISK STATUS INFORMATION
REM     Line 4: NAME    - The current disk name.
REM             ID      - This can be: DOS,  standard type.
REM                                    NDOS, not really DOS....it's in the book.
REM                                    KICK, the kickstart disk for A1000 only.
REM                                    BAD,  not a DOS disk.
REM                       NB this program only guarantees to read the first kind.
REM             ERR     - Refers to disk errors and for 99.9% of the time = 0.
REM     Line 5: CREATED- Note that the date created is entirely different from
REM                       the last accessed date and some weird values can occur
REM                       without anything being wrong.
REM             BLOCKS USED and FREE are self explanatory.
REM             STATE   - This can be 'Read/Write', 'Read Only' and in very rare
REM                       circumstances 'Verifying'(program copes with this).
REM     The only other item left is in the righthand menu second option.  This is
REM     'Exit Program'  and is the ONLY way to exit so check carefully for typing
REM     errors prior to running the program.

REM     WINDOWS: I started out with flexible use of windows,  but it proved to be
REM     impractical.   Users can,  if they wish,  add a move gadget to the status
REM     window permiting it to be moved to access the screen's back/front gadget.
REM     If you add sizing gadgets then the screen formating won't work and I left
REM     out close gadgets to maintain tighter control.

REM     Enjoy the program.                                          20th November '87

ON BREAK GOSUB Finish:BREAK ON     'ensure clean exit if user does CTRL C
REM====MAIN=============================================================================
REM=====================================================================================

DIM tderr$(36)      'store disk and program errors
RESTORE tderrors:FOR dx% = 0 TO 35:READ tderr$(dx%):NEXT dx%
tderrors:
REM     Most of these will never appear but are included for completeness. Errors
REM     20 to end are the full compliment (Libraries and Devices ref) of drive
REM     errors. The last is my translation of the message sent when reboot is
REM     about to occur.
DATA "All OK", "No Memory for sector buffer, exiting"
DATA "No memory for port, exiting", "No memory for IOrequest block, exiting"
DATA "No memory for Info block, exiting", "Cannot open selected drive"
DATA "Read block first", "NO DISK IN DRIVE", "Disk changed reselect block"
DATA "Select unit first", "Disk validation taking too long, exiting"
DATA "Call to Info() failed", "Can't find dos.bmap, exiting"
DATA "Can't find exec.bmap, exiting", "Initialization completed, select unit"
DATA "WAIT.....itializing", "#16", "#17", "#18", "#19"
DATA "Error can not be determined", "Could not find sector header"
DATA "Error in sector preamble", "Error in sector identifier"
DATA "Header field has bad checksum", "Sector field has bad checksum"
DATA "Incorrect number of sectors on track", "Unable to read sector header"
DATA "Disk is write protected", "Disk has been changed or is not in drive"
DATA "Seek error", "No memory for this operation", "No such unit attached"
DATA "Bad drive type" ,"Drive in use", "User pressed CTRL-AMIGA-AMIGA, AARGH"

Unit%           = -1    'current unit
Block%          = 880   'the current block number, initialized at ROOT
ioerr% = 15 : GOSUB UpdateStatus1

REM     Declare library functions and open libraries. CloseDevice(), FreeMem(),
REM     FreeSignal() and RemPort() do not return values. NB DoIO() returns any
REM     error via the IOrequest block. ioerr% = DoIO(...) does NOT work.
DECLARE FUNCTION AllocMem%()    LIBRARY
DECLARE FUNCTION AllocSignal%() LIBRARY
DECLARE FUNCTION FindTask&()    LIBRARY
DECLARE FUNCTION Info%()        LIBRARY
DECLARE FUNCTION OpenDevice%()  LIBRARY
ON ERROR GOTO NoBmaps
ioerr% = 12 : LIBRARY "dos.library"
ioerr% = 13 : LIBRARY "exec.library"

REM     Set up date arrays(save calc time) and init variables.
ON ERROR GOTO ErrCleanUp
DIM monthnum%(2,12), monthname$(12)
RESTORE MonthData:FOR dx% = 0 TO 11:READ monthname$(dx%):NEXT dx%
FOR mdx% = 0 TO 1
FOR dx% = 0 TO 11:READ monthnum%(mdx%,dx%):NEXT dx%
NEXT mdx%
MonthData:
DATA "Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul", "Aug", "Sep", "Oct"
DATA "Nov", "Dec", 31, 59, 90, 120, 151, 181, 212, 243, 273, 304, 334, 365
DATA 31, 60, 91, 121, 152, 182, 213, 244, 274, 305, 335, 366
DIM Unit%(4)    '1 in array means unit is not selected, selected = 2
FOR dx% = 0 TO 3:Unit%(dx%) = 1:NEXT dx%
MyPort$         = "DISPLAY_MsgPort" + CHR$(0)    'note:null terminated strings
TDNAME$         = "trackdisk.device" + CHR$(0)
devopen%        = 0     'device open flag = no
NUMBLKS%        = 1760  'max blocks
TDSECTOR%       = 512   'block size in bytes
InfoData&       = 0     'structure to hold disk data
IOExtTD&        = 0     'IO request block structure
MyPort&         = 0     'comms port
SectBuf&        = 0     'holds one sector
SizeofInfoData% = 40    'size in bytes
SizeofIOExtTD%  = 64
SizeofMyPort%   = 40
SizeofSectBuf%  = TDSECTOR%
ChangeCount&    = 0     'store disk change number
ChangeState&    = -1    '0 if disk in drive
ClearPublic&    = 65537&  'flag for allocmem (MEMF_CLEAR : MEMF_PUBLIC)
```

PROGRAM FILE

```
DIM DiskStat$(3)
DiskStat$(0) = "Read Only "
DiskStat$(1) = "Validating"
DiskStat$(2) = "Read/Write"

REM                             'Disk commands used with DoIO()
ETDREAD%        = &H8002        'read a sector
TDCHANGENUM%    = 13            'get the disk change number
TDCHANGESTATE%  = 14            'is there a disk in the drive
TDMOTOR%        = 9             'change motor state; flag in request block

REM    Allocate memory for buffer, structures and initialize ports.

GOSUB InitializeBuffer
GOSUB InitializeInfo
GOSUB CreatePort
GOSUB CreateExtIO

REM    Set up menus tell user ready then wait

ON MENU GOSUB ReadMenu : GOSUB InstallMenu
MENU ON : ioerr% = 14 : GOSUB UpdateStatus1 : ioerr% = 0

WaitLoop:
REM    system will wake up program on a menu select
    SLEEP
GOTO WaitLoop

REM===INITIALISATION==========================================================
REM==========================================================================

InitializeStatus:
    SCREEN 2,640,264,2,2 : WINDOW 1,wtitle$,(0,0)-(631,40),16,2
    w1% = -1 : WINDOW OUTPUT 1 : COLOR 1,2 : CLS
    LOCATE 1,1  : PRINT "PROGRAM STATUS INFORMATION:"
    LOCATE 2,1  : PRINT "[STATUS:"
    LOCATE 2,59 : PRINT "] [DF :] [BLOCK:    ]"
    LOCATE 3,1  : PRINT "DISK STATUS INFORMATION:"
    LOCATE 4,1  : PRINT "[NAME:"
    LOCATE 4,58 : PRINT "] [ID:    ] [ERR:    ]"
    LOCATE 5,1  : PRINT "[CREATED:                    ] [BLOCKS USED:    ]";
    PRINT " [FREE:    ] [STATE:          ]";
RETURN
InitializeBuffer:
    SectBuf& = AllocMem&(SizeofSectBuf%, ClearPublic&)
    IF SectBuf& THEN RETURN
    ioerr% = 1
GOTO InitExit

InitializeInfo:
    InfoData& = AllocMem&(SizeofInfoData%, ClearPublic&)
    IF InfoData& THEN RETURN
    ioerr% = 4
GOTO InitExit

CreatePort:
    sigBit% = AllocSignal%(-1)
    MyPort& = AllocMem&(SizeofMyPort%, ClearPublic&)
    IF MyPort& = 0 THEN
       ioerr% = 2 : GOTO InitExit
    END IF
    sigTask& = FindTask&(0)
    POKE (MyPort& + 8), 4     ' Node type = NT_MSGPORT
    POKE (MyPort& + 9), 0     ' priority
    POKEL (MyPort& + 10), SADD(MyPort$) 'name of port
    POKE (MyPort& + 14), 0    ' Flags
    POKE (MyPort& + 15), sigBit%
    POKEL(MyPort& + 16), sigTask&
    CALL AddPort(MyPort&)     'add it in
RETURN

CreateExtIO:
    IOExtTD& = AllocMem&(SizeofIOExtTD%, ClearPublic&)
    IF IOExtTD& = 0 THEN
       ioerr% = 3 : GOTO InitExit
    END IF
    POKE(IOExtTD& + 8), 5  'Node type = NT_MESSAGE
    POKEL(IOExtTD& + 14), MyPort&
    POKEW(IOExtTD& + 18), SizeofIOExtTD%
RETURN

InitExit:
    GOSUB UpdateStatus1 : GOSUB WaitaBit
GOTO Finish

InstallMenu:
    MENU 1, 0, 1, "Select Unit"
    MENU 1, 1, Unit%(0), "    DF0:"
    MENU 1, 2, Unit%(1), "    DF1:"
    MENU 1, 3, Unit%(2), "    DF2:"
    MENU 1, 4, Unit%(3), "    DF3:"
    MENU 2, 0, 1, "Command"
    MENU 2, 1, 1, "Read Block"
    MENU 2, 2, 1, "Exit Program"
    MENU 3, 0, 1, ""
    MENU 4, 0, 1, ""
RETURN

InitializeDisk:
    IF devopen% THEN
       Vcheck% = 0
InitDiskReStart:
       Block% = 880 : GOSUB GetChangeNumber : GOSUB ReadDev
       IF ioerr% <> 0 THEN RETURN
       ioerr% = Info%(0, InfoData&)   'similar to Info on WBench menu
       IF NOT ioerr% THEN : ioerr% = 11 : RETURN
       DiskType& = PEEKL(InfoData& + 24)
       IF DiskType& = -1 THEN : ioerr% = 7 : RETURN
       DiskStat& = PEEKL(InfoData& + 8) - 80
REM
REM    It is extremely unlikely that a read could take place and then
REM    somehow the disk was validating but.....................
REM
       IF DiskStat& <> 1 THEN ValidateClear
```

PROGRAM FILE

```
        GOSUB UpdateStatus2 : ON TIMER GOSUB ValidateCheck : TIMER(5) ON
ValidateLoop:
        SLEEP : GOTO ValidateLoop
ValidateCheck:
        TIMER OFF : Vcheck% = Vcheck% + 1
        IF Vcheck% < 12 THEN RETURN InitDiskReStart
        ioerr% = 10 : IF devopen% THEN GOSUB CloseDev
        GOSUB UpdateStatus1 : GOSUB WaitaBit : GOTO Finish
ValidateClear:
        DiskType$ = ""
        FOR n% = 3 TO 0 STEP -1
            temp$ = CHR$(DiskType&\(256^n%))
            DiskType& = DiskType& - (DiskType&\(256^n%)) * (256^n%)
            IF temp$ = CHR$(0) THEN temp$ = " "
            DiskType$ = DiskType$ + temp$
        NEXT n%
        SoftErrs& = PEEKL(InfoData&)
        BlksUsed& = PEEKL(InfoData& + 16)
        BlksFree& = PEEKL(InfoData& + 12) - BlksUsed&
        temp% = PEEK(SectBuf& + 432) : DiskName$ = ""
        FOR n% = 1 TO temp%
            DiskName$ = DiskName$ + CHR$(PEEK(SectBuf& + n% + 432))
        NEXT n%
        offset% = 484 : temp$ = "" : GOSUB GetDate : DiskDate$ = temp$
        ioerr% = 0 : GOSUB UpdateStatus2 : BlockRead% = -1
        GOSUB DumpBlock
    ELSE
        ioerr% = 9
    END IF
RETURN

REM====MENU HANDLING AND STATUS WINDOW UPDATING ROUTINES=======================
REM============================================================================

ReadMenu:
    MENU OFF : menu0% = MENU(0) : menu1% = MENU(1)
    ON menu0% GOSUB SelectUnit, Command
    GOSUB UpdateStatus1 : ioerr% = 0 : MENU ON
RETURN

Command:
    ON menu1% GOSUB ReadBlock, Finish
RETURN

UpdateStatus1:          'PROGRAM STATUS INFORMATION:
    WINDOW OUTPUT 1 : COLOR 3,2
    LOCATE 2,9  : PRINT SPACE$(50) : LOCATE 2,9  : PRINT tderr$(ioerr%)
    temp$ = "*" : IF Unit% <> -1 THEN temp$ = RIGHT$(STR$(Unit%),1)
    LOCATE 2,64 : PRINT temp$
    LOCATE 2,75 : PRINT USING "####";Block%
RETURN

UpdateStatus2:          'DISK STATUS INFORMATION:
    WINDOW OUTPUT 1 : COLOR 3,2
    LOCATE 4,7 : PRINT SPACE$(51) : LOCATE 4,7 : PRINT DiskName$
    LOCATE 4,64 : PRINT DiskType$ : LOCATE 5,10 : PRINT DiskDate$;
    LOCATE 4,75 : PRINT USING "####";SoftErrs%
    LOCATE 5,43 : PRINT USING "####";BlksUsed%;
    LOCATE 5,55 : PRINT USING "####";BlksFree%;
    LOCATE 5,68 : PRINT DiskStat$(DiskStat%);
RETURN
REM===THE PRIMARY TASKS=========================================================
REM============================================================================

