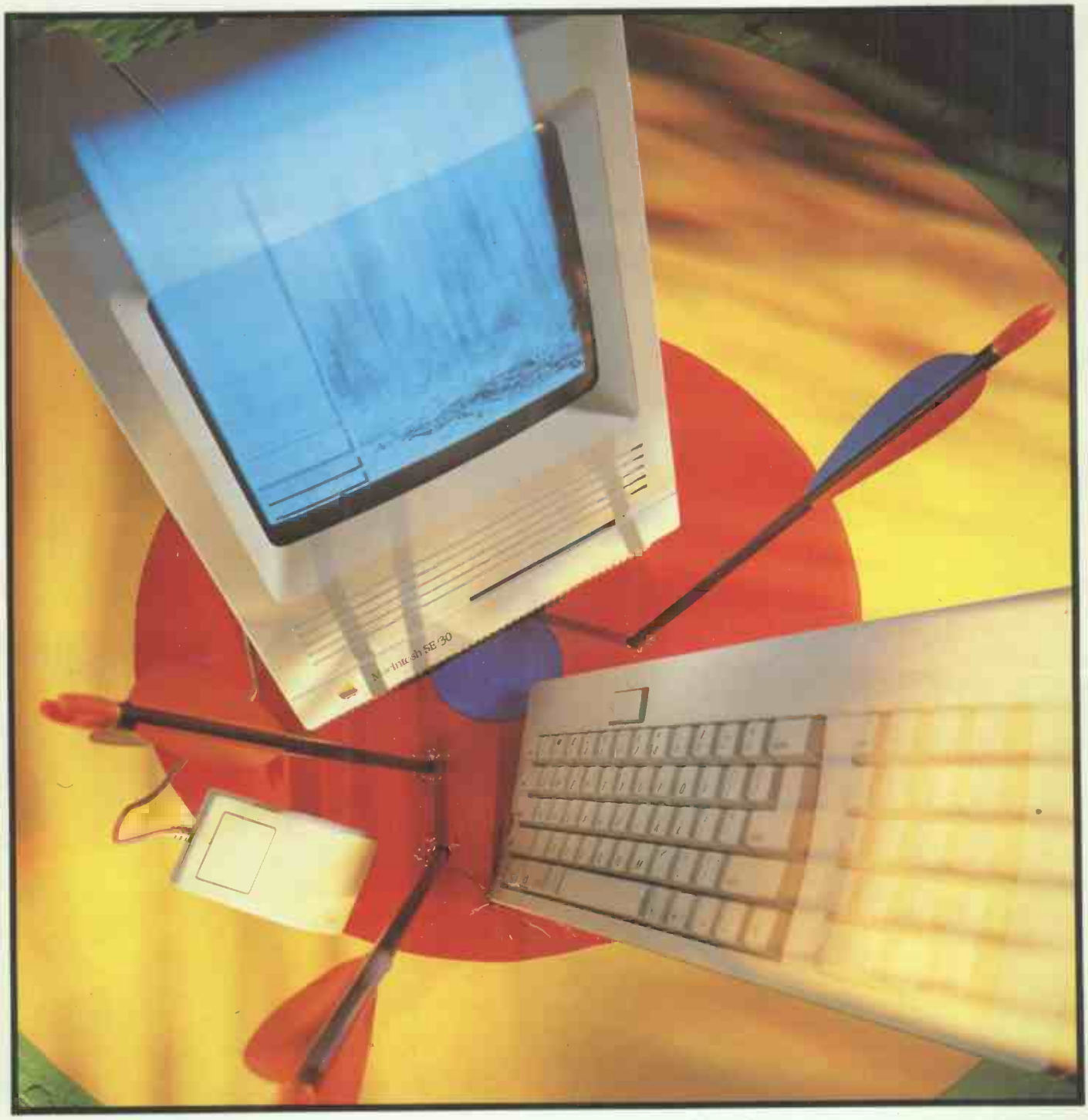
Personal Computer World

Agenda's key to pocket computing

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	Sprint 1.0	WordPerfect 4.2	MS Word 4.0	WordStar 4.0	MultiMate Adv. 1.0
Maximum file size	Disk	Disk	Disk	4MB	128K
Mail Merge	Yes	Yes	Yes	Yes	Yes
Thesaurus (integrated)	Yes	Yes	Yes	Yes	Yes
Windows Open (maximum)	6	1	8	1	1
Files Open (maximum)	24	2	8	1	1
Cross-Reference (dynamic)	Yes	No	No	No	No
Indexing Options	7	1	3	3	No
Snaking Columns (chg # on same page)	Yes	Yes	Not same pg.	No	Yes
Parallel Columns	Yes	Yes	Yes	Yes	Yes
H-P LaserJet Support	Full	Full	Full	Partial	Full
PostScript Support	Full	Text	Full	No	Text
Mouse Support (integrated)	Yes	No	Yes	No	No
AutoSave (without interruption)	Yes	No	No	No	No
User Interface					
Define Shortcuts Dynamically	Yes	No	No	No	No
Run Alternative User Interface	Yes	No	No	No	No
Verify spelling as you type	Yes	No	No	No	No
Fully programmable macro language	Yes	No	No	No	No
Suggested List Price	£199.95	£425	£395	£399	£495

n you can *Sprint*?

electronic co-existence. Your investment in non-Sprint files is completely protected. They're easily imported and exported by Sprint—and for good measure—given a fresh, new contemporary look.

You can change nothing or change everything with *Sprint*

You can use Sprint *as is* and be very happy with the way everything works—or you can easily customize Sprint to do everything *your* way.

It's a completely *customizable* word processor that, for example, lets you re-define keys, delete menu items, make your own short-cuts, invent your own menus and use Sprint's online help facility to create your own quick reference cards.

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The Age of Customization is here—led by Sprint.

See how fast you can *Sprint*!

	Save File[1]	Top to Bottom[2]	Go To Line 1500	Search & Replace[3]	Find Unique Word
Sprint 1.0	***5.9***	***.1***	***.1***	***1.6***	***3.3***
WordPerfect 4.2	41.1	5.3	5.4	6.6	6.2
WordStar 4.0	4.4	4.6	4.7	17.1	13.8
MS Word 4.0	9.7	.1	N/A	4.6	7.0

Tests were performed on a Multitech 286 AT (8 MHz), 640K RAM. [1]file size 103K. [2]1636 lines. [3]14 occurrences. Times shown are in seconds. (Benchmark details available upon request.)

There are 7 different ways you can *Sprint* in your office

Gone are the problem days when you hired someone new who said "I know WordStar, but not WordPerfect"—which is the one you sort of standardized on, or you call in Temps who know *a* word processor, but not *your* word processor—because all you do now is hand them Sprint.

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- Sophisticated formatting capabilities

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BORLAND INTERNATIONAL

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It's already a major success story in Europe; it's the #1 selling word processor in France (and everyone knows, 50 million Frenchmen can't be wrong!) Sprint is proof that the world *did* need another word processor.

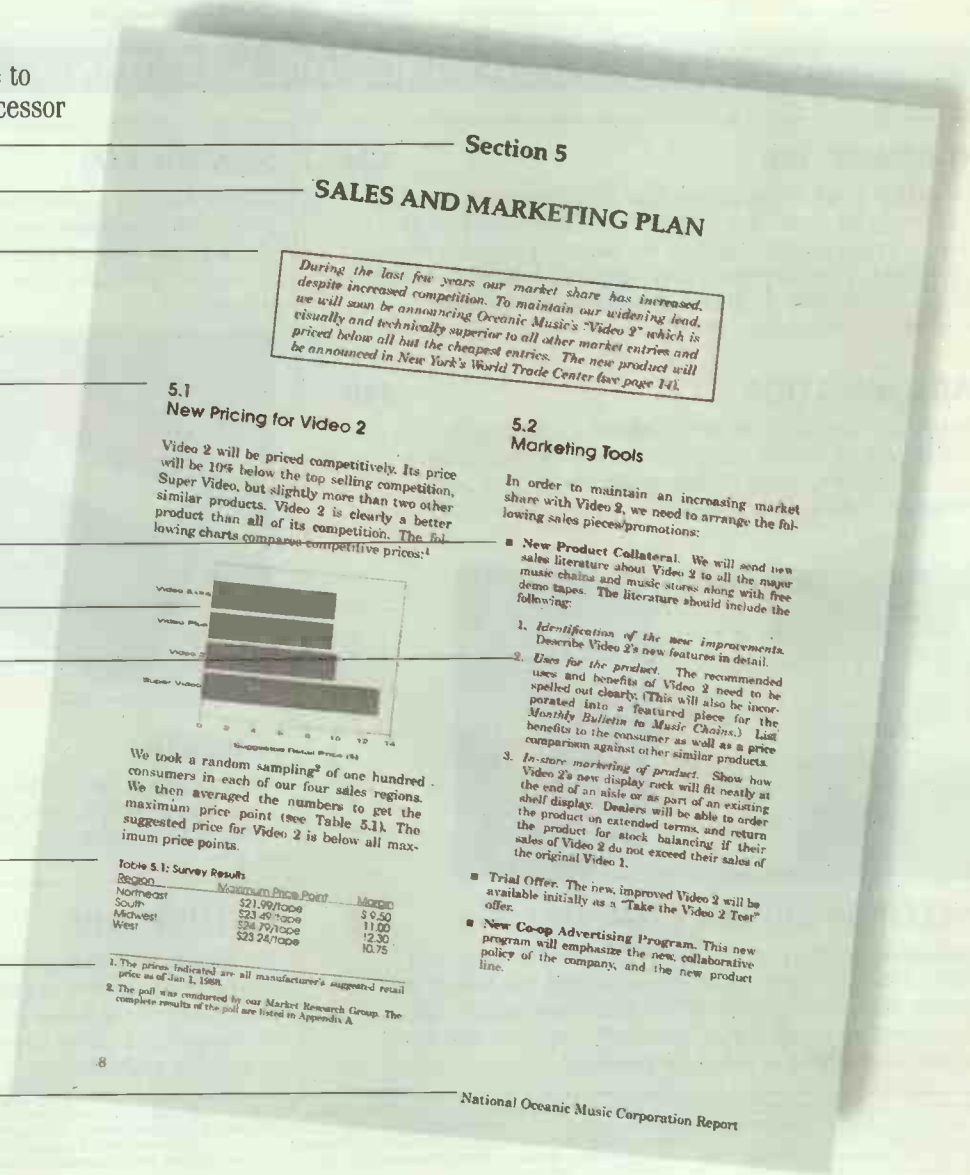
Sprint is so sophisticated, it's simple. It won't terrify a beginner; it's a familiar face to many experienced word processor users who can now get much better, faster results *without having to learn a new program.*

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Section 5

SALES AND MARKETING PLAN

During the last few years our market share has increased, despite increased competition. To maintain our widening lead, we will soon be announcing Oceanic Music's "Video 2" which is visually and technically superior to all other market entries and priced below all but the cheapest entries. The new product will be announced in New York's World Trade Center *(see page 14).*

5.1
New Pricing for Video 2

Video 2 will be priced competitively. Its price will be 10% below the top selling competition, Super Video, but slightly more than two other similar products. Video 2 is clearly a better product than all of its competition. The following charts compare competitive prices:[1]

We took a random sampling[2] of one hundred consumers in each of our four sales regions. We then averaged the numbers to get the maximum price point (see Table 5.1). The suggested price for Video 2 is below all maximum price points.

Table 5.1: Survey Results

Region	Maximum Price Point	Margin
Northeast	$21.99/tape	$ 9.50
South	$23.49/tape	11.00
Midwest	$24.79/tape	12.30
West	$23.24/tape	10.75

1. The prices indicated are all manufacturer's suggested retail price as of Jan 1, 1989.
2. The poll was conducted by our Market Research Group. The complete results of the poll are listed in Appendix A

5.2
Marketing Tools

In order to maintain an increasing market share with Video 2, we need to arrange the following sales pieces/promotions:

- **New Product Collateral.** We will send new sales literature about Video 2 to all the major music chains and music stores along with free demo tapes. The literature should include the following:
  1. *Identification of the new improvements.* Describe Video 2's new features in detail.
  2. *Uses for the product.* The recommended uses and benefits of Video 2 need to be spelled out clearly. (This will also be incorporated into a featured piece for the *Monthly Bulletin to Music Chains.*) List benefits to the consumer as well as a price comparison against other similar products.
  3. *In-store marketing of product.* Show how Video 2's new display rack will fit neatly at the end of an aisle or as part of an existing shelf display. Dealers will be able to order the product on extended terms, and return the product for stock balancing if their sales of Video 2 do not exceed their sales of the original Video 1.
- **Trial Offer.** The new, improved Video 2 will be available initially as a "Take the Video 2 Test" offer.
- **New Co-op Advertising Program.** This new program will emphasize the new, collaborative policy of the company, and the new product line.

8

National Oceanic Music Corporation Report

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Footnote Capability
Page Footing

All prices quoted are exclusive of VAT.

COVER BENCHTEST

Personal Computer World

FEBRUARY 1989



APPLE MAC SE/30 128

The Mac is back. In this exclusive review Guy Swarbrick reveals the cuddly computer's latest launch, marking a leap in power and functionality.

Cover photography by Chris Bell

FEATURES AND REVIEWS

HI-GRADE 386 134

Most PCs pass through several hands before arriving with the end user. But one enterprising dealership is short-circuiting the process by building its own PCs from basic components. Guy Kewney takes the lid off the Hi-Grade 386 — and is pleasantly surprised.

MATHEMATICA 140

Maths and computers go together in most people's minds, yet very few programs exist for the serious mathematician. Jack Weber adds the pluses and minuses of this new package for the Apple Mac, and sums it up.



WELLS AMERICAN COMPUSTAR 144

Hardware innovation in the DOS world is rare, but Wells American seems to have busted the boredom barrier with its highly configurable CompuStar. On taking the modular but mammoth machine apart, Rupert Goodwins is much impressed.

SAMNA AMI 150

Ami is Samna's attempt at breaking into the market for powerful Windows word processors. Bearing in mind the serious lack of such packages, Manek Dubash peers through the frame. Can Samna clean up in the world of Windows?



AGENDA 154

Has the Psion Organiser met its match? Andy Redfern gives this idiosyncratic but strong competitor in the hand-held market the thumbs — and fingers — up.

PICTURE THIS 158

For those who design or draw, and for anyone who needs *really* highly resolution, even VGA just won't do. Nick Hampshire takes a tour around the software, hardware and other components needed for the future of display technology.

Founder Angelo Zgorelec **Editor** Derek Cohen **Production Editor** Lauraine Danker **Sub Editor** Tom Saul **Technical Editor** Andy Redfern **Technical Writer** Guy Swarbrick **Editorial Assistant** Chris Cain **Consultant Editors** David Tebbutt, Dick Pountain **Art Director** Martyn J Rowbotham **Art Editor** Gwynne Davies **Publishing Director** Mike Agate **Publisher** David Mankin **Publishing Manager** Jan Pitt **Production Controller** Simon Maggs **Production Manager** Jim Hewlings **Production Assistant** Ros Hall **Group Advertisement Manager** Moira Thomson **Advertisement Manager** Nick Ascough **Deputy Advertisement Manager** Krystyna Gorczynska **Senior Sales Executive** Mary de Sausmarez **Sales Executives** Caroline Deakin, Fay Callow, Sarah Metcalfe, Julia Olmer, Timothy King, Marcin Miller

REGULARS

NEWSPRINT 100
In his customary style, our regular newshound Guy Kewney takes a sideways look at Presentation Manager and asks who needs EISA.

WEST COAST 117
Tim Bajarin digs under the surface of IBM's recent change of heart regarding MCA licences — but what on earth is President-elect George Bush doing in his column?

BANKS' STATEMENT 122
Is the computer industry in danger of substituting image for content — indeed, Martin Banks has a sly suspicion it may have done so already.

LETTERS 125
More hints and tips for WordPerfect version 5 users, and more uses for old bandwraps.

FROM THE TOP 190
Derek Cohen's views on the problems of OS/2 have provoked reactions from readers. This month he replies, then mulls over the potential of networking the *PCW* office.

PURSUITS 195
NUMBERS COUNT: Mike Mudge looks at generating, storing and analysing Lucas Sequences.
LEISURE LINES: More brainstretchers courtesy of JJ Clessa.
CAT AND MOUSE: Kate Charlesworth's cunning feline hacker.
BIBLIOFILE: Books on the diverse methods and applications of computer graphics form the backbone of this month's reviews.
SCREENPLAY: Despite his misgivings, Chris Cain finds wallowing in arcadian nostalgia is no hardship.

SPECIAL INTERESTS 203
THE MAC FACTOR: The Mac's position in the education market is the theme for this month's column, along with news of the latest software packages.
ST USER STACK: The recent Atari Christmas Show is grist for Marvey Mills this month. In particular, he finds a program designed to forecast pools results especially captivating.
SMALL-SCALE COMPUTING: Now almost a classic, the Z88 is still spawning software. Guy Swarbrick opens up some of the latest packages.

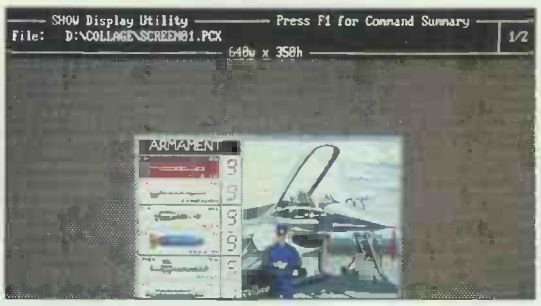
AMIGA NOTEPAD: From the 12th Commodore Christmas Show, Chris Cain reports on a BBC Micro emulator for the Amiga, on desktop video and on icons.

PROGRAMMING 210
PROGRAM FILE: Can you meet the file comparison challenge? Andy Redfern offers a prize for the best program and looks at the latest slew of new books. Readers' programs include a picture-dissolving algorithm and new ways of boosting your batch files.
BSI: Communications problems, detection of data overflows by C compilers and an appeal for compiler test suites are among the items on offer.
SUBSET: David Barrow looks at techniques for sorting and bit-flipping.

DIRECTORY
As well as the regular bulletin board listings, Gerald Janes examines the Data Protection Act and its implications for sysops. Rupert Steele focuses on groups for power users, and Transaction File lists the best private deals around.

CHIPCHAT
All the news that's fit for libel.

FEATURES AND REVIEWS



SCREEN GRABBERS 164
With PCs processing ever more diverse types of information, so the need to integrate it all has increased, with the incorporation of graphics being foremost. Ed Brown looks at six packages designed to convert screen images into files.

A FIST FULL OF MICROS 168
The humble telephone acquires a new use, it seems, almost every day. Tony Dennis goes to the other end of the line and looks at the computer technology which is allowing people to play multi-user games using just an ordinary phone.

LASER LINES 174
Once the laser printer bug bites, it is difficult to shake off. Yet the upgrade path from the common or garden dot matrix to the latest in high-tech page printers is not always as smooth as it appears. Kathy Lang plants some signposts to guide you along the way.

ORACLE 178
One of the biggest names in mainframe databases is bidding fair to occupy the same position in the world of personal computing. Oracle for the PC includes many of the features — including SQL — that made it so attractive to the corporate mainframe user.
Mike Liardet takes a wander round this semi-legendary software.



CHANGING ROOMS 184
In the third of his series, David Tebbutt lends an ear to Xerox EuroPARC's Austin Henderson, who is looking at methods of moulding computer systems to the people who have to use them. The humble photocopier can, it seems, teach systems designers a lesson or two.

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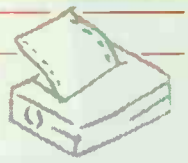
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EPSON	Market Leader	SRP	ISC
LX800	80c/150cps/35nlq/TF	279	195
FX800	80c/240cps/40nlq/TF	459	321
FX850	80c/264cps/54nlq/TF	459	321
LQ500	80c/150cps/50nlq/24 Pin	399	279
LQ850	80c/220cps/75nlq/24 Pin	639	447
FX1000	132c/240cps/40nlq/TF	599	419
FX1050	132c/264cps/54nlq/TF	599	419
EX1000	132c/300cps/50nlq/TF	829	580
LQ1050	132c/220cps/73nlq/24 Pin/TF	849	594
LQ2550	132c/400cps/133nlq/24 Pin/TF	1299	909
SQ2500	132c/540cps/180nlq/JetInk	1349	944
DFX5000	132c/533cps/80nlq/HD	1699	1189

NEC	24 Pin Printers	SRP	ISC
P2200	80c/168cps/56nlq/TF	395	277
P5XL	132c/264cps/86nlq/Col	995	697
P9XL	132c/384cps/86nlq/Col	1295	907
P6+	80c/265cps/90nlq/TF/80K Buf	649	454
P7+	132c/265cps/90nlq/TF/80K Buf	839	587

JUKI	High Quality Daisywheels	SRP	ISC
6100	15cps	395	275
6200	30cps	565	395
6300	45cps	895	625

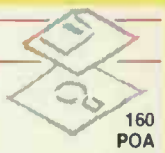
LASER	Silent Fast & DTP	SRP	ISC
EPSON GQ3500	6ppm	1799	1395
Brother HL8	8ppm • SPECIAL •	2195	1535
HP LaserJet II	8ppm	2249	1630
Canon Series 2	8ppm (Excl. Toner)	2095	1495
Canon LBP-811T	8ppm D Bin	2695	1885
Canon LBP-811R	8ppm D Bin Duplex	3100	2170
Kyocera F1000	10ppm	2320	1855
QMS PS810+	8ppm Postcript	3995	3195
Panasonic P4450	10ppm	2100	1750
HP Deskjet	4ppm	799	599

SPECIAL	Dual Mode Printers	SRP	ISC
HP Rugged Writer	480cps/240nlq	1290	903
Panasonic 1081	80c/120cps/28nlq/TF	245	159
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SUPERCALC 5	225
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QUATTRO	120
SMART SYSTEM v3	388
ABILITY PLUS	123
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NEC P7 Plus	265	90	£570.00
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Epson LQ 2550	333	111	£883.00
Fujitsu DL3400	240	60	£561.00
Fujitsu DC2400	215	70*	£686.00
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*dual interface

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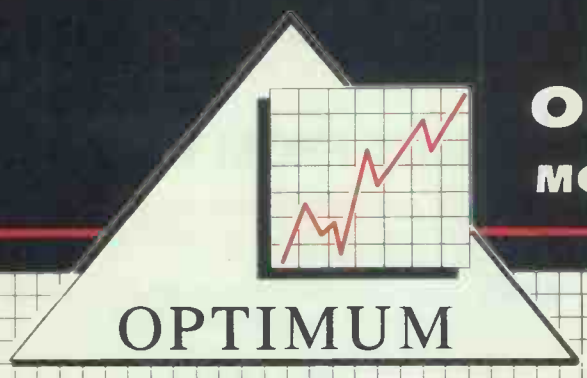
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As last months PCW (Jan '89) put it "All criticism aside, there is nothing in the PC market to touch it."
PC USER had similar words: "A very significant graphics package ... Graphics to rival the MAC ... probably the most exciting graphics program yet seen to run under DOS". Artline does not use bit-mapping so its resolution is dependant only on the resolution of the output device. A package for the serious professional user!

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Quality modems at budget prices!- the WS4000 at £129! - the WS3000 Professional V22bis 2400/2400 at only £395!.

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SUPER LABELLER

NEW VERSION 3
MORE FEATURES ADDED
Please Call for Details

Fast . . . Flexible . . . Efficient . . .

THE PROFESSIONAL LABELLING SYSTEM

PRINTING

UNRIVALLED printing facilities are provided offering TOTAL FLEXIBILITY. These include:

- PRINT A SINGLE LABEL ANY NUMBER OF TIMES
- PRINT GROUPS OF LABELS USING "WILDCARDS" ANY NUMBER OF TIMES
- 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 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.

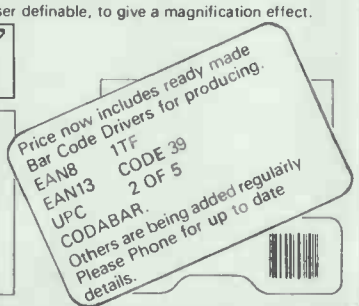
BAR CODE formats can be defined EASILY in a FEW MINUTES and stored on disc for use at any time. An UNLIMITED number of different BAR CODE standards can be created or indeed your own system can be designed.

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.

FILE IMPORT

SUPER LABELLER has comprehensive file import capabilities allowing for the import of data for files held as:

- ★ STANDARD ASCII
- ★ COMMA DELIMITED
- ★ COMMA QUOTE DELIMITED
- ★ BLANK LINE DELIMITED

Labels can be named and categorised MANUALLY or AUTOMATICALLY.

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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T1600: 12MHz 286 20MB
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286 10MHz 1MB Ram 40MB HD 28ms	1,499
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All AST's include 14' FST Mono Monitor, ser/par, MS DOS 3.3

TANDON COMPUTERS

PCA20: 8MHz 286	1,160
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TARGET 40 PLUS 10MHz 286	
PAC 286 1.2 10MHz 286	1,345
386 16MHz 40MB HD	2,099
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All Tandon's include 14' Mono Monitor, MD DOS 3.3 MS Windows

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NEC Multisync II	454
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Taxan Multiscan 770	489
Video 7 Vega VGA	199
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DOT MATRIX PRINTERS

Epson LQ2550	895
Epson LQ1050	578
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Epson LQ500	279
Epson FX1050	408
Epson FX850	313
Epson LX800	179
NEC P6 Plus	454
NEC P7 Plus	587
Star LC10	185
Star LC24-10	289
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HP DESKJET	575
*HP Laseejet II	1,399
*Panasonic KXP 4450	1,499
*Star Laserprinter 8	1,399
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(*inc. 1 year on-site warranty)

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Intel Above board 286 2MB RAM	625
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AST Rampage/2 (xt) 2MB RAM	575
Micron 2MB RAM 286/386	749



NEW TOSHIBA T1600



AST PREMIUM 386



HP LASERJET II



INTEL ABOVE BOARD 286 2MB RAM 625

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MS Windows 2	65
MS Windows 286	65
MS Windows 386	99
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Nortons Utilities v4.5	50
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Ventura Publisher v2 (UK)	545
Word Perfect v5	229
Wordstar Professional v5	210

BORLAND SOFTWARE

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Turbo Pascal v5	65
Turbo Basic v1.1	42
Turbo Prolog v2	65
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Quattro	89
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Pascal, Basic, Prolog toolbox's PHONE!

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Seagate ST251 40MB HD 40ms	255
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1.2MB 5.25' FLOPPY	75
360k 5.25' floppy	65
WDXT-GEN	45
WD1002A-WX1	60
WD1003-WAH	89
WD1003-WA2	99
WD1007-WAH ESDI 1:1 interleave	175
WD1007-WA2 ESDi 1:1 interleave	195

COMMUNICATIONS

Pace Linnett v21,23	119
Pace Linnett V21,22,23	189
Pace series 4 v21,22,23	310
Pace series 4 v21,22,23,22bis	379
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Amstrad MC2400 internal	185
Dowty Quattro	575
Stradcom Pocket	165
Tricom 4824 MNP	575

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AMSTRAD PC 2086



The 2086 is the first of Amstrad's new range of machines aimed at the higher end of the PC/XT market, using the Microsoft MS-DOS 3.3 operating system. The PC2086 also features Microsoft Windows.

SPECIFICATIONS

● 8Mhz 8086 CPU ● parity checked RAM ● 720K 3.5" Disk Drive ● 30Mb hard disk option
● VGA compatible with full EGA/VGA/Hercules compatibility ● 3 expansion slots
● Built in adapter for 5.25" or 3.5' disk drives or tape streamer.

PC2086 SD12MD.....£599	PC2086 DB12MD.....£749	PC2086 HD12MD.....£999
PC2086 SD14CD.....£749	PC2086 DD14CD.....£899	PC2086 HD14CD.....£1149
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RSC'S OWN COMBINATIONS (inc. Western Digital Hard Cards).

Amstrad 2086 SD12 MD + 32Mb H/Card.. £815.00	**Amstrad 2086 SD12HRCD + 32Mb H/Card..£1060.00**	**Amstrad 2086 DD12MD + 32Mb H/Card..£960.00**	**Amstrad 2086 DD12HRCD - 32Mb H/Card..£1200.00**
Amstrad 2086 SD14CD + 32Mb H/Card ..£960.00	**Amstrad 2086 SD14HRCD + 32Mb H/Card.. £1150.00**	**Amstrad 2086 DD14CD - 32Mb H/Card.. £1110.00**	**Amstrad 2086 DD14HRCD + 32Mb H/Card..£1300.00**

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RSC will beat any currently advertised and in stock price on the Amstrad PC2000 series

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AMSTRAD PCW RANGE

PCW8256 offers a high resolution monitor, a ful QUERTY keyboard and near letter quality dot-matrix printer with locoscript and CP/M+ operating system.
RSC Price.....£325.00

PCW8512 some as above but with 512KRAM and a 1MB second disk drive.
RSC Price.....£415.00

AMSTRAD PCW9512

- Daisywheel printer with exchangable daisywheels.
- 512K RAM and paper white high resolution monitor.
- Restyled case with PC type keyboard.
- Locoscript 2 - Locospell - Locomail.

RSC Price.....£439.00

AMSTRAD PC1512

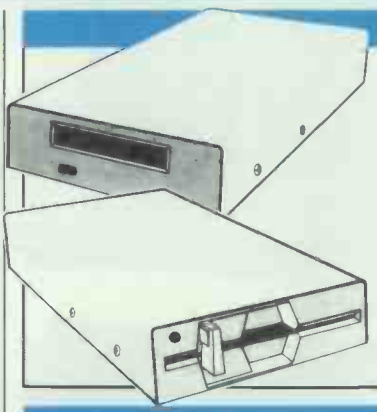
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Amstrad PC1512 SD Mono	£390.00
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Free with every PC1512 4 US gold games and ability package.

In streem with our policy to not only remain competitive in our pricing - RSC is giving with every purchase of a PC1512 or PC1640 (regardless of what is already bundled) - Lifetree Volkswriter deluxe (a powerful word processor).
ALL AT NO EXTRA COST

LIFETREE SOFTWARE EUROPE



PC 2086 ADD-ONS

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RSC-FD16 External 5¼" 360k Disk Drive for the PC 2086. Draws power direct from computer terminal £89.00

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Runs at twice the speed of many competitors.

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Free box of 3.5" disks
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EPSON

Handling simple text. 8088, 10/4.7MHZ. MSDOS 3.2, (inc diagnostics) 640KRAM, 1x20 hard disk, 1x 360K floppy disk 5 slots, mono monitor and adapter, PC AX keyboard small footprint.



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EPSON AT RANGE

New Epsom PC HD AX2.....£1195.00
80286, 12/10/8 Mhz, MS-DOS 3.2. 640K RAM 1x20MB Hard disk, 1x 1.2 MB floppy disk 4 slots EGA adapter - no monitor supplied PC AX Keyboard, small footprint (PCXT)
PCAX2 SD (No monitor/No card).....£929.00



NEW EPSON PC AX
80286, 12/10/8 Mhz, MS-DOS 3.2. 640K RAM 1x40MB or 1X80 MB hard disk, 1x1.2 MB floppy disk 9 slots, no video adapter or display supplied. AX Keyboard, optional floor stand.

40MB.....£1549.00
80MB.....£1949.00
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8088-2 processor, selectable clock speed 4.77/8 Mhz, 7 slots, 640K RAM, RS232 and printer port, Hercules compatible and CGA video driver card, real time clock, 84 key AT style keyboard, twin 360K floppy disk drives, MS-DOS 3.2 and GW Basic included.....£539.00

MODEL SPC3000/3
As above, with 1x 360K flopy disk and 1x 20MB hard disk.....£769.00



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By sinclair - A true portable.....£235.00
Z88 Accesories held in stock.

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PHILIPS NMS 9100
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ZENITH PORTABLES



superSPORT
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TurboSPORT 386
Portable PC/AT 80386 (12Mhz)
2MB RAM 40MB hard disk.....£3875.00

SHARP LAPTOPS



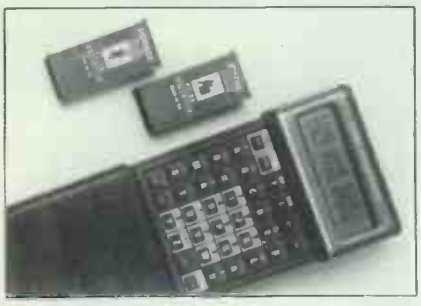
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PC4502 Double drive.....£745.00
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VISA

PSION ORGANISER II



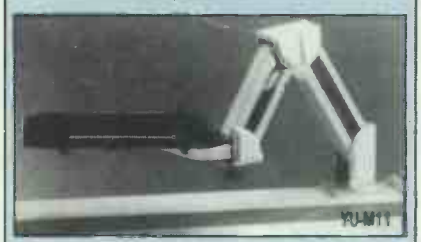
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COMPUTER ADD ONS

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EGA card £149.00
VGA card £189.00
NECV30 replacement for 8086 ..... £26.00

RSC-M11 Monitor mover



- With tray tilting -+15o
- Span 15-51cm
- Heavy duty
- Desk clamp
- Height variable 0-40cm
- Max load 60KG £89.00

COMPUTER ACCESSORIES

EV165A Everex AT 3MB RAM expansion card only £145.00
EV154 Everex PC/XT 2 Mb expansion card only £120.00
EV173 Everex PC/XT 1MB multifunction EMS card £175.00
(unpopulated/2 serial/1 parr/1 comm port)
EV173A Everex AT 1MB multifunction EMS card £169.00
(unpopulated/2 ser/1 parr port)

WESTERN DIGITAL FILECARDS



Western Digital filecards represent the inexpensives and reliable method of upgrading your PC. Simple to install with a low power consumption the filecards come complete with the Xtree file management software, speedread and a one year warranty.
21MB RSC PRICE £195.00
32MB RSC PRICE £245.00

ALL PRICES EXCLUDE VAT

cipher 1525



CIPHER DATA BACKUP

Avert data disaster - backup with Cipher. holds 25MB on a single cartridge. save/restore rate 1MB/minute. Exteranl — self powered.
Cipher 1525 (for Amstrad PC) £275.00
Cipher 5210 (for other PC) £375.00
3M DC600A data cartridge £26.00

CMS FILE CARD

32MB – 28MS access time. For AT Computers
SPECIAL OFFER £295.00

COMMUNICATION

AMSTRAD V21/V23 Internal Card Modem £95.00
(Includes datatalk software)

★★ NEW MC2400 CARD MODEM ★★

Amstrad's new 3/4 length card modem.

- V21,V22, V22BIS, V23
- Auto Answer/dial
- Hayes compatible
- 5.25/3.5 media

Mirror II software included, the best in Comms software all this for £165.00

AMSTRAD SM2400 External Modem

This new high spec. Quad. standard modem is the latest addition to Amstrads stable of high quality modems.
● V21,V22,V22BIS,V23. ● Bell tinkle repression
● AC1 progress monitoring ● Hayes compatible
● Auto answer, with automatic rate detection
● Auto pulse & tone dialling & baud rate selection
● Full duplex with V23. ● RS232 (V2) host interface.
RCS Price £225.00

Dowty Quad speed Multi function modem £599.00
Miracle WS4000 V21/V23 ..... £156.00
Sage Chit Chat software £69.00
Sage Chit Chat pack £182.00
(includes Chit Chat softweare and Linnet modem)
Linnet V21/V23 Auto £129.00
Dialup personal software £65.00

★★ STOP LOOKING ★★
★★ RSC HAVE THE ANSWER ★★

C-FAX SR1 by Communicate.
Installing this card, you can simply turn your PC into a fax machine allowing you to send any file (including graphics) to any group 3 fax machine. The Communicate SR1 will even receive messages in background mode, alerting you when a message has been received.
This impressive device boasts many features – timed and batch transmission, save messages to disk, activity log reports, multi addressing, password protection and batch transmission.

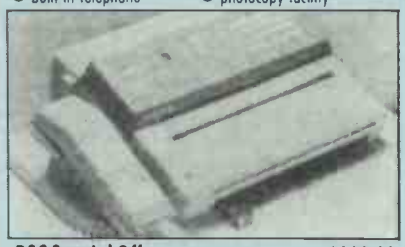
BT Approved £495.00

NEC NEFAX 2

This new addition to NECs range is not only a fax but also a phone, answering machine and copier all in one.
A twenty-four hour desk top communications centre for your office or home. **£1145.00**

CANON FAX 110

- Paper sizes to A4
- fine made buttan
- 26 Numbers Autadial
- 1 Year an site maintainence free!!!
- 5 sheet auto feeder
- built in telephone
- photocopy facility



RSC Special Offer £999.00

MONITORS

NEC Multisync II Best seller 3000x6000 res £459.00
Nec Multisync Plus 15" £695.00
NEC Multisync GS £169.00
Taxan multivision 770 14" colour £499.00
Taxan 764 EGA Colour £425.00
Taxan KX123 high res green £199.00
Samsung MD1257 12"mono £89.00
Samsung CD1469W 14" Colour £229.00
Samsung 14" multisync £399.00
Samsumg EGA & CGA CM4531 ..... £325.00

DOT MATRIX PRINTERS

EPSON

Epson LX800 150cps/150cps £185.00
Epson EX1000 300cps/50nlq 136col £565.00
Epson FX850 80 col 9 pin – New In £329.00
Epson FX1050 132 col 9 pin – New In £415.00
Epson LQ500 24 pin/80col/150cps/50nlq £295.00
Epson LQ850 24 pin/132col/220cps/73nlq £445.00
Epson LQ1050 24 pin/132col/220cps/73nlq £570.00



Epson LQ2550 24 pPin/136col/333cps/111nlq
8K buffer/colour £925.00
Epson DFX5000 136col/533cps/Heavy duty £1295.00

THE star PRINTERS FOR BUSINESS

Star NX15 120cps/30nlq/136 col £289.00
Star LC10 144cps/36nlq T/F £185.00
Star LC10C 144cps 36NLQ T/F £215.00
Star NB24-10 24 Pin 216cps/72nlq 80 col £475.00
Star NB25-1524 Pin 216cps/72nlq 136 col £565.00
Star NB15 same as above but 300 cps £695.00

Telephone: (0923) 243301
(24 HOURS)



Star LC24-10 The latest 24 Pin printer
170cps/57nlq/80col/4k buffer £289.00

NEC

Latest 24 pin introduction - a sure winner Print rate - 168cps/56NLQ Paper handling - unique front feed llows insertion without removing already installed continous stationary. Graphic - 360 x 360 dpi



RSC PRICE.....£275.00

NEW THIS MONTH



The Fantastic Panasonic KX P1124

- 80 Column 24 pin multimode printer
- 160 cps/53 cps NLQ at 10 cpi
- 192 cps/63 cps NLQ at 12 cpi
- Front panel feature selection – no dips switches
- Front, rear and bottom feed
- 10, 12, 15, 17, 20 cpi + proportional

RSC SPECIAL PRICE £289.00

PANASONIC

Panasonic KX-P1081 80 Col 120cps/24nlq	£139.00
Panasonic KX-P1592 132 Col 180cps/38nlq	£365.00
Panasonic KX-P1595 136 col 240cps/51nlq	£445.00
Panasonic KX-P1082 80 col 160 cps	£185.00
Panasonic KX-P1083 80 col 240cps	£298.00
PANASONIC KX-P1540	**£469.00**

CITIZEN RANGE

120D	£135.00	MSP40	£299.00
LSP100	£165.00	MSP55	£495.00
MSP15E	£225.00	HQP45	£465.00
MSP50	£385.00	HQP40	£385.00

NEC NOW AVALAILABLE

P6+ 24 pin 80 column	£475.00
P7+ 24 Pin 132 column	£599.00

Both come complete with;

- 20 in - built fonts
- 265 cps draft
- In Built tractor feed
- 80K buffer
- 90 cps nlq

ALL PRICES EXCLUDE VAT

AMSTRAD

New Amstrad LQ5000 24 pin printer

- Heavy duty
- High resolution
- 288 cps draft
- 96 nlq
- Epson compatible control codes
- IBM Compatible graphics character set
- Over 100 typeface combinations
- In built tractor and friction feeds

RSC PRICE	£360.00
DMP4000 136 col 200cps	£275.00
LQ3500 24pin/160 cps	£285.00

NEW AMSTRAD DMP3250
160cps/40nlq/80 col/T/F - Parr/serr £165.00

DAISYWHEEL PRINTERS

SCOOP!!

JUKI 6200 + Sheet Feeder **£469**

Juki 6200 30 cps	£325.00
Juki 6300 40 cps	£640.00
Juki 6500 60 cps	£995.00
Brother twinwriter	£875.00
Brother HR20	£327.00
Brother HR40	£785.00
Citizen Premier 35	£425.00

LASER PRINTERS

Panasonic

LASER PRINTER KX-P4450



For exceptional speed, features and price, you can't beat the Panasonic laser printer.It affers a speed of 11 pages a minute - the fastest in its class. Plus a wide variety of internal fonts. Convenient paper handling, and more. The Panasonic printer is powered by a Ponsosonic engine. Compare it to any other printer. You'll find that for your demanding business, Panasonic is the easy chiace for sophisticated users

- Prints 11 pages a minute
- Two A4 Size 250 sheet cassetes as standard
- 300 OPI resolution
- Five popular printer emulations for compatibility with popular software.
- Standard RS232 serial and centronics parralell ports
- standard 512kRAM with optional memory expansion to 1.5 MB
- Convenient front panel controls with 15 character LCD display for messages.
- 500 page per manth duty cycle
- Optional fant cards for print style flexibility.

RSC price.....£1595.00

Brother HL8 (8ppm)	£1569.00
Star Laser 8	£1450.00
Canon LBP-8 MKII New Low price	£1395.00
Canon Laser LBP8 II dual bin	£2195.00
Canon Laser LBP8 II duplex printing	£2650.00

CANON LBP -8 Mark II

FEATURES:

- 300 dpi, 8 pages/minute Laser printer
- 200 sheet paper cassette
- 8 Resident Fonts
- 512K RAM (expandible to 1.5Mb)
- Parallel and RS232 interfaces
- Packaged with 'Printility' software for HP Laserjet, HP 7475, Epson and IBM emulation.

Canon LBP-8 Mark II	£1395.00
Canon LBP-8 HR w/ Dual Bin & Duplex (Prn 2 sides)	£2195.00

FOR ALL LASER ACCESSORIES

i.e. Fonts - Memory Expansions - Toner Cartridges

PLEASE CALL

EPSON GQ3500

Provides a full range of typefaces, graphic styles and quality letter fonts, plus the widest selection of options from Bold Gothic print to classic Times Roman. The GQ3500 gives you more opportunity than ever before to explore exciting new presentation techniques. 6 ppm / 640K RAM.

Now comes with 2 FREE font cards and HP ID Card

EPSON GQ3500 with 1 year on-site maintenance – £1295

HP LASER JET II SERIES

"The" industry standard with no emulation needed. Prints up to 8 pages per minute quiet 50 DBo. The corporates choice RSC

PRICE	**£1445**
1 MB memory upgrade 33443	£345.00
2MB Memory upgrade 33444	£699.00
4MB Memory upgrade 33445	£1395.00
Toner cartridge	£75.00
Soft fonts (disk based)	£165.00
Font cartridges	POA

INK JET PRINTERS

Canon Bubblejet BJ0-130	£725.00
Hewlett Packard Deskjet	£655.00
Hewlett Packard Paintjet	£795.00
Epson SQ2500 Inkjet	£875.00
Diconix Portable Inkjet	£275.00

FOR SHEETFEEDERS AND ALL PRINTER ACCESSORIES PLEASE CALL – ALL KEPT IN STOCK – FAR TOO MANY TO LIST

DICONIX

Epson/IBM compatible - portable printer 150 cps/50nlq. Tractor/friction, battery/mains. weight - under 4lbs.

RSC PRICE.....£285.00

KD PRINTER STAND

TPS-25 K D printer stand for 80 column printers. Paper feeds from underneath and the dial adjustable paper feed palte guides the paper onto the collection rack for neat stocking. Sturdy steel and plastic construction with space saving design.



80 col	£25.00
132 col	£29.00

RSC Limited, 75 Queens Road, Watford, WD1 2QN
Fax: (0923) 37946 Telex: 265871 MON REF G. REF CJJ128

Callers welcome

ACCESS VISA

PLOTTERS

ROLAND PLOTTERS



DXY-880A	£565.00
DXY-1100	£635.00
DXY-1200	£885.00
DXY-1300	£1035.00
DXY-2200	£2625.00
DXY-3300	£3650.00

OFFICIAL ROLAND PLOTTER ACCESSORIES DISTRIBUTOR

All lines are available now – please ring for details.

NEW EPSON SCANNERS

For:

Epson EX800/1000	£139.00
Epson LQ2500	£169.00
Epson LQ2550	£169.00

GeniScan

GM 2000 PLUS

105mm Scanning width with 200 or 400 dpi switchable. Includes Dr. Halo III Software .. £179.00

DATA SWITCHES

A range of high quality data switches in centronics or rs232 interface. rotary type with durable steel cases.

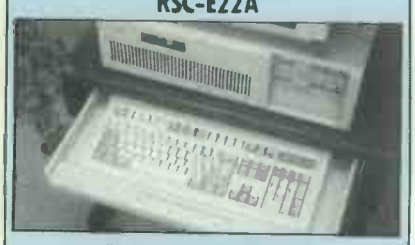
RSC DSC-1 (Par)
(2 device T switch 3 female connections..... £24.00
RSC DSC-2 (par)
(4 device T switch 5 female connections..... £32.00
RSC DSR-1 (ser)
(2 device T switch - 3 female connections..... £20.00
RSC DSR-2 (ser)
(4 device T switch - 5 female connections..... £30.00

PARALLEL BUFFERED DATA SWITCHES

- self test function
- buffer rom status function
- copy function
- printer ready function
- reset function
- buffer ready indicator

RSCPB64 (one in - one out 64K)	£90.00
RSCPB64-2 (1/2 in- 2/1 out 64K)	£125.00
RSCPB256 (one in one out)	£145.00
RSCPB256-2 (1/2 in 2/1 out)	£175.00

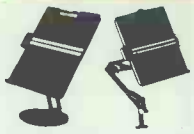
RSC-E22A



Specially designed to hold your detachable keyboard. Snugly mounts under any desktop.

£18.00

COPY HOLDERS



RSC - H33 (Desktop) **£12.00**

RSC - H32 (Deskclamp) **£12.00**

Wide column version & H32–H34 ..... **£15.00**

(132 col) What every work station ought to have. No more looking down - or finding important drafts. They can be positioned at almost any angle.

4 way mains distribution socket



With built-in Arrester to give protection from mainsborne spikes and surges £15.00

Surge Protected Plug £9.50

RIBBONS

PRINTER	QTY 2	QTY 5	QTY 10
Amstrad			
DMP3000/3160	£4.30	£3.90	£3.50
DMP4000	£7.80	£7.60	£7.25
LQ3500	£5.00	£4.75	£4.50
LQ5000	£8.50	£8.00	£7.50
Citizen			
120D	£3.30	£3.15	£3.00
MSP15E	£6.50	£6.25	£6.00
MSP50	£5.00	£4.75	£4.50
Panasonic			
1080/1081/1082/1592	£3.90	£3.50	£3.25
1595	£9.00	£8.50	£8.00
KXP3131, Juki 6200, MP26/40	£4.30	£3.90	£3.50
Epson			
LX80/LX86	£5.00	£4.50	£4.00
FX1000	£7.00	£6.50	£6.00
LQ500/LQ800/LQ850	£6.00	£5.50	£5.00
LQ1000/LQ1050	£11.00	£10.50	£10.00
LQ2500/LQ2500+	£9.00	£9.50	£9.00
LQ2500 Colour	£21.00	£20.00	£19.00
LQ2550 Fabric	£12.50	£12.00	£11.50
LQ2550 Colour Fabric	£20.50	£19.50	£18.50
LQ2550 Film	£10.00	£9.50	£9.00
FX800/LX800	£4.30	£3.90	£3.50
FX800/LX800 Colour	£6.00	£5.50	£5.00
EX800/EX1000	£8.00	£7.50	£7.00
EX800/EX1000 Colour	£16.50	£16.00	£15.50
DFX5000 Fabric	£24.00	£23.00	£22.00
6100 (S/S)	£3.00	£2.75	£2.50
6100 (M/S)	£4.00	£3.75	£3.50
6200	£4.30	£3.90	£3.50
NEC			
P2200	£6.00	£5.75	£5.50
P6	£8.30	£8.00	£7.50
P7	£9.50	£9.00	£8.50
P6+ & P7+ Fabric	£7.50	£7.25	£7.00
P6+ & P7+ Colour	£13.50	£12.50	£11.50
P6+ & P7+ Multistrike	£9.50	£9.00	£8.50
Star			
LC10 Black	£4.00	£4.50	£4.00
LC10 Colour	£6.00	£5.75	£5.50
LC24-10	£5.00	£4.75	£4.50
NX15/ND15/NR15	£8.00	£7.50	£7.00
NB24-10	£6.00	£5.75	£5.00
NB24-15/NB15	£8.00	£7.50	£7.00

BLANK DISKS

TDK.

	Per box	5 or more
M2D DS/DD	£11.00	£10.00
M2HD DS/HD (1.5MB HD)	£20.00	£18.00
MF2DD DS/DD (3.5" 135 TPI)	£20.00	£18.00
MF2HD DS/HD (3.5"HD)	£40.00	£35.00

RSC's OWN BRAND
Fully guaranteed

	Per Box	5 or more
RSC RM2D DS/DD (for PC1512/1640)	£9.00	£8.00
RSC RMQD (96TPI)	£11.00	£10.00
RSC RHD (1.2MB)	£18.00	£16.00
RSC DS/DD (135TPI) (3.5")	£18.00	£16.00
RSC DS/HD (1.6MB) (3.5")	£32.00	£30.00

FOR QUANTITY DISCOUNT PLEASE RING

PC SOFTWARE (3.5" VERSIONS AVAILABLE ON REQUEST)

CLASSIC RANGE

Lotus 1-2-3 V2.1	£265.00
Lotus Symphony V2	£375.00
dBase IV Plus	£385.00
Supercalc 5	£230.00
Wordstar 2000 V3	£269.00
Framework III	£385.00
Wordstar Professional V5	£235.00
Word Perfect V5	£249.00
Microsoft Word V4	£269.00
Smart System	£395.00
Paradox II	£295.00
Microsoft works	£117.00
Lotus Manuscript	£259.00
Lotus Report writer	£75.00
Microsoft Excel	£315.00

DATABASES

Sage retrieve V.III	£125.00
TAS+	£74.00
TAS Developer	£175.00
VP Info	£62.00
Superbase personal	£35.00
Superbase personal II	£66.00
Superbase Professional	£155.00
Superbase 4 (+free mouse)	£345.00
Masterfile PC	£47.00
DBXL Diamond version	£82.00
Infomaster (By Amstrad for all pcs)	£52.00
Timeworks Data Manager Professional	£50.00
Foxbase Plus	£249.00

INTEGRATED PACKAGES

First choice	£110.00
Psion PC4	£49.00
Logistix	£62.00
First Framework	£63.00
Ability Plus	£112.00

PC ACCOUNTS

Sage Bookkeeper	£66.00
Sage Accountant	£100.00
Sage Accountant Plus	£138.00
Sage Payroll II	£103.00
Sage financial controller	£208.00
MAP Integrated Accounts	£96.00
MAP Complete Accounts	£230.00
MAP Payroll	£55.00

Telephone: (0923) 243301

(24 HOURS)

SPREADSHEETS

Sage PC Planner II	£69.00
Cracker III	£49.00
Multipian	£125.00
Sideways (TURNS ROWS INTO COLUMNS)	£38.00
VP Planner	£61.00
VP Planner Plus	£94.00
Quattro	£94.00
Supercalc 3.2† (By Amstrad for all PCs)	£55.00
Words and figures	£59.00
Javelin PLUS	£210.00

WORDPROCESSING

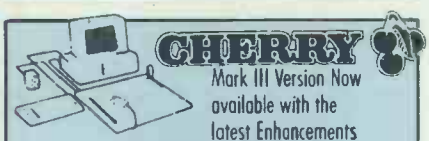
New Word II	£65.00
Word Perfect Personal	£129.00
Gem 1st Word Plus	£50.00
Wordstar Express (By Amstrad for all PCs)	£55.00
Top copy plus	£75.00
Volkswriter Deluxe	£25.00
Volkswriter 3	£89.00
Total Word	£299.00

WORD PERFECT VERSION 5

Best selling word processor which has the ability to integrate text and graphics. Comes complete with a 115,000 word speller.

RSC PRICE.....£249.00

GRAPHICS



Mark III Version Now available with the latest Enhancements

Standard configuration

The CHERRY DIGITISER is a convenient and easy to use device for controlling a screen cursor, or entering drawing data into your computer. Suitable wherever a picture is worth 1000 words, from precision mechanical or electrical design and education, through to drawing cartoons. The CHERRY digitiser allows you to quickly produce and alter your ideas. A high speicification device, with an A3 working area, 0.1 MM resolution and 0.5MM accuracy.

IDEAL WITH GENERIC CADD **£429.00**

GENERIC CADD 3.0

by Robotechnic Software

Computer Aided Drafting & Design gives you true CAD capabilities at speeds faster than most other systems - Basic packages support most mouse pointers - graphic cards plotters and digitisers. Add modules to your own requirements making this program one of the finest and best valued packages today.

GENERIC CADD - LEVEL 1 ..... £45.00
GENERIC CADD - LEVEL 2 ..... £85.00
GENERIC CADD - LEVEL 3 ..... £175.00

GENERIC ADD-ONS

Generic Autoconvert	£45.00
Generic Auto Dimensioning	£45.00
Generic Dotplot	£45.00
Generic Drafting Enhancements 1	£45.00
Generic Drafting Enhancements 2	£45.00
Generic Pen Plot	£45.00

Gem Draw Plus (Amstrad)	£66.00
Gem Graph (Amstrad)	£66.00
Gem Graph (for all PC's)	£165.00
Gem Draw Plus (for all PC's)	£165.00
Freelance Plus	£289.00
Graphwriter II	£299.00
PC Deluxe Paint II	£69.00
VP Graphics	£66.00
Turbo Cad	£73.00
Autosketch	£55.00

ELECTRONIC ARTS PC DELUXE PAINT II

An introduction to the world of computer generated art.

Enables you to create colourful graphics in a fraction of the time it would normally take.

RSC PRICE – £69.00

PROGRAM DEVELOPMENT

Gem Programmer Toolkit	£137.00
Quick Basic Compiler	£65.00
Quick C	£65.00
Turbo Assembler & Debugger	£95.00
Turbo Basic	£42.00
Turbo Basic Database Toolbox	£42.00
Turbo Basic Editor Toolbox	£42.00
Turbo C (Version 1.5)	£42.00
Turbo C (Version 2.0)	£75.00
Turbo Eureka	£65.00
Turbo Pascal (Version 4)	£42.00
Turbo Pascal (Version 5)	£75.00
Turbo Pascal Database Toolbox	£42.00
Turbo Pascal Editor Toolbox	£42.00
Turbo Pascal Graphics Toolbox	£42.00
Turbo Pascal Tutor	£28.00
Turbo Pascal Developer Library	£189.00
Turbo Prolog	£42.00
VP Expert	£67.00
Zorland C	£26.00
Zorland C Powerpack	£52.00
Learning DOS (Microsoft)	£26.00
DB Fast Complier	£59.00

GENERAL UTILITIES

Norton Utilites	£50.00
Gem Word Chart (Amstrad)	£67.00
Gem Font Editor (Amstrad)	£67.00
Portex	£73.00
Microsoft windows	£59.00
VP Expert	£67.00
Copy II PC	£25.00
Norton Commander	£39.00
PC Tools Deluxe	£40.00
PC Copy II Option Board Deluxe	£73.00
MASS Super Labeller	£32.00
File Rescue Plus	£18.00
Borland Reflex	£39.00
Borland Sidekick	£39.00
Borland Sidekick Plus	£149.00
Time Slip	£49.00
Time Slip Plus	£109.00
XTREE Pro	£75.00
Autoroute (Digital Mapping)	£110.00

LINK MASTER

Transfers files from 5.25 to 3.5 or vice-versa

RSC Price £18.00

DESKTOP PUBLISHING

Rank Xerax Ventura Publisher	£499.00
Fleet St. Editor V2	£65.00
Fleet ST. Editor V3	£110.00
Fontasy	£49.00
PFS First Publisher	£79.00
Gem Desktop Pub	£194.00
Page Ability	£135.00
Handy Scanner	£245.00
Handy Scanner & Fleet St. Editor	£299.00
HP Scanner desktop scanner	£1695.00

Authorised Rank Xerox Dealer

VENTURA PUBLISHER

ORIGINAL

RSC Special – £499.00

TIMEWORKS

DESKTOP PUBLISHER

Full featured desktop publishing program with graphics, word processing and page layout. easy to use and learn. Designed to have you up and running in less than one hour.

RSC PRICE.....£77.00

Finesse

By Advanced Memory Systems

Finnesse version 1.1 inc GEM & Fontware	£67.00
AMS Mouse Inc driver software	£55.00
AMS Microscan Inc Driver Software	£189.00
DTP Solution 1 Inc finnesse and AMS Mouse	£115.00
DTP Solution 2 Inc Finnesse and AMS Microscon	258.00
DTP Solution 3 Inc Finnesse, AMS Mouse & Microscan	£289.00

MICE

Microsoft Mouse & Menus	£95.00
Microsoft Mouse & Windows	£105.00
Microsoft Mouse & Easy CAD	£125.00

(The above are available with either serial or bus interface)

Genius Mouse - Serial mouse with mat, mouse holder and software	£39.00
Logitech C7 Mouse	£77.00
Logitech Collectors Clear Mouse	£89.00

NETWORK AND NETWARE

Local Area Network (LAN) by AMSTRAD

An area where computer "mystics" have reigned far too long. As in other spheres of computing Amstrad have designed this network to be simple, practical and easy to install.

The starter pack has all the hardware to configure a three workstation LAN.

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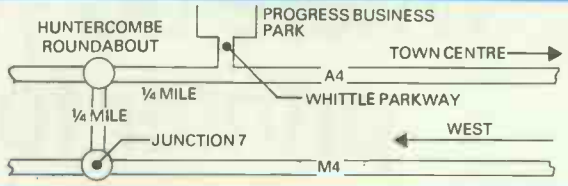
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Microsoft C Compiler Ver 5.1 NEW	230
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Epson EX1000 50NLQ/300cps 136col	545
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Epson LX800 150cps	172
OKI Microline 320 6NLQ/300cps 80cl NEW	440
Panasonic 1595 51NLQ/240cps P&S 132col	408
Panasonic KX-P1081 24NLQ/120cps 80col	132
Panasonic KX-P1592 38NLQ/180cps 132col	292
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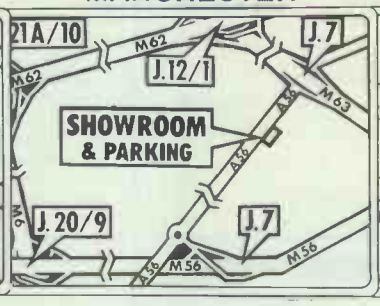
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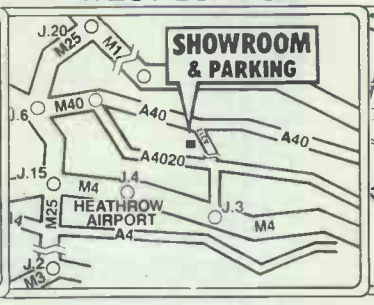
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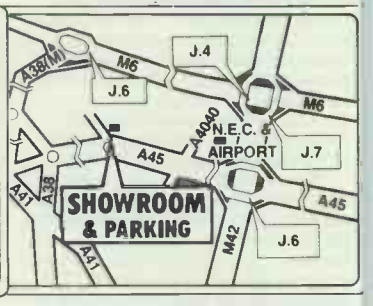
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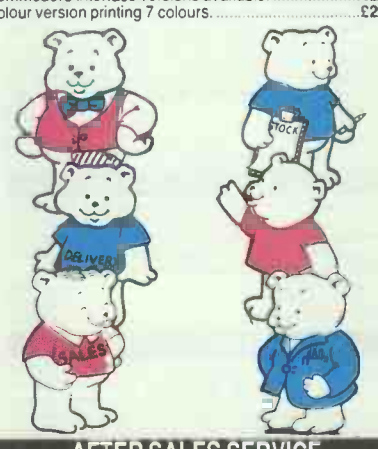
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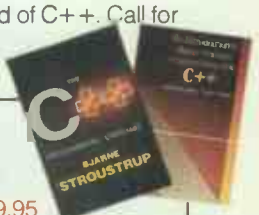
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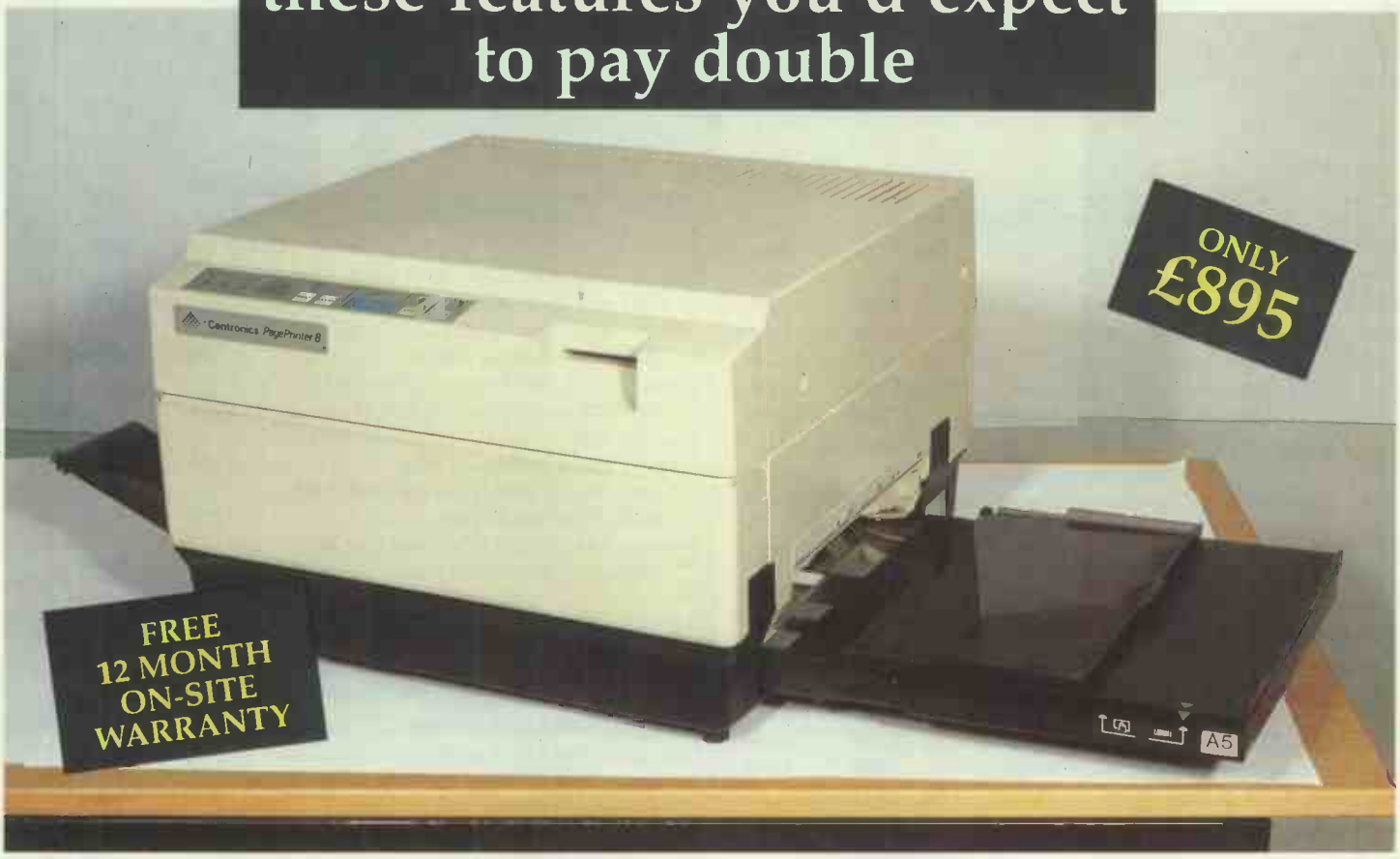
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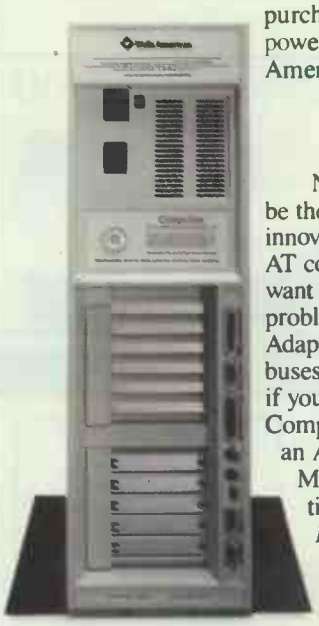


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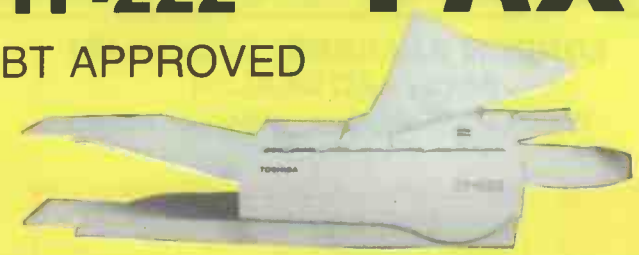
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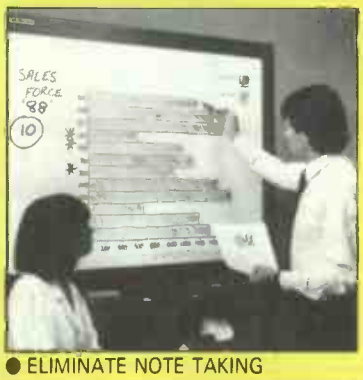
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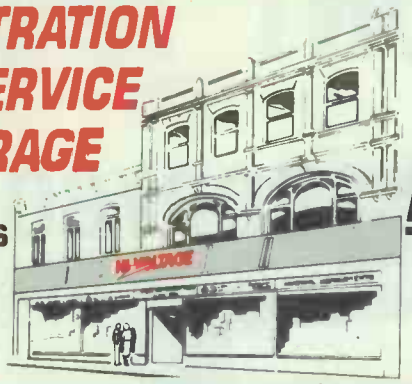
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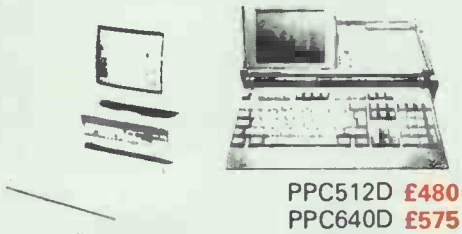
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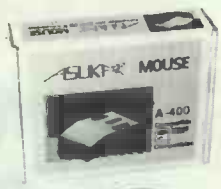
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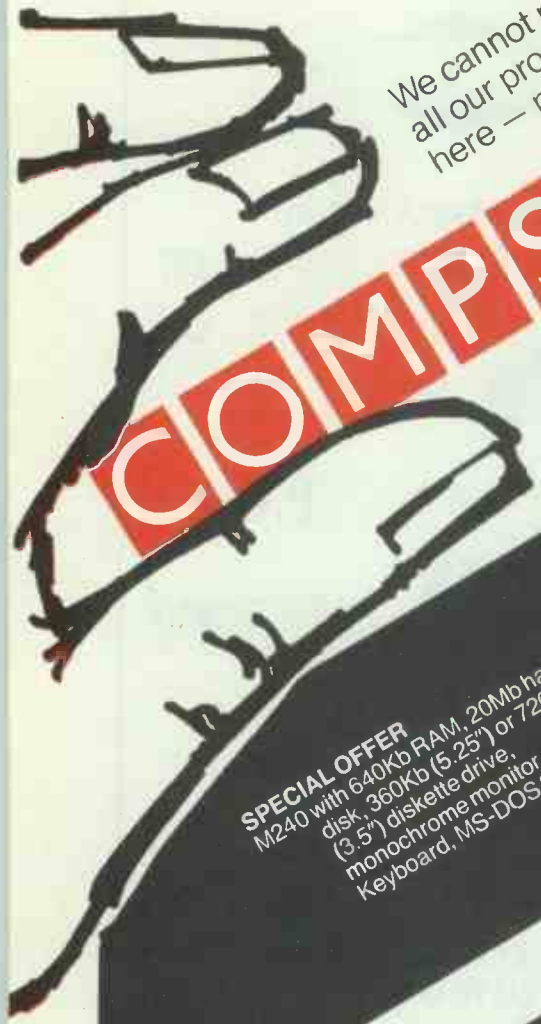
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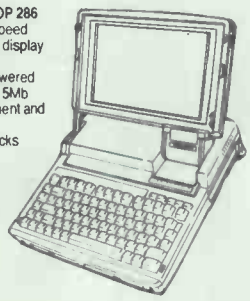


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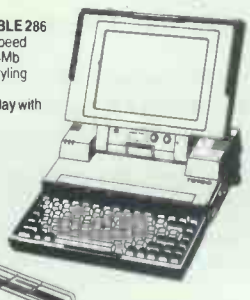
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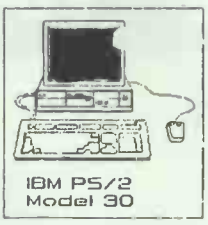
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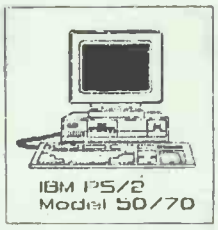
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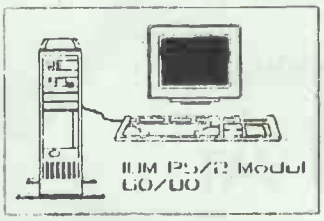
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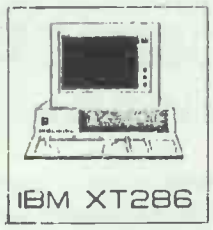
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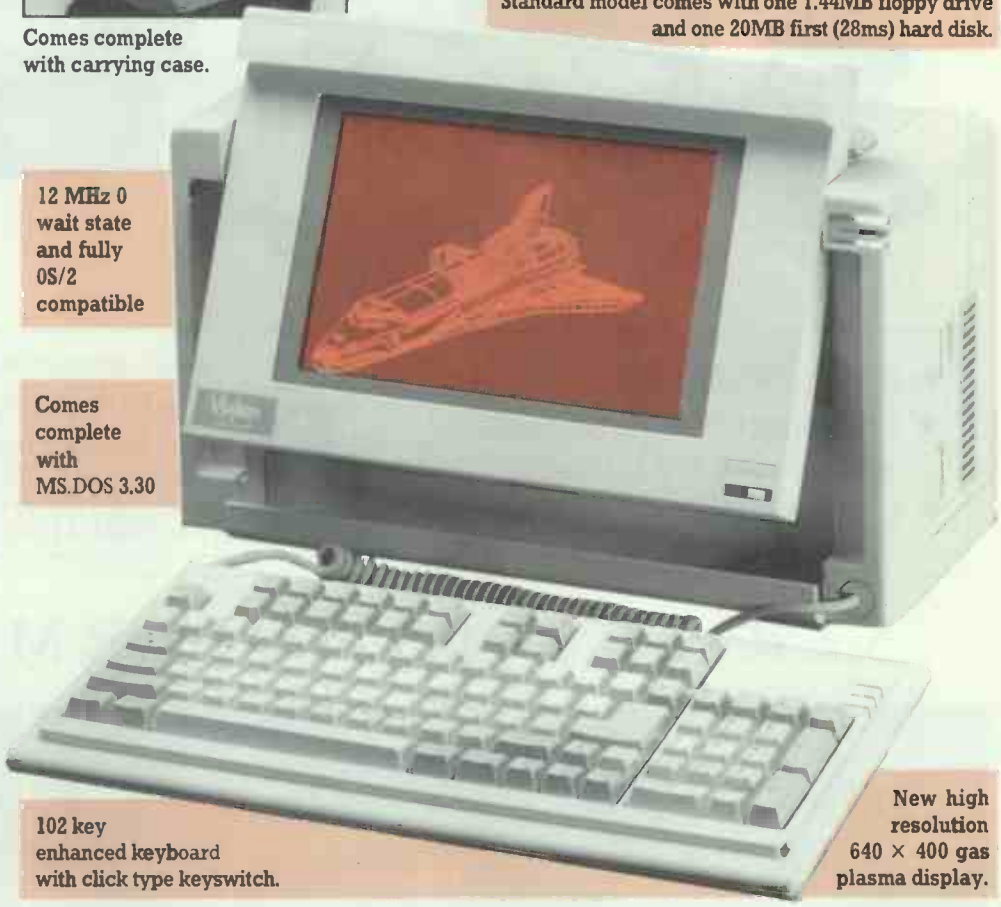
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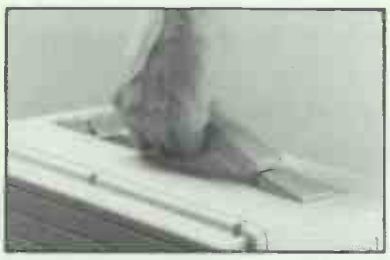
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PC-88S	V20 10MHz	640K	20MB (65mS)	360K/ 720K	1/1	4	£825	£1125	£1175
PC-286C Compact	80286 10 MHz	640K	20MB (65mS)	1.2MB/ 1.44MB	2/1	4	£1095	£1395	£1445
PC-286S	80286 12 MHz	640K	40MB (40mS)	1.2MB/ 1.44MB	2/1	5	£1275	£1575	£1625
PC-386S	80386 20MHz	1MB (max 8MB)	44MB (28mS)	1.2MB/ 1.44MB	2/1	5	£2395	£2695	£2745

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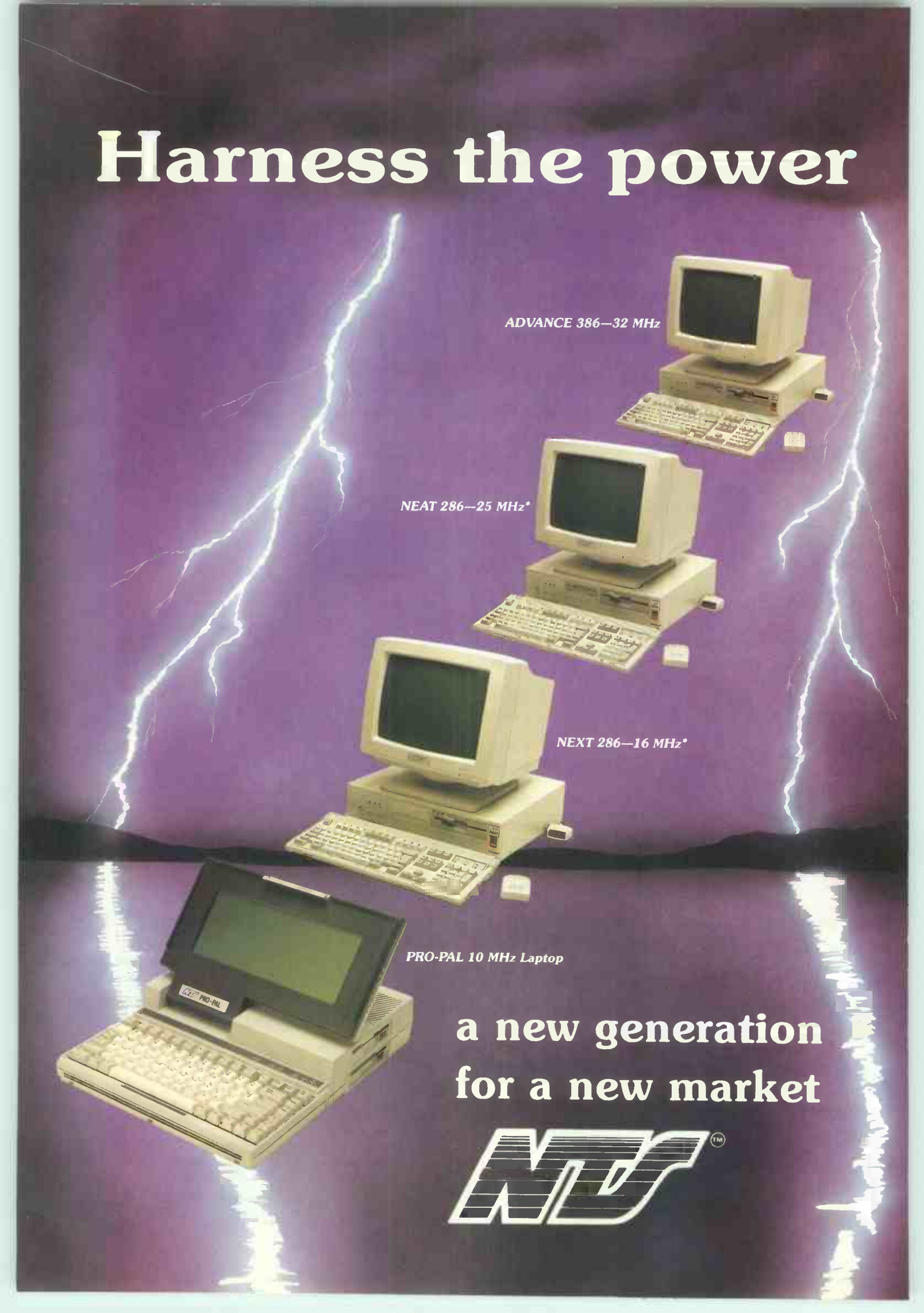
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You will find that your call receives considerate attention and that you are speaking to people with first hand knowledge about every aspect of your system.

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NTS has been a startling success story over the past three years and the company now boasts a large share of the total UK market. Such success is not easy to achieve unless you have very high standards and exceptional products. The NTS philosophy has always been to "engineer for perfection" even if the impossible is not achievable we claim to do what few other manufacturers have accomplished in giving our customers the fastest, most cost effective compatible microcomputers available. The new NEXT 286 has an unrivalled specification and is probably the fastest computer in its class world wide.

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NEXT 286—16 MHz*

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Benchmarks: Norton SI 15.3; Landmark 16.1 MHz*; Mips 1.4

Hercules Mono System **£1,299**
(VGA Mono System £1,449)
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NEAT 286—25 MHz*

80286 micro processor running at 20MHz, '0' WS equal to 26.7MHz, compact VGA system with turbo features, complete package with monitor, operating system, software, AT compatible, fitted 65Mb fast access hard disk/controller.
Benchmarks: Norton SI 23.0; Landmark 26.7 MHz*; Mips 2.15

VGA Mono System **£1,899**
(VGA Colour System £2,099)

ADVANCE 386—32 MHz

80386 micro processor running at 25MHz, '0' WS equal to 32.1MHz, compact VGA system with turbo features, complete package with monitor, operating system, software, AT compatible and 32 bit compatible. 65Mb fast access hard disk.
Benchmarks: Norton SI 27; Landmark 32.1 MHz*; Mips 3.25

VGA Mono System **£2,495**
(VGA Colour System £2,695)

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NEC V20 processor running at 10.00MHz, light weight of only 6Kg, complete with backlit supertwist display, 2 x 720K 3.5" disc drives, Serial and parallel ports, rechargeable Lead Acid battery (20 hours life), separate AC mains adaptor, operating system, carrying case and accessories.

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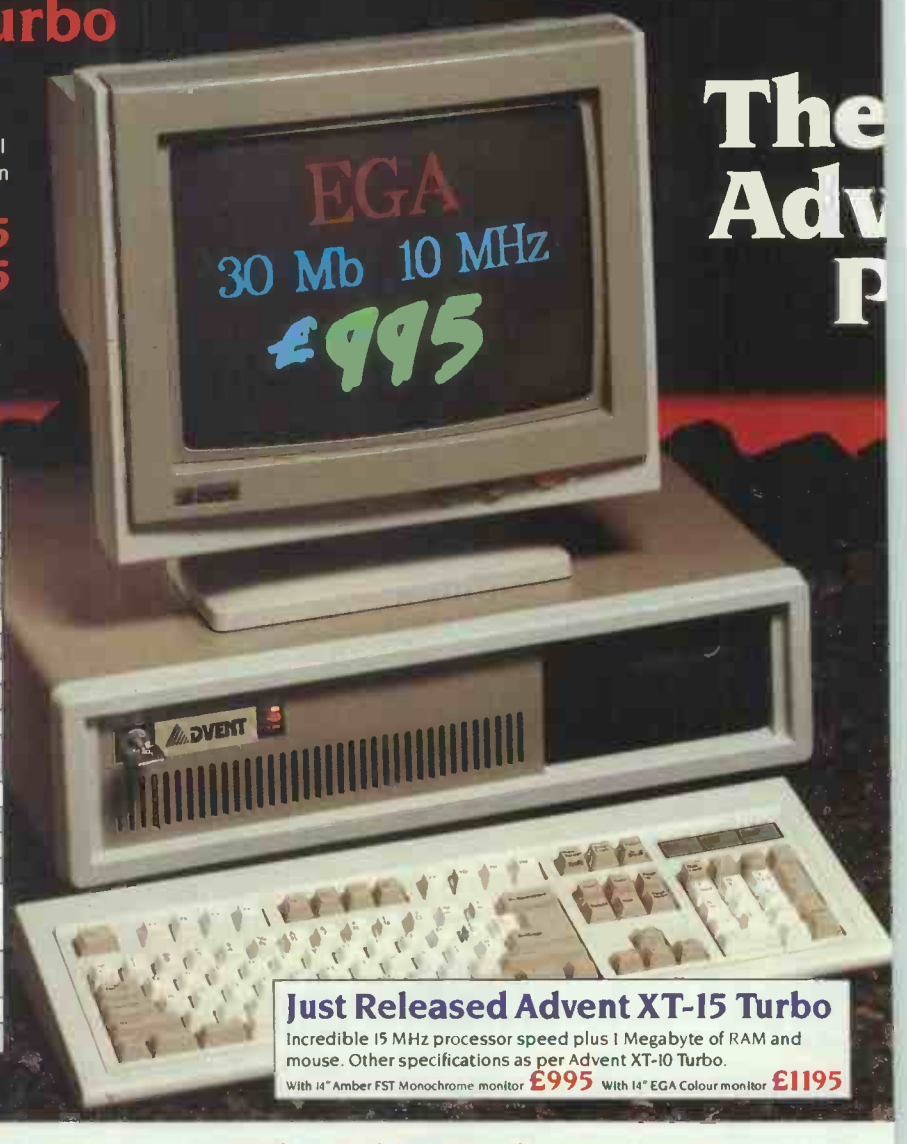
The Advent PC XT-10 Turbo is the latest version of the PC-II range, 25,000 of which have been sold in the past two years. Now supplied with 10 MHz clock speed, 30Mb hard disk and 640K RAM. MS-DOS 3.21 and GW Basic are supplied free as is preconfiguration and on-site maintenance.

With 14" Amber FST Monochrome monitor **£795**

With 14" EGA Colour monitor **£995**

Single, Twin floppy and larger Capacity Hard Disk Models plus choice of monitors available.

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PC XT COMPARISON CHART

	ADVENT PC XT-10	OPUS PC IV	OPUS PC III	AMSTRAD PC 1640	EPSON PCe
EGA Monitor	Yes 14"	Yes 14"	Yes 14"	Yes 14"	Extra
Hard Disk	30Mb	20Mb	30Mb	20Mb	20Mb
Keyboard	102 Key	84 Key	102 Key	84 Key	101 Key
Processor Speed	10 MHz	10 MHz	10 MHz	8 MHz	10 MHz
Expansion Slots	8	3	8	3	5
Drive Apertures	4	2	3	2	2
MS-DOS	Inc. Free	Extra	Extra	Inc. Free	Inc. Free
GW-BASIC	Inc. Free	£60.00	£60.00	Basic 2	£95.00
12 Months on-site Maintenance	Inc. Free	Extra	Extra	Extra	Extra
Floppy Disk	1 x 360K	1 x 360K	1 x 360K	1 x 360K	1 x 360K
System Memory	640K	768K	1024K	640K	640K
Parallel Port	Yes	Yes	Yes	Yes	Yes
Serial Port	Yes	Yes	Yes	Yes	Yes
Maths Co-processor Socket	Yes	No	Yes	Yes	Yes
Full size XT Style Case	Yes	No	No	No	No
Keyboard Lock	Yes	Yes	Yes	No	No
Rec Retail Price	£995	£995	£1395	£1249	£1179

Just Released Advent XT-15 Turbo

Incredible 15 MHz processor speed plus 1 Megabyte of RAM and mouse. Other specifications as per Advent XT-10 Turbo.

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The Advent AT-12+ is one of the fastest AT Compatible PC's available today. Main features include 12 MHz zero wait-state processor (Land mark speed test 16 MHz), 40 megabyte hard disk, 102 key AT Enhanced keyboard, MS-DOS 3.3 and GW Basic. Standard memory is 1 Megabyte which can be expanded to 4 Megabytes. All units are fully configured and ready to use and include FREE 1 year on-site maintenance contract.

With 14" Amber FST Monochrome monitor **£1249**

With 14" EGA Colour monitor **£1449**

PC AT COMPARISON CHART

	ADVENT PC AT-12+	OPUS PC V	DELL 200	EPSON PCAX2	TANDON PCA 20+
EGA Monitor	Yes 14"	Yes 14"	Yes 14"	Extra	Yes 14"
Hard Disk	40Mb	30Mb	40Mb	20Mb	20Mb
AT Style Keyboard	Yes	Yes	Yes	Yes	Yes
Processor Speed	12 MHz	10 MHz	12.5 MHz	12 MHz	10 MHz
Expansion Slots	8	8	6	6	8
Drive Apertures	4	3	4	3	3
MS-DOS	Inc. Free	Extra	Extra	Inc. Free	Inc. Free
GW-BASIC	Inc. Free	£60.00	£65.00	Extra £95	Inc. Free
12 Months on-site Maintenance	Inc. Free	Extra	Inc. Free	Extra	Extra
Floppy Disk	1 x 1.2Mb	1 x 1.2Mb	1 x 1.2Mb	1 x 1.2Mb	1 x 1.2Mb
Standard System Memory	1Mb	1Mb	640K	640K	1Mb
Max Memory on Mother Board	4Mb	1Mb	4.6Mb	640K	1Mb
Parallel Port	2	1	1	1	1
Serial Port	2	1	2	1	1
Maths Co-processor Socket	Yes	Yes	Yes	Yes	Yes
Keyboard Lock	Yes	Yes	Yes	No	Yes
Rec Retail Price	£1449	£1695	£1899	£1699	£2235

Just Released Advent AT20/26 20MHz Clock Speed

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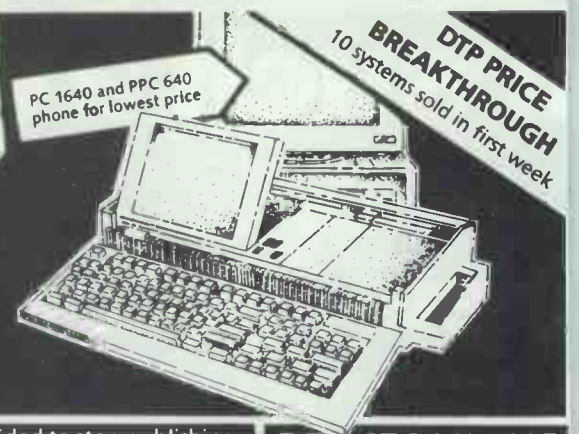
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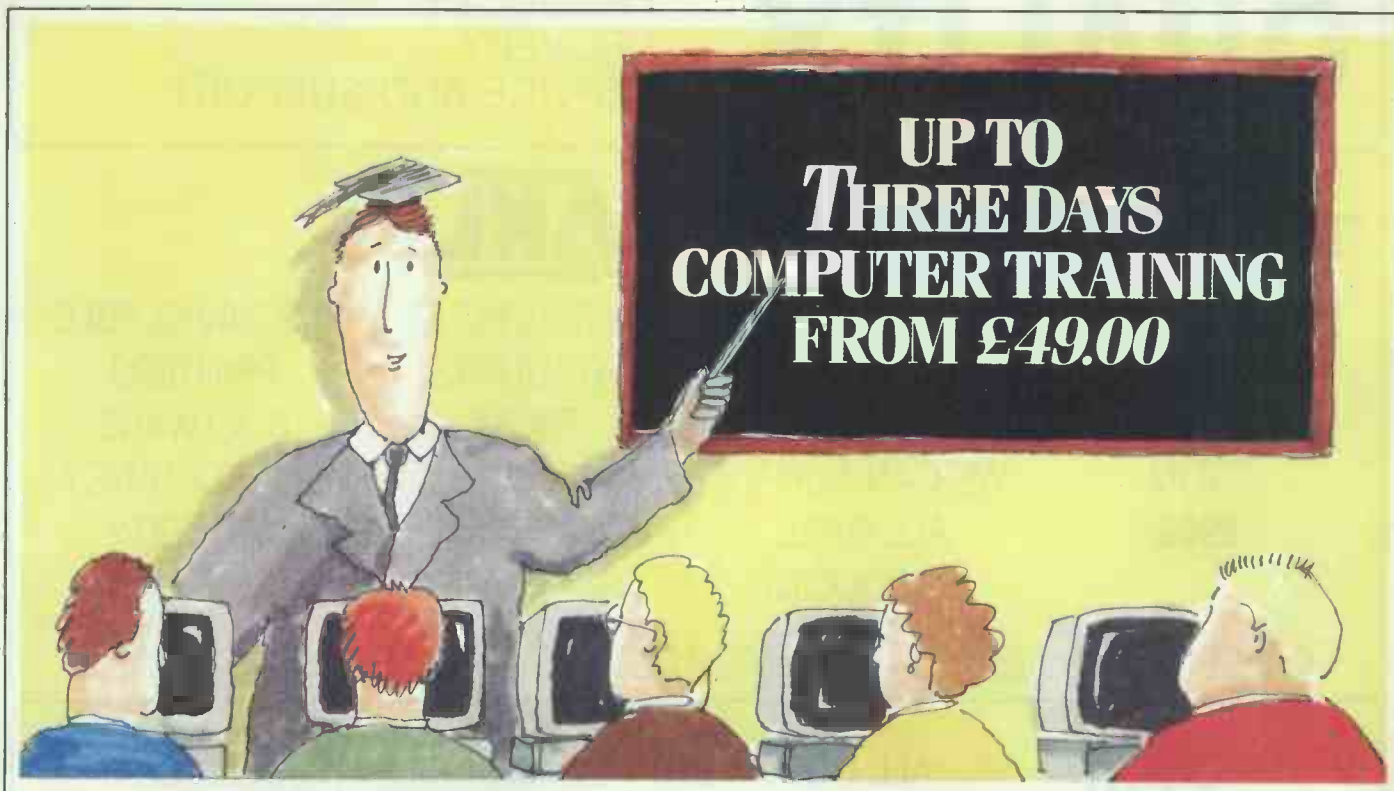
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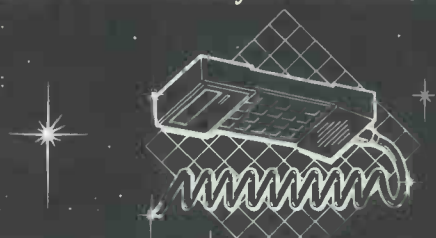
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For ATARI ST/AMIGA 500 & 2000 – scans an A4 page in 11 seconds includes comprehensive software package – Interfaces directly to Printer Port – (Atari version: Supports Atari Laser printer and includes GDOS Driver for the Thermal Printer – Also supports nearly all ATARI File Formats) **£395**



NEW! – 400 DPI HANDY SCANNER FROM DFI

We offer two types of hand Scanners for **IBM PC/XT/AT, Model 25/30** and compatibles – each package includes a short interface card, **SCAN** utility software and **FREE HALO DPE** (Desktop Publishing Editor)

HS-3000: 100, 200, 300 & 400 DPI user selectable – 32 quasi tones (half tones using dither patterns) – Ideal for OCR. **£169**

HS-2000: 200 DPI – 16 quasi tones – otherwise as HS-3000 **£139**

CARETS BY HAND OCR SOFTWARE FOR HANDY SCANNERS
CAN CONVERT AN A4 PAGE OF TEXT TO ASCII – PHONE FOR DETAILS NOW!

