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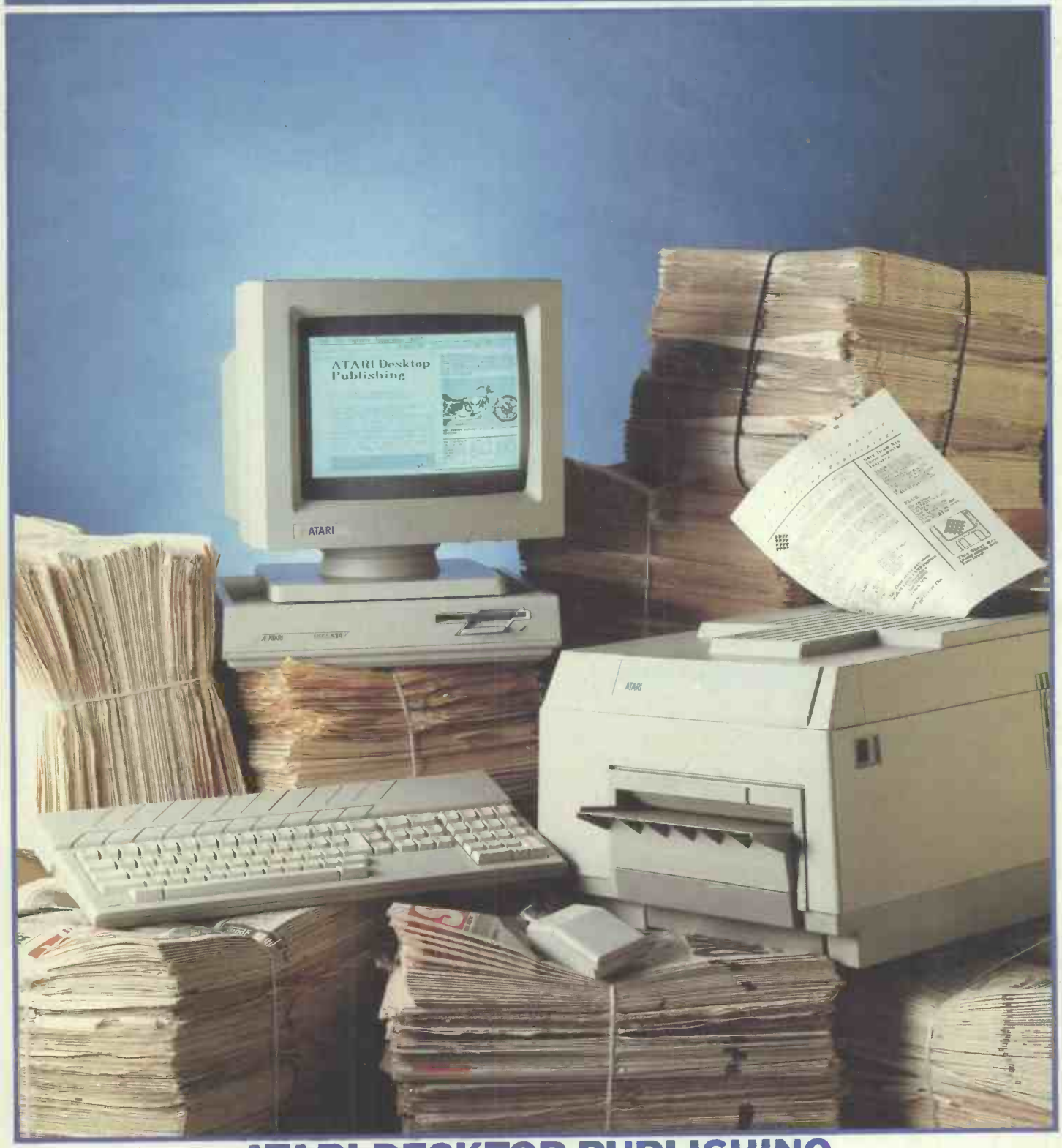

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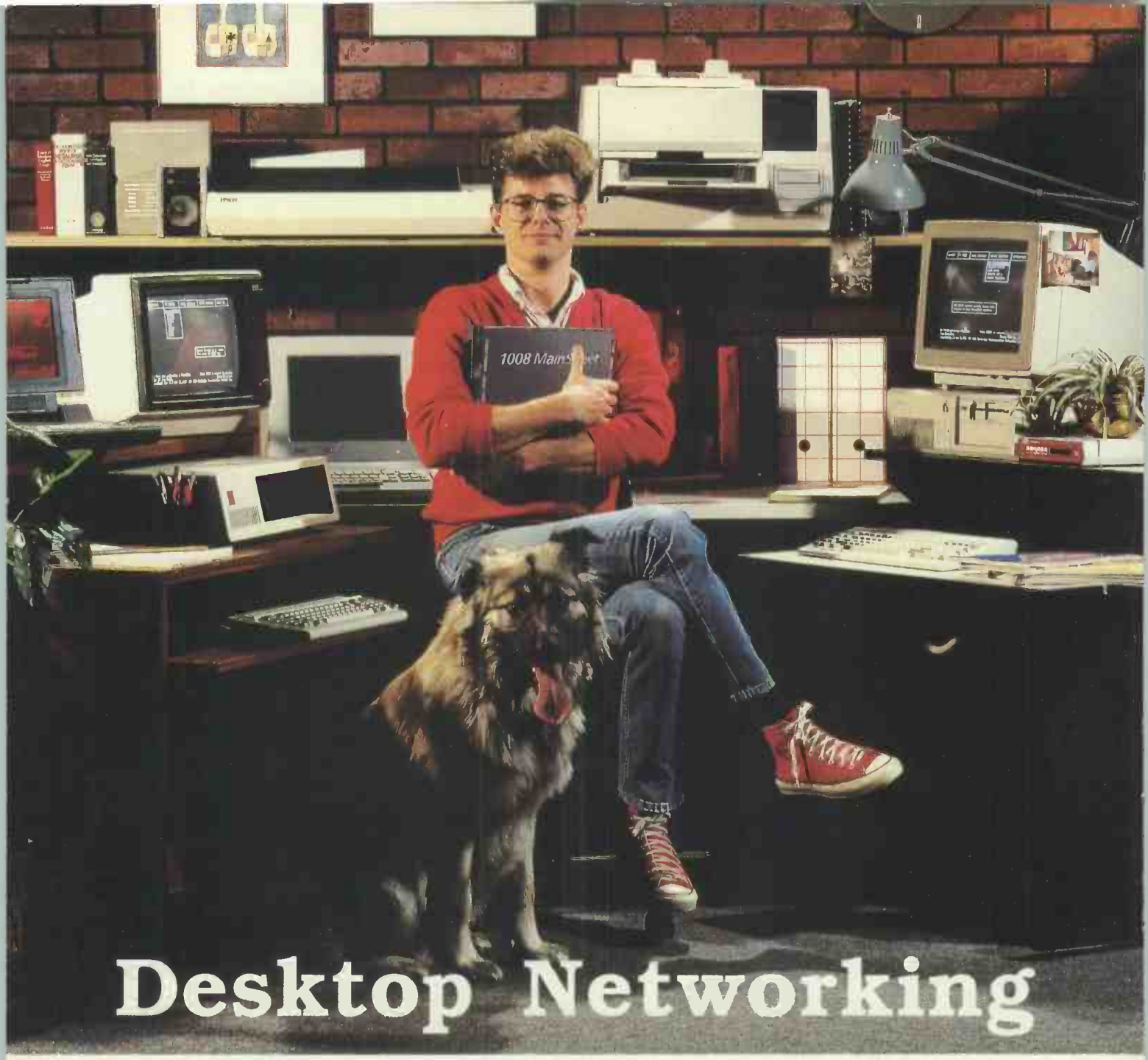

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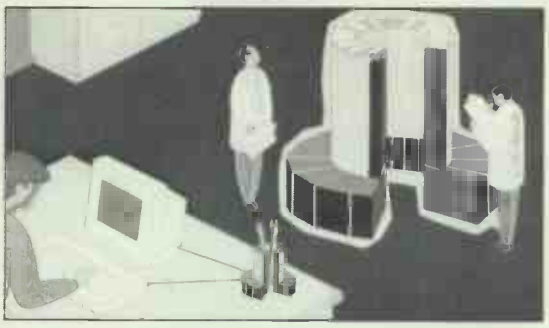

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	6000/2200 Corr	£3.10	£2.70	£2.50
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	6100 Corr	£1.80	£1.50	£1.40
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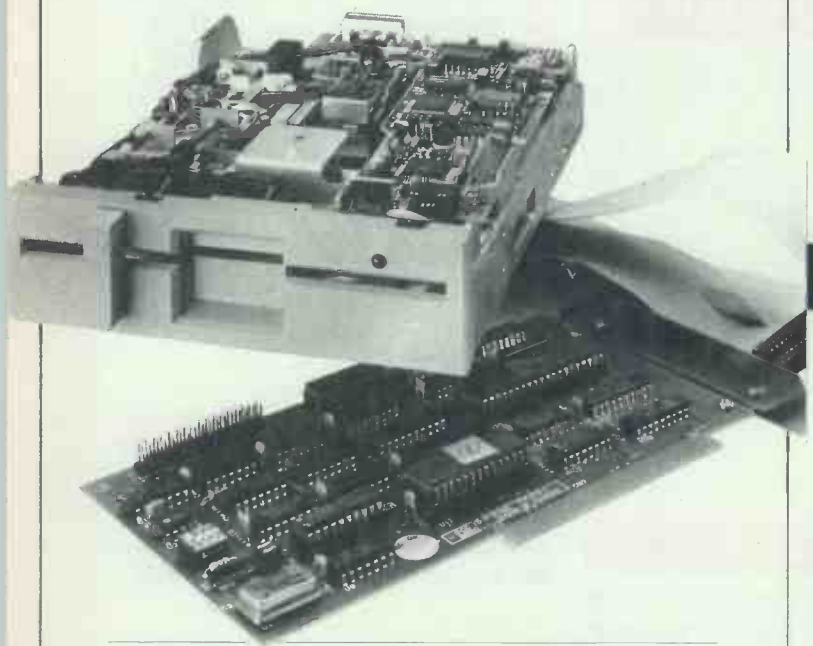

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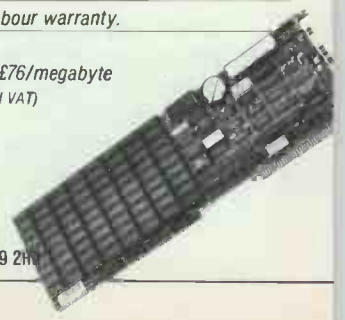

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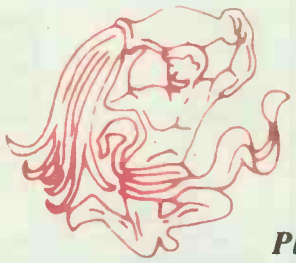

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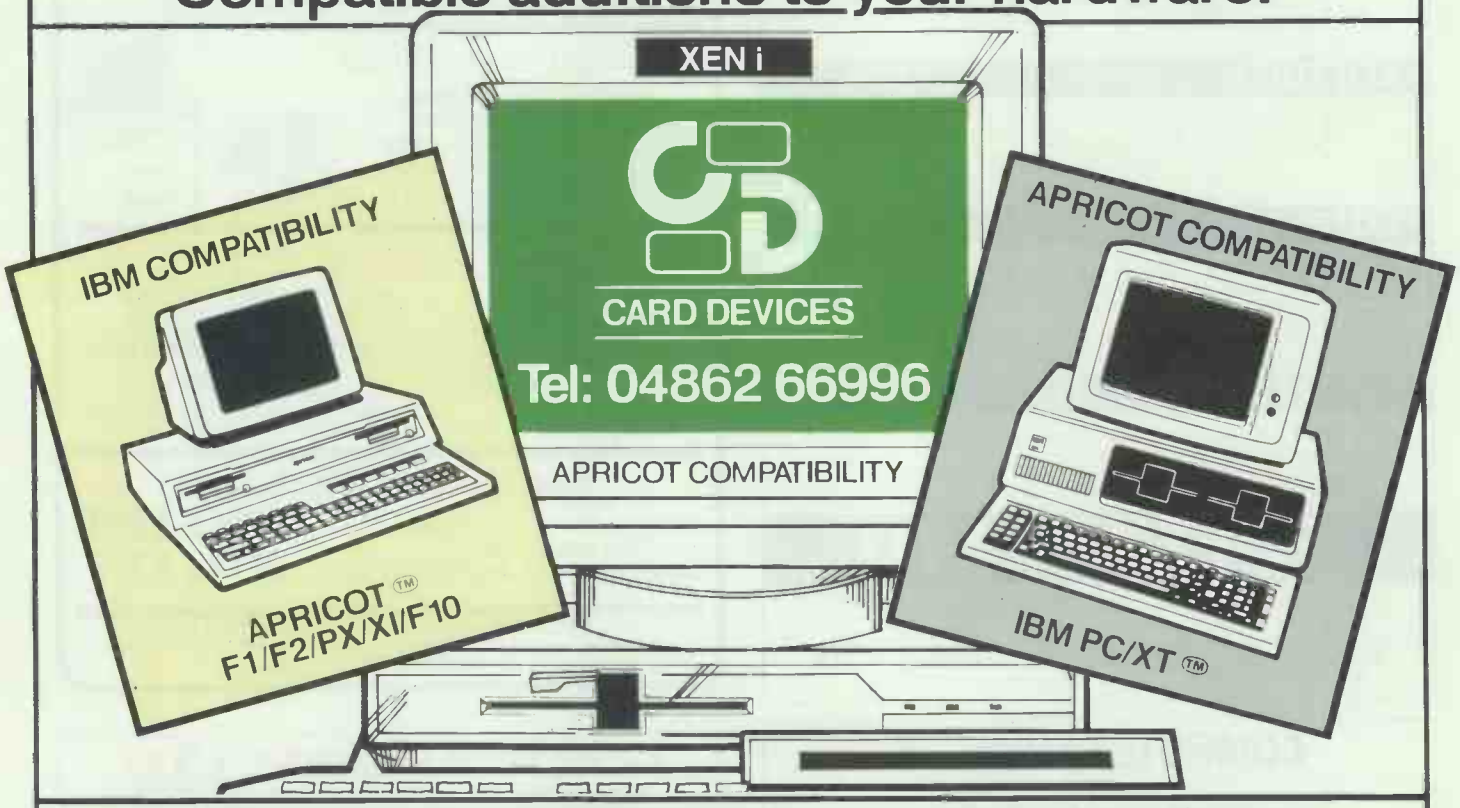

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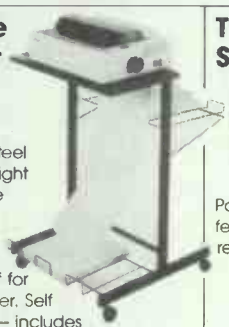
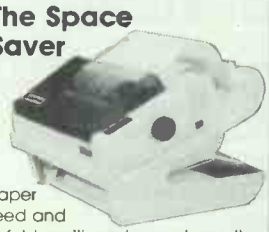


Rugged steel frame. Height adjustable basket for output paper & base shelf for input paper. Self assembly – includes castors.

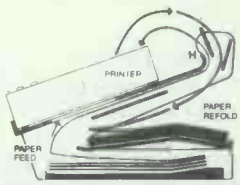
80 column	£50.00
132 column	£65.00

The Space Saver



Paper feed and refold positioned one above the other. Dial controlled paper feed with adjustable deflectors ensures smooth flow and automatic refolding.

80 column 414x380x460mm		132 column 530x380x460mm	
1	34.40	1	43.00
3+	32.10ea	3+	40.70ea
6+	30.50ea	6+	38.65ea



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	3	6	12
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6+ 7.10 each

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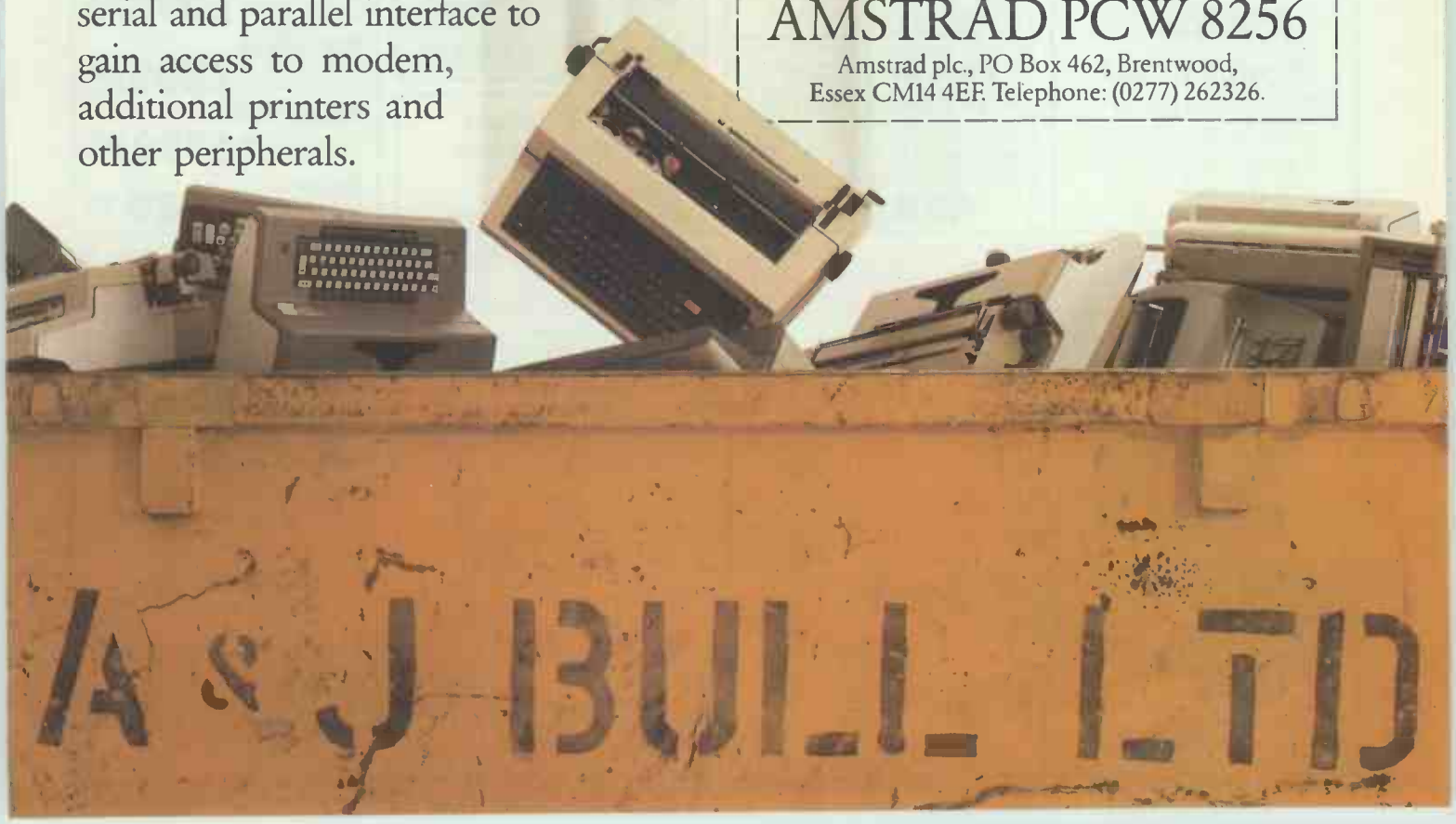

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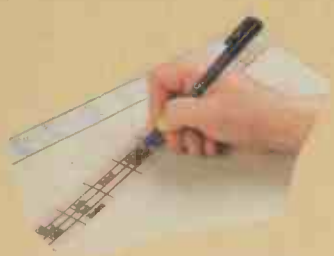

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SPECIAL ANNOUNCEMENT

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This year the Awards presentation and dinner will take place in London on the first night of the Personal Computer World Show, Wednesday 23rd September.

The categories of Awards are:

- **BUSINESS MICRO-COMPUTER OF THE YEAR**
  For the most outstanding personal computer for business/professional use
- **BUSINESS SOFTWARE OF THE YEAR**
  For the most outstanding software package for business/professional use
- **HOME/SMALL BUSINESS MICROCOMPUTER OF THE YEAR**
  For the most outstanding personal computer for use in the home or small business
- **HOME/SMALL BUSINESS SOFTWARE OF THE YEAR**
  For the most outstanding application software package for serious home/small business use
- **GAME OF THE YEAR**
- **BRITISH MICRO-COMPUTING SPECIAL AWARDS**
  In addition to the above categories, three discretionary awards will be given for personal computing products of especial merit. Typically, these awards will be given for such products as peripherals, hardware and software combinations, add-in boards, networking and multi-user systems and education software packages. The British Microcomputing Special Awards are designed to ensure maximum representation across the industry.
- **1987 MICRO-BUSINESS AWARDS**
  Once again, in conjunction with The Personal Computer World Show, the Micro-business Awards will be given for the microcomputing innovations which offer an outstanding and original contribution to business profitability and efficiency. Two awards will be given, one for hardware and one for software.

Nominations for any of the awards may be sent by any reader of this announcement and must reach the organisers by Friday 10th July 1987.

Your nomination should include the following information: Product name; Manufacturer's name; Award Category/ies; a **short** statement of why you think the product/s nominated should receive an award; your name, address and telephone number.

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M2032: NANOVISION UTILITIES. Converts text files to com files for self-display; memory-resident page; visual file deletion. More.

M2033: SELECTED MENU SYSTEM. Menus are created with word processor. 10 options per menu; sub-menus, etc. Makes usage friendlier.

M2034: MULTIPLE FILE CATALOGUER. Catalogues for word processing, databases, games, etc. Searches, sorts, prints reports and directories.

M2035: MORE HARD DISK UTILITIES. A super collection for optimising disk usage. well worth having.

M2036: PC SPEED-UP. Inexpensive way of getting more out of your hardware. Diagrams need Epson-compatible printer.

M2037: MANAGING MEMORY-RESIDENT UTILITIES. Organise and control memory better.

WORD PROCESSING

M42: TYPING TUTOR. Improve your keyboard work. Menu-driven, easy to use.

M43: MULTI-FONT WRITER. On-screen scientific notation. Greek letters, gothic; bold, italics, etc. Recommended.

M48: OUTLINER FOR WORD PROCESSING Considered by many to be the best outliner/ideas processor available.

M49: FORM LETTERS. Examples of the most commonly-used business letters – dozens of them.

M3014: SIDEWRITER. Generates printed output sideways to fit wide reports on to a page.

M3019: PROGRAMMERS EDITOR for source code editing in structured languages. can be memory-resident. Built-in doc.

GRAPHICS

M61: GRAPHICS. Some of the best programmes, including picture-graphics set of commercial standard.

M62: SLIDE PRESENTATION. Prepare transparencies for overhead slides.

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M67+: COMPUTER-AIDED DESIGN. Powerful control over drawing, graphics, printing, and slide show. Two-disk set £18. Requires colour monitor.

LANGUAGES

MB5: PASCAL. A popular language for general programming. Good choice for learning to programme.

M94+: ARTIFICIAL INTELLIGENCE. These 2 disks contain TWO expert system shells – Esie and Expert. £18. They help you gather information and make a recommendation.

M95+: BASIC LANGUAGE. Interpreter with manual. 2 disks. £18.

COMMUNICATIONS

M101: TWO MAJOR COMMUNICATIONS programmes – Qmodem and Kermit. Lots of bells and whistles.

M6010: PROCOMM. Many featured programme for contacting bulletin boards.

M6012: UK BULLETIN BOARDS. A comprehensive listing of bulletin boards in UK. M107 is an Australian listing.

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M121: GENERAL LEDGER ACCOUNTING. A small-business recording system. Highly regarded. Excellent reports.

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M126: STATISTICAL ANALYSIS. Many programmes in Basic for analysis – Chi, Regression, Fisher, Binomial, Variance, Histogram, Poisson, Correlation, etc.

M127: SPREADSHEET. Easily used, comprehensive programme.

M128+: INTEGRATED PACKAGE. Three disks. Includes integrated word processor/spreadsheet/database/graphics. £24.

M129: 1-2-3 UTILITIES. Highly regarded collection of utilities that enhance the operations of Lotus 1-2-3.

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M136: PROJECT MANAGEMENT. Will handle 1000 tasks and does critical path analysis, cash flow, bar charts, cost reports, etc.

M137: STOCK CHARTING SYSTEM. Records highs, lows, volumes, prices, etc. In Basic.

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M7030: CALCULATERS' COLLECTION. Calculations for various occasions – programming, school, finance, many digits, etc.

M7031: PERSONAL FINANCE MANAGER. Manages cheque and credit card a/cs, savings, purchases, withdrawals, interest, budgets.

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M142+: DBASEII/III APLLICATIONS. Extensive group including: cheque payments, mail management, inventory ctl, budgeting, accounting, depreciation, general ledger, graphics, etc. 5 disk set £36.

M143+: FAMILY TREE/GENEALOGY. Recording, tracing, grouping, printing family tree. In Basic. 2 disks with documentat. £18.

M147: DBASEIII SCREEN CODE GENERATOR. Greatly reduces the amount of programming you need to do. Generates coding to include in your own programme.

M150+: DATA BASE MANAGER. Suits sales/stocks/mailing/personnel/payroll. Calculates, prints invoices etc. 2 disks £18. Has full documentation.

M151: MAILING LIST MANAGER. You can add, edit, sort, and print mailing labels for all members or selected groups.

M152+: RBASE LOOKALIKE. Operates as standalone system in menu and command modes or will drive application programmes. 3 disks. £24. Requires hard disk.

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M8013: FREE FILE. Menu-driven, easy to use relational data base that allows 100 fields and up to 2 billion records.

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M201: BASIC TUTORIAL. How to programme in Basic. Onscreen demonstration and explanation.

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Programmes are intended for IBM-PC or close compatibles. If Basic is specified then Basica or GWBasic is required. Most programmes are compiled.

EFFICIENCY WITH FILES AND COMMANDS

U14. FAKE A KEY to provide the input expected when batch processing.

U15. MULTI-CHOICE MANAGER. Very cleverly apportions memory so that you can switch between three files.

U16. SOUND A TUNE that lets you know a stage has been completed in batch processing.

U17. REQUESTS INFORMATION in batch file processing. A timed ask utility.

U18. MULTIPLE FORMATTING of disks. Lets you format a lot at same time.

U19. SMALL, FAST SUPER DIRECTORY. Lists directory in 2,4, 6 columns, sorts, etc.

U20. SORTED DIRECTORY. Screen listing that automatically shows hidden files and offers 2 or 4 columns. Various sorts.

U21. PERMANENT DIRECTORY SORT. Resorts your directory and saves it to file. Will work on subdirectories and hard disks, as well as floppies.

U22. SUBDIRECTORY LIST. Shows subdirectories in a given directory.

U23. SPACE ALLOCATION. Combines Dos Tree and Dir commands to show amount of space to be allocated when files transferred to hard disk.

U24. FILE MANAGER with execution facility for running programmes. Will also copy, view, delete, etc.

U25. MEMORY-RESIDENT FILE MANAGER with multiple windows, variable size. Needs CGA card.

U26. BATMAKER. Creates bat files containing all matching files. This is great when using Find in a text search.

U27. MENU PROGRAM. Allows for tailor made menus. Good screen appearance.

U28. GO TO DIRECTORY directly on a hard disk. Reduces amount of keyboard work.

U29. SECONDARY DOS. Lets you suspend currently executing application and invokes a secondary Dos command processor so new commands can be executed.

U30. ALLBUT the programmes you specify can be acted on. Eg, delete, copy, etc.

U31. MEASURE the time your computer takes to execute commands.

U32. DISK ERROR MONITOR. A resident programme that monitors disk errors and gives more information than the abort/retry/ignore message.

U33. REMEMBER COMMANDS. Remembers last 50 commands which may be edited or executed.

U34. RENAME A DIRECTORY.

U35. DISPLAY COMMENTS FROM CONFIG.SYS file when booting up.

U36. BUILD DIRECTORY FILE WITH COMMENTS. Has asm source code so that you can tailor to own needs. Produces list of files with size, crc, file no. and space for comments.

FILE PRINTING/EDITING

U130. PRINT ITALICS. Set printer for output in italics. Epson compatible.

U131. PRINTER RESET. Resets printer to power-up mode.

U132. GRAPHIC SCREEN DUMP for Epson compatibles.

U133. SET 51 LINES PER PAGE on Epson compatible computer.

U134. SET 132 COLUMNS PER PAGE on Epson compatible computer.

U135. SET UNDERLINE MODE on Epson compatible printer.

U136. SET COMPRESSED PRINT on Epson compatible printer.

U137. SET ENLARGED PRINT on Epson compatible printer.

U138. SET WIDE PRINT on Epson compatible printer.

U139. SET EMPHASISED PRINT on Epson compatible printer.

U140. SET EXTENDED CHARACTERS on Epson compatible printer.

U141. PRINT SPOOLER. Creates a 16k buffer in memory, which allows you to do other work whilst printing.

U142. DISK-BASED PRINT SPOOLER. Uses capacity of disk as buffer for printing, allowing you to continue with other work.

U143. SEND ESCAPE (ESC) SEQUENCES as part of command, such as for printing.

U144. WORD FREQUENCY. Counts number of times each word is used in a text file.

U145. FAST WORD COUNT. Provides count of words, characters, lines, plus a mathematical check sum, which allows you to compare text files for changes.

U146. APPOINTMENT REMINDER. Stores data on disk like a daily appointments diary. Prints details of next 7 days.

U147. PRINT WITH NUMBERED LINES. Great for listing source coding.

U148. SIMULTANEOUS EDIT of multiple text files. Lets you make the same text changes to several files at once.

U149. WORD LENGTH ANALYSER. Checks the length of words in text and compares with readers' level of schooling.

U150. TEXT CHECKER. Examines Wordstar files for typing errors such as missing brackets and quotes.

U151. TEXT FILE SORT. Fast and works with very large files.

U152. LIST NON-ASCII BASIC FILE without loading Basic. Also helpful for listing if you don't have Basica/GWBasic.

U153. PAUSE LISTING so that printer will produce 55 lines on a page.

EQUIPMENT HANDLING

U406. CONTROL BACKGROUND/FOREGROUND COLOURS as displayed on your monitor.

U407. HARD DISK PERFORMANCE TEST. Checks the running of hard disks.

U408. COMPUTER LOG to keep track of amount of time of computer usage, how time spent.

U409. ELECTRIC TYPEWRITER. Converts computer into electric typewriter (for notes, envelopes, etc.).

U410. KEYBOARD OPTIMISER that will set cursor size, give type ahead buffer, more. Easy to use command line editing.

U411. MAP RESIDENT PROGRAMS. Shows program addresses, possible conflict.

U412. TRACK MEMORY as programs are running. Has windows and more.

U413. MEMORY ORGANISER. Determine, mark, release, allocate, display memory. Shows how files are loaded in memory.

U414. MULTI-SCREEN. Allows output to be directed to more than one screen. Needs CGA. Multitasking features.

U415. NEW ANSI.SYS that may aid screen presentation and allow faster execution of many functions.

U416. BLACK & WHITE MODE can be switched on colour graphics card.

U417. TIMEPARK HEAD of hard disk after a specified time has elapsed.

U418. SET 40 or 80 screen columns BW mode on colour systems.

U419. STATUS REPORT on system, including information about drives, memory available.

U420. SPEED TEST (1) checks processor speed and compares with IBM-PC. Similar to Norton test.

U421. SPEED TEST (2) checks computer speed in two areas, including Sieve calculation and track to track access time, and compares with IBM-PC.

U422. SPEED TEST (3) comprehensive checks on processing, including block write, register/memory, multiply, divide, stack operations, far jumps, etc, and compares with IBM-PC.

U423. RAM TEST. Tests and tests and tests ram. Identifies faulty memory.

U424. DOS ENVIRONMENT VARIABLE EDITOR. Make changes to edit path, prompt, etc.

U425. EXPAND DOS ENVIRONMENT SPACE TO 1K.

U426. FLIP ON/OFF (TOGGLE) DOS PARAMETERS. Works on several standard Dos parameters.

U427. WHAT PROCESSOR? Examines and identifies the processor/s being used, such as 8088, 8086, etc.

U428. WHAT DEVICE DRIVERS? Examines and reports on devices (eg ports) installed in your computer.

U429. WHAT DOS CONFIGURATION? Examines and reports on memory, vector addresses, and statistical information about version of Dos you are using.

U430. WHAT EQUIPMENT? Examines your equipment and reports on the installed drives, type of cards (eg, printer, colour, mono, RS232) etc.

U431. EDIT RAM STORAGE in your computer.

U432. DRIVE STATUS. Reports on no. of bytes, sectors, clusters-what capacity is and how much is free.

U433. DIAGNOSTICS. Performs large number of computer diagnostics and reports on serial, parallel ports, video, etc.

U434. DRIVE TEST. Floppy disk test drive utility.

FILE MOVING

U511. HARD DISK UNERASE. Exceptional features. Most unerase utilities don't work on hard disk – this one does!

U512. DELETE ALL BUT those programs you identify.

U513. INTELLIGENT COPY PROGRAM that creates sub-directories as part of the transfer. Also renames rather than over-writes.

U514. SUPERIOR COPY PROGRAM that checks and evaluates target before copying. Eg, copies last dated version.

U515. UNIQUE COPY PROGRAM with same function as £.£ but does not copy those already on target disk.

U516. TREE SURGERY. Prune files unwanted/ duplicated on hard disk. Has source code and compares files with the same name.

U517. KILLDIR. Delete a branch of a directory. Reduces steps and saves time.

U518. MOVE DIRECTORY around if you prefer it stored in different location.

FILE ORGANISATION & CHECKING

U611. BOMB ALERT. Examines new files for malicious intent and reports on possible danger to other files.

U612. BASIC MENU GENERATOR. Better access to your Basic files through a menu. For Basica/GWBasic.

U613. UNSQUEEZE ARC FILES. Small, efficient utility that occupies less space and is simpler to use than Arc.Exe.

U614. HARD DISK OPTIMISER. Related group of files that optimise hard disk usage and eliminate file fragmentation. Helps pack the disk.

U615. FILE RE-ORGANISER. Regroups a fragmented file into contiguous sectors on a disk for more efficient disk access.

U616. RECOVER BAD SECTORS. Re-records data on disk. Does 12 retries and thus may recover bad sectors.

U617. COLLECT BAD SECTORS. Marks bad sectors for collection into a separate file that will not be used. Works with floppies and hard disk.

U618. ADVANCED COMPARE facility that can save as edlin script, generate and update deck.

SPECIAL FEATURES

U805. PREPROCESSOR FOR "C" COMPILERS. Has "C" source and helps organise coding into efficient form for compiling.

U806. VOICE EMULATION. Compiled with Basica source module which allows extensions, revision or use as tutorial.

U807. DEMONSTRATION OF COMPUTER GRAPHICS for those who have CGA.

U808. DAYS SINCE JAN 1ST. Calculate no. of days elapsed since beginning of year. Needs Basica/GWBasic.

U809. BINARY FILE CONVERTER. Converts files from machine language to hex equivalent for examination and modification.

U810. CAPTURE BIOS contents and store in a separate file.

U811. EXPLORE FAT (FILE ALLOCATION TABLE). Shows the table entries, starting clusters of files, etc.

U812. MINICALC. A small, easy to use spread sheet with 11 x 22 cells for quick every day use.

U813. PROGRAMMER'S CALCULATOR which does special hex and other calculations for those writing programs.

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The service charge for each program is £2. There is a minimum charge of £12 (six programs) plus £2 for postage and packaging (£3 foreign). UK purchasers add 15% VAT to total.

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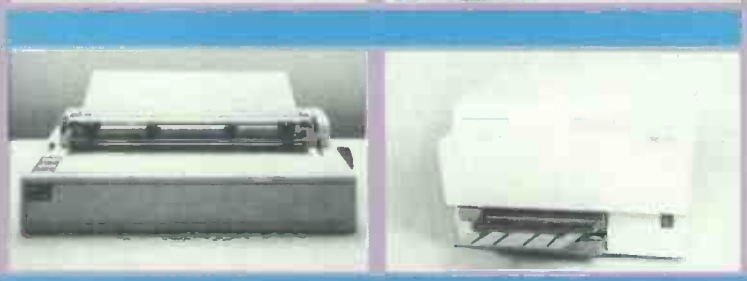

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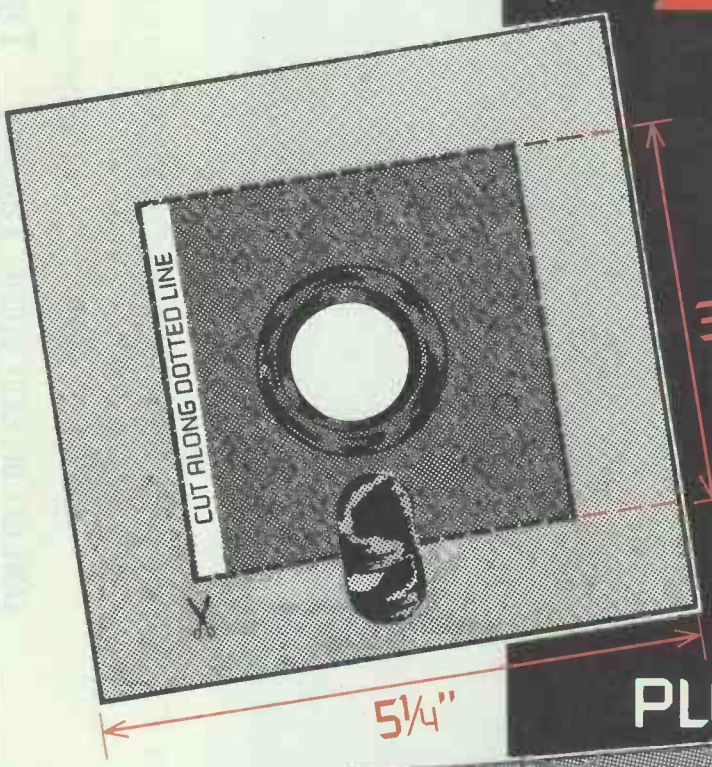

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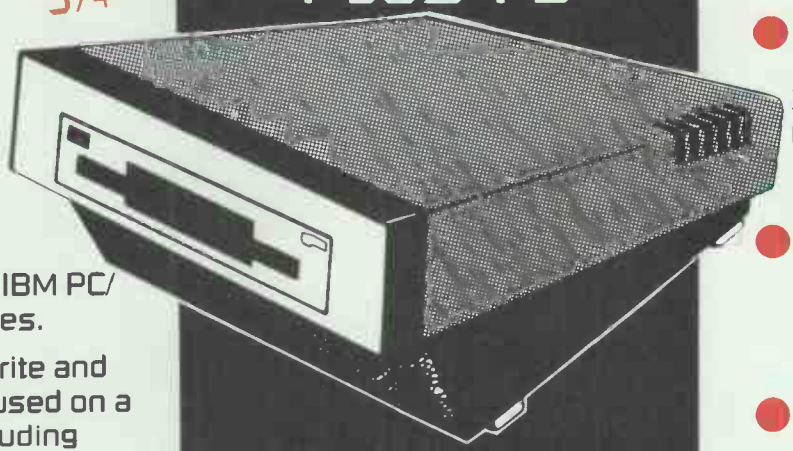

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ANSWERCALL	MINIMODEM	V21	Simple direct connect modem									(75)	**59**
DACOM	DSL 2123AD	V21, V23	Mainstay of Dacom range	Y	Y	HAYES		Y	Y	BOTH		(255)	**195**
DACOM	DSL 2123GT	V21, V23	Fully buffered to 9600 intelligent	Y	Y	Y	Y	Y	Y	BOTH	Y	(398)	**359**
DACOM	PC123	V21, V22, V23	Latest IBM multispeed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		499	**399**
DACOM	PC123 BIS	V21, V22, V22BIS, V23	Latest IBM high speed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		699	**549**
INTERLEKT	PORTMAN	V21, V23	Reliable no frills modem	Y					OPT			173	**139**
INTERLEKT	PROSPECT	V21, V23	Reliable no frills modem									125	**99**
MIRACLE	WS2000	V21, V23	Low cost manual modem	OPT		OPT						108	**89**
MIRACLE	WS3000 2123	V21, V23	Cost effective multispeed	Y	Y	HAYES		Y	Y	BOTH		295	**235**
MIRACLE	WS3000 22	V21, V22, V23	Cost effective multispeed	Y	Y	HAYES		Y	Y	BOTH		495	**385**
MIRACLE	WS3000 22 BIS	V21, V22, V22BIS, V23	Multispeed top of Miracle range	Y	Y	HAYES		Y	Y	BOTH		650	**519**
MIRACLE	WS4000	V21, V23(V22 OPT)	Budget "Hayes" multispeed	Y		HAYES				PULSE		170	**133**
MODULAR TECHNOLOGY	INTERMOVER 5021	V21	Low cost compact stand alone	Y								98	**79**
MODULAR TECHNOLOGY	INTERMOVER 5022	V22	Low cost compact stand alone	Y								295	**269**
PACE	NIGHTINGALE	V21, V23	Low cost manual modem									99	**77**
PACE	SERIES 4 2123S	V21, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		265	**224**
PACE	SERIES 4 1200S	V21, V22, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		399	**339**
PACE	SERIES 4 2400S	V21, V22, V22BIS, V23	Top pace range multispeed	Y	Y	HAYES		Y	Y	BOTH		499	**429**
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MISSING LINK	BREAKOUT 2400	V21, V22, V22BIS, V23 & S/W	IBM internal card & software pack	Y	Y	HAYES	Y	Y	Y	BOTH	Y	945	**819**
MISSING LINK	QUATTRO CARD	V21, V22, V22BIS, V23	Multispeed IBM internal card	Y	Y	HAYES	Y	Y	Y	BOTH	Y	795	**695**
RACAL	MPS1222	V22	Stand alone professional modem	Y		OPT						625	**599**
RACAL	V12422	V21, V22, V22BIS	High spec PSTN multispeed	Y		Y	OPT	Y		AUTO		865	**819**
RACAL	MPS24	V26	Synchronous leased line & PSTN	Y								530	**509**
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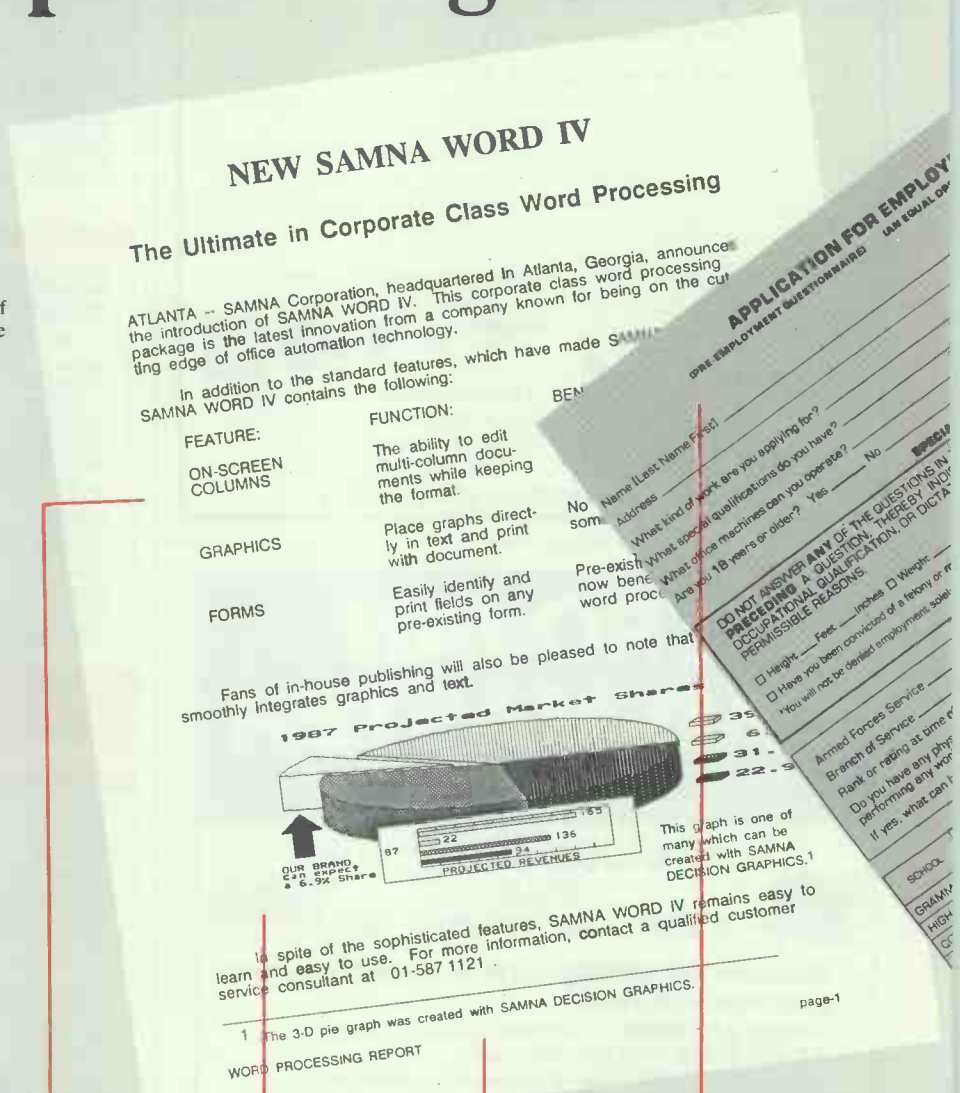

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WORD PROCESSING REPORT

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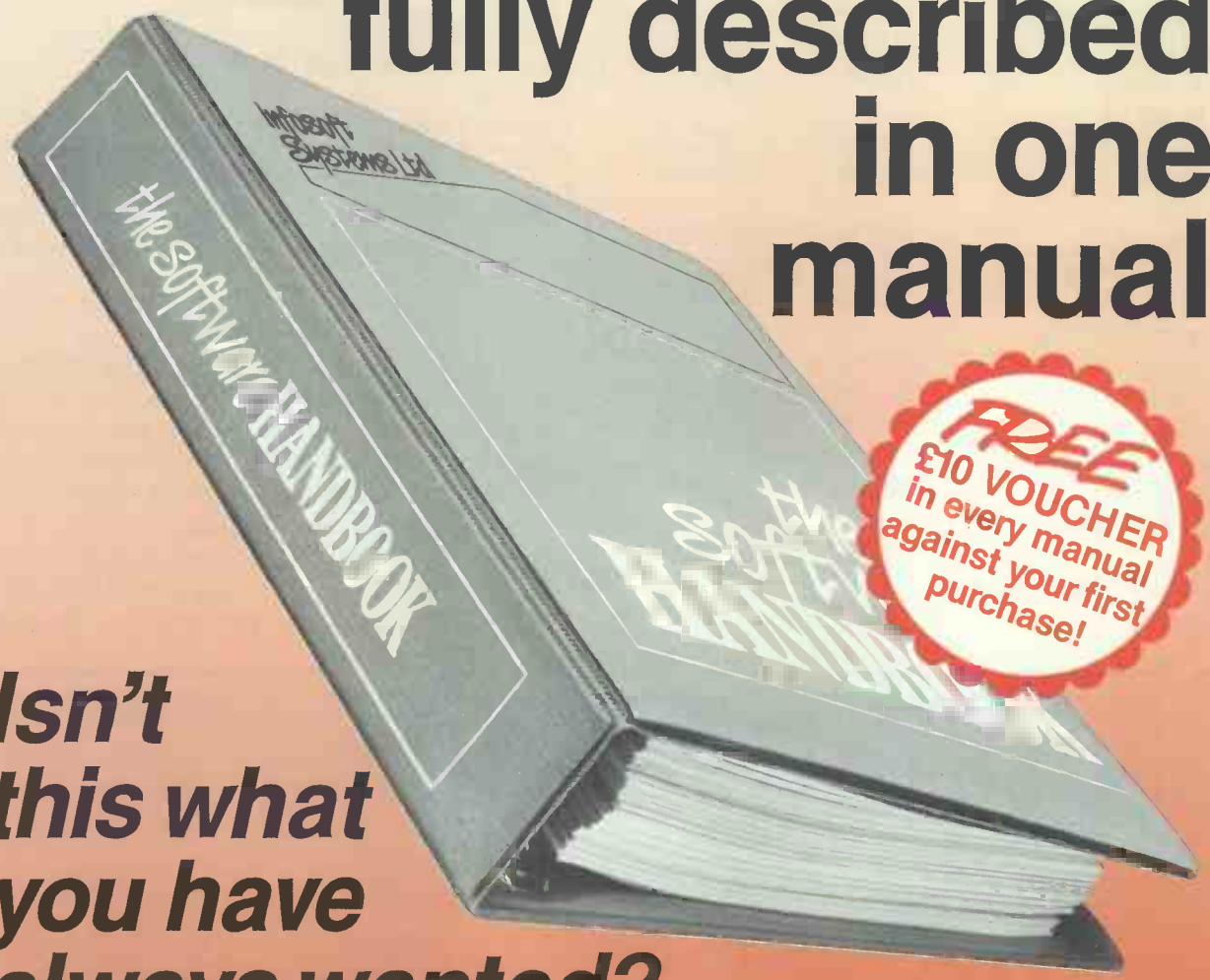

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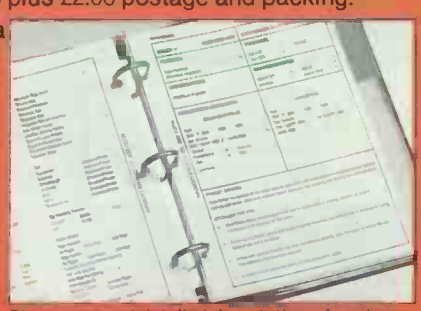

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PCW SHOW FOCUS

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The PCW Show is approaching fast and this year it promises to be even bigger and better than ever before. We preview some of the highlights at this year's action-packed event.

No more queues

Queues to enter Olympia for the PCW Show should be much shorter this year, despite more visitors than ever before being expected to pass through the turnstiles. PCW's organisers at Montbuild have invested in a bar-coding registration system from Coventry Data Services, and this will speed visitors on their way into the exhibition.

This is the first time Coventry Data Services' American-developed system has been used at a computer exhibition, although it has proved highly successful at the past three Motor Shows. Pre-registration tickets for business visitors will need to be completed as usual, but the details will be keyed directly into a registration terminal. Badges with the visitor's name, title, company and all-important bar code are produced in less than a minute, while the data is fed simultaneously into a central database held on an IBM Series 1 mini.

Exhibitors will be issued with light pens so that, instead of filling out enquiry forms or collecting up business cards, they can fill out an index card by passing the pen over the visitor's badge. At the end of the day, the pens can be taken to terminals around the halls to have the information recorded and transformed into a printed report.

'The system will make things much easier for visitors by speeding up registration and simplyfing the process of getting further information,' said Melanie Edwards, exhibitions and conferences sales manager at Coventry Data Services. 'Because it is a central service, they will also be able to find out if colleagues or business contacts have already arrived, regardless of which entrance they used.'

Babani books a regular space

One of the annual exhibitors at the PCW Show over the past years has been Bernard Babani Publishing from Shepherds Bush. The company was set up by the current managing director's late father in 1942, and prides itself on its topical, low-priced selection of technical books.

The books are all paperbacks, with prices ranging from £1.95 to £5.95, and cover the fields of radio, electronics and most aspects of computing. Managing director, Michael Babani, says that his main claim to fame was employing Sir Clive Sinclair when he left school; someone he still encounters at the Show.

Babani usually stocks what is probably the smallest stand in the Show with about 100 assorted titles. He is not particularly disappointed if the majority return to Shepherds Bush, because he sees the Show as a two-way publicity vehicle rather than a sales outlet.

'We don't advertise at all, so it is very helpful to be in front of our potential customers. At the same time, I listen to them and their ideas about what we should do next — the public are never very slow to make suggestions!' he explained.

Despite the small stand, Bernard Babani Publishing sells nearly everywhere in the world. Babani was particularly pleased to have his Spanish sales boosted two years ago when, he says, 'half of Spain seemed to come to the PCW Show.'

New names, familiar faces

Some of the new names at the PCW Show this autumn are actually no strangers to the industry, or to the show itself. Quite apart from Sir Clive Sinclair — who must be one of the most familiar faces around, and his new company, Cambridge Computer, which will be showing off its, by then, six-month-old Z88 — there are familiar household names outside the computer field. One of the biggest of these is leading toy manufacturer Mattel, coming to the show to launch a new range of products from Japan.

Mattel is exhibiting for the first time beyond the childrens' toy exhibition. Although the company has been involved in the games market before, Mattel Electronics was one of the casualties of the video games shake-out a few years ago. Now it is staging a comeback as UK distributor for the Japanese Nintendo Company, the leading home video and arcade games manufacturer in Japan and the US.

Nintendo is currently expanding its distribution network to cover Canada, the UK, Italy and Australia. In the US, about 65 per cent of the games sold are Nintendo's, and about 98 per cent in Japan.

'We are very keen that they should enjoy the same success here,' commented Gordon Macfadyen, group product manager at Mattel. 'Nintendo stopped the decline and proved that the video games market was not dead. They showed that if you go in with quality products with dedicated machines, scrolling graphics and full colour, and not the cubic graphics of the past, you are on a very strong wicket.'

Mattel is acting as a distributor for the Nintendo Entertainment System hardware and 27 software titles, 17 of which will be available at the PCW Show launch. Emphasis will be placed on letting the public have hands-on access and giving them a chance to try out the games for themselves.

Spreading the word

Every year, the PCW Show turns the spotlight onto a number of applications of topical interest. This year one of the major features will be desktop publishing, which represents one of the fastest-growing — and most controversial — sectors of the micro industry. The PCW feature will be no sales hype, however; rather a glimpse of desktop publishing in operation, producing real magazines.

'We want to emphasise the practical side of DTP — independent and impartial advice will be the hub of the feature,' says Henry Budget, editor of *Desktop Publisher*, who is organising the stand. His magazine's show newsletter will be one of the two main items produced 'live', the other being the exhibitors' show newsletter.

The stand will be split into two sections. One half will be an information centre manned by independent people who use desktop publishing, such as bureaux, consultants and journalists. The other half will be set up as a production unit, and a wall of monitors will give the public insight into what goes into producing newsletters.

Information will be gathered electronically, either direct via an RS232 port or using public electronic mail services such as Telecom Gold and One to One.

On show, there will be three different types of system: one PC-based; one on a Macintosh; and one dedicated desktop publishing system, all being used for full production. Budget also hopes to have an A3 duplexing printer, capable of printing on both sides of the paper, over from the US in time for the show. Anyone wanting to try out a system for themselves will be able to do so on the supplier's stand close by, and get further explanations of the hardware and software involved.

'This will show people what desktop publishing systems actually do and not what salesmen are told to say they do,' Budget commented.

INFORMATION

To book your PCW show space contact Richard Hodgson on (01) 486 1951 or (01) 487 5831, or write to: Computer Upgrade, PCW Show, 11 Manchester Square, London W1M 5AB. END

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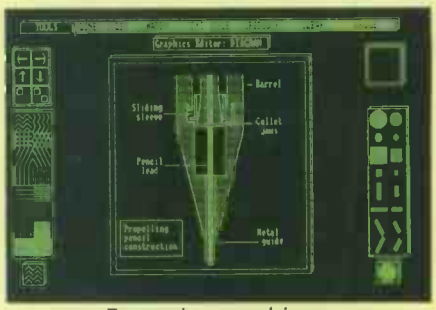

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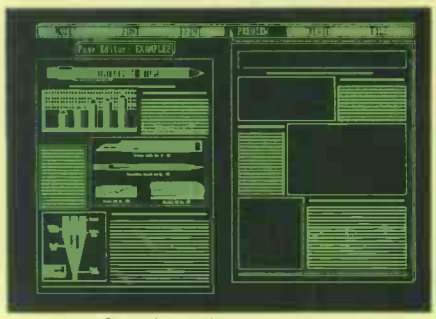

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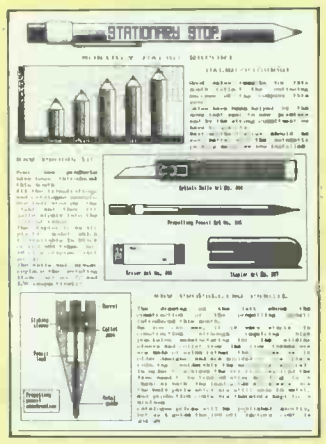

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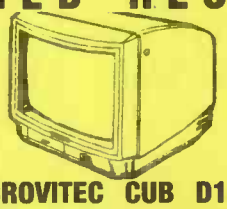

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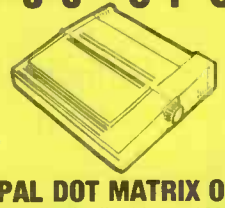

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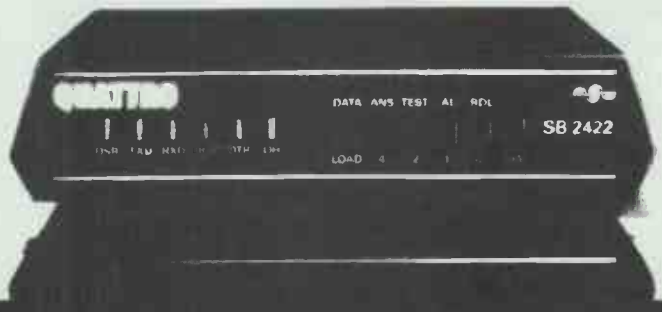

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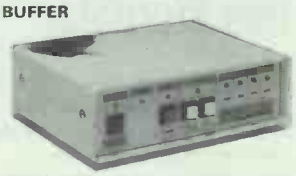

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NEWSPRINT

Acorn's ARM CPU is top of the cut-price processor league; and everyone's favourite word processor, WordStar, could be upgraded to coincide with the launch of a new Amstrad. Guy Kewney presents the facts in this month's news round-up.

Driving towards a revolution — Acorn in gear

A revolution could be about to happen in the cost of driving high-powered computers. Just look at these figures.

For a minimum order of 100, a 20MHz Motorola 68020 costs around £300; 16MHz Intel 80386s cost £240. But a 10MHz Acorn Risc Machine (ARM) CPU, which will comfortably outperform either, and without the need for expensive high-speed static RAM, costs a mere £44.

The 32-bit ARM processor is at the heart of the new range of Acorn machines being launched this month, some of which will form the new BBC Computer series. And a plug in ARM card for PC-compatibles is reportedly in the wings.

The price and performance of the chip set has already aroused the interest of Atari, Apple and IBM, who all have evaluation systems.

The Acorn-designed set comprises four chips — the CPU, video/sound chip, I/O processor and memory manager, and is available to third-party hardware developers from Californian manufacturer VLSI Technologies Inc (VTI) for £130. Given that the full chip set does away with the need for many of the usual support chips found in conventional micros, Acorn is selling what is practically an off-the-shelf micro for half the price of bare, rival CPUs.

Add to this the ARM's ability to work with dirt-cheap 150ns dynamic RAM, and you can see why other manufacturers are taking notice.

Of the four chips, the video/sound (VIDC) chip is likely to be a crowd-puller. It can display up to 1000x1000 pixel resolution in mono, or 256 colours in 640x512 resolution from an overall palette of 4096 colours. The sound side of things offers eight stereo voices of near CD quality.

There will be a catch, though. The VIDC steals processing time off the ARM itself for video display, locking it out of the system for half or even three-quarters of the time on the more memory-hungry screen modes.

Memory itself could also cause problems on those screen modes, with the entry-level Acorn machine having only 512k RAM. The memory management chip itself can only handle 4Mbytes, so all systems using the chip set will have some restrictions.

Acorn's success with the chip set and its own ARM-based machines will probably depend on the speed with which the chip set is adopted by other manufacturers. At present VTI is the sole manufacturer of the chips, and most manufacturers are likely to wait for a second source of supply to come on-stream before taking the plunge.

New Amstrad, new WordStar

It looks likely that a new 8-bit Amstrad will be launched just in time to run a nice new version of the world's favourite word processor, WordStar, perhaps in September.

MicroPro, the author company of WordStar, is a transformed outfit since it re-absorbed the bright go-getters who split away from it originally to launch New Star and New Word.

And, as you can read in this issue (page 158), it has now re-released New Word 3 as WordStar version 4. (That's the real WordStar 'Professional', as opposed to WordStar 2000 which is no more WordStar than it is Supercalc.)

That program will be released in an 8-bit version in August. At that time, roughly, you can expect rumour to be rife, or perhaps even to be confirmed, that

Turn your Atari ST into an audio editing console, by plugging in a £50 piece of hardware and running a single program.

This temptation appeared at the Atari Show (London, 24–26 April 1987) and seemed too good to be true. It was launched by Eidersoft, and I had an amazing fight to get near enough to the machine to use it. And, it turns out, it is true.

The best description of Pro Sound Designer would be a 'desktop publisher' for sound. It includes a 'scanner', a 'font editor' and a 'text editor with cut and paste', and a musical 'graphics' editor — all working not on words or images, but on raw sound.

It lets you record sound from tape, radio or any other electronic source, and store it in the ST's memory. Then you can edit it, play bits of it back, reverse, speed up, slow down, repeat, overlay/echo, cut, paste, and generally fiddle. And the quality is amazing.

If that isn't enough, it also lets you get at the Atari ST sound chip.

The amount of music you can squeeze in depends on the quality you want, of course. The designers sample the analogue sound at anything between 3KHz and 30KHz, so the best frequency bandwidth is up to around 15KHz, which is as good as the BBC gives you on broadcast. But it's only 8-bit sampling.

The reason this product has appeared on the ST is simple: the ST has 1Mbyte or more of RAM in it. You need this internal memory to have any reasonable amount of sampled sound.

Without doing a full evaluation — which I hope PCW will soon be able to do — there's no way of providing a feel for this product.

What use is it? Use? No more than any other musical instrument or noise maker you may have at home. It's entertainment, almost pure and simple. Ignore those people who say you can use it for answering the phone, or burglar alarms, or serious stuff like that. Buy it for fun.

Details on (0708) 856468. Eidersoft also does hard disks for the ST, sprite editors . . .

the PCW 8256 range will have been upgraded to something (possibly) called the PCW 9512.

That will mean a £100 price cut in the old 8256, probably, to £300.

The main difference between the old and new PCWs will be the printer.

Current PCWs have a printer built into the main unit, and no way of driving standard printers. It was a great way of saving cash and lowering the price. Unfortunately, these days the quality of print they give compares rather weakly with what you can get from other suppliers.

There will also be at least one new Amstrad printer to go with the new machine — some say a daisywheel (not my idea of a clever idea) and some say a high-quality dot-matrix printer. Both could be true.

Ignore stories from the US about WordStar 2000 being 'dropped', by the way. That program, once described as an 'elephant on motorised roller skates' by an unappreciative friend of mine (Ezra Shapiro, hi!) rumbles on in the form of WordStar 2000 Plus. It has an integrated comms segment, and a mail-list segment, and an indexing add-on. These are sold as a £119 'extra' in the UK, and may well carry on being sold that way for a while. Either way, WordStar 2000 will be with us for some time.

Also WordStar Easy has disappeared in the US, and that was killed in the UK months ago, when Wordstar 1512 was released on a gullible public. So it won't affect local policy.

Softly, softly

One problem with the version of Basic that you get with an Amstrad PC is that it's graphics-based and runs under GEM.

If you want a Basic interpreter that's compatible with IBM's BasicA, you'd have to buy Microsoft's GW-Basic or a compiler like Turbo Basic.

So imagine the delight that appeared on people's faces when a version of GW-Basic called Prado Basic started appearing on bulletin boards, and was advertised as shareware that users were encouraged to copy and pass on to friends.

I took a look at Prado Basic, and immediately thought it bore more than a passing resemblance to the real Microsoft product. A quick look through the code with DEBUG proved it: there's a message buried in there that says 'Licensed material – program copyright IBM'.

If you already have a copy of Prado Basic, keep quiet. If there's a copy on your bulletin board, take it off.

Robert Schifreen

Rabbit, rabbit . . .

I'd dearly like to be able to recommend that Atari ST users buy a game called Goldrunner.

It's had several good reviews and it really isn't bad to play — you're flying through orbiting 'space rings' dodging missiles and objects, and bombing the ground.

The trouble seems small, when first described: speech.

'Welcome to Goldrunner,' says a digitised voice when you start. You jump. 'Wow!' you say and rush off to find a friend. 'Listen to this — it talks!'

And so it does.

After you've dodged a couple of bombs, you jump again. 'Keep going,' says the helpful machine. You bomb a whole section of stuff. 'You're doing GREAT,' it enthuses.

Then you reach a really tricky section. 'Be careful,' warns the machine. Well, you try. Concentrating like mad, you are thrown by the interjection of an imploring 'Don't fail now!' and so, of course, you crash. 'Oh, NO!' says the machine.

If a human stood behind me and rabbited on like this while I tried to play, it would become a dented human.

The game does have the ability (not mentioned in the instructions, of course) to be muffled. You press one of the ST's function keys and the music stops (and what banal music they always do put in these games, to be sure). You press the same key and the sound effects come back. Sometimes. Sometimes, the sound effects go, and the chat stays. Aargh!

I like sound effects. I can tell whether the bombs have hit, or whether I've got my finger on the button properly, and so on. But on Goldrunner, the sound effects come bundled with the helpful chatterbox. You can have chat without effects, but not effects without chat.

Do yourself a favour and play something else. It's a great game, but no human could put up with it.

Those who remember Future Computing's original claims that the company would 'always have an IBM emulator' — or those who have never heard of Future Computing — might be amused to see this big box, which includes nearly 1000Mbytes of storage, 800-Mbytes of which is optical diskery.

It's a multi-user mini, based on the Intel 80286 or 80386 chips. Future now calls itself Future International and the system is sold by Appropriate Storage, of Croydon, where Future used to be, on (01) 688 2883. No, it isn't personal computing, is it?

I'm using this picture of a North Star multi-user system to illustrate a product called Mirage, now available on the Atari ST.

Mirage is (like the North Star operating system) a multi-user operating system. It has been crammed into a single ROM cartridge, for use on the ST.

Now, no-one should run away with the idea that an Atari ST with a simple 68000 in it will be a match for the North Star, which has the Intel 80286 chip. The Intel chip probably isn't much more powerful in raw instructions per second, but it is vastly more capable of running multi-user software because of its protected-mode instructions.

And Mirage doesn't have the amount of software which the North Star Dimension 50 can run, because multi-user programs for the ST haven't been written by many people, yet.

But it just goes to show that, if you have the skill to do it yourself, it is possible to do amazing things that would cost a fortune in the conventional way.

Full details of the bumpy path to multi-user through Mirage, from Sahara Software, on (01) 735 3806.

Full details of the £6850 (upwards) North Star, on (0442) 41266.

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Atari just window shopping

Atari is *not* going to take over Inmos, the Bristol-based Thorn-EMI subsidiary which makes the Transputer.

Having got that straight, let's look at recent events which might have made it seem possible that Atari would even consider such a move. Let's start with the recent Atari Show, in Hammersmith, London.

'There is a limit to the number of times Jack Tramiel can pull a rabbit out of a hat, before people notice it's always the same rabbit,' commented one attentive Atari watcher after the show.

What he was noticing was that since Atari launched its first 68000-based ST — the 'Jackintosh' machine, which was going to destroy the Macintosh — it has made several other announcements. But nearly all of these are simply of other ST models with a bit more memory. The rest are video games machines which it had in stock when it crashed under Warner, or upgrades to those, or 8-bit machines like the 800 and the 600 and the 1200, which are over five years old.

What he was also noticing was that Atari has no semiconductor plant, no disk manufacturing plant, and no American presence. In short, Atari in Spring 1987 is a one-trick pony. It is all front and no substance; it is a cash mountain made out of paper money, waiting to blow away in the first real wind.

At first sight, that isn't fair. The show featured an amazing amount of new software from UK authors — games, and even some quite serious business software. There was the announcement of the laser printer, and there was the launch of the IBM PC compatibles.

But behind it all, there was a distinct atmosphere of anticipation — of people waiting for the Tramiel family to get it right. So many things have been done which couldn't have been predicted, that no-one is going to be brave enough to stand up in public and say 'Jack Tramiel is blowing it.' But privately there are anxious moments, when they will admit that they do wonder whether things are really going quite as well as they looked when the first STs appeared.

In particular, the questions that need serious answers are: 'When will the laser printer be ready, and working? When will the Mega STs be available? If the PC was virtually ready for launch back in January, where is it? Where is the Unix machine?'

And above all: 'Where are we going from here?'

The answer is: new chips, and new software.

The STs are not the last word in technology. They are nice-enough boxes, properly priced for what they are and likely to be around for five more years yet. But Motorola has pronounced sentence on the chips inside them. The Atari based on the 68020 is going to be a multi-user machine, and the 68030 is not being considered for any current Atari plan because it will be the last in the range, and by then, Atari will want to have its alternative in place.

That's a long way into the future. So far, in fact, that it seems silly to start worrying in public about how Atari will cope. And yet . . . when is the next rabbit going to come out?

A hint about the 'next rabbit' was given in this column last month, when I reported on negotiations between Atari and a designer of Inmos Transputer-based machines.

At press time those negotiations remain unresolved. But an Atari Transputer machine for next year remains a real possibility, despite official 'denials' that the company is interested in the Transputer.

Even more important, however, is the question of what Atari is going to do with all that money. One option that was seriously considered, came to light after Tramiel was seen in Bristol.

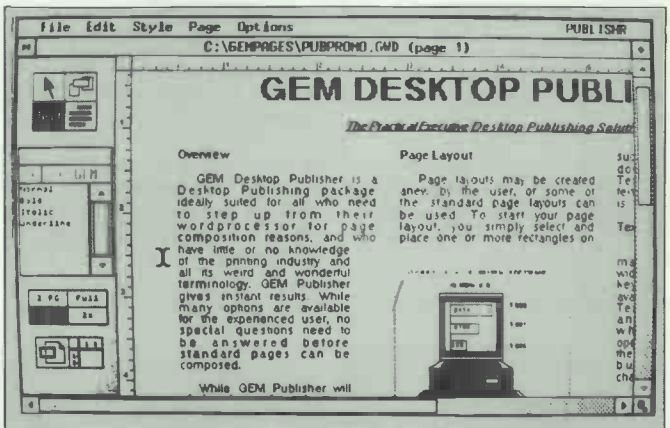
Don't get excited — Atari *can't* buy Inmos — or at least, not without a lot of help. Nor was it trying to. What it was asking was a simple question: 'You have a semiconductor plant in Colorado Springs, USA, and we wondered what you would like to sell it for.' The answer was: 'You wouldn't want it. It's old (4in silicon wafers) and mothballed, and has no staff.' That was that.

Oh, Inmos is likely to be bought — and within a year, to be sure. And it is likely to fetch something like $200 million, which is roughly the amount of cash Tramiel has to spend, he says. But the marriage, otherwise, would be a hopeless mis-match.

For a start, Atari needs a lot of things — a smallish stake in several related companies — rather than one basket with all its eggs roughly packed inside. And Inmos needs a freer hand, and a deeper pocket, than Tramiel would provide.

However, a 10 per cent stake in Inmos would be very much to Atari's taste. A 30 per cent stake in Tim King and Jack Lang's Perihelion, too, would please the Tramiel family. Other software companies, hardware design companies, chip design firms, disk design partnerships, and so on, might also be in line for a share of that cash heap, in exchange for a heap of shares.

Until that happens, however, we can't expect to see much more of the Atari hat — let alone the rabitity of its contents. Too much depends on which, who, where, and when, for decisions to be taken in advance.



There are very many, very expensive desktop publishing products around, among which Fontasy stands out as a ridiculous contrast. And now it has been amazingly upgraded.

Rivalling that product is the latest from Digital Research, which expects its desktop publishing package to be out 'shortly' and which is concentrating on making the thing easy to use.

Both products differ from most in allowing the user to get on with the job, without knowing too much about the skills of traditional typesetting.

According to the Control-Alt-Deli importer of Fontasy, the new version includes a vast number of new fonts, all expandable to amazing sizes. More important, it has a proper control front-end.

Nigel Grant, boss of the Deli, says it now has a text editor built-in, and a proper windowing-style interface with pull-down menus, not the previously slightly cryptic escape code commands.

His list of new fonts amounts to 300 different typefaces, across the various sizes. A sample list: 'Five new fonts for Hewlett-Packard's LaserJet laser printer: for example, Souvenir 5pt to 30pt for £40, sans serif 14pt to 44pt, £24; 14 fonts there. Then there's the genuine H-P LaserJet font Roman at £24 for 14 fonts and a Caligraphy-type face with nine fonts for £24 from 6pt to 34pt.'

The interesting thing about Digital Research's product (which, admittedly, wasn't yet working when the company showed it to the world in early May) is that it was written by the people who went on to write the best-selling Ventura Publisher.

This is nowhere near as ambitious as Xerox's Ventura. It's not even trying to do kerning (fitting adjacent letters like AW tightly together). Proportional spacing is not kerning, and anyone, trained or not, can see the difference when the two are put side by side.

Even the old version of Fontasy had an automatic kerning facility that beats most packages around today.

Grant is on (0908) 662759.

Someone's watching you

It's a horrible feeling, arriving home and finding you've been burgled. You keep asking yourself why you couldn't have come in half an hour earlier and beaten them to it. And you start thinking about all the personal things that they've seen.

I found out at the beginning of May that my Telecom Gold mailbox had been monitored since Christmas 1986. Someone at Gold appeared to have been spooling all my sessions to a file.

The way I found out was quite simple. I typed STAT, which is a Gold command that tells you whether you have any files open. I write CPL programs on Gold, and the STAT command is useful for me to make sure I've closed everything.

The output of the STAT command looked like this:

```
>STAT

USR=VNU209  SYS83

File   File      Open    File
Unit   Position  Mode    Type  RWlock  Treename
 127     101779     W     DAM   NR&1W  <S83-1>SECURITY>VNU209.0

User        NO  Line Disks
VNU209       4*  REM <S83-5> <S83-1> (FROM X.25)

>
```

The Treename is the file that Gold thought I had opened. But although the file was indeed open, *I* hadn't opened it. The fact that the file was in a directory called SECURITY, and that the file name was my mailbox number with a zero on the end, made me suspicious. I called Gold's helpline to ask what it meant.

'Oh,' they said, 'it seems that we're monitoring your mailbox. Let me find out why, and get back to you.'

Quite a few people got back to me.

Shortly before Christmas, I was told, someone logged onto Gold using my account, and tried to access a directory that Gold felt he shouldn't even have known existed. So, Gold started monitoring my mailbox. Then, the person who started the monitoring left, and no-one removed the tap.

I asked whether Gold had a warrant from the Home Secretary, which you'd normally have to obtain to intercept electronic mail. No. I asked why they didn't call me last year, and make sure it really was *me* who tried this unauthorised access, and not someone who had illegally obtained my ID. They said they don't do that sort of thing. But a colleague of mine received just such a phone call some months ago — so they do. I asked which directory I had illegally tried to access. It turned out to be one whose name and access method appears in all Prime manuals, the computers which Gold uses.

Bob Adams, Gold's operations manager, promised an investigation. He said he'd look into everything, and that a full report would be produced for the management at Gold, and that I would get a copy.

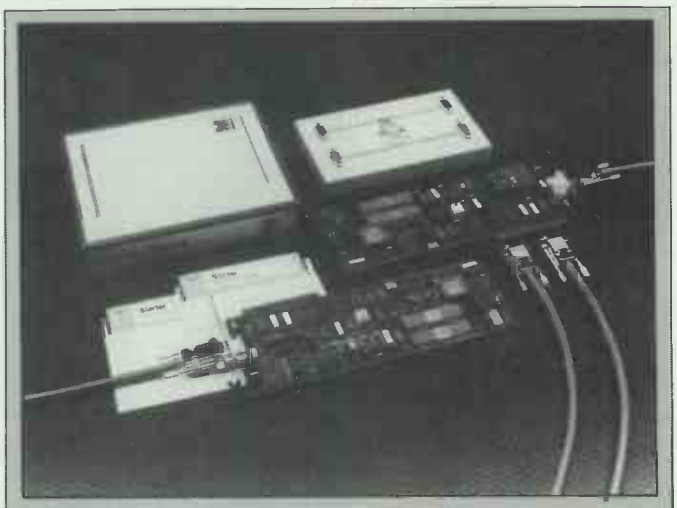
When the report didn't arrive, I called again. Having considered the situation, said Alan Freeman, *PCW*'s rep at TG, Gold has decided that it can't comment any more. There will be no report, and the matter is now closed.

The matter is *not* closed. It is now in the hands of Oftel, who are considering the event in terms of the Interception of Communication Act 1985, and also looking closely at the small print in British Telecom's operating licence.

A week after I complained, the tap was removed. Or rather, the strange file name stopped appearing on the STAT command.

Meanwhile, if you use Telecom Gold to send private or confidential information, think again. And you can't even use Gold's encryption system to protect your data, because someone may be watching you encrypt a file and be able to see which encoding key you choose.

Robert Schifreen



These are the components of Robert Madge's Token Ring, a local networking system which he tried to impress me with by wheeling in Kay Nishi, Japanese super-guru, to vouch for its excellence.

Nishi obliged by describing Madge as a 'visionary, a rare genius who can design in both hardware and software,' and added that his company, Ascii, would be selling Madge's network in Japan.

Madge reckons that he has legitimised the Token Ring with this product, 'in the same way that Compaq legitimised IBM's PC by producing the first clone.' He also reckons his is much cheaper.

I was impressed. I can't squeeze the details of networking in here, but you can contact Madge Networks on (02404) 5651. Or, in Japan, call Nishi.

You have been warned

When you walk into a dealer and order a PC-compatible, they will not tell you, voluntarily and unprovoked, that the machine you've ordered is made by a disorganised bunch of wallies who can't even create correct invoices, let alone get the machine specification right.

They may, at best, admit that delivery could be a couple of days late.

In fact, there are a couple of PC clone makers at the moment who (as a public service) really ought to be exposed to prevent innocent people buying their stuff, so disorganised are they.

Naturally, there is no way the laws of libel will allow this. Nor will the dealers involved let me quote them (for the same reason) on who is causing the problem.

In one case, distributors are the culprits.

I had a call from a dealer who had ordered two machines from a distributor, and was subsequently invaded by credit factors who wanted payment for three invoices, each for the same set of two machines.

The credit factors are people who pay the distributor for the original invoice, and collect the debt.

Normally, said my dealer friend, you can't fob them off with a claim that the invoice is duplicate. They've heard that one before. On this occasion, however, there was no problem.

'Oh, no, not again,' said the debt collector from the factors. 'They're terrible.'

Can I tell you who? No, I can't. My friend won't let me quote him.

Another dealer found that an (anonymous) supplier of clones had messed up his supply of two clones so badly that he was billed for seven when he'd ordered two.

'These people are on their way down,' he said. 'They can't possibly stay in business. They can't do a simple thing like finding out what machines they have in stock, like knowing the price, or like invoicing their customers.'

Who are they? 'I'm sorry, I can't say.'

Now, more than ever, don't buy something unless you can see it working first, and take it home from the store. And ask your dealer, please, how the company's invoicing system is working.

You have been warned.

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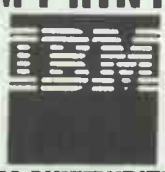
Brother HR25 RS232 & Cent	£195
*HP150 Pertmaster	£95
Brother HR15 XL	£150
Delta 4	£195

IBM PRINTER



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IBM Quietwriter model 1 produces better than daisywheel printout fraction of noise **£450**

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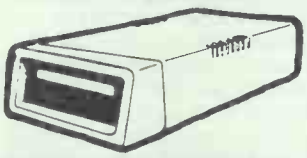

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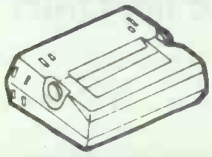

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NEWSPRINT

Opportunity knocks

Tandon has announced 25 per cent price cuts. Officially, this is because the cut in the IBM XT price (because IBM is dumping the XT because of the new PS/2) gives Tandon an 'opportunity'.

In fact, this is the sound of a trumpet blowing.

Tandon is busy re-engineering its ordinary PC-compatibles so that it can slug it out with the cheapest of cheap clone makers, and so it has cut the price of the old PC-compatibles to get rid of them.

Simple as that; but it might mean a few bargains.

Wake up, Lotus

Like religious zealots, Lotus has taken to its logical extreme its own belief that unprotected software may not be used (see last month's piece on the lawsuits). It has stamped on a company which provides a way of unprotecting Lotus 1-2-3 and Symphony.

The company, Trisoft, sold Unlock in two forms, to cope with these products. Mainly, these things were bought by people who had a legitimate copy of Lotus 1-2-3, but didn't like having to put their original into the floppy drive to start the program up every day.

Illicit copying of software is a worrying trend, and I have no doubt that the arrival of the Amstrad buyer has increased it. But making protected software is not the answer, and it really is time Lotus woke up. Soon, it will be too late.

Bypassing passwords

My Mercury phone arrived at home a couple of weeks ago, so I can now make cheaper long-distance calls by going through the Mercury network.

Actually, you don't need a special phone to use Mercury — it's just that you have to tap in your 10-digit password before each call and the Mercury phone lets you program this into a memory to save your finger wearing down.

As anyone who sells you some Prestel software for your PC will tell you, it's not a good idea to program passwords into phones because someone will find a way to get them out. With Mercury, if someone found your access code they could type it in from their home and you'd find yourself being billed for all their calls.

So, I called Mercury's customer assistance number (0800 424 193 — 24 hours a day) and suggested that perhaps their phone manuals should recommend you don't program the full password into your phone, but type it in by hand.

They assured me that the phones being supplied were totally secure and there was absolutely no way that anyone without an oscilloscope and a soldering iron could possibly get the information out.

I called them back a few minutes later, with some bad news. Their security department appeared to have overlooked one important point. I explained to them how, given one minute alone in a room with a Mercury phone and with no tools whatsoever, I could find out the secret number.

The next day I was told that the particular phone in question, the M203, was no longer available. I was also told that the other phones in the Mercury range would not have the fault I described. As for those people who already had M203 phones, these, said the spokesman, were mainly Mercury staff and there were no plans to replace them with safer models (the phones, not the people).

The following week, *PCW*'s editor Derek Cohen received his Mercury phone. It was an M203.

Robert Schifreen

Art, but at a price

Adobe, inventor of the Postscript page description language at the heart of Apple's desktop publishing system, has burst itself upon the Macintosh software scene with a Postscript-based draw package called Illustrator.

On the surface, the program seems very simple and very slick. Like MacDraw, Cricket Draw and other object-orientated graphics packages, Illustrator provides you with some pretty sophisticated tools for creating images out of circles, lines, boxes and textures.

One of the applications built into Illustrator allows the user to trace over a bit image, such as that produced by a scanner, and turn it from a page of dots and fuzziness into line art.

At the launch, two problems became quickly apparent.

Firstly, whatever tools you use and whatever your starting image, everything ends up looking like a Roy Lichtenstein pop-art drawing.

Secondly, some of the tools are fiendishly difficult to use. The most sophisticated — Bezier curves — allows you to define a curve in terms of a number of points. Deciding where those points should be to define part of the outline of an apple, for example, could take a long time. The demo disk shows how quickly you can draw the correct curve, but then it's obvious that the operator already knew the answers.

At £450 Adobe Illustrator is not cheap, and the fearsome copy protection which distributor McQueens has insisted on retaining (there's not even a hard disk install) may put even more people off.

But the demo disk animation and graphics are fascinating, and the digitised rendition of Mozart is certainly worth a listen.

McQueens is on (0896) 4866.

Derek Cohen

While my colleagues were getting excited about the PCs Limited machine (the Dell 286[12], Benchtest, page 112) which is an AT clone runnning at 12MHz (fast), I was desperately trying to get my fingers around an AMT (Applied Microsystems Technology) equivalent.