SelectUnit:
    IF Unit%(menu1% - 1) = 2 THEN RETURN
    MENU RESET : IF devopen% THEN GOSUB CloseDev
    L.Unit% = Unit% : Unit% = menu1% - 1 : GOSUB OpenDev
    IF ioerr% <> 0 THEN
       Unit% = L.Unit%
       IF Unit% > -1 THEN
          GOSUB OpenDev : GOSUB InitializeDisk
       END IF
       ioerr% = 5
    ELSE
       IF L.Unit% <> -1 THEN Unit%(L.Unit%) = 1
       Unit%(Unit%) = 2 : GOSUB InitializeDisk
       IF ioerr% <> 0 THEN
          Unit%(Unit%) = 1 : IF devopen% THEN GOSUB CloseDev
       END IF
    END IF
    GOSUB InstallMenu
RETURN

ReadBlock:
    IF Unit% = -1 THEN
       ioerr% = 9
    ELSE
       'first empty keyboard buffer !
EmptyBuf:
       a$ = INKEY$ : IF a$ <> "" THEN EmptyBuf
       'small temp window to get block number
       WINDOW 3, "BLOCK NUMBERS 0 -"+STR$(NUMBLKS%-1), (20,20)-(300,60), 16, 2
       w3% = -1 : WINDOW OUTPUT 3 : CLS
GetReDo:
       INPUT "Block : ", temp$
       temp% = VAL(temp$)          note that a letter may generate 0 but its safe
       IF temp$ = "" OR temp%   0 OR temp% >= NUMBLKS% THEN
             PRINT "Invalid block number."
             GOTO GetReDo
       END IF
       WINDOW CLOSE 3 : w3% = 0
       Block% = temp% : GOSUB ReadDev
       IF ioerr% THEN
          IF ioerr% = 29 THEN
             GOSUB IsDiskinDrive          'diskchange or no disk
             IF ChangeState& THEN
                ioerr% = 7                'no disk
             ELSE
                GOSUB InitializeDisk : ioerr% = 8
             END IF
          END IF
```

PROGRAM FILE

```
            RETURN
         END IF
         BlockRead% = -1 : GOSUB UpdateStatus1

   DumpBlock:
         IF BlockRead% THEN
            WINDOW CLOSE 2 : w2% = 0
            Btype$ = ""
            type& = PEEKL(SectBuf&)
            secondarytype& = PEEKL(SectBuf& + 508)
            IF type& = 2 THEN
               IF secondarytype& = 1 THEN
                  Btype$ = "ROOT"
               ELSEIF secondarytype& = 2 THEN

                  Btype$ = "DIRECTORY"
               ELSEIF secondarytype& = -3 THEN
                  Btype$ = "FILE HEADER"
               END IF
            ELSEIF type& = 8 THEN
               Btype$ = "DATA BLOCK"
            ELSEIF type& = 16 AND secondarytype& = -3 THEN
               Btype$ = "FILE EXTENSION"
            ELSEIF (type& = 1146049280& AND Block% = 0) OR Block% = 1 THEN
               Btype$ = "BOOTBLOCK"
            END IF
            IF Btype$ = "" THEN Btype$ = "UNKNOWN"
            temp$ = "HEX/ASCII DUMP OF BLOCK "+STR$(Block%)+". TYPE : "+Btype$
            WINDOW 2,temp$,(0,54)-(631,250),16,2 : w2% = -1 : WINDOW OUTPUT 2
            CLS : off1% = 0 : off2% = 23
            hpos% = 1 : apos% = 55 :Sline% = 1
            FOR n% = 0 TO 503 STEP 24
               GOSUB DoLine : Sline% = Sline% + 1
            NEXT n%
            off2% = 7 : GOSUB DoLine
            PRINT : PRINT
            PRINT SPACE$(24);"==========END OF DUMP==========";
         ELSE
            ioerr% = 6
         END IF
      END IF
   RETURN

   DoLine:
      FOR l% = off1% TO off2%
         temp% = PEEK(SectBuf& + n% + l%)
         temp$ = HEX$(temp%)
         IF LEN(temp$) = 1 THEN temp$ = "0" + temp$
         LOCATE Sline%, hpos% + (2 * l%) + ((2 * l%)\8)
         PRINT temp$;
         temp$ = CHR$(temp%)
         IF temp% < 32 OR temp% > 126 THEN temp$ = "."
         LOCATE Sline%, apos% + l%
         PRINT temp$;
      NEXT l%
   RETURN

   REM====DEVICE IO=========================================================================
   REM=====================================================================================
   REM    generally the user is prevented from halting the program while any IO is
   REM    being done and also when any flags are being set/unset.

   OpenDev:
      IF devopen% THEN RETURN
      BREAK STOP
      ioerr% = OpenDevice%(SADD(TDNAME$), Unit%, IOExtTD&, 0)
      IF ioerr% = 0 THEN devopen% = -1
      BREAK ON
   RETURN

   GetChangeNumber:
      BREAK STOP
      POKEW(IOExtTD& + 28), TDCHANGENUM%
      CALL DoIO(IOExtTD&)
      ioerr% = PEEK(IOExtTD& + 31)
      ChangeCount& = PEEKL(IOExtTD& + 32)
      BREAK ON
   RETURN

   IsDiskinDrive:
      BREAK STOP

      POKEW(IOExtTD& + 28), TDCHANGESTATE%
      CALL DoIO(IOExtTD&)
      ioerr% = PEEK(IOExtTD& + 31)
      ChangeState& = PEEKL(IOExtTD& + 32)
      BREAK ON
   RETURN

   ReadDev:
      BREAK STOP
      temp& = Block% * TDSECTOR%
      POKEW(IOExtTD& + 28), ETDREAD%
      POKEL(IOExtTD& + 36), SizeofSectBuf%
      POKEL(IOExtTD& + 40), SectBuf&
      POKEL(IOExtTD& + 44), temp&
      POKEL(IOExtTD& + 48), ChangeCount&
      CALL DoIO(IOExtTD&)
      ioerr% = PEEK(IOExtTD& + 31)
      GOSUB MotorOff
      BREAK ON
   RETURN

   MotorOff:
      POKEW(IOExtTD& + 28), TDMOTOR%
      POKEL(IOExtTD& + 36), 0
      CALL DoIO(IOExtTD&)
   RETURN

   CloseDev:
      IF devopen% THEN
         BREAK STOP
```

PROGRAM FILE

```
        CALL CloseDevice(IOExtTD&)
        devopen% = 0
        BREAK ON
    END IF
RETURN

REM====UTILITIES=============================================================
REM=========================================================================

GetDate:
REM    date is stored as 3 longwords, days since 1-01-78, minutes since midnight
REM    and ticks past current minute (50 = 1 second).  It may not be elegant but
REM    it is reasonably quick.
    temp$ = "00-MMM-YYYY 00:00:00"
    day& = PEEKL(SectBuf& + offset%)
    min& = PEEKL(SectBuf& + offset% + 4)
    tik& = PEEKL(SectBuf& + offset% + 8)
    sec% = tik&\50
    temp% = LEN(STR$(sec%))
    MID$(temp$, 22-temp%) = RIGHT$(STR$(sec%), temp%-1)
    hour% = min&\60
    temp% = LEN(STR$(hour%))
    MID$(temp$, 16-temp%) = RIGHT$(STR$(hour%), temp%-1)
    min& = min& MOD 60
    temp% = LEN(STR$(min&))
    MID$(temp$, 19-temp%) = RIGHT$(STR$(min&), temp%-1)
    year% = day&\365 : day& = day& - (year% * 365) - (year%\4) + 1
    IF day& > 366 AND (year% MOD 4) = 0 THEN
       day& = day& - 366 : year% = year% + 1
    ELSEIF day& > 365 THEN
       day& = day& - 365 : year% = year% + 1
    END IF
    year% = year% + 1978
    MID$(temp$, 8) = RIGHT$(STR$(year%), 4)
    IF day& <= 31 THEN
       MID$(temp$, 4) = monthname$(0)

    ELSE
       mdx% = 0
       IF (year% MOD 4) = 0 THEN mdx% = 1
       FOR dx% = 0 TO 11
          IF (day& - monthnum%(mdx%, dx%)) <= 0 THEN
             day& = day& - monthnum%(mdx%, dx%-1)
             MID$(temp$, 4) = monthname$(dx%)
             dx% = 12
          END IF
       NEXT dx%
    END IF
    temp% = LEN(STR$(day&))
    MID$(temp$, 4-temp%) = RIGHT$(STR$(day&), temp%-1)
RETURN

WaitaBit:     'this lets the user see the error before close
    FOR x% = 1 TO 15000 : NEXT x%
RETURN

REM====EXIT ROUTINES=========================================================
REM=========================================================================

Finish:
    GOSUB MyCleanUp
SYSTEM

NoBmaps:
    GOSUB UpdateStatus1 : GOSUB WaitaBit
ErrCleanUp:
    GOSUB MyCleanUp : WINDOW 1,,,,-1 : ON ERROR GOTO 0
RESUME

MyCleanUp:          'we make sure everything is closed and all allocated memory
    BREAK STOP      'is returned to the system
    MENU RESET
    IF w1% THEN WINDOW CLOSE 1
    IF w2% THEN WINDOW CLOSE 2
    IF w3% THEN WINDOW CLOSE 3
    SCREEN CLOSE 2
    IF devopen% THEN GOSUB CloseDev
    IF IOExtTD& THEN
       POKE(IOExtTD& + 8), &HFF     'insures against re-use
       POKEL(IOExtTD& + 20), -1
       POKEL(IOExtTD& + 24), -1
       CALL FreeMem(IOExtTD&, SizeofIOExtTD%)
    END IF
    IF InfoData& THEN
       CALL FreeMem(InfoData&, SizeofInfoData%)
    END IF
    IF MyPort& THEN
       CALL RemPort(MyPort&)
       POKE (MyPort& + 9), &HFF     'insures against re-use
       POKEL(MyPort& + 20), -1
       sigBit% = PEEK(MyPort& +15)
       CALL FreeSignal(sigBit%)
       CALL FreeMem(MyPort&,SizeofMyPort%)
    END IF
    IF SectBuf& THEN CALL FreeMem%(SectBuf&, SizeofSectBuf%)
    LIBRARY CLOSE
RETURN
REM    PHEW!
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END

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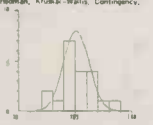

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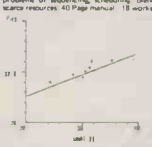

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● **32K Radio Shack TRS-80 Model II Disk System.** TRS-80 Line Printer VI, owners manual and box of 10 diskettes including TRSDOS. Best offers. Tel: (01) 729 0890.

Wanted

● **Torch Unicorn Upgrade.** For BBC. Tel: Ian (01) 206 0544.

● **Software For IBM/Amstrad 1512.** Anything considered, reply to K R Dodd, 6 Newbridge Close, Broadbridge Heath, Horsham, West Sussex RH12 3TN.

● **Tandy TRS-80.** Model II in good order. Lawgreen, 1 Whitelands, Rawdon, Leeds LS19 6BU. Tel: daytime (0274) 733281. Evenings (0532) 503801.

● **Microsoft Fortran-77.** Version 3.3 or later plus manuals. Will exchange for EGA board. Other boards available (all mint). Please phone Jeff on (01) 491 4254 (day).

● **Wordstar Professional.** Wanted for Epson QX10 CP/M Plus or 2.2. Tel: (0202) 518545 after 6pm.

● **Epson QX10 Computer.** Please write with fullest details to: Maxwell, c/o 17 Watford Way, London NW4.

● **Cobol Compiler.** To operate on Z80 based micro running CP/M plus, but MS/DOS version for PC compatible machine might also be considered. 59 Abbot's Grange, Chester. Tel: 380858.

answer. In good working order. Also new colour plotter, Citoh CX4800, boxed with manual and IF-cable, £250 ono. Tel: (01) 708 4424 eve.

DIARY DATA

A look ahead at computer shows to May. Readers are advised to check details before setting out on their journey.

ELECTRON & BBC MICRO USER SHOW UMIST, Manchester — Database Exhibitions (061) 456 8383	**18–20 March 1988**
ELECTRONIC PRINTING AND PUBLISHING EXHIBITION Olympia, London — BED Exhibitions (01) 647 1001	**22-24 March 1988**
COMPUTERS IN RETAIL AND RETAIL TECHNOLOGY Brighton Metropole — Focus Events (01) 834 1717	**29–31 March 1988**
COMPUTERS IN TRANSPORT AND DISTRIBUTION Wembley Conference Centre, London — Computers in Transport and Distribution (0303) 45979	**19–21 April 1988**
ATARI COMPUTER SHOW Alexandra Palace, London — Database Exhibitions (061) 456 8383	**22–24 April 1988**
COMFEST '88 Telford Exhibition Centre, Telford — (0952) 505522	**12-14 May 1988**

LEISURE LINES

Brainteasers courtesy of JJ Clessa.

Quickie

77/77 = 1
(7/7) + (7/7) = 2
(7+7+7)/7 = 3

Can you continue and arrange four 7s together with any standard mathematical symbols to be equal to 4,5,6 . . . up to 20?