INTRAL PRO LASER EII – LASER PRINTER



8ppm, 1 Mbyte memory, RS232/Parallel as standard, 27 Fonts built in, Small Footprint. Many downloadable Fonts available (can also use HP Laserjet Font Cartridge) Emulations: HP Laser Jet+, IBM Proprinter, Qume Sprint11, Epson FX80, Diablo 630 and NEC Spinwriter. **£CALL**

DTK produce a variety of high quality interface cards and Mother Boards. We stock a selection of popular cards at reasonable prices as shown below:–

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DTK RS232 Dual Port	£23
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DTK 10Mhz XT Turbo Mother Board	£65
DTK 10Mhz Multi XT Turbo, Herc./CGA, Par/Ser, Floppy, Clock & Games Port includes case & power supply	£299
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Flycom 8255 I/O Card (48 I/O Lines & Timers)	£42

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Unit 2, Clive Way (off Colonial Way)
Watford WD2 4PX
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386 AT SYSTEM: *incorporates Intel iSBC386 motherboard*

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2.5Mb RAM system + 20Mb HD £1699
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RPTI-NET Short Card Network Adaptors

★ Easy to instal ★ Easy to use ★ Low Cost

These easy to instal and use LAN adaptors offer complete solution for networking on PC/XT/AT/PS2-30 and compatibles at budget prices. You will be surprised at the simplicity with which the network can be installed and simple menu driven software enable even a novice to have a system up and running in no time.

★ On-board CPU and LAN processor
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★ File & Record Locking features as standard
★ No need for a dedicated file server
★ Inter-network messages can be sent and received
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★ Optional utilities for *E-Mail, Remote Boot, Screen Monitor*

RPTI-1000
1 Mbits/sec data rate
R1000-001 Std Adaptor (includes Network OS, User manual and 3m cable) **£129(b)**

R1000-003 Starter Kit
(includes complete kit for setting up a 3 station evaluation network) **£375(a)**

We can also offer Advanced Trans Net 10 Mbits/ Sec intelligent network adaptors. Please write for details.

RPTI-3000
10Mbits/sec Ethernet based system
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Genius Scanner

Free Genius Scanner Utility and Dr Halo III Software

★ Read width: 105mm
★ Pixel Density: 200dpi (8 dots/mm) Horizontal, 256/512/840 dots per line
★ Adjustable switches for Brightness and Contrast
★ Gray Scales: Black & White, 16 Scales
★ Interface Board: for IBM PC/XT/AT, PS/2–30 and compatibles
★ Suitable for Hercules, CGA, EGA, and VGA Display

OCR Supported: scan the text images to OCR format and use OCR software to convert the images to text files.
Extensive supports for image format: images created can be transferred to Dr Halo III, MS Windows, GEM, Ventura, Pagemaker . . . etc.



£149(a)

Multi-Window Scanning: open multiple windows on screen and scan images into these windows.
Transparent Overlapping: place one image on top of another to adjust and edit without any image degradation.
Shading Variations: Allows you to process the image to achieve the appearance you want.

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PPC 640DD 2×3.5"+Int. Modem	£619(a)
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8087-8	£105(b)	80287-8	£190(b)
8087-10	£160(b)	80287-10	£220(b)
80387-16	£325(b)	80387-20	£430(b)

PROCESSORS

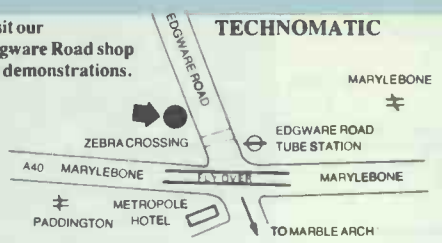
V20-5 (8088)	£10(d)	V30-5 (8086)	£10(d)
V20-8	£12(d)	V30-8	£12(d)
		V30-10	£20(d)
80386-25MHz			£420(b)

POINTING DEVICES

MicroSoft Mouse *(bus or Serial)*	£99(b)
Microsoft PS2 Mouse	£149(b)
Genius GM6+ Mouse	£35(b)
Genius GM6000 (2 or 3 button operation)	£55(b)
Genius GM-U2 (PS2 or Serial, Port)	£61(b)
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FX850	£319(a)	EX1000	£579(a)	LQ500	£285(a)
LQ850	£439(a)	LQ1050	£599(a)	LQ2550	£995(a)

DFX5000 Heavy Duty Line Printer £1249(2×a)

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Philips 7513 12" Green £75(a)
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Seagate ST225 20Mb 65ms £165(b)
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Hitachi DC521 40Mb (24ms) £399(b)
Fuji file card £259(a)
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The EPROM Writer card is suitable for PC, XT & AT machines. It is a short card with an external Textool ZIF socket which is housed in a metal case. Controlled by menu based software, it requires at least 256K of free Ram.
Eproms supported:– 2716, 2732(A), 2764(A), 27128(A), 27256(A) & 27512(A). £90.00(a)

DIGITISING TABLET GT-1212

- ★ Low cost digitising tablet compatible with PC/XT/AT/PS-2.
- ★ Will work with most CAD systems incl AutoCAD, VersaCAD etc and MS Windows.
- ★ Allows tracing & free hand drawing using 4 button puck.
- ★ Fully compatible with MS & PC mouse
- ★ 12"×12" drawing area.
- ★ 1000 lines/in resolution, ±0.01" Accuracy
- ★ RS232 interface, switch selectable baud rate 150/19200.
- ★ Tablet fitted with adjustable flip stand
- ★ Software includes AutoCAD menufile and template, Genius MenuMaker/Library
  Dr Halo III professional graphics package
- ★ Full specification on request £375(a)

★★SPECIAL OFFER★★
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Offer valid whilst current stocks last

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Star LC10 £179(a) Star LC10 Col £229(a)
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Nat Panasonic KXP1081 £145(a)

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Integrex Inkjet Colour Printer £515(a)

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(includes 12 months on site warranty) £1349(a)
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PLOTTERS

Authorised ROLAND STOCKISTS

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DXY1100 £675(a) DXY1300 £1125(a)
Hitachi 672XD A3 Four Colour Plotter £499(a)

BUFFERS/SHARERS/CONVERTERS

TSB 256 Auto Sharer/Buffer
256K buffer with 3 input ports. Each port scanned automatically every 10 secs until data found. PAUSE, COPY and RESET Facitilies.
Full spec on request. £169(a)

Smart Printer Buffers
Facilities include: COPY upto 265 copies PAUSE, RESET, Self-Test.
For serial: X-on/X-off, ETX/ACK or DTR/DTS protocols independently selectable baud rate for each port

PP256 256K Parallel buffer £169(b)
SS256 256K Serial buffer £189(b)

Parallel Multi-Spoolers
Allows connecting 2 printers to 2 or 4 computers
Butter allows quick dumping of data to free the computers
COPY allows upto 999 copies, SELF-TEST, PAUSE, CLEAR

MS422 4computers/2printers 512K buffer £299(b)
MS223 2computers/2 printers 256 K buffer £199(b)

Auto switching Printer Sharers.
Allows 2, 4 or 8 computers to share 1 printer
Auto Self Test, READY and BUSY indicators

	Parallel	Serial
2 input/1 output	£49	£49(c)
4 input/1 output	£59	£69(c)
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Both parallel and serial sharers fitted with 25 way D Connectors

Serial/Parallel/Serial Converters
Compact economical converters which support X-on/X-off, ETX/ACK, DTR/DSR protocols

C-PS Parallel/Serial converter £35(c)
C-SP Serial Parallel converter £35(c)

Add £49 to above prices for units with 64K butter

Manual Printer Sharers:

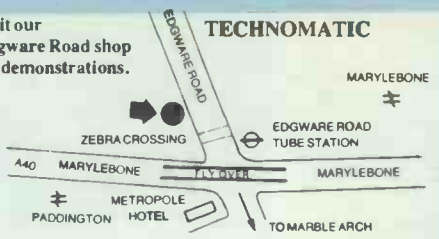
(All lines are switched).	Parallel	Serial
2 computers to one printer	£25(c)	£25(c)
3 computers to one printer	£39(c)	£39(c)
4 computers to one printer	£45(c)	£45(c)
2 computers to 1 or 2 printers	£49(c)	£49(c)

Cable sets for above sharers available for all popular computers

Detailed Catalogue on Printer Sharers available

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Full Borland range in stock.

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A range to suit all requirements and offering good value for money. Fully compatible with Microsoft Mouse.

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- ★ Comprehensive menu Library
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- ★ Mouse mat & cutting pad
- ★ Plastic Mouse pocket

Ideal as a gift

Type:	GM6+	GM6000	GM-U2
Res:	22-200	22-700	22-700
Interface:	RS232	RS232	PS2 Port/RS232
Price:	£35(b)	£55(b)	£61(b)

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Compact Two Way Switch 2 computers to 1 printer or 2 printers to 1 computer Attaches to the side of a computer or a printer **£23(c)**



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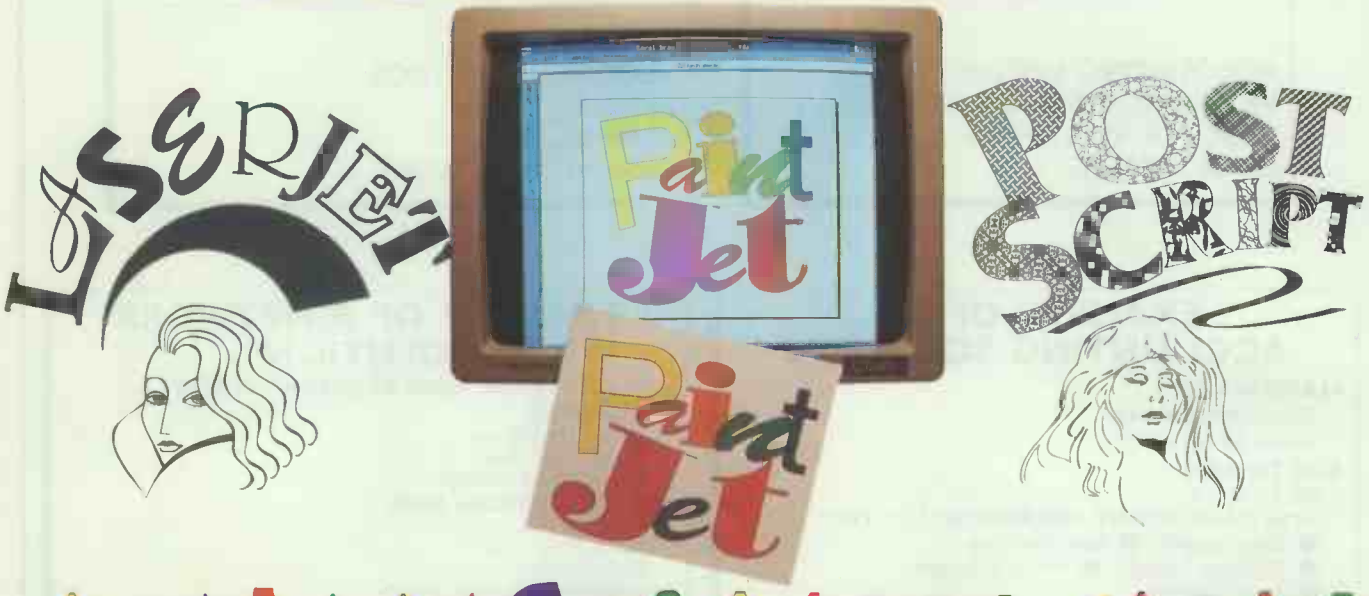
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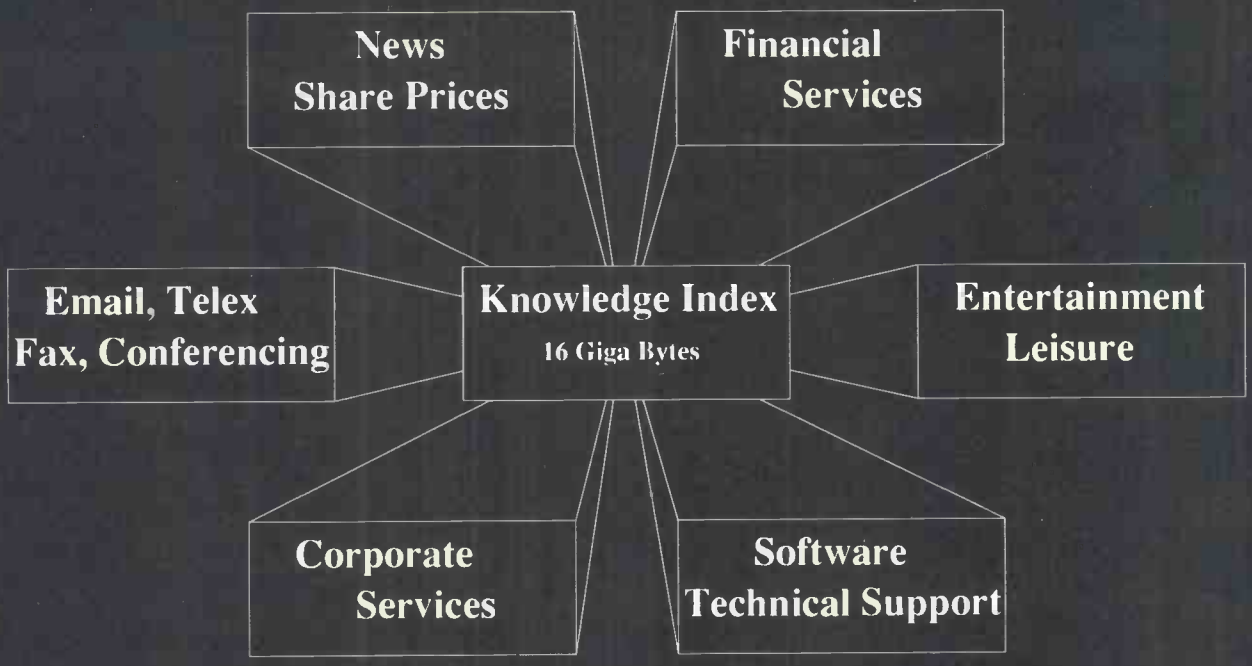
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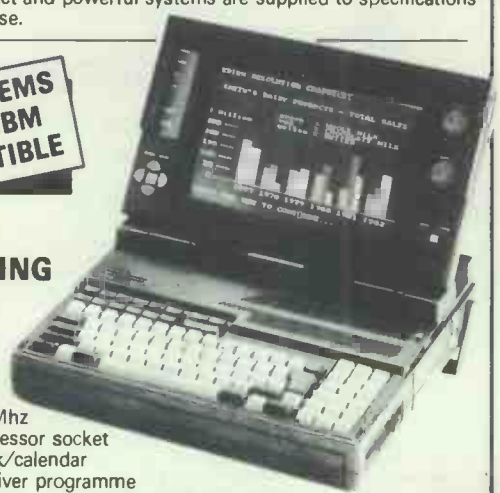
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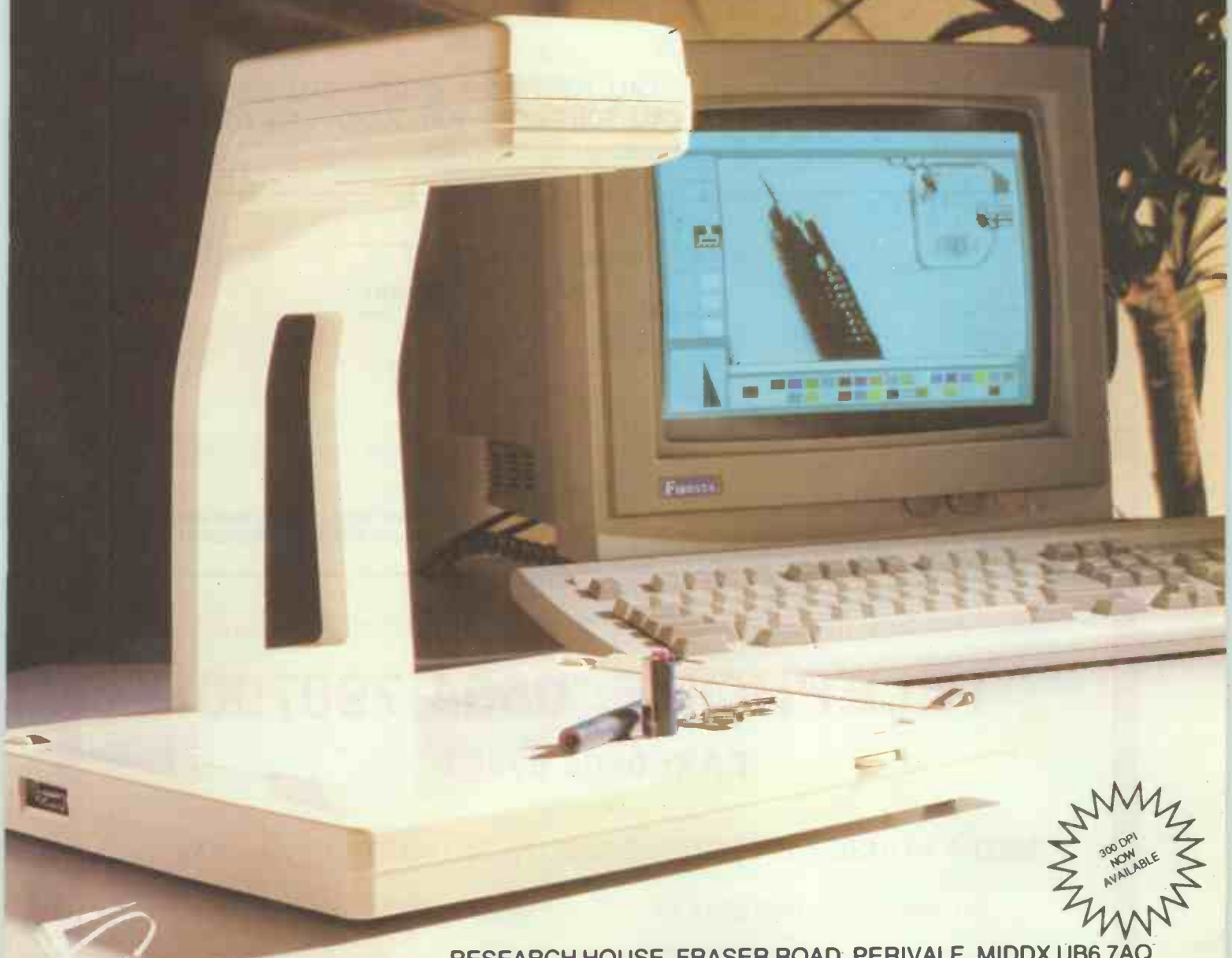
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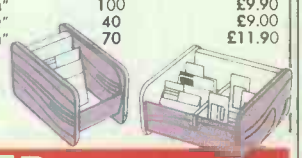
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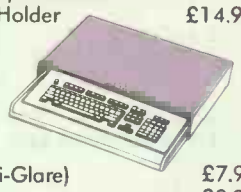


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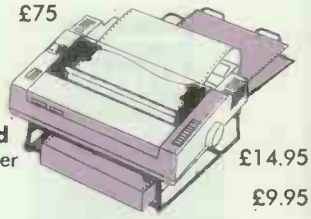


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EPSON GQ-3500	6PPM	*	£1099
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KYOCERA F-1200	10PPM		£2479
KYOCERA F-2200	10PPM		£3389
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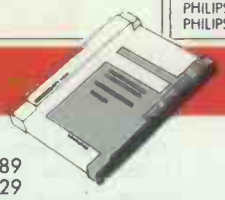
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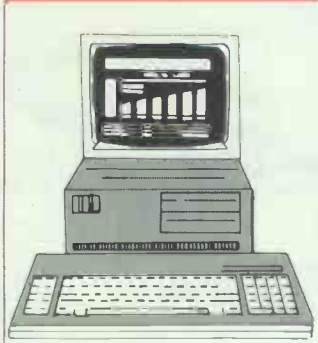
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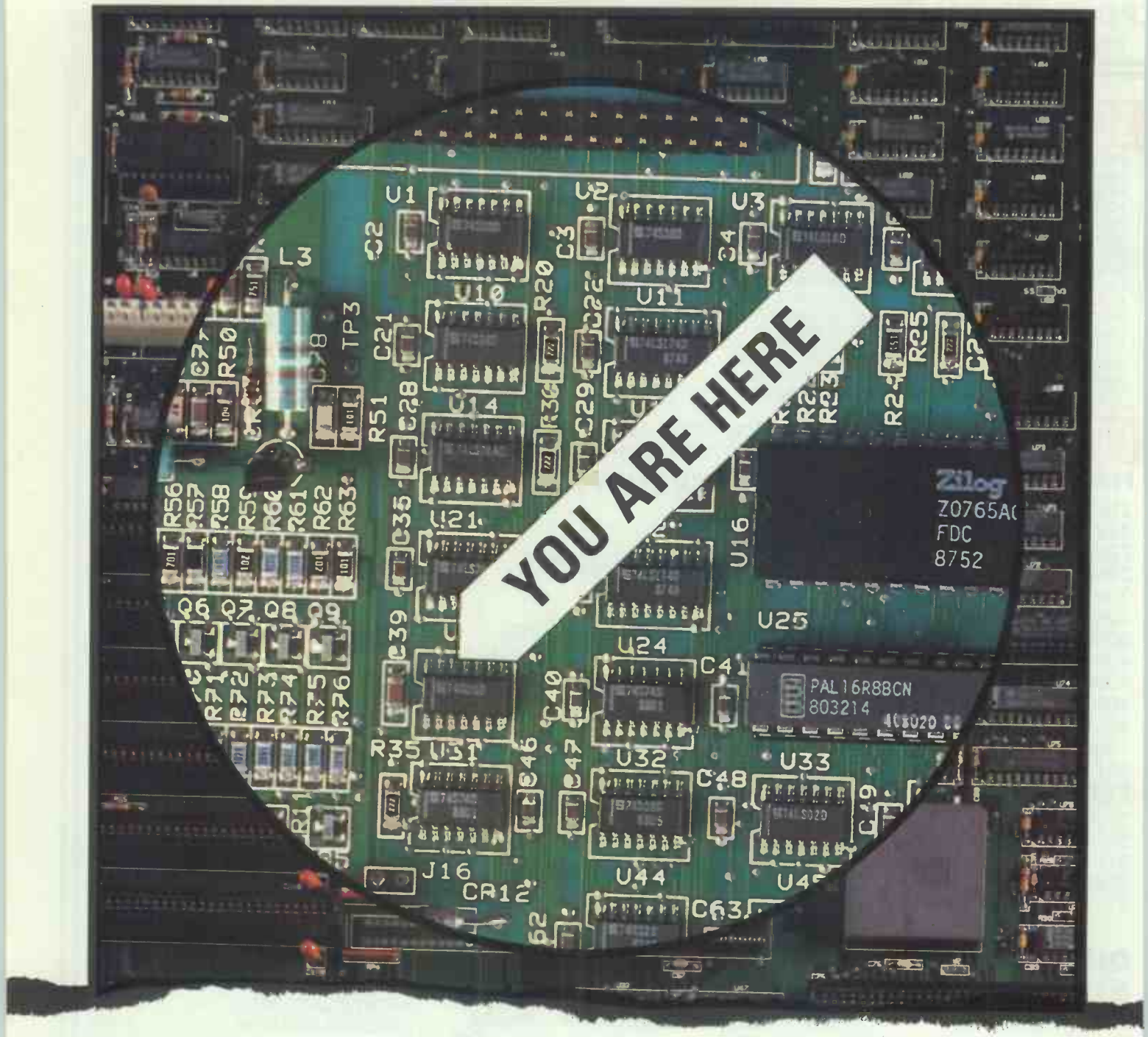
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REXEL QUALITY LOCKABLE BOXES			
LB40-5	40 Cap inc Disk Pen	11.25	10.95	10.50
LB50-5	50 Cap inc Disk Pen	12.85	12.55	12.30
LB90-5	90 Cap inc Disk Pen	15.40	14.90	14.40
LB100-5	100 Cap inc Disk Pen	17.75	17.25	16.75

PAPER · Continuous Fanfold

				£
PAP13	8"x12"	60g	2000 sheet Plain	15.99
PAP1	11"x 9.5"	60g	2000 sheet Micro Perf	11.45
PAP17	11"x 9.5"	80g	2000 sheet Micro Perf	16.25
PAP11	11"x 9.5"	50g	1000 sets NCR 2 Part	17.99
PAP21	11"x 9.5"	50g	700 sets NCR 3 Part	20.99
PAP2	A4 Bond	70g	2000 sheet Micro Perf	16.49
PAP28	A4 Bond	80g	1750 sheet Micro Perf	17.90
PAP3	As above for Epson FX80 (2000 Sheet)			22.75
PAP4	A4 Bond	90g	1500 sheet Micro Perf	16.99
PAP5	11"x12.8"	60g	2000 sheet Plain	16.99
PAP6	11"x14.5"	60g	2000 sheet Plain	16.49
PAP10	11"x14.5"	70g	1750 sheet Plain	18.25
PAP14	11"x14.5"	50g	1000 sets NCR 2 Part	24.25
PAP9	12"x 9.25"	60g	2000 sheet Micro Perf	14.99

Micro perforated paper allows feed hole removal leaving clean smooth edges.

LABELS · Continuous Fanfold

				£
LAB7	69mmx36mm	3 on web	12000 labels	31.20
LAB11	70mmx36mm	1 on web	4000 labels	19.82
LAB14	89mmx23mm	1 on web	2000 labels	7.53
LAB9	89mmx36mm	1 on web	2000 labels	10.08
LAB2	89mmx36mm	1 on web	4000 labels	14.67
LAB1	89mmx36mm	2 on web	8000 labels	27.66
LAB10	89mmx49mm	1 on web	3000 labels	16.42
LAB8	102mmx36mm	1 on web	2000 labels	10.74
LAB5	102mmx36mm	2 on web	8000 labels	28.60
LAB12	102mmx36mm	2 on web	2000 labels	11.90
LAB6	102mmx36mm	3 on web	12000 labels	39.16
LAB16	102mmx48mm	1 on web	2000 labels	13.80
LAB15	102mmx48mm	2 on web	2000 labels	15.43
LAB13	112mmx48mm	1 on web	2000 labels	15.71

Labels are from a quality manufacturer on light backing paper.

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		Unit Price £ 3+	6+
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R298	Brother HR15/25/35/CE50/EM200	1.71	1.60
R417	Olivetti ET110,111,115,116	4.08	3.81
R274	Olivetti ET121,201/21/31,351	2.01	1.88
R274	Silver Reed EX55	2.01	1.88
SINGLE STRIKE RIBBONS			
R262	IBM5201 Quietwriter Original	8.08	7.52
R493	IBM5202 Quietwriter 3 Original	8.56	8.37
R276	Juki 6100 Black (Pink Hub)	1.23	1.16
MULTI-STRIKE FILM RIBBONS			
R497	Amstrad 8256/PCS12 Long Life	3.47	3.24
R534	Amstrad 9512	2.04	1.91
R365	Brother HR10/15/25/35/CE50/EM200	2.06	1.92
R277	Juki 6100 Blue Hub	2.87	2.68
R270	Mannesmann MT80	2.67	2.50
R430	Mannesmann MT85/87 Original	5.59	5.20
R507	Olivetti ET110/1/5/6	6.31	5.86
R325	Qume Sprint 3/5 12/20 Quickload	1.46	1.36
R296	Qume Sprint 7/9/11 IV	2.00	1.87
R273	Ricoh 1300/1600, Flowriter	1.86	1.74
R364	Silver Reed EX55/77	2.40	2.25
FABRIC OR NYLON RIBBONS			
R473	Amstrad 8256/8512/LQ3500	3.44	3.21
R453	Amstrad DMP2000/3000/3160	1.92	1.80
R536	Amstrad DMP4000/1512	3.38	3.16
R279	Apple Imagewriter	2.88	2.69
R299	Brother HR10/15/25/35 CE50/EM200	2.65	2.48
R388	Brother M1009/1109	2.35	2.21
R474	Brother M1509/1709 (Large)	5.36	5.00
R279	C.Itoh 1550/8510	2.88	2.69
R361	Canon PW1080A/1156A, A50/5	2.51	2.36
R312	Canon PW1080A/PW1156A, A50/5 Orig.	7.66	7.50
R464	Citizen 120D Original	3.63	3.40
R367	Commodore MPS801/802	2.15	2.01
R368	Commodore MPS803	2.35	2.21
R385	Commodore MPS1000	2.07	1.94
R368	Commodore VIC 1515	1.83	1.71
R549	Epson EX800/1000	3.87	3.62
R278	Epson FX80/85, LX/FX800/805, MX/RX80	2.49	2.33
R287	Epson FX/MX/FX100/1000/1050 Large	3.12	2.92
R434	Epson LQ500/800/850	2.69	2.51
R477	Epson LQ1000/1050 Large	3.20	2.99
R328	Epson LQ1500	2.35	2.21
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R537	IBM 4207 Proprinter X24 Original	5.77	5.37
R527	IBM 4208 Proprinter 24XL Original	8.00	7.44
R354	Mann. MT85/87(Large)Orig.(5 min)	3.89	3.63
R268	Mann. MT86/88(Large)Orig.(5 min)	5.15	4.81
R265	Mann. MT100/110/120/160 (Large)Orig	4.83	4.51
R371	Microline 182/192/193 Original	5.94	5.53
R335	NEC 2200 Original	5.87	5.46
R279	NEC 8023	2.88	2.60
R445	NEC Pinwriter P1/2/6	3.58	3.35
R480	NEC Pinwriter P3/7 (Large)	4.28	4.00
R481	NEC Pinwriter P5/P5XL/P9XL	4.08	3.81
R448	Panasonic KXP1090/1/2,1080	2.70	2.53
R290	Qume Sprint 3/5	2.35	2.29
R376	Qume Sprint 7/9/11 IV	2.56	2.40
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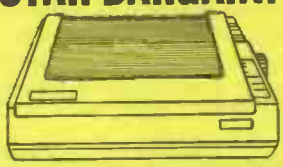
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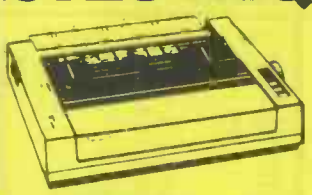


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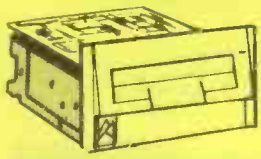
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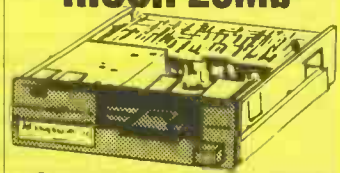
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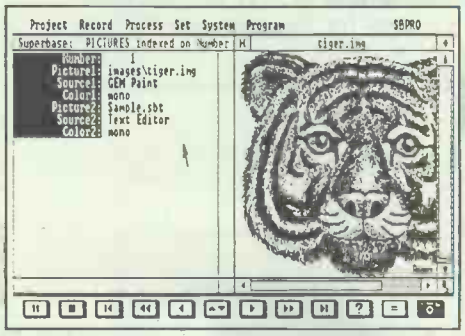
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Advanced features of the Pentax OCR software include column detection, ability to read touching characters and the facility to teach new fonts in various languages.

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3½→ ←5¼ SOFTWARE TRANSFER

3½" Internal upgrade for IBM PC's and Compatibles

To read by the stream of press releases that come into the PCW editorial office, you'd think that making a PS/2-compatible machine required no more than taking an ordinary PC-compatible and fitting it with 3½" disk drives.

To our rescue has come a wonderful product from Citadel — a £129 3½" floppy disk drive in a 5¼" format chassis that slips into a spare drive slot on a PC and uses standard power and data cables.

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 3½" 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 A'T' 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 dicks 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 3½" drive as E: rather than B: I now have no problems with any DOS operation. D. COHEN

(Reprinted from PCW December 1987)

FLOPPY DISK DRIVE UPGRADES

PC XT & CLONES

D357K	720K 3.5" SONY or TEAC in 5.25" frame	£129
FD235HFXT	1.44Mb 3.5" TEAC in 5.25" frame with controller card for two drives to replace existing card. (Not for Amstrad)	£199
FD55BR	360K 5.25" TEAC second drive. (Not for Amstrad)	£79
CHXT1.2	1.2Mb 5.25" CHINON with controller card for 2 drives to replace existing card (Not for Amstrad)	£159

PC AT & CLONES

FD235HF	1.44Mb 3.5" TEAC in 5.25" frame for AT with 1.44Mb BIOS support. Please check your manual for 3.5" 1.44Mb BIOS support. (Later Tandon models etc.)	£149
FD235HFC	1.44Mb 3.5" TEAC in 5.25" frame with controller card for 2 drives for old model AT with no BIOS support. Old controller card must be replaced and separate hard disk controller fitted	£199
F506	1.2Mb 5.25" CHINON second drive	£99

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EW901	EPROM prog., Single gang, 2716 to 27512, 12.5v to 25v	£129
EW904	EPROM prog., 4 gang, as above	£179
EW910	EPROM prog., 10 gang, as above	£249
PAW401	PAL prog., MMI, TI & NS 20 & 24 pin types	£275
UPW48	8748/9, 8741/2, Eprom Vers. of Intel UPI-41/42, MCS-48/49	£179
Software Features (All models)	Load from disk, save to disk, display data, modify data, print data, blank check, read, write (program) verify device and display errors. Load any length of data to specific device address. Split any combine Eproms (i.e. 2764 + 2764 = 27128). Software utility to convert HEX files into BIN files (Intel, Motorola and Tektronics).	
ERASI	Eprom eraser. Large 17 eprom capacity. Variable 60 minute timer	£99

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PC1	RS232/Clock/Calendar. for XT Battery backup. COM1 or COM2	£39
PC4	Memory card for XT. Expand from 256K to 640K	£39
EMS2/OK	EMS card for XT. Expand from 1Mb to 3Mb. Uses 256K Dram	£89
PC10/OK	2Mb Extended memory card for AT. With serial and printer port	£129
PC15/OK	3Mb Extended memory card for AT	£99
PC3	XT multi function. With serial/printer/clock/calendar/games	£69
PC5	As above + floppy disk controller	£79
1200C	V22 modem. 1200/1200 full duplex. Short card. (Not approved)	£79
TR-3000	RPTI Ethernet card. 10Mbit/sec. Thin wire coax. new short card Software included free, includes drivers for Novell or IBM Netbios. Ideal for dBase 3+, Pegasus, Smart etc.	£199

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PC7002	XT Motherboard. 4.77/10MHz. NEC V20. 256K Ram and legal Bios (Norton SI 3.7 and Landmark 4.3 MHz-AT)	£169
PC3001B	AT Motherboard. Directly replaces XT Board. 6/10MHz. 80286. 512K Ram. Special Bios with setup which supports 3½" drives up to 1.44Mb (Norton SI 11.2 and Landmark 13MHz-AT)	£499
PS7025	150W XT Power supply. IBM compatible connectors	£79
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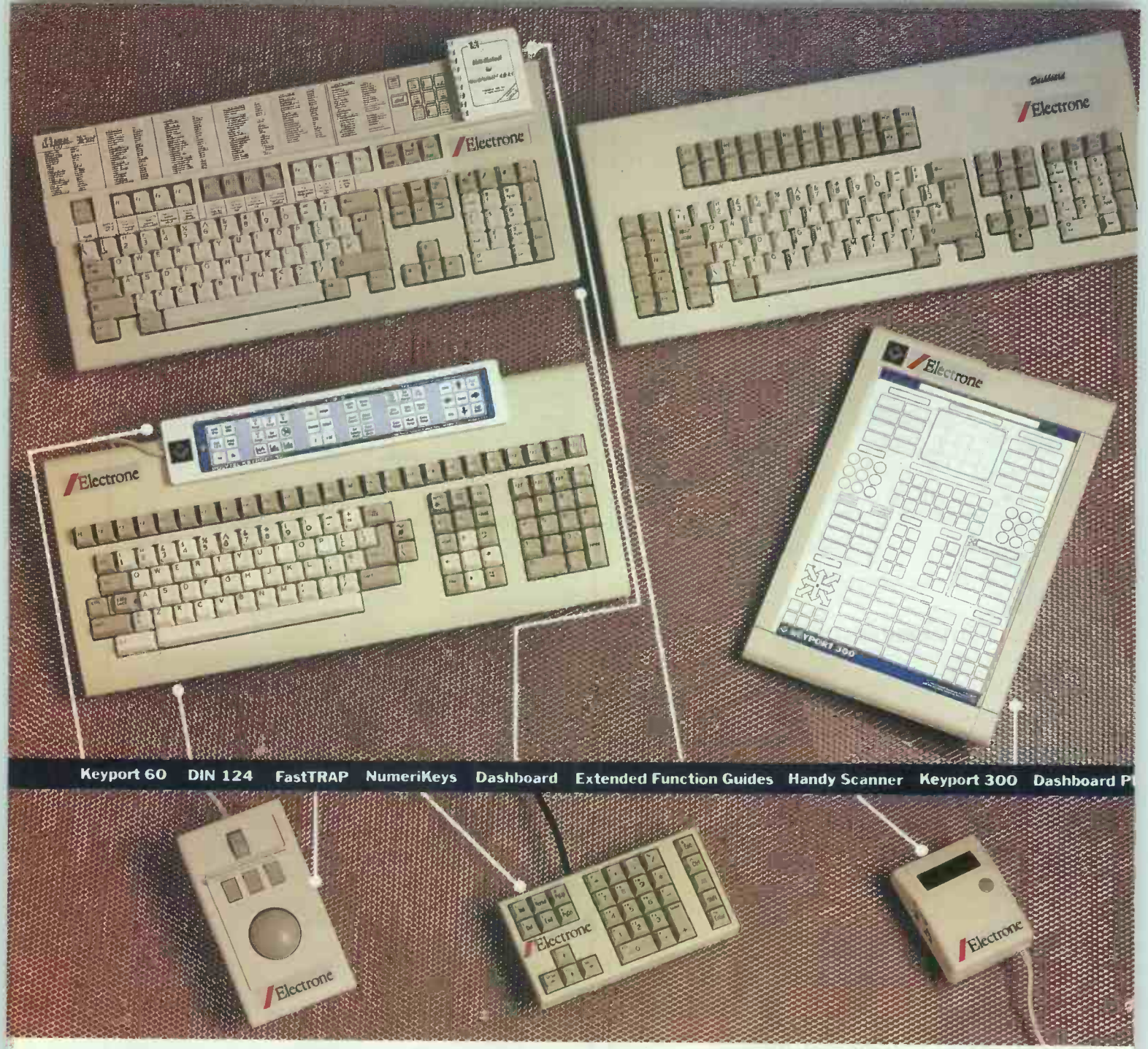
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NEWSPRINT

Scraping the OS/2 barrel

IBM has finally delivered its Extended Edition of OS/2, the operating system of its future. Initial reaction — believe it or not — was sceptical. People said things like 'So what?' and 'I don't need it,' and even 'What does it do that other machines can't?'

In order to prove that IBM knows more about windows, mice, operating software and how to bring them all together, the company recently invited me to a seminar. Together with other 'leading journalists' I was encouraged to listen to a man from Lotus, a man from Borland, someone from Microsoft, and someone from Micrografx.

The man from Lotus assured us that he was working on a truly wonderful product called Notes (except that it wasn't) which would be out 'sometime in our lifetime' (no, I'm not joking, I'm quoting). He was unable to say what the product did, why it needed Presentation Manager, or which bits of Presentation Manager it used.

The man from Borland told us about SideKick PM. This is just like SideKick, except it works under Presentation Manager under OS/2. Which is a little like saying 'it's like hobnail boots, but designed for horses who will be walking on cotton wool.' SideKick is a program, almost essential for users of PC-DOS machines (which can only run one program at a time) because you can pop it up whenever you need an editor or a calculator or a comms program or a diary. Under OS/2, you can run as many programs as you need, so who needs SideKick?

The man from Microsoft was very convincing, and persuaded me that whatever IBM had with OS/2 (Extended Edition) on its own PS/2 range would be available from Microsoft as MS OS/2 to run on other machines. That did rather leave unanswered the question: 'What exactly does IBM have?'

The man from Micrografx persuaded me that his company's painting and drawing tools would be absolutely essential for anybody who was pioneering enough to install OS/2 on a PS/2 machine. And also, he had a useful set of programs which would assist anybody faced with the hefty task of taking a Windows-based program and converting it to be a PM program.

Perhaps I should also mention Digital Research. It's major product, Gem, underlies one of the most successful desktop typesetting products around — Ventura. And Digital Research convinced me that it would be very happy converting its Gem software so that it was actually PM software.

There are times when a lofty silence is far more impressive than a powerful argument. With IBM's latest big weapon in the fight against Apple, the Windows-based Presentation Manager, the lofty silence was all too clearly wearing thin. So IBM decided to go for the powerful argument.

Now, it would be unkind to say that the two days I spent at Hursley Park, IBM's biggest UK research lab, were a waste of time.

But what I did not learn was what IBM was hoping to persuade us — that IBM's software enhancements to its newest PS/2 series are about to sweep all the users of the world away in an irresistible storm of enthusiasm.

What I heard sounded very much like the sound of scraping, coming from deep inside an empty barrel.

Frankly, to pretend that all this was new, was futile. All it could possibly say was what was said a year and a half ago, when IBM launched the PS/2: that by 1989 we would have something that actually matched the Apple Macintosh in its simplicity for the non-expert user — and maybe exceeded it in being able to run more than one program at a time.

It is more than two years, however, since I sat through a very, very much more impressive seminar in Eastbourne, held by Commodore.

The Amiga development team showed us a genuine multi-tasking operating system. They showed us how a programmer would write code for it. How you could make your message pop up in a window, how you could recognise what the user was doing with the mouse, and how to make your program easy for an Amiga owner to understand. How a program would load in whatever memory was available, even if it was scattered throughout the memory map of the machine in fragments. And how the system would expand as newer and faster, cleverer chips became available.

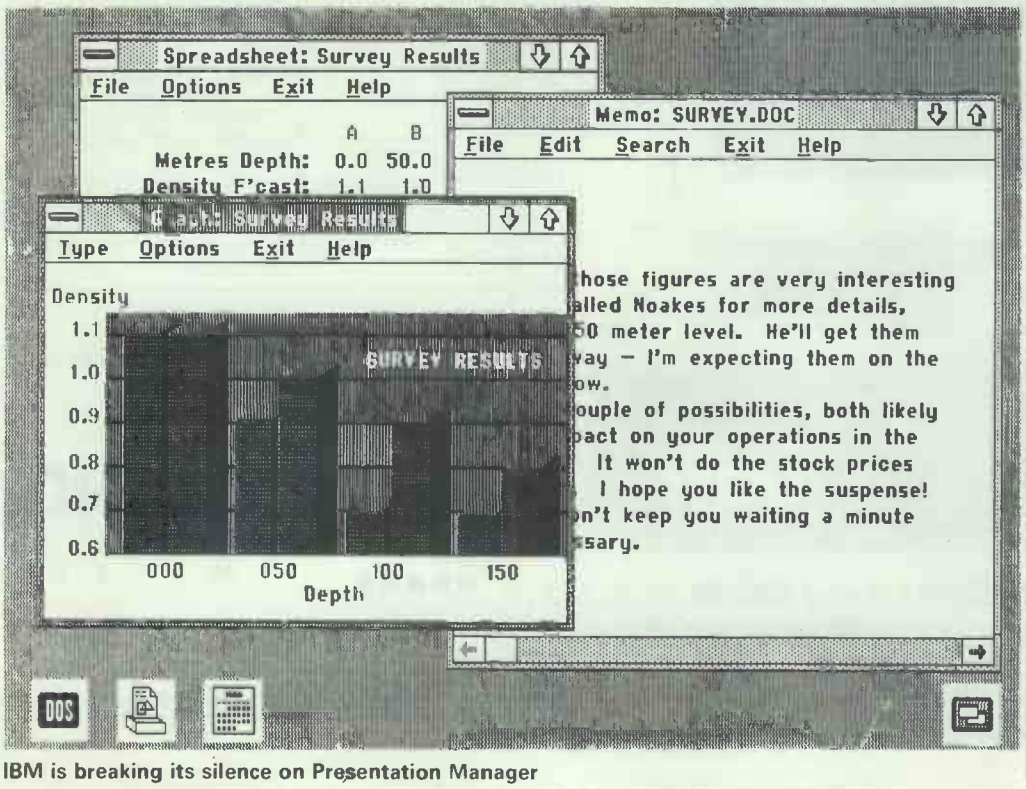
The Amiga didn't sweep the market away. There was only one real reason it didn't: everybody thought Commodore was about to go bust. I know I did. I'm still not quite sure how the company managed to escape from the pit; but escape it did. And today, I would rather run my multi-tasking software on an Amiga than on a PS/2 with OS/2.

My reasons for saying this are not hard to list. First, the only actual program I saw running at Hursley Park was Displaywrite. I needed more time to get into that word processor, but it really didn't look as if it was using PM routines. And in any case, I don't like Displaywrite as a word processor.

So, my feeling is that OS/2 (Extended Edition) does nothing for my machine that I can't get under DOS 3.3 or 4.0 — except, perhaps, boost the amount I have to spend on memory.

Next, the software assumes that I have a four-year-old chip inside my machine — the 80286. Of course, I can actually have an 80386 inside, but PS/2 software doesn't use it that way. You have to tell a 386 to behave in a modern, protected and non-segmented memory way, or it thinks it's an 8086. OS/2 doesn't tell it to do so, because most OS/2 machines are 286-based.

And finally, in a world in which more and more of the data stored is in the form of pictures, IBM has built a Structured Query Language into OS/2. SQL assumes that most data is *not* pixel format ▶



IBM is breaking its silence on Presentation Manager

Chicken-and-egg EISA design



GUY KEWNEY

You may recall laughing heartily at our picture of the 'alternative' to the IBM Micro Channel bus — the 'Extended Industry Standard Architecture' proposed by Compaq.

The original design suggested that the bus should be 32-bit, not 16-bit, and any idiot could see that there wasn't enough room in the socket for the extra pins. So Compaq proposed running a second, parallel row of pins on an outrigger or pontoon.

As I saw it, this was useful for two purposes. First it would force you to exert twice as much force on the motherboard when inserting a card, thus helpfully increasing the risk of breaking connections on the motherboard as well as spoiling the palm of your hand. And second, it made it quite likely that you would snap the pontoon off the add-on card. Finally, there was the bonus: you would only have enough space for half the number of cards in the box.

It turns out that Compaq has come to similar conclusions.

The new design of the EISA card is now to have *both* sets of connectors in the same space as the old. Since this can't be done, the fiddle is to have the new set *below* the old, on a deeper flange. And as long as you really and truly do turn the power off before plugging it in and out, that must be a better idea.

I know it's not the most significant change in the history of computer design. I mention it as a guide to how advanced work is on the full specification of the EISA bus — still pretty plastic.

When they finally finish designing what it has to do, the chip designers can start trying to achieve a bus driver that does it, can't they?

Pegasus flying high before OS/2

It seems that several of the software houses who were banking on OS/2 to make them rich, are now expecting that their software will make OS/2 successful. The latest to announce is accounting software company, Pegasus.

The logic sounds fatally flawed to me. The original decision to produce a version of a program that runs on OS/2 machines was based on the expectation that IBM would sell millions. As a result, all these users would be screaming for software that ran under OS/2.

So far, that hasn't happened. Now, they seem to be saying that although IBM couldn't sell millions, if they publish the software anyway, then people will buy OS/2 to run the software.

'OS/2 is such an advantageous operating system, that we felt we should make our software available on it as a high priority,' was the way Pegasus boss Clive Booth put it.

In a real sense, he is right. With multi-tasking, lots of the work of accounting — programs which have to run one after the other on a standard DOS PC — can go on simultaneously. No more 'I can't enter your order because we're running payroll' stories.

Meanwhile, behind the scenes, the alternate reality is rushing along, and Pegasus is (sensibly) backing that horse as well. It is working on a Unix version of Senior.

Just how hard this will be to do, I can't say. Programmers theorise that all Pegasus software is written in Basic, and then converted. Does the converter produce Unix-style C? Have the programmers at Pegasus learned to write C directly? I can't find out.

IBM has, at last, released the Windows (Presentation Manager) version of OS/2. The extended edition, with database abilities built-in, isn't due in the UK for a while.

My bet: this time next year there will be more Unix Pegasus versions than OS/2 versions.

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and that you can index its structure.

Nothing about all this is new, or a surprise. We've known all these drawbacks and arguments about OS/2 for nigh on two years now. For me, it was out of date when it was announced; it's now even more antiquated, and it still isn't ready. And that's the crunch, for me.

The OS/2 operating software brings to the micro all the things that micro users decided weren't worth having. Big machine databases, control by the corporate computer management, integration into a network — a dead weight of annoying irrelevance to most of us. On the other hand, I'd be happy to have a machine like that if I could also get on with the rest of my work.

And can I get on with my work, under OS/2? I still don't know. Too many questions still float, unanswered, in the air.

For example, what happens to the mighty corporate network when I run one of my badly-behaved DOS programs? On a properly configured 386 (theoretically) nothing. On a 286 chip? If you want to take bets, take them — but not with my money.

For example, what happens to the multi-tasking system if one of my programs accesses one of the IBM screen memory locations directly? A lot of them do. And I know the answer, because some of the nicest features of the VGA screen driver assume that only one program is playing with them; it crashes.

For example, what happens to a program using the serial or parallel port when one of my accumulated bits of software talks to the I/O chip? Oh, yes, my programs have to, because IBM has decreed that you can't run I/O faster than 38,400 bits per second (not terribly fast) while the chips themselves are quite happy running at three times that speed, or more.

History shows that all these arguments are irrelevant if IBM sells enough copies of OS/2.

When the company launched the PC, I recall remarking that only a mug would buy one — but that there were so many mugs that in a year, only a mug would hold back. But when IBM launched the PC, it was clearly superior to any rival.

Really, the same cannot be said of a PS/2 machine running OS/2 Extended. Novell offers a better network, DesqView offers better multi-tasking, and you don't have to have a database built into the disk file system to keep track of SQL files on the mainframe.

For a company computer manager, there are good reasons for buying a few copies. For the rest of us? You'd be a mug to buy one now. And I honestly feel I will be able to put my hand on my heart in a year from now, and say the same thing.

In five years' time, when IBM is all-386 and so is OS/3 (or whatever) and it has mastered the problems of optical storage and multi-tasking displays, I think the descendant of OS/2 will be well worth putting on a shopping list. It may even be the major standard.

In the meantime, there's no need to rush out scouring the shops in a panic for a copy.

NEWSPRINT

A new blue suit

A lawsuit has been announced by IBM; the target is the Dutch builder of PC clones, Tulip.

The subject, says IBM, is the ROM chip inside Tulip's hardware — the chip which holds the basic input/output system (BIOS) which the machine runs when you switch it on, whether it is going to run DOS, OS/2, Unix or anything else.

This software, say IBM's lawyers, is simply a copy of the software in IBM's own machine.

As is usually the case with matters in which legal minds get entangled, establishing just what is going on is a nightmare.

Tulip, naturally enough, says that the suit is nonsense and there is no question of infringement of IBM's copyright. And it has suggested that the chip is the standard Phoenix BIOS — which is something that will worry other Phoenix users until the matter is somewhat clearer.

IBM says that the Tulip BIOS is an 'unauthorised copy' and says nothing about whose unauthorised copy it is.

These lawsuits are proof of nothing, either way. Examples: in a recent case between software company Systems Enhancement Associates against PK Ware, it was agreed that PK's archive files included bits of SEA's code, and PK would withdraw its programs and write new ones. But the case was settled out of court, and one of the terms of the settlement was that the terms remained secret.

Example: Zygal has just had an injunction overturned, granted three years ago, restraining John McNulty (from whom it bought Modular Technology) from working in any communications related field. The company never prosecuted McNulty and eventually the High Court agreed that the injunction had simply expired, after taking one of the UK's brighter inventors out of the business for a substantial period.

Example: Lotus sued Paperback Software for copying the 'look and feel' of Lotus 1-2-3 in VP Planner — the suit, two years old, has yet to come to court.

And the latest example: Ashton-Tate has claimed that Foxbase Plus infringes A-T's rights in dBase II, III and III Plus. And who can forget Apple's suit against Microsoft for Windows — a meaningless attack on a non-existent rival — or NCR's constant litigous approach to anybody who uses the word 'Tower' in the description of a tall box that stands on the floor.

The computer business really has to get together and agree an independent system of settling these disputes. Rarely do the courts betray any serious understanding of the issues involved, and it is hard to see any sign that they do anything but damage to the parties involved — on both sides.

In the IBM versus Tulip case, one has to wonder what IBM thinks it is doing. What it needs, above all, is a set of clone makers for its PS/2 range who are able to run its OS/2 software. Suing people who try to boost the market must be the strangest form of encouragement seen for some years.

The safety game

On most occasions when I've argued with Alan Sugar he's been right, and I've been wrong. So I thought long and hard before getting up the courage to say this: I think Amstrad's PC200 is his worst ever decision.

I base my decision on Amstrad's decision to cut the price of its cheapest PC range (the 1512 and 1640) to £500.

It's true that I've often thought there was room for a PC clone in the games market. The PC200 is a PC clone, and it is packaged for the games market. It's also true that I've often maintained that the PC family was generally over-engineered. Nobody could accuse the PC200 of this.

But never in my worst dreams did I imagine a PC clone with 60-column TV output as its standard display. Never did I imagine anybody would provide a machine which expands only if you open the box up and leave it open. And most important, never have PC clones been so cheap.



Alan Sugar

Perhaps, if the PC200 were cheaper than all other PCs, it might still sell — as Amstrad says, there are a lot of people with a PC at work who would like a PC at home, too.

But the day of the plain, ordinary PC clone with an 8088 or 8086 chip in it is over. And despite getting plenty of warning, several manufacturers have carried on making the things in numbers which the market won't stand.

Digital Matrix currently has the crown for the cheapest 80386-based AT-bus clone at just under £1000. Plus VAT, of course, and the cost of a hard disk. With an Atari ST at £300 (or a Commodore Amiga) and a 386 at £1200, with a genuine 286-based AT around £700, what price should a PC be?

I don't have to answer that one. There are enough adverts in this issue for you to find out what the price is, and no need for hyberbole from me.

Who knows: in six months' time, maybe all the Atari and Commodore and Opus PCs will have been sold to surplus dealer Howard Strowman, and the Amstrad PC200 will be the only PC/games machine in town.

Today, however, the only thing the Amstrad has over its rivals is ease of destruction. With the lid off, in the average house, it isn't going to be a question of *if* somebody drops a pin into the motherboard and starts a fire. It's a matter of *when*.

Saves you buying the box of matches needed to incinerate it, at least.

Well-dressed WORMs

Optical Storage Solutions could not have asked for a better launch commercial for its WORM operating system than the computer virus which struck users of a pirated Activision game, Leisure Suit Larry.

For those who missed it, the story which made the headlines was that the City of London financiers found their machines crashing. It turned out, on investigation, that they had obtained pirate versions of Activision's game, and an attached virus had been playing merry hell with their hard disks.

This is the world in which people are mindlessly asking for erasable optical storage.

Keith Ragsdale, founder of Optical Storage Solutions, arrived in London with his brand new company about the time of the City Larry episode, warning the world that erasable optical storage is a trap, a dangerous step, a mistake, and something to be avoided like the plague.

The problem with hard disks is very simple: they can accidentally lose data. It's as simple as the Copy command, and it can be as complex as a virus — but once erased, the data on a hard disk is gone irretrievably as if it had never been there.

The solution is also simple: save each file onto write-once optical disk. Each time you produce a new version of the file, the old one is not deleted, but ignored.

The drawback to this solution is the nature of a disk file, which is stored as if it used the same space as the old version. Change one word in a 100k file, and your disk system will create a new 100k file, virtually identical to the old 100k file.

Run a standard disk storage system like this on your optical disk, and you will use up the £150-worth of space within months. Yes, you can get a new one, but no, it still isn't cheap.

Ragsdale tackled this problem at its source. His company writes disk drivers. This is software which watches your program, and intercepts all requests to use the disk. And when it gets a request to save some data, it doesn't save the whole file, but just the new data.

Theoretically, this approach could be made even more efficient: an incremental file save already exists for programs like Borland's Sprint word processor.

What this does is to keep a record of the original file, plus all the keys you have typed since it was last saved. At any time, you can interrupt the system and the program will reconstruct the file from the base plus the list of keystrokes.

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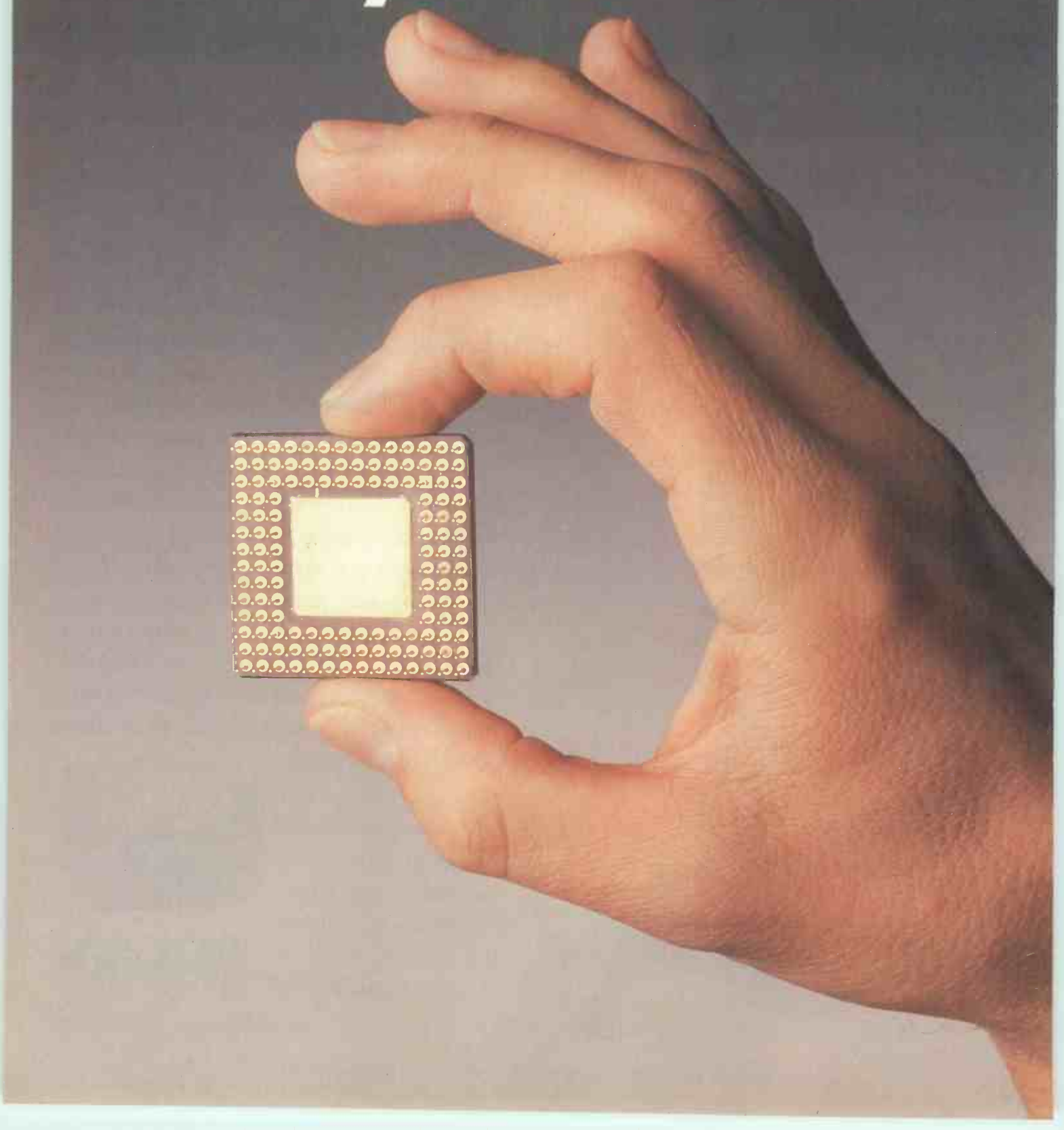


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Others may be tempted by SX. After all they've been told it's good for them.

Dell has two suggestions.

If you're attracted to 386 architecture because you're thinking of the long-term future, why settle for a 16-bit SX machine? The Dell System 310 offers you full 32-bit architecture with 20MHz performance. And it actually costs you £541 less than the 16MHz Compaq Deskpro 386s - the best that SX can offer.

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Dell System 310.

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Ragsdale does some of this, but there are files — highly structured database files, for example, where a single record added can utterly change the shape of the whole — where DOS just doesn't allow real economy.

Strangely enough, even in this worst case system OSS saves more space than you'd imagine because there is one file that DOS is constantly erasing and rewriting, which it really doesn't have to.

This is the file which doesn't appear on your directory when you type DIR. It's the File Allocation Table (FAT). When DOS alters a file, it deletes the FAT and writes a new copy. When the OSS driver sees a file change, it just updates a single pointer.

'I've got two optical disks which I show people,' said Ragsdale on his visit to London. 'One was created by DOS and the other was created on doing the same storage work by our file system. The DOS disk is full. Our disk is 20 per cent full.'

Actually, you don't have to wait for erasable optical storage to see some of the disasters which erasable storage can bring. Big hard disks of over 100Mbyte capacity are already commonplace. Systems with 600Mbytes are not hard to find.

Experts are always on at us to 'back up your data' — copy it onto a tape. Perhaps you'd like to think about this in terms of arithmetic. Imagine your machine is working all day and the major set of files is updated every ten minutes or so — all of them. In the course of the day, you're talking fifty-odd versions of each file. In a week, that's over 200 versions of each file.

How often are you going to back up your disk? Every week? That's 200 versions of each file gone forever. Of course, you could back up three times a day — it would only add an extra 30 minutes or so to your workload, plus the time lost because most systems won't do anything else while backing up.

Now here's the amusing bit. You are a very frequent disk backer-upper. You do it every 48 hours. And you don't know it, but you have a virus on your hard disk. When the system finally crashes and starts deleting important files, how long have you had the virus? A week? Three weeks?

How many back-up tapes do you keep before you re-use the cartridge? Three (most people do)? In that case, your oldest back-up, which will lose you six days' work, is already corrupted with the virus and you dare not restore from it.

Of course, had you been storing things on a write-once disk, you could back-track through the files, reversing time. When you finally found a date when there was no virus, you could copy that set of files to a new optical disk. And then you could work forward from there, to see what had been done and reconstruct the work.

The utilities to track back and forward in time in this level of detail don't exist, not yet, says Ragsdale. On the other hand, the information is stored on his WORM and in an emergency, a competent programmer could retrieve it.

From an engineer's point of view, there is no doubt which storage system is superior. Erasable storage is only of value because we are accustomed to working with smaller-capacity drives than we want.

With WORM drives, when the disk is full, you go and stick another one in. With erasable drives, you delete the least valuable files. At least, you hope they are. My own experiences suggest that those are, remorselessly and inevitably, the files that you really shouldn't have deleted.

Two things need to change. First, disk drives, like those from OSS, need to be more widely used and have to evolve to use less space, allow more fluent reconstruction and (of course) they have to become standard file systems. And second, WORM media has to become cheaper.

Ultimately, erasable optical looks likely to be cheaper, byte per byte, than WORM.

Bob Gleadow, boss of Atari UK, says the reason is perfectly simple: the Japanese consumer electronics business needs a successor to the video tape recorder. A video disk recorder would be ideal. Its disk — re-recordable — would rapidly become a very high-volume, low-cost item, around the £10 mark.

I take the point, but I suspect that the evolution of the computer virus makes the WORM almost essential for serious computer use — to the point where it doesn't matter, not that much, if computer WORM disks are twice, or even three times the price of erasable optical disks.

Viruses are going to get worse, not better. It makes no sense to write viruses, but there is always some Herostratus who will do so, just as there is always some idiot prepared to vandalise a phone booth or mangle young trees in a park.

In order to cure viruses, people who kill them have been explaining how they work. Wouldn't this be very useful to would-be virus writers! And information like this is not suppressible.

A WORM — today, at least — is not totally virus-proof. It is possible to write data onto sectors of a write-once disk which actually hold data already. That has much the same effect as erasing it, of course.

To do this, you have to over-write the fundamental head control software built into the WORM drive, because it is built into the disk controller not to write to a written-on sector.

At the moment this is very difficult but not absolutely impossible. In the future, however, these low-level disk access routines will be better protected. And even if not, trashing a WORM is not a simple question of trashing the FAT. You also have to trash the previous FAT. And the one before that. And the earlier one. And the preceding one. And even when all those have gone, the data is still on the disk and can be retrieved. Unless you have also written a routine to trash that data. And the earlier version. And the one before that. And . . .

A virus that worked that hard would have trouble concealing itself from the system. You'd notice it the first day it ran and purge it.

Optical Storage Solutions has a set of drivers to work with DOS machines. It also has a Novell network driver and a Unix driver. Others will follow.

I reckon the market for WORMs is bigger than the market for erasable optical disks. I'd be interested to hear from readers who feel I'm missing a trick.

OSS is in Concorde, California, on (415) 825 3441.

BABT & BSI tangle over bureaucracy

The loudspeaker can go back into the Courier HST modem — official.

A loudspeaker is (I think) an essential component of a modem. You ask the thing to dial, and as often as not, nothing happens. Is it engaged? Ringing unanswered? Or is there an old lady, terrified out of her mind at the sound of the high-pitched whistling, getting a crossed line?

Up until recently, the approvals body, BABT, made it its business to remove loudspeakers from many modems on the grounds that they 'send too much noise back to line.'

Protests from manufacturers were vain. A 'call progress monitor' (not a loudspeaker, you note) had to meet certain specifications laid down under BS6789 Part 2, and this was one of them.

Miracom, which imports the HST from US Robotics, argued on technical grounds that the requirement was silly. Dowty, I know, wanted to put a loudspeaker in its old Quattro, and was turned down unless it changed the speaker from the one that the American designer put in.

Eventually, I asked BABT why. The conversation that followed started in a friendly vein, with the BABT man explaining kindly that I wasn't technically qualified to understand. I wrote this down, and he began to get cross with me. We parted after half an hour or so, with him informing me firmly that the subject was too complex for me to be able to explain to my readers, and that if I told my readers he'd said that, he'd be very angry, because he hadn't.

Half an hour later, he rang back and said (very nobly, I thought) that he was sorry, he'd been wrong, and he'd reconsidered. And I was quite right, and the loudspeaker restriction was not justified, and he wanted to write to Miracom himself and explain it, and would I very much mind not contacting that company until he had time to do so?

He added that he would be writing to the British Standards Institute to suggest that it consider changing the standard, along with other changes under consideration.

A week later, a letter (from BABT to BSI) arrived on my desk confirming all this. I contacted Miracom.

'The problem,' suggested a man called Neil Mellor (a brave man, as he will have to get more equipment through BABT in the future) 'is that the Board responds bureaucratically to these

problems, and isn't able to take an engineer's response.'

You could argue that the Board had neatly proved that it was not bureaucratically bound. At least, that was the angle I took in a news item I wrote for a trade paper at the time. To my astonishment, BABT called immediately to complain about the piece. Why?

Because I'd said the Board was writing to Miracom to explain that it was going to try getting the standard changed. And I get the impression that what worries BABT is that it has no authority to order BSI standards changed, and shouldn't make statements that imply that it is.

Another bureaucratic wrangle, in fact.

False start

This probably isn't the place to mention it, but I notice that the trend for reviewers to jump the gun is growing.

A friend, writing the documentation of — well, never mind what — bought me a drink, wiped the sweat off his brow, and said, 'Whew! Nearly done — I'll send it to them tomorrow, and then I can start on the Help screens.'

Which surprised me more than a bit, I must say. In print, on my desk was a magazine called — well, tactfully I'll forget which one — with a review of the product. It specifically awarded the documentation a 'Good' rating on the checklist, and the on-screen help got a 'Good' too.

Apple gears up

Never can there have been a better example of how to waste a competitive advantage than Apple's failure to launch a modern operating system for the Macintosh II.

Current UK estimates of how much of the market the Mac holds in the UK suggest somewhere between seven per cent and ten per cent. Plans, suggest sources, are to get this up to around 15 per cent by next Christmas.

The chance to get ahead is wonderful. Apple's major rival in setting standards is IBM, and IBM is still loading its wagon for the journey through the 1990s. There is just loads and loads of excellent software for the Mac, and almost none at all for IBM's OS/2.

All we need to make the Mac look irresistible is the ability to run more than one program at a time. The announcement of a new SE model with the 68030 (reviewed this issue) simply shows that Apple is aware of the need to update its software.

The main difference between the 68020 (the one in the original Mac II) and the 68030 (the one in the new SE and the new Mac IIX) is memory management. There is no memory management chip for the original 68000 chip, and Amiga users will confirm that this makes the machine vulnerable when running two programs. Either of them, if it has a bug in it, can crash the system. And if the other is editing a big file, or updating a big spreadsheet, or merging two big databases at the same time, that can be very embarrassing.



The Mac II: behind the times

The Motorola chip that followed the 68000 was the 68020. It had no memory management on it, but it did allow you to buy a parallel manager chip. Unfortunately, when Apple launched the SE and the Mac II, this parallel chip wasn't available.

The 68030, strangely, doesn't work with that memory management unit (MMU) but has its own memory manager built onto the chip. It is, however, only a cut-down version of the MMU, with several functions abandoned.

Apple's launch of the 68030 looks like a leap into the future. What it is really, however, is a pre-emptive strike. It's designed to stop people buying the MMU for their 68020 machines.

Simply put: if you buy a 68020 plus MMU, you are going down a path which Apple is ignoring. In the future, when Apple does manage to produce genuine multi-tasking, you will find yourself unable to run the software.

Apple's recognition of this is seen in the ease with which you can switch from 68020 chip to 68030 — both on the SE and the Mac II. The strategy, both in terms of how easy it is physically to swap, and also including the price of the upgrade, is unambiguous: get rid of those 020 chips!

As to the chances of the company getting its 15 per cent, I'm not placing any big bets. I'm fed up with recommending to friends that they consider the Mac, only to have them phone back and ask me if I know how much the things cost. And I'm equally fed up with hot air from Apple UK on why this is, and what they propose to do about it.

However, after a recent discussion on this very subject on the CIX online database, I can offer a little advice from those who have taken the plunge. That is: ask for a discount.

Apple is very anxious to keep the fact that its dealers give discounts a secret. I long ago ceased trying to understand this — I'd have thought that discounts were designed to encourage sales, and I simply don't understand the value of a secret discount in encouraging the half-hearted to abandon the IBM standard.

Nonetheless, dealers will knock 30% off if they think this is the only way to get your business. Make sure it is.

No end in sight

It is possible to buy a card which gives all the colours, the high resolution and amazing hidden features of the IBM VGA display card. The trouble is, nobody knows which one is exactly the same — and all the rivals for the position of True Compatible are desperately seeking to slander each other.

'We all want to be the next Hercules', was the way one battle-weary fighter in the VGA clone wars put it, acknowledging that the fight was getting pretty dirty.

A piece of paper, without names, phone numbers or address, was duplicated and left in the Press Release room at the recent Comdex Fair in November. It purported to be a list of ten tests which the Paradise VGA Plus card would fail, and which the IBM card would pass.

The problem is very simple: there are too many features in the VGA card. Most of them are accidental. If you set this register, you get this strange result; if you change that memory location, you see this wonderful picture. The question 'Does any existing software actually use these registers, or try to show these pictures?' is never asked. And of course, there is no way of knowing whether one day soon, some new Lotus might release a wonder product which just happens to require this magic element of the display standard, and without which no card maker will be able to sell.

The trick, of course, is to persuade the market that your own card, while possibly not 100% IBM identical (though naturally it is!) has unique abilities which mean that any such programmer will automatically use your card's facilities as the base standard.

Wyse, for example, showed an enormously high-resolution monochrome monitor for desktop publishing. It shows two full A4 print pages side by side. And it will run VGA — the VGA card will run in parallel with the high-res mono card, and swap information with it. Not just any VGA card, of course — it has to be a Wyse VGA card.

The company which gave us the EGA Wonder (it did EGA on a CGA resolution screen) has now produced the VGA Wonder, which can tell what sort of computer it is inside, and what sort of screen it is connected to. It can also emulate IBM's ultra-high resolution of 1024x768.

Paradise's response to all this was not a data sheet, but a number count. It proudly announced that it has shipped more than a million VGA compatible cards, and over five million EGA plus VGA. If that doesn't make a standard,

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('R' denotes that drive uses RLL Controller)

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('R' denotes that drive uses RLL Controller)

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No. 1 for Everex

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the implication is, what will?

There were one or two comebacks. Most innovative was the response of Cirrus Logic, which has produced its own VGA, and has now 'extended' this to drive the Sharp liquid crystal display — the 640x480 resolution screen which can give 16 grey scales in VGA resolution.

But for the most part, vendors showed pieces of paper which described their own offering as '100% register compatible with IBM' and offered disks which would trip rival cards up. It's a battle with no end in sight.

Fast and full

Latest contender for the 'lowest price on a 386 machine' comes in at £999. This is a pretty bare-bones system with a floppy, a keyboard and 512k of memory.

To have a proper working system, with this 'deskscraper' design (you can't call them towers, since NCR copyrighted the name) you need to add a hard disk and a mono screen.

There's a 'full 32-bit' 386 chip inside it, according to importer Clive Warner at Digital Matrix. And it runs at 20MHz, no wait states.

'We still haven't decided on a name for it, and I'm constantly going over my figures, trying to make sure I can do it for that price,' said a nervous-sounding Warner last month when I spoke to him. 'But it has five proper AT slots, and it will run Xenix.'

The reference to 'full 32-bit' is a sly dig at various Far Eastern clone builders who are using faulty versions of the 386 chip (the ones which Intel sold off cheap as fast 80286 replacements because of a bug in the 32-bit instructions). Those chips, says Warner, will not run Unix.

In confidence

Intel has warned everybody that it is going to post poor financial results 'because of a slowdown in PC sales.'

Chip maker AMD has laid off staff. It blames a slowdown in personal computer growth.

The American research firm DataQuest has forecast a severe slowdown in personal computer business in the US for next year.

Howard Strowmer, purchaser of unsellable hardware which he peddles at incredibly low prices to faraway places like Poland and the Middle East, is receiving 'plenty' of offers of large stocks of PC\XT clones — he reckons £300 will soon be a high price for a hard disk XT.

And what does Compaq have to say?

'The business sector of the personal computer industry is booming,' it said in an announcement at the FT conference on professional PCs. 'And there's never been a time when the future direction of the industry is more predictable.'

There are straws of hope. For example, memory prices are starting to drop. One supplier said that they dropped 35% in the middle of November. Maybe this is a trend? Or maybe the market is collapsing?

Research firm Context said that the value of the UK market for PCs went up by over 60% in 1988, with the number of machines shipped going up 35%.

Well, maybe the 386 market is in for a good time. But I still find it hard to believe that the next nine months aren't going to be slow.

US computer journals on CD-ROM

With an addition to the still sparse category of software on CD-ROM, International Software has come out of the closet. The two-year-old company has been selling its services and solutions to corporates with little publicity but recently decided its £16 million UK turnover needed a boost. So it took on a PR agency, put together a package for which it has the UK exclusive rights, and told the world.

The application, known as Computer Library, is a collection of 43,000 articles from the US computer and associated press, along with the necessary software to find references. Text from directly computer-related journals is held in full, while articles from financial and peripheral publications are held in summary form. No article is over a year old.

Lotus BlueFish, a text retrieval package, used for searching and indexing, is distributed on the CD-ROM along with the library database. From BlueFish, you can select articles by subject, author or publication, or by searching for keywords within the text. Searches can be nested, and the text of a previous search may be edited to increase the precision of a search operation. Boolean operators, such as AND, NOT and OR can be used further to refine a search.

Once found, an article can be printed directly from BlueFish or loaded into the user's word processor for formatting, editing and printing.

The hardware uses the standard HS CD-ROM format which gives over 500Mbytes of storage per disk, although the first ones to be shipped will be only just over half full. International Software expects this figure to grow during 1989, when it will have incorporated material from European journals.

Computer Library is expected to be invaluable to corporate information centres, corporate evaluation and purchasing departments, and those in publicity and computer-related media.

To circumvent the major drawback of CD-ROM-based databases — their tendency rapidly to become outdated — International Software is selling the disks on a subscription basis for £795 per annum. For that, you get a monthly disk update — which may also include a free program upgrade — from which articles over a year old have been eradicated. For £825, International Software will also sell you the necessary kit, consisting of the drive itself, an adaptor card and a device driver, although these are available from third parties

For further details, contact (01) 847 3761.

Manek Dubash

Grapevine

Weighing only nine ounces, a little hard disk drive from **Phase IV** (UK agent for PrairieTek in the US) is light enough for laptop use (and small enough, physically, and miserly enough in terms of electrical power) while still providing 20Mbytes capacity. It requires an average 1.5W of power, has several features designed to make it more reliable when being bumped about the countryside in a suitcase, and is pretty fast (28 milliseconds average seek time) too.

Details can be obtained from Phase IV at Unit 6, Oxford Business Centre, Osney Lane, OX1 1TB or call the company on (0865) 792200.

A compiler for the 48k Sinclair Spectrum has been released by **Mira Software** at £15. At that price, I'll happily overlook the fact that it is BS 6192 Standard Pascal. And for anybody who wants to actually produce their own serious programs that run at meaningful speeds, Pascal, once learned, is a vast improvement at every level over the Basic supplied with the machine. I've no hesitation in urging you to send your cash to Mira; write to 24 Home Close, Kibworth, Leicestershire LE8 0JT.

Insignia Solutions continues to amaze the world with its emulation software for the PC: latest to buy it is minicomputer maker Hewlett-Packard, which is running it on its 9000 series.

As an alternative to File Genie, a new program which converts odd file formats into each other is **Datashuttle**, launched at Comdex by Softway of San Francisco. Formats covered include dBase, Lotus, Symphony, open access, Quattro, Multiplan, VP Planner, Framework, and so on.

Details in the US on (415) 397 4666.

To prove that Windows is not the same as Presentation Manager under OS/2, **Micrografx** has produced a piece of software which helps a Windows program turn into a PM program. The software, called Mirrors, was developed internally to help translate Graph Plus, Draw Plus and Designer to PM.

Details in Richardson, Texas on (214) 234 1769.

As expected, **Mitac** announced its PS/2 clone at the show — a pair of them, in fact. The model 50Z clone is based on the 16-bit 386 SX chip, but it also announced a 20MHz model 80 lookalike — except it is smaller. In the US it will cost under $3000, but at press time there were no details of what that system would include, or what UK pricing might turn out like.

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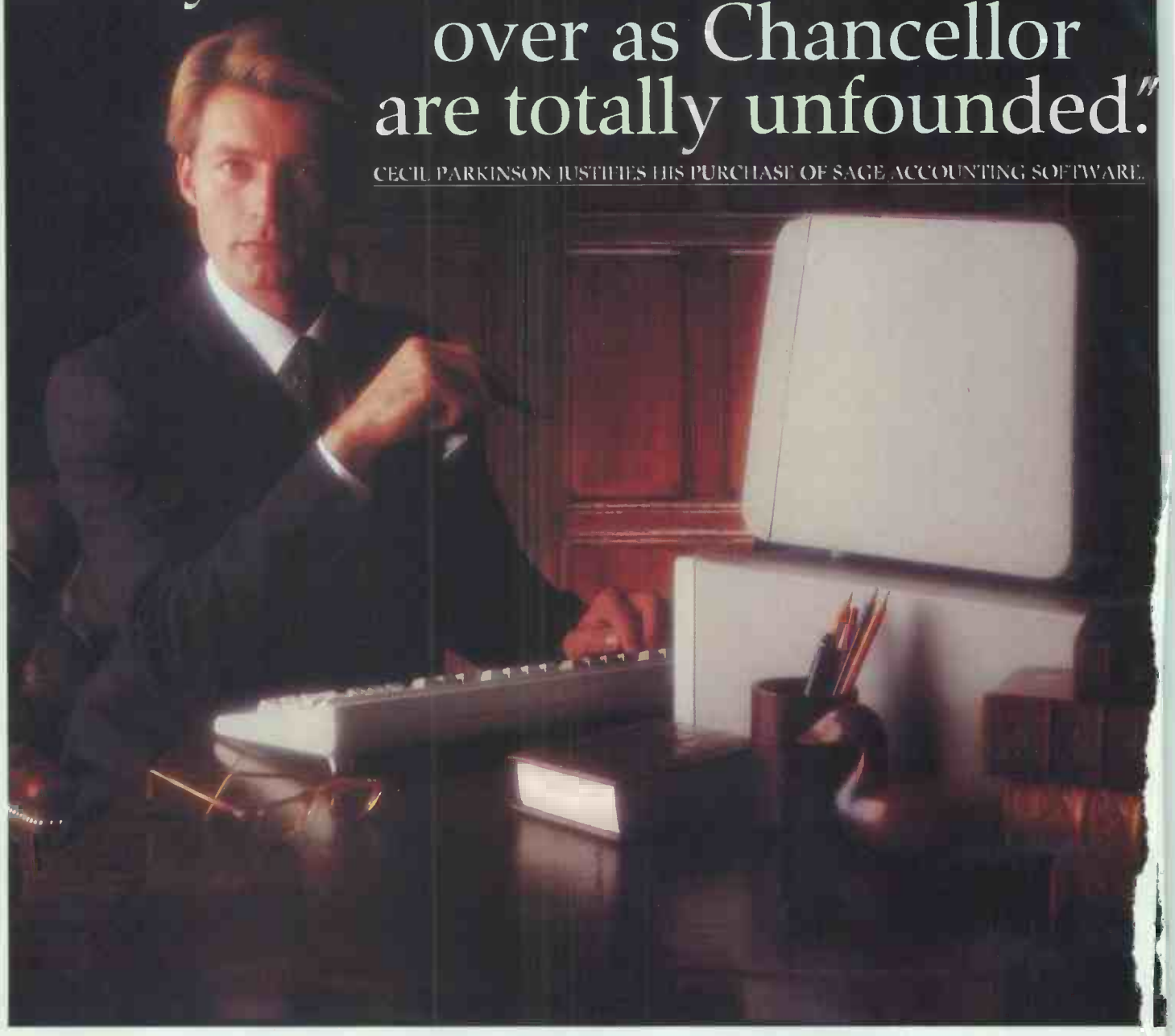
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"Any rumours that I am to take over as Chancellor are totally unfounded."

CECIL PARKINSON JUSTIFIES HIS PURCHASE OF SAGE ACCOUNTING SOFTWARE.



I would like to take this opportunity to adamantly refute any rumours there might be. The suggestion that I am to be Chancellor now, or at any time in the future, is nothing more than conjecture, and my recent purchase of Sage Financial Controller has no bearing on the issue.

Having experienced the Sage 'Businesswise' accounting programs over many years, I am totally convinced they provide the best value on the market. Through Bookkeeper, Accountant and Accountant Plus right up to the sophisticated

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Financial Controller, they provide the small to medium sized business with all the accounting software they need.

They're very easy to use and understand, they work with all IBM compatible PCs, and

Shareware is hard to evaluate because it has such a long 'half-life' — people don't throw it away if it's useless, the way storekeepers throw away unsellable software with a price tag. Latest in a long line of hopefuls who intend to make money out of this problem is **Wizardware**, 'the source for quality shareware' as they call themselves, with a new dodge: a menu. Wizardware products are 'selected' and all have a front end which lets the inexperienced user run them all by typing GO.

Sounds silly to me, but you can talk to them on US (215) 866 9613.

Award Software now has a BIOS program for the 80386SX chip — the 16-bit version of the 386. Intriguingly, the company claims that this BIOS allows programmers to use the 386's special 'protected mode' — something which isn't normally available in DOS-style operating software. Award may have a partner in Chips and Technologies Inc, which has released a chip set to allow any dumb soldering iron user to put together an AT-style machine based on the SX chip. The chips are an enhanced NEAT set called NEATsx.

Award details in California on (408) 370 7979. C&T is on (408) 434 0600.

Disk management software for the PC was always necessary, because finding your way from one sub-directory to another was a bit like wandering through an adventure game maze. **Xtree**, the company which did very well out of mapping this confusion, has now launched a similar product for helping Macintosh users. For the life of me, I can't see why any Mac user with a graphics interface would want it, but obviously there are some deprived PC users out there, stuck in front of Macs they don't like, who want things to appear hard.

Details from Xtree in California on (805) 541 0604.

Tandon didn't launch a Micro Channel based machine at Comdex but they thought about it. Instead, it will appear in Spring, sources confided at the show. Machines which Tandon did launch included three based on the 386, and two (same chip) without disks for network use. All are data pac standard machines, without the data pac. There is just a very big hole where the data pac can be mounted.



A keyboardless machine? Daft, but apparently there is a demand for such — using a touch screen. It's portable, too, called the **Datalite**, and marketed by Quebec firm Varstop Inc from Greenfield Park, Quebec J4V IM9. Tel: (514) 466 8909.

Beep! The missing noise from your HP LaserJet when it runs out of paper has been surgically replaced by **Laser Edge** of California. It costs $79, a lot for a control-G device, but the company says that the machine is so quiet that time is very often wasted by people who simply didn't know it had stopped, waiting for a refill. **PaperPeeper** will ship next month, and details are available on (415) 835 1581.

Unlikely though it may sound, there is space on a 3½in floppy for 20Mbytes of data. Normal drives use 1.4Mbytes. The trick is to get the tracks closer together, and normally, that requires a very, very accurate 'servo track' which makes sure the head is always in the same position. The bright idea of Insite Peripherals of Santa Clara was to make the servo track an optical track, rather than magnetic, which meant that the media didn't have to be perfect.

The **Floptical** drive will ship next year, costing around $250 for a SCSI-based unit. Anybody planning to buy 5000 or more should contact Insite on (408) 727 8484.

The generators of the very fast Optasm assembler for the PC have released a new member of the family; a linker and debugger called Optlink and Optdebug. Cost is $125 each.

SLR Systems is on (412) 282 0864.

Abbey's CCFT display

After Rupp showed the way with a machine-to-machine link using the parallel printer port on a PC, **3X USA** has gone one better with a sort of local network based on the parallel port. What this one does that Fastwire II doesn't do is to work in background mode, letting the user get on with other applications while files transfer from one box to another — and even onto the printer, using the same port. And automatic scripts allow automation of complex backup tasks.

Details on (201) 592 6874; One Executive Drive, Fort Lee, NJ 07024, USA.

Postpone the evil day of having to install a local area network between your Mac and your neighbour's PC with **Lap-link Mac**, from Travelling Software. The new version doesn't just transfer files between the machines: it translates them, too. It can convert popular word processing files into MacWrite and Microsoft Word Mac formats — the list includes WordStar, Multimate, Microsoft Word (PC), IBM Displaywrite, WordPerfect, XYWrite, plus ASCII and DCA conversion format. And the package also does the Mac binary transfer, to help get graphics files from Mac to PC. Price: £100 (including disks, universal cable, and manual) from most dealers — it's certainly available through distributors Softsel and Frontline if your dealers say they've never heard of it).

The photo above shows a genuine paper-white display, not one of those plausible enhanced pictures of supertwist LCDs. The technology is CCFT — cold cathode fluorescent tube. **Abbey Microsystems**, which imports this laptop, claims that CCFT requires even less power than LCD screens and can be used in direct sunlight. The machine itself has lots of nice features worth listing — it can plug into a car cigar lighter, or any voltage around the world from 90v to 260v; it has a high-resolution display (better than EGA but including EGA, says Abbey). And the price? It's £1000 cheaper than the Toshiba 3200 (the Tosh doesn't operate off batteries) at £2734 for a 20Mbyte hard disk model, capable of 12MHz clock speed.

Details from Abbey Microsystems of 30-38 Cambridge Street, Aylesbury, Bucks HP20 1RS, or phone (0296) 393322.

The machine is also available from a number of other importers including Walters on (0494) 32751 and ITS on (0592) 753424. Pricing varies between manufacturers according to specifications.

A Texas company which reckons it can save around £500 per printer per year by recharging the toner cartridge, has started touting for business in the UK. The company, **Laser Charge**, is based in Austin, the capital of Texas; the founders had to face considerable hostility from the laser printer establishment, which clearly makes a useful profit on supplying brand new toner cartridges. 'In the event that our service voids the warranty on your printer, we provide a full printer replacement warranty,' commented the company's UK press agency. 'In the event, no customer has had to invoke this warranty.' Details in the US from Laser Charge on (512) 328 1630. UK contact point is Graeme Mitchell of Mitchell Marketing, Admirals Quarters, Portsmouth Road, Thames Ditton, Surrey KT7 0XA, phone (01) 398 9636.

A 3D module has been added to TurboCAD. The price of the package remains unchanged at £100. Intriguingly, the package runs faster than the two-dimensional version. And unlike the 2D version, drawings are no longer restricted by the amount of RAM in your PC — they are continuously saved to disk. And it works on Hercules, EGA, or VGA displays. Upgrades: a modest £39. Details from Micro Distributors on (0293) 547788. END

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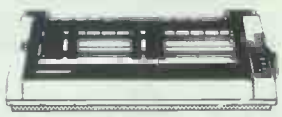
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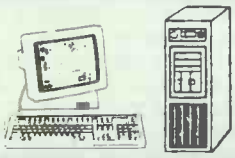
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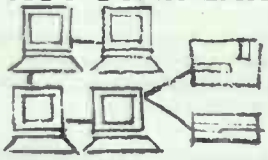
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IBM stacks the deck over MCA



TIM BAJARIN

How is IBM responding to the challenge of EISA? Our US correspondent, Tim Bajarin, reports on Big Blue's latest change of tack.

In recent discussions at Comdex with Bill Lowe of IBM (just before his resignation and move to the Xerox Corporation) he revealed that IBM would not seek any royalty fees for the use of the MCA BIOS until the company received the actual patents that have been applied for.

According to Lowe, IBM's lawyers have decided that it would not be prudent to charge these fees until the patents are actually in hand.

IBM sources also said that retroactive fees would not be sought, and when the patents were finally issued, the company would review each MCA licence individually at that time. They also said that IBM would look for any type of cross-licensing agreement with any of these clone makers and try to find something that IBM could use somewhere in their products, thus keeping the final royalty fee as low as possible.

This is quite a turnaround from IBM's original stance, as it has led the industry to believe that anyone who used an MCA BIOS had to start paying royalties at once. In fact, many vendors who have had discussions with IBM confirm that this was in fact true, and that the royalty fees could have been as much as 5%, depending on what types of infringements existed on the clone box.



Normerel's NS50 — with MCA

Why this new, conciliatory change of heart? It seems that IBM has 'seen the light' and realised that cloning is critical to MCA's acceptance in the marketplace. And, the company never anticipated that an EISA standard would be proposed, this giving its own bus some serious competition.

The most interesting thing to watch, as this drama unfolds, is whether the Gang of Nine will stick together and force a new standard, or will some of them jump ship and add an MCA box to their line, thus watering down the potential impact of EISA.

Sources close to Wyse and NEC say that they will introduce a new MCA box by the end of 1989, and that as many as five of the Gang of Nine will add MCA sytems to their product lines by Comdex Spring. So, although IBM will probably charge a smaller licence fee to these vendors once these patents have been granted, anyone who wants to can sell an MCA box and pay nothing to IBM until the patents are granted.

And, considering the US legal system and its slow rate of granting these types of patents, a vendor could have two to three years free to ride on IBM's coat tails.

But the most important thing that will come out of this unique ploy by IBM is that it sucks many vendors into MCA and will guarantee that MCA will be a major standard. At the same time, it leaves doubts in many people's minds about the true potential of EISA, especially when EISA founders cover their tails by having boxes with both bus structures to sell.

You can be sure that the bus wars are not over, but it looks like IBM is doing everything it can to stack the deck in its favour to make sure it is the ultimate winner.

Action required on a PC Hypercard

When Apple introduced Hypercard eighteen months ago the company made a lot of noise about its potential in the market and how it would change the way we work with data links in the future. Since then Apple has shipped over one million copies of the product and at least 40 related applications are available.

However, a frequently asked question is: when will we see a full-power PC equivalent?

At least one product, Guide from Owl International, lays claim to being a Hypercard-type product in the PC world. But the one that could have a similar impact on the DOS world as Hypercard has had on the Mac community, is a product called HyperPad from BrightBill Roberts, the Syracuse, NY-based software house which publishes Show Partner, a presentation product for the PC.

Although a release date for the product is not firm, HyperPad is getting rave reviews by analysts and media folks who have had a chance to get a behind-the-scenes peek. It is a text-based product, not a Windows-style product like Hypercard or Guide. But, for the traditional DOS user, this style of interface makes a lot of sense. They are not used to Windows environments yet, and this textual-style data-linking tool is easily understandable.

HyperPad basically works and acts just like Hypercard. It allows you to create stacks, link them together and display them. The same tools and metaphors provided by Hypercard allow the user to create a database and use the searching and linking methods to connect everything together.

Sources close to the company say that it could ship as early as February 1989. Whenever it appears, though, you can expect it to set in motion a lot of interest in Hypertext-based systems, leading to the introduction of Windows-based products by Comdex Spring.

BrightBill Roberts is in the US on (315) 474 3400.

Presidential Macs

Now that George Bush has become the President-elect, his staff want to make sure he continues to look good, especially on paper.

His transition team has just put 20 Mac IIxs in their Washington office and will carry them into the White House on 20 January when Bush becomes President.

The Bush campaign team has used Macs throughout to handle their scheduling, word processing, last minute press material and, in some cases, actual flyers and publicity documents to hand out at rallies.

