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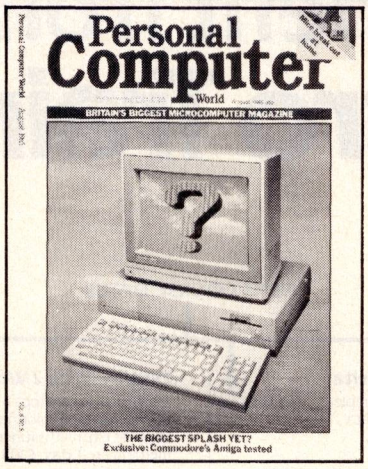

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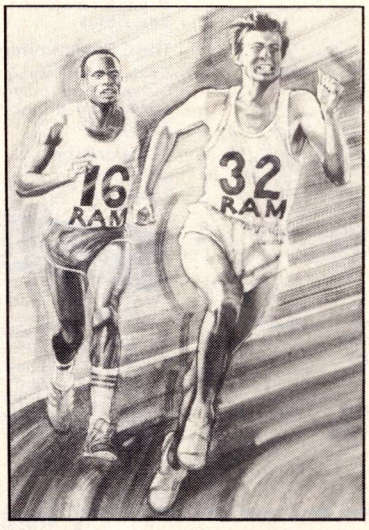

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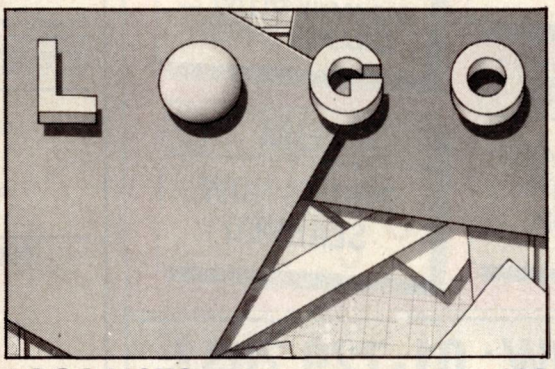

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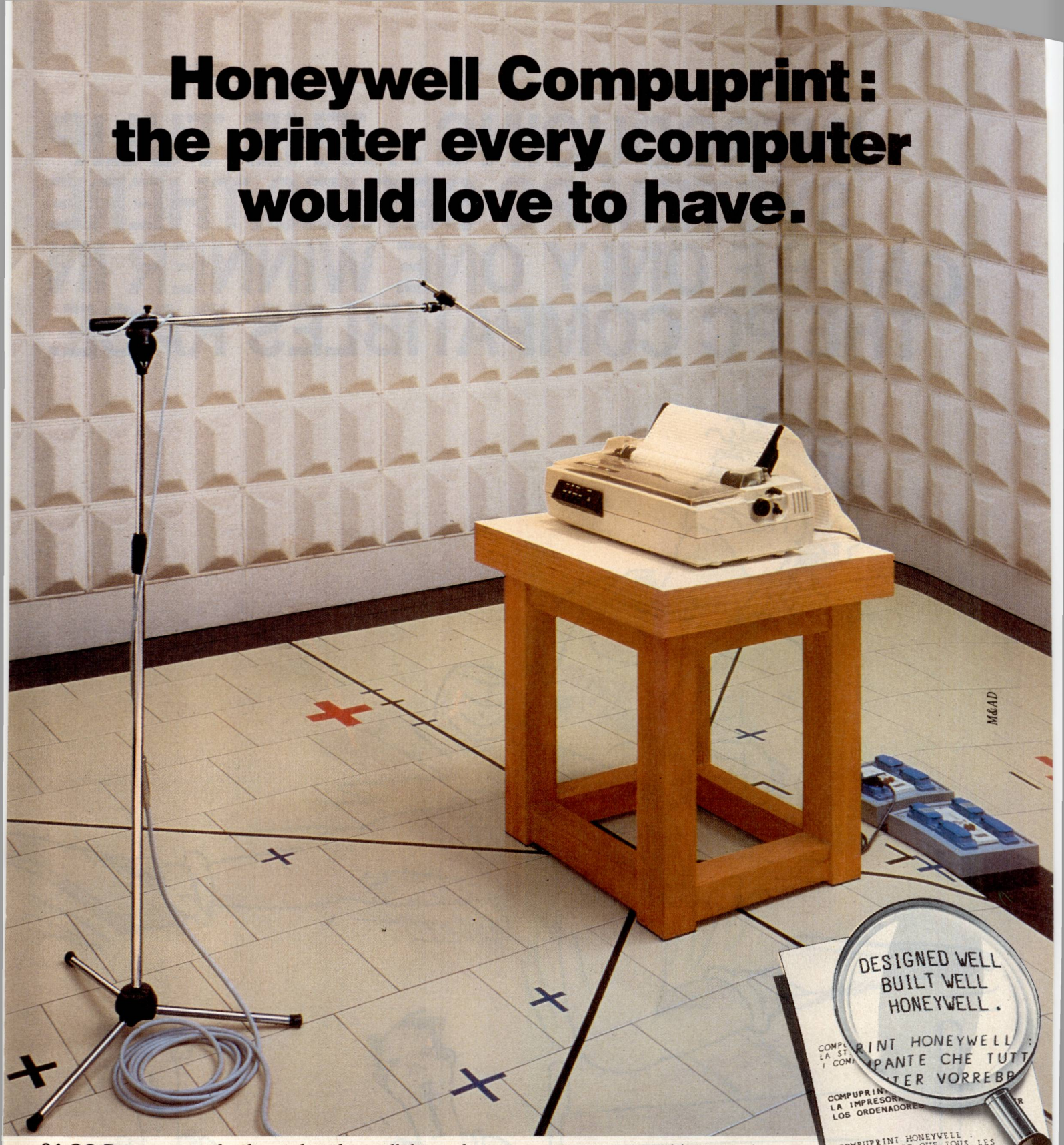

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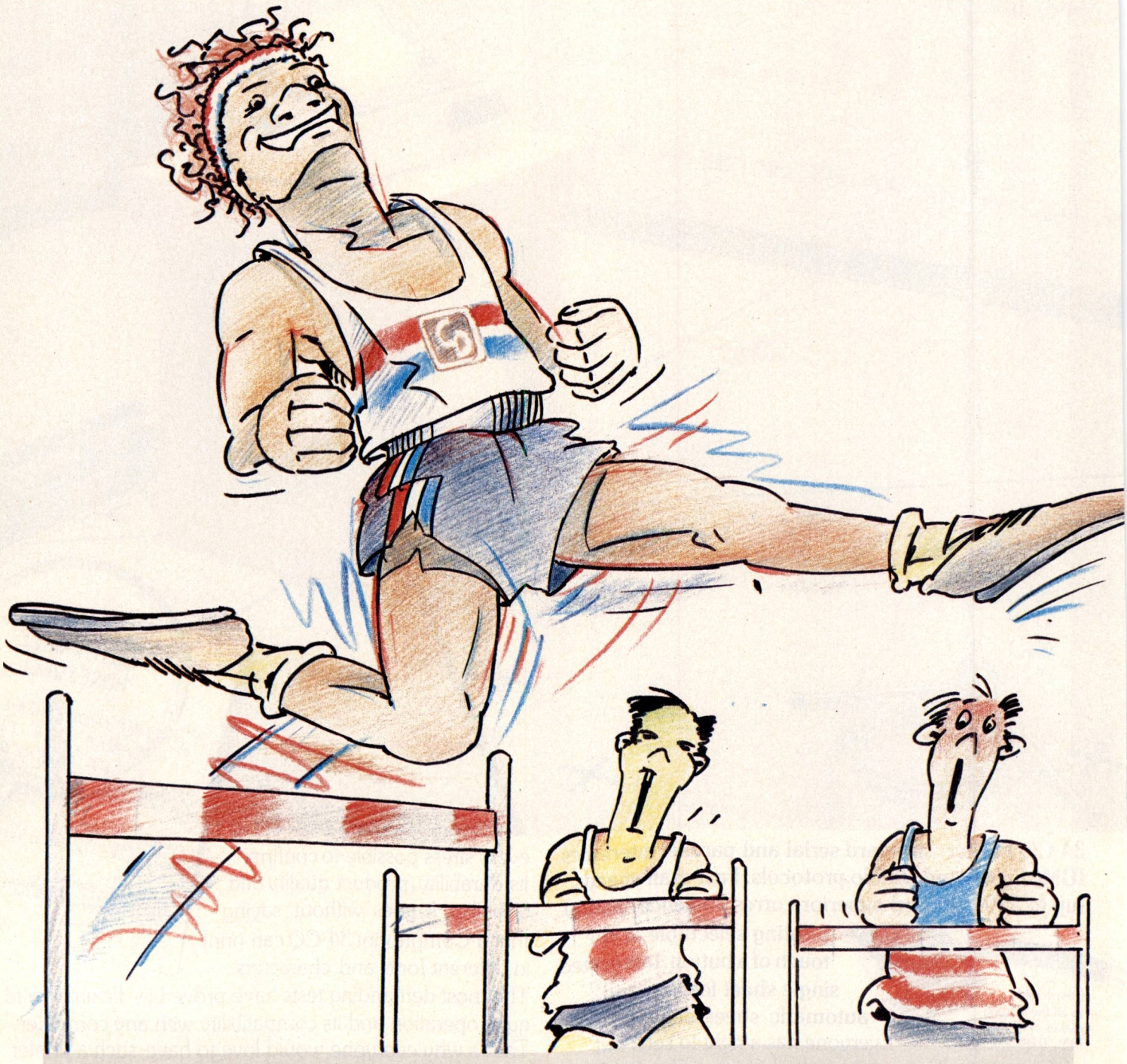

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Display formats	80x25 monochr	80x25 monochr
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International character sets	11	11
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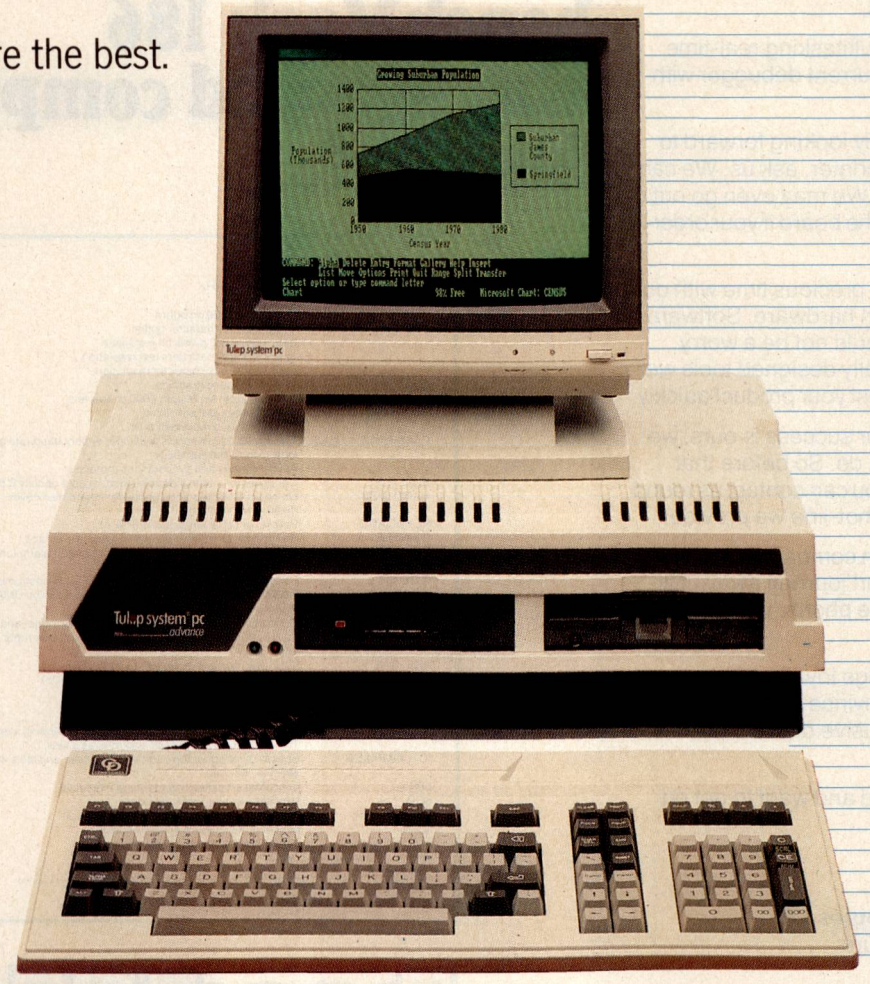

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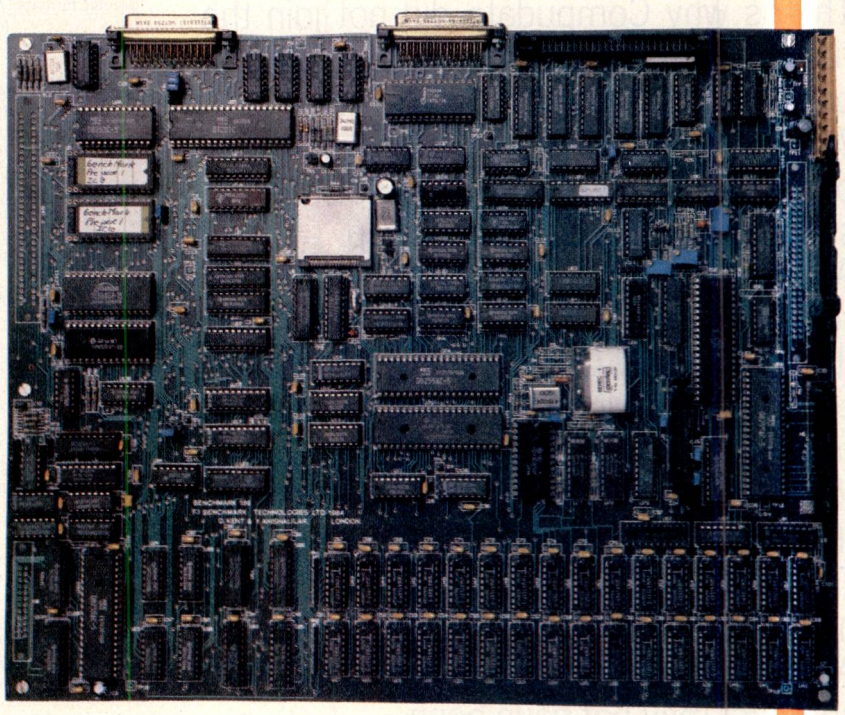

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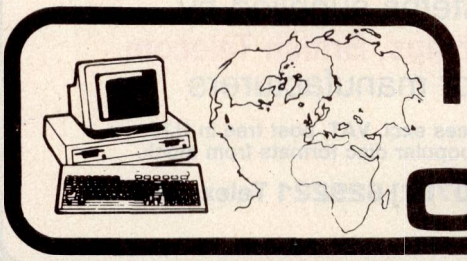

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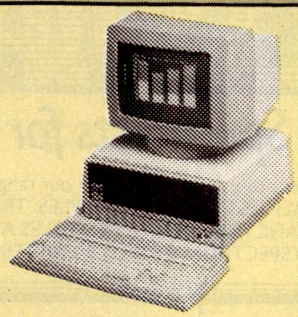

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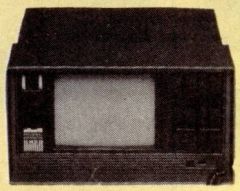

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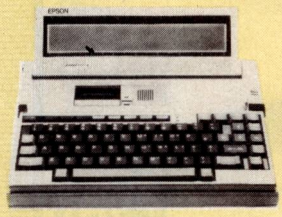

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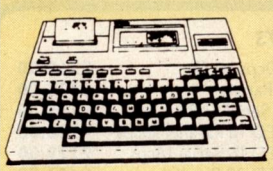

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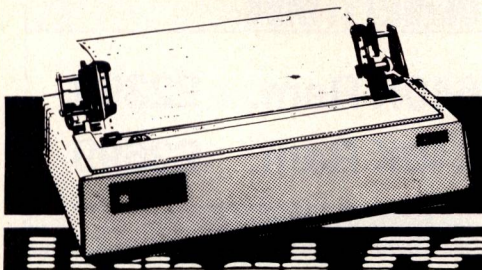