Phone connections baulked it. Well . . . another time, perhaps. But in the meantime, here is the 12MHz AMT 286xii, at £2500 for a 40Mbyte hard disk system. 'Ideal for Unix,' AMT says.

AMT reckons it will soon have 'the cheapest 80386-based model in the UK,' and the company will talk to interested parties who call (01) 450 3222.

Nothing to be proud of

Tramiel himself summed up a perfectly acceptable attitude to the Atari PC compatibles: 'I'm not proud of those machines.'

The machines are one step forward from the Amstrad PC, and one step back.

The step forward is in having built-in high-resolution Enhanced Graphics Adaptor (EGA) output. The step backwards is in using the old 8-bit chip, the 8088, which is noticeably slower in everyday use than the 8086 in the Amstrad.

There was also another step backwards, in providing a non-expandable box, but Atari corrected that by showing an expandable PC

IF YOU WORK WITH COMPUTERS, YOU'LL BE AWARE OF RAPID ADVANCES IN GRAPHICS SOFTWARE. YOU'LL ALSO KNOW OF THE CONSEQUENCES. NEW STANDARDS NEED NEW HARDWARE TO BENEFIT FROM THEM. AND NEW HARDWARE IS OFTEN UNABLE TO SUPPORT THE OLD STANDARDS. WHICH MEANS THAT THE MONITOR YOU BUY TODAY MAY BE UNABLE TO RUN THE SOFTWARE YOU USED YESTERDAY. WORSE STILL, IT MAY BE INCAPABLE OF ADAPTING TO THE GRAPHICS STANDARDS OF TOMORROW. IT'S A PROBLEM. BUT NOW THERE'S A SIMPLE SOLUTION. TAXAN'S NEW MULTIVISION

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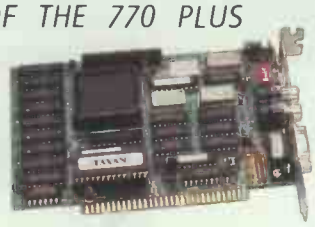

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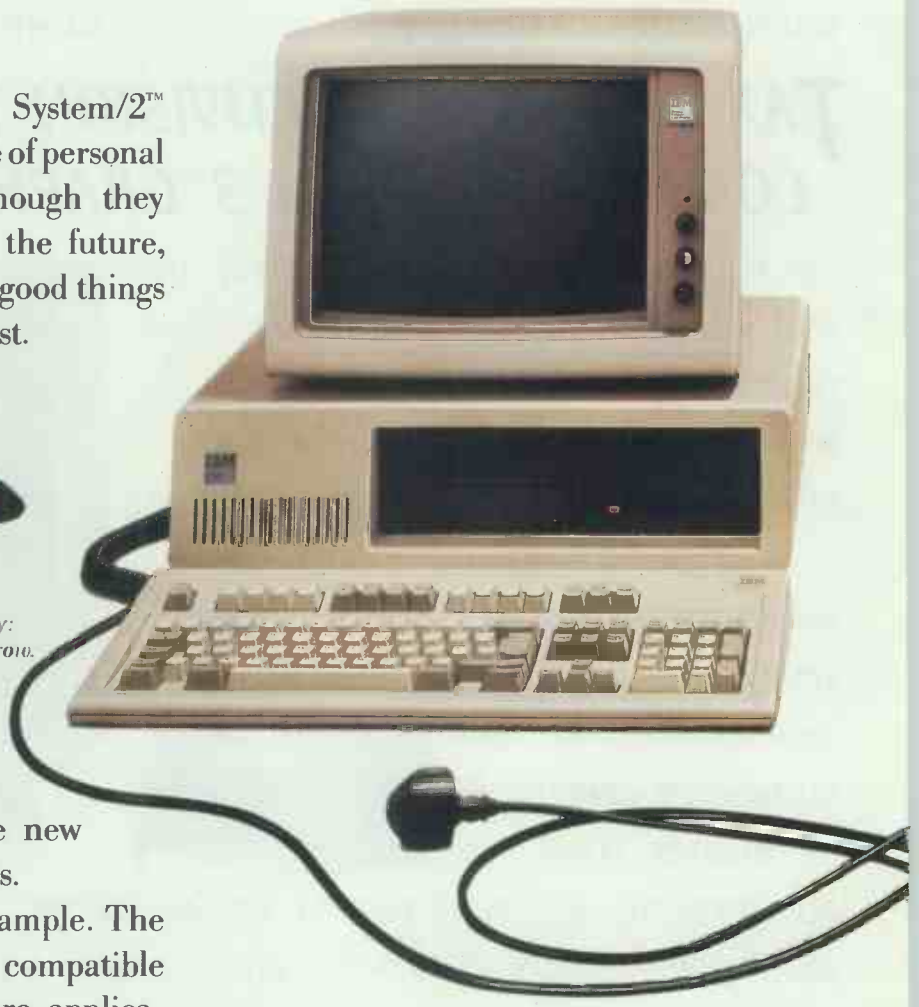

5.25 inch floppies, while a third lets you transfer data directly from the existing family to the new.

So if you're already using IBM PCs your investment is protected.

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Model 80-111

with expansion slots. There was a story to that too, but in the end I had to agree with Tramiel. Nothing to be proud of.

Asked whether these machines will sell well, I have to shrug my shoulders and say 'we'll see.' They're cheap enough, and if the market for PC clones is as big as people think it is, they should get their share. But I really do wonder just how many people in this country are equipped to learn MS-DOS, or GEM, and I suspect that the number is lower than many pundits imagine.

Is anyone listening?

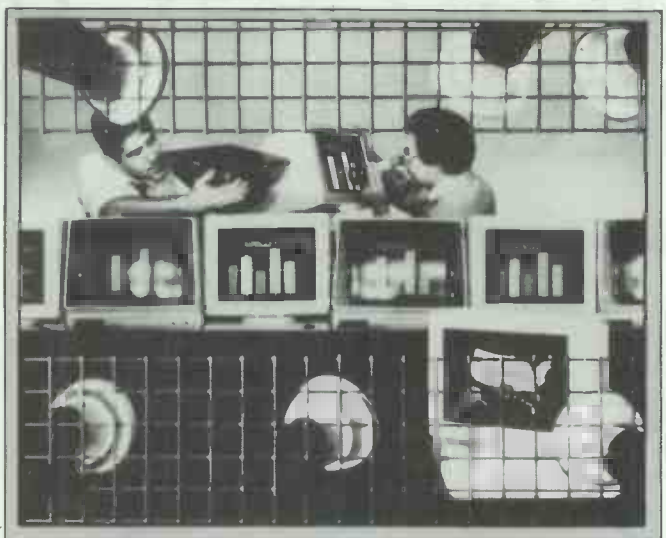
First the good news: Prestel has fixed the bug which caused some interruption in messaging and chatline services.

Now the bad news: in doing so they uncovered a worse bug which meant that messages took two hours or more to get through.

Now the news of questionnable value: Prestel has found the second bug and claims to have fixed it.

The problems experienced by Micronet members chatting to each other late at night were of a particularly infuriating nature. The chatlines would seem to work, with other people's messages appearing one after the other. But when someone logged on to an afflicted computer centre sent a message, it never appeared.

'I'm here. Can anyone read this' they would type in furiously. And the other people online would chat away merrily to each other, oblivious of their poor time-warped comrade who could see what was going on but not join in.



Flatter than any colour TV yet seen, this new display from Zenith is totally flat, has amazingly high resolution, and is compatible (says the company) with the new video VGA standard for IBM's System /2 micros.

Can you get it? No! It will start being available some time soon through Zenith's own computer outlets, on Zenith systems, and the company wouldn't even quote a price at press time.

But it has to be seen to be believed, and Zenith assures me that when it is readily available, the price will be 'very similar' to IBM's new display prices.

Steal one if you can't buy it. They're amazing.

Then, amazingly, about two hours later the message would appear like a signal from outer space. One chatliner even adopted the handle 'Tim E Warp'.

Prestel claims to have solved the problem, but it's too early to say whether it has succeeded. It may have tweaked the software only to unleash an even more fearsome pest.

The next couple of months should, however, see major changes in the hardware side of Prestel. At present the Information Retrieval Centres (IRC) are only loosely linked to each other, but a proper X25 network is being installed which will pass callers on from one IRC to another if there are overloads on one particular unit.

Once installed, this system will also provide all users with higher-speed error-corrected modems to dial into and centralised accounting, which eliminate the need to maintain passwords on each IRC individually.

And as for the poor messaging service, which at present handles 700,000 messages a month (mainly in the evening and week-end off-peak periods), they've given up trying to patch the software.

A completely new system, with extra facilities like message forwarding, distribution lists, a scratchpad area and multi-frame messages, is promised for the first quarter of next year.

With a bit of luck, it won't come with its own set of time-warp features.

Derek Cohen

1987 Business Survival Guide

In a review of Samna Word IV in the *1987 Personal Computer World Business Survival Guide*, it was suggested, in relation to the product, that it might be difficult to obtain good support and training.

Since the article was published, it has been drawn to our attention that these comments were based on information that was somewhat out of date. We are advised by the distributors, Samna International Ltd, that the company now provides a highly responsive telephone support service and comprehensive customer training.

Samna IV costs £550 and is distributed and supported in the UK by Samna International Ltd of Southbank House, Black Prince Road, London SE1 7SJ. Tel: (01) 587 1121.

From the cutting room floor

The story in last month's Newsprint about tone-dial access on British Telecom phones referred to a list of exchange types that offered that facility. We've just found the list on the floor (instead of in the story where it should have been).

The following exchange types offer tone dialling: System X, AXE10 (also known as System Y) and UXD5. Also, some but not all TXE4 exchanges accept tone dialling. Your local BT sales office should know what exchange type you are on.

In any case, recent rumours suggest that BT hopes to have everyone's telephones capable of tone dialling within three years.

The mystery of page 261

Apologies if you looked eagerly last month for page 261 to see how you could influence nominations in this year's British Micro Awards being presented at the PCW Show in September. I'm assured that the ad *is* in this issue but as I file this copy, its exact location hasn't been decided.

PCW: editorial assistant wanted

Do you fancy being the *PCW* editorial office SideKick? Our editorial assistant, Debbie Wallace, is moving on to more creative pastures in the VNU studio, and we're looking for someone to be the glue that holds the office together.

You will need some keyboard and numeracy skills, and have an interest in both computers and magazine production.

To be blunt, much of the time you'll be opening the post, answering the phone and doing the numerous jobs that keep *PCW* in touch with its readers and the rest of VNU.

But there will be an opportunity to help look after some of the regular sections of the magazine like Transaction File and Program File, and you can learn useful skills like proof-reading.

Interested? Send some details about your education, work experience and any computer activity to: Derek Cohen, editor, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

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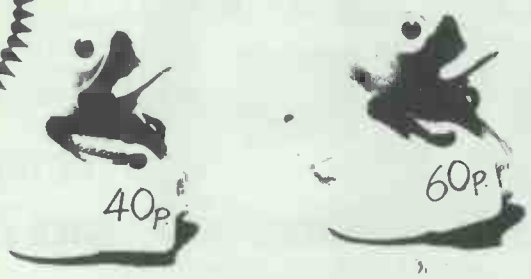

Spot The Difference

If you were looking to buy a rubber duck, which would you choose?
Offered two items, identical in all but price you would naturally choose the cheaper.
Unfortunately, Kudos doesn't sell rubber ducks. We do however stock a large range of top quality peripherals and IBM AT compatibles at prices which will make choosing easy.
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THE WEST COAST CONNECTION

Rumour is rife in the corridors of Apple that the production of a portable Macintosh is now in the hands of researchers. Tim Bajarin reports on the latest happenings in the American computer industry.

A portable Macintosh in the lap of research

For a long time now, Apple Computer has been watching the development of the laptop market and looking into making a version of the Mac that would be portable.

Apple officials to date have said that the technology is not available to make a portable Mac, but company insiders say that Apple is stepping up its research in this area and it could have a portable Mac in the marketplace by March 1988.

According to these sources, Apple has been talking with Epson about its new flat-panel screen: a full 80x25 lines, high-resolution screen that resembles a gas plasma display.

Apple is also reportedly talking with Datavue and looking at making its Keystyle 80 keyboard a part of this new Mac.

Apple is very aware that companies like Dyna, Colby and Intellitect are hotly pursuing the 'portable Mac' concept, and may well have machines on the market by the end of 1987.

The key here will be Apple's continued agreement to license the ROMS to outside developers as they have with Dyna.

If Apple wanted the portable Mac idea for itself, it would just have to discontinue letting these ROMS go to other developers.

But these Apple sources believe Apple will continue to license these ROMS to a select group of developers, while stepping up its own launch plans.

Because of Apple's manufacturing capability, the company could easily underprice all of the competition, and in fact control the entire portable Mac market. Although there are people who would kill for a portable Mac, the real issue in the long run will be price. Apple would have to sell this product at around the $3495 mark, and have a pricing parity with products like the Toshiba T3100.

The laptop market is very large, and no doubt Apple will eventually play a large part in it.

● In other laptop-related news: Hewlett-Packard will soon release a new 80286-based laptop. It is reportedly equipped with a new colour LCD screen that has been getting rave reviews when shown to beta test sites.

Also, IBM is reportedly working on its own 80286-based laptop. It is supposed to come out as the Personal System/2 Model 15, and be introduced by the Autumn.

Also, look for Compaq to bring out an 80286 laptop by the end of the year that looks much like the Toshiba T3100.

A dynasty in the making?

It's been over two years since Jack Tramiel, original founder of Commodore, had a major run-in with Irving Gould, then, and still, chairman of the board of Commodore.

As the story goes, Mr Tramiel wanted to get his boys more involved in the company and asked that they be given executive positions.

At the same time, Mr Tramiel felt that he had strong board support to accomplish this, and began lobbying to move others out and replace them with his own kin.

As you can imagine, Mr Gould felt that Tramiel was overstepping his bounds, and since he had more board cronies than Tramiel, he was able to fire Tramiel and force him out of the company. There has been very bad blood between these two ever since, and various suits and countersuits have been filed against each other since Tramiel left.

Although the most interesting suit, dealing with Atari's claims of ownership of the original Amiga chips, has been settled, there is still no love between these two companies.

In the meantime, Tramiel had started his own company, and then eventually folded this venture into Atari when it was offered to him.

Mr Tramiel's success at Atari is amazing. In just over two years, he has paid off the Warner debt, the firm from whom he bought the company, and has made the company profitable.

His ST computer has been very successful, and his game computers are adding daily to the company's profits. He has taken the company public and raised an additional $30 million in capital for expansion, and no-one in the financial community is willing to bet against this durable man and his company.

On the other hand, Commodore Computer has a debt of over $100 million still outstanding with the banks, and although the company has been barely profitable for the last two quarters, its position is very shaky.

The key figure in the Commodore success formula had been Thomas Rattigan. This former Pepsico executive had taken the company and given it solid strategic planning and product stability. The banks liked him as well; unlike Irving Gould, known as a hard-nosed businessman who can only be in his New York offices two days a week due to his US resident status. The banks are less favourable to him, and preferred the style and stature of Rattigan to Gould.

An Atari family affair: Jack Tramiel and sons

But, two months ago, Gould also felt threatened by Rattigan's continual rise in company power, and got the board to fire him. Although some new senior management has been brought in, this firing will cause Commodore to lose valuable time in its attempt to keep the company alive.

Commodore's Amiga is technically a sound product, but its price and position has made it a failure to date.

While Atari has over 900 software packages for its ST, Commodore has less than half of that available for the Amiga. Add to that Commodore's attempt at the low-end PC market with models that sell well in Europe, but have been a disaster in the US market.

Although the new version of its model 128 has picked up some market steam, the recent US price cut by Atari now means the entry-level version of its model 520 ST, without a monitor, will sell

THE WEST COAST CONNECTION

for $199 (if a disk drive is bought at the same time), allowing it to go head to head with the 128. If the two machines were compared, users would no doubt opt for the ST over the 128.

A few months back, Silicon Valley rumours had it that Jack Tramiel was convinced that Commodore was about to go under, and was interested in bailing Commodore out by offering to merge the two companies into one.

Although this may be more fiction than fact, this possible new pricing by Atari, which pits the ST against Commodore's bread and butter product, the Model 128, could be the straw that breaks the camel's back. While Atari could gain important market share with this tactical move, Commodore could be left holding the bag (and its inventory).

Regardless of whether Tramiel tries to go after Commodore or not, many feel that Commodore's only salvation will be to sell out to someone who could offer the banks a solid guarantee, and give the company some capital to remain a serious player.

Since this is just mid-year and the squeeze is not quite here yet, Commodore has a chance to prove its worth and viability but it is at its most vulnerable point. It would not be too surprising to see some corporate raiders make a charge for this battered company.

The game's on

In 1985, when the market for home computers began to dry up, so did the market for computer game machines. The pundits at that time declared those two markets dead, never to rise again.

Well, it looks like the pundits were wrong again.

The hottest market in the States today, besides business computers, is that of dedicated game machines. Companies like Nintendo and Sega are selling their computer game machines for $125 a pop — and they are selling like hot cakes.

At the same time, game cartridges for these machines, selling at $25 to $35 a piece, are also hot items, and both companies are bringing out at least three new titles a month.

This market has been one of Atari's staples over the last three years, and has kept the company afloat.

Why this resurgence?

When the home computer market began to falter, the serious players like Texas Instruments, Fairchild, Atari and Commodore began shifting gear and moved away from these game machines. TI and Fairchild got out completely, while Commodore and Atari went after the more powerful markets with the Amiga and the ST. But, although a PC approach to this game market also gives the user more versatility, the bottom line is that games are more for kids than adults.

So, while parents would buy PCs for their personal use, they would find that they would have to share it with their kids — who in many cases dominated the PC usage time.

In Silicon Valley, where some 20 per cent of homes have personal computers, a survey has shown that kids are very rough on the keyboards and mice and, since the average PC costs around $1500, many parents have started buying the kids their own game machines.

At last year's Consumer Electronics Show, there were only 11 manufacturers of home- or game-type products. By comparison, this year's show, held May 30–June 2, had over 40 related vendors. As prices of these game machines come down, watch out for this market to take off.

Michael Dell's star rises to the mail-order challenge

One of America's fastest-rising business stars is Michael Dell of PC's Limited. This 22-year-old entrepreneur started to buy parts for PCs and assemble them in his college dorm, and then go and peddle them to local businesses.

He would literally take orders from his customers for the type of PCs they wanted, then call an order into a parts supplier in Dallas, fly up to Dallas, get a car and trailer, bring them back to Austin, Texas and assemble them. And he was soon making between $30,000–$40,000 a month.

Dell felt that the way to go would be to develop a mail-order business, and, as a result, PC's Limited has gone from an enterprise with $500,000 yearly revenues to over $70 million in just three years. He has brought in senior managers to assist him and has recently cut a contract with Honeywell/Bull to service his machines nationwide: he will provide buyers of PC's Limited's products with a full one-year warranty on the machines.

Success story — Michael Dell, boss of PC's Limited

If you compare PC's Limited's revenues to IBM's, Apple's or even Compaq's, the company would still be considered a small player. But, as friends of Dell's point out, don't sell him or his company short. He is a hard-working, bright businessman, and although very young, he has the makings of being a real business tycoon.

He is about to launch a PC's Limited sales effort in the UK selling under the Dell Computers name, and is looking closely at the German market as well.

PC's Limited is an up-and-coming computer manufacturer. It is a company that will show the big guys that the market is 'very big' and there is still room for smart players to make it 'big' in their own way.

Apple design

If you are one of the 2.5 million owners of Apple II computers, you may be feeling excluded from the desktop publishing revolution as there is little DTP software for the Apple II. This situation is about to change.

Data Transforms is due to release shortly its Printrix 1.0, giving Apple users desktop-publishing-quality print and page design. Priced at $65, it is a real bargain for Apple II users.

The Apple version runs under ProDos on the IIe, IIc, and IIGS, and supports more than 100 printers and 40 printer interface cards.

Features include direct printing of text files from AppleWorks, Apple Writer and Word Juggler and merging graphics into text stream.

Graphic files accepted include Fontrix Graphfiles, single-high-res-screen graphics, and Print Shop-style, four-sector clip art.

The basic Printrix package comes with 30 fonts and companion Fontpak disks can be purchased separately.

Two other companies, Springboard and Broderbund, will also have DTP software out for the Apple II by the end of the year.

Data Transforms is on (303) 832 1501.

Prodigious Mac

Serious Mac observers have felt for some time that the Prodigy Board had the potential of some day becoming really big.

The Mac system is very conducive to growth, and here in the US a company called Levo (on 619 457 2011) is looking at helping the new Mac SE grow up very fast. It recently unveiled Prodigy SE, a performance enhancement for the Mac SE which plugs into the SE-bus slot (internal expansion bus) and transforms the computer into a minicomputer-class workstation. This makes the SE capable of running Mac applications 100 times faster.

The board features a 16MHz, 32-bit Motorola 68020, 1Mbyte of RAM and a built-in, non-volatile RAM disk. The SE board provides an expansion bus for connecting additional internal devices. Expansion capabilities include up to 8Mbytes of RAM, a Motorola 68881 and paged memory management with a Motorola 68851. The basic board is priced at around $2000.

With this type of performance added to the Mac's already impressive capabilities, it is easy to see how the Mac could eventually get a much stronger foothold in the corporate world and engineering market-place. END

A PCW without Protext is like a car with one gear.

Cars are useful. You sit down, drive away and — eventually — arrive at your destination. But some people comfortably speed along, while others don't.

The PCW is useful, too. You sit down, type away and — hopefully — produce a neat, accurate document. But some people crawl along using inferior software — while others use Protext.

Protext releases the power of your PCW. It is faster, easier and more flexible than any of its rivals.

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One good idea leads to another.

The Macintosh Plus

The Macintosh SE

And another.

The Macintosh II

In 1984, Apple introduced the Macintosh.™ A computer based on the idea that people shouldn't have to work the way computers work. Computers should work the way people work.

In 1986, the introduction of the Macintosh Plus established Macintosh as the new standard in personal computing.

Which of course led to yet another great idea.

The Macintosh SE. The next step in the Macintosh evolution.

The Macintosh SE combines the same intuitive graphic interface of the Macintosh Plus with many of the technological enhancements corporate customers have been asking for.

Like a second 800K internal drive.

Or a built-in 20 megabyte hard disk with a single 800K internal drive.

The Macintosh SE comes with a full megabyte of internal memory that can be expanded to four megabytes.

There's an expansion slot to customise the Macintosh SE to your specific needs.

So you can add a card for a disk drive that lets you work with documents created on an IBM or IBM compatible PC. Or a card that enables your Macintosh SE to communicate through non-Apple networks to host mainframes.

Of course, the Macintosh SE runs all your Macintosh programs. Only faster. And, because it's a Macintosh, you'll never have to become a computer expert to use it.

In addition to the Macintosh SE, Apple proudly introduces the Macintosh II.

A computer so powerful and so flexible it challenges the very definition of what a personal computer can be. And do.

Inside the Macintosh II resides a new microprocessor. The Motorola 68020.

Which takes you through virtually every Macintosh program at four times the speed of a Macintosh Plus.

The Macintosh II also boasts a new coprocessor which enables it to perform mathematical calculations at two hundred times the speed of the Macintosh Plus.

But the biggest news is the Macintosh II's open architecture, with six expansion slots that allow you to customise your Macintosh to serve virtually any function you can imagine.

Internally, the Macintosh II offers you more memory options than a politician. From one to eight megabytes.

And although our internal forty megabyte hard drive is probably sufficent storage for most users, you can employ an internal drive of up to eighty megabytes.

The Macintosh II offers you a choice of viewpoints. A thirteen inch colour monitor or a twelve inch black and white.

Today, the Macintosh II will satisfy the needs of the most power hungry business user, scientist or engineer.

Tomorrow, it will also lead the way into startling new technologies. After all, one good idea inevitably leads to another.

Please send me more information about the new Macintosh range. Post to: Apple Computer (UK) Ltd., FREEPOST, Information Centre, Eastman Way, Hemel Hempstead, Herts. HP2 4BR or dial 100 and ask for Freefone Apple.

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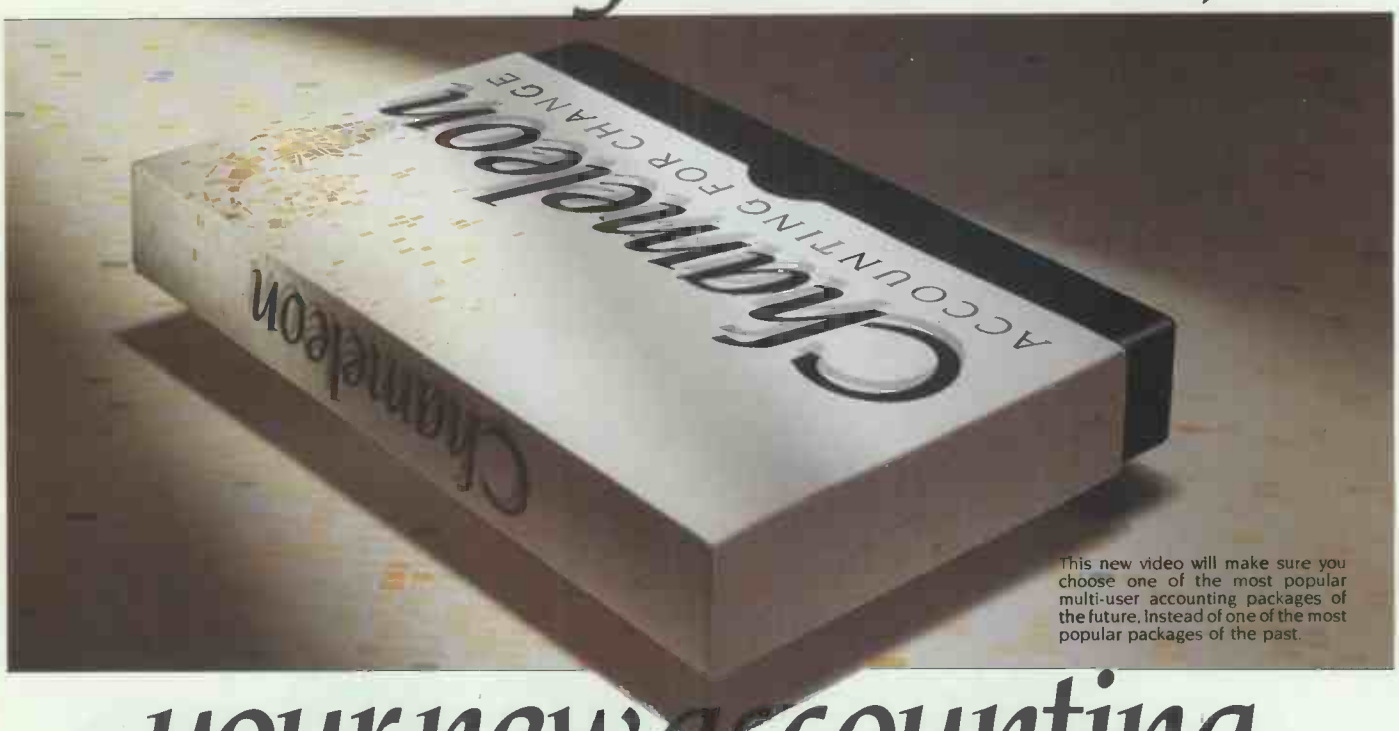

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your new accounting package may turn out to be obsolete.

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Instead of ploughing step-by-step through numerous menus, with *Chameleon* you can skip instantly from one accounting module to the next.

Or rapidly refer back to one ledger while you're working on another. Improving efficiency and productivity every moment of the working day.

Working in a constantly changing environment

You can change descriptions instantly. Easily reformat reports. Create your own menus. Control workstation security and priority.

Or work in different currencies, or allow European colleagues to work in their own language, as you work in your language. And much, much more as you'll discover, when you see *Chameleon* in action on our video.

Don't change your software until you see how software's changed

Chameleon is the first accounting software that can adapt to the way you want to work now, an hour from now, and years from now.

And it's been developed by Tetra Business Systems. The company that's already created one industry standard business accounting product, Tetraplan.

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Post today to find out how accounting software's changing with *Chameleon*

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ACCOUNTING FOR CHANGE

LETTERS

This is the chance to air your views — send your letters or contact us on Telecom Gold 83:VNU200 or PCW Online: PCW 009. The address to write to is: Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Time difference

I refer to your article on the use of the real-time clock in the IBM PC ('Clock this!', *PCW* April). Throughout this article reference was made to the Hitachi 146818.

I would like to point out that Motorola designed and brought to market the MC146818 real-time clock. Hitachi was given the rights to second source this part from us. Although Hitachi may well have some penetration with IBM for the RTC, Motorola is the main supplier, with real-time clocks currently running in the three biggest-selling IBM PCs.

I would be interested to know what prompted your article to be biased towards the Hitachi chip and not that of Motorola. Did you in fact dismantle an IBM PC and find the HD146818 contained inside?

It may be of interest to you to know that the new PCs which IBM manufacture, are using an upgraded version of the original RTC, the MC146818A. Very briefly, the differences in the two parts are the result of changes made to the onboard MOTEL and chip Enable circuitry. These changes improve the bus timing characteristics, ease interfacing to the microprocessor bus and simplify the battery back-up circuitry design.

Mary Gallacher, product marketing engineer, Motorola Ltd, Glasgow

Robert Schifreen replies: I originally discovered clock chips in an Epson PC AX that I was using. I spoke to Epson, who told me that it was a Hitachi chip, and I then contacted Hitachi for a datasheet and full specifications. Because other ATs in the office worked according to Hitachi's specification, I assumed that all the machines used the Hitachi chip. As far as I am aware, no-one had actually published an article about the AT clock chips before, and my only source of information was Epson and the Hitachi data. Had Hitachi told me that the chip was not really its, I would have passed on the information.

The same old story

When will we ever learn. Every single product Sir Clive Sinclair has introduced has suffered from the same essential problems.

His electronic products start from a bright concept and a snazzy black mock-up into which the technicalities have to be fitted. But the technology is never quite suited to its purpose because it is too cheap.

From Sinclair we are expecting a £230 machine with no external storage, no power unit and no modem. Yet Tandy currently sells a laptop with a built-in modem for £299 which is so reliable that it is trusted by the world's press for constant use.

The Tandy may have limited memory at present, but with the drop in the cost and bulk of memory, I think Tandy is overdue to include extra memory in the price.

Sir Clive says his keyboard will be silent, but if the Tandy's subdued clatter is too much for you, placing the machine on your lap reduces the noise considerably.

Once again Sir Clive is offering us a dream machine by mail-order, six months in advance or more. This means you can't handle it first, and that servicing will also be by mail.

In the meantime, serious computer dealers will have their business disrupted and the long-overdue appreciation of portable computing in the UK will be put back further.

Diane Bailey, London NW3

Ins and outs

The *PCW* 'April Fool 1987' award should be given to Simon Goodwin's Computer Answers column ('Pet ports', April). Why? If you read his answer to James McNab's question about the Pet port you will find out.

Mr Goodwin seems very distressed that '1' means output and '0' means input on a user port (mainly because he finds it difficult to remember). Perhaps, Mr Goodwin, you should have found out *why* 'most micro firms' use this 'silly convention'. In fact, far from trying to 'make things as confusing as possible', using zero for input is a safeguard against momentary power failures, faults, rests, and so on, which usually 'zeroise' memory locations. Random output is far more dangerous than random input — see *Assembly language programming for the BBC microcomputer* by Ian Birnbaum.

Still, this is a very minor point in what is certainly the best magazine 'hardware help' page.

Graham Hill (age 16), Midlothian

Amstrad's black-out

In December 1986 I bought an Amstrad PC1512, twin-floppy monochrome monitor version, but within a couple of weeks I noticed that it had a tendency to cut out after about two hours. Dixons, from whom I bought it, promptly exchanged the whole machine but the second model had the same fault. I then phoned Amstrad (no easy task) whereupon I was told: 'Oh, you need a capacitor upgrade.' I was lead to believe that a batch of monochrome monitors had gone out with the wrong-size capacitor on the power supply, hence the cut-out. This was mid-January. Dixons had just heard about this problem and exchanged the monitor.

After a couple of months I realised that my third monitor was really no better, although it would go for about four hours before dying. A further check with Dixons, who by now really knew what was what with this fault, revealed that I had *not* been given an upgraded monitor after all! On the 7 April I received my fourth monitor. This *had* been upgraded: the serial number shows that. But, in upgrading it, the screen must have been disturbed for the display was at a slight angle, inclining upwards to the right! A week later I collected monitor number '5'.

Throughout this sorry tale Dixons has been most considerate, but I wonder how many Amstrad users there are who have not run their machines long enough to notice the fault? Amstrad has not generally informed its suppliers. I know of at least one Amstrad supplier in Oxford (a specialist in computers!) who knew nothing of the problem until *I* told them recently. If users do not run their machines long enough they may not discover the fault until their guarantee runs out. Don't you think Amstrad should be prompted to inform its suppliers, if not its customers? Can you prompt the company?

For the record, the duff monitors are identified by having either a 7, 8 or 9 as the fifth digit of the serial number. Perhaps at least you could publish this information, but in the interest of all those who have bought the model I have, I think Amstrad should be moved to make a general announcement.

Michael Luntley, University College, Oxford

LETTERS

Confusion about PC-SIG

I was quite worried by the first ISD advertisements, as I confused PC-SIG with PD SIG and thought that my favourite library had gone mad! PD SIG carries most public domain software and gives a very prompt and efficient service at £1.50 a disk (if 10 or more disks are ordered — disks are £1.50 each if you need them). PC-SIG (Seltec) charges £13.80 for a single disk without the option of supplying your own.

This is certainly a rip-off, and possibly illegal; PD software is often copyright, with strong caveats against illegal profit making. The CPMUGUK library charges much the same as PD SIG, and I believe other libraries also charge about £2, setting a clear baseline. As Seltec advertises that no guarantee or personal support is given with the programs, it is hard to see how it can justify a factor ten increase in price.

I don't understand why Seltec thinks its service is legal; or why it believes the other libraries are somehow illegal. Could Seltec/ISD explain?

CW Rose, Woodbridge, Suffolk

Your letter reproduces many of the current confusions about the PC-SIG library. ISD is the distributor of PC-SIG library disks. PC-SIG holds copyright on the cataloguing, not the programs, which may be public domain or shareware. As you will read in 'Newsprint' in this issue, PC-SIG is concerned about prices and copyright of its libraries, and is making moves to reduce the cost of its disks. To be fair to Seltec, which is not the same as ISD, whatever it may be charging £12 for, at least it doesn't claim to be distributing the PC-SIG library.

Number pleas

One thing that really annoys me about your otherwise thoroughly enjoyable and informative magazine, is the lack of consistent page numbering.

It is most frustrating to be searching for a particular article or advertisement only to find yourself amidst a series of unnumbered pages. I have in fact counted as many as fifty consecutive unnumbered pages.

Please, please, please can we have more page numbers.

David E March, self-appointed chairman of Frustrated Page Thumbers Inc, Harlow, Essex

We have a whole drawerful of page numbers here in the office, which have fallen off or failed to appear on pages. Volunteers welcome to restore them to their rightful homes.

London's burning

Further to Guy Kewney's piece on computer pollution (Newsprint, *PCW* May) I *do* know where some PCBs get burned — in the backyard of a firm which operates in Biggin Hill (London SE19: it's a street name not the Kent village).

The place is more or less opposite the houses numbered in the 70s and has wire-mesh gates. The firm has huge bonfires at the back, usually late at night, and employees have frequently locked the gates and gone off home leaving them burning. The smell is awful, and complaints to the authorities need backing up by council officials being present (which, late at night, is virtually impossible). The smoke is acrid and thick and causes a great deal of local malcontent.

Peter Skuse, London SW6

Acorn accuracy

I am sorry that such a normally well-informed commentator as Guy Kewney should have written such an inaccurate piece as he has done in the March issue of *PCW*, under the title of 'The Italian job'.

The inaccuracies start in the first paragraph. Olivetti invested in the company in 1985. Since then Acorn has needed funds from no other source, let alone Olivetti, and has been trading profitably for some time. Indeed, Olivetti is currently showing a capital gain in excess of 100 per cent on its investment.

Far from provoking groans from BBC Micro owners, the interfacing capabilities that the machine provides are seen as positive benefits since they cost extra on other machines, if indeed they are available. Third parties keep on making ever more ingenious peripherals, and they wouldn't do so if people didn't buy them. Data capture, alternative I/O devices, sound, and so on, are all taken for granted by the several hundred thousand owners and significantly more users of these machines.

The Master is an extremely reliable machine, with a mean failure rate that puts it among the leaders, particularly when the usage demands of a school are considered. This fact can be confirmed by the independent quality auditors engaged by the BBC. The Master series was never seen as a stop-gap by Acorn; and, in fact, since its launch early last year, has been extremely profitable — so much so that it has enabled us to devote extra resources to our RISC-development activity. The notion that the machine has cost Acorn money obviously didn't come from our accounts department.

Whispers from echoes in boardrooms are never as reliable as being in the boardroom itself. Olivetti has no desire to close Acorn down. What it has said is that it would be quite content to see its shareholding reduced at some point in the future if it became appropriate for Acorn to raise more equity.

I am glad to see that Guy doesn't fall for the 'we should adopt the world standard of MS-DOS' argument. We all recognise that MS-DOS is a commercial standard, which is why we have a low-cost DOS add-on. But the fact is that education has more sophisticated requirements than can be catered for by MS-DOS.

As operating systems become increasingly transparent to the user, users will only have to learn about new applications. The reason for this is that machines such as our RISC-based computer will offer the kind of power that will enable applications to be written in high-level languages, without undue concern for the operating system of the target machine.

Michael Page, corporate communications manager, Acorn Computers Ltd, Cambridge

Yes? No.

Remember that computer (the Philips:Yes) that was heavily advertised, reviewed in the computer press, was far too expensive and was never seen in a shop? Well, I know a bit about it.

In December 1986 I met someone who had been working in Austria on the MS-DOS handbook for the Yes, a good year after the ads had suggested that the machine was in the shops.

The Yes is being offered for sale to Philips' Dutch personnel. (If you remember, something with no memory, no screen and half a disk drive cost an arm and leg.) Translating a bit of paper here, it says:

'The remaining stocks of the Philips Personal Computer:Yes, which is now out of production, are to be sold. Members of (nonamesnopackdrill) have the chance to buy this very advanced system including monitor and very attractive extras for an especially low price.'

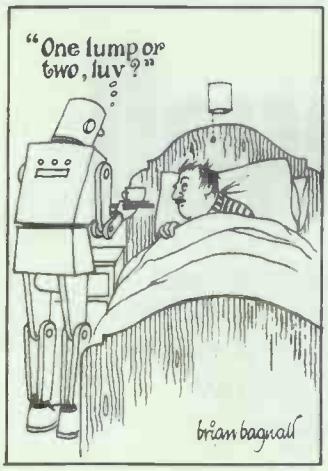
Philips employees get: 640k RAM, 2 × 720k 3½in disk drives, MS-DOS 3.1, DOS Plus 1.1, Pascal MT+, RM Cobol compiler, MS-Basic, GW-Basic, DR Logo, Turbo Pascal, Logistix, Clipper Backup, WordStar (£15 extra), GEM desktop, GEM Draw, GEM Graphics, Open Access, BIS 3270 emulator, Micro SNA 3270 emulator, Acculink, BIS 3780 emulator, Micro SNA 3770 emulator, Yestalk (a Hayes-compatible comms program) and a BM-7502 monitor.

Price? 960 Dutch Guilders including VAT (about £300).

Pity it was never sold to the public at that price.

Name and address supplied. (PS Now to go talk to the man who sold me this roll of non-heat-sensitive heat-sensitive paper.)

More tea, David?



No article about flowcharts, expert systems or project development is complete without the mandatory example of tea- or coffee-making, and David Tebbutt's review of Pertmaster's In Control! in the May issue of *PCW* is no exception.

My complaint is not about Mr Tebbutt's logic but about his tea-making. He may have used the finest software. His use of resources may veritably have been optimised. Doubtless he will have met the timescale and cost constraints of the project. But he will have failed to meet its quality constraints, for the result will be undrinkable!

One of the most important requirements of tea-making is that the water should be actually boiling at the moment of impact. How can this be achieved if the milk is put into the cup (already containing the tea bag) before the boiling water is poured on? As soon as the boiling water hits the milk it will cease to be boiling, and it will be merely hot water that strikes the milk-sodden tea bag. (Adding the sugar while the kettle is boiling is hardly going to improve matters.)

Making tea in the cup is a misguided practice anyway. And if David Tebbutt's example had featured a teapot, he could have provided your readers with a far more interesting network diagram!

David Lewis, London N3

Driving the point home

Nick Walker, in his review of the Compaq Portable III (*PCW* May), seems rather confused about the problems of compatibility between 360k and 1.2Mbyte disks. He states: 'Even disks that were formatted on the straight PC clone were sometimes unreadable after files had been added by the Compaq.' This is hardly surprising since this is the worst possible thing to do!

The salient difference between the formats is that 1.2Mbyte disks have a track 'pitch' half that of 360k disks. When a high-density drive is used to format or write a 360k disk, the head is stepped two tracks at a time so that only the even-numbered tracks are used. This will produce a 'compatible' disk as long as the gaps between the tracks (corresponding to the odd-numbered tracks of a 1.2Mbyte disk) are not recorded. If any signals are present in these gaps, they will be picked up by the (wider) heads of a 360k drive and interfere with the wanted signal.

To produce a disk which can reliably be read by a 360k drive, you should start with an unrecorded disk (either new or bulk-erased), format it on the high-density drive (in 360k mode) then write the data. In this way you ensure that the gaps between the tracks are free from interfering signals. Subsequent writing to the disk with a 360k drive is, of course, acceptable but you should not write to it with a high-density drive thereafter.

Richard Russell, Gravesend

Thanks for the advice. However, no method is 100 per cent reliable.

If it's a question of style...

I was intrigued by your review of various 'style checkers' in the May issue ('Putting on the style'). While I find word processing and spell-checking to be invaluable aids to written work. I view this latest computerised incursion into the literary domain with some trepidation, and was relieved that your reviewer, Jonathan Green, concurred with me.

The concept of 'style-checking' seems fundamentally flawed. Style is such a complex and personal issue that, to my mind, no computer program can be capable of any but the crudest analysis. The FOG index is OK as far as it goes, but surely the only adequate test of readability is the reaction of a human reader. The computer's total lack of any real comprehension of a written work relegates 'style-checking' to nothing more than clever word-counting: this is not what style is about at all. While the use of one of these programs may improve readability to a certain extent, I believe it will actually inhibit the growth of an author's genuine style. For this reason, unlike your writer, I find the whole idea objectionable.

Furthermore, because people tend to believe that if a computer tells them something, it must be true, these programs could well cause grammatical errors among those not totally confident with their English. Even your reviewer falls into this trap; the piece tested on page 147 contains two instances of a punctuation mark appearing after an inverted comma. This is correct in both cases as only a fragment of a sentence is quoted each time. Only if a whole sentence, or at least a clearly marked clause, is within quotes should the punctuation be placed before the closing quotation mark. The computer, in robotic fashion, marks both of these occurences as 'wrong'; your writer, at least in the first case, appears to agree with it. I can well imagine some inexperienced students I have known reinforcing their poor grasp of English with these programs — religiously 'correcting' their 'errors' *because the computer told them to*. This makes these programs downright dangerous, even in education where the fact that they really operate only on grammar is not necessarily a limitation.

Unless we wish our language to degenerate into nothing but tedious pap with miniscule, one-clause sentences containing nothing but two-syllable words, I believe we should leave these 'style checkers' well alone.

My style checkers are invariably human; I think their opinions are infinitely more perceptive and valuable than any mechanical analysis.

James Fryer, Haringey, London N4

...the human touch is best

Coincidentally, I read your review of style checkers ('Putting on the style', *PCW* May) just as I finished a review of Grammatik for BOOG (the former Osborne Owners' Group). I have been using this program for some three years.

Perhaps Jonathan Green is already an accomplished writer. I found that he has missed the point as, in referring to style checkers, he suggests that they picked up silly or not very useful points. This is because he used the directory with which they came. But the directory of Grammatik (the only one of which I have experience) is capable of being tailored to any use, particularly the needs of the user. Unlike spelling, style is a matter of taste, and if I choose to include particular points such as 'vague adverbs', it is because I am having a blitz in getting rid of 'very's' and 'rather's' which add precisely nothing to my meaning.

He is wrong in that individual error types can be included or omitted at will; and the range of categories, including user-defined types, can be created to suit individual needs. Equally, displaying to the screen and waiting for Return to be pressed on errors, are fully user-definable through the configuration screen — or better still, in the configuration file.

The other error of fact is that, contrary to Mr Green's statement that Grammatik picks up only single words, it *will* pick up phrases in which every word is spelt correctly, but which is otherwise wrong. A simple example would be 'can not' in place of 'cannot', and more complex phrases like 'under the circumstances' can be detected and reported.

PCW is usually excellent in its use of English, but even *you* sometimes include an 'it's' when you mean 'its'. Grammatik would at least alert the author to this common error.

In short, people working on their style, like me, can benefit from these 'style checkers'. The reports, however limited, make us think how we could write more clearly; and, by including good advice from Fowler and elsewhere, keep us improving!

Michael J Davis, Rochdale

(Our production editor is insistent that 'it's' and 'its' are always used correctly in PCW. *Ed)* END

BANKS' STATEMENT

Fond farewell

With the launch of IBM's Personal System/2, and the company's aspirations towards corporate mainframe success, has the company set a new standard for other manufacturers to follow? Martin Banks assesses the situation.

There is certainly one thing you can always say about IBM. Once that company decides to stick its toes in the water, it somehow manages to stir it up so much that no-one can see clearly for months afterwards. It did it once before, you will remember, with the launch of the PC. In April, it did it again with the announcement of the Personal System/2.

It has been interesting to read through all the information IBM handed out on this machine. (At the time of writing, I am still reading. Never let anyone tell you that IBM never says anything about new products. When the information comes, it can be quite an arduous task to wade through it all.) It has also been interesting to read some of the initial responses, especially from the compatible-and-clone makers.

Olivetti, for example, promptly said that it was 'underwhelmed' by the announcements, and felt that there was nothing in the new Model 30, Model 50, Model 60 or Model 80 that Olivetti hadn't already done or couldn't clone quite easily. Compaq expressed similar opinions.

This may well be the case, but I suspect that we will find, when the waters have settled (at a time not totally unrelated to when the machines themselves start to appear) that IBM has actually moved the game somewhere else. It is possible that, despite keeping the PC/XT and AT going as current products, IBM has kissed the old PC market a fond farewell. And with that act, it will have also kissed the compatible-and clone-makers goodbye as well.

The reason, if I am right, is quite simple. Compaq, Olivetti *et al* can clone the new machines as accurately as they like. With MS-OS/2, they will even have a close resemblance to the currently promoted operating system. All that will be as nought, however, for they will not be able to clone one vital factor — the typical IBM customer.

Big Blue has always been after the big, corporate market-place, but over the last few years it has lost its sense of direction. The PC took it down a tangential route. It had sufficient importance to the corporate user, however, to remain a significant product for the company. But it was a digression, nonetheless. IBM also failed to develop a coherent environment across its product range, which meant that users could not grow from a small IBM machine to a bigger one without major changes and upheavals.

This didn't matter when no other computer company offered such an environment, but when Digital Equipment announced the VAX family running the MVS operating system, users suddenly had that option. An examination of Digital's balance sheet, compared to IBM's, shows how popular the idea has proved.

But do you, as a personal computer user, want to know about mainframes and minicomputers? These days perhaps you should, for this is what lies behind the IBM Personal System/2 family. The customers IBM wants to sell to want to buy IBM if they can. Now they *can*, for that is what these machines are all about. They are the new, far-reaching fingertips of a coherent product family with mega-mainframe systems sitting at the top. That is what corporate customers want, and it is what the likes of Compaq and Olivetti cannot provide — even if they *can* clone the hardware. And then, can Microsoft clone the software for them?

This may seem a strange question as Microsoft has been working with IBM to produce OS/2 and will be launching a generic version, MS-OS/2, when the IBM system comes out. This is not necessarily the important point, however, for I suspect that OS/2 may not be the important operating system for IBM.

I have written here before about how Unix could take over from DOS as the next generation operating system, and that perhaps IBM's own version, AIX, could prove interesting. I now think this is about to happen.

AIX is a real bells-and-whistles version of Unix, and is already available on IBM's 6150 RT/PC. It was not made immediately apparent at the PS/2 announcement by IBM, but this operating system is also to be made available on the top-end machine, the Model 80. If, over the years, you have grown to understand the peculiar semaphore of nods, nudges and winks which constitutes real communication with IBM executives, this same operating system will appear on mainframe machines at some time in the future.

There are several things which should be understood about AIX. Firstly, it is available, which is more than can be said about OS/2. Secondly, it offers users more facilities than OS/2. In particular, it is said that the Model 80 variant will allow direct multi-tasking of existing MS-DOS applications. This will be done by running them as DOS 3.3 tasks, with AIX controlling their operation and providing all necessary inter-task communications.

This is what many users want, and is more than is possible with even the extended version of OS/2. It must be remembered that the first version of OS/2 does not have things like the Presentation Manager windowing system and can run only one MS-DOS task at a time, in 'go-faster PC' mode. If users want multi-tasking, then they must change their applications software to the specific OS/2 versions.

The last thing about AIX is that it is IBM's own system. It should take little guessing as to which operating system IBM will favour, long-term.

And if this all happens, the PC market as we know and love it could start to disintegrate as each of the other main players tries to take over the leadership role vacated by IBM. They will all, inevitably, try different ideas to gain market leadership; and will, equally inevitably, divide and dismember the loyalties of their long-suffering end-users. END

Illustration by Ron McTrusty

Atari DTP

The Mega ST range represents the pinnacle of ST design to date with lots of RAM, fast graphics and a mature operating system. And Atari has high hopes for this series in the desktop publishing market. Nick Walker and Owen Linderholm evaluate the Mega ST4 and two contenders for the DTP 'crown'.

The Atari 1040ST was proclaimed a bargain in 1986, offering 1Mbyte of RAM for less than a thousand pounds. One year on and Atari is offering a new range of STs with twice that amount of RAM for the same price. The new Mega ST range is Atari's renewed attempt to establish the ST as a serious small-business computer, one of whose target markets is desktop publishing (DTP). Atari intends to poach potential Apple Macintosh DTP purchasers by offering an equivalent system for considerably less cost. On paper the Atari ST looks good against the Macintosh with a higher-resolution white screen monitor, two or four times more RAM and similar processing power. The success of Atari DTP packages depends on the price of Atari's laserprinter, the quality of the software offered for it and the public acceptance of the Atari name as a purveyor of business hardware.

We were privileged to take an early look at both the Atari laserprinter and the 4Mbyte Atari Mega ST4. To gain an insight into the potential of Atari DTP we also took a look at the two leading packages — Fleet Street Publisher from Mirrorsoft and Publishing Partner from Softlogik.

Hardware

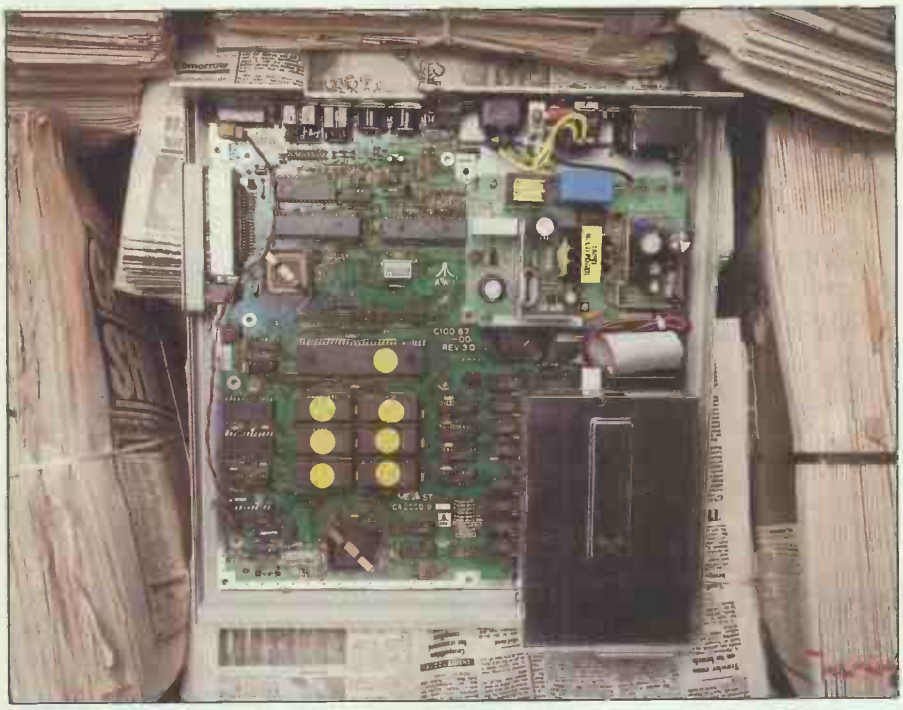
The Mega ST does seem delightfully small, even though the footprint is larger than a 1040. I'm so conditioned to an IBM PC-size box that the Mega ST seems positively minute in comparison. Not having to accommodate IBM PC-type expansion cards means that the Mega ST has a very low profile — being only two and a half inches high. The 'high-tech' slanted function keys, LEDs and light grey colour scheme have been maintained on the Mega which gives it the ST family look. I must admit that when the new Atari 'tilt and swivel' monochrome monitor was mounted on the machine it did look suitably professional.

Like its predecessors the Mega ST is positively bristling with ports. Looking at the back of the machine it has the following: 25-pin RS232 serial port; parallel (Centronics) printer port; MIDI in; MIDI out; video out; external floppy disk drive port and a high-speed DMA (Direct Memory Access) port. Also to be found on the rear of the machine is a reset switch, power input, the fan outlet and an 'empty hole' with a panel over it labelled 'expansion'. On the right-hand side there is a recess that contains the cartridge port (up to 128k of ROM) and the keyboard socket. The only other external features of interest are the two joystick/mouse ports at the rear of the keyboard and the floppy disk slot on the front of the system unit. The internally-mounted fan is very noisy for its size.

The heart of the Mega ST is a Motorola 68000, true 16-bit processor (16-bit external address and data lines, 32-bit internal word size) driven at 8MHz. I was disappointed to see there is still no socket for the Motorola 68881 maths co-processor. In answer to the reader who wanted to know why I was enthusiastic about the 68000, its use of a maths co-processor is a perfect example of the Motorola's superiority over, say, the Intel range of processors. Add a maths co-processor to a Motorola system and all software makes use of it; an Intel co-processor will only work with a small proportion of the available software and then only when re-configured. Five large custom chips perform a lot of the tedious memory manipulation leaving the processor free to get on with its number-crunching. They are not named as on the Amiga but generally their functions are: bus organisation and processor support; graphics processor; blitter and DMA.

RAM on the Mega ST4 is 4Mbytes made up of 32 1Mbit DRAM chips with a refresh rate of 120ns. Previous STs were limited to a maximum of 4Mbytes, addressable RAM due to the way the hardware memory management operated. The new memory manager chip found on the Mega STs removes this limit and allows RAM to be expandable to the 68000's

The Mega ST4 contains a very comprehensive collection of ports compared to the 1040ST — the only difference is the addition of a fan



For a prototype machine the Mega ST4 is very well-finished. The gold-edged chip to the left is the blitter — the fifth of Atari's custom chips

Atari laserprinter

The laserprinter supplied with the review machine was a prototype but I was assured by Atari that it was a prototype of the model the company would be selling in Europe. The engine of the Atari laserprinter is a TEC, which is a Japanese engine that has not been used in any printer other than TEC's.

For Atari the printer has been reboxed and much of the internal circuitry has been removed. It is both smaller and lighter than the majority of laserprinters, but even so it's an imposing box that dwarfs the Mega ST. Along the front there is a row of five graphic LEDs signifying: printer online and ready; printer not ready; toner low; paper jam and paper out. Below the LEDs there is a paper tray capable of taking 150 sheets of paper up to foolscap size, but no bigger. Once printed the paper lands face down on top of the printer and so keeps the original printing order. Otherwise the printer is fairly boring to look at — there is a Centronics-type port on the back and a number of catches to get inside.

The most significant difference between the Atari laserprinter and similar products is that practically all the internal memory and processing power of the printer has been removed. The usual method of sending data to a laserprinter is in some form of code (Postscript and DDL are examples that use graphics; Epson and Diablo codes are frequently used for text only) and then the onboard processor and memory within the laserprinter will convert this into bit-image, for printing.

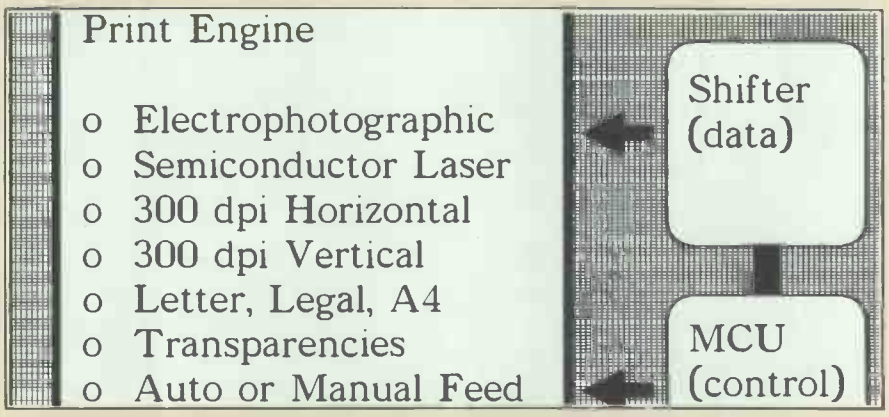
On the Atari system all the page definitions need to be done within the ST and sent down to the laserprinter pixel by pixel, which at a resolution of 300dpi (dots per inch) will take a lot of processing power and memory. Not surprisingly the Atari laserprinter will only work with 2Mbyte or 4Mbyte STs and even with my simple experiments it took up to 15 minutes to calculate a graphic image before printing. Atari claims an eight pages per minute output for the printer, but even a simple page comprising just one dot could only be produced at four pages per minute.

The other problem that Atari has created for itself is the 1.5Mbytes of data that needs sending down a wire to the laserprinter. An ordinary Centronics printer port would be too slow, so Atari sends the data down the DMA channel. Normally data sent down the DMA channel is not meant to travel more than about three feet, so Atari supplies a converter box to amplify and buffer the data. An additional problem is that switching off the laserprinter while it is connected to the DMA channel will cause the ST to crash.

The port on the back of the printer looks like a Centronics but is in fact a custom port with a different pin-out. Connecting it to an IBM-compatible as a standard Centronics proved to be a trauma which it took the laserprinter half an hour to get over. Atari claims that the final model will have two ports, one for Centronics and one for Atari DMA. I couldn't find anyone at Atari who knew how much memory was left on the laserprinter's PCB but my rough calculations with pure text files suggest it is about 2k.

Laserprinter manufacturers claim there is a lot of difference in print quality between an expensive laserprinter and a cheap one. Well, all I can say is that I can't tell the difference — the print quality of this cheap Atari printer is to me as good as that of a £5000 Apple Laserwriter. A colleague of mine who is familiar with most of the commercially available laserprinters was also unable to tell the difference.

The prototype nature of the review model meant that the page counter was disconnected, the socket was badly soldered in place and there was a true Centronics port dangling within the machine. All these problems will, I'm assured, be sorted out. However, the engine will remain the same and it is this that gives cause for concern. It is all too easy, when replacing the toner cartridge to misplace it and spill toner over the printer. Also the drum is too accessible and could be damaged by both fingers and light if the printer were left open for any length of time. The most worrying problem is that when the printer is open, pressing one of the side catches will cause the toner cartridge to fall, which could seriously damage the printer. There are a lot of warnings of this problem both on the printer and in the manual; even so, I say proceed with extreme care.



A sample of the laserprinter output produced using EasyDraw 2

The laserprinter looks nice but the insides are cut-down to the minimum

maximum of 16Mbytes. This new chip will not be made available to existing ST owners. It was nice to see that the RAM chips were socketed allowing this expansion to be internal when 4Mbit RAM chips become generally available. ROM on the Mega ST totals 192k containing the BIOS (basic input/output system); ABIOS (advanced BIOS); TOS and GEM (Graphics Environment Manager from Digital Research).

Getting inside any Atari computer is not an easy job due to the excessive amount of metal shielding needed to conform to FCC radio interference regulation. Removing the outer plastic cover was easy, but then I was faced with a metal box covering the entire PCB and held with about twenty metal tags.

Carefully twisting the metal tags with pliers took half an hour, after which all I needed to do was disconnect the floppy disk drive from its mountings. Having removed the cover I soon realised why Atari makes it so difficult to get inside — to the back right of the PCB is a totally exposed mains-driven power supply capable of delivering a hefty 240 volts if still plugged in.

No-one at Atari had mentioned a real-time clock for the Mega ST, so I was surprised to find a battery carrier in the outer case and a wire leading to the PCB. I plugged in two batteries and it worked fine, although access to the battery carrier is very awkward without removing the outer cover.

In the middle of the board there is the pin-out of what on earlier machines was once a slot designed to take an expansion card. A phone call to Atari confirmed that this is still the case. Apparently someone at Atari had forgotten to solder the socket onto the review machine. At the time of writing the configuration of this slot is still undecided — it will give full access to the internal bus as well as access to other areas such as the cartridge port. Expansion cards that need to talk to the outside world can do so by removal of the plastic cover on the back of the case. Despite the incomplete specification there are already some American add-on manufacturers developing internal modems and hard disks for this socket.

The disk drive in the Mega ST is a standard 800k, 3½in floppy taking a double-sided, double-density floppy disk.

The monitor supplied with the review machine was the 640x400 pixel 'paper-white' monochrome model. This is now packaged in a tilt and swivel casing which makes it a lot easier to position. Owners of existing 520/1040 STs will also appreciate this, as it lifts the monitor clear of the back of their machines. The screen quality is quite acceptable but not as clear or as bright as the screen of, say, an Apple Macintosh.

I was hoping to praise Atari on improving its reliability record, as the number of readers complaining of continually failing systems has dropped. Unfortunately, the two monochrome monitors supplied with the Mega ST failed in exactly the same manner after about six hours of constant use.

The keyboard on the Mega ST4 is identical to that of the Atari ST consisting of 96 keys comprising ten function keys across the top, a numeric keypad to the right, the main QWERTY section on the left and some cursor control keys between the two. For a low-cost keyboard it feels well-made and is pleasing enough to use, although I prefer a positive key click such as on IBM keyboards. A mouse comes as standard with the ST and is the only way of driving much of the available software. Atari will also sell an external Mega-style 20Mbyte hard disk.

Software

The operating system supplied with the Mega ST is called TOS (Tramiel Operating System) and is in fact a version of CP/M68k. However, for the ordinary user, the only way to access this operating system is via GEM, a WIMP (window, icons, mice and pull-down menus) environment from Digital Research. The operating system is now in ROM so that switching on immediately takes you to the GEM desktop.

TOS has gone through numerous revisions with each new ST machine and is now a fairly robust operating system. For those interested in such things the changes in this latest revision include better support for the blitter chip and correction of the bugs that caused the RS232 and VT-52 emulation to crash.

Also the new TOS has been designed to work with the memory management schemes of both the old ST and the new Megas. Rumours that the access and read times of disk drives have been improved with this version of TOS are untrue.

The only visible difference between GEM on the Mega and GEM on the earlier machines is an extra entry to the 'options' menu on the GEM desktop. This allows you to switch the blitter on and off for programs that are either incompatible with it or too fast with it switched on.

Obviously there was no application software designed to work specifically with the laserprinter. The software houses I spoke to said as soon as they were convinced that Atari had truly decided on a specification they would produce drivers for it. The picture is also complicated by the fact that Atari will be using a Ricoh engine in its laserprinter for the US market. In order to use the printer Atari has produced a GEM GDOS driver which operates via the GEM utility 'Output'. This takes a GEM metafile and uses the full resolution of any output device available for it. The only two applications that we could find that produced meta-files were CAD 3D from Antic software and EasyDraw from MiGraph. I'm sure that the number of applications that will produce metafiles will increase with the advent of the laserprinter.

Atari desktop publishing packages

Publishing Partner

Publishing Partner is a desktop publishing program for the Atari ST. It was designed with the ST in mind and the authors took one and a half years to research the program with typesetters and printers. The program was announced at almost exactly the same time as Fleet Street Publisher and the two programs are natural rivals. Publishing Partner has been available in the United States for a short time and has been well-received there.

Desktop Publishing on the Atari ST is a very big topic at the moment with the advent of the Atari laserprinter and SoftLogik is obviously aiming to have Publishing Partner become the official Atari DTP package.

Given this situation, it is hardly surprising that there will be some difficulty in getting users to purchase a desktop publishing program until the Atari laserprinter is in the shops or until Atari endorses one or more products.

SoftLogik has solved this problem to some extent by providing comprehensive support for dot-matrix printers. Not only does the company supply drivers for any dot matrix you can name, but if it doesn't already have a driver, it will write one for you. The big problem with dot-matrix printing for desktop publishing is that the print quality is not good enough for quality output. SoftLogik has to a large extent got around this problem by driving dot-matrix printers to the very limit of their capability and producing dot/pixel densities of up to 240x216 dots per inch on 9-pin printers and 360x360 dots per inch on 24-pin printers. This last resolution is in fact better than most laserprinters, although the actual

ZORLAND

VERSION 2

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per cent to 999 per cent. You can also have the program display rulers along the edges of the window, show a grid over the page, show column outlines, pictures and even text-routing paths.

The 'Style' menu controls text styles from normal through outline to upside down via all sorts of other options. All of these can be used in combination. The menu also controls fonts and point sizes. Then comes 'Format' which is a catchall for the various other facilities available. You can control super- and sub-scripts from it and their spacing relative to normal characters. You can also convert marked blocks of text to upper or lower case; justify blocks as left, centred or right; switch justification between character and word; alter margins; adjust line and character spacing and control manual kerning and hyphenation. Unfortunately, automatic kerning and hyphenation are *not* available.

The final menu is 'Edit'. This lets you delete, search, replace, copy to and from a buffer and control an insert mode toggle. It is also possible to set up and save macros so that simple keystroke combinations can control a whole range of functions. Unfortunately, the operation of the program does not always live up to the promise of all these features. In particular, text layout can be very peculiar. One of my tests of the program was a simple three-column layout on A4 paper of a shortish story along with a picture and a large headline in a greyed box. Since the story was quite short and I wanted it to fill most of the page, I increased the point size and varied the fonts until the story filled most of the page. Unfortunately, this led me to further problems. The spacing between characters now varied wildly from line to line. To solve this, I adjusted the character spacing but was unable to get the text looking right. One thing that did solve the problem was to set the text range left rather than justified. However, this seemed rather backward since the program should be helping you to overcome restrictions, not creating them.

The graphics layout commands were fine, although it would be nice to see some way of importing GEM files so that object-orientated diagrams could be imported to a page. This is especially strange since the


Personal Computer
Evening News

THE NEW LONDON NEWSPAPER!

Fleet Street was today rocked by the news of yet another newspaper launch. What was so special about this one? After every thirty seconds nowadays. The answer, of course, is the new Scourge of the Street of Shame: Owen Underhalm.

For the past month Owen Underhalm has been terrifying the press barons with his new tactics involving ultra-modern technology. His use of Atari ST computers and desk-top publishing has revolutionised production. It is estimated that Owen Underhalm can produce a one page newspaper in only three days!

Adjustment to the same page in Publishing Partner. The character spacing is much better, but still not satisfactory

Conclusion

Publishing Partner is a very interesting program and ideally demonstrates the power of the Atari ST, especially in terms of printer fonts. However, it suffers from a lack of completeness and sophistication, as is common with early versions of advanced programs for relatively new machines.

The potential is there, in combination with the Atari ST and hopefully the Atari laserprinter, for a powerful desktop publishing package at a very low price. To achieve this, SoftLogik will have to put right some of the omissions and faults.

Publishing Partner especially needs automatic hyphenation, kerning and character/word adjustment. These, plus some of the advanced features on Macintosh or PC-publishing programs would make it a front runner.

Fleet Street Publisher

Fleet Street Publisher has been available for some time and is an extension of Mirrorsoft's previous program, Fleet Street Editor. It, too, is regarded as a contender for the Atari desktop publishing crown. However, this is only regarded as a possibility in the UK. Mirrorsoft has carefully targetted the program. Since it is completely GEM-based, it also has its eyes on the potentially extremely lucrative Amstrad PC market.

Fleet Street Publisher has taken a different approach to desktop publishing from Publishing Partner, but not radically different.

Fleet Street Publisher comes on three disks: the system disk, with the basic necessary parts of the program; a font disk; and a graphics library disk. These are included in a wallet at the back of the ring-bound manual and all fit in a slipover box cover. Although upgrades are not yet available, Mirrorsoft promises that they will be in the form of additional printer drivers, additional fonts and clip art.

Fleet Street Publisher uses a standard GEM-based screen. Despite this, the editing screen is fairly similar to that of Publishing Partner; the main difference being that more than one editing window can be open simultaneously and that the windows are

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However, doing
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Atari hasn't real-
clarifying the use
for software de-

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to find out when
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on

that came with
was decent. It co-

vered the operation of the program comprehensively and had several hints and tips on use. The manual was produced using Publishing Partner itself and an Apple Laserwriter. However, if you look carefully, you can observe the character-spacing problem even in the manual.

The documentation also included several additions to cover upgrades and it is obvious that SoftLogik provides a thorough support service.

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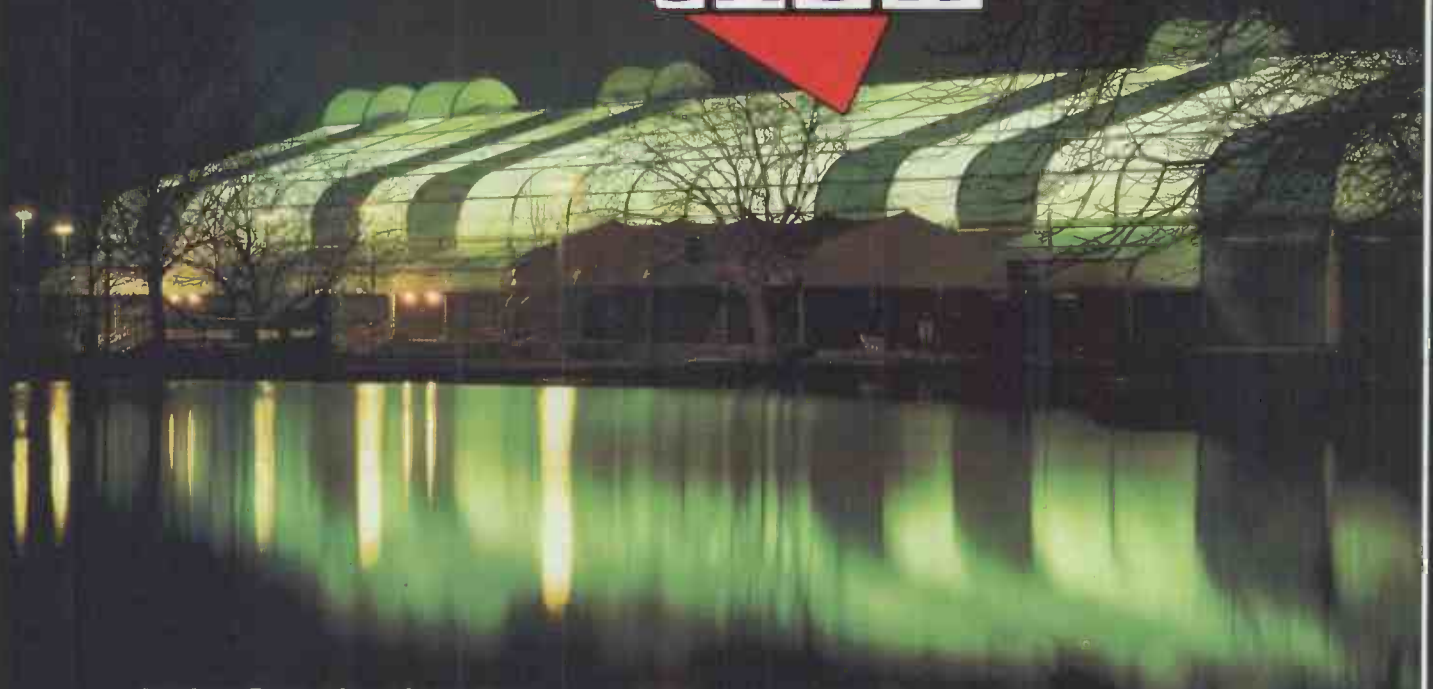

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standard GEM ones and can be freely moved around the screen.

On the left of the screen is a toolbox, a clipboard and a trash icon. The toolbox is a thin rectangular area containing several icons for different basic functions. The clipboard and trash are standard GEM icons except that they cannot be moved. Each independent window displays the title of the document.

The toolbox contains icons for picture block mode, picture edit mode, box rule mode, text edit mode and text block mode. The program starts by displaying a dialogue box showing the date and time so that these can be properly set on machines which don't have a battery-backed clock. The program then displays a standard page with the program in text input mode.

Along the top of the screen is a set of standard GEM menus giving access to a wide range of controls for the program. To start up a new document you choose 'New Page' from the Options menu. A dialogue box pops up for you to name the new document and is immediately followed by another to control the layout of this page. This allows you to choose from standard paper sizes with A4 the default. You can also set up any non-standard size, alter margins and choose the number of columns and the gutter size (a gutter is the technical printing term for the distance between columns. Technical printing terms appear everywhere in the program. Fortunately, the manual explains them clearly).

When the dialogue box has been completed, your page appears and you are ready to start work. The toolbox functions operate in a similar way to those in Publishing Partner. Text and graphics boxes set up areas for text and graphics while text input puts you into a word-processor type text entry mode very similar to that in Publishing Partner, with all the usual functions. Graphics input, however, is very different. The only drawing tool available is a simple one-pixel 'paintbrush'. This is really completely unsuitable for any graphics work and can only be used for very minor touch-ups. The box rule mode allows you to draw lines and boxes in a wide range of sizes and styles and treats them as objects so that they can easily be resized and moved.

The feel of the functions and tools is very much as expected. The only minor difficulty I had was in 'picking up' very small objects with the mouse. Otherwise, the program has the best operation and feel of any program I have come across for the Atari ST. It is one of the very few programs for the Atari which has the classy feel of an Apple Macintosh program.

Fleet Street Publisher, in common with Publishing Partner, has a wide range of commands. Most of these are accessed from the drop-down menus. The menu headings are: 'File', 'Option', 'Typography' and 'Layout'. The 'File' menu controls file operations, text import and merging, picture import and merging, access to keyboard macros, output and help files.

The 'Output' option brings up a dialogue box which is used to select the device to which output is directed. At present, the program only supports FX80 printers fully and other 9-pin dot-matrix printers to a lesser extent. Output can also be directed to GEM bit-image files but not object-orientated GEM files. New printer drivers are being written and at present a 24-pin dot-matrix driver is near completion. Drivers for laser-printers and Postscript-driven Linotron-typesetting machines are also said to be on the way.

The 'Help' option loads in one of a list of prepared files giving hints and tips on certain areas of the program. Each of these is a properly laid-out page rather than simply a text file.

'Option' performs a variety of functions: the magnification at which a page can be viewed can be adjusted, but not as flexibly as in Publishing Partner; rulers given in cms, inches or picas can be displayed; text can be searched for a given string, full text pages can be set up for text editing and new document pages can be set up; various text attributes and document attributes can be assigned to be preserved or changed when text blocks are moved or function key macros used; the program can be set to continually display information about the document at the cursor position; and, finally, printer controls can be set.

The 'Typography' menu controls a very impressive range of layout functions. The first option controls typefaces, sizes and 'leading above and below the base'. This last option refers to relative positioning of lines. The 'Spacing' option covers character spacing — an area where Fleet Street Publisher is far superior to Publishing Partner. A dialogue box controls changes in continuous spacing and in minimum and maximum character spacing allowed. Another option covers indents for paragraphs, hanging indents, and so on. There is also an option for one shot commands for special cases. Automatic hyphenation is available and, although not perfect, is certainly adequate. The other commands available are for justification, upper/lower-case conversion, tabulation, colour, underlining and small-sized capitals.

The final menu controls overall layout and is used to change the size and position of all the different text, picture and box rule objects. The other options control what page aids are visible, the overall page layout and text linked between columns.

In use

Fleet Street Publisher is obviously not designed for large documents. Each page is stored separately, although double page spreads are more easily and sensibly stored as double-sized single pages. This means that multiple page documents are stored as several files. Obviously documents with a large number of pages shouldn't really be laid out with the program.

However, as a program to lay out small documents up to small newsletter size, it is very good. The only major failing at the moment is the very limited range of output printers.

With Fleet Street Publisher you can:

- Change the widths of each font, in half point increments, without affecting its overall height.
- Adjust the leading above and below the baseline.
- Kern characters on the screen at their actual size.
- Vary the interword and the interletter spacing.
- Vary the baseline.
- Automatically produce two levels of sub- and superscripts which are propotional in size to the body text.

All of these features are essential requirements for producing output with a professional look.

A sample of output from Fleet Street Publisher using a pre-release 24-pin dot-matrix driver

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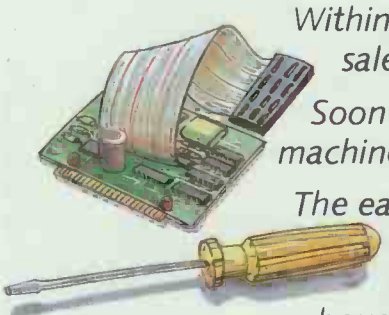

Soon the company was designing and building its own machines. They now sell some 7,000 computers a month.

The early relationship that Michael Dell established with the end user is still central to the business: in America a PC's Limited computer can only be bought direct from PC's Limited.

And in the UK?...

Another serious problem is with the sizes of fonts. Fonts are stored separately for a range of different sizes and intermediate values are generated from these. This results in ragged and unprofessional-looking letters.

I found the program extremely easy to use and exceptionally easy to learn. A great deal of the credit for this must go to the manual which is excellent. However, I quickly became frustrated at not really being able to print out high-quality output.

My test file of an A4 page with three columns, picture and headline was extremely easy to prepare and lay out. Especially impressive was the way the program handled details of the text layout. The text always looked carefully spaced and easy to read. The automatic hyphenation was acceptable and the screen lettering as well as the printer output easy to read. Fleet Street Publisher does not support automatic kerning, a facility which would be especially useful for headlines. Graphics layout was more difficult and rather fiddly. The graphics commands were certainly worse than Publishing Partner's, although they did the job — just. The Atari laserprinter is not yet supported, nor indeed is any laserprinter. This is a serious flaw.

Bill Beret Returns After Fraud Scandal

By Otto Blunt

Legendary pop star and self-ordained Bhuddist monk Bill Beret returned to Britain yesterday from a long vacation that took him all over the world. But the holiday also saw him fall into very deep trouble when he was arrested on fraud charges in South America.

Bill now returns to his bachelor mansion in fashionable Peckham.

More pictures Page 4

Owen Linderholm starts new London paper!

In a bold move today, a new newspaper was launched on the

Output from Fleet Street Publisher on a 9-pin printer in a condensed mode, which is the only way to produce solid black lettering on this printer

Documentation

I wish all computer documentation was like this. The manual is clear and easy to read. The level of information provided goes up on a steady curve as you go through the manual. A section is devoted to a sample session to produce a reasonably complicated page; then the full range of commands are explained in detail. Finally, there is a large and very useful section of tips and ideas for using the program for real projects.

The manual itself is typeset, reflecting the inability of the program to interface with laserprinters or typesetting machines as yet.

Conclusion

Fleet Street Publisher is aimed at a somewhat lower level than Publishing Partner. Because of this, the lack of features such as automatic kerning is not a disaster.

What is a disaster, however, is the lack of printer drivers. Until the program can easily be installed for, and used with, a wide range of printers it cannot gain wide market acceptance. Nevertheless, at the lower end of the desktop publishing market there isn't a program that can beat this one in operation.

Fleet Street Publisher costs £115 (excluding VAT) and is distributed by Mirrorsoft on (01) 377 4837.
Publishing Partner costs £139 (excl VAT) and is available from Silica Shop on (01) 309 1111.

Prices

The Mega ST2 with 2Mbytes of RAM and a monochrome monitor costs £995; a similar system with 4Mbytes of RAM costs £1295. No official price had been agreed for the laserprinter at the time of writing but it will probably cost in the region of £1500. There will be a special bundle of Mega ST2, mono screen, laserprinter and desktop publishing software available later in the year. Once again prices haven't been decided but the whole system will be considerably less than the sum of the individual components.

Technical specifications

Processor:	Motorola 68000 running at 8MHz
ROM:	192k
RAM:	4Mbytes expandable to 16Mbytes
Mass storage:	One 800k, 3½in floppy disk drive
Keyboard:	96-key, full-stroke
Size:	System unit: 14.2ins×14.2ins×3ins Keyboard: 18.8ins×7.6ins×1.5ins
Weight:	18lbs (system unit)
I/O:	RS232 serial, Centronics parallel, MIDI in, MIDI out, video out, external floppy disk, DMA fast data port, cartridge port and two 9-pin mouse/joystick ports
DOS:	TOS (version of CP/M68k) and GEM (Graphics Environment Manager)

Conclusion

In the two years since its launch the Atari ST has evolved into a very desirable small-business computer. The Mega ST is the most developed form of the ST design, and although the laserprinter was an early prototype and had a number of shortcomings, in its final form there will be little to distinguish it from models costing £1000 more.

Application software for the Atari ST is just beginning to fully exploit the power of the system and use the capabilities of GEM. The two packages reviewed here, Publishing Partner and Fleet Street Publisher, have their faults but neither would disgrace an Apple Mac or IBM PC. There should be no shortage of quality DTP software capable of using the laserprinter as soon as its technical specification is made available to the software houses.

The future of the system all depends on availability and price. Our feeling is that if the complete DTP system costs less than £2500, it could make a serious impact on the DTP market. It *must*, however, be made available in the very near future. The DTP market is very competitive and there is no shortage of manufacturers looking to develop systems that could push Atari out of the running. END

Benchmarks

Intmath	1.4secs
Realmath	3.4secs
Triglog	7.6secs
Textscrn	39.9secs
Grafscrn	93.1secs
Store	55.5secs

Benchmarks carried out in STBasic. For a full explanation of the PCW Benchmarks, see the December 1986 issue, page 164.

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HP-28C calculator

Gone are the days when a pocket calculator just provided a quick way of performing mathematical calculations: technological development has produced powerful units with increased programmability and functions. Nick Walker looks at the HP-28C

In the first few years of *PCW*, there were very few ways for the enthusiast on a limited budget to afford a personal computer. The wealthier people could perhaps afford a 16k Apple II or a 4k Tandy TRS-80, but those of us with less money had to settle for build-it-yourself kits or programmable calculators. Such was the interest shown by programmable-calculator owners that *PCW* ran its own column to cater for it, called 'Calculator Corner' and later 'Pocket Computer Corner'.

For a while, pocket computers and programmable calculators offered more power than most home computers of a comparable price. The advent of cheap computers such as the Sinclair Spectrum *et al* offered significantly more power for less cost, making programmable calculators seem limited and expensive. Nevertheless, development has continued and there are now some very sophisticated machines that prove to be truly useful as pocket number-crunchers.