So, when you see photos of the White House staff slaving away at their desks in the future, look for a Mac to be at their side . . .

Mac jottings

A new program from Mediagenic's TEN.0 division really shows how valuable pop-up desk accessories can be. A new Macintosh desk accesory developed by Working Software of Santa Cruz, Quick Letter, is literally an 'on call' word-processing program.

Let's say you are in a spreadsheet when an idea grabs you, or you are working on a graphics drawing and want to jot down some notes. Or you have a full letter planned and you want to write it while it is on the tip of your tongue. Unlike SideKick, you can use Quick Letter as a powerful, robust WP.

The program also allows for pre-designed envelopes and form letters at your command. Just open Quick Letter from the menu bar and you instantly have a full-featured word processor on hand. You even have all the Mac fonts from the font desk accessory at your disposal, and can use the normal cut and paste features like Mac Write. You can then save your work to various file formats as you need them.

Quick Letter is an indispensible productivity tool for your Mac. It will be available in the UK from Mediagenic TEN.0 dealers in late January. ▶

Strong signals about DSP

One of the most fascinating components of the NeXT computer, launched in October, is the high-speed digital signal processing chip that is built directly into the system.

DSPs are incredibly fast chips, capable of taking in a vast amount of data and emitting a response almost instantly. Their speed allows them to handle seven or eight chores in the same time that a conventional microprocessor might handle one or two. This type of chip is usually found in large telephone systems and modems.

The Motorola 56001 DSP chip can execute a command in 97.5 nanoseconds (millionths of a second). That enables it to process at a speed of 10.3 MIPS (million instructions per second) — a speed which, until recently, was found only on supercomputers.

The 56001 chip costs around $100. But even this chip is slow when you compare it to the TI TMS-320C30, the leader in the DSP market. The C30 is about three times as fast, and sells for around $1000.

These chips have other advantages besides speed. They are capable of processing compact disc quality sound. They can be used for speech synthesis, which will allow the development of software that talks to the user. They also enable the computer to accept and store voice mail, adding a dimension to electronic communications.

Because they are telecom-based, they can double as a modem chip set. Since the DSP can send and receive data at 9600 bits per second, it can also be used as a fax transmission device. And it can also provide high-speed number crunching, bringing any machine that uses it almost into the supercomputer class. If that's not enough, it can also work as an array processor, speeding the performance of graphics onscreen for such tasks as 3D modeling and handling the complicated screen commands from the new generation of Windowing environments.

In other words, the DSP chip can make a computer more versatile and much more powerful than other machines of its type.

One of the other imaginative ways this chip could change the way we use computers is in 'Soundware'. Imagine a French language program that pronounces a word when the user highlights it on the screen. In future versions of complicated software, you could cut the keystrokes out completely — just tell the program what to do and it would respond to your voice.

DSP chips will radically change the character of future software, making today's computers seem as if we have all been watching television with the sound off.

To his credit, Steve Jobs has again seen the future. Due to his desire to make a computer for the rest of us he has forced us to make a quantum leap into the next generation of computing. By using a DSP chip, all vendors will be able to create new software that is easy to use and puts powerful computers into the hands of even the most technically illiterate.

But the fact that this technical wizardry is now out in the open becomes Jobs' Achilles heel. If you take a close look at his machine, at least in hardware terms, you soon see that almost any serious vendor could come up with something similar. Indeed, Silicon Valley sources say that Apple and Sun Microsystems have new computers with DSPs embedded into their systems, and will release them in mid-1989. And IBM sources say that a DSP is already in the new RT that the company will launch in the Spring.

In the one area that he does have an edge, software, Jobs' object-oriented programming scheme could be short-lived if he is not able to get both machine and software to market in early 1989.

Although IBM will use NeXTStep, Apple and Sun could adapt the Xerox Smalltalk language to emulate his program, and with the newer versions of this code being streamlined, they could match NeXT with a similar concept by the summer. Even if Smalltalk is not the answer they choose, object-oriented programming is such a surefire market opportunity that industry insiders say at least three software systems similar to NeXT are in the works, and will run on multiple platforms by launch time in 1989.

With the market bigshots all going after this new generation of computers by adding DSP chips to their hardware, computers will become more powerful and easier to use. However, it's still too early to tell if Jobs and his company will actually be successful, or if Sun and Apple will do well out of this marketing opportunity.

Windows of opportunity

I have just had a look at Ami, the new Windows-based word processor from Samna reviewed on page 150 of this issue.

What's important about Ami is that it's the first of a breed. First of breeds tend to enter a market with a bang and slowly take over ground won by products whose features have increased but within an old environment.

Ami is a good case in point. Industry experts agree that the first two or three Windows-based WP programs will have a major impact on the traditional word processor players. WordPerfect could take the biggest hit.

Samna is first, and Microsoft, with its Windows-based WP codenamed Opus, will probably be second. Samna's product will have a good three-to-six month lead on Microsoft and could gain some important ground. But Microsoft, with its marketing clout, will come in quickly and become the number one player. And although Word-Perfect has a lot of users today, the company must watch this Windows development and respond quickly if it wants to stay in the hunt.

A new breed of Windows product is so important because corporate America normally plays it safe, and often stays with a single product even when other, better items appear — to avoid re-training.

However, since IBM and Microsoft have told Mr and Mrs Corporate USA that OS/2 and Presentation Manager are the future, they will start to migrate into the Windows environment in 1989.

But because of the difficulty of making a great leap into the Windows world, they will start slowly and build up steam.

It is for this reason that companies like WordPerfect need to respond to the Windows gauntlet *now*. And, for that matter, so does Lotus. Big corporations are already standardising on Excel, and Lotus could lose some important territory it may never win back, unless it puts out a Windows-based 1-2-3 soon. Lotus 3G is probably only an interim solution and the company will need to produce a Windows application that is truly powerful if it wants to stay out of trouble. END

Better graphics

One of the products introduced at Comdex last month could make many users of the HP LaserJet printer very happy.

Although the LaserJet is great for text, it leaves a lot to be desired when it comes to graphics. In fact, the quality of the graphics output from Apple's LaserWriter or other Postscript-type printers is the best way to get both high-quality text and graphics into your copy. But Visual Edge, a new product from Intel's PCEO division, is a printing enhancement and speed accelerator for any HP LaserJet II printer.

It brings the possibility of photographic-quality half-tone reproductions to a range of applications, improves standard LaserJet II resolution by 300%, and speeds printing by 200% to 600%, depending on the document size. Consisting of a PC-size half-card, a printer board, a cable and software, Visual Edge supports AT-class systems and above.

Priced at $695, it is an inexpensive way to make your LaserJet II act more like a Postscript printer.

According to Mark Christensen, product manager for Visual Edge, users expect to trade resolution for grey scale. 'With the Visual Edge system, they get both.'

For example, at 70 lines per inch resolution, Visual Edge produces 64 levels of grey compared to the 19 levels on a standard LaserJet II printer. At 100-line resolution, the results are 37 levels compared with 10 levels on a LaserJet II.

With this higher grey level, photocopies of the original documents come out sharp and crisp instead of dull and 'bleeding'. Intel plans to start marketing this card as a system for use in publishing by photocopier. If you have ever tried to photocopy a graphics image from a LaserJet II, you know how much room there is for improvement.

Although I don't think it will ever replace Postscript, it will at least make any LaserJet II much better than it is today.

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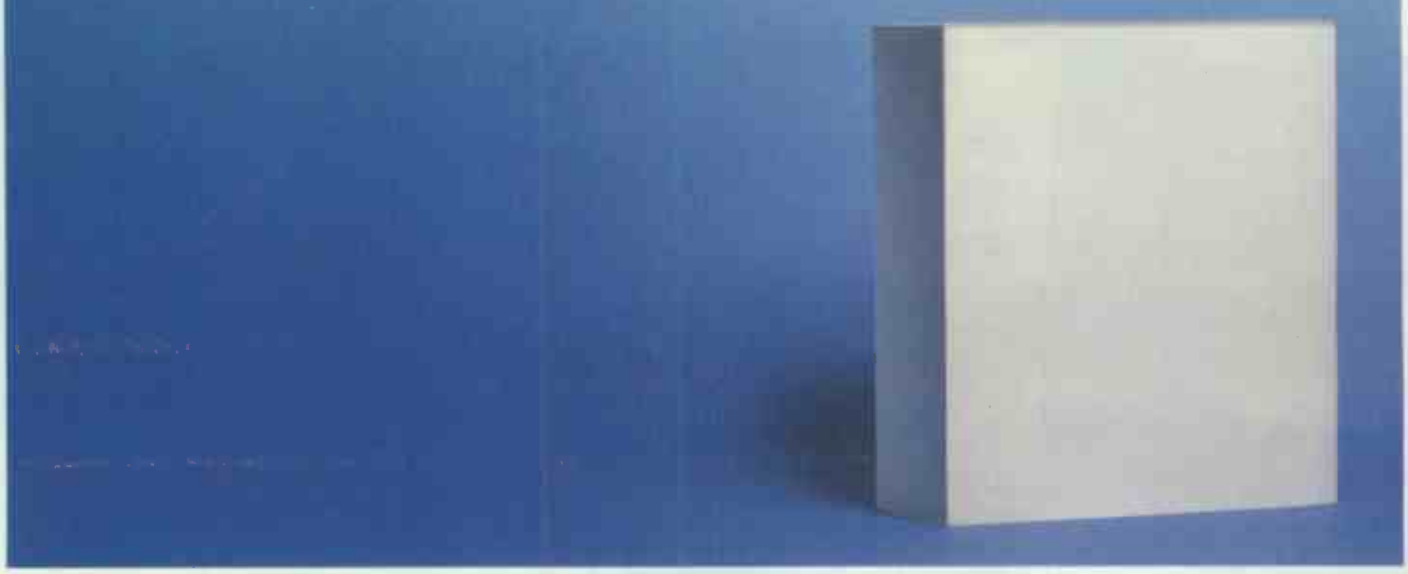
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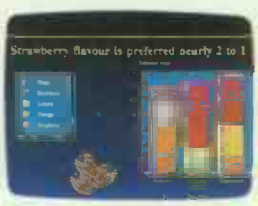
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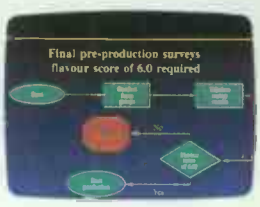
You know how great Freelance Plus was when it came to drawing. Now it's even better to help you with freehand drawing to create almost any image you want from cartoons to flow diagrams, that you may need for business use. What's more, there are over 900 symbols like maps, cars, office equipment – even fruit to make your presentations outstanding.



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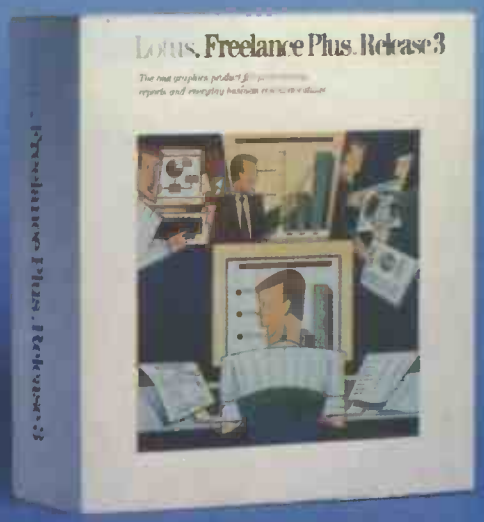


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BANKS' STATEMENT



Illustration by Mark Hackett

Song and dance

Just because computer journalists are so laid-back, it should no longer be assumed that the entire industry has the same image. With their sharp suits and silvery speech, the personal computer showmen are taking over . . .



MARTIN BANKS

I don't care who you are, or indeed, who I am; we are all beset by image. We may like to think that this is an affliction only of 'the others', everyone else except us, but unfortunately that is not the case.

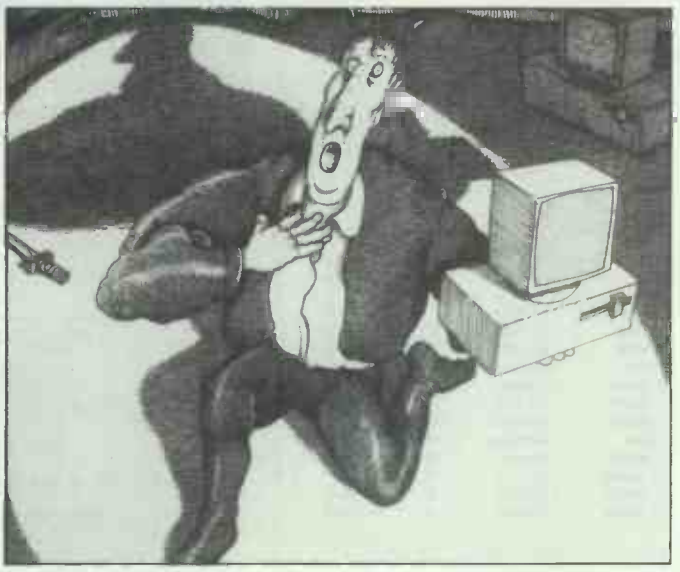
Image is not just something which affects individual people, though we all have our problems in this area. It also affects companies and indeed whole industries. Everyone can spot an undertaker, for example, especially when they are working. It is more difficult to spot diners, of course, for the male version of the breed tends to dress the same as the waiters who serve them. But bank managers always wear sombre suits, don't they? They're so easy to spot, even when they're on holiday.

Image has also had its place in the mainstream computer industry, of course. IBM staff, especially those that have to meet anyone from the outside world, have traditionally worn a white shirt and a dark (preferably blue or grey) suit. And one large management services company used to have the reputation of taking its ideas on image to puritanical lengths, so that no staff could, for example, have any form of facial hair, or they lost their job.

When the personal computer came along, the image changed, though 'image' it certainly remained. Suddenly, one had to be desperately laid-back to be in the PC business. It became very important, even in darkest Oswestry, to have the image of someone who had just come back from the beach, man, where . . . you know . . . you had been . . . you know . . . *thinking*, man.

Not surprisingly, Apple was the company that best personified this image, with Jobs and Wozniak creating the genre almost single-handed. This is ironic, in a way, for it is now Apple which is at the forefront of a sea-change in the image of the PC business, and itself in particular. I have not been alone in admitting a certain sadness at the passing of the 'fun' image of the PC business — while accepting that it has over the years become a much more serious business altogether. But a definite change in attitude has recently come about. The PC business is now *Important*.

And if you don't believe me, look at the evidence the industry presents about itself. It has a higher opinion of its place in the world than anyone else. And the results of this change can be seen not only in the industry, but in some of its products and their impact on the world. It is in danger of making 'image' products that do little more than enhance the image of the already image-conscious. A bit like designer underwear, really.



Take, for example, the recent spate of TV adverts by Apple. Very significant boardroom types sit around a table while 'the boss' demands some form of publishing miracle to be produced in the next thirty-five seconds. Oh gosh, the Apple-freak is the only one who can produce the goods.

In another advert, one important-style executive person is stunned by the quality of the report that another executive-style person is posing with. The first is then stunned again by the fact that the second produces this sort of pretty-looking thing all the time.

Not once, however, does anyone talk about more than production speed and presentation. The content of all this artistic endeavour is probably a heap of dodo's droppings, but so long as it looks pretty, the adverts imply, you'll get a seat on the board and a company Ferrari.

The same effect can be increasingly seen in company videos. Every damned one is packed full of the most boring rubbish you could ever be unlucky enough to observe. All the most tedious facts about a company and its products are intoned by someone with one of those soporific voices guaranteed to send anyone into a catatonic state.

Self-importance is usually on display by the bucket-load, and anything that smacks even remotely of humour or, dare one say it, humanity, is ruthlessly torn out and consigned to the cutting room floor. Pompous company individuals talk pompously to people who, if the market researchers have done their job properly, obviously need to be talked to in that manner.

This is hardly surprising, of course, for the majority of both the talkers and listeners are men, and men just love either to patronise or be patronised. In that way, they can define their place in a heirarchy, a necessity for them which is aided and advanced by the excessive use of image.

Now we are starting to see the ultimate version of this self-importance among members of the PC business. If you ever have the chance to attend the launch of a new product by a PC manufacturer, go along — but not to see the gizmo (it's bound to be just another box with a bit more memory, a bit better disk, a slightly more whizzo processor and a teensie bit more fanciful colour display). Instead, look at the company executives.

There you will see the latest shift in the PC image business — the marketing manager as *performer*.

Yes, you will be stunned by this star turn: you will marvel at lines learned to perfection, slide show precisely timed, demonstrations (usually) going like clockwork. And the clothes . . . well, they are always stylish, à la mode, and direct from the smoothers.

And the product? Since it is just another box of bits, much like all the others, it's the marketing manager's dance routine which now marks it out as 'better', or 'different'.

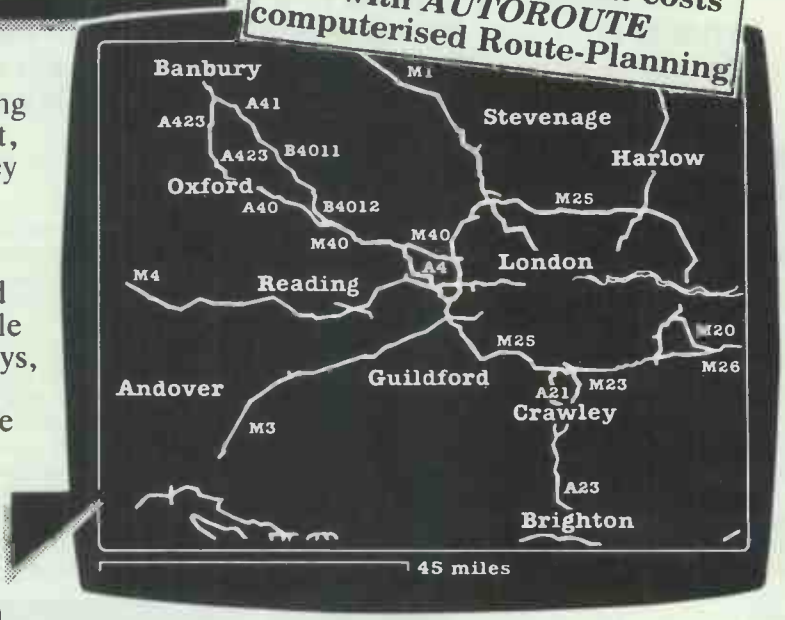
This raises an interesting thought. Noel Coward once wrote a song called something like 'Don't Put Your Daughter On The Stage, Mrs Worthington'. He is still right.

Now, Mrs Worthington, you should send her to the PC industry. She'd get more acting experience, and I'm told the work is more regular.

Rumour has it that RADA is starting an acting course for marketing managers very soon — the market is ready for it. END

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Time		Road	For	Dir	Towards
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11:43	At M23 J11 turn off onto	M23	14 miles	E	(M23 J10)
11:57	At M23 J7 turn off onto	M25	23 miles	W	(Sunbury)
12:25	At M25 J12 turn off onto	M3	7 miles	W	(M3 J3)
12:31	At M3 J3 turn off onto	A322	6 miles	N	Bracknell
12:40	At Bracknell turn left onto	A329	2 miles	S	Reading
12:43	Turn off onto	M329	3 miles	N	(M4 J10)
12:46	At M4 J10 turn off onto	M4	42 miles	W	(Theale)
13:31	At M4 J15 turn off onto	A419	1 mile	N	Cirencester
13:32	Turn off onto	A4259	¼ mile	W	
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Word 5 soon, huh? Exactly who are the pirates in this industry?

Jim Bodley, Paris

School's out for the Spectrum

I brought myself up on Spectrum Basic and wrote educational software that packed into the tiny 48k, each tape taking forever to load: two French programs and one Latin. The French were so popular with the parents at the school where my wife teaches that parents would go out and buy a Spectrum so that they could buy the tapes!

My head swelled. My hopes raised. My adverts went into educational software magazines. My hopes faded. What I did not realise was that schools are full of BBCs, and not Spectrums as I had imagined. Reprogramming the software in BBC meant I would have to take the fun out of the programs, animation and music, which were all part of the joy of the learning discipline. The Archimedes was not around when I was re-educated to IBM compatibles.

IBM and its clones are all the rage. I must rewrite the programs for IBMs. Well, I can program in GWBasic quite well, but how do I get the music and the animation in? I must work on it. Then bingo . . . Matrix ((0752) 796363) brings out the panacea to all my ills, so I am told. 'Layout — you'll never have to write programs again. It is so easy. . .' my friend said.

My copy of Layout is on my Amstrad PC1640 hard disk; I have printed out the massive amount of Help pages. The technical support teams have sent me special software to run with GEM — or rather without it. I have spent many hours trying to make the simplest of routines work, fighting my way through layers of pop-up screens, overlapping one another like blankets on my bed, where I think I will go now, and dream of the possibility of making a breakthrough in producing my fantastic educational software to run on an IBM, or its clone — but sadly without Layout, and a friend less!

David Lacy-Hulbert, Devon

Why the Nimbus is better

I am computer manager at a large college where about half of our micros (that's over a hundred) are Nimbuses. The Nimbus was no more intended to be a flash office or hobbyist machine than a Jaguar was designed for a driving school. We can and do teach standard computer applications using Word 3, WordStar, Multiplan, Lotus 1-2-3, Logistix, Excel, dBase III Plus, Database, Framework II, Turbo Pascal, BBC Basic, PC Paintbrush, Draw!, Aldus Pagemaker 3, Superdraft CAD, Pegasus, Sage Accounts and hundreds of other packages which have been specifically written for schools and colleges.

What makes the Nimbus better than the BBCs, IBMs, ICLs and Apples which we also use is the fact that it was designed as a teaching machine. The most relentless testers any computer can face are a couple of thousand teenage users a year. After a couple of years use, the only failure we have had is one power supply unit. (I wish I could say the same for the monitors and printers on the same networks.) Name any other micro which can have boiled sweets forced into its drives and still run perfectly when they are removed.

What I find disappointing in Guy Kewney's Newsprint (December 1988) is the inaccuracies. The Nimbus does not use the 8088 or 8086 chip. The IBM emulator quoted is several generations outdated. One advantage of the 80186 in an environment of students is that when some bright spark tried introducing a virus of some sort it found the processor incompatible — unlike the IBM network.

Money also matters to educational bodies. The £3000 worth of software (including PageMaker, Windows 2, Word, Dataease and Excel) which comes with a Nimus Network means a lot to us.

Arthur McGiven, North Tyneside Council

Call Archie

As a regular reader of *PCW* since 1984 I like the new layout of the regular items at the back of the magazine, in particular the Special Interest sections. I do however miss the music column.

I have a fairly broad interest in computers, being a former Sinclair ZX81 owner, shortly to take delivery of an Acorn Archie, and using Olivetti M24s and a Prime 2250 in my office.

In common with a number of your readers I regret the concentration which your magazine and others like it have on IBM-compatible machinery, but accept that this reflects the business world.

The possibility of an Archie column is of obvious interest to me, in view of the boxes of Acorn kit that will soon adorn my spare bedroom. I hope that other readers reply with a similar request.

Tony Garland, Essex

There have been a number of requests for an Archimedes section and it is top of the list for additions to the regular columns. But the pagination of PCW is limited and something else will have to go.

Our Reader Survey every year gives us some clues as to what should stay and what should go (and the music column proved the least popular last year), but further suggestions are always welcome.



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.

FullWrite isn't copy protected

The October issue of *PCW* included an article on Ashton-Tate's FullWrite Professional, entitled 'Not quite everything'. I would like to point out that FullWrite Professional is not a copy-protected piece of software. It is not copy-protected, as is the case for all software in the Ashton-Tate Macintosh range.

Also, designed as the best word processor available, FullWrite Professional is built to run on all 1Mbyte Macintosh computers from the Mac Plus upwards. Extra memory is only a requirement for those users heavily reliant on memory-resident INIT's and Desk Accessories above the norm, or those who would need to use 'beefed up' machines for their large scale applications anyway.

P McManus, Ashton-Tate

Where are those Amstrads?

I didn't manage to go the Personal Computer Show but I read that Amstrad demonstrated its 286 and 386 machines. Some weeks later, at the Amstrad show, they were nowhere to be seen. What happened?

DR Hughes, Gwynedd

Being unable yet to deliver the 286 and 386 machines, our guess is that Amstrad would rather arouse interest in the machines it can provide. ▶

Perfectly daft

Can I echo Tony Klouda's letter (*PCW*, November) about the change from WordPerfect 4.2 to version 5.

Having used 4.2 for a year, I was happy to see the new version, although to be honest I couldn't really imagine how Sentinel could improve the product as I hadn't needed two thirds of the features that were already there. I went through the upgrade process, which was painless, and discovered that Sentinel had totally ruined an excellent program.

WordPerfect 5 is a devil to set up, especially matching printer drivers to documents. It is desperately inflexible — changing a paper size is so difficult I have on several occasions re-typed a document manually rather than go through the bother.

If, at some time, you just want to print out a note on a complement slip (something which didn't occur to you three months ago when you defined the printer driver) you can't. Simple as that.

There are other difficulties which arise in actual printing, but they're too stupid to go into here.

I am now using a different word processor. And, as the change came right in the middle of an evaluation of word processors to determine which would be the standard across my company, Sentinel has lost out.

I can hardly wait for the next version, where you have to define paper thickness, height above sea level, printer ribbon supplier and wood pulp used to make the paper.

John-Paul Keates,
Data Services Manager,
Evans Halshaw Contracts,
Birmingham

Please would you publish this letter to help the cause of arguably the best word processing package in the world.

Why does the Support Group Inc in the USA publish the *Word-Perfectionist* and the Netherlands have ClubPerfect?

Here in the UK we have tens of thousands of WordPerfect users and no user group (unlike Word, WordStar, Lotus, and so on). Sentinel Software/ WordPerfect UK has invited comments/suggestions but has neither come with concrete proposals nor adequate support for Version 5 (or even 4.2!).

Should any reader be interested in joining ClubPerfect UK or attending the inaugural meeting, please write to me.

Iain McNeil-Sinclair,
89 Park Road, Uxbridge
UB8 1NW

I read with interest a letter from Tony Klouda in your November issue which suggested that WordPerfect 5.0 had 'lost the useful facility for telling the printer which range of pages you wish to print'. The facility does still exist; accessing it has changed.

WordPerfect realises the importance of this function and now has two methods of choosing and printing pages in 5.0. First, using the List Files function, you can identify the file and select option 4 (Print). This offers the option to print all of the document or a selection of pages, for example 1-3, or 5-6,8. The second method is to use the Print option (Shift f7) and option 3, Print from Disk. Again, it is possible either to print the whole document or take a selection of pages.

I hope this is helpful.

David Godwin, WordPerfect

And a free electric band

In view of the dangers of static electricity to computers you may be interested to hear that the polyethylene band around my December copy of *PCW* was so highly charged it made the hairs on the back of my hand stand up.

The band, when rubbed on the cover of the magazine, is such an efficient generator of static it made a useful science demo for my son.

Thank you for two gifts in one. Perhaps other readers' experiences might not be quite as happy.

Paul Shave, West Lothian

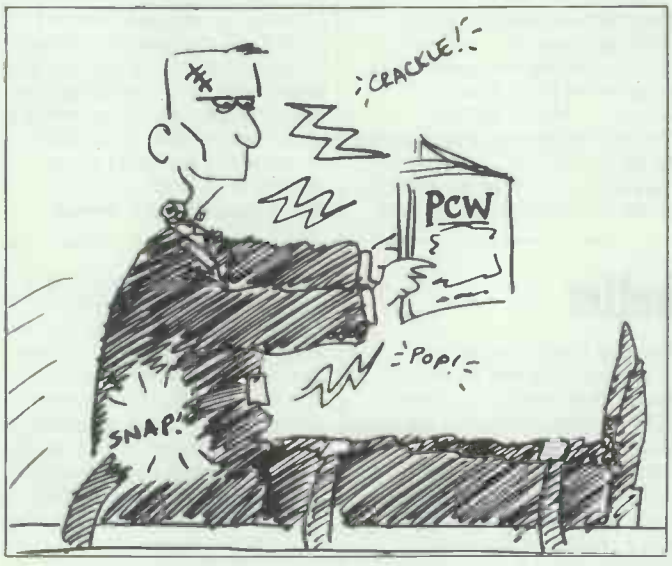


Illustration by Sophie Grillet

Beware the Z88

With Cambridge Computers keen to move the Z88 into the education market I feel compelled to advise the education authorities to stay well clear of the machine.

Ask anyone who has used a Z88 for a few months (less if they are a heavy user) and I can almost guarantee that they will tell you that a keyboard fault has occurred. I got through four Z88s in 12 months before giving up.

The thought of thousands of these machines in schools and colleges under heavy use fills me with horror.

David Whitmore, Wisbech, Cambs

We must admit you are almost alone in condemning the Z88. Among both PCW's staff and readers the Z88 has been welcomed as a very portable and practical notebook computer.

Punishing the innocent

I agree entirely with Guy Kewney's sentiments concerning copy protection ('Breaking down en route', *PCW*, October).

Some months ago our office administrator upgraded his keyboard and the new one had a slightly different layout. At some point in his work he pressed Z and another key, and a message came up: 'Are you sure?' 'Of course I'm sure, he murmured, and pressed Y.

The program or operating system or whatever he was in at the time promptly zapped his hard disk, which contained all our accounts. Yes, he had regularly and carefully backed up so all the data was saved up to the previous day. But the program was gone.

We contacted the software house who said in effect 'Hard luck!' and referred us to the dealer, who then had to contact the software house for a replacement set of disks for which they charged £50 plus VAT.

The dealer then had to make two visits, first to install the software and then to re-install the data for which he charged £200 plus VAT.

The whole process took over two weeks, during which time more data accumulated. If the software had not been heavily copy-protected the simple mistake could have been rectified by ourselves from a back-up copy.

Copy protection is illogical as it penalises honest people. It is ineffective for its supposed purpose, since thieves will find a way round it but honest people won't try. It is unfair since it is the legitimate users who have to pay extra cash for a back-up copy, a replacement, or a 'special non-copy-protected version'.

It is for these reasons that my company decided never again to buy copy-protected business software. If software houses will not trust us with their programs, we will not trust them with our money.

As an author I am fully aware of the need for writers to be properly rewarded, but there is no need to punish legitimate purchasers for the activities of pirates.

Stanley Jebb,
Dunstable, Beds

I/O adaptor for the ZX81

I have passed on one of my old ZX81s to a friend who wants to use it to control an extensive model railway system, but we cannot find an I/O adaptor.

Can you or any of your readers help? Or how else can we harness the ZX81 to its intended task?

What else do you think we will need?

RFG Day, Bognor Regis END

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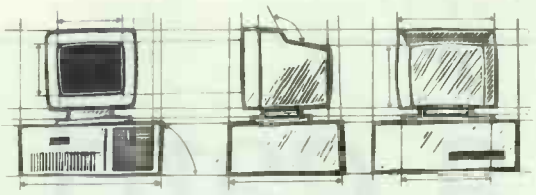
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KYOCERA



Apple Mac SE/30

To many observers, the personal computer world is dominated by two superpowers — the PC and the Apple Macintosh. In the last couple of years the Mac has steadily been losing ground to its technologically inferior rivals; now, as Guy Swarbrick found, Apple has trumped them again.

The Apple Mac's heritage (especially if you consider the ill-fated Lisa, launched in the middle of 1983 as part of the family) is almost as long as that of the PC. In that time the Mac has, until recently, always been ahead of its sheep-like cousins, technologically at least.

Many people, though, even people within Apple, will admit that the original 128k single-floppy Mac was never really in a position to challenge the PC world. In terms of raw processing power it had a significant edge, the 8MHz Motorola 68000 processor making it roughly equivalent to the IBM AT which was still a few months away, and the user interface was (and still is) the best available on a microcomputer. (This position may change in the next few months with the introduction of Unix-based windowing systems on machines like NeXT and Atari's Transputer Workstation, but it is reinforced by the fact that every revision of Microsoft's Windows/Presentation Manager brings it closer to the Mac.)

What the machine lacked which would have made it truly useful was a decent amount of memory and a built-in hard disk. There were other things which, though not essential, would certainly have helped, for instance colour and expandability.

The memory would come in two stages, first with the 512k so-called Fat Mac and then with the 1Mbyte Mac Plus. Both machines, though, were still limited to a single floppy drive, though the capacity had been doubled to 800k; and, at last, the Mac came with a SCSI port to make the connection of an external hard disk less harrowing.

On the subject of a colour Mac, I have been told at different times that colour is 'a nonsense' and that a black and white machine is not worth buying. Both these attitudes lack more than thirty seconds thought, but both have influenced buying trends over the last five years or so.

As for the lack of expandability, the slots in most PCs have always been filled with video cards and I/O ports which the Mac user had on-board anyway. For most people, most of the time, they were unnecessary.

It took the Mac SE, launched in April 1987, to make the Macintosh the machine it always should have been — a 1Mbyte RAM, 20Mbyte hard disk machine with an expansion slot. For those who were still unsatisfied there was even the Mac II; not the conventional cuddly Mac box but 16.8 million colours, a considerable advance over the original two, the more powerful 68020 processor and Nu-Bus, an industry-standard expansion bus for those who needed it.

The timing of this launch was interesting in that, although Apple had finally made the Mac truly useful (and despite several operating system upgrades) it was still basically the same machine they had launched three years earlier.

Taking into account the fact that the Macintosh started from a position of strength (being the equivalent of a 16-bit 80286 machine before such a machine had been introduced) Apple had squandered the




Demo
Speed
Apples (10) -- Using 881 Directly
Macintosh SE/30

lead. In the same time as the PC had moved from the 8088 through the 8086 and 80286 to the 32-bit 80386 (by this time even IBM had a 386 box, in theory, at least), the 'compact' Mac had remained at roughly the same technological level.

By the launch of the SE, the Mac had carved itself a nice little niche in areas such as desktop publishing and graphic design and was a favourite tool among professional writers, but the advantages it had had for the last few years, the excellent user interface in particular, were now being challenged by the newer, faster PC clones.

Now, with the Macintosh SE/30, Apple has catapulted the compact Mac standard back into the forefront of the technological race.

Hardware

Externally the machine is very similar to the current SE range. Indeed, the machine we were supplied for review was cased in a standard SE box, partly for security reasons and partly due to the fact that the new mouldings hadn't arrived from the States.

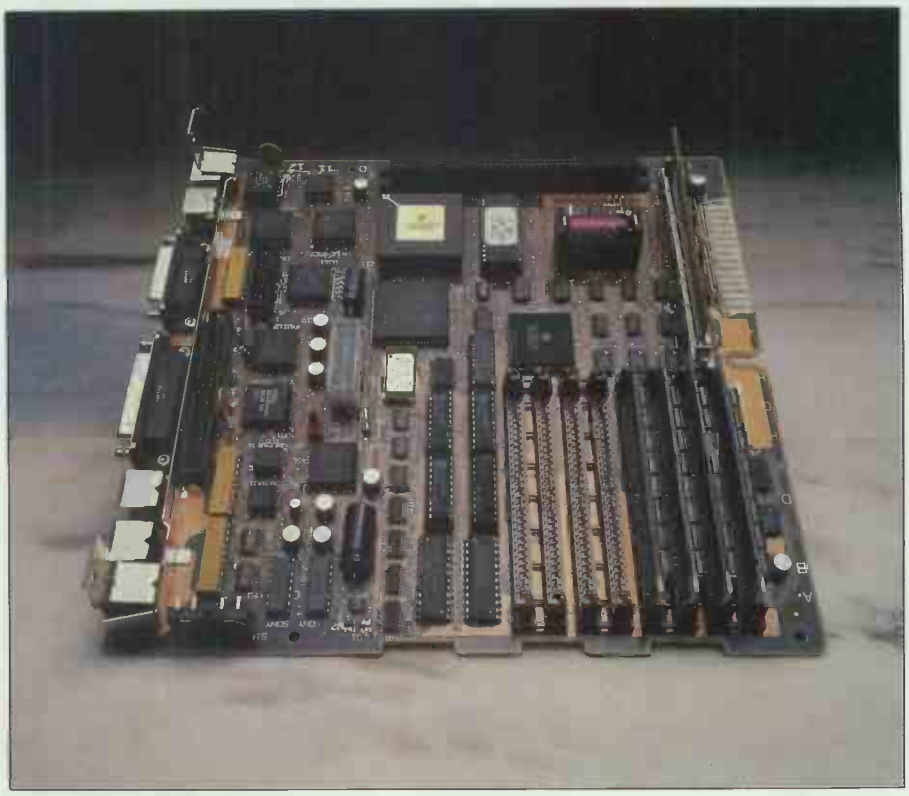
The external ports are, again, identical to those on a standard SE: two Apple Desktop Bus connectors for mice, keyboards, trackballs and so on, an external floppy drive port, a SCSI port for one of the growing range of SCSI devices from scanners to WORM drives, a serial printer port, Apple Talk connector and a stereo headphone socket.

At 9kg the SE/30 is just as transportable as its older brethren, retaining its telephone-style hand grip. And, of course, the integral design means that once you have lugged it to another location there is no need to spend hours looking for two or three spare wall sockets.

The heart of the Macintosh SE/30 is Motorola's 68030 processor. Not as fundamental an upgrade as the 68020 used in the Mac II was from the original Mac, it is nonetheless a significant upgrade from the 68000 in the other compact Macs.

Essentially the 68030 replaces the combination of 68020 processor and 68851 Paged Memory Management Unit (PMMU) by integrating their functions in one chip. In addition to the benefits this provides, the 68030 is also around 30% faster than the older design. Being a direct descendant of the 68020, the 030 is 100% instruction-compatible with its predecessor (hence the decision to use the 68020 Mac II ROMs).

The 68851 is a sophisticated demand-paged memory management unit which will, eventually, be used to bring true multi-tasking to the Macintosh. At present, the system software in both the SE/30 and the IIx is the same 256k ROM set which originated with the 68020-based II. But eventually, probably by way of a much improved MultiFinder designed around the PMMU, the Macintosh will be able to provide a stable multi-tasking environment by taking the memory management tasks away from the overworked 68030 and providing the hardware support a multi-tasking system requires to be effective and secure.



Other than the 68030 and the 68882 co-processor, most of the SE/30 motherboard is made up of VSLI gate arrays

The 68030 actually contains a slightly cut-down version of the 68851 and it would appear that Apple's reasoning behind the introduction of the Mac IIx and, in particular, the SE/30 (which bypassed the 68020 altogether) is to introduce new machines based around the 68030 now, before use of the 68851 is common, and to discourage use of the separate PMMU. In view of the Apple approach to software development and the strict guidelines it maintains, this kind of enforced standardisation has considerable benefits.

The processor runs at a respectable 16MHz which gives the machine a performance roughly four times that of a Mac SE. It is, however, rated to run at twice that speed. Apple's reasoning behind the relatively slow clock speed is partly the increased cost of the support components (faster RAM and so on) but mainly the availability of these higher-specification parts.

This is not an unreasonable excuse but, in the light of Steve Jobs' decision to clock the NeXT cube at a far more zippy 25MHz, it does seem a little conservative. The parts obviously are available, although NeXT will obviously require them in much smaller quantities (initially at least) and faster versions of the 68030 Macs are not beyond the realm of possibility.

Alongside the processor is the 68882 maths co-processor. Said to give a 100% improvement in speed over the older 68881 device found in the Mac II, the 68882 was designed with faster throughput, rather than outright mathematical speed, in mind. The claimed 100% speed increase is obtained only when the co-processor is driven by true 68882 code, but even with 68881 instructions an improvement of up to 30% on that chip is suggested. We were unable to obtain any software which used the 68882 in its native mode but, even driven as a 68881, floating-point operations were improved by nearly 1800% using the co-processor directly and by 110% using Apple's SANE (Standard Apple Numerical Environment) routines, which allow software to run on standard machines but take advantage of a co-processor if it is available.

Also carried over from the Mac II is the sound chip. Fans of the Apple IIGS (and there are some, despite its low UK sales) will welcome this cut-down version of that machine's sound chip as a replacement to the

traditional Mac method of driving the speaker directly with software.

The chip is basically a four-channel version of the 16-channel stereo chip in the IIGS and, as well as the four-voice wave-table synthesizer, it provides stereo sound with a sampling rate of up to 44.1KHz. Although a cut-down version of the IIGS chip, it is nonetheless a welcome addition and will go some way to relieving the load on the main processor.

The two main components on the well laid-out 9in square circuit board are the 68030 itself and a larger VLSI glue chip containing what would have been dozens of small logic chips in days of yore. In fact, VLSI chips make up most of the chip count, controlling the SCSI ports (one external and one internal for the built-in hard disk), the floppy disk drive, the Apple Talk network bus and so on. The rest of the board is made up of the 68882 floating-point co-processor, the cut-down version of Ensoniq's Digital Oscillator Chip (DOC), a SIMM containing the system ROMs and four SIMM sockets containing the standard 4Mbytes of 120ns RAM. Up to 16Mbytes will be possible once the necessary 4Mbyte components become available.

The standard hard disk on the UK specification Macintosh SE/20 will be the comparatively fast (28ms) 40Mbyte hard disk currently in use in the higher spec SEs. This unit, as well as being quicker, is considerably quieter than the 20Mbyte device.

The floppy disk drive on the SE/30 is also significant, especially for those working in mixed PC/Mac environments. Many offices produce text on PC word processors and transfer it to the Mac for desktop publishing. There are many ways of achieving this, but the new FDHD 3½in drive fitted as standard to the SE/30 and IIx has to be the easiest. As well as reading single and double-sided Mac disks, the drive can read 720k and 1.44Mbyte MS-DOS format disks and Apple II disks.

The Finder can still only read Mac format disks, and Apple's File Exchange program must be used to transfer files to and from foreign formats, but the process beats a serial cable hands down. File Exchange also allows for specific file format conversions as documents are copied, which should make life a lot less complicated.

The SE screen is the same 9in 512x342 as other compact Macs, as are the keyboards available for the machine and the excellent, single-button mouse.

Perhaps the best news for current Macintosh SE owners is that the SE/30, like the Mac IIx, is available as an upgrade to existing machines. The job is a half-hour dealer upgrade and, although the price hadn't been set when this review was written, it is unlikely to be less than the price difference between an SE and an SE/30 as everybody would buy an SE and upgrade it (nor will it be much more, as Apple wants to encourage people to upgrade rather than force them to buy new machines).

System software

The system software in the SE/30 is something of a disappointment at first, but it is a disappointment rooted deep in PC/Macintosh psychology. Because it is so easy to use, people somehow expect the Mac to outperform every other machine on the market and, because the PC world treats its customers so badly, these same people expect Apple to be perfect.

The operating system is the 256k Mac II ROM set (System 6.0) and, as such, is written in 68020 code, allowing it to take advantage of the features of that chip, if not of the 030. My first thought was that the machine shouldn't have been launched until an 030 operating system, taking full advantage of that processor's new instructions and the built-in PMMU, was written and tested. I still feel that in an ideal world that would be the case but, in the real world, the competition is quite happy to produce 286 and 386 machines running an 8086 operating system. In those terms, the use of 020 code, omitting only the use of the PMMU, is a huge advance.

One of the spinoffs of using the Mac II ROMS without alteration is that Color Quick Draw routines are available, even though it is a black and white machine. The addition of a colour board in the expansion socket should allow colour applications to run without change.

System 6.0 also includes the latest version of MultiFinder which is far more stable than previous versions. I managed to keep FullWrite Professional, Turbo Pascal and Hypercard in memory at the same time with no problems while I was writing this review. I even managed to run a couple of unfriendly games under MultiFinder without upsetting other applications.

The only compatibility problem I had was with a copy-protected version of Adobe Illustrator 88 which ran fine on a standard SE with the same version of Finder but steadfastly refused to run on the SE/30.

Also supplied are a couple of useful utilities including the invaluable MacroMaker. MacroMaker enables any series of mouse movements and keystrokes to be remembered and played back with a single keystroke. At first, not being a macro fanatic of the Kewney/Cohen ilk, I thought the program was an interesting but pointless gimmick. A little experimentation, however, led to large amounts of word-swallowing *chez* Swarbrick.

Finally, for the complete beginner, there is the Apple Tour disk. As twee as ever, it nonetheless provides an excellent and comprehensive introduction to the machine.

Applications

Bundled with the SE/30, as with all other Macs, is Hypercard, currently version 1.21. The virtues of this remarkable piece of software have been extolled in *PCW* before (November 1987).

Documentation for Hypercard is limited and provides no information whatever about the Hypercard programming language, Hypertalk. A Hypertalk manual, though, is available for those who need it and there are a large number of third-party books now available on the subject.

Expandability

The expansion socket on the SE/30, as with the standard SE, is not a true expansion bus but an extension of the processor bus onto which a single expansion card may be added. Unlike the SE, though, the socket is a 32-bit one to match the 68030 processor, so ordinary SE expansion cards won't fit in an SE/30.

Technical specifications

Processor:	Motorola MC68030
Co-processor (standard):	68882
RAM:	4Mbytes
ROM:	256k Finder (68020 code)
Mass storage:	400/800/720k/1.44Mbyte FDHD floppy disk drive
Keyboard:	Standard 81-key or Extended 105-key
Monitor:	Built-in 9in 512x342 black-on-white
Standard interfaces:	Apple Desktop Bus (2), External floppy disk, SCSI, serial (printer), serial (modem), stereo audio output
Expansion:	Internal 32-bit expansion socket
Size:	343mm×241mm×279mm
Weight:	9kg
Bundles software:	Hypercard 1.21
OS:	Macintosh Finder 6.1, System 6.0.2, MultiFinder 6.0.1

Although potentially an area for criticism, the choice of a new expansion socket was really unavoidable within the framework of the compact Mac. Unlike the PC/AT which was able to expand its bus by adding a second connector to handle the extra address lines, no such option was available to Apple in the far more cramped conditions on the SE board.

Indeed, even in the PC world the problem of going from 16 to 32-bit buses is one that has still to be resolved satisfactorily. Apple's solution should, in fact, affect very few people. The main problem will be with people who bought expansion cards for their existing SEs and want to upgrade without losing this investment. In fact, most of the boards which have been purchased for the SE are accelerator cards which would be redundant in the SE/30.

Colour boards and an Ethernet adaptor are among the options expected to be available by the time the machine is launched.

Documentation

The four spiral-bound manuals supplied with the review machine were all for a standard SE. Presumably some alterations will be made, particularly in the spec sheets and the chapter in the SE *Owner's Guide* which details the Macintosh internals, but there should be no need to change three of the manuals (*Hypercard, System 6.0 Software* and the *Utilities* manual) at all.

The manuals are up to Apple's usual high standard — well laid out with clear diagrams throughout. Separate manuals are supplied for system software and the basic hardware specification (although some of this, obviously, was not applicable to the review machines, much was, particularly details of the I/O ports) and, although they have the characteristic friendly Macintosh feel there is a surprisingly high technical content, far greater than is normally the case with user manuals. For those who require more, however, Apple also offers a superb range of hard-bound reference guides covering subjects from Hypertalk to the LaserWriter.

Prices

Unfortunately, prices had not been fixed by the time *PCW* went to press. We understand, however, that it is Apple's intention to fit the Macintosh SE/30 in between the top of the SE range and the bottom of the II/IIx range. The price of a 1Mbyte RAM, 20Mbyte hard disk SE is £3495 and the price of a 1Mbyte RAM, 20Mbyte Mac II is £4795.

Conclusion

Apple's pricing structure, which places the SE/30 at the head of the compact Macintosh range — the SE's and the Plus — but below the Mac II (see 'Second opinion') leaves the Mac looking frighteningly expensive. But in performance terms this machine is the equivalent of a good 386 and the price reflects that. If you must have colour and expandability then there still isn't a suitable compact Mac, but if you can settle for one or the other then the SE/30 could well be for you.

Apple has once again produced one of the most powerful microcomputers of the current era. (Many Intel groupies would argue that the 80386 is a superior chip. This is a complex, usually heated and, in the end, fairly pointless argument. Suffice it to say that the 386 and the 030 are the most powerful of the current commercial processors.) The SE/30 offers unparalleled performance for its size and it would be a shame to see Apple settle into an IBM-like technology suppression cycle rather than continuing to make the Macintosh the best machine it can possibly be.

Much of the performance, however, has come from unashamed devotion to the V8 approach. The Mac's main performance problem has always been that the processor has to do all the work and the solution, traditionally, has been to fit a bigger, faster processor.

Now, at last, the foundations are there for a Mac where the processor spends the majority of its time doing what it does best, rather than trying to function as a maths processor, memory management unit and sound chip. The MMU is there waiting for the software to drive it and the benefits to be gained from its use are substantial, and the use of SIMMs for the ROMs should make the upgrade a painless one. What is still missing, however, is a dedicated graphics processor to handle the complexities of the Mac's windowing system. Although the scrolling speed is much improved in the new machine it is still slower than an equivalent text-based system. The idea of a separate graphics processor is not totally alien to Apple as the IIGS proved, but it still seems some way off for the Macintosh.

Throughout 1988, Apple constantly told us there would be no new CPUs that year (despite sneaking in the 68030-based IIx). Now the company tells us 1989 will be the year of the CPU. Hopefully, the SE/30 is the shape of things to come, and with 16MHz to spare on the processor speed there is no reason why this superlative performer should not be improved still further.

Until now, my ideal writing environment has been a Mac II and a LaserWriter II. The availability of a compact 68030 machine changes that — and reduces the cost as well.

Apple is on (0442) 60244. END

Second opinion

As a Mac sceptic, I view Apple's latest machine with very mixed feelings. Right from the beginning, the easy-to-use interface of the Mac has led people, myself included, to expect the screen handling to be as fast as a text display. Seeing the SE/30 in action I finally saw a machine that provided the facilities I wanted without the sacrifice in speed brought about by the heavy overhead of processing the graphics. And the 'superdrive' floppy disk drive makes using such a machine in a mixed Mac/PC environment easier. If there was a machine that would persuade the individual power user to switch to a Mac, this would be the one.

Apple's pricing policy is another matter. The different profile of Mac ownership between the UK and the US is striking. In the US everyone and their child has a Mac in the garage. People 'love' their Macs, and the Mac has become the way into serious computer usage for many people. However many Macs exist incorporate environments in both the UK and the US, it is the individual ownership in the US which has fulfilled Apple's promise of the Mac being a computer for the rest of us.

But in the UK the rest of us cannot afford one.

The profit figures for Apple show that its strategy of selling a high-priced prestige computer product pays well. And the company claims that this profitability will enable it to branch out and develop further areas of Mac ownership. So, Apple UK is saying that 1989 will be the year of the CPU.

The Mac SE/30 will increase the interest in Macintosh computing. But until Apple either reduces the prices of some of its machines or introduces low-end products, many people will have to forgo the pleasure of using a Mac.

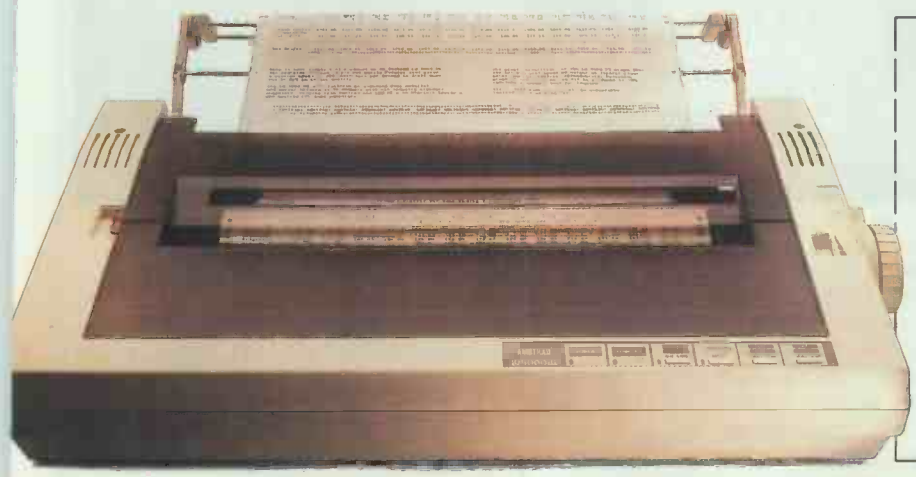
In 1992 the single European market should allow Apple's Cork manufacturing plant to produce large volumes of fewer products rather than having to engineer computers for each country. But even now the production line at Cork can easily switch from one product to another, so 1992 may not herald much change in manufacturing economies.

I like the SE/30 — it's the first Mac I would consider having on my desk, though I'm not sure how I'd cope without colour. But until Macs become more widely owned, computing with a Mac may remain something which, in Apple's own words, 'people aspire to' rather than actually enjoy.

Derek Cohen

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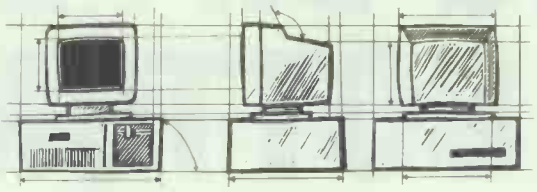
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Hi-Grade

Dealer-built micros offer a way to cut the cost of quality, high-speed machines. Guy Kewney examines the extent to which one, the Hi-Grade, lives up to this promise.

Available from one London dealer is a very fast machine called 'Hi-Grade'. The fully equipped Hi-Grade 386 bristles with speed features; a 20MHz processor, with 2Mbytes of fast static memory and one of those turbo arithmetic chips — the 80387 — and a pretty quick disk, turns out to benchmark at a *PCW* Index figure of 4.0. That's quick.

But no matter how fast, you might be wondering why an international magazine like *PCW* is concerning itself with machines from a small London dealer which sells maybe 50 machines a month at most. And most of those to local businesses.

The answer is: because this is a dealer-built machine.

The dealer-built machine is a phenomenon you can expect to see more frequently in the PC world over the next year or so. The surprising thing is not that dealers build their own machines, but why so few of them do. The reason for this is probably that the average computer retailer will do anything possible to increase profit *and* reduce price.

Buy a machine from Tandon, Victor, Compaq, IBM or Olivetti or Amstrad, and you make your dealer very worried. Why should you buy from one shop, rather than the next? Good question; let's knock another two per cent off the price. Oh, dear, look at the price tags over the road in Dixons! How are we going to make a profit? By bundling expensive (pirated) software in free? Yes, it does happen.

The first legitimate option for the hard-pressed retailer is to try to cut out one of the middlemen. If possible, buy from somebody like Tandon direct, not from a distributor. That gives you an extra two to five per cent. Then try to sell a hundred a month instead of 10 — that gives a much bigger discount.

Of course, if only one could cut out the manufacturer too, the profit would be even better! The only trouble is: who can build a PC from components? Very, very few people.



Kits of components are available, and you can indeed put together a cheap system that way. But even when the kit is made from components which somebody else has selected, making all the bits work correctly is a nightmare of twisted cables, mismatched drivers, hard-to-diagnose faults, and — in the end — complexity.

Dealers like Euromicro and Hi-Grade are the unusual ones, set up by electronics experts who know how to tell a good motherboard from a bad one, who know the difference between a faulty disk and when the controller is below par, who can buy a memory board that will work with

the main motherboard, and know how to fix problems quickly if they arise.

The Hi-Grade company was founded by Ori Yiassoumis, formerly a lecturer in computer science at North London Polytechnic. (Coincidentally Euromicro, a much older firm, was founded by Ori's predecessor.)

I first heard of Hi-Grade a year or so ago, when a journalist friend asked me to recommend a dealer from whom he could buy a cheap, reliable AT-standard machine for desktop typesetting. I never recommend dealers. 'Pick somebody as nearby as possible who looks honest and knows what they have in stock,' I said. 'Most dealers don't know one printer ribbon from the next, never mind how to set up a hard disk, so honesty and proximity are the two prime requirements.'

My friend lived within walking distance of Hi-Grade, and so (since the young directors clearly met the honesty criterion) he asked the price of an AT. The answer was low enough to astound him, and he walked out of the shop with a system.

At that time, Hi-Grade used systems put together in Taiwan by ASI. Yiassoumis quickly discovered that the motherboard was bought from a Californian supplier, Micronics, and soon arranged his own bulk purchase direct from Sunnyvale, cutting out the extra middleman in prime form.

Shortly after, the company found another source of systems in Hong Kong, and it now offers three or more machines, all of which it assembles in its North London premises. Not surprisingly, it recently moved into a larger workspace.

At this stage, I started hearing the name Hi-Grade mentioned in glowing terms by other users. When I made contact, I found a partnership determined to grow into a respectable small, independent, manufacturing operation.

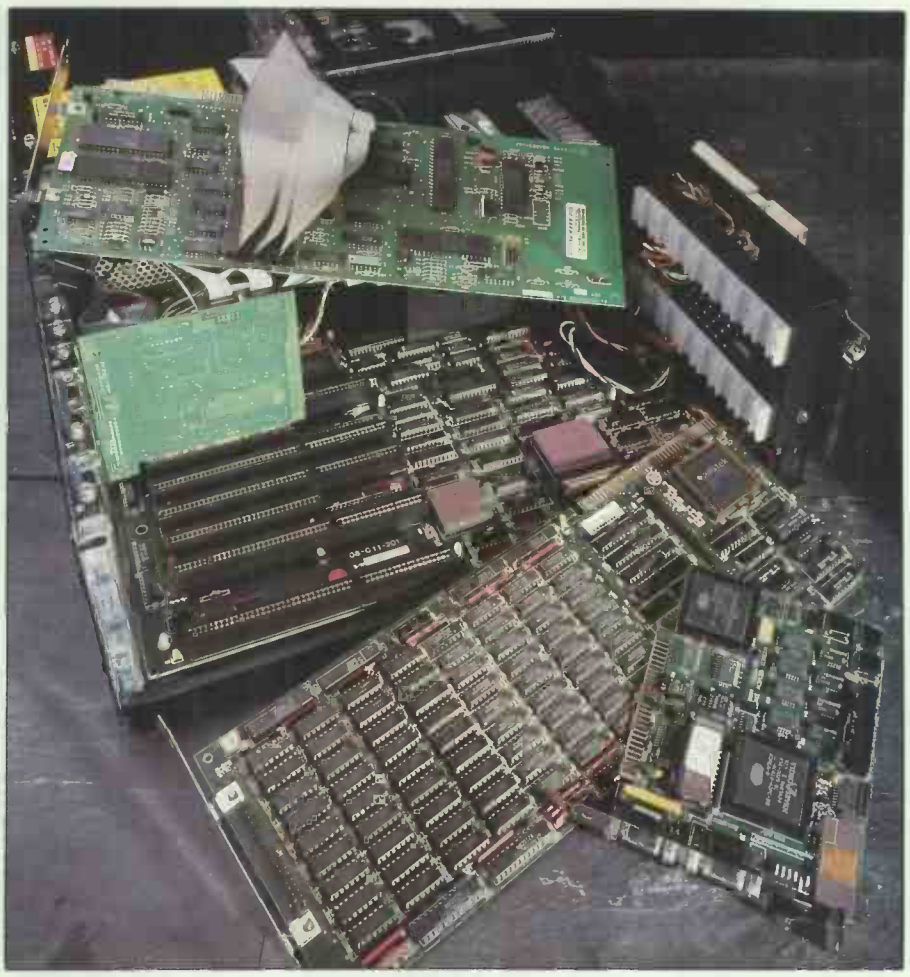
Hardware

The turbo 386 model looks like an AT — you couldn't mistake it for anything other than an AT family machine. That is to say: it's grey, big, and has a row of slits on the front panel to let air in.

There's room for three half-height diskettes on the right-hand side. The test machine had one 5¼in floppy, one 3½in drive, and an empty slot — but one floppy and a full-height hard disk could go in equally easily.

Behind the metal of the case there is room for another full-height device. The test unit had a 40Mbyte fixed disk, a Miniscribe.

Two buttons — one red, one yellow — also decorate the front. The red button is aptly coloured — it will kill the machine whenever you press it, abandoning all your work. Yes, it's a reset button, not often found on PC family machines.



Under the video card, the 32-bit static RAM card also carries an Austek memory cache controller

The yellow button is provided for people who want to build a machine that can switch speed when you press the button. Hi-Grade didn't want to do this, but the panel had the button on anyway. So they left it there. Why not?

And next to the buttons, you can see the keyboard lock, and lights — a red 'power on', a yellow one that shows the machine is running at full 20MHz clock speed, and another red one that flashes when the disk is used. A standard AT.

The only surprises are round the back, where you find that the serial ports are full 25-pin jobs, not the cut-down 9-bit bodge which IBM introduced to plague us all on the AT. And much to my surprise, Hi-Grade appears to fit a games port as standard, too.

Getting started was a simple matter of taking computer and screen out of the box, plugging them together, and switching on.

Because I always do everything wrong first time, it took me a minute or two to discover whether the screen was working. There were too many options — the monitor supplied had a bewildering number of buttons, sockets, options and switches (TTL/analogue, 16 or 64 colour, text/graphics, and so on) and several had to be matched to each other. (An owner's manual would have been useful here, but Hi-Grade doesn't supply one.)

Once switched on, the machine turned out to have its disk formatted already under DOS 3.3, with DOS loaded, and all utility software installed. The BIOS was Phoenix. American Megatrends (AMI) chips are available instead, if you prefer.

The machine can be operated at three clock speeds — full 386 speed of 20MHz, or 8MHz or 6MHz. Some programs, some peripheral cards, and some humans may require the system to be slowed down occasionally. The only problem is: how do you pick the speed?

Irritatingly, the speed is selected by software, not by the Turbo button on the front. I never know which I like less — the system which requires you to be able to load a speed-up program, or one which means you have to remember some unlikely

combination of fingers. If I were to ask for anything on this machine to be changed, it would be to connect that yellow button to the speed function. I'm afraid, however, that you just have to put up with it.

For a hard disk system with a fan, the noise level's pretty acceptable — nowhere near as loud as a Dell, nor as quiet as an Apricot.

Serial ports were provided by a plug-in card, and jumpers are used to select interrupts and port addresses if you need other serial devices — otherwise it came set up to work as COM1 and COM2.

Both ports passed all tests, official and unofficial. The parallel port was also a plug-in board function. The card included a games port, which was not tested. The LPT1 port was fully standard, usable even with highly unorthodox software like Fastwire II which drives the chip direct to give bi-directional data transfer to another PC. On test, this easily clocked up 500kbits/sec.

The reset switch produces a cold restart — its only virtue being that you don't need to use the Big Red Switch (which is a standard BRS, by the way, that sits on the right hand side at the back, the way IBM used to do it, so you didn't have to jerk your disk heads when something crashed).

The only security feature was a standard keyboard lock.

Architecture

This machine is based on the full 32-bit 80386 chip, running at 20MHz — nearly as fast as that chip is permitted to run in any machine. The motherboard has space for a full 32-bit arithmetic chip, the 80387, not the 80287 which often comes with AT machines. It costs more, but for the CAD user or somebody doing fractals, it's worth having that option.

Because the chip is a genuine 386, multi-tasking systems like DesqView can be loaded. Most system crashes under DesqView are caused, not by the memory or the processor or the software, but by the short-sighted design of the VGA card and its lack of properly documented specifications. With the Video 7 VGA card supplied, compatibility with the IBM standard is about as good as one gets today, and the only crashes were screen modes, easily cleared by running MODE to reset the video.

The machine was fitted with 2Mbytes of 80ns static memory chips. There was also a 32k memory cache. As a result, I was quite surprised to get a Landmark Speed indicator of only 27MHz, indicating some kind of memory wait states in operation. Details weren't available at press time, however.



The rear shows the Hi-Grade's twin serial ports, and its TTL and analogue VGA video outlets

There is a single 32-bit slot on the motherboard for the memory board. Apart from the clock memory in which data is maintained permanently (four dry cell batteries, not a board-mounted rechargeable one, maintain the clock) there is no memory on the motherboard.

This means that expansion over 4Mbytes will have to wait for bigger chips — the 256k chips mounted on this board (half socketed) can only be supplemented by a piggy-back board.

Of course, you can add as much 16-bit memory as you like in the remaining four expansion slots. But this would slow your system down — perhaps unacceptably.

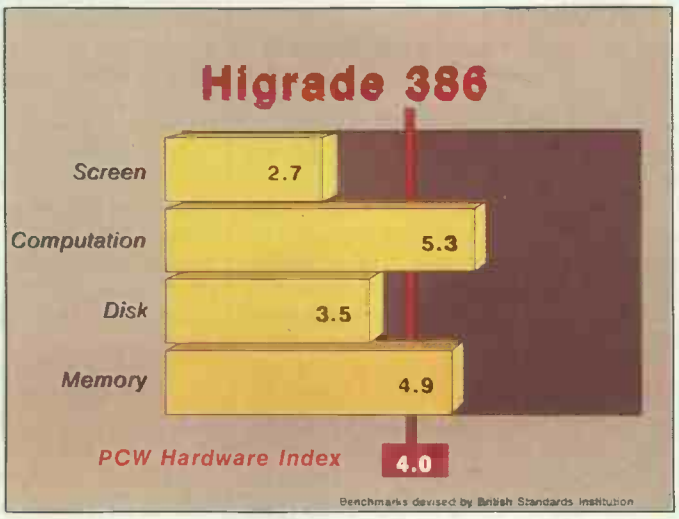
Inside the Hi-Grade case, everything was neat and tidy. The motherboard is an established design. You might even accuse it of being a bit out of date, with no on-board I/O, graphics, or battery. On the other hand, there's no problem with little blue wires and partly debugged circuitry, either.

Access to the main setup switches was straightforward (they did not need setting for this test, but they were properly documented). The 200W power supply happily drove all the boards, hard disk and peripherals. The monitor took its power from the extension socket. Access to the disk connectors was as easy as it ever is in an AT — which is to say, you lose skin off your knuckles if you have to change connectors. I didn't have to.

Mass storage

A Miniscribe 40Mbyte disk was already fitted. The Core International CORETEST program indicated this to have a 33 millisecond average seek time, with a track-to-track seek time of under 6.0 milliseconds.

Two high-density floppy drives, one 3½in and one 5¼in, were fitted for test. Initial problems with the 3½in drive were quickly repaired by the owner of Hi-Grade who arrived within 20 minutes of my phone call on Sunday morning. I mention this because friends who own Hi-Grade kit have reported that this is by no means unusual treatment dished out to impress a journalist, but a measure of how the company reacts to problems.



Machine under test: 20MHz 80386; 45Mbyte hard disk; Video 7 VGA. (Numbers indicate overall and specific function speeds compared with an IBM PS/2 model 30)

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Display

The display is provided by a Video 7 VGA card, which passed all the tests *PCW* has evolved for VGA, except two. The first problem was one of the VGA registers, which appeared to have an extra bit. And second, one of the split-screen modes failed. This behaviour was fully detailed in December's *PCW* article on VGA cards, and provoked no surprises.

What did puzzle me, however, was its problems with a program called GRASPRT, normally used to show a succession of video images in animation mode. My first reaction on running this test was that the VGA was crippled. Whereas I am used to seeing something like 10 frames per second, this one gave two or three. Time didn't permit me to get to the bottom of this. However, the phenomenon is obviously related to some conflict between system clock and screen refresh, because the program ran faster when it was sharing the machine under DesqView than it did on its own.

The Hitachi multi-scan display is excellent, but standard VGA in shape and size. Obviously, other makes and models of CRT can be chosen.

The keyboard is a standard Cherry 102-key model and, like all modern keyboards, appears incapable of generating a control-backslash (ASCII 28) which I need for communications. This appears to be a widespread BIOS problem — I've found it on other, totally unrelated machines.

In perspective

As predicted in Newsprint a year ago, the time has indeed arrived when a sensible buyer wants a 386-based PC for choice.

Apricot's range of Qi machines has the advantage of coming from a manufacturer which still survives, and of having extra features — built in networking, for example, and compatibility with IBM's PS/2 range. On the other hand, the Hi-Grade model matches the Qi pretty well for features, and has the genuine advantage of using a proper 32-bit version of the 386.

It may be that the time when a 16-bit 386SX seems lacking in essential features (memory, speed) is still some years away. On the other hand, if you can get a full 32-bit machine for the same price as the SX, why settle for the half-pint?

Other machines which the potential purchaser of a Hi-Grade machine might want to look at will include the Dell and CompuAdd, plus the new Amstrad (when available) and other mainstream 'bargain' boxes from people like Tandon, Victor, or Opus and Walters.

If Hi-Grade was ten times the size it is, you might worry a bit about its use of static memory. However, the number of chips it needs for a year's production could fall off the back of any Silicon Valley lorry or Hong Kong junk.

On technical grounds, it's hard to see any argument which would favour any of the possible rivals over this machine.

This is the sort of machine and the sort of supplier that worries people like Dell and CompuAdd, because it does what they do best. It can be built exactly to your requirements. You don't have to take whatever the shopkeeper has on the shelf ('yes, I know it only has a 20Mbyte disk, but the supplier has had trouble with the 40Mbyte model, and the 60Mbyte one is twice the price, but isn't the display clean?'). When it breaks down, you don't have to deal with some gaumless shop assistant. You talk direct to the manufacturer, who has several other components which will be built into a similar machine, if your component is genuinely bust.

Dell, of course, counters these smaller operators by noting that they don't design their own boards.

This means that if, say, Micronics gets an order for 10,000 boards from the US Air Force, and has to delay shipping for three months, Hi-Grade has to go and find another board builder. And that may turn out to be nearly, but not quite, the same spec. And it may suddenly not drive this VGA board, or that disk controller.

For the big, corporate buyer who wants at least 10 machines now and another 10 this time next year, this is a frightening thought.

However, for people who want their own fast AT with a 386 in it, who cares? As long as the machine works, never mind whether the company will be selling a different model next year, just look at that price!

And indeed, Hi-Grade's prices are very tempting.

Technical specifications

Processor:	20MHz 80386
RAM:	1Mbyte 32-bit static as standard, expandable
ROM:	Phoenix BIOS
Mass storage:	45Mbyte Miniscribe 30msec
Storage options:	Five half-height slots
Keyboard:	102-key PS/2 style
Graphics:	Video 7 VGA
Standard interfaces:	Two serial ports, one parallel printer port, one games port
Expansion:	Five 16-bit AT slots, two 8-bit XT slots, one 32-bit memory slot
Operating system:	DOS 3.3 available

Software and documentation

The price does not include MS-DOS, but version 3.3 is available. Hi-Grade is a computer dealer as well as manufacturer, and sells a full range of applications software. Not surprisingly, perhaps, it is not much tempted to give away such software — and it doesn't — so there's nothing bundled with the machine.

With the box you get an Hitachi manual for the monitor, a keyboard manual and circuit diagram, and a brief 40 pages from Micronics, builder of the motherboard, on how to configure the system.

Since Hi-Grade supplies it fully configured, this could be described as 'without documentation' for most purposes. It has to be admitted that the company is actively catering for the customer who knows what machine to buy, and has some idea of how to use it. And admittedly, many rival firms which actually do provide an owner's manual for new users seem to think that a patronising tone of voice is all it takes to educate the beginner.

All the same, if you're looking for the weak point of the Hi-grade package, you've just found it.

Prices

A Hi-Grade 386 with 1Mbyte of RAM, a Hercules-compatible video card, two parallel and two serial ports, a hard disk controller, 5¼in and 3½in floppy drives and a keyboard costs £1995. The review machine, including 2Mbytes of static RAM, costs £2995.

Extras: for a 44Mbyte Miniscribe hard disk add £305; for VGA card and monitor add £360; for VGA card and multi-scan monitor instead of analogue add £495.

Conclusion

There are no surprises here, except perhaps for the fact that the machine seems slower than you might expect. On paper, it ought to be a very, very fast machine. In testing, it was fast, yes — perhaps one of the real speed freaks of the PC world — but not streets and streets ahead.

The actual configuration reviewed doesn't have to be what you will be offered, since the machines are built to requirements. But the one supplied for test sat next to the Dell equivalent, and matched it pretty well feature for feature. It was quiet, seemed robust, and there was nothing half-built or botched about it.

For anybody lucky enough to live near North London, it must go to the top of the shortlist.

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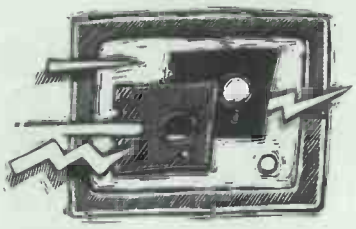
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Mathematica

The art of mathematics in all its forms makes a spectacular appearance on the Mac. If you have a penchant for equations, calculation and problem solving, Mathematica is all you need. Jack Weber figured it out.

How on earth do you even begin describing a program like Mathematica? I mean, here is something that does 3D colour animations, has its own comms software, lays out posters big enough for a hoarding, runs on anything from a Cray to a Mac, does word processing in its spare time. And it understands maths. Not just arithmetic but proper symbolic mathematics. Calculus, simultaneous equations, complex numbers — that sort of thing.

Back in the mid-fifties when Alan Newell and Herbert Simon wrote Logic Theorist — a program for solving problems in symbolic logic — they were far ahead of the field in artificial intelligence. And even now, symbolic calculation is something of a pioneering activity found only on heavy-duty academic machines. A few programs such as TK Solver have, it's true, brought certain aspects of algebra to the micro, but never before has anything like Mathematica been seen on a desktop. Nor even on most university machines.

In recent months Mathematica has received a certain amount of reflected glory from the launch of Steve Jobs' NeXT computer which includes the program as part of its comprehensive software bundle for the complete academic. Versions are also being prepared for various workstations and minis. But, for the time being, the majority of users are going to experience Mathematica on the Mac — the computer on which it makes its first public appearance.

Overview

Reflecting this ability to run on many different machines, Mathematica is made up of two separate programs. The Kernel, which is the mathematical engine, is a hefty 150,000 lines of C. It can be run locally, on a nearby networked machine or even on a remote supercomputer (hence the comms software). But it is never directly seen by the user who interacts only with the Front End. This is a machine-specific interface which sends messages to the Kernel and displays the results of its mathematical deliberations. On the Mac it accounts for another 50,000 lines of code.

Mathematica is the closest thing to a mainframe application that you are likely to find on a micro. But we are not talking low budget here. To run the complete package of Front End and Kernel requires an absolute minimum of 2.5Mbytes on the Mac, though 4Mbytes is actually a more realistic figure, especially if graphics are widely used.

The Front End alone can be run in as little as 1Mbyte which opens up the possibility of using even a basic Mac Plus, provided that it has access to a larger machine. But portability is restricted by the fact that separate versions are provided for the Mac II and for other Macs. Both are identical in every respect except speed — the Mac II version makes use of the 68881 maths co-processor so cannot run on anything less. Given lashings of memory, Mathematica will operate very happily under MultiFinder.

In very broad terms Mathematica works within three areas — numerical calculation, symbolic calculation and graphics. But it is much more than a mere collection of handy solving routines; this is really a programming environment which, at its simplest could be used just for its inbuilt functions but, with more experience, could also be customised and extended in many powerful ways. It is founded on a broad and talented base that presents few limitations.

For example, numerical calculations can be carried out to any arbitrary precision. So, if you need π to a hundred decimal places or a sine to three hundred then Mathematica will readily oblige. The only limitation is your own patience — a square root with a thousand places takes about three seconds on a Mac II but lesser machines will struggle with such extravagance. Positive, negative and undirected infinities are correctly handled, as are imaginary numbers — so you can roam unfettered over the whole complex plane.

Just as impressive on the symbolic side is Mathematica's ability to deal with algebraic equations and cope with notoriously difficult activities like integration. Numerical integration is, broadly speaking, a doddle with well established techniques for approximating to the correct solution. But with something like this:

$$\int \frac{1}{x^3 - 1}\, dx$$

where the result has to be another algebraic expression rather than a number, there are precious few general rules to fall back on. Mathematica tackles that indefinite integral, and many other more thorny ones, with ease. Sometimes, when it cannot solve a complete expression it will still do what it can and leave the rest in symbolic form. But, as in all areas, additional rules can be added at any time to extend Mathematica's abilities.

Mathematica's handling of algebra is pretty intuitive and closer to mathematical than to programming conventions. Enter something like

```
Expand [x^2-x)(2x+1)]
```

and Mathematica immediately responds with

```
-x-x^2+2*x^3
```

Notice that the input line did not require any multiplication signs — Mathematica understands how we write algebra. It will solve simultaneous equations, generate power series for a function, find roots, eliminate variables and do virtually all

the other things that need to be done in order to manipulate algebraic formulae.

I was particularly impressed by Mathematica's ability to cope with awkward problems where singularities, local spikes and discontinuities attempt to make life difficult. For example, the function Sin(x)/x tends ever closer to one as x approaches zero, but becomes indeterminate when x actually is zero. Mathematica finds the limit with no difficulty. In numerical integration it will often deal with singularities automatically and, if it can't will usually warn you of the problem, in which case a very little extra work will tell it explicitly where to look for them.

In use

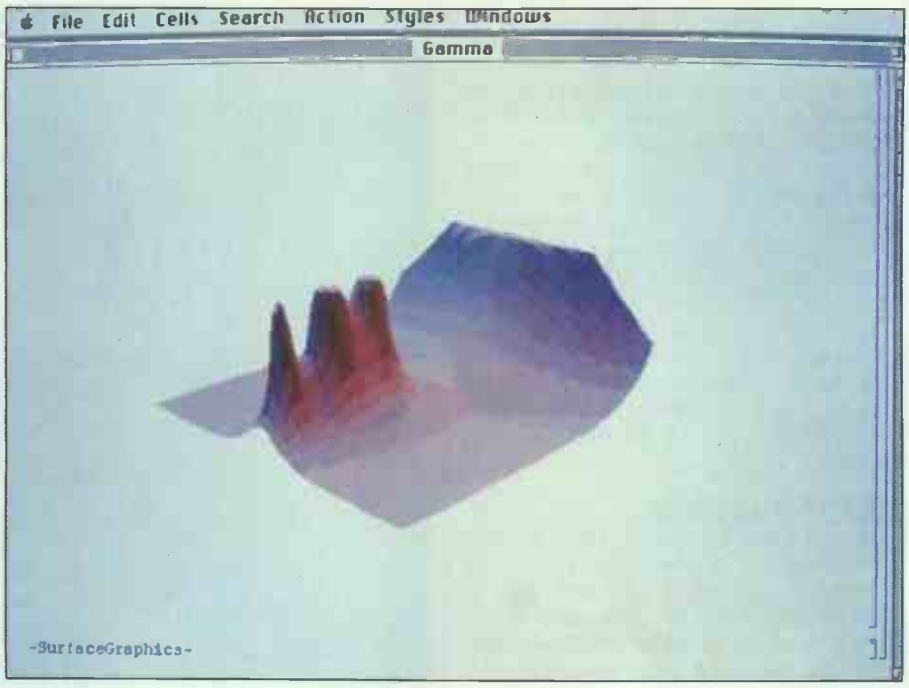
Using Mathematica for the first time is rather like discovering that Father Christmas really does exist — you don't quite believe it but still you can't miss the opportunity to ask for anything that might be going. One of the first things that anyone will grab hold of is the graphics. They are superb — functional and down to earth as befits a serious working program, but capable of being unashamedly decorative. With up to 256 colours available plus dithered tones and some of the most impressive 3D shading and lighting routines that I have seen, this program offers remarkable facilities for visualising mathematics.

For a start, any function, discrete or continuous, can be plotted as a graph — you simply need to specify the range to be covered. All plots are drawn as straight line segments between sampling points (spline curves may be very misleading when you are trying to represent specific functions) but Mathematica automatically adjusts the frequency of sampling according to how much the curve is wiggling about, so you always get a smooth result. Unless specified, the y axis will then be set to contain only the 'interesting' parts of the plot and any singularities or regions where the curve increases too rapidly will be chopped off.

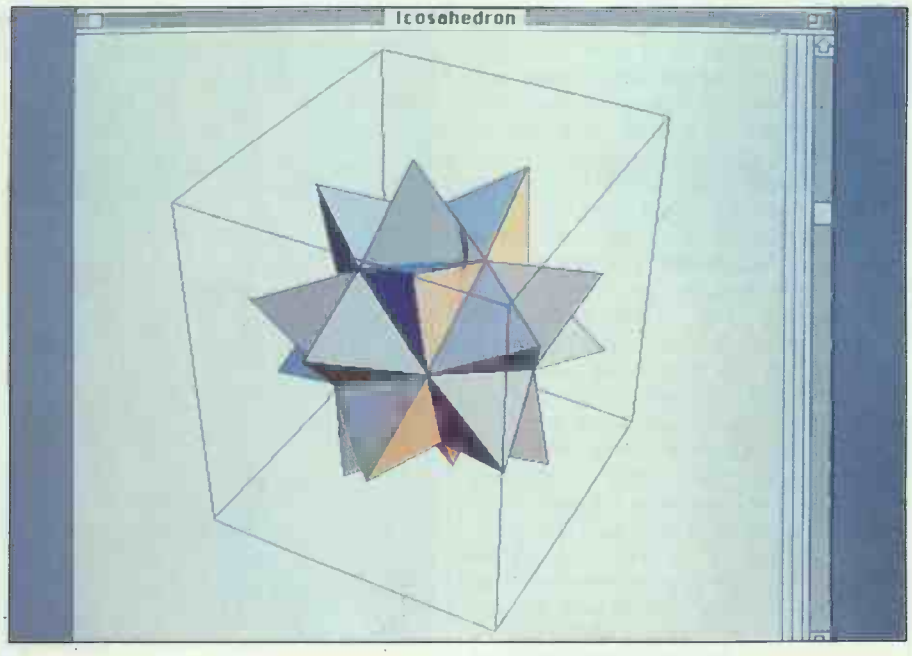
Scales may be linear or logarithmic and routines are provided for drawing point plots as well as parametric and polar graphs. Arrays of data can be displayed as contours, density plots or as 3D surfaces. And here, Mathematica offers really remarkable abilities — you can set shading (in colour or grey scale) to be determined by the height of the plot or by any specified function. Alternatively, turn on the lights and you have an illuminated surface with full control over the colour and intensity of both overall ambient lighting and multiple point sources that can be positioned anywhere. Combine this with the ability to move the viewpoint all around the graphic, and there is very little that cannot be achieved. But specific effects can take a good deal of experimentation to get right.

Although function plotting is likely to be a prime use of Mathematica graphics, there is no reason why it should be the only one. The program actually works with quite general PostScript graphics primitives which can be put to any use; and whatever you draw, you have access to the full range of 3D lighting effects. This versatility is well demonstrated by a set of routines which will draw complicated regular polyhedra such as an icosahedron or a stellate dodecahedron. But even this virtuosity is overshadowed by its ability to produce animations.

If you create a sequence of pictures (Mathematica can do this automatically), each one slightly different from the last, you can make Mathe-



Surface: Another memory eater – this single graphic takes up just over 1Mbyte but shows the excellent results that can be obtained. The surface is illuminated using Mathematica's default settings of no ambient light and three point sources (red, green and blue) at 45° to each other



Icosahedron: Routines for creating regular solids, like this icosahedron, are included with Mathematica, but any two or three-dimensional pictures could be produced using its graphic primitives

matica display all of them in rapid succession within the first frame of the group. In this way you could fly around a 3D shape, see how a function depended on one parameter, or, simulate the development of some activity that is determined by mathematical functions. Even while the animation is running you can vary its speed and direction or single-step through it. But don't expect Disney-like smooth colour animation unless you can provide mountains of memory, so that frames never need to be called up from disk. If you can, I promise you won't be disappointed with the results.

On the whole . . .

So far I have looked in isolation at a tiny selection of Mathematica's more important individual features. But to understand what Mathematica is about you really need to step back and see the whole. For all its flexibility, Mathematica is a very unified environment designed to impose a house style that will make it a medium for sharing mathematics rather than just doing it.

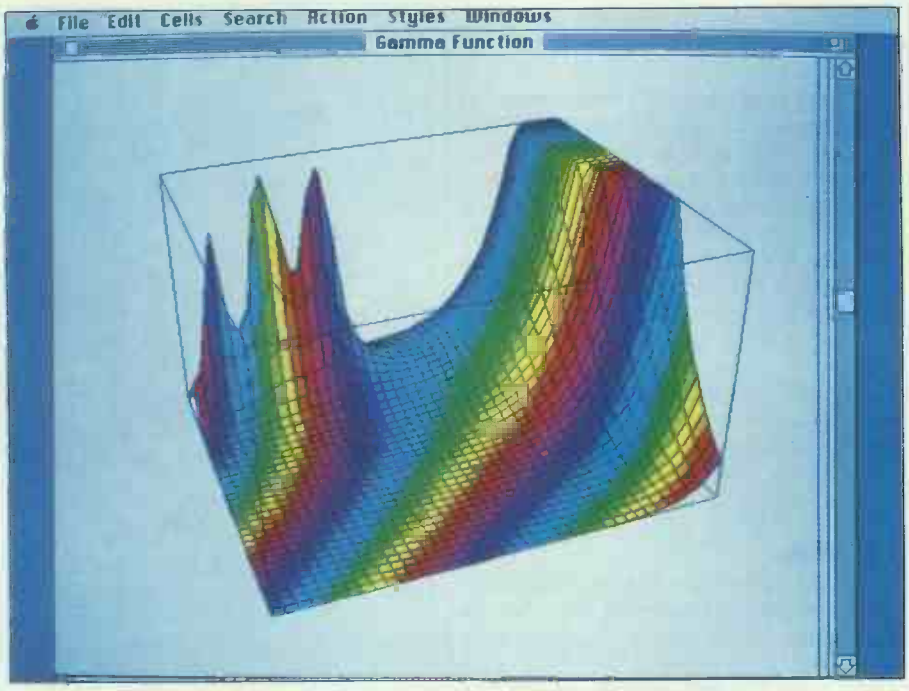
The basic Mathematica document is the Notebook — a sort of magic calculating paper on which user and Kernel conduct a dialogue. This may be as simple as a back of envelope calculation, but the structured nature of Notebooks means that they may just as easily form a presentation, an exam paper or even an interactive textbook. Notebooks are specifically intended to be used as a medium for exchanging, and even publishing, mathematical ideas. This plan is already starting to be exploited and, if it catches on, could do much to boost the success of Mathematica.

Every Notebook is made up of cells — organisational units containing text, graphics or calculations. Each time you enter a formula or command, it forms a new cell. When Mathematica returns a response, that becomes another linked cell. As the dialogue progresses, Mathematica automatically names these cells as In[1], Out[1], In[2], Out[2] and so on. Normally, everything that is typed will be sent to the Kernel as soon as Enter is pressed but cells may also be defined as Inactive, in which case they will be ignored by the Kernel and can be used for explanatory text.

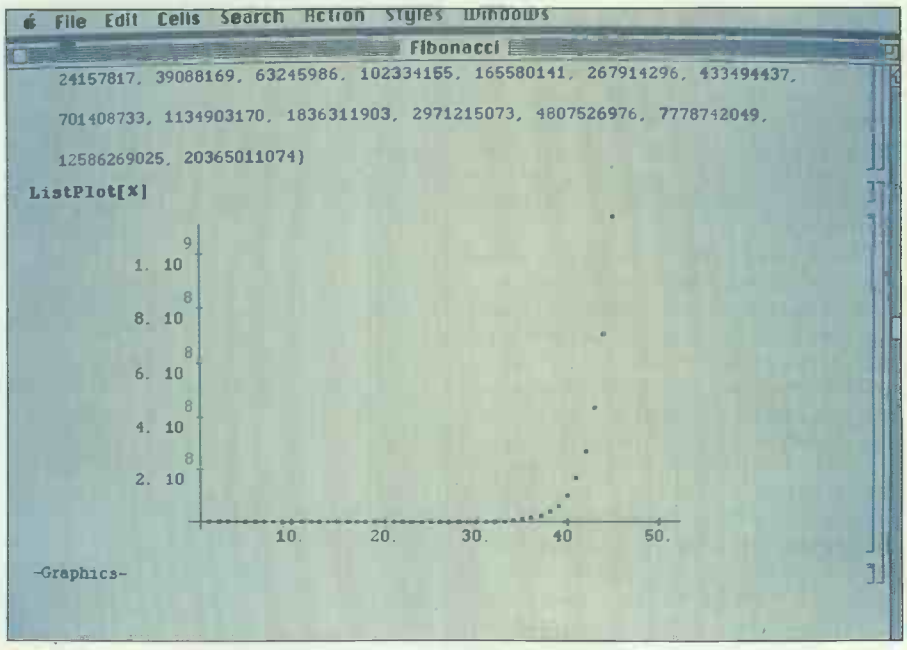
The extent of every cell is marked by narrow square brackets along the right-hand side of the window. They can be grouped and nested in many different ways — for example, as an Evaluation Group which will be re-evaluated whenever any cell in the group changes. Groups of cells may also be opened or collapsed, just as in an outliner, so that increasing levels of detail are revealed. The content of any cell can be referred to simply by its name but the most recent output cell is always more conveniently available as the object '%', so chained calculations will often be a sequence of simple commands like **Solve [%]**.

This arrangement of cells makes using Mathematica rather like working in a single-column spreadsheet — very convenient for calculation, but it does restrict the layout possibilities since cells cannot be positioned side by side. That apart, the display options are very flexible with a comprehensive style sheet containing 22 preset and five custom styles (all 27 may be re-defined), precise control over cell width and spacing as well as special options for pasting up multiple pages to produce giant posters. Notebooks and their individual graphics may also be exported in a variety of formats, but this is not always a straightforward process.

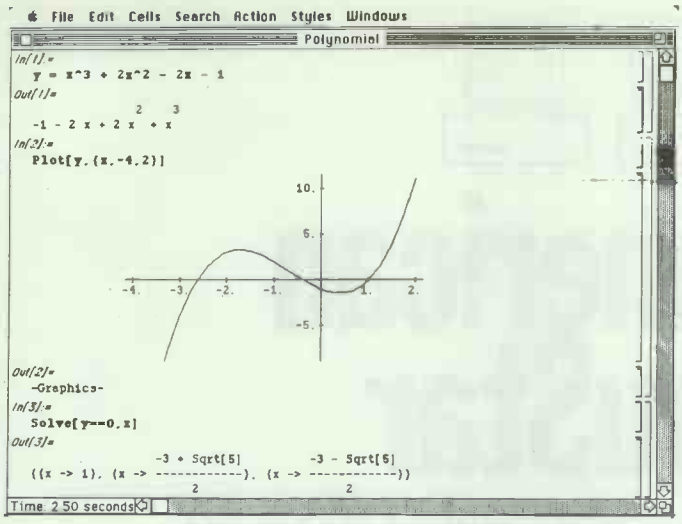
Mathematica is by no means con-



Gamma: A surface plot of the Euler Gamma function – one of Mathematica's built-in functions. The plot command above it contains a list of attributes to be used for displaying the surface



Fibonacci: A simple function definition which allows Mathematica to find any number from the Fibonacci sequence. The first line defines the function recursively, the next line sets the two starting values. When that's done, finding the fiftieth Fibonacci number is a piece of cake



A typical Mathematica Notebook, here being used to work on a simple polynomial equation



Mathematica tackles numerical calculation with ease and understands the difference between precise integer values and approximations like the value for Pi, calculated here to 200 decimal places. Notice the cell brackets on the right: one cell, with the darkened bracket, is currently selected

fined to mathematicians: it will be welcomed by economists, engineers, physicists — everyone who employs any sort of mathematical techniques. And it is designed to be extended into such areas by adding whatever specialist routines may be needed. These come most conveniently in the form of Packages. Packages are not Notebooks but simple input files containing definitions and routines. Around 40 are provided with the Mac version and they cover many topics from permutations to Runge-Kutta methods for solving differential equations. Many more will no doubt become available.

Too good to be true?

The richness and extent of Mathematica's environment is such that there is barely room to skim over the surface here. I haven't even touched on Mathematica's powerful capabilities as a programming language. Nor its ability to produce output in TeX, C or Fortran form. Nor even the possibilities for calling external programs or for exchanging animation data with VideoWorks.

The whole package is a vast and resonant construction and it would take many months to explore all its remoter corners, let alone get familiar with using it all. Evidence of that richness is everywhere: even the wait cursor (equivalent of Apple's wristwatch) demonstrates a mathematical principle. And students of cellular automata — the area of research for which Mathematica's creator, Stephen Wolfram, has become best known in recent years — will find entertainment provided in the About Mathematica box.

But if Mathematica sounds too good to be true then it's only fair to point out the shortcomings. Foremost among these, at least for Macintosh users, must be the program's deep roots in more traditional operating systems. It's quite obvious that Mathematica's authors think in C and dream of Unix. That's not to say that the Front End doesn't make use of menus, dialogue boxes and so on but they feel like a bit of an afterthought — interactive it may be, but there is no possibility of putting buttons into a Notebook, for example. Indeed the Kernel is almost entirely keyboard driven, which is a shame because the Mac's graphical interface could work wonders in speeding up something like colour, viewpoint and lighting selection for 3D graphics.

Sometimes the clash of cultures produces stark contrasts — as in error handling. If something goes seriously wrong you can look under the Apple menu (a bizarre place to choose) for an item called Why The Beep? which will explain the problem in clear, meaningful English. But lesser difficulties, such as when the Kernel is worried about something but decides to continue anyway, will produce Messages within the Notebook. These are mostly gobbledygook and the situation is not helped by the fact that nowhere in the documentation are any of these Messages listed and translated.