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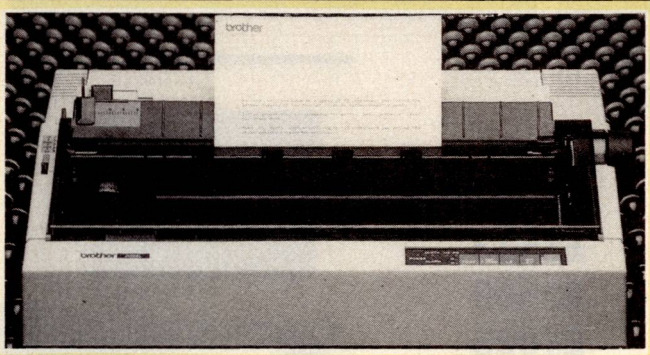

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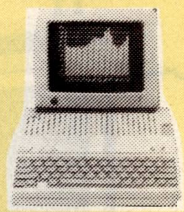

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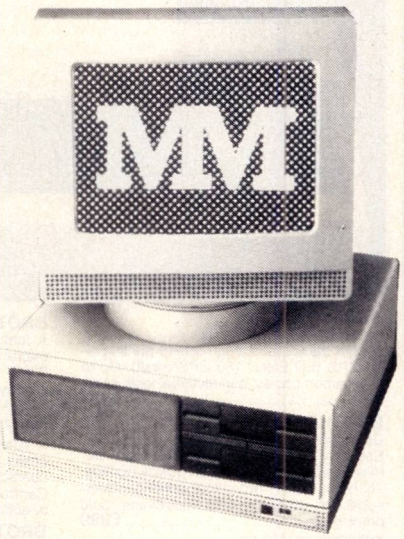

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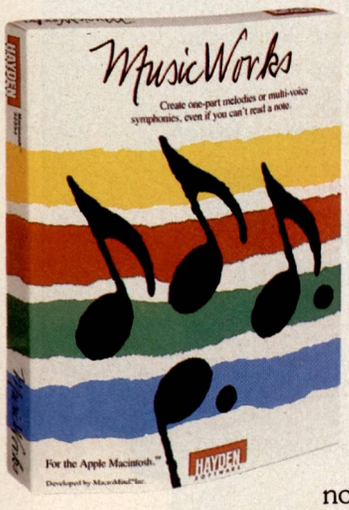

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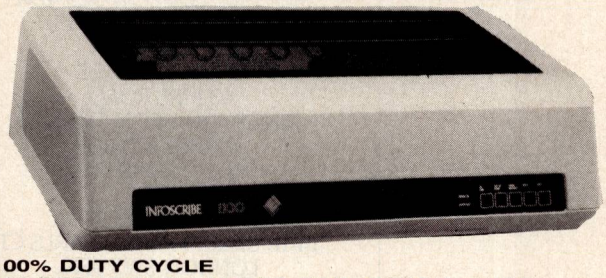

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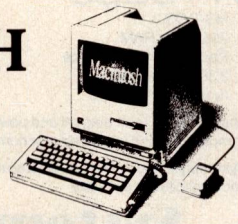

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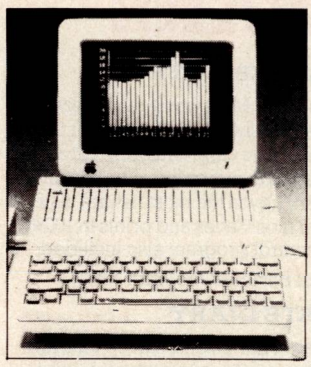

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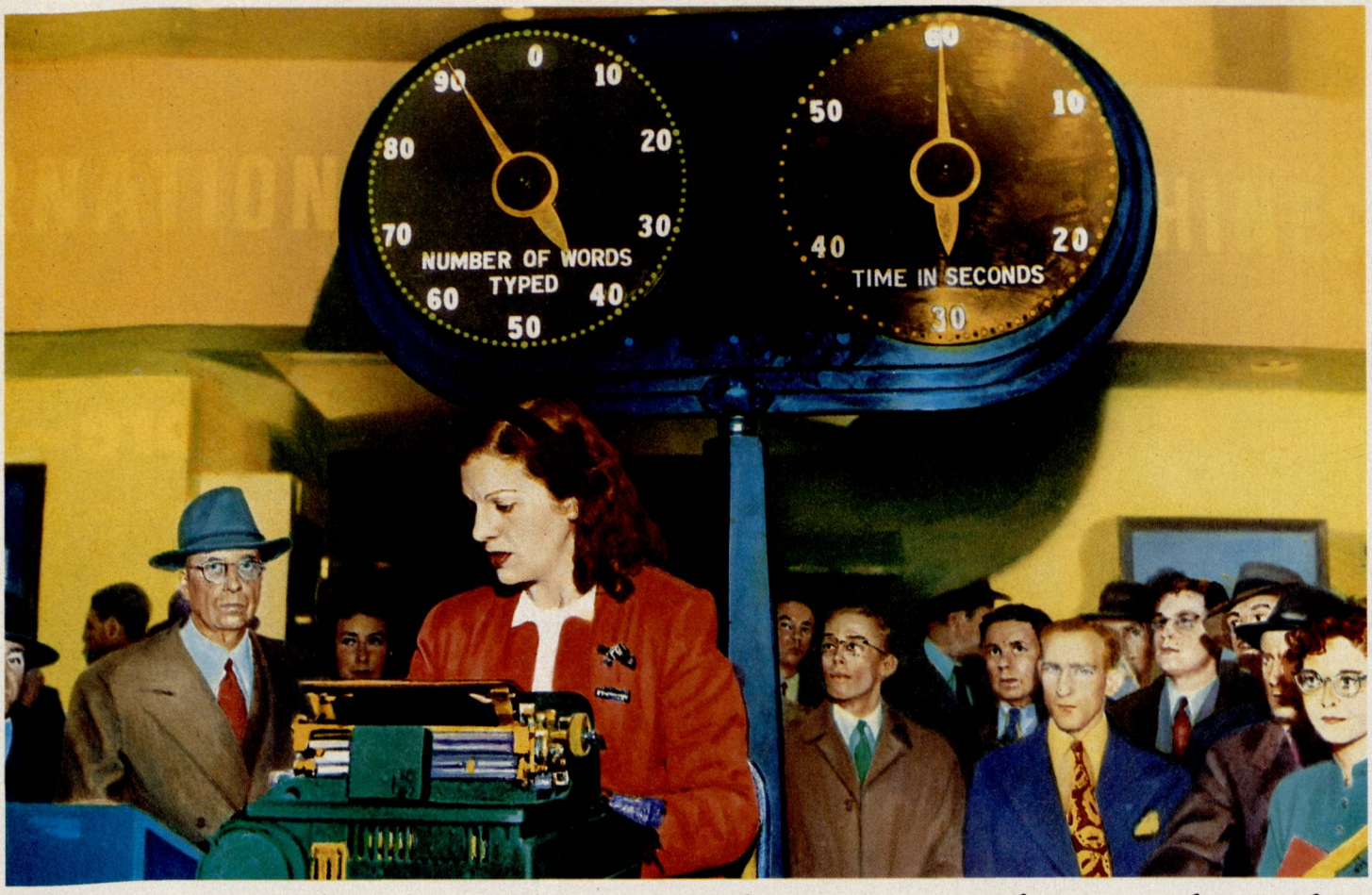
Typing Tutor III™

Simon & Schuster, Inc.



Miss Carruthers beats the clock, thanks to Typing Tutor III™

Deer... Der..... Dear Sur..... Dear Sirr....

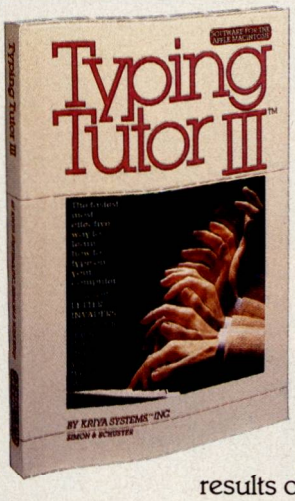
Miss Carruthers fumbled for her correction fluid once again. So much of the stuff was brushed on her letters, they had to be sent by parcel post.

It was costing Harry Armitage, her boss, a fortune.

So he decided to invest in Typing Tutor III.™ The revolutionary typing instruction program from Simon and Schuster.™

After all with a recently acquired computer in the office, she'd have to sharpen up her skills pretty quickly.

TYPING TUTOR III – THE KEY TO BETTER COMPUTING



Available for the Apple II,™ Apple Macintosh,™ Atari,™ Commodore 64™ and IBM PC.™ Typing Tutor III allows professionals, students, writers and secretaries to utilize the power of a personal computer to the full.

It's composed of a series of self-paced custom designed typing lessons and tests. All of which are automatically adjusted to match your ability and progress levels.

Typing Tutor III contains a feature called Time Response Monitoring.™ TRM™ analyzes the results of each test and clearly shows your speed, accuracy, strengths and weaknesses. And to help you see the error of your ways your progress is reproduced in graph form.

EXTRA TERRESTRIAL TYPING

Typing Tutor III also comes complete with Letter Invaders.™ An exciting arcade-style game in which you have to defend earth from invading fleets from outer-space. As each letter or symbol comes into view, blast it by typing it on the keyboard. As your typing gets faster the game gets faster.

Typing Tutor III is simplicity itself to use and comes complete with reference manual.

It's available from your local Softsel dealer along with over 2,600 other titles from over 250 publishers.

Miss Carruthers typing improved beyond all recognition. So much so that Harry Armitage entered her for the Typing World Championships.

And although she romped home with a top score of 160 wpm. he knows of one lady who could beat his secretary out of sight in the words-per-minute stakes.

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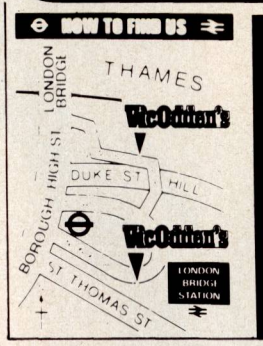

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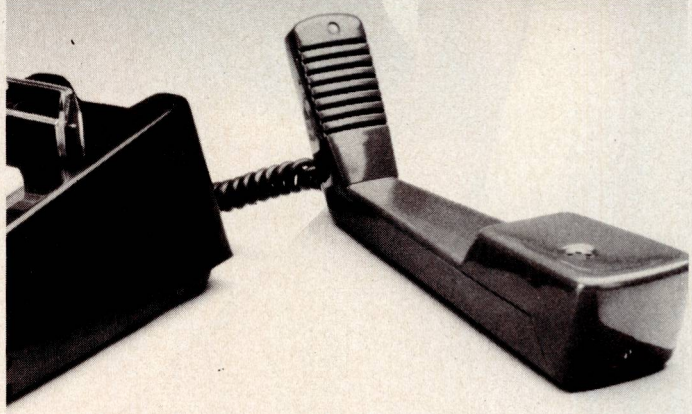

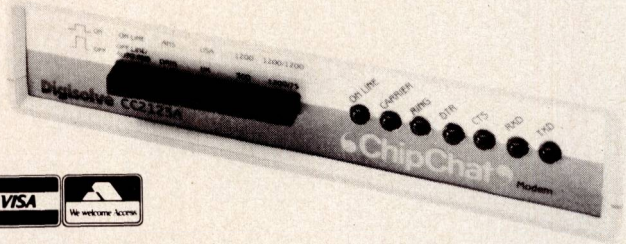

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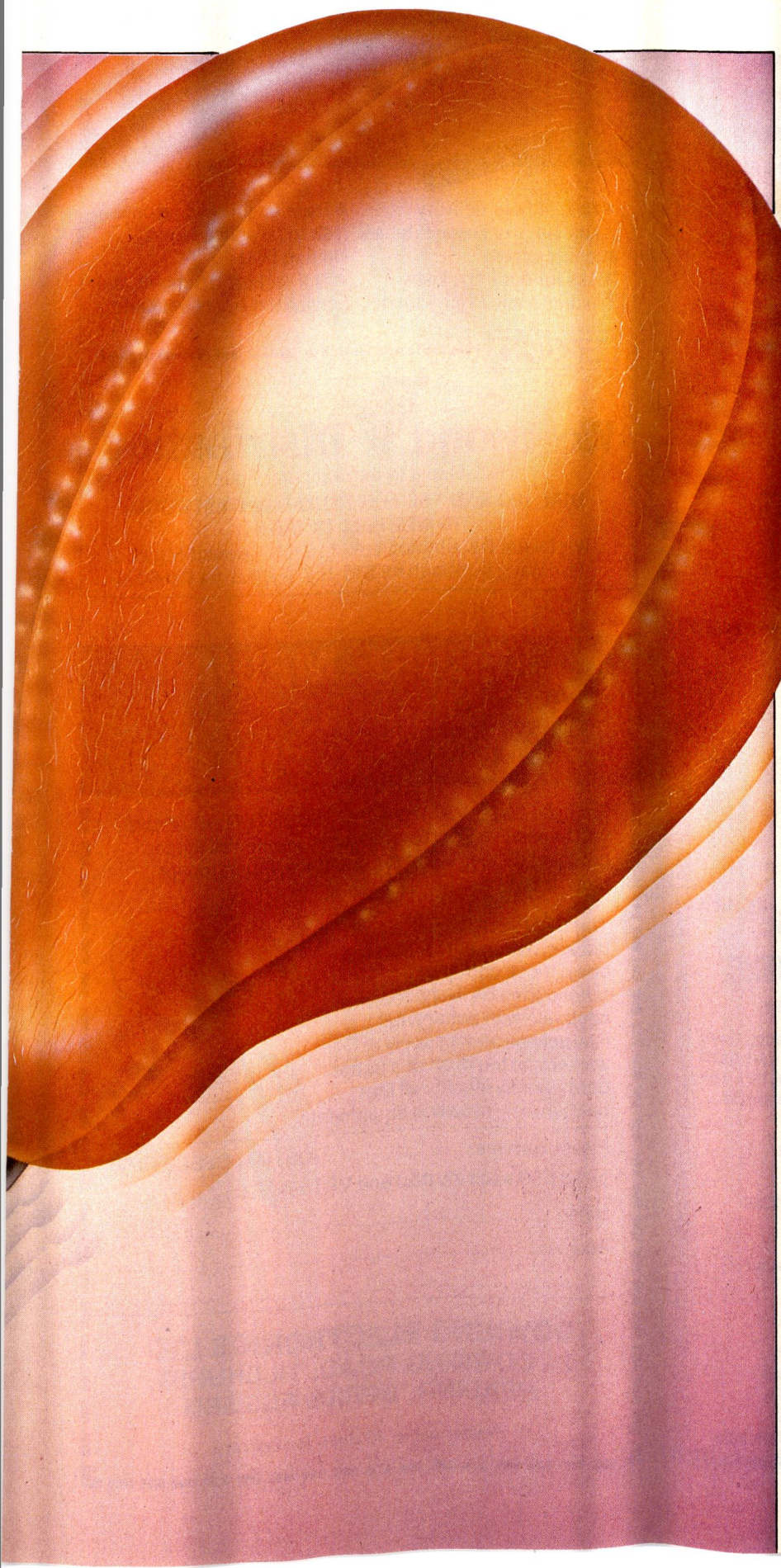

The main event in personal computing has got to be the Personal Computer World Show at Olympia.

It's where the big names and the up-and-coming stars will be put through their paces this September. You'll see a massive line-up of contenders with hardware, software and peripherals from the whole world of the micro. Which means there's something for everybody.

So, whether you're a cold blooded professional or simply an enthusiast, you'll profit from the experience.

Over 45,000 micro users did last year. And this September's PCW Show will be even bigger. With new special features like the Applications Advisory Service, Business Advice Centre and workshop sessions through the National Computing Centre, the Micro Home of the Future, Top Twenty Games, Micros in Education and a separate hall exclusively for business computer buyers.

If your interest in personal computers is business or professional, or if you simply want a family outing that's informative and fun, you must get to the Main Event.

The arena is Olympia, London. The dates are 4-8 September.

For advance tickets at £2.00 each, ring PCW ticket office on 01-486 1951 with your Barclaycard or Access number or write with your cheque to PCW Show, 11 Manchester Square, London W1M 5AB.