(By the way, if anyone can get the value 26, please let me know).

Prize puzzle

My bank account number contains the following eight digits (not in this order, I hasten to add)

1 3 3 3 4 6 8 8

It makes me wonder just how many different integers could be made using some, or all, of these digits. Further, if all these integers were sorted into ascending order, what would be the integer in the 5000th position?

Two answers please — the total number of integers, plus the one in 5000th position.

Answers on postcards or backs of envelopes only to arrive no later than 30 April 1988.

Send your entries to: Leisure Lines Puzzle April, PCW Editorial, VNU House, 32/34 Broadwick Street, London W1A 2HG.

January prize puzzle

Not too difficult this month, although computer program running times to obtain solutions varied from nine hours on a BBC 'B' computer, to one hour by hand (and we call this progress?)

The problem wasn't difficult to solve by hand, and the required solution is

4 8 2		6 1 4
1 5 7	which rotates to	3 5 8
6 3 9		9 7 2

The winning card, drawn at random from the pile, came from Mr M Cooper of Woodford Green, Essex.

Congratulations, Mr Cooper, your prize is on its way. There would have been a different winner, but the card we drew didn't have a name and address. So don't forget to include these with your entries, or you'll never win.

Mike Mudge introduces readers to the elementary concepts of cryptology in this month's 'not-so-secret' Numbers Count.

The need for secret communication in diplomacy and military affairs is readily appreciated. Now that electronic mail, electronic banking and other computer-based business transactions are part of everyday life, the need for security of information is clear to us all. The purpose of this article is to indicate certain aspects of number theory which are the foundations of elementary ciphers (or codes), to display examples of their use, and to invite readers to submit a working coder and decoder package with a specimen message.

It must be emphasised that the types of cipher discussed are elementary and bear little relation to those used in an ultimate security environment; however, they can form part of a challenge among, for example, computer club members: 'How do you go about cracking (even an elementary) code?' This aspect will not be considered here, but may form the subject of a future column, depending upon the response to this article.

Character ciphers

Stage 1 Translate the letters of the alphabet into their numerical equivalents 1–25.

Stage 2 Transform the numerical equivalent, m, of each letter in the message into another number, c, using an 'affine transformation' of the type: $c = am + b$ (modulo 26) where a and b are integers having no common factor. Note that since modulo 26 means retain only the remainder after division by 26, it follows that c lies between 0 and 25 inclusive.

Stage 3 Return each c to its equivalent letter using the reverse process to that described at stage 1; and group into convenient, ordered sets, say, of five to yield the code.

The particular affine transformation in which $a = 1$ is called a 'shift transformation' and clearly corresponds to replacing each letter of the message by that found by shifting b places through the alphabet.

For example, under the affine transformation $c = 7m + 10$ (modulo 26), the message 'PLEASE SEND MONEY' becomes the code 'LJMKG MGXFQ EXMW'!

Block ciphers

Stage 1 Group the letters of the message into convenient, ordered sets — say, for example, pairs. For example: 'PLEASE SEND MONEY' becomes 'PL EA SE SE ND MO NE Y'.

Stage 2 Transform the numerical equivalent, m_1m_2, of each pair in the message into another number pair, c_1c_2, using a pair of affine transformations of the type: $c_1 = a_1m_1 + b_1m_2$ (modulo 26), $c_2 = a_2m_1 + b_2m_2$ (modulo 26).

Stage 3 Return each c_1c_2 to its equivalent letter pair using the inverse translation process. For example: 'STOP PAYMENT' block ciphered in triples using the affine transformations:

$c_1 = 11m_1 + 2m_2 + 19m_3$ (modulo 26)

$c_2 = 5m_1 + 23m_2 + 25m_3$ (modulo 26)

$c_3 = 20m_1 + 7m_2 + m_3$ (modulo 26)

becomes 'ITN NEP ACW ULA'.

Exponentiation ciphers

Invented in 1978 by S Pohlig and M Hellman (see *IEEE Transactions on Information Theory* (vol 24, 1978, pp106–110)) this begins by translating the letters of the message into numerical equivalents, using A,B,C, ... Y,Z becomes 00,01,02, ... 24,25. The resulting numbers are then grouped into blocks of '2s' digits; where 2s is the largest positive even integer, such that all blocks of numerical equivalents corresponding to s letters (viewed as a single integer with 2s decimal digits) is less than an odd prime p. Associated with p is the *enciphering key* k, a positive integer which has no common factors with $p - 1$.

For each message block M, which is an integer with 2s digits, form a code block C using the transformation:

$C = M^k$ (modulo p), O C p.

For example, if $p = 2633$ and $k = 29$, then to encipher:

'THIS IS AN EXAMPLE OF AN EXPONENTIATION CIPHER', first convert to two-digit numerical equivalents, then group in blocks of size four: 1907 0818 0818 ... 0704 1723. The final 23 being an X added to complete a block of four.

Now use $C = M^{29}$ (modulo 2633) to obtain the code:

2199 1745 1745 ... 1841 1459.

Readers are invited to send an encoder, a decoder and a specimen message to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, South Staffordshire WV4 5NF, or phone (0902) 892141 by 1 July 1988.

It would be appreciated if such submissions contained a brief description of the enciphering theory and any peculiarities of the programming, in a form suitable for publication in *PCW*. These submissions will be judged using subjective criteria, and a prize will be awarded by *PCW* to the 'best' contribution received by the closing date.

Please note that submissions can be returned only if a suitable stamped addressed envelope is provided.

Review: October '87

Space restrictions prevent a detailed review of a very popular topic. Refer to Don Thomasson, *Computing Today*, January 1984, pp52–53, and to this month's worthy prizewinner, Bill Hamley, of Church Lane, Scotter, Gainsborough, Lincolnshire DN21 3RZ.

John Gale of Hemel Hempstead is to be congratulated on his n-dimensional graphics on an Amstrad PC1512 SD, invoking the recursive powers of Pascal. Details on request.

Factorisation of Fermat Numbers, Review, September 1987

The factorisation of fermat numbers, $F_m = 2^{2^m} + 1$, proved to be a very difficult exercise even with the assistance of Theorem 3 (*PCW*, September 1987, page 214).

The table shown here is due to Professor Wilfrid Keller of the University of Hamburg and summarises the state of the art at 1980. This table accompanied the then new results that $1985 \times 2^{933} + 1$ is a factor of F_{931}, $19 \times 2^{6838} + 1$ is a factor of F_{6835}, while $19 \times 2^{9450} + 1$ is a factor of F_{9448}.

Subsequently GB Gostin and PB McLaughlin (*Math Comp* vol 18, No 158, April 1982 pp645–649) published a new prime factor for each of F_{29}, F_{36}, F_{99}, F_{147}, F_{150} and F_{201}. It is certain that further results exist in the literature and readers are invited to comment on any which they can locate.

Using the flexibility of the 'subjective criteria' this month's prizewinner is Andrew Slodkiewicz of 25 Taylors Road, St Albans, 3021 Victoria, Australia.

Andrew uses string handling routines in Turbo Pascal to manipulate numbers up to 256 digits. Unfortunately his hardware is undefined; however, the calculation of Euler Number E_{152} having 238 digits (for definitions see *PCW*, January 1987) took in excess of four hours to calculate. 'String division is performed using multiple subtractions, then shifting the numerator to the left, and so on. It takes about three seconds per unit in each decimal place.'

Readers may like to write to Andrew with advice or to obtain further details of his work in this area.

Values of m	Character of F_m
0, 1, 2, 3, 4	Prime
5, 6, 7, 8	Composite and completely factored
12*	Four prime factors known
10*, 11*, 19, 30, 36, 38, 150	Two prime factors known
9*, 13*, 15, 16, 17, 18, 21, 23, 25, 26, 27, 29, 32, 39, 42, 52, 55, 58, 62, 63, 66, 71, 73, 77, 81, 91, 93, 99, 117, 125, 144, 147, 201, 207, 215, 226, 228, 250, 255, 267, 268, 284, 287, 298, 316, 329, 416, 452, 544, 556, 692, 744, 931, 1551, 1945, 2023, 2456, 3310, 4724, 6537, 6835, 9448	Only one prime factor known
14	Composite but no factor known
20, 22, 24, 28, 31, 33, 34, 35, etc.	Character unknown

*Cofactor known to be composite

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or specific, for future Numbers Count articles; all letters will be answered in due course.

Isolated readers can be put in contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prizewinner.

WordStar times out

I have just changed from Superwriter to WordStar Professional Release 4, but have kept my Juki 6100 printer. My problem is that printing has now become extremely unreliable.

I bought the Juki in 1984 and the manual is rather out of date. It advises me to install the printer within WordStar as a Diablo 630 and to include the statement 'mode lpt1:,,p' in AUTOEXEC.BAT. When I tried this, the result was pretty horrendous. I achieved a marked improvement by installing the printer as a Diablo daisywheel, but this has not solved the problem entirely.

During printing, the printer stops, apparently randomly. If I am lucky, pressing 'C' restarts the printing correctly but, all too often, the Juki goes haywire, writing garbage or reprinting a section of text from earlier in the document.

Can you help?

RG Knight, Hendon, London

Solving the timing-out problem is not difficult. Run the program called WSCHANGE that is included with WordStar and increase the printer time-out variable. Using a lengthy document as a test, gradually increase the value until the whole document prints without problems.

I can't explain why the printer goes haywire after pressing 'C' to continue, as no special control codes are sent during a time-out. My only suggestion is that sometime during your experimentation, you've corrupted the printer driver. Try using a fresh copy of the WordStar software.

Monitor mode

I plan to buy an Archimedes 310M, just the base unit. I intend to use my Ferguson MC05 TV/monitor with the machine. Will it work? I know the picture quality won't be very clear if it does work; however, the MC05 has a SCART socket.

Surjit Pardesi, London E12

There would be no problem attaching an Archimedes to the Ferguson MC05. You will be unable to use the machine in its highest graphics resolution mode, but this is no great disadvantage as the highest resolution is designed for use with specialist graphics applications such as CAD/CAM. If you need to run such software, you would be well-advised to buy a good multiscan monitor such as the Hitachi Multi 560 or the NEC MultiSync XL. Even the monitor supplied with the Archimedes is incapable of displaying this mode.

A word of warning about SCART: although it was designed to be a universal standard, there are now *two* SCART specifications. Although the difference is only a resistor's value, getting the wrong lead will result in no picture at all. The Ferguson falls into the Sony/Hitachi grouping as opposed to the Phillips/Thomson grouping, so make sure you specify this when buying the lead from your dealer. Also, SCART is known as PeriTel or Euroconnector in some places.

Finally, if you intend to use the Archimedes mainly for text-based applications on the 80-column screen, you will soon find your eyes suffering with a low-resolution monitor such as the Ferguson.

The least resistance

I am hoping to incorporate results from an experiment with resistances — and be capable of manipulating these values — directly into a spreadsheet or, failing that, a Basic program. The range of resistances are from 0–100k ohms, and the equipment I am using is a Toshiba 1100 with 512k RAM, a single 720k disk drive and only a Centronics port. The spreadsheet I am currently using is Symphony. I am prepared to sacrifice any or all of the above to achieve the desired results.

NL Hart, Hiltingbury, Hants

You're not going to like this. In theory, it would be possible to do this via the Centronics port. In practice, it will be far too much trouble unless you are an electronics expert and very skilled with a soldering iron. The easiest way to achieve your aim is to sacrifice the Toshiba and buy a new machine that can accept standard IBM expansion cards (the Toshiba 1100 Plus has expansion capabilities if you must have a laptop).

Into the expansion slots you can then insert an analogue to digital converter (ADC) card that will read the resistances you require. You can obtain one from Data Translation on (0734) 793838, and also possibly from Maplin or Radio Spares.

I know of no spreadsheet that can accept input straight from an ADC, although most lower-level programming languages (Basic, C, Forth, and so on, not Pascal, Smalltalk or Logo) can read directly from the ADC's address.

The real thing

I bought Borland's Turbo Basic some months ago (influenced by the review in the May 1987 issue of *PCW*) and it really is an excellent program. However, there appears to be a bug in the input/output area, as the following program will not work:

```
OPEN "O",1,"TEST"
FOR k%=1 TO 100000
PRINT£1,"a";
NEXT
CLOSE
```

This will crash when k% is 64000. It works perfectly well in MS-Basic.

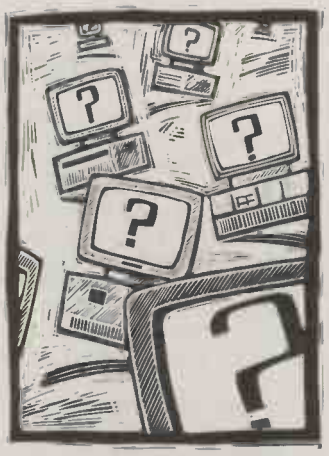
Furthermore, although strings can be up to 32k long, they cannot be INPUT or PRINTed if they are more than 256 bytes long. Is there a fault in the program or am I doing something wrong?

HI Miller, London

I am surprised you have a version of MS-Basic that supports integers over 65535. All the standard MS-Basics I have come across will only use integers *up to* 65535, and this is the root of your problem — Turbo Basic will also only support integers up to 65535.