The market for programmable calculators has had its share of success and disaster stories, following a similar path to the home computer market. The four leading manufacturers were, and still are, Casio, Hewlett-Packard, Sharp and Texas Instruments. Less successful competition came from Commodore, National Semiconductor, Rockwell and Sinclair — all of which have now withdrawn from the scene. The programmable-calculator market called for LSI and VLSI chips, which accounts for the number of chip manufacturers in the list.

Since the boom years of programmable calculators they have developed in two ways. Firstly, an increase in programmability has produced machines that come close to the power of a laptop but in a pocket-size box; and, secondly, increasing the amount of functions within the calculator's hardware, thus widening the number of problems it can solve without the need for programming. The HP-28C falls into the second class, offering more built-in ability than any calculator I have ever seen.

Hardware

The HP-28C is an elegant, traditionally-shaped calculator which opens like a book to reveal two keypads. On the left is an alphabetic keypad arranged in straight

A,B,C . . . fashion; the right-hand keypad contains the numeric keys, arithmetic keys and a further 35 function keys. Above the right-hand keypad is a bulge which contains an LCD screen and the battery compartment holding ordinary 'pen-light' batteries rather than the 'hearing-aid' ones usually found on programmable calculators. To conserve power, the HP-28C will automatically switch itself off if it hasn't been used for ten minutes.

Considering how slim the keypads are, and the amount of space occupied by the screen and the batteries, there seems to be no room for any circuitry. And as there was no way I could get inside the unit, I can only assume a very high level of integration to enable the HP-28C to function in so little space.

There is a feeling of quality to be found in every feature of the 28C, as in all Hewlett-Packard electronics. The attention to detail is superb: the wonderfully positive click of the keys — even the feel of the catch on the case — all reek of quality. This quality must, of course, have a beneficial effect on the reliability of HP equipment. This praise may appear to be rather 'over the top', but after months of using dubious Taiwanese equipment, it's a joy to find a manufacturer who still cares about quality.

The screen is a 32 × 138 pixels, fully addressable LCD capable of displaying a full character set and graphics. A row of annunciators (graphical symbols) above the screen indicate, from left to right: suspended program; Shift key activated; locked alphabetic key entry; busy, not ready for input; low battery; radians mode; and data being sent to the printer.

Also included with the review calculator was a fairly ordinary thermal roll printer, 24 characters wide and not particularly fast. It does have one particularly novel feature — it works via an infra-red link so there is no physical connection between the machine and the printer. Just place the printer anywhere on the desk and it will print when commanded.

Software

Anyone unfamiliar with HP calculators will initially encounter problems when operating the HP-28C. Enter '1 + 1 =' on the HP-28C and you obtain a 'Too few arguments' message on entering the '+' error message; and if you persevere, you receive a 'Syntax error' on entering the '='. This is because the HP-28C, like all HP calculators, uses a stack-based system of algebraic entry called Reverse Polish Notation (RPN).

The majority of calculators use variations on the 'algebraic' calculator interface. The name derives from the fact that the keystrokes used closely parallel the way in which the calculation is specified on paper. That is, to evaluate '1 + 2 − 3', you press '1 + 2 − 3 ='.

This interface works nicely for expressions which contain operators (+,−,*,/) that work in the middle of two arguments — infix notation. More sophisticated calculators allow you to enter parentheses to specify precedence. However, the introduction of prefix functions, like SIN, LOG, and so on, leads to two different variations. Ordinary algebraic calculators use a combination of styles: for example, 1 + SIN(23) is entered as 1 + 23 Sin =; the + is entered as prefix but the SIN is entered postfix. This approach has the advantage of being able to show intermediate results, but has the disadvantage of losing the correspondence with ordinary mathematics which is the primary advantage of the algebraic approach. 'Direct formula entry' calculators have an immediate execution mode, allowing you to key in the entire expression in its ordinary algebraic form, then compute the result when you press a termination key (usually Return or Enter).

'I'm not usually given to rash compliments, but I feel quite justified in claiming the HP-28C to be the 'state of the art' in calculator design.'

All Hewlett-Packard calculators use RPN (so-called because it was developed by a Polish logician named Jan Lukasiweicz (pronounced Wookashyee'veech) which isn't a name that lends itself to acronyms). The basic idea of RPN is that you enter numbers or other 'objects' into the calculator first, and then execute a command that acts on those entries; thus, for '1 + 2 −3' you would enter '1 2 + 3 −'. The 'stack' is just the sequence of objects waiting to be used. Most commands return their results to the stack, where they can then be used as arguments for subsequent operations.

Using the RPN method, simple arithmetic is most likely the biggest stumbling block for algebraic calculator users trying to learn to use RPN calculators. RPN is very efficient, but it does require you to mentally rearrange an expression before you can calculate results. The four-line display on the HP-28C is used to display the last four items on the stack, which makes it much easier to comprehend.

Unlike other HP calculators, with the HP-28C you really don't need to concern yourself over whether RPN logic is better or worse than algebraic logic. The HP-28C has a facility for the evaluation of expressions in a direct formula entry mode, by enclosing the expression quotes. Additionally each result you compute is retained on the stack, which allows you to save results for later use. You can choose the logic that is best suited for the problem at hand, and intermix algebraic expressions with RPN manipulations.

For those familiar with existing HP calculators, there are some differences in the operation of the HP-28C. The most dramatic difference is the size of the stack. Previous HP calculators used a fixed four-level stack, whereas the HP-28C has a dynamic stack that grows as you enter items. Additionally, in the old system the stack was always full, even when you *cleared* the stack; all you were doing was filling it with zeros. As I have stated, the HP-28C can generate a 'Too few arguments' error that previous HP RPN calculators could not.

The other differences are only alterations to the commands that manipulated the four levels in order to allow them to work with a dynamic stack.

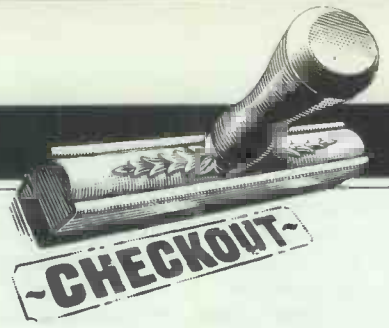
At first glance the HP-28C seems lacking in many of the usual calculator functions because, with the exception of a few more frequently used functions, it operates via a series of menus that correspond to the top six keys on the calculator. There are 24 menu groups, each of which can consist of five lots of six commands, giving a total of over 500 functions. One of these menus is a user menu which contains an entry for each variable currently in existence. Selecting the variable results in a number of actions depending on its type, as I'll explain later.

Distinguishing features

I'll skip the basic scientific-calculator details — the HP-28C is equipped with all of them. I'll concentrate instead on the features that distinguish the HP-28C from similar products.

I was amazed when I started to program the HP-28C. Most computer users criticise pocket computers and calculators for being five years behind the times when it comes to programmability. But the HP-28C is programmable in an object-orientated manner, putting it on a level with current programming trends.

A program is a series of objects and commands contained in a single object. When you evaluate the program, the objects are put on the stack and the commands are executed. Programs are most usable when stored in a variable. The unquoted name of a program variable acts as a command. Running the program just consists of selecting the variable



name from the 'User' menu, or you can call the program as a subroutine by including its unquoted name in another program. In a consistent fashion, variables can also be numerical objects (numbers), alphabetic objects (strings) or expressions.

The difference between a *program* stored in a variable and an *expression* stored in a variable is not immediately obvious. An expression represents a mathematical calculation in a form similar to written mathematical notation. When evaluated, an expression takes no arguments from the stack and returns a single result to the stack. The best way to think of an expression is as the symbolic result of a calculation; as such, it can be used anywhere that a simple variable can be used.

As far as programming the HP-28C is concerned, there are two things you need to understand. Programs can include any commands including loops, IF statements, stack commands and user-memory commands. Expressions can only consist of functions such as '+' or 'SIN'.

You also need to know that programs stored in variables will execute when selected from the user menu, whereas selecting an expression *doesn't* cause the expression to be evaluated. Instead, the expression is returned to level 1 of the stack.

One of the most delightful features of the HP-28C is its ability to plot a mathematical function. Any mathematical function stored in the variable EQ will be plotted on the 28C's 32 × 138 pixels display. If EQ contains an algebraic expression without an equals sign (=), the command DRAW will plot a single curve which corresponds to the expression for each value of the variable within the plot range. If EQ contains a normal algebraic equation, DRAW will plot two curves, one for each side of the equation. The intersection of the curve will then be a root of the equation. If EQ contains a program, it will be treated as an algebraic expression and plotted as a single curve. (This presumes that the program obeys the syntax of an algebraic expression.) It is also possible to obtain a scatter plot in conjunction with the data held in the 28C's statistical data area.

The 28C's graphing capabilities extend to more than just the ability to draw the graph of a function. It is possible to re-scale, zoom in on areas of interest, change resolution, and even select points for digitisation (turn back to numerical coordinates) by means of a movable cross-hair. The selected point is then deposited on the stack for use in further calculations.

The ability to select a point on a graph really comes into its own when it comes to using a feature known as the 'Solver'. The 'Solve' menu contains commands that enable you to find the solution for algebraic expressions and equations. By solution I mean a mathematical 'root' of an expression — a value of one variable in the expression for which the expression has the value zero. For example, entering the equation $x^3 + 3x^2 - 2x = 6$ would result in a value for x of 1.41421 . . . The Solver uses an interactive method to obtain a numerical solution, and the best way to provide it with a 'guess' from which to work is to take the value of a likely looking point on the expressions graph.

It was by accidentally pressing the wrong key when using the Solver that I discovered the one feature which really makes this calculator stand out from the crowd. While attempting to evaluate the numerical solution to an equation, I hit the wrong key and was promptly confronted with a symbolic (still expressed in variables) equation and not any equation I had entered. It's at times like this that you have to consult a manual, and I discovered that the HP-28C can perform many of its operations symbolically (that is, in the case of the Solver, obtain a function that represents the roots of a function). And that was it. The next few days were spent with various pure mathematics text books, putting the 28C through its paces.

As all mathematicians know, a symbolic result is usually preferable to a numerical result. The functional form of the symbolic result gives much more information about the behaviour of the system represented by mathematical expression, than can a single number. Also, a symbolic solution can contain *all* of the multiple roots of an expression. Even if you are only interested in numerical results, solving an expression symbolically can result in significant time-savings in obtaining the numerical roots.

There isn't room within this review to examine the full capabilities of this feature. It does, however, allow you to expand and collate terms, and isolate and perform a whole range of other symbolic operations. There is also a facility for the solution of simultaneous equations, again in symbolic and numerical ways. In many cases I was able to solve equations by a sequence of commands that mimic the steps you would go through in, say, an A-level pure maths paper.

If this isn't enough, it is also possible to perform calculus in both a symbolic and numeric manner. For polynomial expressions you can find the derivative and the indefinite integral. For expressions including only arithmetic, trigonometric, logarithmic, exponential and hyberbolic functions, you can find the definite integrals. For *any* expression you can find definite integrals. You can differentiate an expression step by step as you would on paper, watching how the calculator applies its rules of calculus; or you can differentiate an expression all at once. The final results are identical.

I haven't been able to cover half of the functions that the HP-28C is capable of in this review but, for the record, other features of particular interest include: complex-number operations; vectors and matrices; statistics; binary, hexadecimal and octal arithmetic on user-definable word sizes; unit conversions with over 100 pre-defined units; and the ability to define your own units.

Documentation

Two ring-bound manuals are included with the HP-28C: a getting started manual and a reference manual. Both are excellent, although I would recommend a new user to work their way through the entire getting started manual as it covers most of the calculator's capabilities. When you have discovered the features you want to use, the reference manual is easily understandable and gives the finer details.

Price

The HP-28C costs £199.95 which may sound expensive, but it would cost much more to buy software with similar functions to use on a desktop computer — and there's no way *that* will fit in your jacket pocket.

Conclusion

If you regularly deal with any form of mathematics, be it in an engineering context, a pure mathematical context or even as a hobby, the HP-28C will prove to be an invaluable aid. Its capabilities cover a range so broad that I doubt anyone will use it to its full capacity, but just one of its many features will justify its purchase by many users.

I'm not usually given to rash compliments, but I feel quite justified in claiming the HP-28C to be the 'state of the art' in calculator design.

Hewlett Packard is on (0344) 424898. END

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Dell 286[12]

The concept of mail-order computer shopping was somewhat clouded by the failure of Sinclair to successfully operate such a system, but it's big business in the US. Now, the Dell Computer Corporation aims to restore UK users' faith with the 286[12], a fast but inexpensive AT clone available mail-order in a variety of configurations. Robert Schifreen phoned in to test it out.

In the US, where credit cards are the norm and someone usually summons the police if you try to pay cash in a supermarket, customers have more faith in buying mail-order. Over the last three years, some 60,000 people have phoned a company called PCs Limited and exchanged their credit card number for the promise of a complete PC system with monitor arriving on their doorstep within a week.

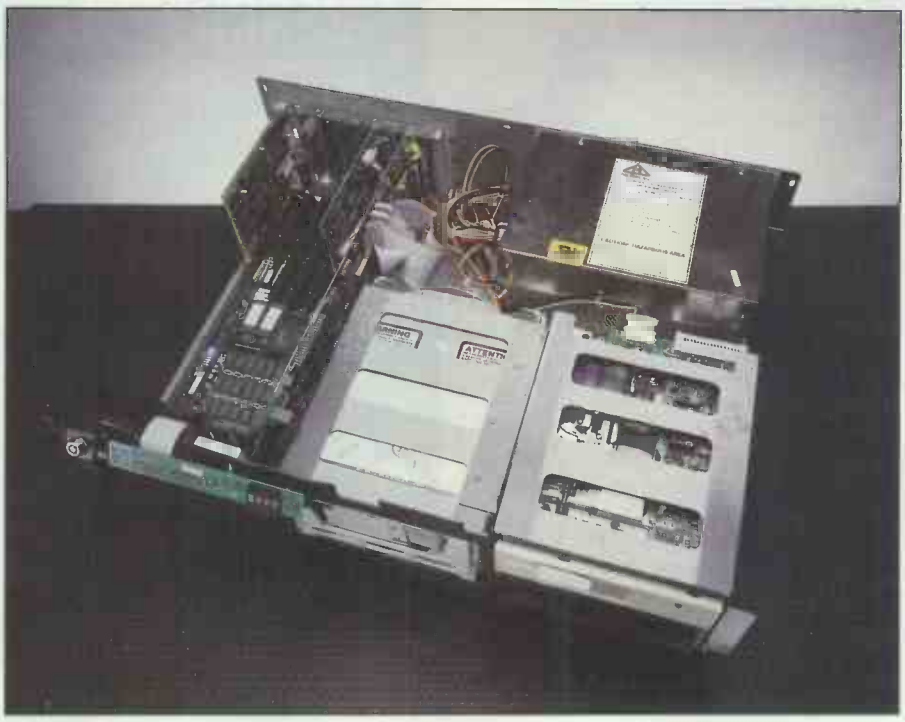
In early June this year, PCs Ltd set up in business in the UK. The company calls itself the Dell Computer Corporation, after its 22-year-old founder and chairman, Michael. As in the US, you can't walk into a dealer in the UK and buy a Dell machine — you have to order it over the phone and it will be delivered by courier to your door.

From its American range, Dell has brought two models across the Atlantic. Both are 80286-based AT clones, and basic configurations comprise a single-floppy drive and a 20Mbyte or 40Mbyte hard drive. One, the model 286^{8}, runs at 8MHz; the other, the 286^{12}, runs at 12MHz and is switchable to 6MHz. The machine I'm reviewing here is the EGA version of the 286^{12}, which includes an EGA card and a monitor as well as a very fast (28ms) 40Mbyte hard disk. It will retail for £2199 including delivery, which is a few hundred pounds cheaper than any comparable system I know of. Not having to find and maintain dealers seems to make good business sense — if Dell can overcome the British prejudices and confusing legislation about mail-order purchases, the company seems set to make a killing.

Hardware

The machine is delivered in two boxes. The smaller holds the monitor which, for my review machine, was an NEC Multisync. On its own, this retails at some £695 and, much as Dell would like to, it seems improbable that this will be the monitor that is shipped to customers. American customers are supplied with Taxan monitors and it may well be that the same are used in the UK.

The larger box holds the system unit and, separately packed inside it, the keyboard. There's also a genuine copy of Microsoft MS-DOS 3.20 and GW-Basic 3.20 complete with manuals, plus a manual which explains how to set up the machine and install cards. (You can have the system without GW-Basic but it's more expensive that way.) An envelope contains thin manuals for the VEGA EGA card and the DIO multi-function I/O card, as well as the VEGA utility disk (for doing CGA/Hercules emulation) and a program for splitting the 40Mbyte hard disk into two 20Mbyte partitions (MS-DOS versions less than 3.30 don't usually allow more than one DOS partition on a hard disk, and even 3.30 won't let any partition be larger than 32Mbytes). Although the multi-I/O card supports a game port, the socket is not connected — a fly-lead is included should you be of the opinion that no business PC is complete without a pair of joysticks. There's also a 9–25 pin RS232 converter cable. There is no diagnostics disk, though Dell says that the IBM Advanced Diagnostics will work.



The machine's motherboard is neatly laid out, with no stray last-minute wires. Hopefully, production machines will make better use of the SmartVu panel, visible here at the front of the machine

The cardboard box that holds all this is about twice the size of the computer in all dimensions, with hunks of foam in all its important little places to stop the computer from rattling around as the unfortunate delivery person struggles with it to your door. Despite my two (one unsuccessful) back-breaking attempts to get the thing into a London taxi to experiment with at home over a weekend, the system behaved well throughout the review period and gave no problems whatsoever.

Should *your* system not be so lucky, there's a year's telephone support and also a 24-hour on-site service warranty for the same period. Both are included in the price.

Also, should you decide that, having received the machine, it isn't exactly what you wanted, there's a 30-day money-back guarantee period.

It took me around five minutes to take everything out of the boxes, plug in the mains cables and switch on. The system unit is fully assembled and tested — there are no cards to plug in or DIP switches to set.

The system is around the same size as IBM's AT, and finished in the same grey and beige. The case is all metal and happily supported the NEC monitor without sagging. The power switch is on the right-hand edge of the machine, so you could stand the box on its side under a desk if you wish. I tend not to do this, as I'm forever plugging cards and interface leads in and out.

Most of the front of the system box is taken up by a grille that acts as an air intake for the machine's fairly noisy fan. The system certainly needs air circulation — running the system with the cover off for an hour made many of the chips untouchably hot.

The floppy disk drive is fixed in the top right-hand corner of the case. There's room underneath it for two more half-height devices, as the hard drive is in the middle of the machine, to the left of the floppy one, and sits on top of the motherboard. The space under the floppy drive consists of two spaces but only one opening — the remainder of the space is inside the body of the case and can't usually be accessed. It could still be used for a hard drive, though, while the accessible slot could take a floppy drive or a tape streamer. Dell can provide 1.2Mbyte and 360k floppy drives and a 60Mbyte Wangtek tape streamer now, and promises a 3½in PS/2-compatible drive for later this year.

At the top left of the case is the standard AT-style keyboard lock (you only get one key) and two LEDs. The red LED tells you when the hard disk is being accessed, while the green one can act either as a power-on light or a speed indicator (the machine is switchable between 6 and 12MHz), depending on the setting of

a DIP switch inside the machine. I'd like to have been able to set this preference through the machine's set-up menu and had it saved in CMOS.

Most interesting on the front of the machine is the SmartVu panel, a four-character dot-matrix display designed by Dell. It's used by the system for error-message displays, and to tell you what speed the machine is running at.

Conspicuous by its absence is a reset switch — if the system crashes you have to switch off and back on again.

From left to right at the back of the machine, the mains output comes first: you can power a monitor from the system's 200-watt power supply if you want to reduce the spaghetti quotient. Next to that is the power input via a standard — though very long — 3-pin mains cable.

The setting-up manual informs you that the 286[12] is shipped for connection to a 110-volt American supply and that you must adjust the setting before using the machine in the UK. My review machine had already been adjusted, and Dell needs its head examined if production machines aren't similarly effected. Conversion between voltages involves no more than turning a dial anyway.

The keyboard connector is a 5-pin DIN plug. There's one standad IBM parallel printer port and two RS232 ports (a 9-pin one and a 25-pin one). The 9-pin port starts life as COM1 while the 25-pin one is COM2, though a DIP switch lets you make either of them into anything between COM1 and 4. The Centronics printer port is LPT1, but again you can change this to 2 or 3 if your favourite multi-everything card insists on being called LPT1.

In the left-hand slot is the VEGA EGA card. Software is supplied to provide CGA, MDA and Hercules emulation, although a proper mono system with matching card and monitor is available if you prefer.

The keyboard is AT-style and has 84 keys. In the US, PCs Ltd has just started shipping an enhanced 102-key version, but no arrangement has yet been made for the UK. The keyboard has a UK layout, with a pound sign above the number 3. On its base are two DIP switches. The first allows you to swap the position of the ESCape key and the Tilde (~) — the keys whose positions would be reversed if you were using a real AT-style keyboard. The other switch lets the keyboard act as an AT or PC unit, and this has to be kept on the AT setting or nothing works. An AT keyboard has a bi-directional link to the computer — you can send commands to it, to alter the repeat rate or turn on the indicator lights, for example.

The system comes with an EGA card, a parallel printer port and two serial ports as standard. The power supply is rated at 200 watts, so you can save a mains socket by connecting the monitor directly to the computer

The keyboard is quiet in use, though some keys insist on being pressed and released fully before the press registers, which made rapid pressing of the backspace key difficult and hard on my typing finger.

The case is secured with strange screws that have hexagonal heads and no slits, so you need pliers or a spanner to remove them. The setting-up manual says that there are three of them, and supplies a helpful diagram to guide you to their exact location. Having removed the screws and pulled the case in all directions to no avail, a closer inspection reveals that there are, in fact, five. With these removed, the case slides off easily from the front.

The layout of the machine is tidy and uncluttered. The motherboard, designed and built by Dell in the US, occupies the left-hand half of the case. It is neatly laid out, with no stray last-minute wiring.

The 80286 CPU runs at 6 or 12-MHz with one wait state, and is made under license from Intel by AMD. There was no 80287 maths co-processor on the review machine: this is an optional extra and plugs into the waiting socket.

The control chip set is made by Chips and Technologies, and consists of four square, socketed chips. One of these is stamped 10MHz, which I queried with Dell as the machine is supposed to run at 12MHz. I was assured that, although the chip was initially guaranteed to 10MHz, each had been individually tested to well in excess of 12MHz and there should be no problems. Future releases of the set, which should be well in time for the launch proper, will all be guaranteed to the higher speed and will lose the 10MHz marking.

Dell's BIOS has been written by the company and is contained in two Eproms of 32k each. In addition to providing IBM BIOS compatibility and containing the set-up routines accessed by pressing Ctrl-Alt-Return, there is also a complete EGA BIOS in there, too. Normally the EGA BIOS is found only on the EGA card, but as Dell has its own as well, which can be switched in and out from the set-up menu, it gives the company greater control should it wish to enhance the standard or if the EGA cards it ships do not work properly. But this is not the case at the moment. Programs like EGA Paint worked well.

There is a single bank of eight DIP switches. These let you specify whether you're using a system with 128kbit or 256kbit BIOS ROMS, what you want the green LED to do, and which monitor is the primary display. The PCB is labelled to tell you what each DIP switch does, which is helpful. But you have to take the machine apart to change them, which is not. If Epson can put its DIP switches at the front of the machine under a flap, so can other companies (sermon mode off).

All Dell machines come with 1Mbyte of parity-checked RAM as standard. This is contained in a bank of soldered 100ns chips, each of which holds 32k. Only 640k of RAM can be used by DOS — the remaining 384k must be configured as a RAM disk using the Ramdrive program supplied. If you'd rather have a bigger RAM disk and less memory available to DOS, a DIP switch lets

you split the megabyte into two equal 512k portions.

Like all IBM clones, there is no ROM Basic on the 286[12] motherboard. Trying to enter the ROM Basic (via the BIOS call that a real IBM machine uses) produces an error message onscreen and the system reboots itself.

There are eight full-length expansion slots, and all but two of these are of the 16-bit AT variety. The VEGA and serial/parallel cards each take up an 8-bit slot, and the combined hard-floppy disk controller takes a 16-bit one. The disk controller card is full-length, and this description is no exaggeration. It's actually too long and buckles slightly in the middle. I made the mistake of removing it to take a better look at the non-Intel 80286 chip it obscures and had great trouble putting it back. With one hand and a knee I had to stretch the system unit, while the other hand and various parts of my anatomy managed to drop the card into its slot. Dell has assured me that it will take a look at the problem, and that it will be fixed when a slightly newer chassis is made available towards the end of the summer.

The hard disk is a full-height drive made by Micropolis, with a formatted capacity of 40Mbytes. Its official speed is 28 milliseconds, which is around four times faster than a fast PC — and it shows. Some performance-checking software (DISKP.COM) rated it at 15ms in ideal conditions. Because of MS-DOS's limit of 32Mbytes for a hard disk, a device driver is supplied that lets the disk act as two 20Mbyte drives, referred to as drives C and D.

The floppy drive is a 1.2Mbyte half-height drive made by Mitsubishi. It worked reliably and seemed more capable than others at formatting a disk to 360k capacity and allowing that disk to be read in a standard PC. Some 1.2Mbyte drives write each track twice in this situation, but this one does not.

'British people have never liked buying computers mail-order . . . despite what Sir Clive asked you to believe.'

Both drives run at the same speed as the machine, so if you switch to high speed (12MHz) the disk access speed increases accordingly. For time-sensitive copy-protection systems like that of Lotus 1-2-3, you need to run the machine at the slower speed while the program's key disk is being checked. When this has been done, you can switch to the full 12MHz.

Turning on the machine, the first thing you notice is the stream of messages that appear on the SmartVu display. This four-character dot-matrix device is Dell's invention and shows you how the self-test and boot process is progressing, and how much of the machine's RAM has been checked so far.

The manual contains no technical information on the SmartVu, though a couple of hours studying the BIOS revealed that it's a clever device capable of displaying any of the 127 standard ASCII characters, in a choice of four brightnesses and a similar number of background brightnesses. A simple Basic program allowed me to have scrolling messages proclaiming that I was the owner of the machine. In the future, Dell plans to ship its own licensed version of MS-DOS, which will enable it to add its own utilities to the system disk.

Programs to turn the SmartVu display into a general-purpose display or a clock are promised. Meanwhile, it remains under-used — confined to displaying the number of the cylinder which the hard disk's head is currently hovering over. On my machine the hard disk was formatted, though this will not be the case in future. Formatting a disk allows DOS to check it for errors and mark any damaged areas as unusable. The advantage of formatting the hard disk after delivery, therefore, is that any errors induced during transit will be marked as such. The disk's heads are parked before shipping, though, so I'd be surprised if anything went wrong.

With the machine up and running, the first thing the manual suggests you do is to switch to the higher speed. The machine is switchable between 6 and 12MHz and normally powers up in the lower speed, though this default can be changed with a DIP switch.

To change speeds, you press Ctrl-Alt and Backslash at the same time. Doing this produces a beep from the speaker, and the SmartVu display changes to 12MHz to show that the higher speed is active. Pressing the same key combination again changes the speed back. The system didn't mind me changing speeds during program execution, or even in the middle of a disk access.

The way that the Ctrl-Alt-Backslash key combination is recognised is by having a special piece of code in the machine's BIOS that constantly monitors the keyboard and switches speeds when necessary. It struck me, then, that if I loaded the MS-DOS UK keyboard driver program, KEYBUK, which works by taking over the machine's default keyboard handler and replacing it with its own, there would be nothing to check for this special key combination and I wouldn't be able to change the speed of the machine.

I was correct. The generic MS-DOS

Technical specifications

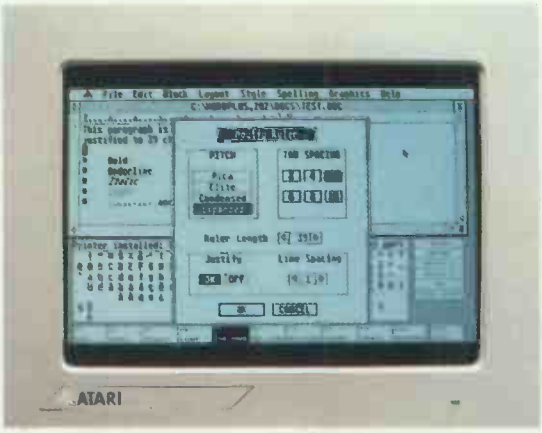
Processor:	80286 switchable 6 & 12MHz with one wait state
RAM:	1Mbyte
ROM:	64k
Mass storage:	Standard configuration one × 40Mbyte, 28ms hard drive; one × 1.2Mbyte floppy drive
Storage options:	360k drive, 3½in drive, tape streamer; additional hard disks extra
Keyboard:	84 keys; separate numeric pad/cursor keys
Monitor:	EGA card and monitor supplied as standard; other configurations available
Standard interfaces:	Two RS232C ports, one parallel port, EGA card, game port
Expansion	Can accept LIM expansion boards
Size:	6.5ins × 18.5ins × 16.5ins
Weight:	55lbs
Bundled software:	MS-DOS 3.20, GW-Basic 3.20, VEGA utilities, split disk partition utilities
Price:	£2199 + VAT (see panel for other prices)

Other configurations

Speed	Hard disk	Monitor	Price (excl) VAT
8MHz	20Mbytes	Mono	£1299
8MHz	20Mbytes	EGA	£1699
8MHz	40Mbytes	Mono	£1599
8MHz	40Mbytes	EGA	£1999
6/12MHz	40Mbytes	Mono	£1799
6/12MHz	40Mbytes	EGA	£2199
6/12MHz	70Mbytes	Mono	£2099
6/12MHz	70Mbytes	EGA	£2499

To be announced: an 80386 machine at 16MHz, with a 40, 70 or 150Mbyte hard disk

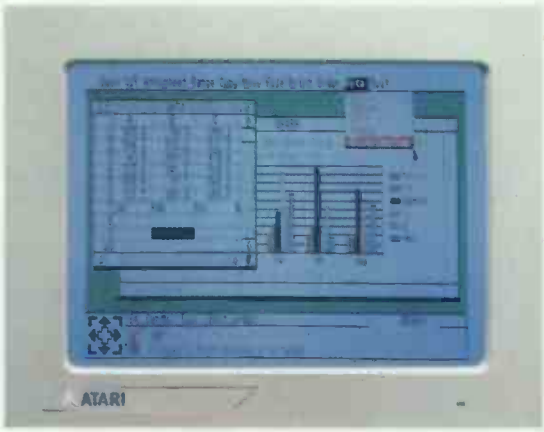
Taxmen, bank managers and accountants are easy to defeat.



1st Word Plus – G.S.T. Professional word processor featuring U.K. spellings and integration of graphics including 1st Mail for full control of form letters etc.

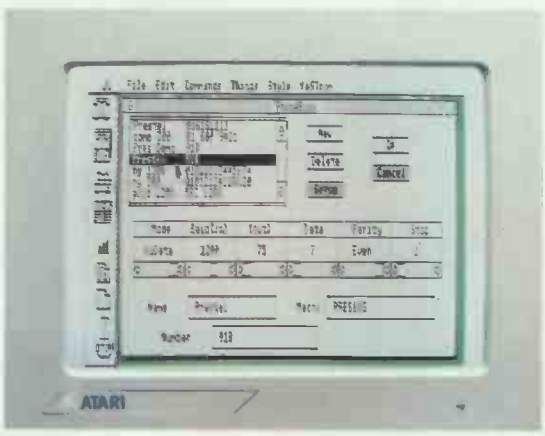
Superbase Personal – Precision Software. All the features of GEM combined with full relational database power. Easy to set up, flexible, plus unique picture index facility.

Fleet Street Publisher – Mirrorsoft. The complete desk-top publishing package. Gives you page make-up combining text and graphics for sophisticated, professional looking documents.



VIP GEM – Silica Distribution. VIP Professional is an Integrated spreadsheet, database, and graphics package. GEM environment plus Lotus 1-2-3 compatibility.

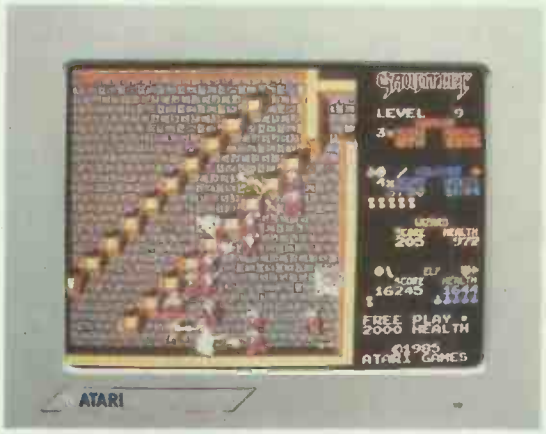
Neochrome – Atari. A powerful, sophisticated painting program for unsurpassed graphics. Work boldly on full screen canvas or in minute detail using Neochrome's magnifier.



Fastcom – Atari. A professional communications software package giving access to most major databases worldwide. (Integrated ASCII/Viewdata package).

*Screenshots

These other fiends may be a bit trickier.



Gauntlet – U.S. Gold. Enter a world of monsters, mazes, mystery and combat in the ultimate role-playing fantasy game.

Tai Pan – Ocean. Voyage to 19th Century Hong Kong for action and excitement with pirates, smuggling and mutiny.

Metrocross – U.S. Gold.* It takes lightning reflexes to get past the potholes, obstacles and forbidden zones to reach the other side. And that's just the beginning!

Arkanoid – Imagine.* The latest smash-hit coin-op game! Are your reactions quick enough to handle 33 different play screens?

Mixing business with pleasure is no problem with an Atari 520 ST. Not when you've got over 1,000 software titles to choose from.

You'll find all the latest games and a huge range of business titles from the top business software houses. And the range is growing all the time.

You won't be short of power, either. The Atari 520 ST is twice as powerful as most business micros.

So you'll be able to create spectacular colour graphics. Even animate them to make your own films. If you're musically minded, you can compose and play a full symphony.

Or, for those who'd rather write programs than music, the 520 ST supports over thirty programming languages.

In fact, whatever you're looking for in a computer, you'll find it in the Atari 520 ST.

ATARI 520 ST
WORKS HARD · PLAYS HARD

he original Arcade game. If you require any further information concerning software featured please write to: PO Box 555, Atari House, Railway Terrace, Slough, Berks SL2 5BZ.

KEYBUK program means that I couldn't change speeds, so I couldn't use it.

The side-effect of this was that the '@' and '"' keys swapped places, but I wasn't really bothered. Dell promises me that it will have its own version of KEYBUK by the time the machines are delivered.

Another key combination that the new KEYBUK program will need to cope with is Ctrl-Alt-Return. This enters the set-up procedure which allows you to configure the machine for the right amount of memory and the drives that are installed, and also contains a routine to park the heads on the hard disk.

This routine, which is normally found in a separate SETUP program, is much better suited to being built into the BIOS and callable from anywhere, though the choice of key combination may interfere with other pop-up programs that also use it. One omission from the menu of options in the SETUP system is a way of turning off the SmartVu display — it always shows the current position of the heads on the hard disk. While an engineer may gain deep and meaningful pleasure from watching a stream of rapidly changing numbers, I don't, and soon resorted to a piece of black tape to stop my eyes constantly wandering from the screen to the green display.

Software

Dell won't generally be supplying CGA machines — you receive an EGA or mono system with a monitor. Almost all software that works with a colour monitor can be installed for use with an EGA instead. For packages that can't, you will have to rely on the CGA emulation program that is supposed to make the system work like a CGA and colour monitor. This program definitely works — with Flight Simulator, for example — but it isn't foolproof. Some games I tried insisted on trying to write directly to the memory in the place that it would be found on a CGA card, resulting in a blank screen and my having to reboot. Admittedly, most business software is better behaved than this and should work properly. If you do find problems, a real CGA card and monitor is available, though Dell's prices may not be so good because the company won't be supplying in volume.

'. . . if Dell can overcome the British prejudices and confusing legislation about mail-order purchases, the company seems set to make a killing.'

Apart from some problems with the CGA emulation, all my software ran perfectly. Having a very fast hard disk is a pleasure. Drain, the public domain program that makes your computer sound like a washing machine, worked fine. True, making your computer sound like a washing machine is a strange thing to want to do, but it does test the timer circuitry, as this is how the sound effects are made.

Procomm, a communications package which makes extensive use of the BIOS, worked fine; but Burger Time, an arcade game, didn't.

Putting the EGA into 43-line mode from the DOS prompt, via a public domain utility called EGA43, worked fine. What's more, DOS gave me a full 43 lines onscreen before scrolling. Some machines, though I don't know why, will still scroll after 25 lines and leave the bottom half of the screen blank.

Copywrite, a naughty program that lets you copy — sorry, back up — protected software and accesses the floppy disk controller chips directly, had no problems.

Documentation

The 286[12] was supplied with Microsoft's MS-DOS and GW-Basic manuals. A spiral-bound manual produced by Dell explains how to unpack the machine and set it up, and plug in cards. The VEGA card, and the DIO card that contains the serial and parallel interfaces, were accompanied by a slim manual explaining installation and DIP switches.

Technical information, including details on Dell's BIOS, the SmartVu, and the way that speeds are changed, was sorely missed, though a proper *Technical Reference Guide* will be available later this summer at additional cost.

Conclusion

I like this machine. It has a fast processor, with a hard disk to match. It has a higher specification than just about any standard machine, with two serial ports and 1Mbyte of RAM as well as a parallel printer port and an EGA card/monitor.

My only query concerns the ability of the EGA card to cope with some of the non-standard ways in which software tries to program the CGA card. If you plan to use a certain piece of software on the machine, you'd be advised to check with Dell that it is known to work.

A complete system costs approximately £2400, when VAT is added. It's not cheap in the same way that an Amstrad is cheap, but if you want value then you've found it. For the money, it's unbeatable. END

How to order

No dealers will be stocking the Dell machines — you have to order by phone. You describe the configuration you want, and will be told the price and a delivery date. Delivery will be within a week, by courier to your door. You will normally have to unpack and set up the machine yourself, though Dell can do it for you — for an extra charge.

The number to call is Bracknell (0344) 863423. There will be a Freephone 0800 number, BT permitting.

Benchmarks

All using supplied GW-Basic and running at 12MHz. No 80287.

Intmath	1.1 secs
Realmath	1.4 secs
Triglog	9.7 secs
Textscrn	41.0 secs
Grafscrn	7.0 secs
Store	(hard disk) 3.0 secs
	(floppy) 9.0 secs

For a full explanation of the PCW Benchmarks, see the December 1986 issue, page 164.

In perspective

There is no shortage of people who will sell you a cheap-ish AT clone. Built into the price, though, is the dealer's assumption that he will probably have to deliver the system personally, set it up and train someone how to use it.

Now that so many businesses have at least one PC, Dell is aiming at the company which already knows how to open a box and doesn't want to pay someone to do it for them.

British people have never liked buying computers mail-order, though the Sinclair ones weren't really business machines — despite what Sir Clive asked you to believe.

Dell's machines definitely *are* aimed at businesses and, if the company can adhere to delivery times and get to know its customers over the phone as well as a dealer gets to know someone who walks into his shop, these machines will do well.

To help you defeat the taxman

and destroy the aliens,

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For a limited period, the Atari 520 STM is even more of a knockout than usual.

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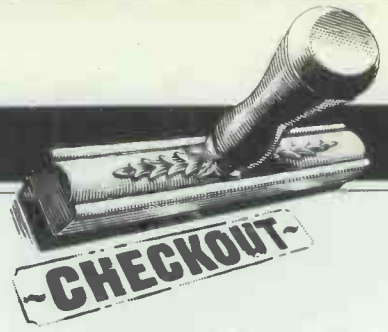
*Offer includes mono monitor. The 520STM plugs into a standard colour T.V.



Intel Inboard 386/AT

The Intel Inboard 386/AT and the Orchid Jet 386 are 32-bit accelerator boards which enable the PC/AT to run 80386 software, and allow 80286 software to run at greatly improved speeds. Peter Jackson examines the approaches taken by both manufacturers in the design and implementation of these boards.

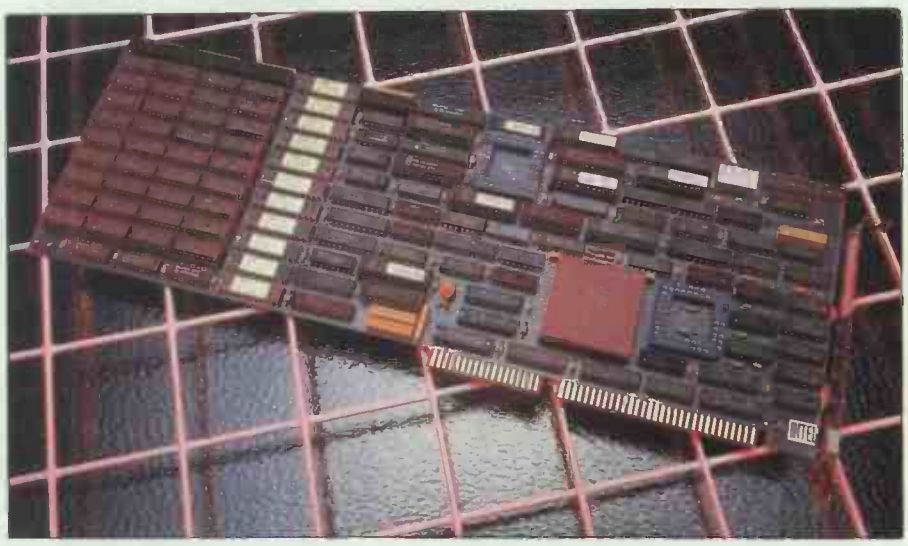
As the pace of 32-bit PC launches continues to accelerate, the pace of the old 8-bit PCs and 16-bit ATs starts to look a little worse than sluggish. And just as plug-in accelerator boards emerged to upgrade the PC's old 8088 engine with a fast 8086 or even an AT-compatible 80286 processor, the appearance of 32-bit accelerators for the AT was just a matter of time.

These boards offer better performance now, just as their 80286 predecessors did. But they also hold out the promise of running the forthcoming OS/2 — and running it rather better than an 80286-based AT — as well as supporting the inevitable 32-bit operating systems that are concealed even deeper in the mists of the future. With, of course, the advantage that this is all possible without throwing away an expensive AT and buying an even more expensive 80386 machine from Compaq, RML or Apricot.

Design problems

The problems faced by the designers of both the Intel Inboard 386/AT and the Orchid Jet 386 were identical, and all caused by the quirks of the 80386 chip itself combined with the quirks of the IBM PC architecture.

The memory interface is the most crucial part of the design, since the performance of any microprocessor depends on how much information it can get from memory in one go, and how quickly it can get it. The 32-bit 80386 can accept data from RAM in 32-bit batches; while the 16-bit 80286, reasonably enough, accepts it 16 bits at a time. So if an 80386 replaces an 80286 in a computer system, and uses the 16-bit RAM of the older processor, the 80386 needs two memory accesses to get 32 bits to work on and is crippled in performance from the start by the extra 'wait states' involved.



Worse, if part of that 16-bit RAM is on an expansion board rather than the motherboard, another slice of slowdown is inserted. And even worse still, it turns out that the 80386 is actually *slower* than the 80286 in using the same 16-bit memory.

In systems built from scratch around the 80386, like the Compaq DeskPro 386 or the similar machines from Zenith, Kaypro and Apricot, this is avoided by putting the processor and RAM on their own separate, fast 32-bit bus so that memory transfers run at full speed.

With that in mind, the 80386 board makers need to put as much performance enhancement aids on their boards as they can, to avoid disappointing customers who expect full-throttle 32-bit performance.

Intel Inboard 386/AT

The obvious solution to the memory speed problem is to include a slab of fast 32-bit RAM on the accelerator board, and that is what Intel has done on the Inboard. A megabyte's worth of 120ns or faster 256kbit RAM chips can be plugged into sockets on the board, and a separate piggyback board is available to provide up to 2Mbytes more. However, because of the 32-bit organisation of the RAM, the entire megabyte needs to be added to the Inboard in one go.

The Inboard RAM can be used in three ways. First, it can be ordinary 'extended memory', a linear lump of memory extending above the 1Mbyte addressing range of MS-DOS. Second, it can be used as Lotus-Intel-Microsoft (LIM) 'expanded memory', which makes banks of extra RAM above the 1Mbyte line available to programs written to the LIM specifications. And third, it can be used as 'conventional memory' to fill up the RAM capacity to the 640k maximum recognised by MS-DOS. There must be a minimum 256k RAM on the AT motherboard, but the Inboard can provide the rest of the memory needed to get to 640k. And even if there is already 640k on the AT motherboard, the Inboard RAM can be used to provide all the conven-

Orchid Jet 386

Like the Inboard, the Jet 386 is an accelerator aimed at speeding up existing ATs; and also like the Inboard it includes its own 64k of fast cache RAM — actually using Inmos 55ns 16kbit static chips — to speed up memory and disk accesses.

Apart from those similarities, the design is very different. The Jet 386 does not try to mimic the 80286 in the 80386 at all, but provides a socket to take the 80286 chip itself when it is removed from the AT motherboard. Combined with a second crystal on the Jet to provide the 6MHz frequency needed by the 80286, this makes the Jet look precisely like a 6MHz AT for software that actually requires it.

And of course, on late-model ATs with 6MHz speed checking in the ROMs, this makes it possible to fool the test and install the Jet successfully in those machines.

Switching between the 80386 and the 80286 can be done physically by flicking a switch on the Jet's back panel, or in software. More, this means that an 80287 installed on the AT motherboard can be used if required; the Inboard will not allow this. Like Intel, Orchid provides a socket to take an 80387 processor and an optional 80287 module to fill this socket until the 80386 becomes more common and cheaper.

There is no room for RAM on the Jet, although there is a piggyback connector that will take a board with up to 8Mbytes of 32-bit RAM. Up to 4Mbytes of total RAM can be cached, so both conventional and extended memory can benefit from the advantages of cache speed. On top of that, Orchid provides disk cacheing software to accelerate that part of the system when the Jet is installed.

Installation, as with the Inboard, involves removing the 80286 from the AT, plugging in an L-shaped adaptor card — a much better solution for old ATs with a half-hidden processor — and then running two cables from the adaptor to the Jet. The Jet must be installed in Slot 8, the slot nearest the processor and the hard disk drive, since the cables are too short for it to go anywhere else. The AT disk controller board, normally in Slot 8, must be moved to Slot 6 and the cables rearranged to suit the new configuration.

Orchid provides a levering tool to extract the 80286, and although this is nowhere near as sophisticated as Intel's gadget, it still seems to work. If no 80287 is to be used, Orchid provides a bulky and hard-to-fit noise suppressor module to go in the empty 80287 socket in the AT.

The software that comes with the board includes a single driver, JET386.SYS, and a JET.COM program. As with the Intel software, JET386.SYS is installed as an MS-DOS driver in the CONFIG.SYS file, but does not allow keyboard speed-switching. Speed is changed by typing JET ON or JET OFF at the MS-DOS prompt, or by flicking the back panel switch; options to the JET command allow the cacheing to be turned on or off.

As with the Inboard, everything ran with no problems. The Lotus 1-2-3 macro took, this time, 31 seconds, slightly slower than the Inboard thanks to the use of slower motherboard RAM rather than fast 32-bit RAM. But the speed difference is not that significant, showing that the 256k of motherboard RAM used by the Inboard does slow things down.

The lack of keyboard speed-switching, and its replacement by a physical switch, is less convenient but the disk cache software is a nice extra to have. The Orchid Jet 386 is another solid enhancement product that may not have the sophisticated memory management options of the Inboard, but that almost matches its performance and is cheaper.

tional memory above 256k; obviously, using 32-bit memory for conventional RAM speeds things up even further.

Various combinations of these memory types can be set using different switch settings on the board, splitting the 1Mbyte RAM space between conventional, expanded and extended memory as required. For now, extended memory is only useful for RAM disks, Xenix and for a few odd applications, so most users will want to use the conventional RAM option for extra speed and use the rest as either LIM expanded memory or a RAM disk.

Besides this main RAM — which is not compulsory, but strongly recommended — Intel also provides a separate 64k block of very fast cache RAM that uses expensive 45ns chips and sits between the processor and main memory. Cache RAM is now often used to speed up disk performance, by storing the most-often-used disk data in the cache rather than on the physical disk. Then, whenever the processor wants that data, it can get it straight from the fast cache rather than from the relatively slow hard disk.

Intel has taken this further by cacheing its fast 32-bit RAM with even faster RAM. The most often-used sectors of RAM are stored in the cache, changing dynamically as the RAM contents and the processor's needs change, to speed up memory access still more and squeeze even more speed out of the 80386.

The rest of the Inboard is conventional by accelerator board standards. There are two big sockets on the board: one to take the cable linking the board with the 80286 socket on the AT motherboard; and the other to accept the 80387 maths co-processor. Given the current shortage of 80387 chips, and their high price, Intel is offering a module that plugs into this socket but uses the cheaper 80287 maths chip instead.

Installation too is straightforward by accelerator standards, although Intel recommends that users get the dealer to install the Inboard to avoid a potentially expensive disaster. The procedure is to unplug the 80286 from the AT motherboard, plug the Inboard connector cable into the newly empty socket, and connect the other end of the cable into the appropriate socket on the Inboard. Then the Inboard goes into a spare 16-bit slot in the AT's expansion bus array, and that's just about it. A noise suppressor module is provided to plug into the 80287 socket on the AT motherboard, but when this is omitted the Inboard still seems to work satisfactorily. A new plug-in 16-MHz crystal is provided to boost the speed of the AT to 8MHz if required, replacing the 12MHz crystal in the older 6MHz ATs. This is essential for the Inboard to work, which prompts questions about its compatibility with the later-model 6MHz IBM ATs. These included a ROM-based speed test which refused to boot the machine if it was running faster than 6MHz, and this was done specifically to stop people plugging in faster crystals. Intel fails to mention this issue at all.

On the review machine, installation was not quite as smooth as it should have been. First, it was an old-model 6MHz AT, with the old 512k motherboard where the 80286 chip is partly concealed by the hard disk drive and its cabling. However, the Intel manual explains clearly how to release the hard disk and slide it out of the case slightly to gain access to the chip. Second, the 80286 resisted removal despite the use of the ingenious screw-driven extraction tool provided with every Inboard, and required a lot of juggling and wriggling before it would come out.

Separate clip-on cable and installation kits are available for those AT clones which have surface-mounted 80286 chips rather than socketed ones, like the Compaq DeskPro 286 and the Tandy 3000. But there is nothing that Intel can do about machines like the Epson AX, where the 80286 is too far from the expansion slots; or the Olivetti M28, where the processor is actually on the underside of the main circuit board, the opposite side from the slots.

Installing the Intel software is also

straightforward. If the Inboard RAM is to be used for conventional memory, the AT's Setup program from the IBM diagnostics disk needs to be run to tell the system how much conventional memory there is, and how much extended memory. Then, Intel's SPEED.COM, SPEED.SYS, IEMM386.SYS, EMM.SYS, INVOC-.SYS, QUIKMEM2.SYS, EGA.EXE and CHKOP.EXE are copied from the Inboard floppy into the root directory of the AT hard disk.

SPEED.COM is a program that runs from the MS-DOS prompt, and is used to switch between the Inboard's four speed modes. Mode 1, the slowest, runs the 80386 at the system board's new 8MHz speed, with the 64k cache disabled. Mode 2 runs at 8MHz but enables the cache; Mode 3 runs at 16MHz without the cache; and Mode 4 runs at top 16MHz speed with the cache enabled.

Intel claims that most users will only use two speeds: mode 1 to handle speed-sensitive software or to boot software with certain copy-protection mechanisms; and mode 4 to obtain the real speed benefits of the 80386.

SPEED.SYS is the alternative way of speed-switching, and makes it possible to switch between the four modes using keyboard combinations. Once SPEED.SYS has been installed as a device driver — by including the line DEVICE-SPEED.SYS in the CONFIG.SYS file in the root directory — holding down the Left Shift-Ctrl-Alt key combination and pressing the key 1, 2, 3 or 4 changes the board into one of the four speed modes. This is useful for copy-protected software like Framework II, which must be booted at 8MHz but which can be run at full speed by switching modes while the software is running.

IEMM386.SYS and EMM.SYS are expanded memory drivers: the first to emulate Lotus-Intel-Microsoft expanded memory in the Inboard's extended memory; and the second to allow Above Board-style expanded memory boards to work with the Inboard installed.

When the software has been installed, the machine acts as a superfast AT. All the software tested ran well in all four speed modes, including word processors like Word Perfect, spreadsheets like Lotus 1-2-3, databases like dBaseIII and Powerbase, and integrated packages like Open Access and the Smart Suite. It all ran faster too, although it is hard to compare processor-bound applications like 1-2-3 with keyboard and disk-bound programs like Word Perfect.

Intel includes extra compatibility notes in an addendum to the manual, and there are some things worth mentioning: for example, despite the manual and publicity the Inboard will not work at all in Compaq Portables, and an IBM EGA card will not work in a Compaq DeskPro 286 when the Inboard is installed. The other problems that are known about include old versions of the Crosstalk XVI communications package, which is speed-sensitive and needs patching to work. Both Intel and Crosstalk Communications will provide patches.

Running a typical program like Lotus 1-2-3, with a complex macro that copies, deletes, moves and recalculates large lumps of a big 500 × 500 spreadsheet model, shows the type of performance improvement that can be expected. On an ordinary 4.77MHz PC, even with an 8087 maths processor installed, the macro takes 2 minutes 45 seconds. On an ordinary 6MHz AT, it takes 53 seconds, while it takes 26 seconds on the 12MHz Compaq Portable III with its fast RAM. On the Intel Inboard, at the fastest mode 4 speed, the same macro took 23 seconds; but at the slowest mode 1 speed it took an extraordinary 96 seconds, not even twice as fast as the 8087-enhanced old PC and worse than an old 6MHz AT. Both of these tests used fast Inboard RAM to fill up conventional memory between 256k and 640k, and used 256k of the memory remaining as Above Board expanded memory.

The Inboard tries hard to do everything as right as it can, considering the design problems of putting a 32-bit processor into a 16-bit machine. For those who want fast performance now, a really quick 12MHz AT like the Compaq Portable III will do the job as well as the Inboard, but at a much greater price and without the prospect of sophisticated 32-bit software to come.

As a combination of speed enhancement now, and 80386 software compatibility for the future, the Inboard 386/AT is a solid piece of work.

Benchmarks

The BasicA Benchmark timings may be surprising: the two 80836 boards are both *slower* than the 6MHz 80286 that they replace in running the BasicA programs.

The reasons for this have already been presented here. When it comes to using conventional AT memory,, an 80386 is slower than an 80286 whatever the clock speed the processor is running at. And even though the Benchmarks were run with the Inboard providing 384k of conventional memory, and both boards had their cache RAM enabled, BasicA runs in the bottom, slow 64k of RAM on the AT motherboard. It is the vital processor/memory bandwidth that gives the 80386 a lot of its speed, and software that only uses conventional memory on the AT is not going to go any faster with an accelerator board.

The Lotus 1-2-3 test, on the other hand, uses the Inboard's fast RAM and the cache on both boards to enhance performance. And that is perhaps a better real-life measure of speed than Basic Benchmarks.

Conclusion

Both boards do what they are designed to do: speed up AT performance by a factor of around two, using existing disk drives and peripherals. The use of cacheing, more and more common these days, conceals the slowness of the AT's 16-bit RAM and the relatively slow hard disk performance compared with the ESDI drives on the Compaq DeskPro 386.

But the real benefit of boosting an AT will be found when the piggyback RAM boards are installed, and the boards are running 80386 control software like PC-MOS/386 or Merge 386 which allow multiple Unix and MS-DOS tasks to be run separately and independently. And then there are the forthcoming 80386-specific applications like Q&A 386 from Symantec and Paradox 386 from Ansa, not to mention semi-80386 operating systems like Concurrent DOS 386.

It is this software that will, in the end, make it worthwhile to have an 80386 rather than an 80286. And an Inboard or a Jet 386 is a good way to get into the 80386 business for the minimum possible outlay.

The Intel Inboard 386/AT costs £1695 (excl VAT); the Orchid Jet 386 costs £999 (excl VAT). Intel is on (0793) 488388; Orchid is on (0256) 479898.

Benchmark timings

Inboard 386/AT	
Intmath	4.3secs
Realmath	4.1secs
Triglog	43.2secs
Textscrn	37.0secs
Grafscrn	—
Store	3.7secs
Orchid Jet 386	
Intmath	5.8secs
Realmath	5.4secs
Triglog	59.6secs
Textscrn	48.7secs
Grafscrn	—
Store	5.1secs

For a full explanation of the PCW Benchmarks, see the December 1986 issue, page 164.

A laser printer for the cost of a daisy wheel?

Imagine the superb results and versatility that a laser printer offers—but at the economical price of a daisywheel printer system*.

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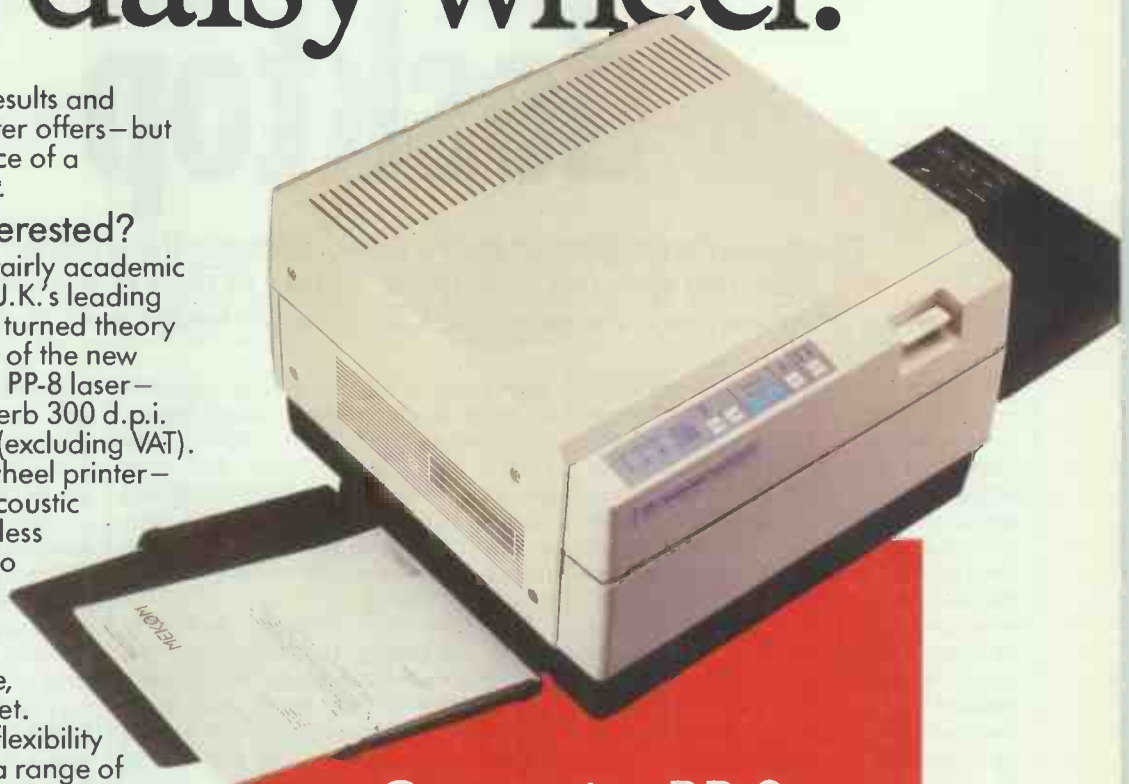

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† Centronics PP-8 base model with 256K RAM. Model illustrated shows optional plug-in font card. (Retail Price £100 each).
*Typical Daisywheel system including Daisywheel Printer, Acoustic Hood and Sheet Feeder.

A Cray on every desktop

The supercomputers of today could become the desktop machines of tomorrow as the prohibitive factors in their development and manufacture are overcome. Nick Hampshire looks at what the future holds.

Are there any limits to the potential power of personal computers? They have been in existence for barely ten years, but during that period the processing power and memory of personal computers has grown at a phenomenal rate. This growth in processing power and memory capacity has resulted in an increasing convergence between the capabilities of the personal computer and the multi-user mainframe. Indeed the new generation of personal computers are now starting to pose a serious competitive threat to mini and super-mini computers. Will their power continue to increase to a level where they would pose a similar threat to the most powerful of today's computer, the so-called supercomputers?

Some of the most powerful computers in existence today are machines like the Cray 2 or the Cyber 205 which are capable of performing at speeds which are ten thousand times that of the most powerful personal computer. However, if this article had been written ten years ago, then the most powerful machines would have had only a few hundred times the power of an 80386 desktop. Going back a further ten years to 1967, and a mainframe had not much more processing power and frequently far less memory than is possessed by an 80386-based personal computer.

The fact that the power of personal computers has developed so rapidly in just ten years would lead to a superficial conclusion that this rate of development will continue over the next decade. If this happens then it is very likely that personal computers could be produced with the power of a Cray 2 and a price tag comparable to a current top-range PC.

The great reductions in the cost of computing power has been almost exclusively produced by the massive amount of electronic circuitry which can now be condensed onto a single silicon chip. The greater the complexity of circuitry which is contained on a single chip, then either the lower the cost or the more powerful the resulting machine, frequently a combination of both.

However, semiconductor technology is beginning to encounter fundamental physical limits in the continual drive to put more and more circuitry on a single chip. This means that over the next decade the rate of increase in power of low-cost minimal chip count personal computers will slow down very considerably. The driving force behind the technological development of the personal computer market will no longer be the semiconductor industry; it will instead be computer science. Rapid developments in computer science are bringing new computer architectures, new forms of computer software, and new types of man/machine interface. It is these developments which will put the affordable personal supercomputer in the offices, factories and laboratories of the world.

Necessity

Supercomputers like the Cray 2, and very large mainframes like the Amdahl 580 series, are very expensive — $10 million plus, and also relatively uncommon — only a few hundred machines in the whole world. This combination of scarcity and high cost has meant that such machines have usually been acquired for very specific purposes: a considerable proportion of the world's supercomputers are employed in weather forecasting. Scientific researchers, particularly those involved in high energy and nuclear physics are users of such machines. Probably the largest users are the military, particularly in the US where they are applied, among other things, to the computationally enormous problems associated with analysing the vast quantities of data involved in missile detection and warning systems.

The small number of existing machines, most of which have dedicated applications, has meant that there is generally very little experience of using such sophisticated and very powerful hardware. There is, firstly, very little software available which fully utilises the capabilities of the machines — most users have produced bespoke packages for their own applications. There are also very few people who fully understand the complexities involved in programming such machines, particularly since there are very few programming tools available to make the programmer's task easier.

With the scarcity of high-level programming tools it is very expensive to create applications programs for supercomputers. It has been estimated that it requires over 50 man-years of work just to optimise a 100,000-line Fortran program so that it would fully utilise the power of a Cray.

The consequence of the very high cost of hardware and software development is that very few attempts have been made at using these machines for anything other than fairly straightforward number-crunching applications. This has started to change in the last few years, particularly in the use of supercomputers to generate very high-quality graphics images, and examples of these have been seen in some of the recent Hollywood science fiction film productions. However, like other users of supercomputers, film companies have large budgets

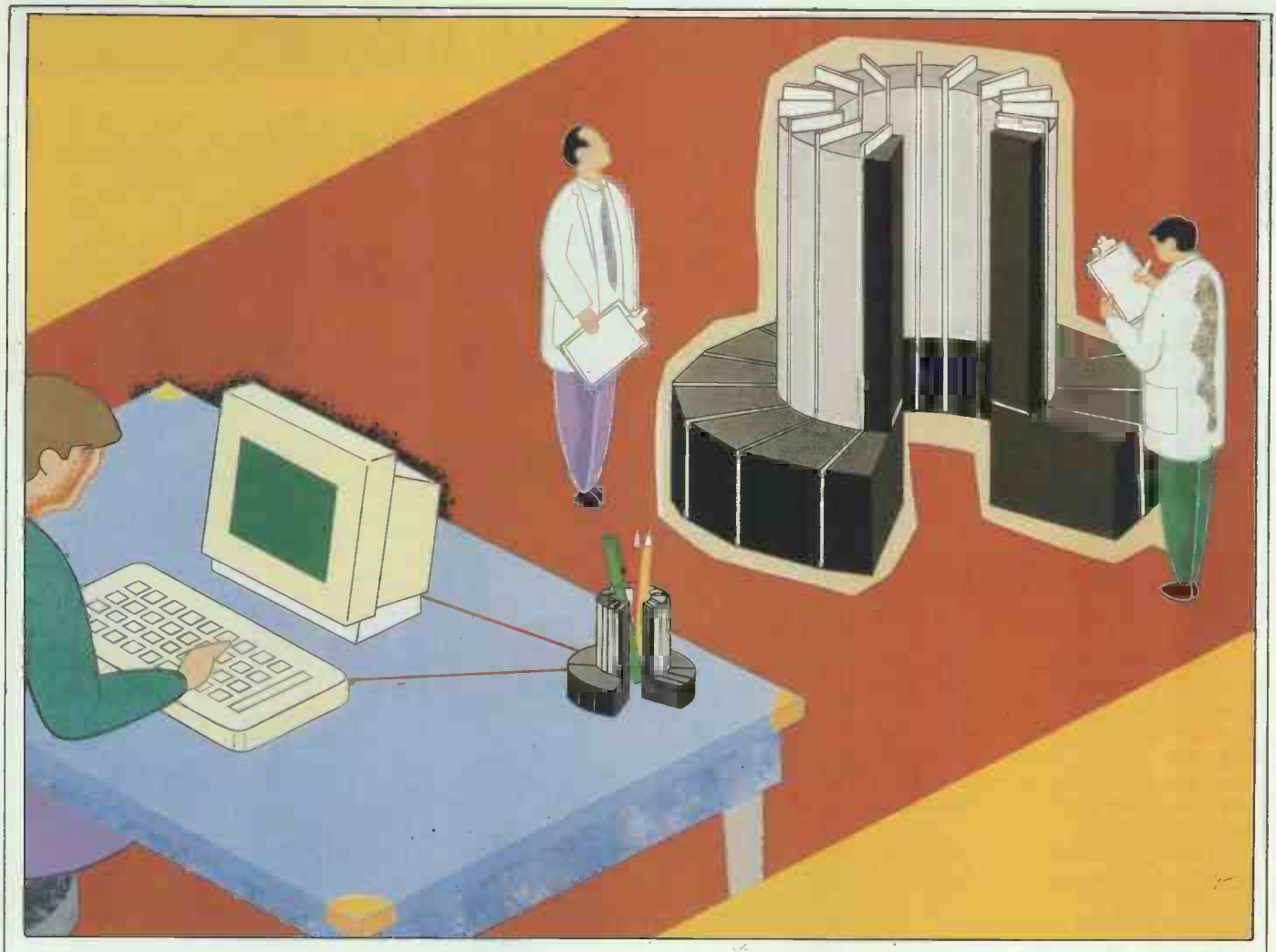


Illustration by Andy Pearson

and can, therefore, afford the investment.

If the price of supercomputing hardware was to come down to a level where it could be afforded by a large number of people as a personal machine, it is unlikely that its application would be confined to those areas where supercomputers are currently used. Of course, it would be silly to use such powerful machines for simple tasks like word processing; they will instead open up new applications for computers. Indeed, there is a fairly universal rule that the complexity of people's applications will expand in order to fully utilise the maximum power and memory capacity of the available hardware. Equally the prospect of a large software market will prompt software houses to produce and market the tools which are essential if such hardware is to be properly utilised.

The reasons why people will want to use affordable personal supercomputers is fourfold: for purely number-crunching applications such as simulations and modelling; for applications which involve very high-quality graphics outputs; for applications which will support new sophisticated man/machine interfaces such as full interactive voice I/O and natural language comprehension; and, finally, in order to support the new generations of AT software.

Differences

Mainframes, minicomputers and personal computers all use a common architecture: they are all single instruction, single data stream processors. The principle differences between a mainframe and a personal computer are speed, multi-user capability and data storage capacity. It is these three factors which account for the enormous price range from a few hundred pounds for a bottom-range PC to a few million pounds for a top-range mainframe.

The much higher processing speed of a mainframe computer is basically achieved in two ways. The electronic components used in mainframes are frequently constructed using semiconductor technologies such as ECL (Emitter Coupled Logic). These forms of semiconductor are capable of operating at speeds which are 20 or 30 times faster than the equivalent MOS (metal on silicon) semiconductors found in personal computers. The use of such high-speed semiconductors has its disadvantages; they produce large quantities of heat which means that computers constructed using ECL or similar semiconductors require very elaborate and expensive chip-cooling systems. Blowing air over the chips is totally inadequate — most mainframes pump liquid refrigerant through heat-sinks attached to each chip; this alone is a very expensive component of a mainframe computer.

Higher processing speed is also achieved by using more sophisticated architectures with techniques such as 'pipelining'. These techniques are starting to be employed on some of the most advanced personal computers. Chips like the 80386 use pipelining and the new IBM PS/2 uses high-speed data channels. The function of all of these techniques is to overcome the problem that memory access is usually far slower than the actual processor. (This means that the processor wastes a lot of time simply waiting for memory access.) Pipelining means that while the processor is performing one operation another portion of the processor is simultaneously doing the next memory access, and the processor no longer needs to wait for memory since it is already accessed and ready for the processor.

Because mainframe computers are primarily intended as multi-user machines, another very large component of the cost of such a computer is the large amount of communications circuitry involved. The multi-user environment and the nature of most applications which are run on mainframe systems also means that the machines need reasonably large amounts of core memory and very

large amounts of online disk or tape data storage. This large amount of data storage hardware is yet another contributor to the high price of mainframe systems.

However, despite the high speed and enormous data storage capacity of mainframe computers, the actual processing power and storage available to any one user is frequently little better than that of a reasonably powerful PC. This fact has been one of the prime contributors to the growing trend towards distributed processing and local area networking. One of the main justifications for the use of mainframe computers is in situations where very large databases need to be accessed and updated by a large number of separate users — for example, an airline booking system.

Applications which require raw processing power are, however, now increasingly being performed by supercomputers. These do not employ the single instruction, single data stream architecture; instead, they are either parallel processors or vector processors.

A parallel processor is constructed by adding more arithmetic operation modules into the system, so that operands may be operated on in parallel. This increases the speed at which the machine can perform calculations but it also means that certain functions have to be performed in order to achieve this high performance. These are functions like monitoring processor occupancy in order to ensure a smooth flow of the programming steps and the optimum utilisation of the processors.

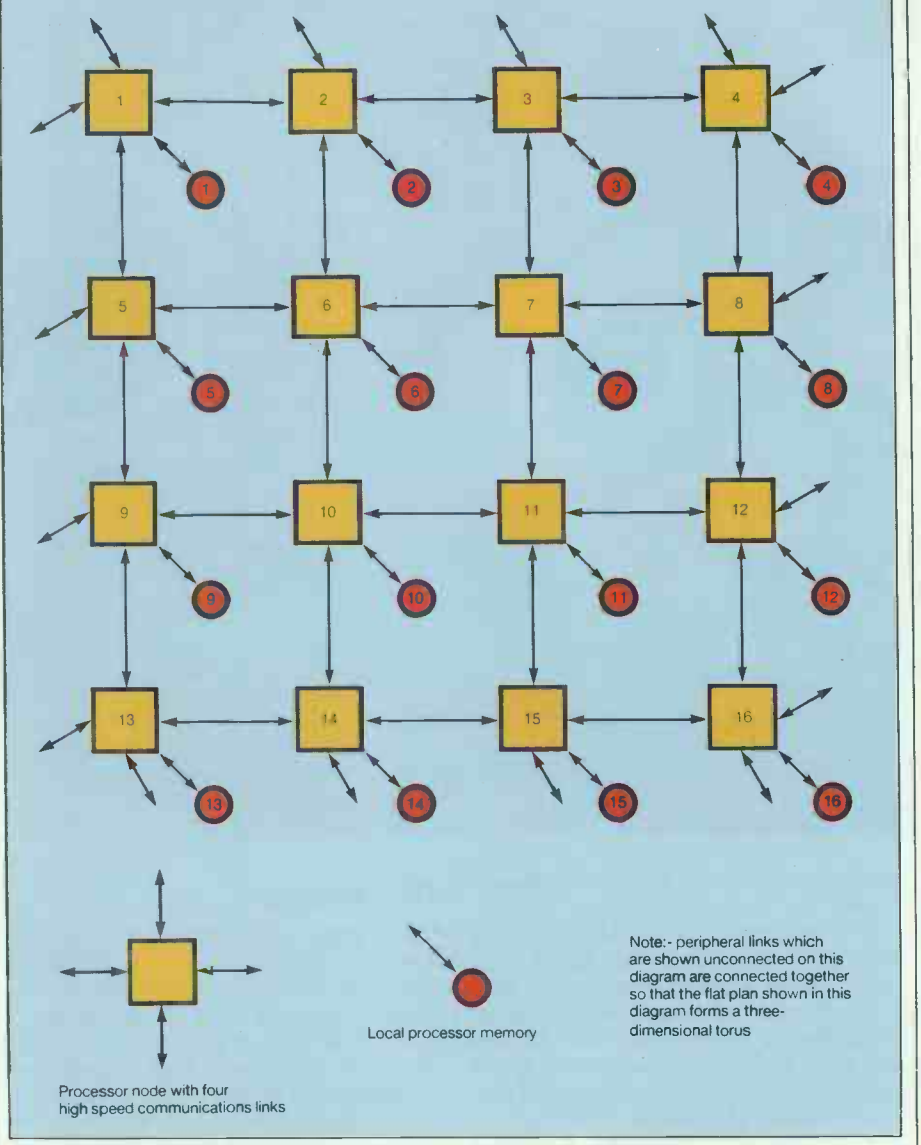
In a vector processor a single arithmetic operation module is segmented so that an instruction is carried out in a pipeline of independent steps, each step being timed by the basic processor timing cycle. Essentially vector processors are only a sophisticated variation of the architecture employed in conventional computers, from PCs to mainframes.

Older generations of supercomputers, such as the Cray 1 and the Cyber 205, are vector processors. Their very high speed is attributable not just to the vector architecture but also to the use of very high-speed semiconductor technology, and very careful attention to the construction of the machine in order to ensure that the length of connections between any two components is kept to a minimum (the longest piece of wire in a Cray 1 is 18ins long).

Newer generations of supercomputers are now being constructed using parallel processing architectures. These have the enormous advantage that the computational power of the machine is dependent on the number of processors and not necessarily on the speed of any one processor. Consequently individual processors can be constructed using low-cost conventional semiconductor technology; these do not require elaborate cooling systems, massive power supplies or ingenious construction techniques to minimise wire length.

Parallel processors are, therefore, potentially relatively cheap to build — even today it would be possible to build a parallel processor with the computational power of a $10 million Cray 2, for under £100,000 (that is, transputer-based systems). There is no reason to assume that this cost will not follow the normal downward curve as such machines become more highly integrated and the components are produced in bigger volumes. It will be parallel processors of this form which will constitute the personal supercomputer.

A typical parallel processor system



Development

A parallel computer basically consists of a two- or three-dimensional array of memories which are joined together at nodes consisting of processing elements (shown above). The interconnections between the processors with their associated memory can be fixed as a network, or in some machines is user-definable with the interconnections being made in much the same way as a telephone exchange.

One of the key components which has made powerful parallel systems possible is the development of processors like the Inmos Transputer. These processors have been especially designed to allow the easy and flexible construction of multiprocessor systems. What makes a Transputer different from conventional microprocessors is the four high-speed communications channels which are built into the proces-

sor. These allow data to be transferred between nodes in a parallel system concurrently at 10Mbytes per second per link. The chip also includes a full 32-bit floating point arithmetic unit and 4k of very high-speed static RAM. The most advanced version of the Transputer chip, the T800, is capable of performing four million full 32-bit floating point calculations per second without any external arithmetic circuitry. Individually this chip has the same power as a supermini: an array of as few as 64 gives a supercomputer with very considerable power.

Problems

The software problem posed by parallel computers is how to divide a particular task into a number of separate processes which can be performed concurrently by each of the processors in the system. All our computing experience and knowledge acquired over the last 35 years has been with sequential machines. Working with parallel computers requires entirely new techniques and methods of thinking. The clear procedural structure which lies behind every program on a sequential machine is almost impossible on a parallel machine. Each of the separate processes into which a task is divided will take different times: some processes will require data produced by other processes, some will require data from external sources — the software problem of controlling and managing a large number of interrelated processes is enormous.

The enormity of the problem is compounded by the fact that it is almost impossible for the human brain to conceptualise what is happening in such a complex system. This makes it very difficult to design and debug.

The initial techniques adopted for dealing with multi-processor systems were to simply dedicate each processor to a specific class of process. This technique is found in many existing personal computer systems, where one processor may be used to handle communications, another for the graphics display and a third as the main arithmetic processor. Similarly multi-user systems have been constructed using multiple processors, where each user is allocated his own dedicated processor rather than time-multiplexing several users' access to a single processor. This type of multi-processor system is very primitive and is certainly not what is meant by the term parallel processor, even though all the processors may be working in parallel.

In a true parallel processing system such as that shown diagrammatically on page 126, the problem of controlling all the individual processes has to a large degree now been solved. It involves the use of a host processor which is responsible for booting up the system, performing hardware monitoring, performing housekeeping functions and running the control software.

Probably the best-known piece of control software for use in parallel computer systems is Occam. This was designed by Inmos to act as a development environment for Transputer-based parallel computing systems. Occam handles the concurrency of a system and is designed to manage a number of independent processes which can run either concurrently or sequentially and communicate with each other via self-synchronising data channels. The great advantage of Occam is that it is independent of the number of processors in the system. Programs using it will work equally well using one processor or a thousand, the only difference being that with a thousand Transputers it should run nearly a thousand times faster.

'Parallel processors will enable systems to be designed with a whole new range of man/machine interfaces. Voice input is one such interface . . .'

Alice — a working parallel system

An example of a true parallel computer is 'Alice', which is an acronym for Application Language Idealised Computing Engine. It was first conceived back in the early 1980s by a team at Imperial College, London, and has come into existence thanks to the Government-sponsored Alvey initiative. This created a link between Imperial College, the University of Manchester, ICL and Plessey under 'Flagship', a £15 million project which will culminate with the construction of a 'fifth generation' computer with considerably more power than the Alice prototype.

The design of Alice is intended to overcome some of the programming limitations of both conventional computers and previous parallel computers, both in terms of speed and power as well as reducing the enormous cost and complexity of software development. Some of these limitations can be overcome by writing programs in what are known as declarative languages; Alice is specifically designed to run declarative languages.

Alice is a parallel processor built around the Inmos Transputer. In its present form Alice has 16 processing elements, each processing element consisting of five Transputer chips and 128k of memory. Memory consists of 16 storage elements, each element having a controlling transputer and 2Mbytes of RAM. The processors are connected with the storage elements by a sophisticated electronic switching network, which operates like a telephone exchange and allows any processor to access any storage element. The whole machine is front-ended by an ICL 2900 mainframe computer which performs all the I/O, file-handling and system monitoring. Even restricted to these simple tasks, the 2900 could be the bottleneck in the system.

In operation the data on which the program is operating is divided into small blocks and distributed through the various storage elements. These blocks of data with their associated control information form what are known as the 'packet pool' — each piece of data being a packet. All the processors are continually accessing this pool looking for data on which to operate. When a processor finds data on which it can operate it removes it from the pool and processes it, an operation which is referred to as a 'reduction'. Having completed this reduction, the packet is returned to the pool in its rewritten form and the processor looks for another packet on which it can operate.

The way Alice operates means that so long as there is data available within the packet pool then all the processors will be operating in full parallel. Obviously the operating system software and high-level languages employed by this kind of machine are very sophisticated. The machine utilises Occam to perform control of process concurrency, and is already running a high-level language called 'Hope' which was first developed by Edinburgh University and which makes full use of the machine's power.

Advanced software

The development over the last few years of declarative and other non-procedural programming techniques for use on parallel processing systems, is opening up whole new areas of potential computer applications. Foremost among these is the area of artificial intelligence and the associated improvements in the man/machine interface; these are things like voice input, natural language comprehension and machine vision.

Declarative languages are designed to be structurally transparent to the user; this means that they can be verified and optimised mechanistically. They are also designed to divide a problem into a large number of sub-problems; and it is this feature which facilitates their use in parallel computers which employ multiple instruction and multiple data parallelism. A declarative language achieves these goals by separating the task that the

program is to perform from the way that the computer performs that task. Declarative programs do not, therefore, specify the flow of control within the program, just the flow of data. A well-known first generation declarative language is Prolog.

These concepts are mainly being used in artificial intelligence systems, foremost among which are the so-called 'expert systems'. These programs use declarative techniques to separate 'knowledge' from 'control' and are used to encapsulate human problem-solving techniques in specific problem areas. The 'knowledge' which such programs contain is derived from a human expert and stored as a set of rules; the structure of the expertise inherent within these expert systems is very loose and can in no way be regarded as having the kind of strict procedural flow found in conventional programs. As such they are ideal candidates for parallel processors since expert systems are easily divided into a large number of small components whose main connection with each other is via a database.

The advent of small personal parallel supercomputers will increase the power and versatility of such systems to a level where the designers can start to incorporate such features as 'common sense reasoning', which is currently impossible because of machine speed and size limitations. Systems of this power will offer users levels of intellectual and skill amplification as well as expertise encapsulation and dissemination, which will show the true potential of expert system and artificial intelligence technology.

Parallel processors will enable systems to be designed with a whole new range of man/machine interfaces. Voice input is one such interface; the techniques are well-understood, but the current range of hardware is just too slow to be able to handle the search techniques necessary for real-time comprehension of speaker-independent continuous speech.

Pattern recognition problems such as this are ideal for parallel processors where each processor can perform a search on a limited part of a very large database.

Researchers at IBM are already starting to follow this route and have demonstrated a practical voice recognition system which has a vocabulary of 20,000 words. It uses an IBM PC RT as the host processor with a parallel array of eight very high-speed processors which perform the actual recognition. However, even this very powerful system is only able to recognise real-time speech from a single individual.

The problems associated with machine vision are very similar to those for voice recognition, only far more complex.

Experimental parallel processor systems have already shown that in limited and controlled conditions it is possible to build practical image recognition devices. However, general-purpose machine vision systems are very unlikely within the forseeable future; the computational problems are too large for even the largest parallel system. The personal parallel computer will prove very useful in image analysis; these are applications like the analysis of satellite images, or photomicrographs. These much more powerful machines will make such analysis far quicker and also allow a greater range of tests to be performed on the image than is currently possible.

'Natural language comprehension is another area where parallel processors will have a considerable impact . . . progress has been limited by . . . computer power.'

Natural language comprehension is another area where parallel processors will have a considerable impact. Natural language comprehension is the ability of a machine to recognise commands and other inputs which are given in the normal linguistic terms which we use to converse with each other, rather than the very formal command syntax currently used for computer input. The basic techniques are already quite well understood but, as with voice input and image recognition, progress has been limited by restrictions on available computer power.

It is, therefore, quite likely that once parallel computer systems with a reasonable power and at a relatively low price start being commercially produced in volume, they will be accompanied by the new generation of man/machine interfaces. These will remove most of the psychological barriers which many people feel when using computers. Communicating with computers will become virtually identical to communicating with other people.

Besides the more exotic applications which are currently impossible on existing serial computer systems, parallel processors will also offer users the facility to greatly expand the power of existing applications: the use of computers for modelling complex systems, such as engineering structures, chemical processes, design simulations and financial and economic systems. These are all applications which currently require a mainframe computer to run on. Given a high-powered personal parallel supercomputer, the users of these types of applications programs will be able to make much greater use of them since they will be freed from the constraints of limited machine time.