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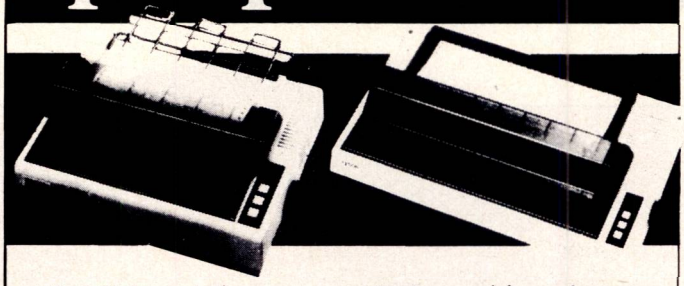

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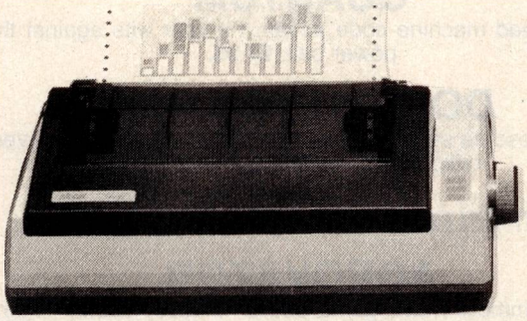

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Character Sets

96 Standard ASCII Characters
88 Standard International Characters
96 Italic Characters
88 Italic International Characters
96 NLQ Characters
88 NLQ International Characters

Character Matrix

Standard Characters: 9 dot × 11 dot
STAR Block Graphics: 6 dot × 6 dot
IBM Block Graphics: 12 dot × 11 dot
User Defined: 8 dot × 4 to 11 dot
Near Letter Quality: 17 dot × 11 dot

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Normal (10 CPI)
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- Commodore 64 version available shortly

Star SG-10 £259 + VAT	**£297.85**
Parallel cable for any Micro (max. price)	**£20**
2 Spare ink ribbons	**£5**
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T-base relational database, Travelling Writer menu-driven text formatter, and IDEA! – the powerful new outline processor all on one 32K ROM for only £175 (ex VAT).

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8K RAM chips for NEC and Tandy
Data recorders
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ATARI ST

520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizeable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below: 1) TOS -Tramiel Operating System based on CPM 68K. 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment. 3) DR GEM Paint for creating graphics masterpieces. 4) DR GEM Write for word processing. 5) Logo learning language to enable you to write your own programs easily using turtle graphics. 6) DR Personal Basic a powerful user friendly version of the Basic programming language. 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3½ inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to do battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:

- ★512K RAM
- ★B/W MONITOR
- ★MOUSE
- ★500K 3.5" DISK DRIVE
- ★GEM
- ★KEYBOARD (95 KEYS)

£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
16K ROM expandable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

GRAPHICS
Individually addressable 32K bit-mapped screen with 3 screen graphics modes:
320x200 pixels in 16 colours (low resolution)
640x200 pixels in 4 colours (med resolution)
640x400 pixels in monochrome (high res)
16 shades of grey in low res mode
512 colours available in low/medium res
8 levels of each in red, green and blue

ARCHITECTURE
4 custom designed chips:
GLUE Chip - MMU Memory Mngmnt Unit
DMA Controller - Graphics Processing Unit
16/32 bit Motorola 68000 processor at 8MHz
eight 32 bit data registers
eight 32 bit address registers
16 bit data bus/24 bit address bus
7 levels of interrupts/56 instructions
14 addressing modes/5 data types

DATA STORAGE
High speed hard disk interface
Direct memory access 1.33 Mbytes per second
CD (Compact Disc) interface
Built in cartridge access
Dedicated floppy disk controller

DISK DRIVE
500K (unformatted) s/sided 3½" floppy d/drive
349K (formatted) storage capacity

SOUND AND MUSIC
Sound Generator
Frequency control from 30Hz to above audible
3 voices (channels) in wave shaping sound in addition to a noise generator
Separate frequency and volume controls
Dynamic envelope controls
ADSR (Attack, Decay, Sustain, Release)
Noise generator
MIDI interface for external music synthesizers

KEYBOARD
Separate keyboard microprocessor
Standard QWERTY typewriter styling
Ergonomic angle and height
95 keys including 10 function keys
Numeric keypad — 18 keys including ENTER
One touch cursor control keypad

MONITOR
12" screen - high res monochrome monitor
640x400 monochrome resolution

VIDEO PORTS
Display - Low Resolution - 40 columns
Med/High Res - 40/80 plus cols
Medium res RGB (Red/Green/Blue) output
High resolution monochrome (Black & White)

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 2 button mouse)
MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
WIMP - Window Icon Mouse Pop-down menus
Two button mouse controller
Icons/Pull down menus/Windows
GEM VDI - Virtual Device Interface
GEM AES - Application Environment Services
GEM BBT - Bit Block Transfer
Real time clock & calendar

SOFTWARE
GEM environment
with user friendly Macintosh style operation
'TOS' - Tramiel Operating System
Atari's own system based on CP/M 68K with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
'BOS' - Business Operating System
to run any standard BOS business programs
GEM desktop
with GEM PAINT graphics mgmt system and GEM WRITE word processor
Personal BASIC and DR Logo
originally written by Digital Research (DR)
Very much like those on other machines except for the extensive use of pull down menus, mouse control and windows

VARIOUS
Dimensions: 470mmx240mmx80mm
Replaceable external power supplies
Expansion: 3½" floppy disk drives 500K/1,000K (two drives can be connected)
3½" 15Mb hard disk
CD (compact laser disc)
Dot matrix & d/wheel prntrs (black)
Thermal dot matrix (colour)
RGB & monochrome monitors

LANGUAGES
BASIC & LOGO supplied
Many others will soon be available, including: Assembler, BCPL, C, Cobol, Compiled Basic Lisp, Modular-2 and Pascal

Note: Some of the above specifications are pre-release and may therefore be subject to change

MACINTOSH v F16 v 520ST

"Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price."
June 1985 - Jack Schofield - **PRACTICAL COMPUTING**

	APPLE	APRICOT	ATARI
FEATURES OF BASIC SYSTEM	**MACINTOSH**	**F16**	**520ST**
Price Includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5¾x2	17½x6½x1	18½x9½x2½
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (16 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	**£2,984**	**£1,362**	**£749**

PRESS COMMENT

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is war'."
August 21st 1984 **FINANCIAL TIMES**

"This is the only personal computer I know of that comes with a Midi interface as standard."
Peter Bright March 1985 **PERSONAL COMPUTER WORLD**

"The (GEM) version running on the Atari 68000 machines will have the additional advantage of leaving the PC version standing."
April 6th 1985 **PERSONAL COMPUTER NEWS**

"It would seem that GEM offers the ideal operating system."
March 7th 1985 **POPULAR COMPUTING WEEKLY**

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
Peter Bright Feb 1985 **PERSONAL COMPUTER WORLD**

"The electronics in the machine are a work of art ... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip ... when the machine appears in the shops, I'll be at the front end of the queue to buy one."
Peter Bright June 1985 **PERSONAL COMPUTER WORLD**

"This machine is significantly more powerful than an IBM PC ... If it's possible to design a sure-fire winning machine, this is it."
May 11th 1985 **PERSONAL COMPUTER NEWS**

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour), that they are already being called 'Jackintoshes'."
May 2nd 1985 **COMPUTING**

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying — easy-to-use computing power without the price."
March 1985 **ANALOG COMPUTING**

"It (the ST) uses the most modern technology that is affordable, in a package that gives a professional impression."
May 23rd 1985 **POPULAR COMPUTING WEEKLY**

"The Atari ST is one of the most elegant designs I have seen ... Atari has used an original and elegant method of memory management which should make the ST faster than any other PC on the market - in any price bracket ... The 64K dollar question is would I go out and spend money for one? To which the only answer is 'Try and stop me!'"
John Lambert July 1985 **ELECTRONICS & COMPUTING**

"The 520ST is technically excellent ... The 520ST hardware is the new standard by which others will be judged."
July 1985 **YOUR COMPUTER**

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PC WEEK

PILOT ISSUE APRIL 1

WEEKLY FROM WEDNESDAY SEPTEMBER 4

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PC Week, a glossy tabloid newspaper, will appear for the first time on Wednesday 4 September, and from then on will provide a unique news media for both readers and advertisers – every week.

PC Week caters for a new generation of professional micro users and has been developed by VNU – the UK's biggest computer publisher – in partnership with Ziff-Davis, publisher of the hugely successful *PC Week* in the USA.

response to a new but increasing demand for information in a market whose development continues to be remarkable.

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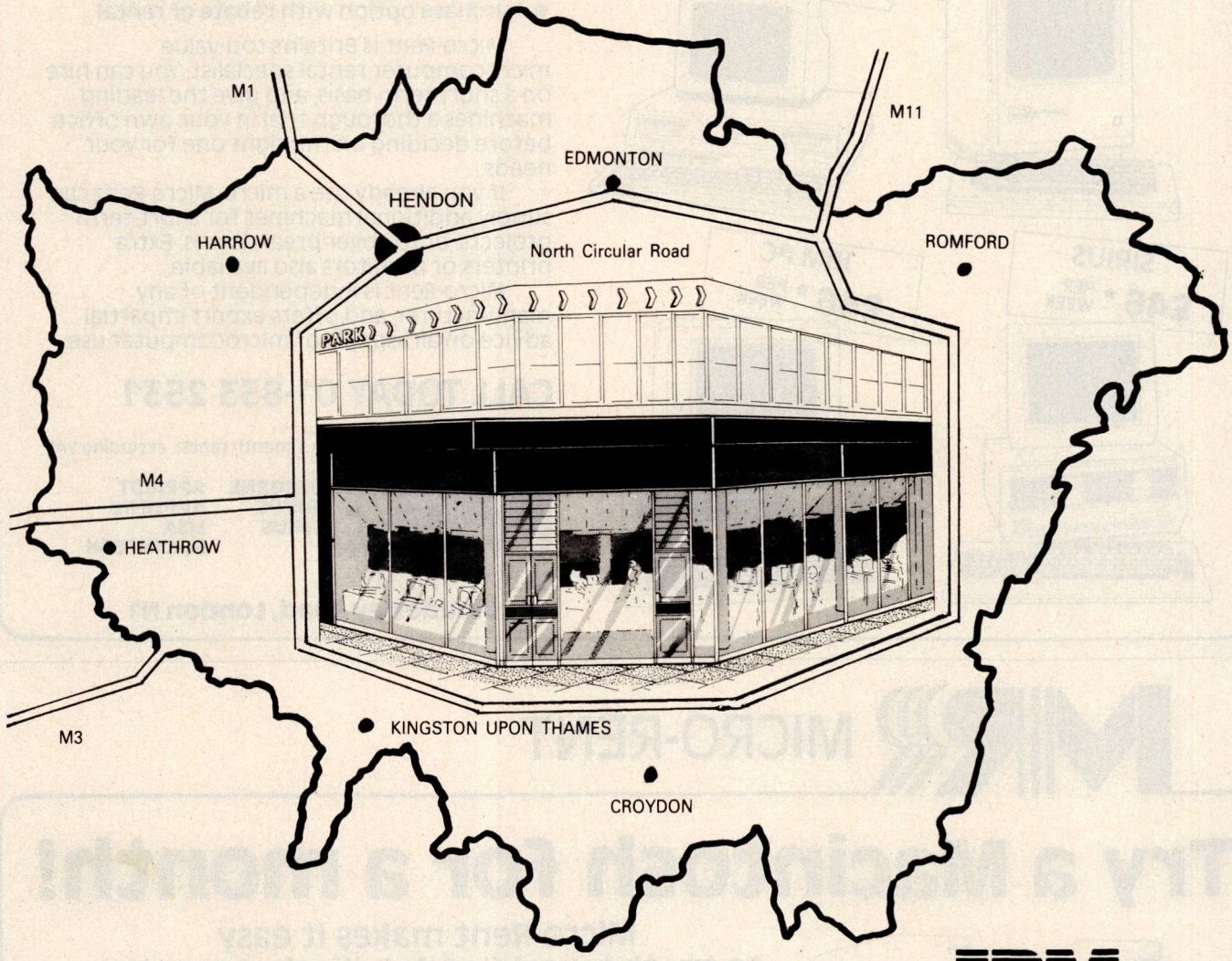

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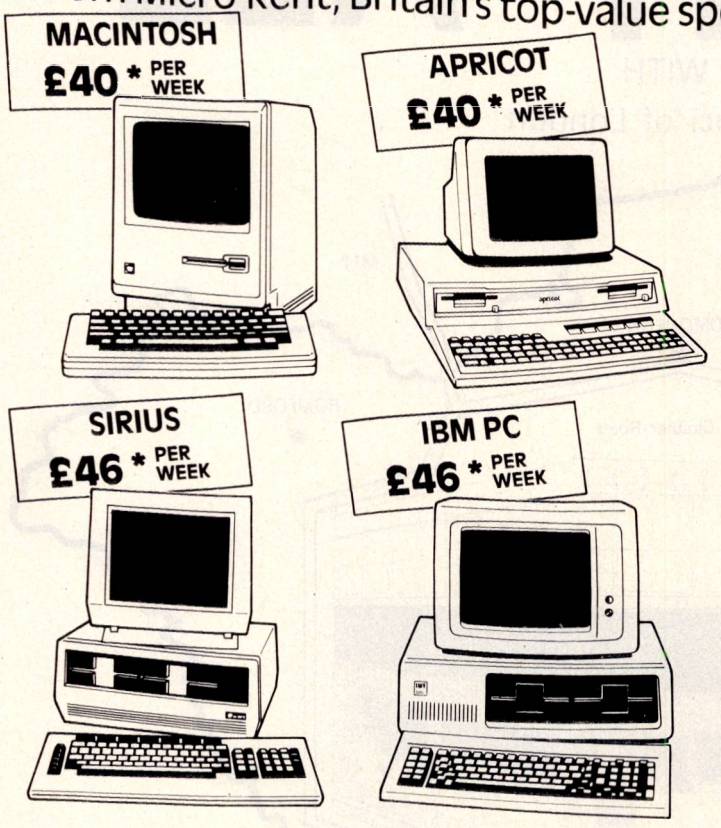

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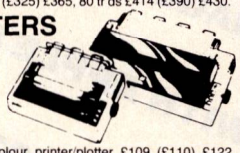

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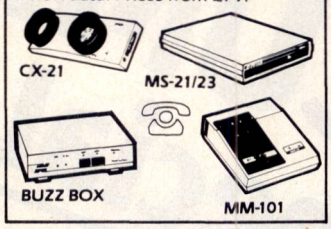

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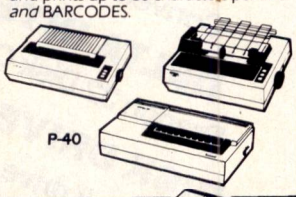

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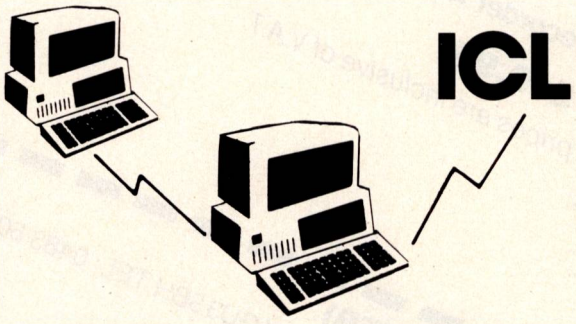

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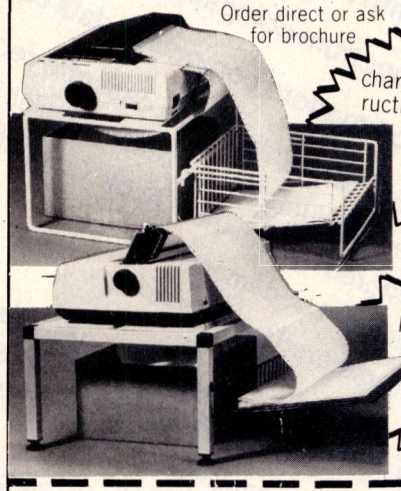

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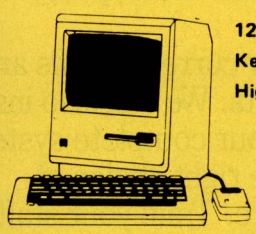