You can get round this by using reals. If you *must* use integers over 65535, then you will have to write routines to control them yourself. The best method is to write a set of routines that perform integer operations on reals, and only express reals as if they were integer numbers. Alternatively, if you need exact precision in using large integers, you could take a look at some of the routines that appeared in Program File towards the end of last year.

The way to achieve INPUT and PRINTing of longer strings is to work around it. I suggest you use the string-splitting and concatenation routines to build up and break down longer strings. For example, if you want to input a 500-character string, input the first 256 characters and then the second 244 separately. You can then stick the two together.



***PCW* is always interested in readers' hardware and software problems and solutions, but can only help through the pages of the magazine. Send your contributions to: The Editor, *PCW*, VNU House, 32-34 Broadwick Street, London W1A 2HG.**

Basic garbage collection

I am converting my programs from Commodore Basic 4 to a Victor VPC IIE computer using Victor's VBasicA. My programs produce a lot of string garbage. Also, my Commodore programs contain 'PRINT FRE(1)' at regular intervals, and garbage collection takes about one second. However, in VBasicA the equivalent 'PRINT FRE(X$)' at regular intervals causes a delay of about 80 seconds and gives worse results than omitting it altogether.

Is there any way round this problem, and are there any other MS-DOS Basics that can garbage-collect faster than VBasicA and as fast as Commodore Basic 4?

Bill Stephens, Bristol

True, the garbage collection of VBasicA is a lot slower than Commodore Basic. There are two reasons for this: the Victor has a larger data area than the Commodore (64k onVBasicA before version 3.1, up to 640k after version 3.1); and, the FRE function is designed to be used in a different way. Either don't run it at all, and garbage collection will only occur when absolutely necessary (usually not at all); or call FRE regularly in the main (tightest) loop of your program.

As for an alternative, Turbo Basic and Microsoft Basic should prove satisfactory in the garbage collection stakes.

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(0642) 588989 24hrs; 300; MSX
The Sharrow BBS; Ripon
(0765) 707 887 24 hrs; 3/1275
Viewdata & scrolling BBC based

The North West

Bolton BBS (0204) 43082
MF:8pm-8am; WE:24 hrs; 3-24
8am-8pm on ring back
CNOL; Lancaster (0524) 60 399
24 hrs; 300
Clinical BBS for medics
Fido Compulink North; Liverpool
(051) 220 3761 24 24 hrs
3/1275
Fido Manchester (061) 773 7739
24 hrs; 3/1275
Mektronic Electronic design cons
Liverpool Mailbox
(051) 428 8924 24 hrs; 3-24
UK TBBS HQ system
Matrix; Liverpool
(051) 737 1882; 24 hrs; 3/1275
Multi-user games; 4 lines
Might Micro; Manchester
(061) 224 8117; MF:6pm-9am; Sun:24hrs; 3/1275; Fido/Opus
Commercial system
OBBS Manchester
(061) 427 1596 24 hrs; 3/1275
Portal; Wirral (051) 355 0911
MF:8pm-6am; WE:24 hrs; 3/1275
Pyramid; Leigh; Lancs
(0942) 609 611 24 hrs; 3
Stoke ITeC (0782) 265 078
24 hrs; 1275v
TeePee Link; Manchester
(061) 494 6938 24 hrs; 3-24
Telemac 15; Macclesfield
(0625) 33 703 24 hrs; 3/1275

Scotland

Aberdeen ITEC (0224) 641 585
24 hrs; 1275v
Aberdeen Commodore
(0224) 781 919 24 hrs; 300
Commodore 64 based
A.L.A.N. Fife; (0592) 860313
9.30pm-8am; 3
Betelgeuse 5; Inverness
(0463) 231 339 24 hrs; 3/1275
Kirklees ITeC; Batley
(0924) 442598 24 hrs; 1275v
Information Technology Centre
Livingstone BBS; Livingstone
(0506) 38 526 24 hrs; 300
People's Palace; Glasgow
(041) 956 6537 Daily 6pm-8am
3/1275 Colour

Northern Ireland

Deep Thought Fido; Bangor NI
(0247) 467 863 24 24 hrs; 3-24
PC-DOS; CP/M; BBC; Tech help Sigs
PBBS 1 Portadown (0762) 333 872
Daily 10pm-1am; ring back; 300

Eire

DUBBS; Dublin (0001) 885 634
MF:8pm-8am; WE:24; 3-24
Amiga based; astronomy SIG
Dublin Fido; Dublin
(0001) 854 522; 24 hrs; 3-24
IACCBBS; Eire
(0001) 903 341 24 hrs; 300
Irish ACC Runs on Commodore 64
Infomatique; Dublin
(0001) 764 942 24 hrs
3/1275 Amiga based

Channel Islands

Jersey Fido (0534) 39 389
24 hrs; 3/1275

Prestel

Demonstration area access
South (01) 618 1111
Midlands (021) 618 1111
North (061) 618 1111
Scotland (041) 618 1111
ID: 4444444444
Password: 4444

ABBREVIATIONS

3	V.21 (300 baud)
1275	V.23 (1200/75)
12	V.22 (1200/1200)
24	V22bis (2400/2400)
3-12	V.21,V.23,V.22
3-24	V.21,V.23,V.22,V.22bis
v	viewdata graphics
s	scrolling (non viewdata)
h	half duplex
r/b	ring back
*	Fide Net node

Most systems are
8 bits no parity
1 stop bit.
Viewdata 7bits,
even parity,
1 stop bit

END ZONE

Rupert Steele presents his regular round-up of UK user groups.

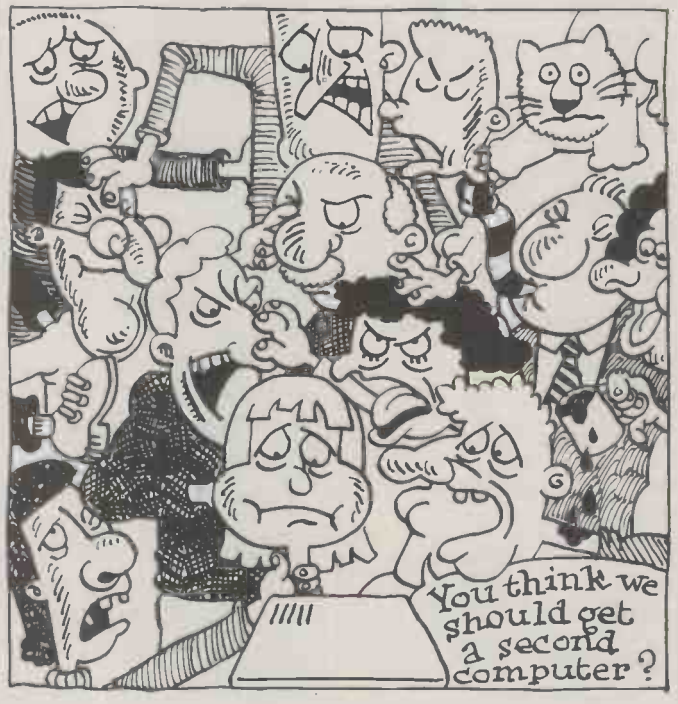
I think 1988 is rapidly becoming the 'Year of The Interesting User Group Newsletter'. A number of lively, useful and detailed newsletters have arrived on my desk in the last few months, ready to be reviewed in this column. A few groups remain silent, which is a shame because I would like to tell *PCW*'s readers what you are up to, but you cannot expect me to review a newsletter I have not seen.

The IBM PC User Group has redesigned its newsletter into an A4 format from A5, renamed it *Connectivity*, improved the typesetting and installed red stripes on the cover. The material inside remains interesting. For example, among the contents of the issue I received was an article on how to recover data from a floppy where you have zapped the directory, and a way to avoid accidentally damaging files with Lotus 1-2-3. There was also a hilarious article by Alan Solomon on how a disk speed-up program wrote a fish wholesaler's price list over the boot and partition sectors of the drive. Well worth a read, whether you have a Charlie or a clone. For more details contact the IBM PC User Group, PO Box 830, London SE1 0DB.

In a rather different style, I have received the first copy of *Special Needs Computing*, the journal of SNUG, the Special Needs User Group. This is 32 pages of cleanly-produced A5 typescript aimed at those using computers for people with 'Special Needs'. There are articles about devices for the blind, the mentally handicapped and children needing remedial help, as well as advice for social workers, including software for recording the case of a handicapped person and planning their development. Perhaps the most interesting article was the Report Writer for the 'Pethna' toy. Pethna is a robust toy designed for students with profound and severe learning difficulties. Report Writer allows the toy to be interfaced to a BBC Micro, and a report of how the child used it can be made and analysed. This is a serious newsletter aimed at those caring for people with special problems.

The group also runs workshops in Liverpool on alternate Saturday mornings from 10am to 12 noon at Christ and Notre Dame College, Woolton Road, Liverpool. The workshops are free, with a large selection of software, most of it non-copyright. The next sessions are on 26 March, 30 April, 7 & 21 May, 4 & 18 June and 2 July. For more details contact Jeff Hughes, the secretary and organiser, on (051) 709 6664 (daytimes) or (0744) 24608 (evenings up to 10pm). Or you can write to 39 Eccleston Gardens, St Helens, WA10 3BJ.

I have also been sent a copy of *NATGUG News*, the journal of the National Amstrad, Tandy and General User Group. This comes as around 30 pages of A5, in condensed print. It is written in a chatty style, is less formal than, say, the IBM User Group magazine, but does not go quite as far overboard as Jeff Walker's WACCI. Quite a bit of the journal is taken up with material about running the club — mainly encouraging people to write to the correct committee member, but there is a very good piece on CED (a command line editor for MS-DOS) and some detailed Tandy TRS information as well as various pieces from Tandy users in the process of falling victim to the charms of the IBM standard.



As well as the newsletter, a group of eight local clubs is connected with NATGUG. These are: **Bournemouth**: call Carl Rabe on (0202) 730617 or Mark Austin on (0202) 428856. **Chelmsford**: call Richard Creak on (0245) 413725. **Edinburgh**: call Dick Mackie on (031) 447 6651 out of hours. **London NE**: write to 77 Old Church Road, Chingford, E4 6ST. **London NW**: call Geoff Smith on (01) 950 6345 after 8pm. **Milton Keynes**: call Brian Pain on (0908) 564271. **Sudbury**: call John Kilpatrick on (0787) 79504. **West Midlands**: call Fred Challenor on (0203) 78180. It is good to see that NATGUG is still promoting the local side of computer clubs; many groups nowadays can be rather introverted, concentrating wholly on the production of their newsletter. For details of NATGUG, send your request with an *sae* to Roger Storrs, NATGUG, Oakfield Lodge, Ram Hill, Coalpit Heath, Bristol BS17 2TY.

I have also had a letter from the CP/M User Group (UK). This long-established group is run by Diana Fordred who was involved, with her husband Derek, in the old Amateur Computer Club which ran in the 1970s and early 1980s before the Association of Computer Clubs floated off as a separate organisation. I have not had a chance to examine a copy of the group's journal, but their letter says that it has covered such areas as the internal structure of CP/M, bug fixes and modifications for CP/M, and reviews of various implementations of Pascal. The group also has a BBS available free to members; this contains additional information and a 'helpline', mainly about CP/M and the Z80, and there are limited facilities to download public domain software.

The CP/M User Group also has considerable quantities of public domain software available. Not only does it have its own library, it also has access to the US CP/M User Group library, the SIG/M Group, the C Users Group, and MS-DOS software from the PC Blue library. With many years of MS-DOS behind us, it is easy to forget that a huge library of CP/M software was built up a few years ago, much of which was more than adequate for the intended tasks. I don't know how much of this material will run on the Amstrad PCW machines, but it must be worthwhile for PCW owners who are thinking of expanding their horizons to get in touch. Send Diana an *sae* at 72 Mill Road, Dartford, Kent DA2 7RZ.

The CP/M User Group also has two local sub-groups, based in East Anglia and Oxford. The East Anglian group, formally called the 'East Anglian Chapel', is run by Mr S Waller who can be found on Ipswich (0473) 623993. The Oxford group is run by my old friend Sebastian Linfoot who lives at Flat 10, Pembroke Court, Rectory Road, Oxford OX4 1BY. You can call him on (0865) 725094.

I have also had a bundle of information from Pete Rowan of Community Computing Network. Its main objectives are the promotion of community computing projects, the promotion of the 'socially responsible use of new technology' and the provision of a forum for those interested in the implications of new technology. There is a very full membership directory of organisations involved in all sorts of community work, including a variety of computer literacy centres. I was less impressed with being told that computers were all about 'unemployment, health hazards and impersonal working environments', but the contacts are good even if the opinions are rather more questionable. Contact Pete Rowan at 5 Windmill Street, Frindsbury, Rochester ME2 3XQ or call him on (0634) 716729.

And, finally, a quick mention for the Central Scotland BBC User Group. David Davidson of 2 Akarit Road, Larbert, Stirlingshire, FK5 4BY, has written to explain that it meets twice a month at Larbert High School and that the group caters for users of Acorn products: BBC Model Bs, Masters, Compacts and the Archimedes. You can call him on (0324) 558692.

If you would like your user group or club to have a mention in this column, or you wish to be considered for the Directory of User Groups, please write to **Rupert Steele**, 12 Philbeach Gardens, London SW5 9DY or tel: (01) 370 0601.

DIRECTORY OF USER GROUPS

Machines H-Z

HEWLETT-PACKARD HANDHELD
HPCC Membership Secretary, Geggs Lodge, Hempton Road, Deddington, Oxford, OX5 4QG.