Another computationally very intensive process is the graphics generation for CAD, desktop publishing and real-time graphics simulations. These are all applications which are currently severely limited by available processor power. Many are only possible by making a frequently undesirable concession that limited processing power necessitates a long processing time. As with modelling, long delays in producing images inhibits the user from being more adventurous with his use of the system. Parallel processing techniques are already being applied in this area — plug-in Inmos Transputer boards have been used to create small but very powerful parallel processor systems which run with an IBM PC host with a very high-resolution graphics card to generate high-quality images. This type of system has been applied to the generation of computer images for animated films and advertising graphics.

The future

Parallel processing supercomputers, and the software which is necessary to make full use of them, are under development in many universities and computer companies around the world. At the top of the market there are already products like the Computing Surface from Meiko whose arrays of transputers can rival a Cray 1. At the bottom end of the market come self-assembly systems which use Inmos's IMS-B003-1 cards and plug into a PC.

Personal supercomputers are at a very early stage of their development, but as more people gain experience in using such systems and developing software for them, so the price will come down and the hardware become more readily available. Personal supercomputers are at a stage in their development now which is very similar to that of personal computers ten years ago: the next ten years are likely to see great advances in this area.

Technical author Nick Hampshire has edited three magazines and written numerous articles. He has just started working for Intelligent Systems International on documentation for its new product. END

Canon technology has set the industry standard for laser beam printers throughout the world and the introduction of the compact new LBP-8 Mark II heralds a new generation of technical excellence and sophistication. Lighter and smaller it might be, but its performance is enough to make most of its established rivals look decidedly flat-footed. Even though they charge more for the pleasure. And the LBP-8 Mark II is aptly named, because so many of its features have been advanced twofold. Just look at the repertoire: **Twice The Paper Capacity** The LBP-8 Mark II paper cassette has a capacity of 200 sheets. So you waste less time re-loading. It can handle varying weights from 60 to 135 gsm, plus envelopes, and there are face-up and face-down modes for easy collating. **Twice The Fonts** The LBP-8 Mark II can mix 32 different fonts and 64 shading patterns on a single page. It has 8 resident fonts. But, if you want to be more creative, there is an expanding library of slot-in cartridges which will soon give you access to more than 100 type styles and point sizes. **Twice The Memory** The LBP-8 Mark II has a built-in memory of 512K for better graphics and font downloading. For full page graphics the memory is expandable to 1.5 MB. **Twice The Emulations** The LBP-8 Mark II has the ability to emulate just about any of the most popular printer brands currently in service. And that means it can use the software they use. **Twice The Life** The LBP-8 Mark II will go on running for 300,000 pages before it needs a major overhaul. And its unique maintenance-free toner cartridge will print 4,000 pages before it has to be replaced. A simple 30-sec job.

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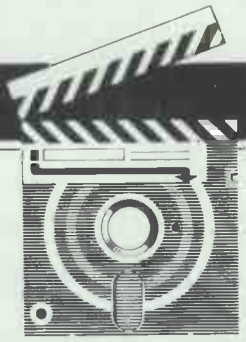


SCREENTEST

Graphicworks

From humble beginnings as a comic-book graphics program for the Macintosh, Mike Saenz's Comicworks has evolved into Graphicworks, an art package with some DTP facilities. Ian McKinnell sees how the scales balance.

The Apple Macintosh was never aimed at the average computer user — it was the first computer for the visually aware. It had style. People who'd previously classed computing on the same level as train-spotting saw the bit graphics-based program, MacPaint, and were transfixed. For some people, MacPaint didn't come with the Macintosh: the Macintosh came with MacPaint.

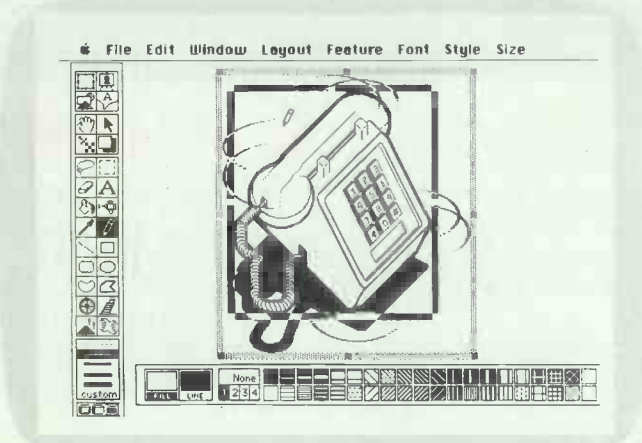
One of those people was a comic-book illustrator, Mike Saenz. Mike is an American, and in the US the words 'comic-book' have a different association. To you and me they may conjure up images of the *Beano*, Desperate Dan and the Bash Street Kids; but to an American they mean Superman, Ironman and the Incredible Hulk, and they and their ilk have a fanatical following.

Modest beginnings

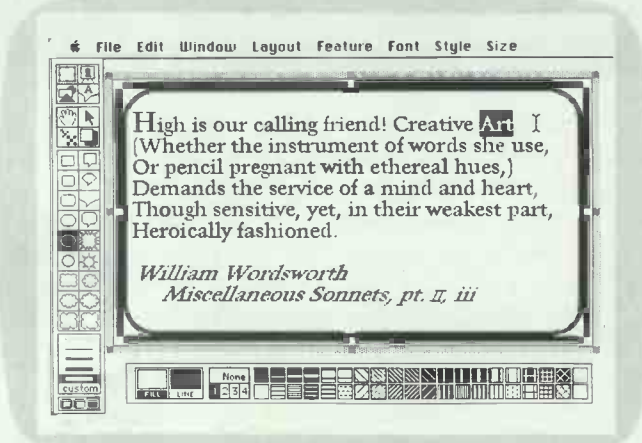
Mike was one of the first people to own a Macintosh, three and a half years ago. He took the Macintosh home and decided to draw a comic-book with it, and in retrospect this could have been called a brave decision. It could also be called lunacy, for those were the days when MacPaint was the only graphics software in town when the Macintosh came in only one flavour — 128k; and when Mike didn't even have an external disk drive. Eventually, months and months of work produced *Shatter*, published by First Comics and now a very hot collectors' item which changes hands for serious money. It was a sci-fi cops & robbers story inspired by the imagery of the film *Blade-Runner*. It was a breakthrough: the first comic-book ever to be generated on computer, and it attracted a great deal of media coverage. It was also, perhaps, the first major example of desktop publishing, an idea that also attracted a great deal of attention in the marketing departments of this world.

After such a baptism of fire, Mike was, to say the least, aware of MacPaint's limitations, and had ideas of his own about how a graphics program should work and what facilities it should have. Armed with these ideas he approached Macromind, producer of the seminal Videoworks and Musicworks programs for the Macintosh, and eventually they began work on the program that was to become Comicworks.

Comic-books consist of two items — words and pictures. In convention-



The bones of the Graphicworks system are 'panels' which contain 'easels', 'balloons' and 'graphic primitives'. In this case the panel, represented by the light grey outline, contains three easels



Text is contained within 'balloons'. As can be seen from the toolbox down the left-hand side, a wide variety of styles are available and most of these can be edited — you can also have no borders or fill patterns

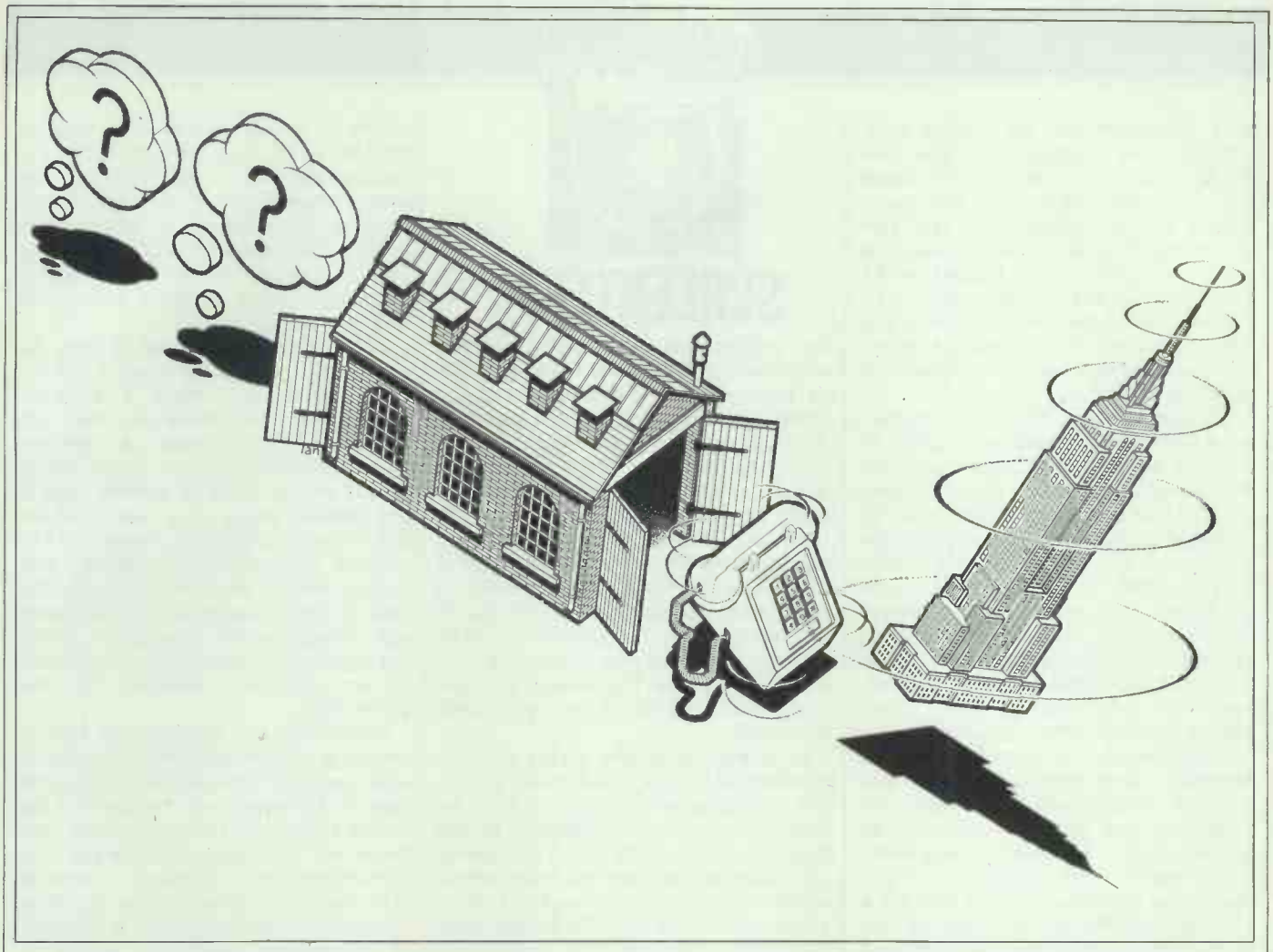


Illustration by Ian McKinnell (using Graphicworks)

al books and magazines these two elements sit together politely like strangers on a train, each in their separate compartments. In comicbooks their relationship is much more promiscuous: in fact anything goes, and so the tool needed to work with them has to be very versatile, allowing much more flexibility than MacPaint can offer with text, but not impose the straight-jacket that a program like Pagemaker demands. The result is desktop publishing, but from an illustrator's point of view.

It's difficult to take a program seriously that has the word 'comic' in the title. It makes it seem like a fun, but ultimately a frivolous package, which isn't the case — Comicworks is a serious and useful program, although it does have a fun element. The marketing men had made a blunder, for by trying to define the program too narrowly (how many Macintosh users produce comicbooks?) they were in real danger of alienating a potentially huge audience of people using the Macintosh to produce graphics. Even its relatively cheap price (£75 — and much cheaper still in the US) counted against it; after all, if it was a serious graphics tool, wouldn't you expect to pay far more? And finally, the packaging was . . . well, not the kind of thing you could leave lying around the office without being laughed at.

A package in disguise

Comicworks was originally released in the summer of 1986. The marketing men's answer to its identity problems appeared shortly after, in the form of a package called Graphicworks, 'the only graphics, text and layout tool you'll ever need'. Everything about the program had an uncanny sense of *déjà-vu*, from its packaging to the actual program. It was, of course, Comicworks in disguise. The only difference was its packaging — now much more sophisticated, with subtle duo-tones of airbrush, scalpel and technical pen, and with a completely different set of clip-art. Gone were Mike Saenz's weird and wonderful bug-eyed monsters and spaceships, their place taken by invoices, business reports and menus.

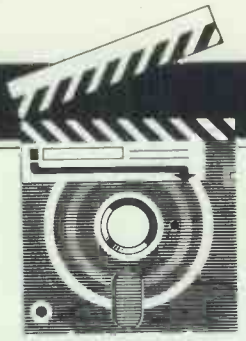
Despite its identity problems Comicworks/Graphicworks was a versatile program, and had the good fortune to be released not long after the Mac Plus was launched, when Apple had made the decision not to bundle MacPaint with the new machine. If users wanted a graphics program, they now had to make a choice and put their hand in their pocket. Comicworks/Graphicworks was not only cheaper than MacPaint, it was much more powerful and capable of far more.

But the original program also had a few problems, and the new version reviewed here, Graphicworks 1.1 (from now on referred to as Graphicworks) tries to redress these, as well as add a number of new features. It has also given the marketing men a chance to reposition the product a little more, to repackage it more conventionally, to put the price up (£99.95), and to distance it from its roots. Comicworks is still available, but only in version 1.0, at the old, cheaper price.

Graphicworks

Graphicworks is a unique program that has many original features. Although the Graphicworks desktop looks like that of most other graphics programs, following the convention of the toolbox along the left-hand side and patterns at the bottom, you soon find that Graphicworks works on a number of different principles. The biggest difference — and this can cause enormous confusion for new users — is that graphics and text cannot be placed directly onto the page.

The skeleton of Graphicworks is its system of 'panels', 'easels', 'balloons' and the new 'graphics primitives' or 'draw' tools. Unlike MacPaint, Graphicworks documents are not 'flat'. They are not all on the same level, but 'layered' — each element



SCREENTEST

of a document can be treated individually. For example, if you are working with a landscape, the trees can be drawn separately and positioned on the background, and can be changed again at any time. The basic element of a Graphicworks document is the panel, which can contain up to 64 easels (where the paint elements of the program live), balloons (where text is entered) or graphics primitives.

To begin a document in Graphicworks, it's first necessary to position a panel on the blank page (normally this panel has a thin, black outline, though this is easily altered). It is not possible to paint or type directly into this panel. For a painting it's necessary to create an 'easel' which can be of almost any size — even bigger than the panel. This easel is in effect an individual MacPaint window — all the paint tools can be used, and images cut and pasted from other easels, or from other programs.

Graphicworks is compatible with MacPaint and comes with an extremely useful desk accessory, Art Grabber+, so that images can be copied from MacPaint documents from within the program. High-resolution documents produced by a scanner (in TIFF format) can be imported into a Graphicworks easel and still retain their original resolution, although Graphicworks proved unable to open a TIFF document produced by a Dest scanner.

Impressive features

Regardless of any other pretensions, Graphicworks is first and foremost a paint, or bit-mapped graphics, program *par excellence*, offering far more facilities than any other paint program available. It has all the conventional tools that will be familiar to most Macintosh users — the lassoo, the eraser, the paintbrush, together with the small but vital features, such as trace edges — that many of the other paint programs have omitted. A considerable number of easels can be contained in a panel, and there are a number of ways for the pictures to work with each other by their 'ink' modes. For example, it is possible to have them matted so that they act as if they were a series of cut-out shapes stacked one on top of the other. But a number of other effects are available, such as 'or' which will make the image transparent, and 'xor' which reverses black and white.

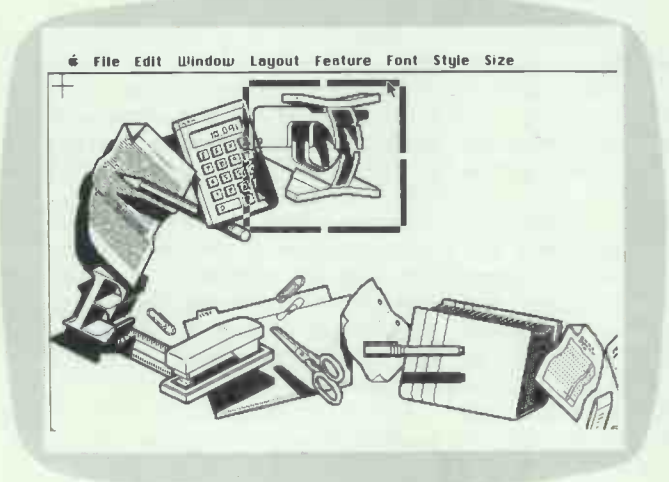
It is also possible, using a combination of image and a mask, to create an image with 'holes' in it — so that, for example, it's possible to see through a car's windows. This facility of Graphicworks can be very useful when creating effects such as drop shadows, but it is unfortunate that the Laserwriter cannot understand many of these effects and will not print them as they appear onscreen. However, any part of a Comicworks screen can be instantly transformed into paint image using the FKEY facility included in Graphicworks' system, and pasted into the easel in place of the existing images. Alternatively, the entire document can be saved as a MacPaint document, where such effects will be preserved.

This new version of Graphicworks also has new special-effects tools — perspective, skew, distort and free rotate — which will be very familiar to users of Click Art Effects, and whose absence in the original was sorely missed. Also, there are new options for working at higher than screen resolution to take full advantage of the Laserwriter, and a facility allowing colour printing using the Imagewriter II.

But I've saved the best till last. All other paint programs have a 'spray can', which is simply a stippled paint-brush. Graphicworks has an 'airbrush' which gives a random spray adjustable from 1 to 96 pixels across and of variable density, and is the nearest thing to a real airbrush this side of Quantel's Paintbox. For serious Macintosh illustrators, this feature alone can perhaps justify the cost of the package. As a paint package, Graphicworks is without doubt the most comprehensively equipped of any currently available for the Macintosh.

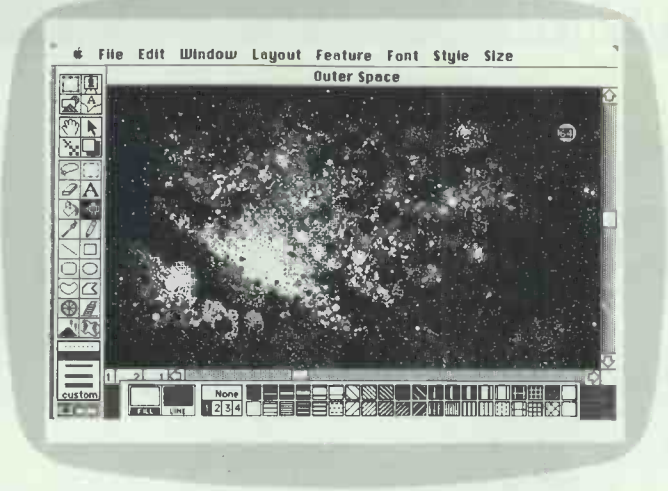
Graphicworks' approach to text is certainly unique and where its heritage becomes obvious, as the words have to be typed into 'balloons'. Like easels these can be of any size, and there are a number of different balloon styles, from 'thought' balloons like small cumulus clouds to plain rectangles. There are also a number of reshapable balloons, where a pointer can be pulled out, and all can be in a variety of line widths.

But perhaps most important of all, it is possible to have no border at all. Text can be pasted in, via the clipboard, from any word-processing program (MacWrite, for example), or entered within the program. Any or all of the entered text can be in any variation of font and style, can be changed and edited at any time, and will print at the highest resolution of the printer. Text is easily reshaped by moving one of the 'handles' that

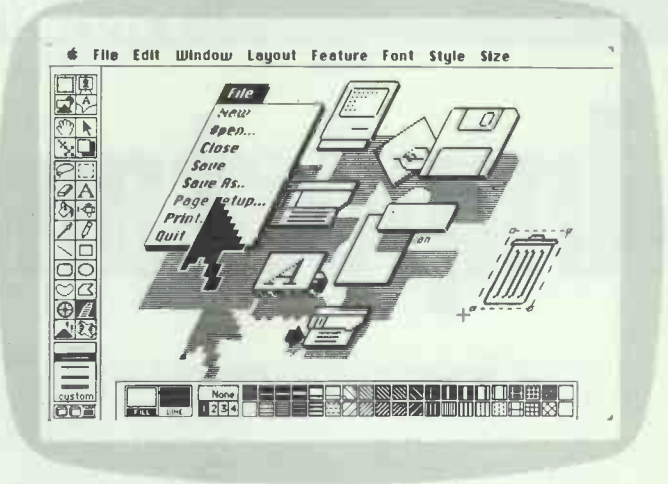


Included in Graphicworks is a separate program, Postermaker from Strider software. This takes an image and enlarges it up to 3200 per cent!

Images can all be handled separately, so that at any time an image can be picked up and its position changed, without affecting the others around it



Most paint programs have a spray-can — Graphicworks has an 'airbrush. It's the nearest thing to a real airbrush you're likely to find this side of Quantel's wonderful PaintBox



Click Art Effects has been incorporated into the new version of Graphicworks. Using the FullPaint and SuperPaint tools, objects can be ratated, skewed (as shown here), and distorted to any extent

appear at each corner when the balloon is selected, and the text will automatically word-wrap to fit the new width.

Although this text facility was originally intended as a 'free-form' tool so that text can be placed anywhere, it can be used for more conventional use in columnar form, though each column will have to be a separate balloon. One limitation of the program is that text cannot be 'justified' (all lines made the same length).

A completely new set of elements are included in this release of the program— 'object orientated' (or draw) graphics primitives such as circles and boxes. These have a number of advantages over 'paint' (or bit-mapped) images, the first being that such shapes print at the highest resolution of whatever printer you have hooked up to it (unlike paint images). Draw images are also far more memory-efficient and can be easily reshaped at any time.

The disadvantage is that draw images can never offer the freedom and expression of a painting program. The draw facilities are fairly limited, but Graphicworks also allows PICT (draw) images to be pasted in from programs such as MacDraw or CricketDraw, although they cannot be edited other than resized.

Not plain sailing

Graphicworks is virtually three programs all working on the same document, although the 'joins' are much less obvious than with most integrated programs. However, the approach of using individual panels, easels, balloons, and so on, does present a number of problems; the worst of which being that it is not an intuitive approach. It is extremely difficult and frustrating to get to grips with, and many potential new users may retire, confused. It is not a program that can be learned quickly — it could take days.

The original Graphicworks had two main problems. Firstly, it could be slow to use, with response times far from instant even when using a simple facility such as 'FatBits', where the picture is enlarged for working on an individual pixel level. The delay may only be a fraction of a second (though sometimes longer) but it can be very irritating, and it interferes with a natural flow of work. This problem is still evident in the new version.

Graphicworks' other problem (and here it begins to get complicated) is its relationship with Apple's Laserwriter. The combination of bit-mapped and object-orientated graphics is never really a happy one. Much of the problem stems from the fact that bit-mapped graphics are device-dependent — that is, they can only work at the same resolution as the Macintosh screen, 72 dots per inch. The Laserwriter works at 300 dots per inch. A quick calculation shows that 72 into 300 won't go, which leads to a number of problems not just confined to Graphicworks. Suffice it to say that the problems are basically speed (Graphicworks can be slow. And I mean *slow*. A fairly complicated document could take half an hour to print. A very complicated document could well take longer) together with the relative sizes of bit-mapped and object-orientated graphics, which may not appear in the proportion they do onscreen.

Macromind is very aware of the problems and has taken a number of steps to improve Graphicworks' printing problems. However, it is still far from perfect. The easy way out is to print the whole page in bit-mapped form, so it looks exactly as it does onscreen, and to regard Graphicworks purely as a paint program. The hard way needs plenty of patience. There is a third way, however, an option more relevant perhaps to most users, and that is by sticking to an Imagewriter dot-matrix printer. Graphicworks works fine with Apple's Imagewriter.

Documentation

The manual is not as helpful as it could be, and any confusion is exacerbated by the manual being produced for the original version of Graphicworks and containing a lot of information now far from relevant, with only a thin 26-page booklet referring to the changes in version 1.1. There are also a few new features that even this booklet fails to mention, such as the space bar changing the current tool to the grabber.

Conclusion

Graphicworks is not a DTP program with a few art tools. It's an art package with a few DTP facilities.

And the acid test? As an illustrator I do a lot of work using the Macintosh and I have had a copy of the original Comicworks for almost a year. However, I confess that for a paint program it was not my first choice, mainly because it didn't have the special-effects facilities (particularly skew) built into other paint programs.

When I did use Comicworks it was mainly for its unique ability to work with separate paint images using matte and masking ink effects, so as to be able to move each element around *ad infinitum* until satisfied with the composition; particularly as Graphicworks was the first paint program to take advantage of the larger screens now available in profusion for the Macintosh. Now that those special effects are included, I can see myself using Graphicworks 1.1 much more.

Graphicworks costs £99.95 and is distributed by Mirrorsoft on (01) 377 4837.

Ian McKinnell is a photographer and graphic artist. He was one of the UK's first Macintosh owners. END

Importance of style

It is every programmer's dream to write clear, well-designed programs but good programming style takes practice. In this article Mark Burgess explains the significance of 'structured ' programming with a working example to guide you through.

It is a sad but certain fact that the general standard of programming today, both in the popular press and in the industry, is diabolical and that the quality of its presentation is even worse. In May 1980 *PCW* took positive steps to combat this menace by publishing Alan Tootill's letter on the presentation of assembly language programs. This has resulted in a high standard of presentation for assembly language routines alone. The time has now come to do the same for all possible languages and to improve not only the presentation, but the quality of programming itself.

The underlying problem has its roots in the way in which computing is taught. It is only too common to read articles extolling the virtues of structured programming; it is less common to read an article explaining precisely what this means! This article is intended to remedy this oversight, by explaining the significance of structure and then by offering some simple guidelines for developing and presenting program text.

Two totally independent skills are involved in computer programming. These are:

(1) solving problems (of structuring); and

(2) writing down problem solutions in a particular programming language.

The most difficult of the two is the former.

Structure

Stucture is a very simple and elegant idea, but one which has far-reaching implications. Its real importance derives from the fact that it is a major simplifying tool for solving problems and hence writing programs. Problems are most clearly understood when they can be viewed as a list of things to be done, and structuring is a way of ordering the individual tasks to be performed in a coherent way. The ordering of tasks is what distinguishes a program from gibberish and it is, therefore, something which must be addressed seriously in programming. It is almost impossible to solve a difficult problem without first planning a strategy.

Consider the simplest possible structure: a *numbered list*. No-one would consider writing out such a list of things to do in a random order. It would be absurd to do so and would obscure the object of the list. Computer programs *are* just lists, however, although slightly more complicated than simple numbered lists, but in almost every published instance their procedures are ordered in a quite random way, making a mockery of very fundamental program logic.

Consider the structure of a computer program, then. Just as a simple list can be written out in point form (1..10), a computer program can always be drawn as what one might call a *structure diagram*: this is a generalisation of the list, with a very simple form, and it imitates the very operation of the computer program. Structure diagrams are excellent tools both for helping to design programs and for keeping them sound and logical, and thus they are described in some detail in this article.

A computer program naturally generates many patterns; the simplest and most important ones are considered here. By recognising and welcoming these patterns, programming can be made almost trivial, even in the most insidious cases. It is possible to distinguish, for instance, between large-scale and small-scale patterns and structures: a program which is very logical in small areas may in fact be a complete mess when taken as a whole (a randomly ordered list of clear tasks). It is not good enough that programs merely be made up of more than one procedure or function: this in itself is not structuring. The procedures and functions of a program must themselves be logically ordered so that a program has a true logical structure which reflects exactly what it does.

What then are the simple patterns which make programming so easy? They are called *hierarchies* and *trees* in the jargon and they permeate programs in an extreme way. Two other words which appear in connection with the two above are *nesting* and *levels*; these will become more apparent as things proceed. Loops, for example, are said to be nested when one loop is executed inside another loop, which is executed inside another loop, and so on, a given number of times. The idea of a hierarchy can be understood with the help of the following analogy:

Consider an artist who is making a drawing of an object which lies under his/her microscope. The artist has the power to zoom in and out by altering the magnification of the microscope and can, therefore, examine as large or as small an area as is necessary. To begin with he/she uses the lowest possible magnification in order to sketch the general shape (or structure) of the object. Next he/she proceeds by zooming in on a small part of the object and fills in the general details. This is repeated until the original general shape is filled with general detail. Having done this, the artist goes back and adds the very finest details at the highest magnification and keeps on doing this until the picture is finished.

The connection with programming is straightforward. Each part of the drawing process is actually a procedure to be carried out. The magnification relates to the *level* at which the artist is working (hence the terminology) and so the structure diagram for the drawing process also splits up into levels. Low magnification is called *high level* because one looks down on the object as a whole; high magnification is called *low level* because it is down among all the detailed working parts. The value of the structure diagram shown here is that it shows how the low-level parts of the drawing (the details) are related to the high-level parts, hence showing the overall scheme of the prog-

ram in as much or as little detail as is desired. In this respect, structure diagrams are far superior to old-fashioned flow diagrams, which are actually steps in the wrong direction, encouraging the programmer to think at the low level first.

This approach to problem-solving is called 'Top Down analysis' for obvious reasons. Its significance is that it reflects the way that we think most efficiently. We see outlines first and fill in details afterwards, rarely the other way around.

Each procedure in a program (or its structure diagram) branches out into other procedures which lie in the level below. The procedures in a particular level actually serve the root procedures in the higher level which use them, like the slaves of the Roman households. A structure diagram manifestly displays the chain of command and neatly pieces together a task as the sum of its parts. It is quite possible to follow exactly what the artist (or computer) does merely by tracing the diagram.

To summarise the form of structure diagrams (and, therefore, the form of well-structured programs): a structure diagram consists of one main procedure at 'LEVEL 0', which branches out into a new LEVEL called 'LEVEL 1' and contains all those procedures which are contained by (used in) LEVEL 0. All the procedures used in LEVEL 2 are found in LEVEL 1, and so on, until there are no more procedures left. (There are no procedures left when a particular task can be easily performed, using only the functions offered by the programming language.) While it is obviously not possible for programs written in a language, using a normal screen editor, to look exactly like their structure diagrams, they can retain the essential features (see the example program, page 137). The structure diagram can be squashed sideways so that the levels are preserved and the tasks or procedures are listed, one after the other, inside their respective levels. This shows, at least, the status of every procedure in the hierarchy and means that procedures can be found very easily: any procedure which is called in LEVEL 1 would be found in LEVEL 2 and, conversely, any procedure defined in LEVEL 2 would only have been called in LEVEL 1.

The above scheme is not quite complete, it turns out, and must be appended slightly in order to work faithfully in all instances. The question naturally arises as to what happens to procedures which are used throughout all the levels, such as special printing routines or graphics routines to draw certain shapes: some logical scheme has to be found for these.

The key to this lies in the reusability of such procedures. With a little consideration it can be seen that they are routines of a very general nature, which behave as basic tools for the main procedures. This motivates their inclusion in a special level, or set of levels called 'toolkits'. A good reason for doing this is that toolkit routines are a type of routine which come to be needed again and again, in many different programs perhaps, and can subsequently be isolated and re-used. Toolkits automatically result in routine libraries, some of which hold details relating to particular computers only. Programs constructed in this way are highly portable, since it is only necessary to replace a particular toolkit in order to carry a program over to a new machine.

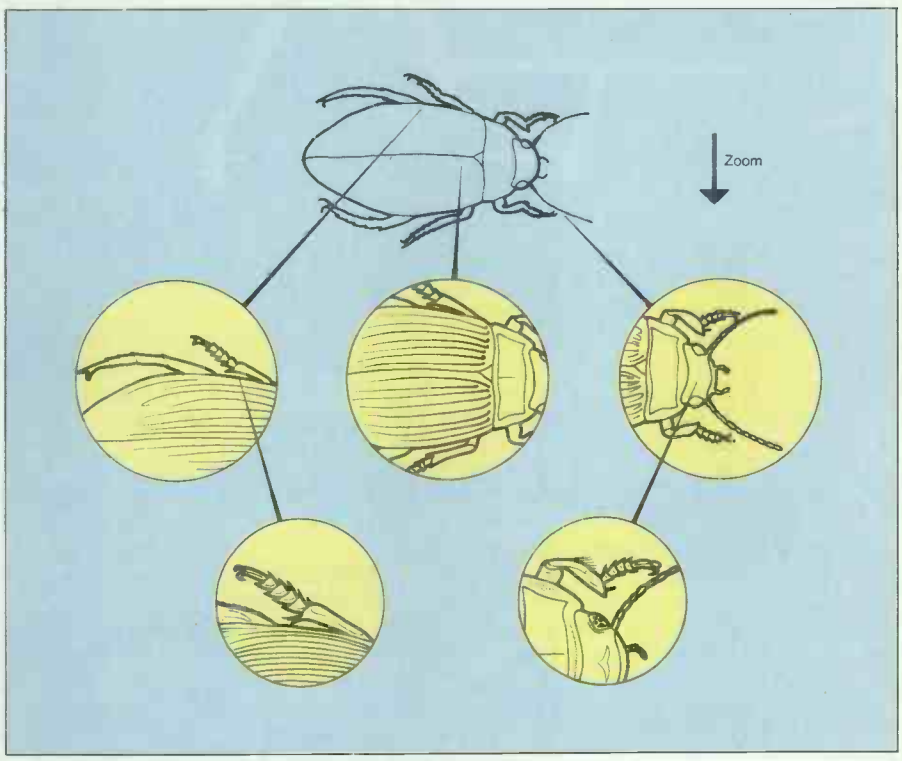
A corollary to the toolkit is the 'zone', for very awkward programs — see the example program for details. Zones are important when programming in complex operating environments, such as WIMP environments. They can be regarded as logically independent parts of a program: places for interfacing to an operating system, for instance. They could also be an alternative to the use of object languages.

The writing of a computer program is identical to the construction of a structure diagram. Indeed, a program *is* just a structure diagram which has been written down in a programming language, rather than as an annotated picture.

This, in fact, is the crucial point. It means that, by understanding structure diagrams, programs can be written without the need for a particular language: they can be written by simply drawing a picture. A structure diagram is nothing to do with language and can be written down in *any* language at all (provided it has a sufficient vocabulary); each language is as good as the next and learning new ones is a trival matter of looking up equivalent words in the manuals.

Presentation

So far only tidiness and clarity have been discussed. Another crucial facet of programming is *presentation*. Programming languages are as much for communicating ideas to people as they are for communicating ideas to computers. In the next section, some rules are described which can be illustrated with the help of an example program (see the program listing). The chosen program is a graphics demonstration (to be written in C, for the Commodore Amiga) and will be developed with the aid of the guidelines given. You should try to convert it to run on other computers — and in other languages.

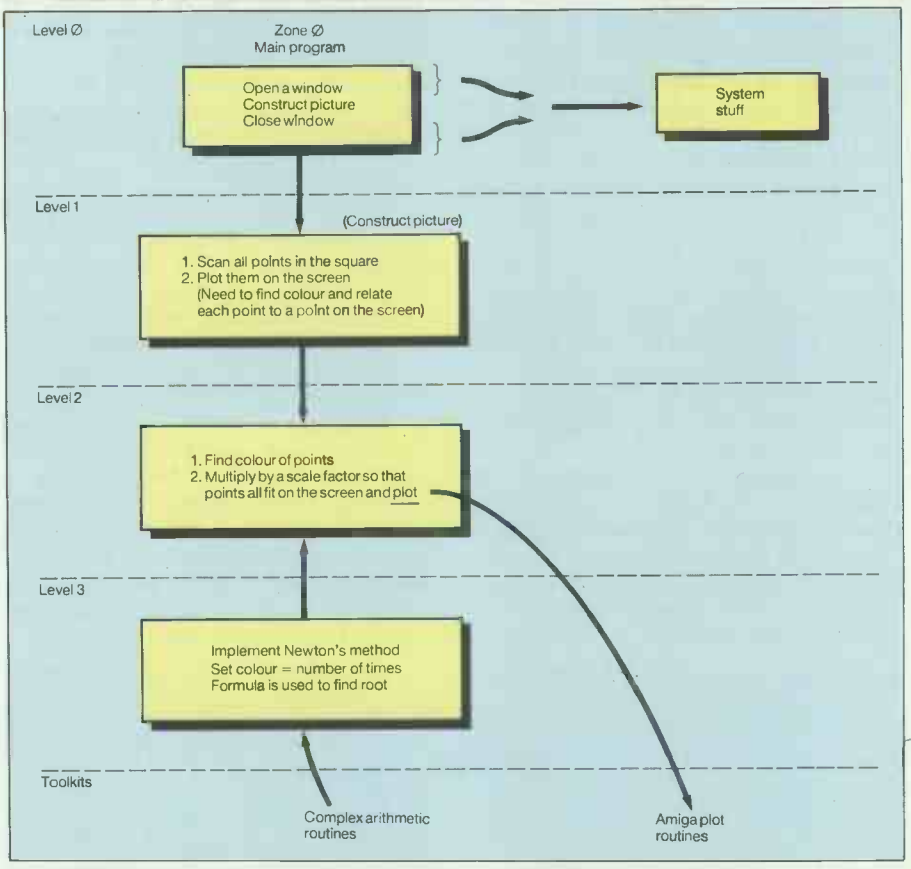


Each level of magnification reveals new complexity

Guidelines for presenting programs

These guidelines essentially say: be neat and take a pride in programming; be consistent and write clearly! The examples given are for Algol-like languages (Pascal, Algol, Modula2 . . .) and C, but they are simple to implement in Basic, BCPL . . . in fact, any language at all which allows comment to be included in a program file.

The first step is always: **solve the program problem with the help of a structure diagram** and some sound planning.



Structure diagram for plotting complex numbers on the Commodore Amiga

LAYOUT & USE OF SPACE

All procedures and functions must be written down in their correct levels (as described in the main text). A procedure should never be longer than a page of A4 (that is, about 70 lines) and should rarely need to be that long. Both the levels and the procedures themselves should be clearly segregated, with a banner heading each level/toolkit. An area should be reserved on the right-hand side of the page (or screen) for comments and notes (see more under Comments). Each new program statement should be on a new line. Don't make programs nebulous by hiding statements in among comments.

NAMES AND IDENTIFIERS

The names of procedures should clearly reflect their functions. The names of variables should clearly reflect their usage. *Never* choose names without good reason. *Never* use GOSUB if PROC or a procedure will do instead.

Take advantage of actual/formal parameters (permitted in all good language implementations) to make the labelling of variables consistent and sensible: that is, when variables are passed as arguments to several different procedures, make sure that a consistent name is given to particular quantities, throughout the whole program. In other words: try not to confuse the reader.

Examples

(a) If a procedure works out the total of a list of figures, call it something like FIND TOTAL or TOTAL or FIND TOT or something short and descriptive.

(b) if a variable stands for the total value of something, call it TOTAL, not X.

COMMENTS & DOCUMENTATION

Each procedure should have at least one brief comment describing its function. Any further comments should also be brief. Do not lecture: this obscures the program code. Procedures ought to be self-explanatory anyway if the names of variables and procedures have been chosen judiciously. Further comments should be written in the documentation to the program. Documentation must include a specification of the program: it must describe exactly what the program does and does not do and should contain notes of any known instances when the program will fail to work sensibly, either bugs or limits of the program specification.

Example

```
find_total (array : a);
begin

...    {Comments should be separate
       from program code}
end;
```

LOOPS AND NESTED LOOPS

Loops and their surrounding brackets should be indented and should be clearly visible. Always put a block bracket (that is {, }, begin, end . . .) on a line of its own. For example,

```
for n := 1 to 10 do
  begin
    writeln ('. . . . .');
  end
```

When loops are *nested* (that is, when there are loops inside other loops), indent for every loop and make the *level of nesting* clear.

Write:

```
for ( n=1; n <= 10; n++)
  {
  while ( a < b)
    {
    printf (". . .");
    printf (". . .");
    }
  printf (". . . .");
  }
```

in preference to

```
for (n =1; n <= 10; n++)
  { while (a < b) {
    printf (". . . .");
    printf (". . . .";  } }
```

GOTO

It is never *necessary* to use GOTO. If the need ever *seems* to arise, it is a sign that the program is either poorly constructed or inappropriate for the given language.

FINAL POINT ABOUT BLOCK BRACKETS

Block brackets (like begin, end and C's { and }) are essential punctuation in a program. It is best to adopt a consistent practice in their use so that a program looks the same all over. This means that every time such brackets are used, the same structure should be adopted: for example, write:

```
complex = record
    real : x, y;
  end;
```

in preference to

```
complex = record real : x,y; end;
```

Perhaps the clearest use of brackets is the method which has been adopted here.

SPECIAL NOTE FOR USERS OF PASCAL/ALGOL . . .

In Algol-based languages, a programmer is required to define every variable, procedure and function before it is used. This makes the appearance of the final program slightly odd: the main program lies

at the end of the text and the toolkits are all found at the top. In other words, the structure diagram in Pascal/Algol is upside down. This doesn't really matter: the rules still apply — and in fact they reveal their usefulness in a very obvious way. If the levelled structure is adhered to strictly, then the requirement that everything be defined before it is used, is automatically satisfied.

The example program

(1) The problem

The example program is deliberately complicated, to illustrate as many of the ideas as possible. It follows a theme which has been explored recently in many of the popular computer magazines and lends itself neatly to the illustration. The objective is to plot out a diagram in the complex number plane. (For the benefit of non-mathematicians, this is just a flat square, with coordinates traditionally called (z) where z is actually made up of two parts, labelled by x and y like: (z.x,z.y) — instead of the more usual (x,y) coordinates. They are, in effect, the same.) The diagram is based upon finding the cube roots of 1, which are complex numbers.

For every point in the square region from bottom left (X0, Y0) to top right (X0+range, Y0+range), the program will use Newton's method of finding the cube root, starting with that point as a first guess. Newton's formula for obtaining a better approximation (z) to the cube root of 1, starting with a random guess (zp) is:

$$z = \frac{2*z3 + 1}{3*z2}$$

where z3 = zp cubed and z2 = zp squared. The rule for multiplying the zp's is part of complex-number theory and must be defined in the program. Since z and zp are complex numbers, they have two parts, and this is subsequently two formulae:

$$zp.x = \frac{2*3.x + 1}{3*z2.x}$$

and

$$zp.y = \frac{2*z3.y}{3*z2.y}$$

The program must obtain quite a good estimate of the cube roots, and so it should reapply Newton's formula to z in order to obtain a new z, and keep doing this until z doesn't change very much (the formula has reached the actual value of the root and can't get more accurate). The diagram will be made up of points of colours (1 . . . numofcolours) which show how many times the process had to be repeated in order to get close to the answer. (The resulting pattern is pretty, if not interesting.)

(2) The solution/structure diagram

To implement this process, a structure diagram is drawn. It is worth remarking that one purely practical thing which must be done in a graphics program is to make a window or define a screen mode in which graphics can be drawn. This is nothing at all to do with the main problem, so it ought to be kept apart from the main core of the program. The scheme above for structuring allows us to use a new zone for this. The simplest way to see the usefulness of doing this is to just look at the listings and observe how this keeps the irrelevent detail out of the way of the main program logic. (Imagine how messy the program would look if it were included in the middle of the main logical structure.)

Try to follow the structure diagram and relate it to the listing. Points to notice in the listing are:

- the rules for multiplying and dividing z's (that is, complex numbers) are defined in a toolkit, so that they can be used again in later programs;
- logically separate parts of the program are separated either by blank lines, separate procedures or different zones; and
- the program contains very few comments, but variable names are clear and relate to what is happening.

Finally, notice how the structure of the program relates to the structure diagram.

(3) Program Documentation

Here is part of a summary of each procedure. This is rather shorter than ideal, for the sake of brevity in this article.

ZONE 0

main () Trivial

create picture () This scans through every point in the square and calls PlotArgandPoint at each point. It passes the point z so that it can be used in Newton's formula. It also passes a parameter called 'scale' which adjusts the values of the complex numbers, so as to fill the screen. To do this it makes use of the constants' 'screensize' and 'range' as defined in the program. These device-dependent (or computer-dependent) constants are defined at the start of the program.

PlotArgandPoint () This accepts a complex number z and the scale factor relating the numbers to the points on the screen. It then calls 'num-of-repetitions-to-root ()' to find out what colour it should plot, and multiplies z so that the points all fill the window size. It then passes the adjusted coordinates to an actual plotting routine for the screen.

num of repetitions to root () This repeats Newton's method of finding the roots and counts the number of times it must repeat the process in order to get close to the root. The technical details of this are not really relevant to this article, but would be included here otherwise.

The toolkit routines and Zone 1 can also be described, either separately or collectively, depending upon the clarity of their coding.

Conclusion

The example program shows the way in which a program can be structured. The structuring is not only a matter of pride and professionalism but is extremely important in keeping control of programs, especially when they become large and complex. The rules are not only aesthetically pleasing in this respect, but are an important tool for coping with the increasingly complex operating environments which are now being developed.

It is to be hoped that something akin to these rules will become a standard of practice and will improve the rather low programming standards which exist now, in the way that Alan Tootill's remarks raised the standard of assembly language programming.

Example program to plot a diagram in the complex number plane

```
/*****************************************************************/
/*                3                                              */
/*  Roots of Z + 1 == 0                                          */
/*  (M.Burgess 1986 / Lattice C for Commodore AMIGA)             */
/*                                                               */
/*****************************************************************/

   /* Program plots a rectangle in the complex plane, starting at  */
   /* (Xo,Yo) and ending at (Xo+range,Yo+range). Colours are given */
   /* to each pixel to indicate the number of iterations of Newton */
   /* Raphson method required to reach the cube roots +/- a const. */
   /* called "toobig" with (z) as a starting estimate              */

    /*******************************************/
    /* Include some library files for linking  */
    /*******************************************/

    #include "stdio.h"
    #include "math.h"
    #include "limits.h"
    #include "zone1.c"

/*****************************************************************/
/** Manifest Constants / Macros                                 **/
/*****************************************************************/

    #define range          4.0          /* square box centred on 0,0 */
    #define toobig         0.01
    #define Xo            -2.0
    #define Yo            -2.0

    #define numofpixels 100.0           /* choose resolution */
    #define numofcolours   16           /* maximum no of colours */
    #define screensize  160.0           /* max resolution */
    #define divbyzero      0            /* for readability */
    #define pixsize screensize/numofpixels /* size of one pixel */

/*****************************************************************/
/** Structures                                                  **/
/*****************************************************************/
```

```
   typedef struct                /* Define a datatype called complex */

      {
      long float x,y;
      }

   complex;

/*************************************************************************/
/**  LEVEL 0 : Main Program                                             **/
/*************************************************************************/

   main ()

   {
   open_graphics_window ();
   create_picture ();
   wait_for_window_close ();
   }

/*************************************************************************/
/** LEVEL 1                                                             **/
/*************************************************************************/

   create_picture ()                        /* generate complex diagram */

   { long float increment,scale;
     complex z;

   increment = range/numofpixels;
   scale = screensize/range;

   for (z.x = Xo; z.x  <= Xo+range; z.x += increment)
      for (z.y = Yo; z.y <= Yo+range; z.y += increment)
         {
         PlotArgandPoint (z,scale);
         }
   }

/*************************************************************************/
/**  LEVEL 2                                                            **/
/*************************************************************************/

   PlotArgandPoint (z,scale)       /* Adjust complex numbers to x,y coords
                                      choosing appropriate scale        */
   complex z;
   long float scale;

   { int colour = 0;

   colour = num_of_repetitions_to_root (z);

   z.x = (z.x-Xo)*scale;
   z.y = (z.y-Yo)*scale;

   ActualPlot (z.x,z.y,colour);
   }

/*************************************************************************/
/**  LEVEL 3                                                            **/
/*************************************************************************/

   num_of_repetitions_to_root (zp)      /* Find root and count repet'ns */

   complex zp;

   { int reptcount = 0;
     complex z,z2,z3,top,bottom;
     complex multiply(),divide();

   if ((zp.x == 0) && (zp.y == 0)) return (divbyzero);

   do {
      reptcount++;
      z = zp;
      z2 = multiply (z,z);
      z3 = multiply (z2,z);
      top.x = 2*(z3.x) + 1;
      top.y = 2*(z3.y);
      bottom.x = 3*(z2.x);
      bottom.y = 3*(z2.y);

      zp = divide (top,bottom);
      }
   while (fabs(zp.x-z.x) > toobig || fabs(zp.y-z.y) > toobig);

   return (itcount % numofcolours);
   }

/*************************************************************************/
/** TOOLKIT Graphics (AMIGA)                                            **/
/*************************************************************************/

   ActualPlot (x,y,colour)             /* Plot a point (x,y) on the screen */

   long float x,y;
   int    colour;

   { struct RastPort *r = wG -> RPort;
     int    ix,iy,p;

   SetAPen (r,colour);                      /* set colour pen */
   ix = (int)(x+0.5);                       /* round to nearest integers */
   iy = (int)(y+0.5);                       /*                           */
   p = (int)(pixsize+0.5);                  /*                           */

   RectFill (r,ix,iy,ix+p,iy+p);            /* Plot and fill a rectangle */
   }


/*************************************************************************/
/** TOOLKIT Complex Number Arithmetic                                   **/
/*************************************************************************/

   complex multiply (a,b)                   /*  return a times b  */

   complex a,b;

   { complex z;

   z.x = (a.x * b.x) - (a.y * b.y);
   z.y = (a.y * b.x) + (a.x * b.y);

   return (z);
   }

/*************************************************************************/

   complex divide (a,b)                     /*  return a divided by b */

   complex a,b;

   { complex z;
     long float denominator;

   denominator = (b.x * b.x + b.y * b.y);
   z.x = (a.x * b.x + a.y * b.y)/denominator;
   z.y = (b.x * a.y - a.x * b.y)/denominator;

   return (z);
   }

                                    /* end */

/*************************************************************************/
/*                                                                       */
/*  ZONE 1 : GRAPHICS open a graphics screen & window                    */
/*           (AMIGA system details)                                      */
/*                                                                       */
/*************************************************************************/

   #include "types.h"
   #include "intuition.h"

   #define WINDOWGADGETS (WINDOWSIZING|WINDOWDRAG|WINDOWDEPTH|WINDOWCLOSE)
   #define true     1

   extern struct Window *OpenWindow();
   extern struct Screen *OpenScreen();

   int IntuitionBase = NULL;
   int GfxBase = NULL;
   USHORT class;

/*************************************************************************/
/** STRUCTURE ASSIGNMENTS                                               **/
/*************************************************************************/

   struct NewWindow nwGraphics =

      {
      20, 20,                       /* top left x,y */
      480, 160,                     /* width,height */
      1, 2,
      MOUSEBUTTONS |
      CLOSEWINDOW,
      WINDOWSIZING | RMBTRAP |
      GIMMEZEROZERO | WINDOWGADGETS,
      NULL,
      NULL,
      "Graphics Window",
      NULL,
      NULL,
      50,40,200,100,
      CUSTOMSCREEN
      };
                                          /* SEE "INTUITION" MANUALS */

   struct NewScreen NewScr =

      {
      0,0,            /* top left x,y       */
      640,400,4,      /* width,height,type */
      1,0,
      HIRES,
      CUSTOMSCREEN,
      NULL,
      "Graphic Screen",
      NULL, NULL
      },

    struct Window *wG;
    struct Screen *Scr;

/*************************************************************************/
/** LEVEL 0                                                             **/
/*************************************************************************/

   open_graphics_window ()              /* Opens INTUITION and a gfx window */

   {
   GfxBase = OpenLibrary("graphics.library", 0);
   if (GfxBase == NULL)
      {
      printf("graphics library open failed\n");
      exit(0);
      }

   IntuitionBase = OpenLibrary("intuition.library", 0);
   if (IntuitionBase == NULL)
      {
      printf("intuition library open failed\n");
      exit(0);
      }

   Scr = (struct Screen *) OpenScreen (&NewScr);
   if (Scr == NULL)
      {
      printf("Couldn't open new screen\n");
      CloseLibrary(GfxBase);
      CloseLibrary(IntuitionBase);
      exit(0);
      }

   nwGraphics.Screen = Scr;       /* Must precede window open  */

   wG = OpenWindow(&nwGraphics);
   if ( wG == NULL )
      {
      printf ("open window failed\n");
      CloseScreen (Scr);
      CloseLibrary(IntuitionBase);
      CloseLibrary(GfxBase);
      exit(0);
      }
   }

/*************************************************************************/

   wait_for_window_close ()      /* Wait for the user to close window */

   { struct IntuiMessage *message;

   while (true)
      {
      while ((message=(struct IntuiMessage *)GetMsg(wG->UserPort))==NULL);
      class = message->Class;
      ReplyMsg(message);                    /* Must reply to messages */
      if (class==CLOSEWINDOW) break;
      }

   if (wG != NULL) CloseWindow (wG);
   if (Scr != NULL) CloseScreen (Scr);
   if (GfxBase != NULL) CloseLibrary (GfxBase);
   if (IntuitionBase != NULL) CloseLibrary (IntuitionBase);
   }
```

END

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Name _____

Address _____

_____

_____ Telephone _____

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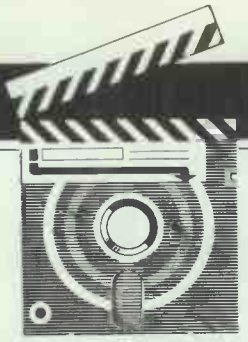


SCREENTEST

AMX Desktop

Amstrad PCW 8256 users who do not wish to explore the CP/M facilities of their machine for running applications may benefit from the friendly approach of an inexpensive mouse and desktop program from AMS. Robert Schifreen tested it out.

When Amstrad's PCW 8256 was first launched, it was marketed as a complete everything-in-a-box word processor. It was only later that people realised there was a real CP/M-based micro in there, and that Locoscript wasn't the only software the machine could run. So along came WordStar, and other text-based software from various sources was ported across from other CP/M machines to the PCW.

Only text-based software, though, because machines originally designed to be word processors *don't do graphics*. Wrong. Actually, the machine turned out to do *only graphics* — all text is pixel-mapped on the screen. Now that software writers have gained a deep enough understanding of Amstrad's machine, graphics software has started appearing on it. The only limitation is that graphics programs tend to take up more memory than text ones, as all the data for the images needs to be stored somewhere.

Enter a company called AMS, which has got round this problem by cramming a graphics-based, mouse-driven desktop into just 75k of memory, and that includes half a dozen desk accessories. Because the PCW 8256 doesn't come with a mouse as standard, one is included, complete with the necessary interface box.

Installation

The whole package comes in a single box, similar in size to a couple of hefty novels stacked on top of each other. Included is a mouse, an interface box, a very thin manual (as such things should be) and a disk containing the desktop software.

The mouse is of the three-button species. It looks a lot like the classy Logitech one as used, for example, in Epson's Taxi system for the PC — but it doesn't feel like it: it's very light for a start, and the ball is quite shiny and made of thin plastic. The click on the buttons is not very positive either, but despite all this, it was fully compatible with my desk and the bench in our computer room, and didn't need a special mouse mat.

The left-hand button is used to select menu items and files, while the right-hand one is used as a cancel button — for example, to remove menus from the screen. The centre button is not used by the desktop software, but is to be used by software developers.

Setting up the system involves plugging the mouse into the interface box and then fitting the box into the expansion connector on the back of the computer. Like Sinclair interfaces of old, there is a duplicate edge connector sticking out the back of the interface, so you can keep attaching peripherals to the machine until it becomes too deep to fit on your desk. The cable on the mouse is around four and a half feet long. This easily stretches round from the back of the machine and gives you enough leeway to work with.

Installing the interface took just a couple of minutes and presented no problems. With everything plugged in, there should never be any need to unplug the interface, though it seems sturdy enough to survive your doing that should the need ever arise.

Loading the desktop

With all the hardware ready, you turn on the PCW and boot up with a CP/M system disk. You then remove the CP/M disk and replace it with the single AMX disk or, if you have two drives, you just insert it in the other drive.

The disk contains seven files, two of which are the desktop system: one main file and one overlay. Together, the two files total 75k and contain the complete system including the desktop, icons and desk accessories. Because the data for all the icons is embedded in the program, the system isn't as programmable as, say, Gem, which lets you design your own icons and desktop patterns and store the definitions as separate files.

The other five files contain the data for the diary, notebook, phone directory, and so on. These are not essential (you won't needs lots of copies of the same file), so making an existing program disk into a desktop-driven version *should* involve no more than copying two files. Unfortunately, this is not the case.

Typing DESK starts up the desktop. A brief copyright message appears, during which time the two main files are copied from the AMX disk to drive M:, the RAM disk. Because the whole system can fit into the RAM disk, it frees any floppy drives (very useful if you have only one) for applications programs. If you quit the desktop, return to CP/M and then try to restart the desktop, the system will know if the two files are still intact on the RAM disk and won't bother loading them again unless it has to.

After loading, the desktop opens out on the screen, starting as a thin horizontal line across the centre and spreading rapidly and evenly up and down. The standard message at the

bottom of the screen telling you which drive is active remains, while the desktop fills the rest of the screen. There's still room for the printer line, which appears in its normal place when you activate the printer.

Mouse and icons

The pointer is shown on the screen as an arrow, and moves very smoothly in all directions as you move the mouse around your desk. For every inch that you move the mouse on your desk, the amount by which the pointer moves on the screen is very small compared to other systems, and I was initially concerned that I wouldn't have enough free desk space to make the product usable. A telephone call to the company revealed that the mouse is 'velocity-sensitive' which basically means that the faster you move it, the faster it goes. An option on the control panel (accessible via a menu on the screen) lets you set one of three movement ratios, but these only affect movement while you push the mouse fast. If you always push it slowly, you really will need a large desk, or you'll have to keep lifting up the mouse to cover any distance.

Anyone who has used Gem or a Mac will instantly recognise the layout of the desktop. The menu bar at the top of the screen has menus headed File, Edit, View and Special. There's also a menu represented by a picture of a mouse (a real one) that leads to the desk accessories, control panel and an Info box. The Edit menu is not really used like the rest of the desktop — it is only available within the accessories that allow text editing, like the memo pad and jotter. Unless one of these utilities is active, all options on the Edit menu are greyed out and can't be used.

Down the right-hand side of the screen are seven icons. First come drives A, B and M. If you try to access drive B and you don't have one, the standard CP/M message about inserting a disk appears and you have to press a key when you've done so. It's a shame you can't press a mouse button instead. Below the disk icons are pictures of a telephone, diary and memo pad. The first leads to a telephone directory desk accessory, while the other two icons are self-explanatory. These are known as the feature icons, which, for some reason, AMS sees as being different from desk accessories. The latter are available from a menu and comprise a notebook, alarm clock, calculator and puzzle.

Last in the stack of icons comes the trashcan. You can delete a file or a whole disk by using the mouse to select an icon and then dragging it to the trashcan. Some desktop systems allow you to whizz round the screen selecting groups of icons, but AMS's is not one of these. There are no 'are you sure?' boxes to click on after dragging a file to the trashcan. It just disappears from screen and disk, and that's that. Thankfully if you try to delete a whole disk, you are asked to reconfirm your intentions.

Opening a disk

Just like Gem, Windows, Taxi and other desktops, you open a disk by pointing to its icon with the mouse and double-clicking (a double-click is two clicks *in quick succession*). Once you have opened a disk icon, a window appears on the screen, and the icon you clicked to open the disk changes colour to remind you that it can't be opened again until you close the window. You can, though, open a different disk and have two windows on the screen. With two windows open, you can copy files from disk to disk by moving icons between windows. The name of the open disk appears in the title bar at the top of the window, and a line below that tells you how much space is free on the disk (there's 88k on the AMX distribution disk) and how many files are available. Each file is represented by an icon and the system looks at the extension of a file (the three letters after the dot) to decide which type of icon is going to represent that file on the screen. For example, data files (extensions of .DAT) are portrayed by a filing cabinet, while a document (.DOC) is portrayed as a letter. Programs are represented by a small picture of the PCW screen, complete with slot for disk drives (always two, even on an 8256).

You can open the drive M: icon (the RAM disk) just like any other, though the two files that make up the desktop system are not visible as icons — they are hidden to prevent the user from inadvertently deleting them, as this would crash the system (the files need to be accessed while the system is working).

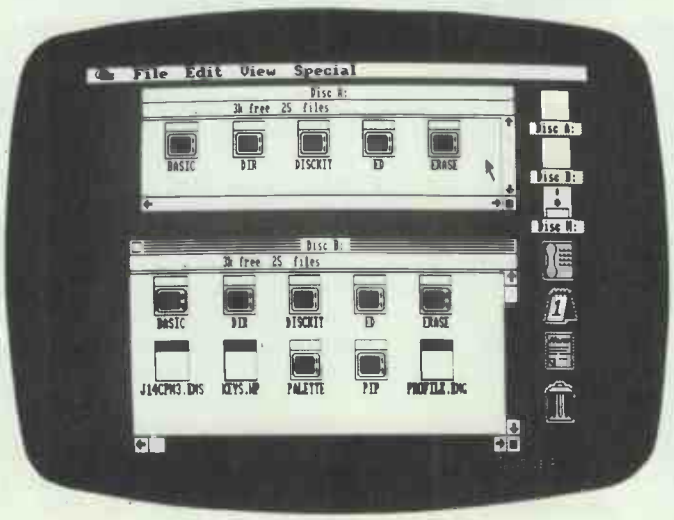
The position of a window can be altered by 'dragging' it to anywhere on the desktop. Scroll bars at the bottom and side of the windows are used to scroll the icons if there are too many files on a disk to fit in the current window. By dragging the bottom right-hand corner of the window in any direction, the window can be resized. But it's a shame that AMS has copied the Mac's way of displaying icons. Icons are always displayed in horizontal rows of six. If you make the window only half a screen wide, there won't be enough room to show a row of six so it will only show, say, three. But, even if there is loads of space at the bottom of the window (because it is long and thin), the extra icons won't appear there. Instead, there will be a lot of blank space, and missing icons that you have to imagine sticking out the side of the window. All this is done for reasons of memory space, says AMS, and unfortunately it does take some getting used to. Just remember that the message on the top of the window telling you how many files are on a disk will often not tie up with the number of icons actually displayed, so your best bet is to keep windows as wide as possible at all times.

Instead of using icons to represent files, a menu option means that you can have files shown as names as well. This way, the pictures are replaced by a textual single-column list of files that shows the name, extension and size in kbytes. The files are sorted alphabetically too.

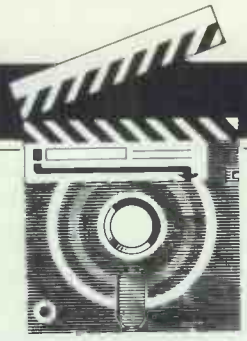
To close a disk window, you click the small box at the top of the window called its 'close' box. The window is removed from the screen and the disk icon is restored to its former colour.

Launching a program

With a disk open and a list of files or a set of icons displayed, you can launch a program by double-clicking its name or icon. For example, pointing to the Basic icon and double-clicking is the same as typing Basic under CP/M. Once you've clicked, you are given the opportunity of typ-



Copying a file no longer requires the PIP program. Instead, you open one window for each of the disks and then use the mouse to drag a file's icon from one window to the other; the file will then be copied. If you have only one drive, the selected file will be duplicated and you will be asked to type in a name for the new version



SCREENTEST

ing any parameters at the keyboard before the program is run. To run the program, the desktop program stuffs the name of the chosen program into the keyboard buffer, followed by an exclamation mark and the command M:DESK. This is a standard command in CP/M on the PCW machine, and will ensure that after the program has finished executing, the program called DESK.COM on drive M: will be run, effectively returning you to the desktop.

If the program you launch deletes one or more of the desktop program files on drive M: though, a message appears which indicates that you have to restart the desktop from the floppy disk.

On more versatile systems like Epson's Taxi for the IBM, you can set up links between data files (like DOC, DAT, TXT) and programs, so that clicking a DOC file would automatically load up WordStar and then call in the specified document. With AMX Desktop, though, double-clicking anything that's not a proper program results in an error message.

Clicking a file icon (or a program) once is called 'selecting' it. The icon turns black, and you can copy it to another disk by dragging it with the mouse to another window. This is far easier and faster than using the Peripheral Interchange Program (PIP), CP/M's normal method for copying files. Files can be viewed on the screen or printed by selecting an icon and then clicking the desired option from a menu.

Feature icons

Underneath the disk icons down the right-hand side of the screen are three feature icons. Double-clicking these leads to a telephone directory, diary or memo program respectively. These programs all work in small windows which occupy around a third of the desktop — and, apart from the memo program, their size can't be adjusted. Furthermore, you can't have more than one feature icon active simultaneously, and if a disk window is open when you summon a feature icon, that window will be closed and won't be reopened afterwards.

There's no way that any of these facilities can compete with the functionality of a standalone piece of software, and they don't attempt to. Suffice it to say that if your needs are simple, they will be adequate.

Briefly, the telephone list/address book is just that. The window contains seven lines of 36 characters (though this scrolls) for someone's name and address, and a small two-line window underneath this lets you specify their phone number. New entries are added by clicking the Create option on the Special menu at the top of the screen, and there's also a Delete option there to remove the current entry.

A Find line at the bottom of the address book lets you type in a partial name and have the system dig out the correct record. There's also a complete alphabet written along the bottom line, and clicking a letter will display the first entry that begins with that letter.

All the data for the address book is held in a file called TELE.DAT which is maintained on the RAM disk until you exit, at which point it is copied to the floppy disk in the drive that was used to start the desktop. (While you're typing in any of the windows, the mouse can be used to move the cursor.)

The desk diary is another utility that works in a non-expandable window, though its position can be moved. Again, you are given seven lines to enter details of an appointment. At the top of the window, the current day and date are shown, and this can be moved back and forth in increments of a day, month or year by clicking on an appropriate box. A calendar for the entire current month is also shown on the screen, and by clicking a particular number on it the appointments for a particular day are displayed.

While the diary is active, the Special menu is replaced by a Print one that will print a copy of the current diary file or just a selected part of it.

The memo pad, unlike the other two feature icons, *is* resizeable. You can make its window as big as the whole desktop, or just keep it in a corner of the screen. The desk accessories (from the mouse menu, not one of the feature icons) can be used while this is active, though these appear on top of the memo pad so you won't have to resize the memo pad unless you want to.

If there's a file called MEMO.TPL on the current disk when you start the memo pad, it assumes that this is a template and always loads it for you. The supplied template is set out like a standard office memo, with spaces for you to fill in who the memo is from and to, the subject and the date.

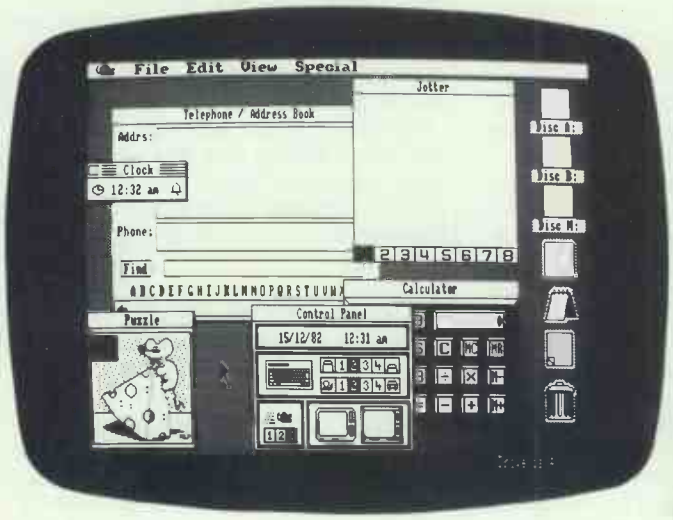
For this feature icon, the Print function has migrated to the File menu, while the Special menu is for saving a memo or opening a new one. These inconsistencies are annoying but soon forgiven.

Desk accessories

In addition to the feature icons are four desk accessories. These are utilities accessible from a pull-down menu (the mouse-shaped one). Like all the other parts of the desktop system, the code for these utilities is in the two main files, so it's not possible to modify the desk accessories or to add your own to the menus.

The jotter takes up around a quarter of the desktop size and is AMS's version of a notepad. It can be popped up over other windows, and contains eight pages, each of which is selected by clicking a number from the set in the bottom line. The desktop contains a clipboard which can be used to copy and move notes between the jotter, the memo pad, diary, address book, and so on.

The alarm clock looks very similar to that on the Mac: its window is only two lines high — the first of



The AMX Desktop allows you to have more than one window open on the screen at a time, though only one can be active. Here, the clock is the active window, as shown by the horizontal lines at the top of it.

If you activate one of the feature icons, any open windows on the screen will be closed and you'll have to open them again afterwards

which is the title (Clock) while the second contains the time. Clicking the clock-shaped character (which tells you you're looking at the current time) makes it change to a small alarm clock that indicates that you are looking at the time the alarm is set for. In the same way, a picture of a calendar brings up the date. This is where you set the system time and date each day, as the Amstrad doesn't have a battery-backed clock calendar. In addition, one alarm can be set — though you can't specify a date — so the alarm has to be some time between now and midnight. When the alarm goes off, the machine beeps and a small window appears to tell you that the time has come. This only works if you are actually using the desktop at the time — the window won't pop up in the middle of an applications program. If an alarm does reach its allotted time while you're inside another program, the beep goes off when you next return to the desktop.

The calculator is a 10-digit floating point version with the four basic functions as well as a memory. It can be controlled with mouse or keyboard, though there's no facility for pasting the result of a calculation into another window.

The puzzle is one of those sliding-tile affairs, where you get a grid of 16 squares containing tiles numbered 1-15. By moving various combinations of tiles into the empty space, you are supposed to end up with the numbers in order. To make the thing harder, the numbered tiles alternate (each time you call up the puzzle) with a picture of a mouse standing on a lump of cheese. When you quit the desktop, you are asked if you want to save the current state of the picture from the RAM disk onto the floppy disk, so you can take your time over solving it.

Control panel

The control panel is another idea borrowed from the Mac. This window shows you the current date and time (though you have to use the Clock accessory to set them), along with the various system settings. You can choose from four different settings for the length of time a key must be held down (not a mouse button) before it starts auto-repeating, and there are a similar number of settings for how fast the key actually repeats once it starts. The mouse movement scale, described earlier, is also set from here, and there's an option to reverse the screen to make the desktop black on green, instead of green on black.

Changes to the control panel result in a patch version of the DESK.OVR file on the RAM disk, which is automatically copied to the floppy (if you want it to be) when you quit to CP/M.

How it all works

For those interested in how the interface works, a brief explanation is in order. Unlike the IBM machines, the PCW 8256 doesn't have any hardware interrupts. With desktop software on the IBM PC, for example, the graphics software can get on with its job and, if the user moves the mouse, the interface will interrupt the software and tell it that the pointer needs updating on the screen. This is like someone sitting at home watching television and waiting for a friend to arrive — when the doorbell rings you turn off the TV and answer the door.

With the Amstrad, the interface box and mouse are constantly talking to each other independently of the computer. The interface contains a counter inside, which is automatically updated when you move the mouse, to reflect the current position of the mouse. The software, every few hundredths of a second, has to check this counter and, if its value has changed since the last time, the pointer on the screen will need updating. This method is similar to what would happen if your doorbell had broken — instead of waiting for it to ring, you'd have to keep looking through the window every couple of minutes to make sure your friend wasn't outside.

As for the software, the Amstrad works in graphics mode anyway, so the hardware exists to produce graphics on the screen. GSX, the official way of doing this, was deemed to be far too slow and memory-intensive, so everything is done by writing directly to the screen memory. This gives the programmer greater control.

Transferring the system to program disks

One menu option is labelled Set Startup. In theory, this copies the two desktop system files onto any disk, and sets up a SUBMIT job that makes any program disk boot straight up into the desktop. Unfortunately, I couldn't get this to work, as I kept being told that there wasn't enough space on my disk for the copies. When I told AMS about the problem, I found I wasn't the first person to have discovered this. Rest assured that it should be fixed by the time you read this.

GSX

The official way of producing graphics on the PCW is via a program called the Graphics System Extension, or GSX. Programs that use GSX to produce graphics, like DR Draw, need a special driver in order to make use of the mouse to emulate the keyboard. Although the manual contains a chapter detailing the use of the GSX driver that is supposed to be included with the desktop disk, a small sheet at the front explains that the driver is not quite ready. Before you hand over any money, make sure that it is.

Screendumps

It's an undocumented feature of the PCW 8256 that pressing EXTRA and PTR will do a graphics dump of the screen. This worked fine with the AMX Desktop, and produced some reasonable-quality printouts.

Documentation

The manual for the mouse, interface and software comprises 37 pages of A5 text. It was written before the software was completely finished, and it shows. There are a couple of silly errors, like referring to a dialogue box (an error message in a window) as a dialling box. Nevertheless, the chapter on installing the mouse and interface is excellent and should be all you need.

Conclusion

There's not a great deal you can do with the AMX Desktop; although it certainly is more friendly than a solitary A> on the screen, and I had no problems using it to start programs by clicking an icon instead of typing a name; and the desktop faithfully reappeared automatically when I exited the program. But once you've left the safety of the desktop to run a program, the mouse might as well not be there. It is actually dead. It ceases to be. Indeed if it wasn't nailed to its perch ... anyway you get the drift. I am told that a keyboard emulator will soon be available (free to existing users, I hope) that lets the mouse emulate the cursor keys and allows each of the three buttons to be programmed to produce a single key or a whole string. Even when this arrives, though, it won't work with Locoscript, which unfortunately is non-standard.

Despite these limitations, AMS is certainly worthy of praise for fitting a mouse-driven desktop into just 75k of memory. For the money, you get a well-written piece of software that is both fun and educational to use. It works comfortably on a machine with just one single-sided drive and, if you want a computerised diary, address book and calculator, you've got one. You also get a mouse, whose purpose in life will multiply as AMS increases its range of software to include, around September, full desktop publishing using just the PCW's bundled printer.

Perhaps the mouse and desktop software are a little ahead of their time, but they could also signal a revival of interest in the PCW machines. For home and small office, and especially in the educational field, a PCW-based DTP system may be perfectly adequate. A Mac it isn't, but then it's not Mac-priced either.

The mouse, software and interface together for the Amstrad PCW 8256 or 8512 cost £79.95 (excluding VAT) from dealers. AMS is based in Warrington, on (0925) 413501 END

Sixth sense

It seems that at long last manufacturers are applying some 'lateral thinking' and adapting computer technology to benefit the disabled — but unfortunately such developments don't come cheap. Martin Banks looks at what's currently on offer.

Microelectronics has been responsible for many things in its relatively short life, not least of which has been the personal computer in all its many guises. It has also spawned some amazing developments in obscure areas, many of which have had considerable impact across a wide range of applications, notably those that beneficially affect the disabled in our community.

Obstacles

As always, the underlying problem with any developments for the disabled is money. In brutal marketing terms, the disabled do not constitute a large target for the majority of companies, even when there is a common disability to address, such as blindness or deafness. As consultant Julia Schofield points out, no two disabilities are the same, if only because the effect of the same disability on different individuals will itself be individual. It is difficult, therefore, to arrive at one solution that will serve the full needs of a large group of disabled people.

This makes the creation of specifically engineered solutions difficult, and more to the point, expensive. That is why the trend among systems developers working in the disabled field is now towards 'lateral thinking': looking at what is available on the general market and trying to work out whether it can be applied to the needs of the disabled, either directly or with the minimum of modification.

According to Schofield, the commercial computer market has now started to be the source of increasing numbers of potential tools that can be adapted for use by the disabled, especially with a little bit of thought. She gave as one example the spelling-checkers that have been developed as an adjunct to word-processing systems. Their obvious benefits to those who constantly use the written word can be equally applied to those that have physical problems with creating written communications at all. Coupled to a word processor, itself a major advance for the disabled, the spelling-checker can quickly take the user to those words that require re-spelling, making their efforts that much simpler.

One increasingly common factor in this is the availability of the personal computer as a cheap and effective engine for such applications. According to Corri Barratt at the Royal National Institute for the Blind, the most popular machine by far is the IBM PC or one of its compatibles. This is because this machine is so dominant in the work place — and it is in integrating themselves with the work environment that most disabled people face the greatest problems.

The PC range has also generated the greatest single group of applications programs with which those seeking products to adapt can work. Word processors and spelling-checkers have, for example, proved easily adaptable to the needs of the disabled, even though they were never developed with that application in mind. Speech synthesis systems have grown as much from the commercial/industrial potential of applications such as spoken warning systems as from the desire to create a speech system for the disabled.

This, Julia Schofield thinks, is now inevitable and beneficial. Those applications of technology which gain commercial acceptance also become cheap enough to make their adaptation for the use of the disabled a viable proposition, whereas they would never see the light of day at all if their development had been initially targetted at the disabled market-place.

One trend in many modern work practices is working to the advantage of many disabled. This is the trend towards greater intellectual and reduced manual content in productive work, which is making it increasingly possible for technology to give them the means to create their own independence by getting a job. Cheap personal computers are the ideal tool for providing the communications capabilities needed to be productive in one way or another. Using the technology, it is even possible for those with major physical disabilities to peform significant tasks.

Communications has always been among the most significant disabilities, and is the area where the technology is best suited to providing some satisfactory solutions. In terms of disability, communications means speech, hearing and sight, the three ways in which we take in and give out information. In all three there have been significant developments in the potential capabilities of the technology available. In some cases, however, the developments have so far failed to get too far past the stage of theoretical applicability to the problems of the average individual.

One area that fits this particular description is hearing. For the hard of hearing there are a wide range of options available that all work by amplifying sound to a level where the wearer can hear it. But for the totally deaf the only input medium they have is through their eyes. For those that have not learned either sign-language or lip-reading, which according to Julia Schofield are skills which are not so widely known now, the written word is the only way of receiving information. This makes receiving direct communications with another person difficult, as speech is then precluded.

Theoretically, technology has the means to solve this problem, and has realised many others to at least some extent. Systems have been developed that can hear the spoken word and convert this input into a textual output. It is an area where much work is being done, but where there are still many problems to be solved to achieve a workable solution for the disabled.

Speech systems

One of the leading companies in this field is IBM. It has been working on speech-recognition systems for many years, and has made some significant developments in that time. One application of the technology which is important to the deaf is the capability to convert speech into text. The company announced a system which could achieve this some three years ago. It had two major disadvantages, however. First, and most obvious,

obvious, was the fact that the software ran on a large mainframe computer system well beyond the means of an individual. The second was that it was slow, taking up to 20 seconds to convert a word to text.

As a measure of what the technology can achieve, however, IBM has continued to pursue the idea, and recently came up with a new version which offers dramatic improvements. The size of the hardware required has been cut dramatically from a mainframe to a PC, while the speed of conversion has been raised sharply. Most words now appear after a second or two. In addition, the vocabulary the system can handle has been raised from 5000 to 20,000 words.

Like all speech-recognition systems, however, it is still speaker-dependent, which means that it has to learn the voice of the speaker to work at all. While making the system highly applicable to many aspects of the work environment, especially for the physically disabled, systems such as this continue to hover tantalisingly close to providing the deaf with a workable speech-to-text system without being able to yet provide it. Ironic as it may seem, it is extremely difficult to produce a speech-recognition system which is speaker-independent, and therefore usable by anyone wishing to communicate verbally with a deaf person. Until such systems appear, the rest of the technology remains essentially unusable by the deaf.

For those with speech and sight disabilities there is more on offer from the technology. Speech-synthesis systems, for example, have been developed to a very high level now, and are at last starting to become available in small and inexpensive forms.

The typical speech system these days is an add-on box designed to connect directly to the serial or parallel port of a personal computer, with the IBM PC proving to be the favourite host, closely followed by the BBC Micro. The systems work to a number of different phonetic rules, but all offer the user the facility of being able to have the machine 'speak' for them. As well as the synthesiser, therefore, the system depends upon a program which will drive it, applying the word keyed into the computer to the specific phonetic rules used by the synthesiser to create the correct sounds.

Speech synthesisers were among the earliest applications of microelectronics technology to the needs of the disabled. Among the first was the American Votrax system. In its initial form this cut the communications needs of the disabled down to the bare minimum and provided them with a small vocabulary of commonly used words and phrases of the 'yes', 'no', 'I'm hungry' variety, each accessed by pressing the required key on a large, lapheld keypad. The latest versions of this system are still available today.

As in every other area of technology the user does tend to get what they pay for in speech synthesisers. To get an output that sounds reasonably human in tone quality, and can speak with human-like inflections is quite possible, but the cost will be dramatic. This is because the software and processing power required to provide these facilities is expensive. A simple synthesis system, however, is now relatively cheap. The drawback is that the speech tone is poor and takes a good bit of practice to understand. It is interesting to hear one of these machines and realise quite how much understanding comes from voice inflections and speech timing as from the raw sound itself.

This can be a drawback for those with speech disabilities, of course, for the majority of listeners will face this difficulty every time the system is used. As with most applications of technology, however, speech-synthesis systems can be expected to improve in quality, as well as reduce in price.

One of the least expensive now on

Illustration by Kate Charlesworth

the market comes from Dolphin Systems in Liss, Hampshire. This is the Mimic synthesiser which was actually developed by the Technical Department of the Royal National Institute for the Blind. The RNIB's objective was to develop a simple speech system that would 'tell' the blind what was appearing on a computer display. Versions of the system have now been produced for the BBC Micro, the IBM PC and, potentially interesting for the speech impaired, the NEC laptop.

At a price of £235 this is a small, battery-powered machine that is quite easy to work with as soon as you have got used to the voice. Coupled to an NEC lap-portable it offers the potential of a workable speech system for well under £1000. This compares well with some of the other speech-synthesiser systems that cost well over £2000 and are, in some respects, more restrictive in application by being designed specifically for use in the work place.

Since taking on the production and marketing of the Mimic system, Dolphin Systems has put considerable efforts into additional software developments. The company has now come up with a product called PC Read. Aimed at the IBM market, this package allows the user to define individual window areas on the screen and then enter text into them. Each text block can be whatever the user decides, from a simple 'yes' or 'no', through to a complex phrase.

To access a window with the speech synthesiser, the user calls up a facility called Screen Review. This allows the user to position the cursor over the window area desired and have the contents read out by the synthesiser. As an additional feature, the PC's function keys can be programmed to take the cursor directly to a specific window. If the user wants more than ten windows the alpha keys of the keyboard can also be brought into play. They can be programmed in the same way as the function keys, with the ALT key being used to determine their roles. Alternatively, the system also allows the user to verbally 'review' whatever is on the screen at the current location of the cursor.

Perhaps the most significant aspect of the PC Read development, particularly so in the view of the RNIB's Corri Barratt, is the cost. 'A lot of the products aimed at the disabled are relatively expensive, because of the work involved in adapting them and because it is not mass market. But the Dolphin has aimed at getting the price right down.

At £64 I don't suppose they could get PC Read much cheaper,' he said.

Developed by the Royal National Institute for the Blind and produced by Dolphin Systems, the battery-powered Mimic speech synthesiser is ideal for use with the NEC laptop, the BBC Micro and PC-compatibles

This is an interesting example of taking common development from the commercial computing world and adapting it simply and cheaply to the use of the disabled. It will eventually become a matter of history whether the same lateral thought processes are applied to some of the latest developments in speech-based computer systems. What, for example, could be made of the Spicos dialogue system developed jointly by Siemens and Philips.

Spicos is an experimental system which offers some interesting long-term potential. It not only recognises continuous speech, which is something most other speech-recognition systems find difficult, but it can respond via a speech synthesiser. In short: you ask Spicos a question and it can answer. In theory, it can cope with 1.5 trillion questions-and-answers.