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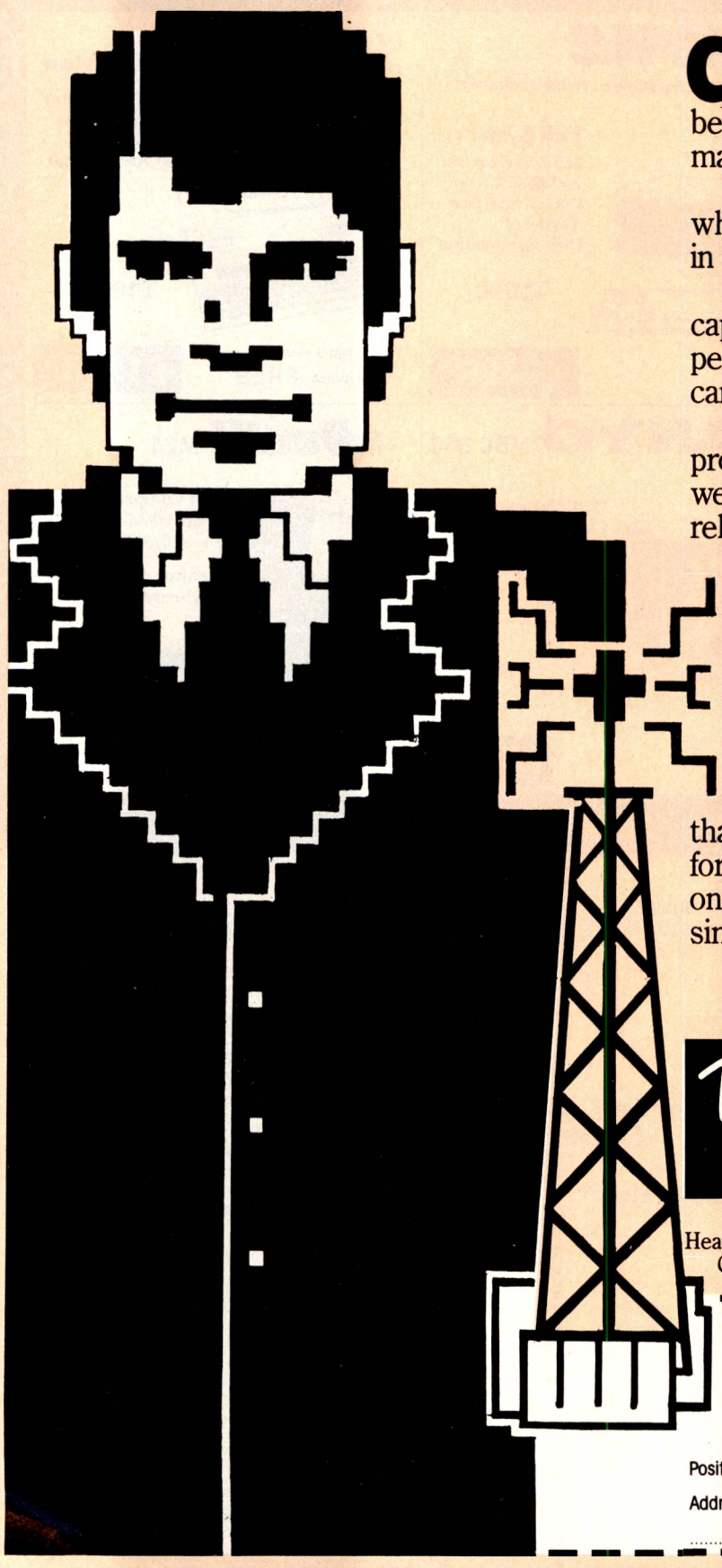

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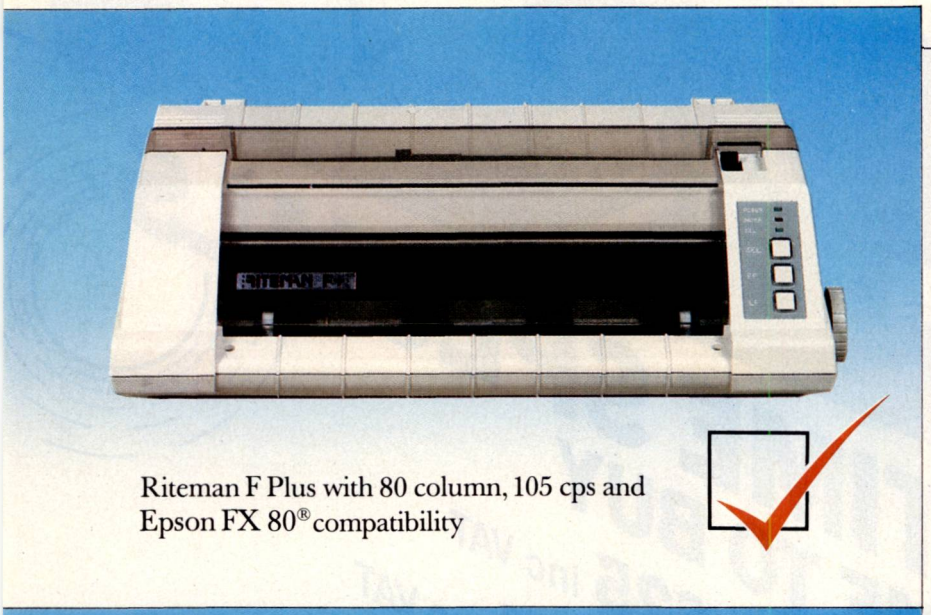

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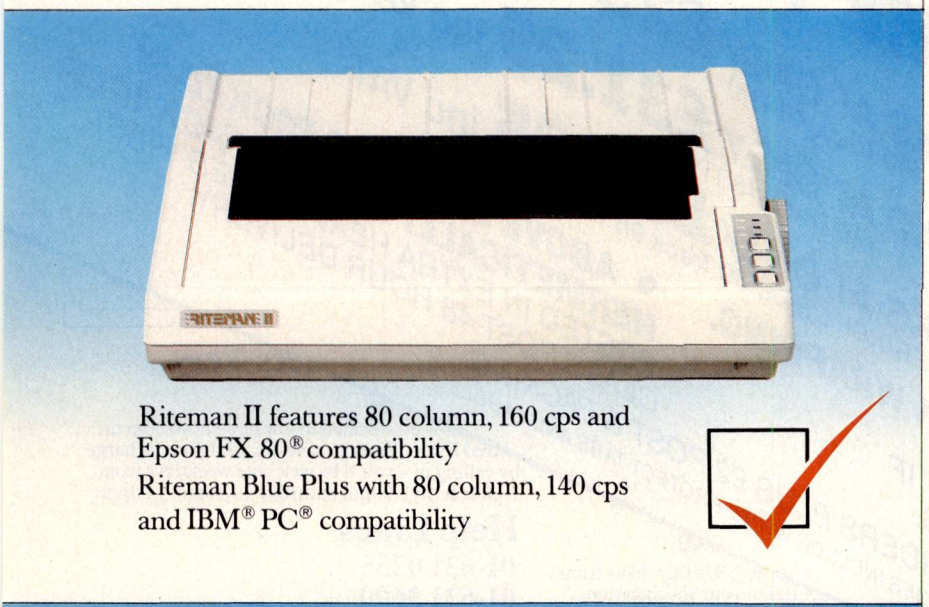

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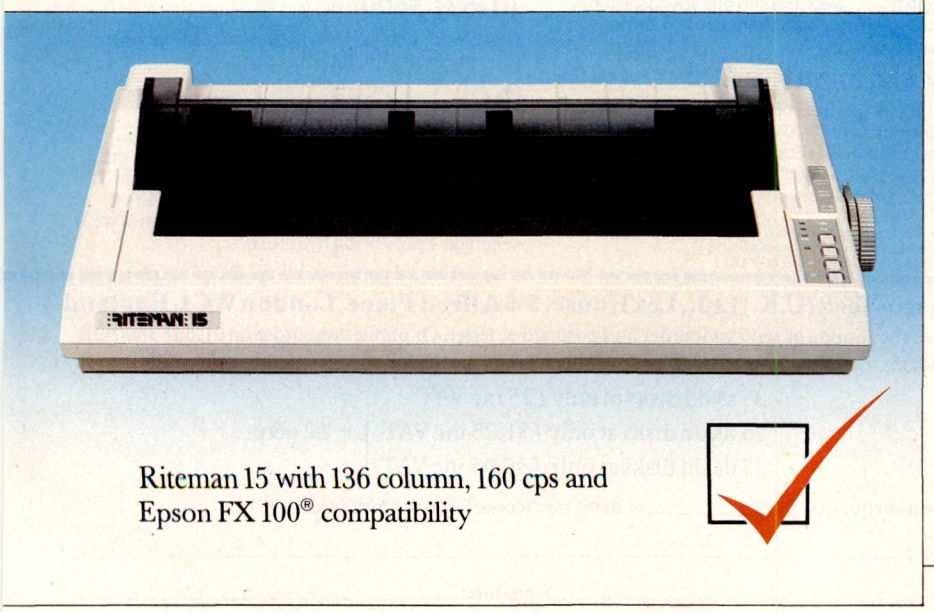

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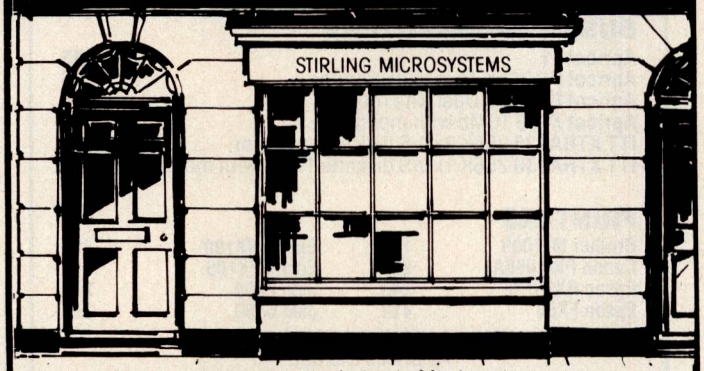

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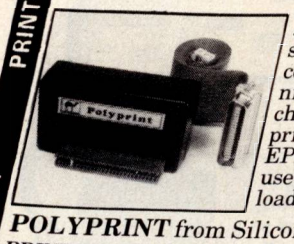

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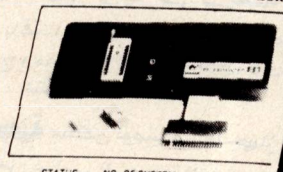

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RAM START ADDR —4000
EPROM ST ADDR — 0000
JOB LENGTH — 4000
TASK — CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
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Q TO QUIT R TO RESTART
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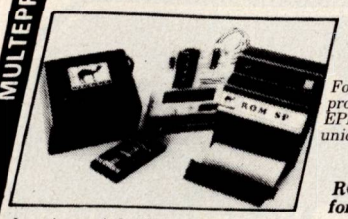

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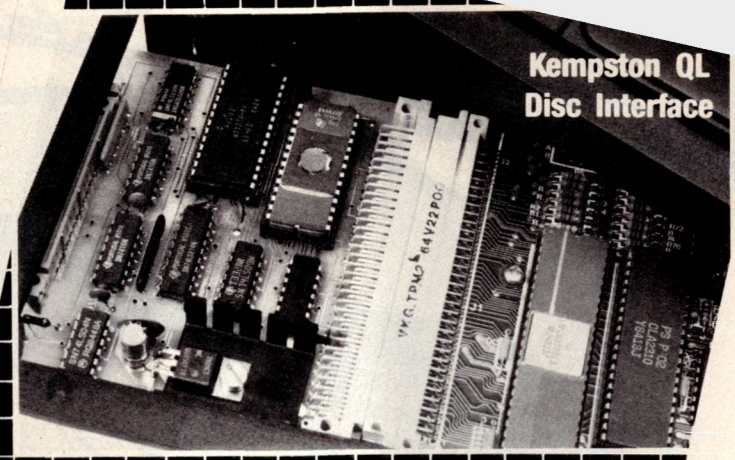

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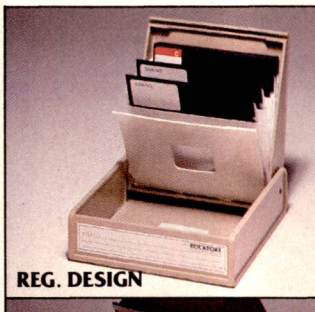

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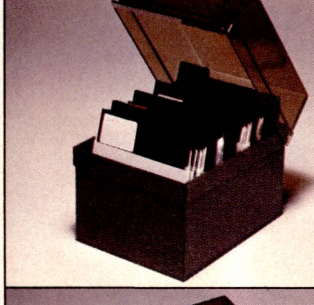

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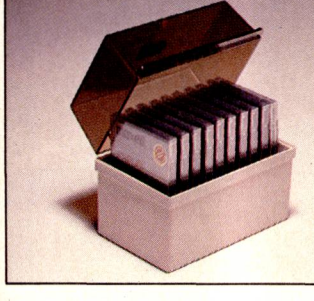

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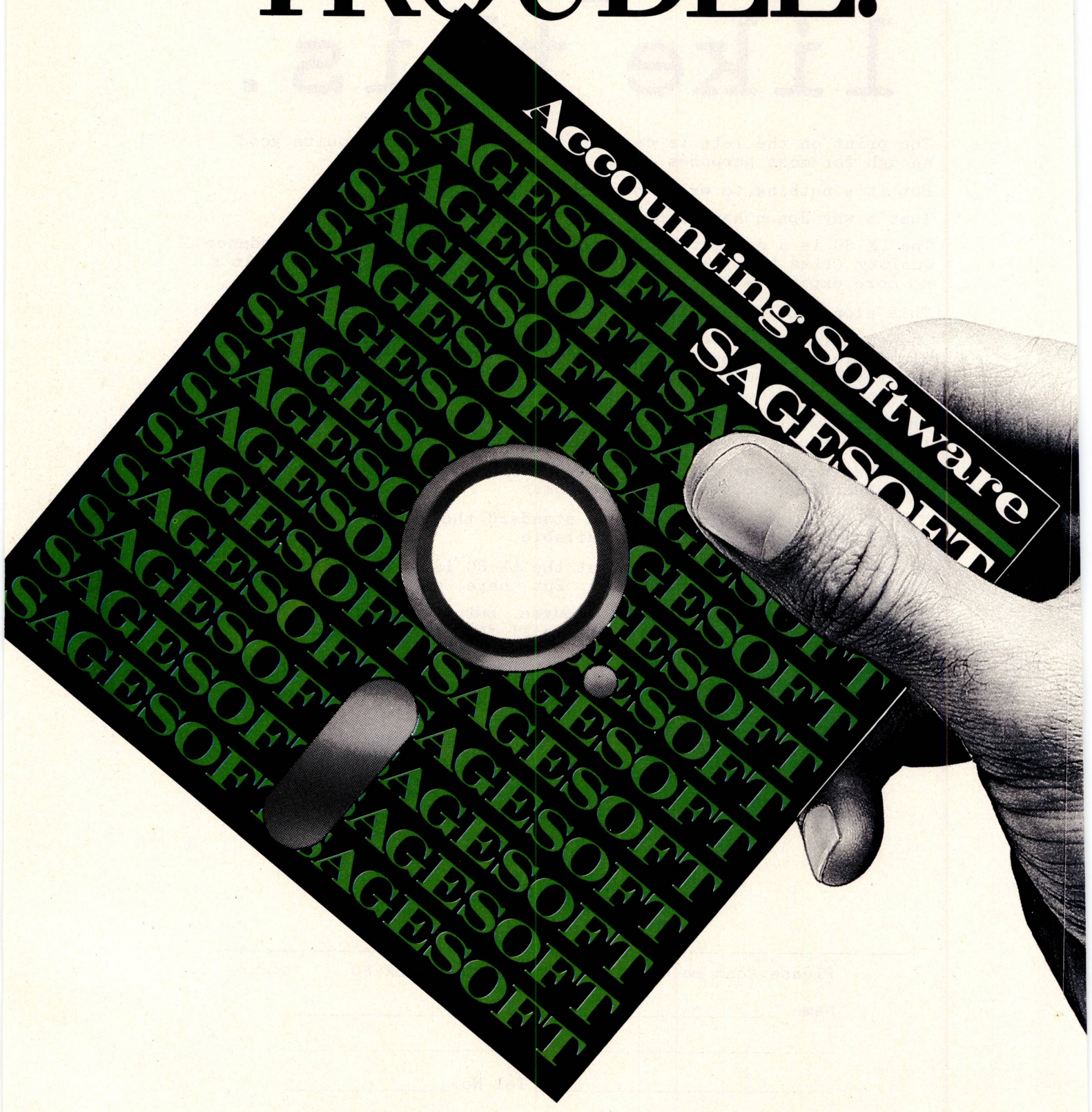

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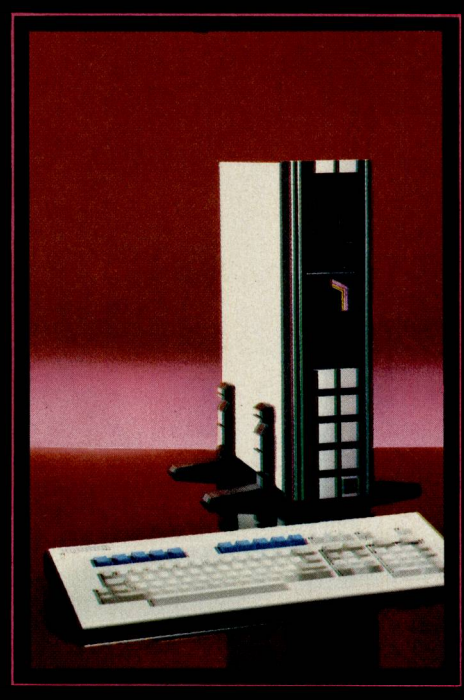

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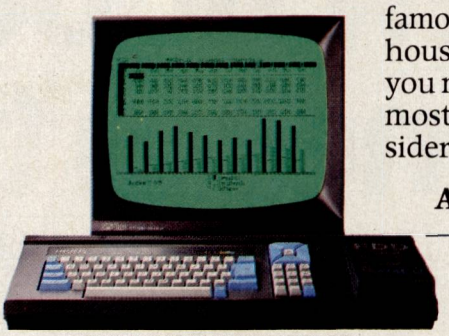

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Among the system's impressive list of capabilities are:

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These advanced features represent a significant step forward from the existing and very successful Bitstik Graphics System. Yet Bitstik 1 users can obtain Bitstik 2 at a Special Upgrade Price.