HITACHI MBE 16002 PC
Bruce Ainge, HICUPS, 16 Nine Acres Road, Cuxton, Kent, ME2 1EL. (0634) 715759

IBM PC
IBM PC User Group, PO Box 830, London, SE1 0DB. 01-620 2244. £25 personal; £95 corporate. Professional.

JUPITER ACE
Mr J R Charter, Jupiter ACE Users Group, 8 Abney Close, Cheedale Ave, Chesterfield, S40 4PF. (0246) 37555. SAE.

MEMOTECH
Phil Eyres, Memotech Owners Club, 23 Denmead Road, Harefield, Southampton, SO2 5GS. SAE.

MOTOROLA 68xxx MICROS
Rick Applegate, 68 Microgroup, 8 Great Cob, Springfield, Chelmsford, Essex. BBS 01-316 7402.

MSX SYSTEMS
Keith Neal, MSX Link, Austerby House, 80 Austerby, Bourne, Lincs. PE10 9JL. (or) Craig Bell, North Lodge, Cairnhill Road, Airdrie, Lanarkshire, Scotland, ML6 9RJ.

MSX SYSTEMS
Lee Simpson, MSX User Group, 3 Mayfair Pl, Tuxford, Newark, Notts, NG22 0JD.

MSX SYSTEMS
Memory Alpha, 16 Mayfield, North End, Portsmouth, Hants. SAE.

NASCOM/80-BUS/CPM
Scorpio Systems, PO Box 286, Aylesbury, Bucks, HP22 6PU. (0296) 624868.

NEWBRAIN
Gerald McMullon, NBUG, 36 Armitage Way, Cambridge, CB4 2UE. SAE.

NEWBRAIN
Ron Bury, OPEN*STREAM, 70 Cranberry Lane, Darwen, Lancs, BB3 2HL. (0254) 771891.

ORIC
Gary Ramsey, IOUG, 1 Kingsway Crescent, Burnage, Manchester, M19 1GA. Newsletter.

OSBORNE/CPM/MSDOS
Jeremy Browne, BOOG Ltd., 102a Aldershot Road, Hants, GU13 9NY. (0252) 621745. BBS on (0252) 626233.

PSION ORGANISER
Mike O'Regan, Independent Psion Organiser User Group, 130 Stapleford Lane, Beeston, Nottingham, NG9 6GB. Monthly newsletter. SAE.

RESEARCH MACHINES (RML)
RML National User Group, Steve Burrows, Wirral CAE Services Ltd, Gorsey Lane, Wallasey, Wirral, L44 4HE. 051-639 8237. All RML micros.

SAMURAI S16
Andrew Lee, Samural S16 Self-Help User Group, 57 Darnley Rd, Gravesend, Kent, DA11 0SF. SAE. S16 is discontinued MSDOS non-PC.

SANYO MBC-550
Mr M H Syed, Wistaria, 53 Acacia Grove, New Malden, Surrey, KT3 3BP. 01-942 9009. Informal group.

SHARP
Andrew Fergusson, Sharp User Group, 11 Harcourt Clo, Henley on Thames, Oxon, RG9 1UZ. (0491) 574850. £6. 60pp Newsletter. Software.

SINCLAIR QL + COMPATIBLES
Brian Pain, Quanta, 24 Oxford Street, Stony Stratford, Milton Keynes, MK11 1JU.

SINCLAIR QL + COMPATIBLES
Richard Turner, QL Super User Bureau, PO Box 3, Shildon, Durham, DL4 2LW. £15 (£30 business). 50p for sample of monthly newsletter.

SORD M-23
Mr B Nicholson, c/o Aberdeen Reservoir Interpretation Centre, Woodlands Drv, Kirkhill Industrial Estate, Dyce, Aberdeen. (0224) 771117. Informal group.

TANDY/GENIE/AMSTRAD/MSDOS
Roger Storrs, NATGUG, Oakfield Lodge, Ram Hill, Coalpit Heath, Bristol, BS17 2TY. (0454) 772920. Newsletter. PD software.

TEXAS TI99/4a
Peter Walker, TI99/4a User Group (UK), 24 Bacons Drive, Cuffley, Potters Bar, Herts, EN6 4DU. (0707) 873778. £10. Newsletter. Software library.

TEXAS TI99/4a
Gordon Pitt/Peter Brooks, International TI User Group, 259 Sneyd Lane, Bloxwich, Walsall, WS3 2LS. £12.50. Bloxwich 476373. Newsletter.

TRANSPUTER
Dr Howard Oakley, Transputer Users Group, Brooklands Lodge, Park View Close, Wroxall, Ventnor, Isle of Wight, PO38 3EQ. £5.

Local clubs

DETAILS OF YOUR LOCAL CLUB
SAE please to John Dale, British Association of Computer Clubs, Banc-y-rhosyn, 14 Bron Y Glyn, Bronwydd Arms, Carmarthen, SA33 6JB.

Amstrad

AMSTRAD (SERVICES USERS)
LtCol Charles Joint, Services' Amstrad Society, Leros TA Centre, Sturry Rd, Canterbury, CT1 1HS. (0227) 61397. £5. Newsletter.

AMSTRAD 1512/1640
1512 Independent User Group, PO Box 55, Sevenoaks, Kent, TN13 1AQ. (0732) 63157. £22 pers; £25 business.

AMSTRAD ALL MACHINES
National Independent Amstrad User Club, 1 The Middle Way, Wealdstone, Harrow, HA3 7EG. £9 (specify machine). A5 SAE. Discounts. Newsletter.

AMSTRAD ALL MACHINES
Jeffrey M Green, Advantage, west One House, St Georges Road, Cheltenham, GL50 3DT. (0242) 222307. Newsletter; software lib; SAE.

AMSTRAD BUSINESS USERS
Amstrad Professional User Club, Enterprise Hse, PO Box 10, Roper St, Pallion Industrial Estate, Sunderland, SR4 6SN. 091-510 8787. £39.95.

AMSTRAD CPC HOME USERS
Jeff walker, WACCI, 75 Greatfields Drive, Hillingdon, Uxbridge, UB8 3QN. (0895) 52430. £12. Newsletter. Special offers. Good fun.

AMSTRAD LOCAL GROUPS
Amstrad Groups Federation, 4 Sutton Road, Gorton, Manchester, M18 7PN.

AMSTRAD PCW
Robert Mobberley, PCW Users Group, 37 Clifford Bridge Road, Binley, Coventry, CV3 2DW. (0203) 441417. Monthly newsletter. SAE.

AMSTRAD PCW
Ron Morland, The PCW Computer Club, 12 Deneve Avenue, Poole, Dorset, BH17 7LR. SAE.

AMSTRAD PCW
Chris Bryant, PCW File, 11 Havenview Road, Seaton, Devon, EX12 2PF. £7 with free PD software. Large SAE for sample newsletter.

AMSTRAD PD SOFTWARE
Peter Vass, Computer Services (Scotland), PO Box 244, Glasgow.

AMSTRAD SOFTWARE
Amstrad User Software Database, PO Box 11, Gosforth, Newcastle-upon-Tyne, NE3 1RP. 091-285 6017. Fido bulletin board.

Software & networks

ASHTON TATE SOFTWARE
Clare Winter, Servicelne, Ashton Tate UK Ltd, 1 Bath Road, Maidenhead, Berks. (0628) 33123. Online support via Telecom Gold.

C LANGUAGE
Martin Houston, CUG, 36 Whetstone Close, Farquhar Road, Edgbaston, Birmingham, B15 2QN. £10.

CPM MACHINES
PIP, 28 Gordon Mansions, Torrington Place, London, WC1E 7HF. Supports Amstrad, Einstein, Osborne etc; BBS.

CPM USERS
Diana Fordred, CPM Users Gp (UK), 72 Mill Road, Dartford, DA2 7RZ. (0322) 22669. PD Software. Also covers MSDOS.

ECONET
Michael Ryan, Econet User Group, Balkeerie Cottage, Eassie by Forfar, Angus, DD8 1SR. £8.60. Newsletter.

ENET (like Econet)
Mr T K Boyd, Enet (Amcom) User Group, Seaford Cottage, Petworth, West Sussex, GU28 0NB. Frequent info sheet in return for SAEs to despatch.

LOTUS PRODUCTS
Lotus User Group, 79-80 Peascod St, Windsor, Berks, SL4 1DH. (0753) 841686. £95. Magazine, helpline etc.

LOTUS PRODUCTS
World of Lotus, Telecom Gold Ltd, 60-68 St Thomas Street, London, SE1 3QU. Online (Gold) support £9.60/hour. Free macros, drivers etc.

PC SOFTWARE
PC-SIG, ISD Ltd, PO Box 872, Sutton Coldfield, W Midlands, B75 6UP. £6/disk + donation to author. 700+ disks.

PC/APRICOT/CPM SOFTWARE
PD-SIG Ltd, 90 Braybourne Close, Uxbridge, UB8 1UJ. (0895) 51978 or 01-864 2611. BBS on 01-864 2633. PD software & disk conversions.

SINCLAIR SPECTRUM SOFTWARE
Neil Smith, The One & Only, 42 Hayes Road, Bromley, BR2 9AA. Software exchange. SAE.

SOFTWARE VIA BBS
Frank Thornley, Compulink, 67 Woodbridge Rd, Guildford, GU1 4RD. BBS (0483) 573337 V21/23. Voice (0483) 65895.

Special interest

AMATEUR RADIO
Trevor Tugwell (G6TJT), AMRAC, 6 Kestrel Drive, Mudeford, Christchurch, Dorset, BH23 4DE. Tel Phil Bridges G6DLJ (0703) 847754. BBS V21 (0736) 518818.

CHRISTIAN USERS
Philip Clark, Christian Micro Users Association, 138 Bramwell Gdns, Sheffield, S3 7PW.

CHURCH ADMINISTRATION
Rev Stoker Wilson, Church Computer Users Group, St John's Vicarage, Greenside, Ryton, Tyne & Wear, NE40 4AA. 091-413 8281.

COMMUNICATIONS
Comms File, TP Group, FREEPOST, London, N1 1BR. 01-833 3501. £75. Newsletter.

COMMUNITY COMPUTING
Pete Rowan, Community Computing Network, 5 Windmill St, Frindsbury, Rochester, ME2 3XQ. £5 (£1 unwaged). Good contacts; left wing opinions.

DISABLED
Jeff Hughes, Special Needs User Group, 39 Eccleston Gardens, St Helens, WA10 3BJ. (0744) 24608.

EDUCATION - VARIOUS MICROS
TECUG, 27 Ingoldsby Road, Gravesend, Kent, DA12 2LF. Schools/colleges support grp. £50. Sample pack £3.65.

GENEALOGISTS
Computer Group, Society of Genealogists, 14 Charterhouse Buildings, London, EC1M 7BA. 01-251 8799. Meets monthly re micros to trace ancestors.

GENERAL HARDWARE
Andy Leeder, Amateur Computer Club, Church Farm, Stratton St Michael, Norwich, NR15 2QB. Large SAE.

LOCAL AUTHORITIES
Local Authority Microcomputer User Group, c/o John New, Borough Engineer's Dept, Municipal Offices, North Quay, Weymouth, Dorset, DT4 8TA. (0305) 785101 x 272.

MAGAZINE INDEX
Find-it, Orkney Computing, 60 Albert Street, Kirkwall, Orkney, KW15 1HQ. (085 686) 268. Index to PCW & 5 other business micro mags. Sent out on disk - requires PC.

PRESTEL
Andy Leeder, ClubSpot 810, Church Farm, Stratton St Michael, Norwich, NR15 2QB. Hobby database on Prestel (key *810#). Clubs may be able to edit own free pages.

SEAFARERS
Mr C E Watson, 29 Doods Place, Doods Road, Reigate, Surrey, RH2 0NS.