Like all experimental systems it has its drawbacks. It is currently very slow, taking five minutes to analyse a query, search through its files and formulate an answer. It also takes a Digital Equipment VAX 11/780 super minicomputer to run on. The system also works only in German for now, though an English-speaking system is being developed, as is a version capable of answering queries in real-time.

Given the pace at which technology develops and the cunning minds of those working in the disabled field, it will be interesting to see what becomes of Spicos in five years or so.

New lease of life

Adapting commercially available products can also give a new or alternative lease of life to something that has lost its mainstream sparkle. Take the Microwriter, for example. This one-handed keyboard device was first developed as a word-processor keyboard by the writer, Cy Endell. Though extremely clever in design, using just five keys to produce a full character set, its difference from the standard QWERTY keyboard meant that it never took off as a mass market product. It has, however, found considerable interest among the blind, many of whom are trained to relate the physical sensations of Braille to an alpha or numeric character. Many disabled people have now acquired QWERTY keyboard skills, however, which makes them much more likely to find some form of remunerative employment. Keyboards themselves are also readi-

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ly adaptable to provide the special facilities the disabled need. This is one indirect reason why the IBM PC family and compatibles have become extremely popular engines for disabled solutions. The keyboard is a separate item from the machine, which makes it a much easier system to modify and adapt to specific disablements.

There is, for example, the Audio-Data keyboard for use with the PC. This incorporates two slider controls working in X and Y orientations. These control the movement of the cursor, so that blind people can get a much more accurate 'feel' of where the cursor is on the screen. This keyboard also includes a speech synthesiser, so that the words or characters at the cursor location can be read out to the user.

The other prime source of input and output for the blind is, of course, Braille. This hard-copy character system, sensed by the user through the fingertips, can be adapted by modern technology, but only with some difficulty and not inconsiderable expense. So-called 'soft-Braille' systems have been developed, but the cost has so far proved prohibitive.

The reason is the way Braille works. The character is formed by a matrix of nine 'bumps' embossed into paper. The presence or absence of any one bump in the matrix helps to form the information transmitted to the reader through the fingertips. To produce an electronic response, a 'soft' version of this has been produced as a single cell with nine pins that can be pushed up above a surface plate by small solenoids. In practice, the mechanism is rather like the print head of a nine-pin matrix printer. This system works extremely well, but at around £100 per cell, makes any reasonable reading machine very expensive.

The first successful reading machine, the Optacon from Telesensory Systems Inc in the US, did not even use Braille. Still a popular system, this can read only one character at a time, and works by translating a visual character image into discrete pin movements. The basis of the machine is the hand-held miniature TV camera used to scan over text. This scans one character at a time and the system converts this input into a matrix of 144 points. If part of the character appears at a specific point, the machine causes one pin in a matrix of 144 to rise above a plate where the reader's finger rests. With practice, it becomes possible to sense the actual shape of the character being transmitted through this system to the finger.

Even with only one output cell the Optacon is an expensive system, costing around £3000. A Braille reading system costs more. One of the latest, the Delta System from Systelec in France, costs around £5000. This uses the same approach as the Optacon, utilising a miniature camera as the text input system. Output is in the form of 12 Braille cells, which is the prime cause of the system's expense. In operation, the readers rest their fingers on the cells and the information 'passes' beneath them as the camera moves across the text.

This Braille Screen Reader from IBM combines a mouse with a single Braille cell mounted into its top surface, all in a self-contained unit

An interesting variation on this idea has recently come from IBM, in the form of the Braille Mouse. This is an adaptation of the standard cursor-controlling and function-key-providing rodent that has a single Braille cell built into it. The user works the mouse in the traditional way to position the cursor at the desired point on the PC screen, and the Braille cell then gives a read-out of the character at that location. Two advantages come with this experimental system. One is that it requires no additional software, being a completely self-contained unit. The other is that it is expected to be relatively cheap.

The way ahead

Though much has been achieved in the adaptation and application of computer technology to the problems of the disabled, there is still much that can be done, especially in the area of making systems that are both usable and inexpensive. There is also considerable scope for the UK to play a major part.

'The majority of the equipment currently available for the disabled comes from either America or Europe,' said Corri Barratt, 'especially from Sweden and West Germany. The UK has now fallen a very long way behind in the development and adaptation of new products.'

There are several areas where he would like to see UK effort being applied in the future. 'The one big need for the blind is the availability of a low-cost, portable reading system,' he said. 'What is needed is something that is the size of the Optacon machine, which is as big as a reasonably-sized hardback book, uses Braille if possible, and is cheap enough for the majority to purchase.'

As with Julia Schofield's remarks about applying lateral thinking to existing commercial products, Barratt sees considerable opportunities for developers providing suitable access systems to these commercial applications, particularly word processors and spreadsheets. One specific area he highlighted was an access system that would put the manuals for a commercial product onto disk, in a readily addressable form. This would make learning a new application much easier for a wide range of disabled people.

The need for rapid development and adaptation of new products is made greater by the lull in overall PC developments that stemmed from the adoption by most people of the IBM PC as a standard. This has allowed technology for the disabled to catch up and find a new relevance, particularly in the work-place.

The growth of that standard, and its development into aggressively priced machines such as the Amstrad PC1512, is encouraging to Barratt. He sees this as one of the main engines of the future for developments that aid the disabled. 'When it is possible to buy a PC costing £500 this should put some pressure on the further development of reading or speaking systems that currently cost more than £2000,' he said. END

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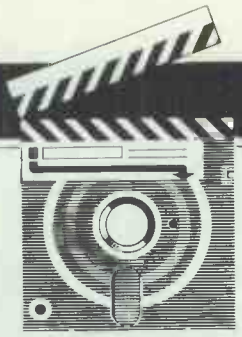


SCREENTEST

Turbo Prolog Toolbox

Borland International may be a comparative newcomer to the Prolog market, but its latest product, the Turbo Prolog Toolbox, complements the Turbo system beautifully, and will be a boon to application developers. Mike Liardet considers its capabilities.

Readers who followed the 'Teach Yourself Prolog' series which we ran between February and May this year may perhaps have been sufficiently enthused to try Prolog in a real application, instead of just using it for experimental prototyping systems such as those developed during the series. Prolog is unsurpassed as a programming language for some types of application, as was illustrated by the many examples we gave, and hopefully many readers will now be seriously considering it for full-blown projects.

It is worth inserting a note of caution at this point: Prolog programming projects are subject to the same general constraints as projects in any other programming languages. In particular, in Prolog as in any other language, about 90 per cent of an application's code will be concerned with the interface to the user and the various peripherals, while only about 10 per cent will actually do the real computational or processing work at the heart of the system. It is this 90 per cent part of an application's code, dominated by the user interface, that transforms what might be just a clever idea into something easily usable in a normal working environment.

This '90/10 split' is a well-known phenomenon, and in response to it, many of the conventional programming languages now have a large number of application-utility 'subroutine libraries' (see, for example, the Vitamin C and PforCe article in *PCW*, September 1986). With an appropriate library, for a comparatively modest investment, a wide variety of utilities are made available to handle user interaction, database access, and communications with other software, and so on.

Unfortunately, until now, there have been precious few really useful application-utility libraries for Prolog, so a Prolog programmer, who had just developed the clever processing part of a system, would be largely on his own resources for turning it into a fully functioning application. Possibly the established Prolog purveyors believe that practical tools, for menus or whatever, are simply too mundane to be of interest in the exciting world of Artificial Intelligence and Expert Systems. But that is where Borland International, a comparative newcomer to the Prolog market with Turbo Prolog, disagrees. And in line with this thinking, it has recently released Turbo Prolog Toolbox, to augment the Turbo Prolog system with the vital facilities that an applications programmer will need.

Overview

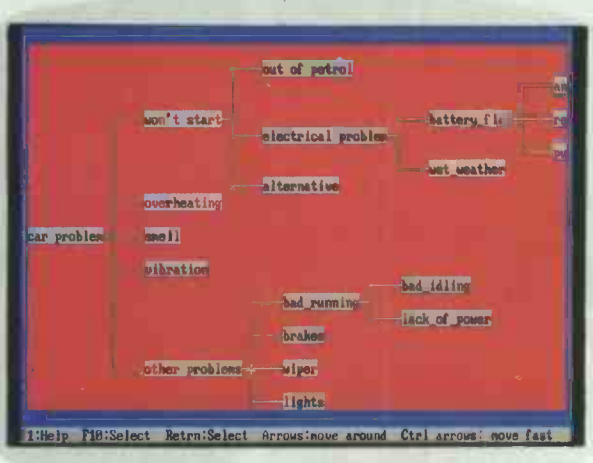
Although very extensive, the Toolbox facilities are fairly conventional, and primarily concerned with aids to develop the user interface in an application. The product is definitely not an Artificial Intelligence Toolbox, and most of its facilities are concerned with the familiar menus, help screens, graphics, communications and file access, and so on. Not everything is covered though. For example, there is no database facility, mouse control or graphics printing, and no pop-up 'memory-resident' facility that would make applications such as Sidekick work. Also the Toolbox does not offer any windowing facility, as Turbo Prolog already has this!

The only really unusual facility in the Toolbox is a 'parser generator'. This would be particularly useful for handling 'knowledge representation languages', commonly used in expert systems, or indeed for more conventional projects such as programming language compilers or command interpreters.

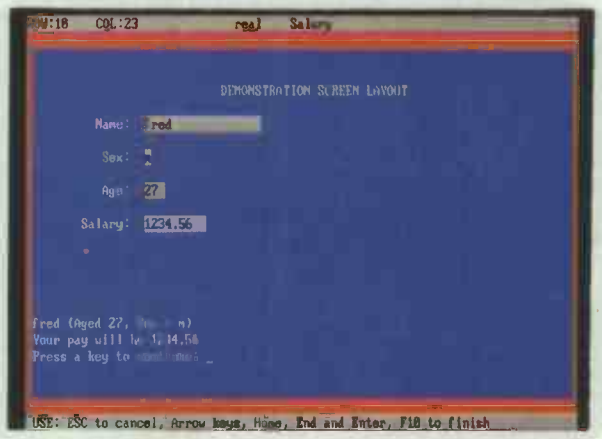
The Toolbox is supplied on two disks, together with a manual. The manual is split between a reference section, with descriptions of all the predicates supplied, and a tutorial, which shows how the various types of problem should be tackled. The disks contain, in effect, a library of over 80 'predicates' (a predicate is the Prolog equivalent of other programming language's subroutines or functions), along with over 40 example programs to illustrate their usage. Most of the Toolbox facilities are written in Turbo Prolog itself, and their complete source code is provided. For reasons of efficiency, a few of the predicates are written in C or assembler, and for these there is no source code but merely 'object' files.

When working with the Toolbox, the best way to regard all the 80-plus predicates is simply as an extension to the hundred or more built-in predicates that are already present in Turbo Prolog. As with the real built-in predicates, their internal workings need be of no concern to the programmer, but the availability of the source code can be useful occasionally for customisation or just to see how other programmers tackle particular problems.

Most PCs that can already run Turbo Prolog should also be able to use the Toolbox. The minimum memory requirement for Turbo Prolog with Toolbox is 512k, whereas for Turbo alone it is 384k. Apart from that the requirements are the same, with a



'Treemenu' contains a tree-structure argument which is automatically formatted onscreen. It can be clipped and scrolled so that the whole structure can be seen



'Option(3)' in the 'option' clause uses Turbo Prolog's built-in 'consult' predicate to access a file which contains information on the screen layout to be used

twin-floppy PC being needed as a minimal system. The Toolbox will not work with Version 1.0 of Turbo Prolog, and users of 1.0 will need to upgrade to 1.10. This is well worth doing in any case, as Version 1.10 has a number of improvements over 1.0, not least a number of bug-fixes, even faster compilation, and some extra built-in-predicates.

The facilities provided by the Toolbox fall into five categories: user interface, graphics, serial communications, interfaces to other software and the parser generator. I shall deal in some detail with the user interface and graphics facilities, and then summarise the others.

User interface

The Toolbox's user interface facilities include predicates for handling help-screens, status lines, screen and report layouts, and menus. In addition to all this, Turbo Prolog already has windowing capabilities. The demonstration program shows some of the many user interface predicates in action, but in particular, omits the help-screen facilities.

Once the Toolbox has been installed alongside the Turbo Prolog system, the demonstration program can be run in the normal way, by selecting 'Run' in the main menu. Of course, if it were a real completed application, it would not be used this way, but run as an 'EXE' file — that is, as an independent executable program. It is quite easy for Turbo Prolog to create EXE files and I shall describe how this is done when describing the graphics demonstration program.

The demonstration program has a number of 'include' directives, in the first thirty lines. When the Run option is processing the program, it reads in any 'include'd files and processes them in the normal way, as if they had been typed in as a part of the program. These 'include'd files, 'tdoms.pro', 'tpreds.pro', and so on, are all supplied as a part of the Toolbox, and contain the definitions and declarations for the predicates required by the demonstration. Although all these files are normal readable source files, there is no need to actually look at them. The manual describes how the predicates in them should be used, and also which files to 'include' for the various predicates. This is more than sufficient information for most requirements.

organised as a main menu offering three options, two of which demonstrate other types of menu facility, and one of which uses a screen layout to get user input. Because it is a demonstration system, none of the options actually *do* anything, but for a real application it would be relatively easy to embed all the appropriate actions alongside the interactive facilities.

The execution of the program starts with the goals following the 'goal' directive. These goals create a window that completely fills the screen area, set up a status line message (on the bottom line of the screen), handle the master menu (with the 'menu' goal), and then perform whichever action the user selected in the master menu (with the predicate 'option'). The 'repeat' and 'fail' goals are a Prolog device to ensure that all the goals between are repeated *ad infinitum*, rather like an infinite loop in a conventional programming language.

The 'makewindow' predicate, like all the windowing predicates, is actually a part of the standard Turbo Prolog system, and could be used without the Toolbox. The various arguments allow a choice of colours and display attributes for both the border and the window area itself — a title, size and position. For this particular goal there is no border or title, and the window fills the entire screen area.

The 'makestatus' predicate displays a 'status' line at the bottom of the screen, with the message indicated.

The 'menu' predicate takes a list of options, in this case 'Treemenu'; a title ('Which would . . .'), a position for it to be displayed (row 10, column 7), some display attributes, and the initial option on which to have the 'menu bar' (option 1, the first option here). When it is executed it produces a display with the menu options contained in a window. The user can use the arrow keys, along with 'Home' and 'Page-Up', and so on, to move the menu bar around in this window, until it rests on the option he wants. Pressing the 'Enter' key selects this option, with the option number selected being returned in the last argument of menu (that is, into Sel). The menu is automatically erased once a selection is made. If the user pressed escape, this is returned as selection 0, otherwise the option number (1 to 3 in this case) is returned. In the demonstration selection, 0 results in the next goal being:

option(0)

and this (see the definition of 'option') just calls on 'exit' to terminate the program.

There are several variations on the basic menu predicate, most of which are not illustrated in the demonstration program. For example, very large menus can be handled, where all the options can be scrolled through a comparatively small menu window; tables of options can be given (like Turbo Prolog's file directory menu, when 'load'ing programs); the menu can be left onscreen when it is finished, and multiple choice menus are allowed, and so on. Among the many possibilities I have chosen to feature just two: 'Treemenus' and 'Pull-down menus', selected as the first and second options on the main menu.

The clause with head 'option(1)'

handles the treemenu. It has only one goal: 'treemenu'. One of treemenu's arguments is a tree structure, and this is automatically formatted on the screen. Not all of it may fit on the screen, but it can be automatically clipped and scrolled in a fairly obvious way in order to see the rest of it. The tree menu is a rather unusual menu facility, but could be useful in, for example, an expert systems application. Many Prolog programs generate or work with tree structures. It would be interesting to interface the decision tree in the 'Pool Ball' problem (see the Teach Yourself Prolog article in *PCW*, April 1987) to this facility.

Each 'node' in the tree data structure has a unique identifying number associated with it (for example, 'alternative' is numbered '10'). The treemenu facility allows the user to move the cursor around to point at different points in the tree, and when one is selected it calls the goal:

treeaction(Num)

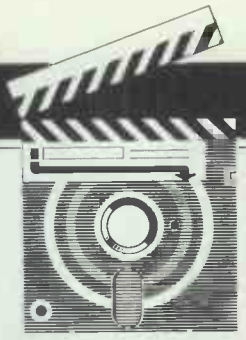
with Num being set to the identifying number of the option. It is up to the calling program to define 'treeaction'. For a real application treeaction would probably be defined by many clauses, for each node in the tree.

One of the problems with treemenu is that the cursor does not skip from one node to another, but instead is allowed to roam freely around the screen. Without a mouse, as an alternative to the arrow keys, this makes interaction with it rather slow.

The clause with head 'option(2)' handles the pulldown menu option. The pulldown goal in this clause is the one that deals with the pulldown menu. The menu works very like the main menu in the Turbo Prolog system. It gives a list of options displayed across the top line of the screen, and a selection is made either by the arrow keys or the initial letter of an option. The pulldown happens after an option is selected. A further menu drops down from the option selected, and a further selection can be made. Once a second selection has been made in the pulldown menu, the pulldown predicate calls the goal:

pdwaction(Main,Sub)

with Main and Sub being set to the main option and sub-option numbers that were selected. As with treemenu and the treeaction predicate above, it is up to the calling program to define pdwaction. The pdwaction clause corresponding to the 'Quit' option on the menu has a 'fail' at the end. The failure causes pulldown to terminate. None of the other pdwaction clauses fails, and pulldown continues to maintain control after the execution of each of these is completed.



SCREENTEST

The third option on the main menu in the demonstration shows how a screen layout can be used. This option is handled by 'option(3)' in the 'option' clauses, and uses Turbo Prolog's built-in predicate 'consult' to access a file ('xperson.scr') containing information on the screen layout to be used. Although it is quite feasible to create screen layout files directly, the Toolbox offers a special utility that enables them to be designed interactively. When using this utility, explanatory text and prompts can be sprayed arbitrarily around the screen, and 'fields', where data is to be entered, are positioned in appropriate places. During the layout design the field type (integer, real or text) and maximum field size can be specified.

All the work in the screen interaction is done by the 'scrhnd' predicate. The user can use the arrow keys to jump between fields, and freely make changes to any of them. On termination of the screen input, the values entered by the user can be picked up by the program, by using the 'value' predicate. This associates a textual name for a field, assigned when the screen layout was designed, with a Prolog variable which can receive the value. The demonstration program just prints out these values, but a real application would probably store them on file somewhere. Note that the Toolbox does not offer any special database facilities (other than an interface to dBase), so this part of an application would have to be written from scratch.

Graphics

The Toolbox's graphics predicates can generate bar graphs, mathematical plots and pie charts, for example. They can work in colour and also handle either the standard IBM color graphics adaptor, or the EGA card. The facilities can operate with the normal windowing system, with text and graphics freely intermixed. With all these facilities it should be possible to build highly sophisticated graphics applications, although some extra work would be needed to develop graphics printing facilities, which are not included in the Toolbox.

Along with some of the graphics facilities a number of other predicates in the Toolbox are written in C or assembler, and they are supplied not as source code, but in a few 'object' files. Object files can only be used with a Turbo Prolog program if it is first compiled into an object file itself. Following the compilation, all the various object files can then be 'linked' into an executable program, which can then be 'run'. This compilation and linking is the way many programming languages are used. It may sound complicated, but it is actually very easy to do — with Turbo Prolog at least. In Turbo Prolog, information about the files to be linked can be set up in a 'project' file, the 'Compile to EXE' option is specified on the main menu, and thereafter the program can be run at any time, by selecting 'Compile' instead of the usual 'Run'. On the surface, everything is the same as usual, but object and executable files are being created on the disk, behind the scenes.

The graphics demonstration program comprises mainly a huge list of goals, which demonstrate many of the Toolbox's graphics predicates. Let's now examine, working steadily downwards from the 'goal' directive, some of the more interesting of these goals.

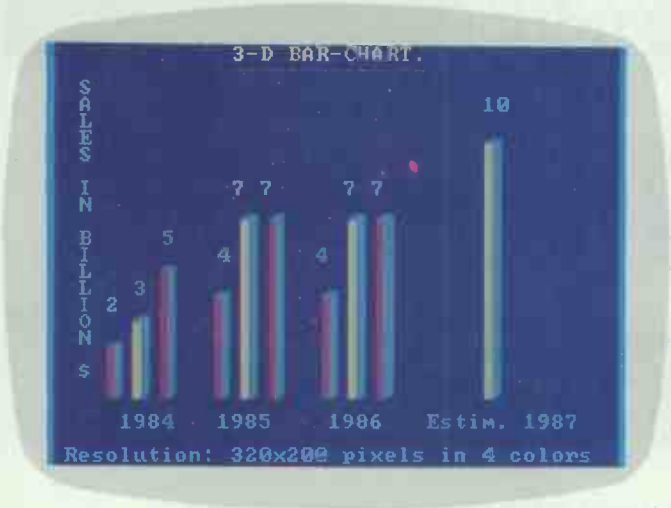
The 'graphics' predicate, used near the top of goals list, is a Turbo Prolog facility, not in the Toolbox. It allows one of five graphics modes to be selected, from 320 to 200 resolution in four colours through to 640 by 350 in three colours (for the EGA card). A variety of different background colours can be selected as well.

The 'gwrite' predicate is used to write text onto the screen, in graphics mode. Position and colour can be specified, and vertical or horizontal writing is possible.

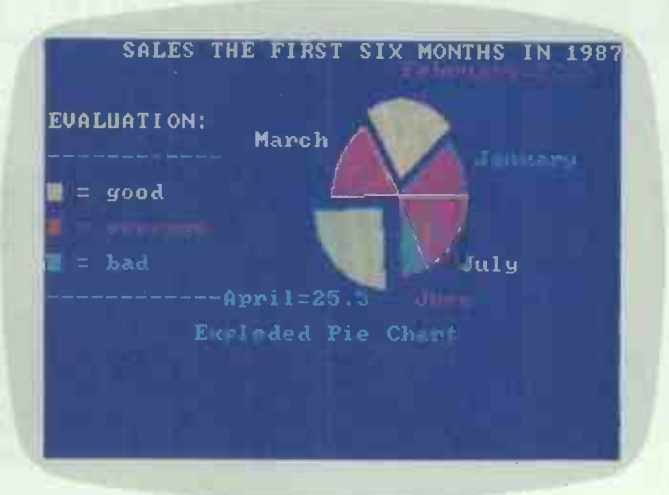
The 'bargraph3D' goal is self-explanatory. The first four arguments specify the amount of space to be left in the four margins of the screen. The next two arguments specify how the three-dimensional bars are to be drawn, and the final argument is a list of 'bar' structures to be drawn. Each 'bar' structure specifies the height of bar to be drawn, its label and colours. The spaces included in the list enable gaps to be introduced between bars.

Following the code to generate the 3D bar graph the mathematical plot code follows, immediately after the comment to that effect. This plot is done in 640 by 200 resolution, black and white only, and the 'graphics' goal sets up this display mode.

The 'defineScale' goal defines the coordinate system to be used in the plot (X values from 0 to 100 and Y values from −100 to 100 in this



The Toolbox's demonstration program shows some of the graphics predicates in action, one of which results in this 3-D bar chart generated by the 'bargraph3D' goal



A slice of pie of negative size indicates that the slice is to be drawn slightly out of the pie — the exploded pie effect. This can be used for emphasis

case). This coordinate system need bear no relation to the actual screen resolution in operation.

The axes are drawn by the 'makeAxes' goal. 'makeAxes' enables a variety of different axis-markings to be specified. The axes are then labelled by the 'axisLabels' goal.

The 'function(0)' goal actually plots the graph. The 'function' predicate is defined at the bottom of the demonstration program, using 'scalePlot' to actually plot the points. It can plot a point with given colour at a given position.

After the mathematical plot, the code for a pie chart follows. Although it is not apparent in the display this is actually drawn in a window. Drawing graphs in windows can be useful for handling multiple graphs onscreen. Each window can be changed and erased independently of the others. This means that it would not be necessary to redraw all the graphs just to erase one of them, for example.

The 'pieChart' goal, in the first three arguments, specifies how big the pie is to be and where it is to be positioned, and to do this virtual screen coordinates are used. Immediately following these arguments is a list of the slices for the pie. In a slice structure the size of each slice is given, along with its label and display colours. The sizes do not all have to total a hundred — the underlying software compensates for this. A negative size is used to indicate that the slice is to be drawn slightly out of the pie — giving the exploded pie effect, and this can be used for emphasising exceptional figures.

Other facilities

The two demonstration programs illustrate the use of no more than a third of the predicates in the Toolbox, but with perhaps another third of the system being simply permutations and variations on the predicates used in these demonstrations. Let's now take a look at the remaining Toolbox offerings.

The Toolbox includes facilities for handling serial communications. With the Toolbox communications tools a Turbo Prolog program could perform file transfers to another computer, or do terminal emulation, or allow connection to a (Hayes-compatible) modem. The predicates work with the PC's serial ports, and are buffered and fully interrupt-driven. The manual takes care to explain how the PC should be connected to the remote device and, as with all the other facilities, gives a number of example programs illustrating how the predicates might be used. It warns that to use the communications facilities effectively, it is necessary to be familiar with communications in general, and the IBM PC communications hardware in particular — but the manual does itself a disservice there as it provides as clear an introduction to PC communications as I have yet seen.

Most PC systems will use one of the standard software packages: for example, Lotus 1-2-3, Ashton-Tate dBase. It is not unusual for an application to need to pick up data from one of these packages' data files, and the Toolbox has facilities for doing this. It can handle Borland Reflex, Lotus 1-2-3 and Symphony, and Ashton-Tate dBase III, working with the 'internal' formats of their files in all cases. Of course, other software packages can also work with these standard file types, so the range of software that can be accessed is rather larger than this.

The 'parser generator', included with the Toolbox, is the sort of facility that only a Prolog Toolbox would offer, essentially because it is a lot more easy to implement in Prolog than it is in any other programming language. The manual makes some extravagant claims about this facility, not least that it can produce parsers that run almost as fast as the Turbo Prolog system itself (which is very fast).

To do the parser generator full justice would need an article in itself. In brief, it can be supplied with a 'grammar' specifying a programming language, or a command language, for example. This grammar is devised by the application developer. From this grammar, the parser generator can automatically generate a Turbo Prolog program that can recognise and parse statements in the language specified by the grammar. This generated program can be used as a major component in the implementation of a programming language. For a simple language, it would only be necessary to add a small amount of code, to the generated parser, either to execute the resulting parse-tree structure directly (thus producing an 'interpreter' in the application), or alternatively to generate executable code (and this would be a compiler).

Conclusion

It is clear, from the type of facilities in the Toolbox, that Borland expects Turbo Prolog to be used as a serious application development tool. Turbo Prolog already offers the sort of run-time performance that quality applications need, and the Toolbox fills an important gap with its extensive range of well-designed application utilities.

At the price, any Turbo Prolog application developer would be mad not to use the Toolbox. Even if only three or four of the predicates were used it would easily pay for itself in time saved. But, in practice, it is likely that most developers will be seduced into using a considerable number of the facilities.

Turbo Prolog Toolbox costs £69.95 and is available from Borland International on (01) 258 3797.

END

CP/M makes progress

The CP/M operating system has acquired a bad name for itself and, despite being the 'backbone' of the successful Amstrad machines, it is finding it hard to shake off its old 'unfriendly' tag. Mike James looks at how the operating system has improved in the shape of CP/M Plus.

CP/M is part of the micro pioneering folk memory — it was unfriendly, inflexible and often didn't work. It frustrated so many people and made so many enemies that the name CP/M is still a swear word in some circles. What they don't seem to know is that things changed with CP/M version 3, or CP/M Plus — a mature version of CP/M, just right for small systems. The reason that they don't seem to know is that CP/M Plus appeared just as everyone was changing to IBM PCs and MS-DOS!

But now, rising from the grave courtesy of the Amstrad CPC and PCW range, CP/M Plus has a new generation of users who can't understand why the old timers spit at every mention of CP/M! Some of the bad comments that the PCW, for example, has attracted have been due to the stigma of having CP/M as an operating system. In fact I know of one ex-PCW owner who changed to a PC solely on the advice that MS-DOS was a better operating system than that 'primitive' CP/M! If you are still handing out such advice, are a little ashamed of liking CP/M or just unaware of what CP/M Plus can do, then read on.

A short history

CP/M (Control Program for Microprocessors) was the first commonly used Disk Operating System (DOS) for the 8080 and Z80 range of machines — which in those early days was practically all there was apart from a few eccentrics like the Apple II and the Pet. Version 1 of CP/M was incredibly primitive by today's standards and it was quite difficult, some say impossible, to write any decent commercial software to run under it.

Version 2.2 was the first to be of any real use to anyone. From the programmer's point of view it was a lot better — you could have larger files and it supported random access. From the user's point of view it was still a frightening piece of software. The worst thing about it was the quality of its error messages, and many will remember the infamous "BDOS ERR ON A: BAD SECTOR" message which could mean anything from a total disk crash to just forgetting to close the disk drive door!

So many people felt that CP/M 2 wasn't good enough that they produced their own improvements and upgrades and many of these ideas were incorporated in CP/M 3, or CP/M Plus as it is usually known. CP/M Plus is a considerable revision and almost deserves a completely new name to distance it from the bad press of both of the earlier versions.

Although there are plenty of machines still using CP/M 2 (and very few using version 1) the most successful CP/M-based machines on sale today — that is the Amstrad CPC and PCW range — use CP/M Plus. If you are in the position of using a machine with CP/M 2 and want to upgrade to Plus, then you will have to get in touch with your machine's manufacturer to see if they have a suitable version.

A first impression

When you sit down in front of Plus it looks exactly like any other version of CP/M — with the familiar A> prompt waiting for you to type a command. The first hint that anything is different is the increased speed of disk operations. CP/M used to be known as a snail among operating systems but Plus has improved performance between 2–10 times by using some very sophisticated techniques. Another change that affects disk files, but few users, is that a single file can now be as large as 32Mbytes as opposed to an 8Mbyte limit under CP/M!

A more practical change concerns

Banking on memory

There are two ways of using CP/M Plus — banked and non-banked memory. Memory banking is a standard way of getting around the 64k memory limit imposed by all the common eight-bit processors.

Essentially all that happens is that there are a number of alternative 64k banks or blocks of memory but the machine can only access one of them at a time. Changing from one bank to another is called 'bank switching' and this is usually where all the difficulties and complications arise. You obviously cannot treat a set of memory banks as if they were a single large area of memory because only one is accessible at any given time. To allow communication between different banks it is usual for one area of memory to be shared: that is, when you change your banks one 'non-banked' area of memory stays put.

Some applications programs tried to take advantage of banked memory but the number of different hardware schemes used by different manufacturers and any lack of standards severely hampered such developments. CP/M Plus has managed to provide a way around this problem by providing a standard interface to all the non-standard hardware. A banked version of Plus can be seen in Fig 1 and you can see immediately that the main payoff is that the TPA can be as large as 60k. You can have as many as 16 banks but a minimum banked system only needs bank 0 for the operating system and bank 1 for application programs. The best-known examples of banked systems are the Amstrad CPC6128 which has two banks, the PCW 8256 which has four and the PCW 8512 which has eight. Although in theory banks two, three, and so on, could be used by application programs their most common use is to provide a RAM disk.

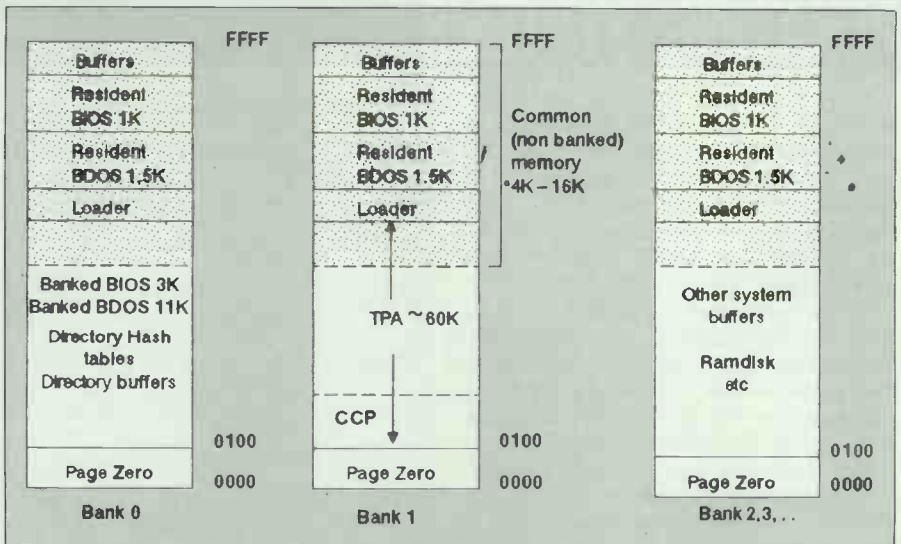


Fig 1 Memory map of banked CP/M Plus system

'disk logging'. This is CP/M's jargon for what happens when you change disks. Version 2 could get into a mess if you changed disks without telling it to re-log the drive (by pressing CTRL-C, also called a 'warm boot'). The biggest danger was losing your work because CP/M marked a drive as R/O (Read/Only) in an attempt to defend the innocent disk that you had failed to log on. Plus has improved this situation by logging a disk each time its directory is read. You can still screw up the system by changing a disk while a file is in use but then most operating systems find this a difficult situation!

Passwords and time and date stamping

The whole area of file-handling has been improved by the provision of password protection and time and date stamping. Password protection is only available in the banked version of CP/M Plus, but this includes a great many cases. You can set a password for any file and also specify for what operations that password has to be supplied.

For example:

SET [PROTECT=ON]
turn password protection on
SET MYFILE [PROTECT=READ]
specify that a password is required to read the MYFILE
SET MYFILE
[PASSWORD=ELIFYM]
set the password to ELIFYM

and from this point on each time you want to read MYFILE you will have to include its password as in

TYPE MYFILE;ELIFYM

You can password protect a file at three levels: reading, writing and deleting. You can also password protect an entire disk and set a default password so that you don't have to keep on typing it after every file name. If you forget the password to the entire disk, then you will have a lot of trouble getting access to your files — so don't do it!

Date and time stamping allow you to keep track of which version of a file you are looking at. You can enable date and time stamping for when the file is updated — that is actually changed and either for when it is accessed or created.

For example, following

SET [CREATE=ON]
SET [UPDATE=ON]

all files will be saved along with their time and date of creation and last update. Before you can start time and date stamping you have to initialise the directory using INITDIR, but Amstrad users be warned that this command makes a disk unusable with Locoscript or AMSDOS. You can see the time and date information on each file using the extended form of the DIR command

DIR [FULL]

To make date and time stamping possible CP/M Plus has to admit that a modern system might just have a built-in hardware clock. CP/M 2 ignored this possibility and left it to individual machine manufacturers to solve the problem of integrating unnecessary extras such as clocks! CP/M Plus, on the other hand, makes it easy to include a full date and time clock and it provides an extra command DATE to allow the user to set and examine the current setting.

To complete the file protection and general file utilities CP/M Plus supports the original CP/M file attributes of RO (Read Only), SYS (SYStem), DIR (DIRectory) and R/W (Read/Write) and extends it to include an archive and four user-defined attributes. The old attributes are handled better in that new easy-to-use commands are provided to make use of them. For example, SET MYFILE[RO] makes MYFILE Read-Only and DIRSYS displays any system files that are on disk.

Another useful change is that system files in user area 0 can be executed from any user area. This clearly saves having to make a copy of a program for each user. The archive attribute is set whenever a file is created or changed. You can use the PIP command to copy only files with the archive attribute set and as they are copied PIP resets the attribute. You should be able to see that this gives you an ideal way of keeping your files backed up without copying unnecessary files.

Devices

I/O redirection is usually something that only advanced operating systems offer but CP/M Plus has it. In fact Plus's ability to control I/O devices in general is rather good once you have managed to untangle the idea of logical and physical devices. A physical device is a real piece of hardware that is connected to your machine. A logical device, on the other hand, is a description of the purpose that a physical device can be put to. For example, CONIN is a logical device that is used for system input. This is normally assigned to the physical device that corresponds to the keyboard but you can assign it to another physical device if you want to. There are five logical devices in every CP/M Plus system —

CONIN: the console input
CONOUT: the console output
AUXIN: an auxiliary input
AUXOUT: an auxiliary output

and

LST: the printer output

The physical devices that are available vary from system to system. To find out what they are in any given case all you have to do is type DEVICE [NAMES]. If you just type DEVICE you will see a list of their current applications. You can change any of these assignments using

DEVICE logical device=physical device

For example, on the Amstrad machines the serial port is physical device SIO, so to send all future printer output to the serial port you would type:

DEVICE LST:=SIO

As an extension of this idea of using different I/O devices you can also replace the input normally provided by the keyboard by a disk file and then send the output that normally goes to the screen or printer to a disk file. Following the command

GET CONSOLE INPUT FROM FILE AUTO

the contents of file AUTO would be read in and treated as if it had been typed at the keyboard. This sort of thing has an obvious use in running your machine automatically — but more of this idea later. Following the command

PUT CONSOLE OUTPUT TO FILE LOG

all of the output that would appear on the screen is stored in the file LOG. A similar command can be used to redirect printer output. This is obviously useful for capturing the output of programs for further pro-

cessing by, say, a word processor.

The subject of automatic running of your machine using the GET command was briefly mentioned above but there is a much more sophisticated method based on the use of the SUBMIT command. If you type SUBMIT filename, then the file that you have specified (with the default extension .SUB) will be read by CP/M Plus as a set of commands typed at the keyboard. So far this is nothing new on GET and CP/M 2 for that matter. But CP/M Plus will also accept the name of .SUB as an instruction to use the SUBMIT command to run it. For example, you can type SUBMIT DOJOB or just DOJOB and, as long as there is a file called DOJOB.SUB on the disk, both will work. This means that you can almost create new commands. You can also alter the order in which CP/M Plus looks for such commands. Normally if you type BASIC, CP/M Plus will go and look first for a file called BASIC.COM and load and run it, but if you type SETDEF [ORDER=(SUB,COM)] it will look for the file BASIC.SUB first. This means that you can replace existing commands with more suitable submit files. The SETDEF command can also be used to define which disk drives will be searched for commands and in what order.

Another auto-run feature of CP/M Plus is PROFILE.SUB. If this file is present on disk when CP/M Plus is first started it will be read and obeyed as a standard submit file. Using this you can arrange for your machine to be set up just as you want before you begin using it. For example, if the PROFILE.SUB file contained the single line BASIC you would find yourself in Basic each time you started the system.

Non-resident residents

One of the best features of CP/M 2 was its provision of resident or built-in commands such as DIR. A resident command is really just a program that is already loaded into memory ready to run, so it will come as no surprise to discover that non-resident commands are programs that are stored on disk and have to be loaded before they can be run!

The advantage of resident commands is that they are faster but they are also more limited. CP/M Plus has kept the best of both worlds by introducing a set of commands which have the commonly used options resident and the less common non-resident.

This has enabled the original version 2 commands to be extended without slowing everything down. For example, when you type DIR you are using a resident command and a directory appears at once, but if you type DIR [FULL] CP/M Plus loads a non-resident command file DIR.COM and then proceeds to give you full details complete with file sizes, attributes and time and date stamps. All of the familiar CP/M 2 commands have either been extended in this way or completely replaced by more logical commands — see the table. For example, the old STAT command has gone and its functions have been replaced by options in DIR and new commands SHOW and SETDEF.

All-in-all the commands provided are more logical and more flexible. Perhaps the only exception to this is the infamous PIP (Peripheral Interchange Program). Once you get to know PIP you'll like it for its flexibility but until you know it you wonder why a simple COPY command couldn't have been provided.

Errors

A disk error is never a very nice thing to have but at least CP/M Plus has managed to do away with the appalling error messages that frightened most users as soon as they appeared — or rather the Amstrad implementations have. Now you are gently warned something along the lines of "track 3, sector 5 data error — Retry, Ignore or Cancel". To which you can answer 'R' if you think that the fault can be put right, 'I' if you think it doesn't matter (it usually does) or 'C' if you want to give up!

Unfortunately this nice error-handling isn't part of CP/M Plus, it's something that Amstrad has added. Other versions of CP/M Plus have a much improved and larger set of error messages than CP/M 2's but you can still come across messages such as "CP/M Error on A: Disk I/O BDOS Function = 15 File=MYFILE" which is more informative but not really friendly!

HELP commands

You might be a little irritated by the way the Amstrad PCW or CPC use the unhelpful phrase: 'These options/commands are not described here.' You can obtain more information by u#ing the CP/M Plus utility HELP.

Conclusion

There are many more good features of CP/M Plus that I haven't had the space to go into in this article but I hope that you are beginning to see that CP/M Plus isn't the half-thought-out operating system that CP/M 2 resembled. Although still not ideal it is a good operating system for eight-bit machines and it makes excellent use of their cheap and cheerful technology. CP/M Plus is a response to many years of user criticism; it was late but not too late! END

CP/M Plus commands

DATE	Sets or displays date and time
DIR	Directory listing but now with many extra options
DIRSYS	Directory of system files only
DEVICE	Assigns logical to physical devices and sets device characteristics
ERASE	Now includes a CONFIRM option that will prompt for verification before deleting a file
GET	Gets console input from a file
HELP	Displays information on CP/M Plus commands
INITDIR	Initialises a directory for date and time stamping
PUT	Puts printer or console output to a disk file
SET	Sets file operations including disk labels, file attributes, type of time and date stamping and password protection
SETDEF	Sets system options including drive and file search order
SHOW	Displays disk and drive information
TYPE	Lists a file and pauses after each page

There are also a number of advanced commands that form an assembly language development system

LIB	Library manager
LINK	Linker for modules produced by RMAC
MAC	Macro assembler
RMAC	Relocatable macro assembler
SID	Symbolic debugger
XREF	Cross referencer

BDOS calls

41	Test and write record (for MP/M compatibility)
42	Lock record (for MP/M compatibility)
43	Unlock record (for MP/M compatibility)
44	Set multi-sector count
45	Set BDOS error-handling mode
46	Get free disk space
47	Chain to program
48	Flush buffers
49	Get/Set system control block
50	Direct BIOS call
59	Load overlay
60	Call RSX
98	Free temporarily allocated blocks
99	Truncate file
100	Set directory label
101	Return directory label
102	Read date and time stamps and password mode
103	Write XFCB
104	Set date and time
105	Get date and time
106	Set default password
107	Return serial number
108	Get/Set program return (error) code
109	Get/Set console mode
110	Get/Set output delimiter
111	Print block (character string)
112	List block (character string)
152	Parse filename

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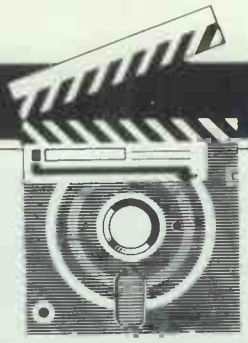


SCREENTEST

WordStar 4

With more powerful and 'friendlier' word-processing packages appearing on the market, it's hard to believe that WordStar — with its complex command structure — retains a huge following. Owen Lindenholm looks at MicroPro's latest update of this old favourite.

In these days of WIMP systems, when even IBM has decided to standardise on a windowing system, it is strange for a manufacturer to continue to provide a piece of software that is regarded as the typical example of user-unfriendliness. The program I'm referring to is, of course, WordStar, the old friend of many micro experts and the bugbear of many novices. Nevertheless, WordStar is arguably the most used program in the world; and although it hasn't sold as many copies as other programs, it is the most widely pirated program. Estimates and surveys reveal that three times as many copies have been pirated as sold.

The reason why MicroPro, the company behind WordStar, continues to provide new versions, is to get more unregistered users to pay for the program; later versions of the program have been less copied because of additions like licence numbers. Also, the later versions of the program have all been considerably enhanced both in terms of power and speed.

One additional thorn in the side of MicroPro was a company called NewStar, set up in the US by ex-MicroPro employees. That company re-wrote WordStar to be quicker and more powerful, and sold the program as NewWord at a much lower price than WordStar. NewWord is similar to WordStar but it has an extended range of commands and facilities and operates significantly faster. MicroPro recently purchased the company and its last product, NewWord 3 (reviewed in *PCW*, July 1986).

I have used WordStar for five years in various forms, ranging from WordStar 2 to NewWord 3, the immediate precursor of the subject of this review. WordStar Professional version 4 is essentially NewWord 3 with some additions and cosmetic changes, and the similarities are obvious with WordStar 4 looking more like NewWord 3 than WordStar 3. The most major change is the addition of a 220,000-word thesaurus program. This is the Word Finder thesaurus, available separately from Microlytics, and which comes bundled in. Some major improvements have also been made to the spelling-checker and to the more powerful commands.

Until recently, WordStar was the established market leader in word-processing. Newer programs are now jostling it and, indeed, overtaking it with programs such as Microsoft Word 3 and Word Perfect providing a huge range of features for the 'power' word-processor user. Nevertheless, many people want one important feature that such programs lack — WordStar-compatibility.

The big advantage WordStar has over other word-processing programs is that many users are already familiar with its complex command

WordStar command structure

Like many other programs, WordStar is controlled by a set of nested menus. The opening menu lets you edit, print, index, quit, and perform file operations like copying; obviously the major selection is editing. This prompts you for a file name and opens the file for editing. While editing, a series of menus are available from the main editing menu.

At this point, you can enter text and the preset options for WordStar will control how the text is stored, displayed and how basic movement, insertion and deletion commands work. Five other menus are available from this one to cover onscreen formats and display; saving, block operations and file operations; printer controls; quick cursor movements and miscellaneous operations; and shorthand macros.

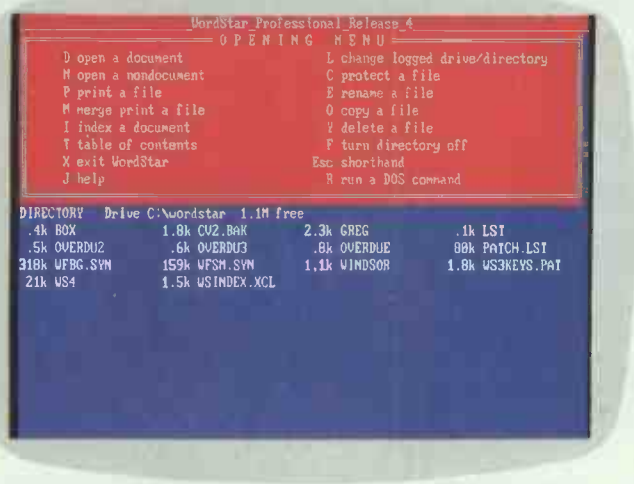
To give some idea of how the commands work in practice and why they are often regarded as clumsy, here is a summary of what I need to do to create a short document of four paragraphs; say, for the picture captions to this article.

First, hit 'D' from the main menu to edit a document. Then enter a file name. The program moves to the editing screen. Here I need to enter CTRL-O, 'S', '2' and hit Return to let WordStar know that I want double line-spacing. I now need to enter a header line so that anyone looking at this document will know what I'm writing about. The header line goes at the top of the document. Here it is in full:

'.he picture captions/Owen Linderholm/July 87/#'

The '#' symbol is to let the program know I want a page number there. I'm ready to start now, so I move down a few lines by hitting Return. I enter my text and correct it until I am satisfied. Deletions involve ordinary backspacing or CTRL-G when the cursor is on the character to be deleted. Moving chunks of text around involves marking them with CTRL-K, 'B' at the start of the block and then CTRL-K, 'K' at the end. Then move the cursor to where you want to go and type CTRL-K, 'V' to move the block.

To finish and print out the document, hit CTRL-K, 'D' to save and exit the editing mode, then 'P' followed by ESC prints the document. Hardly intuitive and straightforward.



The WordStar Professional 4 opening menu installed for an unusual colour preference. Notice the display of file sizes and free disk space. Menus and new options are available from this opening menu

Using WSCHANGE to install WordStar is very easy. This screenshot shows how to set up display attributes and colours for all the different layout possibilities and character attributes

structure and, therefore, are reluctant to learn a new set of commands. Although WordStar has fallen behind the times, it is still a good program; it does its job well, and it is extremely robust.

Installation

The program comes in a smart maroon box holding a large packet of disks, registration forms, a licence agreement, a command summary card, printer information, the *Word Finder* manual and a leaflet describing what's new in WordStar Professional 4 (from now on known as WordStar 4) besides the main program manual. The disks are: two for Word Finder, an installation disk, the program disk and the dictionary and the tutorial disks.

The installation instructions are thorough, to say the least. They give you all the important information first so that you are unlikely to make a mistake, although it does take a while to sort out what to do next. There are two levels of configuration for WordStar 4, just like NewWord 3. The first, enough to get you going, is to run a program called WINSTALL. This sets up WordStar 4 to work properly with your computer and printer. The second level, WSCHANGE, lets you change colours, screen formats, operation and other things relevant to the program.

One of the nicest aspects of the way the documentation and manual have been written is that novice users are separated from those who already know the program and who only need to learn the new commands and features. This means that you can dip into the manual at your specific level of familiarity.

The WSCHANGE program gives access to practically every feature of WordStar 4 and lets you configure it exactly to your requirements; system variable values for the program can even be changed. This means that you can use the program with displays other than the usual 25-line by 80-column format. I tried it with EGA's 43-line mode and it worked perfectly. WSCHANGE also lets you set up the cursor keys, create printer driver libraries, decide how much memory the program and dictionaries should take up, choose a page layout and more besides.

New commands

The range of options available in WordStar 4 is impressive. It is hard to imagine a useful word-processing operation that is not available, although many people do expect esoteric functions from word-processors that cannot yet be provided. That said, several features are missing from WordStar which are now becoming standard among powerful word-processing packages. These include: footnotes, column-based editing, 'outlining', interfacing with desktop publishing and the ability to edit several documents at once.

One of the major changes in WordStar 4 is the facility to 'unerase' the most recently deleted portion of text. The amount of text that can be undeleted is effectively limited by the amount of spare memory you have, but to make full use of the option, you will need to use WSCHANGE to alter the size of the unerase buffer.

Another significant change is the addition of the shorthand menu which is accessed by the ESC key. This brings up a secondary menu of keys and associated commands that you can alter and add to at will. Any combination of WordStar commands can be allocated to a single key, so you could set up ESC-S to swap the current word with the previous word (CTRL-T, CTRL-A, space, CTRL-S, CTRL-S, CTRL-U). Note that this only works if the cursor is at the start of the word.

One of the major omissions in previous versions of WordStar was the inability to access files in other directories or subdirectories. This has now been rectified and it is easy to access all files on all disks in a simple and logical way.

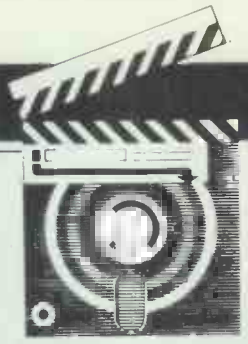
WordStar 4 supports mathematical commands within the word processor, including the ability to add up numbers within a marked block. You can also run other programs from within WordStar 4 now as long as there is room for them within memory.

The function keys can also have a combination of WordStar commands assigned to them and the bottom two lines of the display can be set up to display what the function keys do. This means that you can customise WordStar for your own purposes so that frequently used commands can be accessed by a single keystroke.

WordStar 4 is only available on IBM and compatibles. As a result, some ability to access IBM-character graphics has been added so that users can display and print the IBM 'box-drawing' characters.

The spelling-checker on this version has been considerably improved and is the best I have come across by a large margin. This one not only allows you to add words to a personal dictionary — as do most spelling-checkers — but also 'temporarily' remembers them. For example, if you haven't bothered to tell the dictionary that 'PCW' is a word you often use, then when the spelling-checker finds it, it will query it and bring up a list of suggested alternatives (none in this case). However, if you tell it to skip on to the next spelling mistake, then WordStar will assume that PCW is a real word within the document and all further references to it will be ignored.

Even more impressive, if you mistook the name 'PCW' and typed



SCREENTEST

'PCQ' instead throughout the document, you would get a query. When you enter the replacement, 'PCW', it is automatically replaced; and whenever the spelling-checker encounters 'PCQ' within the document, 'PCW' will be given first in the list of potential correct spellings. In other words, as it checks a document, WordStar temporarily adds words to the dictionary *and* links new words in as possible corrections. It is also possible to tell the spelling-checker to leave a word alone just once, but to query it when it reappears — useful for unusual words that are like misspellings. This is all on top of a list of 87,000 words which have all been properly anglicised. It is a great relief not to have all my 'ise's' queried with 'ize's' suggested as alternatives (as is the case with American spelling-checkers).

Another simple but useful touch is the addition of file-sizes to the opening menu and the file directory. You are also told how much space is left on the disk. No more worries about whether the file will fit on the disk!

It is possible to display 'soft spaces' on the display as dots. These are the 'imaginary' spaces that the word processor inserts to pad out a line to justify it. Another minor change is that the DEL key on the IBM keyboard now deletes the character at the cursor position rather than the one preceding it in line with usual MS-DOS practice.

The embedded 'dot-commands', which are instructions to the printer when the file is being printed, have been considerably extended in scope. IF . . . THEN constructions can be used and a much wider range of options is included. These include the addition of sheet-feeder controls, extra merge-printing commands, variable formatting and some new standard variables.

A new option from the opening menu, '?', displays how much memory is being used by WordStar. Background printing is now fully supported and allows more flexible control of printing while still editing.

'WordStar Professional version 4 is essentially NewWord 3 with some additions and cosmetic changes, and the similarities are obvious . . .'

Additions to the 'Quick' menu options include the ability to move to the next occurrence of a specified character and to delete up to the next occurrence of a character.

There are some new printing commands, too. The major changes are in the addition of the WSCHANGE program for complete, in-depth customisation and in the addition of a wide range of printer drivers, especially for laser printers.

Word Finder

Word Finder is a RAM-resident thesaurus program that has been available for several years. As mentioned above, the WordStar version of it is bundled with WordStar 4. The program has not been changed for use with WordStar since no changes were needed. Operating it is simple; simply press ALT-1 when the cursor is on the word you need to find a synonym for. The thesaurus itself is extensive, containing 220,000 words. Any alternative word can itself be looked up, so that a chain of possibilities can be created.

Once you have found a word, it can be easily replaced. The only problem with Word Finder is that it cannot produce synonyms for phrases, only single words. As a quick example of Word Finder's power, here are some of the first set of synonyms for 'power' (the program produced 88 words in all): current, electricity, administration, forces, authority, clout, pull, weight, tumult, mastery. . .

Installation of Word Finder is a bit more complicated. You have to fill in an electronic name and address form to be issued with a licence number. However, following the instructions is not difficult and it would be impossible to make an unrecoverable error.

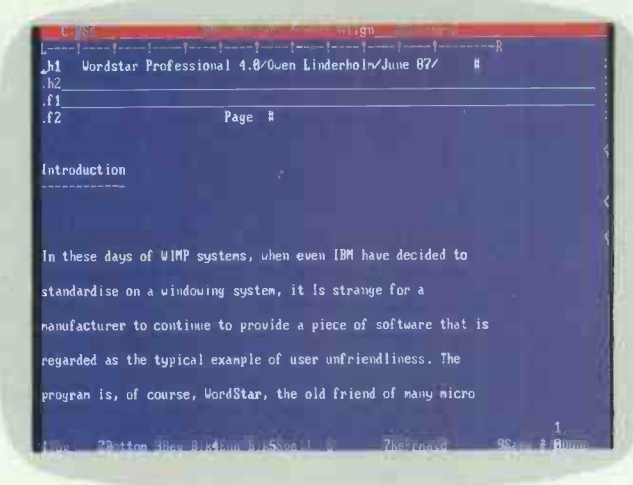
The disadvantage of using Word Finder is that it uses up some extra memory, and you will need at least 360k to use it with WordStar 4. If you want to keep the WordStar spelling-correction dictionary in memory (much faster), then you will need a bit more memory.

One problem to be aware of is that memory-resident programs like Word Finder *stay* in memory, so if you leave WordStar 4 to run another application, you may need to remove Word Finder from memory in order to leave room for the new application.

WordStar 4 comes with a tutorial program that is a bit 'simple and twee' but does serve its purpose. The object of this program is to reassure novice users that computers are nothing to be scared of and to introduce them gently to the basics of using WordStar.

In use

I consider myself a long-term user of WordStar and NewWord and had no difficulty at all getting to grips with WordStar 4. At first I thought it provided a rather sluggish response compared with NewWord 3, but after I had started customising it with WSCHANGE, I realised that I had reduced the forced delays in NewWord 3. The same option is available in WordStar 4, so I changed the delays to a shorter interval. Immediately, WordStar 4 had the fast keyboard response I was used to. It should be pointed out that WordStar 4 is about twice as fast as WordStar 3 — a very



This is the standard editing screen in WordStar. No menu commands are visible because the program has been configured for an experienced user. Inexperienced users can force menus to be displayed at all times. The main uses to which the function keys have been set are displayed at the bottom of the screen

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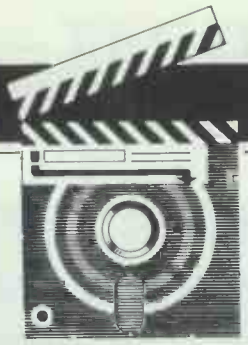


SCREENTEST

significant improvement.

The other most important part of word-processor installation turned out to be very easy. This is, of course, installing the program to work with your printer. WordStar 4 had an Epson LQ-1500 printer driver available and it worked immediately. This is very important since three of us share the same printer in the *PCW* office, so I was not able to alter the DIP switches. The biggest problem was finding the correct printer name from the huge range of 65 drivers available.

If is also easy to alter the colours and screen display of WordStar 4 to suit your requirements. I use a combination of pink text (highlighted red), a black background, and light blue for function key labels and ruler information lines. We have diffused fluorescent lighting in our office, and I find these colours on the screen make the text easier to read.

I only had one major problem with WordStar 4: I couldn't get the indexing or table of contents to work. However, after various attempts at reconfiguring the program, it still didn't work. Eventually I tried reinstalling the program, with success. Mysterious gremlins like this are very frustrating, but since it was possible to fix it without damage, it can't be too serious a bug.

One other minor problem with NewWord 3 that has successfully transferred to WordStar 4 is that under certain conditions — when the display hasn't been fully installed — odd page-breaks can appear in the middle of your text. They aren't *really* there since when the screen is redrawn because of moving, they disappear. However, you might start deleting things if you thought the page breaks were real.

I am sticking with WordStar for the moment, but I can't help feeling that the day will come when I switch to some other word processor; the attractions of WIMP systems are alluring and the arrival of desktop publishing are both strong indications that the time for change is coming.

Documentation

The manual accompanying WordStar 4 is an updated version of the old one. It is clear and comprehensive and there is a good index covering all the features. Diagrams are scattered through the text, especially in the tutorial section, and there are even a few cartoons.

As computer manuals go it is both easy to read and to understand. It could, however, be a bit more lucid in the section dealing with customisation, and the section on hints and tips for WordStar could definitely be enlarged. WordStar users, continually struggling against the unfriendliness of the program, are always on the look-out for tips to make their lives move bearable.

Conclusion

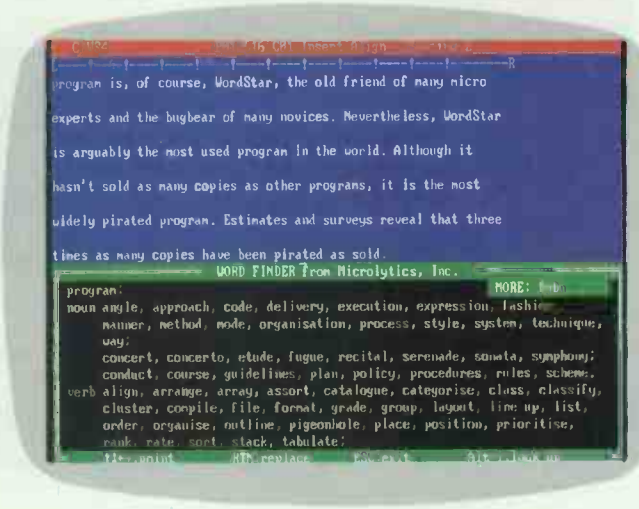
WordStar 4 is a worthy improvement on previous versions. The one area where the program could do with a complete overhaul is in the area of user-friendliness and user-inferface. Unfortunately, this is the one area where MicroPro cannot improve the program. Whatever happens, it is unlikely that the WordStar command structure will change.

MicroPro will have to watch out, since its dominant position in the word-processing market is slowly being eroded by users switching to friendlier or more powerful programs. The other area where MicroPro is losing out is in that of new users. Since they don't have to 'unlearn' their conditioned WordStar responses, such users will have no inhibitions or qualms about trying other programs.

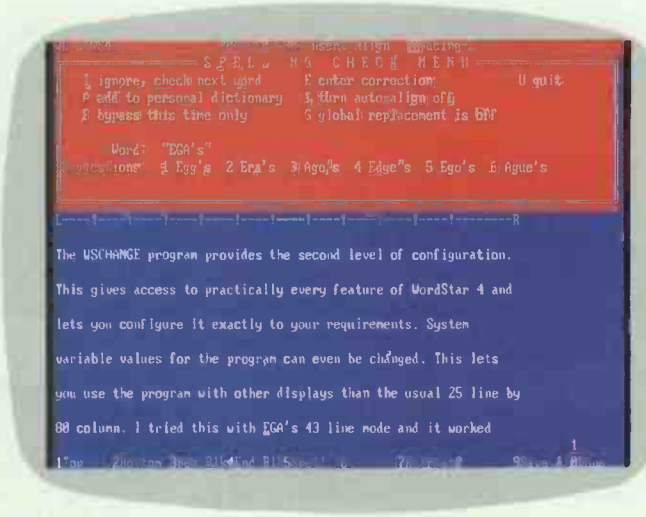
WordStar 4 is also rather on the expensive side; although its pricing is in line with other major word-processing programs, it seems a bit expensive for a program that is essentially several years old. Bear in mind that NewWord 3, the program on which WordStar 4 is based, is considerably cheaper.

WordStar 4 is a very useful upgrade for WordStar fans who *cannot* or *will not* switch. It provides a wide range of new features while maintaining WordStar's standards. If WordStar compatibility is high on your list of desirable attributes, then WordStar Professional 4 should fit the bill nicely.

WordStar Professional 4 costs £399 and is available from dealers. MicroPro can be contacted on (01) 879 1122 END



This screen shows WordFinder, the memory-resident, pop-up thesaurus program provided with WordStar 4. When you hit ALT-1, the window pops up displaying alternatives for the word at the cursor position. WordFinder can nest words it looks up, so any word appearing in the pop-up window can itself be looked up



The internal spelling-checker in operation. The spelling-checker scans through the document finding words it does not recognise. Whenever one is found, a menu of options and suggested alternatives appears. The scanning process is visible and can easily be interrupted

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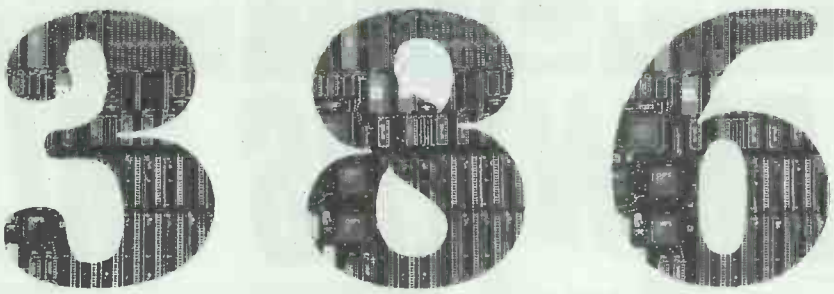

Expansion Planned for More Market Demand

Several companies in Taiwan have started to make 80386-based products. Algol Enterprise Co., Ltd. is one of the first companies in Asia to offer a 386-based product. Another new offer turned out by the company is portable computer.

The company took some capital and time to invest in designing and making its 80386 product, an AT-compatible main board featuring a 16MHz 80386 CPU, at the end of 1986. Full production started at the beginning of March of this year, with a targeted output of 300 units a month. Development of the 386 AT board started last July and the company has received several inquiries, mostly from European companies.

The board only runs at 16MHz and incorporates 2M of RAM, expandable to 4M. A choice of 128K or 256K of ROM is available. There are seven AT-compatible slots and one 32-bit slot for the memory bus. Also included is a socket for an 80287 or 80387 math coprocessor. The board features an 80386 as well as an AT-compatible chip from Chips and Technologies of the U.S. The size of the 386 board is the same as that of an AT-compatible main board and can be interchanged.

Established in 1983, the company has been offering 16-bit personal computers, interface cards and power supply system at a monthly production capacity of 3,000 sets and PC boards at 10,000 pcs per month. According to Danny Jan, director of the company, Algol hopes to double its production output in the near future if the demand for the above computer products continues to be brisk.

All the computer products offered are compatible with IBM. "We also provide a full range of interface cards capable of handling all the tasks you need for your computer system," said Mr. Jan. "They are suitable for IBM PC/XT/AT."

Equipped with automatic test system, the company's computer products undergo a 72-hour burn-in test to ensure reliability. "We enforce stringent QC throughout the production stages," company manager Titus Liu noted. "That's why our defection percentage rate is between 2% and 3%," he said. "Each production line is manned by an experienced supervisor whose main job is to see the on-going process is at without fault before they are passed on to the next line."

With a skilled workforce of 100, the company's 16-bit personal computers, interface cards, power supply system and PC boards turned out are of high quality because 70 percent of them are exported to European countries and the remaining 30 percent go to the United States. According to Mr. Liu the company plans to diversify its exports to other areas of the world in the not too distant future.

The company's 360,000 square-foot factory located in the Taipei suburb of Peitou is equipped with modern production facilitites where the 100 workers work efficiently. "We attribute skilled workmanship and punctual deliveries to our fully automatic production facilities," Mr. Liu pointed out.

In order to further upgrade the quality of the company's computers, cards, etc. and to add extra new lines, Algol always emphasizes on constant R & D. The company spends thousands of dollars on R & D every year, thus meeting the current world demands. "We will never let our customers down when it comes to product quality and services," concluded Mr. Liu.

For further information on the above products, contact the company today!

Algol Enterprise Co., Ltd.
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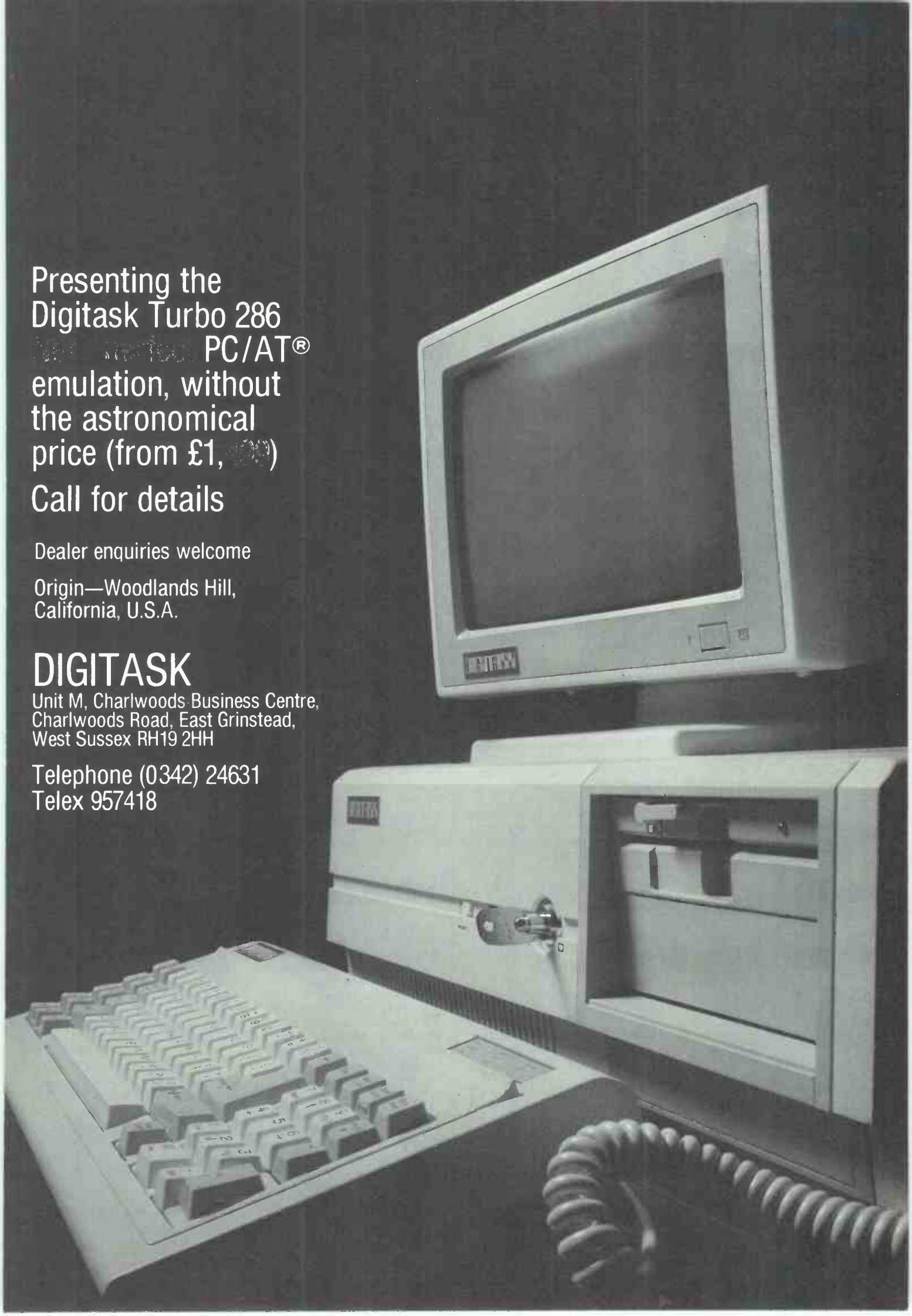
Fax: 886-2-8314657 Telex: 23682 ALGOL
Tel: (02) 8343255, 8341491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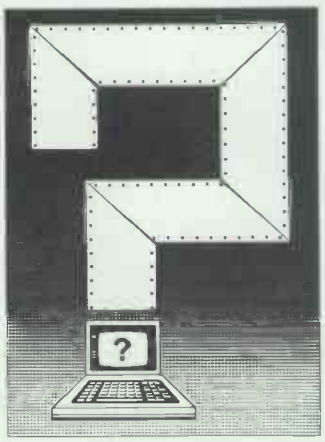


Computer Answers is PCW*'s help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.*

Making the right resolution

I have a problem with my programs for the Atari ST. Some of them need to be run when the computer is in medium resolution and some when it is in low resolution. Why is this? Also, is there any way I can switch resolutions in a Basic program?
Martin Barr, Glasgow, Scotland

The Atari ST has three resolution modes: low-resolution colour, medium-resolution colour and high-resolution monochrome, each of which are independent and operate differently. It is difficult to change screen resolutions without resetting the computer and until recently no-one has been able to do so. This meant that early programs for the ST would only run when started from the resolution for which they were designed. When they are run from the wrong resolution mode, they generally display some sort of message such as 'This program must be run in low-res!'

More recently, some programs seem to be able to switch resolutions without resetting the computer and with these you shouldn't have any problem.

Your second problem stems from the first. Atari Basic was one of the very first programs for the ST, so it would not be possible to switch resolutions without resetting the machine and, therefore, erasing Basic from memory. So the answer is: you can't do it.

Slow print run

I use an Epson LQ-1000 wide-column printer. I have discovered that, if I print long lines in condensed mode, the printer gives up printing bi-directionally. It reverts to a rather confused uni-directional print method for any line longer than 213 characters, which slows down printing somewhat. Is there anything I can do about this problem?
B Rice, South Wimbledon, London

Robert Schifreen replies:
The LQ-1000, like nearly all matrix printers, composes the dot patterns for an entire line of print in a special line buffer and then prints the whole line at once. However, if you are using condensed mode, and you create a particularly long line, the printer may not have enough room in the line buffer to assemble the dot patterns for the whole line.

If this happens, the printer will need to take the line in two parts, printing what it can, then stopping the print head while it recomposes the last few characters.

In order to maintain perfect registration so that the break in printing is invisible, the print head will return to the spot where it started (which could be either the left or right side of the page) before printing the second part of the line, and carefully skip over the first part it printed. So although alternate lines are printed bi-directionally, the two passes on extra long lines are printed uni-directionally. This slows down printing, but ensures that the print quality is kept high.

It would not be possible to change the length of the line buffer without comprehensive modification of the printer's hardware and firmware, so there is no easy solution to the problem. It does not happen on the LQ-2500, which has been designed with a larger line buffer.

Relocation problems

Is it necessary to have the RAM disk installed in order to run GEM on the Amstrad PC 1512? I recently moved my (twin-floppy) machine and it now won't install the RAM disk. Attempts to do so result in the 'drive not ready' error from GEM.
What's wrong?
Steve Dalton, Barrow-in-Furness

For reasons best known to Digital Research and Amstrad, running GEM on the Amstrad PC destroys any previously created RAM disks. I suspect this is done in order to disguise the fact that GEM uses over 200k of RAM — and that's *before* you run any GEM application.

As for the effect of moving the machine, I can only assume that before you moved it, you accessed drive C: from MS-DOS or DOS Plus and are now accessing drive C: from GEM.

Wait for Mercury

I've just got a Mercury telephone account which I want to use for accessing long-distance bulletin boards and doing other long-distance data transfers.

To dial the number I have to do the following: dial 131; wait for the Mercury carrier; change to tone dialling; dial my authorisation code and the number I want.

How do I do this with my autodial modem?
G Hamilton, Harpenden, Herts

You don't say which modem you are using, but the following scheme, using Hayes commands, should provide a guide for the command set for your modem.

The problem you will encounter is that you can't start dialling the authorisation code and number until the Mercury carrier has started. Because British Telecom exchanges can take anywhere between 1–10 seconds to get through to the Mercury network, you need to get the modem to wait an indeterminate time for the carrier.

Mercury has told *PCW* that a wait of eight seconds will usually ensure that the carrier has started and that it hasn't 'timed out', which happens ten seconds later.

To specify a pause in a dial string, in Hayes-command language, you insert a comma. The length of this pause is held in register S8. To set the register type AT S8=8.

Fig 1 is the dial string we have successfully used on a Hayes Smartmodem and a Dowty Quattrocard.
(See 'Mailbox', page 175, for more news on Mercury.)

Don't panic!

It's no good. If only I could figure out how to stop the Babel fish being cleared away by the cleaning robot, I could then understand the Vogon Captain's poetry which would enable me to obtain the Atomic Vector plotter before being thrown out into space. Help, please!
Sarah Marston, Norton, North Yorkshire

I assume you're talking about the Infocom adventure game *Hitch-Hikers' Guide to*

```
AT  S8=8 D  P   131  ,  T 1234567890 0999123456  <CR>
|    |   |  |    |  |  |  |        |  |        |   |
|    |   |  |    |  |  |  |        |  |        |   carriage
|    |   |  |    |  |  |  |        |  |        |   return
|    |   |  |    |  |  |  |        |  |        |   to end
|    |   |  |    |  |  |  |        |  |        |   command
|    |   |  |    |  |  |  |        |  |        BBS number
|    |   |  |    |  |  |  |        |  Mercury auth
|    |   |  |    |  |  |  |        |  code
|    |   |  |    |  |  |  |        switch
|    |   |  |    |  |  |  |        to tone
|    |   |  |    |  |  |  |        dialling
|    |   |  |    |  |  |  pause
|    |   |  |    |  |  Mercury
|    |   |  |    |  |  access
|    |   |  |    |  |  number
|    |   |  |    |  use
|    |   |  |    |  pulse
|    |   |  |    |  dial
|    |   |  |    set
|    |   |  |    pause
|    |   |  |    to 8
|    |   |  |    secs
|    |   |  dial
|    |   |
|    |   |
|    |   |
Put  |   |
modem|   |
into |   |
command  |
mode     |
```

Fig 1

the Galaxy. The Babel fish problem is sufficiently early on in the game and has caused so many people problems that I think we are justified in printing the full solution, so here it is.

If you didn't collect the junk mail from your doormat on leaving the house, you need to start from the beginning again and do so. Once in the Vogon hold what you need to do is: put your dressing-gown on the coat hook to cover the hole in the wall; put the towel over the grating in the floor; put the satchel in front of the panel in the wall to stop the lower-room cleaning robot in its track; and place the junk mail on top of the satchel. Then press the button on the Babel fish vending machine.

The Babel fish will then: fly out of the vending machine, run down the sleeve of the dressing-gown, hit the towel, bounce and fly through the air in a graceful arc. In the meantime the lower-room cleaning robot will hit the satchel and send the junk mail flying.

This will keep the upper-room cleaning robot sufficiently busy that the Babel fish will continue on its natural course and, providing you keep still, land in your ear.

Work of art

I have designed myself a graphic in GEM Draw on my PC which I want to include in a word-processed file. A laborious way is to print part of the text, exit my word processor, print from GEM and then return to the word processor for the rest of the text. Is there an easier way?
Frank Gorton, London E14

Ideally you need a word processor which allows you to include graphics files at print time. These files are not processed by the editor, but passed straight through from the disk file to the printer.

For these files to work, they must contain all the escape sequences necessary to turn the printer into graphics mode, the actual graphics data, and the codes to turn it back again into text mode.

Unfortunately, GEM doesn't allow you to print to disk — a sad omission given its range of output devices. However, there are public-domain programs such as LPTX600 which will intercept all printer output and redirect it to a file.

The other work you need to do is to edit the graphics file that LPTX600 produces. GEM adds lots of line feeds at the end of the file to do a form feed — which you probably don't need.

To edit the graphics file you need a text processor which will cope with non-ASCII characters. PC-Write will include both graphics files at print time and allow you to edit them beforehand.

Load the graphics file you have created and go to the end of the file. The last line will contain a sequence with the following ASCII codes: <27> <2> <12> <12> <26> (Escape, character 2, form feed, form feed, end-of-file).

Delete the two form feed characters from this line as well as the end-of-file character. Above this line, there will be a large number of identical lines about three or four characters long, whose only function is to advance the paper. Delete as many of them as you don't need.

The technique needs a few trial runs to make sure you don't remove too much of the graphics file, but as the sample here shows, it's possible to include a graphics file and then revert to straight text, all from one print run.

This method will allow you to include technical drawings within a document, or put a distinctive heading at the top of your letters.

Dear PCW

How can I capture an image I have created in Gem and use it as my letter heading?

Frank Gorton

Readers' responses

In the March issue of *PCW* we published a piece about how to stop your Amstrad interfering with radios and televisions. Two readers have embroidered on the techniques explained.

From: EA Johnson, Worcester
I had no success with the interference filter, but discovered the reason and was able to remedy it.

Tests with a signal generator and an oscilloscope showed that the filter design was good but that it required a low-impedance earth to be connected to its earthing point (the junction of two capacitors). However, the earth contact in the mains socket, while of low impedance at 50Hz, is higher at radio frequencies. And so the filtering failed.

The solution was to connect the earthing point of the filter to the central heating piping which, in my bungalow, is buried in the concrete and is low impedance to earth.

For reasons of safety, I would not have done this had the mains supply not been protected by a Residual Current Circuit Breaker (RCCB).

From: RSJ Good, Loughborough
I found that the noise which interferes with FM and not very much with medium-wave broadcasts comes mainly from my printer (I use an Amstrad PWC 8256). Just disconnect it and see what happens. A piece of PVC-insulated wire looped through a ferrite ring and attached to the extended aerial can eliminate the noise.

The wire has to be moved about to get the best effect.

I am typing this with the end of the wire resting on my lap and listening to Radio 3 without any interference.

A bad taste

We have just replaced the daisywheel printer in our office with a laser printer, as the daisywheel one was too noisy.

Although the laser printer is quiet, and the print quality is better, I find that my nostrils are sensitive to the toner particles and I get an awful taste in my mouth as soon as I walk into the room.

What can I do to make sure the toner stays in the printer?
Brian Parry, Edinburgh

Robert Schifreen replies:
Laser printers work by charging a drum with static electricity and then using the charge to attract or repel toner particles. With all that charge around, it's impossible to prevent minute particles of toner from being catapulted out of the printer and into your office. Although no-one has yet decided that this is harmful, it does irritate some people.

There are two possible ways to suck the particles out of the atmosphere. First, buy an ioniser. The problem with this, though, is that you'll find an area of your wall going black as it is bombarded with toner. Putting the ioniser in an up-ended cardboard box may help.

Secondly — and much prettier — is to put a fountain in the middle of the office. The humidity that the water adds to the atmosphere will stop the particles floating in the air.

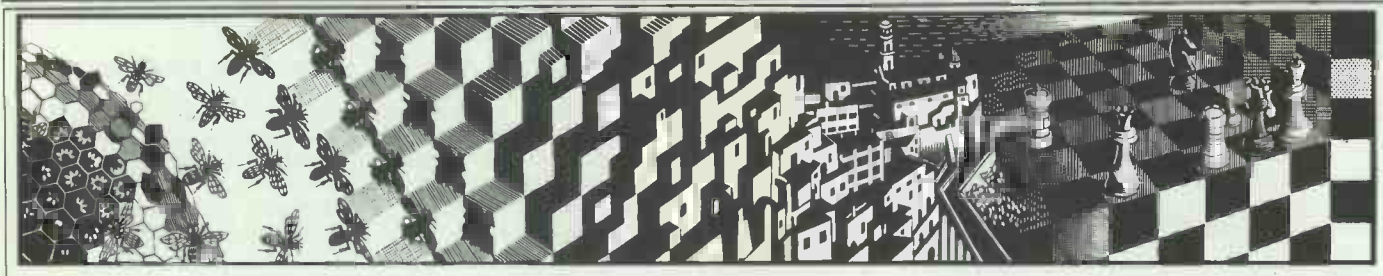
We have a laser printer and an Epson SQ-2500 ink-jet in the *PCW* office, and we all agree that the ink-jet is the quieter of the two and less environmentally invasive.

Perfect garbage

I use Word Perfect version 4.2 on my PC clone and find it to be one of the best word processors I've used.

Unfortunately my printer is a Toshiba P321 and if I use Word Perfect's Toshiba driver I just get a load of garbage printed. I have found that the generic text printer driver will work, but it means I can't use any of the Tosh's fancy features or fonts.
Peter Hibbert, Aberystwyth

Robert Schifreen replies:
There is a problem with the Toshiba printer driver. The driver that is supplied is actually labelled P321/351, and was designed to work with both these Toshiba printers. However, the P351 comes with Qume emulation and the P321 does not. The problem is that Word Perfect is trying to drive your P321 as though it had Qume emulation, hence the garbage. Both companies are working on the problem, so call Word Perfect on (0932) 231164 or Toshiba on (0932) 785666 for the latest fixes. END



Stephen Applebaum dons his trendiest gear for a trip to Tonetown, rescues innocent people from a cruel warlock and still has time to squeeze in a murder party. How, and why, does he do it? Find out, in the best of this month's games.

Time of your life

Title: Tass Times in Tonetown
Computer: Atari ST
Supplier: Activision
Format: Disk
Price: £24.99

Tonetown is a unique world on the other side of your imagination: it is oddly familiar, and yet so different, that survival there depends on your ability to assimilate into the subculture created by the ultra-hip inhabitants.

To be acceptable to the denizens of Tonetown you must be chic, urbane and a little on the weird side. Tourists are definitely not 'cool'. Their 'Jonboi Waltune' (red-neck) outfits are reviled by the locals and can even lead to a bad case of rigor mortis if not traded in for the right gear; such is the extent of the hatred their dowdiness inspires in the sartorially aware Tonetownians.