Bitstik 2 is produced in the UK by Robocom, the people behind the best-selling Robosystem family of CAD packages for the Apple II (+ or e) micro. To run Bitstik 2 you will need a BBC Model B with 6502 Secondary Processor, Twin Disk Drives and colour or monochrome monitor. Quality hard copy can be produced from a wide range of supported plotters.

So whether you need to produce complex architectural plans, detailed circuit diagrams or simply teach CAD on a fully implemented CAD set-up (with scope for advanced project work) you ought to be tuning into Bitstik 2 for your BBC...

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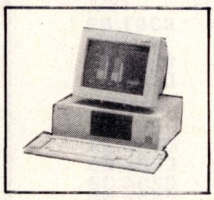

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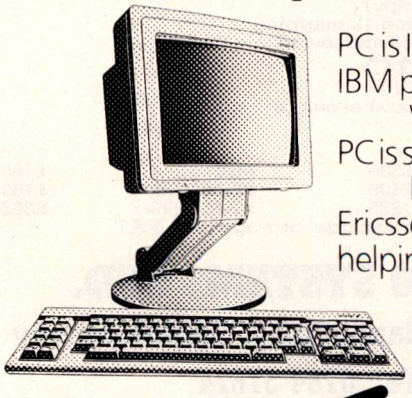

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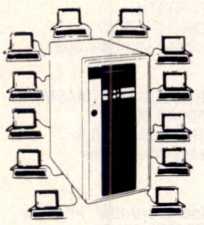

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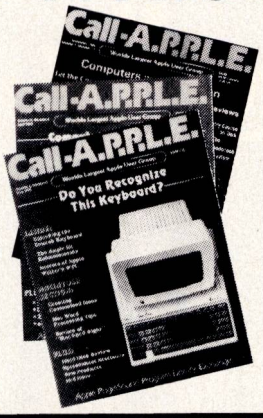

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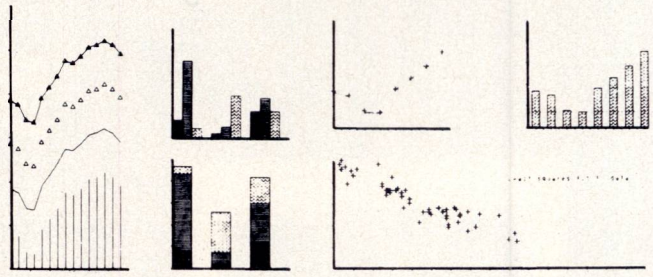

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C	25.00	34.95		*	(MON QL)
Ultrakit	9.45				
Font64		7.95	(Font designer/screen dump)		
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PCW SHOW FOCUS

The 8th Personal Computer World Show

The 1985 PCW Show at Olympia, London, is the industry's annual showcase. Here's the second look at what's on show for personal computer users in business, industry and education, and for the home computer enthusiast.

The winning combination

The combination of changing technology and increased competition is making more computer power available to more users than ever before, and the PCW Show is the place to find out just what that means: wider choice, improved performance and better value.

There's something for everyone at Olympia in September: for business and professional users, for teachers, for families — and of course for every personal computer enthusiast. Alongside the big names, you can also find many smaller, specialist firms and an unrivalled range of features designed to inform, to educate and to entertain.

For the first time since moving to its new Olympia home, the show occupies two halls. Olympia 2, scene of last year's event, will this year cater for business and professional users only. That's where to find the ATs and XTs, Apples and Apricots, plus the special PCW Show help and advice services for business users, particularly first-time users.

Next door in the National hall is where the "battle of the giants" takes place, with Atari, Commodore and Amstrad lined up right inside the front door — all offering powerful machines for the enthusiast and small-business user. This hall is also the setting for Britain's biggest selection of games software, and features such as the "living room of the future" sponsored by a big name in MSX computing, Toshiba.

For business and professional visitors, complimentary tickets are available. These include the facility for advance registration, by-passing the cash desks and registration counters at the entrance to the show.

Admission for all other visitors is £2.00 (with a discount for groups). These can be bought in advance using the coupon inside this PCW Show Focus feature.

Tour the new technologies

An easy-to-understand presentation dealing with the impact of new computing and communications technologies in the corporate environment will be one of the highlights of Olympia 2, the business and professional hall.

Covering such developments as networks, mini and mainframe links, electronic mail and corporate information systems, the area will include displays, videos and small-group seminars. It is intended for professionals in partnerships and firms, managers and their staff in company departments — in fact anyone who works as part of a group.

This Corporate Computing Centre will be organised to give visitors a "conducted tour" of the new technologies and their impact, catering for different levels of understanding.

CAD system at low cost

KGB Micros, which attracted a lot of attention at last year's PCW Show with the Torus Icon network software, expects a similar impact this year with Autocad, the micro-based design system.

Originally developed as a low-cost CAD system for engineers, Autocad is now finding friends in an increasingly wide range of businesses, says KGB's Sandy Saunderson. Recent customers have included interior designers, airconditioning installers, electronics firms using the system to produce pcb schematics and even stockbrokers using it to draw flowcharts.

Success with Autocad, he says, is attributable to two factors: the capability of the product itself, which has become almost an international standard for micro-based drawing systems, and KGB's own investment in specialist staff, who will be on hand at the show to demonstrate the system and



Atari chief Jack Tramiel will personally spearhead the launch of the much-heralded 520ST on the opening day of the Show. The outspoken Tramiel says the "power without the price" of the new machine will mean another revolution in computing. For anyone unfamiliar with his style, this is how he introduced the 520ST in the US: "We're in the business of People's Technology. And as Henry Ford said, for every dime you remove from the cost, a whole new stratum of buyers is revealed. I believe it, and that's how this business is going to be from now on."

Atari has been working with many leading software houses for several months, and expects to have about 100 software packages demonstrated on its stand in Olympia's National hall — the majority being for business and education users. The mouse-driven GEM graphics environment comes as standard on the 520ST, making the operating system "easier to use than explain" and Atari says that a full range of software and peripherals will be available when the machine goes on sale.

The 520ST debut marks a new round in the fight for the small business machines market, with Amstrad and Commodore among the other contenders at the Show. All three will be found on the ground floor of the National hall.

PCW SHOW FOCUS

answer visitors' queries.

The latest version of the system has a 3D capability, and also on demonstration at the show will be CADCamera, which can scan drawings in minutes to store the information on the computer for incorporation in future designs. This appeals to users such as building services engineers who have to plan new installations within existing buildings, for which drawings are already on file.

Helping hands for buyers

This year for the first time, the PCW Show provides some special features designed to help buyers in choosing the hardware, software and systems for their particular business. It's often difficult to discover what software is available for specific applications, so at PCW Show we are providing two key sources of advice and information.

The most extensive of these is the consultancy area, which brings together a number of specialist consultants and the Applications Software Advisory Service, sponsored by Micro Decision magazine. This is a database system which lists every available piece of business software for personal computers, identifying the application, supplier, operating system and other details — whether or not it is being demonstrated at the show.

On the ground level there is the NCC Microsystems Centre stand on which will be running the NCC Directories on Disc, providing up-to-date information on more than 5 000 business software packages.

Next door in the PCW Show lecture theatre, a team from the Microsystems Centre will be running daily seminars on how to choose your system. These sessions cover the main issues involved, starting with the question why use a micro at all? The NCC view is that one business in four needs a computer "like a hole in the head" while for the other three the key to a successful, effective system, is one part discipline, one part training and operation, and one part dealer support.

The seminars will be given at 10.30 and 2.30 on Wednesday, Thursday and Friday, September 4, 5 and 6, and at 2.30 only on Saturday September 7. The fee at the door will be £25 + VAT, but for those booking in advance there will be a 50% discount, making the fee £12.50 plus VAT.

New Philips range debut

In a renewed assault on the UK market, Philips, the European electronics giant, is launching its latest range of machines at the PCW Show, with first deliveries to end-users following a few days later. First shipments have been placed with leading software houses since the end of June to ensure early implementation of a wide range of business packages, and Kingsway Data Services, the UK distributor, says the launch has been planned to ensure adequate stocks from the start.

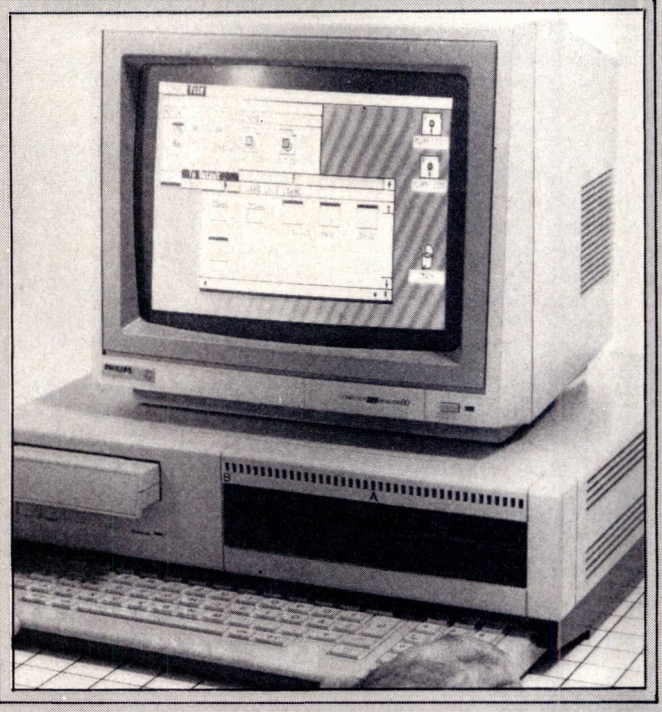
There are three machines in the range, all priced and packaged very competitively. The entry-level machine, selling for about £1000 has 128k memory and one 720k 3½ in. disk drive — a configuration which will appeal to first-time business users and the education world. Next up the scale comes the £1500 twin-disk machine, and at the top of the range comes a 10Mb hard-disk model. The main operating system is DOS Plus, which resides in ROM so that the main memory, which is expandable to 640k, is almost entirely available to the user.

In addition to DOS Plus, MS-DOS and Concurrent DOS are also available, and GEM will be available shortly. Language versions offered are GW Basic and DR Logo. The twin-disk machine comes complete with Open Access. This is an integrated business system which includes a powerful database, graphics, WYSIWYG wordprocessing, and a spreadsheet which features 'goal-seeking' — you provide the desired solution and the computer calculates the starting figures.

The machine has a comparatively small footprint, (42 × 36cm for the main system box, into which the keyboard clips when not in use) and weighs in at 5.5kg, putting it comfortably in the luggable class. A further aid to using the machine out of the office is the ability to substitute a domestic colour TV for the monitor, using a simple adaptor.

Kingsway has been closely involved in the development programme over the past two and a half years. Peter Crawley, the firm's technical chief, has recently returned from Philips in Vienna, where he was involved in implementation of operating systems, and the company offers a 24-hour delivery service from its base in Chertsey, Surrey, to the UK dealer network.

Stella Tempest, a Kingsway director, says that the September launch is being carefully planned to ensure that there will be no shortage of products in the weeks and months following the Show — and that means applications software as well as the Philips hardware. A number of systems for vertical markets are being developed in conjunction with software houses, and among those which are expected to be demonstrated at the Show are systems for newsagents, hotels, the building industry and golf clubs.



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PCW SHOW FOCUS

Award for school projects

London Plus, BBC Television's London and South East news programme, is sponsoring a new award for schools which will be presented at the PCW Show. The awards will go to the school team or individual using a micro to the best advantage in the study of another specific subject — not computers.

The variety of schools computing projects grows daily, ranging from a fish farm controlled by a micro to a Logo turtle used to draw dress patterns for needlework students, and it is applications such as these which are now being sought by London Plus.

The 1985 projects, which will be submitted for The London Plus Schools Micro Awards will be judged by a team of specialists who will be looking for the imaginative use of the new technology to obtain practical and interesting results.

First prize is £1000-worth of equipment, hardware or software, followed by £750 and £500-worth for the second and third placings, all to be selected at the Show.

Also of interest to teachers is a help and advice area, the PCW Show Computers in Education feature. Located in the main National hall, this will be manned by teachers or former teachers with first-hand experience of using computers in primary and secondary schools, and in higher education. They will be able to answer questions, help in solving problems, and demonstrate some of the projects undertaken with their pupils and students.

The stand is sponsored by Computers in Education Journal, the specialist publication, which operates a comprehensive database listing thousands of educational hardware and software products, all listed and cross-indexed by age, subject and other parameters including operating system. The system will be operating on the stand so that teachers and others involved in the education world, such as advisers, trainers and local authority support staff, will be able to identify the products which meet their needs.

Complimentary tickets for individual teachers are available in advance from the show organisers and these are valid for any day of the show. Admission at the door is £2.00; groups of 10 or more (including school parties) can obtain a discount of 50p per head by booking in advance but this is only available for Friday-Sunday, 6-8 September.

Record entries for efficiency and innovation Awards

More than 40 firms have already entered the 1985 Standard Micro Business Awards. Sponsored by The London Standard newspaper, the awards are given for innovations in hardware and software which offer "outstanding contributions to business efficiency and profit".

Anthony Hilton, City Editor of The London Standard and chairman of the judging panel, said: "At a time of so much uncertainty in the computer market, the importance of thorough marketing and product development is greater than ever before. The Awards are intended to give recognition to worthwhile efforts in these directions".

The entrants include both major names in the industry and several smaller, specialist software houses. They are being judged by a panel drawn both from the computer industry and the world of business and finance. In addition to Anthony Hilton, other members include Eric Bagshaw of the NCC Microsystems Centre, David Tebbutt, software author and consultant, Graham Cunningham, editor of PCW, together with Michael Jones, finance director of The Standard's publishing company. Presentation of the Awards takes place at Olympia on 4 September, the opening day of the Show.

Among those companies taking part are: Amstrad, Apple, ABS Oldacres, Aston Technology, Enterprise, Kempston, KGB, MicroPro, Olivetti, Philips, Sanyo and Systime.

Walk right in

Complimentary tickets with advance registration are now available for business, professional and trade visitors to PCW Show.

Apply now, and you can receive a VIP visitor pass, so that you can walk straight in at the entrance to Olympia, avoiding the cash desks and eliminating delays.

Both complimentary tickets and visitor passes are valid every day of the show — but business and trade buyers may prefer to attend on Wednesday 4 and Thursday 5 September, when the general public will not be admitted.

Designation of these two Trade & Business Days is a response to the demand both from visitors and exhibitors, who value the extra space and time.