Summing up

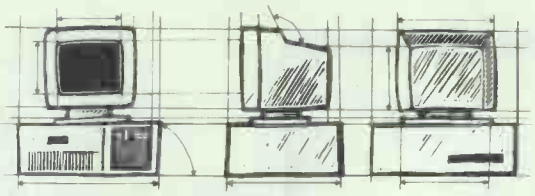
But, enough of harsh reality. There are good enough points for me to forgive all these failings. Mathematica is the most extraordinary program that I have ever used, and, I believe, one of the most significant. Notwithstanding that it is designed for a small and specialist market, it has an importance which affects all micro users because it points the way towards a new generation of more intelligent machines that will have the power to solve problems.

Not many of us have an everyday need to deal with Fourier transforms or integration but we do have a need for information derived by such means — whether it's finding seasonal patterns in sales figures or calculating the concrete needed to lay a semi-circular patio. For the ordinary user, I can envisage more developed front ends coping with natural language requests and sending them on to something like a Mathematica kernel, which will remain hidden and be apparent only in the fact that the computer knows how to do maths.

That prospect lies in a (not too distant) future when computers operate as intelligent assistants. In the meantime, for anyone who takes professional or recreational pleasure in doing mathematics, this program will be an absolute joy. If it succeeds then it could certainly revolutionise the teaching of mathematics and the exchange of mathematical ideas. Its only major limitation is likely to be the cost, both of the software and the machines to run it. But if you need an excuse to buy a Mac II, then look no further.

Mathematica is distributed in the UK by The MacSerious Company on (041) 332 5622. The Macintosh II version retails at £795 and the Mac SE/Plus version at £495. Review copy supplied by InTouch on (0222) 882334.

An MS-DOS version of Mathematica to run on 80386-based PCs was released in the US at the end of December 1988 and will soon be available in the UK. It will need 6Mbytes of hard disk and EGA/VGA graphics. END



Wells American CompuStar

Built to last in an aluminium tower, with a plethora of ports and drives, the Wells American CompuStar's fairly high price is certainly matched by its very high power. Rupert Goodwins even found it behaved well, too.

The most interesting IBM compatibles are those that are very cheap and those that are very expensive. Between these two types, the ground is fiercely contested by hoards of near-identical clones. Nearly all of the innovation in the market happens at the edges. At the bottom, it's a contest to produce the cheapest computer that doesn't make the user go blind. At the top end, the battle is on to provide features that can tempt buyers to spend more. Not easy, when the whole idea of this game is for both sorts of computer to run much the same software and perform the same sort of job.

The CompuStar, from Wells American, is an expensive computer with many new ideas and a few old ones. In price, design and intended market it's very much a head-on competitor for the IBM PS/2 model 80, though with some ideas that IBM wouldn't or couldn't include. It can use both AT and MCA expansion buses, for example, which is a first for any computer.

Wells American is an American (surprise!) company with more history behind it than most microcomputer manufacturers. Best known previously as Intertec Data Systems, the company behind the fondly-remembered SuperBrain CP/M computer, it was badly shaken by the explosion in the IBM compatible market at a time when it had only non-compatible options. In 1985, following dramatic drops in revenue, it changed its name to Wells American and brought out its first IBM-compatible computer, the A*Star. That was a success in America, and now the company is confident enough to try out the UK market again with the CompuStar.

Hardware

What the CompuStar offers above everything else is flexibility. Instead of choosing one computer from a range of three or four, the prospective CompuStarter buys a Base Model 100 and chooses from an array of options. A computer more unlike its Tandy portable namesake is difficult to imagine; the Model 100 is the largest and heaviest 'micro' of my acquaintance. A desktop computer only by virtue of being able to be both desktop and computer, it's barely carriable by an unaided reviewer, even with its fold-down handle folded up from the top. In overall design, it follows the tower format with the front panel housing power switch, reset button, lock and miniature display.

This display, similar to that included in the first Dell computers, can show up to four characters or numbers. It's normally used for error reporting if the computer finds something wrong when first turned on; if everything's OK it indicates the speed the processor's running at. Program developers, who must be one of the target markets for Wells American, should find the display more than a gimmick as it can be used to divulge information from within a program without using the video screen at all.



Wells' co-resident MCA module sits below the six conventional bus slots

All the technical information needed to drive the display is in the manual, which even includes a small Basic program to output a message. The display hardware is independent of operating system, BIOS or processor, and thus can be accessed at any time from any program. It would be possible to write a small program to, say, constantly display the amount of free memory, but I suspect the main purpose of this gimmick is to let Wells American soaktest a roomful of computers without having to plug in VDUs all over the place to check on their progress. During normal use, the display just looks pretty.

The lock on the front panel isn't like most AT locks — it doesn't disable the keyboard. Instead it secures or releases one of the side panels of the main case. The panel then slides out to reveal both the reason for the CompuStar's weight and the depth of thought that's gone into the design of the computer. The mass is provided by an extruded aluminium chassis, a sturdy framework with a lot of metal in it. Ernest Swinton (inventor of the World War 1 tank) would have a good look-and-feel case against these people.

Into this massive monolith are set seven slots for drives. Two are 3½in and front-facing; these normally (as on the review machine) accommodate 1.44Mbyte floppy drives. There are four 5¼in half-height front-facing slots; one was taken up by a 1.44Mbyte floppy on the review machine. Wells American can, or will be able to, supply tape streamers and a number of disk drives, both magnetic and optical. On the 'Available Jan 1989' list is an erasable optical drive with 1Gbyte capacity and a removable disk; it looks like the technology is here to stay. Shame that it costs about £4000, though. Maybe next year . . .

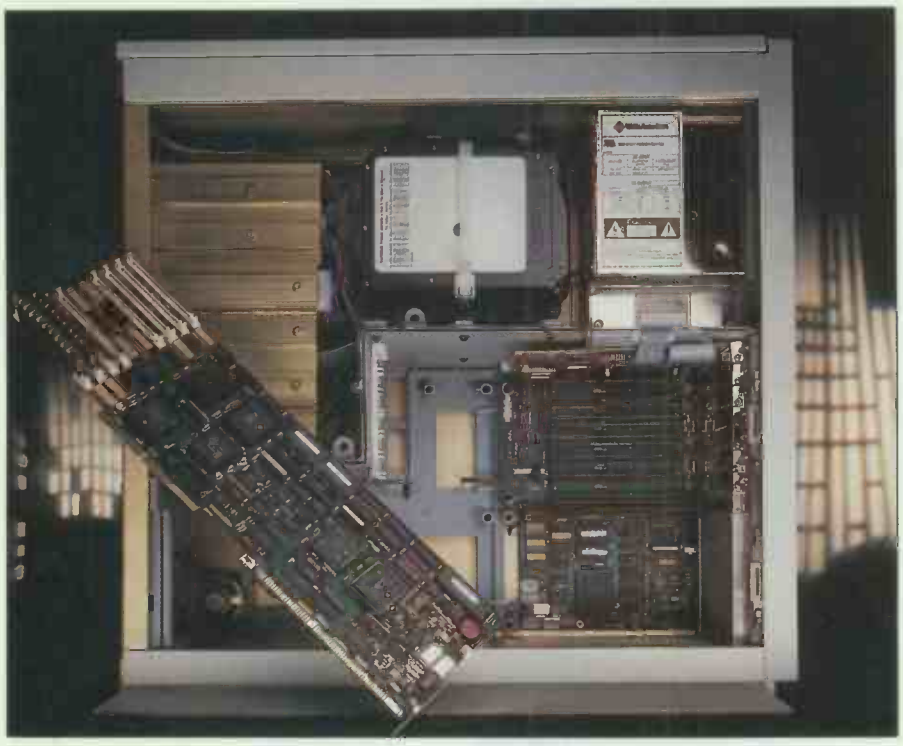
The final slot is internal, and can hold a single, full-height hard disk. On the review model, this was a 150Mbyte, 28ms access time ESDI drive. It's a good bet that there's no combination of standard mass storage devices that can't be catered for by the CompuStar; the maximum capacity of the computer, if fully stocked, is currently about 3Gbytes, and next year will be half that again. Enough for even the largest spreadsheet.

The unit's power supply can produce 220W, which should keep at least some of those storage acres happy. It sits above the card frame, an enclosed area of the computer which houses most of the digital electronics.

The general design of the CompuStar is a series of boxes isolating the various units: disks, power supply and so on. The covers to these boxes are held on by a special type of snap-fit fastener which can be removed and replaced by hand. In fact, the only screws in the chassis, those that hold disks and cards in place, are Torx pattern. These star-shaped screws were pioneered in PC manufacture by Compaq, and although no flat-blade or Philips/Posidrive screwdriver fits them the special tools needed are now generally available.

However, Wells American provides a Torx wrench, which is found in a special storage socket on the main chassis. So it is possible — provided the main key is available — to install and remove drives and expansion cards by hand with no tools other than those provided in the machine. That's what they used to call attention to detail.

The power supply also forces air around the computer, and the placement and sizes of the boxes is such as to maintain adequate ventilation



The processor card contains RAM and slots into either or both types of bus module: industry standard or MCA

for (hopefully) all the options. I'd be a bit worried if more than three disk drives were installed on the front panel, as these can generate a lot of heat, but by then the chances are that the power supply would be getting close to overload.

Unclipping the cover of the card frame reveals the main computing section. The only part that comes as standard is the motherboard. This houses seven AT-compatible bus slots, a keyboard and mouse interface (both with PS/2 rather than AT sockets), two serial and one parallel ports. There's a floppy disk controller built in with four cable connectors, and it can cope with all common floppy disk drives.

The main board also has built-in VGA, based around the same Paradise chip as used in the new Amstrad PCs. This should mean that any Amstrad 2000 series graphics software which uses the extra modes will run, unmodified, on the CompuStar. In any case, the video supports Hercules, MDA, CGA, EGA and VGA standards, with extra modes up to 1024×768 pixels with upgrades. There are both old-style CGA/MDA/EGA/Hercules and VGA connectors, meaning that any old (as well as any new) monitor will work with the beast.

What's missing from the standard board is any sign of a computer. That's because CPU and memory are supplied on separate boards which plug in, and the user has to choose from many options. The cheapest, lowest performance option is the 8086-based board which provides a 10MHz CPU with 512k of RAM, expandable to 2.5Mbytes on board. It doesn't seem likely that this will be a popular option, since the minimum system based on this will still cost around £1000 before any hard disk.

The next CPU board, and one which should be far more popular, is the 80286-based circuit. This can work at up to 20MHz, and has space for 8 or 16Mbytes of RAM. This, with 1Mbyte, was the board provided on the review machine, and the one which was benchmarked. Most of the standard tricks for speeding up an AT-compatible are implemented; the copying of ROM into faster RAM so that the system BIOS (written by Wells American, apparently) and interleaved memory are standard.

Interleaved memory, by the way, is a method of doubling or quadrupling the speed of cheap RAM chips. Because the chances are very high that the computer will read RAM in strict sequence, location 1 followed by location 2, followed by 3 and so on, it makes sense for all the odd locations to be held in one set of RAM chips and all the even ones in another. This means each chip is accessed once every two memory reads, instead of once every one. It's like playing the drums; using just one hand results in a far slower drum roll than if each hand is used alternately. It's even possible to have four banks of memory, each taking one out of four memory accesses, which is four times faster — a drummer with four hands.

Since the maximum speed of a RAM chip is the speed at which two different locations can be accessed, slower, cheaper chips can be used to support fast processors if interleaving is employed. Interleave fails if the processor jumps out of sequence, in which case the memory hardware has to tell it to wait while the new location is accessed. Even then, the chances are that the processor will start to read in sequence again and full speed will be regained in a few reads. The practical upshot of all this cleverness is that the computer runs fast without needing memory circuits that cost the earth.

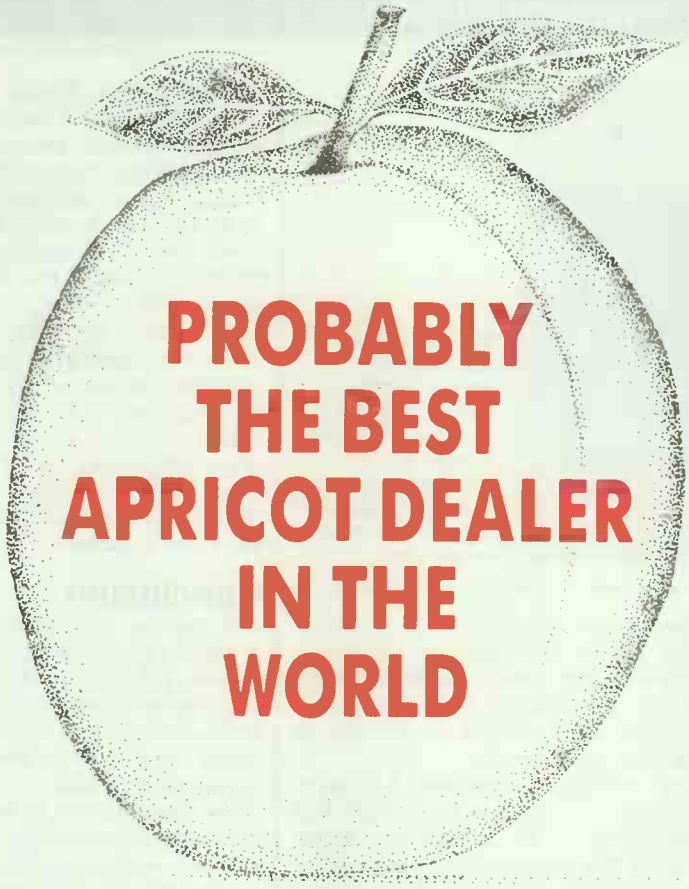
Another trick of the 80286 board is the second bus connector. The board has to plug into the main circuit, using one of the AT-standard slots. But it has another connector, into which plugs a PS/2 adaptor module. This wasn't available for testing, for (Wells American assured me) legal rather than technical reasons. Certainly the board exists and has been seen to work, and might become available any day now. Another board provides five MCA slots, which turn the Wells into a dual-bus machine. If all this PS/2ery doesn't appeal, a second board full of AT-style slots can be attached in its place, thus upping the total to thirteen. Even after losing two, one to the CPU card and one to a hard disk controller card, there are enough spare slots for almost any conceivable purpose.

There are also 80386 and 80386SX modules available, though only up to 16MHz at the moment. They, like all other processor boards, have a real-time clock. Wells American says that as new technology becomes available and reliable — EISA bus (though that looks increasingly unlikely ever to happen), 80486 or whatever — a board will be produced to utilise it. Furthermore, during the guarantee period of the computer — a year in the UK — a user can upgrade to a higher-performance board by sending the original board and the difference in price. Most people won't want or need to take advantage of this service, but for those occasions where a DTP or network server has just run out of steam, the option to add another MIP's worth of processor for minimal outlay will sound inviting. And upgrading is just a matter of ten minutes and no screwdrivers.

Peripherals

Another option in the (extensive) list of Wells Americana is an SCSI (pronounced Scuzzy) interface. SCSI — Small Computer System Interface — is the up and coming standard for microcomputer storage.

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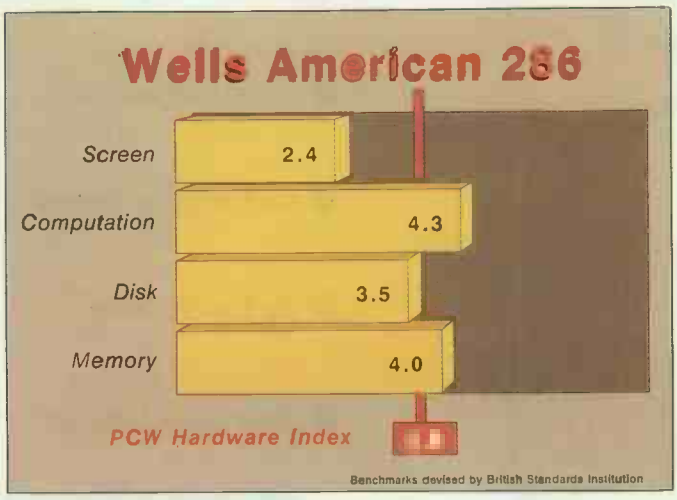
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PHONE and ASK



Machine under test: 20MHz 80286; 130Mbyte hard disk, VGA. (Numbers indicate overall and specific function speeds compared with an IBM PS/2 model 30)

the RS232 of mass storage, and since IBM's November announcement of PS/2 SCSI it should become increasingly important within the Big Blue world as well. A SCSI interface board is capable of controlling up to seven devices — Wells American is selling theirs as an interface to the optical media, but it can cope with SCSI magnetic hard disks, tape back-up drive and whatever turns up in the future. Most kinds of devices are available as SCSI, currently for a premium.

There's nothing to stop a user from fitting to the CompuStar whatever disk drives seem appropriate, and Wells American's own offerings are priced competitively in recognition of the fact. The 20Mbyte drive costs under £200, although that needs a controller. There's a range up to 650Mbytes; there are four separate options above 100Mbytes indicating that the systems are aimed at the nascent workstation and network server markets.

The display supplied with the test system was a colour VGA monitor. Although not of the highest resolution, and (with a dot pitch of 0.31mm) not quite as highly specified as the Amstrad competition, it was steady, even and of low geometrical distortion. Circles were circular, and squares square. For a while, I indulged in my current hobby of fractal picture generation, and the display proved itself more than capable of doing justice to high-resolution, colourful pictures. Other monitors available are a Hercules version in green or amber, and a VGA monochrome device in paper white.

The 102-key, extended AT style keyboard is a follower of the IBM PS/2 standard, with a curved slope bringing the top rows of keys within typing distance of a pair of relatively stationary hands. There will be two keyboards available, identical to look at but with different amounts of tactile feedback (so says Wells American). Mine was slightly stodgy, but it nevertheless seemed to be the third most pleasant keyboard I've used, after the IBM PS/2 keyboard itself and the Amiga 2000. I'd have liked to have tried it at work for a few days, but because the PS/2 keyboard connector is different from the more common AT/PC, I couldn't. As most keyboards are currently AT standard, this might make obtaining an emergency replacement a problem while Wells fixes the old one.

Wells' standard 1-year on-site maintenance goes a long way towards mitigating such fears, however, especially as it is (like Dell's) free. Likewise, each machine comes with a free on-site set-up, courtesy of a real live technician, although every ounce of Wells' design effort seems to have been expended producing a computer which doesn't need this sort of mollycoddling. Which is, no doubt, why they feel so happy about offering the service, and people like Dell have proved that investing in such backup is well worthwhile, for a quality product that doesn't really need it.

All this hot design would have been irrelevant if the machine wasn't capable of running the software it was bought for. The usual spreadsheet, database and word processing applications worked; and the computer accepted a variety of odd cards without turning a hair. 20MHz of 286 is potent, even with the 386 breathing down its neck, and the benchmarks reflect both this and the fast hard disk supplied.

Conclusion

The closest analogy I can find to this machine's design philosophy is in a similarly large, similarly heavy bit of electronics called the B40. This was state-of-the-art in 1948: an Admiralty radio receiver that was designed as separate modules for serviceability. Improvements could be slotted in (to an aluminium chassis, as it happens) as they were designed. It had a built-in toolkit for non-standard (at the time) fasteners that were part of the design. Many of those receivers worked for thirty years with upgrades that hotted up the performance as electronics advanced — proof of the soundness of the initial concepts.

It's not cheap, but Wells American, aka Infotec Data Systems, has been around for a long time and this shows in the quality of the documentation and the sturdiness and ingenuity of the design. The performance of the system on test wasn't the best recorded, and those with an eye for pure speed should be able to find a faster machine for the price.

However, quality of construction is also important to many people, and avoiding a technological cul-de-sac is similarly appealing. I can't see that anyone who decides to buy a Wells American will be disappointed, which is possibly not the case for other PC compatibles.

The CompuStar is a computer designed to make an impression. It combines old and proven ideas from many sources with a very plausible guess at what will be needed over the next couple of years. It's a machine for a mature marketplace, aimed at people who know what they want and who aren't overawed by big names. Whether the design trade-offs made by Wells are as relevant in the UK as they are in the US remains to be seen, but with the CompuStar the decision is, more than ever, up to you.

Wells American is on (0494) 26211. END

Technical specifications

CPU:	20MHz 80286 processor, zero wait state
RAM:	1Mbyte SIMM, expandable on-board to 16Mbytes
Mass storage:	Two 1.44Mbyte, 3½in floppy disk drives; one 1.2Mbyte 5¼in floppy disk drive; one 150Mbyte ESDI hard disk drive
Display:	MDA, Hercules, CGA, EGA and VGA
I/O ports:	Two RS232 serial, one Centronics parallel, mouse and keyboard
Expansion:	Seven AT-style 16-bit expansion bus slots
O/S:	MS-DOS 3.3

Note Spec for the test machine (total price £3765) only. Many other options are available.

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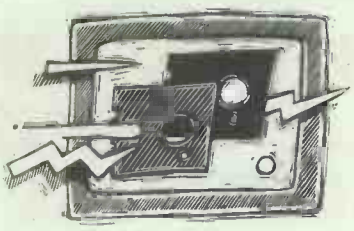
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Ami

PC users have looked enviously at graphical word processors on the Mac, with only Windows Write offering a limp alternative on their own machines. Until now. Manek Dubash considers whether Samna's Ami lives up to people's expectations of a Windows-based word processor.

They've been using graphics with word processing on the Mac for years, yet WP applications that use Microsoft's Windows are not common. The longest-standing package in the field is the one that Microsoft bundles with the environment, Windows Write. It is widely acknowledged to be fairly basic and does not supply the kind of features to which high-end users are accustomed.

Windows WPs — the theory

A few stabs have been made at producing a Windows word processor. The West German company, Siemens, developed Comfotex which did not fulfil the expectations that its authors may have had for it. Palantir's Wintex has had a good press but again has not set the market alight. All in all, Windows word processors have been pretty enough but have not possessed enough features to justify users re-starting at the bottom of a new learning curve. So now Samna, producer of Samna Word IV, has come up with Ami. It has been a long time in the brew; can it live up to high expectations?

People demand a lot of a Windows-based word processor. Of course, it should at least cover the majority of functions that users now demand of word processors, but it should add a lot that most don't. At the top of this list would be WYSIWYG-ness — or what you see is what you get. Windows' graphics-based front end can compensate for the accepted shortcomings of purely text-based word processing.

Next on the list for most people is the integration of graphics and text. The distinctions between DTP and word processing are blurring, chiefly due to the ever-more extensive range of graphical features carried by a larger number of word processors. Samna will have to give its product a high level of graphical functionality in order to persuade a significant number of users to switch, not just to Ami but to Windows as a standard interface.

Finally, of course, Ami has also to satisfy those who want a full-featured word processor with a top-end degree of functionality. Unfortunately, this is where Ami is the most disappointing.

Overview

Ami offers the usual range of features expected of a WP, including text attributes like bold, italics, subscript and superscript. Others that you would expect to be there, such as search and replace, headers and footers do exist, along with slightly more esoteric options such as configurable bullets.

'All in all, Windows word processors have been pretty enough but have not possessed enough features . . .'

Like many packages, Ami uses style sheets to store information relating to three determinants of a document's format: page layout, frames (for graphical images) and paragraph styles. And it does make use of native Windows features like extra fonts, integrated graphics and on-screen formatting.

Installation

Samna recommends a minimum hardware setup of a PS/2 model 50, or a PC/AT or compatible with 640k RAM, EGA, VGA or Hercules monochrome graphics display, a 10Mbyte hard disk and DOS version 3.0 or later. I got it going on a Dell 20MHz 386 machine. A special version on 360k floppies is available for those who want to run it on PC and PC/XT clones.

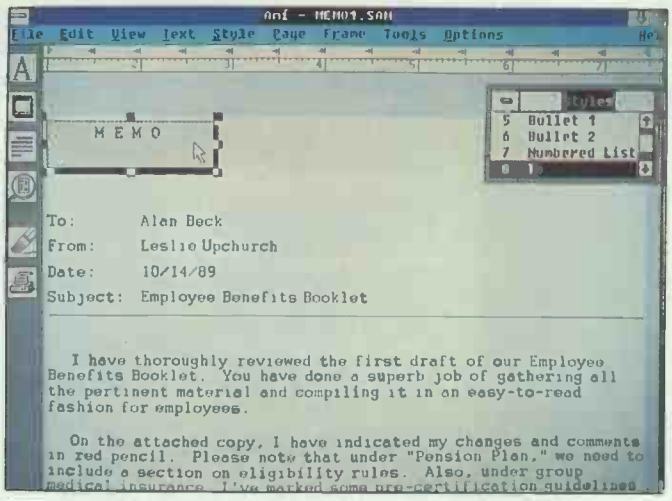
Ami is installed in a similar manner to Windows. It comes on no less than five disks, one of which is marked as the program disk. The others contain utilities, fonts and display information. Most of the program information is too big to fit on a single disk and is stored in the popular archived format created by programs like PKARC.

On typing Install at the DOS prompt, Ami un-archives itself and installs on the drive and directory of your choice. The program creates its own directory as instructed, along with two sub-directories — one for styles, the other for documents. An alternative procedure, using the disk marked SAE (Single Application Environment) Setup, installs the program with a run-time version of Windows/286.

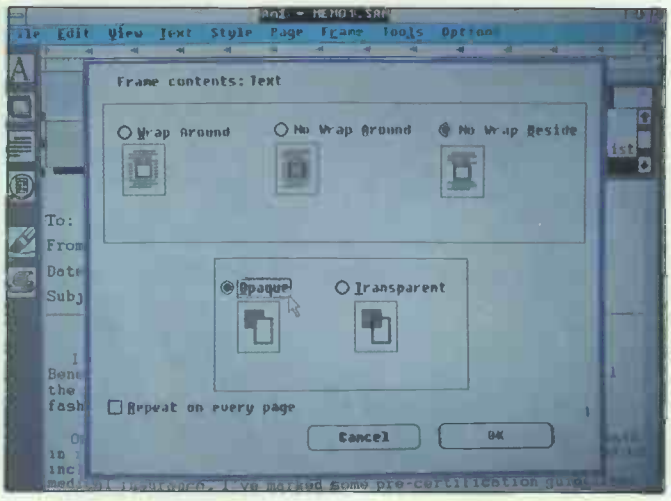
First impressions

Booting the program produces an attractive front screen, starting with a twinkling Ami logo. The opening screen resembles the top half of an A4 sheet of paper. It is surrounded on the left-hand side by half a dozen icons — more on these later — and extended scroll bars to the right and below.

The scroll bar below controls sideways movement, which can be slow if the screen is full of text in a graphical font. Next to it, a pair of up and down arrows mounted in small, dog-eared page icons motor through documents a page at a time. A small window in the top right-hand corner headed Styles is the most prominent feature.



Text in working mode stays within the boundaries of the screen. The Memo box is a separate object that can be moved around at will



From the Frame menu, the current frame can be made transparent or opaque, and its relationship with the surrounding text altered to taste

Ami will import several foreign formats, including ASCII, WordPerfect version 5.0, TIFF files, and WordStar. Like many reviewers I believe that software should be usable straight out of the box, so the first thing I tried to do was import into Ami some notes I had made. They were generated by Tornado, a notepad program that produces ASCII files. The program reported it could not find the conversion routine, even though it was sitting in the same directory as the main program, Ami.Exe. The same problem recurred no matter which file format I tried.

Similarly, when I tried the spelling checker and editing the dictionary, Ami reported it could not find the relevant program files and insisted that I insert the program disk into drive A:. This was doubly irritating as, on my Dell, drive A: is a 3½in drive, whereas the program is shipped on the larger 5¼in disks; there is no way of telling Ami to look on drive B:. Only pathnames for style sheets or documents may be altered, and even those changes are temporary and must reset each time Ami is loaded.

In use

Ami defaults to layout, one of its two text-viewing modes. Here you get the half-sheet of A4 displayed in the font of your choice. The default display in this mode is Courier, and is recognisable as Courier on-screen.

Text snaps to fit the margins when the cursor leaves the current line. On the fast PC I was using there was little problem with screen updating but, on less zippy machines, users could find themselves waiting a while for the screen to be repainted after each character.

The other viewing mode is draft, which shows a document in Windows' standard text without any attempt to make it appear like the finished article. Screen updating is, of course, much faster.

Ami makes looking at a document as a whole relatively easy, as it gives a full-page view, somewhat like WordPerfect's page preview but with the added bonus that it is not passive. Although you can manipulate text in it, in most fonts, all you can see on-screen is a grey mass — it is better at showing the shape of text rather than the detail. It is a pity Samna did not add a 'facing pages' option, as many authors might otherwise move the program higher up their wish lists.

Ami provides an enlarged mode which gives a close-up of the text and is useful for examining the fine details of graphical images. The final view of the document is called standard by Samna; it makes no attempt to squeeze the text into the on-screen window. The manual suggests that it is good for comparing Ami documents with those from other Windows applications. In effect, the text looks bigger and the ends of lines disappear. They can be viewed using the horizontal scroll bar.

Like many other Windows products, Ami makes provision for experienced users and those without a mouse by recognising keystrokes that shortcut the pull-down menus. They cover the most frequently accessed options. Most are fairly mnemonic so, for example, Ctrl-R aligns text right, Ctrl-C centres it and Ctrl-S saves the current document. Cursor movement is fairly intuitive too, with Ctrl-Left moving a word to the left and vice versa for Ctrl-Right. In particular, I liked the way the cursor moved to the end of a word, rather than the start of the next one, if it was immediately followed by a punctuation mark such as a hyphen or a full stop.

Mouse shortcuts are provided too, with a double-click on the page number box allowing users to go directly to a specific page number. In this case a dialogue box pops up into which the next page is inserted as a default; it can of course be altered. A word upon which an operation is to be performed, such as emboldening, can be selected by double-clicking.

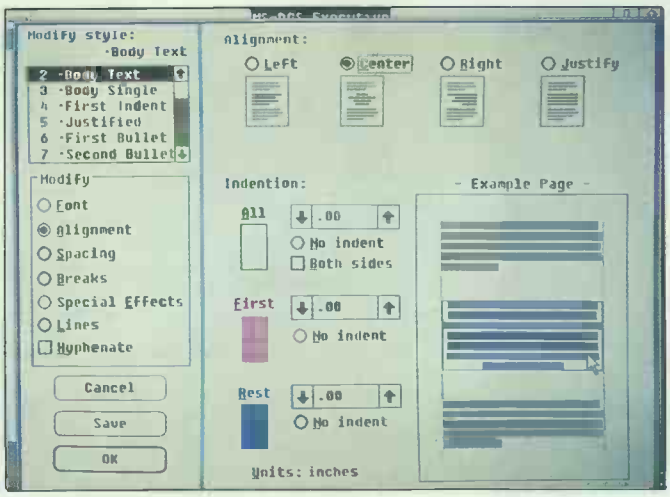
An alpha icon — one of those on the left of the screen — gives a shortcut between layout and draft modes. The other five are also shortcuts through to menu options and, from top to bottom, allow the user to modify the default text style — adding underline and so on — to go directly to page preview, to undelete and to print.

Style sheets

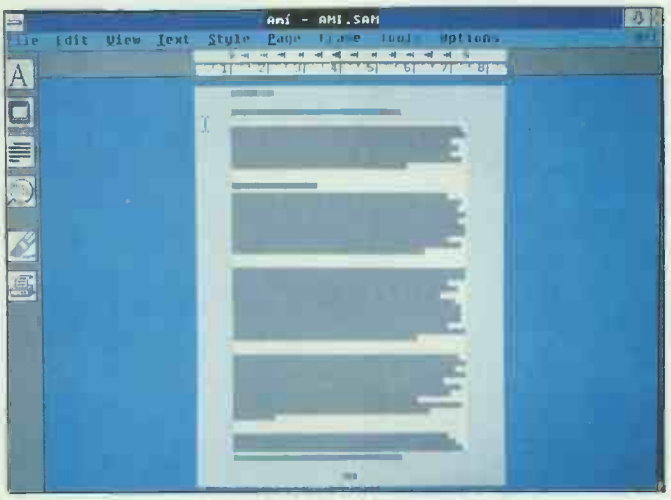
When starting a document, a decision has to be made as to which style sheet it will use. Style sheets are also a major part of the method Ami uses to change the appearance of text. It is worth examining the process in some detail, as it gives an insight into the way the program works and into whether it is easy to use.

Either the default style (the file named Default.Sty), one of the ten styles provided, or a user-defined style, has to be selected. Ami's predefined styles, displayed in the Styles box on the opening screen, apply either to a highlighted block — if there is one — or to the current paragraph. So, for instance, you can choose one of the indented, bullet or bold styles and the entire current paragraph will adopt that style.

Clicking on the Modify Style icon on the left of the screen, or using the Modify Style option from the Style menu, brings up a large dialogue box. This contains a number of smal-



Modifying a style. In this case, a dynamic picture shows the effect of changing the paragraph style to centre



Text cannot be read in Page Preview mode but you do get an idea of what the finished page will look like

ler boxes, the first port of call being the list of styles in the top left-hand corner. Once chosen, the attribute within that style to be altered is selected from the list. The default font for that style can be changed or the font itself manipulated. If, for example, you want to alter the Courier font, then bold, underline or other attributes can be added using a large box that opens to show the changes dynamically, as they happen. The possible changes depend on the attributes installed in Windows.

Alignment, line spacing and the way Ami provides page breaks can also be altered for the current style, with both a dynamic, page preview-style image of a paragraph's appearance, and either up and down arrows or text boxes with which to change characteristics like line spacing.

An option not often found on word processors is the non-exclusive choice Ami offers of breaking a page within, after or before paragraphs. This can be used to add protection against widows and orphans. A special effects option allows elements like bullet styles to be altered and, for line drawing, the line thicknesses and spacing can be altered.

Finally, hyphenation is turned on and off from within Modify Styles. On hyphenating a document, Ami will restrict the consecutive number of lines to be hyphenated to two, will not hyphenate if the word contains numerals, and will not break words with hard hyphens in.

Also on the Style menu is a Style Management option. It allows you to select which of the document's styles — user-created or bundled — should be included in the program's default settings. Styles may also be deleted. The Styles box previously mentioned can be used to switch quickly between styles or it can be turned off, as there is nowhere on-screen to put it where it will not obscure text.

Graphics

Graphical images — created with a Windows application or imported into Windows' clipboard — may be imported into a document. It is best to create a frame as this allows text to flow around it. This default option can be changed to allow text to flow vertically or horizontally only. The graphic is then pasted into it in the normal way. Frames can be resized or moved as desired, and it is even possible to rescale the image while retaining its original aspect ratio. The image cannot, however, be rotated in the frame. Moving it within the frame can be accomplished by resizing the frame around it.

Bugs

I did hit a couple of snags relating to the problem I mentioned earlier of finding the program files of this modular application. When attempting to hyphenate the document, Ami reported it could not find the relevant hyphenation module of the program. It then opened another box that invited me to put a disk in drive A: or hit Cancel. I clicked on Cancel, whereupon I got the first box back again. Nothing could persuade Ami to leave the loop it had got itself into and, in the end, I had to reboot. Although the version I looked at was on late beta test — it was version 0.998 — this type of bug should have disappeared by now.

When asked, Samna said the problem could be solved by including the Ami directory in the path setting, advice not in the manual.

Other less drastic bugs meant that updating of the screen after a change was not always complete. For example, the tops of some letters in one line would be offset to the right or, occasionally, what looked like truncated underline characters appeared, randomly dotted around the text. Like the lost files problem, by the time the shrink-wrapped version is shipped Samna will have dealt with this too.

Other features

Bugs aside, I found the program generally simple to use, although there were exceptions: for example, adding an attribute to the entire text can be cumbersome. I found I had to move to each page individually to, for instance, add justification or columns. Another way is to go either to the top or bottom of the document by pressing Shift-Ctrl-Home or Shift-Ctrl-End respectively, highlighting the entire text along the way.

One of the reasons for Ami's general simplicity in use is that it is not a very rich environment. It lacks a large number of features that users now want and is sometimes not as intuitive as you might expect. For example, you might anticipate that adding a visible ruler to the top of the page would result in that setting being saved along with the document. But it is not.

A major drawback has to be that Ami can support only one open document at a time, while most word processors allow at least two; Sprint gives you over twenty. A way round this is to open two or more copies of Ami, but this could lead to excessive memory consumption — a problem in unexpanded machines.

And I found the document management facility a curiosity, largely because of its location. Rather than hanging somewhere off the file menu, it is buried at the bottom of the tools menu, above which are the search and replace option, the spelling checker and the dictionary editor. On choosing the document manager, you get the choice to copy, move, rename or delete document files. Files other than documents can be manipulated by changing the default

mask of *.Sam, Ami's document file extension.

Columns are a feature with which many word processors have problems and Ami is no exception. It offers up to eight columns in snaking, newspaper format only. The default gutter widths can be altered and the columns balanced so that they line up at the tops and bottoms of the page. Ami failed this test when running into a Mannesmann Tally laser printer and using its native Courier font. Printing this review with two or more columns resulted in some pages having one column about half a line higher than the other, with no consistency to the error.

Ami provides a 114,000-word dictionary, although the only version I saw was the US edition. By the time Samna ships the program, a de-Americanised version will be available. From the Tools menu the dictionary may be edited, although you cannot get into it while the program is doing a search and replace.

Spell checking is reasonably fast; it took 25 seconds to proof a 4000 word document with no mistakes in it. But presumably in an effort to keep itself clear of the relevant word, the spelling checker's dialogue box jumps unpredictably from the top to the bottom of the screen.

I found this extremely irritating as, no sooner had I got the mouse positioned in more or less the correct position it leapt to the other half of the screen.

What I missed most, though, were macros. As a WordPerfect user, I find that the most tortuous of keystroke combinations can be assigned to a single keystroke — or for dangerous commands, to a named macro. That means I don't have to remember which particular pot-pourri of function keys does what. It makes life easier but, sadly, Ami does not give you the option.

Another two features I use a lot are automatic red-lining and strikeout. If a document has to be revised, it is valuable to see at a glance the differences between it and the original.

An ability to produce indices, tables of contents, and perform simple calculations on columns of figures would also be useful to many authors, but Ami gives no joy here either.

The last three elements I hoped to find were an undelete facility, a timed autosave and an ability to look at text over a page break. But Ami does not allow you to peek at the next few lines if they happen to fall on the next page. To do so means a wait while Ami updates first its internal pointers then the screen. Even on a 20MHz 386, this operation was by no means instantaneous.

It also only provides one level of undelete — surely some mistake when so many packages provide up to three — and has no timed backup facility.

On the other hand, though, all beta test software tends to be slower than its shrink-wrapped version. Once the debugging code has been removed, this may become less of a problem.

Documentation

Ami's three manuals are of a reasonable quality. The first covers the usual ground on how to use a word processor, about word-wrap and simple operations like searching and replacing, moving and copying text, and file handling. The back end forms the bulk and describes each menu, option by option. Even though my manuals were draft documents — produced, according to the blurb, using Ami — Samna has added plenty of clear diagrams to show what the real thing should look like.

What it lacks is a decent index and a chapter on troubleshooting. Looking up hard hyphens, for example, took me to a page that mentions them in passing, and the same goes for hard spaces; I still haven't found out how to produce either.

'Samna Ami is evidence that Windows on the PC still has a long haul to catch up with the Macintosh.'

Anyone who gets into trouble with the package will get no assistance from the manual either. This has to be a major minus point as, in my experience, what new users find most disheartening is not knowing how to get out of mistakes they have made, or if pressing a key will cause them to lose the work they have already done.

The second manual is dedicated to style sheets and takes a tour round the 25 bundled styles. It starts with the bold heading 'If you're not going to read this guide . . .'. A two-page introduction to style sheets and how best to use them follows. The remainder goes through each style individually.

Last of the three tomes is a guide to Microsoft's Windows. It leads the newcomer round the scroll bars via the keyboard, taking in elements like dialogue boxes and menus on the way. All the keyboard equivalents are shown.

Conclusion

It is ironic that the Apple Mac should be so much better endowed with powerful *word* processors when it is the Mac's *graphical* ability that seems to make the guys on the aeroplane gush so nauseatingly. Samna Ami is evidence incarnate that Windows on the PC still has a long haul to catch up. Billed as a powerful package, it is in fact a middle-ranking product in terms of the features it offers. One thing is certain — power users will not be mobbing Samna to demand copies.

And if it is aimed at pulling new people into the Windows environment, I believe it will fail. With a manual that does not cover the ground in anything like enough detail or tell newcomers how to back out of trouble, and a lacklustre list of features, it is more likely to reaffirm prejudices about Windows being pretty on-screen but delivering little real punch.

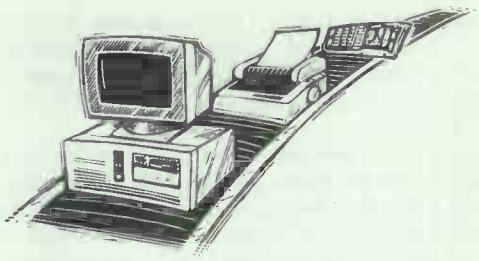
But that is not to say that it does not have a role to play. Many businesses, both small and large, are experimenting with Windows in the hope, firstly, that it will make the computer easier to get along with and, secondly, that it will future-proof them against OS/2. Once familiar with Windows, the argument runs, OS/2 — which in this instance means Presentation Manager — will come easy. So the more Windows applications with a list of features long enough to satisfy the majority of users, the better.

With the impending arrival of Microsoft's Word for Windows, however, Samna will find it has a fight on its hands. While this product will be more expensive at around £475 compared to Ami's £199 price tag, it will fill a lot of the gaping holes in Ami's list of features. If you rush, Ami will be on offer at a special price of £99 until the end of February.

Alternatively, Samna is producing an upgrade soon, called Ami Professional. It will include many of Ami's missing features and is likely to have a price tag to match — somewhere around the £400-£500 mark. Samna couldn't give very precise details about it or about its release date but did mention it would include mail-merge, surely an essential feature in most offices.

So it's horses for courses. If you need a relatively modest package that goes further than Windows Write (not difficult) then Samna Ami could be the answer. Power users will have to wait for the Microsoft product — or for the somewhat more nebulous Ami Professional.

Samna is on (01) 587 1121. END



Agenda

Now that, to some people, the diary and notebook have been consigned to the scrap-heap of history, the electronic equivalents are poised to take over. Andy Redfern has been testing the Agenda from Microwriter Systems, a pocket organiser with several differences.

Even the directors of Psion could never have predicted just how successful the Psion Organiser would be. In fact, were we to have believed the pundits' reviews, Psion would have bitten the dust long before it became a public limited company earlier this year. But its small, brick-like *aide-memoire* has managed to find a space in the hearts (and pockets) of efficient people everywhere.

What has been more surprising is that in the Organiser's three-year rise to fame, no-one has been able to produce a product that competes on size, performance and cost. There have been attempts from companies such as Victor and Sharp, but they have failed to achieve a volume of sales to compete with the Psion. It was with some interest, therefore, that we greeted a new Psion-sized computer when it arrived in the *PCW* office. A hefty dose of surprise was added to our interest when we discovered the company which had produced it was Microwriter.

Microwriter Systems designed and sold a new-style keyboard/word processor called, imaginatively, the Microwriter. Those of you familiar with the TV adverts showing Dennis Norden clicking away on one, will remember that it was a grey, odd-looking box with a set of keys recessed in the top section. In fact, although it was a fully functioning keyboard it only had seven keys. Each individual character was generated by pressing and releasing a combination of the keys.

An unusual and original idea it certainly was, but Microwriter only managed to sell 13,000 of them. When the company designed its new product it aimed at a much bigger and far more lucrative market — the filofax-carrying members of our society. The Agenda is being sold as a filofax basher although, as we'll see in the 1989 electronic filofax price war, it will be treated by most people as a Psion basher. I have to admit that when it first arrived I was fascinated by this electronic notepad and diary, but I was more than a little cynical about which was greater — its usefulness or its poseur value.



Hardware

The Agenda is a small, black piece of plastic about 7ins×4ins in size. Although it is only three-quarters of an inch thick, it is far from flimsy as it weighs well over a pound. The case is constructed from two stylish matt black plastic shells that join round a third piece, which mounts the circuit board and the interface connectors securely inside. On the right-hand side are the on-off switch, the DC voltage input, a 'battery charging' indicator and a single connector which can operate as a serial or parallel port, depending on which cable you attach to it.

The top of the Agenda is the working surface containing the keys and the screen. The keys are divided into three sections — the function keys, the alphanumeric keys and a halo of Microwriter keys.

In the top left-hand corner is the screen, a standard LCD unit with no backlighting. It can display 4 lines of 19 characters, which makes it approximately twice as big as the Psion's screen. The characters are generated from a 5×8 pixel matrix which gives a reasonable-looking font except that the characters with descenders (g,j,p,q and y) look a little compressed and flattened.

The Agenda contains a Hitachi 63A03Y being driven by a 4MHz crys-

tal. It comes with 32k of RAM and 32k of system ROM as standard. A real-time clock and five cadmium button cell batteries also reside in the slim case. The batteries are rechargeable and a small DC recharger is supplied.

On the back of the Agenda are two expansion slots which allow up to 128k of RAM to be added. They are protected by dummy blanks that slide into the slots. Adding a RAM pack is simply a matter of turning the machine off, removing the blank and inserting the RAM cartridge. The RAM cartridges contain a small non-rechargeable battery (similar to the kind used to power a camera), a RAM chip and a small amount of control circuitry. When connected to the Agenda the RAM cartridge draws its power from the main batteries. Upon its removal from the machine, the lithium battery will power the RAM for over five years.

Software

When you design a proprietary operating environment, no matter how advanced the hardware technology is, the software must be just as impressive or your product will never be successful. The software on board the Agenda is basically a free-form database, with simple word-processing capabilities for adding and updating the database records. There is also an easy-to-use but fully functioned calculator.

Each piece of data you wish to store is added into a file. This is where new users will have an advantage over veteran computer hackers, as a file is actually a record in normal database terminology. I could see no reason why Agenda's couldn't have been called a record and it certainly confused me to begin with.

Each file of data is placed with a 'drawer' in the Agenda's filing cabinet. This allows different types of data to be stored in separate places and also allows special functions to be performed on certain drawers. When you first enter any data into the Agenda, like a phone number and contact name, it is added to the O(ordinary) drawer. A diary entry is added to the D drawer and special system commands are added to the Z drawer. A file can be switched from one drawer to another, but it should be noted that drawers X,Y and Z are special system drawers.

To search for data within a specific drawer, simply press the letter of the drawer at the main menu. The screen will then display the first record in that drawer, and a count at the top left will indicate how many files are present. You can scan the files and switch between them using the four arrow keys.

24th January 1988

David Smith
231 Cocksparrow St
Warwick
CV35 6PP

RE: Overdue payment of invoices

It has come to our attention that the following invoices remain unpaid.

Date	Description	Price
10/10/88	Star LC10 with printer cable and a box of fan-fold paper	£329.00
12/10/88	Amstrad 1640ECD	£599.00
		£928.00

Much as it grieves us to hear that your bank isn't keen to offer you overdraft facilities, we do feel it is a little bit cheeky to then ask your computer dealer.

Your prompt settlement of this account should stop us from taking your wife hostage, although she would provide a bit of company for your dog, who, during his 3 week 'stay' with us, seems to be missing you.

Also, if payment happens to be in the post when the boys come round on Monday, please accept our heart felt apologies for any inconvenience we may have caused and you can rest assured the flowers are on the way.

Sarcastic Systems PLC

This print sample was generated using the Agenda with a Star LC24-10. The Agenda dealt with the columns and different styles of text by the simple addition of a printer command look-up table and a tab set-up string

If there is a large number of files, you can search for a text string simply by typing it at the prompt. As each letter is typed, the number of files which contain the string so far entered is displayed. After four or five keystrokes this number will reduce down to one and the file you are searching for will be displayed. If the search is invoked at the main menu rather than in a drawer, the search will be performed across all the drawers.

As mentioned before, the D drawer is used to store diary data. When you select New, a default time and date appears which can be modified for the event you're about to enter. You will then be asked if you want an alarm to remind you of the appointment. This is a piercing beep-beep that sounds even when the Agenda is switched off. You can disable the alarm if you are going to be somewhere you don't want it to sound.

The word-processing software that allows you to edit the files is far superior to anything else that is viable on a machine of this class. It has word-wrap unlike the Sharp IQ. It understands what a carriage return means, unlike the Z88. And it has the ability to drive a printer without any additional software, unlike the Psion Organiser.

It has many excellent features, too many to list in full, but I used the Agenda to create and print out the document above. This is a complex document where the middle section is created using column mode, and is not generated by entering lots of spaces. A tabbed heading descriptor is set up. Between two special descriptor markers, the three headings are separated from another special column set character. Entering the tabular data is then simply a matter of typing the text with a tab between each field. The Agenda even

prompts, at the top line of the screen, which heading you are currently under. It doesn't matter on the first couple of items, but because of the small screen the headings quickly disappear up the document. Also, 'Star LC10 with printer cable and a box of fan-fold paper' was entered in full and the Agenda calculated at print time how many characters could be fitted within the space.

The above example is complex, but it helps to underline just how good the system software is. Setting up the printer was simply a matter of adding to the Z drawer strings of escape codes for the different fonts and effects I wanted to use.

The final area of importance for Agenda owners is data integrity. If you are committing your schedule and notes to the little machine, you want to be sure you can get them out again. You can back-up the data either to a plug-in cartridge or to a PC. The back-up and restore software was not finished while I was reviewing the machine, but the back-up system to the RAM packs worked. Simply select Backup at the main menu and the system is saved; select Restore and it is restored. It is very fast, simple to use and comes with suitable warnings to make sure you realise everything on the RAM card will be lost when you overwrite it with the new back-up data.

Although the utility to back up and restore to and from the PC isn't finished, data can be sent between the Agenda and the PC (or any other computer with a serial interface). Set the baud rate to be the same on each of the machines and connect the special serial cable. To send from the Agenda, simply select the files you want to transfer and then print them. On the PC, type COPY COM1: NEWFILE. The reverse operation is achieved by moving to the Y drawer and typing COPY OLDFILE COM1:. The text will then miraculously appear in the Agenda. (Due to the Agenda's file size limit of 8k, you can't send files bigger than that to it.)

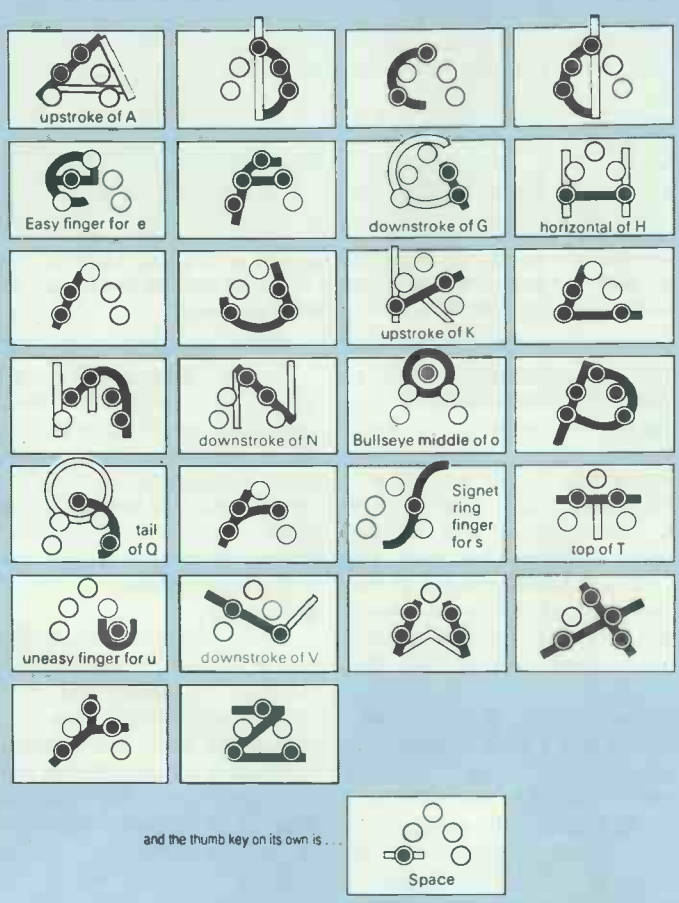
What is Microwriting?

Microwriting is a specialist form of typing that only uses seven keys. The keys are pressed and released in different combinations to generate all the characters you need. These combinations are called chords, and in some ways learning to use the Microwriter does bear a passing resemblance to practising your scales on a piano.

Each finger, including the thumb, rests on one of the five black keys, and in normal use you hardly ever need to move your fingers off them. This has some distinct advantages. Firstly, you don't need to look at the keyboard while you're typing. Secondly, you can hold the Agenda in one hand and still type with the other. Thirdly, even in the most unfriendly typing situations, like the top deck of the number 55 bus, typing is possible because once you've placed your fingers firmly on the keys, you hardly move them at all.

An obvious disadvantage, for left-handed people, is that the Microwriter keys are in a right-hand configuration.

The chords you need to learn in order to type the lower case alphabet are shown below. The overlaid letters which are used to remind you of the keys may look a bit odd but they actually do work. It took me about 20 minutes to learn the basic characters and about a week to improve my speed sufficiently to make Microwriting faster than using the Agenda's normal keyboard. Even so, I can still write faster than using the Microwriter keys and I can certainly type faster on a full-size keyboard. People who have been Microwriting for longer than I have suggest it is possible, with practice, to improve your speed to around one-and-a-half times faster than normal writing.



The Microwriter chords for the lower case letters are generated by pressing and releasing different combinations of keys. Microwriter Systems provides some useful tips for remembering the different key combinations

Conclusion

The Agenda is a well made, thoughtfully designed product that should prompt a great deal of interest from outside the usual computer markets. Many first-time computer owners will be attracted to this machine, and they will not be disappointed as the Agenda shields the user from most of the complex, jargon ridden areas of personal computing.

Having said that, just how useful is an electronic filofax? Personally, I will use the Agenda for a few more weeks to give it a full evaluation, but after that I'll return to paper and pen.

Often, when I make a note of someone's address, I also sketch a map of how to get there. When I'm in a boring meeting and come up with a useful programming idea, I draw a sketch of the logic rather than write the code directly. The Agenda can't cope with with either of these problems — but neither can my PC!

Whether you find the Agenda useful or not will depend on the way in which you work. You'll love it so much only surgery will separate you from it, or you'll wander round with a bemused look wondering what all the fuss is about. Whether you need an electronic filofax is a question only you can answer (I've managed to survive the last 22 years without even a paper one), and if you do, this is probably the best on the market.

Microwriter Systems is on (01) 685 0300. END

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Picture this

The field of computer graphics is in a state of extremely rapid change — as developers strive for perfection, systems which were once acceptable are regarded more critically. Nick Hampshire assesses what further improvements we can expect in the next few years.

A few weeks ago, while clearing junk from a cupboard, I came upon my old, 1982 vintage, Commodore VIC 20 computer. Amazingly the machine still worked, and the next few hours were happily spent rediscovering some original VIC games.

This discovery was a revelation. It clearly demonstrated how far the personal computer has developed over the last seven or eight years. For many, the VIC or the Spectrum was their first introduction to colour computer graphics. By today's standards they were crude: the VIC had a screen resolution of just 176×184 pixels with 16 colours. In contrast, a modern Extended VGA screen has a 640×480 pixel resolution with 256 colours out of a 262,144 colour palette.

Early computers like the VIC 20 may now be considered primitive, but at the time they seemed wonderful. Most importantly, they demonstrated the potential of colour computer graphics. They made people think of possible applications. They made people dream of having a display that was as crisp and clear as reality; one that could show images moving in real time, and even (that dream of dreams) a true three-dimensional image.

The goals and the problems

The enormous improvements in computer graphics which have taken place are the result of thousands of man-years of work around the world, and an enormous investment. Why has this enormous effort and expenditure been committed to producing stunning pictures on a monitor screen?

The answer to this lies in that old saying, a picture is worth a thousand words.

It is not surprising that graphical output has long been considered an essential requirement for computers. The development of graphics devices has been encouraged because higher resolution and colour displays can have a higher information content. Improved displays have in turn led to the development of computer applications such as CAD and desktop publishing.

The ultimate goal for computer displays has to be photographic-quality output. This is determined by the resolution of the human eye, and varies from one individual to another. It also depends upon viewing distance. One can see more detail in a photograph at close range than at arm's length.

In printed matter or photographs, the unaided eye's ability to resolve fine detail lies in the range between 1/1000 and 1/2500in, the thickness of a very fine hair. There would be little point, therefore, in having a display technology with a finer resolution.

The need for such fine resolution is further reduced by the increased viewing distance and the fact that most video displays are active light producers rather than light reflectors. With an active light producer there is a tendency for any pixel to be visually blurred: a light pixel will become larger and a dark pixel smaller. The fact that a display is a light producer also means that we view it from a further distance than a reflective display (such as a sheet of paper).

However, light producers have the advantage of allowing a wide range of light intensities to be created on a single pixel: 256 grey shades is quite common. In printed matter, grey shading requires image screening, which reduces resolution because it utilises a variable dot size. The increased viewing distance means that we will visually lose very fine detail.

These factors cause the maximum display resolution to be little more than about 1/400in. Such a display would need to have 400 dots per inch vertically and horizontally, or 160,000 per square inch. There is an additional factor that any movement in the display, such as character animation, will reduce the need for high resolution, since movement blurs image detail further.

For colour displays this maximum resolution is somewhat lower, due to the higher information content of colour images and their lower contrast. The maximum colour resolution is therefore probably about 1/300th of an inch.

We are also limited to a maximum perceptible number of colours. The human eye has excellent colour discrimination, but with a hundred different shades of the same colour ranging from full saturation to colourless it is virtually impossible to distinguish between two adjacent shades. However, this is required to give a display a sense of depth, light reflection and surface texture. Colour palettes with 16.7 million colours are therefore justified. Systems limited to 256 colours on the screen at any one time are unsatisfactory and such limitations must be overcome in future generations of displays.

Display technologies

The most important component in the further development of computer-generated graphics is the display technology. Without further progress in this area all other developments in computer graphics would be pointless. There are five different technologies in commercial use: cathode ray tube (CRT), light emitting diode (LED), liquid crystal display (LCD), gas plasma (GP), and electroluminescent (EL).

Other potential techniques include scanned laser beams and vacuum fluorescent panels, but the computer displays of the 1990s will undoubtedly be developments of the five current technologies. Given this range of different display technologies, how will they develop over the coming years, and what problems will be encountered in their development?

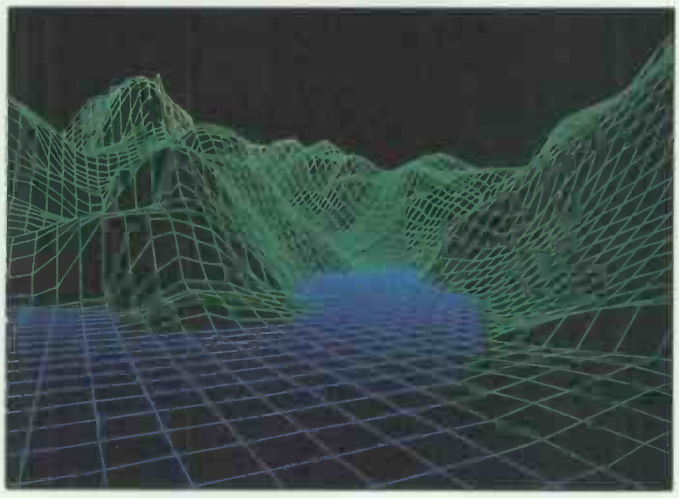
The CRT is the most widely used display. A CRT works by scanning a thin electron beam across a phosphor coating on the inside of a glass vacuum tube. Improving display resolution means focusing this beam to a very fine spot. The size of this spot is known as the display's dot pitch. Reducing dot pitch also means increasing the number of horizontal scan lines and ensuring that the circuitry can turn the beam on and off fast enough.

Making the electron beam smaller means that it will produce less light when it hits the phosphor. Improvements in phosphor formulation can help, so can raising beam power. But the best way is to increase the beam scanning rate. This ensures that it produces the maximum amount of light and has the added effect of reducing screen flicker.

Unfortunately, the increased scan-



False colour shading of a 3D map from a battle management system



3D colour display of map data

ning rate means an increase in the current switched through the deflection coils, and therefore an increase in their heat generation. Dissipating this heat without affecting the magnetic deflection field is quite complex.

Focusing the beam to a finer resolution also means that there is an increased defocusing due to the curvature of the screen. Flatter and more even screens are being made, but curvature can never be eliminated since it gives strength to the tube.

The solution is to vary the focusing as the beam sweeps across the tube so that an even dot pitch size is maintained. Some systems use analogue electronics to do this, but one of the most sophisticated systems uses digital electronics. This system, manufactured by Westwood, stores a map of any surface irregularities in the screen so that it can exactly focus the beam for every pixel location. This map is created and stored in ROM when the display is manufactured and is unique to each screen; it is controlled by its own focusing processor.

Monochrome CRT displays with a 1660×1200 dot image size are now quite common. There is even a 4096×3300 dot screen available from MegaScan Technology of Pennsylvania. This screen has a dot pitch of just .003in — equal to a resolution of 300 lines per inch, which is very close to true photographic quality.

Because three electron beams are used in a colour CRT, the maximum resolution is less than that of a monochrome CRT. Increasing the resolution means decreasing tri-dot pitch size. The development of high-resolution colour CRTs faces the same problems as monochrome CRTs, with the additional problem that making the dot size smaller means that the holes in the shadow mask must be smaller.

This increases the number of electrons hitting the shadow mask rather than the phosphor. The result is images of lower intensity and a heating of the shadow mask due to absorbed electron energy. This heating is the biggest problem, since it causes the shadow mask to buckle and thereby distort alignment. This is being overcome by using thermally stable metal alloys (such as Invar) and by keeping the shadow mask under tension. This type of mask tension system, known as FTM, has been commercially developed by Zenith in the USA.

The resulting colour display is claimed by Zenith to have better colour purity, to be 50% brighter and to have a 70% better contrast than conventional displays.

Colour computer monitors with a resolution of 1280×1024 are now quite common in computer workstations. Such displays have a resolution of about 100 lines per inch with a tri-dot pitch of about 0:01in and offer good image clarity. But further improvements can be expected: Mitsubishi has demonstrated a 2000×2000 dot colour CRT with a resolution of 150 lines per inch, about half way to our ideal display.

The other widely used computer display technology is the LCD panel, the most common form of display for laptop and portable computers. It provides a monochrome display which has the advantage of small size, lightness, and low power consumption.

Creating a graphics image using LCD technology is simply a matter of having rows of fine electrodes on each of the transparent surfaces of the screen. These are placed at right angles with the nematic liquid between them. Dots are created by addressing the correct row and column.

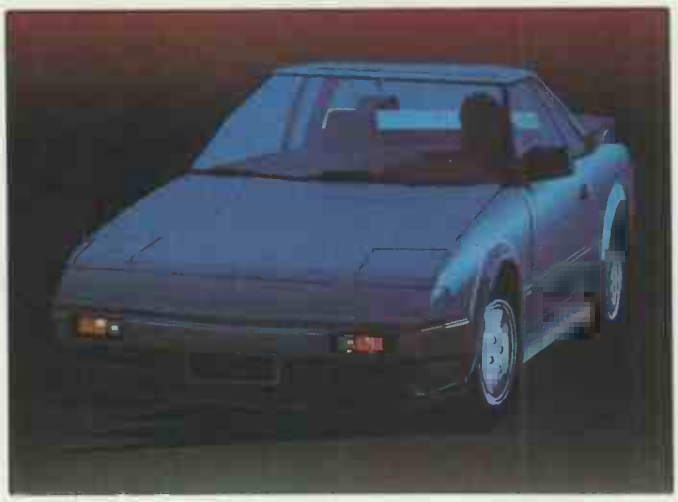
Increasing the screen resolution makes the control electronics very complex, but that can be overcome by using an 'active matrix' LCD. Thin film transistors are used at every pixel location, effectively turning the display into a memory. Once a pixel is addressed it stays illuminated until it is switched off. There is no need for multiplexing so the scanning effect seen on large displays is eliminated.

The use of active matrix LCDs has enabled the development of colour displays. These use coloured organic filters in front of each pixel which are then backlit. The range of colours is rather limited, typically either eight or sixteen, but this system is employed in the manufacture of 3½in colour screens for pocket televisions. The resolution is only about 50 lines per inch, and there is the added disadvantage that such panels are very difficult to manufacture, with nearly 80% being rejected as substandard.

Despite this we can expect to see colour LCD displays with a resolution of 1500×1500, and better than 100 lines per inch, within the next five years — a trend which has been reinforced by the announcement a few months ago of the joint development by IBM and Toshiba of a 14in square colour LCD display of 770×550 pixels, with a range of sixteen colours.

A display technology employed in high-price portable computers as well as military and aerospace applications, is gas plasma. This is the type of display employed in machines such as the GRiD portables and the Compaq transportables, as well as the top-range Toshibas.

The attraction of this type of flat panel display is that it is light emitting and visible in all light conditions. It can also be manufactured in much larger panels, and 20in plasma screens are already available. Such large displays could form the 'hang-



Synthesised image from a CAD file showing both multiple light-source reflection and surface shading



Use of a high-resolution colour display to show a colour photographic image with associated text

on-the-wall TV' of the future, or they could be used to create an 'intelligent' drawing board for CAD. The drawback is that a high operating voltage, about 200v, is required in order to generate the plasma.

High voltages are an inherent problem with plasma display technology, and developments in semiconductors, such as Bi-CMOS, will make their control far easier. These developments are enabling designers to reduce the number of components, thereby reducing both the cost and complexity. Improved control techniques have also allowed pixel brightness control to be incorporated into plasma displays — up to 16 levels of grey scale are now possible.

Progress is also being made in the manufacture of colour plasma displays. Since the colour is dependent upon the type of gas, it is impossible to manufacture a simple triad of pixels. Instead, designers have stacked a red, a blue and a green display on top of each other to create the colour display.

Some Japanese display manufacturers regard plasma displays as being a serious contender to replace the CRT for high-definition TV. Already, major manufacturers like Fujitsu have started manufacturing a full colour 500×500 pixel display on an 8in square panel. In the laboratory, plasma displays may now be rivalling high-quality CRT resolution, but making them is a complex process and it will be some years before they can be manufactured as cheaply as the CRT.

The electroluminescent panel is very similar to the plasma display, but instead of a gas it uses a chemical phosphor which emits light in the presence of an alternating electric field. It has proved very popular in military applications since it is an extremely rugged device with a long operational life.

The drawback with electroluminescent displays is that they operate at high voltages and, like gas plasma, use a lot of power. However, such displays can be manufactured as large high-density panels with a very low weight.

Like plasma displays, the light intensity of any pixel can now be varied thanks to advances in the control electronics. The display has a very high contrast, and current manufacturing techniques allow extremely small pixel sizes. The standard current generation of an EL display has a 640×640 pixel resolution with a 10in screen. However, prototype 1024×1024 pixel displays have already been demonstrated by several manufacturers.

The power behind the display

A computer graphics display is a partnership between several technologies. It is no good simply having a high resolution display with lots of colours; we also need a means of creating the image from a manageable amount of data. A high resolution colour image contains an enormous amount of data: the average colour display on a low-cost workstation occupies over a megabyte of memory. It also requires fast electronics, repeatedly shifting that megabyte out to the display at a flicker-free refresh rate of 1/30 second, or less.

The use of graphics primitives to compress an image cuts down on memory requirements, but has the negative effect of forcing the computer into extensive image reconstruction. For a large full-colour image the processor time involved starts to slow the system down noticeably.

By using a special graphics image processor, the main system processor can be left free to perform its normal computing function. The main processor simply feeds the graphics processor with the compacted image in graphics primitive form. The primitives are used by the graphics processor to reconstruct the full image in a special display memory.

Graphics systems processors (GSPs) are now used in virtually every graphics computer system. They range from a simple dedicated chip to a highly complex parallel processor circuit. Some GSPs now utilise the most advanced computer architectures to deliver supercomputer power which is considerably higher than the main processor. Such computering power is needed to handle the vast amount of data, as well as performing calculations which are now considered essential for graphics display creation.

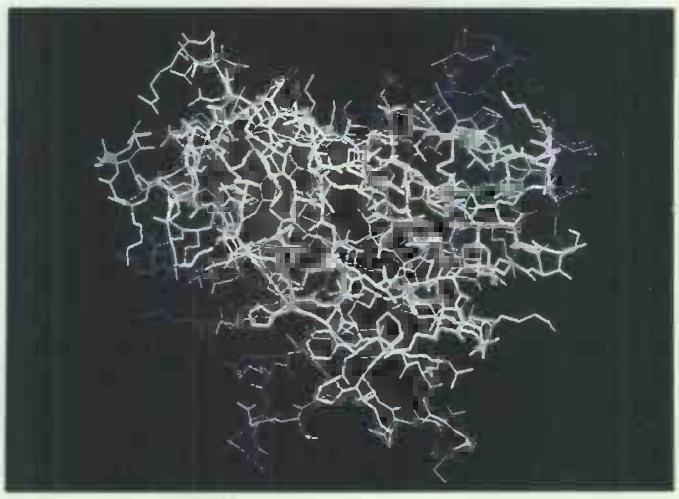
Now that displays tend to make two-dimensional representations of three-dimensional objects, they involve surface texture synthesis, shading and reflection from multiple light sources. These features require a lot of complex processing on each pixel. In addition, there is now an increasing requirement for real-time animation. With a million or more pixels and a thirty frames a second refresh rate, it is no wonder that designers are working on GSP systems with a processing power of one thousand megaflops, or about the same as a small Cray computer.

An example of a device where this type of computing power is being applied to graphics creation is the AT&T Pixel Machine, and in particular the PMX900 series. This machine delivers 820Mflops of computer power, derived from a parallel architecture of 32-bit floating point digital signal processors.

The only way to generate such computing power economically is, like the Pixel Machine, to use parallel processors. Graphics image proces-



A high-resolution synthesised image showing extensive use of Giraud shading, texturing and specular reflection



3D image of a complex organic molecule

sing is an ideal application for parallel processing since the data can easily be divided into a number of discrete blocks: each processor works on its own small sub-display. Another factor in the designers' favour is that the number of basic graphics operations is quite small, so they can construct the parallel GSP from fast RISC processors.

At the moment there are seemingly as many different types of processor employed in graphics systems as there are graphics systems. They include special-purpose RISC processors, digital signal processors — originally designed for use in radar and telecommunications systems — and commercial RISC processors such as the Inmos Transputer. Whichever processor is used, they all have very high instruction execution rates and the ability to work as part of a parallel system.

Video memory

Combined with the increasing amount of computing power required by a graphics processor, there is also an ever increasing demand for video memory. Two types of memory are used in a display system, video RAM and dual port RAM.

The video RAM stores the bit image and consists of ordinary dynamic RAM chips. Although data is read from video RAM at very high rates by the display circuitry, it does not have to have an unduly fast access time. Data is accessed in blocks and placed in a high speed shift register which then pumps it out at a rate of between 50 and 80MHz.

The dual port RAM is a special type of memory which can be accessed by two processors. It is used to communicate the graphics primitives from the main processor to the graphics processor.

Even a fairly modest display such as that found on low-cost workstations will need at least a megabyte of video RAM. In top range systems the amount of video memory can be between 8 and 20Mbytes. In a colour display each pixel will have three associated values, the intensity values of the red, green and blue dots comprising the desired pixel colour. Allocating four bits to each of these three values, a total of twelve bits in all, will allow generation of 4096 colours, insufficient for an advanced colour system.

A full colour range requires between six and eight bits per primary colour or eighteen to twenty-four bits per pixel. To this must be added further information about depth coordinates, reflectivity, window ID and so on: it's little wonder that in some graphics workstations as many as 96 bits are needed for each pixel.

It would require 3Mbytes of RAM to store a colour image with a resolution of 1024×1024 and 16.7 million colours. It is not surprising, therefore, that most current systems limit the range of colours which can be used in a particular image. This is typically set to 256 colours which are obtained not by storing the RGB intensity values in memory, but by using a colour value which is converted into the RGB values by a special colour palette chip located in the video output circuitry. As RAM chips become larger and cheaper we can expect such limitations on colour range to be considerably reduced.

Software standards

The third major component in advanced display technology is the software which allows increasingly sophisticated display hardware to be utilised by applications programs. At the lowest level, graphics display software simply involves the routines which convert the graphics primitives into a bit image.

These are basic commands such as line draw, circle draw and block fill. On top of these basic graphics commands there are, in an advanced system, a fairly large number of functions relating to operations such as 3D rotation, scaling (and transformation), specular reflection, shading and perspective, complex functions which involve calculations such as matrix inversion and multiplication. True graphics primitives are implemented by software resident within the graphics system processors.

The graphics primitives constitute a language in which application programs can model their desired display. How these graphics primitives are converted into a bit image is irrelevant to the application; that is the function of the GSP. At this level, standardisation is very important. Without any standards for graphics primitives it would be impossible to transfer programs between machines which have different graphics systems but are in all other aspects identical.

What is needed is a universal standard which can be independent of display hardware. Developing such a standard has proved no easy task, but has been undertaken by the international sub-committees on computer graphics of both the ISO and ANSI standards organisations.

The result of several years' work by these committees has been the publication of the Programmer's Hierarchical Interactive Graphics Standard, or PHIGS, which has just been adopted as an international standard by both the ISO and ANSI. It is designed as a common programming base for graphics hardware and applications programs, providing a system of graphics primitives as well as firm data structure for modelling any desired 2D or 3D image. It also includes standards for the description of surface textures, reflectivity and shading.

While providing a fixed standard for applications software interfacing, PHIGS supports a flexible definition of the graphics hardware, so it should be applicable to any future form of graphics hardware. It offers us a path out of the current chaos of graphics hardware/software incompatibility and will hopefully lie at the core of most future developments.

However, in order to achieve its potential, PHIGS will have to be incorporated into future generations of operating systems, and we may have to wait a long time for this to happen. Unfortunately, the designers of OS/2 did not have advanced graphics systems too high on their list of priorities.

What about 3D?

Currently available computer graphics systems are used to display either two-dimensional images or two-dimensional representations of three-dimensional images. For many applications this poses no great problem, but there are some where a true three-dimensional image would be invaluable. These are applications where simply being able to walk electronically around or through a computer model is insufficient, where the user needs to be able to see the object in its entirety.

Over the years a great deal of thought has gone into the creation of systems capable of displaying true 3D images, an image which is contained within a cubic space rather than a projection of that image on a flat screen. So far three potentially viable techniques have emerged: computer-generated stereoscopy, computer-generated holograms and a rotating mirror projection system.

All three systems have been made to work in laboratory environments and each has its own particular advantages. However, of these three techniques only the rotating mirror projection system offers *real* 3D. The other two systems, while better than 2D projections of 3D images, are probably best described as 2½D because the viewer is still limited in viewing angle.

It is possible to generate a holographic image of a three-dimensional computer-generated object. There are two ways in which this can be done: direct hologram synthesis or creation via photographic images. It is possible to model the interference pattern which makes up a hologram, but the results are coarse-grained and impractical.

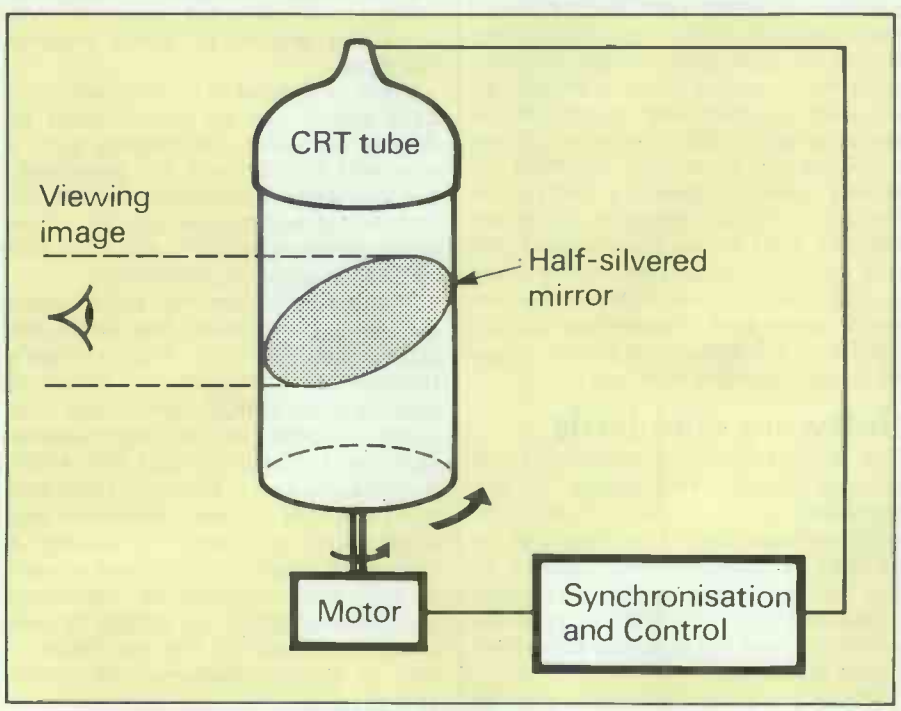
Alternatively, a hologram can be built up in exactly the same way as the moving image of Shakespeare on the new cheque guarantee cards. It involves producing a series of photographic images of the object, each taken at a slightly different angle of rotation. These are used to create a hologram of the object which can then be viewed at different angles as if it were a real physical object. The main drawback to the use of holograms is that they are far from interactive, and their production is a lengthy and expensive process.

Stereoscopy *is* interactive, and gives the user true depth perception which is lacking in a 3D image projected onto a 2-D surface. Full use is made of our binocular vision — humans see two slightly different images because our eyes are in different locations. The brain fuses these two images into a single one, and in so doing extracts depth information from the scene.

We can simulate this by creating two images, one for each eye. To do this requires a special pair of spectacles with a liquid crystal shutter in each of the lenses, an electronic means of alternately blanking out one eye then the other. By synchronising the shutters with a CRT which is rapidly alternating a display of the two stereoscopic images, it is possible to give the user an illusion of three-dimensional depth on a flat screen.

There is currently only one system which can create a 3D image which appears to hang in space and can be viewed at any angle simply by walking around it; this is the rotating mirror projection system. The development of such systems dates back to about 1968, but it is only recently that improvements in computing and display electronics has made it a practical possibility.

The system is conceptually quite simple (see below). A half-silvered mirror held at a 45° angle is rotated about its central axis. This mirror reflects an image which is projected onto it from either a CRT screen or a scanned laser beam. As the mirror rotates it traverses every 3D coordinate within a volume of space, the size of which is dictated by the size of the mirror. By projecting a series of images which are synchronised with the rotating mirror, you can create a true 3D object in beams of light.



Conclusion

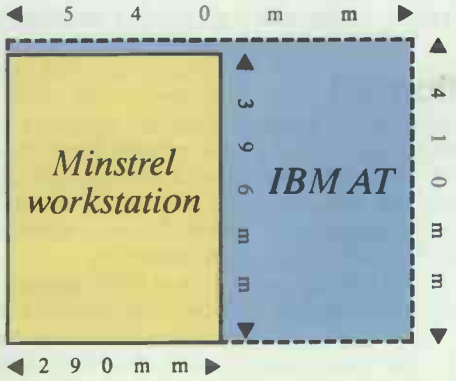
Computer graphics have come a long way since the VIC 20. In the last half-dozen years we have seen the development of the graphics workstation, the birth of new graphics-orientated applications such as CAD and desktop publishing, and the arrival of relatively low-cost systems capable of creating three-dimensional images with all the features of shading and reflection which are encountered in real life. During this period we have also seen the development of new graphics display technologies such as LCD, plasma and electroluminescent panels.

Looking forward over the next five to ten years, there is certainly no evidence to suggest that the rate of development in this particular area of the computer industry will slacken. In 1995, looking back to today, it is certain that we will be looking on our PCs with their VGA displays in the same way as we now look upon the display capabilities of machines like the VIC 20 or the Spectrum. There is also a strong likelihood that new technologies will have emerged, and that forecasts in articles such as this will have seriously underestimated the rate of change.

BIG BRAIN *small* FEET



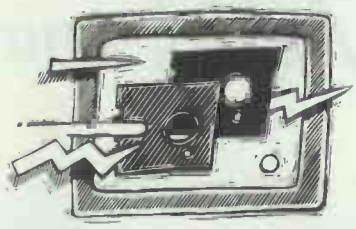
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Screen grabbers

When you want to preserve certain screen images for later use in a desktop presentation or feature, a screen capture program is what you need. Ed Brown looks at some of these 'screen grabbers' in action.

How often have you looked at a screen display on your computer and wished you could save it for use in another situation. Perhaps something interesting happens within a program, or you've created a graphic you want to include in a document either using a word processor or a desktop publishing package. Perhaps you're writing the documentation for a computer program and you want to include some pictures of the application in action, pull-down menus and all.

When computer programs were simple and text-based, and printers were equally unsophisticated, a simple PrtSc key would provide a hard copy of what was on your screen. But as both applications and printers become more graphic in their capabilities, more sophisticated tools are necessary. In addition, the multiplication of graphics standards on PCs has meant that existing screendumping programs often could not cope.

Another area in which screen grabbing programs come into their own is prototyping — where you want to create sample screens for a new application. Not all screen grabbers and screen print programs allow for editing, but some do.

While researching this article, the packages were used on an AT clone with a Hercules graphics card and a Microsoft mouse. Some of the programs were also used on a Compaq with a VGA screen fitted. The DTP software used to check the loading of the graphics files was Ventura Publisher version 2.0. Where the files produced were in an IMG or PCX format, they were also tested with graphics programs which support these formats.

Unfortunately, it was not possible to check the file formats with PageMaker as the copy required did not arrive in time. Due to the nature of screen capture programs and the way they take over the keyboard and screen when they are invoked, it was not possible to provide any screendumps of the programs in action. However, examples of screen captures can be seen in the article 'Font facts' published in October's *Desktop Publishing World*.

Pinch & Punch Version 3.0

This low-cost capture program compares with a five-page manual and the programs all on one diskette. It is easy to install and run, although the choice of screen is currently limited to CGA, EGA and Amstrad format with VGA promised soon.

The program was easy to install and use, enabling up to 99 graphics screens to be captured at any one time. This was achieved by running the Pinch utility followed by the program to be captured. It is then a simple matter of pressing the Print Screen key to capture the screen to a file.

Following the capture of the screen a standalone utility was run to convert the captured screen to a TIFF image file which can then be loaded into the DTP package.

Pinch & Punch does not support the capture of text screens or any format other than TIFF but is unique among the packages looked at here as being the only one to support the Amstrad format. It also provides a way of displaying the captured screens as a presentation using the Punch utility.

GrafPlus Version 3.1

This program is designed to allow the printing of screens as a Print Screen enhancer and, as such, the manual cleverly hides the essential information for capturing screens for use in DTP programs. For the record the program to use is GRAFLSR on the diskette supplied with the 26-page manual.

When GRAFLSR is run you are asked to specify the screen type and the output printer you wish to use. For DTP the printer option to select is the file option for PCX which is buried in the middle of the options.

When the method of installing the file option was discovered and the software installed, the program was easy to use and supported a good selection of screens. It was able to capture both text and graphics screens but was again limited to a specific hot key — in this case, the shifted Print Screen key. On pressing the hot key the current screen is saved to disk with a predefined name which is automatically incremented. Unfortunately, the file is saved on the current directory and this can lead to problems in tracing where files have been saved.

Halo DPE Version 1.2

DPE, or Desktop Publishing Editor, is a graphics editing program which comes on three disks accompanied by a 159-page manual that includes a table of contents and three pages on the screen capture option, but no index.

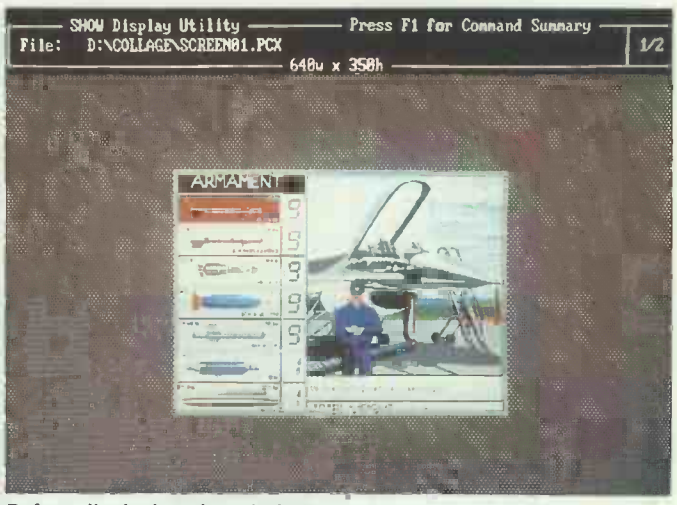
Installation is a straightforward process of copying all the files to the hard disk and then running the set-up program to configure the software to the screen and printer being used. This process leaves many files on the disk with no indication of which can be deleted.

The process of capturing graphics screens is described clearly and concisely, and you can quickly get the system up and running to capture screens. The DPE screen capture program supports most of the popular screen formats and again uses a fixed hot key which, in this instance, is based on a hardware scan code that, for my machines, was the multiplication key.

The DPE screen capture program does not capture text or Windows screens and was the only package to cause memory problems with other programs. The process of getting a captured screen into a DTP format is



Collage's Show program has a useful front end which displays available files and allows the user to rename or delete them to form a complete presentation



Before displaying the whole screen, Show presents the screen in miniature which is useful for quickly scanning through the files. Oversize images can be cropped first

accomplished by using DPE itself, and the captured file has to be loaded into the editor and then exported in either an IMG or a TIFF format.

Although this approach has the benefit of allowing the captured screens to be edited, the usual mode of operation does not require any editing to take place. Halo would have benefited from a standalone utility to convert the captured screens directly into a format suitable for DTP.

PC Paintbrush Plus Version 1.02

PC Paintbrush Plus is another graphics editing program which comes on two diskettes accompanied by a 152-page manual that includes a table of contents, an index and 17 pages on the screen capture program. Several problems were encountered in attempting to install and capture screens, and the manual left much to be desired when it was referred to for assistance.

PC Paintbrush Plus allows the capture of screens by using the Frieze program which comes supplied with the package. This is capable of capturing graphics screens only and uses the Shift Print Screen key as a hot key.

When tested, Frieze would not capture GEM or Windows screens but was capable of capturing screens from other graphics applications such as Doodle and TurboCAD.

When captured, the screens can be loaded into the DTP program or edited using the Paintbrush Plus editing features which are the prime strength of the package.

Collage Release 4

Collage is one of the two packages examined which was designed specifically for assisting the user to include captured screens in desktop publishing software. It comes on a single diskette together with a manual of 80 pages. Installation is accomplished smoothly with a program supplied which copies across all the necessary files and prepares the program for use. The manual is well written and clearly explains the program's features, and provides several useful tips for including the files in DTP packages such as Ventura or PageMaker.

The process of capturing screens is a simple one of loading the Snap screen capture program and then the application to be captured. Snap will capture both text and graphic screens and save them in a text or PCX format to the sub-directory specified when it was loaded. The hot key is the Shift Print Screen by default, but you can change this to Alt and Shift if there is a conflict with the default hot key.

When the hot key is pressed a capture menu comes up which allows you to specify what action is to be taken.

You have the choice of printing the screen directly to the printer, saving

Screen capture

A screen capture program has to reside in memory when the program you wish to capture is run, and wait until you command it to capture a screen. This type of program is called a Terminate and Stay Resident (TSR) program; it is run before the application you wish to capture and activated by the use of special keystrokes.

Once activated, the program may need to display a message on the screen so that you can interact with it. To do this it needs to first save the area of the screen it is going to use for display so that it can be restored at a later stage, and then carry out the commands required. Before returning to its idle state, it must return the screen to the state it was in before it was called up. The TSR must be able to perform this save and restore function regardless of whether the screen is in text or graphics mode, to avoid corruption of the screen.

The task of saving and restoring the screen is not easy, as the screens use the memory in different ways depending on whether they are monochrome or colour, text or graphics, and what resolution they are in. In general terms all screens are located at address A000 which is the top of the 640k address space for a DOS application. Varying amounts of memory above this address are used to store the screen information, and the amount of memory used is dependent on the resolution of the screen and the text and graphics mode in use.

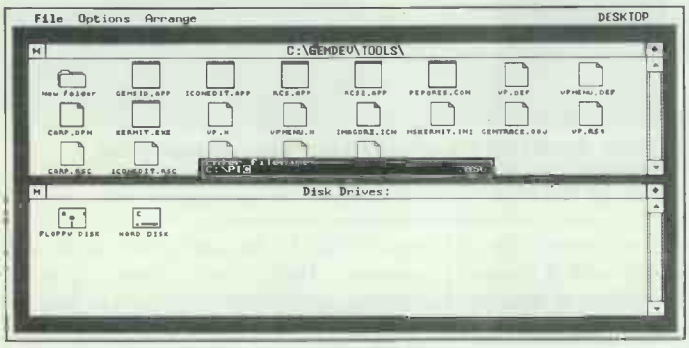
If the screen is in text mode the memory is divided in such a way that each byte containing a character is followed by a byte describing its attributes, such as colour and bold. In graphics mode two mapping methods are employed: the first is similar to the text mode where each dot is followed by its attributes such as colour and intensity. This method is called multi-bit-per-pixel (MBP). The other method is where the screen is divided into four planes, each of which contains dots for the full screen, and each plane represents a colour. This method is called multi-plane-per-pixel (MPP). The EGA and VGA screens use the MPP method and the other graphics screens supplied by IBM use the MBP method.

When graphics screens have been captured there are no significant problems in converting them to graphics files as it is just a matter of converting screen pixels to graphics file format pixels. Text screens, however, provide more of a challenge as the characters which have been captured need to be converted from character codes to pixels and retain the correct spacing which was shown on-screen.

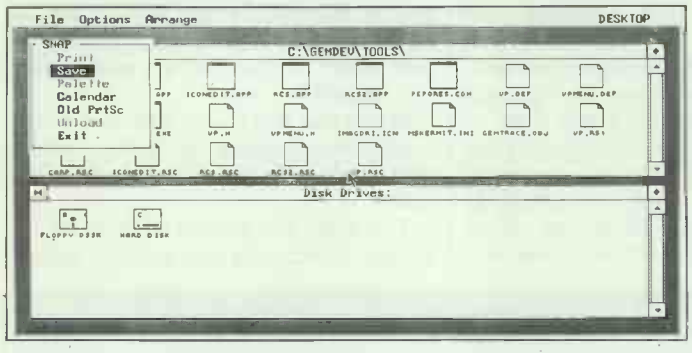
Screen capture is not a straightforward process, and for those who are interested in examining the process further I can recommend *The Programmer's PC Sourcebook* by Thom Hogan, published by Microsoft Press.



When installed under Windows, Hotshot Graphics appears as a camera icon on the desktop. Hotshot also comes in a non-Windows version which saves screens to an intermediate HSG format



Hotshot is invoked by a Control-Alt combination under Windows. It then prompts for a filename and the screen is saved in PCX format



The Collage screen grabber, Snap, provides for a number of file formats as well as reinstating the original PrtSc function. The calendar is a strange addition with no obvious function

it in a text or PCX file format, adjusting the palette of colours (only on colour monitors), displaying a calendar, using the old print screen function or unloading the utility. By selecting the 'save' option you are provided with a selection of PCX file formats which you can save in. The exact use of these is not clear from the screen but the manual takes several pages to clearly explain under what circumstances it is best to use each option.

When the file format has been selected the package captures the screen and returns you to the main menu. The menu has then to be specifically cancelled to continue with the application from which the screen was captured.

All the popular screen formats are supported and the software is quick and easy to use with the ability to capture text, GEM, Windows, and other graphics screens.

In addition to the screen capture facilities there are other facilities, for playing back the screens as a presentation, smooth-scrolling the screen and increasing the number of lines onscreen.

Hotshot Graphics

This is the second of the two packages designed specifically for assisting the user to include captured screens in desktop publishing software. It comes on two diskettes together with a 170-page manual. Installation is accomplished smoothly with a supplied install program which firstly copies across the necessary programs and then prompts the user for information about the system being used. The manual explains the features of the package in detailed and logical form. The screen capture programs are relegated to the reference section of the manual but again are clearly explained.

Unlike Collage there are two screen capture packages supplied with Hotshot, one of which is specifically for Windows applications. Both work very well, although the Windows screen capture uses a fixed hot key of holding Alt and then pressing Ctrl which will cause the screen to be saved to a file with a PCX extension. This is in contrast to the non-windows screen grabber which allows the user to specify the hot key and the file path and name which the file is to be saved under. In this mode, the file is saved in an internal HSG format which is later processed by HSG to produce the file for inclusion in a DTP package.

The screen capture utilities can capture both text and graphics screens which can then be converted to a number of popular graphics formats including TIFF, PCX, EPS and IMG format. The HSG program can also load and edit these files and the screen captures, and includes a section of editing facilities for annotating any screen captures as well as cropping the screens which have been captured. You can manipulate many of the parameters of the captured screen, for instance to alter the size and adjust the mapping of colours to grey scales. These two overcome the problems associated with scaling and adjusting these parameters inside the DTP package, which tends to result in moire ('watered') effects on the output.