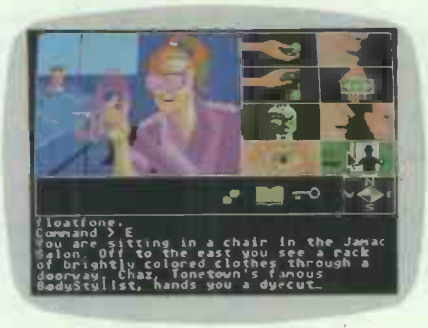
Cool is tass and tass is a dyecut dyeorama hairdo, a Troppowear jumpsuit or the Daglets singing 'Tass', their smash hit single.

On the surface, Tonetown is a Sybaritic paradise: there's music, 'acid' cocktails, glo burgers and even a wood where 'magic' mushrooms grow wild. But below this exterior of unmitigated superficiality there flows an undercurrent of dread.

Everything bad that happens in Tonetown — and there is plenty — can be traced back to Franklin Snarl, an evil character who resembles a cross between an alligator and a shagpile carpet. He, it would be fair to assume, is solely responsible for the disappearance of Gramps, the reason for your foray into Tonetown.

Having discovered a way of passing between dimensions, Gramps has got himself stuck in Tonetown and is unable to return to his cosy, winterised log cabin. His only hope of making it back is if you, too, enter Tonetown and show him the way.

You are escorted throughout the adventure by Ennio the Legend, an esteemed reporter employed on the *Tonetown Times,* who would not warrant a mention were it not for him being a dog. In fact, Ennio is the incarnation of Gramps' faithful hound Spot's alter ego.



Excellent as it is, Tass Times in Tonetown will most likely be ignored by adventure purists since it goes against virtually everything they believe in; not only does it have graphics, but also a system that allows commands to be executed without the necessity for typing them in beforehand. (It is worth noting here that the graphics can be turned off and the game played as a straight adventure. But if you are going to do that, why buy the game in the first place?)

All the most commonly used commands have been put onto the ST's 10 function keys. This means that if you want to drop an object, for example, all you need to do is press the key programmed with the 'drop function' and then either type in the name of the object or point to it on-screen using the mouse.

Tass Times in Tonetown's display is divided into a number of different sections, the largest being a graphical representation of the current location. There are quite a few such pictures in the game, many of which are animated. The opening frame, for instance, depicts the interior of Gramps' cabin, where a clock complete with swinging pendulum ticks away noisily on one of the walls.

Some of the aforementioned pictures contain objects which can be picked up and kept for use later on in the game. An inventory of all that you are carrying is displayed in a strip running along the bottom of the picture. In addition to the graphics, each location is also described using text. This gives the story so far, telling you what is happening in the picture and who the characters are.

On the right-hand side of the display are a number of icons, some of which represent the same operations programmed onto the function keys: 'talk to' and 'tell me about' are different though, and allow you to communicate with characters.

To talk to someone, you must know his or her christian name, as this is the accepted form of address. Some people's first names are not available from the program itself, and in this case you must refer to the copy of *Tonetown Times* supplied as part of the overall Tass Times in Tonetown package. The newspaper is not simply a piece of otiose gimmickry, cynically tossed in at the last minute to beef-up the package (a practice currently pursued by *some* companies I could mention). Rather, it is an extra dimension that contributes to the adventure's atmosphere.

Tass Times in Tonetown is one of the most enjoyable computer adventures I have played. The graphics are excellent, the storyline is unusual and, most important of all, it is accessible. And because many of the clues needed to progress in the game have been conspicuously 'hidden' in the newspaper, not even the most naive adventurer could get so stuck as to give up. Definitely one for the collection.

Fantastic adventure

Title: Phantasie II
Computer: Atari ST; Commodore 64/ 128; Atari 800 series; Macintosh
Supplier: US Gold
Format: Disk
Price: £24.99

Sequels have always been big business at the cinema box office. One has only to look at the number of *Rocky* and *Star Trek* films made to realise that if people like a formula they will lap up as much as they can until surfeited. Much the same is true of the computer games industry, where 'big' products are marketed in a similar way to films, albeit on a smaller scale; even here in certain sectors, the sequel is almost *de rigueur*.

Some sequels to popular arcade games have been made over the years, though they have not always fared well because it is difficult to maintain the feel of the original and still make the sequel different enough to be of interest to fans.

Conversely, the fantasy role-playing game has provided rich pickings for the sequel merchants; a trend that must be attributable in part to the ease with which the thread of a story can be continued from one program to another.

One of the latest follow-ups to a successful role-playing game is Phantasie II, a program riding the wave created by ... wait for it ... Phantasie I.

Like its predecessor, and in fact almost every game of its ilk, Phantasie II features a beautiful isle whose inhabitants have been made the thralls of an evil sorcerer — in this case, a warlock named Nikademus. The source of Nikademus' power lies in a terrible orb. If the orb is destroyed, Nikademus will be rendered powerless and his reign of terror ended. If not, the good people of fair Ferronrah will remain his slaves till death releases them from his grip.

Before setting out on the quest to destroy Nikademus, you must first recruit a band of six hale and hearty adventurers. Aficionados will be able to use experienced fighters left over from their adventures in Phantasie I. Those of us, however, who have come into the fray rather later must go through the procedure of building a motley crew from scratch.

Parties of adventurers are traditionally multi-racial affairs, comprising humans, dwarves, elves, gnomes and halflings. All are available in Phantasie II along with a new race, the nebulously named 'random creatures' — so called because when chosen, the computer randomly selects a race from an exhaustive list of mythical beasties which includes goblins, minotaurs, pixies and sprites.

Unlike the other types of being which can be trained in almost any trade, random creatures, who, because of their sheer grossness are generally disliked by humans, can only become thieves or fighters and are charged inordinately large sums of gold for training.

All the beautiful people — that is, members of every race bar random creatures — can become not only fighters and thieves but also monks, priests, rangers and wizards.

Some races have a bent for particular trades. How you combine the two has either a positive or negative effect on the character's physical and mental attributes. It is therefore important to get the mixture right, else you could, for example, find that your wizard's magic peters out just at the moment when a fireblast from his wand could save the team from a grisly death. But, *c'est la vie*.

Characters can be created in any of the towns on Ferronrah; which means losses picked up in battle can easily be overcome by inducting new characters from the nearest town's Guild, the training ground for would-be heroes. On the other hand, battle-hardened survivors who have earned experience points by mutilating some of Nikademus' minions can be presented to the 'board' for training. At a cost, of course.

This set-up is rather hard on random creatures, since to progress they must earn far more gold, and take more risks, than their fellows.

Once you have built your team of adventurers and vestured them in protective rigs from the local armoury, it is time to leave the safety of the city walls and enter the hurly-burly without. Whereas the towns are presented as a pretty, three-dimensional view down the main thoroughfare, the graphics outside are rather drab. The main playing area features a map with a cross-hair cursor representing your party. Most of Ferronrah is woodland and therefore much of the map is a monotonous mass of green, broken up in places by a path or a range of mountains or a river. Small inns dotted about the map offer oases of calm where your group can recuperate. Yellow castle symbols represent villages, while a small archway is the opening to one of several underground labyrinths.

Phantasie II's programmers must have spent a long time wondering how to show the subterranean environment that presents itself to our heroes as they descend through the dark portal that opens to the surface. They could have used a 3D maze as in The Bard's Tale and Wizardry, or a simple two-dimensional bird's-eye-view as in Rogue. But no; instead they opted for a plain grey square devoid of detail. When you move the cursor, however, a chunk of grey disappears, revealing a corridor; and sometimes a small yellow square representing a door appears.

Much the same happens above ground, where vast areas of the map are shrouded in a black mist which miraculously evaporates as you move your team through it.

When you meet up with a group of the sorcerer's evil hordes, a frustratingly all-too-frequent event, you can either run or fight. Choosing the latter activates combat mode, whereby you have to inform the computer of the action you wish each character to perform. Fighters can be commanded to attack in different ways, while the fey members of the bunch can be ordered to cast spells at the foe.

The regularity of these skirmishes means that your entire crew is often wiped out in a few minutes. When this happens, they arrive on the Astral plane where His Sable Majesty presides over their fate. The luckier characters are resurrected or made one of the undead. Useful in battle but short on chat, the undead cannot be trained like their living counterparts. (And the random creatures think *they* have problems.) Their role is that of pawns to be thrown to the enemy before the living members of the group.

Phantasie II leaves me thinking that there should be something more. What, I can't quite put my finger on, since as role-playing games go it really isn't bad: it is difficult, there are numerous spells to be gained and a morass of puzzles to be solved. Technically Phantasie II is not much to cheer about, although there is enough action and complexity to make you want to pick it up and start again, even after your best team of adventurers has been ravaged for the umpteenth time.

Murder made easy

Title: Make Your Own Murder Party
Computer: Commodore 64/128
Supplier: Electronic Arts
Format: Disk
Price: $38.95

Murder parties have apparently been popular in the US and some European countries for over a century. These peculiar events entail a bizarre game of charades, where visitors play the different characters involved in a murder investigation: the aim of the game being to uncover who has committed the crime.

Make Your Own Murder Party is quite a departure for Electronic Arts. It is a difficult package to define, since it does not slot neatly into any of the accepted divisions of software; anyone thinking they were buying a detective adventure, for example, would be sadly disappointed, and no doubt want his or her money back. People looking for something a little unusual, on the other hand, might just find it to their liking.

The preparations for a good murder party are time-intensive and laborious. Not only do you have to think up a good scenario, but also design and send out invitations as well as write personalised clue books for each of the guests. With Make Your Own Murder Party this is all handled by the computer; leaving you with the less onerous tasks of deciding who to invite and what you are going to give them to eat and drink. And since a murder party is a kind of cross between human *Cluedo* and *The Mouse Trap*, you are also responsible for creating the right ambience. A murder party could be scuppered from the off if the atmosphere is not right, as players might find it difficult to act out their respective roles unless they had something other than the game to stimulate their imagination.

Make Your Own Murder Party comes complete with two mysteries entitled The Big Kill and Empire. The first tale is about the 'apparent' suicide of an actor, while the second one surrounds the murder of a wealthy widow.

Both scenarios require a minimum of six players including yourself. Who you choose to invite depends mainly on the personalities of the characters in the story.

To help you decide, Electronic Arts provides a file containing 'close-ups' on the personalities of the characters in both stories. Reading these provides useful information on each of the characters' strengths and flaws which you can match as closely as possible to those of your prospective guests.

Casting guests in the right parts is important, as it wouldn't do to ask a timorous person to, say, take the role of a playboy, as they would be unlikely to do the part justice and therefore detract from the game's realism.

Having completed the guest list, you are ready to get down to the business of designing the party, a procedure akin to forming a band of adventurers in a fantasy role-playing game. When you create a party, you first tell the computer the date of the drama, the time it is to start and the location. Then you cast the roles, keying-in personal information about each of the guests requested by the computer. It pays to be truthful here because the computer bases the clues on the information you give it. And the more players are able to identity with the information in the game, the more relaxed they are likely to be when playing.

Most of the information fed into the computer is incorporated into clue-booklets, a personalised form of which is given to each player. Inside the booklet is contained two different kinds of information, some which must be read out and some which must only be disclosed if the player cannot do otherwise.

The booklets, together with the invitations, envelopes and a special set of materials for the host — designed to help the evening run smoothly — can be output to a variety of devices including a laser printer. Because of the sheer volume of written material needed for a game, the time taken to print everything can be quite extensive. Of course, this is entirely dependent on the speed of your printer. Those lucky enough to own a laser printer can have everything ready for The Big Kill in a matter of 35 minutes or for Empire in 45 minutes. A printer that works at only 15cps takes much longer — at two and a half and three hours respectively.

When the 'big night' comes around and the guests arrive, the host begins by handing each one a clue-book. One of the books is a page longer than the others and reveals its owner to be the killer. Players must therefore be disciplined enough not to turn the pages of their clue-books unprompted.

A game takes place over four rounds during which players reveal the information given on the current page of their clue-books. At the end of each round, players question each other further, which is when the second kind of information, mentioned earlier, might possibly be revealed. When all the rounds are finished, the host requests that the guests write down who they think is the murderer on a special verdict sheet at the end of their booklets. The winner is the one who guesses the villain of the piece, motive, the means and the opportunity.

Make Your Own Murder Party is an excellent idea, well-executed (if you will excuse the pun) and painstakingly detailed. But having never held a murder party of my own, I cannot tell whether or not it is better or worse than the 'real thing'.

What I *can* say is that the amount of information included in the package would take a long time to put together without the help of such a program, so on the level of time-saver alone, Make Your Own Murder Party is a good investment. END

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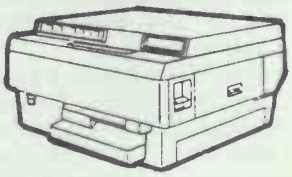

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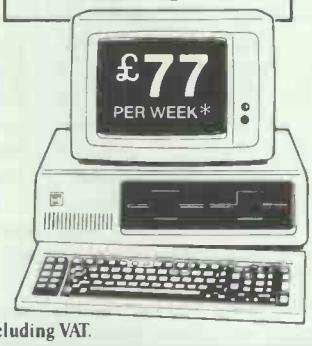

* Prices quoted are based on 3-month rental, excluding VAT.

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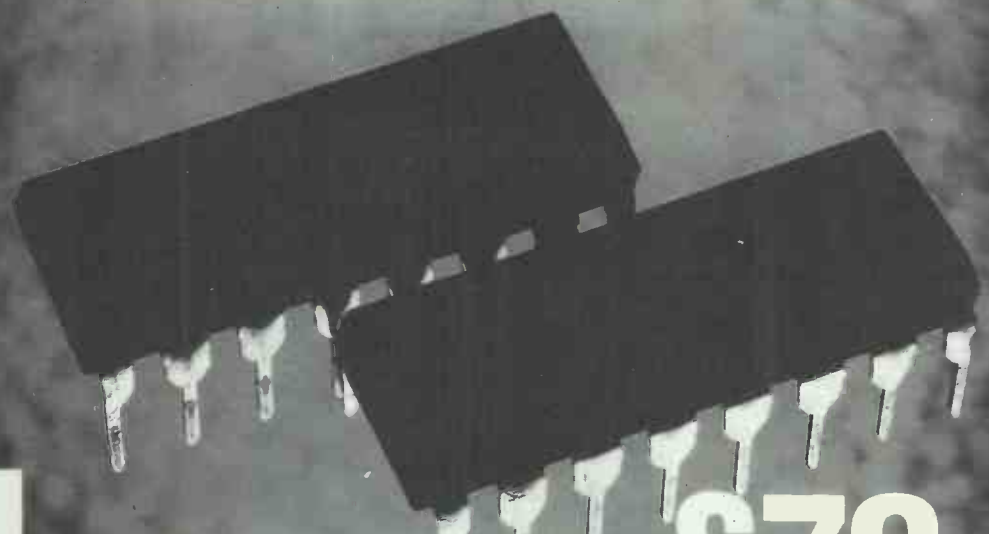

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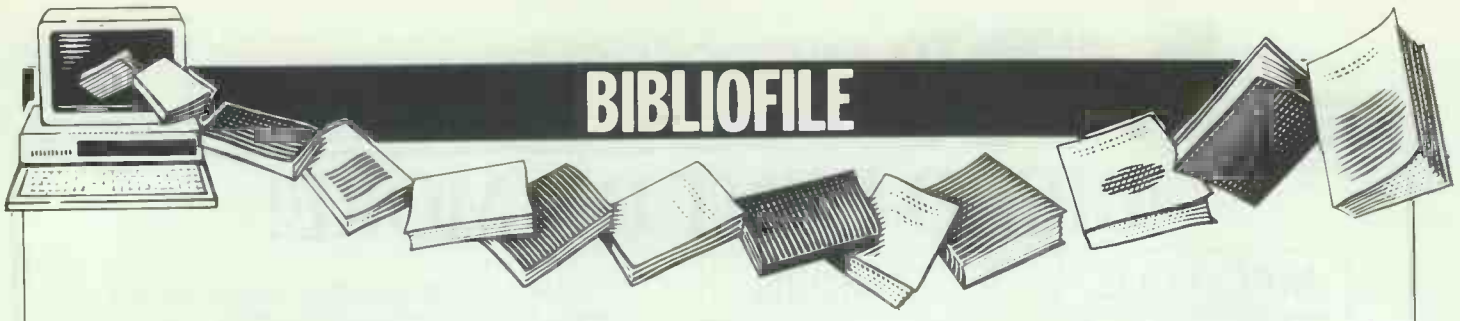
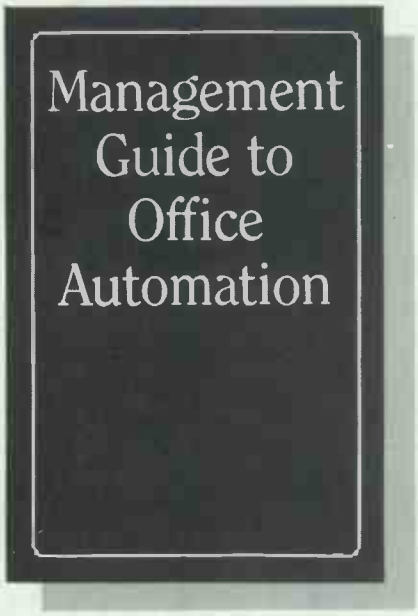


BIBLIOFILE

In our crop of books under review this month, there's something for everyone — from philanthropic researchers to xenophobic managers.

Management Guide to Office Automation



Author: Joseph St John Bate
Publisher: Collins
Price: £14.95

If I worked in an office where the senior managers were as considerate as those in Joseph St John Bate's *Management Guide to Office Automation*, then I'd be a very happy worker indeed. I would have thought that 90 per cent of all office staff are presented with a *fait accompli* as regards office automation — that is, 'make a space on your desk on Monday morning; the word processor will be delivered then.' 'What word processor?' might come the shocked reply.

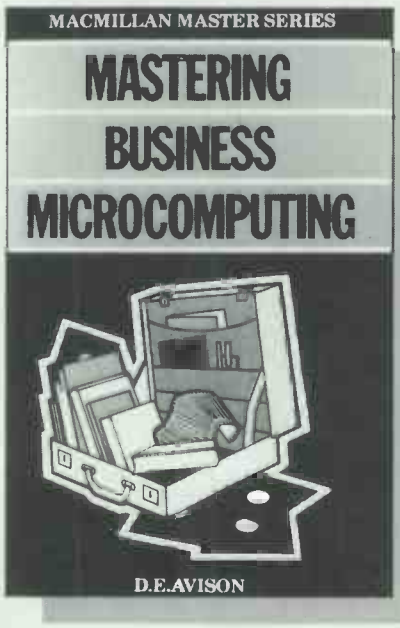
Joseph St John Bate's objective is to help managers overcome such unwarranted fear: *'It is curious that automation has been portrayed as a frightening and unnatural invention,'* he assures us, when *'automation is seen in nature. Most of our body is automated...'* It's a very benign approach, and it works well.

To help management inject a human aspect into the idea of 'office automation', this book should be compulsory reading whenever that dreaded phrase is mentioned. You'd probably have to take a sabbatical week off first, as there is certainly a mountain to read and digest — over 200 pages, with only the odd few graphs and statistical tables to lighten the load. Reading the Contents page might also put you off ever starting — for example, Chapter 7 on 'Technology in Support of Knowledge Workers' sounds like something out of *1984*. But you would be well-advised to persevere with this book as the author does talk a great deal of (slightly long-winded) sense.

He even takes a kindly view of managers themselves, stating that they are usually the first people to be frightened stiff of new technology, as they are expected to be keyboard experts plus resident engineer/analyst/programmer. That, I thought, was carrying the sympathy too far!

Lorna Kyle

Mastering Business Microcomputing



Author: DE Avison
Publisher: Macmillan Master Series
Price: H/c £12.95; Paperback £3.95

There is a plethora of books on the market that claim to be 'the businessman's guide to microcomputing'. Some good, some adequate, some a waste of time and money. Thankfully, DE Avison's *Mastering Business Microcomputing* does not fall into the latter category. If anything, it is among the elite of books that I have read dealing with this topic. It concentrates on applications which are of most interest to managers of small/medium-sized companies, and the author's *'aim is to keep the book readable and to avoid unnecessary technical detail'*. He also keeps clear of any preferences in hardware and software.

Each chapter opens with a concise and pertinent introduction to the individual sections, informing the reader of the information to be discussed and exactly where to find it in the chapter. Chapter 1 covers the nail-biting subject of choosing a microcomputer system and deserves to be re-read until all the salient points are driven home. I was pleased to see emphasis placed on the quality of documentation, help facilities and the availability of a disk tutorial system within a package, as so often with the purchase of a microcomputer and/or application packages, the 'new' user doesn't realise until it is too late that most of his knowledge will be self-taught.

'Word processing and the electronic office' is the first application to come under close scrutiny — logical enough, as it is one of the main areas of microcomputing. Plenty of diagrams and illustrations here, showing possible screen formats and text layouts, and also the real aspects of people and ergonomic factors are discussed: *'If human factors are given the importance that they deserve, then the business stands a far greater chance of the computer system being a success.'*

File management, spreadsheets, financial modelling, graphics, accounting applications and integrated systems are all treated with equivalent detail in individual chapters, and the advantages and disadvantages of different systems are discussed clearly and fairly.

Mastering Business Microcomputing is a very useful book to learn from initially and a handy reference book for all times: a worthy addition to the Macmillan Master Series.

Lorna Kyle

Pebbles to Computers: The Thread

Authors: Hans Blohm, Stafford Beer, David Suzuki
Publisher: Oxford University Press (Canada)
Price: £12.95

The cover of this book reminds me of those delicious-looking cookery books you get at the checkout in Sainsbury's: you may be tempted to buy, but it's often just a pure indulgence. And frankly this is how I would sum up *Pebbles to Computers*, only this time the *indulgence* is on the part of the authors.

The book purports to be not so much a history of computers *per se*, although it does include brief biographical details of the major personalities involved in their development, ranging from Leonardo da Vinci to Alan Turing. Rather it represents a chronological dossier of humanity's efforts 'to create order out of chaos' by recording information about its environment, with the pebble being the earliest *'mark of distinction'*. *'A pebble'* the authors remark *'is an entity.' 'It is one of the simplest, most familiar things that demonstrate a unity. All computing is based on this idea.'* It's powerful stuff, but a bit hard to swallow.

Messrs Blohm and Beer (not so much Suzuki) have obviously spent some time meditating the meaning of life, the universe and everything else as they link together the efforts of past and present cultures in an attempt to show how everything in the cosmos is interwoven — ramming the point home by a tacky red thread which encircles key words on *every* page.

Pebbles to Computers is glossy and beautifully illustrated (Blohm is first and foremost a photographer, of microchips no less) but for my money I expect a book to offer more than randomly linked pictures and text (and somehow my philistine nature will not allow me to dwell too long on the similarities in design between an ancient Aztec courtyard and an integrated circuit board).

I don't like this type of book with its self-congratulatory style and its liberal smatterings of anthropology, philosophy, aesthetics and scientific truths. Although it looks very appealing (apart from that *awful* red thread), there's nothing to really get your teeth into.

Joanna Murchison

Dirk Gently's Holistic Detective Agency

Author: Douglas Adams
Publisher: William Heinemann & Co Limited
Price: £9.95

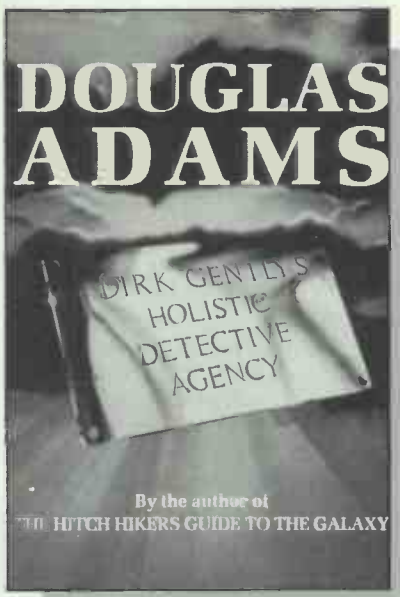
There's no doubt from reading this book that Infocom has already got its hands on it. And considering that the HitchHikers Guide to the Galaxy, by the same author, is the company's best-selling adventure after Zork, it's not really surprising.

Every event, feeling or movement is accompanied by a long description, written in pure Infocom-ese. My favourite is that of the bathroom. After a couple of dozen sentences about lavatories, basins and bathroom cabinets, the text ends: *'There was also a large horse in the room, taking up most of it.'*

The story, for it is fiction and not like a normal computer book, is set in the present day. It's also set in the past and future, too, as each of the 36 short chapters takes us to a different place and time. Fans of *The Singing Detective* should feel quite at home.

Like earlier Douglas Adams books, this one gives more than a passing mention to computers. Our hero, for example, has a network of half a dozen Macs, as well as a Laserwriter. Most of the time, the screens show a picture of a revolving sofa stuck halfway up a staircase, though the exact reason for this is not clear.

Staying with technology, my favourite character is the Electric Monk. In the same way that dishwashers perform the tedious job of doing your washing up, and video recorders watch all the boring TV programs that you don't want to watch yourself, the Electric Monk is a



robot-like device that will believe anything it is told, to save you having to believe it yourself.

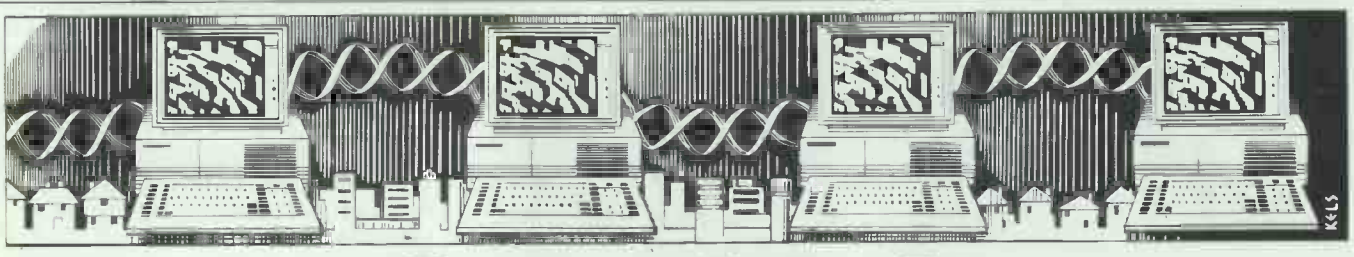
Although such a device is certainly useful, not many have been sold yet as everyone's waiting for the Monk Plus to be launched.

Holism, by the way, is the theory that the fundamental principle of the universe is the creation of wholes. And Dirk Gently's holistic detective agency has a brass plaque on the door that says: *'We solve the WHOLE crime. We find the WHOLE person. Phone today for the WHOLE solution to the problem. Missing cats and messy divorces a speciality.'*

If you like Douglas Adams books and/or Infocom adventures, you'll find this a good read. It's handy for the coffee table, too, to let guests dip into during dull moments. I'd even go so far as to say that, if you don't have a coffee table, it's worth buying one just to put this book on.

What's the plot? Oh, I've no idea.

Helen Rappoport



On a high

Peter Tootill examines the advantages of high speed modems.

This month we present a survey of some higher speed modems for use on ordinary telephone lines (often called the public switched telephone network, or PSTN). This complements the survey of budget modems we presented in the December 1986 issue.

Until two or three years ago the most common standard for dial-up computer systems was V21 (300 bits/sec). V23 has been used by Prestel for a few years — this is 1200 to the user but only 75 back — and it's reasonably good for receiving data but not for uploading prepared messages: for example, V22 modems are more recent and more expensive. They provide 1200 bits/sec in both directions at the same time (full-duplex). Even at this sort of speed a screen full of 80-column text takes around 15 seconds. The latest modem standards provide 2400 bits/sec (V22bis) and a staggering 9600 (V32). V22bis modems are widely available and prices are falling. They currently cost between £500-£1000 (see the table). V32 is very new and pricey at around £3000.

Error correction

At the higher data speeds some sort of error correction becomes essential and is usually included in terminal software (Xmodem and Kermit are examples). This is fine for transferring files — but if you get a poor line you can have great difficulty even signing on to a system. Try entering your password when the telephone line is trying to help by adding the odd curly bracket!

Again, if you are carrying out an online search of a database, looking for articles on a particular topic, a noisy phone line can corrupt your search commands and you can waste a lot of (possibly expensive) online time repeating it until it gets through unaffected. Error-correcting modems deal with this problem by filtering out line noise and ensuring that only *real* data passes between your terminal and the system you are using. The usual way of doing this is to cut the data into blocks and send it with a CRC check, which is called ARQ (Automatic Repeat on reQuest — see the April 1987 issue for more information on error-correcting protocols). The new V32 standard uses a feature called trellis code

Selection of high speed modems

MAKE & MODEL	MODES 1,3,2 B	TYPE	PRO	DI	NO	MO	CS	S	ARQ	LED	SY	PHONE NO	PRICE	NOTES
Case 400/24	X X X X	SC*	H/P	M	4	A	Y	N	T/MNP	9	A/S	(0923) 58000	£795	Security dial back
CDS V22bis comp	XX Bell	SC	P/V	A	—	A	Y	N	P	22	A	(0923) 58000	£995	Data compression gives 400 bps
CDS V32	V32	SC	P/V	A	—	—	Y	N	P	22	S(A)	(0923) 58000	£2850	
Dacom Unity Quad	X X X X	PC	H	A	—	A	Y	Y	MNP	—	A	(0923) 58000	£599*†	Epad, asynch port options
Dacom 1-2-3	X X X	SC	H	—	—	A	N	Y	—	5	A	(0923) 58000	£399	
Dataflex Stradcom	X X	PC	H	A	—	A	N	Y	—(V)	—	A	(01) 543 6417	£199†	V22bis version planned: £299
Dataflex Chameleon	X X X X	PC	H	M	—	A	Y	Y	—(V)	—	A/S		£599+	Serial port. Options:V.26,27&29; & IBM 3270 Emulation
Dowty Quattro	X X X X	SC/PC*	H/P	M	20	A	Y	N	T/MNP	6	A/S	(0635) 33009	£795*	
Gandalf DMV2422	X X X X	SC/PC	H/P	A	20	A	Y	N	T/MNP	6	A/S	(0925) 818 484	£795*	
Hayes Smartmodem 2400	X X	SC/PC	H	M	4	A	N	Y	—	8	A/S	(01)848 1858	£725	
Lion Orator	X X X X	PC	H/P	A	—	A	N	N	P/E/V	8	A	(024026) 3951	£800+	Also voice synthesis, answering etc
Micom-Borer 3024	X X	SC*	P	M	20	A	N	Y	(T)	8	A/S	(0734) 866 801	£580*	MNP coming soon
Miracle WS3000	X X X XBell	SC	H	M	64	A	N	Y	—	10	A	(0473) 216 141	£650*	
Pace Series Four	X X X X	SC	H	M	64	A	Y	Y	—	10	A	(0274) 488 211	£499	LCD display, front panel controls
Racal VI 2422	X X X	SC*	H/V	A	20	A	Y	?	M	10	A/S	(025672) 3911	£795*	LCD display, front panel controls
Tandata Tm602	X X X	SC	P/V	M	—	M	Y	N	—	5	A	(06845) 68421	£399+	
Tandata Tm722	X X	SC	H	M	10	A	Y	Y	MNP	7	A/S		£499	
Trinitas Phasor 2221	X X	SC/PC*	H	M	48	A	Y	Y	—	7	A	(0473) 215 719	£295	ARQ planned

Notes:
MODES = 1 = V.21 (300); 3 = V.23 (1200/75); 2= V.22 (1200/1200); B = V.22bis (2400/2400). **TYPE** = PC = IBM card, SC = self-contained,* = rack-mounting version available. **PRO** = protocols. H = Hayes, V = V25bis, P = Proprietary. **DI** = dialling (dialling selection method). A = automatic selection, M = manual. **NO** = size of internal phone number store. **MO** = auto-answer mode. A = Automatic, M = Manual selection of incoming call speed. **CS** =Constant Speed Interface. **S** = loudspeaker. **ARQ** = Error correction method. MNP.E = Epad. P = Proprietary. V = Vasscom. T = Tulse. **LED** = number of LED indicators. **SY** = Synchronous/asynchronous or both.
Prices: Exclude VAT, * = a range of version available. Highest price model quoted. † = software included.

modulation (TCM). TCM interleaves the data with additional information to allow the receiving modem to decide the most likely format of the correct data. This system avoids the data going in fits and starts as tends to happen with the block-based system, which can be very intrusive.

Selection

The table on page 174 is a selection from the range available. Many manufacturers have a number of models in the V22/V22bis area and we have listed those that provide V21 and V23, as well as V22 and V22bis standards; otherwise a typical V22bis modem is included. Two unusual modems from Dacom have also been included — a V32 modem (one of the first, if not the first available in the UK) and the V22bis data compression modem. The latter gives up to 4800 bits/sec by using data compression techniques. The Lion Orator is a totally different animal to the others — Lion calls it an 'integrated services communications manager'. It handles voices as well as data and can act like a telephone-answering machine, storing incoming voice calls on disk. (Review, *PCW* April.)

Most of the modems listed are available through normal retail outlets, but in case of difficulty, the manufacturer's telephone number is included. You will also find the Dowty (originally called the Steebek) Quattro rebadged by a number of other modem manufacturers and not all these versions have been included. These companies may have commissioned variations in the specification, so they may not be identical to the Quattro. From a quick look at the outside of the boxes and the specifications, Gandalf, X-Tec, Jaguar, PC Communications and Modular Technology appear to be examples.

News Item

Mercury now offers cheaper telephone calls for domestic and small-business subscribers. Mercury is the new competitor for British Telecom and as yet has not been selling its services very hard. Because of this, you may not have realised that Mercury has now introduced a service (for trunk calls only) for the small business and domestic subscriber called Mercury 2200. If you are in one of the areas served by it, all you need to use it is a BT phone line and a special Mercury telephone.

If you have more than one line, you need a 'smart box' adaptor instead of the telephone. This checks the destination of all outgoing calls, and routes them via Mercury if that would be cheaper than using a BT line. The advantages of using Mercury are: cheaper phone calls (see the 'Ready Reckoner' box): itemised phone bills: individual bills for individual cost centres: and cleaner telephone lines. I have produced a Ready Reckoner for calculating the cost of phone calls using Mercury 2200 in the same format as last month's, which was based on BT charges. Local call charges are quoted but you don't normally use Mercury for them. The savings on trunk calls are generally around 10 per cent on the ones I've looked at, but Mercury claims 15 per cent overall — they can be as high as 30 per cent in a few cases.

Access to Mercury 2200 is available from over 60 national telephone exchange areas. They are mainly in the central part of the country, based on a figure of eight loops centred on Birmingham and stretching from London and Bristol in the South to Manchester, Leeds and Sheffield in the North. Extensions to York, Hull, Newcastle and Edinburgh have recently been completed and others are planned. Another service, Mercury 2100, is aimed at larger businesses. These are connected directly to the Mercury network (usually by a microwave link). Calls are cheaper than 2200 but you need at least 10 lines in London and around 30 outside this area to make it viable.

As a Mercury 2200 subscriber you gain access to the network via your ordinary BT line by dialling 131, which connects you to the local Mercury node. You then dial your personal identity code and the number you want to call. The last two states require a tone-dialling telephone. The Mercury system then routes the call to its node nearest the point you are calling and sends it out on BT lines again. The procedure may sound a bit tortuous but it is simplified by the Mercury telephone — all you do is press a special blue button (which automatically dials 131 and sends your identity code) and the number you are calling. It does, however, add around 8-10 seconds to the time taken to make a call.

It is said that if your quarterly phone bill is over £100, then you will save money in the first year by becoming a subscriber. This covers the cost of the telephone (£40 incl VAT) and the identity code (£8.62 a year, including VAT). The phone is good value as it includes 50 memories and 'on hook' dialling as well as the Mercury access feature. You can, if you wish, dispense with your BT telephone if it is rented. If you have several phone lines, then Mercury will rent you a smart box which automatically diverts calls via Mercury without extension users needing to do anything. If most of your money is spent on local calls, then Mercury is of no use to you.

(For information on programming auto-dialling modems and software to use Mercury, see Computer Answers.)

Ready Reckoner

Mercury 2200 call charge Ready Reckoner. All costs in £(incl VAT).

		Call duration (mins)					Download cost at 1200 bps			
Rate	Pence/min	1	5	10	20	60	10k	50k	100k	200k
T5 Cheap	2.50	0.03	0.14	0.29	0.58	1.73	0.06	0.29	0.58	1.15
T5 Std	7.45	0.09	0.43	0.86	1.71	5.14	0.17	0.86	1.71	3.43
T5 Peak	9.72	0.11	0.56	1.12	2.24	6.71	0.22	1.12	2.24	4.47
T4 Cheap	2.50	0.03	0.14	0.29	0.58	1.73	0.06	0.29	0.58	1.15
T4 Std	7.50	0.09	0.43	0.86	1.73	5.18	0.17	0.86	1.73	3.45
T4 Peak	10.00	0.12	0.58	1.15	2.30	6.90	0.23	1.15	2.30	4.60
T3 Cheap	2.50	0.03	0.14	0.29	0.58	1.73	0.06	0.29	0.58	1.15
T3 Std	7.45	0.09	0.43	0.86	1.71	5.14	0.17	0.86	1.71	3.43
T3 Peak	9.72	0.11	0.56	1.12	2.24	6.71	0.22	1.12	2.24	4.47
T2 Cheap	4.10	0.05	0.24	0.47	0.94	2.83	0.09	0.47	0.94	1.89
T2 Std	8.75	0.10	0.50	1.01	2.01	6.04	0.20	1.01	2.01	4.03
T2 Peak	11.73	0.13	0.67	1.35	2.70	8.09	0.27	1.35	2.70	5.40
T1 Cheap	3.75	0.04	0.22	0.43	0.86	2.59	0.09	0.43	0.86	1.73
T1 Std	8.48	0.10	0.49	0.98	1.95	5.85	0.20	0.98	1.95	3.90
T1 Peak	11.16	0.13	0.64	1.28	2.57	7.70	0.26	1.28	2.57	5.13
Eire Cheap	22.00	0.25	1.27	2.53	5.06	15.18	0.51	2.53	5.06	10.12
Eire Std	33.00	0.38	1.90	3.80	7.59	22.77	0.76	3.80	7.59	15.18
USA Cheap	48.10	0.55	2.77	5.53	11.06	33.19	1.11	5.53	11.06	22.13
USA Std	52.80	0.61	3.04	6.07	12.14	36.43	1.21	6.07	12.14	24.29
USA Peak	57.72	0.66	3.32	6.64	13.28	39.83	1.33	6.64	13.28	26.55

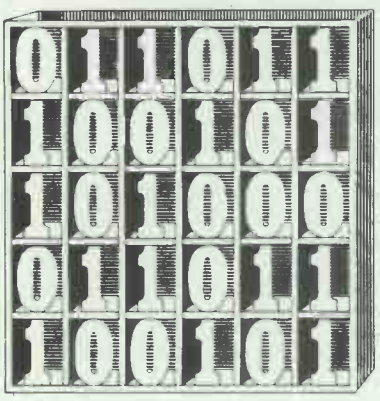
Notes:
T5 (Tier 5) = Local area (not usually available via Mercury)
T1 = over 56km, Mercury access areas. T2 = over 56km, other areas
T3 = under 56km, Mercury access areas. T4 = under 56km, other areas
Calls are charged to nearest 0.1p. Min charge Tiers 1 to 4 is 3p (excl VAT), Tier 5 is 7p (excl VAT) Download costs are approximate only, and are for file of given size using Xmodem protocols.

Correction: The phone number for Marctel as printed in *PCW* May, page 174, is incorrect. It should be (01) 346 7150.

You can contact Peter Tootill electronically on: Telecom Gold 83: VNU202, Prestel 219991119, or CompuServe 72746,3202.

END

SUBSET



David Barrow presents more machine code routines and information for assembly language programmers. All helpful programming hints and short, useful new routines are welcome, as are improvements to or conversions of those already printed. Submissions must be printed or typed clearly and be documented to the SubSet standard, although documentation may be amended for publication. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

Days to date

Datasheet 1 from Stephen Hunt of Birmingham is an 8086 translation of a similar routine for the Z80 which was published in SubSet, December 1983.

CVDATE converts the number of days since any base date to day month and year numbers. Day 1, month 1, year 1 must be 1st January following a leap year.

The method used is not fast and it fails to take into account the absence of leap days in century years not divisible by four. However, the routine does the job intended and Stephen uses it in a printer listing program to include the date in a header to each page.

DATASHEET 1

```
;
;CVDATE          Convert number of days since (and including) a base
;                date 01/01/01 to day/month/year.
;
;STRUCTURAL CONCEPTS
;PROGRAM         year = 0.
;                WHILE daysleft > 0
;                {
;                  year = year + 1.
;                  yeardays = 365 + (1 AND (year MOD 4 = 0)).
;                  daysleft = daysleft - yeardays.
;                }
;                daysleft = daysleft + yeardays.
;                IF (year MOD 4 = 0) AND (daysleft = 60)
;                [
;                  month = 2.
;                  day = 29.
;                ¦
;                  IF (year MOD 4 = 0) AND (daysleft > 60)
;                  [
;                    daysleft = daysleft - 1.
;                  ]
;                  month = 0.
;
;                  monthindex = 0.
;                  WHILE daysleft > 0
;                  {
;                    month = month + 1.
;                    monthdays = (monthtable + monthindex).
;                    monthindex = monthindex + 1.
;                    daysleft = daysleft - monthdays.
;                  }
;                  day = daysleft + monthdays.
;                ]
;
;SYSTEM REQUIREMENTS
;PROCESSOR       8086
;HARDWARE        None, unless 3-byte store located separately from
;                routine but in same segment.
;SOFTWARE        None.
;
;PROGRAM DETAILS
;INPUT           BX = number of days since base date.
;                (Base day 1 must be 1st January in any year following
;                a leap year.)
;OUTPUT          [year]  = years since base date.
;                [month] = month number, 1 to 12.
;                [day]   = day number, 1 to 31.
;STATE CHANGES   Flags changed. All other registers unchanged.
;I/O ERRORS      None known.
;OPTIMISATION    Leap year mod 4 tested for by logical AND.
;INTERRUPT EFFECT May be interrupted but not re-entered.
;LOCATION NEEDS  Not specific.
;                Not relocatable, except by segment.
;                Not PROMable, unless 3-byte store separated.
;PROGRAM BYTES   101 (code: 86. table: 12. store: 3.)
;STACK BYTES     8
;CLOCK CYCLES    Not given.
;
;
CVDATE  PUSH  AX          ;Save registers used.      50
        PUSH  CX          ;                          51
        PUSH  DX          ;                          52
        PUSH  SI          ;                          56
        XOR   CL,CL       ;Clear year count init'ly. 32C9
;
LOOP    MOV   DX,365      ;DE = days in year.        BA      6D01
        INC   CL          ;Increment year count      FEC1
        MOV   AL,CL       ;and copy to AL for        8AC1
        AND   AL,3        ;test of a leap year,      24      03
        JNZ   CV2         ;skipping if not; else     75  01
        INC   DX          ;DE = days in leap year.   42
;
CV2     SUB   BX,DX       ;days left - year's days.  2BDA
        JZ    CV3         ;Repeat subtracting year   74  02
        JNB   LOOP        ;days until days left =<0. 73  EE
;
CV3     ADD   BX,DX       ;Replace final year        03DA
        MOV   [YEAR],CL   ;and store year count.     880E lohi
        OR    AL,AL       ;Test this year a leap     0AC0
        JNZ   CV4         ;year, skip if not.        75  08
;
        CMP   BX,3CH      ;Test if leap day          83FB    3C
        JB    CV4         ;skip if before FEB 29     72  03
        JZ    FEB29       ;go if FEB 29, else        74  20
        DEC   BX          ;adjust for extra day.     4B
;
CV4     MOV   SI,MONTHTBL ;SI = table pointer.       BE      lohi
        XOR   AX,AX       ;Clear AH for later SUB.   33C0
        XOR   CL,CL       ;Clear month count init'ly 32C9
;
LOOP2   INC   CL          ;Increment month count.    FEC1
        LODSB             ;AL = month days, bump SI. AC
        SUB   BX,AX       ;Days left - month's days. 2BD8
        JZ    CV5         ;Repeat subtracting month  74  02
        JNB   LOOP2       ;days until days left =<0. 73  F7
;
CV5     ADD   BX,AX       ;Replace final month and   03D8
        MOV   [MONTH],CL  ;store month number        880E lohi
        MOV   [DAY],BL    ;and day number.           881E lohi
;
FINISH  POP   SI          ;Restore registers used.   5E
        POP   DX          ;                          5A
        POP   CX          ;                          59
        POP   AX          ;                          58
        RET               ;Exit, date calculated.    C3
;
;...Special leap day store sequence.
;
FEB29   MOV   [MONTH],2   ;Store FEB month number    C606 lohi 02
        MOV   [DAY],29    ;and day number 29,        C606 lohi 1D
        JMP   FINISH      ;then exit.                E9   EEFF
;
;...Table of days in month.
;
MONTHTBL DB   31,28,31,30 ;                          1F1C 1F1E
         DB   31,30,31,31 ;                          1F1E 1F1F
         DB   30,31,30,31 ;                          1E1F 1E1F
;
;...Storage for computed day, month and year numbers.
;
YEAR    DB    0           ;                          00
MONTH   DB    0           ;                          00
DAY     DB    0           ;                          00
;
;
```

Z80 circles

Datasheet 2 comes from John Hardman of Welling, Kent and is a routine to draw a fast complete Z80 circle. ARC45 is John's Z80 translation of a Pascal program based on Michener's derivation of Bresenham's algorithm. John thinks there is a faster algorithm, Pitteway, which he has been unable to locate.

DATASHEET 2

```
;
;ARC45           Calculate all points along a 45 degree arc of a
;                circle from x=0, y=radius to x=y, both positive.
;
;STRUCTURAL CONCEPTS
;PROGRAM         x = 0.
;                y = radius.
;                d = 3 - 2 * radius.
;                WHILE x<y
;                {
;                  CPOINTS (x,y).
;                  IF d>=0
```

```
;                   [
;                     d = d + 4 * (x - y) + 10.
;                     y = y - 1.
;                   |
;                     d = d + 4 * x + 6.
;                   ]
;                   x = x + 1.
;                 }
;                 IF x=y
;                 [
;                   CPOINTS (x,y).
;                 ]
;
;-------------------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR         Z80
;HARDWARE          Screen or other output device.
;SOFTWARE          "CPOINTS" - subroutine to plot points (x,y) = (DE,BC).
;                              CPOINTS should not change registers.
;                  To plot a full circle, CPOINTS must plot the points:
;                    (ox+x,oy+y), (ox+x,oy-y), (ox-x,oy+y), (ox-x,oy-y),
;                    (ox+y,oy+x), (ox+y,oy-x), (ox-y,oy+x), (ox-y,oy-x),
;                  where (ox,oy) is the centre of the circle.
;
;-------------------------------------------------------------------------
;PROGRAM DETAILS
;INPUT             BC = radius, 0 to 7900H (see I/O ERRORS).
;OUTPUT            None.
;STATE CHANGES     Circle plotted to output device.
;                  All registers and flags unchanged.
;I/O ERRORS        Radius > 7900H may cause 16-bit overflow problems.
;OPTIMISATION      None.
;INTERRUPT EFFECT  May be interrupted and re-entered.
;LOCATION NEEDS    Not specific. Relocatable. PROMable.
;PROGRAM BYTES     67
;STACK BYTES       12 or (10 + CPOINTS stack use).
;CLOCK CYCLES      Not given.
;
;-------------------------------------------------------------------------
;
ARC45   PUSH AF             ;Save registers used          F5
        PUSH BC             ;in ARC45.                    C5
        PUSH DE             ;                             D5
        PUSH HL             ;                             E5
;
        LD   DE,0           ;DE is x. Initialise x = 0.   11 00 00
        LD   HL,3           ;HL is d.                     21 03 00
        AND  A              ;BC is y and also radius.     A7
        SBC  HL,BC          ;Initialise d = 3 - 2 * radius. ED 42
        AND  A              ;                             A7
        SBC  HL,BC          ;                             ED 42
;
LOOP    PUSH HL             ;Save d while using HL in     E5
        LD   H,D            ;comparison x-y.              62
        LD   L,E            ;                             6B
        AND  A              ;                             A7
        SBC  HL,BC          ;                             ED 42
        POP  HL             ;Restore d to HL.             E1
        JR   NC,FINAL       ;If x>=y then exit LOOP.      30 22
;
        CALL CPOINT         ;Plot 8 corresponding points. CD lo hi
;
        PUSH DE             ;Save x while using DE.       D5
        BIT  7,H            ;If d<0 then deal             CB 7C
        JR   NZ,NEGTIV      ;with d negative.             20 0C
;
        EX   DE,HL          ;Else DE = x - y.             EB
        AND  A              ;                             A7
        SBC  HL,BC          ;                             ED 42
        EX   DE,HL          ;                             EB
        DEC  BC             ;y = y - 1.                   0B
        PUSH BC             ;Save y while using BC.       C5
        LD   BC,10          ;to add 10 to d.              01 0A 00
        JR   BYFOUR         ;                             18 04
;
NEGTIV  PUSH BC             ;Save y while using BC        C5
        LD   BC,6           ;to add 6 to d,               01 0A 00
;
BYFOUR  ADD  HL,BC          ;If d>=0 then                 09
        ADD  HL,DE          ; then d = d+4*(x-y)+10       19
        ADD  HL,DE          ;       (and y decremented)   19
        ADD  HL,DE          ; else d = d+4*x+6.           19
        ADD  HL,DE          ;                             19
        POP  BC             ;Restore y to BC.             C1
        POP  DE             ;Restore x to DE.             D1
        INC  DE             ;x = x + 1 every loop.        13
        JR   LOOP           ;Repeat until arc completed.  18 D5
;
FINAL   CALL Z,CPOINT       ;Plot any x=y points.         CC lo hi
;
        POP  HL             ;Restore all registers        E1
        POP  DE             ;used in ARC45.               D1
        POP  BC             ;                             C1
        POP  AF             ;                             F1
        RET                 ;Exit circle completed.       C9
;
;-------------------------------------------------------------------------
```

Z80 wipeout

Kim Bastin of Stockholm offers the following information on the Z80 block transfer instruction, LDIR.

'I was modifying a public-domain encyphering program and planned to have it end with a "silent bang" by filling the TPA with RST O instructions (code OC7H), thus overwriting any memory copy of the encyphered file and then executing a warm boot. Accordingly, I wrote the short code sequence RESTO shown as Fig 1.

'Then, I thought, the RST O written by LDIR in the address ENDCODE would be fetched and executed, causing a warm boot and return to CP/M.

'It didn't quite work out that way. The code seemed to run correctly when I single-stepped through it with a monitor but when I ran the program under CP/M and then inspected the TPA, the expected multiple RST Os were not there.

'Further investigation revealed that RST Os were indeed propagated through the portion of memory from 100H to the first byte of the LDIR instruction but no further. Yet a warm boot occurred as planned.

'Evidently the LDIR instruction is refetched from memory on each iteration. When its first byte is overwritten with the code OC7H, the instruction RST O is fetched and executed instead. Presumably LDDR, CPIR, CPDR, INIR, INDR and OTDR are also refetched in the same way until the counter reaches zero.

'Since there was no necessity to overwrite the entire TPA, just the portion above the encyphering program, I settled for the sequence RESTWB (Fig 2).

'One could also implement something along the lines of the original plan by placing LDIR in the top two bytes of the TPA and jumping to it with location (0100h) = OC7H, HL = 100H, DE = 101H and BC = O. This would fill the entire TPA and then reboot when LDIR was overwritten.'

Fig 1

```
;
;... N.B. This doesn't work.
;
RESTO   LD   BC,(6)         ;Get TPA end + 1 and subtract  ED 4B 06 00
        DEC  BC             ;101H by decrements to give    0B
        DEC  B              ;BC = repeat count for all TPA. 05
        LD   HL,100H        ;Source at start of TPA,       21 00 01
        LD   DE,101H        ;Destination at start + 1.     11 01 01
        LD   (HL),0C7H      ;Source = "RST 0", propogate   36 C7
        LDIR                ;RST 0 through entire TPA      ED B0
ENDCODE                     ;then warm boot from here.
;
;-------------------------------------------------------------------------
```

Fig 2

```
;
;... N.B. This works.
;
RESTWB  LD   DE,CODEEND     ;Point to 1st destination byte. 11 lo hi
        LD   HL,(6)         ;Get TPA end + 1 and           2A 06 00
        OR   A              ;(clear Cy for SBC)            B7
        SBC  HL,DE          ;calculate byte count above    ED 52
        LD   B,H            ;program and copy into BC      44
        LD   C,L            ;as repeat counter.            4D
        LD   HL,RESET       ;Point to source value and     21 lo hi
        LDIR                ;propogate to end of TPA.      ED B0
;
RESET   RST  0              ;Copy, then warm boot.         C7
CODEEND                     ;Program + 1 address.
;
;-------------------------------------------------------------------------
```

Memory wipeout challenge

It would be interesting to see the shortest and/or fastest solutions to Kim's wipeout problem in all codes, given the following conditions:

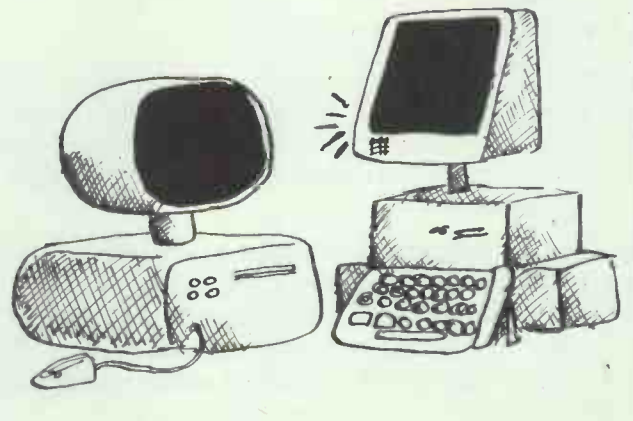
(1) The program must overwrite all user memory and terminate with a warm boot, or reset.

(2) After overwrite, entry at any point in user memory must cause only a warm boot or reset.

(3) Either the start or end address of user memory (or both) must be read from system parameters.

(4) The program must originally reside in user memory but not necessarily at any specific address.

END



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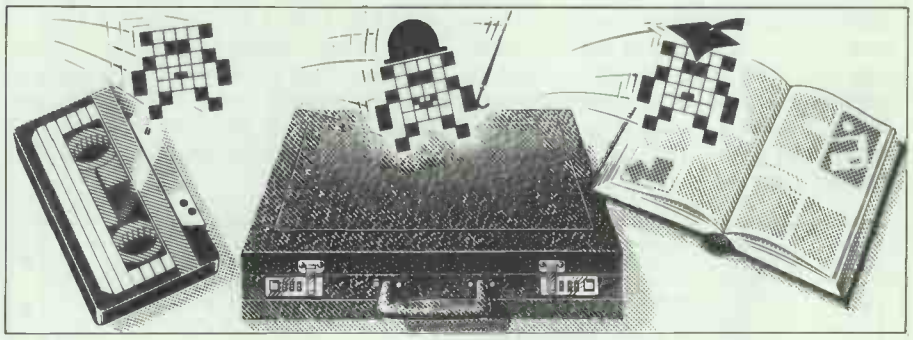

Games

Scientific/mathematic

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To be precise

Owen Linderholm's introductory feature gives ideas on how greater accuracy can be obtained from numerical calculations on a computer, plus there's this month's selection of readers' programs.

One problem that many people encounter when performing numerical calculations on a computer is obtaining sufficient accuracy from these calculations. Mike Mudge in his 'Numbers Count' column has undoubtedly had many readers cover this ground far better than I can. However, my purpose in this month's programming tip is not to produce the most efficient algorithm, but merely to produce a working algorithm while illustrating how it works.

The problem with arithmetic in standard computer languages such as Basic is that numbers are represented by bytes in the computer's memory. A typical technique is to use four bytes for real numbers, one for the exponent and three for the mantissa. The mantissa represents the digits of the number — for example, 31415926 . . . in PI. The exponent represents the number of powers of ten of the number; or, in other words, where the decimal point goes.

The number is thus stored as 314159 coded into binary in three bytes and 0 for the exponent stored in one byte, representing 3.14159×10^0. If more bytes were available to store the number, then the number of digits represented in the mantissa could be expanded to give higher precision. Obviously, since the number is crammed into four bytes, it cannot represent a wide range of real numbers so the precision is limited.

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer. Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in). All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface. If possible, please include printed sample output.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month.

Send your contributions to Owen Linderholm, Program File, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

The purpose of precision

Why would you want to do arithmetic to more than eight decimal places? If you're a millionaire you might want to do your accounting down to the last penny, to the greatest accuracy. For the rest of us paupers, the most common use is to make a computer solve mathematical problems, which is why Numbers Count readers would be particularly interested.

There are various ways around this problem, but all result in a significant loss in speed. You have to create a new way of storing high-precision numbers and write new routines for all the standard arithmetical functions to operate on the high-precision numbers. A typical size that is used is 255-digits accuracy, compared with the 8, 12 or 16 in most ordinary computer languages.

There are various techniques for storing high-precision numbers. The most common is to store numbers as strings and then operate on them, and perform calculations in exactly the same way as people do in longhand. The disadvantage of this technique is that the length of strings is limited and, therefore, the precision possible with this technique is limited.

Another possibility is to use arrays. With care, the precision possible is only limited by the storage space available. The problem is that the technique is complicated and is wasteful of storage space.

In my program I have chosen to use the string technique. The program is to add and subtract numbers

of infinite precision, although in practice this is limited to the maximum string length available in your Basic. Multiplication and division are more complicated and will be covered within the next few months.

The technique

First, input numbers are 'normalised'. This involves making sure that the strings are of the same length and that the number of digits before and after the decimal point is the same. A sign is also added to the front; this lines up corresponding digits in the numbers which, in turn, makes processing them simpler. In order to pad out the numbers, zeros are added.

When normalised, addition becomes a simple problem, solved by repetitively adding pairs of digits and looking after a carry if there is one. The only problem is with the sign of the numbers, which is dealt with by sorting it out first and turning the calculation into a subtraction if necessary. For example, 10 + −4 is really 10−4, a subtraction.

Subtraction is much more difficult. There are really two cases: the first is when the number being taken away is smaller; the second when it is larger. In the former case, it is simple enough to do subtraction in the same way as addition — a digit at a time while looking after the carry. This, however, doesn't work in the second case.

In the first case, the result is obtained by taking the second digit from the first and adding 10 if the result is negative. If you consider 2−9, you can see that this won't work. 2−9 equals −7, then add 10 to get 3, which is *not* the right answer.

The solution is to look at the carry. Whenever the result of a subtraction is negative, as in the above case, the carry is set to 1. If the result is positive, it is set to 0. If, after the last subtraction, the carry is set to 1, the result should be negative so some action must be taken. In fact, you need to take the 'nine's complement' of the number. This involves going through the number digit by digit and subtracting each digit from 9. When this is done, add 1 to the result. This gives the final answer to the subtraction.

The above method sounds complicated, so let's try it with an example. 10−1413 becomes +0010−1413 when normalised. The result of this after normal subtraction is 8597 with the carry set to 1. The nine's complement of this number is 1402 and adding 1 gives the nine's complement of this number is 1402 and adding 1 gives 1403. The final part of the process is to put a minus sign in front to give −1403, the right answer.

Neither of the two routines has been optimised and there is a great deal of room for improvement. There was one persistent bug which I managed to iron out, which applied to adding 1 to the nine's complement. The 1 has to be added to the rightmost digit and I was, initially, simply adding 1 to the number. If, however, the number was something like 0.11110, then I was getting 1.1110 as the result rather than the correct answer. The problem was solved by normalising 0 with the result and then changing the last digit to a 1, with a little adjustment for the decimal point.

```
      REM/Program to add and subtract numbers to infinite
      REM/precision by performing operations on the numbers as
      REM/strings. Main program inputs two strings which are
      REM/assumed to be numbers and a command to add or subtract
      REM/them. It then calls the appropriate routine and repeats.
      REM/Variables used:
      REM/  N1$,N2$ - the two numbers to add or subtract.
      REM/  R$ - the result.
      REM/  I$ - temporary command string.
      REM/  P1,P2 - position of decimal point in the two numbers.
      REM/  I - temporary loop variable.
      REM/  A1,A2 - number of digits after decimal point in 2 nos.
      REM/  C - carry
      REM/  D1$,D2$ - individual digits in nos as strings.
      REM/  R1,R - temporary result values.
      REM/  T$,T1$,T2$ - temporary storage strings.
      REM/  D1 - temporary digit value.
 1000 PRINT"Enter number 1: ":INPUT N1$
 1010 PRINT"Enter number 2: ":INPUT N2$
 1020 GOSUB 2000
      REM/Normalise routine.
 1030 INPUT"(A)dd or (S)ubtract: ";I$
 1040 IF I$="A" THEN GOSUB 3000 ELSE GOSUB 4000
      REM/3000 - Addition routine, 4000 - Subtraction routine.
 1050 PRINT"Number 1 normalised was: "
 1060 PRINT N1$
 1070 PRINT"Number 2 normalised was: "
 1080 PRINT N2$
 1090 PRINT"Result: "
 1100 PRINT R$
 1110 GOTO 1000


      REM/Normalise routine. This makes the two strings N1$ and
      REM/N2$ the same length and ensures that they have the same
      REM/number of digits before and after the decimal point.
      REM/If either number has a sign then ignore it, otherwise
      REM/add a plus since plus is usually assumed.
 2000 IF LEFT$(N1$,1)="+" OR LEFT$(N1$,1)="-" THEN 2020
 2010 N1$="+"+N1$
 2020 IF LEFT$(N2$,1)="+" OR LEFT$(N2$,1)="-" THEN 2040
 2030 N2$="+"+N2$
      REM/Next section finds the decimal point in N1$ if there is
      REM/one. If not it sticks one on the end.
 2040 P1=0
 2050 FOR I=1 TO LEN(N1$)
 2060 IF MID$(N1$,I,1)="." THEN P1=I
 2070 NEXT I
 2080 IF P1=0 THEN N1$=N1$+".":P1=LEN(N1$)
      REM/Next section does decimal point for N2$.
 2090 P2=0
 2100 FOR I=1 TO LEN(N2$)
 2110 IF MID$(N2$,I,1)="." THEN P2=I
 2120 NEXT I
 2130 IF P2=0 THEN N2$=N2$+".":P2=LEN(N2$)
      REM/This line finds the number of places after the
      REM/decimal point.
 2140 A1=LEN(N1$)-P1:A2=LEN(N2$)-P2
      REM/Fill N1$ before d-p with zeros to length of N2$.
 2150 IF P1>=P2 THEN 2190
 2160 FOR I=1 TO P2-P1
 2170 N1$=LEFT$(N1$,1)+"0"+RIGHT$(N1$,LEN(N1$)-1)
 2180 NEXT I
      REM/Fill N2$ before d-p with zeros to length of N1$.
 2190 IF P2>=P1 THEN 2230
 2200 FOR I=1 TO P1-P2
 2210 N2$=LEFT$(N2$,1)+"0"+RIGHT$(N2$,LEN(N2$)-1)
 2220 NEXT I
      REM/Fill N1$ after d-p with zeros to length of N2$.
 2230 IF A1>=A2 THEN 2270
 2240 FOR I=1 TO A2-A1
 2250 N1$=N1$+"0"
 2260 NEXT I
      REM/Fill N2$ after d-p with zeros to length of N1$.
 2270 IF A2>=A1 THEN 2310
 2280 FOR I=1 TO A1-A2
 2290 N2$=N2$+"0"
 2300 NEXT I
 2310 RETURN


      REM/Addition routine. Adds numbers in N1$ and N2$ and puts
      REM/result in R$. This is done by first checking it should
      REM/be an addition, then repetitively adding the digits and
      REM/any carry. Finally, check if there is a carry at the end
      REM/and add it in as an extra digit.
      REM/The following line checks to see if the addition should
```

```
      REM/really be a subtraction.
3000 IF (LEFT$(N1$,1)="-" XOR LEFT$(N2$,1)="-") THEN 3120
      REM/Initialise carry then repetitively add digits. Skip if
      REM/d-p or sign. Add result to R$.
3010 R$="":C=0
3020 FOR I=1 TO LEN(N1$)
3030 D1$=MID$(N1$,LEN(N1$)-I+1,1)
3040 D2$=MID$(N2$,LEN(N2$)-I+1,1)
3050 IF D1$="." OR D1$="+" OR D1$="-" THEN R$=D1$+R$:GOTO 3090
3060 R1=VAL(D1$)+VAL(D2$)+C
3070 IF R1>9 THEN R1=R1-10:C=1 ELSE C=0
3080 R$=RIGHT$(STR$(R1),1)+R$
3090 NEXT I
      REM/If carry left over, then add in a 1 at start after sign.
3100 IF C=1 THEN R$=LEFT$(R$,1)+"1"+RIGHT$(R$,LEN(R$)-1)
3110 RETURN
      REM/Arrive here if it should have been a subtraction. Sort
      REM/out signs and call subtraction routine to get result.
3120 IF LEFT$(N1$,1)<>"-" THEN 3160
3130 T$=N1$
3140 N1$=N2$
3150 N2$=T$
3160 N2$="+"+RIGHT$(N2$,LEN(N2$)-1)
3170 GOSUB 4000
3180 RETURN

      REM/Subtraction routine. Operates in a similar manner to the
      REM/addition routine except that the procedure at the end if
      REM/the carry is set is more complicated.
      REM/The following line checks if it should really be an
      REM/addition.
4000 IF (LEFT$(N2$,1)="-" OR LEFT$(N2$,1)="-") THEN 4130
      REM/Initialise carry, then repetitively subtract digits and
      REM/put results in R$, setting carry if necessary. Skip if
      REM/character is d-p or sign.
4010 R$="":C=0
4020 FOR I=1 TO LEN(N1$)
4030 D1$=MID$(N1$,LEN(N1$)-I+1,1)
4040 D2$=MID$(N2$,LEN(N2$)-I+1,1)
4050 IF D1$="." OR D1$="+" THEN R$=D1$+R$:GOTO 4080
4060 IF VAL(D1$)<(VAL(D2$)+C) THEN R=10+(VAL(D1$)-VAL(D2$)-C):C=1
      ELSE R=(VAL(D1$)-VAL(D2$)-C):C=0
4070 R$=RIGHT$(STR$(R),1)+R$
4080 NEXT I
      REM/If carry not set then skip, otherwise do 9's complement.
4090 IF C<>1 THEN 4190
      REM/Do 9's complement in similar repetitive way to
      REM/subtraction.
4100 T$=R$:R$=""
4110 FOR I=1 TO LEN(T$)
4120 D1$=MID$(T$,I,1):IF D1$="." OR D1$="+" THEN 4150
4130 D1=VAL(MID$(T$,I,1))
4140 D1$=RIGHT$(STR$(9-D1),1)
4150 R$=R$+D1$
4160 NEXT I
      REM/Do addition of 1 to last digit by converting 0 to
      REM/normalised form and changing last digit to 1 and adding.
4170 T1$=N1$:T2$=N2$:N1$=R$:N2$="0":GOSUB 2000
4180 IF RIGHT$(N2$,1)="." THEN N2$=LEFT$(N2$,LEN(N2$)-2)+"1."
      ELSE N2$=LEFT$(N2$,LEN(N2$)-1)+"1"
4190 GOSUB 3000
      REM/Finally, sort out sign.
4200 N1$=T1$:N2$=T2$:R$="-"+RIGHT$(R$,LEN(R$)-1)
4210 RETURN
      REM/If subtraction should have been an addition, then sort
      REM/out signs and call addition routines.
4220 IF LEFT$(N2$,1)="-" THEN N2$="+"+RIGHT$(N2$,LEN(N2$)-1):GOTO 4240
4230 IF LEFT$(N1$,1)="-" THEN N2$="-"+RIGHT$(N2$,LEN(N2$)-1)
4240 GOSUB 3000
4250 RETURN
```

This month's programs

Firstly, a blunder occurred in the BBC Hints and Tips section of Program File, *PCW* May. The key definition string should read: ... F.F%=&482TO&4F4S.2 ... My apologies to those who tried it and couldn't get it to work.

The Program of the Month is yet another by the prolific Jack Weber. This one is again for the Macintosh in Microsoft Basic, but the general idea should prove possible to adapt for other computers by any reasonable programmer. The program is on the subject of worm (write once read many) tracks. This may not sound very exciting, but is in fact concerned with generating complex, repetitive patterns.

The accompanying documentation is a perfect example of what I would always like to receive. It is, however, very long and I would ideally like to see shorter programs and routines which are presented in the same impeccable manner.

The second program is an unusual one and marks the debut of a new machine in Program File — the Psion Organiser. The program is to play a simplified version of Space Invaders. For the BBC there is a drawing program based on icons and pointers, called Artwork.

Other programs featured this month are a BBC Micro tip which goes some way to solving the problems generated by the machine's assembling source program and its assembled object code; plus, also for the BBC there's Drop-Out, a computerised version of Milton Bradley's two-dimensional matrix-lever game.

Program of the Month Macintosh Worm Plotter

by Jack Weber

About one hundred million years ago, simple worms crawled through the sediment of an ancient sea floor. Their soft bodies left no fossil remains but they did produce one indirect record of their activities — the winding paths they excavated through the mud have, in places, been preserved as 'trace fossils'.

Far from random, these fossil worm paths display intricate patterns that have intrigued palaeontologists, mathematicians, biologists and computer programmers. Their interest was aroused by the realisation that these worms were following very simple sets of rules yet managing to solve, very flexibly, the complex problem of how to cover a patch of nutrient in an efficient manner. Leaving out a region, re-tracing a path or simply heading too far from the feeding patch are all wasteful and to be avoided; but finding a simple behaviour pattern that meets all these needs is quite a challenge.

Most of the computer work on worm paths was done some fifteen years ago, although they were first commented on back in 1928. In the late 60s mathematicians became interested in creating various new designs of worms and examining the rules they might follow. This program allows us to simulate the activities of one such group called 'simple isometric worms', but the techniques used could be extended to many other types of worms.

The simple isometric worm

Whereas the creators of real trace fossils could turn through various angles, their computer cousins have usually been constrained to moving over a square grid (quadrille worms) or over a grid with three axes at 60° angles (isometric worms). At each node of the grid, a quadrille worm has three possible paths ahead of it; an isometric worm has five. As it moves around this grid, the worm leaves behind an eaten path which it may cross but never retrace. A basic distinction is between 'look-ahead' worms which can count the number of eaten segments at the nodes ahead and select their direction accordingly, and 'simple' worms which just respond to the distribution of eaten and uneaten segments at their present position.

The simple isometric worm moves one segement at a time and sees how many segments at its new node have already been eaten. If all five have gone, it has no way to move

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and dies. If four have gone, there is only one way to continue. If fewer than four are eaten, then the rule that governs its behaviour tells it which of the available paths to take. It is this rule that distinguishes the different worms, from the trivially simple to the infinitely complex.

At first sight it would seem that every possible arrangement of eaten and uneaten paths must be allowed for in the rule, but in fact we can exclude many of them. Consider first what happens when the worm is at a node that has never before been visited. There are five uneaten paths to choose from. We can ignore the path straight ahead because that simply sends the worm heading off towards the horizon in an endless straight line. That leaves us with the choice of a sharp turn or a gentle turn to either left or right; but left and right just produce mirror images of the same pattern, so we can decide to always go right and simply choose between a sharp or a gentle turn.

We know that the worm will never encounter a node with two eaten paths lying in a straight line. Similarly, if it is a 'gentle' worm it will never encounter a node where only two eaten paths form a sharp turn, and vice versa. This allows us to lump together certain options because no worm can ever have to choose between them. In fact, we find that there are two options at a node with five paths free; four options with four paths; nodes with three paths divide into four sub-fields with three options each; and there are two options where two paths are free. Michael Beeler of the Massachusetts Institute of Technology has drawn up a standard table of these choices (Fig 1) and a notation to describe them. The four main fields are numbered 1 to 4 (corresponding to 5,4,3 & 2 uneaten paths) and each choice within a field is denoted by a letter; field three has four sub-fields so it needs four letters. A typical worm rule would be written like this — 1a2c3acba4a, showing which choice applies to each field. This program follows Beeler's conventions.

Worm's eye view

At every node that it reaches, the worm must look around to check the number and arrangement of eaten paths. This presents some interesting programming problems because the worm's eye view is always relative to the direction it is currently facing; so,

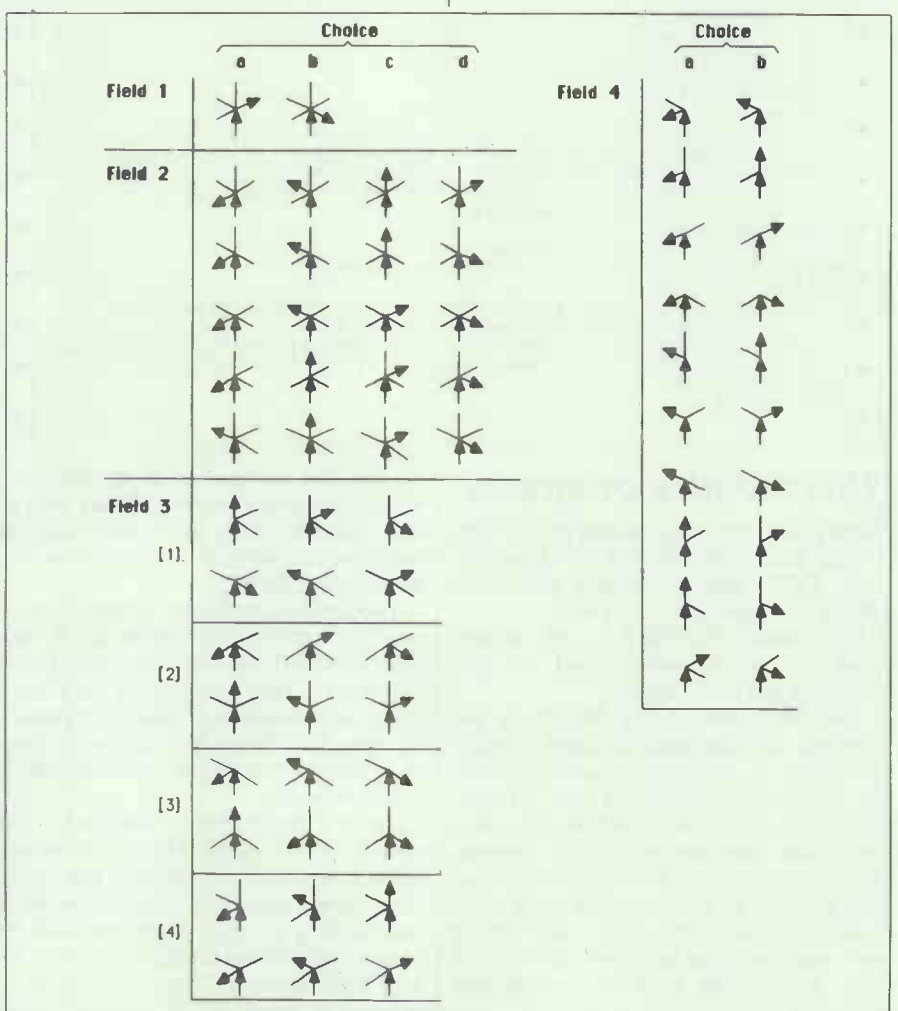

Fig 1 Choices available in each of the four fields

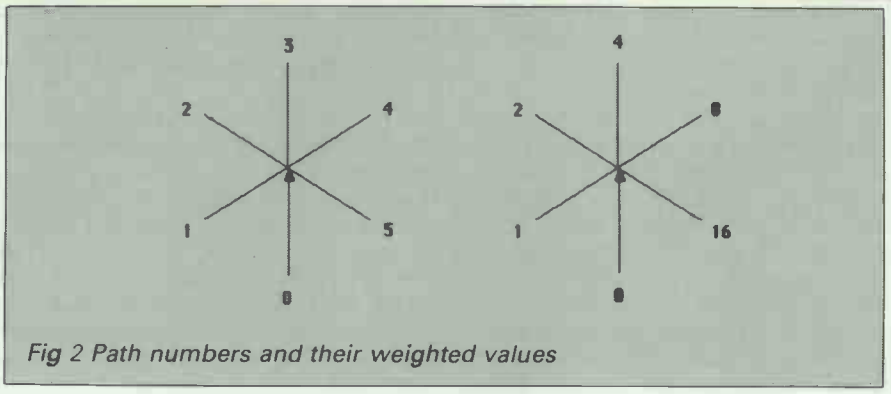

Fig 2 Path numbers and their weighted values

the layout of paths that radiate from that particular node on the screen must, in effect, be rotated to compensate for the way the worm is pointing. This is done by using two techniques — modulo-6 arithmetic and a system of weighted values for each path.

The six paths that radiate from every node are numbered [0..5] clockwise, starting from the path vertically below the node (Fig 2). The subroutine 'Plot' calls one of the 'Scan' subroutines to check pixel values at a point on each of these six paths and puts the values into an array. At the very least, one of these paths will be eaten because it will be the one by which the worm has just arrived. Its number is available in the variable 'direction%'; so, if direction% = 2, then the worm has come in from the upper left.

In order to see how the worm views the pattern stored in the array, we need to create a temporary, new numbering system in which path zero is the one just used by the worm and the rest go clockwise from there. This is done in the line:

j% = (6+i%−direction%) MOD 6

where i% is the normal path number and j% is its value relative to the worm. So, for example, if direction% = 4, then path 5 in our global view becomes (6+5−4) MOD 6 = 1 in the worm's view. And similarly, all the other paths will be correctly counted clockwise from the worm's current direction.

Having converted to the worm's view, we must now represent the pattern that it sees in a way that uniquely identifies every possible combination of eaten and uneaten paths. This is done by assigning weighted values to each path and adding up the values of all paths that have been eaten. We can ignore the path just consumed, so its value is zero. The others [1...5] are given values 1,2,4,8,16. If all five have been eaten, the sum is 31; every number below this represents a unique arrangement. Because having to calculate 2^n five times at every node would slow the program unacceptably, the array 'p%(n)' is set up to store the weighted values as a look-up table. Another array, 'a%(s)', holds the number of the path to be taken for each sum from zero to thirty. Again, this is rotated by modulo−6 arithmetic to allow for the worm's current direction; the variable 'drawpath%' is set to the path (in our global view) that must be drawn next and direction% is updated.

The program draws the worm's progress at a healthy speed of over 500 segments per minute until a sum of 31 is encountered, showing that the worm has reached the end of the line. A little thought reveals that this will happen only when the worm returns to its starting point for the third time. Every other node will have 0,2,4 or 6 paths eaten, depending on how many times the worm has previously passed through it. Only the origin has an odd number of paths — 1,3 or 5 — and only on the third visit is this enough to kill the worm.

Four scales of plotting are available and the worm can be made to start anywhere on the screen. Both these facilities can help to keep a plot entirely within the screen area. If the worm does get too near the edge, the whole display will scroll by one third of a screen. Some worms will produce enormous plots that cover many screens, so a 'Birdseye View' option is available that will show, at any stage, the overall pattern scaled down to fit into the screen.

Operation & translation

As with all Macintosh programs, ease of use is achieved with pull-down menus, windows, buttons, and so on. On other machines the menu options could be put into function keys or, indeed, *any* keys, as the keyboard is not otherwise needed. The subroutine 'Algorithm', which is used for entering the rule that the worm will follow, employs edit fields and buttons but could just as easily use INPUT statements. The subroutine 'Ruleload' which converts the rule string into an array of path numbers need not change. The 'Scaling' and 'Origin' subroutines can easily be converted to keyboard entry.

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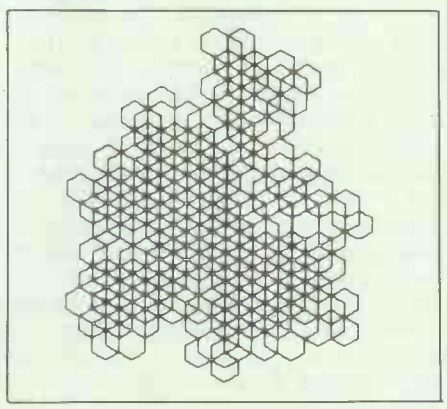
Two areas — scanning and scrolling — may present problems on other machines. The 'Scan' subroutines look at pixels lying on the six paths around a node; they must, of course, be certain of hitting a line if it is there. According to their line-drawing algorithms, different machines may put the steps into a 60° line at slightly different places. Trial and error will be needed to find the correct point to use. Unfortunately some machines are inconsistent, in which case the only solution is to check more than one point to be certain of not missing a line.

The Macintosh contains very powerful routines to help with scrolling, but most computers should be able to move bit images around the screen and to save to disk any areas that are lost from view. The screen is treated as nine rectangular blocks [3×3] so that scrolling in any direction entails saving a row of three blocks and loading in another three on the opposite side. On the Macintosh, the bit maps of these blocks are put into integer arrays and saved as resources. Microsoft Basic cannot directly handle resource files but the Toolbox Library provided with Basic version 3.0 contains all the necessary routines. Note that the volume name 'MyDisk:' which appears in several places in the program will have to be changed to the actual disk name being used.



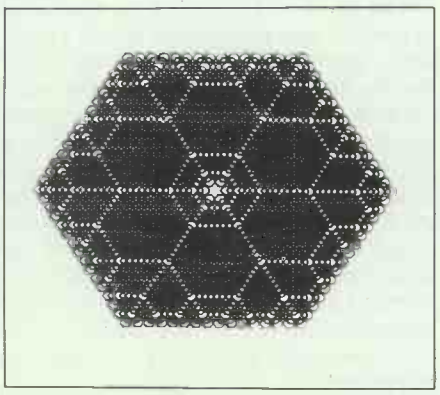
Path produced by worm 1a2a3aaaa4a

The resource IDs are kept in the array 'map%(x,y)'. This is dimensioned (27,45) so that the overall plotting area covers 9 × 15 screens, but there is no reason why it should not be made larger. The program keeps track of where it is by using the variables 'horiz%' and 'vert%' to hold the position of the screen's current centre block. Initially they are set to 14 and 23, which is the middle of the available plotting area. If you are not familiar with resources, studying the *Toolbox* manual that comes with MS-Basic as well as *Inside Macintosh Vol 1* should help to make them clear. Users of other machines will not have these facilities but can probably adapt the system of using blocks and a block map to keep track of the files containing their screen images.

The Birdseye View option finds the farthest blocks that have been used left, right, up and down, and calculates from the overall extent of the plot a scaling factor that will reduce it to fit the screen. This is easy on the Mac because it will automatically draw images scaled up or down to any extent. Other machines may need some added calculation to cope with this.

Worm activities

There are 1296 simple isometric worms but many produce the same patterns so that only 299 distinct plots exist. The shortest is nine segments long, many are infinitely long, while the longest known finite path



Path produced by worm 1a2d3cbaa4b

lasts for 220,142 segments. It results from the rule 1a2d3cbac4b (use the smallest scale and be prepared to wait a few hours). Back in the early 70s, other paths were tested for millions of segments without it becoming clear whether they would ever reach an end; perhaps someone has resolved this since then or it may be waiting for a user of this program to attempt.

Taking these techniques as a starting point, it would be quite easy to explore other types of worm. Look-ahead worms would apply the scan routine to all five nodes that lie ahead; several interacting worms could be put together; and straight-ahead moves could be allowed if their number were restricted. There are many possibilities.

References

For further ideas, see:
Mathematical Games by M Gardner (*Scientific American*, November 1973, pp 116-123).
Fossil Foraging Behavior: Computer Simulation by DM Raup & A Seilacher (*Science*, vol 116, 21 November 1969, pp 994-995).
Tools For Thought by CH Waddington (Jonathan Cape, 1977).