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END ZONE

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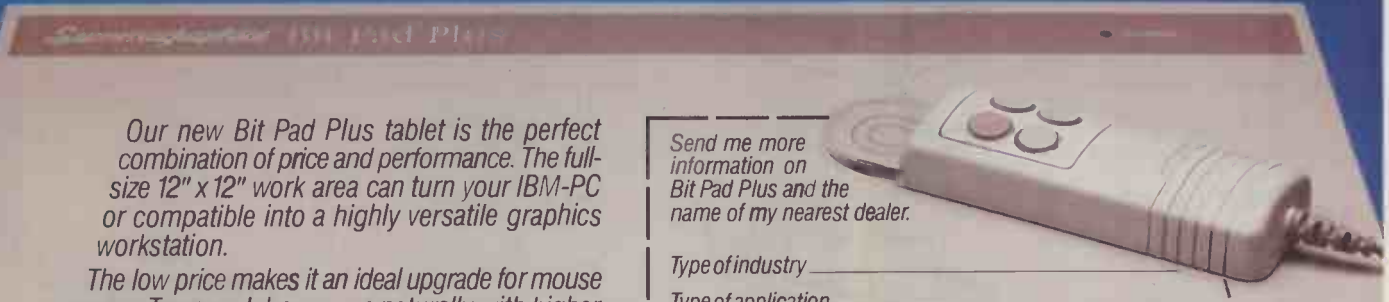

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1640 20MB EGA	£1100
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PCC640 DD & Modem	£570
Olivetti	
M240 (Mono Ver)	£1774

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AST Rampage 512k Populated	£300
AST Rampage 1.5mb Populated	£570
AST Rampage 2.0mb Populated	£730
Everex Magic I/O PC, XT M/C	£ 80
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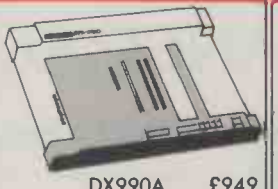

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All starter kits are supplied with One fileserver card, two workstation cards, Novell netware software and cables

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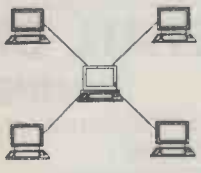
Sample Configuration (1) — CONCURRENT DOS

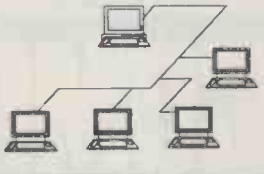
5 User System
Mitac 386, 40MB
4 Ampex 232 terminals
Concurrent DOS



System Price £4195
Each additional user £415

Sample Configuration (2) — NOVELL NETWARE

5 User System
Mitac 386, 40MB File Server
4 Amstrad 1640 SD Work Stations
MSDOS/Novell Netware G/NET



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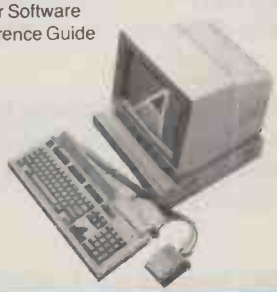

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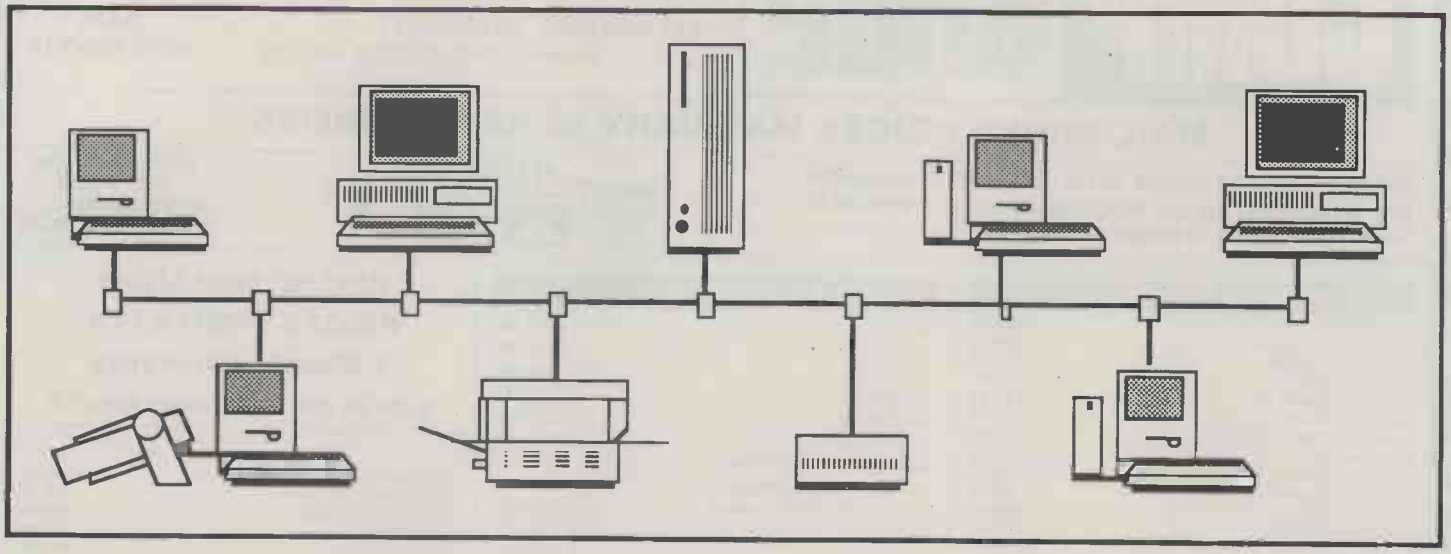

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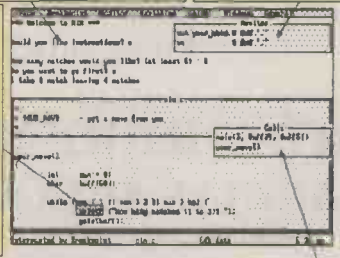

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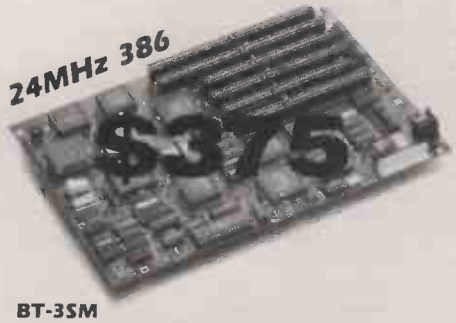

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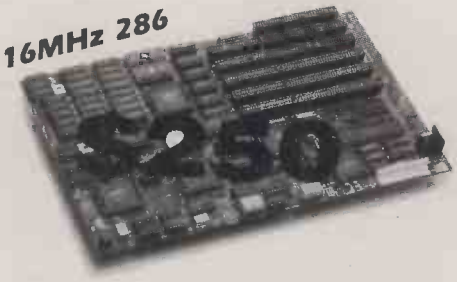

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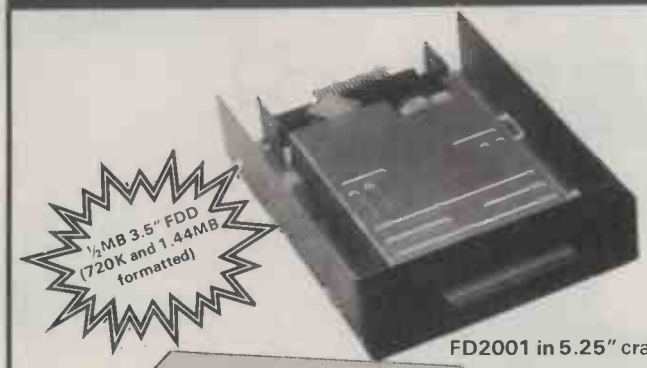

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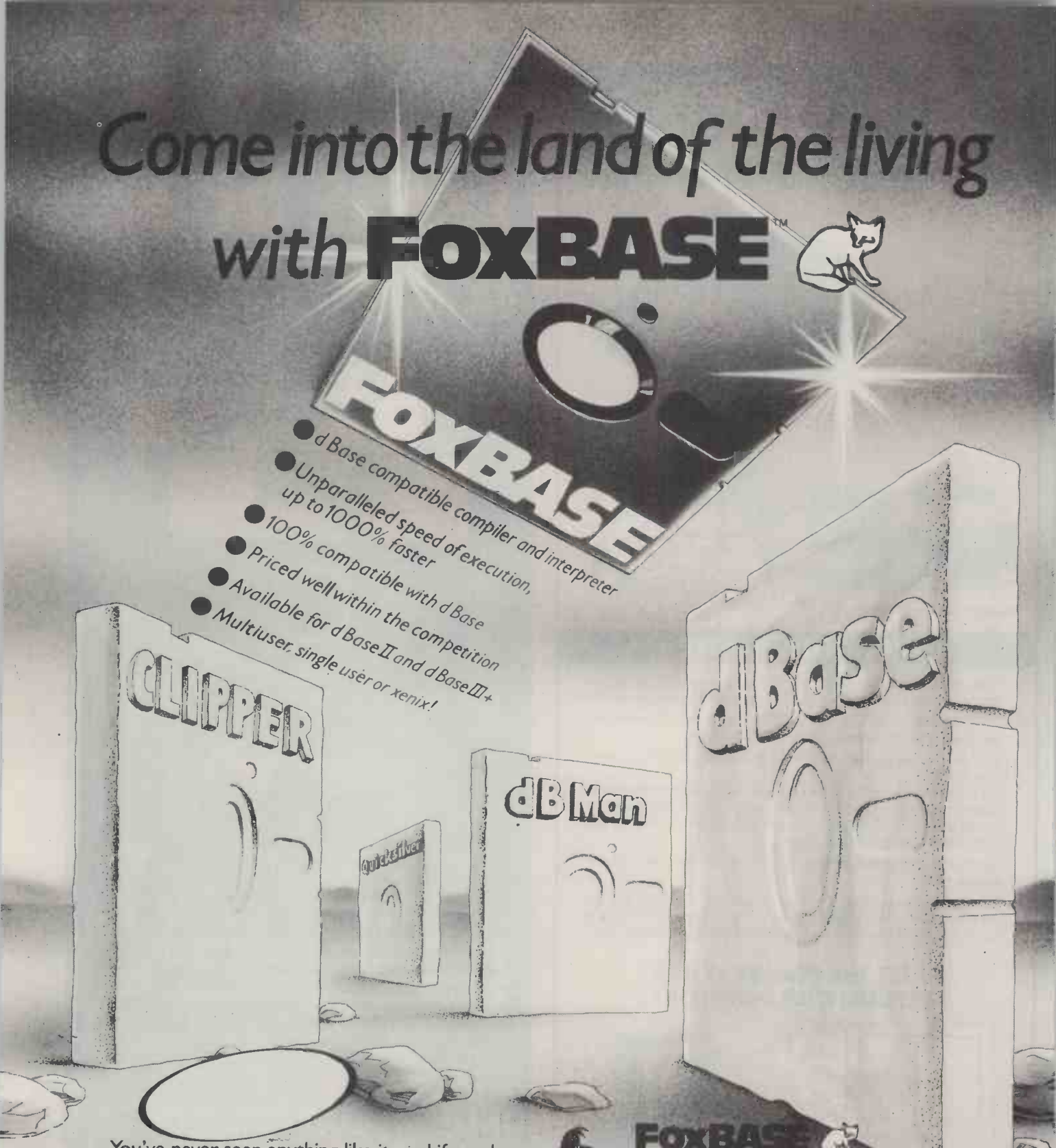

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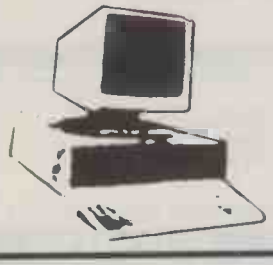

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106	Mr. BILL	11.50	Billing system for professionals. (ie. Accountants, solicitors etc.) Counts as 2.

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703	PC-File Plus	11.50	Paint screens,71 relational files,screen tutorial, inbed & nest calculations, sophisticated report writer. Works with PC-Type Plus. Easy. Supported by us. Counts as 2
700	U-Mind	7.99	Generates (GWBASIC) programs. A bit like The Last One.
70	Biblical Quotations	11.50	Huge database of Biblical quotes. Min. 2 drives.Can be memory resident. Counts as 2.
101	Family Tree	7.99	Genealogy program.
113	Newsbase	7.99	Helps publishers keep track of the contents of each issue. Useful for both advertising & editorial.
701	Wampum/ Wampum docs.	11.50	Menu driven dBase III clone. Best on hard disk. Counts as 2.

GAMES (Please note that you need a CGA card. All 1512's ok)

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800	PC-Chess	7.99	2 games. Graphical simulation.
100	Computer pranks	7.99	Lots of high links to play on your friend's computer!! Safe.
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92	Bermuda Triangle	7.99	A sort of yacht simulator with a quest! EGA only.
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47	Sleuth	7.99	Great detective adventure with graphics.
64	Cavequest	7.99	Graphical adventure. Reminds me of Elite with castles!
52	Games IV	7.99	Mahjong, Backgammon, Spacewar, Flightmare, Dragons.
60	Pianoman	7.99	Play music on keyboard, "record" it on disk, play it back!

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903	PC-Key-Draw	7.99	CAD/Animation/Graphics/Scale/Rotate/Slides/Text. More facilities than ProDesign & PC-Paint. Represented by us in UK.
72	Express Graph	7.99	Very easy to use colour business graphics. Pie, Exploded Pie, Segmented Lines, 3D bars etc. from typed data or imported.
108	DROEGE V1.85	11.50	CAD for printed circuit design. Now supports dot-matrix but ideal for HP plotters. Counts as 2.
99	HI-RES	7.99	Super painting program. Works with mouse. Lots of facilities but no text on Shareware version. Ok single drives so could replace GEM paint. CGA in colour/ EGA in mono.
121	PCPG	7.99	PC Picture Graphics. Create libraries. Enlarge, Reduce, Flip, Plotter support.

LANGUAGES

25	Macro Assembler (A86)	7.99	Probably the best 8086 assembler in the world. With debugger. We are the UK agents for this superb product. Version 3.07 (later version available to registered users).
408	Fig-Forth	7.99	Very good implementation
83	"C" Tutorial	7.99	
400	Z80/8080 Emulators	7.99	Runs CP/M software if on MSDOD format disks.
409	Small "C"	7.99	With primer and compiler.
502	P-Basic / PC-Prof	7.99	GWBasic clone with hands-on Basic tutorial.
155	Z80 Cross-Assembler	7.99	Pseudo-Sam 80Z
406	CHASM	7.99	CHeap ASseMbler. Compiled version of old standby. Retained mainly for the tutorial – otherwise use disk 25. (Now compiled)
63	Lisp/Xlisp	7.99	
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178	Turbo Pascal utils.	15.00	Various programming tools & routines. Counts as 3.
7	PD-Prolog V1.95c	7.99	Latest version with expert systems demo.
59	Expert System	7.99	This one works well and is straightforward to set up. See also PD-Prolog.