One of Hotshot's strongest features is its ability to batch process screens for inclusion in a DTP package. You can capture all the screens needed for the document, then batch process them to produce a standard format. Extras include the full 300dpi bit editor and the ability to playback captured screens as a presentation.

Conclusion

A range of screen capture programs has been covered here and, depending on the features required, one or other of them may be more appropriate. Both Pinch & Punch and GrafPlus provide good facilities but do have limitations which some may find too restrictive.

Although Halo DPE and PC Paintbrush Plus provide screen capture facilities this is not their primary function, and this is highlighted by their relatively poor performance in this area. If, however, you already have these programs or need their editing capabilities then they may well suffice.

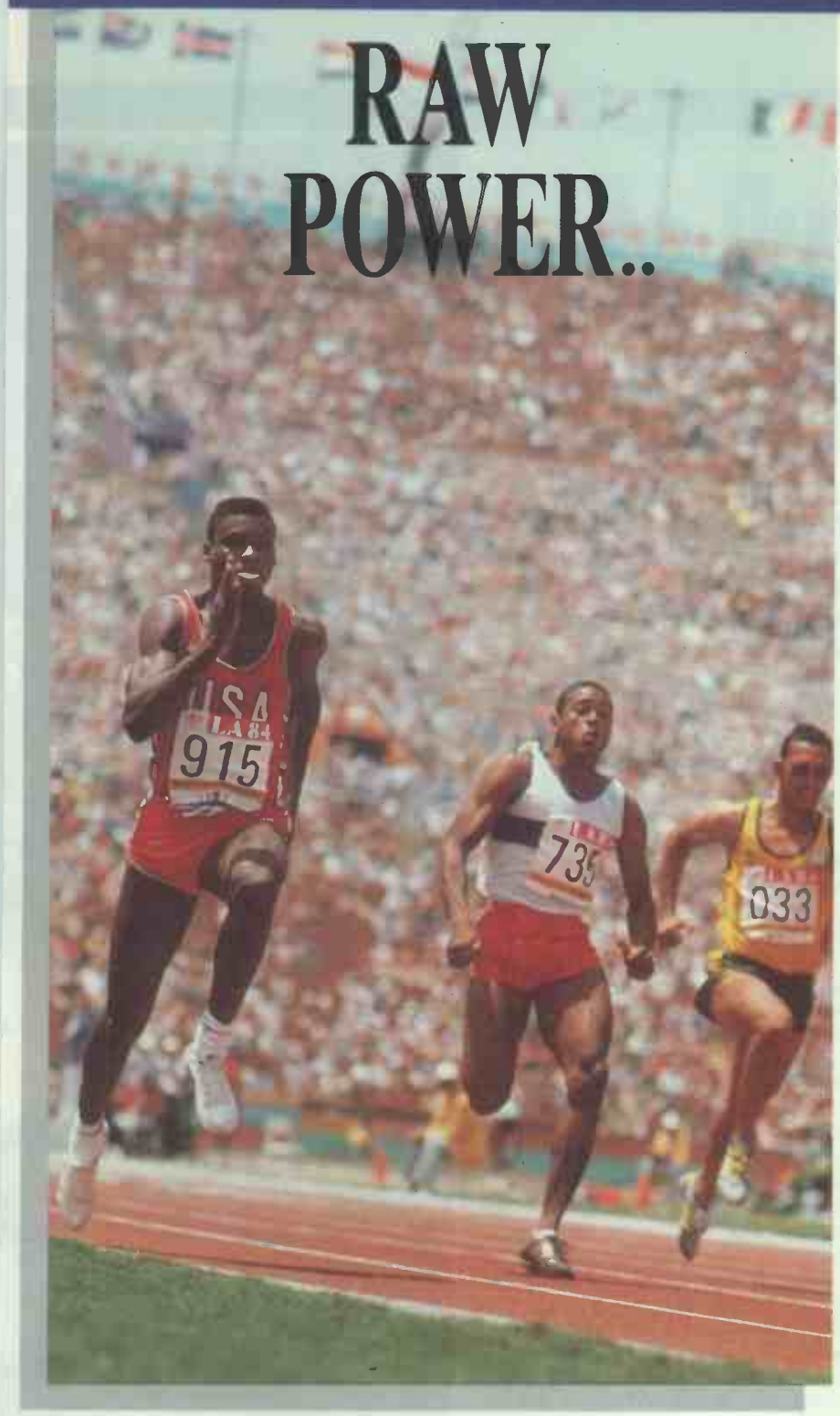
Any choice between Collage and Hotshot Graphics will depend on the functions which are required from the screen capture program.

Pinch & Punch costs £20 from **Iolo Davidson** on (0453) 860827.
GrafPlus costs £49 from **Ctrl-ALt-Deli** on (0908) 662759.
Halo DPE costs $150 from **Media Cybernetics** on US (0101) 301 495 3305.
PC Paintbrush Plus costs £120 from **Graphics Displays** on (0793) 512700.
Collage costs £100 from **Software Forward** on (0234) 272474.
Hotshot Graphics costs $250 from **Symsoft** on US (0101) 415 941 1552.

Edward Brown is principal of Cavalier Data and Documents Ltd, a company specialising in desktop publishing. He can be contacted on (0295) 720425.

END

RAW POWER..



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PC 7 TURBO CACHE 386

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In short the PC 7 Turbo Cache has the muscle to tackle the toughest applications from local area networking through computer-aided design to desktop publishing. What's more, at just £3,999 + VAT, it can show most of its rivals a clean pair of heels on price as well as performance.



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A FIST full of micros

Fantasy Interactive Scenarios by Telephone employ an unusual mix of computer technology to provide hours of entertainment and adventure via a telephone handset. Tony Dennis dials in to describe the development of the services provided by those 0898 numbers.

A new way of playing dungeons and dragons launched earlier this year onto the unsuspecting world may have escaped the attention of all but avid games freaks. Called FIST, the game is accessible over normal telephone lines. Nothing unusual about that, perhaps. After all, hackers were using their modems to play MUDD (Multi-User Dungeons & Dragons) on the computer at the University of Essex many moons ago. The novelty with FIST is that players don't have to possess a micro or terminal of any description.

Dialling into FIST, players can hear realistic sound effects of such fantasy characters as Vampira and the Demon Prince Kaddis-Ra. And then kill them. In order to make such a move, however, all the player has to do is use the telephone handset to dial a number. As an incentive, of course, those who become proficient at killing their opponents then have the chance to win real gold pieces.

FIST, and its recently launched rival, Dial Dr Dark, are especially intriguing since they employ a mixture of computer technology in rather offbeat ways. For example, FIST employs some six hours of digitised voices and sound effects which are stored on hard disk. Microprocessors are also used for recognising the commands given by the player over the phone as well as for dealing with the incoming telephone calls in the first instance. One company, TIC, even has a network of micros to handle its range of services.

The word FIST stands for Fantasy Interactive Scenarios by Telephone and it was specially created for its operator, Computerdial, by Steve Jackson — a leading light in fantasy gaming in the UK. He is best known for his *Fighting Fantasy* books. FIST took to the lines in March 1988 and was effectively the first game of its kind in the UK. Its success has led to FIST II being launched, which is a separate game called The Rings of Allion. FIST and Rings are rather unusual in that both games can recognise responses made by the caller from rotary dial telephones as well as tone dialling ones.

Technology

A brief sortie into telephone technology would seem appropriate at this point. Currently in the UK the majority of telephone subscribers (approximately 80 per cent) are still using handsets which use the old 'pulse' method of signalling a number to the exchange. As this method originated from phones where it was a matter of sticking a finger into a rotating dial and then turning it, the method has also come to be termed 'rotary dialling' even though the actual moving dial has disappeared from most handsets. The alternative technology is to generate a specific audio tone for each number which the exchange can then recognise.

Most readers will be familiar with tone dialling since it is used extensively by switchboard extension phones. In North America where tone phones are widespread, it was only a short step to utilising audio tones to instruct not just telephone exchanges but a whole range of other telecomms equipment, such as answering machines. Hearing a recorded message saying something like 'Key 1 to leave a message' or 'Key 2 for more information' is now becoming an everyday occurrence for most Americans.

FIST and Dial Dr Dark come under what British Telecom describes as CallStream services for which callers are charged at BT's highest M rate (or what used to be called the Irish Republic rate). This translates to a hefty 38 pence per minute at the standard rate and 25 pence at offpeak times. CallStream services begin with the numerals 0898 and share this price privilege with cellular radio services like Cellnet and Vodafone. Companies operating CallStream services, however, have to split the profit with BT so they have no real say over charges. The effect is, therefore, to encourage the suppliers to make games like FIST as realistic and spellbinding as possible.

From 12 January FIST won't be alone. Telephone Information & Communication (which is itself part of ICD) is competing directly against FIST with a new service called Dial Dr Dark. This is another fantasy game which has been developed for the company by the rather appropriately named Nightmares for Real. Dr Dark is itself based on the Robert





Englund film *976 Evil*, so those who have seen the film/video will be at an obvious advantage when playing the telephone game. Unlike FIST, Dr Dark will only respond to tone-generated commands.

Jennie Wilson, systems development manager at TIC, admits that her company drifted into the games field rather than setting up specifically for the leisure market like Computerdial. TIC had originally been formed to supply financial information to the general public but was left rather high and dry after the share price collapse in October 1987. Jennie Wilson explained: 'Basically, because people lost interest in the market, they stopped trading (shares). And once they stopped trading, they stopped needing access to financial information. We therefore started looking around at other areas, and sport, leisure and pop were the routes we picked.'

Thus, apart from continuing to operate Sharecall (information on share prices), TIC is starting up a number of pop services so people can dial in and listen to their current favourite single. Another good example of TIC's offerings is the Genius game which is effectively a quiz based around questions from the *Guiness Book of Records*. TIC therefore has a whole batch of services, most of which have numbers in the form of 0898 345XXX. In fact, the company is actually responsible for dealing with these last three digits so it needs line-switching equipment.

Hardware & software

It's at this point that matters become rather complicated. British Telecom supplies the incoming lines as far as physical devices known as P-muxes (Primary multiplexers) which are effectively multiplexing (splitting up) the calls from a single 2Mbit/sec feed. The P-mux then passes the incoming calls to DDI (Direct Dialling In) equipment owned by TIC. The function of the DDI unit is to look at

the last three digits dialled by the caller and attempt to link him/her to the service required. Ribbon cables connect the DDIs to several types of 'intelligent boxes' installed by TIC.

TIC has bought a number of different systems from Marconi Speech & Information Systems which go by the names of Keycall, Marcall and Incall. The last two are the easiest to describe since they are 'passive' systems that can best be thought of as giant telephone answering machines. An Incall holds 96 minutes' worth of speech in RAM and can cope with 60 lines. On the other hand, the Marcall holds three to seven hours' worth of speech on hard disk but can cater for only 30 lines. Both machines will support 100 different services from their speech banks.

The most interesting device is the Keycall, the unit that has the job of responding to callers' input (that is, audio tones). It is normally referred to as an Interactive Voice Response Unit, or IVRU for short. Currently these machines are equipped with 380Mbyte Winchester disks capable of storing up to 26 hours' worth of speech/sound effects. The intention is to upgrade to twice the storage capacity with 760Mbyte drives.

These are basically 80286-based machines which were originally designed by a gentleman in the States called Brite, under the auspices of Voice Systems Inc. They are now being marketed in the United Kingdom by Marconi.

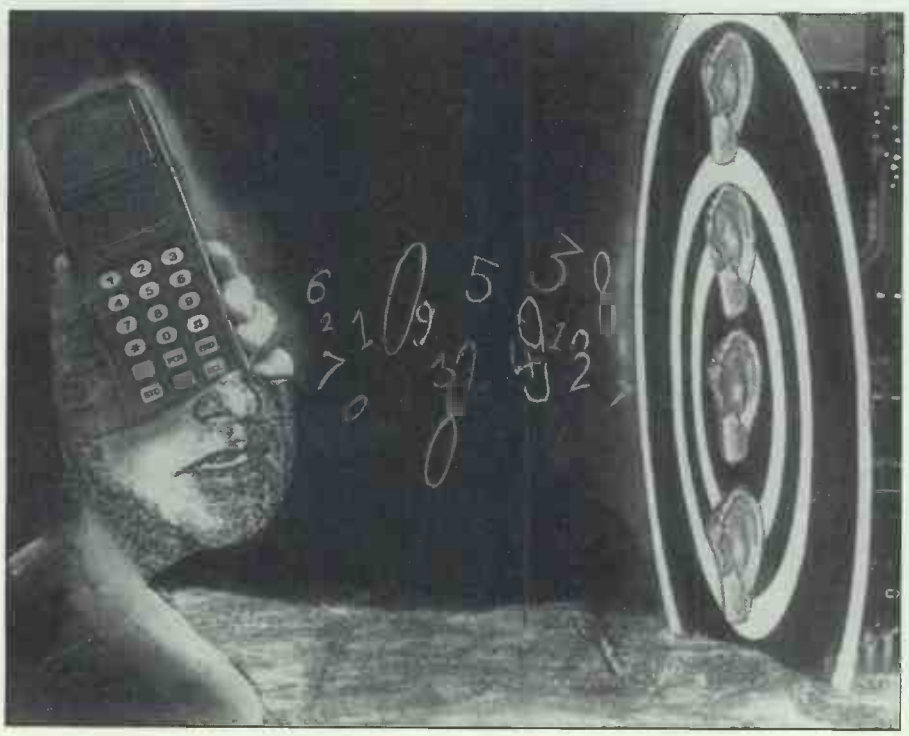
The system was originally intended as an advertising vehicle whereby callers could dial in and hear what was playing at the local cinema or what was on special offer at the local supermarket, for example.

To further confuse the casual observer the guts of these machines have been installed in a box that carries the Sperry name! They have standard 5¼in floppy disk drives as well as internal hard disk drives (in most cases). Interestingly, these micros are all networked together over a proprietary form of Arcnet and, as such, go into an Arcnet hub from Standard Micro Systems.

In their favour the 80286s are not running anything as mundane as MS-DOS. Oh, no! They are running a version of Unix known as QNX which was written by Quantum Software Systems of Ontario. In order to control the Marconi/Brites, Jennie Wilson and colleague Peter Haddow have written what they refer to as IAS (Interactive Audio Systems) code in C, using QNX C from Quantum.

The system also calls for a great deal of information to be held in the form of a database. In the end Wilson ended up using a database package called ZIM from Zante Information of Ontario which is compatible with QNX. Luckily Jennie Wilson has found a UK importer for QNX and ZIM, Genus Systems of Edinburgh, from which she was able to obtain all the necessary user manuals and support.

Despite the hardware complexity, writing the code is relatively straightforward: it is just a matter of telling the system where to look for the right pre-recorded response. The latter may just be a 'passive' announcement or the set response generated by the Keycall recognising a specific choice indicated by the caller sending a particular tone.



Basically TIC has nine of the Marconi units, all networked together. Three are used for development purposes, two hold the administrative databases and the other four are acting as IVRUs.

Jennie Wilson explained that TIC originally opted for Keycall because it was a purpose-built system with the tone recognition abilities already built in. Although it wasn't particularly applicable for the UK market, at least the Brite system had software designed for the US financial market, called Dowphone. This could be used as the model for TIC's own Sharecall service, working with information supplied by the Stock Exchange rather than Dow Jones.

At the time of writing, few details about Dial Dr Dark were available but the company would say that the sound effects were created with professional actors in a sound studio and recorded on reel-to-reel tape machines. The results were then fed into the Marconi systems via their internal digital-to-audio processors. Each sound segment is referenced to a database stored on a separate machine. TIC then writes the IAS code which accesses the database, thus instructing the system which sound effects to play according to the response the caller has selected, and thereby creating the game.

Computerdial

Unlike TIC, Computerdial is using a more homegrown mixture of technology. Each of its systems has 32 individual cards which handle 32 incoming lines, and according to managing director Bret Pirquet, there are at least four of these systems. The line cards are in turn governed by a Eurolog line controller which receives its instructions serially from an IBM PC.

Depending on these instructions, the caller will hear a particular prerecorded message conveyed by a BTK 30 digital-to-audio processor supplied by Voicetek. The actual messages have been stored digitally on a 150Mbyte Priam hard disk drive. A simple audio jack is all that is needed to load the disk from the BTK processor. Interestingly enough the process is reversible, allowing the caller's speech to be recorded onto disk if so desired.

To record FIST took the equivalent of seven days of studio time. This resulted in some ten and a half hours of tape which was eventually edited down to six hours. The final product was then transferred to hard disk. The result is that it is possible to roam around FIST's Castle Mammon, entering many new locations, and never hear the same message twice.

Some of what the caller hears are

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stock sound effects, most of which were manipulated using a Yamaha SPX 90 digital effects processor. In order to provide an echo-prone environment another processor, this time an AMS RMX 16, was brought to bear. Finally, voices were mixed over the top. What a shame that the end result is sent down a telephone line!

The clever stuff comes from the line cards which originate from a French company called Ferma and go by the name of Divaphone 1. Responding to audio tones is relatively easy technically speaking, but these cards have also been trained to handle rotary-dialled numbers through an adaption of voice recognition technology. Basically, the cards are trained to count the number of clicks and calculate the caller's response from that information. A Divaphone card is quite capable of accepting voice-given commands as well (that is, words such as Yes or No). However, Pirquet maintains that regional variations in British accents make implementing such technology more trouble than it is generally worth. Life is much simpler for all concerned if the system sticks with numerals.

Surprisingly, feeding instructions to the line controllers isn't a complicated task. Computerdial currently has a number of IBM PC/ATs and compatibles like Compaqs which are fitted with AST Fourports. The latter provide the PCs with four serial ports and mean that one PC can control up to 126 lines (four systems). The control program has been written in Microsoft Basic, chosen because of its good string handling abilities. There's no need for any complicated multi-user operating system either. Pirquet admitted, however, that the plan is to eventually migrate to Unix on a VAX with the software being written in C. (Incidentally, Computerdial's Basic code was written by its own in-house programming team.)

Why did Computerdial go to all the trouble of assembling its own system when speech recognition cards like the Votan for IBM PCs are available from companies such as VSI of Cambridge? As Bret Pirquet explained: 'We looked at other speech-activated interactive systems and found them to be cumbersome and subject to the accent of the caller. We have yet to find an (existing) system which works to our satisfaction.'

In addition, Computerdial needed a system which could cope with large numbers of simultaneous calls. The advantage of its current setup is that all the cards are rack-mounted rather than sitting inside individual PCs. With Computerdial's existing system it is possible to update all 32 cards simultaneously with a new message. There's no need to insert floppy disks into a multitude of individual PCs each time a change has to be made.

In order to operate the service, Computerdial was originally able to obtain site-specific authorisation from BT. However, the company has been developing a more compact version of its system which received the appropriate BABT approval last summer. The deliverable product has yet to be finalised but it will probably have eight line cards inside a typical PC casing. The system will naturally be running a version of Computerdial's own program.

One potential application is sales order processing where the system recognises a credit card number dialled by the caller, checks the credit rating via a separate modem link, then records the caller's spoken address so that the product can be sent out.

Over and out

With Computerdial soon to market a BABT approved system, a great many similar services should soon start to spring up in the UK. The ability to accept rotary-dialled responses effectively provides the mass market required. Add to this the potential to respond to voice commands as well as recording speech back to disk, along with the facility to link up with other external services (the Stock Exchange, credit card companies, and so on) and the scope for innovative new applications is enormous.

FIST and The Rings of Allion are available on (0898) 800876. More details from **Computerdial**, 7 Leapale Road, Guildford, Surrey GU1 4JU.
A demo of Dial Dr Dark is available on (0898) 345976. More details from **TIC**, 16 Hatton Garden, London EC1N 8AT, tel: (01) 242 1002.
Marconi Speech & Information Systems is on (0705) 664966.
Genus Systems is on (031) 225 6924.
VSI (Votan cards) is on (0223) 862327. END

How to access telephone fantasy scenarios

What is the best way to access such services? The straightforward approach would be to swap your existing telephone handset with one which is switchable between pulse and tone dialling. With such a phone it is possible to call up one of these services using standard/pulse dialling, then flick the switch to tone and start issuing commands.

Some readers might even be in for a pleasant surprise. British Telecom doesn't often publicise the fact, but many subscribers are already on System X style exchanges which handle both tone and pulse dialling. If this is the case, those subscribers will find that tone dialling works anyway. And it's worth changing over since calls connect much faster using tone dialling.

A recent trip to London's Tottenham Court Road revealed that it is quite possible to purchase a switchable phone for under £30 (including VAT). For those who are interested, one such device is an Answercall Trojan 3000 which costs £29. It isn't too difficult to spot other switchable phones going at lower prices (around £19) but closer examination will reveal that such equipment is missing the Green Circle sticker (indicating BABT approval). To our knowledge no one has actually been prosecuted for using unapproved telephones, but is it worth taking the risk?

An alternative route is to buy a tone generator from one of the CallStream suppliers. Both Computerdial and ICD can supply such devices for around the £10 mark (and they have BABT approval too). All the user has to do is hold the device close to the telephone mouthpiece and key the appropriate numeral. The generator then emits a tone which should happily travel down the phone line.

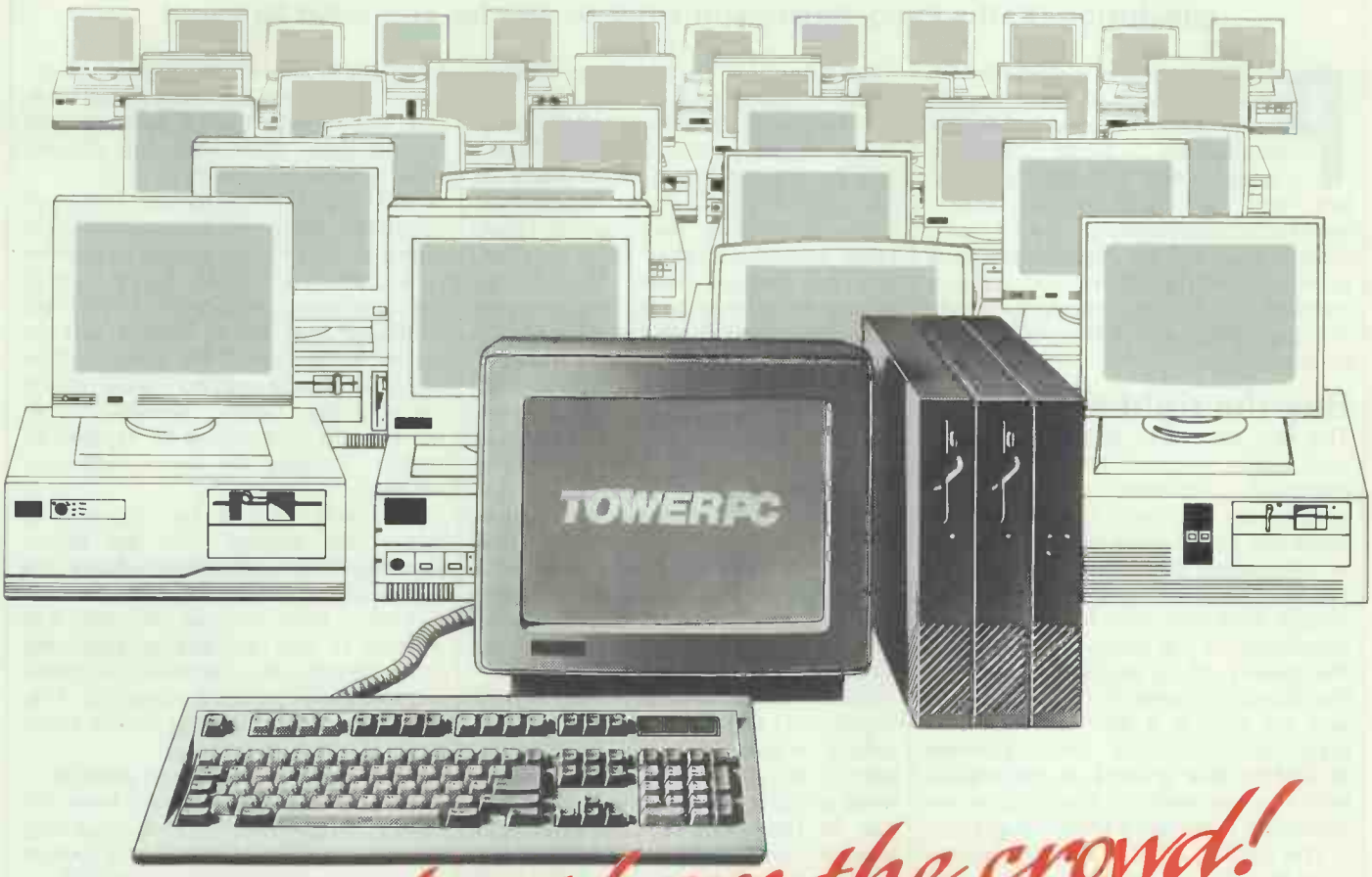
The best deal seems to be offered by Computerdial which supplies a tone generator with its £10 Adventurer's Pack along with details on how to play the game. According to Computerdial's Bret Pirquet, the company is supplying them almost below cost in order to promote the game.

Before rushing out to buy a generator, it might be worth joining one of the trendier building societies first. These companies have been supplying their members with tone generators so that they can call up a similar system to check their current balance, pay a particular bill, and so on. Members are asked to supply a £10 cheque which will only be cashed if the generator isn't returned. A building society beeper will work just as well on FIST as it will with the Nationwide/Anglia!

There are even ways of persuading a typical autodialling modem to generate the right tones since the majority of modems support tone dialling anyway. Cobbling together a routine which generates Hayes commands is one possible way to make it work. It's really a question of plugging the handset and the modem into the same BT socket using a two-jack adaptor. Dialling with the handset will then prevent the modem from dropping the line. Determined readers will probably be able to come up with their own more elegant ways of doing this.

Obtaining a tone generator or tone phone will be a major boon with FIST since it will allow a player to take advantage of the special 'limbo' feature which cannot be activated by rotary dialling. This facility allows a caller to store his/her character against a PIN number which remains active for 30 days. It therefore provides a means of rejoining the game at a specific point without the need to start over again. (Incidentally, those on System X exchanges will be doubly lucky in not only being able to use tone phones but being able to hear the games better through superior line quality!)

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Laser lines

Trying to produce good-quality laser printer output without paying attention to some important little details can lead to a disastrous conclusion. Kathy Lang shows you what to aim for and what to avoid.

Properly handled, output from a laser printer can look significantly better than even the best daisywheel, while printing many things a daisywheel cannot, and can come close to low-resolution typesetting. Badly produced laser printer output can look pretty appalling. There are quite a number of things you can do to make sure you come out on the side of the angels.

Buy the right system

The first step is to acquire, not only the right printer, but also well-matched software and other peripherals such as a scanner. If you have not yet bought a system, proper integration should be high on your list of criteria. For example, whatever others may tell you, the amount of resolution in the scanner does affect the quality of its output, as well as the levels of grey it can handle. If you are buying a 300 dots per inch laser printer, then your scanner should be able to work at that resolution too, as well as handling a respectable number of levels of grey.

The basic quality of the printed results should also, of course, be a significant criterion. It is a good plan to organise a simple set of test files which can be output on each printer you are considering. If you haven't yet bought the desktop publishing software, go for test files which are widely available, such as the Ventura Capability Page on IBM PC systems. And it pays to evaluate these in relation to your own applications.

For instance, if you don't print many illustrations, it makes sense to go for a printer which produces good characters even if its graphics are not so hot. This is often a basic choice, since most 'write white' engines give excellent solid blacks, but tend to be slightly fuzzy around the edges of characters at small point sizes; whereas 'write black' engines tend to show the reverse characteristics.

Using good consumables

Just as it pays to buy good-quality floppy disks, it also pays not to skimp on printer consumables if you want good results.

The element requiring renewal most often will be the toner. Buying decent quality not only helps get good printing, it also, perhaps even more important, helps to avoid damage to the more expensive parts of the printer itself. Toner which has larger-than-usual particles, or contains spurious matter such as dust, can do serious harm. The printer manufacturer will be able to suggest authorised suppliers of toner cartridges; these now include most of the big mail-order companies, who carry a much wider range than they did even a year ago. Their stock also turns over faster, so you should not be sold toner which is past its 'use by' date. (That happened to me once. I was reassured by the supplier that it did not matter, and since I was desperate for the stuff and it was the day before Christmas Eve, I had to reluctantly believe him. But the results proved him right.)

Some toner cartridges are made expensive by their sealed design (which makes them easier to transport). It may seem that all you really need to do is replace the toner powder in the existing cartridge, and several firms provide a service for refilling the most popular of this type of cartridge. I have not tried this route myself, and am rather wary of it, since it is impossible to check the quality of the toner supplied for impurity or coarse particles.

The increasing availability of the most popular brands makes it worth shopping around, and if you have the space and don't mind losing (or paying) interest, it may be substantially cheaper to buy in bulk.

Probably the most important thing is to establish a regular source of supply, and to check this out before buying the printer. Some less common brands may be hard to find, at least in small units (perhaps two cartridges at a time rather than six). And the longer you store your toner, the more important it is to make very sure that it is in a completely dry place, since damp toner tends to stick everywhere it shouldn't.

Keep it clean

Any equipment which works by charging and discharging surfaces will attract and generate a lot of dust. And particles of toner will sometimes build up at vulnerable places inside, causing streaks on the printed output. The outside can be cleaned with an ordinary cloth, but the insides need special treatment.

Most suppliers of consumables sell complete cleaning kits, which provide part of what you need at exorbitant cost. It is usually better to buy the elements separately; that will probably cost more initially but be much better value for money. The platen and other rollers inside, which occasionally need cleaning, can usually be cleaned with typewriter platen cleaner or with isopropyl alcohol.

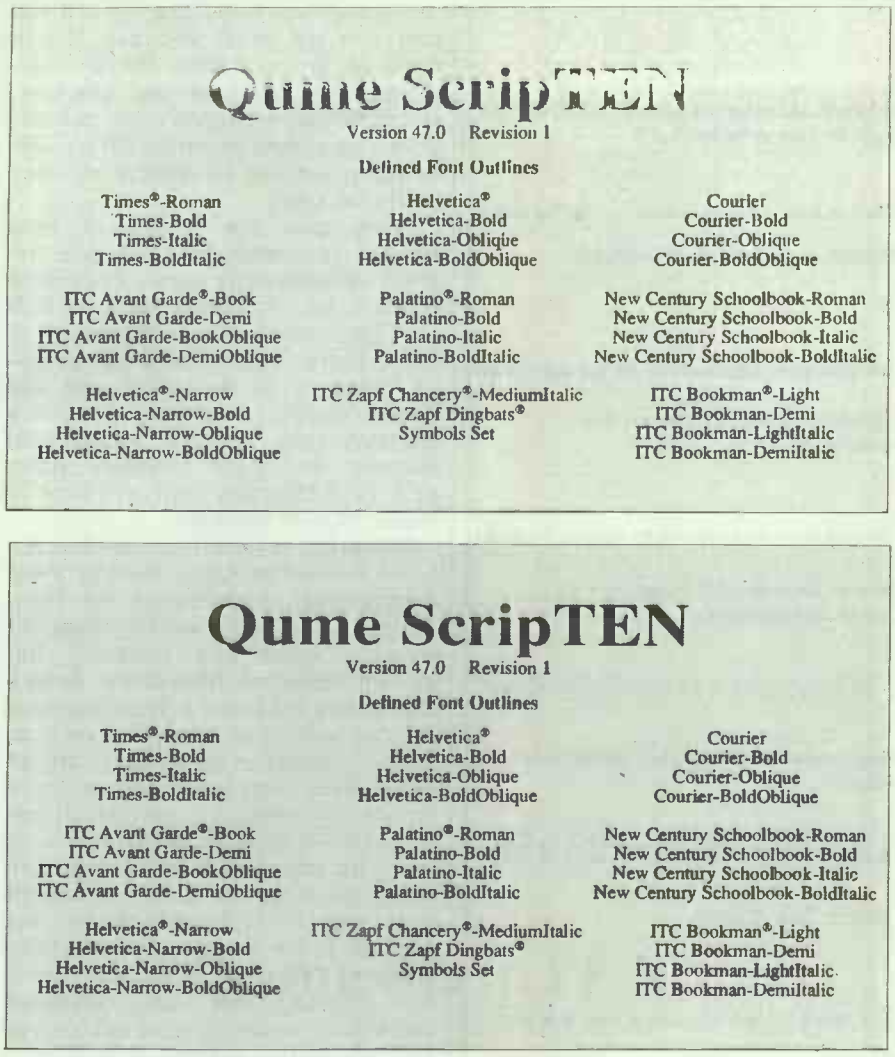
No fluid should be allowed to come into contact with the drum. Lint-free (that's *vital*) cotton buds and thin wipes are very useful for removing toner from internal crevices. It is unwise to use for this purpose the compressed air aerosols supplied with general-purpose cleaning kits, since you risk blowing loose toner around inside the printer.

All this advice applies in general — your printer manual should have detailed instructions about cleaning, and it pays to check it out before buying or using cleaning materials.

Paper for conventional printing

Laser printers work by depositing particles of toner, through an electrical process, onto areas of paper. For this to work well, you also need good and appropriate quality paper. Printers vary quite widely in the maximum thickness of paper they can handle, but most can tolerate at least 100gsm, which I have found to be the best for routine office printing of final copies. (It is more expensive than lighter-weight paper, so I generally also keep some 80gsm for draft work.) The paper should be uncoated, like ordinary office copier paper, so as to absorb the toner. I use Conqueror High White Wove and get quite good results.

It is wise to avoid the laid papers often used for letter-head stationery (you can tell them by the crinkly surface) because the electrical process deposits ink unevenly on this surface, unlike the impact process used by daisywheel printers. (This can oblige you to hunt around to find



Different brands of copier paper produce widely varying standards of output

coloured paper, since few suppliers stock coloured paper in a wove finish, especially in heavier weights.) It is as well to be sure that the toner is quite dry on the paper before you make large piles of printed sheets, especially if you have to fold them for insertion in an envelope.

In the US, there is an increasing trend towards paper sold specially for laser printing. It is, of course, more expensive, but some reports suggest that it is worth it for high-quality work. Certainly not all copier paper is suitable — the samples above were printed by the same printer on the same day, using two different brands of paper from the same manufacturer. As usual, it is worth experimenting before you stock up with reams of the wrong stuff.

Every computer user knows that, far from bringing about the paperless office, the computer is the worst enemy trees have. Desktop publishing, which encourages you to tweak your output many times to get it just right, has just exacerbated the situation. You may be tempted to recycle the wasted paper, or you may want to print on both sides anyway, but this is very unwise if your printer is not explicitly recommended for this mode of use.

Some printers leave a lot of static on the paper, causing paper jams. Others curl the edges of the paper in passing it between the rollers, and again tend to jam when the paper goes through the second time. Worst of all, once-printed paper may scatter odd bits of toner through the machine as it goes through the second time, doing your machine no good and affecting the quality of printing adversely.

These problems may be felt most keenly when printing addresses. Envelopes have to be hand fed on most laser printers, so that's definitely out. The obvious alternative is labels. But the number of addresses you need to print rarely coincides with the number of labels on a sheet, so you may be tempted to pass a sheet through again to avoid waste. But the dangers of passing a sheet of labels through more than once are significantly greater than for ordinary paper, and I don't think the game's worth the candle. (I once got a label stuck in a matrix printer. Ninety minutes later, as I withdrew the last tiny piece, I swore never to risk that again — and it would be much worse on a sensitive instrument like a laser printer drum!) I've gone over to window envelopes for everything — they don't look at all bad if they match your stationery properly.

Paper for camera-ready copy masters

When preparing camera-ready copy on paper, which will be used by a (human) printer as masters in the duplicating process, different considerations apply. To give the clearest possible image, the general consensus seems to be that, rather than use an uncoated paper into which the toner can be absorbed, a coated paper is best. This produces a sheet in which the image is slightly raised from the surface, and there will be no blurring of character edges caused by absorption of toner into the paper surface.

Such pages need careful handling, however, since the same characteristic makes them likely to smudge, or even to lose part of the image by sliding off the page. Heavier paper gives better results, too. Putting those two constraints together, 120gsm blade-coated paper has been recommended to me by several people who ought to know.

Fonts

Another major aspect of quality is the availability of the right fonts. All laser printers come with a basic set of fonts: on PostScript printers these are usually Helvetica, Times Roman, Courier and Symbol, while on printers which use bit-mapped fonts (such as the Hewlett-Packard LaserJet and its emulators) there is no such unanimity. Your ability to use extra fonts depends on three things: the market view taken by font suppliers, the depth of your pocket, and the amount of memory on your printer. All typefaces (the styles from which particular fonts are built) were designed by humans who, either themselves or through typesetter manufacturers or type suppliers, own the copyright.

Manufacturers supplying cheap printers to the mass market try to keep the cost down by implementing their own typefaces, usually in imitation of the standard designs; this is one reason why the same text may take up different amounts of space in two fonts with almost identical names. (This need be no handicap unless you plan to use your printer to proof material which is later to be typeset, of which more later.)

A more serious problem may be the aesthetic quality of the typeface;

Choosing your typefaces

When deciding on the ideal typeface for your work, you should bear in mind that at different sizes, different typefaces may be more or less suitable.

TThe quick brown fox jumps over the lazy dog. The quic

Palatino 6 point: serif face, not readable

The quick brown fox jumps over the lazy dog. The quick b

Helvetica 6 point: just readable

The quick brown fox jumps over the lazy dog. The quick brow.

Galliard 6 point italic: fussy and serif, worse than Palatino

The quick brown fox jumps over the lazy dog. The qui

Helvetica 6 point bold: on the borderline

The quick brown fox jumps over the lazy d

Helvetica 8 point: getting clearer

The quick brown fox jumps over the lazy dog. The quick b

Stone Sans Serif 6 point: not as good as Helvetica

The quick brown fox jumps over the lazy

Helvetica 8 point bold: just readable

1234567890 1234567890 1234

Garamond 12 point: thin uprights for digits

The quick brown fox jumps over the lazy d

Garamond 18 point: even at this size, uprights still small

1234567890 123456

Stone Sans 8 point

The quick brown fox jumps over the lazy

Stone Sans 8 point bold

The quick brown fox jumps over the lazy d

Stone 8 point as printed

The quick brown fox jumps over the lazy d

Palatino 8 point

The quick brown fox jumps

Stone 12 point

The quick brown fox jumps over the lazy dog.

Palatino italic 8 point: fussy serif just readable

The quick brown fox jumps over the l

Galliard 10 point italic: now readable

The quick brown fox jumps over the lazy do

Galliard 8 point

The quick brown fo

Helvetica 18 point: OK for headlines, but how boring otherwise!

The quick brown fox jumps over th

Galliard 18 point: readable and interesting

The quick brown fo

Helvetica 10 point

The quick brown fox jumps over

Palatino 10 point

The quick brown fox ju

Zapf Chancery 18 point: italic only. Note how the narrow characters and large x-height make it look cramped

many typeface designers will tell you that you get what you pay for, in fonts as in most other things. Supplementary fonts are not, however, cheap to buy whatever your printer; prices vary from around £100 to £250 or so, depending on what is included in the package.

Price, plus the length of time needed to download fonts, are the main reasons why some PostScript printers, usually named with the suffix Plus, come with a larger set of basic fonts. This usually comprises (in addition to Helvetica and co) Avant Garde, Bookman, Helvetica Narrow, New Century Schoolbook, Palatino and Zapf Chancery Italic, plus Zapf Dingbats with its range of more unusual symbols.

There are several sources of supply of PostScript fonts, among them Adobe (the originator of the PostScript language, which supplies through Aptec and Letraset), Bitstream Fontware (distributor Aptec), Qume and Publisher's Type Foundry. Adobe, and other suppliers such as Qume, simply supply packages of disks, each containing one or more typeface in several styles, which can be installed directly. Bitstream fonts must be installed first, using an installation program which is bought separately (though included in that package is the medium weight of Bitstream's specially designed laser font, Charter). This makes Bitstream fonts more expensive per set, unless you plan to buy several.

Bitstream fonts can also be used with Hewlett-Packard LaserJet printers, and others which emulate them and permit downloading; an additional benefit is that you can create fonts larger than those available on the basic printers of this type. For cartridge-based printers, Fontware supplies a range of font cartridges called DoubleTops in which the grouping of fonts is such that a wider variety of styles and sizes is available on each cartridge, thus reducing the need to change cartridges. Fontware also provides a service for creating customised fonts and logos, in both cartridge and outline form.

The typefaces available vary among the suppliers, and include both conventional fonts and those designed explicitly for laser printers.

By and large, the more curvy and 'fussy' a font is, the more trouble you will have in getting good, precise results from your laser printer, especially in smaller point sizes, because of the limitations of 300 dots per inch. Other features to avoid include heavily contrasting stroke thicknesses — in particular, the very thin strokes found in, for example, the digits in Garamond often do not

print well, and relatively closed hollow letters sush as O and P.

Some fonts designed for laser printers are, by contrast, rather dull for my tastes. My personal favourite among them is the Stone range from Adobe, which very usefully includes semi-bold varieties as well as bold, giving you three levels of emphasis in a single typeface, and three styles: Serif, San Serif, and Informal (similar to Souvenir). This combination makes it easy to get a good variety of styles and weights, yet you can be sure, even if you are not an expert on typography, that all the variations will harmonise well.

On laser printers with a resolution as low as 300 dots per inch, readability at small typesizes is often a problem. In general, San Serif faces will be easier to read; Helvetica's reliability in this area is one reason for its tremendous popularity. Fortunately for the reader, such material is not usually meant to be read at length — it is usually parts lists, catalogues and the like, where data compression is vital — otherwise readers would see dots before their eyes in no time.

The availability of a wide range of fonts has great attractions, but it can also go to your head and give your readers eyestrain. Some fonts are more suitable for particular applications than others — for more details see my article 'If the face fits, print it' in *PCW*'s *Desktop Publishing* supplement, June 1988.

Briefly, it is better to keep to two fonts for a single document, and to at most four variations of size, weight and style on one page. Every change of font, size, style and weight should have a reason — don't just alter them arbitrarily, but try to 'style-code' text just as you might colour-code your keys or your Filofax pages. And the universal conclusion of the vast amount of research on reading suggests that capital letters are harder to read than lower case, and that underlining distracts the eye from the text it is supposed to emphasise.

Graphics

Very few page make-up systems have adequate facilities for creating graphics, so you must import them from other packages or from scanners. This immediately raises questions of scaling and orientation. It is important to match the scaling applied to a graphic to its original scale. For example, if you create a graphic file in Encapsulated PostScript format, you, or the program which writes the EPS file, must include at the start of the PostScript code a bounding box. This defines the extremities of the graphic, usually in points. If you then import this graphic into Ventura, and if you make the size of the frame identical to the dimensions of the bounding box in the EPS file, the graphic will appear at exactly the same size as the original. You can then scale it appropriately if you need to, ensuring that Ventura uses the Maintain Aspect Ratio option to keep the relationship between the dimensions in step.

Not all packages allow you such exact control over scaling, but at least, if you begin with having the imported graphic the same size as the bounding box, you will start with the correct relative dimensions.

Page & document design

This is not the right place, and I am not the right person, to give you an extended lesson on page design. But some brief general rules hold good for most types of publication: by and large, you need a good reason for breaking them, and this is most likely to happen when creating something to be really eye-catching.

Balance is probably the most important aspect of a well-designed page: for example, top and bottom margins should be about the same size, though sometimes the bottom needs to be slightly larger to avoid the text appearing to 'fall off the bottom' of the page. Left and right margins need not match each other, but should either be the same on every page or mirror each other on left and right pages.

Balance is important within the page, too: for example, if you have several figures all near the top of two facing pages, the pages tend to look top-heavy. Cueing — in headers and footers — also needs to balance, for example by putting the chapter or document title at the outside edge of each header. And readers tend to see the upper and outer quarter of right-hand pages most often when browsing, so this can be used to attract attention, for example, in a manual, by starting each major section on a new right-hand page.

I hope these comments are enough to start you thinking: for more on page design, try John Miles' book *Design for Desktop Publishing*, published by Gordon Fraser.

Gilding the lily: reduction

If you are producing master pages on your laser printer, which will subsequently be used for replication either by photocopying or by conventional printing, you may get better results if you produce the masters larger than the final desired page size, and reduce to final size when duplicating. It is important to remember that reduction affects the overall dimensions of all margins and of any columns, as well as the size of the characters and of line spacing, and allow for this in your page design.

If your material includes graphics, still greater care is needed. The best approach is to create some sample pages, including graphics as well as text, and get these reduced to the final size to see how they look, before you make any irrevocable decisions about layout.

Proofing

You may use your laser printer only or occasionally as a proofing device, to make sure copy is correct before it is typeset. At present, the only way to be sure of getting entirely compatible results from page make-up programs such as PageMaker and Ventura is to proof on a PostScript printer, send the output to a PostScript file, and have the copy run out on a typesetter with a PostScript RIP.

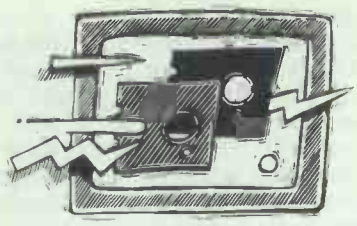
If you do not go for this combination there may be inconsistencies, such as different line endings or column or page breaks. There is also some suggestion that the width tables used by Bitstream fonts are not identical with those used by Adobe, and hence even if the typeface has exactly the same name on the Linotron, the results may not be identical.

This is just one aspect of a wider problem, the coincidence of fonts on your proofing printer and the typesetter — not every Linotron will have the complete range of available fonts since they are expensive to buy. And even where the fonts are the same, the character sets may have some minor variations. As with reduction, serious experimentation, including all the fonts and styles you plan to use, and a test file of all characters involved (such as that provided with Ventura) is an essential preliminary to serious work.

PostScript's virtual monopoly in this situation has strengthened considerably in the last six months, with all the major typesetter manufacturers falling into line, concluding agreements with Adobe to produce their own PostScript machines.

Putting it all together

The secret of success, overall, is to test every link in your chain before you put any weight on it. This applies to buying a system in the first place, but it is also relevant to producing good final results. For example, when generating masters for final printing, you should check the process through to duplicating one or two masters, to make sure the duplicated version is as readable as you expect it to be. END



Oracle Developer

What are the advantages — and disadvantages — of a powerful mainframe relational database implemented on a PC? Mike Liardet gets to grips with the complex and expensive Oracle Developer.

Relational databases are currently one of the great growth areas in mini and mainframe computing. A number of relational database management systems (RDBMS for short) are available on PCs, and traditional micro database companies such as Ashton-Tate are frantically (and ill-temperedly, according to many accounts) implementing their own versions as well.

In this article we are going to look at one particular PC version of one particular RDBMS, Oracle Developer, but before going any further we should pose the question of why the reader should be interested in any RDBMS on a PC. Why should he give up his elegant and simple PC database system for all the complexity (and expense) of an RDBMS?

There are two ways of analysing this RDBMS/PC marriage. Firstly, for a PC user, we should consider: what are the possible benefits of an RDBMS; and secondly, for an RDBMS user: what are the benefits of a PC?

For the established PC user, the main benefit of switching to an RDBMS, the one that finally might prise him away from his favourite PC database product, is that an RDBMS offers solid multi-user capability via networked PCs (and other hardware). All data can be shared, with all staff having instant access to the latest information in the organisation. This can even benefit traditionally off-line activities like spreadsheeting, by guaranteeing that the various budgets and financial models are based on the most recent figures and not on some floppy disk copied several weeks previously.

Another benefit to the PC user is greater expansion capability. If an application were ultimately to outgrow the PC, it could instantly be transferred lock, stock and barrel, programs and data, onto a larger machine, and without a major rewrite. Also, RDBMS are not based on *ad hoc* database techniques but all conform to well known standards (ANSI and IBM), and accordingly have a strong measure of compatibility with one another. Thus an organisation opting for a particular RDBMS on a PC is not really putting all its eggs in one basket, but has a number of future options to change either hardware or software relatively painlessly.

Looking at the marriage from the other viewpoint, PCs also have a role for established RDBMS users, arising from the PC's capability as an inexpensive calculating engine. An RDBMS can eat up mainframe power at an alarming rate, and some of its functionality (notably the 'forms' that handle user interaction) can readily be off-loaded onto PCs. And, of course, application development falls into this category too. If an application can run unchanged across all different types of hardware, then why tie up expensive mainframe resources during a project development? Instead, let the developers work on PCs, running their resource-hungry compilers and debuggers, and then only transfer the application to its ultimate destination towards the end of the project. And this is precisely where Oracle Developer comes in . . .

Getting started

Oracle appears highly intimidating on first inspection. Firstly there is the plethora of manuals, and then there is the fact that it comes on no fewer than 18 disks. It's a big system, with a lot in it!

Unfortunately, because of Oracle's size it will not run on an ordinary PC, but requires the power of an AT or compatible and at least 896k of extended memory in addition to the machine's 640k fitted as standard. Not surprisingly, with 18 disks of software a hard disk is mandatory, and Oracle will eat up 8Mbytes if all the facilities are installed — and that's before you start using it for any data.

Because it uses extended memory the 640k of ordinary non-extended memory is barely touched by Oracle, so any other applications on the PC should still be runnable as normal.

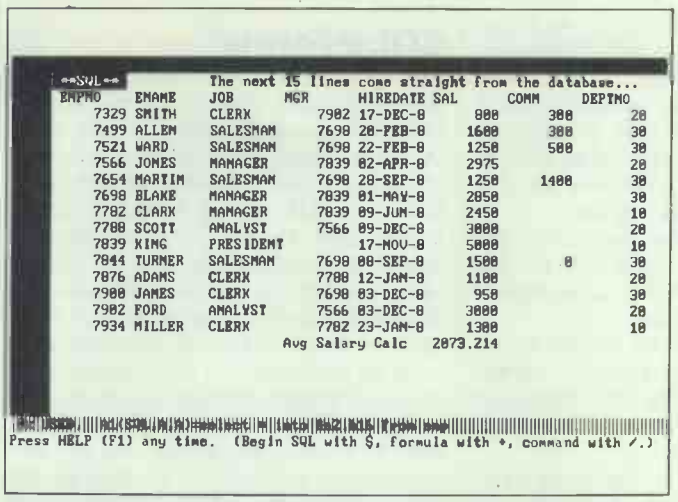
The machine used for this review was a Dell 286 with a 20Mbyte disk and 1Mbyte of extended memory. Oracle was installed by simply running the installation program contained on one of the supplied disks. This program directs the whole installation operation, with simple, clearly worded instructions and explanations. It can even automatically adjust your system's configuration files should they not be correctly set up for Oracle's requirements. The whole process took about 30 minutes of tedious swapping in and out of disks, and set up demonstration tables in the database, help files, and absolutely everything you subsequently need.

Before any Oracle work can proceed the kernel must first be loaded into extended memory. There is a special program to do this, which could easily be run from the Autoexec.Bat file when the system is first switched on. Thereafter, the Oracle facilities are run directly from DOS — there is no overall menu for the system.

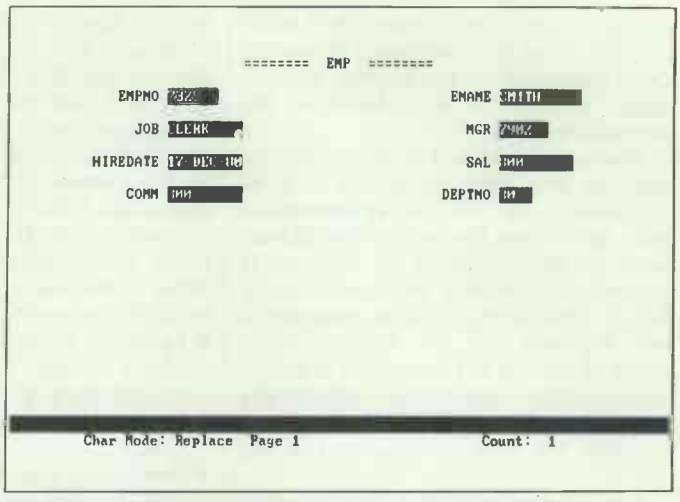
SQL*Plus

The SQL*Plus component of Oracle allows the user to query and change the database via a complex and powerful set of commands. As the name implies it is an implementation of SQL, but with additions to the ANSI standard, such as the ability to modify the structure of database tables after they have been created.

SQL stands for Structured Query Language, but do not be misled by



Oracle provides a spreadsheet-type facility for viewing tables of data



A simple screen-based form for entering or viewing information

this; it can handle more than just queries, and it is not really that highly-structured. It is at least a language — a command language in fact — and at the heart of nearly all RDBMSs. I cannot go into great detail about SQL here but I'll give the reader just a flavour, with some observations on Oracle's implementation of it.

The key concept behind relational databases and SQL, the usual language used to manipulate them, is that the data is organised in 'tables', where each row in the table represents a 'record' of some item, and each column represents a property or feature (a 'field') applying to all these records.

On page 180 there are three tables with which we shall be working throughout this article. They represent part of a personnel database. To read the EMP table observe that each row represents an employee, and the columns represent various employee attributes — for example, the JOB column of EMP specifies what jobs the employees do, and so on. Notice that the different tables cross-reference one another, with more information on a particular employee's department becoming available if his or her department number is looked up in the DEPT table. Similarly, an employee's grade can be ascertained by checking his salary against LOSALs and HISALs in SALGRADE.

SQL*Plus enables commands either to be typed in and executed directly from the keyboard or run non-interactively from batch files. The listing on page 182 is of a fairly typical (brief) interactive session with SQL*Plus. The session starts from DOS command level — as I have said, the Oracle system has no overall menu control. Notice that the user has to log in to the system first, with a password.

Oracle maintains tight security on all aspects of the database, and the security system can restrict individual users to access only certain tables, or even just parts of tables, or to be denied the option to make changes, and so on. Clearly, the security is essential in multi-user applications but of rather less importance for a single-user developer.

Following the log-in, the SQL> prompt is displayed to indicate that SQL*Plus is ready for user input. The commands typed alongside it were keyed in directly at the keyboard, and numbered within comments (/* Statement x */) so that they can be referred to here. The system's responses followed immediately after each command and generally disappeared off the top of the screen before I could read them — that is, until I discovered the SQL*Plus Set Pagesize and Set Pause commands.

Nine SQL commands were used, briefly summarised as follows:

1 Display the entire contents of the EMP table;
2 Display the entire contents of the SALGRADE table;
3 Display everything on employees earning between £800 and £1100;
4 Display the employee number and name, for grade three employees;
5 Change employee number 7329's department to 30;
6 Visual check that it really happened to precisely one employee.
7 & 8 For the whole organisation display the management structure under the heading HIERARCHY (in a 'sawtooth' format, so we can see that Jones, Blake and Clark report to King; Allen and Ward report to Blake, and so on along with each employee's level from the top of the organisation, his number, manager and department.
9 Finish and return to DOS.

This simple session only scratches the surface of SQL*Plus. There are a number of other basic SQL commands to create and delete tables, add or delete fields from tables, and insert and delete records. The Select command is even more powerful and flexible than we have shown here. And there are a number of more exotic SQL*Plus facilities, typically restricted to a skilled 'database administrator' — commands to improve database performance, assign new users and monitor existing users.

There is also a Help facility in SQL*Plus. Simply type 'help' followed by topic required, and you are treated to a screen version of a section from the *SQL*Plus Reference Guide*. As the *Reference Guide* is arranged alphabetically for ease of reference, and it has a bigger page size than the PC, it is simpler to just use it directly and ignore Help altogether.

To an experienced PC user, the lack of menus, windows and function key facilities in SQL*Plus may seem a little barbaric, but be reassured: this is only Oracle revealing its mainframe origins. To be fair we should say here that, in a number of areas, Oracle Corporation is now striving to attain the higher standards of user interaction pioneered by PC software. And one of its newer products, which may overcome some of these objections, is Easy*SQL. Easy*SQL is not included with the Developer, but will shortly be available as an option for the PC.

SQL*Calc

SQL*Calc is a fairly standard spreadsheet system, working much like, say, Lotus 1-2-3, but without the graphics, and without what Lotus refers to as 'database'. Of course there was no way Oracle Corporation would get involved with implementing this level of rather puny RAM-only 'database' facility!

As with all Oracle programs, SQL*Calc cannot be run without first logging into the database. This feels slightly odd in this case as it is quite feasible to use SQL*Calc as a stand-

alone spreadsheet system and without touching the database. However, once logged in all the normal spreadsheet interaction and facilities become available.

Formulas, text and numbers can be entered into cells on a 256 × 8192 worksheet. As with all spreadsheets you can't use the entire worksheet area on offer because PC memory is insufficient for this amount of data. Some interesting effects happen if you try and use the bottom right-hand corner of the area (cell IV8192): recalculation becomes alarmingly slow, even for trivial two or three-cell models. It's best to keep to the top left.

The interesting part of SQL*Calc is its interface to the Oracle database, which allows data in the database to be read into the spreadsheet and subsequently written back. This is achieved by entering SQL statements into the cells, distinguished by a leading '$'. To get data into the worksheet a Select statement would be used, for example:

```
$select * into &a2 from emp
```

This statement reads all the data in the 'emp' table into the worksheet starting at cell A2. The column headings are included, and the table is loaded into the worksheet in a fairly obvious fashion, each worksheet row corresponding to a row in the table. Once loaded, calculations can be performed with the data in the normal way.

The screendump on page 179 shows the 'emp' table loaded, and then the average of all the salaries calculated by:

```
+avg(f3.f16)
```

Of course, the Select statement can be used in all its full generality with search conditions, sorting and calculations, and so on. SQL*Calc also allows Update, Insert, Delete and Lock SQL commands to be placed in the spreadsheet. All SQL commands are distinguished from other entries by the preceding '$' and they are displayed as ****SQL****.

There is an 'Oracle' option on the main menu which contains all the other database-specific spreadsheet facilities. Its options are:

- **Table** — a facility to create or re-create tables. The column names for the table and the data itself can be read straight out of the worksheet;
- **Rollback/Commit** — standard database management facilities to undo (rollback) or finalise (commit) any changes to the database during the session, or rather since the last 'commit';
- **Logon** — it is possible to log in to the database as an alternative user, without quitting and restarting the spreadsheet session;
- **Options** — when a table is loaded (by a $select...) the system checks there is room for it in the area specified, and warns the user if there is not. The Options option enables this checking to be switched off, or for excess rows to be ignored;
- **Show-info** — lists the database tables available to the particular user currently logged into the database;
- **Execute** — The system does not redo any of the SQL statements when it does a spreadsheet recalculation, as this would not normally be required. Instead these statements must be re-executed under separate control, from the Oracle/Execute option. Since it is not normally required to execute the whole lot together, each different type of statement can be re-executed independently.

SQL*Forms

SQL*Forms is the Oracle facility for designing and then running screen layouts to interact with the end user. Without forms, data entry and modification to the database would have to be in SQL, using Select, Update, Insert, and so on. This would just about be acceptable for a skilled programmer, but quite worthless for the less expert users who will typically be running Oracle applications.

At its simplest it is quite feasible to set up a simple form in less than two minutes. Such a form might enable a user to view, add, delete and modify records in a single table, but would not involve any further complexities. The first form shown on page 179 was created in about this time, and allows the user to work with the EMP table below.

To create a form, the forms designer facility must first be used. When a form has been designed a 'generator' compiles the design into a state that can be used by the third program, the 'forms processor'.

The forms designer is menu-driven with a complex range of options, and its function keys take a little getting used to. This is mainly because the documentation describes a generalised version of the system, and it is necessary constantly to cross-reference a list of keyboard assignments which tell you that, for example, [Accept] in the documentation means function key F2 on the PC keyboard.

To set up a simple form is simply a matter of running the designer, specifying a name for a form and a name for the table it will access, and asking for the default setup. This automatically designs the second form shown on page 179. The prompts on the screen, and the areas where data will actually appear (the fields) are all put in place by the system making appropriate choices of defaults.

However, with the designer it is possible to be considerably more complicated than we have shown here:

- Validation can be specified for each field so that any data entered for a particular field can be checked for range, type, and so on;
- Forms can be spread across several pages if the quantity of information is too great to fit on a single screen;
- In multi-table applications forms can be split up into 'blocks', where each block handles a different table;
- 'Triggers' provide a powerful processing capability, where following an 'event' (usually a user data entry), arbitrary calculations and

EMP

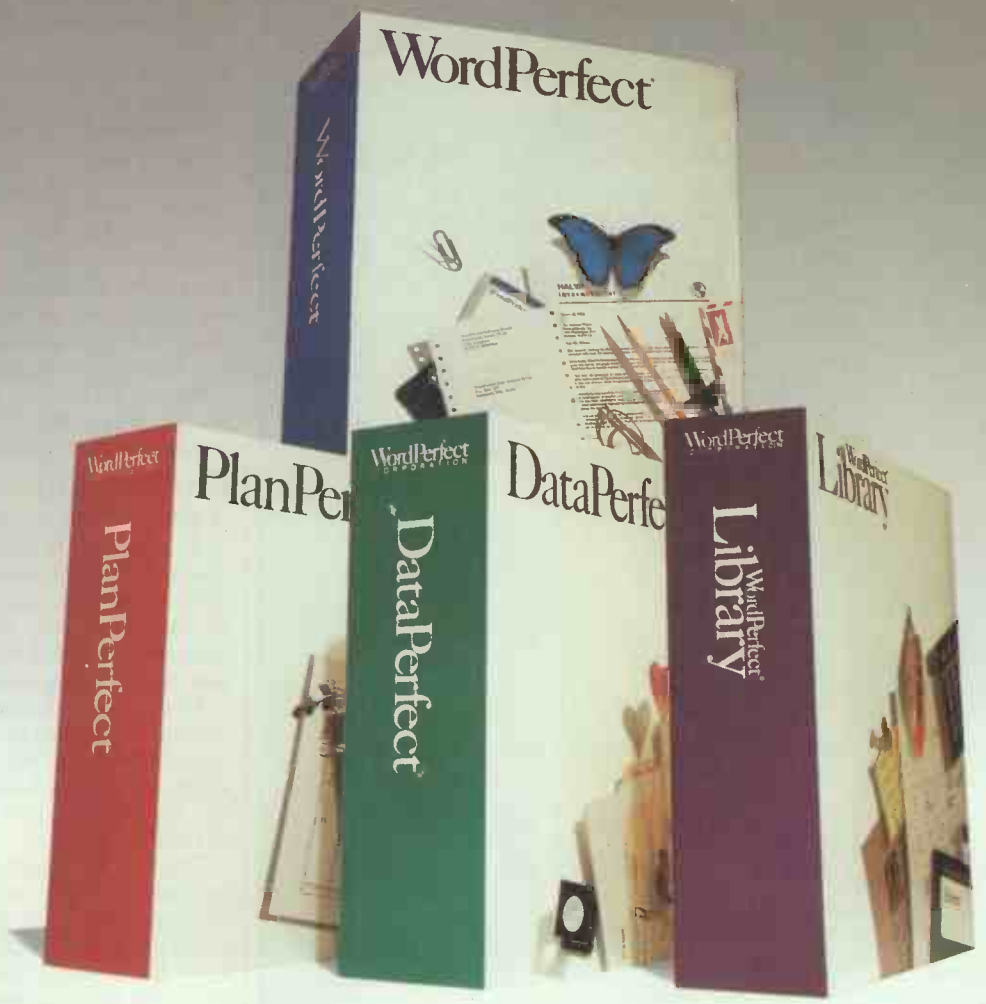
EMPNO	ENAME	JOB	MGR	HIREDATE	SALARY	COMM	DEPT NO
7329	SMITH	CLERK	7902	17-DEC-80	800.00	300.00	20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1,600.00	300.00	30
7521	WARD	SALESMAN	7698	22-FEB-81	1,250.00	500.00	30
7566	JONES	MANAGER	7839	02-APR-81	2,975.00		20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1,250.00	1,400.00	30
7698	BLAKE	MANAGER	7830	01-MAY-81	2,850.00		30
7782	CLARK	MANAGER	7839	09-JUN-81	2,450.00		10
7788	SCOTT	ANALYST	7566	09-DEC-82	3,000.00		20
7839	KING	PRESIDENT		17-NOV-81	5,000.00		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1,500.00	0.00	30
7876	ADAMS	CLERK	7788	12-JAN-83	1,100.00		20
7900	JAMES	CLERK	7698	03-DEC-81	950.00		30
7902	FORD	ANALYST	7566	03-DEC-81	3,000.00		20
7934	MILLER	CLERK	7782	23-JAN-82	1,300.00		10

DEPT

DEPT NO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

SALGRADE

GRADE	LOSAL	HISAL
1	700	1200
2	1201	1400
3	1401	2000
4	2001	3000
5	3001	9999



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A typical Oracle session

```
SQL> select * from emp;

  EMPNO ENAME      JOB              MGR HIREDATE       SAL      COMM    DEPTNO
------- ---------- --------- ------- --------- -------- -------- --------
   7329 SMITH      CLERK          7902 17-DEC-80      800      300        20
   7499 ALLEN      SALESMAN       7698 20-FEB-81     1600      300        30
   7521 WARD       SALESMAN       7698 22-FEB-81     1250      500        30
   7566 JONES      MANAGER        7839 02-APR-81     2975                 20
   7654 MARTIN     SALESMAN       7698 28-SEP-81     1250     1400        30
   7698 BLAKE      MANAGER        7839 01-MAY-81     2850                 30
   7782 CLARK      MANAGER        7839 09-JUN-81     2450                 10
   7788 SCOTT      ANALYST        7566 09-DEC-82     3000                 20
   7839 KING       PRESIDENT           17-NOV-81     5000                 10
   7844 TURNER     SALESMAN       7698 08-SEP-81     1500        0        30
   7876 ADAMS      CLERK          7788 12-JAN-83     1100                 20
   7900 JAMES      CLERK          7698 03-DEC-81      950                 30
   7902 FORD       ANALYST        7566 03-DEC-81     3000                 20
   7934 MILLER     CLERK          7782 23-JAN-82     1300                 10

14 records selected.

SQL> select * from salgrade;

  GRADE    LOSAL    HISAL
------- -------- --------
      1      700     1200
      2     1201     1400
      3     1401     2000
      4     2001     3000
      5     3001     9999

SQL> select * from emp where sal between 800 and 1100;

  EMPNO ENAME      JOB              MGR HIREDATE       SAL      COMM    DEPTNO
------- ---------- --------- ------- --------- -------- -------- --------
   7329 SMITH      CLERK          7902 17-DEC-80      800      300        20
   7876 ADAMS      CLERK          7788 12-JAN-83     1100                 20
   7900 JAMES      CLERK          7698 03-DEC-81      950                 30

SQL> select empno, ename from emp, salgrade
  2  where grade=3 and sal between losal and hisal;

  EMPNO ENAME
------- ----------
   7499 ALLEN
   7844 TURNER

SQL> update emp set deptno=30 where empno=7329;

1 record updated.

SQL> select * from emp where empno=7329;

  EMPNO ENAME      JOB              MGR HIREDATE       SAL      COMM    DEPTNO
------- ---------- --------- ------- --------- -------- -------- --------
   7329 SMITH      CLERK          7902 17-DEC-80      800      300        30

SQL> update emp set deptno=30 where empno=7329;

1 record updated.

SQL> column hierarchy format a21;

SQL> select lpad(' ',2*level) || ename hierarchy, level, empno, mgr, deptno
  2  from emp
  3  connect by prior empno = mgr
  4  start with ename = 'KING';

HIERARCHY               LEVEL   EMPNO     MGR  DEPTNO
--------------------- ------- ------- ------- -------
KING                        1    7839              10
  JONES                     2    7566    7839      20
    SCOTT                   3    7788    7566      20
      ADAMS                 4    7876    7788      20
    FORD                    3    7902    7566      20
      SMITH                 4    7329    7902      30
  BLAKE                     2    7698    7839      30
    ALLEN                   3    7499    7698      30
    WARD                    3    7521    7698      30
    MARTIN                  3    7654    7698      30
    TURNER                  3    7844    7698      30
    JAMES                   3    7900    7698      30
  CLARK                     2    7782    7839      10
    MILLER                  3    7934    7782      10

14 records selected.
```

other consequences can be invoked.

- Forms can also be multi-record, where a number of records can be tabulated beneath the column headings.

Normally the generator program can be invoked as an option within the designer program, but due to memory limitations this is not possible on the PC, and the designer program must be exited and the generator run independently. When this has been done the form can be used. (The usual Oracle security arrangements apply before any information in the database can be accessed.)

Conclusion

Oracle Developer has a mainframe 'feel' about it, in terms of size, scope, and (on the minus side) user interaction. It contains an amazing breadth of facilities, too many to mention here, and a great deal of power once you can get to grips with it.

The Oracle software is really a family of products and tools, all of which relate to the central relational database in one way or another. Oracle Developer does not encompass the full range.

The price of Oracle Developer is pitched at a PC level but it is really the spratt to catch the mackerel, and everything that follows is at a higher rate. Don't forget that the Developer can only be used to develop applications, and that to actually run them involves purchasing Oracle Professional, which costs considerably more.

The above points indicate that a considerable commitment is being made when purchasing Oracle Developer. It is not just a matter of spending £400 on a piece of PC software, but ultimately a great deal more money will be spent if the system is to be used as intended: staff training, outside professional expertise, network hardware, maintenance agreements and further Oracle software purchases are all likely to follow as a natural consequence of the initial purchase.

Prices

Oracle PC Developer: £399
Oracle PC Professional: £1600
Lotus 1-2-3 add-in: £200
Maintenance: £550 per year

Versions of Oracle for larger machines are typically priced in tens of thousands of pounds.

Oracle Corporation UK can be contacted at Oracle Park, Bittams Lane, Guildford Road, Chertsey, Surrey KT16 9RG.
Tel: (093287) 20220.

Thanks to Dell for the loan of a Dell 286 for this review. They can be contacted on (0344) 860456.

END

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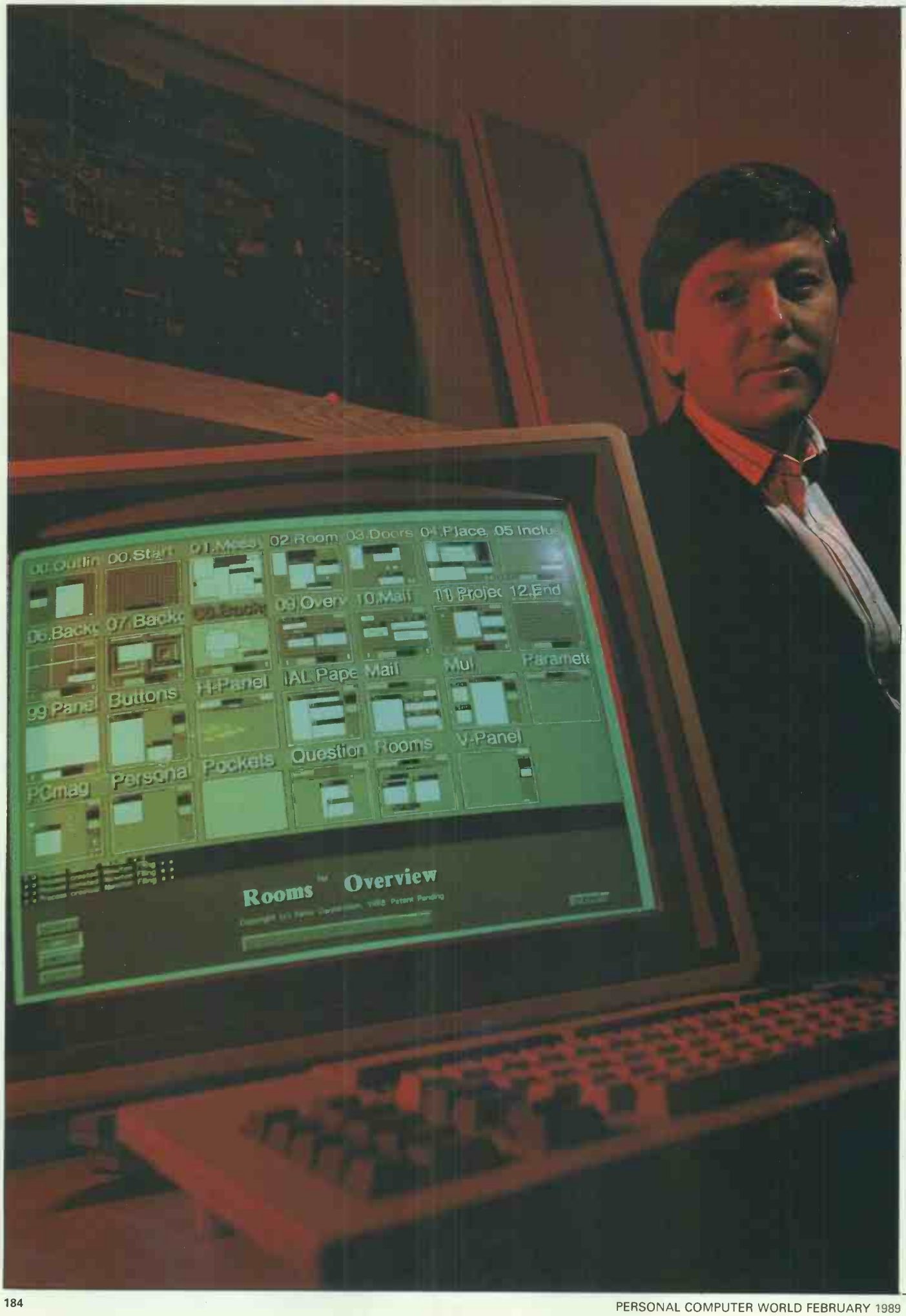
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Rooms Overview

Changing rooms

In the last of his visits to Xerox EuroPARC David Tebbutt learns about Austin Henderson's work in tailorability and development, and his belief in reconciling system design with the changing needs of the user.

Austin Henderson spends his life whizzing between the Palo Alto Research Center in California and the UK equivalent, EuroPARC in Cambridge. When in the UK, he heads up the Tailorability and System Development research efforts. He is a kind of human bridge, facilitating cooperation between the two laboratories.

Henderson's view of the world is that effective systems aren't simply designed by producers then used by users. They are developed over time by a wide range of individuals from the system architect right through to the end user. Feedback from the various participants results in change both before and after the product reaches the market. Once in use, people adjust their work practices to accommodate the new technology and, as the nature of the work changes, the technology is modified still further.

Photocopier patterns

Although his research centres around computer systems, Henderson likes to illustrate the points he makes by using the photocopier as an example. Installing a photocopier is not just a case of plonking it on the floor and expecting everyone to use it. People need to decide things like where it will go, what systems it replaces, who will operate it and how it will be paid for. They then have to figure out how to make the most of it. It's bound to have features they hadn't anticipated and, maybe, lack some they had expected.

Users find themselves involved in the process of discovery, each trying to assess how the copier affects their own work. They all ask themselves 'is this new machine better for me, or worse, than what I had before?'. This adaptation of the individual and the environment to a new system is central to Henderson's research. His team studies the processes of adaptation and looks for ways of helping users and designers to come up with better systems.

Even a relatively rigid product like a photocopier stimulates new patterns of usage as people's awareness grows. The manufacturer will try to build into the machine as much flexibility and user control as possible. After all, the last thing it wants is for users to call each time they want to do something new.

If the humble photocopier stimulates new patterns of usage, computers must do this to a far greater degree. All the more reason for putting control of this adaptation into the hands of the users. Henderson wants to push design as far down the development chain as possible. He thinks that design is a process which should continue even while the product is in use, partly because users often don't know what they want until they start using it.

To continue the photocopier analogy, Henderson talks of users finding that the image doesn't fit on the paper, so they re-orient it or use a different size. This is an admittedly trivial example of what he refers to as 'design continued in use'.

Henderson regards photocopiers as mid-way between low-tech unchanging systems, like paper and desks, and high-tech complex and malleable technologies like computers. Even with static technology like paper, we adapt it to our needs as we use it. We fold it, tear it, staple it and file it according to our personal preferences. But, once other people start to get involved in our paper systems, things change. It then becomes part of a wider system.

The public use of paper involves a lot of agreement between the affected parties. How is it to be filed? Where? What about access by other people? Conflict arises if everyone does their own thing. And that's just paper.

This sort of problem is at the heart of Henderson's tailorability issue. It's the need to reconcile the interests of the individual with those of the group. It's also a question of striking a balance between the design of the system and the user's preferred way of doing things.

Henderson's team focuses much of its research effort on tailorable human interfaces. These enable users to experiment with changes to their systems without the active involvement of any of the systems designers, developers, analysts, consultants, support staff and tinkerers who usually have a hand in the more conventional systems. For such a system to work it has to be very easy to use and, in EuroPARC's view, be as simple as moving icons on the screen.

Rooms

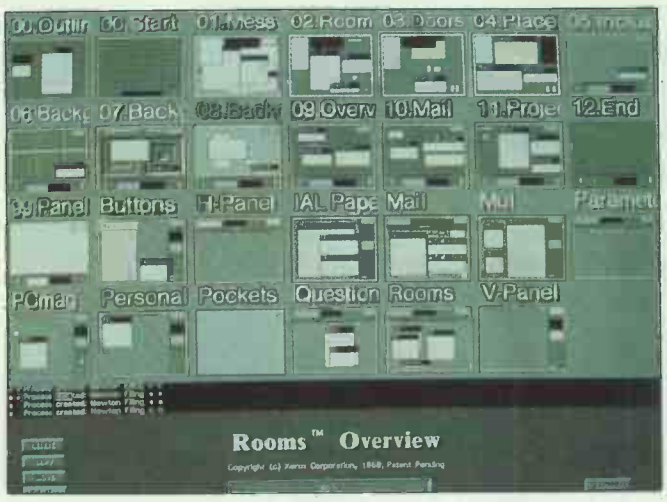
Henderson is co-inventor, with Stuart Card, of just such a system, called Rooms. This is a window management system which lets users assemble 'Rooms' of the programs and data they need for different tasks. In the 'Mail Room', for example, they may have a word processor, an electronic mail program, a chat window, an address book and an on-line diary. This kind of system works very well, but Henderson would like to find ways of enabling users to make even more complex alterations to their systems.

One of the major causes of user alienation and dissatisfaction with computer systems is that they cannot articulate exactly what they require of the end system. In fact, they usually don't know because they have no idea of what the system will be capable of. What is delivered is usually the system developer's interpretation of what he or she thinks the user wants. Blame is hurled back and forth but it's not really anyone's fault. Until users are actually sitting in front of the finished product, they don't fully realise what they should have asked for in the first place.

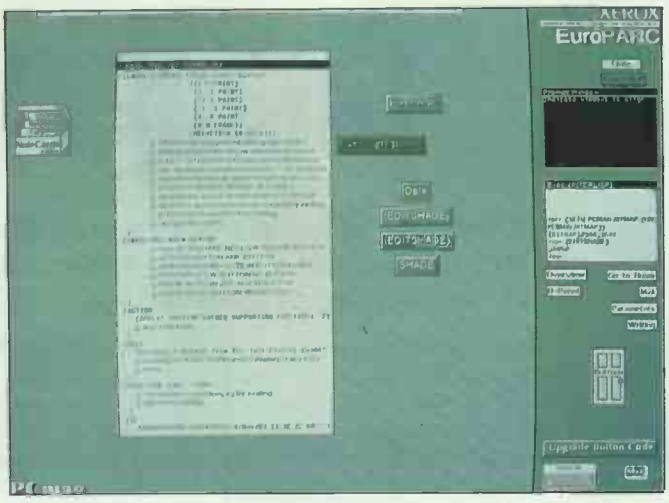
Henderson would like to see users in this situation being able to take the design further and to adapt it to their particular working methods. He wants them to be able to imprint their own way of working on the system. So, rather than simply replicating their working practices, the computer will begin to complement and enhance them.

When users are able to tailor their systems, they will often want to share their discoveries with others. They will also want to find out about other people's discoveries to see if the problem they face has already been solved.

Traditionally, programmers have been well known for their resistance to other people's ideas, preferring instead to reinvent their own version of the wheel. This is usually called the NIH, or Not Invented Here, syndrome. Apparently, NIH is less of an issue among users when the solution



Overview of the rooms in Henderson's own system



The code which drives the Exec Event button

is directed at improving their work environment. Henderson actually had someone else's 'discovery' running on the screen while he was being interviewed. The program simply stepped through a series of clip art illustrations to prevent 'burn in'. Henderson was obviously immune, but it was highly distracting for the interviewer (me).

Henderson would like to design hooks in the technology to help users to find others of like mind, and locate the community of users who are most likely to want to share ideas with each other. He returns to the copier for more parallels. Setting the contrast for pink forms might be a problem. One day, someone discovers the right combination of settings. Their community is all the 'pink form users'. One way of communicating the discovery might be to install a bulletin board on the wall by the photocopier. This would be a user-implemented solution. Or, if the designer of the machine gets to hear about it, he or she could build in a special panel onto which users can stick post-it notes.

This, at the photocopier level, is how patterns of use are developed and shared and the technology evolved. Actually, Henderson believes that non-technological solutions like this are often appropriate, even among a community of networked computer users. He believes 'it is the arrogance of the technologist to assume that all problems have a technological solution.'

On the InterLISP computer system at Xerox, users are able to hide all sorts of complexity, from a note to a full-blown application, behind a device called a Button (see also last month's EuroPARC article in *PCW*). In one sense Buttons are similar in concept to keyboard macros. InterLISP can be driven from direct commands, some of which can be very complex. Rather than run the risk of error, Henderson simply makes the most common ones into Buttons, activating them whenever he needs to repeat these commands.

The difference between a Button and a keyboard macro is that the Button is a movable, copiable object and it can be a keyboard sequence, a program or a document. Henderson says: 'I, who can do something arcane, can do something at my workstation, put it in a Button and send it to someone else.' A Button can be sent over electronic mail, on disk, through a direct link or through a chat window hooked up to another user. This is one way of sharing discoveries with others in a way which is very simple for the users. When the Button arrives at its destination, a click of the mouse button activates it and the program executes or the document is displayed.

Henderson's 'Rooms' is also a deceptively simple technique which enables users to define the computer resources they need for any task. This enables them to overcome the limitations of a small screen and the problems which come from trying to display too much information at the same time. When Henderson was dreaming up Rooms, he reckoned that a typical user would need a screen the size of a dining table to display all the possible activities and files. This was obviously impractical and led to the idea of having a different workspace for each task.

A Room is simply a screen, which displays all the application windows a user needs for a given task, in the layout best suited for that task. A user might have a programming room, a writing room and so on. Some applications may, and usually will, appear in several different Rooms. 'Door' icons can easily be defined, which take the user directly into other Rooms. Moving from one Room to another causes all the windows in the current Room to be closed and those in the new Room to be opened. Users can, if they wish, take active windows with them when they change Rooms. Otherwise, the new Room is in exactly the state it was left in the last time it was used.

Another way into a Room is to go in through the Overview, a display of all the Room icons. If users have the time, they can design some quite elaborate Room icons and Room layouts just as they can with the real rooms that they live and work in.

Designing Room layouts and icons doesn't involve the users in any systems analysis and design, they just do it. The benefits of icons and background designs are that they make the workspace attractive and they also make it easier to find Rooms. Since the creation of a Room is so simple, users will even find themselves setting up *ad hoc*, or transitory, Rooms for one task and then throwing them away immediately afterwards.

The creation of a Room results in a source code file in Rooms' own LISP structure. The more adventurous users (programmers perhaps) can edit these and create new ones from scratch. Most users will make their Rooms simply by opening windows and moving icons into them. The source code would then be generated automatically.

In Henderson's EuroPARC world, everyone has access to a Xerox workstation running InterLISP and which is networked. His environment is designed so that no-one else can rummage around from their remote workstations. If he wants to share stuff with others, he likes to do it explicitly. He would like to see a system that incorporates security measures which give remote access to certain Rooms to appropriately authorised visitors. Some would still re-

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Behind the Doors

In last month's article, we learned the importance of passing on, to future designers and programmers, the rationale behind an application. It would be relatively easy for someone to pick up the Rooms ideas and to take them further. What they may not appreciate is why the program has been designed the way it has.

Henderson and Card identified nine desirable properties for a user interface which would enable users to switch between tasks. Most user interfaces concentrate on helping the user follow the current task through to completion. The truth is that users like to switch back and forth between several concurrent tasks. With a command line system this is exceedingly tedious and, even in a normal windows-based system, much effort can go into moving, resizing and repositioning windows and shrinking and expanding icons. Added to the physical problems are the mental ones of keeping track of all the various tasks and their related data files.

The two problems Henderson identifies in task switching are: a) the amount of time it takes; and b) the complexity of remembering how to invoke the other task and how to get into mental context. He and Card identified three related requirements for an effective task-switching system:

- Fast task switching
- Fast task resumption
- Easy to re-acquire mental task context

Fast task resumption is necessary when the new task is a digression or a short sub-task. And users need to get back 'in the swing of things' more or less instantly.

A user might need to work with rapid access to a couple of word processor documents, a files browser, a prompt window, a thesaurus, a dictionary and a clock. The user may not be able to have all these windows open at the same time, so the access time is slowed while windows are closed and new ones opened. These observations led to three additions to the requirements list:

- Access to large amounts of information
- Fast access to information
- Low overhead

Although users do switch between tasks, they are only involved in a single task at a time. This led to the decision to set up independent workspaces around each task and to allow fast transitions between them. But the task environments quite often require access to the same resources. This led to the next three requirements:

- Engaged Tools shareable among several tasks
- Collections of Engaged Tools shareable among tasks
- Task-specific presentation of shared Engaged Tools

'Engaged Tool' is the term used to describe a Tool and the data it contains which makes it unique. The three properties above enable an Engaged Tool to be used in multiple tasks, for groups of regularly used tools to be used in different tasks, and for the appearance of the Engaged Tool to be varied in different tasks.

The Rooms concept, that of a screen-sized workspace containing a number of Engaged Tools, was created to enable the rapid transition between tasks. The icon-like Doors give a one-way route into another Room. Any Room may have several Doors.

Because users will want to use the same window in multiple rooms, Henderson and Card had to allow it to change its position and appearance between tasks; otherwise it would impose an impossible constraint on the design of subsequent Rooms. They came up with the abstract concept of Placement, which combines the identity, position and presentation of a Window in a Room. This splits the functional aspect of the window as a Tool from its appearance and position on the screen.

Many users will want collections of Engaged Tools to appear in a number of different Rooms. Furthermore, they will want all changes made to the collection to appear at the other locations as well. An example, according to Henderson, might be a control panel with an executive window, a prompt window, a clock and a system memory indicator. The answer they came up with was Room Inclusion, the ability of one Room to contain another. This way, the common elements could be defined in a Room of their own and then that Room could be included in all the other Rooms that required the information.

Sometimes users will want to carry Engaged Tools to another workspace or they may want a permanent collection of Engaged Tools to go around with them, regardless of destination. In the first case, the users can enter a mode in which they select the windows to be carried to the next Room, then they go through the door. In the second case, the act of going into the next Room causes the permanent set of Engaged Tools to appear on the screen. The user would have defined these as a Room first. Henderson describes the first of these methods as putting the Engaged Tools into the user's Baggage and the second as filling the user's Pocket.

As you can imagine, a complex set of Rooms with all sorts of interconnections can cause serious navigational problems. The most obvious of these is how to get back to the Room last used. The answer comes in the form of a Back Door. Because Doors are one-way, Rooms automatically creates a Back Door, in inverse video, which takes the user back to the Room they just came from. This Back Door is destroyed after a single use.

Henderson and Card have provided two solutions to users who have forgotten which rooms exist and how to reach them. The first is a pop-up menu of all the Room names. The other is the Overview mentioned earlier which contains a set of Room pictographs. Each looks like a miniature screen showing its layout and reminding the user of the Tools it contains. The name of the Room is underneath and they are all listed in alphabetical sequence. Other help is provided by allowing the user to instantly expand a Room pictograph to full size or to call upon a drawing command to show how the Rooms are connected.

The final set of facilities relate to the user's need to quickly change the arrangements of Tools and windows in the various Rooms, While in a Room, the user can create, move shape and delete windows. At the Overview level, the user can copy, move, reshape and delete windows and have the changes reflected within the Rooms.

Users also need to save, restore and share their Rooms with other Users. This is all done using the ubiquitous Buttons.

The discoveries made as a result of the development of Rooms are that users experience a strong psychological sense of relief when their tasks are separated into different Rooms. They actually end up with a far larger workspace – Henderson estimates it is the equivalent of between one or two five-foot desks in terms of raw screen space.

The users tend to make three different types of Room. Firstly they have functional Rooms, such as a mail Room. Secondly they have project Rooms, for the different tasks upon which they're engaged. Thirdly they have management Rooms where they keep Tools for systems initialisation, storage management and so on.

main strictly private. Within those Rooms, individual documents might be sensitive, so they might be fronted by a marker saying something like 'For information about this, please call Fred Bloggs.'

Summary

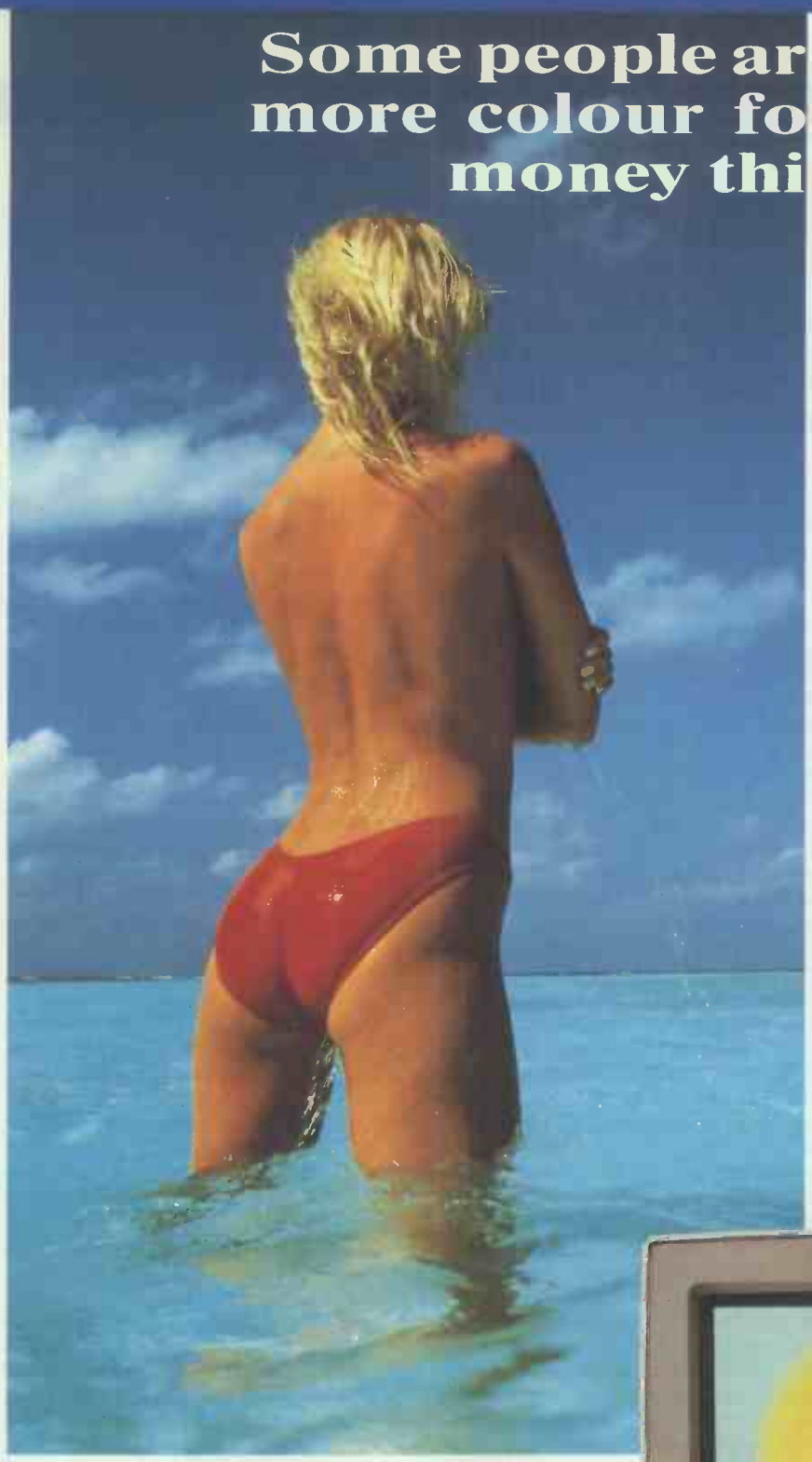
Summarising his work at EuroPARC, Henderson says that the thing to be tailored is not just the technology, it's the practice of its use. The technology is at the centre, but it is work which is being tailored. He stresses the fallacy of seeing design and use as separate stages in the creation of a usable system. He focuses instead on design as an on-going process while a product is in use.

He thinks it is worth pulling out the theme of substrates. The different people involved in the design process operate to different timescales, using different skills.