To obtain your complimentary ticket and registration for VIP visitor pass, write on business letterhead to: PCW Show Advance Registration, 11 Manchester Square, London W1M 5AB.

BOOK IN ADVANCE FOR THE No.1 SHOW

To obtain tickets (£2.00 each) in advance complete this form and return to PCW Show 85 Ticket Office, 11 Manchester Square, London W1M 5AB

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Business and Trade Days 4-5 September 1985

Only bona fide business, professional, education and trade visitors over the age of 18 will be admitted on Wednesday and Thursday 4 and 5 September.

Moving into business

Cumana, which made its name supplying add-ons for educational and home-user machines, is now moving into the business market with a number of new products. These include an upgrade board for the BBC which will offer 512k RAM, a full implementation of the OS9

PCW SHOW FOCUS

operating system, plus multi-user and multi-tasking operation. A powerful graphics kernel is also included, and the package also comes complete with a spreadsheet and word processing.

Clive Martin, the company's marketing manager, says the new board gives Cumana "the ability to bring high-quality performance to the High Street at a price well below the usual cost of business machines." In addition to the 512k memory, the board also offers a 68008 processor, controller for up to four floppy disk drives and a SASI interface for one or two hard-disk systems.

The state of the industry

Leading figures from the world of personal computing will discuss the state of the industry at a special Keynote Conference on the opening day of the PCW Show.

Those taking part include Paul Bailey, vice-president of Digital Research, Nick Bessey, head of Commodore UK, and either Roger Foster or Brian Androlia of ACT. In the chair will be David Tebbutt, industry consultant and former editor of PCW.

The event is organised by MicroScope, the weekly newspaper of the industry, which is also arranging three half-day trade conferences. Under the chairmanship of Russ Nathan, managing director of Romtec, these will cover the selling of business hardware and software, selling to home computer enthusiasts, and selling peripherals.

On the air

PCW Show will be on the air this year, with a special edition of Thames TV's Database programme. The Database crew will film at Olympia on the opening day, and the programme, which attracts an audience of more than one million viewers, will be transmitted the following day, Thursday 5 September, in the London area. The following week it will be repeated nationally on Channel 4. Producer Michael Feldman says he cannot yet say what the programme will cover, but it is expected to concentrate on innovations such as GEM.

Special for Business

Business and professional visitors will all receive a free copy of the latest PCW Special — Profit through Business Computing — price £2.25, which will be published at the Show. This latest publication builds on the success of the Business Computing Survival Guide which was published earlier this year, and will be valuable both to experienced users and those buying their first system.

In-depth coverage includes first-hand accounts of several very different users' experiences in using business micro systems, including a small financial institution, a firm of project managers and consulting engineers and a market research organisation. The case studies will examine what each firm did — and why — the selection of hardware and software, the problems encountered, and an assessment of how successful each system has been.

"Icons, windows and mice — a gimmick or the way ahead?" will examine the new approach to operating environments and take a critical look at these techniques.

The PC's role in corporate computing will be examined in a "future history" feature, which will look back from the viewpoint of the early 1990s. Back in today's world, there will also be special articles on gateways and information services — electronic mail systems and major databases such as World Reporter. How good are they? How easy to use — and are they value for money? Expert systems will be subject to a similar examination.

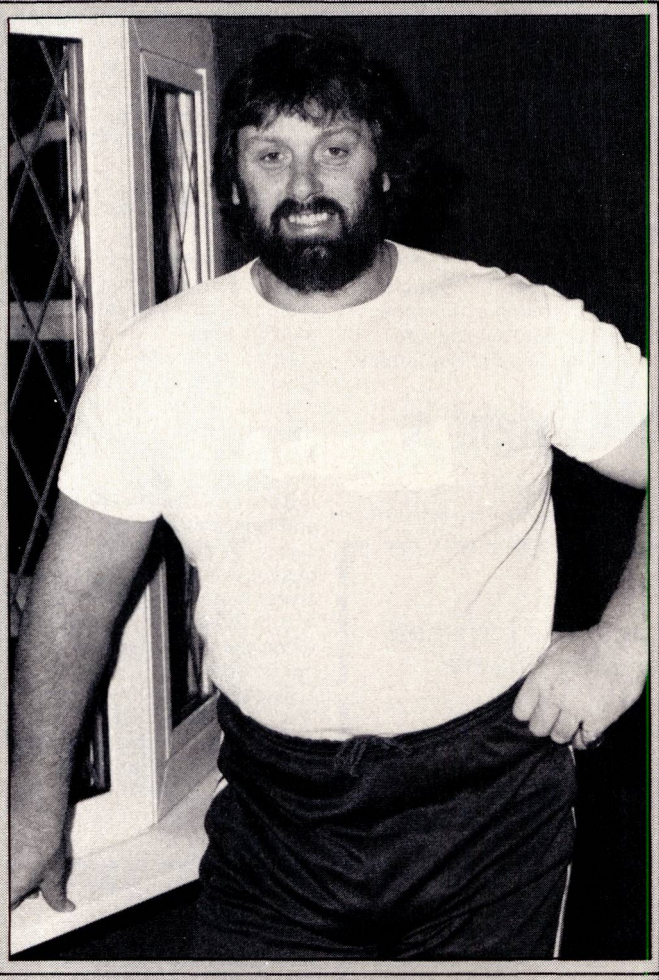
"Getting the best out of the best sellers" will help many experienced users to make the most of popular packages such as 1-2-3, Dbase II and Wordstar: helping you to make the big leap from using them to exploiting their full potential.

Also included in this complimentary publication will be a look at support services, such as training and maintenance, some advice on security, and a view of the future from four major manufacturers.

Where to find the Show

The PCW Show takes place at Olympia, in West London. The exhibition centre has its own Underground station so it can be easily reached from all parts of the capital. Travel to Earls Court on the District or Piccadilly Lines and look out for the special PCW trains running from there throughout the show. For visitors travelling by car, Olympia is readily accessible from the M1, M4, M40 and North Circular Road. There is ample parking for cars and coaches within a few minutes walk of the exhibition halls.

Those spending more time at the show — whether visitors or exhibitors — can take advantage of special discounts arranged at hotels in all price categories from budget to 5-star. For details phone the Expotel hot-line on 01-741 4411.



Anyone who fancies his chances against 23-stone strongman Geoff Capes in the Highland Games need look no further than Software Communications' stand on the gallery of the National hall.

Geoff Capes Strongman Challenge is the latest game to be introduced by the South Coast software house and the Olympic athlete himself will be launching it on the opening day of the show — shortly before leaving to compete in the Highland Games at Braemar.

Also making its debut at the show will be an educational program about Halley's Comet. This is linked with a new Channel 4 series called The Planets which will be presented by Heather Couper, President of the British Astronomy Association. She is acting as a consultant to Software Communications for the development of the Halley's Comet program and it is hoped she will also be able to put in an appearance at the Show.

The 8th Personal Computer World Show
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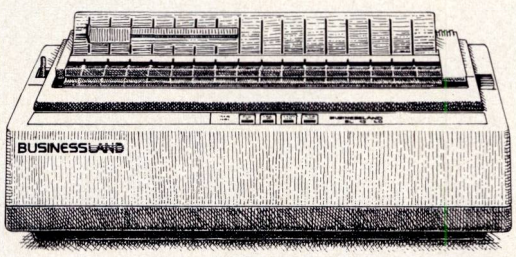

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Superzap	35
Cornerman (SANYO's Sidekick)	38
M-Disk (Ram disk program)	25
Mi-Term (Communications Prog)	65

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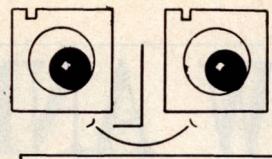

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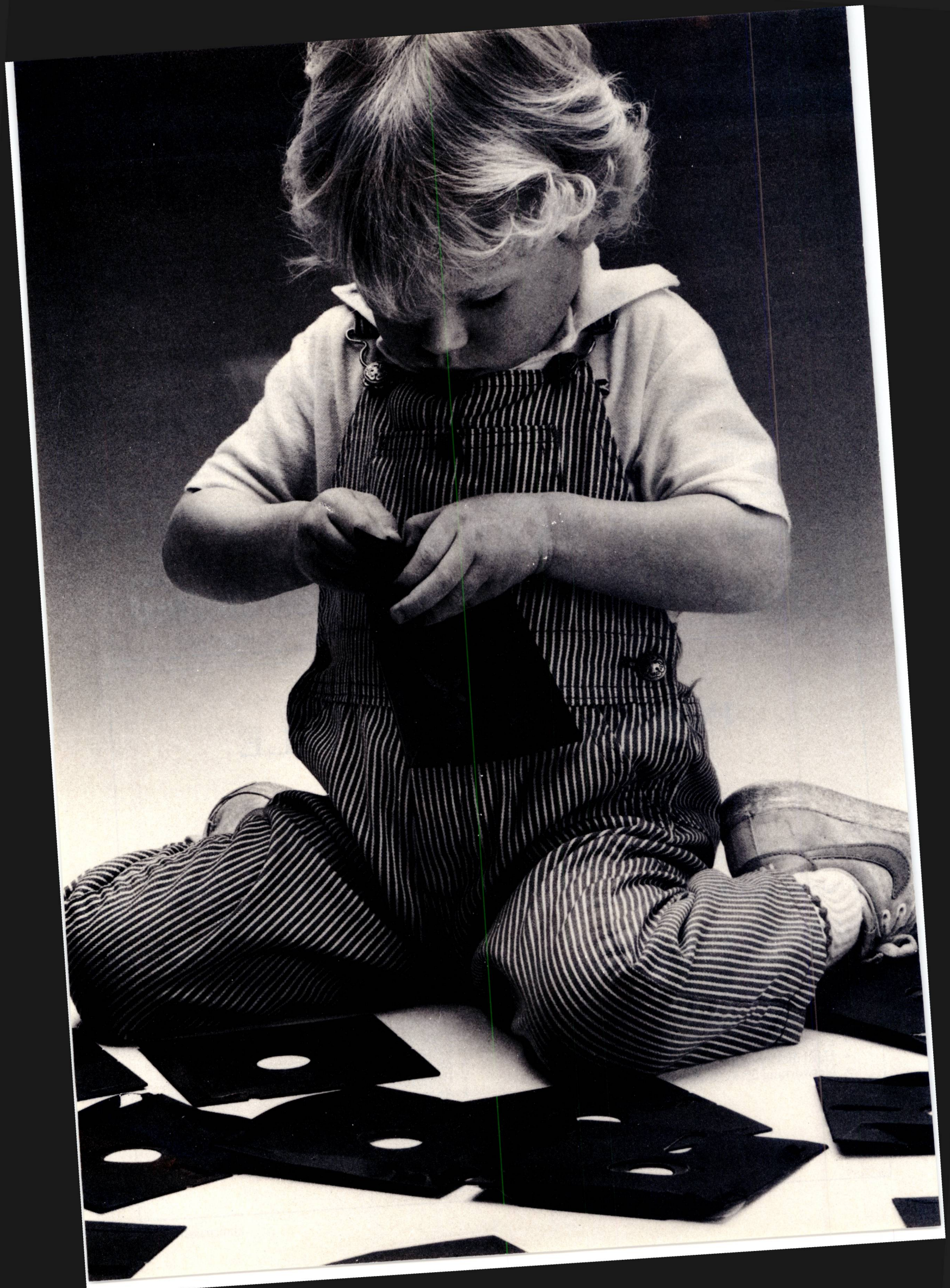

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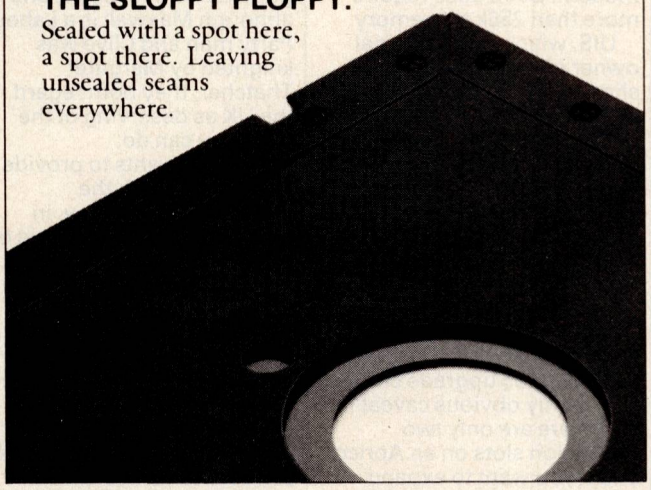

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NEWSPRINT



Error-correcting comms is offered by a new British invention, MultiStream, and Robert Maxwell extends a helping hand to Sinclair. Read all about it, courtesy of Guy Kewney.

MultiStream synchronisation

British communications people have come up with MultiStream, which attempts to do part of the job performed by Microsoft's intriguing X.PC.

MultiStream does not offer the X.PC feature of connecting a user to 15 different databases simultaneously, but it does offer error-correcting comms, and it does it by sending asynchronous packets.

Packet switching involves sending blocks of data instead of single characters, and checking mathematically to ensure that the blocks get there intact.

On the X.PC protocol, Microsoft has added the (logical enough) feature of saying that the packets can behave in exactly the same way as they do when the big boys are playing with them. They don't just say how big they are, but also where they are going.

That's how you get connected to more than one database at a time. Your software has to keep track of which database you're talking to, and put the right address on the packets.

MultiStream has a different job to do: it has to make sure that people are sending data at the right speed.

Our European way of getting ultra-cheap modems is to use simple-minded hardware, which can transmit at 75 bits per second (about the speed of the slowest typist in the world) but can receive at 1200 bits per second, rather faster than you can read.

This only causes problems if you're trying to send a letter to someone, with your software pretending to be the slowest typist in the world. This Newsprint column, for example, runs to about 7000 words each month. I will never forget the time I prepared it on an Apricot, and transmitted it to *PCW's* editorial offices at 75 bits per second.

If it had gone without trouble, it would have taken two hours or more, but in fact, Telecom Gold got into an argument with Packet SwitchStream half way through and lost the lot. The second time, it got about two paragraphs further on and found an ordinary WordStar character which I didn't know I'd left there, by mistake, and obediently stopped receiving.

The new Epad service allows your modem to switch about, so that it can send at 1200 bits per second. Software to take advantage of this Epad service is already on the market. United Information Services, producer of the excellent Unicom RAP program, has produced one called Hush for the IBM and its compatibles, the Apricot and the TI Professional.

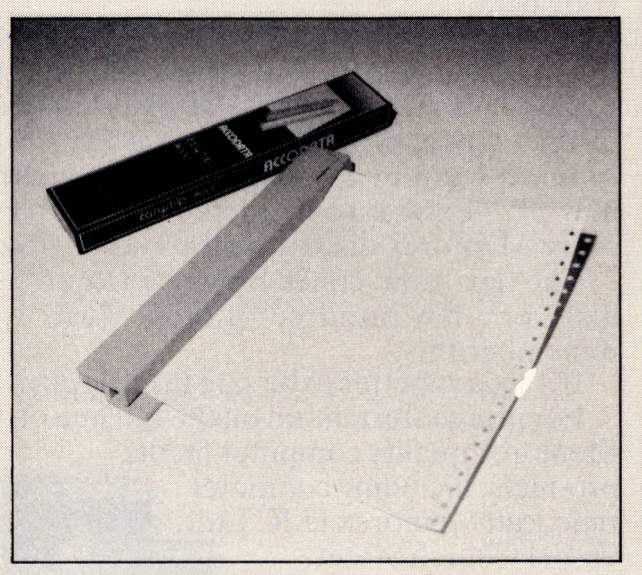
RAP, by the way, is the one reliable way of using the Apricot internal modem without ACT's own Communique or Micromail programs.

When Lion House's Comm is fully debugged, that will be an alternative, but at the moment, RAP is by far the quickest and most reliable program for driving that modem. But it does require more than 256k of memory.

UIS, which is the original owner of the Unicom name, should not be confused with the Demon, which was first launched as the Unicom before UIS objected. Contact UIS on (03727) 29655.

Another software package to support MultiStream comes from ACT — a new version of Communique. This costs £395, including a plug-in modem for the Apricot. For existing Communique users, there is a £95 upgrade charge.

The only obvious caveat is that there are only two expansion slots on an Apricot, and if you want to expand memory (and you do), that will use them both up. After memory and modem, you can't plug in anything else.