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36	PC-Type Plus / PC-Label	15.00	Includes 100,000 word on-line "Fault Finder". Work 10 files simultaneously. Easy to learn (interactive tutorial) Mailmerge.Direct access to PC-File Plus databases. Direct access to PC-Style & DOS.Multi-columns. Maths. Graphics. Support by us.Counts as 3.(ok single drives). ted by us.
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125	SimCGA	7.99	Enables Hercules monitors to run many CGA programs. Enables Amstrad 1640 mono to run Fastype, Bushido etc.
126	Snobol4	7.99	Interpreter/Compiler jam packed disk with progs.
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MOD	Modem Bundle	79.00	Modem pack. Includes 1200/75 modem, Amstrad/IBM cable, Colour Prestel/Telecom Gold software.
127	Quickstep	7.99	A unique UK program for analysis & projection (modelling) of company accounts. This disk contains the first level.
128	SOAR	11.50	Service Oriented Accounts Receivable. Sales ledger with Invoicing & analysis. Min. 2 drives. Counts as 2.
130	Manage	11.50	For controlling rented accomodation. Hard disk only.Counts as 2.
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138	Composer	7.99	Compose, edit & print music.
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141	Minigen	7.99	Turbo Pascal screens creation code generator.
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166	PC-Shell	11.50	Unix shell environment. Counts as 2.
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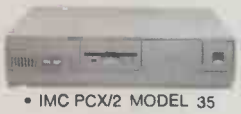

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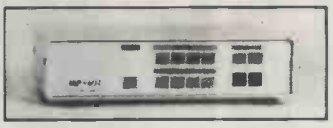
£95  **£95**

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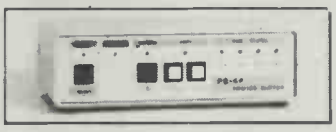

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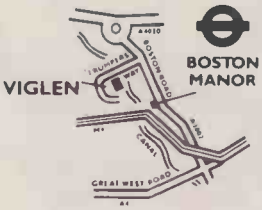

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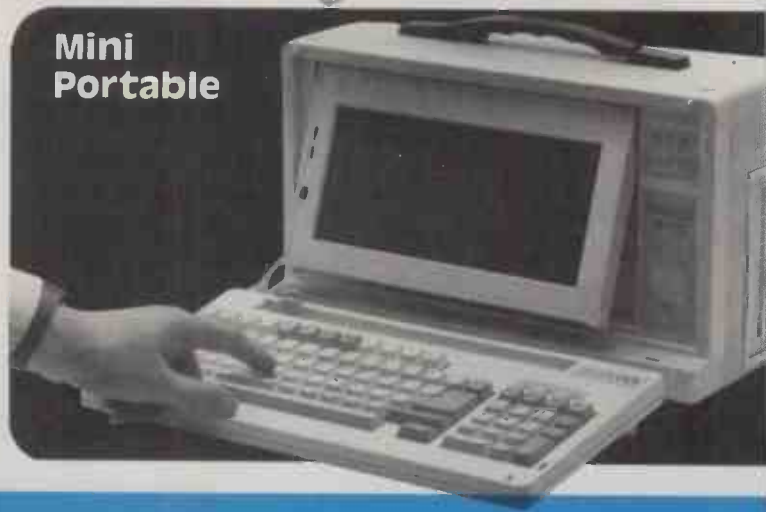

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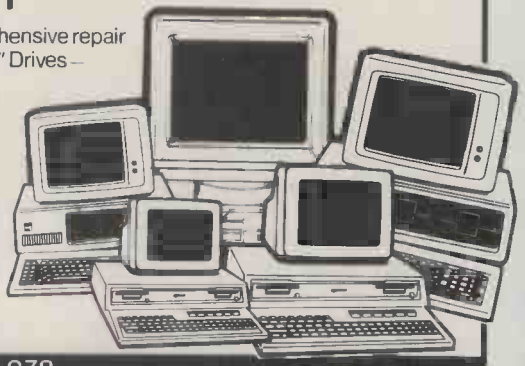

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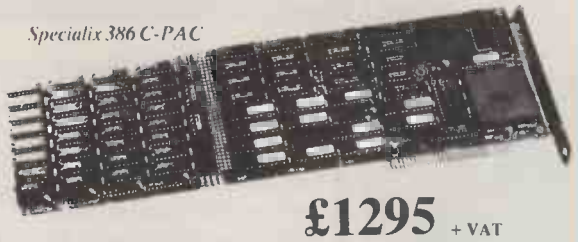

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I/O (Game)	Game, Parallel and Serial Ports	■	■			
Multifunction	Extended Memory, Simulated EMS Memory, Parallel and Serial Ports			■	■	
Modems	Internal (1200/2400 baud)	■	■	■	■	■
	External (1200/2400 baud)	■	■	■	■	■
Connectivity	Format Converter	■	■	■	■	■
	ZuckerLINK	■	■	■	■	■
Electronic Imaging	320 × 240 Resolution			■	■	■
	640 × 480 Resolution			■	■	■

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PC1640 SD CD	£ 649.00
PC1640 SD ECD	£ 799.00
PC1640 DD MD	£ 599.00
PC1640 DD CD	£ 749.00
PC1640 DD ECD CD	£ 899.00
PC1640 20MbHD MD	£ 899.00
PC1640 20MbHD CD	£1049.00
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PC colour pack (DD)	£1063.00
PC 30 mono pack (30Mb HD)	£1103.00
PC 30 colour pack (30Mb HD)	£1332.50
286i Model A (1.2Mb FD, 512k)	£ 917.00
286i Model C (20Mb HD, 640k)	£1340.00
286i Model C Mono	£1379.84
286i Model C EGA	£1571.84
286i Model C+ (40Mb HD, 640k)	£1512.96
286i Model C+ Mono	£1561.60
286i Model C+ EGA	£1763.84
386 Model A (640k)	£2199.00
386 Model E/40 (40Mb HD, 2Mb)	£3299.00
386 Model E/130 (130Mb HD)	£4599.00

Archimedes

Model 310 base unit only	£ 775.00
Model 310 mono system	£ 825.00
Model 310 colour system	£ 975.00
Model 310 + NEC multisync	£1259.00
Model 310M base unit only	£ 835.00
Model 310M mono system	£ 885.00
Model 310M colour system	£1035.00
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ATARI

Atari 520 STFM	£ 260.82
Atari 520 STFM mono system	£ 391.26
Atari 520 STFM colour system	£ 608.65
Atari 1040 ST-F	£ POA
Atari 1040 ST-F mono system	£ 565.00
Atari 1040 ST-F colour system	£ 782.00
Atarl Mega ST-2 Mb	£ 869.50
Atarl Mega ST-4 Mb	£1126.08
Atari SM125 12 mono hi-res	£ 130.42
Atari 12" low-res colour	£ 260.00
Atarl 12" med-res colour	£ 347.82

As well as the above range of Atari hardware, we also stock add-ons such as external disk drives, upgrades, MIDI hardware and a comprehensive range of software.

AMIGA

Amiga 500 base unit only	£ 434.79
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PC III SF Mono (256k, SD)	£ 499.00
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PC III TF EGA (768k, DD)	£ 999.00
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PCX20/M (SD, 20Mb HD, MD)	£ 985.00
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All the running needs for your system can be obtained from us. Printer ribbons, disks (3, 3.5 and 5.25) cleaners, dust covers, streamer tapes, disk boxes, many types of printer paper/stationary and daisywheels are some of the many items we can supply.

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Plink-86 Plus v2.24	MS-DOS	£285
Link & Locate v3.2d	MS-DOS	£265
Plink-II	CP/M-80	£315
SLRNK (Z80)	CP/M-80	£ 45
SLRNK-PLUS (Z80)	CP/M-80	£150

PROGRAM EDITORS

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EC Editor v2.1	PC-DOS	£ 40
Epsilon v3.2	PC-DOS	£105
Lattice CVUE	PC-DOS	£ 95
FirsTime for Pascal	PC-DOS	£180
FirsTime for Turbo-P	PC-DOS	£ 55
Kedit v3.53	PC-DOS	£ 75
Norton Editor V1.3	PC-DOS	£ 80
PC VI	PC-DOS	£105
Pmate PC v4	PC-DOS	£105
RED v6.6 (with C S'ce)	PC-DOS	£ 65
XTC (with Pascal source)	PC-DOS	£ 69
Vedit-Plus v2.03	PC-DOS	£105
CSE (with C source)	MS-DOS	£ 75
MIX Editor	MS-DOS	£ 20
Pmate 86 v4.00	MS-DOS	£105
Vedit-Plus	MS-DOS	£105
Vedit-Plus	CP/M-86	£120
CSE (With C source)	CP/M-80	£ 75
MIX Editor Z80 +	CP/M-80	£ 25
Red v6.6 (with C source)	CP/M-80	£ 65
Vedit-Plus v2.33	CP/M-80	£110

PASCAL LIBRARIES

Most Turbo Pascal libraries have not yet been updated to work with the new v4. Please call us for advice.

TURBO PASCAL LIBRARIES

Blaise Power Tools Plus	PC-DOS	£ 65
Blaise Turbo Asyn.Plus	PC-DOS	£ 80
Mathpak 87 (TP3)	MS-DOS	£ 60
Paragon Supertools	PC-DOS	£ 65
RM Graph Nimbus +	MS-DOS	£ 49
Science & Eng.Tools	MS-DOS	£ 50
Report Builder	MS-DOS	£ 70
System Builder	MS-DOS	£ 90
Turbo Halo Univ.Graph.	PC-DOS	£105
T-Debug Plus v2	PC-DOS	£ 35
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Turbo Extender	PC-DOS	£ 55
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Turbo Advantage (Lader)	MS-DOS	£ 60
Turbolink Plus v3.15A	PC-DOS	£ 60
Turbopower Utilities	PC-DOS	£ 60
Turbo Optimiser	PC-DOS	£ 45
Turbo Professional	PC-DOS	£ 45
Turbo Screen CP/M,MS,	PC-DOS	£ 60
Turbo Tutor CP/M &	MS-DOS	£ 29
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Blaise Tools (s'ce)	(MS)	PC-DOS	£ 85
Blaise Tools 2 (s'ce)		PC-DOS	£ 80
Blaise Asynch (s'ce MS)		PC-DOS	£120
Btrieve	(MS)	PC-DOS	£160
MetaWINDOWS	(MS)	PC-DOS	£110
Halo	(MS)	PC-DOS	£175
Blaise View Mngr.	(MS)	PC-DOS	£205
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Prospect v2	(Pro)	MS-DOS	£ 80
Panel (Screen)	(MS)	MS-DOS	£205
Shark database (Propas)		CP/M-86	£250
Prospect Graphics (Pro)		CP/M-86	£ 80
Shark database (Propas)		CP/M-80	£150

PROLOG LANGUAGE

Arity Standard	PC-DOS	£ 7
Arity Prolog v4.0	PC-DOS	£285
Arity Interprtr+Compil.	PC-DOS	£630
LPA PROLOG Prof.Int.v1.5	MS-DOS	£265
LPA Micro-PROLOG v3.1	MS-DOS	£ 75
Prolog-86 v2.01	MS-DOS	£115
Prolog-2 Personal	PC-DOS	£145
Prolog-2 Programmer	PC-DOS	£495
Prolog-2 Professional	PC-DOS	£995
Turbo-Prolog v1.1	PC-DOS	£ 60
ADA Educ.Prolog	MS-DOS	£ 45
ADA FS Prolog	MS-DOS	£ 55
ADA VMI Prolog	MS-DOS	£ 85
ADA VML Prolog	MS-DOS	£165
Prolog-1 v2.2	CP/M-86	£299
LPA Micro-Prolog v3.1	CP/M-86	£ 75
LPA Micro-prolog v3.1	CP/M-80	£ 60
Prolog-1 v2.2	CP/M-80	£225

MODULA-2 COMPILERS

New Farbware compiler. FTL is an excellent value learning tool.

Pecan P-Sys. w.Mod-2	PC-DOS	£ 80
Farbware Modula-2	MS-DOS	£ 70
FTL Modula-2 (sml.mem)	MS-DOS	£ 45
FTL Modula-2 (lge.mem)	MS-DOS	£ 55
Interface M2-SDS	PC-DOS	£ 75
Interface M2-SDS-XP	PC-DOS	£185
Mod-2/86 Compiler pack	PC-DOS	£ 58
Mod-2/86 Dev.system	PC-DOS	£145
Modula Corp.PC Mod.2	PC-DOS	£150
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Hochstrasser Mod.2	Z80/CP/M-80	£100
Turbo Modula-2	Z80/CP/M-80	£ 50
Modula-2 (Mod S/W)	ATARI 520ST	£ 75
MacModula-2 v4.1	MACINTOSH	£100

Library source is available with some compilers. Please enquire about other utilities available.