PROGRAM FILE

```
' Worm Plotter
' © Jack Weber - April 1987

' Plots worm paths on an isometric grid
'  Variable scale of plotting
'  Movable origin
'  Auto scrolling of large patterns
'  Overall pattern can be viewed at any time

' ---------------------------------------------------------------------------
' Runs on any Apple Macintosh under MS Basic v3.0 with Toolbox Library
' ---------------------------------------------------------------------------

ON BREAK GOSUB Quit
BREAK ON
GOSUB Initialise
GOSUB Algorithm
restart:
GOSUB Begin
MENU STOP
WHILE sum% < 31 AND flag% = 0
   GOSUB Counter
   GOSUB Plot
   MENU ON
   MENU STOP
WEND
MENU ON
WHILE flag% = 0
WEND
GOTO restart
END
'---------------------------------------------------------------------------

Initialise:
   DIM a%(31), map%(27,45), p%(5), rec%(3), screen%(1113), simp$(4), spot%(5)
   ' Declare name of file containing Toolbox library routines for this program
   LIBRARY "MyDisk:Wormlib"
   CALL TEXTFONT (3)
   CALL TEXTSIZE (12)
   WINDOW 1,,(7,21)-(505,321),3
   WINDOW 2,,(7,324)-(505,339),3
   ' Put worm options into menu bar
   MENU 6,0,1,"Worm"
   MENU 6,1,0,"Change rule"
   MENU 6,2,0,"Change scale"
   MENU 6,3,0,"Move origin"
   MENU 6,4,0,"Birdseye view"
   MENU 6,5,1,"Quit"
   ON MENU GOSUB Menuhandle
   ON DIALOG GOSUB Dialoghandle
   ' Provide default scale and origin of plot
   scale% = 3
   xo% = 250: yo% = 150
   ' All variables used by Toolbox library routines must be initialised by Basic
   id% = 0
   handle1 = 0
   ref% = 0
   ' Create array of weights (0,1,2,4,8,16) for defining combinations of paths
   p%(0) = 0
   FOR i% = 1 TO 5
      p%(i%) = 2^(i%-1)
   NEXT
   ' Create and open a resource file and obtain its file reference number
   OpenResFile "MyDisk:Wormscreen",ref%
RETURN

Menuhandle:
   ' A menu selection has been made - find what it is and set flag to stop plot
   menunumber% = MENU(0)
   IF menunumber% <> 6 THEN RETURN
   flag% = 1
   menuitem% = MENU(1)
   ON menuitem% GOSUB Algorithm,Scaling,Origin,Birdseye,Quit
   MENU
RETURN

Dialoghandle:
   ' A dialog event has happened - find what it is
   action% = DIALOG(0)
   number% = DIALOG(action%)
   IF action% = 1  THEN GOSUB Dobutton
   IF action% = 2  THEN GOSUB Dofield
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```
    IF action% = 6 THEN done% = 1
    IF action% = 7 THEN GOSUB Dotab
  RETURN
  Dobutton:
  ' A button has been pressed - find its number, toggle buttons if needed
  ' 1 = OK, 2-5 are mutually exclusive "radio buttons", 6+ are "check boxes"
    IF number% = 1 THEN done% = 1: RETURN
    IF number% > 5 THEN BUTTON number%,(1+BUTTON(number%) MOD 2): RETURN
    FOR i% = 2 TO 5
      IF i% = number% THEN BUTTON i%,2 ELSE BUTTON i%,1
    NEXT
  RETURN

  Dofield:
  ' Something has happened in an edit field - select it
    edfield% = number%
    EDIT FIELD edfield%
  RETURN

  Dotab:
  ' Tab pressed - move to next edit field, wrapping round from last to first
    edfield% = (edfield% MOD fieldrange%)+1
    EDIT FIELD edfield%
  RETURN

  Dialogwindow:
    WINDOW 3,,(55,50)-(455,220),2
  RETURN

  Algorithm:
  ' Offer window for entry of four worm fields
    GOSUB Dialogwindow
    CALL TEXTFACE (69)
    CALL MOVETO (140,20)
    PRINT "Simple Worm"
    CALL TEXTFACE (0)
    BUTTON 1,1,"OK",(315,135)-(375,155),1
    BUTTON 6,2," Normal format",(25,135)-(150,155),2
    CALL MOVETO (25,45)
    PRINT "5 paths free"
    CALL MOVETO (250,45)
    PRINT "[a,b]"
    CALL MOVETO (25,65)
    PRINT "4 paths free"
    CALL MOVETO (250,65)
    PRINT "[a,b,c,d]"
    CALL MOVETO (25,85)
    PRINT "3 paths free (enter 4 sub-fields)"
    CALL MOVETO (250,85)
    PRINT "[a,b,c]"
    CALL MOVETO (25,105)
    PRINT "2 paths free"
    CALL MOVETO (250,105)
    PRINT "[a,b]"
    EDIT FIELD 4,simp$(4),(320,90)-(370,105),1,3
    EDIT FIELD 3,simp$(3),(320,70)-(370,85),1,3
    EDIT FIELD 2,simp$(2),(320,50)-(370,65),1,3
    EDIT FIELD 1,simp$(1),(320,30)-(370,45),1,3
    edfield% = 1
    fieldrange% = 4
  ' Allow entry of fields until OK button is pressed
    getrule:
    done% = 0
    valid% = 1
    DIALOG ON
    WHILE done% = 0
    WEND
    DIALOG OFF
  ' Entry finished - check if correct number of letters was entered in each field
    rule$ = ""
    FOR i% = 1 TO 4
      simp$(i%) = EDIT$(i%)
      length% = LEN(EDIT$(i%))
      rule$ = rule$+EDIT$(i%)
      edfield% = i%
      IF i% <> 3 AND length% <> 1 THEN GOSUB Badrule
      IF i% = 3 AND length% <> 4 THEN GOSUB Badrule
    NEXT
    IF valid% = 0 THEN GOTO getrule
  ' Check that only permitted letters have been entered
    FOR j% = 1 TO 7
      letter% = ASC(MID$(rule$,j%,1)) MOD 32
```

PROGRAM FILE

```
        IF j% < 4 THEN
        edfield% = j%
        ELSEIF j% < 7 THEN
        edfield% = 3
        ELSE
        edfield% = 4
        END IF
        IF (j% = 1 OR j% = 7) AND letter% > 2 THEN GOSUB Badrule
        IF j% = 2 AND letter% > 4 THEN GOSUB Badrule
        IF (j% > 2 AND j% < 7) AND letter% > 3 THEN GOSUB Badrule
    NEXT
    IF valid% = 0 THEN GOTO getrule
     A valid rule has been entered - convert it into an array of actions
    GOSUB Ruleload
     See whether the "Normal format" button is checked
    format% = BUTTON(6)
     Display the rule in the counter window at bottom of screen
    WINDOW OUTPUT 2
    CALL TEXTFONT (0)
    CALL MOVETO (280,12)
    PRINT "Simple worm";
    CALL TEXTFONT (3)
    CALL MOVETO (380,12)
    PRINT "1";MID$(rule$,1,1);"2";MID$(rule$,2,1);"3";MID$(rule$,3,4);"4";MID$(rule$,7,1);
    WINDOW 1
    WINDOW CLOSE 3
     If normal format was not selected, offer entry for scale and origin of plot
    IF format% = 1 THEN
    GOSUB Scaling
    GOSUB Origin
    ELSE
    scale% = 3
    xo% = 250: yo% = 150
    END IF
RETURN

Badrule:
    An invalid entry was detected - select and clear its edit field
    BEEP
    valid% = 0
    EDIT FIELD edfield%,"",(320,10+edfield%*20)-(370,25+edfield%*20),1,3
RETURN

Ruleload:
    Converts the rule into an array that shows which path to take
      given any possible combination of eaten paths that may be met
    First field
    letter% = (ASC(MID$(rule$,1,1))) MOD 32
    a%(0) = 3+letter%
    Second field
    letter% = (ASC(MID$(rule$,2,1))) MOD 32
    a%(16) = letter%
    IF letter% = 4 THEN a%(8) = 5 ELSE a%(8) = a%(16)
    IF letter% = 3 THEN a%(4) = 4 ELSE a%(4) = a%(8)
    IF letter% = 2 THEN a%(2) = 3 ELSE a%(2) = a%(4)
    IF letter% = 1 THEN a%(1) = 2 ELSE a%(1) = a%(2)
    Third field
    letter% = (ASC(MID$(rule$,3,1))) MOD 32
    a%(3) = 2+letter%
    IF letter% = 1 THEN a%(5) = 5
    IF letter% = 2 THEN a%(5) = 2
    IF letter% = 3 THEN a%(5) = 4
    letter% = (ASC(MID$(rule$,4,1))) MOD 32
    IF letter% = 1 THEN a%(6) = 1: a%(17) = 3
    IF letter% = 2 THEN a%(6) = 4: a%(17) = 2
    IF letter% = 3 THEN a%(6) = 5: a%(17) = 4
    letter% = (ASC(MID$(rule$,5,1))) MOD 32
    IF letter% = 1 THEN a%(12) = 1: a%(10) = 3
    IF letter% = 2 THEN a%(12) = 2: a%(10) = 1
    IF letter% = 3 THEN a%(12) = 5: a%(10) = 5
    letter% = (ASC(MID$(rule$,6,1))) MOD 32
    IF letter% = 1 THEN a%(24) = 1: a%(20) = 1
    IF letter% = 2 THEN a%(24) = 2: a%(20) = 2
    IF letter% = 3 THEN a%(24 )= 3: a%(20) = 4
    Fourth field
    letter% = (ASC(MID$(rule$,7,1))) MOD 32
    a%(28) = letter%
    a%(25) = 1+letter%
    a%(19) = 2+letter%
    a%(7) = 3+letter%
    IF letter% = 1 THEN
    a%(11) = 3: a%(13) = 2: a%(14) = 1: a%(21) = 2: a%(22) = 1: a%(26) = 1
```

PROGRAM FILE

```
    ELSE
    a%(11) = 5: a%(13) = 5: a%(14) = 5: a%(21) = 4: a%(22) = 4: a%(26) = 3
    END IF
     Only one path clear
    a%(15) = 5: a%(23) = 4: a%(27) = 3: a%(29) = 2: a%(30) = 1
RETURN

Origin:
    Allows user to select x and y co-ordinates at which the pattern will start
    GOSUB Dialogwindow:
    CALL TEXTFACE (69)
    CALL MOVETO (120,20)
    PRINT "Set origin of pattern"
    CALL TEXTFONT (0)
    CALL TEXTFACE (0)
    CALL MOVETO (25,85)
    PRINT "x"
    CALL MOVETO (130,85)
    PRINT "y"
    CALL TEXTFONT (3)
    EDIT FIELD 2,STR$(yo%),(155,73)-(200,88),2,3
    EDIT FIELD 1,STR$(xo%),(50,73)-(95,88),2,3
    edfield% = 1
    fieldrange% = 2
    BUTTON 1,1,"OK",(315,135)-(375,155),1
    BUTTON 6,1,"Centre",(315,70)-(375,90),1
     Allow entry until the OK button is pressed
    getorigin:
    valid% = 1
    done% = 0
    DIALOG ON
    WHILE done% = 0
    IF number% = 6 THEN
    EDIT FIELD 2,"150",(155,73)-(200,88),1,3
    EDIT FIELD 1,"250",(50,73)-(95,88),1,3
    number% = 0
    END IF
    WEND
    DIALOG OFF
     Check that selected origin is not too near edges of window
    IF VAL(EDIT$(1)) < 8 OR VAL(EDIT$(1)) > 490 THEN
    edfield% = 1
    GOSUB Badstart
    END IF
    IF VAL(EDIT$(2)) < 8 OR VAL(EDIT$(2)) > 292 THEN
    edfield% = 2
    GOSUB Badstart
    END IF
    IF valid% = 0 THEN GOTO getorigin
     Get starting co-ordinates from the edit fields
    xo% = VAL(EDIT$(1))
    yo% = VAL(EDIT$(2))
    WINDOW CLOSE 3
RETURN
Badstart:
    An invalid entry was detected - select and clear its edit field
    BEEP
    valid% = 0
    EDIT FIELD edfield%,"",(edfield%*105-55,73)-(edfield%*105-10,88),1,3
RETURN

Scaling:
    Offer choice of four plotting scales
    GOSUB Dialogwindow
    CALL TEXTFACE (69)
    CALL MOVETO (130,20)
    PRINT "Select scale of grid"
    Draw specimen pattern at each scale
    FOR i% = 4 TO 10 STEP 2
      xd% = INT(.866*i%+.4)
      yd% = i%/2
      LINE(60+(i%-4)*48,65)-STEP(-2*xd%,-2*yd%)
      LINE -STEP (0,i%)
      LINE -STEP (2*xd%,-i%)
      LINE -STEP (-xd%,-yd%)
      LINE -STEP (0,2*i%)
      LINE -STEP (xd%,-yd%)
    NEXT
    BUTTON 1,1,"OK",(315,135)-(375,155),1
    BUTTON 2,1,"tiny",(30,100)-(100,120),3
    BUTTON 3,1,"small",(121,100)-(191,120),3
    BUTTON 4,1,"normal",(212,100)-(282,120),3
```

PROGRAM FILE

```
    BUTTON 5,1,"large",(308,100)-(378,120),3
    BUTTON scale%+1,2
    ' Allow entry until the OK button is pressed
    done% = 0
    DIALOG ON
    WHILE done% = 0
      IF number% > 1 THEN scale% = number%-1
    WEND
    DIALOG OFF
    WINDOW CLOSE 3
RETURN

Begin:
  ' Initialise all variables then draw first segment of a new worm plot
    WINDOW 1
    ' Make all menu items active
    FOR i% = 1 TO 4
      MENU 6,i%,1
    NEXT
    CLS
    CALL TEXTFONT (3)
    size% = 2*(1+scale%)
    flag% = 0: sum% = 0
    x% = xo%: y% = yo%-size%
    direction% = 0
    count# = 0
    tally% = 1
    horiz% = 14: vert% = 23
    left% = 13: right% = 15: top% = 22: bottom% = 24
    hblock% = 166: vblock% = 100
    xorigin% = 0: yorigin% = 0
    SetOrigin xorigin%,yorigin%
    SetRect rec%(0),xorigin%,yorigin%,xorigin%+498,yorigin%+300
    ClipRect rec%(0)
    xd% = INT(size%*.866+.4): yd% = size%*.5
    LINE (xo%,yo%)-(x%,y%)
RETURN

Counter:
  ' Display length of path at bottom of screen
    WINDOW OUTPUT 2
    count# = count#+1
    CALL MOVETO (10,12)
    PRINT count#;
    WINDOW OUTPUT 1
RETURN

Plot:
  ' Find next path and draw it
    sum% = 0
    ' Check all paths radiating from present node
    ON scale% GOSUB Scantiny,Scansmall,Scannormal,Scanlarge
    ' Calculate sum of weights of pattern as seen by worm
    FOR i% = 0 TO 5
      j% = (6+i%-direction%) MOD 6
      sum% = sum%+SGN(spot%(i%)-30)*p%(j%)
    NEXT
    ' Convert path given by the rule to be relative to worm's last path
    drawpath% = (a%(sum%)+direction%) MOD 6
    ' Move present position to (ox%,oy%), find co-ordinates of next position
    ox% = x%
    oy% = y%
    IF drawpath% = 0 THEN y% = y%+size%: GOTO draw
    IF drawpath% = 1 THEN x% = x%-xd%: y% = y%+yd%: GOTO draw
    IF drawpath% = 2 THEN x% = x%-xd%: y% = y%-yd%: GOTO draw
    IF drawpath% = 3 THEN y% = y%-size%: GOTO draw
    IF drawpath% = 4 THEN x% = x%+xd%: y% = y%-yd%: GOTO draw
    IF drawpath% = 5 THEN x% = x%+xd%: y% = y%+yd%
    draw:
    ' If next position is too close to edge, scroll window
    IF x% < xorigin%+size% THEN xscroll% = 166: yscroll% = 0: GOSUB Screenscroll
    IF x% > xorigin%+498-size% THEN xscroll% = -166: yscroll% = 0: GOSUB Screenscroll
    IF y% < yorigin%+size% THEN xscroll% = 0: yscroll% = 100: GOSUB Screenscroll
    IF y% > yorigin%+300-size% THEN xscroll% = 0: yscroll% = -100: GOSUB Screenscroll
    ' Draw next segment
    LINE (ox%,oy%)-(x%,y%)
    direction% = (drawpath%+3) MOD 6
RETURN

Scantiny:
    spot%(0) = POINT(x%,y%+3)
    spot%(1) = POINT(x%-2,y%+2)
```

PROGRAM FILE

```
    spot%(2) = POINT(x%-2,y%-1)
    spot%(3) = POINT(x%,y%-3)
    spot%(4) = POINT(x%+2,y%-1)
    spot%(5) = POINT(x%+2,y%+2)
RETURN

Scansmall:
    spot%(0) = POINT(x%,y%+3)
    spot%(1) = POINT(x%-3,y%+2)
    spot%(2) = POINT(x%-3,y%-1)
    spot%(3) = POINT(x%,y%-3)
    spot%(4) = POINT(x%+3,y%-1)
    spot%(5) = POINT(x%+3,y%+2)
RETURN

Scannormal:
    spot%(0) = POINT(x%,y%+4)
    spot%(1) = POINT(x%-5,y%+3)
    spot%(2) = POINT(x%-5,y%-3)
    spot%(3) = POINT(x%,y%-4)
    spot%(4) = POINT(x%+5,y%-3)
    spot%(5) = POINT(x%+5,y%+3)
RETURN

Scanlarge:
    spot%(0) = POINT(x%,y%+4)
    spot%(1) = POINT(x%-5,y%+3)
    spot%(2) = POINT(x%-5,y%-2)
    spot%(3) = POINT(x%,y%-4)
    spot%(4) = POINT(x%+5,y%-2)
    spot%(5) = POINT(x%+5,y%+3)
RETURN

Screenscroll:
  ' Scroll worm plot, first saving to resource file the area lost
  FOR i% = 0 TO 2
    IF xscroll%% = 0 THEN
      xget% = xorigin%+i%*166
      yget% = yorigin%+100+yscroll%
      ELSE
      xget% = xorigin%+166+xscroll%
      yget% = yorigin%+i%*100
      END IF
    mx% = horiz%+SGN(xscroll%)+(i%-1)*ABS(SGN(yscroll%))
    my% = vert%+SGN(yscroll%)+(i%-1)*ABS(SGN(xscroll%))
    GOSUB Blocksave
  NEXT
  ' Every fifth scroll, write all outstanding resources to disk
  tally% = (tally%+1) MOD 5
  IF tally% = 0 THEN UpDateResFile ref%
  SCROLL (xorigin%,yorigin%)-(xorigin%+498,yorigin%+300),xscroll%,yscroll%
  ' Move window origin to compensate for scroll
  xorigin% = xorigin%-xscroll%
  yorigin% = yorigin%-yscroll%
  SetOrigin xorigin%,yorigin%
  SetRect rec%(0),xorigin%,yorigin%,xorigin%+498,yorigin%+300
  ClipRect rec%(0)
  ' Update outer bounds of whole plot
  horiz% = horiz%-SGN(xscroll%)
  vert% = vert%-SGN(yscroll%)
  IF horiz% = left% THEN left% = horiz%-1
  IF horiz% = right% THEN right% = horiz%+1
  IF vert% = top% THEN top% = vert%-1
  IF vert% = bottom% THEN bottom% = vert%+1
  ' Read from resource file the area revealed by scrolling
  FOR i% = 0 TO 2
    IF xscroll% = 0 THEN
    xput% = xorigin%+i%*166
    yput% = yorigin%+100-yscroll%
    ELSE
    xput% = xorigin%+166-xscroll%
    yput% = yorigin%+i%*100
    END IF
    mx% = horiz%-SGN(xscroll%)+(i%-1)*ABS(SGN(yscroll%))
    my% = vert%-SGN(yscroll%)+(i%-1)*ABS(SGN(xscroll%))
    GOSUB Blockload
  NEXT
RETURN

Birdseye:
  ' Show complete worm plot scaled down to fit the screen
  ' First save whole of window to resource file
```

PROGRAM FILE

```
        FOR i% = 0 TO 2
          FOR j% = 0 TO 2
            xget% = xorigin%+i%*166
            yget% = yorigin%+j%*100
            mx% = horiz%+i%-1
            my% = vert%+j%-1
            GOSUB Blocksave
          NEXT
        NEXT
        tally% = (tally%+1) MOD 5
        IF tally% = 0 THEN UpDateResFile ref%
        ' Open window to show birdseye view
        WINDOW 4,"Bird",(7,21)-(505,321),3
        BUTTON 1,1,"OK",(410,260)-(470,280),1
        ' Find if plot is larger in x or y - use this size to fit both dimensions
        hextent% = right%-left%+2
        vextent% = bottom%-top%+2
        IF hextent% > vextent% THEN extent% = hextent% ELSE extent% = vextent%
        hblock% = 498/extent%
        vblock% = 300/extent%
        ' Read whole plot from resource file and display
        FOR mx% = left% TO right%
        FOR my% = top% TO bottom%
          xput% = (mx%-left%)*hblock%
          yput% = (my%-top%)*vblock%
          GOSUB Blockload
        NEXT
      NEXT
      MENU
      MENU ON
      ' Wait for user to press OK button
      done% = 0
      DIALOG ON
      WHILE done% = 0
      WEND
      DIALOG OFF
      MENU STOP
      WINDOW CLOSE 4
      ' Restore full-size plot from resource file
      WINDOW OUTPUT 1
      hblock% = 166
      vblock% = 100
      flag% = 0
      FOR i% = 0 TO 2
        FOR j% = 0 TO 2
          xput% = xorigin%+i%*166
          yput% = yorigin%+j%*100
          mx% = horiz%+i%-1
          my% = vert%+j%-1
          GOSUB Blockload
        NEXT
      NEXT
    RETURN

    Blocksave:
      ' Save one bit-map block from screen to resource file
      GET (xget%,yget%)-(xget%+165,yget%+99),screen%(0)
      ' Get a new resource id
      UniqueId "GNRL",id%
      ' If a previous bit-map exists for this block, destroy it
      IF map%(mx%,my%) > 0 THEN
      oldid% = map%(mx%,my%)
      GetRes ref%,"GNRL",oldid%,handle!
      RemoveRes ref%,handle!
      DisposeHandle handle!
      END IF
      map%(mx%,my%) = id%
      SaveArray ref%,screen%(0),2226,id%
    RETURN

    Blockload:
      ' Load one bit-map block from resource file to screen
      IF map%(mx%,my%) = 0 THEN RETURN
      id% = map%(mx%,my%)
      LoadArray ref%,id%,screen%(0)
      PUT (xput%,yput%)-(xput%+hblock%-1,yput%+vblock%-1),screen%(0),PSET
      GetRes ref%,"GNRL",id%,handle!
      ReleaseRes handle!
    RETURN

    Quit:
      CloseResFile ref%
```

PROGRAM FILE

```
    KILL "MyDisk:Wormscreen"
    MENU RESET
    END
RETURN
```

List of Variables Used in Worm Plotter

a%	Array - each element holds path number to take for that value of sum%
action%	Number returned by Dialog function showing type of last user action
bottom%	Bottom-most block in resource file
count%	Number of segments drawn since start of plot
direction%	Path number by which worm arrived at current node
done%	Flag - set to 1 when OK button or Return pressed in dialog window
drawpath%	Path number to be drawn
edfield%	Number of currently selected edit field
extent%	The larger of hextent%, vextent% - used to scale Birdseye view
fieldrange%	Number of edit fields in window - used to wrap round Tab key presses
flag%	Flag - set to 1 when a menu selection is made to stop plotting
format%	Flag - set to 2 for normal display format, else calls Scaling & Origin
handle!	Handle to a resource
hblock%	X size of screen blocks - normally 166, scaled down for Birdseye view
hextent%	Number of blocks used left-right
horiz%	X value of centre block on screen
i%	General purpose loop counter
id%	Resource id
j%	General purpose loop counter
left%	Left-most block in resource file
length%	Length of string in edit field - used to check valid entry
letter%	Temporary variable used when getting individual letters from rule$
map%	Array to hold resource ids for screen blocks
menuitem%	Number of item in menu selection
menunumber%	Number of menu bar selection
mx%	X value of block being saved or loaded
my%	Y value of block being saved or loaded
number%	Number returned by Dialog function of selected button or edit field
oldid%	Resource id of a block that is being replaced by updated version
ox%	X co-ordinate of node from which worm is moving
oy%	Y co-ordinate of node from which worm is moving
p%	Array holding path weights as a look-up table
rec%	Array used by Toolbox Library to hold rectangle corner co-ordinates
ref%	File reference of resource file
right%	Right-most block in resource file
rule$	String made up of all letters in the rule
scale%	Plotting scale - 1 is smallest, 4 is largest
screen%	Array used to hold bit image of a screen block
simp$	Array to hold choice letter(s) for each field of the rule
size%	Segment length at current scale
spot%	Array to hold pixel values of scanned points - white=30, black=33
sum%	Sum of weighted values of all eaten paths at current node
tally%	Circular count of scrolls, used to update resource file periodically
top%	Top-most block in resource file
valid%	Flag - set to 0 if invalid entry detected in an edit field
vblock%	Y size of screen blocks - normally 100, scaled down for Birdseye view
vert%	Y value of centre block on screen
vextent%	Number of blocks used top-bottom
x%	X co-ordinate of current node
xd%	X length of 60° line at current scale
xget%	X co-ordinate of top-left corner of block to be got from screen
xo%	X co-ordinate of worm origin
xorigin%	X co-ordinate of current screen origin
xput%	X co-ordinate of top-left corner of block to be put to screen
xscroll%	Number of pixels to be scrolled left or right - ±166
y%	Y co-ordinate of current node
yd%	Y length of 60° line at current scale
yget%	Y co-ordinate of top-left corner of block to be got from screen
yo%	Y co-ordinate of worm origin
yorigin%	Y co-ordinate of current screen origin
yput%	Y co-ordinate of top-left corner of block to be put to screen
yscroll%	Number of pixels to be scrolled up or down - ±100

Psion Organiser II Space Invaders

by Vik Oliver

This program converts the Organiser display into a 4 by 16 grid of user-defined characters. There is a base, UFOs, rockets and missiles — all with sound effects. The program displays one moving target at a time, and keeps score of any successful shots and of how many bases you

have left.

The program will run on an unexpanded Organiser but it uses all the RAM on the CM model unless the program is put on a ROM pack. The program comes in two parts: a utility to set up the user-defined graphics, and the main program.

The program is controlled by the up and down arrow keys to move your ship, which is on the left-hand side of the display. The EXE key is used to fire the double-barrelled missiles. You have three ships and can only fire one missile at a time. Rockets cannot be shot down and must be dodged. UFOs may be shot, but when they explode, you must be out of their path or debris will destroy you too.

If you press MODE in mid-game, the game will pause and bring up your score, a quit option and the volume control.

```
UDG: (n%, a1%, a2%, a3%, a4%, a5%, a6%, a7%, a8%)
POKEB $180, 64+(n% AND 7)*8
POKEB $181, a1%
POKEB $181, a2%
POKEB $181, a3%
POKEB $181, a4%
POKEB $181, a5%
POKEB $181, a6%
POKEB $181, a7%
POKEB $181, a8%

Now the main invader program:

INVADER:
LOCAL i%, j%, k%, ba%, mbx%, mbh%
LOCAL snd%, mex%, meh%, mes%, rfl%, typ%, mbs%, bc%, sc%
udg: (0, 24, 31, 31, 24, 0, 0, 0)
udg: (1, 0, 0, 0, 0, 24, 31, 31, 24)
udg: (2, 4, 14, 31, 14, 0, 0, 0, 0)
udg: (3, 0, 0, 0, 0, 4, 14, 31, 14)
udg: (4, 23, 0, 0, 23, 0, 0, 0, 0)
udg: (5, 0, 0, 0, 0, 23, 0, 0, 23)
udg: (6, 1, 14, 14, 1, 0, 0, 0, 0)
udg: (7, 0, 0, 0, 0, 1, 14, 14, 1)
CLS
snd%=0 :typ%=2: mes%=5: mbs%=5
ba%=0 :PRINT CHR$(0);
mbx%=0 :mex%=0
sc%=0 :bc%=3
rfl%=1
DO
DO
k%=key
IF k%<>0 OR rfl%<>0
rfl%=0
CLS
IF k%=3
ba%=(ba%-1) AND 3
ELSEIF k%=4
ba%=(ba%+1) AND 3
ELSEIF k%=13
IF mbx%=0
mbx%=mbs%*2 :mbh%=ba%
ENDIF
ENDIF
AT 1, 1+ba%/2 :PRINT CHR$(ba% AND 1);
ENDIF
IF mbx%<>0
AT mbx%/mbs%, 1+(mbh%/2) :PRINT " ";
mbx%=mbx%+1
IF snd%=1 :BEEP 1, mbx%*5 :ENDIF
IF mbx%=16*mbs%
mbx%=0
PRINT " ";
ELSE
PRINT CHR$(4+(mbh% AND 1));
ENDIF
ENDIF
IF mex%=0
IF RND<.2
meh%=ABS(ba%+INT(RND*3)-1)
IF meh%>3 :meh%=0 :ENDIF
IF RND>.6
typ%=6 :mes%=3
ELSE
typ%=2 :mes%=6
ENDIF
mex%=17*mes%
ENDIF
ELSE
AT (mex%/mes%)-1, (meh%/2)+1 :PRINT " ";CHR$(8);CHR$(8);
```

PROGRAM FILE

```
mex%=mex%-1
IF (INT(mex%/mes%)=INT(mbx%/5)+1) AND mbh%=meh% AND typ%=2
CLS
mbx%=0 :mex%=0 :sc%=sc%+5
IF snd%=1 :BEEP 20,600 :ENDIF
ENDIF
IF mex%<=3*mes%
mex%=0 :PRINT " ";
rfl%=1
IF ba%=meh%
CLS
PRINT "** KER-SPLATT **";
IF snd%=1 :BEEP 20,700: BEEP 10,300 :BEEP 40,1400:ENDIF
VIEW(2,"BASES="+GEN$(bc%,32)+" SCORE="+GEN$(sc%,32))
bc%=bc%-1 :IF bc%=0 :RETURN :ENDIF
CLS
ENDIF
ELSE
PRINT CHR$(typ%+(meh% AND 1));
ENDIF
ENDIF
UNTIL k%=2
k%=MENU("LOUD,SHH,QUIT,"+GEN$(sc%,32))
snd%=k% AND 1
rfl%=1
CLS
UNTIL k%=3 OR k%=0
```

BBC Artwork

by Daniel Tang

Artwork is a graphics package similar to the ones used with a mouse, but it uses a joystick or a keyboard. When using a keyboard use the cursor keys to move, the space bar for fire, and Shift to accelerate movement.

Artwork has the facilities to: draw, spray and paint; erase; flood fill; magnify; draw rectangles; circles; lines; triangles; arcs; write text; and load and save pictures.

These are represented by icons to the right of the screen. Along the bottom of the screen are the words 'system', 'separated' and 'continuous'. These can be selected by placing the pointer over the word and pressing fire; the selected word will then be highlighted in yellow.

The word 'system' is to allow system commands ('*' commands) to be typed in. When selected a * will be shown in the window (at the bottom of the screen) and the command can then be typed in. Press <RETURN> to enter the command. When cataloguing a disk using this facility, the icons will be deleted and the files will be shown in the space left. Press <SHIFT> to allow the filenames to scroll up the screen and press <RETURN> to end.

The word 'continuous' and 'separated' affect the line, arc, rectangle and circle facilities. When in continuous mode, the last point of the previous shape is taken as the first point of the next shape. When in separated mode, all shapes are separate from each other. When using circles with continuous selected, the centre will stay fixed, allowing concentric circles. When in continuous mode, the routine will end when the shape is dragged off the drawing area.

Also at the bottom of the screen is the colour palette and the 'select block'. A colour can be selected by positioning the pointer over a colour on the palette and pressing fire; the selected colour is then shown in the block beside the palette, the select block. The palette may be changed by placing the pointer over the select block and pressing fire repeatedly until the required colour appears.

To select a facility, place the pointer over an icon and press fire; the icon will then be highlighted. The selected facility may then be used as follows:

● **Draw, spray and paint**
Move the pointer to the required start position and press fire. By moving the joystick, a line of spray or paint will be left behind. When you want to finish, press fire again and the pointer will reappear. You may now either choose another icon or start the same option again (by pressing fire again).

● **Erase**
Move the pointer to the start position for erasing and press fire. A line will appear which can be moved around the screen and will rub out everything it goes over.

● **Flood fill**
Place the pointer anywhere inside

the shape to be filled and press fire. This will not always fill the whole shape, although it should for simple shapes. If it doesn't, just fill the part it has left — this shouldn't normally have to be repeated more than two or three times. Flood fill can also be used to change the colour of a solid shape by filling the shape with another colour, or can delete it by filling it with black.

● **Magnify**

When selected, a square will be shown. This should be placed over the portion that needs to be magnified. Press fire, and after accessing the disk a grid should appear. Each square inside the grid represents one pixel inside the original square. Any individual pixel can be changed to the colour shown in the select block by placing the pointer over the corresponding block in the grid and pressing fire. The colour of the select block can be changed in the normal way (see above). To exit from this facility, simply select another icon. This routine creates a file called 'A.magnify' which stores the part of the screen that is rubbed out by the grid. Sufficient space for this file should always be left on the disk that you are using.

● **Draw rectangles**

Press fire while in the display area to fix one corner. By moving the joystick, the rectangle can be dragged about until it is just the right shape and size. This is called 'rubber-banding'.

● **Circles**

Pressing fire while in the display area will fix the point of the centre of the circle. A series of dots will appear in the shape of a circle (dots are used for speed of drawing) and the radius can then be changed by pushing the joystick left or right. Press fire when ready to draw the circle.

● **Lines**

Move the pointer to the start position and press fire; a line can then be rubber-banded to the correct position. To draw the line, press fire again.

● **Triangles**

Press fire to fix one corner of the triangle; do this for another corner. A line will be drawn between the two points and the rest of the triangle can be rubber-banded to the correct shape. Press fire to draw the triangle.

● **Arcs**

Three points must be plotted by pressing fire. A dot will be drawn at each point, and when all three points have been plotted, an arc will be drawn that passes through all three points in the order in which they were plotted.

● **Write text**

Move the pointer to the start position of the text so that the pointer represents the placing of the first letter of the text. Press fire, type the text and press <RETURN>.

● **Load and save pictures**

Pictures may be loaded and saved by selecting the icons at the bottom right of the display which show a disk, and an arrow signifying data direction (towards the disk for save and away from the disk for load). You will be asked for a filename; type it in and press <RETURN>. The icons will be rubbed out and the picture will be saved or loaded; the icons will then be redrawn.

If any errors occur while using the package (for example, disk full) it will be reported, usually in the window at the bottom of the screen. To continue after an error, press any key.

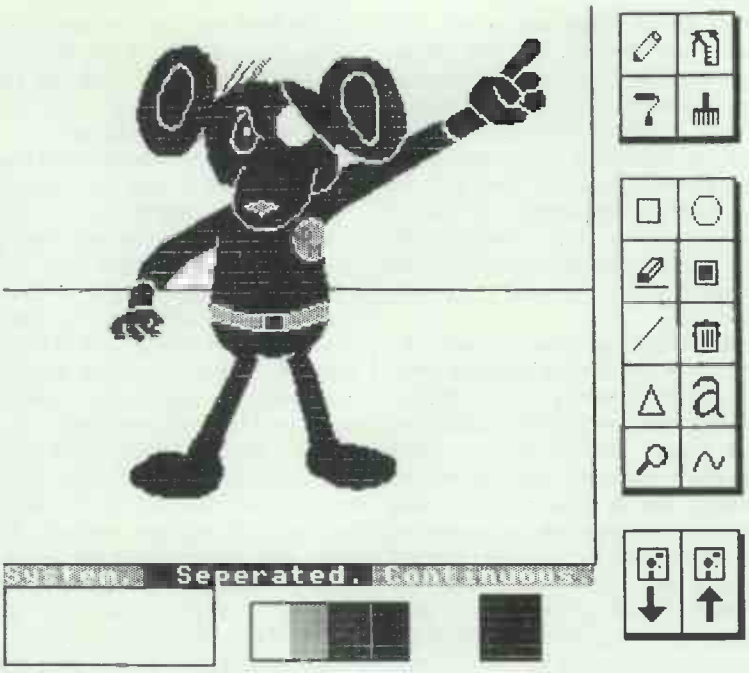
Any attempt to drag shapes outside the drawing area will result in the current drawing routine being aborted and the shape deleted. This can be used to exit from a procedure half-way through if the shape is incorrectly positioned.

If you want to use another input device, change PROCconvert to give an X, Y coordinate where X=0 to 1280, Y=0 to 1024, PROCclick to sense a button being pressed, and put either 0 or 1 into the variable E (0 if not pressed, 1 if pressed). If you require different keys, change the values on the INKEY statements in PROCconvert and PROCclick to the values shown on page 275 of the BBC Micro's *User Guide*.

The system needs Basic 2 wherever OSCLI is used (although it should be possible to make it work with Basic 1 by replacing OSCLI ("Drive"+X$) by call$="DRIVE"+X$: CALL&C00,call$), a proportional joystick, and should use a disk drive. Using a cassette is possible but will involve tedious rewinding and reloading. The program is split into two parts: the first part draws the screen and icons; the second part handles the routines. While using the package, a disk containing both programs should be kept in the drive as some of the routines require reloading.

When Program One is running it will check if a joystick is plugged in or not; this is done by checking the constancy of the resistance on channels 1 and 2. This means that if you are using a joystick and you move the joystick about while the program is loading, the incorrect input device will be selected. Therefore, it is advisable to plug in the joystick *before* loading the program and not to touch the joystick *during* loading. Part one of the program should be saved as 'art' and part two should be saved as 'art2'.

PROGRAM FILE




```
10REM ************************
20REM ****                    ****
30REM ****     Artwork        ****
40REM ****       By           ****
50REM ****  Daniel Tang       ****
60REM ****    1/2/87          ****
70REM ****                    ****
80REM ****   Program 1        ****
90REM ****                    ****
100REM ************************
110
120IF PAGE<>&1100 MODE1:PROCkeyboard
130VDU28,31,31,39,0
140CLS
150COLOUR7
160GCOL0,7
170VDU24,0;0;1279;1023;
180VDU28,0,31,39,0
190PROCicon
200I%=132
210FORY%=1TO12 STEP3
220IFY%=7 Y%=Y%+2
230I%=I%+8
240PRINTTAB(33,Y%)CHR$(I%);CHR$(I%+1);" ";CHR$(I%+4);CHR$(I%+5)
250PRINTTAB(33,Y%+1)CHR$(I%+2);CHR$(I%+3);" ";CHR$(I%+6);CHR$(I%+7)
260NEXT
270PROCicon2
280I%=164
290FORY%=15TO23 STEP3
300I%=I%+8
310PRINTTAB(33,Y%)CHR$(I%);CHR$(I%+1);" ";CHR$(I%+4);CHR$(I%+5)
320PRINTTAB(33,Y%+1)CHR$(I%+2);CHR$(I%+3);" ";CHR$(I%+6);CHR$(I%+7)
330NEXT
340PRINTTAB(33,26)CHR$(164);CHR$(165);" ";CHR$(164);CHR$(165)
350PRINTTAB(33,27)CHR$(166);CHR$(167);" ";CHR$(166);CHR$(167)
360MOVE0,156
370DRAW992,156
380DRAW992,1024
390PRINTTAB(33,28)CHR$(140);CHR$(141);" ";CHR$(168);CHR$(169)
400PRINTTAB(33,29)CHR$(142);CHR$(143);" ";CHR$(170);CHR$(171)
410PRINTTAB(33,15)"  "
420PRINTTAB(33,16)"  "
430FORX%=1040TO1232 STEP96
440MOVEX%,48:DRAWX%,208
450MOVEX%,272:DRAWX%,752
460MOVEX%,816:DRAWX%,1008
470NEXT
480FORY%=264TO1008 STEP96
490IFY%=848 Y%=808
500MOVE1040,Y%:DRAW1232,Y%
510IFY%<272 Y%=Y%+4:GOTO500
520IFY%<816 AND Y%>807 Y%=Y%+4:GOTO500
530NEXT
540FORY%=40TO48 STEP4
550MOVE1040,Y%
560DRAW1232,Y%
570NEXT
580MOVE1040,208:DRAW1232,208
590MOVE1060,490:DRAW1110,538
600FORX%=1232TO1240 STEP4
610MOVEX%,40:DRAWX%,200
620MOVEX%,264:DRAWX%,746
630MOVEX%,808:DRAWX%,1000
640NEXT
650FORX%=416TO679 STEP68
660GCOL0,(X%-416)/60
670MOVEX%,10:MOVEX%,96:PLOT85,X%+60,10
680MOVEX%+60,10:MOVEX%+60,96:PLOT85,X%,96
690NEXT
700GCOL0,7
710MOVE416,10:DRAW679,10
720MOVE416,96:DRAW679,96
730MOVE416,10:DRAW416,96
740MOVE550,10:DRAW550,96
750MOVE0,0:DRAW352,0
760DRAW352,120:DRAW0,120
770DRAW0,0
780PROCextra
```

PROGRAM FILE

```
  790VDU5
  800GCOL0,1
  810MOVE0,152:PRINTSTRING$(31,CHR$255)
  820COLOUR7
  830COLOUR128
  840GCOL0,7
  850*FX16,2
  860C%=640:D%=512
  870PAGE=&1100
  880CHAIN"art2"
  890END
  900
  910DEFPROCicon
  920REM ***** PENCIL *****
  930VDU23,140,0,0,0,0,0,1,2,4,23,141,0,0,48,104,164,28,8,16,23,142,8,16,32,49,5
8,60,0,0,23,143,32,64,128,0,0,0,0,0
  940REM ***** SPRAY *****
  950VDU23,144,0,0,15,60,14,14,27,17,23,145,0,0,248,60,56,12,4,132,23,146,16,16,
16,16,16,0,0,0,23,147,228,132,228,132,228,132,228,252,0
  960REM ***** ROLLER *****
  970VDU23,148,0,0,31,63,31,0,0,0,23,149,0,0,224,248,232,8,16,32,23,150,0,0,0,1,
1,1,1,0,23,151,64,128,128,192,192,192,192,0
  980REM ***** BRUSH *****
  990VDU23,152,0,0,1,1,1,1,1,1,23,153,0,0,192,192,192,192,192,192,23,154,31,31,2
1,21,21,21,21,0,23,155,252,252,84,84,84,84,84,0
 1000REM ***** RECTANGLE *****
 1010VDU23,156,0,0,0,31,16,16,16,16,23,157,0,0,0,248,8,8,8,8,23,158,16,16,16,16,
31,0,0,0,23,159,8,8,8,8,248,0,0,0
 1020REM ***** CIRCLE *****
 1030VDU23,160,0,0,7,8,16,16,32,32,23,161,0,0,240,8,4,4,2,2,23,162,32,32,16,16,8
,7,0,0,23,163,2,2,4,4,8,240,0,0
 1040REM ***** RUBBER *****
 1050VDU23,164,0,0,0,0,0,1,2,4,8,23,165,0,0,124,140,20,36,72,144,23,166,31,31,31,3
1,0,63,0,0,23,167,32,64,128,0,0,255,0,0
 1060REM ***** FILL *****
 1070VDU23,168,0,0,0,31,16,23,23,23,23,169,0,0,0,248,8,232,232,232,23,170,23,23,
23,16,31,0,0,0,23,171,232,232,232,8,248,0,0,0
 1080ENDPROC
 1090
 1100DEFPROCicon2
 1110REM ***** BIN *****
 1120VDU23,144,0,0,1,31,63,16,18,50,23,145,0,0,128,248,252,8,168,172,23,146,50,1
8,18,18,18,16,31,0,23,147,172,168,168,168,168,8,248,0
 1130REM ***** TRIANGLE *****
 1140VDU23,148,0,0,0,0,0,1,1,2,23,149,0,0,0,128,128,64,64,32,23,150,2,4,4,8,8,16
,31,0,23,151,32,16,16,8,8,4,252,0
 1150REM ***** TEXT *****
 1160VDU23,152,7,15,24,56,32,0,3,6,23,153,224,240,24,8,8,232,248,8,23,154,12,24,
24,56,56,24,31,6,23,155,8,8,8,24,56,232,140,6
 1170REM ***** MAGNIFYING GLASS *****
 1180VDU23,156,0,0,0,1,1,2,2,2,23,157,0,0,112,140,4,2,2,2,23,158,3,7,14,28,56,48
,0,0,23,159,4,140,112,0,0,0,0,0
 1190REM ***** WIGGLY LINE *****
 1200VDU23,160,0,0,0,0,0,0,3,4,8,23,161,0,0,0,0,0,0,128,66,23,162,8,16,16,32,32,0,
0,0,23,163,66,36,36,24,0,0,0,0
 1210REM ***** DISC *****
 1220VDU23,164,0,0,63,32,32,32,33,35,23,165,0,0,254,2,58,58,130,194,23,166,35,33
,32,33,33,33,63,0,23,167,194,146,2,130,130,130,254,0
 1230REM ***** ARROWS *****
 1240VDU23,168,0,0,1,3,7,15,31,1,23,169,0,128,192,224,240,248,252,192,23,170,1,1
,1,1,1,1,0,23,171,192,192,192,192,192,192,192,0
 1250VDU23,140,0,3,3,3,3,3,3,3,3,23,141,0,128,128,128,128,128,128,128,23,142,3,6
3,31,15,7,3,1,0,23,143,128,252,248,240,224,192,128,0
 1260ENDPROC
 1270
 1280DEFPROCextra
 1290VDU23,128,252,248,240,240,216,140,6,3
 1300VDU23,130,0,0,60,60,60,60,0,0
 1310VDU23,131,68,16,9,64,20,0,8,0
 1320VDU23,132,3,7,14,&1C,&38,&70,&E0,&80
 1330VDU23,255,255,255,255,255,255,255,255,255
 1340ENDPROC
 1350
 1360DEFPROCkeyboard
 1370T%=0:C%=ADVAL(1)+ADVAL(2)
 1380FORAX=1TO300
 1390T%=T%+ABS(ADVAL(1)+ADVAL(2)-C%)
 1400NEXT
 1410T%=T%/300
 1420IFT%>362 K%=1 ELSE K%=0
 1430ENDPROC
>
>L.
   10REM Artwork
   20REM Prog2
   30REM Daniel Tang
   40cont%=0:PROCinvert(620,152,988,124):PROChighlight
   50ON ERROR PROCerror:IFERL=4530 AND cx>1136 GOTO490 ELSE IFERL=4530 GOTO350
   60VDU28,1,30,10,29
   70VDU4
   80CLS
   90VDU5
  100off%=0
  110X%=620:PROCcolour
  120PROCmove
  130IFX%<996 GOTO120
  140VDU24,0;0;1279;1023;
  150IFendproc=0 GOTO230
  160IFY%>208 Y%=Y%-64
  170IFY%>752 Y%=Y%-64
  180choice%=((Y%-112)/96)+1
  190IFchoice%=0 choice%=1
  200P=(choice%*96)+108
  210IFchoice%>1 P=P+64
  220IFchoice%>6 P=P+64
  230IFcx>1136 GOTO380
  240PROCinvert(1044,P,1132,P-88)
  250VDU24,0;164;988;1023;
  260IFendproc SOUND1,-5,200,2
  270IFchoice%=1PROCload
  280IFchoice%=2PROCmagnify
  290IFchoice%=3PROCtriangle
  300IFchoice%=4PROCline
  310IFchoice%=5PROCedit
  320IFchoice%=6PROCrectangle
  330IFchoice%=7PROCpaint(126)
  340IFchoice%=8PROCdraw
  350VDU24,0;0;1279;1023;
  360PROCinvert(1044,P,1132,P-88)
  370GOTO150
  380PROCinvert(1140,P,1228,P-88)
  390VDU24,0;164;988;1023;
```

PROGRAM FILE

```
4001Fendproc SOUND1,-5,200,2
4101Fchoice%=1PROCsave
4201Fchoice%=2PROCarc
4301Fchoice%=3PROCtext
4401Fchoice%=4PROCclear
4501Fchoice%=5PROCfill
4601Fchoice%=6PROCcircle
4701Fchoice%=7PROCpaint(1)
4801Fchoice%=8PROCpaint(2)
490VDU24,0;0;1279;1023;
500PROCinvert(1140,P,1228,P-88)
510GOTO150
520:
530DEFPROCinvert(XX,YX,PX,QX)
540GCOL3,7
550MOVEXX+4,YX
560MOVEPX,YX
570PLOT85,PX,QX
580MOVEXX,QX
590MOVEPX-4,QX
600PLOT85,XX,YX
610ENDPROC
620:
630DEFPROCdraw
640PROCmove:IFendproc ENDPROC
650GCOL0,colour%
660MOVE XX,YX
670REPEAT
680PROCconvert
690DRAWXX,YX
700PROCclick
710UNTILE<>0
720REPEAT:PROCclick:UNTILE=0
730ENDPROC
740:
750DEFPROCline
760PROCmove:IFendproc ENDPROC
770AX=XX
780BX=YX
790GCOL3,7
800REPEAT
810PROCconvert
820IFXX>992 OR YX<160 ENDPROC
830MOVEAX,BX
840DRAWXX,YX
850*FX19
860*FX19
870MOVEAX,BX
880DRAWXX,YX
890PROCclick
900UNTILE<>0
910REPEAT:PROCclick:UNTILE=0
920MOVEXX,YX
930GCOL0,colour%
940DRAWAX,BX
950IF cont% GOTO770
960ENDPROC
970:
980DEFPROCmove
990endproc=0
1000VDU24,0;0;1279;1023;
1010GCOL3,7
1020REPEAT
1030PROCconvert
1040MOVEXX,YX
1050PRINTCHR$128
1060*FX19
1070*FX19
1080MOVEXX,YX
1090PRINTCHR$128
1100PROCclick
1110UNTILE<>0
1120REPEAT:PROCclick:UNTILE=0
1130IFYX<120 AND XX<900 AND XX>416 PROCcolour:GOTO1010
1140IFYX<160 AND YX>119 AND XX<992 PROCsystem:GOTO1010
1150IFYX<160 AND XX<996 GOTO1010
1160IFXX>992 endproc=-1:cx=XX
1170VDU24,0;164;988;1023;
1180ENDPROC
1190:
1200DEFPROCclear
1210VDU4
1220CLS
1230FORS=1TO200:NEXT:*FX21,0
1240PRINT" Are you    sure?";
1250A$=GET$
1260CLS
1270IFA$="Y" OR A$="y" CLG
1280VDU5
1290PROCmove
1300ENDPROC
1310:
1320DEFPROCcircle
1330PROCmove:IFendproc ENDPROC
1340VDU29,XX;YX;
1350AX=XX
1360GCOL3,7
1370REPEAT
1380PROCconvert:IFXX>994 UNTILTRUE:GOTO1610
1390RX=ABS(AX-XX)
1400FORTX=1TO2
1410RESTORE1630
1420FORSX=1TO6
1430READX,Y
1440UX=X*RX
1450PX=Y*RX
1460PLOT69,QX,PX
1470PLOT69,QX,-PX
1480PLOT69,-QX,-PX
1490PLOT69,-QX,PX
1500NEXT
1510NEXT
1520PROCclick
1530UNTILE<>0
1540GCOL0,colour%
1550MOVE0,RX
1560FORS=0TO2*PI STEP0.1
1570DRAWSIN(S)*RX,COS(S)*RX
1580NEXT
1590DRAW0,RX
1600IFcont% GOTO1360
1610VDU29,0;0;
1620ENDPROC
```

PROGRAM FILE

```
1630 DATA0,1,0.295,0.955,0.565,0,825,0.783,0.622,0.932,0.362,0.997,0.071:REM Fo
r faster circles
1640:
1650DEFPROCtext
1660PROCmove:IF endproc ENDPROC
1670FORS=1TO200:NEXT:*FX21,0
1680REPEAT
1690MOVEX%,Y%
1700GCOL3,7
1710PRINT"_"
1720A=GET
1730MOVEX%,Y%
1740PRINT"_"
1750GCOL0,colour%
1760MOVEX%,Y%
1770PRINT;CHR$(A)
1780X%=X%+32
1790IFA=127 X%=X%-64
1800UNTIL A=13
1810ENDPROC
1820:
1830DEFPROCedit
1840PROCmove:IFendproc ENDPROC
1850REPEAT
1860PROCconvert
1870GCOL0,7
1880MOVEX%,Y%
1890PRINTCHR$132
1900*FX19
1910*FX19
1920GCOL0,0
1930MOVEX%,Y%
1940PRINTCHR$132
1950PROCclick
1960UNTILE<>0
1970REPEAT:PROCclick:UNTILE=0
1980ENDPROC
1990:
2000DEFPROCrectangle
2010PROCmove:IFendproc ENDPROC
2020A%=X%:B%=Y%
2030GCOL3,7
2040REPEAT
2050PROCconvert
2060IFX%>992 OR Y%<160 UNTILTRUE:ENDPROC
2070FORT%=1TO2
2080MOVEA%,B%:DRAWA%,Y%
2090DRAWX%,Y%
2100DRAWX%,B%
2110DRAWA%,B%
2120*FX19
2130*FX19
2140NEXT
2150PROCclick
2160UNTILE<>0
2170REPEAT:PROCclick:UNTILE=0
2180GCOL0,colour%
2190MOVEA%,B%:DRAWA%,Y%
2200DRAWX%,Y%
2210DRAWX%,B%
2220DRAWA%,B%
2230IFcont% GOTO2020
2240ENDPROC
2250:
2260DEFPROCtriangle
2270PROCmove:IFendproc ENDPROC
2280A%=X%:B%=Y%
2290PLOT69,A%,B%
2300PROCmove:IFendproc ENDPROC
2310P%=X%:Q%=Y%
2320GCOL3,7
2330PLOT69,A%,B%
2340MOVEA%,B%
2350DRAWP%,Q%
2360REPEAT
2370 PROCconvert
2380IFX%>992 OR Y%<160 MOVEP%,Q%:DRAWA%,B%:UNTILTRUE:ENDPROC
2390FORT%=1TO2
2400MOVEA%,B%:DRAWX%,Y%
2410DRAWP%,Q%
2420*FX19
2430*FX19
2440NEXT
2450PROCclick
2460UNTILE<>0
2470REPEAT:PROCclick:UNTILE=0
2480GCOL0,colour%
2490MOVEA%,B%
2500DRAWX%,Y%
2510DRAWP%,Q%
2520DRAWA%,B%
2530ENDPROC
2540:
2550DEFPROCsave
2560VDU4
2570CLS
2580INPUT"Filename:"'File$
2590CLS:PRINT" Saving.."
2600VDU28,31,31,39,0:CLS
2610OSCLI("*SAVE "+File$+" 3000 7380")
2620CHAIN"art"
2630ENDPROC
2640:
2650DEFPROCload
2660VDU4
2670CLS
2680INPUT"Filename:"'File$
2690OSCLI("*LOAD "+File$)
2700CHAIN"art"
2710ENDPROC
2720:
2730DEFPROCfill
2740PROCmove:IFendproc ENDPROC
2750bgc%=POINT(X%,Y%)
2760GCOL0,128+bgc%
2770P%=X%:P%=Y%:Q%=Y%
2780GCOL0,colour%
2790PLOT77,X%,Y%
2800REPEAT
2810PROCmid
2820Q%=Q%+4
2830REPEAT:A%=A%+4:UNTIL POINT(A%,Q%)=bgc% OR A%>B%
```

PROGRAM FILE

```
2840IFA%<=B% PLOT77,A%,Q%
2850UNTIL A%>B%
2860Q%=PY%-4
2870PLOT77,PX%,Q%
2880REPEAT
2890PROCmid
2900Q%=Q%-4
2910REPEAT:A%=A%+4:UNTIL POINT(A%,Q%)=bgc% OR A%>B%
2920IFA%<=B% PLOT77,A%,Q%
2930UNTILA%>B%
2940GCOL0,128
2950ENDPROC
2960:
2970DEFPROCmid
2980A%=&D:X%=&70:Y%=&00
2990CALL &FFF1:REM OSWORD
3000A%=256*?&71+?&70
3010B%=256*?&75+?&74
3020ENDPROC
3030:
3040DEFPROCcolour
3050IFoff%=16 off%=0
3060IFX%>687 off%=off%+1:VDU19,colour%,colour%+off%,0,0,0:ENDPROC
3070colour%=(X%-416)/68
3080GCOL0,colour%
3090MOVE900,10:MOVE800,10
3100PLOT85,900,110:PLOT85,800,110
3110GCOL0,7
3120MOVE900,10:DRAW900,110
3130DRAW800,110:DRAW800,10
3140DRAW900,10
3150ENDPROC
3160:
3170DEFPROCpaint(T)
3180PROCmove:IFendproc ENDPROC
3190GCOL0,colour%
3200REPEAT
3210IFT=2 FORS=1TO50:NEXT
3220PROCconvert
3230GCOL0,7:MOVEX%,Y%:PRINTCHR$(129+T)
3240GCOL0,colour%:MOVEX%,Y%:PRINTCHR$(129+T)
3250PROCclick
3260UNTILE<>0
3270REPEAT:PROCclick:UNTILE=0
3280ENDPROC
3290:
3300DEFPROCclick
3310IF K%=0 E=ADVAL(0)AND3:ENDPROC
3320E=INKEY(-99)
3330ENDPROC
3340:
3350DEFPROCconvert
3360IF K%=0 X%=1280-(ADVAL(1)/50):Y%=ADVAL(2)/64:ENDPROC
3370IFINKEY(-1) S%=24 ELSE S%=8
3380IFINKEY(-58) D%=D%+S%
3390IFINKEY(-42) D%=D%-S%
3400IFINKEY(-26) C%=C%-S%
3410IFINKEY(-122) C%=C%+S%
3420X%=C%:Y%=D%:*FX21,0
3430ENDPROC
3440:
3450DEFPROCmagnify
3460VDU4
3470VDU28,0,31,39,0
3480GCOL3,7
3490REPEAT
3500PROCconvert:X%=X%-200
3510IFX%>992 OR Y%<160 VDU5:PROCmove:UNTILTRUE:GOTO3980
3520FORT%=1TO2
3530MOVEX%,Y%
3540DRAWX%+64,Y%:DRAWX%+64,Y%-64
3550DRAWX%,Y%-64:DRAWX%,Y%
3560*FX19
3570*FX19
3580NEXT
3590PROCclick
3600UNTIL E<>0
3610PX=X%:QX=Y%
3620FORB%=0TO15
3630FORA%=0TO15
3640?(&B00+(16*B%)+A%)=POINT(X%+(A%*4),Y%-(B%*4))
3650NEXT
3660NEXT
3670*SAVE"A.magnify"3000 6400
3680FORB%=0TO15
3690FORA%=0TO15
3700COLOUR (?(&B00+(16*B%)+A%))
3710PRINTTAB(A%,B%)CHR$255
3720NEXT:NEXT
3730GCOL0,6
3740FORY%=1023TO511 STEP-32
3750MOVE0,Y%
3760DRAW512,Y%
3770NEXT
3780FORX%=0TO512 STEP 32
3790MOVEX%,1024
3800DRAWX%,511
3810NEXT
3820VDU5
3830PROCmove:IFendproc GOTO3910
3840VDU4
3850COLOURcolour%
3860X%=INT(X%/32):Y%=INT(32-(Y%/32))
3870IFX%>16 OR Y%>16 GOTO 3820
3880PRINTTAB(X%,Y%)CHR$255
3890?(&B00+(16*Y%)+X%)=colour%
3900GOTO3730
3910*LOAD"A.magnify"
3920FORB%=0TO15
3930FORA%=0TO15
3940GCOL0,?(&B00+(16*B%)+A%)
3950PLOT69,PX+(A%*4),QX-(B%*4)
3960NEXT
3970NEXT
3980COLOUR7
3990VDU4
4000VDU28,1,30,10,29
4010VDU5
4020ENDPROC
4030:
4040DEFPROCarc
4050an=-1
4060PROCmove:IFendproc ENDPROC
```

PROGRAM FILE

```
4070X1=X%:Y1=Y%:PLOT69,X%,Y%
4080PROCmove:IFendproc ENDPROC
4090X2=X%:Y2=Y%:PLOT69,X%,Y%
4100PROCmove:IFendproc ENDPROC
4110X3=X%:Y3=Y%:PLOT69,X%,Y%
4120PLOT69,X1,Y1:PLOT69,X2,Y2:PLOT69,X3,Y3
4130IF X1=X2 AND X2=X3 GCOL0,colour%:MOVEX1,Y1:DRAWX3,Y3:GOTO4400
4140IFX1=X2 OR X2=X3 X2=X2+1
4150IF(Y2-Y1)/(X2-X1)=(Y3-Y2)/(X3-X2) GCOL0,colour%:MOVEX1,Y1:DRAWX3,Y3:GOTO440
0
4160A=2*X2-2*X1
4170B=2*X3-2*X1
4180YC=(A*Y3^2-A*Y1^2-A*X1^2+A*X3^2-B*Y2^2+B*Y1^2+B*X1^2-B*X2^2)/(2*B*Y1-2*B*Y2
+2*A*Y3-2*A*Y1)
4190XC=(Y2^2-2*Y2*YC-Y1^2+2*Y1*YC-X1^2+X2^2)/(2*X2-2*X1)
4200R=SQR((X1-XC)^2+(Y1-YC)^2)
4210VDU29,XC;YC;
4220s=ATN((X1-XC)/(Y1-YC))
4230m=ATN((X2-XC)/(Y2-YC))
4240e=ATN((X3-XC)/(Y3-YC))
4250IF (Y3-YC)<0 e=e+PI
4260IF(X3-XC)<0 AND (Y3-YC)>0 e=(2*PI)+e
4270IF(Y1-YC)<0 s=s+PI
4280IF(X1-XC)<0 AND (Y1-YC)>0 s=(2*PI)+s
4290IF(Y2-YC)<0 m=m+PI
4300IF(X2-XC)<0 AND (Y2-YC)>0 m=(2*PI)+m
4310IF(s<m AND e<m AND s<e) OR (s>m AND e>m AND e>s) OR (s>m AND e<m) t=s:s=e:e
=t:an=1
4320IFs>e e=e+(2*PI)
4330MOVESIN(s)*R,COS(s)*R
4340GCOL0,colour%
4350FORA=s TO e STEP0.1
4360DRAWSIN(A)*R,COS(A)*R
4370NEXT
4380IFan=1 an=-1:DRAWX1-XC,Y1-YC:GOTO4400
4390DRAWX3-XC,Y3-YC
4400VDU29,0;0;
4410IF cont% X1=X3:Y1=Y3:GOTO4080
4420ENDPROC
4430:
4440DEFPROCsystem
4450IFX%>232 AND X%<620 AND cont% cont%=0:PROChighlight:ENDPROC
4460IFX%>620 AND cont%=0 cont%=-1:PROChighlight
4470IFX%>232 ENDPROC
4480PROChighlight
4490VDU4
4500FORS=1TO200:NEXT:*FX21,0
4510INPUT"*"A$
4520IFA$="." OR A$="C." OR A$="CA." OR A$="CAT" A$=".":VDU14,28,31,31,39,0:CLS
4530OSCLI("*"+A$)
4540IFA$="." A=GET:CHAIN"art"
4550CLS:VDU5,15
4560PROChighlight
4570ENDPROC
4580:
4590DEFPROChighlight
4600IF X%>232 PROCinvert(236,152,988,124) ELSE PROCinvert(0,152,232,124)
4610GCOL0,0:MOVE0,152:PRINT"System.  Seperated. Continuous."
4620GCOL0,7
4630ENDPROC
4640:
4650DEFPROCerror
4660VDU4
4670REPORT
4680IFERR=17 END
4690A=GET
4700IFERL=2620 OR ERL=2700 OR ERL=4540 GOTO ERL
4710GOTO(ERL+10)
```

BBC Assembler Tips

by Terry Blunt

The BBC Micro's built-in assembler is undoubtedly excellent, but has one notable failing — the assembling source program has to reside in the machine along with the assembled object code, often in the same area that the object code is to run from. From Basic 2 onwards this is partly alleviated by the ability to use offset assembly (OPT 4 – 7). However, the main problem still exists — namely, that of having the source code taking up valuable space.

If you are sufficiently involved in assembly language programming, you may feel it worth investing in a more sophisticated assembler that can assemble from source text files, sending the object code directly to other files. For those of us with more modest aspirations, there is an alternative approach which goes a long way to solving the problem.

The method described here will work with Basic 1 and with tape, but is only really practical working from disk, preferably with Basic 2 or later.

Most of us have, without thinking about it, used the computer to perform simple calculations entered directly from the keyboard. What is not so obvious is that almost the whole of the Basic language structure is available from the keyboard; this includes the assembler. Try the following:

```
>P%=&C00
>[OPT 2:LDA #ASC"A":JSR
  &FFEE:RTS
>CALL & C00
```

PROGRAM FILE

You could find that the computer will print the letter 'A'. Notice that the assembling line must start with [OPT and all the statements are on that line. There is no need for the closing] as the assembler is automatically switched off at the end of the line.

This can be expanded using labels and variables, and spread over several lines:

```
>NEW
>base=&C00
>oswrch=&FFEE
>P%=base
>[OPT 2:LDX #&0A
>[OPT 2:.label
>[OPT 2:LDA #ASC"A"
>[OPT 2:JSR oswrch
>[OPT 2:DEX:BNE label
>[OPT 2:RTS
>CALL base
```

All of that is a rather contrived way of sending 10 'A's to the screen. You could be forgiven for thinking that this is an unbelievably tedious way of assembling code, particularly as the idea is to assemble very large amounts!

Fortunately, there is a way of fooling the computer into thinking that it is receiving keyboard entry; this is done by *EXECing a file. What is needed is a word processor that can produce unformatted raw text with no added control codes or (time-wasting) padding spaces. Wordwise is ideal for this or, if you have the Master series, the text editor.

If the previous lines are typed in and saved to a file named, say, 'source', then all you have to do when you want to assemble the code is to *EXEC source. Note that the variable/label stack will start at LOMEM which will be PAGE+2, so if you want code to be assembled here you must either move LOMEM or use offset assembly, and save and re-load the object code.

As an example, suppose you want to assemble your brilliant new game at &1900 and you expect the code to be less than 8k. Construct the file 'source' as:

```
NEW:base=&1900:LOMEM=base+
  &2000:P%=base (CR)
[OPT 2: {code} (CR)
[OPT 2: {code} (CR)
and so on.
```

It should be noted that the lines of code must not exceed 255 characters (about six lines of 40-column text) and for safety I usually stick to about half of that. The fewer lines you have, the faster the code assembles, but you gain nothing memory-wise as the source code exists in file form.

Astute readers will have noticed that I have only used OPT 2, whereas you usually have to use two-pass assembly within a FOR...NEXT loop, the FOR variable used to set OPT. When assembling from the keyboard or from an EXEC file, only the current line exists in the computer's memory (at &700); so FOR...NEXT and REPEAT...UNTIL constructs can only be made to operate over this line, which I have already said can't be more than 255 bytes long.

The solution in quite simply to EXEC the code twice, adjusting the OPT variable accordingly. Using OPTs 1-3 and 5-7 cause confusion: you end up with repeated lines on the screen, so stick to 0-2 and 4-6. As you don't want to reset the whole system with NEW each pass, you also need to split the file into two parts. Call them 'init' and 'code'.

Taking this one step further, 'code' can be made to re-run itself, so:

'init' file:

```
NEW
base=&1900
LOMEM=base+&2000
zero=&70
oswrch=&FFEE
osbyte=&FFF4
N=0
*EXEC code
```

'code' file:

```
P%=base
[OPTN: {code} (CR)
[OPTN: {code} (CR)
and so on
IF N=0 THEN N=2:*EXEC code
  (CR)
```

All you need to do now is to EXEC 'init', and let it get on with it. Notice that all constants should be set in 'init' in the same way that you would use a PROCedure in a 'real' program. I've spread the lines out in the example to make this clearer. Also, in 'code' the OPT variable will be entered for every new line: that's why I've made it a single letter.

Ideally you want the labels and variables to take up as little room as possible, therefore use minimum-possible abbreviations and lots of REMs and blank lines, as they use up no memory. The assembler drops out every line so REMs are quite possible and, in fact, clearer than comments. Purists will hate me for saying this, but don't use unnecessary variables. Use the actual addresses for OS calls, and so on, as below:

```
REM this is an A writer (CR)
  (CR)
[OPTN:.a1:LDX #&0A (CR)
  (CR)
REM loop to here for more A's
    (CR)
  (CR)
[OPTN:.a2:LDA #ASC"A":JSR
    &FFEE:DEX:BNE a2 (CR)
  (CR)
REM no more A's so exit (CR)
```

(CR)
[OPTN:RTS (CR)

One problem that isn't obvious is the computer's response to errors. These will be reported in the usual way, but as you are assembling via the 'keyboard' there is no program for Basic's error-handler to stop, so it will keep on trying to assemble with the error message being scrolled off the top of the screen. Obviously you can't sit glued to the screen watching for errors as they occur, so an error-handler has to be added.

The lines in Fig 1 should be put in at the very start of 'init' so that when the code RUNs, NEW will wipe out the variables used. The routine works quite simply by redirecting BRKV, where all errors pass. The new code closes the current EXEC file then puts BRKV back where it belongs. The result is that you see the error message at the bottom of the screen. You then know that the line above is the one containing the error.

With a little ingenuity, you will find that almost all assembly can be done from files like this, including lists and tables. Very occasionally there is a problem that has to be solved with a PROCedure, which can't exist in a file for the same reasons as FOR...NEXT loops. However, it is possible to tuck very small PROCedures away in memory and call them when required. If you have a block of PROCedures that is less that 512 bytes long and are careful about LOMEM, it is possible to have it residing at &900.

Below is an arrangement that does just that:

```
    PROCedures:
10DEFPROCa:PRINT"PROCa":END
    PROC
20DEFPROCb:PRINT"PROCb":END
    PROC
```

Save as 'PROC'.

'init' file:

```
PAGE=&900 (CR)
LOAD"PROC" (CR)
  (CR)
LOMEN=&7000:  (and so on,
  as before)
```

To run the whole suite, *EXEC init. This, or any later files, can now call the PROCedures as they need to. If the PROCedures use variables, they will be put safely on the variable stack above LOMEM. Notice that I've used the maximum possible compression in the PROCedures to save memory space. Also, the LOAD command in 'init' must be on its own line. Finally, OLD must be used instead of NEW; otherwise, the computer will lose the program lines that have already been loaded!

When you develop really large source code you will find that it won't all fit into one text file. This is not a problem — you simply make files daisy-chain each other.

For example:

```
    file 2:
REM basic tools (CR)
  (CR)
[OPTN: {code} (CR)
and so on
*EXEC ftools (CR)
    file 3:
REM filing tools (CR)
  (CR)
[OPTN: {code} (CR)
and so on
*EXEC mtools (CR)
    file 8:
REM subroutines (CR)
  (CR)
[OPTN: {code} (CR)
and so on
IF N=4 N=6:*EXEC.btools (CR)
```

I used this method to produce a 16k EPROM using offset assembly. It requires eight files and takes around five minutes to assemble.

```
LOMEM=&7000:brkv=&202:P%=&C00  (CR)
  (CR)
[OPT2:.store:EQUW &FFFF  (CR)
  (CR)
[OPT2:.err:PHP:PHA:PHX:PHY  (CR)
[OPT2:LDA#&77:JSR &FFF4  (CR)
[OPT2:SEI:LDA store:STA brkv  (CR)
[OPT2:LDA store+1:STA brkv+1:CLI  (CR)
[OPT2:PLY:PLX:PLA:PLP:JMP(brkv)  (CR)
  (CR)
[OPT2:.set:SEI  (CR)
[OPT2:LDA brkv:STA store  (CR)
[OPT2:LDA brkv+1:STA store+1  (CR)
[OPT2:LDA#err MOD256:STA brkv  (CR)
[OPT2:LDA#err DIV256:STA brkv+1  (CR)
[OPT2:CLI:RTS  (CR)
  (CR)
CALL set  (CR)
```

Fig 1

PROGRAM FILE

BBC Drop-Out

by KA Povall

This program is a computerised version of Milton Bradley's game, Stay Alive, for the BBC Micro. This is a game involving a two-dimensional matrix with levers. The matrix holds marbles which can drop through holes in the levers. Each player has seven marbles and they take turns manipulating the levers, trying to drop their opponents' marbles out of the matrix.

The program should also work on the Acorn Electron but it has not yet been tried. It is in two parts, the first of which is a loader program to load in the second part.

```
L.
    1 REM            D R O P   O U T
    2 REM      -------------------------
    3 REM      A Computerised version of
    4 REM      M. & B.'s game STAY ALIVE
    5 REM      reproduced by courtesy of
    6 REM      MILTON BRADLEY EUROPE LTD
    7 REM      -------------------------
    8 REM
    9 REM      Author:      K. A. Povall
   10 REM
   11 REM      part-1 / SAVE as "Loader"
   12 REM
   13
   14 VDU 23,224,255,252,243,239,223,223,191,191
   15 VDU 23,225,255,63,207,247,251,251,253,253
   16 VDU 23,226,191,191,223,223,239,243,252,255
   17 VDU 23,227,253,253,251,251,247,207,63,255
   18 VDU 23,228,0,0,3,15,31,31,63,63
   19 VDU 23,229,0,0,192,240,248,248,252,252
   20 VDU 23,230,63,63,31,31,15,3,0,0
   21 VDU 23,231,252,252,248,248,240,192,0,0
   22 VDU 23,232,0,0,127,127,127,127,0,0
   23 VDU 23,233,14,30,126,126,126,126,30,14
   24 VDU 23,234,0,60,60,60,60,60,60,60
   25 VDU 23,235,0,60,60,126,255,255,255,0
   26 VDU 23,236,126,129,189,161,161,189,129,126
   27 VDU 23,237,255,255,255,255,255,255,255,255
   28
   29 ENVELOPE 1,1,0,0,0,0,0,0,126,-1,0,-3,126,126
   30 ENVELOPE 2,129,0,-10,-1,1,0,2,6,-1,0,-1,126,74
   31 ENVELOPE 3,131,-1,0,0,200,1,1,1,-1,0,-2,100,80
   32 ENVELOPE 4,16,16,1,1,200,0,0,126,0,0,-126,126,126
   33
   34 PAGE=&1900
   35 CHAIN "DROPOUT"

   10 MODE1:VDU23;8202;0;0;0;
   11
   12 DATA 1,0,0,1,1,0,0,0,1,1,0,1,0,0
   13 DATA 1,0,1,1,1,1,0,1,0,0,1,0,0,1,1
   14 DATA 0,0,1,1,0,0,0,1,1,1,0,0,0,1
   15 DATA 0,1,1,1,1,1,0,0,0,0,0,1,1,1,0
   16 DATA 0,0,0,1,0,1,1,1,0,1,0,1,0,1
   17 DATA 0,1,1,0,1,0,0,1,0,0,1,1,1,0,1
   18 DATA 1,0,0,1,0,1,1,0,0,0,1,0,0,0
   19 DATA 1,1,1,0,0,0,1,0,1,1,1,0,0,1
   20 DATA 0,1,0,1,1,1,0,1,0,1,0,1,0,1
   21
   22 DIM H%(6,8),B%(6,8),D%(13),F$(2),E$(2),P$(2)
   23 H$=CHR$10+CHR$8:I$=CHR$10+CHR$8+CHR$8
   24 E$(0)=CHR$233:E$(1)=CHR$232+E$(0):E$(2)=CHR$232+E$(1)
   25 F$(0)=CHR$235:F$(1)=CHR$234+H$+F$(0):F$(2)=CHR$234+H$+F$(1)
   26 G$=CHR$224+CHR$225+I$+CHR$226+CHR$227
   27 M$=CHR$228+CHR$229+I$+CHR$230+CHR$231
   28 J$=CHR$237+H$+CHR$237+H$+CHR$237:K$=CHR$237+CHR$237+CHR$237
   29 FOR N%=0 TO 6:FOR P%=0 TO 8:READ H%(N%,P%):NEXT:NEXT
   30 FOR N%=0 TO 6:FOR P%=0 TO 8:READ B%(N%,P%):NEXT:NEXT
   31 FOR Q%=1 TO 2:P$(Q%)="":NEXT:GOTO33
   32 VDU26,12
   33 VDU19,2,6;0;
   34 FOR X%=0 TO 3:VDU28,X%,31-X%,39-X%,X%:COLOUR129+X%:CLS:NEXT
   35 COLOUR1:PRINTTAB(1,1)"DROP-OUT ";:COLOUR2:
   36 PRINT"a two player board game"
   37 PRINT" to test your memory and sense of  strategy."
   38 PRINT'" Drop your opponents marbles down"
   39 PRINT" the holes without loosing your    own."
   40 PRINT'" Be careful, as you push and pull  the levers, holes appear."
   41 COLOUR3:PRINT'STRING$(34,"_")'''"      Please Enter Your Names":*FX15
   42 FOR Q%=1 TO 2:IF Q%=1 C$=" RED" ELSE C$="BLUE"
   43 COLOUR0%:PRINTTAB(7,17+Q%*2);C$;" PLAYER = ";:REPEAT
   44 A%=ASCGET$:IF A%=13 GOTO48
   45 IF A%<65 OR A%>90 GOTO44
   46 P$(Q%)=P$(Q%)+CHR$A%:PRINTTAB(21,17+Q%*2)P$(Q%)
   47 UNTIL LENP$(Q%)=5 OR A%=13
   48 IF P$(Q%)="" P$(Q%)=C$
   49 NEXT
   50 CLG:S%=0:T%=0:FOR Q%=0 TO 13:D%(Q%)=RND(3)-1:NEXT
   51 COLOUR128:COLOUR3:PROCB:PROCF
   52 G%=RND(2):E%=0:F%=0:D%=7:REPEAT
   53 PROCC:PROCA("Which  lever  "+P$(G%),10,28,G%)
   54 REPEAT:L$=GET$:L%=ASCL$-65:UNTIL L%>=0 AND L%<=13
   55 PROCA(L$,30,28,3):Q%=INKEY20:PROCC
```

PROGRAM FILE

```
 56 PROCA("MOVE",8,28,G%):PROCA("LEVER "+L$,13,28,3)
 57 PROCA("IN or OUT ?",21,28,G%)
 58 REPEAT:I%=INSTR("IiOo",GET$,1):UNTIL I%>0
 59 IF I%<3 AND O%(L%)=2 N$="IN !":GOTO65
 60 IF I%>2 AND O%(L%)=0 N$="OUT !":GOTO65
 61 IF I%<3 O%(L%)=O%(L%)+1 ELSE O%(L%)=O%(L%)-1
 62 IF L%>=0 AND L%<=6 PROCG ELSE PROCH
 63 G%=G%+1:IF G%=3 G%=1
 64 UNTIL E%=7 OR F%=7:GOTO155
 65 PROCC:VDU7:PROCA("Lever  "+L$+"  is. ALREADY  "+N$,5,28,3)
 66 COLOURG%:PRINTTAB(4,30)"press SPACE BAR to choose again"
 67 REPEAT UNTIL GET=32:GOTO53
 68
 69 DEFPROCD
 70 VDU5:GCOL0,128+GCOL0,C%:MOVE416+N%*96,988-P%*96:PRINTM$
 71 ENDPROC
 72
 73 DEFPROCB
 74 FORR%=0TO3:VDU19,R%,0;0;:NEXT
 75 VDU24,384;320;1088;1023;:GCOL0,129:CLG
 76 VDU24,400;336;1072;1007;:GCOL0,128:CLG
 77 VDU24,408;344;1064;999;:GCOL0,131:CLG
 78 VDU24,72;320;276;1023;:CLG
 79 VDU24,80;328;268;1016;:GCOL0,128:CLG
 80 VDU24,0;16;1279;175;:GCOL0,131:CLG:PROCC
 81 FOR U%=0 TO 6:Z%=U%*96:GCOL0,3
 82 MOVEZ%+432,212:PRINTCHR$(85+U%):MOVE1200,394+Z%:PRINTCHR$(78-U%)
 83 GCOL0,2:MOVEZ%+432,312:PRINTF$(2-O%(U%))
 84 MOVE1096,972-Z%:PRINTE$(2-O%(U%+7)):NEXT
 85 VDU4:FOR U%=13 TO 31 STEP3:FOR V%=1 TO 20 STEP3
 86 PRINTTAB(U%,V%)G$:NEXT:NEXT
 87 COLOUR0:FOR V%=1 TO 19 STEP3:COLOUR129
 88 PRINTTAB(3,V%)G$:COLOUR130:PRINTTAB(6,V%)G$:NEXT
 89 VDU5:FOR V%=412 TO 988 STEP96
 90 MOVE96,V%:GCOL0,1:PRINTM$:MOVE192,V%:GCOL0,2:PRINTM$:NEXT
 91 ENDPROC
 92
 93 DEFPROCF
 94 FOR N%=0 TO 6:FOR P%=0 TO 6
 95 IF H%(N%,P%+O%(N%))=0 AND B%(P%,N%+O%(P%+7))=0 THEN C%=0 ELSE C%=3
 96 PROCO:NEXT:NEXT
 97 COLOUR128:PROCA("press SPACE BAR to start",7,28,3)
 98 VDU19,1,1;0;19,2,6;0;19,3,3;0;:REPEAT UNTIL GET=32:PROCC
 99 C%=1:LX=96:LY=988:RX=192:RY=988
100 FOR W%=1 TO 14:C%=C%+1:IF C%=3 C%=1
101 N%=RND(7)-1:P%=RND(7)-1
102 IF POINT(448+(N%*96),982-(P%*96))=3 PROCE:PROCD:ELSE101
103 NEXT
104 VDU4:PRINTTAB(3,0)"      ":VDU5:GCOL0,3:MOVE112,1020:PRINT"LOSE"
105 ENDPROC
106
107 DEFPROCE
108 GCOL0,0:O%=INKEY3:SOUND1,-15,C%*100,1
109 IF C%=1 MOVERX,RY:PRINTM$:RY=RY-96:ENDPROC
110 MOVELX,LY:PRINTM$:LY=LY-96
111 ENDPROC
112
113 DEFPROCG
114 VDU5:GCOL0,0:MOVE432+(L%*96),312:PRINTJ$
115 GCOL0,2:MOVE432+(L%*96),312:PRINTF$(2-O%(L%))
116 N%=L%:FOR P%=0 TO 6:PROCI:NEXT
117 ENDPROC
118
119 DEFPROCH
120 P%=L%-7:VDU5:GCOL0,0:MOVE1096,972-(P%*96):PRINTK$
121 GCOL0,2:MOVE1096,972-(P%*96):PRINTE$(2-O%(L%))
122 FOR N%=0 TO 6:PROCI:NEXT
123 ENDPROC
124
125 DEFPROCI
126 IF H%(N%,P%+O%(N%))=0 AND B%(P%,N%+O%(P%+7))=0 PROCJ:ENDPROC
127 C%=POINT(448+(N%*96),962-(P%*96)):IF C%=0 C%=3
128 PROCD
129 ENDPROC
130
131 DEFPROCA(A$,J%,K%,M%)
132 VDU4:A%=10:X%=114:Y%=0:D=114+COLOURM%
133 FOR I%=1 TO LENA$:B$=MID$(A$,I%,1):?D=ASC(B$):CALL&FFF1
134 VDU23,254,D?1,D?1,D?2,D?2,D?3,D?3,D?4,D?4
135 VDU23,255,D?5,D?5,D?6,D?6,D?7,D?7,D?8,D?8
136 VDU31,J%+I%,K%,254,31,J%+I%,K%+1,255:NEXT
137 ENDPROC
138
139 DEFPROCC
140 VDU24,11;27;1268;164;:GCOL0,128:CLG:VDU26,5
141 ENDPROC
142
143 DEFPROCJ
144 C%=POINT(448+(N%*96),962-(P%*96)):IF C%=0 OR C%=3 ENDPROC
145 IF C%=2 GOTO150
146 C%=0:PROCD:SOUND0,1,4,1:O%=INKEY20
147 GCOL0,1:MOVELX,LY+96:PRINTM$
148 LY=LY+96:F%=F%+1:S%=2:T%=1
149 ENDPROC
150 C%=0:PROCD:SOUND0,1,4,1:O%=INKEY20
151 GCOL0,2:MOVERX,RY+96:PRINTM$
152 RY=RY+96:E%=E%+1:S%=1:T%=2
153 ENDPROC
154
155 VDU4:SOUND1,4,30,36:O%=INKEY250:CLG:VDU19,2,0;0;:COLOUR2
156 FOR O%=0 TO 39 STEP2:FOR W%=4 TO 27 STEP2:PRINTTAB(O%,W%)M$:NEXT:NEXT
157 VDU28,2,25,37,6,17,131,12
158 PROCA("C O N G R A T U L A T I O N S",2,3,1)
159 S$=P$(S%)+", On Winning That Game":PROCA(S$,17-LEN(S$/2,6,1)
160 IF S%=1 O%=O%-F% ELSE O%=O%-E%
161 IF O%>1 s$="s" ELSE s$=""
162 PROCA("You Were Left With "+STR$O%+" Marble"+s$,3,11,0)
163 COLOUR1:PRINTTAB(4,15)"Would You Like To Play Again"
164 COLOUR0:PRINTTAB(13,17)"( Y - N ) ";:VDU19,2,9;0;
165 REPEAT R%=INSTR("YyNn",GET$,1):UNTIL R%>0
166 IF R%>2 CALL !-4
167 PRINTTAB(0,15)SPC79"SAME PLAYERS ( Y - N )"
168 REPEAT R%=INSTR("YyNn",GET$,1):UNTIL R%>0
169 IF R%<3 GOTO50
170 FOR O%=1 TO 2:P$(O%)="":NEXT:COLOUR128:CLS:GOTO32
```

END

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LEISURE LINES

Brainteasers courtesy of JJ Clessa.