I'm a sucker for these gadgets — things costing £10 which do work you could do with a pair of scissors. This one takes the sprocket holes off wodges of computer printout. It'll cut perforated or unperforated paper, says Associated Computer Supplies, and any fool can use it. It has pegs to hole the sprocket holes, and a blade to clamp over the margin. If I can get hold of one, I'll be able to fit my printout into envelopes without folding it.
Details on (0782) 632178.

Uncle Clive and Captain Bob

To talk to Sir Clive Sinclair, you'd think that there were no 'problems' attached to Robert Maxwell's refinancing of Sinclair Research.

He (Sinclair) didn't want to run the company himself, he said, and never pretended he had wanted to.

There were no problems with the accounts, and the whole report that there was a delay was 'nonsense' and he had no idea how it had come to be suggested that there was.

Plans for new Sinclair Research projects had not been held up by uncertainty, nor was there any chance that they would go ahead any faster now.

There's no need to doubt this, for one good reason: had Sinclair Research really been in terminal trouble, then people might have waited for it to crash before buying the bits from the receiver.

On the other hand, £15m doesn't sound a lot for Sinclair Research, and Robert Maxwell, the high-profile technofreak who is now becoming chairman, is almost as hardline a patriot as Sir Clive himself.

Maxwell and Sinclair have shared a board before, 15 years ago, on Cambridge Consultants. They've been on good terms ever since, and although Maxwell is a Labour Party man and Clive was knighted by Margaret Thatcher, they both regard the UK as deserving of the best they can do.

Sir Clive wants to provide this country with the necessary technology, in silicon, for the next couple of decades. Maxwell agrees.

As far as the rest of us are concerned, however, the most important immediate consequence is that Sinclair Research is no longer under a financial cloud, and that the portable Spectrum, another portable and the cellular radio projects can all go ahead.

The Metalab remains part of Sinclair Research, and Clive will now receive a fee, through his own company (Sinclair Ltd, or something like that) to be the tame inventor and R&D director, effectively leaving Sinclair Research.

The car project remains Clive's. Also left with him is his planned fifth generation project, which is still only a gleam in the inventor's eye, needing 'hundreds of

millions' to develop.

We'll keep wishing him luck, I suppose.

Orika!

You were wondering what had happened to Oric? It is sold.

The buyer is Eureka Informatique, described in the announcement as 'the leading independent distributor of home computers in France'. This company has a factory in Normandy, where it will now assemble the machine (the factory already assembles colour displays for the micro).

Anyone with a need to get in touch should contact John McKay Associates, which is handling publicity for the new outfit, on (01) 734 4554.

One bad apple

You can forget all about seeing a fast Macintosh, or a colour Macintosh, this year. The project has been put on ice. The reason? Personnel changes at the top level.

My contacts in the software business say they are pleased to see Steve Jobs, founder of Apple, forced to take a back seat in the struggle with the man he hired, John Sculley. The phrase used by one (who obviously wants to stay anonymous) was: 'The folks in charge don't include some whose egos were rather too involved in their work,' and he meant Jobs.

On the other hand, the news is not really all that good because the 'ego' of Jobs was heavily involved in the Macintosh.

It remains true that Apple's fortunes were built on the Apple II, and that without it, the corporation would be lost. Even today, most of the money that flows in comes from the IIe and IIc, and the machine still needs development.

But if the company has a future, that future lies with the Macintosh. And a full halt has been called in Macintosh development, now that Jobs has been relieved of control of that.

A Macintosh with more memory — both disk and RAM — was due out in September. That has been postponed, indefinitely. And the colour Macintosh, scheduled for February 1986, is equally abandoned — not permanently, but for some time.

This has got to be a mistake. The Atari ST has both speed and colour advantages over the Mac (see June's *PCW*), and the Commodore Amiga (reviewed in this issue) has even more of both. Apple invested a fortune in getting the first low-cost icon machine onto the market, and it has a whole year's start on those two, especially in software.

But this is not the time for Apple to go to sleep! Getting software started on the Macintosh was hard. Getting versions of things already written for the Motorola 68000 and icons onto another machine with the Motorola 68000 and icons isn't more than about two months' work.

I don't expect Commodore's Amiga to be fully debugged until Christmas. The Atari ST may well take longer. Even so, at the prices those two will be selling for, a lot of potential customers are bound to be tempted, and the only thing that can keep Apple right in front is hard work.

Publicly, of course, Apple is saying that 'nothing has changed' and that if it looks necessary to compete with Atari or Commodore, it will respond.

But the truth is that software houses are not going to continue burning the midnight oil on colour versions of their Macintosh software if the company isn't fully committed to producing the colour Mac.

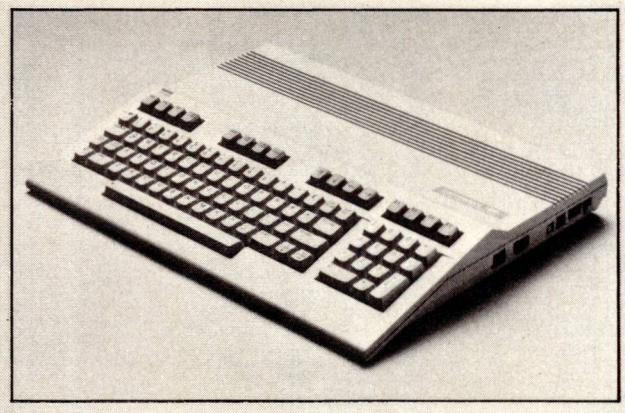
And everyone who has ever used a Mac is agreed that the thing is wonderful, but slow and short of disk space. Included in those people are software authors.

Talking about 'Steve Jobs taking on a more global role in new product innovations and strategies' is polite flannel for saying that things had to change. Many in the business believe that, and who knows — it may be true.

But sacrificing the lead Macintosh in the icon-micro market is not going to pacify the gods who say: 'The Apple II is nearing the end of its life,' because that time is coming.

Even if the 6502 chip were usable in reliable multi-tasking (and it isn't), it has already reached the effective speed limit of its design. Even if it could address a megabyte of memory, as the IBM PC chip can, it wouldn't be possible to standardise it on a system, at this stage, for software houses to use the extra.

But worst of all, the 6502 has no big brother, and the 8088 has the 80286, which is already out in the market. There is very little difference between the IBM PC and the Apple IIe, apart from that — but that is enough.



The fact that the Commodore 128 (reviewed in July) will run CP/M software when it is released has prompted a lot of philosophers to indulge themselves long-windedly about the return of CP/M, just when we thought it was going to disappear. Indeed, I seem to remember doing something similar myself when ruminating recently over the Tatung and Amstrad machines.

Actually, the 128 may do something for CP/M which hasn't been seen before. The machine includes the option of a RAM disk, and a great deal of CP/M software, which was unmanageably slow from floppy disk, can be acceptably fast from a good RAM disk.

Nevertheless, I expect people to be more impressed with the repackaged 64, with the option of buying £430 worth of peripherals, including disk and modem (plus Compunet subscription) for £229.

After the own goal which Commodore scored by releasing the Plus 4, the 64 took quite a hiding, and this offer may save it — or at least, it may keep the company making money long enough to get the 128 launched. And the attempt to turn the Plus 4 into a business system by including a disk and a printer may not turn it into a best-seller, but at least it stops people getting confused, in shops, over whether to buy the 64 or the Plus 4.

Anyway, for CP/M fans who really believe that it's coming back, Davis Rubin Associates has a book of 'free software', the public domain programs that have grown up around these machines.

The company says that 'the problem with public domain software has always been the lack of good documentation', and this is its attempt to sort that out.

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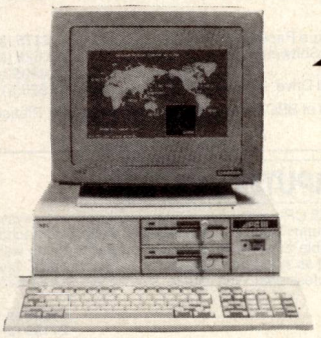

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PCB Mtg Skt
Ang. Pin 36 Way 750p 24 Way 700p

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	No of Ways 9	15	25	37
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Angled Pins	120p	180p	240p	350p
IDC	175p	275p	325p	—
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A disk in the lap

Those invaluable lap-top portables that started with the Tandy 100 and followed with the NEC 8201 and the Olivetti M10 now have the one thing they really needed — a disk drive.

The market, says the company which has produced the £200 device, is small. 'As such, it gives us two choices,' says Zeotek. 'To distribute through normal retail channels and see, in consequence, an increase in price by up to 50 per cent, or to market the product by direct mail ourselves.'

It has chosen the latter, and is looking for people who want to distribute the disk inside their companies.

Without having tested it yet, I suspect that it won't work like a true disk system on CP/M micros, simply because it uses a serial RS232 link. That's bound to make it slower than the parallel data highways normally used for disks.

However, for those of us who find the Tandy 100 (or the other versions, all the same design) indispensable, and who aren't prepared to step up to the near £1000 required for next-generation hardware, any disk is better than none. And this one has a rechargeable battery so it can travel with you.

Details on (01) 205 9068, and please, anyone who uses one, feel free to pass on your comments. Just a memo would do.



At a mere £1300, this little IBM-compatible portable, with disk, is enough to make even the Osborne name seem irrelevant to people who are afraid that the company can't really have recovered from bankruptcy.

The machine has been upgraded since this model was first touted (you saw it on the PCW front cover in August 1984), but the original version remains a good bet as a travelling machine if you can afford something better than a Tandy 100.

It's only limitations are the 16-line ICD screen and the fact that it isn't very easy to read in dim lighting. The Mark Two version, of course, has battery backlighting for the display.

But this one does have the ability to plug into an ordinary CRT display, with the full 25-line PC-DOS/MS-DOS display showing.

Prices start at the £1300 already mentioned for the 128k version. A more sensible 256k version with two disks (but no rechargeable battery) costs £1700. With the external display adaptor, plus 512k, the price rises to £5 short of £2000.

By comparison with the 'second generation' versions of the Tandy 100 — well, there is no comparison. The only really serious rival will be the Interquadram Datavue, when the company gets a UK version together.

Details from Future Management on (0908) 615274.

Dressing up an image

Despite the fact that he is a computer nut and a chartered accountant, I look forward to meeting Brian Garton Jenkins, who has just been elevated to president of the Institute of Chartered Accountants. A meeting is just what the Institute had in mind, no doubt, when it sent me his biographical details.

The man is obviously not content to be pegged into the conventional staid image of accountants or computer industry 'respectables', and is prepared to work hard at avoiding this fate.

'Many will remember how, in the early 1970s, he lectured around the country and in Europe, waving a cheap ladies' dress,' remarked his publicist, Andrew Colquhoun, somewhat ambiguously.

Assuming that it was the garment, not the wearer, which was cheap, the tale tells of how (in an effort to test computer accounting systems) his staff purchased the item 'in his wife's name', and did not pay.

The accounting system in question proved equal to the task, and the company (assuming Mrs Jenkins to be another light-fingered swindle merchant) sent round the heavies.

Now, if we can get him interested in micros rather than computer audit standards, perhaps the image of the accountancy trade will improve yet again.

Basic translation

The problems of writing in Pascal are made far worse if you're a trained Basic programmer because the two langauges don't think alike, so a translator program, to take your Basic (Applesoft version) programs and rewrite them in Pascal, might not seem optimal.

However, Woodchuck Industries has produced such a translator in the belief that people will be able to sell their software on other machines.

Today, P-Tral costs $125, and when it is fully debugged (in the autumn) the price will double. Existing customers will be charged an extra $25 for the bug-free version.

What makes the translator unusual is that while it works on your Applesoft code, it stops and asks you for suggestions when it comes up against problems, so you probably develop some Pascal skills as the thing goes on.

For example, it may request a new variable name if the Basic version isn't acceptable in Pascal.

Woodchuck also claims that your Pascal code will run around three to 10 times faster than the Basic, using Apple Pascal 1.1.

Details on (212) 924 0576.

To sell or build — that is the question

Olivetti is 25 per cent owned by AT&T, the American phone giant. AT&T owns Unix, and sells a big micro worth £20,000 called the 3B2, while Olivetti sells an IBM PC compatible called the M24.

In exchange for having AT&T sell the M24 in the States (under the title PC6300), Olivetti is now going to sell the 3B2 in Europe.

What is going to slow down the company, I think, is the fact that AT&T owns Unix.

Someone has to decide whether AT&T will make more money from selling an operating system to lots of different Unix systems' builders, or by building systems that use Unix.

The man in charge of selling Unix to UK dealers insists that the 3B2 is a wonderful opportunity for the dealer, and can be used as a Unix machine, or a local area network controller, a file server (or both), and so on. And when the software is all ready and polished and slick, I think he's right.

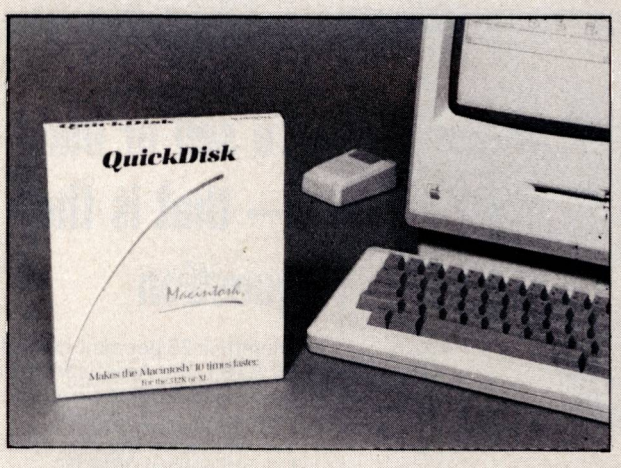
But AT&T's 'determination to be a force in data processing' could be likened to Intel's determination to be a leading force in microprocessors.

Intel sells the 8086 family, and also builds systems that use the chip. But, very sensibly, it doesn't sell imitation IBM PCs. It does quite well with a pricey range of boards and boxes for people who want to build a system of their own, but who only want a hundred or so (often fewer) for specialist purposes.

Can AT&T really command the Unix hardware market, *and* sell an exactly similar Unix to rival hardware builders? And can it sell the microprocessor chip — a 32-bit design — that is inside the 3B2?

In the States, the general feeling is that the M24 has flopped. Inside Olivetti, they say that in fact it's done much better than they forecast.

It's true that in Europe, the M24 is looking like the



The theory behind this RAM disk software for the Macintosh is: you don't need all that 512k of memory, so use some of it as an imaginary fast disk.

At $34, you might think it's cheap enough not to gripe, but I don't. I know that the Mac is unreasonably slow at using its disks, and I also believe that this product is rather more clever than Assimilation Process's Mac Memory Disk in deciding how much memory to sacrifice to the imaginary disk.

But many programs for the Mac use more than half the memory anyway, and you may find that the overall speed increase is roughly what you'd expect for $34. What we really want is 512k of memory, plugged into the second disk slot. But that would cost . . .

Details on (602) 224 5944 from Symmetry Corporation, which makes its appearance with this announcement. More software, it says, will follow.

number one rival to the original PC. We'll just have to wait and see if AT&T sticks it out in the American hardware business.

A UK Christmas for the new Amstrad

It was Alan Sugar's intention, when he launched the Amstrad micro, to keep temptation away. Temptation, he said, was going to the States with it. 'I won't go there,' he said.

Now he has. Well, sort of. Well, hardly at all, really.

What he's done is to produce a version for the American market which will hardly cost him buckets and buckets. He hasn't set up an American outfit — he's just selling the CPC6128 to Indescomp. That company will charge over $700 for the machine, which will have one clear advantage over the UK version — CP/M.

You may have read, in the past couple of issues, a warning in this column saying that the CPC664 wasn't anything other than a disk version of the ordinary Amstrad (normally with tape), but that a proper version was on the way. This, it seems, is it.

The bad news is simple: it is, says Sugar, 'unlikely' that the CPC6128 will appear in the UK this year. There's no reason to believe a word of this. If ships had already left the Far East with stocks of the 6128, they'd be likely to arrive in September, but Alan Sugar would not make any announcements that might stop dealers stocking the 664 in the meantime.

My information is that the ships have indeed already sailed, and a machine capable of running CP/M version 3 will be in the shops in plenty of time for Christmas.

IBM PC Think Tank — more than an editor

It's enthusiasm time again.

This issue of Newsprint comes to you from yet another editor — this time, ThinkTank on the IBM PC. (Well, to be accurate, on the Zenith imitation XT, but that's as near as makes no difference the same thing.)