He reiterates the aim to push as much as possible of a system's tailorability down towards the user, but without making it compulsory. Users should be able to use a system as it arrives. The attitude should be 'you can tailor it if you want'.

He wants the technology to help the social process of information exchange, especially through the capture of knowledge and of its communication. END

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Operating difficulties

Derek Cohen seems to have started something with his recent comments on OS/2. This month he responds to criticism of his views, explains why we're networking the *PCW* office, and spends some time on the floor switching jumpers.

Letter to the editor

Dear Sir

I am horrified and quite amazed at your apparent lack of understanding about OS/2. Indeed, your article ('From the top', *PCW* December) contains technical inaccuracies — for example, saying that OS/2 sessions would be frozen when the DOS box was entered.

Programs like DesqView and Windows only run existing applications in a pseudo multi-tasking environment. No additional function or feature is added. The environment is somewhat unstable and no protection exists for program crashes.

OS/2 provides re-entrant processes, stability for errant programs, and the ability to write applications that could *never* be done under DOS/DesqView/Windows. Why do you think that companies like Lotus have not released their long-awaited group productivity tools?

You have also failed to understand what motivates any large company to standardise on an operating system. The software has to provide a base for future growth — in such environments *systems* are the key. The individual PC is now part of a much larger structure, be it LAN or a HOST/PC symbiotic environment. Have you ever tried running a 3270 session, Token Ring drivers and a large 640k package at the same time? I have and it is not possible.

You espouse the virtues of Unix, and so on. These are fine multi-user ASCII environments but they are most unsuitable for the SAA environments that will come. In addition, they too require large amounts of memory to run effectively. With the lower-cost LANs now appearing, a multi-user environment will be based on co-operative processing and server/requestor technology and not on ASCII/serial systems.

Mike Gove
Senior technical analyst
Sun Alliance Insurance Group

Mike Gove's letter, printed above, deserves a considered reply. For a start, I must acknowledge my error in saying that, under OS/2, when you are running a program in the compatibility box, all OS/2 applications are frozen. I checked this with a number of colleagues from different publications and they all agreed with me. Further checking with a Microsoft representative reveals that in fact the OS/2 applications continue to run. But it is a measure of how little take-up there has been of OS/2 that this misconception is so widespread.

What concerns me more about Mr Gove's letter is the basic premise that only IBM and Microsoft know anything about operating systems. I'm not criticising him personally because I think that, from his perspective as a systems engineer in a large corporate organisation, I too would see OS/2 as the solution to many of my problems.

Underlying his argument that DesqView *et al* provide pseudo multi-tasking is a belief that somehow OS/2 has privileged access to something which other software does not. Now if you look at OS/2 code you'll see that, like MS-DOS and Unix and DesqView and Concurrent DOS, it's all just CPU instructions. OS/2 may be cleverer software than most, but then it's larger, has taken longer to develop, and is designed to do snappier things than many of the others.

But you can't get away from the fact that, whatever PC operating system you are running, you still have only *one* CPU. And whether you call time slicing real or pseudo multi-tasking, ultimately you are sharing that processor's attention among many applications. OS/2 adds some extra functions, such as multi-tasking within programs. But then Concurrent DOS is a multi-user system as well; and DesqView multi-tasks ordinary DOS applications and provides inter-application messaging.

On anything lower than an 80386 CPU there is no foolproof, built-in protection of one application from another: you have to do it in software. Even OS/2, which will run on an 80286-based machine, can only use software methods of protection. Even so, on most multi-tasking operating environments it is possible to Ctrl-Alt-Del one shell and leave the others running.

It's early days for OS/2, and I don't see why we should believe all the PR blurb about it. In a year's time, when we've seen plenty of badly-behaved OS/2 programs running alongside each other, then I'll be willing to listen to claims that OS/2 offers real protection of one application from another. Get a Borland OS/2 application and you'll have a *real* test of OS/2's ability to provide protection against delinquent programs. Borland's DOS applications are about the worst offenders around, and that from a company which founded the association for treating other TSRs nicely.

This past month we received the real 386 version of DesqView. This uses the virtual 8086 protected mode of the 80386, provides various levels of software protection, and gives each application anything up to 580k of its own protected DOS shell. Not only that, but you can also run this alongside your LAN drivers and mainframe sessions.

I don't want this column to become a running advert for DesqView. But I do think that we need to remember that IBM and Microsoft are not somehow privy to skills and information denied other software houses. In fact, both OS/2 and DesqView have some common ancestry in Topview. And even the great god Bill Gates started out as an ordinary small-time computer programmer.

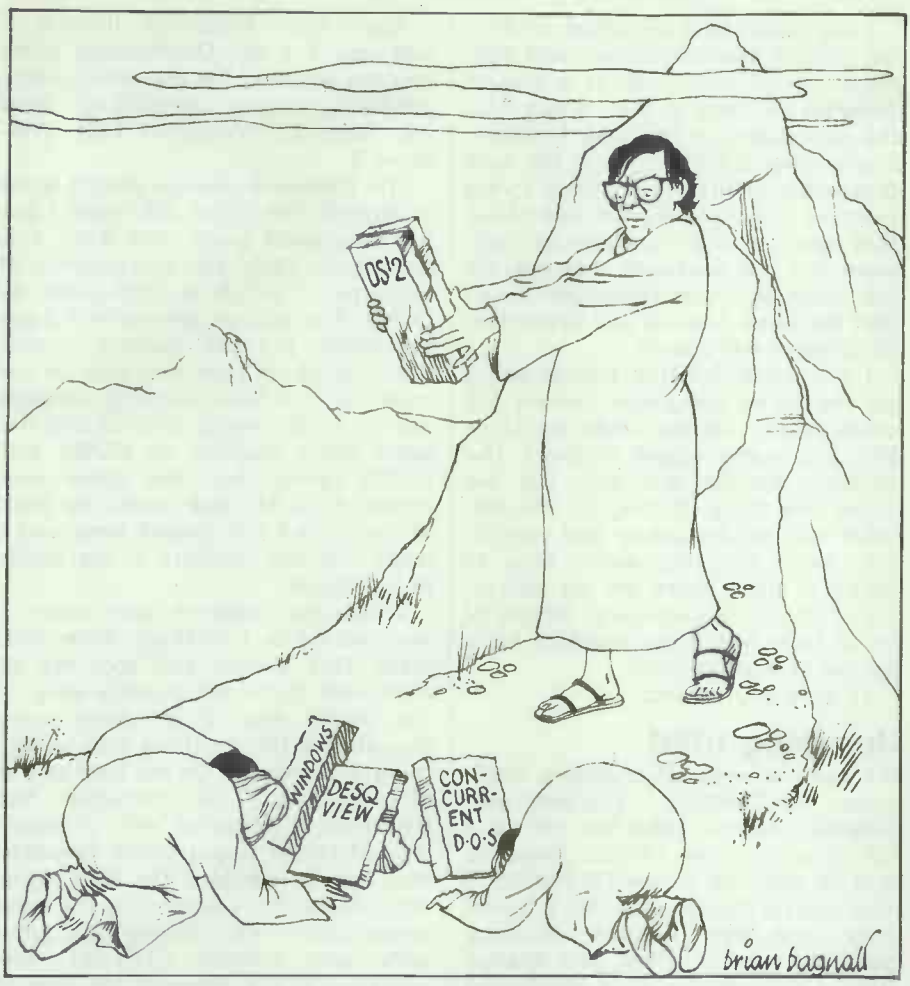
OS/2, DesqView and Concurrent DOS all run on the same family of CPUs. And IBM and Microsoft don't have a magic key which unlocks new, secret capabilities of that family of processors. Making CPUs sing and dance requires hard work and imagination, not a magic wand and a seat in the ear of Intel.

To see how much innovation there is, you have only to look at Hewlett-Packard's New Wave or its DOS emulations running under Unix, or Presentation Manager for Unix (PMX) or the work of many other companies who are developing operating environments. Ultimately what I want is to be able to make choices about what sort of operating environment I use, who I buy it from, and how much I gain or lose in functionality and compatibility moving from one to the other.

Making connections

Just look at this *PCW* editorial office. It's probably one of the best equipped small offices around. Four of the editorial staff are running 386 PCs — from Zenith, Dell and Delta Gold. We have two laser printers — from NEC and Mannesman Tally. We are one of the most technically knowledgeable teams around. And we spend our day passing floppy disks around the office when we want to access each other's information.

We aren't networked. The most sophisticated resource sharing in this



office is an Inmac printer buffer/sharer.

Any systems manager used to the efficient management of information would throw their hands up in horror on entering this office. Three of us use AskSam for our contacts database, one uses a dBase application. So what started as one common database has become sibling-like, each a bit different from the next but having a common parent. I forward-plan the contents of *PCW* using GrandView; deputy editor Manek Dubash uses Lotus Agenda. We each use different scheduler programs — Andy Redfern and Guy Swarbrick use WordPerfect Library, Manek and I use DesqView Datebook.

We haven't been networked for one main reason — memory. We all use DesqView (sorry — I'll stop boring you with that in a sentence or two). And any programs, such as network drivers, loaded as they must before DesqView to be accessible to all applications, take memory away from *all* those applications. Fortunately, with the new 386 version of DesqView we can load resident programs and drivers above the 640k DOS limit so that each program has the maximum size DOS shell available to it.

Now we are going to network the office. We're going to use Sagesoft's MainLAN because our experience has shown it to be the easiest to install and it has a good software front end. It allows for each PC to be both host and terminal, and we can treat each other's resources such as disk drives and printers as if they were our own (if we are given security clearance).

But networking is going to impose a certain discipline on us which I'm not sure I relish. If we are to do the sensible thing and use one common database for our contact details; if we are to share one scheduler for all our appointments; if we are to freely transfer text files around the network, we will need to standardise on some packages.

And I suspect that is where the arguments will start. Do we use WordPerfect's scheduler or DesqView's? Which will win between Agenda and GrandView? Will my little oasis of PC-Write resist the onslaught of WordPerfect?

The coming couple of months are bound to see some heated arguments. There is no great systems manager in the sky imposing software on us. We are an autonomous group of computer anarchists able to use what we want. We don't even have financial constraints as nearly all software companies are happy to give us products to test. ▶

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I see networking the office, arranging proper standardisation and centralisation of resources, as a way of growing up. And, in that, it jars with the delinquent in me and, I reckon, many other people. This is the side that experiments, that enjoys trying out new hardware. It's the side of me that uses not the most popular software but the packages that get the job done. Will standardisation mean that the quick take-up and discarding of software will cease?

I am concerned that standardising on the same programs around the office might dull our creativity. Or is this just some hippie fantasy? The coming months will tell. But we know one thing. Setting up the network will be disruptive and painful. So, we're devoting some time to doing it when there are no distractions, and no requirements for any of us to have a working machine for a couple of days at least.

I'll keep you posted.

Jumping mad

It's been a week of changing hardware. At Comdex I bumped into Stephen Marmoy who has set up a UK operation for Mouse Systems, and he sent me a new PC Mouse II. This optical mouse now has a hunch back and two buttons. Marmoy admitted that, in effect, the change from a three-button to a two-button mouse is a climbdown for Mouse Systems and a victory for the Microsoft standard. Mouse Systems (and Summagraphics, and other companies using three-button mice) use a 5-byte data format which can cause some compatibility problems with certain software, though I personally have never had any problem. Mouse Systems has moved down to the Microsoft 3-byte data format.

Previously at home I had been using a Summagraphics three-button mouse, and all my software — Gem, Ventura and Windows — needed reconfiguring. This is no trivial task. For reasons that I do not understand, many programs do not provide easy ways of altering their hardware set-up. In fact, Ventura is one of the few programs I know where command line parameters carry the necessary hardware information.

The line below specifies my screen driver (S=SDFVGA86.VGA) and mouse (M=13 means Microsoft mouse on COM2). To use the 800×600 driver supplied by Video 7 with its Fastwrite card I just change the S= argument to SD_VGA_5.VGA or something like that. And if the mouse is on COM1 I change it to M=03.

```
DRVRMRGR VPPROF %1/
     S=SDFVGA
     86.VGA/M=13
```

Apart from DesqView (honest, I just use it a lot, Quarterdeck don't pay me anything) every other major program needed reinstalling Gem 3.0, Gem 3.1, Windows 1.03, Windows 2 . . .

The hardware change wasn't quite as simple. The Arche 386 tower I use has two serial ports, one 9-pin and one 24-pin. And I also use an internal Quattrocard which is configured as COM1. The mouse came with a 9-pin connector, but my Summa mouse used the 24-pin port. So I was on my knees on the floor, moving jumpers around on the serial card so that the ports were mapped as COM2 and COM3 rather than the other way round. It's a bit dark under my desk at home and I'm always surprised I don't lose the jumpers in the depth of the carpet.

While the machine was open, I also added a 1.44Mbyte 3½in disk drive. This 'simple' task took me all afternoon. Some things were easy — the Arche has 3½in drive bays though the Citizen drive was something of a snug fit. On the back of the drive is a 2×17-pin connector, but the drive is supplied with a small, printed circuit board which converts this into a standard flat disk drive edge connector. Confusingly the converter board also carries two jumpers, one marked AT-PC/XT, the other just OPEN. Interestingly, one of these labels is incorrectly marked.

The documentation, as is often the case a translation from the Japanese via Serbo Croat, merely suggests that, should the drive not format correctly, the OPEN jumper should be moved. The fact that the documentation was all about 360k and 720k formatting, with not a mention of 1.44Mbytes, inspired little confidence. But Arche had assured me this drive would work.

Fortunately, the Arche disk drive ribbon cables carry both edge connector and 2×17 plugs so the data cable was easy to fix. I don't know what I would have done had I needed the jumpers.

The power cable did in fact need a converter, as the drive used a small 4-pin socket and I needed to use the supplied conversion cable to join it to the chunkier standard power lead.

All the connections were very stiff, and I managed to bend some pins on the 2×17 plug and snap one of the minute power connections while testing the drive before final installation. A Saturday afternoon, just days after they've just closed down your local Tandy store and your motorbike has a flat battery, is no time to discover that a minute sliver of metal poking out of the carpet stands between you and a working floppy disk drive.

I won't bore you with the sorrowful

details of how, using a table-top vice, two pairs of pliers, an ancient soldering iron and a less than steady hand I managed to rejoin the cable, but the drive is now fitted and working, and it does format to 1.44Mbytes. In fact I tested it on one of my prized possessions — one of the first ever 1.44Mbyte 3½in disks ever produced, given to me by Maxell which had just received a very large order from IBM. It took another year for machines using the disks to appear. I still have a 2½in floppy disk, also made by Maxell at the same time, which has yet to be used in a mainstream computer. But then it only holds about 200k.

Returning to the floor . . . As I lay there, trying to fit the drive, I wondered why it is that, with all this micro circuitry, intelligent peripherals and high-tech development work, the basic ways that computer hardware fits together haven't advanced much. I remember how, seven years ago, my heart beat loud when I did my first memory upgrade on my Acorn Atom. I knew enough to rock the chips on the table first to bend the pins in slightly so they'd slide into the sockets more easily. But bent legs on pins are still a hazard and SIMMs are a welcome if still not yet universal means of memory upgrade.

If there is anything which encourages a fear of computer hardware among people who have the courage to open the box it must be those damned little legs on the chips, just waiting to get bent or, worse still, snapped off. I've been told that soldering a paper clip to the side of the chip is the answer, but I'm not recommending it.

When IBM first demonstrated its PS/2 range, one of the selling points was the ease of configuration of the machines. There are no jumpers on the motherboard; the disk drives slide in and out almost as easily as Tandon's PACs, and the machines are intelligent enough to work out what's inside them.

I ask you. What sense is there in a machine which, at power up time, counts up 4Mbytes of memory on its system board and then bleats at you that the Setup says there ought to be two and what are you going to do about it? These are supposed to be intelligent machines. I find the PS/2 idea of a Reference Disk program that takes stock and synchronises the hardware and software very attractive. Though why *you* have to run the program I don't know. Why can't the machine just make the adjustments, just asking for permission on the way so you're still boss?

One of the reasons why our reviewers found MainLAN a good network was that its cards are self-configuring. Serial communications are a nightmare of interrupts and base addresses. Just look at this table from Procomm Plus:

PROCOMM PLUS SETUP UTILITY

	BASE ADDRESS	IRQ LINE
A– COM1	Ox3F8	IRQ4
B– COM2	Ox2F8	IRQ3
C– COM3	Ox3E8	IRQ4
D– COM4	Ox2E8	IRQ3
E– COM5.....	Ox3F8	IRQ4
F– COM6.....	Ox3F8	IRQ4
G– COM7	Ox3F8	IRQ4
H– COM8	Ox3F8	IRQ4

Who needs all this? Consider too this extract from the documentation for the bus version of the PC Mouse II:

'The new Bus Plus Card now has only 2 jumpers. This will eliminate confusion in setting the jumpers on the Bus Plus Card. When you have run the BUSSET program it will show you where to place the three jumpers. Instead you will place 1 jumper on the IRQ address (as shown in BUSSET) and the other jumper on the single port address. If BUSSET recommends placing jumpers on the pairs of pins marked with xF8 and 2xx, you will place the second jumper on the pair of pins marked 2F8 (xF8+2xx=2F8). Now continue with the rest of the instructions'.

We shouldn't have to bother with all this junk. Mice, like modems, give off distinctive signals. To set up a serial communications device like a modem or mouse you should merely run a program that sends out a signal and watches to see where the response comes from. It then stores that address somewhere safe. If MainLAN can do it, why can't the others?

I've always been struck by the difference in ease of use between computer communications and fax. When did you last see someone standing by a fax wondering whether they'd got the data format and baud rate right? Why can't serial devices in computers be as simple?

And as for jumpers, in this weather I'd rather wear them than switch them.

PCW's editor, Derek Cohen, can be contacted at the editorial offices (see page 3); and electronically on Telecom Gold, 83:VNU200; on The Source BEK303; on CIX as derek, and on Prestel 919993794.

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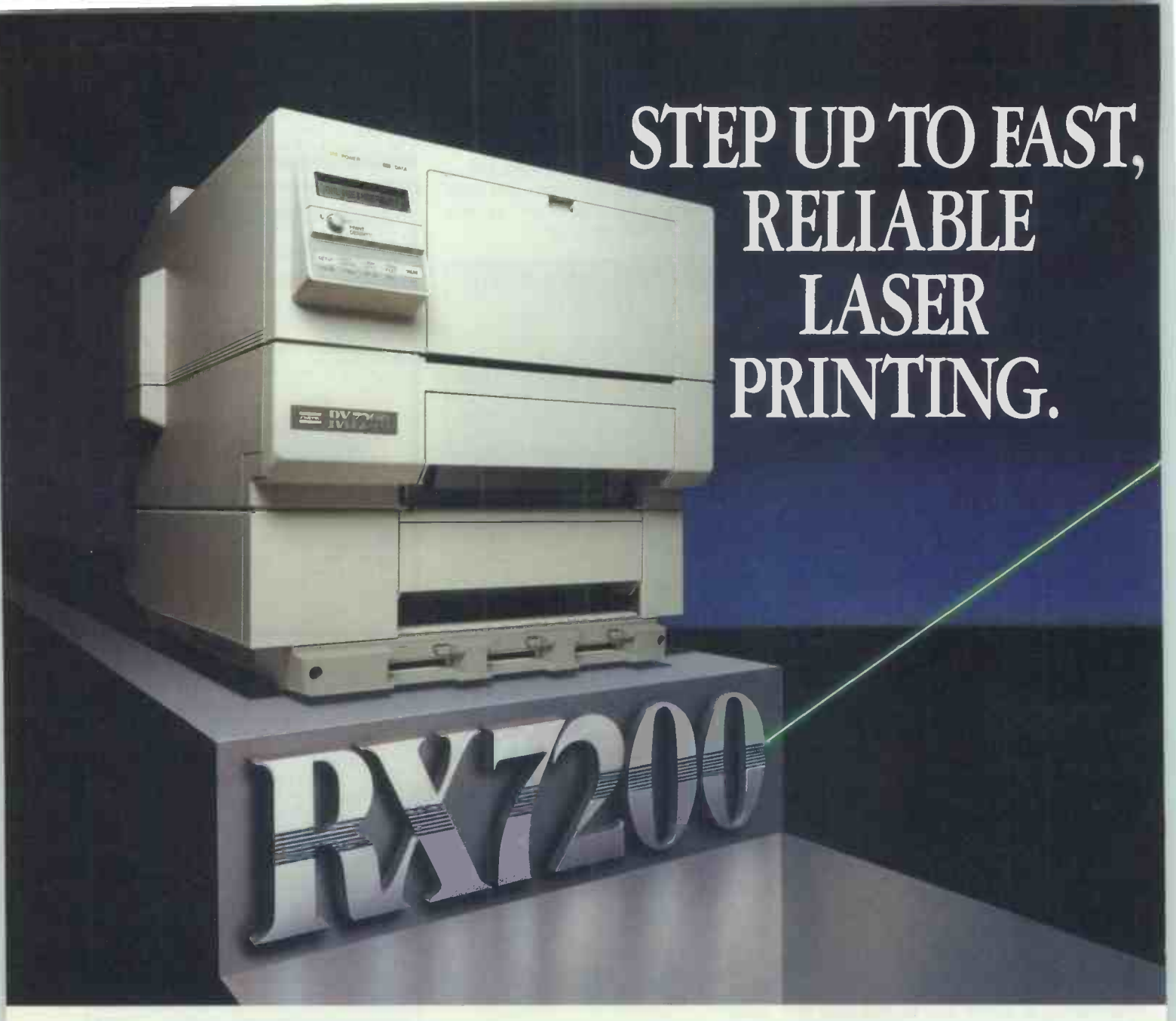
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Personal Comp World

NUMBERS COUNT

Mike Mudge looks at the generation, storage and analysis of Lucas Sequences.

In the latter half of the last century, E Lucas, working in Paris, considered two distinct one-dimensional arrays which we shall denote by $(U_0,U_1,U_2,\ldots)$ and $(V_0,V_1,V_2,\ldots)$. The elements of these arrays are positive integers (or zero) and are defined in two stages:
(i) the first two elements of each array are given, $U_0=0$, $U_1=1$, $V_0=2$ and $V_1=P$.
(ii) Two integer parameters P & Q are specified, and all subsequent elements of the arrays are defined in terms of the two preceding ones by the linear recurrence relations of the second order in terms of P & Q,
$U_n=P\times U_{n-1} - Q\times U_{n-2}$
similarly
$V_n=P \times V_{n-1} - Q\times V_{n-2}$.

We now illustrate particular examples of these Lucas Sequences.

Example I P=1, Q=−1.

Recall that $U_0=0, U_1=1$ and, therefore, using the given values of P & Q in the recurrence relations above:
$U_2=U_1+U_0=1$, $U_3=U_2+U_1=2$
etc.
3,5,8,13,. . . $U_{46}=1836311903$ . .

These are the Fibonacci Numbers (see 'Numbers Count', *PCW*, May 1983).

For $3 \leqslant n \leqslant 1000$,21 Prime Fibonacci Numbers are known, $U_3,U_4,U_5,\ldots U_{569},U_{571}$. What are the other members of this list? Recall that $V_0=2$, $V_1=P1$ and, therefore, using the given values of P & Q in the recurrence relations above:
$V_2=V_1+V_0=3$, $V_3=V_2+V_1=4$
etc.
7,11,29, . . . $V_{46}=4106118243$ . .

These are the Lucas Numbers for $0\leqslant n\leqslant 500$, 22 Prime Lucas Numbers are known,
$V_0,V_2,V_4,\ldots V_{353}$. What are the other members of this list? V_{503},V_{613},V_{617} and V_{803} are also known to be prime.

Example II P=3, Q=2

Exercise for the reader to identify the U_n and the V_n, certainly no computer is needed! Note that $U_{50}=1125899906842623$ while $V_{50}=1125899906842625$.

Example III P=2, Q=−1. Here it is readily seen that $U_{10}=2378$, $U_{20}=15994428$ and $U_{40}=723573111879672$. These are the Pell Numbers.

$V_{10}=6726$, $V_{20}=45239074$ and $V_{40}=2046573816377474$. These are the Companion Pell Numbers.

Example IV P=4, Q=3.
$U_{10}=29524$, $U_{20}=1743392200$
$U_{30}=102945566047324$
$V_{10}=59050$, $V_{20}=3486784402$
$V_{30}=205891132094650$

Do these have any particular significance? What are their prime factors?

Detail any other Lucas Sequences which have attracted particular attention in number theory.

Readers are invited to generate Lucas Sequences for particular P & Q values, hence verifying some or all of the numerical results for U_r and V_r given here. Further problems involving the Prime Lucas and Prime Fibonacci numbers, and the identification in Example II and factorisation in Example IV, are hinted at.

Attempts at some or all of these problems may be sent to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, South Staffordshire WV4 5NF, tel: (0902) 892141, to arrive by 1 April 1989. These submissions will be judged using suitable subjective criteria and a prize will be awarded by *PCW* to the 'best' contribution received by the closing date. It would be appreciated if such submissions contained a brief description of the hardware used, details of programs and run times, and a summary of results obtained, together with suggestions for further investigation; all in a form suitable for publication in *PCW*.

Please note that submissions can only be returned if a suitable stamped, addressed envelope is provided.

Note Further to the decoding challenge from TK Boyd in *PCW*, October 1988, the program listing in the box below may help.

Mr Boyd still thinks that without the appropriate seed value a decode is unlikely. Who can prove him wrong?



Review, August

This topic involved Prime Residue Indices and Artin's constant, it was surprisingly popular, and all interested readers are referred to a book called *Repunits and Repetends* by Samuel Yates, particularly pp102-105.

Mention must be made of the efforts in Forth on an Atari 520 STFM with a single-sided disk drive by Christopher Brooksbank of Peterborough; also the 230 hours of BBC Basic on an Electron attacking Problem B up to 15,000 primes by Frank Webster of Middlesbrough.

However, this month's very worthy prizewinner is Fred Hartley of 46 Hughes Road, Hayes, Middx UB3 3AP, who has used an Archimedes 310 in ARM assembler to calculate indices for 11.6 million primes in about 68 hours. Fred has also carried out a very detailed empirical and theoretical analysis of this problem (details on request) and should be recognised in the literature as and when his results are published.

```
10 INPUT"SEED",S     11 IF S>0 THEN S=S^-1     20 C1=RND(S)
30 INPUT"MESSAGE",M$     35 VDU2     40 FORC1=1TOLEN(M$)
50 C2=ASC(MID$(M$,C1,1))+RND(255)     60 IF C2<256 PRINT"";
62 IF C2<16 PRINT" ";     70 PRINT; ~C2;" "; 80 NEXT     90     VDU3
```

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 articles. All letters will be answered in due course.

LEISURE LINES

Brainteasers courtesy of JJ Clessa.

Quickie
Here's one to get you thinking. If the letters of each word in an English dictionary are put into alphabetical order (for example, Fish would become FHIS, Cat would be ACT) and the resulting 'words' were then made into an alphabetical list, which original English word would be the last in the list, and which would be the second? (First would be 'A', of course.)

Prize Puzzle
My thanks to Roy Newham of Nottingham for sending in the idea for this puzzle — almost four years ago. (We may be slow but we got there in the end!)

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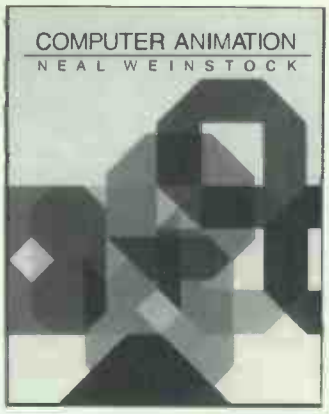
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Graphic art

You only have to look at the 'Smarties' television advert to appreciate the ingenuity of computer graphics, so this month our reviewers take a look at some of the more interesting titles on the subject, plus there's our general section too.

Computer Animation

Author: Neal Weinstock
Publisher: Addison-Wesley
ISBN: 0-201-09438-X
Price: £23.95



Neal Weinstock's *Computer Animation* is a balancing act between the author's keen interest in the present state of the animator's art, and his sincere respect for work produced prior to the quiet revolution which he claims is 'changing the making of animated motion pictures.' I say 'claims' because until a short while ago it looked as if computer animation of one kind or another would indeed kill the practice of hand-drawing cartoons. However, *Who Framed Roger Rabbit?*, a new full-length feature film containing live actors and hand-drawn characters, apparently heralds a backlash to the cold hyper-realism of computer-generated animation.

The development of 'low cost' high-performance machines such as the Commodore Amiga and the IBM PC (equipped with a graphics card) has put the tools for producing fairly high quality animation within easy reach. Computing power obviously separates these machines from those used by most professional animators. But as Weinstock endeavours to show, animation theory is much the same regardless of the machine one uses.

The book's opening chapters deal with fractals, ray tracing, vector graphics, aliasing and antialiasing, and so on. Weinstock communicates well the complex ideas in a lucid and, even, chatty writing style, which neither belittles the difficulties which some of the ideas might pose, nor patronises readers who might already know something about the subject.

At *Computer Animation's* core are several sections about programming graphics on an IBM PC (or PC compatible) in Basic and C. Windows, viewports, paint palettes, structures and arrays are just some of the many subjects covered in depth.

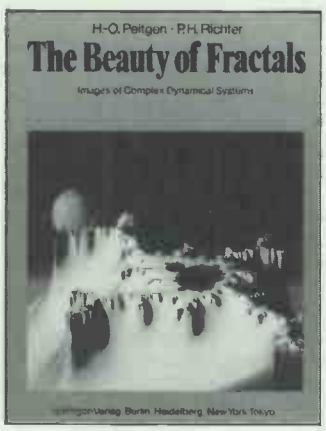
In the detailed appendices which round off *Computer Animation*, Weinstock gives vent to the film buff in him as he talks about the history of animation in movie making. Many of the landmarks between Peter Mark Roget's theory of the persistence of vision, in 1824, and relatively recent films like *Blade Runner* and *Close Encounters* (as well as numerous X-rated cartoons), are considered in the context of their place in the development of animation during a period spanning almost two centuries.

Computer Animation is an indispensable guide for anyone interested in trying their hand at animation: it is informative, instructive, and a good read.

Stephen Applebaum

The Beauty of Fractals

Authors: HO Peitgen & PH Richter
Publisher: Springer-Verlag Berlin
ISBN: 3-540-15851-0
Price: DM78



Half coffee table gloss, half text book formality — *The Beauty of Fractals* is a rare and extraordinary book. Originally produced to accompany a German photographic exhibition that travelled through Europe and North America, its language is nevertheless concentrated mathematical symbolism. I am not at all convinced that this synthesis works either as an exhibition catalogue or as a maths text. But I am quite certain that anyone who has ever explored the intricate folds of the Mandelbrot set will want this book and will be delighted by it.

With over 180 fractal illustrations, around half of them beautifully printed in colour, this is certainly a book to leave lying around, to flip through at idle moments and to use as an atlas when exploring the fractal realm. As something to sit down and read it leaves much to be desired — clarity for a start. And it is not helped by the occasional diversion into philosophical ramblings about art and science that offer little insight for the weight of words.

There are high spots though — especially a chapter by Benoit Mandelbrot (written in his unmistakable self-centred style) which describes his early work with fractals, and one by Adrien Douady — the French mathematician who first coined the name 'Mandelbrot set'. But even they cannot hold the attention for long in competition with the pictures.

This book, above all, is a celebration of fractal forms and as such it works superbly. More than any other book I've seen, it demonstrates to those innocent of algebra why maths is so often described in aesthetic terms. It is exactly about the beauty of fractals. But existing fans of fractals will rightly quibble that the title suggests more than it delivers. There are no Gaussian hills in these pages; no Menger sponges or self-squared dragons. *The Beauty of Fractals* is really the beauty of the Mandelbrot set (and its associated Julia sets) with precious little recognition that fractional dimensions apply anywhere else.

That bias could be limiting but the familiar forms are interpreted in so many different ways, and with such good use of colour, that even the most jaded fractalist must find much to wonder at.

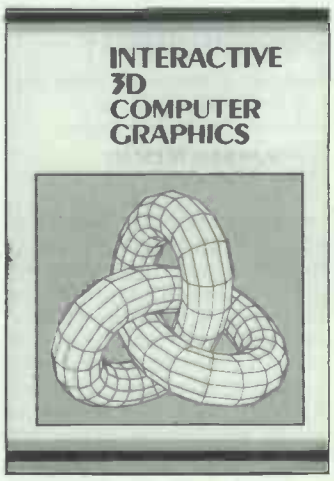
An appendix provides some limited explanation of how these fractal sets can be created on the computer screen but overall this is no recipe book. There is, however, a new title, *The Science of Fractal Images*, emerging from the same stable, which promises more for the experimenter. In the meantime, buy this book (or, better still, get someone to buy it for you) and enjoy it.

Jack Weber

We shall be looking at
The Science of Fractal Images
as soon as it is available.

Interactive 3D Computer Graphics

Author: Leendert Ammeraal
Publisher: John Wiley & Sons
ISBN: 0-471-92014-2
Price: £00.00



Interactive 3D Computer Graphics is an eminently practical book, free from any notions of collaterality with other mediums such as film. Like *Computer Animation* it is targeted at users of IBM PCs and PC clones, but unlike that

work it is based on a suite of three dimensional modelling programs, designed by the author, Leendert Ammeraal. What he has produced, in effect, is an interactive guide which supplies readers with the raw materials for producing line and hidden-line 'three-dimensional' models.

The aforementioned programs are designed to run on any IBM PC fitted with a graphics adaptor; and since they are written in C, require a good C compiler to run them. Readers with time on their hands (and protective plasters on their finger-tips) can enter the programs manually. As the program listings account for some 49 or more pages, you might prefer to pay an extra £14.95 for a disk-based copy being offered by the publisher. (Buying the disk also obviates the need for a C compiler.)

Whether you type in the programs or buy the disk, you really need to have the programs up and running to appreciate the book. What makes this necessary is its division into sections for users and programmers respectively. If you are one of the former, you need only read chapters one and two, whose primary aim is to teach readers how to create and manipulate models with D3D, the aforementioned design program. Ammeraal does not expect all his readers to be able to program, but he does expect them to have a more than average grasp of trigonometry.

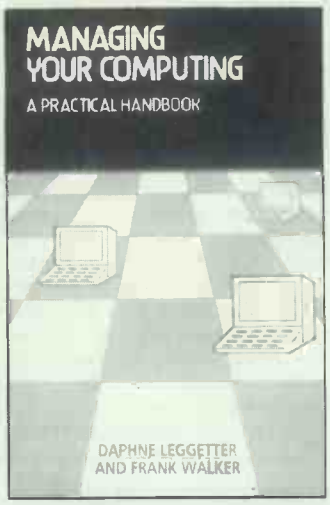
Programmers are directed to chapters three and four, wherein they will find guidance about writing application programs. To come through these sections requires a good working knowledge of the C programming language, coupled with a proclivity for advanced trig. Anyone who possesses these qualities, and is particularly interested in creating 3D models for themselves on an IBM PC, will find Ammeraal a rich source of information.

Stephen Applebaum

GENERAL

Managing your Computing: A Practical Handbook

Authors: Daphne Leggetter and Frank Walker
Publisher: Blackwell Scientific Publications
ISBN: 0-632-01808-9
Price: £14.95



Well, to be honest, on first impressions *Managing your Computing* left me feeling gloomy. The chessboard-like cover looked dull and flicking through the book, it was page after page of closely-typed text with the occasional mock-up schedule springing out. As a possible 'non-specialist with administrative responsibility for the strategic planning and implementation of the commercial office systems' it wouldn't have jumped off the bookshelf at me and persuaded me to part with £15.

But, as we all know, you shouldn't judge a book by its cover (tee-hee) or, come to that, by just flicking through its pages. It *is* a heavy read but then it has got a lot of ground to cover. Chapter 1 deals with planning resources, physical and otherwise, the use of a Steering committee, annual plans and budgets and estimated guidelines — for projects — these are all pretty hefty topics on their own, never mind being combined together in the opening chapter.

To be fair to the authors, I cannot fault their thoroughness. They really have thought it all out for you. They cover 'all aspects of planning, implementation and maintaining computer systems' and have put down on paper a lot of things that many people take for granted and then possibly ignore, such as recognising when disaster is looming, whether it be tardiness with project planning or financial debt through to how to deal with resignation and dismissal of staff. I did feel that the Contents page left a lot to be desired — so much is covered in each chapter that merely quoting the page number on which each chapter begins really isn't enough (subsections and titles exist within the chapters so why not in the Contents page?)

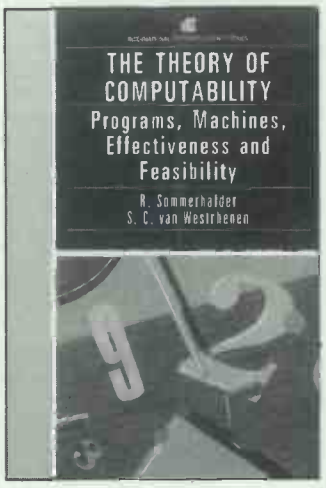
Also, I was horrified to find overprinting followed by blank pages from pages 181-188, therefore completely obliterating a good portion of Chapter 8: The Human Factor. I sincerely hope that this was only in my review copy.

If this is your area, then take your time looking through this book, start to read some of the sections and I'm sure you'll find as I did that it definitely grows on you.

Lorna Kyle

The Theory of Computability

Authors: R Sommerhalder and S C van Westrhenen
Publisher: Addison-Wesley
ISBN: 0-201-14214-7
Price: £15.95



I must admit that I found this book difficult to read. Not difficult in the sense that it has nothing to say, but more in the sense that it is so obviously a subject course book that it is out of context to try and read it like a novel or refer to it as a reference book. It is quoted as being 'suitable for self-study' but I would have thought that it would take an extremely gifted person to understand, unaided, that 'A Cantor numbering of K-tuples of natural numbers is a bijection beteen N^k and N'. Or who could prove that 'The set R of all real numbers is uncountable'. So, if you are a student of Computer Science or Electrical Engineering read on; if not, beware!

Faced with questions such as 'What is an algorithm?' 'What is the computational complexity of a problem?' and 'What are the limitations of computation?' the authors have set themselves no easy task. They aim 'to provide a rigorous mathematical introduction to the theory of algorithms and computability, encompassing both the practical and conceptional aspects of the subject.' Chapters 1 to 5 cover a short historical preamble to the theory of computation, introduce the programming language SAL, Simple Algorithmic Language, together with recursive functions and their relations to SAL, and the Halting Problem: 'Does the computation on a given input x, induced by a given program P, terminate' is discussed in Chapter 6.

The Turing machine comes into play in Chapter 10 and is used thereafter as the model of computation. Exercises are provided throughout, and each chapter commences with a boxed section showing the subsections in that chapter and ends with references to papers and literature of interest. A serious book for the very serious student.

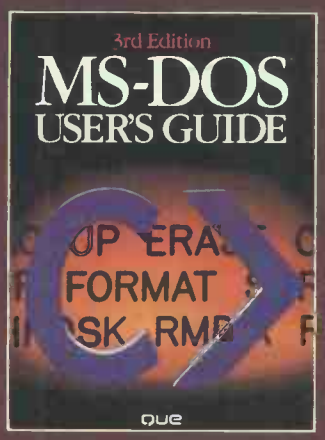
Lorna Kyle

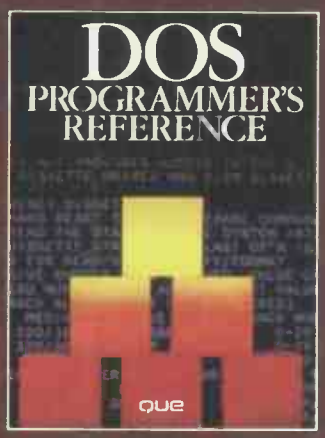


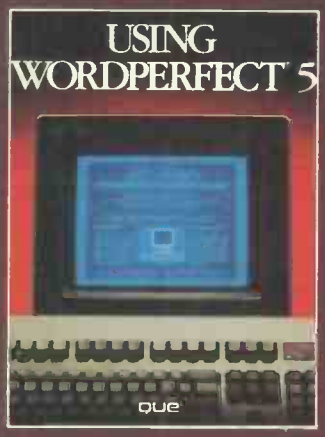
Stephen Applebaum is a freelance journalist. **Jack Weber** is a television producer. **Lorna Kyle** is a systems analyst/programmer.

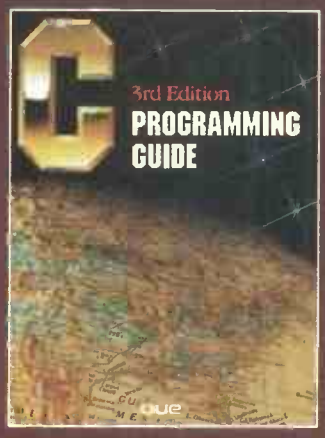
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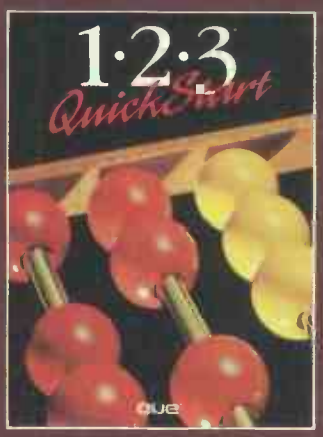
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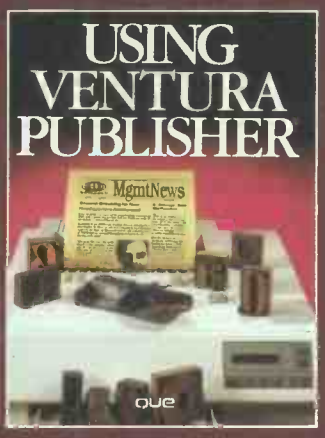


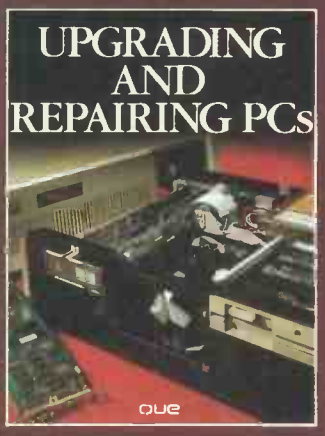


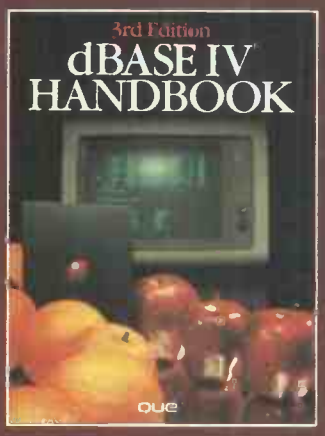












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PURSUITS

Pacmania

Chris Cain wallows in nostalgia as he re-lives the fledgling years of computer games in a fun-filled, power-packed update of a true original.

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A couple of years ago, if someone had told me that in 1987 I'd be going to arcades especially to play Breakout I would have been inclined to doubt them. If they had then informed me that Pac-Man would be one of my favourite computer games at the end of 1988, I'd think it was time for the men in white coats to pay a visit.

However, they would have been absolutely right. In 1987 I was pushing coin after coin into Arkanoid, a game based on the old bat-the-ball-against-the-wall machines of the late Seventies. Now, in December '88, I am playing Pacmania, a highly entertaining and addictive version of the all-time classic, Pac-Man.

Pac-Man has become something of a legend in the computer entertainment sector. People played it in the amusement arcades for absolutely ages. It had pathetically 'blocky' graphics and the sound was rough, but its sheer playability brought you back over and over again.

In fact, it was so popular that Atari converted it to run on its brand new VCS computer games system. *PCW*'s long-standing Production Editor, Lauraine Danker, actually went to the launch of the cartridge. What an honour!

The Pac-Man arcade machine was then followed by Ms Pac-Man and, more recently, Pacmania.

The basic idea behind Pacmania is simple. Using a joystick, you must guide Pac-Man through mazes which are littered with little dots. As you move along a maze, Pac-Man eats the dots and you collect lots of points. Easy, yes? No. Unfortunately, the maze has some other inhabitants. Inky, Pinky, Blinky and Clyde are four evil ghosts who haunt the mazes and they don't like visitors — especially small, round, yellow ones.

As the player attempts to collect all the dots and gain supreme position in the high-score table, Inky and the gang try to stop them. Should one of the spooks manage to catch Pac-Man they will 'chomp' him and the player loses a life. When all five lives have been lost, the game is over.

To help Pac-Man achieve his goal, each maze contains four power pills. Power pills render Pac-Man with the ability to strike back at the ghosts for a short time. Upon eating one, any ghost giving chase will turn blue and suddenly remember some urgent business over the nearest horizon. However, when the effect of the pill has worn off it will make a speedy return.

Other edible items to be found in the mazes include pieces of fruit and two more special pills: a red power pill that lasts for around five seconds and a go-faster green tablet.

An extra feature in Pacmania not found in the older games is the ability to bounce. At the press of a button you can send the grapefruit with a gob flying into the air. This can be a life-saver when you're cornered by gnashing ghouls.

You can also steer Pac-Man while in mid-air. Just to make life more complicated, though, the green ghosts have the ability to jump on some of the later levels and the purple ones gain Ferrari engines.

When you manage to completely clear a maze of dots, you are transported to the next world. There are four worlds in Pacmania — Block Town, Pac-Man's Park, Sandbox Land and Jungley Steps — and each world looks vastly different from the others. Block Town, for example, is a maze made up of what appear to be pieces of multi-coloured Lego while Pac-Man's Park consists of various sets of railings.

The actual graphic display in Pacmania is a far cry from the original idea. What were once two-dimensional, single-colour mazes are now glorious, multi-coloured, scrolling three-dimensional affairs. They look a real treat, but looks aren't everything. Due to the size and nature of the graphics you can't view the entire playing area, so the ghosts can spring surprise ambush attacks.





The mazes span the entire screen area on the Amiga as the game is set in 'overscan'. Overscan allows graphics to be displayed in what is usually the border area of the screen, which gives the game that arcade look. Unfortunately this is not the case with the other versions, so they don't look quite so polished.

Most of the display moves smoothly — the sprites work very well indeed. The vertical scrolling routine, however, appears to contain a bug. When racing along a vertical corridor in one of the first three worlds the screen has a slight judder to it. This is present on both the Archimedes and Amiga versions of the game. On the Amiga, this is corrected in the fourth world and doesn't happen again. The Archimedes version, however, continues to wobble. Luckily, this is just a cosmetic detail and does not affect gameplay.

Sonically, the game is just as impressive. Three jazzy tunes accompany the frantic action and the effects are true to the arcade version. My personal favourite is the Jungley Steps theme.

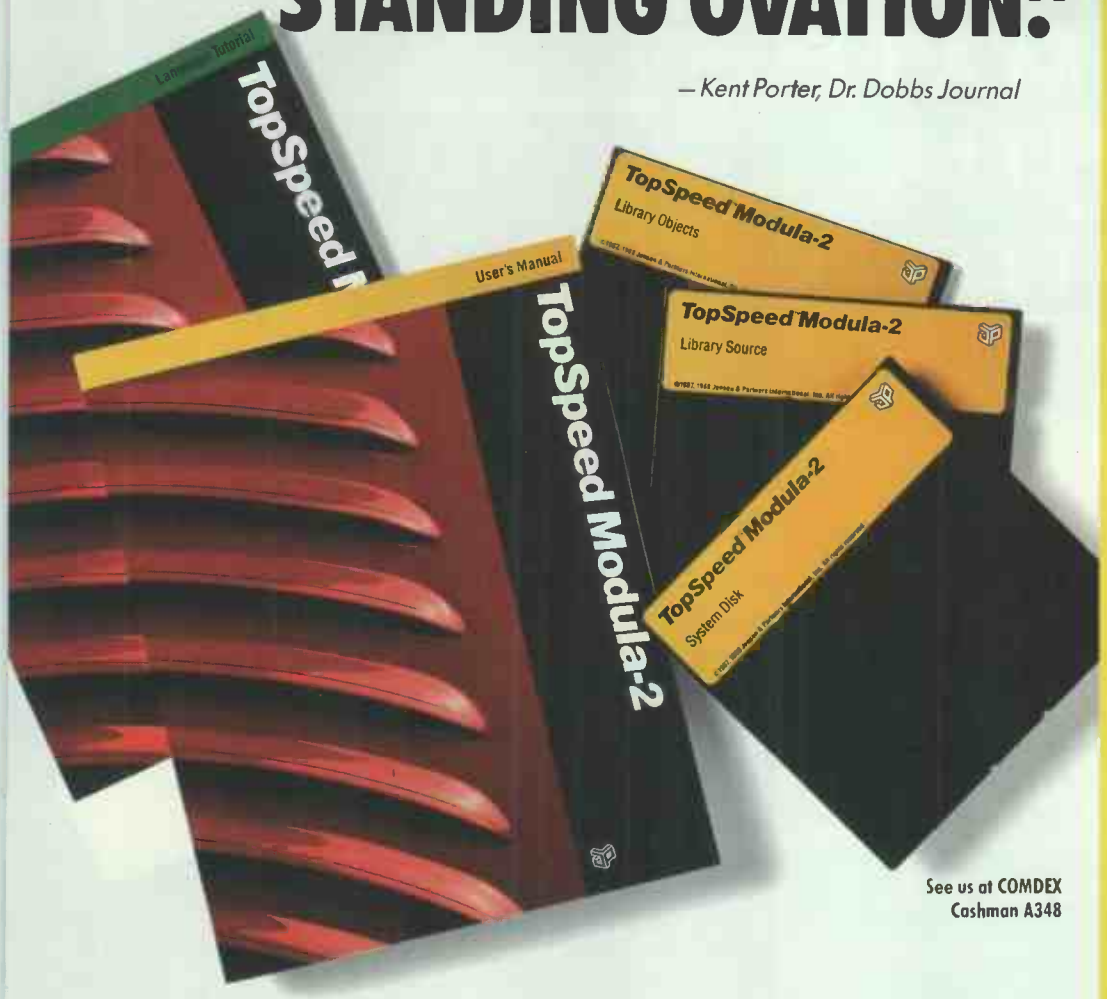
Also included in the Archimedes and Amiga versions are two or three intermission cartoon sequences which pop up occasionally between levels. One such sequence involves Pac-Man chasing a single blue ghost across the screen. Then, suddenly, a hundred ghosts come racing out of the border at him. It's quite funny the first time you see it.

Pacmania is a great little game. It combines all the qualities you expect from a computer game such as smooth, colourful graphics and stereo sound, with the addictiveness, speed and genuine fun of the original. I've put an awful lot of hours into this game and I can see myself playing it for a long time to come. The only real complaint I have is that it doesn't have an 'if the boss wanders past, bring up a word processor' mode so the monitor has to be switched off when Derek goes for a stroll!

Highly recommended. END

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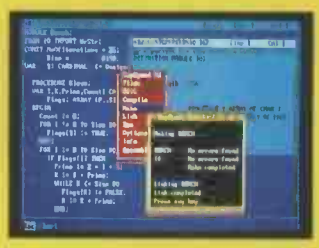
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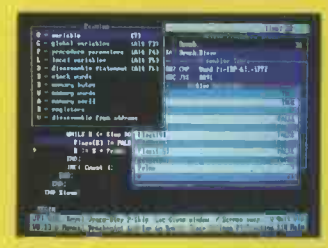
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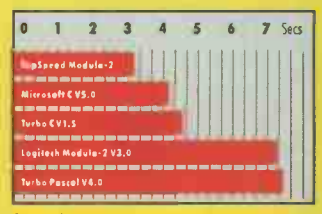
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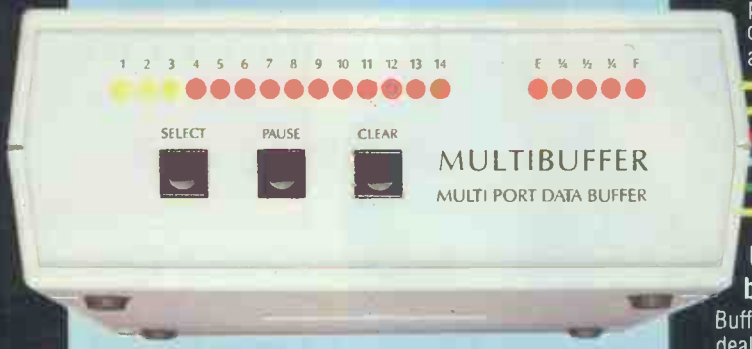
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MULTIBUFFER: THE ULTIMATE PRINTER • PLOTTER SHARER



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.

New: Inter-PC File Transfer

DON'T BUY A NETWORK UNTIL YOU HAVE READ THIS!

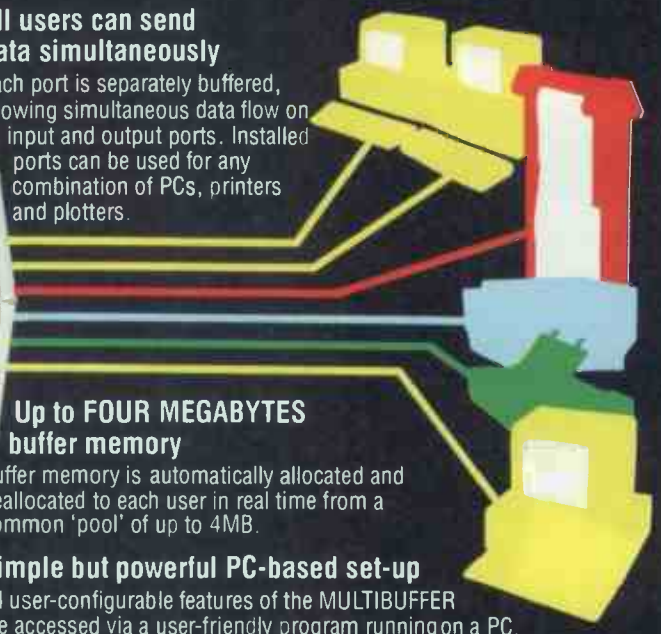
Users can now transfer multiple files of unlimited size between IBM & compatible PCs, irrespective of disk or PC types, with a user-friendly interactive program. The Multibuffer offers these network-like features at fraction of the cost of any network. Serial ports are required.

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

Buffer memory is automatically allocated and deallocated to each user in real time from a common 'pool' of up to 4MB.

Simple but powerful PC-based set-up

All user-configurable features of the MULTIBUFFER are accessed via a user-friendly program running on a PC. No fiddly switches are used. Also, when the MULTIBUFFER is driven from several PCs, each user can activate a RAM-resident pop-down menu for printer selection and other useful functions. Setups are 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 lasers and DTPs such as Ventura or Pagemaker.

The perfect choice for CAD

The MULTIBUFFER can allow THIRTEEN PCs to share a plotter – or 10 PCs to share 4 plotters, and so on. You can now optimise the utilisation of a single high-performance plotter with AutoCAD, Robocad, Cadstar and most other popular CAD programs.

OTHER DATA COMMS PRODUCTS AVAILABLE FROM RINGDALE INCLUDE



MEGABUFFER – Universal Data Buffer

- Reduces computer waiting time while printing/plotting.
- Allows you to use your PC more.
- New battery backup version.
- Compatible with most computers.
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- Software – independent.
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UK Delivery £6 per unit. Cables from £15. All prices excluding VAT. Dealer and Export enquiries welcome.

MULTIBUFFER PRICES

½MB	1MB	2MB	4MB	Serial Card	Parallel Card
£545	£695	£995	£1895	£80	£40

RINGDALE PERIPHERALS

Southdownview Way,
Worthing, West Sussex BN14 8NR
Sales, Tel: 0903 213131
Tech/General, Tel: 0903 213752
Fax: Tel: 0903 204296
Telex: 265871 (REF: JBC 2021)

The learning curve

Mick O'Neil describes the Mac's emergence in the education market and looks at events in the software world.

Although originally marketed as a business machine, the Macintosh has become an inevitable force in education. This may seem particularly surprising when a survey of the field shows a relative scarcity of dedicated educational software. But educational software is based on curriculum structure, goals and methodology, and in most school systems these change and evolve.

Thus, educational software developers have been shooting at moving targets; much educational software is outdated as soon as it's published. Macintosh software developers, on the other hand, have attempted to deliver written communication and information management skills to the lowest level. Their success in the business world has almost inadvertently spilled over into education.

Young students with a few simple lessons in keyboarding can access word-processing functions that are still far too complex on rival systems. Niche software areas like desktop publishing, idea processing and desktop presentations are changing both student and teacher methodology, while Hypercard and CD-ROM could have an enormous impact on our whole information delivery system.

Back to Works

Microsoft Works is considered a 'low-end' integrated package in that it combines word-processing, database, spreadsheet and communications modules in one integrated package and does so in a way that each module seems a subset of a more sophisticated standalone program.

For that reason, Works received rather mixed reviews with inevitable comparisons to power programs like Word and Excel. Some observers failed to notice, however, that each module is sufficient to accomplish what most users want, and that the integrated desktop and overlapping command structure provide an improvement in accessible power similar to the Macintosh System and Finder's improvements on DOS.

Works 2.0 both fine tunes and enhances the original program. Common improvements include a print preview option, a stationery option that allows you to save a group of formats such as font, type, and style and then apply them to other documents, a networking capability, and an option to save a Works Desktop without quitting Works.

MacLink Plus vs Lap-Link Mac

Traveling Software recently upgraded its PC/Mac file transfer system to include built-in translators, a convert international characters option, and a method of transferring text to a Macintosh in text or MacBinary format. At release time the translators are limited to word-processing documents but the company promises a more extensive series of translators in a free update to all registered users.

Impressively, LapLink Mac can transfer data between the Mac and the PC at rates of up to 57,600 baud and includes a cable with connectors for the Mac 512k, MacPlus, Mac SE and II, and both the 9 and 25 PC DIN plugs

MacLink Plus doesn't include as nifty a cable but the transfer software options and translators are far superior. The fact that MacLink uses the Macintosh as a base means that it's much simpler to use than the PC-based Lap-Link Mac.

Scanner in view

I've finally had a chance to use Apple's new scanner and it's pretty impressive. The software that drives it is simple but powerful and the scanner itself behaves flawlessly. Power users will be disillusioned that it only handles 16 shades of grey but I found myself quickly running out of disk space after scanning just a few pictures at this resolution.

For that reason, a scanner might not be useful to everyone. I used mine to copy company forms into FileMaker II to produce perfectly formatted reports, and to set up standard headings and logos for word-processing documents.

Sequence of events

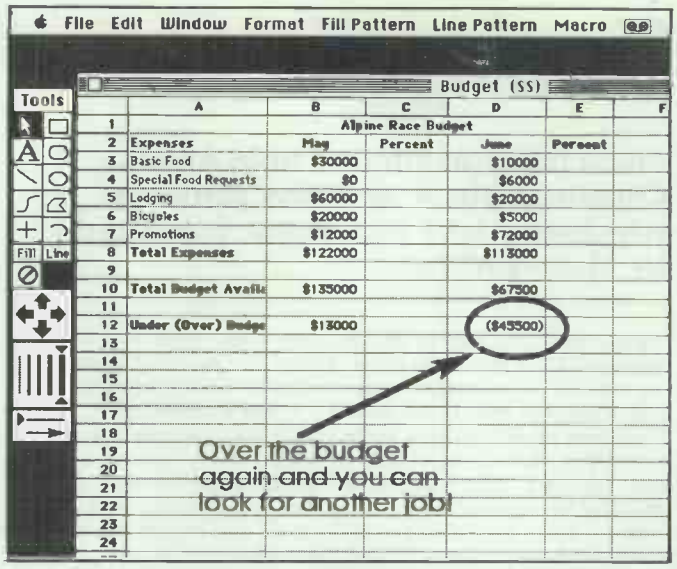
In late November Ashton-Tate shocked the software industry by filing suit against Fox Software, maker of a dBase clone called FoxBase+ and a dBase 'workalike' called FoxBase+ \Mac, claiming Fox unlawfully copied the dBase concept, 'look and feel', programming language, sequence of events, and arrangement of the program as presented to its end-user.

A successful outcome for Ashton-Tate on concept, programming language or sequence of events could plunge the industry into the software dark ages, with suit and counter suit based upon any arbitrary criteria. Small software developers would disappear under the shadow of the enormous legal expenses and lack of competition would slow progress to a virtual halt. On the other hand, FoxBase+\Mac appears to be quite safe as no jury in the world could accuse it of having the 'look and feel', sequence of events, or same concept as dBase, and surely Fox Software must be preparing a similar release for PS/2 compatibles under Presentation Manager.

In the end it may be Ashton-Tate which is forced to emulate the speed and interface of FoxBase+\Mac. Surely, no developer would release software under Presentation Manager that confronts the user with a dot prompt.

Copy protection by any other name

An alarming new trend in the entertainment market is to copy protect software by requiring the user to recall something obscure from a manual or coding device. AFT, the Advanced Flight Trainer from Electronic Arts, asks a question about the size or flying capabilities of a particular aircraft which can only be gleaned from the reference section of the manual, while Mindscape's Colony is a 3D space simulation that asks you to refer to a code sheet which comes with the game. Unfortunately, if you're not the organised type and misplace these items, the software becomes virtually useless.



	A	B	C	D	E	F
1		Alpine Race Budget				
2	Expenses	May	Percent	June	Percent	
3	Basic Food	$30000		$10000		
4	Special Food Requests	$0		$6000		
5	Lodging	$60000		$20000		
6	Bicycles	$20000		$5000		
7	Promotions	$12000		$72000		
8	Total Expenses	$122000		$113000		
9						
10	Total Budget Avail	$135000		$67500		
11						
12	Under (Over) Budge	$13000		($45500)		
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						

Works 2.0 includes new drawing tools which can be accessed from either the word processor or the spreadsheet

Contacts

MacLink Plus
$195
DataViz Inc
16 Winfield Street
Norwalk, CT 06855, USA
Tel: 0101 (203) 866 4944

Lap-Link
£100
Frontline Distribution
(0256) 463344

AFT
Electronic Arts
Tel: (0753) 49422

Colony
$49.95
Mindscape
3444 Dundee Road
Northbrook, IL 60062, USA

Works
Microsoft
Tel: (0734) 500741

Apple Scanner
£1295
Apple Computer
Tel: (0442) 60244

Mick O'Neil is computer coordinator for the US Department of Defence Schools in the UK and a regular contributor to *PCW* and other computer magazines. He welcomes readers' comments on Telecom Gold 72: MAG20370 or c/o *PCW*.

SPECIAL INTERESTS

Showing off

Some items of interest from Atari's Christmas Show, and new software which may take your fancy, presented by Marvey Mills.

'How would you like to win a fortune?' Thus went the opening line of an erstwhile salesman's pitch at the recent Atari Christmas Show. Being a sucker for this sort of sales ploy I was instantly captivated and drooling for more cliches.

The subject of all this excitement was a program called Jackpot 2 ('The power to forecast the pools the way you want to') from Futuresoft. I'd like to forecast wins every time, please. 'Well, it doesn't actually tell you how to win,' said the aforementioned salesman, 'you enter a formula of our own design and the program calculates past wins.' Then you compare this against the true results until your formula is as near perfect as you can make it, then presumably make your 'fortune' by applying the formula to the next fixtures.

Sounds like jolly hard work to me but they said it was selling well (they would, wouldn't they) and that there was a great demand for this type of program. If Ernie isn't your best friend at the moment then this may well be just what you're looking for.

Contact Futuresoft at 8 Pump House, 49 Greenwich High Road, London SE10 8JL.

Atari on show

I know that by the time you read this the Atari Christmas Show will be a foggy memory but I'll tell you what I got up to just the same. Judging by Peter 'Atari do know how to design computers, you know' Walker's (Atari's PR chieftain) comments when I called him a few weeks ago, it seems my little daydreams about a perfect ST of a few months ago may have upset a few people in the Atari camp, so I thought the show would be an ideal place to clarify a few details about the forthcoming laptop ST, the ST Plus and the Transputer Workstation.

Armed with only a notepad and my enthusiasm to protect me I approached the nearest friendly-looking Atari person, introduced myself and waited to be enthralled by tales of wonderful hardware 'in the pipeline'. 'Actually, you probably know more about it than me,' he wailed. 'I read all I know in *CTW* this morning!'

I was incredulous to say the least but I did manage to prise a few titbits from the woebegotten representative. The ST Plus will basically be a souped-up ST or, in the words of Mr Atari Rep, an 'Amiga beater'. It will contain a blitter chip, a custom scrolling chip and a brand new custom sound chip (could this be the long awaited Amy, I asked myself but alas, not him). What's more, it will be 100 per cent compatible with existing ST software!

How then, I asked, would software directly addressing the existing Yamaha sound chip make any noise if it wasn't there? Easy, the Yamaha chip *will* be there, hiding itself away on the motherboard waiting to be POKEd.

If Atari really does manage this colossal feat then it may well have an Amiga beater on its hands, especially since I was told that the price would be 'approximately £100 more than a normal ST'. Can't wait.

We did get on to the subject of the DRAM shortage and Mr Atari Rep took great pride in explaining to me that Atari how has a chip manufacturing plant all of its own in Germany and is producing its own DRAMs and custom chips there. 'Great,' I said, 'so that means you'll be dropping the price of the entry-level 520STFM back to £299?' Silence!

I reminded him that Atari blamed the £100 price hike on the global DRAM shortage and now that it was over (for Atari at least) the company could revert to the original pricing structure, but strangely enough I could not get confirmation on this subject. In fact the price was dropped before Christmas, with the ST Super Pack and 20 games being offered for £399.

I did get a quick look at a prototype transputer workstation running a demo animation program and the colour and resolution were stunning, but I'm not going to comment further until I see something running which is worth the rumoured £5000.



Shopping around at the Atari Christmas Show

Also starring . . .

So much for Atari. The rest of the show was, as usual, generally given over to the software and hardware box shifters vying with each other to unload their stock at bargain prices. I did, however, uncover a few dainty morsels.

Most notable on the hardware front was Vidi-ST, a video digitiser for only £99.95. I saw it running real-time frame grabbing at 50 frames a second in colour (using 16 shades). The software seems fairly comprehensive (although I didn't get a close look) and at that price is sure to be a winner.

Romantic Robot was showing Multiface ST, a ROM cartridge that allows you to 'freeze' a program and save it out to disk.

Built in is a comprehensive set of monitor/debugging tools but at £49.95 it's fairly expensive.

Always one of the most interesting stands to visit at an Atari show is, of course, the Llamasoft stand. Trip-a-Tron, Jeff Minter's latest pride and joy, was the main attraction and Jeff was happily taking it through its paces (until the wide-screen projector broke down, that is!).

The light synthesiser has been an ongoing project with Llamasoft and has appeared in various guises on machines other than the ST. One of my favourite quotes is that Colourspace (as Trip-a-Tron used to be known) is fine but it should really come with a Jeff Minter emulator built in since he can produce a fine display.

Now you can get about as near to that as possible, as Llamasoft has just released Merak, a 50-minute video set to synthesiser music showing just what can be done when you set your mind to it. It used at least five Mega STs with a video mixer and the initial results look out of this world.

Llamasoft did promise to send me one to review so I'll say more when I see it.

Come the revolution

I recently received a little program from HiSoft (of DevPac fame) which should revolutionise the ST. Called Turbo ST, it is in fact a 'software blitter' and replaces key parts of the GEM operating system with fast, compact machine code routines (GEM has suffered in places from being written in C). Judging from the Benchmarks on the back of the manual it even manages to outdo the hardware blitter chip on certain operations.

What you get for your money is faster windows, alert boxes, screen refreshes, drop-down menus and, most important of all, faster text scrolling. It really does work and I urge you to take a look for yourself — the ST seems to whizz along when it is installed.

HiSoft also sent me its new FTL Modula-2 developer's kit which I'll write about in the next issue of *PCW*, together with a world exclusive preview of the innovative Talespin adventure writing software from Microdeal. Also coming up — a serious look at educational software on the ST.

Details can be obtained from HiSoft on (0525) 718181.

Any suggestions for this column in future issues, or any general comments about the Atari ST, should be sent to ST User Stack, PO Box 102, Southend-on-Sea, Essex SS1 2UU.

Casting a spell

The Z88's weak points have been well documented, especially the problems with Pipedream. Guy Swarbrick has found some solutions.

Cambridge Computer's Z88 portable doesn't have many faults. It's reasonably cheap (far cheaper than its MS-DOS based rivals), the battery usage is minimal and, most of all, it's ridiculously light. It is the only portable I have ever been able to use on the coach commuting from Kent to London every day without crippling myself and annoying my fellow passengers, most of whom are trying desperately to get to sleep and could well do without the clacking of keyboards, the whirring of disk drives and the irritating PC bleep.



Z-Term in action, via a Pocket Stradcom modem.

Pipedream problems

The faults may be few in number but they're there alright, and those that *are* there tend to be fairly fundamental ones. The main problem is the built-in spreadsheet cum word processor, Pipedream; and, for most people, Pipedream is the only piece of software on the Z88.

A word processor based on a spreadsheet was never going to be perfect and although the authors had a pretty good try, it is Pipedream more than anything else which lets the machine down. It has been criticised for many things, some of them trivial, but 'features' like not being able to delete back onto the line above the cursor and the difficulty of splitting a paragraph, make using Pipedream for any length of time somewhat less than enjoyable.

One of the less serious criticisms is the lack of a built-in spelling checker. I suspect most people use the Z88 'on the road' and upload the files to a 'real' computer with more sophisticated software. For them, the inevitable higher cost of the base machine might well have outweighed the advantages the spell checker would have brought.

QuickEdit

Ironically, the solution to the Pipedream problem may lie with a spell checker cartridge from Computer Concepts. Spell Master provides a dictionary, a pop-up utility called WordFinder which combines a dictionary browser and an anagram and crossword solver, and adds a new text editor, QuickEdit.

QuickEdit, while in many ways inferior to Pipedream in terms of features, is, in the end, a far more usable program. As I said, I think most people are quite happy using the Z88 for fairly basic text entry and QuickEdit does this very well, with sensible paragraph splitting, deletion and real tabs.

It is also the only way to spell check Pipedream documents. If you're using Pipedream to edit a document (and there are still good reasons to do that — QuickEdit has no maths features, for example, nor does it have emboldening or italics) the procedure for spell checking sounds a little ridiculous.

First you save the file, then exit Pipedream and load QuickEdit. Re-load the file and run the spell checker. When you've corrected the document, you save it again and return to Pipedream where you re-load the file and continue editing.

In practice, because of the way the Z88 keeps multiple applications in memory, the swapping about is more like an over-complex menu system and although it sounds clumsy, you soon get used to it.

One potential problem with transferring files to QuickEdit is that Pipedream's formatting and maths control codes are not used in QuickEdit. The solution is that, although the program ignores Pipedream control codes, it retains them unaltered and re-saves the file in its original state.

QuickEdit's only major handicap is the lack of a word count, a strange omission as it is a natural side effect of a spell checker whose function rather obviously depends on its ability to distinguish separate words within a file.

The solution, for those unwilling to carry on using Pipedream with QuickEdit for spell checking is, of course, to use QuickEdit to enter and edit the text and Pipedream for word counts and tidying up.

The other feature of Pipedream which I thought I would miss in QuickEdit is the excellent page preview at the right-hand end of the screen. Strangely, since I have always maintained that it makes the Z88 usable despite its small screen, I don't miss it.

The spell checker itself is reasonably fast and the dictionary pretty comprehensive (it's got 'Sinclair' in it ...) though it's not particularly good at guessing correct spellings. The anagram and crossword solvers, likewise, do what they do at a reasonable rate: the function of the former is obvious; the latter will find, for example, WARSHIP and WORSHIP given W#RSHIP and CATCHWORD and CROSSWORD given C*WORD. WordFinder can also help if you are unsure of a spelling. Asking it to find a close match for WORSHIP again brings up WARSHIP and WORSHIP.

Spell Master is the best product for the Z88 so far. That is as much a criticism of Pipedream as anything else but nonetheless it is an essential purchase for anyone who uses their Z88 regularly.

Z-Term

When you've finished your masterpiece (or even your *PCW* copy) you need some way of uploading it to a desktop machine and, while there are programs for most machines which enable you to connect directly and transfer files, that's not much use if the machine in question is 4000 miles away (or 40, for that matter).

The answer to this could well be Z-Term from Wordmongers. Now bundled on Superchip 2 with Z-Base (see *PCW*, November 1988) and two games (of which more later) it is the latest version of a comms package that has been around for a while and includes Viewdata emulation as well as normal scrolling text.

Using a comms package on the Z88 can be a real pain, particularly if you frequent bulletin boards where the participants are prone to attacks of verbosity. At 2400 baud a 40-line message on an eight-line screen is not really a viable proposition.

One way around this is to have all the text spooled to a file but, although it is possible to instruct some bulletin board software (CIX, for example) to pause every eight lines, it would have been nice to be able to set Z-Term up to stop the scrolling after each screen of text.

Z-Term also claims to provide Prestel Viewdata emulation. Don't expect, however, to see Prestel pages in all their graphical glory(!). All Viewdata mode does is display text in the correct places and *s or £s in place of the graphics. There's no real reason why it couldn't have been done properly: one of the games on the same cartridge uses bit-mapped graphics, so it is not beyond the capabilities of the machine. That aside, the software works reasonably well, coping with Prestel's Dynamic Pages which can give some software problems. END

SPECIAL INTERESTS

Show me what's new

Chris Cain reports from Commodore's 12th Christmas show.

BBC2 Amiga

Possibly the show's biggest attraction was the announcement of a BBC Micro emulator for the Amiga. Entitled the BBC=Emulator, this program allows the user to run most well behaved BBC software within an Amiga environment (that is, software which does not drive the hardware directly).

On hearing of this product I was sceptical, to say the least. I have seen computer emulators on lots of different machines and none of them have been all they're cracked up to be. Now, having seen this program up and running, I am fully convinced of its potential.

Running on a standard Amiga 2000 under the emulator was a BBC Basic graphics demonstration. A copy of this program was also running on a genuine BBC model B. While the Acorn machine struggled to draw a complex pattern across the screen, the Amiga finished it, coloured it in and went on to the next stage of the demo. The speed difference was impressive.

What was more impressive, however, was the fact that the demonstrator then pulled down the Amiga screen to reveal not one but two more emulators running, each going faster than the original hardware.

The BBC=Emulator runs pure 6502 programs slightly slower than the original machine, but BBC Basic programs can go up to seven times faster. Most software has a mixture of both. It supports all text and graphics modes including Mode 7, the BBC's teletext mode. The program is being aimed at schools, giving them the opportunity to upgrade to more powerful machines without the need to scrap all their existing educational software.

The BBC=Emulator is the work of a specialist software design house, Ariadne. Ariadne is a London-based company which has previously enjoyed only limited recognition in the Amiga world, for work with interactive video applications. Commodore approached Ariadne because it had detailed knowledge of the Amiga, the BBC Micro and of teaching environments; two of Ariadne's founding members are ex-teachers. The choice proved to be a wise one.

When asked about the emulator, leading Ariadne programmer David Parkinson said: 'This has been a fascinating project for us. It's like introducing two of your best friends to one another. The Amiga and the BBC Micro are excellent machines, so it was a pleasure to link them up.'

At present, BBC programs are transferred to the Amiga via a serial link. Ariadne should have it reading BBC disks soon, though. The finished product should be on sale by the time you read this, at £49.95 (or £39.95 for schools). I'm sure the BBC=Emulator will be the breakthrough into the education market Commodore has been seeking for a long time.



Education answer: the Amiga to receive BBC emulation

Key to Genlock

Although Desktop Video (DTV) is popular among Amiga users, many have been put off by the high price of equipment. An Amiga set-up is much cheaper than dedicated hardware, but specialist bits like Genlock have always carried a price of around £300.

Until now, that is. A relatively new company called The Electronic Workshop has come up with a composite video Genlock (full colour) for just £99. Yes, £99. That will certainly please a few people. MiniGEN, as it is known, is a small unit which looks not unlike a TV modulator, and plugs into the RGB output port.

The unit allows you to mix computer-generated images with video signals to create special effects, titling and so on. It does not require any special software and is a doddle to use. Such was its popularity at the show that the company sold all the units it had by 5pm on the Friday. I will be taking a closer look at this product just as soon as The Electronic Workshop can get one to me.

Brighter outlook

Amiga Workbench icons have always been a pleasure to look at. Disks look like disks, Basic listings are shown as small flowcharts and games often have icons which animate when selected. Yet Workbench, although in a resolution capable of displaying 16 colours, is restricted to only four, which is a waste. Just think what icons would look like in sixteen colours!

Icon Paint is a revolutionary new program that lets you create and display Workbench icons in 16 glorious colours. It takes the form of a very small utility which, when run, looks something like a mini version of Deluxe Paint — hence the name.

Many drawing tools are supported, including outlines and filled boxes, circles of a similar nature, lines, text input and freehand. Icons can be anything from a pixel to a quarter of the screen in size. You can even import brushes for packages like Deluxe Paint.

All that is needed to use these newly designed icons on a standard Workbench disk is a pair of files which can be quickly copied from the master disk. When these are placed in your start-up sequence, your Workbench will take on a whole new image.

Icon Paint is available from Hi Tension and costs £14.95.

Contacts

Ariadne Software
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Dippen
Brodick
Arran
Scotland KA27 8RN
Tel: (077082) 234

The Electronic Workshop
Queensway Business Centre
Brigg Road
Scunthorpe DN16 3RT
Tel: (0724) 281317

Hi Tension
Alexander House
Station Road
Aldershot
Hants GU11 1BQ
Tel: (0252) 344454

Cain Comments

PD or not PD — that is the question

A number of Amiga public domain libraries have been set up to allow users to access the vast amount of free software floating about. Two of the best known distributors are George Thompson Services (famed for the disk magazine *Jumpdisk*) and 17 Bit Software.

Both of the above had stands at the show, and both were doing a roaring trade. In fact, I purchased a 'Best of Public Domain' software pack and a 'Mega Demo' collection from GTS. The PD pack contains nine disks full of useful programs, utilities and games. At £19.99 I thoroughly recommend buying a copy.

The Mega Demo pack concerned me, though. It has some clever demos, some of which have to be seen to be believed, but it also has a lot of music on it.

And this music comes from commercial software. The Compact Hi-Fi disk was one example, containing a program which played five different pieces of music, two of which I recognised as being from games I had played.

I must admit, I do like having the tune from Electronic Arts' Fusion pounding away as a background task, but I wonder if GTS has the right to sell it. If it has the all-clear from software houses then that's fine, but is that likely?

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PROGRAMMING

No comparison!

Following last month's challenge, Andy Redfern sets another in his article on file comparison. Meanwhile, certain programming books seem to be helping him with his MSc. This month's programs include a picture dissolving algorithm and new batch file techniques; the BSI columnists look at language standards (among other things), and in SubSet the heapsort receives David Barrow's close attention.

Program File, like all things, has to be regarded as an evolutionary part of the magazine. This is for the obvious reason that just as the computers you use change, programming techniques change and so do the languages we program in. In the last year Program File has changed dramatically to cater for the needs of users and programmers alike.

From the feedback I have been receiving, most of you seem to like the new direction in which Program File is going, but the changes will continue to make it even more useful as a programming resource. If you have any good ideas about the way in which Program File should progress, or you just want to air your views on what you like or what you don't, then get in touch either electronically or by snail mail.

In case you're sceptical about whether I actually listen or not, the two ideas for Program File I'm about to introduce were suggested by readers. Admittedly I made them contribute the material needed to prove their ideas would work, but I don't think they'll complain, as all contributors to Program File get paid at the usual *PCW* rates.

Firstly Graham Robinson from the Cleveland ITEC, a regular contributor to Program File and other programming journals, suggested that we should include a regular column called 'Making use of:'. This column will carry your tips and tricks on how to get the most out of the languages and operating systems you program in. They will be simple tips that anyone can use and will help to improve the programs you write.

In this month's issue, he considers a couple of examples how typed constants in Turbo Pascal can be used. He explains why Borland should have used true initialisers and didn't, but they did provide a useful feature for programmers to use instead.

Secondly Richard Drake from Objective Computer Systems suggested that a series on object-orientated computing would be a valuable reference and starting point as the languages we use change in the next few years. Object-Orientated Programming Systems (OOPS) allow development speed and system security to be enhanced. There are also gains to be had in using more advanced compilers and languages. In this three part series he will be looking at three specific areas of object-orientated programming.

To begin with, in the first two parts he will explain the concepts that lie behind object-orientated programming in C++. C++ is an extension of the C language that has gained a great deal of publicity in the last year due to rumours of products from Microsoft and Borland, and the launch of a budget C++ compiler from John Haggins at Zortech (See the July 1988 issue of *PCW*).

Finally, in the third part, Richard Drake will be explaining about a practical implementation of a C++ system. In fact, he has been commissioned by Zortech to write the Database Class Library for Zortech's C++ Tool Kits and he will be explaining the pitfalls and the advantages of undertaking a large project in C++. Many of the criticisms aimed at OOPS are connected with the fact that most professionals see them as research toys without any benefits for large programming projects. In this series he'll be explaining how real projects are done and what to watch out for.

Also in this month's Program File are the regular features and a selection from the best programs and programming ideas I was sent this month. In the BSI column the team are looking at standards for languages and C compilers. The Disk Library listing contains some new disks for the Atari ST and the PC while this month's flood of books contains a number of excellent technical references.

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Guidelines for submissions to Program File

PCW is interested in publishing programs, programming tips and hardware modification ideas. Submissions should be sent in for any popular home or business micro and programs can be written in any of the major programming languages. Include *printed, double-spaced* documentation and a *dark single-spaced* listing. Where applicable a disk or tape copy of the program and documentation should also be supplied.

The listing should be no more than 80 characters wide and, if possible, a sample output from the program should be included. Ensure all items submitted are marked with your name, address and daytime telephone number. Also the exact type of machine used and the program's minimum hardware requirements should be clearly explained.

All programs submitted (unless explicitly indicated) will also be eligible for inclusion in the Disk Library. A royalty of 50p per disk is charged and this is divided between all the writers of the software contained on the disk sold.

Check through previous issues to see the type of programs we usually publish. Both original ideas and new implementations of tried and tested techniques are welcome. The programs should be well written and simple to understand. If the program is short it may be printed in full but longer programs will only be available from the Disk Library. All programs should be fully debugged and your own, original, unpublished work. You may use routines from programs already published but acknowledgement must be included.

Hardware submissions must include a complete, double-spaced explanation of exactly what you've done, the approximate cost and any dangers involved, such as invalidating manufacturer's warranties.

We try to return all submissions but you *must* include a stamped addressed envelope of a suitable size. Programs and documentation are paid at the rate of £50 a page, plus a bonus of £50 for Program of the Month.

Send your contributions to: Andy Redfern, Program File, *Personal Computer World*, VNU House 32-34 Broadwick Street, London W1A 2HG.

File comparison utilities

Comparing the contents of two files is a task I perform regularly. Whether it be to check an .EXE file hasn't become corrupted or to prove that the latest version of my Reflex database conversion and global update program has worked successfully, I always feel very dissatisfied by the file comparison tools that are available. Most utilities perform a very simple byte-for-byte comparison. This is fine for checking that two files of equal length are exactly the same, but that isn't always how things are.

Let me explain the problems the standard utilities fail even to recognise. Firstly the files might be of unequal length. If the file comparison program simply returns the message 'Files are of unequal length', I've been told nothing that I couldn't have figured out myself simply by executing a DIR command and comparing the file sizes myself. In fact, it was probably the fact that they were of different lengths which prompted me to compare their contents in the first place. And just because the files are of different lengths doesn't mean I don't want to know what the differences are — I may be performing the file comparison to find out what has been added to one file, so it can be changed when compared with the other.

Getting in touch

If you want to send me material for publication such as letters, book reviews, product reviews, programs, hardware projects or simply your comments, I can be reached in a number of ways. Please, wherever possible, send programs and their accompanying documentation by post, as this makes it much easier to deal with. Any other communication, however, can be sent by whatever manner is convenient to you.

On the Compuserve Information eXchange (CIX), I'm registered as 'aredfern'. You can either send me a mail message or put your comments in the 'prog.file' conference. Prog.file is a topic of the *PCW* conference where, you will also find discussion about a number of issues, including the Benchmarks.

On Telecom Gold I can be contacted at the mailbox address 83:vnu201. If you are in the US I can be contacted on the Source at the mailbox address BEK303. Telex messages should be sent to the VNU telex machine, 23918 VNUG and addressed to me personally.

Finally, if all else fails you can send your submissions to me at the usual *PCW* address — Andy Redfern, Program File, *Personal Computer World*, VNU House, 32-34 Broadwick Street, London W1A 2HG.

The second problem comes when a single byte has been added in the middle of the file. For example, I may have created a database file with records in it. The program I'm testing should add a single byte to the first record, but appears to add two bytes. To find out where the bug is, it would be helpful to know where in the file the second character has been added.

Simple, you think — compare the two files and the two extra bytes will be marked as not being the same, the program will tell me the offset from the start of the data file and I can begin to trace the bug in the source code. Wrong.

What actually happens is that the file comparison program flags everything as being OK until it finds the first of the added bytes. It then reports every byte after that as being different, because from a strictly logical point of view they are. A long stream of bytes fly past, scrolling up the screen — and spotting where the next added byte occurs is more than a little tricky.

```
Figure 1(a)
Contents of source file

RECORD1,RECORD2, ... ,RECORD64, ... ,RECORD128


Figure 1(b)
Contents of modified file

RECORD1*,RECORD2, ... ,RECORD64*, ... ,RECORD128


Figure 1(c)
Screen output from a 'standard' comparison utility

Offset      File 1      File 2
8           ,           *
9           R           ,
10          E           R
11          C           E
12          O           C
.           .           .
.           .           .
558         ,           4
559         R           *
560         E           ,
561         C           R
562         O           E
.           .           .
.           .           .
End of File reached  1156 differences found

Figure 1(d)
Screen output from ideal comparison utility

8           ,           *
Resynchronised File
559         ,           *
Resynchronised File

End of File reached  2 differences found
```

Fig 1

As you can see in the example shown in Fig 1, the program is logically correct in what it shows in (c), but it would be far more useful if it resynchronised the files as shown in (d). Once it hit a single extra byte, it simply checked to see if the following bytes could be resynchronised with the file that was intact. If it finds that it can resynchronise, it should indicate what it has done and then continue the comparison.

Fig 2 is a pseudo-code listing of the logic behind such a program. In a practical implementation it would run much quicker if the files were compared using block reads rather than byte reads.

```
Character a=0
Character b=0
integer offset=0

While not EOF
  repeat
    offset=offset + 1
    Read (a,first_file)
    Read (b,second_file)
  until a<>b
  report_difference()
  check_synchronisation()
endwhile
```

Fig 2

Of course, the program would need to be a bit cleverer than that. The distance it checks for a resynchronisation should be switchable, as should the resynchronisation feature itself. This is because if we searched forward 128 bytes for every byte that is different, the program could slow down unreasonably.

Also the length of search forward for a resynchronisation is directly related to the programming task you're involved in. If you're working on a computer that stores data in 128-byte blocks then, if you are searching for a block being inserted in a file, you will need a forward search value of 136 bytes — 128 bytes to clear a duff record and 8 bytes to check if the file has resynchronised. In fact the 8 bytes we've specified here should also be a variable value called the 'confirmation accuracy'. If the file contained a lot of similar data then a longer confirmation accuracy would be needed to guarantee that a resynchronisation has occurred.

Finally the order in which files are specified is also important, as the result of comparing A with B (instead of B with A) will produce a different output. A pseudo-code listing of a practical resynchronisation loop is shown in Fig 3.

```
Check_resynchronisation()

integer runlength=0
boolean resync = FALSE
const confaccuracy = 8

while not resync
  read b
  if a = b then runlength=runlength+1
  else runlength = 0
  if runlength > confaccuracy then
    resync = TRUE
endwhile
return (resync)
```

Fig 3

Although this is my main criticism of the utilities I currently use, there are some other features I can cope without, but which would certainly be nice to have as extras. For inst-

ance, the ability to work in text, hex, octal or even binary mode so that, whatever the file contained, the output would be useful to me. Another handy feature would be the ability to merge the two input files into one new file, where all the common data was included, all additional data in each file was included, and where the data that conflicted could be specified as having a higher precedent from a selected file.

This way a database file could be merged. The common records would be added untouched. The records that were only in one file could be included in the output file. And the data that was different in both files could be set to be taken from only one of the files. Now that would be handy when I've made updates to two copies of the same file! (And just think of it — no more network conflict errors!)

Challenge

I and other people I've talked to want this utility (or an even better one). I'm therefore making this the second prize program of 1989 (the first was mentioned in the January issue).

What I want is for you to implement your perfect file comparison utility in any language you choose, on any machine you choose. I will judge the entries and make the best Program of the Month in the June issue.

Not only will the winner receive the usual remuneration for submitting Program of the Month, but there will also be a special prize of a years' free subscription to *PCW* (oohs and ahhs all round as everybody staggers at Andy's generosity!).

I will try and publish a selection of the best runners up. The closing date for entries is 24 March 1989. Good luck!

Programming books

PCW Machine Code

No, not a book about the assembler code I've written for *Personal Computer World*, but how to program in assembly language on one of the 8000 series machines from Amstrad. It really is quite a neat book, with a simple introductory section that should allow most people at least a chance to dabble.

As well as handling how to program the Z80, it handles some of the ways of accessing the more quirky aspects of these machines. It looks at the printer, RAM drives and how to use CP/M calls directly from assembly language.

This is exactly what PCW8256 *et al* owners need to get them started in Z80 assembly language and, as the machines come with an assembler and debugger as part of the bundled software, it won't cost you an arm and a leg to get started.

I only saw a proof copy, but this book will be available soon: I'll put it in the Booklist box when it is.

More Peter Norton

Peter Norton is one of those people you love to hate. You appreciate the books and programs produced by his company, but why does his picture have to adorn them all?

To be fair, the original incarnation of this book is probably what made him into the guru he's supposed to be. The original *Guide to the IBM PC* was the first book to lift the lid of the PC and explain what it contained in a more sensible language than the IBM *Technical References* (IBM being a big company that became famous despite the efforts of the Plain English Society). And because it was first, it sold 300,000 copies.

But just because it was the first doesn't mean it was the best — in fact there are far better books than the original now available. To counter this loss of the leading edge, Peter Norton and Richard Wilton (who probably did all the work) have released the new improved version.

The new *Peter Norton Guide to the IBM PC and PS/2* simply adds some more detail to one or two items and brings the book into the late 1980s. Apart from that, little of the content has really changed, and after being spoilt by the quality of technical information from Ray Duncan, Richard Ferraro and Joerg Mayer, the book seems fairly tame.

If you're looking for a friendly front end to the *IBM Technical References* then it will certainly suffice, but it definitely isn't the best technical introduction or advanced programming guide for the PC.

EGA and VGA Programming

Richard Ferraro's book is excellent. This is a well written guide that takes you from display technology to directly programming the EGA and VGA registers. It explains everything from Bresenham's straight line drawing algorithm to using the horizontal pixel panning register.

Each item of the two standards covered is fully documented with an accompanying assembler or C listing. If you're having problems programming a display, then this could well be the book to buy in the January sales. The best recommendation I can give it is that I'll probably get through my Masters Degree because of it.

My only whinge is the price of the supplemental toolbox disk. Not only does it cost $24.99 (and you thought the *PCW* Disk Library was extortionate!), but the postage and packaging adds another $24 to the price. One has to assume it will arrive hand-delivered by Federal Express.

The full titles and ISBN numbers of the books mentioned, and other books that came into the office this

Booklist

The New Peter Norton Guide to the IBM PC and PS/2 by Peter Norton and Richard Wilton. Microsoft Press, 1988: ISBN 1-55615-131-4; £19.95.

Programmer's Quick Reference to Essential OS/2 Functions by Ray Duncan. Microsoft Press, 1988: ISBN 1-55615-177-2; £7.95.

Quick Reference Guide to MS-DOS Commands by Van Wolverton. Microsoft Press, 1988: ISBN 1-55615-182-9; £4.95.

Programmer's Guide to the EGA and VGA cards by Richard F Ferraro. Addison-Wesley PC, 1988: ISBN 0-201-12692-3; $26.95. *The companion toolbox is available on disk for* just *$48.99 mail order from the USA.*

Mastering Turbo Pascal 5 by Douglas Hergert. Sybex, 1988: ISBN 0-89588-529-8; $21.95.

Introduction to Pascal including Turbo Pascal, 2nd Edition by Rodney Zaks. Sybex, 1988: ISBN 0-89588-533-6; $22.95. *Includes support for Turbo Pascal 5.*

Supercharged Graphics, A programmer's source code toolbox by Lee Adams. Tab Books Inc, 1988: ISBN 0-8306-9259-9; $19.95.

Programmer's Guide to the Hercules Graphics Cards by David B Doty. Addison-Wesley PC, 1988: ISBN 0-201-11885-8; $24.95.

Microsoft QuickBasic Programmer's Toolbox by John Clark Craig. Microsoft Press, 1988: ISBN 1-55615-127-6; £21.95.