Quickie
If you write down every positive 2-digit number (that is, from 10 to 99), which digit will you have written the most number of times?

Prize puzzle
(1) Take a 4-digit palindromic number — that is, one which reads the same from right to left as it does from left to right.
(2) Reverse the digits and add the result to give a new number.
(3) Repeat step 2 with the new number until the result becomes palindromic.

To illustrate, suppose we have the number 3883;

```
 3883 +  3883 =  7766
 7766 +  6677 = 14443
14443 + 34441 = 48884
```

which is palindromic after three cycles only.

Two numbers, however, do not yield palindromic results even after 1000 cycles. What are they?

Answers on postcards, please, or backs of envelopes only, to reach *PCW*, Leisure Lines July 1987, 32-34 Broadwick Street, London W1A 2HG, no later than 31 July 1987.

April prize puzzle
A moderate response — over 100 replies. As usual there was a trace of ambiguity in the problem — does the digit zero follow the digit 9 in the definition of 'consecutive'?

We decided not, since the problem already stated '... digits 0–9 are used ...', which really precludes the ambiguity. Anyway, most entrants who realised the possible ambiguity, sent in the correct solution as well — which was 123341234.

The winning solution came from Scotland — from Mr D Poyner of Charlestown. Congratulations.

NUMBERS COUNT

This month Mike Mudge looks at Cyprian's Last Theorem.

This theorem is due to the Reverend DC Stockford of Downside Abbey, Stratton on the Fosse, Bath; acknowledgement is also due to Mr M Kochanski of 7 Courtfield Gardens, London SW5 0PA who has carried out significant empirical and theoretical studies related to the theorem.

Clearly $3^2+4^2=5^2$, the smallest integer-sided Pythagorean triangle, is familiar to many readers; however, it is less well-known, although equally trivial, that $3^3+4^3+5^3=6^3$.

The geometrical model of a cube with side 6 units, dissected into three smaller cubes with sides 3, 4 and 5 units respectively, is an interesting application of computer graphics. Clearly more than three portions have to be dissected and then some reassembled. What is the smallest number of parts needed?

Cyprian's Last Theorem

$$\sum_{1}^{k}(x-1+r)^k=(x+k)^k$$

has no r=1 solutions in positive integers other than x=3 with k=2 or 3.

Note. The notation on the left-hand side is simply shorthand for $x^k+(x+1)^k + (x+2)^k \ldots (x+k-1)^k$ there are k terms.

As an appetiser readers are first invited to find 64 consecutive positive integers, the sum of whose cubes is a perfect cube. It is known that only one such set exists. What about the sum of the n^{th} powers of 64 consecutive integers being an n^{th} power?

What about the sum of the n^{th} powers of k consecutive integers being an n^{th} power?

What about the sum of the n^{th} powers of two integers being an n^{th} power? . . . Fermat's Last Theorem.

Readers are invited to send their thoughts together with complete or partial attempts at the investigations of the above questions to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Staffordshire WV4 5NF, tel: (0902) 892141, to arrive by 1 October 1987.

It would be appreciated if such submissions contained a brief summary of results obtained in a form suitable for publication in *PCW*. These submissions will be judged using subjective criteria, and a prize will be awarded by *PCW* to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a stamped addressed envelope is provided.

Review: January 1987

This problem involving Bernoulli's Numbers, Euler's Numbers and the connection with Regular Primes can be further studied by reference to *13 Lectures on Fermat's Last Theorem* by Paulo Ribenboim (Springer Verlag 1979). It proved to be a very popular problem among regular contributors but did not appeal to new readers. Why was this so?

The very worthy prizewinner was John B Cook of 34 Joan Crescent, East Burwood, Victoria 3151, Australia. John used a Tandy TRS-80 Model 4P to compute N(X) and D(X), to find irregular primes as defined in the article, and to calculate and factorise E(X), the latter up to X=28.

Test data, together with much other interesting material is to be found in *A Handbook of Integer Sequences* by NJA Sloane (Academic Press 1973).

It must be recorded, however, that Geoff Lockwood of 254 Crystal Palace Road, London SE22 9JH computed Bernoulli Numbers up to the 200^{th} halting then because the computation was taking two hours per number.

Geoff, however, unfortunately did not have time to consider the computation of the Euler Numbers but obtained some rather interesting results comparing true Bernoulli Numbers with the asymptotic formula in Ribenboim's book referred to above.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future Numbers Count articles; all letters will be answered in due course.

Isolated readers can be put into contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prizewinner directly.

MICROCHESS

A chess machine capable of beating a world champion may seem improbable, but it's already happened. Kevin O'Connell recounts the recent match between Hitech and Joel Lauthier of France.

Hitech wins match against human World Champion!! Regular readers of this column, who now know something about Hitech, the chess monster from Carnegie-Mellon University in Pittsburgh, will realise what a sensational headline that would make. The amazing thing is that it is true! No, Gary Kasparov is safe for some years yet, but Joel Lauthier of France, the World Under-14 Champion, has suffered a 2–0 defeat in a match at the hands of Hans Berliner's monster.

It seems that many computer chess fans in France were not at all convinced that Hitech could justify its US rating of nearly 2400 (about 2300 on the international scale) and so they arranged for the World Under-14 Champion, with an international rating of 2255, and a playing strength of nearer 2300, to play a two-game match against Hitech during the 2nd International Games Festival in Cannes.

Either those French organisers had not heard about what happened in Hitech's match against Dr Jana Miles (I reported in a previous issue of *PCW* how Hitech demolished Jana and thus became the first non-human to win a serious game against a Grandmaster); or they had heard about it but chose to believe that the result (2–0) was a fluke; or that it could not possibly happen to someone like Joel Lauthier who has some experience of playing against chess computers and so has an understanding of their strengths and weaknesses; or they simply believed, as do many in the chess world, that women do not really know how to play chess. However, Zsuzsa Polgar, the strongest woman player in the world, was well aware of the Miles match result and she believed that Hitech would probably beat Joel Lauthier, a view that was apparently not shared by any of the match organisers.

The course of the match was an almost exact re-run of the match against Jana Miles. In both games Hitech got a clear advantage from the opening and went on to win with some ease.

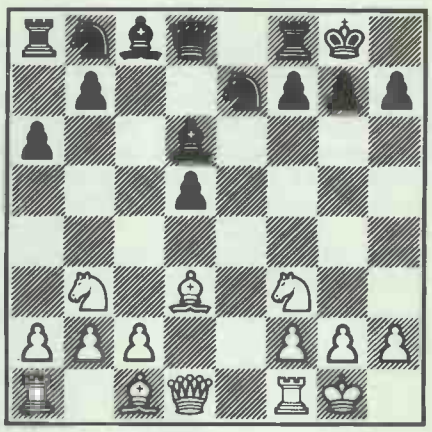
So last year Hitech beat a Grandmaster, this year a World Champion. That leaves Garry Kasparov . . .

The game which follows was the second one of the match.

White: Hitech. Black: Joel Lauthier (World Under-14) Champion.

Opening: French Defence.

1	e2–e4	e7–e6
2	d2–d4	d7–d5
3	Nb1–d2	c7–c5
4	Ng1–f3	a7–a6
5	e4xd5	e6xd5
6	d4xc5	Bf8xc5
7	Nd2–b3	Bc5–d6
8	Bf1–d3	Ng8–e7
9	O–O	O–O



This position is reasonably well-known in Grandmaster play.

10 Nf3–d4!?

Apparently a new idea, opening a route for the queen to start attacking the king-side, planning to switch the knight back once the queen has entered the fray.

10 . . . Ne7–g6

This is too slow. Black should concentrate on developing pieces, and exchanging to relieve the pressure, with 10 . . . Nb8–c6; for example, 11 Qd1–h5 g7–g6; 12 Qh5–h4 Nc6xd4; 13 Nb3xd4 Ne7–c6; 14 Bc1–g5 Qd8–b6; 15 Bg5–f6 (threatening mate in two) Rf8–e8; 16 Rf1–e1 Bc8–d7 with a comfortable position for Black.

11 Qd1–h5

What a difficult game chess can be. Last month we saw a program fall to pieces after playing this same move, also in a French Defence, but there it was inappropriate, while here it is a very strong move.

11 . . . Nb8–c6

12 Nd4–f3!

This threatens 13 Nf3–g5 h7–h6; 14 Ng5xf7, followed by capturing on g6.

12	. . .	Nc6–e7
13	Rf1–e1	h7–h6
14	Bc1–e3	Bc8–d7
15	Nb3–d4	Bd6–f4
16	Re1–e2	Qd8–c7
17	Ra1–e1	Ra8–e8

This seems perfectly normal, but it fails. 17 . . . Bd7–c6 is horribly passive but might have held the position.

18 Bd3xg6! f7xg6

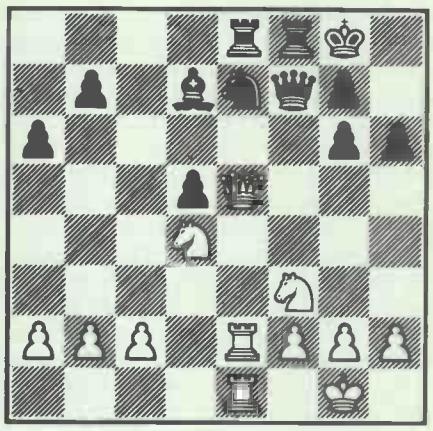
18 . . . Ne7xg6 loses the d-pawn, to 19 Qh5xd5.

19 Be3xf4 Qc7xf4

20 Qh5–e5 Qf4–f7

20 . . . Qf4xe5 fails to 21 Nf3xe5 Bd7–f5 (otherwise 22 Ne5xg6); 22 Nd4xf5 g6xf5; 23 Ne5–g6, winning at least an exchange (rook for knight).

21 Qe5xe7!



This wins rook, bishop and knight for queen — a handsome profit.

21	. . .	Re8xe7
22	Re3xe7	Qf7–f6
23	Re7xd7	g6–g5
24	Re1–e7!	Rf8–c8

If Black proceeds with his idea of 24 . . . g5–g4?, then 25 Re7xg7+ Qf6xg7; 26 Rd7xg7+ Kg8xg7; 27 Nd4–e6+ wins easily.

25	Rd7xb7	g5–g4
26	Nf3–e5	h6–h5
27	Nd4–f5!	
27	. . .	Kg8–h8

27 . . . Qf6xf5 fails to 28 Re7xg7+ Kg8–h8 (28 . . . Kg8–f8; 29 Rb7–f7+); 29 Ne5–g6+.

28 Nf5xg7 Rc8xc2?

28 . . . Rc8–f8 would merely have postponed the inevitable for a few more moves: 29 Ng7–f5 Qf6xf5; 30 Ne5–f7+ Rf8xf7; 31 Re7xf7 Qf5–c8; 32 Rf7–h7+ Kh8–g8; 33 Rb7–g7+ Kg8–f8; 34 Rh7–h8+.

29 Re7–e8+

Here Hitech announced mate in four moves.

29	. . .	Kh8–h7
30	Ng7–f5+	1–0

Black resigned. The mate announced was mate in four because Black could still postpone the end for two moves from here by interposing on his second rank first the rook on c7 and then the queen.

USER GROUPS

Micro users of the world unite! This month Rupert Steele explains how the Directory of User Groups can help you.

The User Groups column exists to help put people needing information about their micros in touch with a relevant support group. For reasons of space, the Directory of User Groups alongside only covers the Amstrad and Special Interest categories, but next month we aim to produce the listing in its entirety to cover all machine groups. If you have any information about user groups which you would like to bring to the attention of readers, please let me know.

The Directory does not cover one important area of home computing; this is the local computer club where enthusiasts get together to hear a talk, see a demonstration, or just play with the machines. However, you can get in touch with your local club through the Association of Computer Clubs (ACC), which is listed under the 'Special Interest' section of the Directory. The ACC has a national database of such groups, and is also able to provide cheap insurance as well as other services. The ACC also runs the highly successful ClubSpot 810 area on Prestel in collaboration with Micronet and Prestel Microcomputing.

User Group news

I have received a good deal of material from WACCI, which has dropped the 'worldwide' claim from its title to become the 'Europewide Amstrad CPC Users Club'. The club prints a newsletter running to 40 A4-pages printed in condensed type — probably one of the most comprehensive user group newsletters that I have ever seen. Low on gloss, high on content, the newsletter is written in a very cheerful style and contains a variety of information.

WACCI also runs a software library. You supply the media (tape or disk) and the club returns it to you with whatever public domain items you have requested copied to it for a nominal fee. The library contains over 50 items, including some CP/M favourites such as assemblers, Basic compilers and disk-sector editors. The group also runs a 20 per cent discount software service, and may also be able to obtain similar terms for hardware purchases by members. There is also a monthly competition, with prizes donated by software houses; it is not unusual for the prize to be worth £50 or more.

Just like me, WACCI is a fan of Nick Godwin and his printer ribbon re-inking service 'Aladdink'. The issue of the newsletter that was sent to me was printed with a re-inked ribbon which, WACCI claims, lasted better than a new one used the previous month. The print quality looked fine to me, so if you want to help eliminate over-pricing of matrix printer ribbons, drop Nick Godwin a line at Aladdink, 4 Hurkur Crescent, Eyemouth, Berwickshire TD14 5AP. If enough people start re-inking, the price of new ribbons will have to drop.

In summary, WACCI would look to be a good bet for anyone with an Amstrad CPC machine, and if future newsletters are as good as this sample, I would recommend the £12 subscription as money well spent. For more details, contact Jeff Walker, the editor, at WACCI, 75 Greatfields Drive, Hillingdon, Uxbridge, Middx UB8 3QN or call (0895) 52430.

'Well, one of us has come to the wrong place!'

For the more serious electronics enthusiasts, I have had details of AMRAC, the amateur Radio and Computer Club. The club's publicity officer, Trevor Tugwell, writes explaining that instead of using phone lines, radio amateurs connect up their computers using a two-way radio link — avoiding expensive telephone bills. The most popular frequencies are on VHF — 144.650 and 144.675 MHz, and these transmissions can apparently be picked up by anybody with the right sort of 'scanner radio'. As well as direct communications, many mailboxes and bulletin boards have been set up and are proving very popular.

Most amateurs are moving over to a system known as AX.25 Packet Radio. This provides error-correction to beat radio interference. The modems used operate at 1200 bits/sec using Bell-202 tones (1.2/2.2KHz — are these the same as the blanked-off switch positions on your old WS2000?). If you need to buy the kit, you can get units for about £150 which also implement the AX.25 protocol. AMRAC publishes a bi-monthly newsletter devoted to this subject: it is a voluntary group and membership is £5 pa in the UK, £8 pa in Europe. Further details are available by sending an sae to the secretary, Phil Bridges, G6DLJ at 9 Hollydene Villas, Hythe, Hants SO4 5HU. Or you can telephone him on (0703) 847754 or use Prestel mailbox 703847754. There is also a telephone bulletin board on (0376) 518818 using 300 baud V21 protocol.

I am glad to say that I continue to receive mail about a variety of local clubs as well as the national groups now featured in the Directory. Paul Cuthbertson of 18 Morningside Crescent, Blackhall, Inverurie AB5 9FA has written to me with details of the newly re-vamped Grampian Amateur Computer Society. The new group will have a complete programme of courses, demonstrations and lectures in premises which it shares with the Aberdeen Amateur Radio Society. During the summer months it is organising visits to various industrial sites, with computer-controlled breweries and distilleries being top of the list. The club meets every Monday and the first meeting of the month is intended to be a 'special guest' lecture or 'in-depth' demonstration. At a recent exhibition, the club exhibited robot arms, fibre-optics, LANs, modems, CAD, communications gear and a fish weigher(!). Send an sae to Paul at the address above for more details.

And, finally, perhaps the *least local* local club that I have ever mentioned. I have received a letter from the software librarian of the Green Screen Club, described as the largest computer club in Zimbabwe. It provides an excellent newsletter, and there are also meetings in Harare and Bulawayo for the membership of 350, whose micros range from ZX80s (remember them?) to IBM PCs. So, if you're an expatriate or otherwise reading *PCW* in Zimbabwe, why not contact the club via the librarian, EM Stuart-Walker, Green Screen Club Library, PO Box UA 393, Union Avenue, Harare, Zimbabwe. PS: the club is looking for public-domain contributions to the library.

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 and Support Groups, please write to Rupert Steele, 12 Philbeach Gardens, London SW5 9DY.

DIRECTORY OF USER GROUPS

GROUP	CONTACT	NOTES
Amstrad		
1512 Independent User Group	PO Box 55, Sevenoaks, Kent, TN13 1AQ	£20 subs; PC clone only
Amstrad Professional User Club	John Ainsworth, Amstrad Prof User Club, Victoria House, 1-6 Low Row, PO Box 10 Sunderland, SR1 3PY. (0783) 673395	Business users only; £49.95 subscription
Amstrad User Software Database	AUSD, PO Box 11, Gosforth, Newcastle-upon-Tyne, NE3 1RP. (091) 285 6107	Fido bulletin board available
PCW Users Group	Robert Mobberley, 37 Clifford Bridge Road, Binley, Coventry, CV3 2DW. (0203) 441417	Monthly newsletter. SAE with postal enquiries
The PCW Computer Club	Ron Morland, 12 Deneve Avenue, Poole, Dorset BH17 7LR	SAE please for details
AP.Ex	Nick Godwin, 4 Hurkur Crescent, Eyemouth, Berwickshire, TD14 5AP. Eyemouth 50965	Amstrad home machines. SAE please. Subscription £5
Advantage	Jeffrey M Green, 33 Malyns Close, Chinnor Oxon, 0X9 4EW	Amstrad CPC 664. Subscription £8.75
Amstrad CPC Computing Newsletter	Chris Bryant, 11 Havenview Road, Seaton, Devon, EX12 2PF	Home users. Large SAE for sample newsletter
PCW File	Chris Bryant (as above)	Subscripton £2 including free PD software. Large SAE for sample newsletter
WACCI (Europewide Amstrad User Club)	Jeff Walker, WACCI, 75 Greatfields Drive Hillingdon, Uxbridge, UB8 3QN. (0895) 52430	Newsletter; £12 sub; special offers
Amstrad Groups Federation	4 Sutton Road, Gorton, Manchester, M18 7PN	Umbrella organisation for Amstrad User Groups
Special Interest		
AMRAC-Amateur Radio & Computer Club	Trevor Tugwell, G6TJT, 6 Kestrel Drive, Mudeford, Christchurch, Dorset, BH23 4DE. Or phone Phil Bridges on (0703) 847754 (G6DLJ)	300/300 Bulletin Board on 0736 518818
Church Computer Users Group	Rev Nigel Hardcastle, 112 Rotherfield Rd, Garretts Green, Birmingham, B26 2SH. (021) 743 2971	Support group for those using computers in the running of churches
Local Authority Micro-Computer User Group	John New, Borough Engineers Dept, Municipal Offices, North Quay, Weymouth Dorset, DT4 8TA. (0305) 785101 (ext 272)	
Seafarers	Mr C E Watson, 29 Doods Place, Doods Road, Reigate, Surrey, RH2 0NS	
SNUG — Special Needs User Group	Jeff Hughes, 39 Eccleston Gardens, St Helens WA10 3BJ. (0744) 24608	Computing for the disabled handicapped, and so on
Society of Genealogists	Society of Genealogists, 14 Charterhouse Buildings, London, EC1M 7BA. (01) 251 8799	Use of computers in tracing ancestors. Monthly meetings
Comms file	TP Group, FreePost, London, N1 1BR (01) 833 3501	Comms users newsletter. Subscription: £75
Amateur Computer Club	Andy Leeder, Church Farm, Stratton St Michael, Norwich, NR15 2QB	Hardware Club. Large SAE for sample newsletter
Association of Computer Clubs	John Dale, 12 Poplar Road, Newtown, Powys, SY16 2QG. (sae please)	Umbrella group for all hobby clubs. National database of local groups
ClubSpot 810	Andy Leeder, Church Farm, Stratton St Michael, Norwich, NR12 2QB. *810#	Hobby Information Provider on Prestel. Clubs may be able to edit own free pages
Find-It	Orkney Computing, 60 Albert Street, Kirkwall Orkney, KW15 1HQ. (085 686) 268	Disk-based index to PCW and five other UK business micro mags. Runs on PC
Christian Micro Users Association	Philip Clark, 138 Bramwell Gardens, Sheffield S3 7PW	

END ZONE

UK BULLETIN BOARDS

An up-to-date list of UK bulletin boards, compiled by Peter Tootill.

(0001) 764 942 Infomatique, Dublin
MF:10pm-6pm ; WE:10pm-6pm,3/1275
Amiga based

(0001) 854 522 Dublin Fido
24 hrs. 3-24

(0001) 885 634 DUBBS, Dublin
MF:8pm-8am ; WE:24hrs, 3-24
First BBS in Eire. Amiga based

(0001) 903 341 IACCBBS, Eire
24 hrs, 300bd.
Irish ACC. Runs on Commodore 64

(01) 200 3439 Airtel TBBS, London
24 hrs, 3/1275. Has a pilots area.

(01) 200 7577 Hendon Fido, London
24 hrs. 3/1275. Also (01) 220 8281
Opus system (FIDO clone)

(01) 207 2989 Dark Crystal Fido, London
24 hours, 3-12

(01) 248 5747 Prestel, London
24 hours, 300 bd.
No graphics on this number.

(01) 346 7150 Marctel, London
24hrs,3/1275
FBBS system.

(01) 348 9400 TBBS London
24hrs, 3-12

(01) 399 2136 MG-Net, London
Only open Sun 5pm-10pm. 300

(01) 429 3047 OSI Lives!, London
24 hrs RING BACK. 300.

(01) 450 9764 Techno Line, London
24hrs. 1275v. Commercial

(01) 452 1500 Techno-line 2, London
Evenings 24hrs 1275v Commercial

(01) 455 6607 NNBBS London
24hrs 3/1275

(01) 542 3772 WBBS Wimbledon, London
Sat 7pm-Mon 8am 3/1275

(01) 542 4977 TBBS Rovoreed, London
24hrs 3-24

(01) 543 7020 Dataflex Fido, S.London
24hrs 3/1275

(01) 573 8822 Taecom, London
MF:7pm-8am. All day Sun. 300
Interak micro section.

(01) 580 1690 Poly Fido, London
24hrs. 3-12

(01) 624 5338 Twighlight Phone,London
24hrs. 300. Fido.

(01) 638 2034 CyberZone, London
24hrs. 300.

(01) 648 0018 MBBS Mitcham, London
24hrs. 3/1275

(01) 659 6992 Link Fido, London
24hrs. 3-12

(01) 735 6153 Brixton ITeC, London
24hrs. 1275

(01) 863 0198 London Underground
24hrs. 3-12. Opus system.
Amiga, Atari ST , IBM sigs

(01) 883 5290 NBBS London
24 hrs. 3/1275

(01) 886 2813 Crystal Tower, London
24hrs. 3-24. Apple, IBM and more.

(01) 888 8894 Gnome at home, London
24hrs. 1275v
Home of the Micrognome

(01) 927 5820 Owltel, London
24hrs. 1275v

(01) 941 4285 Metrotel, London
24hrs. 1275v

(01) 960 4742 ITCU Exchange & Mart
24hrs 1275v ITeCs central system

(01) 968 7402 Communitel, London
24hrs. 1275v

(01) 985 3322 Hackney BBS, London
24hrs. 1275v

(01) 986 4360 Health data, London
24hrs. 1275v

(0204) 43082 Bolton BBS
MF:8pm-8am ; WE: 24hrs. 8am-8pm
RING BACK. 3-24.

(0206) 862 354 Pete's Place, Colchester
24hrs. 3/1275. Opus system.

(021) 430 3761 CBABBS, Birmingham
24hrs. Not Thurs. 300
Atari based. Mail to Canada

(021) 444 1484 TUG II, Birmingham
24hrs. 3/1275
Amstrad, Tandy, online Adventure

(021) 476 9881 Infocom BBS, Birmingham
24hrs. 3/1275
On-Line games, adult stories, BBC

(0222) 464 725 Cardiff ITeC
24hrs. 1275v

(0223) 243 642 Acorn BBS, Cambridge
24hrs. 1275v

(0224) 641 585 ABERDEEN ITEC
24hrs. 1275v

(0224) 781 919 Aberdeen Commodore
24hrs. 300
Commodore 64 based

(0247) 455 162 SBBS II (Irish Man),
MF:9pm-11pm RING BACK
WE:11pm-9am RING BACK
3/1275

(0247) 467 863 Deep Thought Fido, Bangor
24hrs. 3-24
PC-DOS, CP/M, BBC,Tech.help sigs

(0258) 54 494 TBBS Blandford, Dorset
24hrs. 300
Blandford Computers

(0268) 22 177 BITEC, Basildon ITeC
24hrs. 1275v
Also on (0268) 25122

(0272) 421 196 Octopus, Bristol
MF:6pm-6.30am ; WE:24hrs. 3/1275

(0274) 480 452 OBBS Bradford
24hrs. 3/1275. Colour for BBC users

(0277) 228 867 NBBS Essex, Brentwood
24hrs. 3/1275
Subscribers only

(0295) 720 812 Bloxam Board
10pm-1am every day. 300

(0367) 81 507 Trinity 2, Faringdon Ox
24hrs. 3/1275
Sponsored by Courier Consultancy

(0376) 518 818 ARCNET, Colchester
24hrs. 300

(0384) 635 336 West Midlands, Stourport
6pm-8am every day. 300
TBBS system

(0392) 53 116 CBBS South West, Exeter
24hrs. 3/1275

(0394) 276 306 BABBS, Felixstow
24hrs. 3-12

(0395) 272 611 Trinity 1, Exmouth
24hrs. 3-12

(0401) 50 745 MBBS Leconfield
24hrs. 3/1275

(041) 956 6537 People's Palace, Glasgow
6pm-8am every day. 3/1275 Colour

(0443) 733 343 MGBBS Mid Glamorgan, Ferndale
6pm-1am every day. 300
Used to be on 0443 755298

(0463) 231 339 Betelgeuse 5, Inverness
24hrs. 3/1275

(0482) 465 150 Hamnet, Hull
MF:6pm-8am ; WE:24 hrs. 3/1275
Radio Hams' area

(0482) 859 169 Forum-80, Hull
MF:7pm-11pm ; WE:1pm-11pm 3/1275
Midnight - 8am on Bell 103 tones.

(0483) 573 337 Compulink CIX, Guildford
24hrs. 3-24. Multi-user. CoSy system.
Also on 0483 573338

(04862) 25 174 PBBS 'Adult' BBS, Mitcham
24hrs. 3/1275

(0492) 49 194 Cymrutel, Colwyn Bay
24hrs. 1275

(0506) 38 526 Livingstone BBS
24hrs. 300

(051) 220 3761 Fido Compulink North, Liverpool
24hrs. 3/1275

(051) 428 8924 Liverpool Mailbox, Liverpool
24hrs. 3-24
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(0524) 60 399 CNOL, Lancaster
24hrs. 300
Clinical Notes OnLine - BBS for medics

(0532) 600 749 L.E.M.S Fido, Leeds
10pm-8am every day. 3/1275

(0534) 39 389 Jersey Fido
24hrs. 3/1275

(0592) 860 313 JMBBS Amstrad BBS, Fife
9.30pm-8am every day. 300
Sponsored by John Menzies

(0602) 811 950 MacTel Green Box, Nottingham
24hrs. 3-24
For Macintosh users

(0602) 817 696 MacTel HQ, Nottingham
24hrs. 3-12
For Macintosh Users

(0604) 20 441 Norview, Northants
24hrs. 1275v

(061) 427 1596 OBBS Manchester
24hrs. 3/1275

(061) 494 6938 Fido TeePee link, Manchester
24hrs. 3-24

(061) 773 7739 Fido Manchester
24hrs 3/1275
Mektronic Electronic design cons

(0625) 33 703 Telemac 15, Macclesfield
24hrs. 3/1275

(0628) 824 852 C.A.T.S. Fido, Maidenhead
24hrs. 3/1275 V22/bis shortly.

(0642) 481 643 System 2000 Comp Club, Redcar
7pm-7am every day. 300

(0642) 784 819 Fido Teeside, Cleveland
24hrs. 3/1275

(0698) 884 804 SABBS, Larkhall
24hrs. 300
Atari based system

(0702) 54 6373 C.View Rochford
24hrs 1275v

(0705) 524 805 Gosport Apricot BBS
24hrs. 300

(0705) 736 025 BBS09, Portsmouth
Weds:7pm-7am ; WE:24hrs 300
OS9, Sci-Fi sections

(0707) 52 242 RSGB, London
24hrs. 1275v

(0734) 484 847 Trinity 3, Reading
24hrs. 3/1275 TBBS system

(0742) 350 319 MacTel Sheffield
24hrs. 3-24 For Macintosh Users

(0762) 333 872 PBBS1 Portadown, N.Ireland
10pm-1am RING BACK every day. 300

(0766) 4154 Prometheus (Opus), Porthmadog
24hrs 3-24. ANSI colour graphics

(0767) 50 511 Fido Gamlingay, Sandy, Beds
24hrs. 3-24

UK BULLETIN BOARDS

(0782) 265 078 Stoke ITeC
24hrs. 1275v
(0792) 203 953 FBBS Swansea
24hrs. 300
(0792) 297 845 Bulletin AT Fido,
MF:6pm-9pm WE:24hrs 3-12
(0832) 73 003 Intel-Ace, Oundle
Swansea
MF:6pm-8am WE:24hrs 1275v
(0865) 882 872 Banat Board, Oxford
24hrs. 3-24
Opus - colour graphics for ANSI
(0874) 711 147 Communitree
24hrs 300
(0883) 844 164 LABBS
24hrs. 3/1275
The Prisoner - 2 lines
(08926) 61 149 PD-Sig Fido 1,
Crowborough
24hrs 3/1275
PD software interest group
(0895) 420 164 CBBS, London NW
24hrs 300
(0895) 52 685 London West Tech
24hrs. 3/1275 TBBS system
(0903) 212 552 Lasermail Fido
24hrs. 3/12
Subscribers only.
(0905) 52 536 Access Fido, Worcester
24hrs 3-24
Midi section
(0908) 668 398 Key Board, M.Keynes
MF:8pm-8am exc.Tue and Thurs.
WE:12h
Spectrum Micron BBS
(091) 477 3339 Log On the Tyne Fido
10pm-7am every day. 3/1275
(0923) 675 644 SBBS - Watford
MF:9pm-11pm ; WE:11pm-6am 3/1275
(0924) 442598 Kirklees ITeC, Batley
24hrs 1275v
Information Technology Centre
(0925) 411 265 OSI Health Line,
Warrington
24hrs 3-24
(0934) 29 570 Avon Fido, Weston S/Mare
24hrs 3/1275
(0936) 77 025 NBBS Cheshire
24hrs 3/1275
(0942) 609 611 Pyramid, Leigh, Lancs
24hrs 300

Note to sysops

If you want your BBS to appear in the list please send all the above details to Peter Tootill either by post or on Telecom Gold to 83:VNU202.
Include a voice telephone number for verification purposes (this will not be published.) Any additions or updates will be gratefully received.

Key to baud rates, etc
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300 = 300 (V.21)
1275 = 1200/75 (V.23)
h = half duplex
v = viewdata graphics
12 = 1200/1200 (V.22)
24 = 2400/2400 (V.22bis)
3-12 = V.21,V.23,V.22
3-24 = V.21,V.23,V.22,V.22bis
MF = Monday-Friday times
WE = weekend times

DIARY DATA

A look ahead at computer shows throughout 1987. Readers are advised to check details before setting out on their journey.

ELECTRONIC PUBLISHING AND PRINT SHOW '87 — **30 June-2 July 1987**
Wembley Conference Centre, Middx — Online International (01) 868 4466
(For all aspects of home and office desktop publishing, including professional page makeup systems)

PC USER SHOW — **30 June-2 July 1987**
Olympia, London — EMAP International Exhibitions (01) 608 1161
(For business PC users)

AMSTRAD COMPUTER SHOW — **10-12 July 1987**
Alexandra Palace, London — Database Exhibitions (061) 456 8383
(Covering the entire range of Amstrad machines — CPC, PCW and the PC1512)

IBM SYSTEM USER SHOW — **2-4 September 1987**
Olympia 2, London — EMAP International Exhibitions (01) 608 1161

PERSONAL COMPUTER WORLD SHOW — **23-27 September 1987**
Olympia, London — Montbuild (01) 486 1951
(Obviously the UK's No 1 computer show. Make sure you don't miss it!)

DEC USER SHOW — **6-8 October 1987**
Barbican, London — EMAP International Exhibitions (01) 608 1161

COMPUTER GRAPHICS '87 — **13-15 October 1987**
Wembley Conference Centre, London — Online Conferences Ltd (01) 868 4466
(Includes a number of conferences)

AMSTRAD COMPUTER SHOW — **23-25 October 1987**
G-Mex, Manchester — Database Exhibitions (061) 456 8383

ELECTRON & BBC MICRO USER SHOW — **13-15 November 1987**
New Horticultural Hall, London — Database Exhibitions (061) 456 8383

COMPEC — **17-20 November 1987**
Olympia, London — Cahners Exhibitions (01) 891 5051
(Trade and business only)

COMPUTER RECRUITMENT FAIR — **27-28 November 1987**
Novotel, London — Intro UK Ltd (0491) 681010

THE WHICH COMPUTER? SHOW — **19-22 January 1988**
NEC, Birmingham — Cahners Exhibitions (01) 891 5051

END

ALTAIR

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1000 Colour system Twin floppy £1029 20meg	£1604
1000 Mono system, Twin floppy £799 20meg	£1374

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M24 640K 20MB HARD DISK	£1295
M24 640K SINGLE 360K DRIVES	£1035
M19 256K TWIN 360K DRIVES	£845

ARC

286 Turbo system unit	£1195
Mono display add	£229
Colour display add	£499
EGA display add	£679
20MB Hard Disk	£299
Serial/Parallel card	£89

Please call for quotation on any OLIVETTI/ARC systems not shown above

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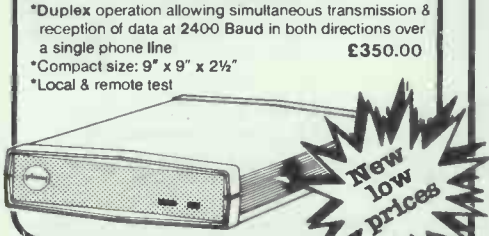

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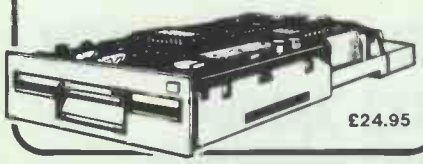

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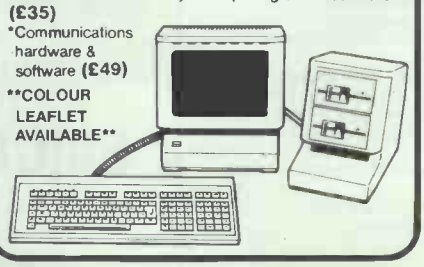

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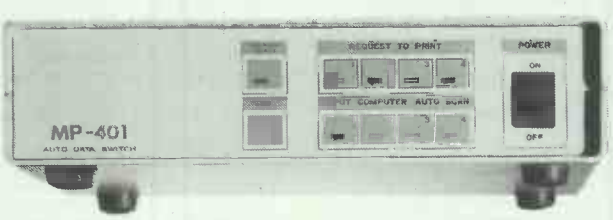

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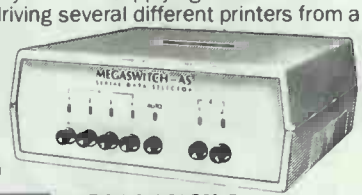
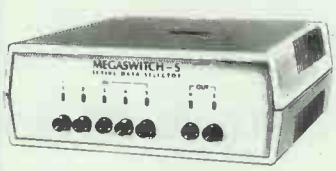


INPUT UP TO 5 PCs



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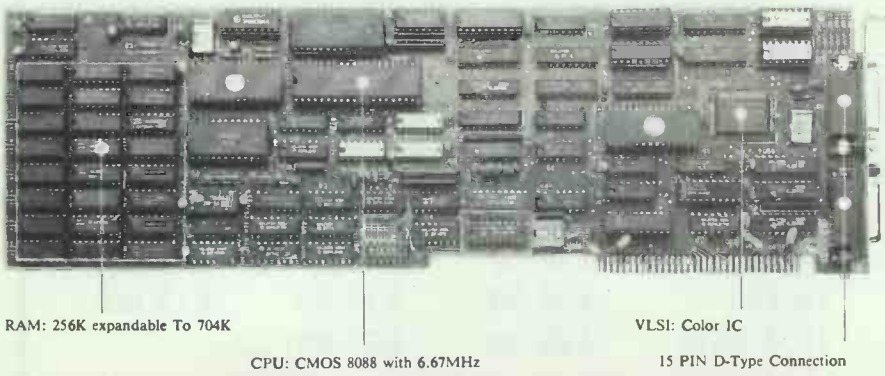

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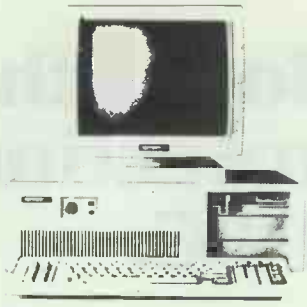

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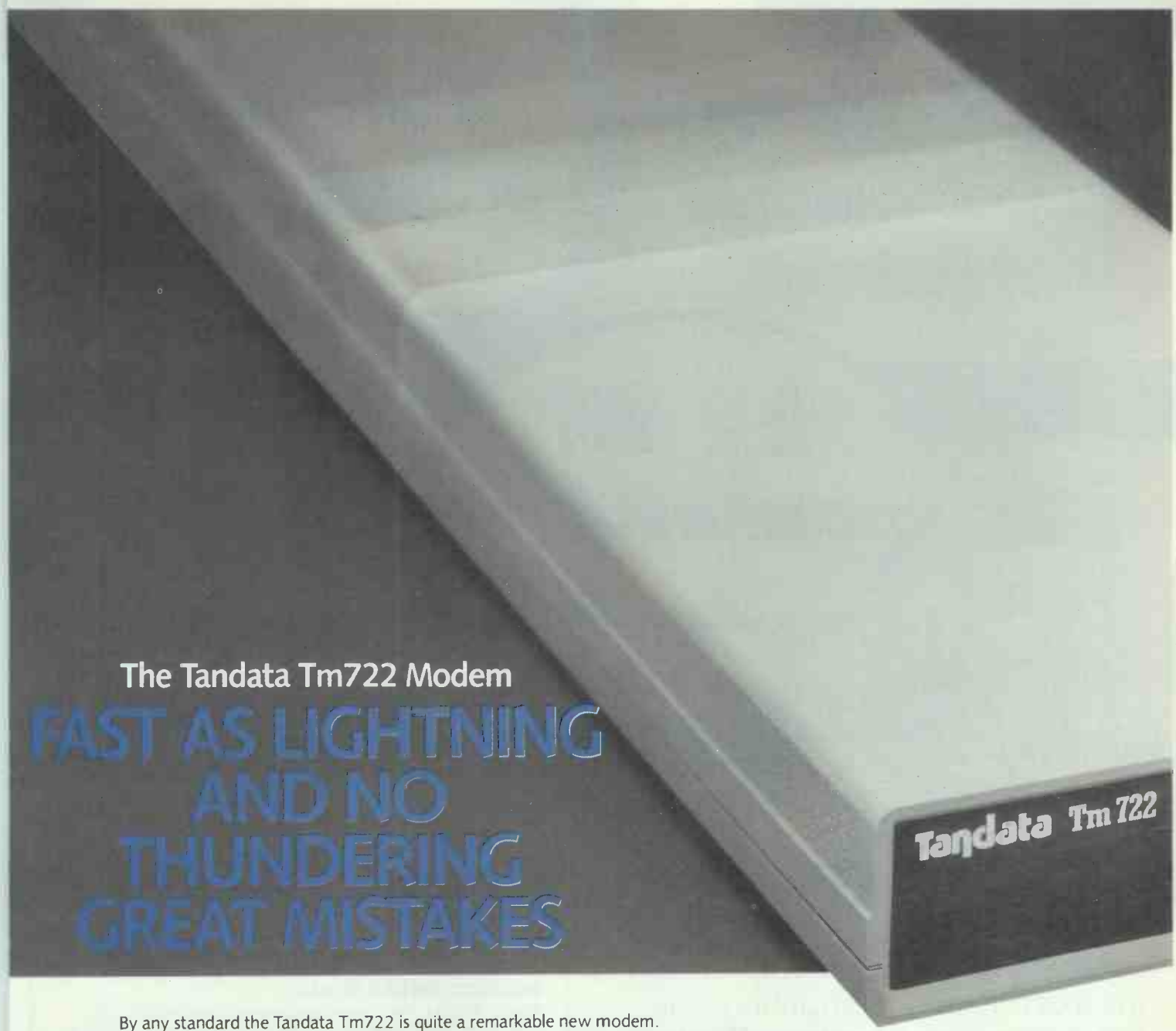

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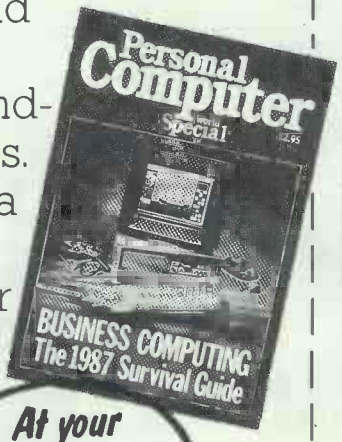

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TECHNOLOGY SO ADVANCED ...

MEMORY
* 512Kbytes RAM (520ST-M, FM)
* 1024Kbytes RAM (1040ST-F)
* 192Kbytes ROM
* 128Kbytes external plug-in ROM option

ARCHITECTURE
* Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
* 16-bit external data bus
* 32-bit internal data bus
* 24-bit address bus
* 8×32-bit data & address registers
* 7 levels of interrupts
* 56 instructions
* 14 addressing modes
* 5 data types
* DMA (Direct Memory Access)
* real time clock as standard

GRAPHICS
* full bit-mapped display
* palette of 512 colours

Using Atari Monitors (on 520 & 1040):
* 640×400 high resolution - monochrome
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 80 column text display (40 col low res)

Using Domestic TV (on 520):
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 40 columns × 25 line text display

SOUND AND MUSIC
* 3 programmable sound channels
* frequency programmable 30Hz - 125KHz
* programmable volume
* wave & dynamic envelope shaping
* programmable attack, decay, sustain, release
* Musical Instrument Digital Interface (MIDI)
* MIDI allows connection of synthesisers etc.

MOUSE
* high precision
* 2 button control
* free with 520ST-FM/1040ST-F
* non slip ball motion sensor
* removable ball for easy cleaning

STANDARD SOFTWARE
* GEM desktop + TOS operating system
* ST BASIC interpreter/language system

INPUT/OUTPUT
* MIDI out ..... (5 pin DIN) 31.25K baud
* MIDI in ..... (5 pin DIN) 31.25K baud
* audio out ..... 1.0V DC peak to peak, 10K ohm
* audio in ..... 1.0V DC peak to peak, 10K ohm
* RGB monitor ..... 1.0V DC, 75 ohm
* mono monitor ..... 1.0V DC, 75 ohm
* mono horizontal scan rate 35.7KHz
* mono vertical scan rate 71.2KHz
* sync ..... 5V DC (active low) 3.3K ohm
* modem/serial ..... RS232C, 50 to 19,200 baud
* floppy disk ..... 250 Kbits/s
* hard disk ..... 11.3 Mbits/s
* mouse ..... standard Atari connector
* joystick ..... standard Atari connector
* cartridge port ..... 128K capacity
* RF output (520ST-FM) ..... for TV use

OPERATING SYSTEM
* TOS with GEM environment in ROM
* hierarchical file structure with sub-directories and path names
* user interface via GEM, with self explanatory command functions
* multiple windows + icons
* window resizing, re-positioning and erasing
* drop down menus (selected by mouse)
* GEM virtual device interface

COMMUNICATIONS
* RS-232C serial modem port
* 8-bit parallel printer port
* MIDI port (also for networking use)
* VT52 terminal emulation

KEYBOARD
* standard QWERTY typewriter format
* 95 full stroke keys
* 10 function keys
* 18 key numeric keypad + cursor keys
* variable auto-repeat & key click response
* keyboard processor reduces CPU overhead

... IT'S AFFORDABLE

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FREE STARTER KIT - Only From Silica

When you purchase any Atari ST keyboard, you will not only receive the best value for money computer on the market, but you will also receive the following from Atari Corporation as part of the package:

** BASIC Language Disk * BASIC Manual * ST Owners Manual * TOS/GEM on ROM*

If you buy your ST from Silica Shop, you will also receive:

** NEOchrome - colour graphics program * 1st Word - Word Processor*

In addition, we at Silica would like to see you get off to a flying start with your new computer, so we have put together a special ST STARTER KIT worth over £100, which we are giving away FREE OF CHARGE with every ST computer purchased at our normal retail prices. This kit is available ONLY FROM SILICA and is aimed at providing users with a valuable introduction to the world of computing. We are continually upgrading the ST Starter Kit, which contains public domain and other licensed software, as well as books, magazines and accessories all relevant to ST computing. Return the coupon below for full details.

DEDICATED SERVICING - Only From Silica

At Silica Shop, we have a dedicated service department of five full time Atari trained technical staff. This team is totally dedicated to servicing Atari computer products. Their accumulated knowledge, skill and experience makes them second to none in their field. You can be sure that any work carried out by them is of the highest standard. A standard of servicing which we believe you will find ONLY FROM SILICA. In addition to providing full servicing facilities for Atari ST computers (both in and out of warranty), our team is also able to offer memory and modulator upgrades to ST computers.

1Mb RAM UPGRADE: Our upgrade on the standard Atari 520ST-M or 520ST-FM keyboard will increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT = £100).

TV MODULATOR UPGRADE: Silica can upgrade the 1040ST-F to include a TV modulator so that you can then use it with your TV set. This is an internal upgrade and does not involve any untidy external boxes. A cable to connect your ST to any domestic TV is included in the price of the upgrade which is only £49 (inc VAT). The upgrade is also available for early 520ST computers at the same price.

THE FULL STOCK RANGE - Only From Silica

We aim to keep stocks of all Atari related products and our warehouse carries a stock of £½ million. We import many software titles direct from the USA and you will find that we have new releases in advance of many of our competitors. Unlike dealers who may only stock selected titles, we have the full range. In addition, we carry a complete line of all books which have been written about the Atari ST. A range as wide as ours is something you will find is available ONLY FROM SILICA.

AFTER SALES SUPPORT - Only From Silica

Rest assured that when you buy your ST from Silica Shop, you will be fully supported. Our free mailings give news of releases and developments. This will help to keep you fully up to date with what's happening in the Atari market. And in addition, our sales staff are at the end of a telephone line to service all of your Atari requirements. If you purchase an ST from Silica and would like any programming or technical advice, we have a full time technical support team to help you get the best from your computer. Because we have both the staff and the systems specifically dedicated to providing after sales service on Atari ST computers, we are confident that our users enjoy an exceptionally high level of support. This can be received ONLY FROM SILICA.

FREE CATALOGUES - Only From Silica

At Silica Shop, we recognise that serious users require an in-depth information service, which is why we mail free newsletters and price lists to our ST owners. These are up to 48 pages long and are crammed with technical details as well as special offers and product descriptions. If you have already purchased an ST and would like to have your name added to our mailing list, please complete the coupon & return it to us. The information service is available ONLY FROM SILICA.

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We hope that the combination of our low prices, FREE UK delivery service, FREE Starter Kit and FREE after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, then please contact our sales department, providing us with our competitor's name, address and telephone number. If our competitor has the goods in stock, we will normally match the offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. We realise that we are not the only company who will match a competitor's price. However, if you come to us for a price match, you will also be entitled to our after sales service, including free newsletters and technical support. This makes our price match promise rather special, something you will receive ONLY FROM SILICA. We don't want you to go anywhere else for your Atari products. So shop at Silica, the UK's No1 Atari Specialist.

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520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a ½ Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a ½ megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages:

520ST-FM Keyboard Without Monitor	*- £399 (inc VAT)*
520ST-FM Keyboard + High res mono monitor	*- £499 (inc VAT)*
520ST-FM Keyboard + Low res colour monitor	*- £599 (inc VAT)*
520ST-FM Keyboard + Med res colour monitor	*- £699 (inc VAT)*

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one mains lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1028K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one mains lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040ST-F Keyboard Without Monitor	*- £599 (inc VAT)*
1040ST-F Keyboard + High res mono monitor	*- £699 (inc VAT)*
1040ST-F Keyboard + Low res col monitor	*- £799 (inc VAT)*
1040ST-F Keyboard + Med res col monitor	*- £899 (inc VAT)*

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead.

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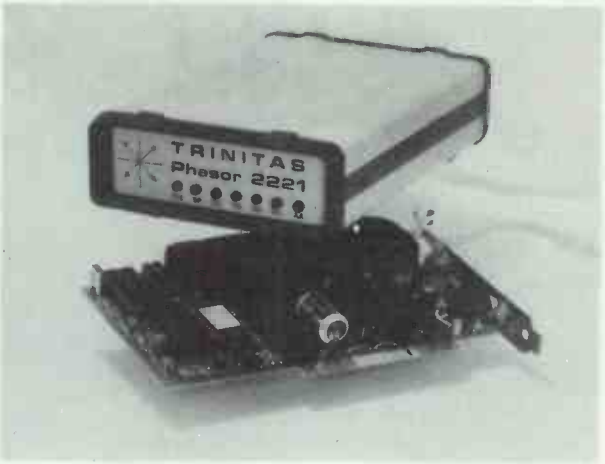

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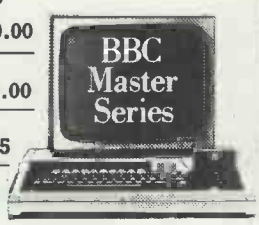

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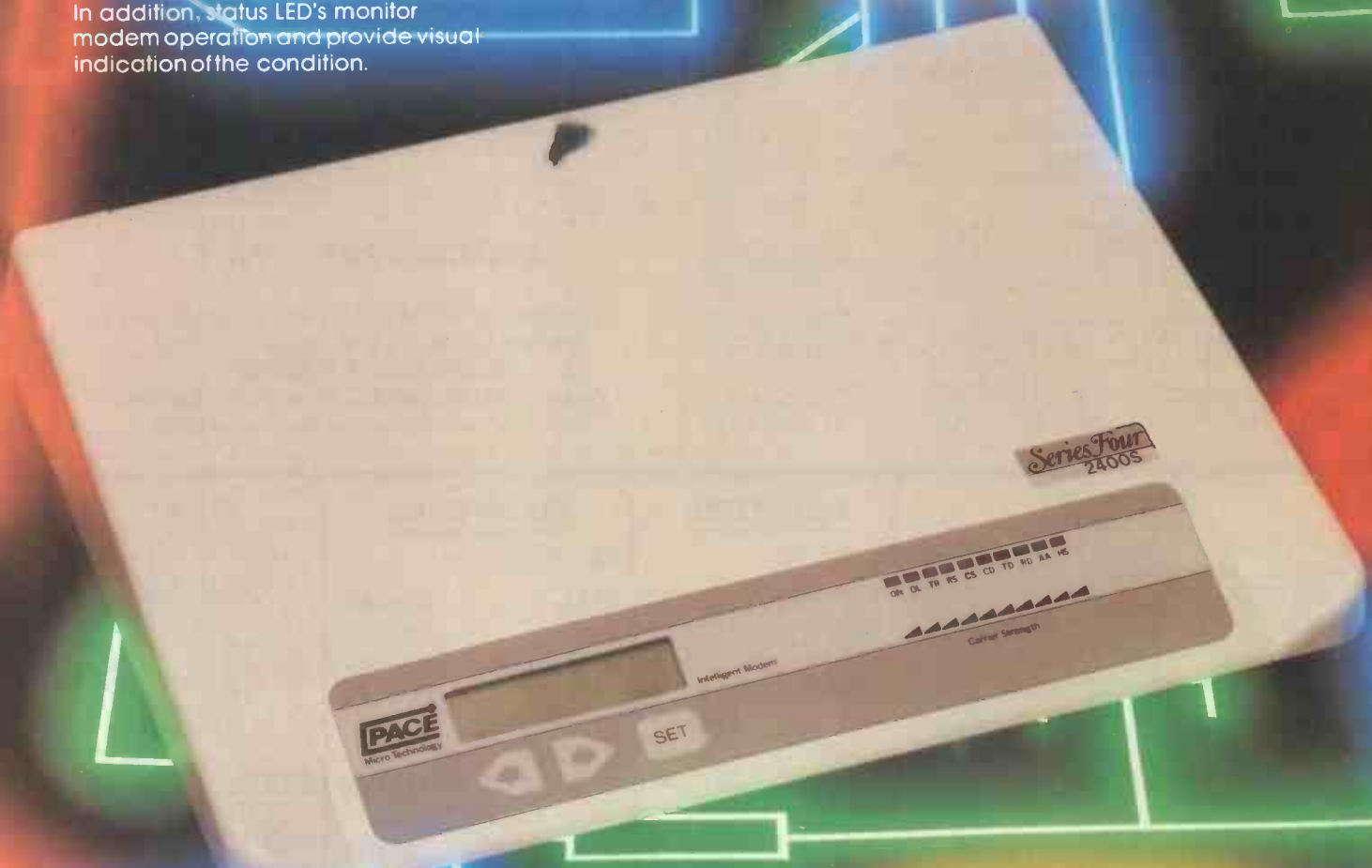
All Series Four models include as standard V21/V23 CCITT capability coupled with microprocessor control, automatic dialling and answering. Hayes compatibility and standard ports for RS232C, telephone, and parallel printer connection.

A 32 character LCD display and three 'touch' controls are used to relay messages about call progress to display time, date etc and to simplify programming of the modem via the Hayes commands. In addition, status LED's monitor modem operation and provide visual indication of the condition.



Multiple baud rates are supported by all Series Four models with 300/300, 1200/75 and 75/1200 rates being available for use with standard viewdata and low speed full duplex systems. For more exacting requirements the Series Four 1200S will support 1200 baud full duplex (V22), and the Series Four 2400S will provide 2400 baud full duplex (V22 bis) operation.

Some of the features of Series Four:

- Multiple baud rates (upgradeable)
- Auto dial/auto answer
- Microprocessor control
- Inbuilt date/time clock
- Automatic speed buffering
- Automatic baud rate detection
- Hayes compatibility
- Auto re-dial
- Dial tone detect
- Number store
- Call progress monitoring
- Printer port
- Unattended printing of incoming data
- 32 character LCD display
- Tone dialling
- Comprehensive 'help' command pages
- Visual line condition indication

The features offered by the new Pace Series Four modems are too numerous to detail fully here, a comprehensive fact sheet is available free on request.

PACE

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BBC Master Compac + Colour Monitor.....£544

ATARI

520STM.....£205
520STFM.....£305
520STM + mono monitor.....£390
520STM + Philips colour.....
520STFM + Philips colour Hi-res £556
1040STF + mono.....£556
1040STF + Philips colour.....
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PC Single D/D 20Mb mono mon.256.....£1199
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Victor machines.....POA

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M24 2 D/D.....£1025
M24 20Mb (Olivetti).....£1350
M24 20Mb (Seagate).....£1250
M24 30Mb (Seagate).....£1450
M24 SP.....£1499
M28 20Mb H/D.....£1999
M28 20Mb + T/S.....£2499
M28 40Mb.....£2549
M28 40 Mb + T/S.....£2999
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HT 400.....£1425
HT 450.....£1715
HT 500.....£2100
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2DD Mono.....£522
1DD Colour.....£567
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Brother M1509.....£365
Brother M1709.....£499
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OKI ML193.....£365
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OKI ML294.....£799
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Panasonic 1091.....£235
Panasonic 1092.....£310
Panasonic 1592.....£399
Panasonic 1595.....£525
Panasonic 3131.....£259
Panasonic 3151.....£425
Star NL10.....£203
Star SD15.....£269
Star SR10.....£269
Star NX15.....£319
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Star NB15.....£639
Phone for prices on Diablo, Newbury, Data, Qume and Ricoh.
Prices due to change so phone for better deals

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Panasonic 3031.....£259
Panasonic 3151.....£425
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Maths Co-processors 8087.....£98
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Miracle WS4000.....£119
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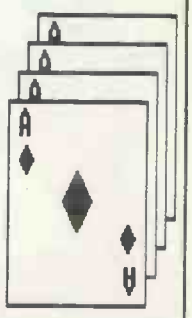

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3 Pack C 520 STM 1Mb drive, mouse and 1st Word	£399.00
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520STFM including built in half Meg drive and Hi-Res b/w monitor	£499.00
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520STM incluidng mouse + 16 disks	£299.00
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Atari SF 314 1 Meg Drive	£189.00
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If it's quality, reliability and security, then it's 3M. Direct Disk Supplies always give the best price. In fact it's so special that the minimum quantity is 20 disks.

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Offer 3 New Premium Universals

Not only are all our universal disks individually certified to 96tpi but they are now prepared to an even higher specification to ensure fewer problems, high reliability and value for money. Plus, of course, our Lifetime Warranty. Disks are packed in 25s complete with envelopes, labels and write protect tabs.

£ 14.99	25 disks
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★ Full spec Higrade disks, made to 75% clipping level
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10-Disk plastic library boxes
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Smoked acrylic with dividers & 2 keys. Price includes VAT & postage.

3.5"	40/50 disk box	£ 9.99
	80/90 disk box	£13.99
5.25"	50 disk box	£ 9.99
	100 disk box	£13.99

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£129.99	200 disks
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Reversible disks have a notch on either side and 2 index holes in the jacket. The disk itself is tested double-sided up to 96tpi. So save money and use both sides. Again, disks are packed in 25's with labels and tabs.

Bargain Box.

Have no doubts – these prices are the business. DDS offer you branded SCOTCH (made by 3M) at prices below other people's plain label disks. They're certified & tested error free by 3M; branded disks in tyvek envelopes with re-inforced hubs, labels & WP tabs are also included.
We only have a limited stock, and so it's first come, first served. A saving not to be missed!

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100 disks	£ 42.99	.38
200 disks	£ 82.99	.36
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1. DIAL-A-DISK ON 01.979 7811, and give your ACCESS or VISA number and expiry date.
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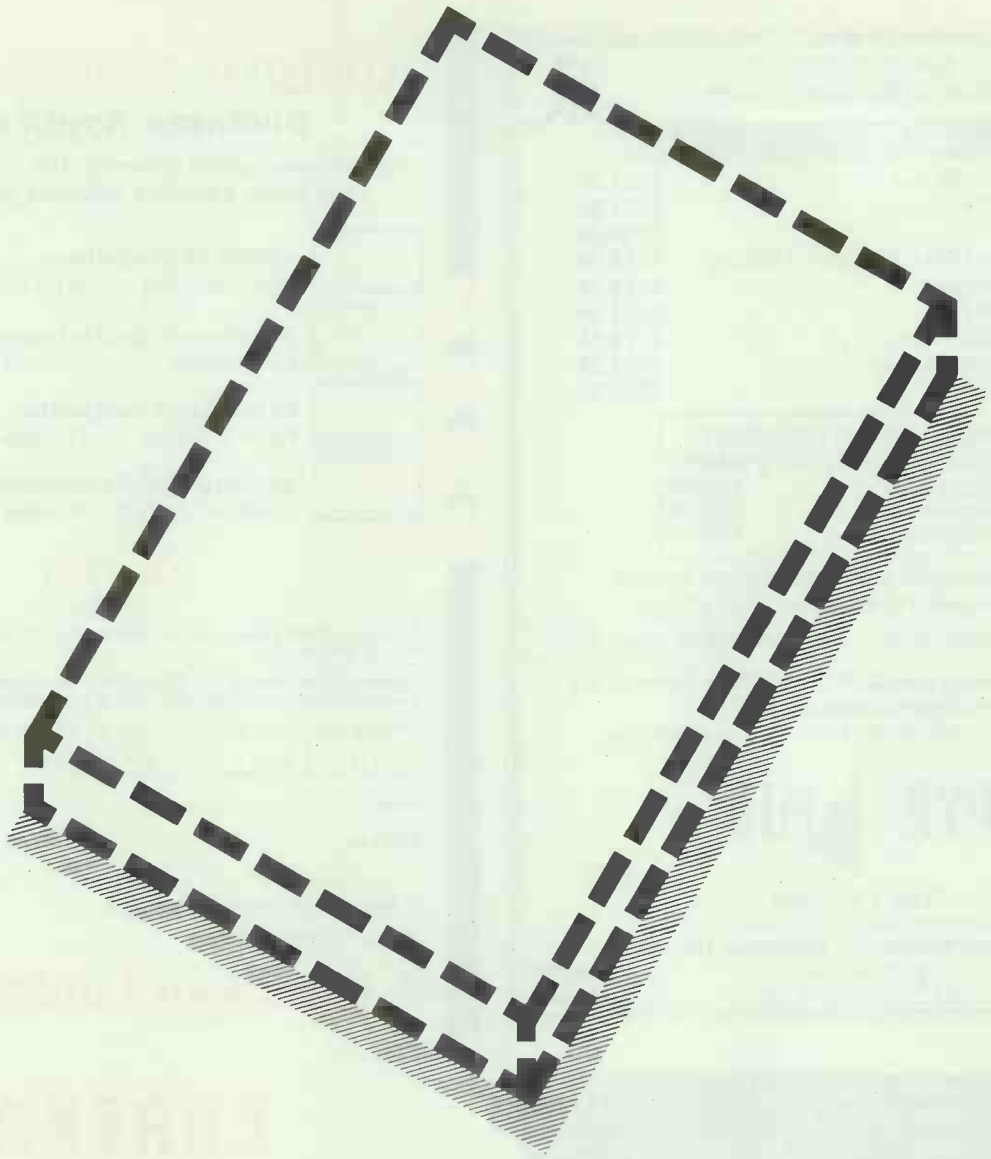

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DESKTOP PUBLISHING
WITH PUBLISHING PARTNER™ ON THE ATARI ST

ATARI ST SOFTWARE

1 WHAT IS DESKTOP PUBLISHING?

Desktop Publishing is a method by which documents can be produced using a computer, software and a printer. These documents are near professional appearance and cost only a fraction of the price which you might otherwise pay to a designer, artwork studio and printer. Because the 'middle men' are elimnated from the production process, desktop publishing allows the user to retain total control over his or her documents, making last minute updates without panic and without incurring extra charges for 'rush' work.

2 WHAT CAN I USE IT FOR?

As we all make use of the printed word in one way or another in our daily lives, the applications for Desktop Publishing are all around us. If you belong to a club or society or if you run your own business, the possibilities are endless! Our list of example applications will give you some other ideas.

Advertisements	Distribution Leaflets	O/head Transparencies
Application Forms	Fayre Programmes	Personal Cards
Brochures	Invitation Cards	Personal Letterheads
Business Contracts	Invoices	Presentations
Charts & Tables	Labels	Price Lists
Club Certificates	Menus	Special Offer Leaflets
Club Newsletters	Office Forms	Technical Sheets
Dance Tickets	Order Forms	Work Estimates

3 PUBLISHING PARTNER

Publishing Partner, from SoftLogik Corp™, includes all of the features which you would expect in a good Desktop Publishing package. It combines word processing, page layout and graphics facilities all in one program, allowing you to create 'stunning' documents on your Atari ST. First you can do a rough page design and start adding blocks of copy. See how it fits. See how it looks. See how it flows onto the next page. Make some changes. Try a different type style, or a different size, or some borders, some shapes, or even some pictures. Because Publishing Partner incorporates WYSIWYG (What You See Is What You Get), you'll see instantly if your new idea works or not. The computer's screen will show you just how the page will look when it prints - no more guesswork. You can adjust fonts, character sizes and even character spacing, anytime and anywhere on the page. Watch an ordinary letter transform into a professional looking piece right before your eyes, as you experiment with mixing graphics and text. And, when you want to see a 'hard copy' of your masterpiece, just send it to any one of the printers which the program supports (the list is growing all the time).

SoftLogik Corp™

SoftLogik Corp™ was set up in the USA by Shawn Fogle and Deron Kazmaier to produce quality desktop publishing software with uncompromising power and features. Publishing Partner was developed after 1½ years of research, working with typesetters and printers and the results achieved are outstanding.

4 SIMPLE, POWERFUL, AFFORDABLE

Printing and publishing is a fairly complex business which takes years of training and experience to master. You wouldn't think so with Publishing Partner, which takes full advantage of the ST's user friendly GEM environment. It is so user friendly and easy to understand, most people find they can produce their first document without even opening the fully comprehensive 159 page manual which accompanies the program. Using the mouse to manipulate the self explanatory pull down menus and windows, you can be up and running in no time, creating a variety of documents quickly and easily. In addition, the flexibility of Publishing Partner allows you to choose between mouse or keyboard operation, whichever suits your personal preference. Although simple to use, Publishing Partner is by no means a simple program. Quite the contrary. Behind the user friendliness of GEM, lies a most complex and powerful publishing tool. The combination of Publishing Partner and Atari's powerful low-cost ST computers has brought an affordable alternative to the desktop publishing systems currently available from Atari's competitors.

5 THOUSANDS OF TYPE STYLES

This is no exaggeration. Unlike most other desktop publishing software packages, which offer you 2 or 3 different fonts, Publishing Partner gives you true flexibility of over 4,000 type styles per font. Publishing Partner offers you 14 variations of each font:

BACKSLANT	**MIRROR**	**STRIKE THROUGH**
BOLD	**OUTLINE**	**TALL**
DOUBLE U/L	**REVERSED**	**UNDERLINE**
ITALICS	**SHADOW**	**UPSIDE DOWN**
LIGHT		**WIDE**

And you can 'mix and match' any number and combination of styles to your own requirements. The total number of possible permutations is over 4,000. And that's not all, each style can be used in any one of 216 sizes in one point increments from 1 point to 216 points! All this is achievable on an unexpanded 520ST with just 512K RAM! Other competing packages require 1024K RAM just to get the larger sizes above 72 point and still can't match all of the variations available.

Publishing Partner is a trade mark of SoftLogik Corp™.

6 WORD PROCESSING

Publishing Partner contains the power and features that you would expect to find on a dedicated word processing package. In addition it includes facilities which a professional typesetting machine would offer. For example the program can cope with 216 different type sizes, with over 4,000 style variations of each one. The following are some of the facilities you will find within the capabilities of Publishing Partner:

- Adjust margins for any column
- Change block to uppercase or lowercase
- Change margin indents
- Character spacing from -128 to +127
- Copy text to and from the buffer
- GEM based
- Import and export files
- Insert and delete pages
- Justifies right/left/centred as you type
- Justifies to the character/word
- Kerning from -128 to +127
- Line spacing/leading in ½ points from -64 to +57
- Link columns together
- Macros
- Manual Hyphenation
- Merge files together
- Optional grid & ruler display
- Over 4,000 type style variations of each font
- Page numbering
- Pica, Inches or Centimetre measuring system
- Print to paper vertically or horizontally
- Read & merge any ASCII file
- Search and replace
- Tabs for charts/tables
- Unlimited headers & footers
- User definable page size
- User variable superscript/subscript characters

7 PAGE LAYOUT

Whatever you require, custom logos, unique borders, unusual letterheads etc. Publishing Partner is your solution. After all, it was specially designed by professionals who realize that there's more to your computer than just typing letters.

- Accurate to 3 decimal places
- Adjust character size from 1 to 216 points
- Auto text flow between columns
- Change columns on finished page
- Display 15%-1500% of original size
- Display actual size
- Display multiple pages/rulers/text routing
- Layout multiple columns
- Print to disk
- Set auto text routing
- Snap to guides
- Superimpose text on tint or tint on text

8 GRAPHICS

Not only can you load any Degas, N-Vision, Neochrome or digitized pictures into your Publishing Partner files, you can also enlarge or reduce them for an exact fit. Or, you can copy just a section of a picture and then paste it into your document as many times as you want. You can still go back and resize it at any time or crop it to delete unwanted areas.

- 3 types of line ends, square/rounded/pointed
- 7 types of line which are all editable.
- 7 weight lines ranging from ½pt to 6pt
- 40 fill patterns each with a border option making a total of 80 fill options
- Ability to produce separations for 2 colours
- Copy graphics to and from clipboard
- Cut, paste, copy or crop graphics
- Import graphics from third party graphic programs such as Degas, Neochrome, N-Vision or any art program that produces compatible ASCII files
- Select colours to use and print with
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9 OUTSTANDING OUTPUT

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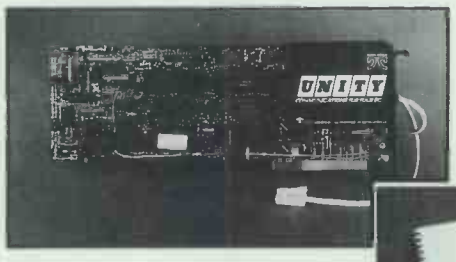

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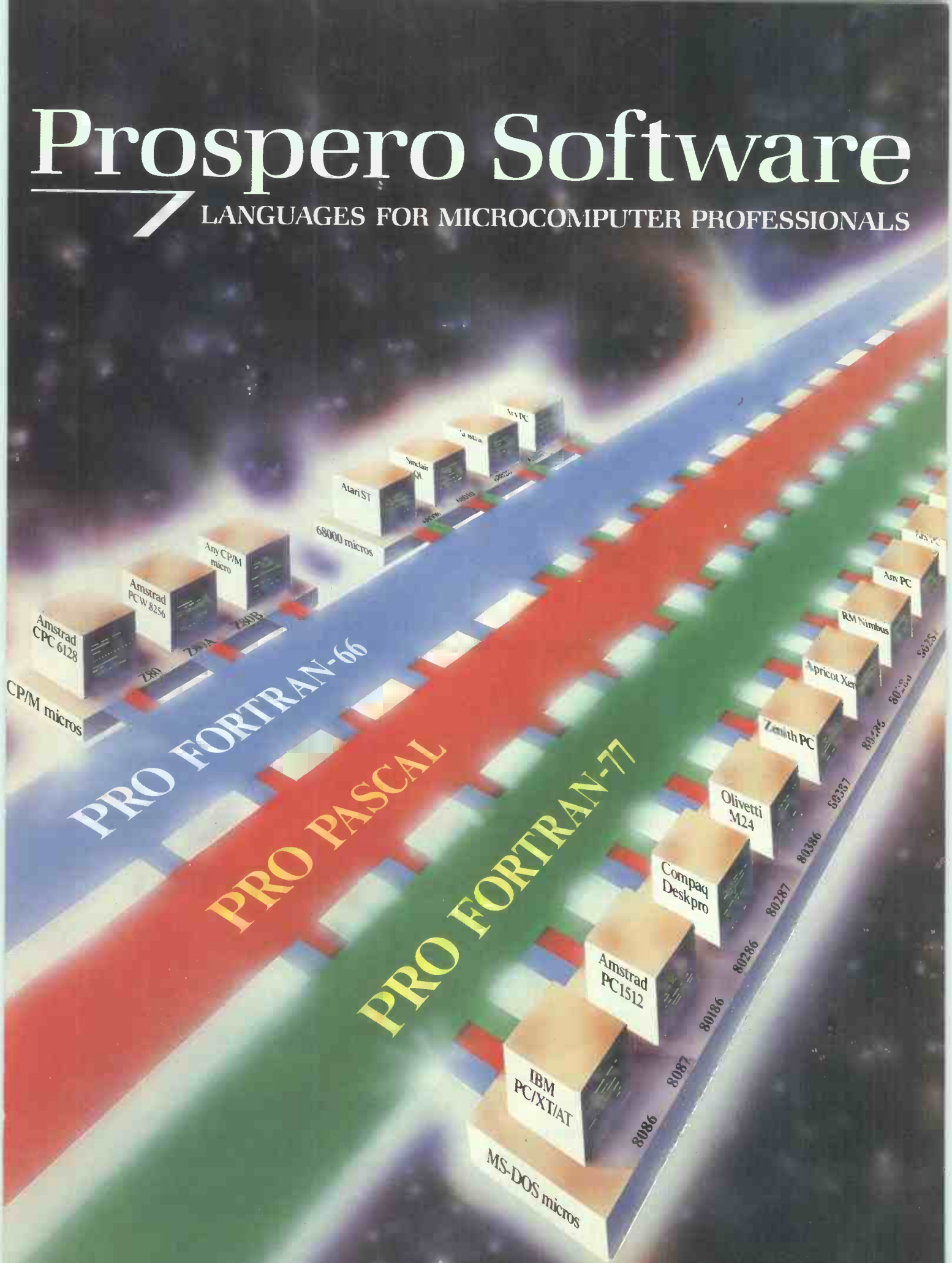

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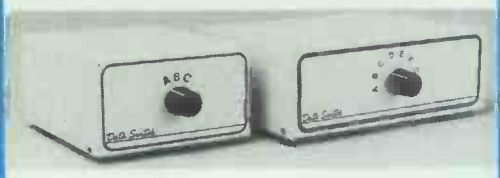

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CHIP CHAT

Want a cheap 80386 machine? Ness Industries sent us a blurb about its new model with 512k RAM, two 32-bit slots and the usual drives and ports. The price? 'A highly competitive £295.'

'Gosh, Arfur. Get the motor out and we'll get a couple of dozen for 'er indoors.'

Let's hope that Ness' 386 machine is better than the two 286 machines it delivered to VNU (publisher of *PCW*). One didn't specify a destination and came with a keyboard with no 'I' but two 'Y's. The other had an Arabic keyboard — very useful here in the middle of Soho . . .

You've probably seen that advert where cyclists wearing hats straight out of Flash Gordon zoom round and round a race track, never stopping.

The advert is for Tandem whose fault-tolerant computers are having a big success at the moment. What we can't understand is why, if the advert is for Tandem, the company chose a race sponsored by another computer manufacturer — Apple — whose logo is clearly visible on the cyclists' shirts . . .

Talking of media exposure, we know who won the general election and it wasn't a political party. All over the place Zenith 181 laptops kept appearing on the television — on the SDP coach, on the analysis programs linking Norman Tebbit with Tory headquarters, and so on.

Mind you, we don't know what Zenith made of Tebbit's remark that he 'wasn't using a real computer, just a terminal linked to the real computer in his office . . .'

If you thought that MS-DOS was a Microsoft product, think again. MS-DOS 3.3 has yet to appear from Microsoft, yet we hear that IBM has a warehouse full of packaged products ready to go.

The hold-up at Microsoft's end?

Our mole tells us that IBM's corrections to MS-DOS were late back to Microsoft. Meanwhile IBM, having made sure the system worked on its *own* hardware, went into full production . . .

A little knowledge can lead to the most amazing nonsense. Applied Microsystems Technology informed us that its 16MHz AMT386 'gives a performance rating 18 times that of an IBM PC. (Norton SI 3.0).'

Now, come on chaps. Either it's 18 times as fast as an IBM PC or it's 3 times as fast. You can't have it both ways unless you've found a way of applying micro technology we've never heard of . . .

Desecration can be found in the games world too. Anita Sinclair revealed recently that the original version of her graphic adventure The Pawn was censored. Seems like Sir Clive took exception to one scene where, in order to proceed, the player had to rape one of the characters.

Didn't realise it was that sort of 'porn' Magnetic Scrolls was producing . . .

OK. Silly product time again. If you've got a Texas Instruments TI-99/4A lurking in the cupboard, you can turn it into a PC compatible. Easy really, you just buy a PC compatible from Triton along with the Bridge Box which lets you use your 99/4A as the keyboard and you're away.

The price in the US is a very reasonable $499, though for the life of us we can't see where they've hidden the function keys and other essentials to PC computing.

Oh, alright, here's the phone number of the TI-99/4A user group as well: (0273) 503968 — after 7.30pm.

Fancy yourself as a *PCW* expert?

Do you fancy seeing your name in *PCW*? We're looking for people with expertise in personal computing to help us review the wide range of hardware and software products that grace our pages.

If you are well versed in a particular area of computing — be it programming, business applications, future technology or software development, and would like to put some of the latest products through their paces, why not drop us a line?

We'd like to know something of your computer interests and experience, as well as which areas you feel competent to write about.

We're not looking for people to write 'What I did on my holidays' type anecdotal stories, nor have we yet come across anyone who's offered us computer fiction that's worth printing. If you think you can persuade us otherwise in either area, you're welcome to have a go.

We pay for all articles published and have guidelines to help those nervous about meeting *PCW*'s high standards of review writing.

Address all biographies, synopses and holiday snaps to: Derek Cohen, editor, Personal Computer World, 32-34 Broadwick Street, London W1A 2HG.

This month

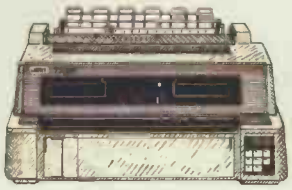
Atari is doing well in the market with its ST capturing many sales from other home and small business machines. The desktop publishing system exclusively reviewed in this issue (page 96) could set the cat among the pigeons in another market dominated by high-priced products.

What makes it most interesting is that, as desktop publishing becomes cheaper and more accessible, we may see a burst of low-budget magazines and fanzines parallel to those which appeared when people started using photocopiers.

If your club has got in on the act, why not drop a copy to our user groups columnist Rupert Steele?

It's gratifying to see how those power-mad keyboard junkies are having to spend less to get more. Hopefully, either Dell's low-cost high performance 286 machines or the 386 add-ins from Intel and Orchid will satisfy the insatiable for a few months. Frankly, if my fingers had to move any faster across the keyboard they'd need the streamlining of Concorde.

Finally, we're giving some money away . . . Well, to be precise we're saving you some. You will of course be going to the Personal Computer World Show at the end of September. If you collect the vouchers from the next two issues of *PCW* you can save yourself £1 off the admission price. And you thought we all had hearts as cold as silicon.



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The U.K.'s best selling daisywheel printer. 100 character wheel. 2K memory expandable to 8K.
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6000 DAISYWHEEL
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The first printer in the world that can print anything.

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Why waste time with BASIC, PASCAL or C when you can develop faster programs more quickly with PCL...

PCL is a major fourth generation high level language, implemented as the fastest interpreter on earth. It is specifically designed for the IBM PC/XT/AT and compatibles.

PCL gets the maximum performance out of its hardware. It combines the flexibility of an interpreter with an execution speed that puts most compilers to shame.

PCL is a well structured procedural language along the lines of C or Pascal but without the restrictions and idiosyncrasies of either. It is easier to learn yet offers considerably more features than both.

PCL has over 330 built-in functions, providing high level support for:

- ★ sophisticated windowing and menu building commands. Extremely fast screen displays
- ★ extended text-manipulation and scientific function set
- ★ array arithmetic
- ★ character and numeric sorting
- ★ powerful file I/O, directory and disk management
- ★ dynamic record structures
- ★ DOS command interface
- ★ RS232 communications up to 19200 Baud handled by built-in background tasks

...and much more.

Apart from its high level functions **PCL** also offers HEX and binary arithmetic and most standard assembler mnemonics. Arrays can make use of all DOS addressable memory. Decimal arithmetic to 16 digits. Automatic 8087/80287 support.

Any program can call on the **PCL** interpreter itself at run time and pass it one or more source lines for immediate execution. Useful for spread-sheets, data dictionaries etc.

Any application written in **PCL** can be made RAM-resident with a single command. It can then be invoked from any other application with just two key strokes. **PCL** can also be used as a RAM-resident full scientific calculator.

PCL sample program to display a sorted list of all files on the current disk directory:

```
CHAR DIRECTORY[300,45],X; INTEGER N
X=?DIR "*.*"; N=0
WHILE LEN X > 0 THEN DO
  N=N+1; DIRECTORY[N]=X; X=?DIR
ENDDO
DIM DIRECTORY,N; SORT DIRECTORY
? DIRECTORY
```

PCL is the ideal language for beginners and experts alike since it is easily learned and offers great programming power. **PCL** has a clear and simple syntax, without reserved words, and a block structure which encourages the writing of very readable programs. Extensive built-in debugging features help you to pinpoint errors, should your program ever go wrong.

You will find that program development is much quicker with **PCL** than with third generation languages where you have to waste time re-inventing the wheel. **PCL** allows you to concentrate on making sophisticated and extremely fast programs in record time.

Benchmarks, comparing TURBO PASCAL 3.0 with **PCL 2.0**

Description	PASCAL	PCL	
Empty loop × 10000	.25	.04	525%
BYTE Magazine decimal arithmetic Benchmark:	31.88	14.82	115%
With 8087:	6.29	6.09	3%
Display 24 lines of 80 characters on standard colour display:	2.7	.15	1700%
Mono or EGA display:	2.45	.04	6025%
Format & display 100 decimal numbers:	1.51	.42	260%
With 8087:	1.35	.25	440%
Convert 1000 decimals to character strings:	3.89	3.17	23%
With 8087:	2.87	1.04	176%
Convert 1000 character strings to decimals:	8.18	2.43	237%
With 8087:	3.48	1.12	211%
Catenate two 10 byte strings × 1000:	.58	.32	81%
String search x 1000	1.03	.28	268%
Sequential write, 1000×90 byte records	7.5	2.9	159%
Sequential read, 1000×90 byte records	7.4	2.5	196%

All timings are in seconds. They were taken on a standard IBM PC with PC DOS 3.1, a real-time clock and a 10MB hard disk.

Minimum system requirements: 256K RAM, mono or colour monitor, 1 disk drive, PC DOS or MS DOS version 2.1 or later.

PCL comes on a 5¼" diskette with a comprehensive manual including many programming examples. Not copy protected. 30 days money back guarantee.

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