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2500AD 8086 Asm.	MS-DOS	£ 75
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Phar Lap 386	MS-DOS	£415
2500AD 8086 Asm.	CP/M-86	£ 75
Dig.Res. RASM-86	CP/M-86	£180
2500AD Z80 ASM	CP/M-80	£ 80
Dig.Res. RMAC	CP/M-80	£180
Microsoft Macro-80	CP/M-80	£ 60
SLR Z80ASM	CP/M-80	£ 45
SLR Z80ASM-PLUS	CP/M-80	£175
SLR MAC	CP/M-80	£ 45
SLR MAC-PLUS	CP/M-80	£175
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BASIC LANGUAGE

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MEGABASIC	CP/M-86	£235
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Microsoft MBASIC	CP/M-80	£ 75
MEGABASIC	CP/M-80	£195

BASIC COMPILERS

Microsoft QuickBASIC v4	PC-DOS	£ 60
Softaid MTBASIC	PC-DOS	£ 60
Turbo Basic	PC-DOS	£ 60
ZBASIC v4	PC-DOS	£ 69
Microsoft MS-BASIC	MS-DOS	£235
Dig.Res. CBASIC	MS-DOS	£390
Dig.Res. CBASIC	CP/M-86	£390
Dig.Res. CBASIC	CP/M-80	£395
ZBASIC	Z80+CP/M-80	£ 75
Softaid MTBASIC	Z80+CP/M-80	£ 60

LIBRARIES & UTILITIES

Database

CADSAM (source code)	MS-DOS	£ 75
Btrieve MS-BASIC +	MS-DOS	£160
Btrieve/N MS-BASIC +	MS-DOS	£380
Multikey MS-BASIC +	MS-DOS	£145
T.Basic database tlbx.	PC-DOS	£ 65
CADSAM (source code)	CP/M-80	£ 75

Graphics

Enhanced Graph.Tlkt QB +	MS-DOS	£145
Halo MS-BASIC +	MS-DOS	£175
GSS Graph.Dev.Tkt	PC-DOS	£305

Sundries

Finally Quickbasic +	PC-DOS	£ 70
PANEL Screen Manager	MS-DOS	£ 80
Wiley Scientific Lib.	PC-DOS	£ 90
Screen Sculptor QB +	MS-DOS	£ 90

Tuning & Debugging

Betatools Dev.System	PC-DOS	£100
Vicar	MS-DOS	£ 45

ADA COMPILERS

AdaVantage v2 now validated by American Department of Defence.

AdaVantage v2	PC-DOS	£ 700
Artek Ada v1.25	MS-DOS	£ 350
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JANUS/Ada ED-Pack	MS-DOS	£ 285
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Icon	Linkers
Lisp	Modula-2
Nial Interpreters	OPS 5
Pascal Compilers	Pascal Libraries
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Snobol	

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ADVERTISERS INDEX

MICROMART ADVERTISERS INDEX

PROGRAMMING TOOLS

Ada Compilers	Algol Compilers
Assemblers	Assembler Libs.
Basic Compilers	Basic Interpreters
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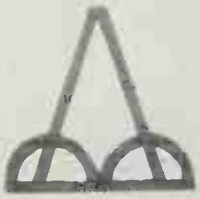

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CHIPCHAT

Turn to page 64 of the latest Inmac catalogue. There you will see a befuddled executive supposedly lamenting the fact that the snappy colour bar chart we see on his screen has emerged from the printer smeared and unrecognisable. 'You need better quality cables to prevent data corruption' is Inmac's message.

We recommend they stop trying to get colour copies out of a black and white laser printer like the Kyocera F1010. Just how did they get it to produce a colour image in the first place? Answers on a postcard. . . .

Time and again, *PCW* receives products which have clearly required many months of sweated labour to produce and which, in effect, reinvent the wheel — and often less satisfactory wheels than existing products. One such was a word processor 'aimed at users who have relatively unsophisticated word processing requirements.' Some aspects of this product are indeed useful and unique. Others, like its command keys, could only have been invented by someone who has been protected from industry software standards for quite some decades. How else to explain 'Ctrl-PgUp deletes word right and Shift-Tab deletes word left'. On what sort of keyboard would this make sense? The author is rewriting the package. . . .

The bad news is that the plan by British Telecom and Ordnance Survey to convert the latter's 230,000 maps into digital, computer-readable form is taking a long time. The good news is that the task will be finished earlier than anticipated. The projected end of the century completion date might be brought forward by about five years. Don't hold your breath. . . .

A colleague was beta-testing a new online conferencing service. On logging-on for the first time, he was asked to allocate himself a name by which other users would identify him. 'The Lone Ranger', he typed. 'Welcome, The', came the reply. An undocumented 'feature' of the system is that it only accepts single-word names. And until a system operator intervenes, he is doomed to be known as 'The' by all the other users. . . .

Unscrupulous dealers part 94: A reader reported problems in printing long files from Lotus 1-2-3. Long files from other packages were no problem, but only the first few pages of any worksheet were printed and then the system hung. The local dealer identified the problem immediately. 'You need a bigger print buffer,' he said with pound signs rolling up his eyeballs. That would, of course, merely mean that the system hung on page 14 of the worksheet rather than page 3. . . .

Magazine and software publisher, Database, has announced 'a truly dramatic software event'. It has 'reached a pinnacle' for one of its products, Mini Office Professional. What great feat of programming is this? Why, it has released a 3½in disk version of the software. Which over-hyping PR company has turned out this trash about a mere bit of magnetic media manipulation? None other than that well-known Cheshire PR company, Database. . .

A recent Lloyds Bank Commercial Service advert shows that the company knows more about Amstrad's plans than most. One photo shows a smart bank manager with his online terminal complete with screen and 'enhanced' IBM-style keyboard. The other shows the small businessman with his Amstrad 9512 and, what's this? Why none other than an 'enhanced' IBM-style keyboard. So, if you don't like the 9512's keyboard and want to upgrade to something used by Lloyds bank managers, Amstrad's number is. . . .

If you want to know where all the Tandon PACs have gone, we've got the answer. Personal Systems Training in Henley-on-Thames uses them as the heart of its in-house and on-site schemes. Pity you may have to sign up for a course to get sight of one.

Fry's, the Californian supermarket which sells everything from potato chips to silicon chips via PCs, laser printers, soap powder and video cables, has a new line. A chocolate disk. It's called a chocolate byte . . .

Rental Research, London-based computer services and laser printer specialist, recently made a further commitment to quality when a total of 20 new four-wheel drive Ford Sierra XR4×4s were presented to the company's sales force. It's anyone's guess what sort of 'quality' they are talking about.

Picture a white-coated engineer sitting in front of a high-performance Goupil PC workstation (10MHz AT to you and me). Clipboard in hand, measuring equipment flashing important-looking numbers. And on the screen? A Windows Notepad with a set of names and phone numbers. . . .

The lure of show business is increasing. We've heard about actors entering the computer business (Jamie Minotto of Tandon). And of computers becoming film stars — HAL in *2001*. Now, it seems, computer personnel are aiming for Hollywood. How else to explain this rather alluring picture of Dell's managing director Andrew Harris? Let's hope he gets as many offers as the machine (a System 300) probably will.

This Month

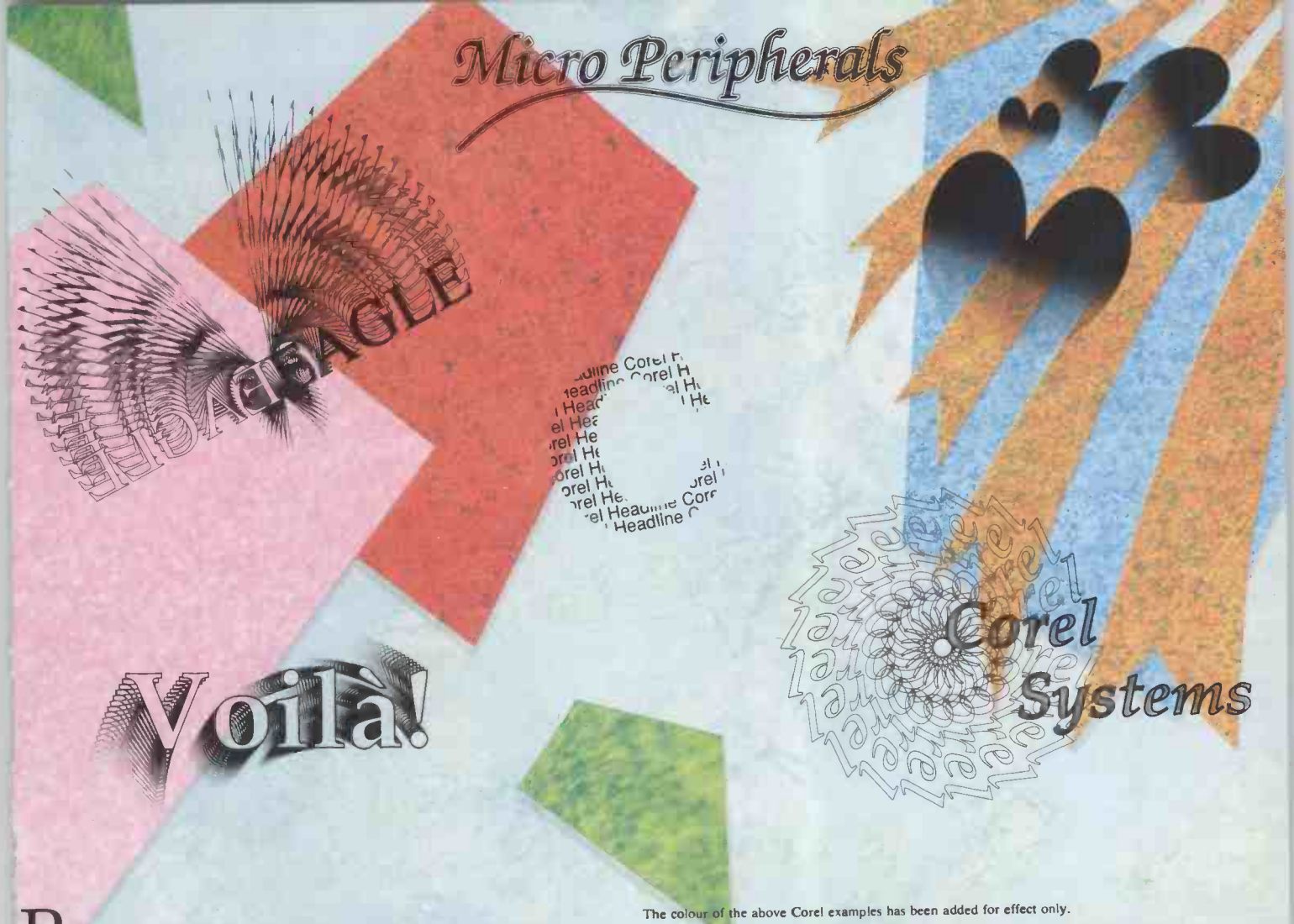
Welcome to the 10th anniversary issue of *PCW*. We know that some of you will have been regular readers since the first issue, and will have seen huge advances in the price/performance of personal computing in that time. Ten years ago personal computers were an unknown territory reserved for those as adept with a soldering iron as an assembler. What present-day computing skills will have become as similarly unnecessary to the ordinary user in ten years' time? Our cover feature will give you some ideas.

We would like to express our deepest thanks to those companies and individuals who made our cover feature possible. Sun Microsystems in both the UK and USA gave us vast amounts of technical support and information, and without the interest and efforts of staff in both countries we would have found it very much harder to help you enter the world of the workstation. In addition, our thanks must go to Carl Gericke of Stephenson Moore in Bristol who made the cover screen possible.
Stephenson Moore manufactures Silver Tree, a Sun-based presentation graphics system which can process photographic images and output 35mm slides with a quality indistinguishable from original photography.

Finally, our thanks to the many manufacturers who have supplied the birthday presents *you* can win in our Reader Survey on page 150. *PCW* is supporting a number of charities on your behalf, including a new one this year, Enterprise Technology. This charity provides computer training for disabled people who often find it easier to obtain the hardware than the skills to use it.

***PCW* photographer Chris Bell wondering whether he can miniaturise the power of the Sun into his next camera**

Micro Peripherals



The colour of the above Corel examples has been added for effect only.

PostScript is a powerful de facto standard page description language for page printers. Unlike a conventional page printer which contains typefaces in limited sizes, a Postscript page printer stores its typefaces as outlines.

Postscript can scale these outlines to produce fonts ranging from $^{1}/_{18}$ of an inch up to any size you want. Its even possible to produce fonts 10 foot high or even higher, albeit they would be made up of several sheets of paper.

Postscript can also be used to create in minutes styles such as the ones shown above, some of which could take the most avid artist weeks to produce. These are just a few examples produced with the help of COREL a simple to use program that bypasses the need to learn the complex Postscript language.

Postscript is so powerful and versatile it is supported by all the professional DTP packages such as Ventura and Pagemaker.

So if you are about to upgrade your micro for DTP or are looking to get more out of your DTP system, here are a few clever ways you can get into PostScript printing. They range from a low cost PC card to modify your HP Laser Jet through to a top of the range Linotype typesetting Laser.

Whatever the words, we've got the abilities.

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QMS Jetscript
Fits neatly into IBM PC's or compatibles with output to convert an HP Laser Jet to Postscript. Complete with 10 fonts in 35 different typestyles on card.
£1,995 RRP

QMS PS Jet +
Replaces controller on any Laser printer using Canon CX engine. HP/ Canon/ Wang etc to convert to Postscript. Complete with 10 fonts in 35 different typestyles and 2MB of page RAM, serial and Appletalk interface. Simple to fit.
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QMS PS 810
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Linotype processing of DTP files- prices on request.

Corel Headline
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