Experiments in Artificial Neural Networks by Ed Rietman. Tab Books Inc, 1988: ISBN 0-8306-9337-8; $16.95. *This book is amazing, and deals with every aspect of neural networks from programming them to growing neurons on the surface of a 68000 processor!*

month, are listed in the box opposite.

It is worth noting that many of these books are in a second or third edition. This means you can't expect there to be price reductions as shops clear the old stock. So if you're not too bothered about getting the most up to date information then now is probably the time to buy.

Correspondence

When 'Computer Answers' was cut as a section in the April 1988 issue of *PCW*, I promised that I would continue to support any technical queries that were sent in. Here is this month's selection of questions and answers.

If you are having problems with hardware or software, don't hesitate to get in touch with me and I'll try to sort out where the problem lies. (Perhaps we ought to rename this the section as *PCW's* Problem Page?) Also, if you don't think my answer is good enough or you know a better way of tackling the problem discussed, send in your solution and I'll publish it as an updated answer.

VGA Palette

I have just purchased a Video Seven VEGA VGA card. I bought the card so I could use the 256,000 colour palette, but I don't seem to be able to access it from any of my programs. Also, in mode 19 (320×200 pixels), there are 256 colours available but they don't seem to follow any pattern. It seems to be fairly random in the way that colours are assigned to each number. Can you shed any light on this?

Simon Lewis

When a VGA card boots up, it fills the look-up table with a default selection of colours from the palette. To keep compatibility with previous video cards, the first 16 colours are the CGA text colours and the next 48 are EGA extended colours; then, above that, a selection of other colours is loaded.

Changing the palette is very simple and only requires a single DOS interrupt call to be performed. It can also be achieved by writing directly to the correct port addresses, but this is not recommended as it may not be very portable. You can use assembler to make the interrupts set the palette colours, but the example I've included is written in C.

The union REGS is available in most versions of C on the PC but isn't always called REGS. Check out the header file DOS.H to find out. The colours themselves are generated by setting different quantities of red, green and blue. For example, to get a 256-band grey scale simply set each RGB value to be the same. Now colour 0 (red=0, blue=0 and green=0) will be black and colour 255 (red=255, blue=255 and green=255) will be bright white.

```
/*Define the 3 palettes */
#define  P_RED     0
#define  P_GREEN   1
#define  P_BLUE    2

/*Assign some storage to hold the palette */
int palette_table[256][3];

/*This routine reads the contents of the current VGA palette
  into the palette_table.  Note there is no checking to see
  if a VGA is actually present.
  Call with: nothing
  Returns: nothing
*/
read_palette() {

     int color=0;
     union REGS r;

     while(color++<256) {
          r.x.ax=0x1015;      /*8086 AX register */
          r.x.bx=color;       /*8086 BX register */
          int86(0x10,&r,&r); /*Call interrupt 10 */
        /*read the results into the palette */
          palette_table[color][P_RED] = r.h.dh;
          palette_table[color][P_BLUE] = r.h.cl;
          palette_table[color][P_GREEN] = r.h.ch;
     }
}

/* This routine only sets a single colour in the look up
   table.  Simply include a loop if you want to fill the
   whole table up.
*/

write_color(int colorno)  {

     union REGS r;

     r.x.ax=0x1010;      /*8086 AX Register */
     r.x.bx=colorno;     /*8086 BX Register */
     r.h.dh=palette_table[colorno][P_RED];
     r.h.cl=palette_table[colorno][P_BLUE];
     r.h.ch=palette_table[colorno][P_GREEN];
     int86(0x10,&r,&r);  /* DOS interrupt 10 */
}
```

How to set VGA palette colours using interrupts from C

The union REGS is available in most versions of C on the PC but isn't always called REGS. Check out the header file DOS.H to find out. The colours themselves are generated by setting different quantities of red, green and blue. For example, to get a 256-band grey scale simply set each RGB value to be the same. Now colour 0 (red=0, blue=0 and green=0) will be black and colour 255 (red=255, blue=255 and green=255) will be bright white.

Accurate Timing on the PC

I am a research student working on a project which requires a large amount of data to be input into the computer through an A/D converter. The sampling rate we use is 5ms. Is there any way for a PC to record the exact time of the sample?

I tried using the MS-DOS system clock, but this only seems to be able to give accuracy of around ±20ms. I also tried using the real clock but that only appears to be updated every second. Do I need to install another real-time clock in one of the free slots?

Steve Roberts

You are correct about both the real time clock and the PC system clock. They will not give you the accuracy you require. You basically have two solutions — one hardware and one software.

The hardware solution is to use one of the other channels of the A/D converter to read a ramp voltage. Generating a ramp voltage only requires a simple circuit and would provide a way of checking the time as accurately as you can switch channels on the A/D converter.

Set the ramp generator to swing between 0 and 1 volt every second. Then each time you read the sample in, read in the ramp voltage as well and, by dividing its value by the maximum ramp voltage (1 volt) a reading in milliseconds will be provided. This will only work if your sampling rate is often enough to be able to count each time the maximum is reached so you can measure the time elapsed.

Although the hardware solution above would work, I think a software solution would be much neater. The PC contains a timer chip with three channels. Channel 0 is used to generate the memory refresh timing, and if you don't let it refresh your memory it will begin to 'forget' things, so it's best not fiddling with it.

Just as an aside, you can make your computer run much faster by reducing the refresh rate. Many manufacturers not only set the refresh rate for the fastest possible RAM, but include a quite unreasonable margin for error. So if you reduce the refresh rate you can make the computer run much faster. But beware, it only takes one bit to flip its state and the whole system can crash.

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Channel 2 is used by the sound output chip for the frequency of the beep, and although it can be changed to modify the beep, it doesn't help us much with more accurate timing.

Channel 1, on the other hand, is used by the PC to update its system clock. Every 18ms it adds one to 32-bit number stored in the BIOS data segment. This number is then converted into the usual time format. Simply by writing to the timer control port, it is possible to make the timer interrupt the PC even more often. This will then facilitate more accurate timing, although it does have a nasty side effect — the system clock will be speeded up.

The solution to this is therefore to set the timer to generate the interrupt every millisecond: each time you're interrupted, increment your own clock byte. Then every 18th time you're interrupted, call the system clock interrupt. (See page 145 of Peter Norton's new book for details.)

One final point is that even if you can get the timer to run faster, if another interrupt interrupts and performs a large number of instructions, the accuracy is once again lost. So for a definite solution with little margin for error the ramp voltage would be more accurate, despite being less elegant.

Changing the printer assigned to PRN

In the December issue of *PCW*, I published a letter from a reader who wanted to know how to switch the default printer, PRN, from LPT1 to LPT2. I mentioned at the time that the only way it could properly be done was by messing about in the system BIOS data area. This is how.

All you need to do is swap the two addresses that are stored in the BIOS. Simply read the address pointed to LPT1 and then read the address pointing to LPT2.

Then write each back to the other's port. Now whenever DOS sends data to PRN and therefore LPT1, it will instead be sent to LPT2. Of course, running the program again will simply restore the two printer ports to their original states.

The address of LPT1 is stored in the BIOS data segment (0040H) at 0008, while LPT2 is stored at 000A.

Using the information I explained in the September issue, it would be very simple to create a TSR printer swap program in assembler. The following listing is written in Turbo C but could be simply converted into other versions of C or other languages. I've checked it works with all versions of DOS higher than 3, but if you want to use it with version 2, do take care.

```
#include <stdio.h>
#include <dos.h>

#define lpt1 0x0040,0x0008  /*Address of LPT1 in BIOS */
#define lpt2 0x0040,0x000A  /*Address of LPT2 in BIOS */

main() {

    unsigned int  printer1;   /*Storage for addresses */
    unsigned int printer2;

    printf("\n\n");
    printf("PRN is now working with other printer!!");
    printf("\n\n");

    printer1 = peek(lpt1);  /* Get LPT1 address */
    printer2 = peek(lpt2);  /* Get LPT2 address */
    poke(lpt1,printer2);    /* Write LPT2 to LPT1 -
    now PRN */
    poke(lpt2,printer1);    /* Write LPT1 to LPT2
}
```

Changing PRN from LPT1 to LPT2

This month's programs

This month's selection of programs has an unusual mixture of discussion, pseudo-code and short listings.

The picture dissolving algorithm by Charlie Dancey is a neat idea for making your programs look more professional. It requires a little study to work out exactly what is going on, but it definitely works, — I've used it.

Sending listings in pseudo-code form, whether as a complement to a full listing or not, makes it far easier for people who program in a different language (or on a different machine) to gain some insights from your ideas.

'Creative batch file techniques' explains how to get the most out of the world's slowest interpreted language — the MS-DOS command line interpreter. This article takes you from the simplest batch file right through the commands available. It makes use of the What command available from Microsoft; there are many other commands available in the public domain, like Ask.Com.

The Find command is an enhanced version of one I published last year. This article is of some interest as it explains how to write machine code on a Psion. We would have liked to include more details about how to use machine code, but unfortunately we are restricted by non-disclosure agreements.

Object-Orientated Programming in C++

by Richard Drake

It's a well-known quip that you can always spot a group of computer experts — because they'll be disagreeing with one another. In the old days they'd no doubt have been disagreeing about what was the best programming language. Nowadays, as likely as not, they'll be disagreeing about whether somebody's favourite object-orientated language is *really* object-orientated at all.

The fact that there are as many different definitions of object-orientation as there are computer experts does little to help the average programmer make sense of this exciting but jargon-ridden area of software. But before the marketing experts spread the confusion to everyone, including themselves, there are some very cheap ways of gaining experience of object-orientated programming — and one of the most popular looks like being AT&T's successor to the C language, C++.

Now I happen to believe in object-orientated languages, having used them for over four years, and as I think that C++ is a genuine object-orientated language, I'm excited about the prospect of it becoming widely used. I have to admit, though, that my experience of C itself could be written on the back of a smallish postage stamp, so apologies in advance to C gurus if anything that follows offends you. (Come to think of it, if you like C's cryptic syntax you would probably compliment me on getting a full-featured C program onto a postage stamp.)

In this article I'm going to concentrate on introducing the object-orientated facilities of C++, and at the end I'll make a few controversial comments on the implications of C++ for how we're going to program computers in the next few years. As I'm likely to be involved in a large C++ programming project in the next few months I may well be back to tell you more of the nitty gritty detail in future articles.

Although software is meant to be soft, anyone who has programmed anything larger than good old Eratosthenes' sieve to produce the first 100 prime numbers (as if we didn't know them already) knows that in practice it isn't. It may be to the person who wrote it, just after they wrote it (or, if they're very talented, the next week) but give the source code to someone else months later and ask them to make a minor change . . . and there's a good chance that either you won't see them again, or worse, you won't see your system working again.

I call this kind of system 'brittleware'. It's not soft, in the sense of being mouldable into any desired shape, yet it's not totally unchangeable; it's just that if you try to change it very much you have a high chance of breaking it altogether. And I happen to believe from experience that if anything can save us from having to pay for the construction and breakdown of brittle software systems in the future, the best answer on the horizon is object-orientated programming, just like it's possible to do in good old C++.

So what *is* object-orientated pro-

gramming? The minimum requirements for a language to be object-orientated, in my book, are two things: *encapsulation* and *inheritance*. Before the jargon numbs the brain, let's take a look at how C++ provides each of these mechanisms.

C++ introduces the notion of *class* into C (in fact it used to be called 'C with Classes') but as a C++ struct(ure) is more or less the same as a class, let's talk about structs for the moment. A C++ struct differs from a C struct in that it not only has member *fields* (that is, data such as integers, strings and user-defined types), but it can also have member *functions*. For example, assume we want to define a bank account. A C definition might be (conveniently ignoring size limits on identifiers):

```
struct bankAccount {
        char*   name;
        date    dateOpened;
        long    overdraftLimit;
        long    balance;

and there might also be functions to deposit and withdraw money which would be used as follows:

bankAccount   myAccount;
long          salary;
long          weeksCash;
...
deposit(myAccount,salary);
withdraw(myAccount,weeksCash);
```

In C++ the equivalent code would be:

```
struct bankAccount {
        char*   name;
        date    dateOpened;
        long    overdraftLimit;
        long    balance;

        void    deposit(long amount);
        void    withdraw(long amount);
};
...
bankAccount   myAccount;
long          salary;
long          weeksCash;
...
myAccount.deposit(salary);
myAccount.withdraw(weeksCash);
```

Deposit and **withdraw** are now 'member functions' of the struct **bankAccount**, which means that any variable declared as a **bankAccount** will 'know about' these functions but variables of other types won't know anything about them (unless they too have identically named functions declared in their struct definition, but we'll look at that important point a bit later).

Encapsulation is a lot more than the 'privatisation' of publicly-owned functions into member functions owned by a single type (fashionable though such an idea might be in the current political climate). Like most really good ideas in software, its power only becomes apparent when you try to build something really big or complex. But in any case I claimed that a language like C++ is fully object-orientated because it has encapsulation *and* inheritance. So let's look at inheritance before we decide if encapsulation is worth having.

Assume that we have just opened a deposit account for the extra money we've earned as an object-orientated programmer and want the program referred to above to cope with this. A lot of our work defining an ordinary bank account seems like it should be applicable to a deposit account, and happily inheritance allows us to take advantage of this, as follows:

```
struct depositAccount : bankAccount {
        float   interestRate;

        long    interest(int numberOfDays);
};
```

The colon signifies that **depositAccount** is a derived struct (or class) of **bankAccount**, and this means that any **depositAccount** will automatically inherit both the member fields (such as balance) and the member functions (such as deposit) from **bankAccount**. In other words, in the following extract from our program:

```
depositAccount   myDepAccount;
long             salary;
...
myDepAccount.balance
            +=myDepAccoutinterest(30);
myDepAccount.deposit(salary);
```

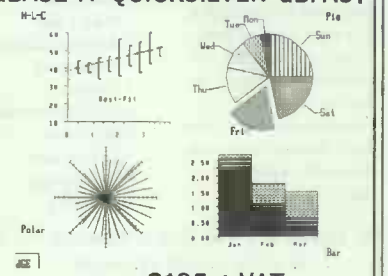
myDepAccount knows about both the member field balance and the member function **deposit()** defined for **bankAccount**. In a real system, of course, there would probably be member functions to work out the monthly interest in **depositAccount** and provide other facilities, but this simple example is meant to illustrate both the way inheritance works and how useful it can be in building programs that will change gracefully with a changing world.

My examples have used C++ structs, rather than the very similar but slightly more sophisticated classes, because I wanted to emphasise how well Bjarne Stroustrup, the designer of C++, has managed to disguise a brand new object-orientated language in the familiar old clothes of a much less powerful language, C.

In fact, classes add just one important facility to C++ structs, and that is the ability to protect certain member fields and functions from being used from outside the class — these are implicitly declared as private by being listed before the public members of the class.

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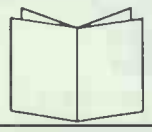


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For example, the **cumulativeInterest** field is a private member (is this beginning to sound too political?) in the following alternative definition for **depositAccount**:

```
class depositAccount : bankAccount {
        float    cumulativeInterest;
public:
        float    interestRate;

        long     interest(int numberOfDays);
};
```

This facility is called 'information hiding' and can be enforced very effectively using classes rather than structs in C++; although if you're a newcomer to object-orientated concepts as a whole I suggest that it's much more important to get to grips with encapsulation (structs and classes having functions as members as well as fields) and inheritance (derived structs or classes) than information hiding.

Having said that, nobody in their right mind should use structs for long in C++, as classes give you everything that structs do plus the private/public distinction, and that is well worth having once you're familiar with it. So for the rest of the article I will abandon all pretence of nostalgia for the old C name and refer only to classes.

Although we've covered member functions and derived classes, there's one vital ingredient missing that makes these mechanisms really earn their keep — 'virtual functions'.

Let's say that in our home banking system we want to include a facility to forecast the amount in a bank account a given number of days in the future. One way to do this would be to subsequently define a virtual function, **forecastAmount()**, in **bankAccount** and redefine it in **depositAccount**:

```
class bankAccount {
public:
        char*    name;
        date     dateOpened;
        long     overdraftLimit;
        long     balance;

        void     deposit(long amount);
        void     withdraw(long amount);
virtual long     forecastAmount(int noOfDays);
};
class depositAccount : bankAccount {
        float    cumulativeInterest;
public:
        float    interestRate;

        long     interest(int numberOfDays);
        long     forecastAmount(int noOfDays);
};
```

forecastAmount() needs to be redefined in **depositAccount** because the rules for working it out are different for the different types of account (because of interest payments) and straight inheritance won't work. The implementation of these two functions needs to be provided elsewhere in the program, using the following syntax:

```
long bankAccount::forecastAmount(int noOfDays)
{
    // code for forecast amount without interest
};
long depositAccount::forecastAmount(int
                                        noOfDays)
{
    // code for forecast amount including interest
};
```

(In fact all the member functions we've defined so far would be implemented in the same fashion.)

The powerful thing about virtual functions is that having provided the above definitions you don't need to worry what kind of bank account you are dealing with in a particular part of the program — you simply ask for its forecast amount as required and C++ does the rest (technically this is called 'late binding' of functions). An example might be:

```
bankAccount*
  newAccount(long initialAmount)
{
    bankAccount*  account,

    if (initialAmount>500)
    account = new depositAccount
else
    account = new bankAccount;
account->deposit(initialAmount);
...
if (account->forecastAmount(365) >
                                    1000)
...
return account;
};
```

Note that **account** is declared as a pointer to **bankAccount**, but may hold a pointer to either a **depositAccount** or **bankAccount** (the C++ operator **new** creating a new object of the required class in free store and returning a pointer to it). More importantly, although the compiler cannot tell which of these it is going to be, at run time the correct **forecastAmount** function will be invoked.

As with all small-scale examples, this may seem like a lot of extra trouble to achieve something that could equally well be coped with in plain old C. The real crunch comes when you scale up to life-size problems, with all their complexity. The fact that in C++ the same member function call can cause different code to be executed, depending on the class of the object concerned, opens the door to truly general-purpose code that does not have to be modified for every change in the real world or in the scope of the system.

For example, suppose you decide to open a building society account. Of course, you will probably have to create a new class, derived from one of your original ones, and re-implement member functions such as **forecastAmount** if they happen to

be different. But once you've done that you *don't* have to change any of the code where **forecastAmount** is used — late binding of this function will automatically make sure that your new code gets used whenever a building society account is being dealt with.

Notice that this change in specification leads to a very localised change to the program, making implementation and testing far easier and more secure. This increase in speed and reliability of modification is one of the most impressive factors about C++ and other OOPs when you are building really large systems with them.

So how will all of this change the way programming is done? Not everyone thinks that it will. In a classic phrase from the preface of Bertrand Meyer's excellent book on *Object-Orientated Software Construction* the object-orientated 'tidal wave' is viewed '... by some as typhoon, by some as a tsunami, and by some as a storm in a tea cup'!

My own view is that nothing can stop the object-orientated tidal wave from sweeping across all kinds of computer systems, and that one of its biggest effects, within a few years, will be to change programmers into true software designers. Because object-orientated languages are able to describe the real world much more naturally than conventional languages, the real rewards will be for those who use them to make software more and more intelligible to its users.

I like to think of this as the revenge of the programmer for all the current talk of putting him out of business through the use of Computer Aided Software Engineering (CASE) and the like. Object-orientated languages will give him the power and flexibility to stay in control of his job and remain a valued part of his organisation, but only if he is willing increasingly to think and program in terms which the users of his software understand.

A picture dissolving algorithm

by Charlie Dancey

The principle of this algorithm is that every pixel in the rectangle defined by XBASE, YBASE, WIDTH and HEIGHT is to be visited once and once only in a pseudo-random order. That is, it should *look* random.

One way of doing this would be to index each pixel in some way, say a list of coordinates, and then shuffle the list before plotting the points. Unfortunately this is slow and consumes a large amount of memory for the list.

This algorithm takes advantage of the fact that the pixels in the rectangle are addressed by separate X and Y coordinates. Normally to plot every pixel in the rectangle you would simply write a pair of nested loops which would spew out every coordinate once. For the dissolve effect we first scramble the order in which the Y coordinates are generated (by using the array YORDER as an index), and then apply an offset to it.

The offset is held in the array XOFFSET (the X means that it is indexed off the X value of a given point). Because adding to the Y value may cause the point to move outside the rectangle, we use the MOD operator to cause it to wrap round, and thus remain in the required limits.

Now I realise that this may sound a little incomprehensible, so I have two suggestions for the puzzled reader. First: use it! It works whether you follow it or not. Secondly: try the following substitutions for the 'plot' line in the algorithm:—

```
plot(XBASE+N,YBASE+YORDER[M]+
  XOFFSET[N]) {No 'mod HEIGHT'}
plot(XBASE+N,YBASE+(XOFFSET[N]
  mod HEIGHT)) {No scrambled order}
plot(XBASE+N,YBASE+YORDER[M])
  {No Offset}
```

By seeing the effects of these alterations you will find the algorithm easier to follow.

DISSOLVE algorithm.

```
Variable names in upper case.
Functions and procedures in lower case.
Curly braces enclose comments.

Procedure Dissolve{parameters are XBASE,YBASE,WIDTH and HEIGHT}

  Define an array YORDER(0 to HEIGHT)
  Define an array XOFFSET(0 to WIDTH)
  Declare M,N, and R as integer variables.

{initialise YORDER array}

  for N=0 to (HEIGHT-1)
    YORDER(N)=N
  end for N
```

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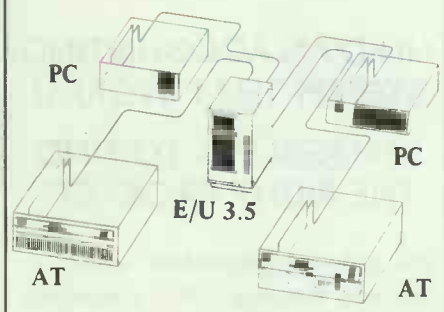
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```
{shuffle YORDER array
random(LIM) is a function that returns a random integer between 0 and LIM;
swap(A,B) is a procedure that swaps the contents of a and b}

  for N=0 to (HEIGHT-1)
    R=random(HEIGHT)
    swap(YORDER(N),YORDER(R))
  end for N

{initialise the XOFFSET array}

  for N=0 to (WIDTH-1)
    XOFFSET(N)=random(WIDTH)
  end for N

{now visit each pixel in the rectangle once, in this example we plot points}

  for M=0 to (HEIGHT-1)
    for N=0 to (WIDTH-1)
      plot(XBASE+N,YBASE+((YORDER(M)+XOFFSET(N)) mod HEIGHT))
    end for N
  end for M
```

Creative batch file techniques for DOS

by David R Stout

To most people, batch files are relatively straightforward and present few problems. However, if you feel that batch files ought to do a lot more besides setting paths, changing directories and starting programs, then this article is for you. A lot of the information presented here isn't immediately obvious from the relevant section in the DOS manual, and much of it has been gleaned from using DOS over a number of years. A rudimentary knowledge of the workings of batch files is assumed.

Batch files can be created in a number of ways by using a WP package, EDLIN or typing them directly in DOS after typing the command sequence 'COPY CON name.BAT' at the DOS prompt, where 'name' can be any name of your choice as long as it follows the normal DOS file-naming rules. To terminate input to the file when using the COPY command it is necessary to enter an end-of-file character (Ctrl-Z) — by typing the letter Z while the Ctrl key is depressed.

Personally, I prefer to use EDLIN to edit batch files as it loads quickly and is fairly simple to use, especially if you use a utility such as NDOSEDIT which allows you to use the Insert and Delete keys à la Basic. Also EDLIN will allow you to enter control characters, including Escape for use the with ANSI driver.

User interaction

One of the biggest drawbacks with batch files is their almost total lack of interaction with the user — the Pause command being about the only way a batch file will stop and wait for input from the keyboard (whereupon the batch file will continue regardless of whichever key was pressed). This command is often used to provide an option to abort the batch process by typing Ctrl-C at the Pause prompt. For example:

```
ECHO OFF
CLS
ECHO ** About to format the disc in
  drive A **
ECHO Press Ctrl-C to abort, or
PAUSE
FORMAT A:
```

will wait for a keypress before moving onto the Format command, but pressing Ctrl-C will terminate the batch file and return to DOS before any damage is done.

I always find Ctrl-C a little clumsy in use and I prefer to take a user directly to the 'Terminate batch job (Y/N)?' prompt by inserting a Ctrl-C into the input buffer from within the batch file. This is not as tricky as it sounds and the above example can be modified quite simply:

```
ECHO OFF
CLS
ECHO ** About to format the disc in
  drive A **
ECHO ^C | TIME >NUL
FORMAT A:
```

The ECHO command is used to pipe a Ctrl-C character to the Time command which, in turn, redirects its output to NUL (redirection and piping are considered in more detail later). NUL is a dummy device that behaves like COM1 or LPT1 but does nothing with the output sent to it. Time is used here as it is one of the few internal DOS commands that require keyboard input.

On receiving the Ctrl-C, the Time command is aborted and DOS displays the 'Terminate batch job (Y/N)?' prompt to ask if we wish to abandon the entire batch file or continue with the next command. Perhaps the least obvious stage is inserting the Ctrl-C character into the Echo command. It is not simply a matter of typing ^C or Ctrl-C directly from the keyboard — this would simply abort the command as we type it in.

Instead, we use EDLIN and type Ctrl-V followed by C. On the screen this appears as ^VC but when the entire line has been entered and accepted it converts this to ^C. Ctrl-V tells EDLIN that the next character is a control character, so this is the way that control characters should be entered in batch files. The only exception to this rule is the Bell character or ^G which may be entered directly as Ctrl-G. In fact, the Escape character is really ^[and this can be entered as Ctrl-V[— handy for use with Ansi.Sys or controlling printers, as will be discussed later.

Creating menus

If you are serious about batch files then you will need a utility to allow the batch file to perform different tasks depending on user input. A number of such utilities can be found amongst the Public Domain software and exist under various names — ASK, REPLY, CHOICE and so on.

These all work by waiting for a valid keypress and setting an exit code within the utility, the exact code being dependent on the key pressed. This exit code can then be tested by using IF ERRORLEVEL within the batch file. For example, the following code forms the basis of a simple menu facility.

```
ECHO OFF
CLS
ECHO SIMPLE MENU
ECHO**********
ECHO.
ECHO a) Show DOS version
ECHO b) Show volume name
ECHO.
CHOICE ab
IF ERRORLEVEL 2 GOTO VOLUME
VER
GOTO EXIT
:VOLUME
VOL
:EXIT
```

In this example, the Echo command is used to display the menu on the screen and then a full-stop immediately after the Echo command will echo a blank line to the screen. Using Echo on its own will cause DOS to display the current state of the screen echo (On or Off).

Setting Echo Off will prevent the batch commands from being echoed to the screen and only the initial Echo Off command will be visible. However, users of DOS 3.3 and above can precede the Echo command by the @ character to prevent even this from being echoed to the screen.

When the Choice command is reached, the program halts for keyboard input and will only accept lower case a or b, whereupon ErrorLevel is set to 1 or 2 respectively, and the batch file continues.

The next stage is to test the ErrorLevel value and, if necessary, branch to another part of the batch file using the Goto command. If we wished, we could have tested for upper case letters as well by including these as parameters to the choice command, for instance, CHOICE abAB, and using further IF ERRORLEVEL commands to trap these responses.

By far my favourite utility for this is What.Exe as supplied with the Microsoft Macro Assembler. This little gem can also provide other information regarding disk space, file sizes, printer status, memory and the presence of a co-processor or ANSI driver. It does this by saving the required data as a DOS environment variable of the same name (What). It is then a simple matter from within the batch file to test the value of this variable and take appropriate action.

The various options provided by the What utility are stored in a Help file; this information is printed out when What is invoked with no parameters. This utility could be used to form the basis of a more sophisticated menu program, as the following example shows.

```
@ECHO OFF
:START
CLS
TYPE MENU.TXT
ECHO.
SET WHAT=
WHAT C"Your selection =>" ABCDE
IF "%WHAT%"=="A" WP
IF "%WHAT%"=="B" SPREAD
IF "%WHAT%"=="C" PCTOOLS
IF "%WHAT%"=="D" GOTO PRINT
IF "%WHAT%"=="E" GOTO EXIT
GOTO START
:PRINT
WHAT P
IF "%WHAT%"=="1" GOTO OK
ECHO
ECHO ERROR — check printer
PAUSE GOTO START
:OK
ECHO.
SET WHAT=
WHAT S "Name of file to print?"
IF NOT "%WHAT%"=="" TYPE
  %WHAT% >PRN
GOTO START
:EXIT
ECHO.
```

As batch files read each line from disk they tend to run slowly and, in order to display a large amount of text quickly, it is often wiser to use the Type command to put the menu on the screen. A typical menu file, Menu.Txt, as used in the example above, may look like this:

```
Menu Selector

A) Word processor
B) Spreadsheet
C) PCtools
D) Print text file
E) Exit Menu
```

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By enclosing a DOS environment variable with the per cent character (%), DOS replaces this construction with the actual value of the variable as the batch file executes. This can be demonstrated by removing the @Echo Off from the example given above and observing the IF expressions as they are evaluated.

The command following the equality test is executed if the test is true. If the command is a program name, then that program will be executed and, on termination, the batch file will continue.

In this example, a Goto loop has been incorporated so that the menu is again displayed. If the command is the name of another batch file then control is passed to this file in a similar way to the Basic Chain command. If we require the original batch file to continue processing, we could insert the name of the first batch file as the last command in the second batch file, thus chaining back again. Alternatively, the second batch file could be treated as a subroutine by using the Call command:

```
IF "%WHAT%"=="A" CALL WP
```

Now when execution of the WP batch file is complete, the Menu batch will continue with the statement following this IF. Unfortunately, the Call command was not implemented for versions of DOS earlier than 3.3, and to achieve a similar effect it is necessary to invoke another copy of the command processor by replacing the IF statement with the following:

```
IF "%WHAT%"=="A" COMMAND /C WP
```

The /C means that the command processor will exit and return to the previous level on termination of WP. In effect, this is now running another program (Command.Com) and not a batch file, so execution of the original batch file continues when WP terminates.

Of course, if you do not have any of these utilities, you could display a similar menu and the batch file could exit to DOS, where you would type a single letter and press Enter to kick off a batch of that letter, such as A.Bat.

The command to display the Menu would also be inserted at the end of A.Bat to re-display the Menu when that batch file terminates.

Using DOS variables

DOS environment variables can be very useful. For example, you may have a batch file that loads a driver or 'Terminate and Stay Resident' program (TSR) before loading some other program, and it may be important to ensure that this is loaded only once. In the start-up batch, we could insert the following code:

```
IF "%LOADED%"=="YES" GOTO
   LABEL1
. . . initialisation code . . .
SET LOADED=YES
:LABEL1
. . . rest of start-up code . . .
```

Other DOS environment variables may also be put to good use.

Often, batch files are used to change to a specific directory and change the DOS search path before loading a program. When the program exits, the path and directory may be wrongly set.

Although we could insert two extra lines into the batch file to set another path and directory, it would be nice if the original path and directory were restored whatever they may have been set to. Resetting the path is easy. In our batch file we could insert the line:

```
SET OLDPATH=%PATH%
```

before the path is changed, and the line:

```
SET PATH=%OLDPATH%
```

just before the batch file terminates. Storing the current directory is not quite so easy, as DOS does not store this as an environment variable. We could of course use the What utility by inserting the line:

```
WHAT Y
```

in our batch file in conjunction with:

```
CD %WHAT%
```

to restore our directory at a later stage.

If the What utility is to be used for other purposes within the batch file, the returned string must be copied to another variable. For example, to save path, drive and directory we could have:

```
@ECHO OFF
SET OLDPATH=%PATH%
WHAT YE
SET DRIVE=%WHAT%
WHAT Y
SET DIRECTORY=%WHAT%
. . . rest of batch file . . .
SET PATH=%OLDPATH%
%DRIVE%:
CD %DIRECTORY%
```

If you don't have What.Exe then a little more cunning is needed to restore the current directory.

First we have to create a small file as follows:

```
COPY CON PREFIX.CD
CD_<Ctrl-Z>
```

The underscore represents a space, so press the Space bar and *not* the underscore character. It is important that you do not press Enter after the CD_ but press the Ctrl-Z key combination to insert the end-of-file character. This is then utilised in our batch file as follows:

```
@ECHO OFF
COPY PREFIX.CD OLD-DIR.BAT
REM now append current directory
CD >>OLD-DIR.BAT
. . . rest of batch file . . .
CALL OLD-DIR.BAT
```

As mentioned earlier, if you are using a version of DOS below 3.3 then the Call will have to be replaced by Command /C. If this line is at the end of the batch file then just use Old-Dir without the Call or Command to chain to that file. Also ensure that you have changed back to the correct directory for Old-Dir-Bat to be found — I generally prefix all such files with a backslash (\) character to put them in the root directory and I can call them from there.

How about a small batch file to extend the current search path? A file called Addpath.Bat may contain:

```
@ECHO OFF
IF "%1"=="" GOTO ERROR
SET PATH=%PATH%;%1 GOTO EXIT
  :ERROR ECHO ^GUsage: %0 directory
:EXIT
```

By typing 'ADDPATH C:\UTILS' the directory C:\UTILS (which replaces the %1 on the third line) is appended to the current path. If no parameter is specified, the batch file branches to the line labelled Error and then proceeds to process the Echo command. The ^G in the Echo command is the control character to produce a beep (enter this in the batch file with Ctrl-G) and the %0 is the replaceable parameter which holds the batch file name, so that, even if you subsequently rename this file, the correct name is always displayed. Although this is a simple batch file, it will save a lot of hassle if you need to add an extra directory to an already fairly lengthy search path.

Increasing the DOS environment

If you make extensive use of DOS variables or have very long paths set, you may find DOS coming up with the error message 'Out of environment space'. This is because, by default, DOS allocates only 127 bytes to the DOS environment when it starts up. Although, in theory, the DOS environment can extend beyond this, the presence of a TSR program will prevent this. Remember that DOS utilities like Mode, Print and Graphics are also TSRs. To overcome this problem the following line can be added to your Config.Sys file.

```
SHELL=C:\COMMAND.COM /E:256
```

This will tell DOS that the top-level command processor is Command.Com (which it defaults to anyway) and that 256 bytes are reserved for the environment. You can of course adjust this to whatever value you wish up to 32768 bytes, but remember that this is being taken out of your usable memory.

Utilities

We can, of course, enlist other DOS utilities to make our batch files even more useful. Search.Bat searches for all files containing a certain string.

```
@ECHO OFF
IF "%1"=="" GOTO ERROR
SET FILESPEC=%2
IF "%2"==""
SET FILESPEC=*.*
FOR %%A IN (%FILESPEC%) DO FIND
  %1 %%A
GOTO EXIT
:ERROR
ECHO ^GUsage: %0 "string" [filespec:
  default=*.*]
:EXIT
```

The variable Filespec contains the file specification to be used for the search, and this is supplied as the second parameter to Search. If this is unset then Filespec is set to *.* to search all files for the key string. As the Find utility cannot accept wildcards for the filename (and so cannot search multiple files), a For loop is used where the Find command is successively repeated for all files matching Filespec.

The For is perhaps the most difficult batch command to understand. In essence, the specified variable (in this case %%A), is sequentially assigned to whatever is enclosed by the brackets. This may be a list of items, commands, filenames or parameters. If a wildcard is used then this is expanded so that the variable is sequentially set to each of the files which matches the file specification. For each evaluation of the variable, the command following the Do is executed using the evaluated parameters.

Piping and redirection

Another useful batch file is Where .Bat which searches an entire disk to find a file or filenames containing a specified string.

```
@ECHO OFF
IF "%1"=="" GOTO ERROR
CHKDSK /V | FIND "%1"
GOTO EXIT
:ERROR
ECHO ^GUsage: %0 filename
:EXIT
```

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PROGRAM FILE

Here CHKDSK is used with the /V parameter to list all the files on the disk. This is piped to the Find utility where only files matching the supplied parameter (%1) are listed. For example, Where Results.Doc will show the complete file specifications of directories containing Result.Doc and Where.Bat will show all directories and names of batch files.

Note that the Find utility will not expand wildcards, and the search is case-sensitive (so enter search strings in capitals and do not use ? or *). The vertical bar is used to signify piping, which is simply chaining the commands and using the output of one as the input to the other. If we wanted the output sorted we could pipe the output to the Sort utility.

```
CHKDSK /V | FIND "%1" | SORT
```

This would produce an output which is sorted alphabetically.

Note that the Sort utility is used after the Find. If our search string produces more than one screenful of output we could pipe it to the More utility:

```
CHKDSK /V | FIND "%1" | SORT | MORE
```

By typing 'WHERE DIR' a listing of directories is obtained. Ensure that all these utilities are in the DOS search path for the commands to work properly.

Before moving away from piping, here is another example called Dirsort.Bat. This batch file will sort a directory by name, extension or size and uses an interesting variation of the For loop.

```
@ECHO OFF
FOR %%A IN (n e s N E S) DO IF
  "%1"=="%%A" GOTO %1
ECHO Usage: %0 followed by N or E or S
  [/R] ^G
ECHO to sort by name, extension or size
ECHO /R reverses sort (option)
GOTO EXIT
:N
DIR | FIND "-" | FIND /V "<DIR>" | SORT
  %2 | MORE
GOTO EXIT
:E
DIR | FIND "-" | FIND /V "<DIR>" | SORT
  /+10 %2 | MORE
GOTO EXIT
:S
DIR | FIND "-" | FIND /V "<DIR>" | SORT
  /+16 %2 | MORE
:EXIT
```

Here the For loop is used to test the first parameter (%1) against any of the valid inputs. If a match is not found then processing continues with the subsequent lines, which display the instructions for use. If a match is found, then control is directed to the appropriate label. Interestingly, the Goto label does not appear to be case-sensitive, hence it is convenient to use whatever was supplied as the first parameter (in this case %1).

For each of the options a degree of filtering is necessary. The first filter, FIND "-", finds only lines containing a date — file entries, and other redundant information is rejected. The second filter, FIND /V "<DIR>", finds only lines that do not contain <DIR>, — directory entries are rejected. Finally, the resulting output is sorted on the appropriate field and piped to the More utility to display it one screenful at a time. If /R is used as the second parameter on the command line, the sort order is reversed.

There are two forms of redirection: redirecting output (>) and redirecting input (<). Output can be directed to (and input can come from) a file or a device: by default, input normally comes from the keyboard and output normally goes to the screen. Both keyboard and screen use the device name Con (for console). Another example of input/output redirection is a small utility to show when the computer was last used. First, create a small file called CRLF with the following keystrokes:

```
COPY CON CRLF <Enter> <Ctrl-Z>
```

This file contains only a carriage return/line feed sequence (hence the name). Next, create two more files called Editdate and Message with the following keystrokes:

```
COPY CON EDITDATE
2D1RCurrent date is e
<Ctrl-Z>
COPY CON MESSAGE
Computer last used on<Ctrl-Z>
```

The batch file Lastused.Bat would then use these three files to store the current date to a file called Lastused.Txt.

```
@ECHO OFF
IF EXIST LASTUSED.TXT TYPE
  LASTUSED.TXT
DATE <CRLF >TODAY
EDLIN TODAY <EDITDATE >NUL
COPY MESSAGE LASTUSED.TXT >NUL
TYPE TODAY >>LASTUSED.TXT
DEL TODAY
```

The Date command effectively reads an Enter from the CRLF file, but the output is redirected to a file called Today. This file is then edited using EDLIN but instead of taking commands from the keyboard, the commands come from the file Editdate. Editdate contains the commands to delete the second line of output, delete the text 'Current date is' and end the edit. The output is redirected to NUL to avoid seeing the editing process on the screen — the required

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date is still in the file Today. The message prefix contained in Message is copied to the new file Lastused.Txt; redirection to NUL is again used to avoid echoing '1 file copied' onto the screen. Finally, the date in Today is appended to Lastused.Txt using the redirect-with-append characters, >>.

File deletion

Another utility using a For loop is Delbut.Bat which deletes all files except those named as parameters. To use this utility type Delbut followed by the filespec(s) of the files not to be erased. For example:

```
DELBUT *.COM *.EXE *.C *.H
```

will delete all files having an extension other than COM, EXE, C or H. A maximum of eight filespecs is allowed.

```
@ECHO OFF
IF "%1%"=="" GOTO ERROR
FOR %%A IN (%1 %2 %3 %4 %5 %6 %7
  %8) DO ATTRIB +R %%A
ECHO Files about to be deleted . . .
ECHO.
ATTRIB *.* | FIND /V "R " | MORE
ECHO.
PAUSE ECHO Y | DEL* . *>NUL
ATTRIB -R *.*
ECHO Done GOTO EXIT
:ERROR
ECHO ^GUsage: %0 filespec1 filespec2
  . . . filespec8
:EXIT
```

This utility uses Attrib to set the read-only attribute of each file in the supplied filespecs. A file cannot be deleted if its read-only attribute is set. Attrib is used again in conjunction with Find and More to show those files which do not have the read-only attribute set (those about to be deleted).

The files are deleted with the Del *.* command but with Y piped to it from an Echo command to avoid further keyboard input. After the deletion, the Attrib utility is once more used to restore the files to their original condition.

Printer control

Using the Echo command and redirection it is possible to send escape sequences and set up strings to printers. I frequently use the HP DeskJet printer for dumping C source code listings, which are often more than 80 characters wide. Although the DeskJet is limited to A4-size paper, the fine print quality means that 6pt-size characters are perfectly legible, so I use a batch file, Dump.Bat, to set up the printer accordingly.

```
@ECHO OFF
REM setup sequence for HP DeskJet to
  give 132 column mode
REM send reset to printer
ECHO ^[E >PRN
REM set NLQ mode (Courier) @ 20cpi and
  6 point size
ECHO ^[s2q3t6v20H >PRN
REM set 0 characters for left margin
ECHO ^[&a0L >PRN
REM set 2 lines for top margin and 8 lines
  per inch
ECHO ^[&l8d2E >PRN
REM print file and send form-feed
TYPE %1 >PRN
ECHO ^[&l0H >PRN
```

Remember that the Escape character ^[is entered by typing CRTL-V[when using EDLIN — it should appear as ^V[when typed. (And note that the character following the ampersands in the fourth-last and last lines is a lower-case L.)

Some of the batch files shown here are disk-intensive, and may run very slowly on a twin floppy XT system. However, these examples illustrate some of the more interesting features of batch file processing and form a basis on which you can develop your own utilities. Have fun!

Find for the Psion Organiser

by Jeremy Roussak

Find is a replacement for the top-level Find function of the Psion Organiser II. In addition to all the features offered by that function (such as editing the found record and/or storing it on a different pack), Find allows the user to:

- search all the data packs currently inserted (drives A:, B: and C:);
- specify in the usual fashion on which pack the search is to start;
- search any file (not just Main);
- scroll backwards through up to 32 previously found records, even if they are on different packs;
- find out in which file the currently displayed record resides, what its record number is and how many records are in the current file.

The complete routine comprises three OPL procedures: Find, Finded and Testos%. In addition, one other OPL procedure, Install, must be run once to provide the machine code interface and another, Insfind, may optionally be run to allow access to find from the main menu. These routines are described below.

Insfind
Insfind subtly alters the top-level menu of the Organiser so that the Find option runs the OPL Find procedure, and not the built-in Find function. Once made, this change lasts until the next top-level Reset or cold boot. To reserve it (and so access the built-in Find function), simply delete Find from the main menu and then re-insert it.

Install
In order to carry out various operations, Find needs to call some functions provided by the Organiser's operating system. This must be done from a machine language program. Install puts such a program into the top of the Organiser's RAM and fiddles a pointer so that the routine will not be overwritten.

Install thus needs to be run only once (and indeed will refuse to allow itself to be run more than once). The routine will then remain resident until a top-level Reset or a cold boot is carried out.

The machine code routine installed is shown in the first listing. (The first byte is not resident, but is used by Install to fix up the 'sta a,fncode' instruction.) Usage is as follows:

1 Declare three variables: local fn%,d%,x%;
2 Execute the following:

```
mc%=peekw($2065)
if peekw(mc%)<>%j*256+%r or
  peekb(mc%+2)<>$12 raise 203 :rem
                        missing procedure
  mc%=mc%+3
```

This checks that Install has been run and then sets mc% to the code address;
3 Set the function code into fn%;
4 Set d% and x% to the required values of the d and x registers for the call. Also poke appropriate values into utw_s0 ($41) and utw_s1 ($43) if necessary;
5 Call by r%=usr (p%,addr(x%));
6 If r%=–1, the error code is in d%. If r%=0, d% and x% hold the contents of the d and x registers on return from the call, and any values put by the swi into utw_s0 and utw_s1 are still there (but probably not for long).

Find
This is the main program. It first gets the search string with the usual Find A: prompt. Pressing Mode changes the A: to B: or C: as usual, but this merely governs which pack is to be searched first; all three packs will be looked at. On/Clear exits and a null string finds all records, as usual.

If the Shift key is held down when Exe is pressed to enter the search string. Find will prompt for a filename to be used instead of Main. If a null string is entered here, Find will use Main as usual.

Find then displays the found records in the traditional manner. The following keystrokes are recognised while a record is being displayed:

- up/down arrow: move around the displayed record;
- Mode: edit the displayed record (see FindEd);
- On/Clear: exit;
- Space: show a message in the format:

  File A:MAIN
  Record 17/175

  and wait for a keypress. If it is On/Clear exit, otherwise redisplay the current record;
- Del: show previous record. 32 previous records are stored in a circular buffer. pc% has the number of records in the buffer, p% points to the most recently inserted and ppk% and pp% are the buffers, holding the pack and record numbers of the records;
- Exe: show next record.

When end-of-file is reached, the usual '** End of packs **', message is displayed. If no matches have been found for the search string, a '** No match **' message is shown instead. Exe then restarts the search, Del moves backwards and On/Clear exits.

FindEd
Perhaps this procedure should be called Found! FindEd handles the editing of the current records. It copies the record into the editor buffer using system function 109 (copy) and allows it to be edited using function 104. The edited record is then saved using the same algorithm as used by the top-level Find function, namely:

```
if new length is zero
  if drive unchanged
    erase old record
  endif
else
  if drive unchanged
    update old record
  else
    save new record on new drive
  endif
endif
```

Testos%
Testos% performs the functions described under stage 2 of the section on using the machine code routine above. If the machine code is present, Testos% returns its start address: if not, it prints a message and stops. There is, therefore, no error return from Testos%.

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PROGRAM FILE

```
;
; Aug 88: 1.0       all the basics
; Sep 88: 1.1       fn% introduced (previously, user had to poke)
; Sep 88: 1.2       push & pop before & after swi for UT$DDSP
;

0d          .byte     $0d                 ; offset for fncode
6a 72       .ascii    "jr"                ; this is the header
12          .byte     $12                 ; version 1.2

18          xgdx                          ; var addr to x
3c          pshx                          ; save for later
a6 05       lda       a,5,x               ; get code from fn%
b7 00 00-   sta       a,fncode            ; fixed up by INSTALL
ec 02       ldd       2,x                 ; load from d%
ee 00       ldx       0,x                 ; load from x%
3c          pshx                          ; in case it's 110
3f          swi                           ; do it
   fncode:
00          .byte     0                   ; function code goes here
31          ins                           ; lose pushed x
31          ins                           ; (doesn't affect carry)
25 0d       bcs       error               ; whoops

df 45       stx       utw_s2:             ; temporary save
38          pulx                          ; retrieve var addr
ed 02       std       2,x                 ; save into d%
de 45       ldd       utw_s2:             ; retrieve return x
ed 00       std       0,x                 ; save into x%
ce 00 00    ldx       #0                  ; signal success
39          rts

   error:
38          pulx                          ; retrive var addr
4f          clr       a                   ; so d=error code
ed 02       std       2,x                 ; save in d%
ce ff ff    ldx       #-1                 ; signal failure
39          rts
```

Install — resident machine code

```
testos%:
local mc%
mc%=peekw($2065)
if peekw(mc%)=%j*256+%r
    if peekb(mc%+2)=$12
       return mc%+3
    endif
    print "Wrong",
else
    print "No",
endif
print "system"
print "Must run INSTALL";
get :stop
```

Testos%

```
insfind:
local f%,p%,sw%,s$(13)
s$="Press any key"
sw%=$1839
print "Insfind:",
p%=peekw($2002)
do
    if lower$(usr$(addr(sw%),p%))="find"
       pokew p%+5,0
       f%=1
    endif
    p%=p%+peekb(p%)+3
until peekb(p%)=0 or f%
if f%
    print "success";s$
else
    print "failure";s$
endif
get
```

Insfind

```
finded:(pk%)                          : rem part of find to edit records
local ps(4),b%,i%,fn%,d%,x%,ax%,tmp$(255)
ax%=addr(x%)                          : rem saves effort later
b%=peekw($2016)                       : rem file a buffer address

pokew $41,peekb(b%)+1                 : rem record length
d%=$2187                              : rem to = edit buffer address
x%=b%                                 : rem from = file a buffer
fn%=109                               : rem copy
usr(mc%,ax%)                          : rem do it

p$="Save"                             : rem edit prompt
x%=addr(p$)
d%=$01fe                              : rem multi-line, maxlen 255
fn%=104                               : rem edit function
pokeb $a2,pk%                         : rem make our drive current

if not usr(mc%,ax%)                   : rem ie if ON/CLEAR not pressed
    if peekb($2187)=0                 : rem new record length zero
       if pk%=peekb($a2)              : rem still original drive selected
          erase                       : rem so erase current record
       endif
    else
       tmp$=usr$(addr(sw%),$2187)     : rem copy from edit buffer

       while i%<=len(tmp$)-2          : rem scan for new line delimiter
          i%=i%+1
          if mid$(tmp$,i%,2)="<>"  : rem found,  so replace with tab
             tmp$=left$(tmp$,i%-1)+chr$(9)+right$(tmp$,len(tmp$)-i%-1)
          endif
       endwh

       if pk%=peekb($a2)              : rem still original pack
          pokeb b%,0                  : rem clear current record
          a.a$=tmp$                   : rem actually sets all fields
          update
       else
          close
          trap open chr$(peekb($a2)+%A)+f$,a,a$
          if err
             create chr$(peekb($a2)+%A)+f$,a,a$
          endif
          pokeb b%,0                  : rem clear first record
          a.a$=tmp$                   : rem again, sets all fields
          append                      : rem brand new record
       endif

    endif
endif
```

FindEd

```
find:
local k%,pk%;opk%,p%,pc%,ppk%(32),pp%(32),v%,p$(4),s$(255)
local fn%,d%,x%
global mc%,sw%,f$(9)

escape off
mc%=testos%:
sw%=$1839

p$="Find"                         :rem prompt
d%=$ff :x%=addr(p$)
pokeb $2187,0                     :rem initial length of string
fn%=104                           :rem function code
if usr(mc%,addr(x%))              :rem ON/CLEAR pressed
```

▶

```
        return
    endif
    a$=usr$(addr(sw%),$2187)          :rem copy string up into a$

    if peekb($7b) and $80             :rem SHIFT-EXE pressed
        at 1,2 :print "File:";
        input f$
    endif
    if len(f$)=0
        f$=":main"
    else
        f$=":"+f$
    endif

    pk%=peekb($a2)                    :rem start pack (set by fn 104)
    opk%=pk%

    do
        do
            trap open chr$(pk%+%A)+f$,a,a$
            if err=0
                while find(a$)
                    v%=-1
                    do
                        k%=disp(v%,"")
                        v%=0

                        if k%=1               :rem ON/CLEAR
                            close
                            return
                        elseif k%=2           :rem MODE
                            findadd(pk%)
                            close
                            return
                        elseif k%=8 and pc%   :rem DEL
p::                         if ppk%(p%)<>pk%
                                pk%=ppk%(p%)
                                trap close
                                open chr$(pk%+%A)+f$,a,a$
                            endif
                            position pp%(p%)
                            p%=(p%-2 and $1f)+1
                            pc%=pc%-1
                            v%=-1
                        elseif k%=32          :rem SPACE
                            cls
                            print "File",chr$(pk%+%A);f$
                            print "Record",pos;"/";count
                            if get=1
                                close
                                return
                            endif
                            v%=-1
                        endif

                        until k%=13
                        p%=(p% and $1f)+1   :rem wraparound pointer 1..32
                        if pc%<32
                            pc%=pc%+1
                        endif
                        ppk%(p%)=pk%
                        pp%(p%)=pos
                        next
                    endwh
                    close
                endif

                if pk%=2
                    pk%=0
                else
                    pk%=pk%+1
                endif
            until pk%=opk%

            cls
            print rept$("*",17);
            if pc%=0
                print "** No match ***";
            else
                print " End of packs *";
            endif

            do
                k%=get
                if k%=8 and pc%
                    goto p::              :rem Aaaaaaaarrrrrggggghhhhh!!!!!!
                endif
            until k%=1 or k%=13
            cls
        until k%=1
```

Find

```
install:
local space$(100)
local i%,oks%,op%,p%,v%,vn%,vnmj%,vnmi%,c$(100),h$(16)

vnmj%=1 :vnmi%=2                      :rem major & minor version numbers
vn%=vnmj%*16+vnmi%
print "Install v";vnmj%;".";vnmi%;

p%=peekw($2065)
if peekw(p%)=%j*256+%r and peekb(p%+2)=vn%
    view(2,"System "+chr$(%0+vnmj%)+"."+chr$(%0+vnmi%)+" already installed.")
    stop
endif

    :rem last byte of c$ is checksum
c$="0d6a7200183ca605b70000ec02ee003c3f003131250ddf4538"
c$=c$+"ed02dc45ed00ce000039384fed02ceffff399b"
h$="0123456789abcdef"
i%=1
p%=p%-len(c$)/2
op%=p%

do                                    :rem poke in the code
    v%=(loc(h$,mid$(c$,i%,1))-1)*16+loc(h$,mid$(c$,i%+1,1))-1
    pokeb p%,v%
    oks%=oks%+v%
    p%=p%+1: i%=i%+2
until i%>len(c$)

:rem checksum should add to $xx00
if oks% and $ff
    view(2,"Checksum error: check c$")
    stop
endif

pokeb op%+3,vn%                       :rem fix version number
v%=op%+4+peekb(op%)
pokew op%+9,v%                        :rem fix address for sta a,fncode
pokew $2065,op%+1                     :rem offset byte is non-resident
print ": okPress any key.";
get :stop
```

Install

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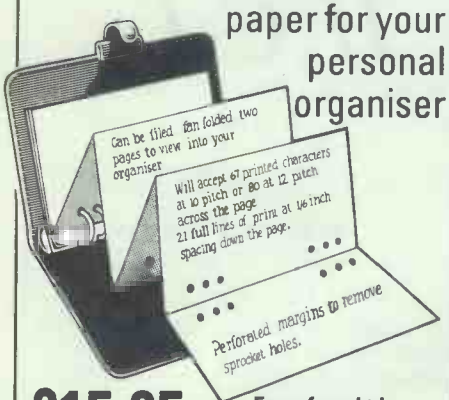
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Making use of:

Typed constants in Turbo Pascal

by Graham Robinson

Turbo Pascal provides a number of extensions to standard Pascal, a very handy one being typed constants. Typed constants, as their name implies, provide the facility to define constants of a type of our own choice. The most useful ones are arrays and records. The syntax for defining typed constants is a logical extension of the standard syntax:

Standard syntax is <id> = <constant>
Extended syntax is <id> : <type> =
<typed constant>

C programmers will see the resemblance to their variables with initialisers. In fact, I find it much better to consider typed constants as global initialised variables, in that we can use them as variables, including being able to assign new values to them. Even typed constants declared within a procedure or function are allocated global storage; as a result, local typed constants will retain their value from one invocation of a procedure to the next (as demonstrated by the accompanying listing 'StaticVariables').

The second listing 'Romans' demonstrates the use of typed constants as initialised look-up tables. The provision of initialised variables removes the space and run-time overhead of explicit initialisation code. An added benefit is that 'reference' variables are distinguished from 'working' variables, making the meaning of the code clearer.

Borland should have added true initialisers to variables, as this would have provided a more general and flexible alternative to typed constants. All the same, typed constants are a handy addition and we don't want to upset the purists too much do we?

Listing 1 — typed constant as hidden global variable

```
PROGRAM StaticVariables;
{
  Program to demonstrate the use of typed constants as local static
  variables.  (c) Oct 1988 by GC Robinson
}
VAR
  I: INTEGER;

  PROCEDURE ErrorReport(IsError: BOOLEAN);
  {
    This procedure gives increasingly "helpful" messages
    in response to repeated errors.
  }
  CONST                       { Typed constants are effectively initialised }
    ErrCount: INTEGER= 0;     { global variables, even if they are declared }
  BEGIN { ErrorReport }       { inside a procedure or function. This means  }
    IF IsError THEN           { that they will retain their value from one  }
    BEGIN                     { invokation of a procedure to the next, but, }
      ErrCount:=              { since they are declared locally they remain }
          Succ(ErrCount);     { hidden from the rest of the program.        }
      CASE ErrCount OF
        1:   Writeln('Retry.');
        2:   Writeln('Single digits please.');
        3:   Writeln('Enter a number in the range 1 to 9, or 0 to quit.');
        ELSE Writeln('You must be joking.');
      END;
    END
    ELSE ErrCount:= 0;
  END; { ErrorReport }

BEGIN
  Write('Enter an integer :');
  Readln(I);
  WHILE I <> 0 DO
  BEGIN
    ErrorReport( (I < 1) OR (I > 9) );
    Write('Enter an integer :');
    Readln(I);
  END;
  Writeln('Zero ends the test. Thank-you.');
END.
```

Listing 2 — typed constants as look-up tables

```
PROGRAM Romans;
{
  Roman numeral to decimal and decimal to roman numeral converter.
  Copyright (c) Oct 1988 by GC Robinson.
}
```

```
  CONST
    { Look-Up Tables are handled very nicely using Typed Constants }
  TableTop= 13;
  { Store the valid roman numeral 'prefixes' along with their decimal values}

  Value:  ARRAY[0..TableTop] OF INTEGER=
( 0, 1,   4,  5,   9, 10,  40,  50,   90, 100,  400, 500,  900, 1000);
  Symbol: ARRAY[0..TableTop] OF STRING[2]=
(' ','I','IV','V','IX','X','XL', 'L', 'XC', 'C', 'CD', 'D', 'CM',  'M');

TYPE
  RomanStrType= STRING[80];

PROCEDURE DecimalToRoman(    DecVal: INTEGER;
                         VAR RomVal: RomanStrType;
                         VAR Valid:  BOOLEAN);
{
  Convert integers in range 1..3999 to a roman numeral string
  Valid returns false if number out of range.
}
VAR
  i: INTEGER;
BEGIN { DecimalToRoman }
  IF (DecVal < 1) OR (DecVal > 3999) THEN Valid:= FALSE
  ELSE
  BEGIN
    Valid:= TRUE;
    i:= TableTop;                    { Starting at M or 1000 }
    RomVal:= '';
    WHILE DecVal > 0 DO              { While anything left of the decimal }
    BEGIN
      WHILE DecVal < Value[i] DO     { Find largest value that can be taken }
        i:= Pred(i);                 { out of the decimal.                  }
      RomVal:= RomVal + Symbol[i];   { Add approp. roman symbol to result.  }
      DecVal:= DecVal - Value[i];    { Reduce decimal value by approp. value.}
    END;
  END;
END; { DecimalToRoman }

PROCEDURE RomanToDecimal(    RomVal: RomanStrType;
                         VAR DecVal: INTEGER;
                         VAR Valid:  BOOLEAN);
VAR
  i,j: INTEGER;
  TmpRom: RomanStrType;
BEGIN { RomanToDecimal }

  RomVal:= RomVal+'$';               { Add end of string marker and }
  FOR i:= 1 TO Length(RomVal) DO     { convert input to uppercase.  }
    RomVal[i]:= UpCase(RomVal[i]);
  DecVal:= 0;
  i:= 1;
  WHILE RomVal[i] <> '$' DO          { until end of string          }
  BEGIN
    j:= TableTop;                    { find valid roman prefixes    }
    WHILE (j > 0) AND                { ignoring invalid symbols     }
          (Symbol[j] <> Copy(RomVal, i, Length(Symbol[j])) ) DO
      j:= Pred(j);
    DecVal:= DecVal + Value[j];      { accumulate value into result }
    i:= i + Length(Symbol[j]);       { skip along string            }
  END;
  { to validate the input we compare it with the correct roman     }
  { representation for our result.                                 }
  DecimalToRoman(DecVal, TmpRom, Valid);
  Valid:= Valid AND ( (TmpRom+'$') = RomVal );
END; { RomanToDecimal }

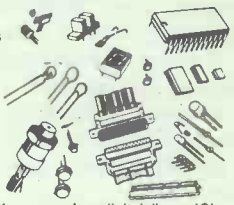
VAR
  ARomVal: RomanStrType;
  ADecVal: INTEGER;
  ValCode: INTEGER;
  IsOK:    BOOLEAN;

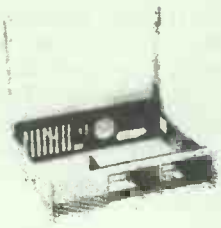
BEGIN { Main Program }
  Writeln;
  Writeln;
  Writeln('Decimal <-> Roman Converter');
  Writeln;
  Writeln('Enter a number in the range 1 to 3999,');
  Writeln('      a roman numeral in the range I to MMMCMXCIX or');
  Writeln('      return only to quit.');
  Writeln;
  Write('Convert: ');
  Readln(ARomVal);
  WHILE ARomVal <> '' DO
  BEGIN
    Val(ARomVal, ADecVal, ValCode);
    IF ValCode <> 0 THEN
    BEGIN
      RomanToDecimal(ARomVal, ADecVal, IsOK);
      IF IsOK THEN Writeln(ARomVal, ' in decimal is ', ADecVal, '.')
              ELSE Writeln(ARomVal, ' is not a valid roman numeral.');
    END
    ELSE
    BEGIN
      DecimalToRoman(ADecVal, ARomVal, IsOK);
      IF IsOK THEN Writeln(ADecVal, ' in roman numerals is ', ARomVal, '.')
              ELSE Writeln(ARomVal, ' is not a valid decimal number.');
    END;
    Writeln;
    Write('Convert: ');
    Readln(ARomVal);

    END;
    Writeln('Bye!');
  END.
```

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Fun and games

Our BSI correspondents ensnare MS-DOS with a C trap and offer an overview of worldwide language standardisation, plus various useful tips and queries including the problem of what makes a good manual.

Feedback

This is our fourth monthly column, and we'd like to thank everyone for the very supportive and positive feedback: keep it coming.

Here is a small selection from the many comments we received on Martin's 'comms' problems that caught the eye.

Mr R Smith of Follansbee (UK) Ltd seems to be having the same problem as we are. On using an Amstrad MC2400 modem with Mirror on a Dell 300 he said: 'Despite reducing the processor speed to 8MHz we still have problems receiving, often being left with a clear screen, the cursor flashing down it and no reaction to any of the keys — we have to reset and try again.' This can't be right, can it? He goes on to say 'The price/performance of this modem/software looked very attractive, but its performance seems very poor.'

On the other hand, J Gale from Hemel Hempstead says he has no problems accessing the Luton PSS mode, although he uses an Amstrad V21/V23 modem card — whereas we use V22.

Mike Florey managed to send over four pages to us via Luton PSS (from Croydon) all about communications standards. He even managed to send it error-free. (Even after reading it I don't know how!) As he says: 'Default to Useless — most things do in my experience, humans included.'

M Stockwell of New Life (a financial services company) needs to download equity and unit trust prices for a graphical analysis package. The company receives the prices from Finstat via a Telecom Gold mailbox. On requesting information on what file transfer protocols were available, 'No-one at Telecom Gold seemed to know that such things existed, never mind whether Telecom Gold provided this sort of service.'

PC comms is a lot of fun, isn't it? It's almost like an arcade game at times.

Matthew Horton

C bits and bugs

Well, actually just bugs. This month I am going to take a look at how well the leading C compilers detect and cope with data overflow on MS-DOS systems.

Stackrap

No, this is not the latest song to hit the charts, just an interesting means of creating unions with Turbo C and killing our favourite O/S.

```
/*
 *  STACKRAP.C
 *  Demonstration of stack wrap around.
 *  Using Turbo C under MS-DOS
 */

#include<stdio.h>
#include<process.h>

int i;
int * ip1; /* pointer 1 to an int */
int * ip2; /* pointer 2 to an int */
main()
{
    int big0[25000]; /* size  50,000 bytes */
    int big1[7780];  /* size  15,560 bytes */
                     /* Total 65,560 24 byte overflow of segment ? */

    for( i=0; i< 20; ++i)
        big0[i] =128;/* set first 20 entries of big0 to 128 */

    puts("big0 initialised");

    for( i=0; i<7780; ++i)
        big1[i]= i; /* initialise all of big1 */

    puts("big1 initialised");

    for( i=0; i<10; ++i)
        printf(" big0[%d] = %d \n", i, big0[i]);

    ip1 = &big0[0];
    ip2 = &big1[7768];
        printf( "big0[0] at %p big1[7768] at %p \n" ,ip1, ip2);
        exit(0);
}
```

Here is the output from this program from Turbo C v2.00, compiled as a small model program with stack checking on!

```
big0 initialised
big1 initialised
 big0[0] = 7768
 big0[1] = 7769
 big0[2] = 7770
 big0[3] = 7771
 big0[4] = 7772
 big0[5] = 7773
 big0[6] = 7774
 big0[7] = 7775
 big0[8] = 7776
 big0[9] = 7777
big0[0] at FFC2 big1[7768] at FFC2
```

This generates a pretty nasty problem. No error is given at compile or run time but the two arrays overlap. Stackrap has actually occurred undetected. I tried compiling this using Turbo C, with and without stack checking, and with various memory models: the result was the same.

Microsoft C v5.0

This compiler successfully diagnosed the potential problem with the following output at compilation time:

```
stackrap.c
stackrap.c(16) : error C2126: main : automatic allocation exceeds 32K
stackrap.c(16) : error C2126: main : automatic allocation exceeds 32K
```

Watcom C v6.5

This compiled and executed in a reasonable manner when a large memory model was selected. The small model program compiled successfully, but on execution (and boy do I mean *execution*!) MS-DOS went bye-bye.

Zortech C++

This gave similar results to Turbo C when there was no stack checking but did give a stack overflow error when stack checking was used — which seems entirely reasonable.

Turbo C and Watcom C users beware of using too many stack variables — it's bad for your computer's health.

Neil Martin

Appeal for test code

As you'll be aware by now, BSI tests compilers. To do this we need large, powerful test suites, made of programs designed to meet various criteria. We'll be writing more about testing strategies another time (perhaps in a separate article), but we can summarise the different types of test under the following broad categories:

- conformance tests (designed to investigate correct execution of legal programs);
- deviance tests (designed to investigate how a compiler handles incorrect programs);
- quality tests (such as benchmarks).

Tests are useful only if they help to establish attributes of a compiler that are relevant to users. We have

already begun to receive suggestions for new tests from *PCW* readers and would welcome more. These tests could be for validation or evaluation; either way we offer you the opportunity to influence the type and degree of testing we perform.

All contributions will be acknowledged both personally and with a suitable source code comment. Over to you...

John Souter

A quick canter around language standardisation

One of the most frustrating aspects of writing for *PCW* is the long lead time between drafting and publication (approximately six weeks). As November draws to a close, here is a quick and somewhat biased summary of what is going on in programming language standardisation around the world:

Ada The agonising over Ada-9X is starting; but have PC users caught up with existing Ada yet? Lots of work going on on Ada language bindings (to POSIX, SQL, GKS and so on).

Basic After the tremendous success of standard Minimal Basic, what new heights can standard Basic reach? Again, unlikely to influence the PC world, which opted for diversity long ago.

C The scoop in our last column was to report that the ANSI C committee (X3J11) has voted to publish the existing draft. (Note: it is not actually *published*, as the column implied.) However, the document still has two important hurdles to clear. Firstly, ANSI must endorse the committee recommendation (usually a formality) and then ISO must also decide whether to accept the ANSI standard as an international one. The news here is a little worrying, since ISO members (such as BSI) are not totally happy with the current document. Watch for developments.

C++ Is this the next one up for standardisation? The ANSI X3J11 committee is talking about it.

Cobol We find it hard to get excited about Cobol, but apparently over 70% of the world still has to program in it. Is this one occasion where the PC world is a lot more sensible than mainstream (mainframe) commercial data processing? Despite the pressure from 4GLs, standard Cobol continues to develop, with the publication of substantial amendments to the 1985 standard (rather than waiting for the traditional eleven-year cycle of complete revision and replacement).

Fortran Vying with Lisp as biggest international standards muddle of the moment, the draft Fortran-8X remains controversial and subject to political ploys, death threats and so on. At one stage, it looked too big to be of interest to PC users (it seemed to combine the features of all known languages other than Fortran) — again, watch for developments.

Lisp Lisp is one of the oldest languages, which makes standardisation late in its life an almost intractable problem. I receive vast tracts of e-mail correspondence about the efforts to resolve two (perhaps three) seemingly incompatible standardisation efforts (IsLisp at ISO level, based on European work, Common Lisp by ANSI, and Scheme by IEEE). Do PC users care?

Modula-2 I can speak a little more authoritatively here, since I am the secretary of both the BSI and ISO Modula-2 standards committees. We have a semi-complete formal draft (in VDM, the Vienna Definition Method) but need more help with drafting and review. Are any readers with Modula-2 experience interested?

Pascal The existing standard is effectively frozen, except for bug fixing (yes, standards do have bugs). A completely compatible Extended Postal draft standard was issued recently; we will cover this in a future column.

PL/1 Another muddle. Standard PL/1 differs from IBM's mainframe implementation (remember who invented it), and the standardisation committee doesn't seem able to resolve this. There is talk of standardised PL/1 subsets. Again, do PC users care?

Prolog This is another standard being drafted by BSI, and is nearing completion. Again, we'll cover this in a future column.

(Note the views expressed here are BSI Quality Assurance, not BSI Standards.).

John Souter

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PIC files

A recent e-mail message from an Alan Griffiths asked the question: When is a .PIC file not a .PIC file?

Alan has problems with Timeworks DTP when importing .PIC files that were produced with VP Planner. We have tried importing .PIC files created by Lotus 1-2-3 into Timeworks and this works perfectly. Unfortunately we do not have VP Planner so we have not been able to check this. Has anybody else suffered a similar problem? It strikes us as an example of where standards (small 's') are letting us down.

It might be interesting to try to establish a directory of PC file interchange formats, their specifications, who developed and/or controls them and so on.

Would anyone with detailed knowledge of .PIC and other file formats like to contribute?

Neil Martin

Manuals

A bastardisation of Parkinson's Law is: 'manuals always expand to overfill the shelf space allotted to them.'

At BSI we have hundreds of manuals: the Xenix manuals take up a shelf and the Vax VMS manuals keep arriving in crates. What on earth do you do with them? 5 November only comes round once a year, most of us have converted from coal to gas, and there are only so may paper animals you can construct during working hours without being considered frivolous or work-shy. Taking as a baseline '101 uses for a dead cat' I wonder if any of you can think of interesting uses for particular manuals.

The best manual I ever owned was a one-page reference guide to MVS (the horrendously complex IBM mainframe operating system). It didn't contain anything at all — except the name of the technical support guy and an ASCII to EBCDIC conversion table. This gave me all the information I needed to fix any problem, without the effort of having to read anything.

Turbo Pascal version 3 has a one-volume manual, and version 4 has a two-volume manual. Microsoft C version 5 has three manuals. Are they strictly necessary? I must admit to not reading manuals until I am already irritated with the product. I try to do something. I fail. I ask the next twenty people I see if they know how to make it work. They don't. Eventually, I turn to the manual to try and find out what I want.

As software gets bigger and more complex, so do the manuals. The problem is that to use a manual you have to identify your problem in the terms in which the manual was written. This gets more and more difficult the larger and more complex the manual is. Terminology changes from product to product and the functionality provided (and indeed expected by the users) is increasing at such a rate that duplicate terminology can be a real problem. Even where it is commonly agreed, what each term actually means is often ill-defined.

The problems caused by the expansion of manuals do not stop at shelf space. The cost of changing from one word-processing package to another, for instance (Sprint: 4 manuals, 1300 pages in all) becomes phenomenal. This may have two effects — firstly to tie people to packages they are familiar with, but which may not be the best on the market, and secondly to create experts (like my adviser on MVS), who then increase the overheads of owning a computer.

A manual has to be comprehensive if it is to be useful. As software becomes more complex, it is necessary to increase the size of the documentation provided and decrease its usability.

An attempted solution that many packages provide is on-line help. In most cases this is as useless as the manuals, because it suffers from the same problems of volume. Help has to be accurate if it is to be useful, and it is as difficult to index the help as it is to use the manual.

The second line of defence used is to endow a package with an intuitive command set. The only command set I would accept as being intuitive is one that accepts only one command ('Do what I mean') and always gets it right. Some are better than others, but there are always going to be cases where the default is wrong and you want to know how to change it.

The best way to make a manual easy to use is to structure it functionally, limit its size and use a common vocabulary. If a product can only be used by experts then it is either an extremely specialised product or it is never going to be used at all. As Occam's Razor states: 'It is vanity to do with more what you can do with less.'

Martin Davies

We'd like to try and keep to our original goals, and write about standards and software quality assurance — but we'll try to keep this focused on our experience as PC users. However, we will attempt to respond to reader feedback, so feel free to suggest the areas/products or standards (large or small 's') you are interested in.

You can contact us via uk.ac.rl.gm (JANET), 84:MNU174 (Telecom Gold) or via Andy Redfern at the *PCW* office. We look forward to hearing from you!

Disk Library

None of this month's programs were suitable for the disk library — they are all either short hints or (in the case of the Psion Organiser) for a machine which does not take disks. The listing is therefore unchanged from last month.

```
IBM PC    5.25 inch 360k

IBM5-OCT87-0001          Oct 87    MBasic Molecular Models
            Create and display correct 3D molecular models
                         Sept 87   MBasic MS-DOS File Manager
            Access files via a menu system with password protection

IBM5-APR87-0002          Apr 87    Turbo Pascal Circuit Validation
            Create and analyse logic circuits on screen in graphics
                         Apr 87    PC/AT CMOS RAM Editor
            Examine and modify the AT's CMOS RAM

IBM5-SEP86-0003          Sept 86   Turbo Pascal Logiprog
            Interpreter for simple version of Prolog
                         Aug 86    Turbo Pascal Sideways Printer
            Print things out sideways on the printer

IBM5-JUL86-0004          Jul 86    Turbo Pascal 6502 Emulator
            Run 6502 code on your PC. Can run the BBC Micro OS!
                         Feb 86    MBasic Expert System
            Powerful expert system shell

IBM5-NOV87-0005          Nov 87    Turbo Pascal Menus
            Front-end menus for programs and DOS in Turbo
                         Sep 87    Graphics Algorithms
            Very fast graphics routines in assembler and Turbo

IBM5-FEB87-0012          Feb87-Apr 87   Teach Yourself Prolog
            Programs from the Teach Yourself Prolog series

IBM5-NOV87-0015          Nov 87    MBasic Number Pursuit
            Educational arithmetic game based on Trivial Pursuit
                         Dec 87    Turbo Pascal Circuit2
            Design and layout circuit boards (with disk 2 above)

IBM5-DEC87-0017          Dec 87    C Screen Writer
            Fully featured scrolling sign display op screen
                         Jan 88    C Pop-Down Menus
            A set of routines for pop-down menus written in Turbo C
                         Feb 88    C Pdump command
            A simple memory dump program in hex, octal or decimal

IBM5-JAN88-0018          Jan 88    Turbo Pascal Organ
            Used to play chords by switching the tones very fast
                         Jan 88    Turbo Pascal Christmas Tree
            Shows how to use 16 colours on an Amstrad PC-1512-CM
                         Jan 88    MT+ Textchecker
            Style-checking program to accompany feature in PCW

IBM5-FEB88-0019.         Feb 88    Turbo Pascal Movie Maker
            Lets you create animation sequences on a CGA screen
                         Apr 88    Turbo Prolog Universal Parser
            A parser useful as a front end to other systems

IBM5-JUL88-0024          Jun 88    DOS Shell
            A handy Xtree-style utility package
                         Jul 88    Keytree
            GWBasic, MBasic and TBasic listings to accompany article

IBM5-AUG88-0025          Aug 88    Viruses, Trojans and Virus killers
            A set of programs to accompany Alan Solomon's article

IBM5-DEC88-0031          Dec 88    TP4 Mouse Unit
            An excellent mouse control unit
                         Dec 88    TP4 Example units
            Example units to accompany G Robinson's intro to TP4 units

IBM5-JAN89-0032          Jan 88    Prune DOS utility
            Allows whole directory structures to be deleted
                         Jan 88    Connect 4
            The Connect 4 game written in TP4


BBC Micro (single-sided/single-density 100k disks)

BBC1-JUL87-0006          Jul 87    Artwork
            Fully featured painting program, icon based
                         Mar 87    1D Cellular Automata
            Investigate a fascinating mathematical world

BBC1-NOV87-0013          Nov 87    *USE
            Text file display and search utility for help files
                         Nov 87    Empty Drive
            Checks if a drive is empty, works with most DFS's

BBC1-JUN87-0022          Jun 88    Stellator
            Excellent polygon plotting program

BBC1-JAN89-0033          Dec 88    Merata Desktop
            A desktop and diary utility
                         Jan 88    DiscAid
            A disk sector data recovery and repair utility


Apple Macintosh    single-sided disks

MAC--JUL87-0007          Jul 87    Worm Plotter
            Unusual mathematics-based patterns
                         Jun 87    Excel Macros
            Derive rules from tables of data using Excel

MAC--DEC86-0008          Dec 86    Mac Mandelbrot
            Mandelbrot program with a new, fast plotting algorithm
                         Mar 86    Mac Fractal
            Create realistic 3D landscapes using pseudo-fractals


Atari ST  single-sided disks

ST---JAN87-0009          Jan 87    Derwin's Lens
            Investigate natural selection (black and white)
                         Sept 86   Super Breakout
            The old favourite in black and white

ST---MAR88-0021          Mar 88    Fast Basic Chaos
            Uses a mono screen to explore chaos plots

                         May 88    Yamaha TX81Z Editor
            Synth editor for Yamaha TX81Z series

ST--SEP88-0027           Jul 88    ST Link Prog
            Z88 to ST file transfer and conversion utility
                         Sep 88    FETCH!
            A gofer-style file and data search desk accessory

ST--OCT88-0028           Aug 88    Data compression
            A simple Huffman encoding file utility
                         Oct 88    Btree
            Examples and a library of btree functions

ST--NOV88-0029           Nov 88    Timer
            An interrupt-driven memory-resident timer
                         Nov 88    Memory Management Unit
            An improvement on the TOS memory manager


Amstrad PCW    single-sided disks

PCW--JUN87-0010          Jun 87    Mailout
            Mailmerge program for LocoScript
                         Jun 86    Touch Typing Tutor
            How to untangle your fingers

PCW--NOV87-0014          Nov 87    Kong
            Donkey Kong game written in Basic - design screens!
                         Dec 87    File recovery
            Menu-driven undelete program - good and classy

PCW--MAR88-0016          Mar 88    Nimble Fingers
            Useful typing game for brushing up your technique
                         Apr 88    Communications program
            Excellent comms package with Prestel capabilities


Amstrad CPC    single-sided disks

CPC--AUG87-0011          Aug 87    Adventure Creator
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                         May 88    Brelnchild Outline Processor
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Commodore Amiga

AMGA-DEC87-0020   Dec 87    Amiga 3D image maker
            Using the Amiga's blitter for 3D moving graphics
                         Feb 88    Amiga Label Printing Utility
            An address label printer to accompany PCW feature

AMGA-AUG88-0026   Apr 88    Disk Sector display
            A byte-level disk sector display utility
                         Aug 88    Nonplussed
            A simple tactical game using a variable-sized grid


Acorn Archimedes

ARCH-JUL88-0023          Apr 88    Mouse pointer editor
            Allows the creation and use of any shape of mouse icon
                         Jul 88    Acorn Logic
            A simple educational digital circuit logic emulator

ARCH-DEC88-0030   Nov 88    Archimedes Utilities
            A number of relocatable modules for screen, memory and disks
                         Dec 88    Archimedes File Utilities
            A collection of Archimedes file utilities in module form
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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.
- The catalogue list is organised by machine and disk size. The first number is the disk's catalogue number which should be quoted when ordering. The date is the issue of *PCW* in which the program appeared, and the rest is a brief description of the disk's content.
- **IMPORTANT** Disks can only be ordered from S&S Enterprises, *PCW* Disk Library, Weylands Cottage, Water Meadow, Germain Street, Chesham, Bucks HP5 1LP. Payment can be made by credit card, cheque, banker's draft, postal order or cash. Telephone orders can be made by credit card on (0494) 791900.

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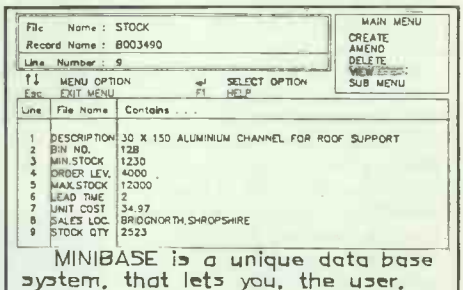
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There's more to life than a fast Batcher sort — try a heapsort instead. David Barrow helps things along.

Heapsort

Martin Simmons of Cambridge is surprised at all the effort being put into speeding up the Batcher sort when other sorts are intrinsically faster. This being so, he offers a Z80 routine to perform the 'heapsort' on files of any size or type of record (Datasheet 1), along with a set of subroutines performing the file access operations on 16-bit signed integers (Fig 1).

The 'heap' used in a heapsort is a partially ordered binary tree with the following properties:

- The root is always the largest element of the tree.
- The one or two children of each node are always less than or equal to the parent node.
- There is no ordering between the two children of any node.

The sorting technique consists of placing a new element at the root, comparing it with its two child nodes and exchanging with the larger child if found to be smaller. The inserted value thus moves down the tree until its correct heap position is found — either as a terminal node or greater than or equal to both child nodes.

By starting with single node heaps and combining them, the largest element must necessarily have found its own level at the root of the tree when the entire file is heap structured. The root node can thus be removed from the heap and placed in correctly sorted order at the end of the file. The process iterates with one less element in the heap each time until the whole file is sorted.

Program description

Instead of a Datasheet program description, Martin has provided a complete test program in BCPL (Fig 2). The latter part provides the algorithms used by Martin for his HEAPSZ, PILEUP, SWAP and BACKWD routines.

In Martin's opinion a program written in a structured language, such as BCPL, can show a routine's structure more clearly than any pseudo-code description. This may be so, but only if you can understand the syntax or quirks of the language concerned. For reasons of spatial, logical or ergonomic economy these are not always clear to non-users of the language.

On the whole, I would far rather see an algorithm boringly described in a bog-standard pseudo-code whose three or four constructs are obvious to anyone with no more than a modicum of intelligence.

Digital reorganisation

Recent SubSets have featured routines in many common codes that rapidly reverse the order of bits within a byte, known as 'byte-flips'. The 256-byte look-up table method has proved fastest.

I have had queries as to the usefulness of this type of routine. In October I suggested a major use in dot matrix and laser font redefinition. Now Chris Blackmore of Taunton has written to say that he remembers this process as part of the Fast Fourier Transform. He didn't say which part.

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*, VNU House, 32-34 Broadwick Street, London W1A 2HG.

Datasheet 1

```
;=================================================================
;HEAPSZ          Own-space in-RAM Heapsort.
;=================================================================
;STRUCTURAL CONCEPTS
;PROGRAM         See BCPL program.
;-----------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR       Z80
;HARDWARE        RAM as needed by file length and subroutines.
;SOFTWARE        Local subroutine: PILEUP.
;                User supplied file access routines:
;                KSWAP : locate & swap two records, given keys.
;                        input:  HL  = 1st key
;                                DE  = 2nd key
;                                BC' = address of R(0)
;                        output: Cy  = 0 = error.
;                ASWAP : swap two previously located records.
;                        input:  HL' = 1st record address
;                                DE' = 2nd record address
;                        output: Cy  = 0 = error.
;                BACKWD: locate & test if two records are backward
;                        given record keys.
;                        input:  HL  = 1st key
;                                DE  = 2nd key
;                                BC' = address of R(0)
;                        output: HL' = 1st record address
;                                DE' = 2nd record address
;                                S   = 0 if 1st R. is after 2nd ...
;                                Cy  = 0 = error.
;                CALC  : find addresses (2nd level subroutine).
;                        input:  HL  = 1st key
;                                DE  = 2nd key
;                                BC' = address of R(0)
;                        output: HL' = 1st record address
;                                DE' = 2nd record address
;                                Cy  = 0 = error.
;-----------------------------------------------------------------
;PROGRAM DETAILS
;INPUT           DE = size = number of records.
;                HL = address of 1st record, R(0).
;OUTPUT          Cy = 0 for error in user supplied routine.
;                Cy = 1 for sort completed.
;STATE CHANGES   AF BC DE HL AF' BC' DE' HL ' changed.
;                Main memory affected by KSWAP & ASWAP.
;I/O ERRORS      None known but errors could occur in user
;                supplied routines.
;OPTIMISATION    Use of known carry for exit/error flag.
;                A reversed comparison to eave next record in NODE
;                reducing number of addresses calculated.
;INTERRUPTS      Interruptable and re-entrant, depending on user
;                supplied routines.
;LOCATION NEED   Not specific. Not relocatable. PROMable.
;PROGRAM BYTES   100
;STACK BYTES     8 + subroutine use.
;TIMING          23 seconds to sort 10 000 random signed integers,
;                using supplied routines, at 4 MHz with no wait
;                states and no interrupts.
;=================================================================
;
HEAPSZ  PUSH    HL          ;Copy array start into BC'.         E5
        EXX                 ;                                   D9
        POP     BC          ;                                   C1
        EXX                 ;                                   D9
        LD      H,D         ;Save arráy length.                 62
        LD      L,E         ;                                   6B
        SRL     H           ;Get middle element.                CB 3C
        RR      L           ;                                   CB 1D
;
HPL1    PUSH    HL          ;Save current node.                 E5
        CALL    PILEUP      ;Add new element to the heap.       CD lo hi
        POP     HL          ;Retrieve current node.             E1
        RET     NC          ;Exit Cy=0 if error.                D0
;
        DEC     HL          ;                                   2B
        LD      A,H         ;                                   7C
        OR      L           ;                                   B5
        JR      NZ,HPL1     ;Loop until node 0.                 20 F5
;
HPL2    LD      HL,1        ;Set first node.                    21 01 00
        CALL    KSWAP       ;Swap max element with end of       CD lo hi
        RET     NC          ;heap, exit if error.               D0
;
        DEC     DE          ;Put old last element               1B
        CALL    PILEUP      ;back into heap.                    CD lo hi
        RET     NC          ;Exit if error.                     D0
;
        LD      A,D         ;                                   7A
        AND     A           ;                                   A7
        JR      NZ,HPL2     ;Loop until high byte = 0           20 F0
;
        LD      A,E         ;                                   7B
        CP      1           ;                                   FE 01
        JR      NZ,HPL2     ;Loop until low byte = 1            20 EB
;
        SCF                 ;Set Cy=1 for success               37
        RET                 ;and exit, sort completed.          C9
;
;... Local subroutine to rebuild heap (preserves DE = NEXT)
;
PILEUP  LD      B,D         ;Copy DE=NEXT to BC=LAST.           42
        LD      C,E         ;                                   4B
;
PUL1    LD      D,H         ;Find 1st child of NODE             54
        LD      E,L         ;at NODE*2.                         5D
        ADD     HL,HL       ;                                   29
        JR      C,PILED     ;Exit Cy=1 if end of array.         38 11
;
        SBC     HL,BC       ;Check for end of array.            ED 42
        ADD     HL,BC       ;                                   09
```

```
        EX    DE,HL     ;                              EB
        JR    C,PMORE   ;                              38 0E
;
        SCF             ;                              37
        JR    NZ,PILED  ;Exit Cy=1 if LAST < NODE.     20 08
;
        CALL  BACKWD    ;Deal with an only child.      CD lo hi
        JR    NC,PILED  ;Exit, Cy=0, if error.         30 03
;
        CALL  M,ASWAP   ;Swap records if needed.       FC lo hi
;
PILED   LD    D,B       ;Restore DE=NEXT to entry value. 50
        LD    E,C       ;                              59
        RET             ;Exit, Cy flagging any error.  C9
;
PMORE   PUSH  HL        ;Current node has 2 children.  E5
        LD    H,D       ;Calculate 2nd child node.     62
        LD    L,E       ;                              6B
        INC   HL        ;                              23
        CALL  BACKWD    ;Ensure HL := greater child.   CD lo hi
        JP    P,GOTBIG  ;                              F2 lo hi
;
        EX    DE,HL     ;                              EB
;
GOTBIG POP    DE        ;Current node into DE=NEXT.    D1
        JR    NC,PILED  ;Exit Cy=0 if BACKWD error.    30 EF
;
        CALL  BACKWD    ;Test order of node and child. CD lo hi
        JR    NC,PILED  ;Exit Cy=0 if error,           30 EA
        JP    M,PILED   ;or Cy=1 if correct order.     FA lo hi
;
        CALL  ASWAP     ;Swap if out of order and      CD lo hi
        JR    C,PUL1    ;loop if no error              38 CC
        JR    PILED     ;else exit, Cy=0, if error.    18 E0
;
;===============================================================
```

Fig 1

```
;===============================================================
;
;... KSWAP, ASWAP, BACKWD, CALC for signed 16-bit integers.
;... input/output:     HL, DE contain keys.
;...                   HL', DE' contain record addresses.
;... (see HEAPSZ)      BC' contains address of record (0).
;
;... Swap two records given keys.
;
KSWAP  CALL  CALC       ;Get addresses from keys.      CD lo hi
       RET   NC         ;Exit if error, else fallthru... D0
;
;... Swap two records given addresses.
;
ASWAP  EXX              ;Access addresses.             D9
       LD    A,(DE)     ;Swap record low order bytes.  1A
       EX    AF,AF'     ;                              08
       LD    A,(HL)     ;                              7E
       LD    (DE),A     ;                              12
       EX    AF,AF'     ;                              08
       LD    (HL),A     ;                              77
       INC   DE         ;Point to hi-bytes.            13
       INC   HL         ;                              23
       LD    A,(DE)     ;Swap high order bytes.        1A
       EX    AF,AF'     ;                              08
       LD    A,(HL)     ;                              7E
       LD    (DE),A     ;                              12
       EX    AF,AF'     ;                              08
       LD    (HL),A     ;                              77
       EXX              ;                              D9
       SCF              ;Set Cy=1 to flag success.     37
       RET              ;                              C9
;
;... Locate and test order of two records given keys.
;
BACKWD CALL  CALC       ;Get addresses from keys       CD lo hi
       RET   NC         ;Exit if error.                D0
;
       EXX              ;Access addresses.             D9
       LD    A,(DE)     ;Compare low order bytes.      1A
       SUB   (HL)       ;                              96
       INC   DE         ;Point to hi-bytes.            13
       INC   HL         ;                              23
       LD    A,(DE)     ;Compare high order bytes.     1A
       SBC   A,(HL)     ;                              9E
       JP    PE,SAMESN  ;Return result if same sign.  EA lo hi
;
       XOR   80H        ;Else complement result.       EE 80
;
SAMESN DEC   DE         ;Leave pointers at             1B
       DEC   HL         ;record addresses.             2B
       EXX              ;                              D9
       SCF              ;Set Cy=1 to flag success.     37
       RET              ;                              C9
;
;... Locate records given keys.
;
CALC   PUSH  HL         ;Save keys.                    E5
       PUSH  DE         ;                              D5
       EXX              ;                              D9
       POP   HL         ;Retrieve key and double it    E1
       ADD   HL,HL      ;for 2-byte records.           29
       ADD   HL,BC      ;Add base (address of R(0)).   09
       EX    DE,HL      ;Address into DE'.             EB
       POP   HL         ;Repeat for 2nd key,           E1
       ADD   HL,HL      ;                              29
       ADD   HL,BC      ;address in HL'.               09
       EXX              ;                              D9
       SCF              ;Set Cy=1 to flag success.     37
       RET              ;                              C9
;
;===============================================================
```

Fig 2

```
;===============================================================
;
;... HEAPSORT program in BCPL showing the algorithm used in the
;... Z80 routine HEAPSZ.
;
; GET "LIBHDR"
;
; manifest
; $(
;     size0 = 39
;     numbersize = 10
;     numberbase = 0
;     seed0 = 12341
; $)
;
; static
; $(
;     array = ?
;     size = ?
;     seed = seed0
; $)
;
; let start() be  // The main routine
; $(
;     let mem = vec size0
;
;     array := mem
;     size := randy(1, size0)
;     selectoutput(findoutput("SYSPRINT"))
;
;     fillrandom()
;     displayheap()
;
;     heapsort()
;     displayheap()
; $)
;
; and fillrandom() be     // Initialize
; $(
;     for i = 1 to size do
;         array!i := randy(numberbase, numbersize)
; $)
;
; and displayheap() be    // Print out heap
; $(
;     writes("*NHeap contents:*N")
;
;     for i = 1 to size do
;         writef("%N ", array!i)
;
;     newline()
; $)
;
; and randy(base, mag) = valof    // Find the next random number
; $(
;     seed := (13*seed+time()) & #x7FFFFFFF
;     resultis (seed rem mag)+base
; $)
;
;
; and heapsort() be   // ACTUAL SORT ALGORITHM of "HEAPSZ".
; $(
;     for i = size/2 to 1 by -1 do
;         pileup(i, size)             // Ensure a partial order
;     for i = size to 2 by -1 do
;     $(
;         swap(1, i)                  // Remove maximum
;         pileup(1, i-1)          // Re-establish partial order
;     $)
; $)
;
; and pileup(node, last) be   // Establish partial order in heap
; $(
;     let next = node*2
;
;     if next > last then break
;
;     if next = last
;         then                // Deal with an only child
;         $(
;             if backward(node, last) then swap(node, last)
;             break
;         $)
;
;     if backward(next, next+1)   // Find greater child
;         then next := next+1
;
;     test backward(node, next)   // Move up a large child
;         then
;         $(
;             swap(node, next)
;             node :=next
;         $)
;         else break          // Heap is now partially ordered
;
; $) repeat
;
; and swap(x, y) be           // Exchange A(x) and A(y)
; $(
;     let temp = array!x
;
;     array!x := array!y
;     array!y := temp
; $)
;
; and backward(x, y) =        // Test for A(x) before A(y)
;     array!x < array!y
;
;===============================================================
```

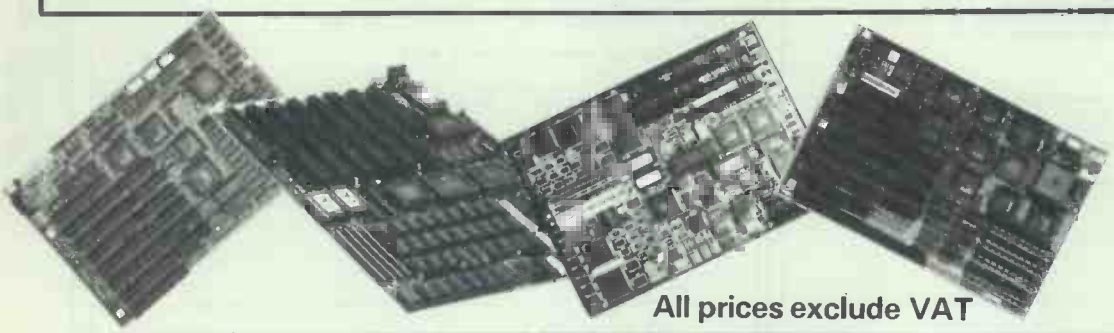
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Protect yourself

As a bulletin board user or SysOp, do you know where you stand in relation to the Data Protection Act? Gerald Janes gives some guidelines.

I have received many suggestions for future articles for this column, including a discussion about the Data Protection Act, a novice's guide to setting up and running a bulletin board, and comparisons of the features and benefits of the many file transfer protocols in use on bulletin boards. This month I'll look at the Data Protection Act 1984.

The Data Protection Act 1984

The Data Protection Act 1984 is a wide-ranging piece of legislation. The Data Protection Registrar publishes a comprehensive set of guidelines which are available free of charge from The Office of the Data Protection Registrar, Springfield House, Water Lane, Wilmslow, Cheshire SX9 5AX. The telephone number for enquiries is (0625) 535777. I have drawn upon some of the salient points from the guidelines, some extracts of which are quoted here.

The Act is about the storage, use and availability of 'personal data'. Personal Data, which is information about people, is not subject to the Data Protection Act 1984. The Act places obligations on those people who record and use personal data; these are called 'data users'.

Personal Data is defined as information recorded on a computer about living, identifiable individuals. Statements of facts and expressions of opinion about an individual are personal data but an indication of the data user's intention towards the individual is not. Data users are people or organisations who control the contents and use of a collection of personal data. A data user will usually be a company, corporation or other organisation but it is possible for an individual to be a data user.

I have spoken to the Office of the Data Protection Registrar on more than one occasion to try to obtain clarification about how the Act applies to bulletin boards and bulletin board SysOps. It appears that we fall in a grey area not specifically categorised. The general response was that if you were not sure whether or not you should register, err on the side of caution and do so. I have outlined here some personal opinions which I hope will enable you to determine if the Act applies to you and whether or not you should register.

BBS guidelines

For me, the key phrase in the guidelines was the fact that the Act covers information stored on a computer about *living, identifiable individuals*. The question you need to ask yourself is 'do I fall within this definition as a consequence of running my bulletin board?' Certainly you are storing information on your computer. Is the information about living, identifiable individuals?

Unless you have a unique bulletin board and a route to the afterlife, it is almost certain that your users are living! Therefore, it comes down to whether or not the information you store makes your users identifiable. The chances are it is almost certain to be the case.

Unless you run a bulletin board which operates exclusively using pseudonyms and 'handles', and users give no other information, it may be that you do not fall within the scope of the Act. If you have one or more users whose real name and/or telephone number and/or address and/or date of birth are stored on your system in the user database, then it is almost certain you fall within the scope of the Act.

Having determined this, what do you do about it? Do you register your BBS with the Data Protection Registrar or do you do something which takes you outside the scope of the Act? It has been suggested to me that turning your bulletin board into a club and declaring it as such obviates the need for registration.

Exemptions

Guideline 6 contains a list of the exemptions. Exemption 5 is unincorporated members' clubs (see page 15 of the guidelines). The guideline says that personal data held by an unincorporated members' club and relating only to members of the club is exempt from the whole of the Act so long as two conditions are observed:

- *The first condition* is that all members of the club must be asked whether they object to the personal data relating to them being held by the club.
- *The second condition* is that the personal data about members may only be disclosed in limited circumstances. The guideline also covers instances where members do object to personal data being held by the club and where disclosure may be made.

The exemption does not apply to any personal data held by the club about individuals who are not members of the club, if the club is a corporate body, and to a club which is not owned by its members — a proprietor's club.

It is this last condition which causes me concern. I own and operate my bulletin board but the users join the 'club'. Am I operating a proprietor's club? It is most likely that provided I comply with the conditions laid out in the guideline I am OK and do not need to register, but I cannot say this with 100% certainty. When I spoke to the Office of the Registrar I was told that it was almost certain that compliance with these conditions exempted me, but again, if you are in doubt do contact them directly.

How have I overcome the problem? I have created a display which declares my BBS to be a club and which broadly covers the exemption conditions, and all new users are presented with a message describing them. (Having started to write this article I have realised there is a mistake in my own message. It refers to the 1985 Act — it should be 1984!)

At present I am considering whether to register under the Act. At the time of writing I have not come to a decision. If I decide to, I will let you know how I get on.

What do you, the readers, think? Are you a SysOp who is debating whether to register or not? Are you a BBS user who is interested in the impact of the Data Protection Act upon your activities? If you have any strong views why not drop me a line?

Suggestions, information and amendments to the BBS list should be sent to Gerald Janes via his own BBS, Hawk's Castle, or on Prestel (MBX 819990436); CompuServe (71571,347); or Telecom Gold (81:TWH153). He can also be contacted on CIX as 'gjanes'.

London

- 01 for Amiga (01) 377 1358 MF: 6pm-10am; WE:24hrs; 3/1275; Amiga & ST
- ACS BBS (01) 591 6687 10pm-9am; 3/1275; Mainly ST
- Arrakeen (01) 738 7304 24hrs; 3/1275
- Body Matters (01) 603 7581 24hrs; 3-24; Medical topics
- Brixton ITeC (01) 735 8153 24hrs; 1275
- Brown Bag (01) 591 6687 24hrs; 3/12/24
- Carshalton Atari BB (01) 773 0408 24hrs; 3/1275; Mainly ST
- CBBS-London (01) 249 3238 24hrs; 3/1275; Mainly Spectrum
- CIX (01) 399 5252 24hrs; 3-24; multi-user; conferencing; subscription
- Club 1512 (01) 204 8755 24hrs; 3-24
- Communitel (01) 968 7402 24hrs; 1275v
- Co-op Board (01) 316 6488 24hrs; 3-24; PC & BBC
- Crystal Tower (01) 886 2813 24hrs; 3-24 Gen interest; Apple & IBM
- Cynotel (01) 346 2816 9pm-8am; 1275v; Amstrad
- Dark Crystal Fido (01) 207 2969; 24hrs; 3-12
- Data Network (01) 478 5464 24hrs; 3-24; PC, Atari, CP/M
- Databank (01) 534 1200 24hrs; 3-24; PC,CP/M
- Dateflex BBS (01) 543 7020 24hrs; 3/12
- Direct Connection (01) 853 3985 24hrs; 3-24; MU; Subscription;
- Direct Line (01) 841 1647 24hrs; 3/12/24; PC Support
- Distel (01) 679 8183 24hrs; 3/1275 Commercial
- The Embassy (01) 366 1778 24hrs; 3-24
- The Emerald Tower (01) 405 8983 9am-5pm; 3/1275
- Gnome at home (01) 866 8894 24hrs; 1275v; MU; Public areas & Subscription
- Hackney BBS (01) 985 3322 24hrs; 1275v
- Health Data (01) 986 4360 24hrs; 1275v; Medical topics
- Heaven (01) 994 9119 24hrs; 3/1275a; MU; MultiUser games
- Infotel ROS (01) 581 3376 24hrs; 3/1275; Amstrad
- Jolly Roger (01) 742 1640 24hrs; 3/1275
- Kybernesis (01) 673 7294 24hrs; 3-24 For church & charity computer users
- London Connexion (01) 657 3240; 24hrs; 3-24; Subscription
- London Metropolis (01) 519 1055 24hrs; 3-24
- London U'gnd (01) 863 0186 24hrs; 3-24; MU
- MacTel Metro (01) 543 8017 24hrs; 3-24; MU
- MBBS Mitcham (01) 648 0018 24hrs; 3/1275
- Metrotel (01) 941 4265 24hrs; 1275v
- NNBBS London (01) 455 6607 24hrs; 3/1275
- Notlingdale Tec Ctr (01) 968 6033; 24hrs; 1275v; Communitel system
- OSI Lives (01) 429 3047 24hrs; Ring back; 300
- PC Access (01) 608 0081 24hrs; 3-24; M PC USER Mag BBS; Subscription
- PC Server (01) 864 2833 24hrs; 3-24; M
- The Pink Triangle (01) 961 5866 10pm-8am; 3/12/24; Gay BBS
- Prometheus (01) 300 7177 24hrs; 1275v; Astronomers' SIG
- Sirius/WBBS (01) 542 3772 24hrs; 3/1275
- Skull's Tower (01) 943 1194 24hrs; 3/1275; IBM
- SW10 Warehouse (01) 351 7262 24hrs; system

3-24; HST
- **TBBS Rovorsed** (01) 542 9767 24hrs; 3-24
- **TBBS London** (01) 348 9400 24hrs; 12/24
- **Techno-Line** (01) 450 9764 24hrs; 1275v; Commercial
- **Technoline 2** (01) 452 1500 MF: evenings; WE:24hrs 1275v Commercial
- **The Village** (01) 464 2518 24hrs; 3-24 Atari 520ST based
- **Third Wave Systems** (01) 585 3163 24hrs; 3/1275
- **Wanderland** (01) 680 5530 24hrs; 1275; MUG
- **Woodgreen BBS** (01) 889 5624 24hrs; 3/1275

The Midlands

- **AIX 386 BBS; Worcester** (0905) 754127 & 52536 24hrs; 3-24; Subscription
- **Academica; Birmingham** (021) 705 9677; 24hrs; 3/1275
- **Barney's Rubble; Birmingham** (021) 444 2854; 24hrs; 3-24
- **Central Opus;* Birmingham** (021) 711 1451 24hrs; 3-24; PEP; 130Mb storage; Trailblazer
- **CBABBS; Birmingham** (021) 430 3781 24hrs (not Thurs); 300 Atari based can send mail to Canada
- **Chrono's Lair; Birmingham** (021) 744 5561 24hrs; 3-24
- **Digital Matrix; Birmingham** Birmingham (021) 705 5187; 24hrs; 3/1275/12
- **Exchange Centre;** (0767) 50511; 24hrs 3-24
- **Intel-Ace; Oundle** (0832) 73003; 24hrs; 1275v
- **The Junction; Crewe** (0270) 580099; 24hrs; 3-24 08:00 - 23:59 and 3/12/24/HST 00:00 - 07:59
- **MacTel HQ; Nottingham** (0602) 455444; 24hrs; 3-24; MU; Mac
- **MonuSci Opus; Coventry** (0203) 545665; 24hrs; 3-24; For DP professionals
- **MWCFE; Leamington Spa** (0926) 21844; 24hrs; 3-24
- **The City; Birmingham** (021) 353 5488 24hrs; 300 Atari 8 bit & ST; Lonely Hearts
- **Project Stourbridge** (0384) 401770; 24hrs; 3-24
- **Sherwood Forest BBS; Nottingham** (0602) 397113; 24hrs; 3-24
- **TABBS Amiga BBS; Leicester** (0533) 550893; MF:8pm-9am Sun:24hrs; 3/1275/12; Amiga
- **Trinity 4; Leamington Spa** (0926) 28294; 24hrs; 3-24
- **TUG II; Birmingham** (021) 444 1484; 24hrs; 3/1275 Amstrad;Tandy
- **Wolverhampton BBS** (0902) 745337; 24hrs; 3/1275 MS-DOS; CP/M; Commodore areas

The North East

- **Enterprise; Beverley** (0482) 872294; 24hrs; 3/1275
- **Forum-80; Hull** (0482) 859 169 MF:7pm-11pm; WE:1pm-11pm 3/1275
- **Hamnet; Hull** (0482) 465150 MF:8pm-8am; WE: 24hrs; 300; Radio Hams
- **Kirklees ITeC; Batley, Yorks** (0924) 442598; 24hrs; 1275v Information Technology Centre
- **Kirklees Opus** (0484) 685415 6pm-9am; 3-24
- **Leconfield RCPM**(0964) 550745 24hrs; 3-12
- **LEMS Wildcat!; Leeds** (0532) 600749; 24hrs; 3/1275
- **Log On Tyne Fido; Tyneside** (091) 477 3339 24hrs; 3-24
- **Merlin; Bradford** (0274) 573481 24hrs; 3-24
- **N. Yorks Opus Knaresborough** (0423) 868065; 24hrs; 3-24
- **Poacher CBCS; Grantham** (0476) 62450; 24hrs; 3-24; M
- **Stockton QBBS; Stockton** (0642) 588989 24hrs; 3-12
- **Typesetter's Workshop; Bradford** (0274) 370381; 24hrs; 3/1275/12 Desk Top Publishing

The North West

- **The Co-op Board; Manchester** (061) 832 1961; 24hrs; 3-24
- **Diggertel** (0925) 411265 24hrs; 3-24
- **The Gaslamp Rochdale** (0706) 358331; 24hrs; 3-24
- **Liverpool Mailbox** (051) 428 8924 24hrs; 3-24 UK TBBS HQ system
- **Matrix; Liverpool** (051) 737 1882; 24hrs; 3/1275
- **Mektronic; Manchester** (061) 773 7739; 24hrs; 3-24
- **Merkinstead; Manchester** (061) 434 7059; 24hrs; 3-24 Desk Top Publishing
- **OBBS; Manchester** (061) 427 1596 24hrs; 3/1275
- **Road Runner; Manchester** (061) 456 4620; 9pm-8am 3-24
- **Stoke ITeC** (0782) 265078 24hrs; 1275v
- **TeePee Link; Manchester** (061) 484 6938 24hrs; 3-24 Subscription
- **Ultimate Source; Manchester** (061) 678 9580; MF:8pm-9am; WE:24hrs; 3-24

The South East

- **Acorn BBS; Cambridge** (0223) 243642 24hrs; 1275v
- **Airtel TBBS** (0342) 717600 W Sussex; 24hrs; 3-24; Pilots' area
- **Andrew's Fido** (08444) 4833 & 4430; 24hrs; 3-24 M; IBM-based system
- **ASD Opus; Watford** (0923) 247637; 24hrs; 12/24
- **Audio Output; Weybridge** (0932) 244906; 24hrs; 3/1275 Viewdata & scrolling
- **Banat Board; Oxford** (0865) 882872 24hrs; 3-24 FidoNet UK coordinator multi-line TBBS
- **Basingstoke Opus** (0256) 726331; MF:8pm-8am WE:24hrs; 3-24
- **BBS09 II; Portsmouth** (0705) 736025 24hrs; 3/12/24; HST;M; OS9; Sci-Fi, Dragon
- **BITEC; Basildon** (0268) 22177 24hrs; 1275v
- **BOOG BB; Fleet; Hants** (0252) 626233; 24hrs; 3/1275 Osborne; MS-DOS; CP/M areas
- **C View Rochford; Kent** (0702) 546373; 24hrs; 1275v
- **Castle BBS; Camberley** (0276) 66741; 24hrs; 3-24
- **CATS BBS*; Maidenhead** (0628) 824852; 24hrs; 3-24
- **The Co-op Board; Bournemouth** (0202) 532701; 24hrs; 3-24
- **The Co-op Board; Portsmouth** (0705) 754841; 24hrs; 3-24
- **CP/M User Group; Windsor** (0753) 868196; 24hrs; 3-24 CP/M and MS-DOS software
- **Datasoft Opus; Ilminster** (04605) 4615; 24hrs; 3-24 Inc Datatalk Support area
- **Dave's Opus, Addingham** (0943) 830820; 24hrs; 3-24
- **Dr Solomon's Fido; Amersham** (0494) 724948; 24hrs; 3-24 mostly for IBM programmers
- **Eddie's BBS; Newbury** (0635) 71324; 24hrs; 3-24
- **Eye-2; Camberley** (0276) 66212 24hrs; 3/1275; PC, Atari Amiga
- **Exchange Software** (0767) 50511; 24hrs; 3-24M
- **Fido UK 1; Reading** (0734) 713909; 24hrs; 12-24
- **Folkestone TBBS** (0303) 42690 24hrs; 3-24; Portable SIG
- **Frix; Reading** (0734) 420229 24hrs; 3-24
- **GABBS; Gosport Apricot BBS** (0705) 524805; 24hrs; 3-24
- **Grapevine; Basingstoke** (0256) 471757; 24hrs; 1275v
- **Hawk's Castle; Bracknell** (0344) 411621; 24hrs; 3/12/24/HST; M (Leave details of your BBS here)
- **Ichthus; Reading** (0734) 484847; 24hrs; 3-24
- **ID2; Worthing** (0903) 700771; 24hrs; 3-24; games authors BBS
- **The Lamplight; Portsmouth** (0705) 811531; 24hrs; 3-24
- **MacTel Phoenix; Ipswich** (0473) 610139; 24hrs; 3-24 MU; Mac users
- **The Manor QBBS; Salisbury** (0980) 863031; 24hrs; 3-24; Node 251/24
- **Maptel; Southend** (0702) 552941 24hrs; 300; commercial system
- **Mirrorworld; Surrey** (0883) 844044/844184; 24hrs 3/1275; Multi-user games
- **Music World; Weybridge** (0932) 245583; 24hrs; 3/1275v Viewdata & scrolling
- **PD-SIG; Crowborough** (0892) 661149 24hrs; 3/1275 PD software interest group
- **PC Serve; Uxbridge** (0895) 420184 24hrs; 3-24; M also on 0895 52685
- **Reflex BBS; Southampton** (0703) 685527 24hrs; 3-24; Node 251/20
- **RSGB** (0707) 52242 24hrs; 1275v
- **SBBS; Watford** (0923) 676644 9pm-11am plus 11pm-6am daily 3/1275
- **Sentinel; Maidenhead** (0628) 781429; 3-24 IBM PC; FidoNet
- **Shareware; Tonbridge** (0732) 770539; 24hrs; 3-12 Shareware Marketing's BBS
- **Sistel Viewdata; Southampton** (0703) 775566; 1275v What's on, sports, notices etc
- **Sky Channel; Guildford** (0483) 275455; MF:6pm-8am WE:24hrs; 1275v
- **Staines BDS** (0784) 65794 24hrs; 3/1275
- **Typenet** (0689) 50866 24hrs; 300; Budget Typsetting
- **Vampire's Coffin; Weybridge** (0932) 245593 24hrs; 1275v Viewdata & scrolling
- **Wazzy's Opus; Worthing** (0223) 213784; 24hrs; 3-24
- **Wiggynet; Southampton** (0703) 267602; 10pm-7am; 3-24; ST system
- **Winchester Remote** (0962) 89322 24hrs; 3-24

The South West

- **ROS South West; Exeter** (0392) 53118 24hrs; 3-24
- **Cryton #1; Street Somerset** (0458) 47608; 24hrs; 3-24
- **FAL Opus; St Ives** (0736) 794827; MF:6pm-8am; WE:24hrs; 3/1275
- **Kernow BBS; Cornwall** (0209) 821870; 24hrs; 3-24
- **Light Fingers Place; Dorset** (0202) 485723; 24hrs; 3-24; Atari ST, QL
- **Microdeal; St. Austell** (0726) 65422; 24hrs; 3/1275
- **Plymbase; Plymouth** (0752) 670714; 6pm-9.30pm 300; Einstein oriented
- **Trinity 1; Exeter** (0392) 410210; 24hrs; 3-24 Christian, Infomat mag
- **Trinity 2; Faringdon** (0367) 22784; 24hrs; 3/1275 Sponsored by Courtiers Consultancy Node 255/113
- **West Country BBS; Saltash** (0755) 58806; 8am-11pm 3/1275; Einstein oriented
- **World of Cryton; Street** (04580 47608; 24hrs; 3-24

The West

- **Avon Opus; Weston-s-Mare** (0934) 29570; 24hrs; 3-24
- **Bubble BBS; Swindon** (0793) 851454; 24hrs; 3-24
- **Crow's Nest; Swindon** (0793) 813633; 7pm-7am; 3-24
- **Firefox; Swindon** (0793) 828780; 24hrs; 3-24
- **Lazer Tower; Bristol** (0272) 783733; 24hrs; 3-24
- **MIX; Bristol** (0272) 583818; 24hrs; 3-24 MIRROR II Support BBS
- **The Phoenix; Calne** (0249) 817704; 24hrs; 3-24
- **STABB BBS; Swindon** (0793) 855178; 24hrs; 3-12

The East

- **Amiga Board; Basildon** (0268) 510485; MF:8pm-8am; WE:24hrs; 3/12/24
- **Apple Crackers; Basildon** (0628) 781318; 24hrs; 3/1275
- **Armadillo BBS; Norfolk** (0362) 695314; 24hrs; 1275
- **BABBS; Felixstowe** (0394) 276306; 24hrs; 3-24
- **Barnabas BBS; Upminster** (0708) 852526; 24hrs; 3-24
- **Bob's Bizarre; Felixstowe** (0394) 279644; 24hrs; 12/24
- **Eureka; Norwich** (0603) 250689; 24hrs; 3/1275/1275v; Archimedes
- **Felixstowe Opus** (0394) 673855; 24hrs; 3-24
- **Folkestone TBBS** (0303) 42690; 24hrs; 3-24
- **Index Linked; Whitstable** (0227) 770403; 24hrs; 3/12/24/HST; M
- **Ivory Tower; Chelmsford** (0245) 415321; 24hrs; 3-24
- **The Official Amstrad BBS; Brentwood** (0277) 231278; 24hrs; 3-24
- **Softmatic Innovations; Peterborough** (0733) 322540; 24hrs; 3/12/24

Channel Islands

- **Central Line Opus; Jersey** (0534) 58989; 24hrs; 3-24 PC, BBC, CP/M
- **Jersey Fido** (0534) 39 389 24hrs; 3/1275
- **Psychobabble Jersey** (0534) 52088; 24hrs; 3-24 PC & ST oriented
- **Master Control; Jersey** (0534) 58929; 24hrs; 3-24

Scotland

- **Aberdeen ITEC** (0224) 641585 24hrs; 1275v
- **The Auld Reekie BBS; Edinburgh** (031) 663 9924; 24hrs; 3/1275/12
- **Boffin BBS; Edinburgh** (031) 664 2147 RB 3/1275/1275v
- **Beteigeuse 5; Inverness** (0463) 231339; 24hrs; 3/1275
- **Jock's Away!; Edinburgh** (031) 225 5368; 24hrs; 3-24
- **Kirklees ITeC; Batley** (0924) 442598 24hrs; 1275v Information Technology Centre
- **Lambda Board; Edinburgh** (031) 556 6318; 24hrs; 3/1275/1275v
- **Livingstone BBS; Livingstone** (0506) 38526 24hrs; 3
- **Magpie Opus; Glasgow** (041) 941 1333; 24hrs 3-24; Education oriented
- **People's Palace; Glasgow** (041) 956 6537 24hrs; 3/1275/1275v
- **SBBS Aberdeen** (0224) 781919 24hrs; 3
- **Scot Air; Paisley** (041) 884 7170; 24hrs; 3-24
- **Scottish Opus** (041) 880 7863; 24hrs; 3-24
- **Scottish Wildcat!;** (0357) 22582; 24hrs; 3-24
- **South Side Wildcat!; Glasgow** (041) 649 9043; 24hrs; 3-24

Wales

- **Bulletin 80; Swansea** (0792) 297845 MF:8pm-9am WE:24hrs; 3-24;
- **Cardiff ITeC** (0222) 464 725 24hrs; 1275v
- **Cath Wylit; Llanelli** (0554) 770517; MF:8pm-8am WE:24hrs; 3/12/24; M
- **Communitree; Powys** (0874) 711147; 24hrs; 300
- **Cymrutel; Colwyn Bay** (0492) 49194; 24hrs; 1275v; Subscription
- **The Dark Side; Cowbridge** (04463) 3729; 22:00-08:00; 3/1275
- **Empyrion; Swansea** (0792) 580781; 9pm-8am 3/1275; Amiga
- **MGBBS Mid Glamorgan; Ferndale** (0443) 733343; 24hrs; 3/1275
- **Sunshine BBS;Tenby** (0834) 4562 24hrs; 3-24
- **WGBBS; Swansea** (0792) 203953; 24hrs;3

Northern Ireland

- **Breda QBBS; Belfast** (0232) 645942; MF: 7pm-7am; WE: 24hrs; 3/1275
- **Deep Thought; Bangor NI** (0247) 270199; 24hrs; 3-24 Subscription
- **Toni Board; Londonderry** (0504) 263779; MF:8pm-8am WE:24hrs; 3/1275
- **The Wild One; Belfast** (0232) 59812; 5pm-9am; 3/12

Eire

- **DUBBS; Dublin** (0001) 885634 MF:8pm-8am; WE:24; 3-24 Amiga based; astronomy SIG
- **Infomatique; Dublin** (0001) 764 942 24hrs; 3-24; Amiga based + IBM
- **Styx RBBS; Limerick** (0001) 332229 24hrs; 3/12; PC, BBC, CBM & Amiga

Abbreviations

3	V.21 (300 baud)
1275	V.23 (1200/75)
12	V.22 (1200/1200)
24	V.22bis (2400/2400)
3-12	V.21, V.22, V.23
3/1275	V.21, V.23
3-24	V.21, V.22, V.23, V.22bis
27	V.27 (4800/2400 baud)
29	V.29 (9600 baud)
v	viewdata
s	scrolling (not viewdata)
h	half duplex
HST	Courier HST 9600 baud
M	MNP error correction
MU	Multi-user
RB	Ring Back
*	Fidonet node

Most scrolling systems are 8 bits, no parity, 1 stop bit.
Most viewdata systems are 7 bits, even parity, 1 stop bit

END

DIRECTORY

Power to the people

Clubs which cater for special interests and power users attract Rupert Steele's attention.

Hear Ye! The UK now has an OS/2 Users' Group. The cynical ones among us may wonder whether there are any OS/2 users to join it, but rest assured that the group is not (yet) aimed at users like you or me. They see themselves as supporting developers, corporates, system builders and support personnel.

Membership of the group is priced accordingly: £85 + VAT for the first year's membership including joining fee. Special interest groups hold 'very focused' meetings with good speakers, and a conference is planned for 13 February.

The group's newsletter — sorry, 'information bulletin' — is described in the membership form as 'a comprehensive guide to the latest OS/2 information ... backed up by a fulfilment service to get this important data into your hands'. Unfortunately, they did not send me a sample copy, so I don't know if the product justifies the hype. Directory: Software/networks — OS/2.

Also for power users is the new RISC User Group which is aimed at the Acorn Archimedes. RISC User is in fact part of the BEEBUG empire run by Sheridan Williams (Directory: Machines — BBC Micro). Sheridan has been involved with the micro business since the beginning and so you can rely on an experienced team being involved.

The new RISC venture involves a journal which is specifically written for the Archimedes. The program listings which appear in this are also available on disk and there



there is a technical support team available to members. They can also fix your Archimedes or trade in your Beeb for one. Directory: Machines — Acorn.

Special interests

Turning our attention to special interests, I have recently received information on the Open Software Library and its associated bulletin board, Healthlink. The aims of the group are to promote the use of computers in health care with an accent on the training of health staff. Much of this is done through the bulletin board which uses the Fido system (Node 2:255/64 on FidoNet). There are several international conferences running, discussing AIDS, psychiatry and other topics.

As well as providing textual information, the group provides software covering health topics; this can be downloaded from the BBS. Directory: Special Interest — Health. You can also MBX them on Prestel 942712385 or call the BBS on (0942) 722984.

And locally...

As well as the activity in the national groups, the local computer clubs are busy in many parts of the country. The local scene is proportionately rather thin in London — no doubt because of the pace of life that tends to exist there — but elsewhere things are quite busy.

Starting from the west, Robert Gahan has written to me from 54 Riverside Drive, Castlepark, Dublin 14, to mention that he is running Ireland's new (and only?) Acorn users' club, called Acorn Power House. It meets on Saturday afternoons on the third floor of 60 Bolton Street, Dublin.

For more information, write to Robert or phone him on Dublin 905147.

Across the water, you can find the North Wales PCW/PC Club. The secretary is Brian Hall of 17 Cae Glas, Old Colwyn, Colwyn Bay, Clwyd LL29 9DL. The group meets every Tuesday evening at a school in Colwyn Bay, and the address is Ysgol Tan y Marian, Swn-y-Don, Penmaenrhos, Old Colwyn.

Meetings cover the two main Amstrad disk systems, namely the PCW and PC series. Cheap supplies of floppy disks, paper and other consumables are available. The club also has a newsletter which reached the finals of the Desktop Publishing Awards in 1987.

Why not write to Brian or call him on Colwyn Bay 514004?

Back in November, I mentioned the Swindon Psion Organiser User Group which was just starting up. Jeremy Holt, the 'organiser', has written to me reporting the success of the group's inaugural meeting and giving details of the next one. Unfortunately, the meeting will have taken place about six weeks before you read this. Please remember, in telling me about events, to give three months' notice so to be sure I can meet the copy deadline.

Contact Jeremy at 14 Belmont Crescent, Old Town, Swindon, Wiltshire SN1 4EY or on (0793) 619664.

Also in the M4 corridor is RUG — The Reading Computer Users' Group. They meet at 7.30pm on the first and third Thursday of each month in the Senior Common Room at Reading University. This group is aimed at users of all machines and there is a short newsletter. The issue they sent me has some clear material on programming in C as well as details of how to get cheap Beeb disk drives.

Contact Michael Mallett, 19 Knollmead, Calcot, Reading RG3 7DQ or call him on (0734) 410597.

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

ACORN ARCHIMEDES
RISC User, Dolphin Pl, Holywell Hill, St Albans, Herts, AL1 1EX. (0727) 40303. Journal 10x/£14.50.

APPLE MACINTOSH
John Lewis, Macintosh User Group (UK), 55 Linkside Avenue, Oxford, OX2 8JE. (0865) 58027. £25. Professional.

APPLE SYSTEMS
Irene Flaxman, Apple2000, PO Box 3, Liverpool, L21 8PY. 051-928 4142. Was named BASUG. Local groups; newsletter; BBS.

APRICOT
Apricot File, TP Group, Unit 20, 11-17 Exmouth Place, Hackney, London, E8 3RW. 01-254 2245. Technical newsletter.

ATARI
N Lewis, Atari National User Group, 13 Weavers Walk, Courthouse Green, Coventry, CV6 7LG. Newsletter; SAE.

ATARI 8-BIT USERS
Atari Correspondence Club, 160 Newland Rd, Withywood, Bristol, BS13 9DX. (0272) 647196.

ATARI LOCAL GROUPS
Association of Atari User Groups, 45 Coleburn Rd, Lakenham, Norwich NR1 2NZ. (0603) 661149.

ATARI SERIOUS USERS
Glenn Leader, Sigatari, 143 Richmond Rd, Leytonstone, London, E11 4BT. 01-556 0395. £5.

ATARI ST
Paul Glover, The ST Club, 9 Sutton Place, 49 Stoney Street, Nottingham, NG1 1LX. (0602) 410241. Journal. PD software.

ATARI ST - FAST BASIC
Simon Rush, FaST, 42 York Road, Rayleigh, Essex, SS6 8SB. Uses Computer Concepts' Fast Basic.

BBC MICRO
BEEBUG, Dolphin Place, Holywell Hill, St Albans, Herts, AL1 1EX. (0727) 40303. Journal 10x/£14.50.

BBC & SIDEWAYS RAM
Ron Marshall, Solinet, 41 Westbrook Drive, Rainworth, Mansfield, Notts NG21 0FB. Disk jrnal. SAE.

CAMBRIDGE Z88
Roy Woodward, Z88 Owners' Clb, 68 Wellington St, Long Eaton, Nottingham, NG10 4NG. £6. SAE.

COLECO ADAM
Keith Marner, UKAS, 33 Homer Road, Croydon, CR0 7SB. Bi-monthly journal. SAE.

COMMODORE ALL MICROS
Jack D Cohen, ICPUG, 30 Brancaster Road, Newbury Park, Ilford, IG2 7EP. 01-346 0050 home; 01-579 1229 day. £10 +£1 to join.

COMMODORE AMIGA
UK Amiga Users Grp, 66 London Road, Leicester, LE2 0QD. (0533) 550993 voice; (0533) 550893 BBS.

COMPUCORP
Compucorp University Users

Group, c/o Compucorp, Cunningham House, Westfield Lane, Kenton, Middx, HA3 9ED.

EINSTEIN
Graham Bettany, UKEUG, 80 Dales Road, Ipswich, IP1 4JR. £15. Monthly newsletter. SAE.

ENTERPRISE
Martin Wallace, Indept Enterprise User Group, PO Box 13, Crowborough, E Sussex, TN6 1XQ. (08926) 3890 7pm-10pm. £15.

HP 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
The IBM PC User Group, PO Box 360, Harrow, HA1 4LQ. 01-863 1191. £25 pers/£95 corp. Professional. BBS 01-863 6646.

JUPITER ACE
J R Charter, c/o Customers Mail, Barclays Bank, 27 Regent Street, London, SW1. (0246) 37555. SAE.

LYNX
R B Jones, Lynx User Group, 39 Ashton Close, Needingworth, St Ives, Cambs. £9/UK.

MATMOS PC/ADLER
Ron Drew, Matmos Users Group, Clattering Ford, Roadhead, Carlisle, CA6 6NT. (069) 78672. SAE. Bug guide.

MEMOTECH
Phil Eyres, Memotech Owners Club, 23 Denmead Road, Harefield, Southampton, SO2 5GS. SAE. (0703) 585106.

MOTOROLA 68xxx MICROS
Rick Applegate, 68 Microgroup, 8 Great Cob, Springfield, Chelmsford, Essex. BBS 01-316 7402.

MSX SYSTEMS
Craig Bell, MSX UK, North Lodge, Cairnhill Rd, Airdrie, Lanarkshire, ML6 9RJ. (0236) 64045.

MSX SYSTEMS
Keith Neal, MSX Link, Austerby House, 80 Austerby, Bourne, Lincs, PE10 9JL.

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.

NIMBUS/RM AX/VX
Dr Martin Hatfield, NIMBUG, 13 Belle Vue Ave, Gosforth, Newcastle-upon-Tyne, NE3 1AH. 091-285 7806

ORIC
Gary Ramsay, IOUG, 1 Kingsway Crescent, Burnage, Manchester, M19 1GA. Newsletter. SAE.

OSBORNE/CPM/MSDOS
Jeremy Browne, BOOG, 102a Aldershot Rd, Hants, GU13 9NY. (0252) 621745 voice, 626233 BBS.

PSION ORGANISER
Mike O'Regan, IPSO, 130 Stapleford Lane, Beeston, Nottingham, NG9 6GB. Monthly journal. (0602) 735482. SAE.

RESEARCH MACHINES
RM National User Gp, Tim Davey-Winter, Computer Teaching Cntre, 59 George St, Oxford. (0865) 278826. All RM micros. £15.

SAMURAI S16
Andrew Lee, Samurai S16 Self-Help User Group, 55 Spencer Rd, Strawberry Hill, Twickenham, TW2 5TG. SAE. S16= MSDOS non-PC.

SANYO MBC-550
M H Syed, Wistaria, 53 Acacia Grove, New Malden, Surrey, KT3 3BP. 01-942 9009. Informal group.

SHARP
Andrew Ferguson, Sharp User Group, 11 Harcourt Close, Henley on Thames, Oxon, RG9 1UZ. (0491) 574850. £6. 3 mags/yr. Software. Sharp 'micromart'.

SINCLAIR QL & SIMILAR
Phil Borman, Quanta, 15 Grosvenor Cres, Grimsby, S Humberside, DN32 0QJ. (0472) 49850.

SINCLAIR QL & SIMILAR
Richard Turner, QL Super User Bureau, PO Box 3, Shildon, Durham, DL4 2LW. £15 (£30 business). Sample journal 50p.

SINCLAIR SPECTRUM
Chic Computer Club, PO Box 121, Gerrards Cross, Bucks, SL9 9JP. (0753) 884473.

SIRIUS
Simon Sheppard, ISSUE, PO Box 222, Brighton, BN1 3BR. Informal free news sheet.

SORD M-23
B Nicholson, Aberdeen Reservoir Interpretation Centre, Woodlands Drv, Kirkhill Ind Est, Dyce, Aberdeen. (0224) 771117. Informal gp.

TANDY/GENIE/MSDOS
Roger Storrs, NATGUG, Oakfield Ldge, Ram Hill, Coalpit Heath, Bristol, BS17 2TY. (0454) 772920. Journal. PD software.

TEXAS TI99/4a
Peter Walker, TI99/4a User Group (UK), 24 Bacons Drive, Cuffley, Potters Bar, Herts, EN6 4DU. (0707) 873778. £10. Software library. Newsletter.

TEXAS TI99/4a
Peter Brooks, International TI User Group, 96 Banbury Road, Oxford, OX2 6JT. £11. (0865) 510822. Monthly Newsletter.

TRANSPUTER
Howard Oakley, Transputer User Group, Brooklands Lodge, Park View Close, Wroxall, Ventnor, Isle of Wight, PO38 3EQ. £5.

Local clubs

FIND YOUR LOCAL CLUB
John Dale, British Association of Computer Clubs, Banc y rhosyn, 14 Bron Y Glyn, Bronwydd Arms, Carmarthen, SA33 6JB. SAE. 0267 230771.

Amstrad

AMSTRAD 1512/1640/PPC
PC Independent User Group, PO Box 55, Sevenoaks, Kent, TN13 1AQ. (0732) 63157. £22 (£24 bsns). 1700 PD disks. Journal.

AMSTRAD ALL MACHINES
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AMSTRAD ALL MACHINES
Jeffrey Green, Advantage, West One Hse, St Georges Rd, Cheltenham, GL50 3DT. (0242) 222307 Newsletter; software lib; SAE.

AMSTRAD BUSINESS USRS
Amstrad Professional User Club, Enterprise Hse, PO Box 10, Roper St, Pallion Ind Estate, Sunderland, SR4 6SN. 091-510 8787. £39.95.

AMSTRAD CPC USERS
Gary Carter, United Amstrad User Group, 1 Magnolia Close, Fareham, Hants, PO14 1PX. (0329) 281324 evenings. SAE.

AMST. CPC HOME USERS
Steve Williams, WACCI, 59 The Green, Twickenham, TW2 5TU. 01-898 1090. £12. Newsletter. Special offers. Good fun.

AMSTRAD LOCAL GROUPS
Amstrad Groups Federation, 4 Sutton Road, Gorton, Manchester, M18 7PN.

AMSTRAD PC SHAREWARE
Colin Smith, COLBAR, 10 Penwood Cl, Westbury, Wilts, BA13 3LW. Info: A4 26p sae +blnk disk.

AMSTRAD PCW
Chris Bryant, PCW File, 11 Havenview Road, Seaton, Devon, EX12 2PF. (0297) 20456. £7. PD software. Big SAE.

Software/networks

ASHTON TATE SOFTWARE
Silvia Robinson, Baseline, Ashton-Tate, 1 Bath Road, Maidenhead, Berks. (0628) 33123. Prestel page *43221#.

C LANGUAGE
Martin Houston, CUG (UK), 36 Whetstone Close, Farquhar Road, Edgbaston, Birmingham, B15 2QN. £10. 021-454 3448.

C LANGUAGE
Expert User Group, FREEPOST, Grimsby, S Humberside, DN32 7BR. £9. 48pp journal 6x a yr.

COMPUNET
Independent Compunet Club, 148 Furzehill Road, Boreham Wood, Herts, WD6 2DX.

CPM MACHINES
PIP, 28 Gordon Mns, Torrington Pl, London, WC1E 7HF. Amstrad, Einstein, Osborne etc. BBS.

CPM & MSDOS USERS
Diana Fordred, CPM & MSDOS Users Group, 72 Mill Rd, Dartford, DA2 7RZ. (0322) 22669. PD sftwr.

ECONET
Michael Ryan, Econet User Group, Balkeerie Cottage, Eassie by Forfar, Angus, DD8 1SR. £8.60. Newsletter.

ENET (like Econet)
T K Boyd, Enet (Amcom) User Gp, Seaford Cottage, Petworth, West Sussex, GU28 0NB. Info sheet (send SAEs to despatch).

FORTH Language
Douglas Neale, FIG (Forth Interest Group) UK, 58 Woodland Way, Morden, Surrey, SM4 4DS. Jrnal £10/6 issues. London meetings.

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, 60-68 St Thomas St, London, SE1 3QU. Online support £9.60 /hr. Free macros, drivers etc.

OS/2
Karen Burns, OS/2 User Group, c/o QA Training Ltd, Cecily Hill Castle, Cirencester, Glos, GL7 2EF. (0285) 655888.

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 SFTWRE
PD-SIG Ltd, 90 Braybourne Clo, Uxbridge, UB8 1UJ. (0895) 51978 or 01-864 2611. BBS. PD software, disk conversions.

SMART SYSTEM USERS
Martin J Smith, Smart Users!, 38 Chavey Down, Ascot, Berks, SL5 8RP. £20.

SOFTWARE VIA BBS
Frank Thornley, Compulink, 67 Woodbridge Rd, Guildford, GU1 4RD. BBS (0483) 573337 V21/23. Voice (0483) 65895.

UNIX USERS
UKUUG Secretariat, UKUUG, Owles Hall, Buntingford, Herts, SG9 9PL. (0763) 73039. £55 individual £105 corporate. Europe-wide journal & software library.

VENTURA PUBLISHING
VPU (Ventura Publisher User grp). Stella Glass 01-251 8567 or Neil Maroni (0273) 430902.

Special interest

AMATEUR RADIO (CBM)
Simon Lewis GM4PLM, Commodore Radio Users Group, 69 Irvine Drive, North Clippens, Linwood, Paisley, PA3 3TB. £8. Software.

AMATEUR RADIO (COMMS)
Pat & John Beedie GW6MOJ /MOK, BARTG, Ffynnonlas, Salem, Llandeilo, Wales, SA19 7NP. (0558) 822286. MBX 558822286.

CHRISTIAN USERS
Philip Clark, Christian Micro Users Association, 138 Bramwell Gardens, 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 Flle, TP Group, FREEPOST, London, N1 1BR. 01-833 3501. £75. Newsletter.

COMMUNITY COMPUTING
P Rowan, Community Computing Netwrk, 5 Windmill St, Frindsbury, Rochester, ME2 3XQ. £5 /£1 unwaged. Contacts. Left wing views.

DISABLED
Jeff Hughes, Special Needs User Group, 39 Eccleston Gardens, St Helens, WA10 3BJ. (0744) 24608.

GENEALOGISTS
Computer Grp, Society of Genealogists, 14 Charterhouse Buildings, London, EC1M 7BA. 01-251 8799. Using micros to trace ancestors.

GENERAL HARDWARE
Andy Leeder, Amateur Computer Club, Church Farm, Stratton St Michael, Norwich, NR15 2QB. Large SAE.

HEALTH WORKERS
Sue McKendrick, HealthLink, 164 Windsor Rd, Ashton-in-Makerfield, Wigan, WN4 9ES. Voice: (0942) 712385. Health sftwre etc BBS.

LOCAL AUTHORITIES
Local Authority Micro User Grp, John New, Borough Engineer's Dept, Municipal Offices, North Quay, Weymouth, Dorset, DT4 8TA. (0305) 785101 x 272.

PRESTEL
Andy Leeder, ClubSpot 810, Church Farm, Stratton St Michael, Norwich, NR15 2QB. *810# club area. Clubs may be able to edit.

SERVICES USERS
Major JF Huskisson, Services Personal Computer Association, Leros TA Centre, Sturry Rd, Canterbury, CT1 1HS. (0227) 61397. £3. Magazine. END

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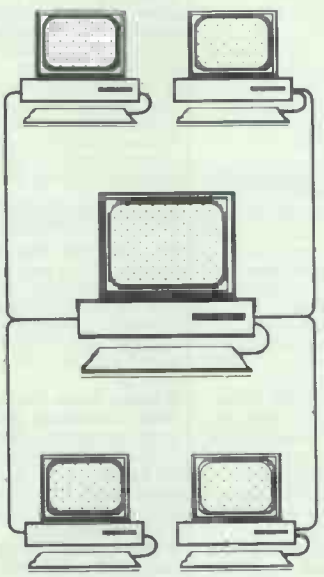
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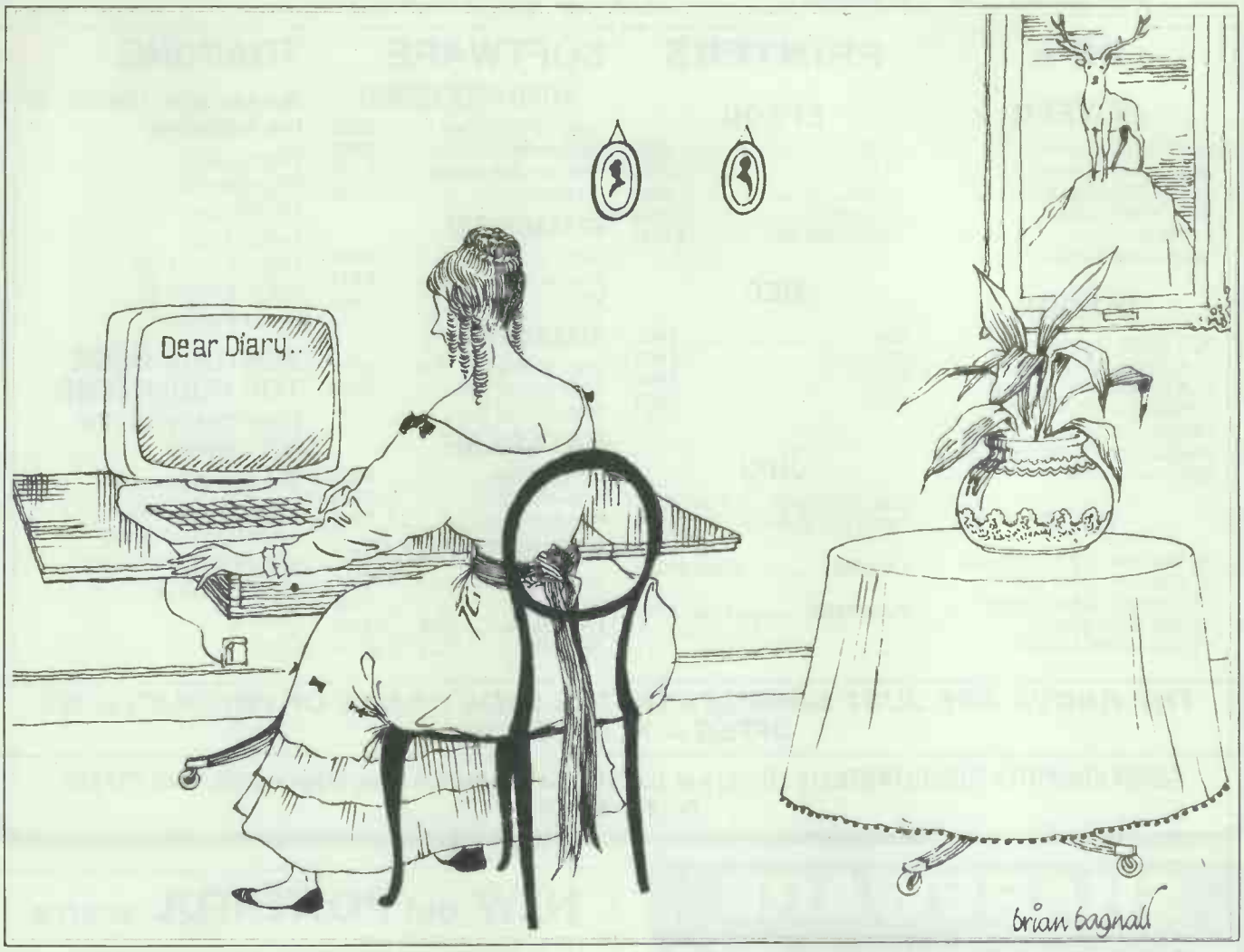
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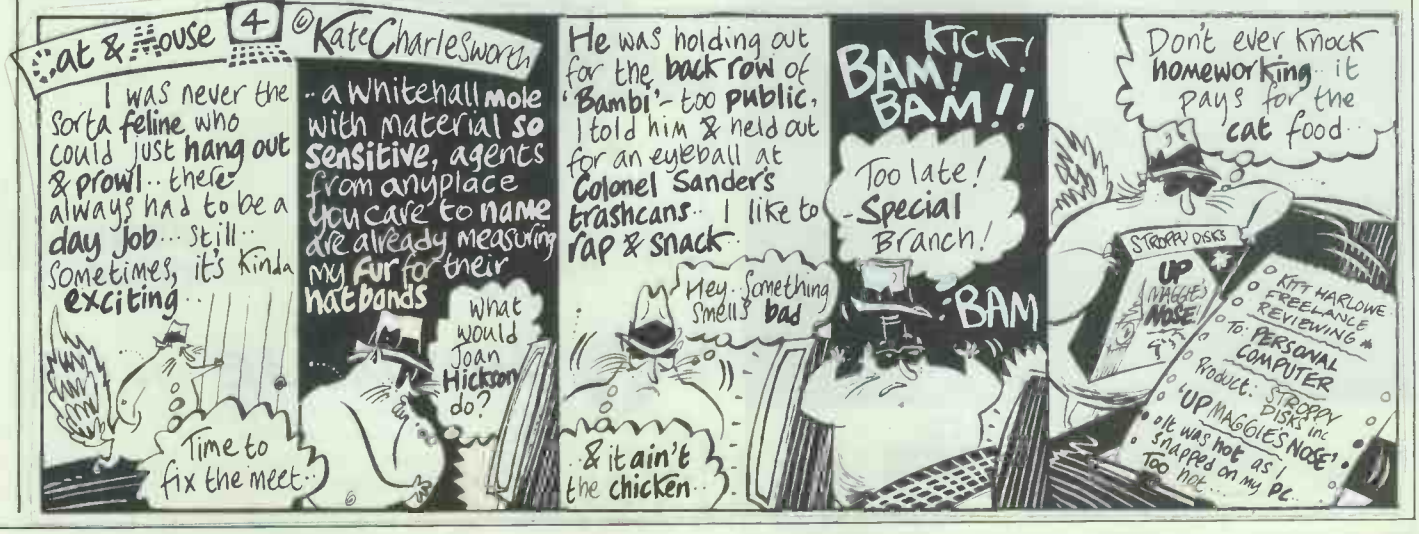


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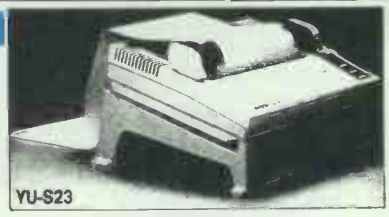


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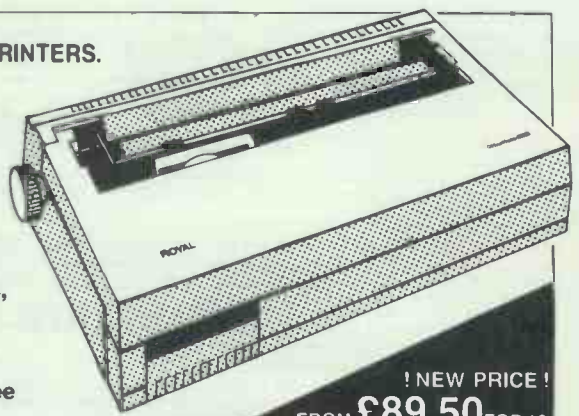
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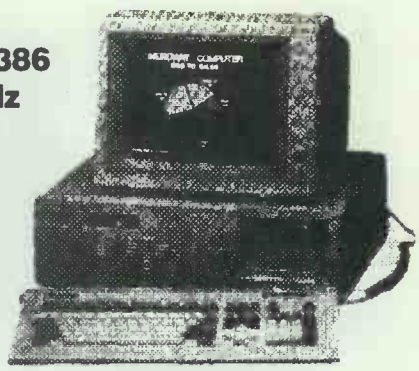
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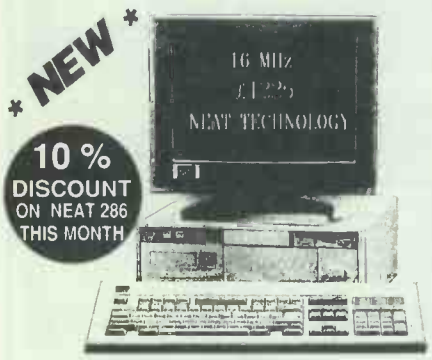
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Clock Speed	8Mhz	8Mhz	12Mhz	12Mhz	20Mhz	20Mhz
RAM	640K	640K	640Kb	640Kb	1Mb	4Mb
Video adaptor	MGA	VGA	VGA	VGA	VGA	VGA
Serial Parallel	1/1	1/1	2/2	2/1	2/2	2/1
FDD	360K	360K	1.2Mb	1.4Mb	1.2M	1.4M
HDD	20Mb	30Mb	40Mb	40Mb	60Mb	65Mb
Keyboard	102	102	102	102	102	102
Keyboard lock	Yes	Yes	Yes	Yes	Yes	Yes
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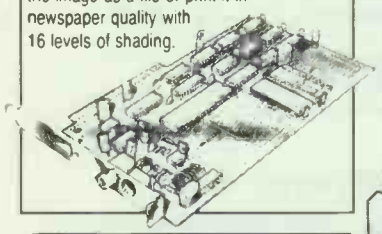
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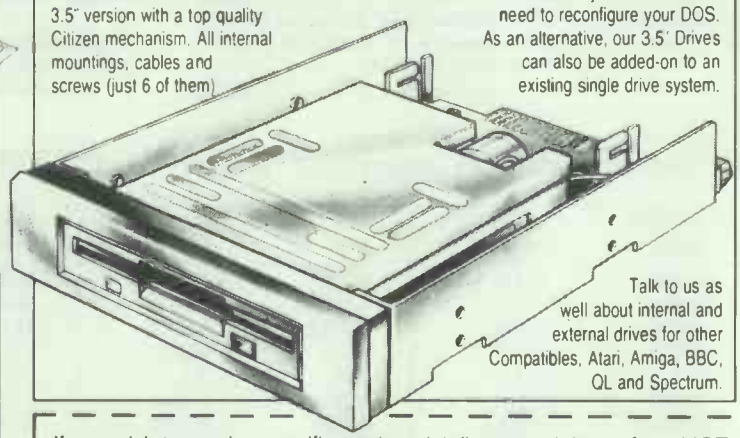
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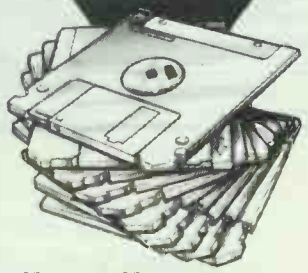
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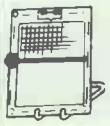
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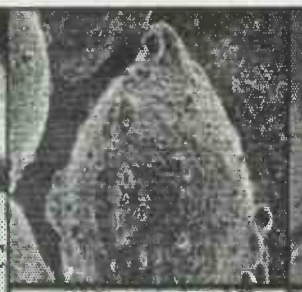
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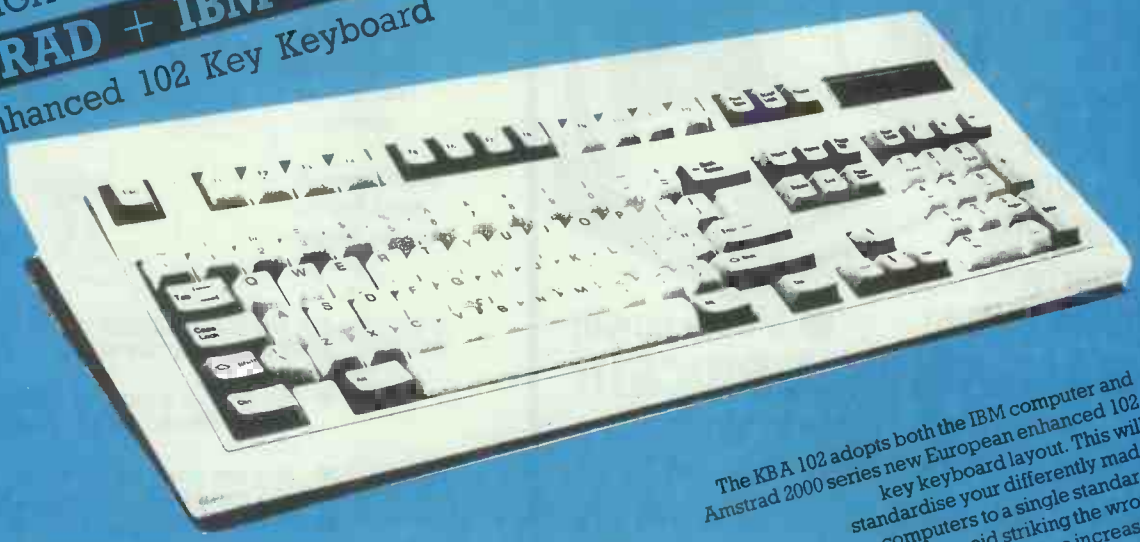
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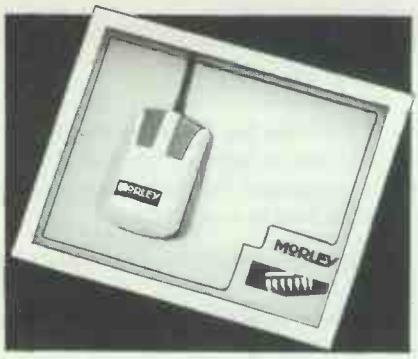
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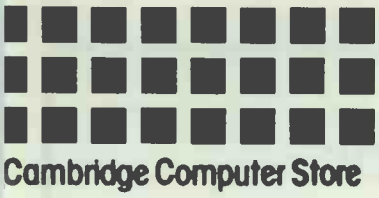
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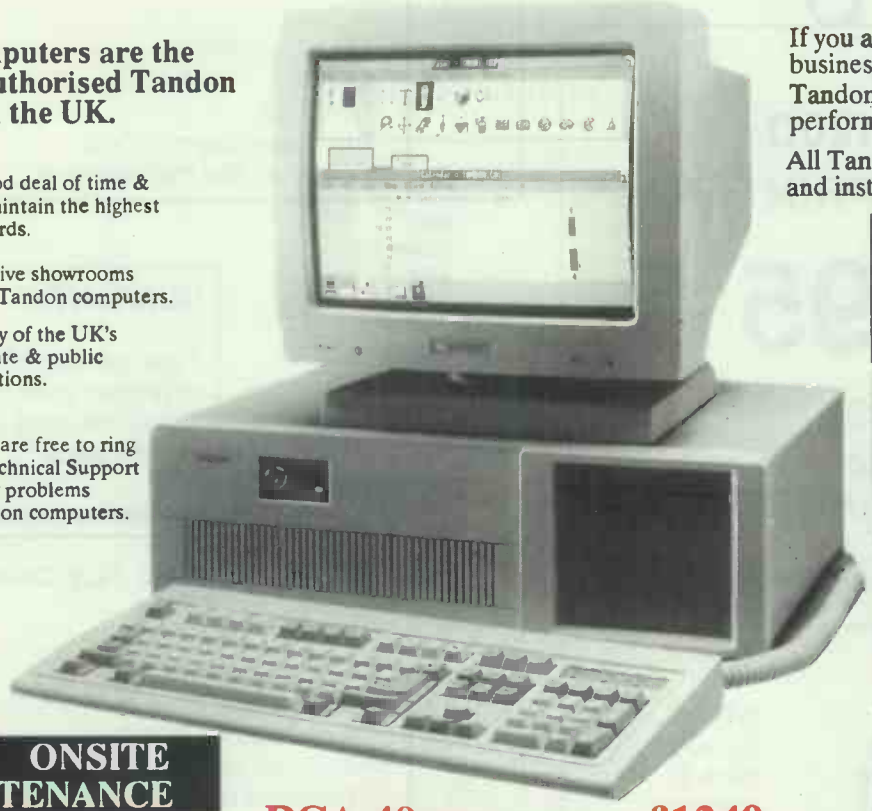
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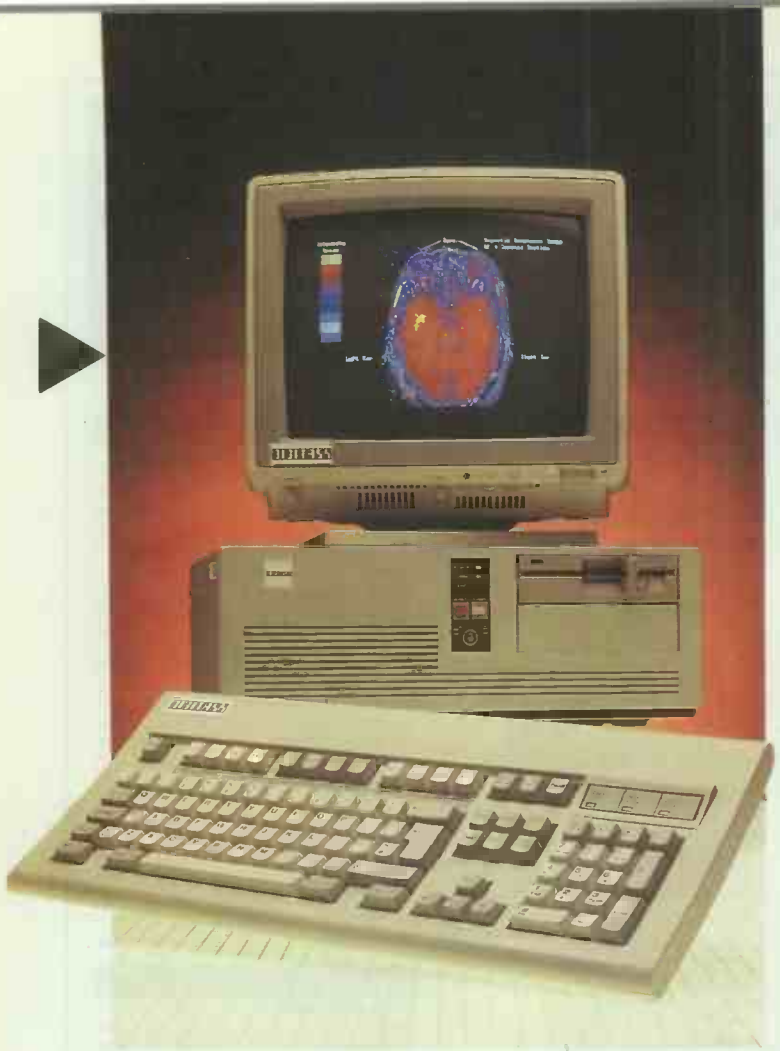
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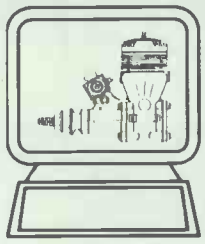
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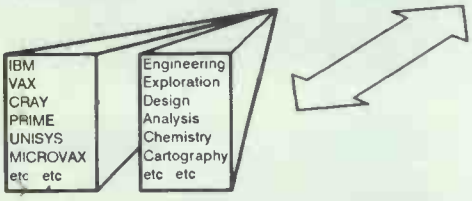
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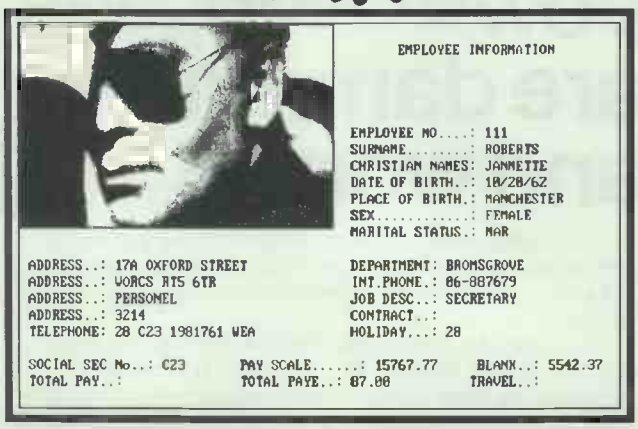
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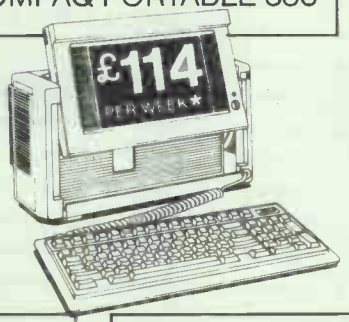
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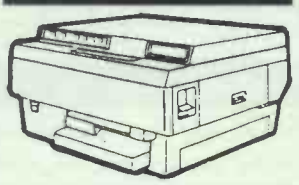


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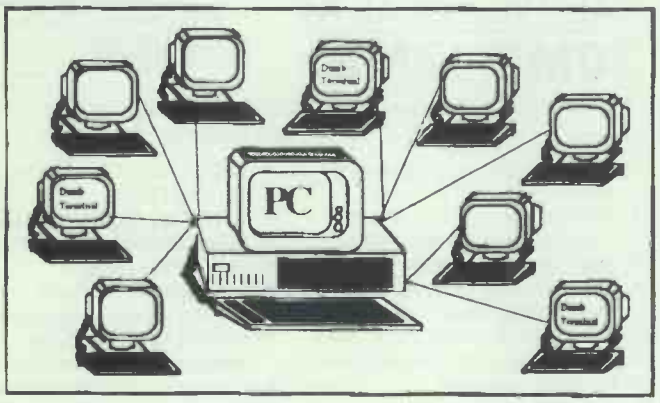
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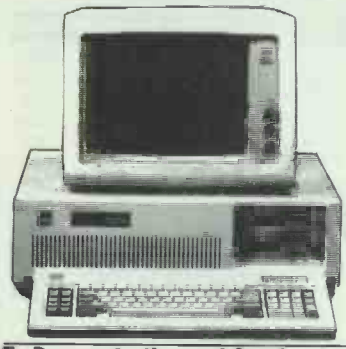


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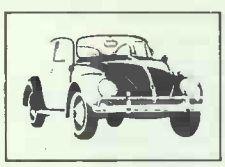
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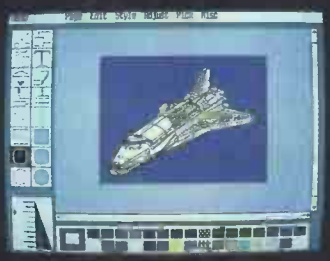


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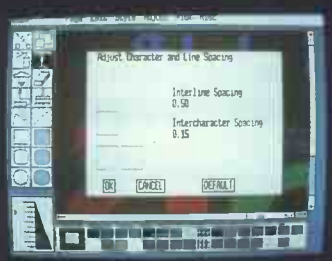


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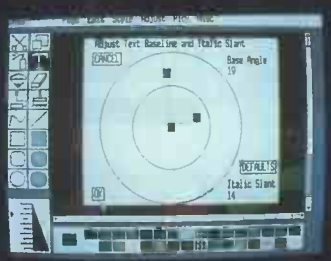


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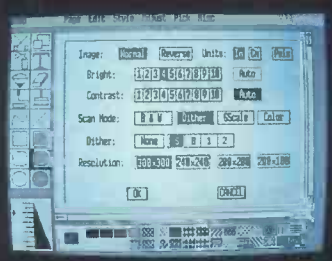


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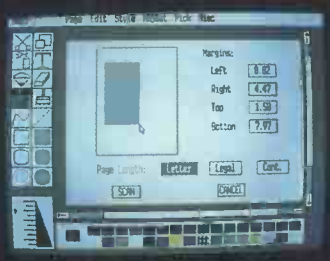


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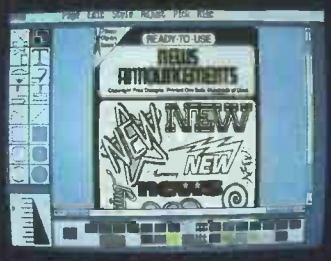
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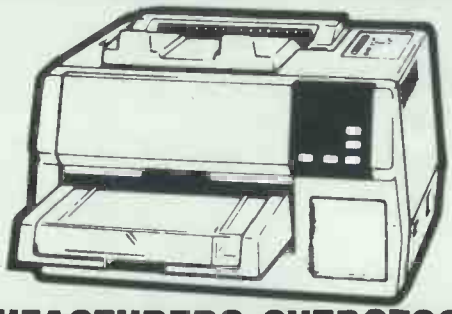
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PASCAL LIBRARIES

TURBO PASCAL LIBRARIES

Blaise Power Tools Plus	PC-DOS	£ 80
Blaise Turbo Asyn.Plus	PC-DOS	£ 80
Mathpak 87 (TP3&4)	MS-DOS	£ 60
Paragon Supertools (TP3)	PC-DOS	£ 65
RM Graph (TP3) Nimbus +	MS-DOS	£ 49
Science & Eng.Tools	MS-DOS	£ 50
Report Builder (TP3)	MS-DOS	£ 70
System Builder (TP3)	MS-DOS	£ 90
TP4 Developers Library	PC-DOS	£190
Turbo Halo Univ.Graph.	PC-DOS	£ 75
T-Debug Plus v4 s'ce	PC-DOS	£ 49
Turbo Database	PC-DOS	£ 45
Turbo Editor Toolbox	PC-DOS	£ 45
Turbo Extender (TP3)	PC-DOS	£ 55
Turbo Gameworks (TP4)	PC-DOS	£ 45
Turbo Graphix Toolbox	PC-DOS	£ 45
Turbo Advantage (Lader)	MS-DOS	£ 60
Turbolink + v3.15A (TP3)	PC-DOS	£ 60
Turbopower Utils (TP3)	PC-DOS	£ 60
Turbo Optimiser (TP3)	PC-DOS	£ 45
Turbo Overlay M'ger(TP4)	PC-DOS	£ 29
Turbo Professional	PC-DOS	£ 60
Turbo Screen CP/M,MS,	PC-DOS	£ 55
Turbo Tutor	PC-DOS	£ 30
TurboWINDOWS/Pasc.(TP4)	PC-DOS	£ 55

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Blaise Asynch (s'ce MS)	PC-DOS	£120
Btrieve (MS&TP4)	PC-DOS	£160
MetaWINDOWS (MS&TP)	PC-DOS	£105
HALO '88 (MS,TP4)	PC-DOS	£175
Blaise View Mngr. (MS)	PC-DOS	£205
Shark database (Propas)	MS-DOS	£250
Prospect v2 (Pro)	MS-DOS	£ 80
Shark database (Propas)	CP/M-86	£250
Prospect Graphics (Pro)	CP/M-86	£ 80
Shark database (Propas)	CP/M-80	£150

ADA COMPILERS

AdaVantage v2.1	PC-DOS	£1065
AdaVantage Opt compiler	PC-DOS	£1255
Janus Ada C-Pack	PC-DOS	£ 100
Janus Ada ED-Pack v2.0.2	MS-DOS	£ 340
Augusta (with source)	CP/M-80	£ 75
Janus Ada C-Pack	CP/M-80	£ 80

PASCAL LANGUAGE

New version of Turbo Pascal with support for the Borland debugger is available

MS Pascal v4.0 OS/2&	PC-DOS	£190
ALICE Pascal Intrprtr.	PC-DOS	£ 80
Dr Pascal Interpreter	MS-DOS	£ 39
Metaware Prof.Pascal	MS-DOS	£380
Metaware Prof.Pas/386	MS-DOS	£545
Mystic Pascal v1.6E	PC-DOS	£ 29
Oregon Pascal-2	MS-DOS	£295
Prospero Pascal v3.15	MS-DOS	£240
Prospero Pascal for GEM	MS-DOS	£ 75
Prospero PC Pascal	PC-DOS	£ 75
Turbo-Pascal v4	PC-DOS	£ 50
Turbo-Pascal v5	PC-DOS	£ 75
Pecan P-Sys w.UCSD Pas.	IBM-PC	£ 80
Pecan P-Sys Pascal Prof.	IBM-PC	£155
Metaware Prof.Pascal	Flexos	£415
Pro-Pascal v2.14	CP/M-86	£240
Pascal MT+ v5.6	CP/M-80	£ 99
Pro-Pascal v2.18	CP/M-80	£240
MCC Pascal	ATARI ST	£ 75
Pecan P-Sys w.UCSD Pas	ATARI ST	£ 80
Pecan P-Sys w.UCSD Pas	APPLE][	£ 80

PROGRAMMING TOOLS

Ada Compilers	Algol Compilers
Assemblers & Libs	AWK
Basic Compilers	Basic Interpreters
Basic Utilities	Basic Libraries
BCPL Compilers	C Compilers
C Interpreters	C Libraries
C Utilities	Cobol Compilers
Comms.Libraries	Cross Assemblers
Database Libs.	Debuggers
Dis-assemblers	Editors
Engineers Libs.	Expert Systems
Forth	Fortran Compilers
Fortran Libraries	Graphics Libraries
Icon	Linkers/Locaters
Lisp	Modula-2
Nial Interpreters	OPS 5
Pascal Compilers	Pascal Libraries
Prolog	Rexx
Risc	Screen Libraries
Smalltalk	Snobol

We stock many items for which there is no space in these advertisements.

LINKERS

The new Link & Locate++ is specifically for Microsoft C v5 & MASM v5. Phar Lap LinkLoc for 286 & 386 protected ROM targets. OPTLINK offers very fast linking

Phar Lap LinkLoc	PC-DOS	£285
Link & Locate++ (MSC5)	PC-DOS	£265
Plink-86 Plus v2.24	MS-DOS	£260
Link & Locate	MS-DOS	£265
OPTLINK	MS-DOS	£105
SLRNK (Z80)	CP/M-80	£ 40
SLRNK-PLUS (Z80)	CP/M-80	£140

MODULA-2 COMPILERS

The new Taylor Modula-2 challenges JPI object code quality

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
FTL Modula-2 Developer	MS-DOS	£ 85
Interface M2-SDS	PC-DOS	£ 75
Interface M2-SDS-XP	PC-DOS	£185
JPI Topspeed Modula-2	PC-DOS	£ 59
Mod-2/86 Compiler v3	PC-DOS	£ 58
Mod-2/86 Dev.system	PC-DOS	£145
Modula Corp.PC Mod.2	PC-DOS	£150
Taylor Modula-2 Dev Sys	PC-DOS	£505
FTL Modula-2	Z80/CP/M-80	£ 45
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

PRICES & DELIVERY

Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

This page lists some of our products. Call us for a complete pricelist.

Order by phone with your credit card.

DISK COPYING SERVICE

We can copy files to and from 600 disk formats including CP/M, CP/M-86, MS- DOS, PC-DOS, ISIS, APPLE, SIRIUS, BBC, TORCH, APRICOT, HP-150, TRSDOS, DEC RT- 11, IBM BEF, ATARI ST, AMSTRAD, MACINTOSH.

Our charge is £10.00 + disk + VAT with discounts on small quantities and disks are normally despatched within 24hrs of receipt. For more information call us.

OBJECT ORIENTATED LANGUAGES

The increasing acceptance of object-oriented programming has prompted this new section

C SUPERSETS

Advantage C++ (L,MS)	PC-DOS	£395
Guidelines C++ (MS)	PC-DOS	£260
Zortech C++	PC-DOS	£ 90
C-Talk	PC-DOS	£105

SMALLTALK

Smalltalk/V	PC-DOS	£ 75
Smalltalk/V 286	PC-DOS	£140

OTHERS

Actor	PC-DOS	£370
RisC	PC-DOS	£ 55

BASIC LANGUAGE

Microsoft Basic v6.0 for PC-DOS and OS/2 is in and Quickbasic compatible

BASIC INTERPRETERS

BBC Basic (86)	PC-DOS	£ 95
Professional BASIC	PC-DOS	£ 70
TrueBasic v2.0	PC-DOS	£ 80
MEGABASIC v5.404	MS-DOS	£210
BBC BASIC	Z80+CP/M-80	£ 95

BASIC COMPILERS

Microsoft QuickBASIC v4	PC-DOS	£ 60
Microsoft Basic v6 OS/2&	PC-DOS	£180
Turbo Basic v1.1	PC-DOS	£ 60
ZBASIC v4	PC-DOS	£ 69
Microsoft MS-BASIC v5.36	MS-DOS	£235
Dig.Res. CBASIC	MS-DOS	£390
Dig.Res. CBASIC	CP/M-86	£390
Dig.Res. CBASIC	CP/M-80	£390
ZBASIC	Z80+CP/M-80	£ 75

LIBRARIES & UTILITIES

Database

CADSAM (source) (MS,QB4)	MS-DOS	£ 75
Btrieve (MS&QB4)	MS-DOS	£160
Btrieve/N (MS&QB4)	MS-DOS	£370
Multikey MS-BASIC +	MS-DOS	£145
T.Basic database tlbx.	PC-DOS	£ 49

Graphics

Enhanced Graph.Tlkt QB +	MS-DOS	£185
HALO '88 (MS&QB4)	PC-DOS	£175
GSS Graph.Dev.Tkt	PC-DOS	£350
Finally XGraf (QB4)	PC-DOS	£ 80

Sundries

Finally Quickbasic +	PC-DOS	£ 70
ProBas (QB4)	PC-DOS	£ 85
ProBas Toolkit (QB4)	PC-DOS	£ 85
ProBas Telecomm Toolkit	PC-DOS	£ 65
Wiley Scientific Lib.	PC-DOS	£ 90
T. Basic Editor Toolbox	PC-DOS	£ 49

Tuning & Debugging

Betatools Dev.System	PC-DOS	£100
Vicar (MS&QB&TB)	MS-DOS	£ 45
Vicar (CBasic)	MS-DOS	£ 65

Screen

Blaise Power Screen(QB4)	PC-DOS	£ 80
PANEL Screen Manager	MS-DOS	£ 80
Pro Screen (QB4)	PC-DOS	£ 85
Screen Maker	PC-DOS	£120

PROLOG LANGUAGE

Arity Standard	PC-DOS	£ 79
Arity Prolog Int. v5	PC-DOS	£225
Arity Int. & Comp. v5	PC-DOS	£495
LPA PROLOG Prof v2.0	PC-DOS	£755
Micro-PROLOG v3.1	MS-DOS	£ 75
Prolog-86 plus v1.0	MS-DOS	£195
Prolog-2 Personal	PC-DOS	£145
Prolog-2 Programmer	PC-DOS	£495
Prolog-2 Professional	PC-DOS	£995
Turbo-Prolog v2	PC-DOS	£ 75
ADA Educ.Prolog	MS-DOS	£ 26
ADA FS Prolog	MS-DOS	£ 45
ADA VMI Prolog	MS-DOS	£ 70
ADA VML Prolog	MS-DOS	£150
Prolog-1 v2.2	CP/M-86	£299
Micro-Prolog v3.1	CP/M-86	£ 75
Micro-Prolog v3.1	CP/M-80	£ 60
Prolog-1 v2.2	CP/M-80	£225
LPA Mac Prolog v2 Apple Mac Pls		£445

FORTRAN COMPILERS

Microsoft Fortran for OS/2 is in stock now and new Lahey for the 286. New low price PC Fortran by Prospero.

Lahey F77L v2.21	MS-DOS	£320
Lahey Personal Fort-77	PC-DOS	£ 70
RM/FORTRAN 77 v2.42	MS-DOS	£430
MS-FORTRAN 77 v4.1 OS/2&	MS-DOS	£275
Pro Fortran 77 v1.22	MS-DOS	£240
Pro Fortran for GEM	MS-DOS	£ 95
Prospero PC Fortran	PC-DOS	£ 95
Utah Fortran	MS-DOS	£ 35
FS-Fort.(CGA & Herc)	MS-DOS	£ 39
Pro Fortran v2.1	CP/M-86	£240
Pro Fortran v1.25	CP/M-80	£240
Nevada Fortran v3.3	CP/M-80	£ 35
Pro Fortran 77	ATARI 520ST	£ 95

We have Fortran Libraries in stock.

GREY MATTER
4 Prigg Meadow, Ashburton, Devon TQ13 7DF.
TEL. (0364) 53499

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Justifiably worried about the prospect of one or two Tory MPs ending up with the best part of British Steel's share issue, the government appointed a team of hi-tech investigators to track down the culprits from this and, by inference, other share issues. To help them in their task they were given, according to the ITN team, 'sophisticated software' and a new 'supercomputer'. Supercomputer? The PS/2 Model 50? Really. . .

Three account managers at Frontline Distribution have collectively won a Suzuki Jeep. Must be something to do with their turnover. . .

Walters International will launch a new Laptop 286 machine at the Which? Computer Show in February and on the stand will be the current Miss World, Linda Petursdottir from Iceland. Walters' top executives are so enchanted with the Icelandic tradition of naming sons and daughters after their fathers (Petursson and Petursdottir, for example) that the new machine is to be named the 286 Arfurdalisdottir. . .

Epson is understandably proud of the excellent (it says here) GQ3500 laser printer range. At least, we think that's the case. Unfortunately, the press release (at least fifth generation photocopy. Still, from a Japanese company. . .) is so badly printed it's difficult to tell exactly what it's talking about. Try using the GQ next time. . .

It's incredible! Those wonderful money-saving people at Inmac have come up with a revolutionary device! Struggle no more with unwieldy grey boxes! Be rid of unsightly cables! It may look like an ordinary VDU arm but their incredible £99 device not only serves to 'create space and clear bulky equipment off the desk', but also acts as a replacement for an IBM PS/2 machine! At least, we assume it does. The picture attached to the press release showed a fully functioning PS/2 monitor but no sign of a PC to drive it. Maybe ITN could run a feature on this incredible, compact supercomputer. . .

Perhaps Inmac could use the machine to sort out its mailing lists. No, this isn't going to be the standard 'I get 24 Inmac catalogues every month, isn't that funny?' story. It's the non-standard 'I get 24 Inmac catalogues every month and I'll tell you what's funny' story. A member of the staff in VNU Towers (a rather shifty character who moves from magazine to magazine) built up, over the years, the standard set of Inmac mailing list entries and, until recently, received around ten copies of that company's ubiquitous catalogue, all to the same name, at the same address, but in different departments. Someone at Inmac noticed. What a waste of money, Inmac finally decided. Why send so many copies to what was, apparently, the same person in different departments. Ah, the wonder of database search functions. So now he isn't haunted by dozens of Editorial Assistants tossing catalogues at him. Inmac bundles ten together. . .

It's alright, you can come off the valium now. The sleepless nights are over. No more need to spend hours wondering how to swap dates with people. The BSI, that most august of bodies, has finalised BS 6957 the 'Guide to construction and use of 130mm' (that's 5¼in to you) 'flexible disk cartridges for date interchange'. Once you've worked out that they mean *data* interchange, you're ready for Part Two. Part Two of this vital attempt at standardising the 5¼in disk, an area in which there is such fierce competition, contains a track format for 77 track disks. Yes, 77 track disks, as used by the Ministry of Housinge. . .

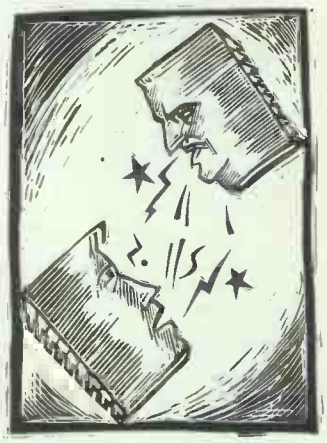
The Unix software for Van Diemen International Racing Services' production control system may turn out to be a little difficult to use. Christian Gobbe of Prosys, the company responsible for the code, is described by Convergent (supplier of the hardware) as 'himself and ex-formula ford driver'. Schizophrenic software. Who knows? It might catch on. Maybe it could even be Borland's excuse this week for Sprint. . .

There is a new virus. It is potentially more serious than any of the previous strains. It eats shelf space. The Computer Virus Book virus was first noticed late last year, the first symptom being an innocent-looking book from Abacus. The disease spread, the latest outbreak centred on publishers Von Nostrand Reinhold. Valuable manual space (we interrupt this joke for a cheaper one: 'Coming soon from Inmac! Automatic space. Takes up less of your desk by automatically redistributing itself') is taken up as the dBase handbooks make way for another book on the stimulating subject of computer viri. . .

Finally, many thanks to the hundreds of people who phoned in to tell us that Lunn Poly is a chain of travel agents and not, as we suggested last month, the Marie Celeste of the educational world. In particular we would like to thank a Mr Thomas Cook. . .



At last! The solution to all the waste paper that piles up around the office. Feed the output from your dot-matrix printer directly into a shredder and use the result as a valuable fossil fuel substitute . . . or packing/nesting material . . . answers on a postcard. . .



STOP PRESS

Apple has now informed *PCW* that its Mac SE/30, reviewed on page 128, will be available in the UK in two separate configurations, both with a 40Mbyte hard disk. The differences are that one model will have 2Mbytes of RAM, the other, as in the review, will have 4Mbytes. Final prices are not fixed but will be in the range £3900 to £4500.

This month

This month's hardware feels like a set of fugitives from *Gulliver's Travels*. We have an AT in a storage heater sized box, a 68030-based Mac in a small footprint case and power for the pocket in the Agenda. All exciting stuff. And on the software side, Mathematica knocked Jack Weber's socks off.

We're getting plenty of response to the new features we've added to *PCW*, but more letters and electronic mail are welcome.

PCW is to gain a new partner. From next month we will be bundling a second magazine free with each issue, with each supplement focusing on a particular area of hardware or software. These magazines will build up into a reference work of invaluable reviews and tables of information for anyone buying computer products for the first time or upgrading their system.

The first issue will look at buying a computer system and take you through the process of deciding what sort of computer best suits your needs, be it PC compatible, Macintosh, Atari or whatever. It will be accompanied by what we expect will be the most comprehensive listing of PCs yet published anywhere.

In addition, there will be a feature on the pros and cons of integrated software packages accompanied by a survey of products available.

See you then!



Bold Printing

Clean up the quality of your printout with the Juki 6200 daisy wheel printer. With its speed of 30cps, you can create a deep and lasting impression on paper in more ways than one!

Whatever your printing requirement, the Juki 6200 will produce clean crisp copy everytime and like all of the versatile Juki range, the cost of the Juki 6200 is so economical that the price will wash with just about everybody.

Whilst we wouldn't try to soft soap you into believing that the Juki 6200 can lighten your work load like Bold! We can say that you will be bubbling over with the sparkling printout on your sheets (of paper!)

Micro Peripherals ltd

Intec 2, Unit 3, Wade Road, Basingstoke, Hampshire RG24 ONE. Tel:(0256) 473232. Telex:859669 MICROP G. Facsimile:(0256) 461570.

4 Petre Road, Clayton Park, Clayton-le-Moors, Accrington, Lancashire BB5 5JP. Tel:(0254) 871717. Tel:(0706) 217799. Telex:635153 MICROP G. Facsimile:(0254) 653153.



6200
This performance daisy wheel printer gives quality printing for all office use. 3K buffer, proportional spacing, parallel interface.
Optional: Sheetfeeder, tractor and serial interface.
Speed: 30cps.
Compatibility: Diablo 630.
Price: £399

6300
A professional wide bodied daisy wheel printer.
3k buffer, proportional spacing, parallel interface.
Optional: Sheetfeeders and tractor.
Speed: 40cps.
Compatibility: Diablo 630API.
Price: £699

6500
A high speed daisy wheel printer designed specifically for high speed office use.
3k buffer, proportional spacing, parallel interface.
Speed: 60cps.
Compatibility: Diablo 630API.
Price: £899

7100
The 24 pin LQ matrix printer.
Dual interfraces, 7k buffer, colour, LCD display.
Optional: Sheetfeeders, tractor and font cards.
Speed: 288cps.
Compatibility: IBM or Diablo 630 or Epson.
Price: £899

7200
The total printing machine
Colour or B/W, 360dpi.
Dual interfaces, A3 printing.
Optional: Sheet and envelope feeders and font cards.
Speed: 324cps.
Compatibility: IBM or Diablo 630 or Epson.
Price: £1625

All prices are R.R.P Ex VAT. and specifications subject to change at anytime. All trademarks recognised.

MISSION TECHNOLOGIES



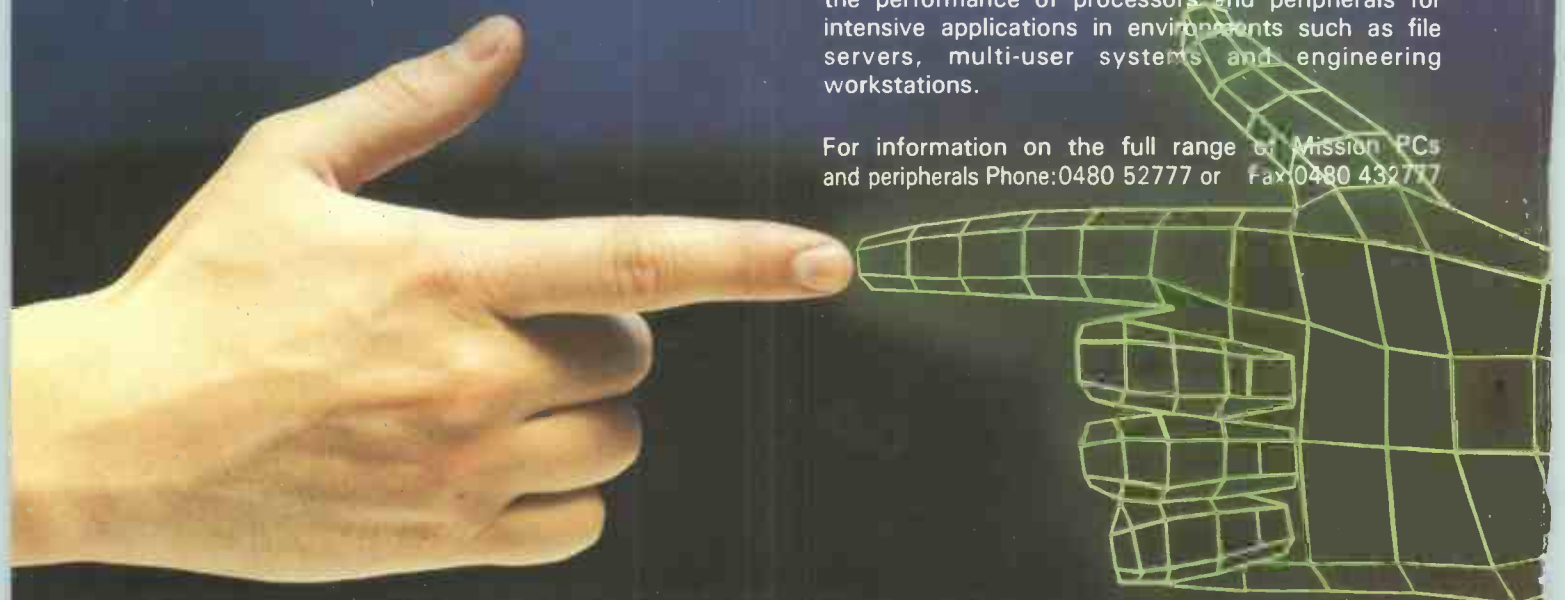
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Now, Mission brings you the "state-of-the-art" in compatible computing with the new FlexCache 386. The Mission FlexCache delivers zero wait-state CPU performance, together with unique high performance intelligent disk subsystems with up to 10MB of disk caching!

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