This is the nicest thought-organising program I've used. It goes well beyond the Macintosh version of ThinkTank 512 which I raved about recently, because of its colour, its replication, its smart printing abilities, and its data transfer abilities, among many features.

The program is a development of what is called a 'folding editor', but used as Living Videotext uses it, it becomes very much more. Most users never realise that it can be used as a simple editor, using it instead to structure thoughts, plan schedules, organise new routines, and otherwise keep tabs on their organisational life.

As is usual with complex programs, it's almost impossible to describe. Unusually, it's very easy to learn. However, I'll try to give some idea of what version 2.0 on the IBM is like by asking you to compare it with one of those lectures which computer people are always giving.

You may never have sat through a computer expert's tutorial, but if I say that 'it's always a question of drawing boxes and linking them with arrows', perhaps you'll know what I mean.

The normal end-result of such a tutorial session is a series of words, all over the board, linked with lines like a spider's web overloaded with flies. It's a neat way of explaining things in outlines, but somehow, when you come to look at it all later, you can't remember which box was drawn first, and which others had the arrows coming out of them.

ThinkTank gives you a single word, the outline headline. Type the + sign, and it will expand itself to show the sub-headlines. Move the cursor onto one of those sub-headlines, and you can expand them into sub-sub headlines.

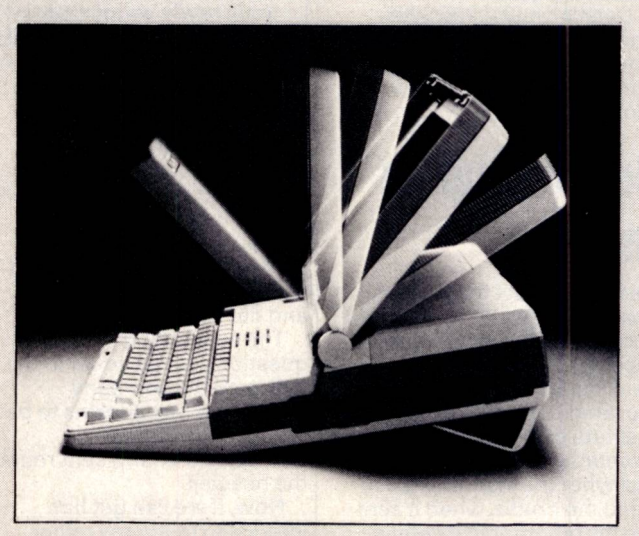
Better than that, however, is the fact that you can also expand them into large explanatory documents.

Take an example — that always makes things easier. Your main headline might be 'Tuesday', a day which involves several complex tasks.

Expand it and you might find your sections: 'Before Work', 'Morning at office', 'Lunch at client XYZ' and 'Afternoon in seminar'.

It doesn't matter in what order you remember them because you can put a headline anywhere and move it anywhere else.

Things that happen nearly identically can be copied. If your presentation over lunch will be much the same as your



For a mere £1000 more than the Osborne Encore, this Data General One, at its recently reduced price of £2241, offers the same single diskette, 128k and liquid crystal display. The extra money is for a full 25-line, tilting display of the same shape as the original IBM PC which the One emulates.

The reduction can be as much as 20 per cent on some models of the DG One, and a 512k system with two diskettes fetches a fat £3850. The good news is that many manufacturers are doing disks for this machine now, but the bad news is that I bet whichever program you actually want, it's only available in 5in IBM disks.

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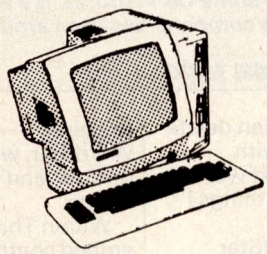

Televideo TS1605, full IBM PC compatible, runs Flight Sim, 1-2-3, Framework. 2 360K drives, 128K memory, (512K for £400 extra), 14" display, RRP £1990 **1290.00**
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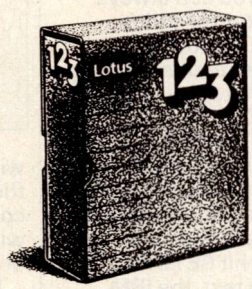

LOTUS 1-2-3, the most popular software package in the World is now available in Apricot and IBM formats. RRP now £440: **375.00**
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introduction for the afternoon seminar, you can copy the one, rename it, and modify it.

For things which are exactly the same, you can 'clone' the outline.

This started out, according to Living Videotext, as a mistake — a 'bug'. The idea was to have identical copies, but not to have them work as clones. Clones (in folklore) are so alike that they all change simultaneously, and so it is with these. If you remember to add a new joke in your presentation to one client, all clones of that outline will now have 'new jokes' in that place. If you delete something, it will disappear from all clones, too.

When they came to fix the bug, all the test users protested that it was the most useful feature in the new version of the program.

Of course, I'm more concerned with planning my output as a journalist than with planning a day's work, but the similarities are strong. The effect is that where your average administrator produces a complex network of things to do, and sub-heads of how to do them, I produce a relatively simple outline — Newsprint in four parts, for example.

To edit the stories, I can use the ThinkTank controls. These involve fairly obvious menu prompts on the bottom of the screen, but you can always type in the control codes direct. To edit a document attached to a headline, for example, you type F10 (to get the menu) ED (for Edit Document). To edit the headline, you'd type EH. If you can't remember that, just tap the space bar until you see the right selection at the bottom, and hit RETURN.

To edit the text, the IBM arrow keys can be used, but there's a big plus — WordStar keys.

These were an addition at my own prompting, so I'm proud of them. I was rabbiting on to David Winer at Living Videotext about how stupid Microsoft and Apple had been to ignore WordStar cursor controls when so many people can do them in their sleep. Winer went all thoughtful, and a couple of months later, when my review copy arrived, his note mentioned that he'd taken the thought seriously. 'You weren't the only one to ask for it,' he added, 'but we hadn't taken it seriously till then.'

The result is that I can get to the top of the document with control-Q, R, and the bottom with control-Q, C. I can delete the next character with control-G, or the next word with control-T — all things I do in my sleep.

If you're not WordStar trained, you tell the program to ignore these keys, and it does.

The use of colour is a definite plus over the Macintosh version: you select your own favourites, and they appear. Text being edited is one colour, text selected is a different colour. An outline shows up in your favourite colour, with all connected sub-headlines in the same shade.

As a word processor, the program lacks only one thing — the ability to format paragraphs to different widths. This hardly matters if you own an ordinary word processing program because ThinkTank will create a text version of any outline and prepare it for your own word processor — even for WordStar, with 'soft carriage returns' and all the other things.

Within ThinkTank, you can embed control characters to turn on your printer's special features — bold face, underline expanded, condensed, and so on.

Any headline (plus associated document) can be printed, with attached sub-headlines, to whatever depth you chose, or the whole document can be printed.

And when the document is printed out, your recipient will be delighted to find that the date is printed at the top of the page and an index is attached, showing which page (numbered, of course) has each headline, and which are headlines attached to superior headlines.

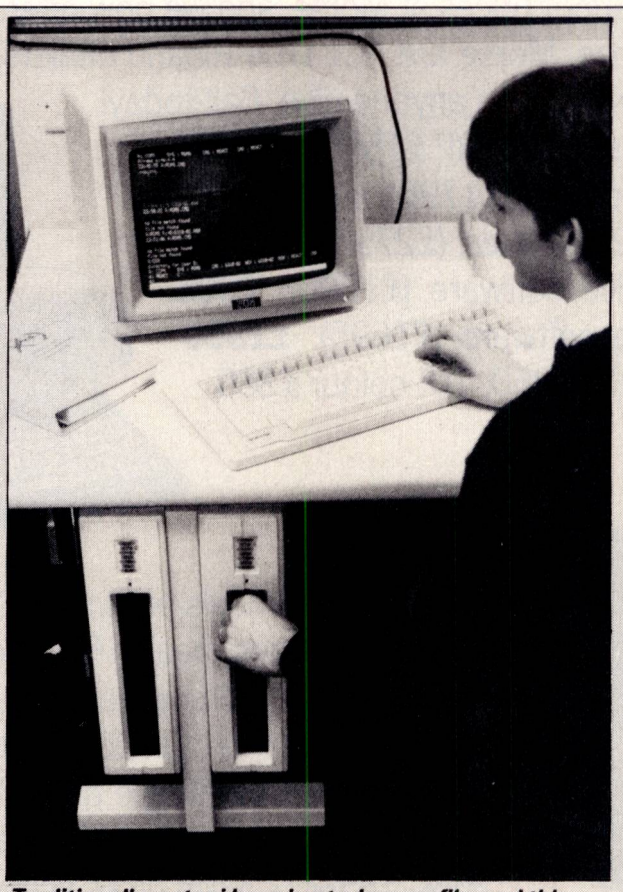
Finally, I have to put in a word for a very underrated feature — speed.

From the top to the bottom of quite a large outline takes a split second. From the top of a large document to the end is instant. Going back, also, is instant.

In other words, you can use this program to *read* stuff you've written, as fast as if you were flicking pages in a book.

I wish I could think of something about ThinkTank which I didn't like. Well, I suppose I can. It's the cut-and-paste routine. For example, take the detail about distribution at the end of this story — I got that off my Spotlight index. To get it here, however, I had to get out of this document and create a new headline with the FILES command. Then I had to edit that headline's document and cut it with the selection menu. Then I had to get out of the editor and switch to this headline. Then I had to get the Paste menu and stick it in. Still, it worked.

In the UK, ThinkTank will be handled by Rapid Recall on (0494) 26271; the contact is Andy Kitchener.



Traditionally, octopi have kept a low profile, and this Octopus from LSI is no exception. Something like 10,000 have been sold, and no-one tells me anything about it.

LSI has now produced this bigger version of the Octopus, again with twin processors giving both eight and 16-bit processing, like the old Rainbow.

I know 10,000 is nothing compared with things like the 'failed' Macintosh with 'only' 200,000 units sold, but by comparison with some UK ventures, it's worth a passing mention. And the company has been around for quite a while.

Details on (04862) 73883.

Networks everywhere

At last, I have found a local network system which can link all other local area nets together.

It is a system called **Banyan,** launched by a new company, and was one of several really impressive networking announcements at the recent Comdex fair in Atlanta, but on a level of cleverness that isn't matched by any of the others.

A Banyan is a swamp-growing tree which sends out new trunks to hold its wide-spreading branches out of the water, and it looks more like a local area net than anything else you could find.

The network seems able to link any type of computer to any other, and to provide proper file server facilities across the network, not just a shared disk system. Better than that, it can reconcile two completely disparate local nets.

It can link a 'star' network of IBMs to an Ethernet, to a host mainframe, to a token-passing ring-main net or to a Corvus network, using synchronous or asynchronous protocols. It can even support the different file structures of MS-DOS, Unix, Macintosh, minicomputer operating systems, and mainframes.

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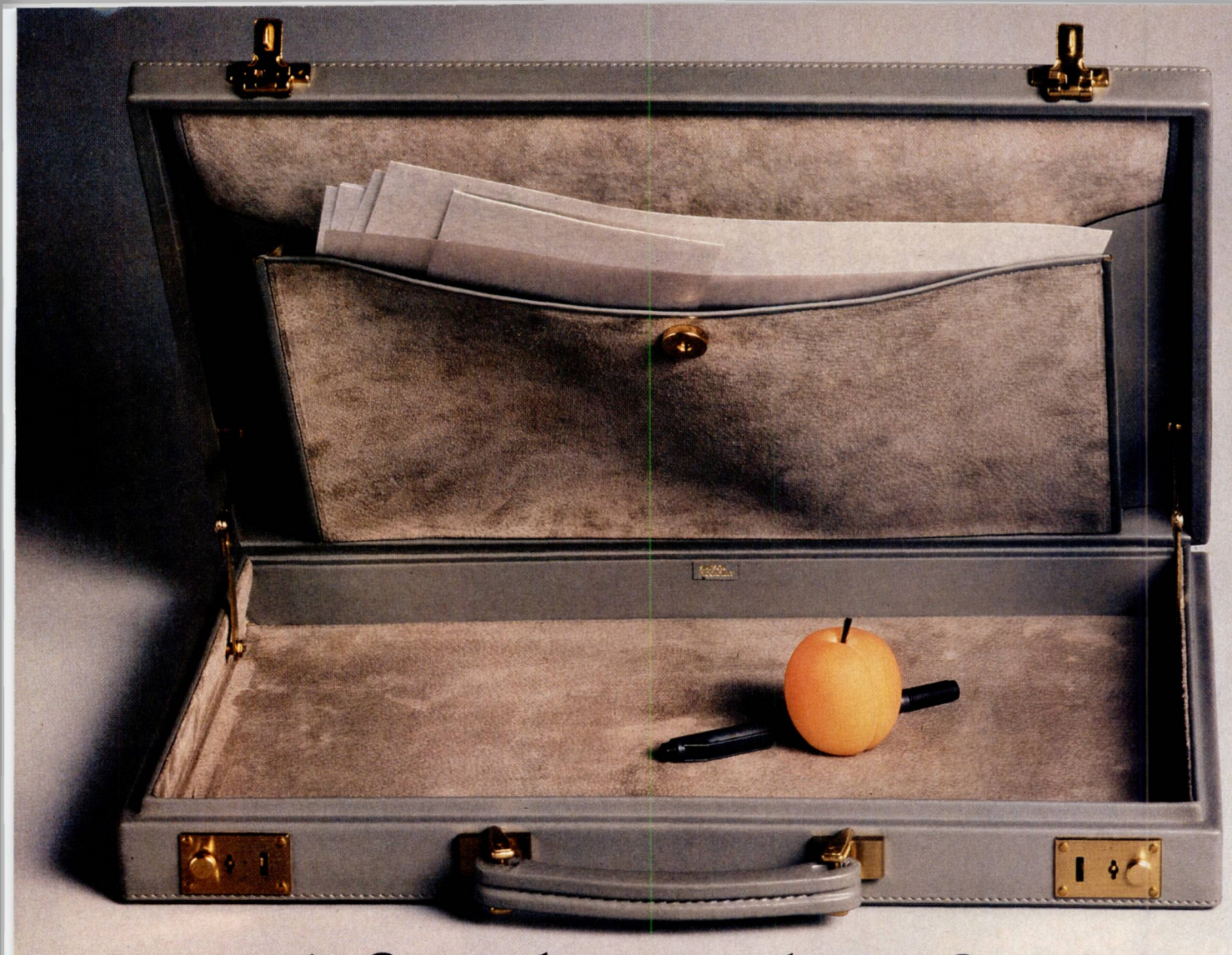

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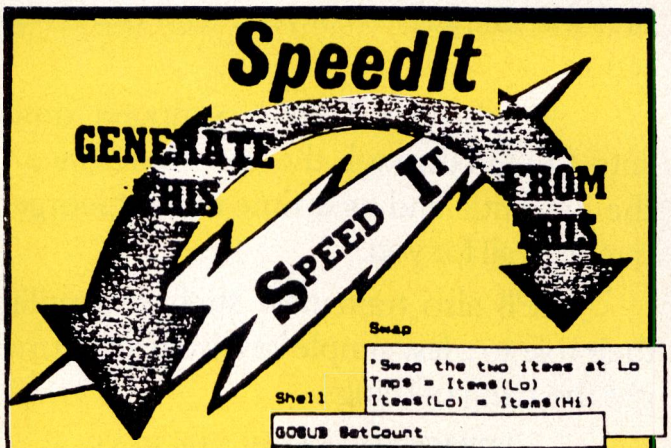
SpeedIt




```
Swap
'Swap the two items at Lo
Tmp$ = Item$(Lo)
Item$(Lo) = Item$(Hi)

Shell
GOSUB SetCount
Dim Item$(Count)
GOSUB SetData
Span = Count
WHILE Span>1
  'Cut the Span width.
  Span = INT(Span/2) : J = 1
  Lim = Count - Span
  WHILE J <= Lim
    Lo = J
    WHILE Lo >= 1
      'Need to interchange?
      Hi = Lo + Span
      IF Item$(Lo) > Item$(Hi)
        GOSUB Swap        Lo = 0
        Lo = Lo-Span
    J = J+1
'Print the sorted array
GOSUB DisplayData
```

```
100 'Shell: Procedure
110 'Shell Sort algorith
120 '
130 GOSUB 560:    'SetCou
140 DIM ITEM$(COUNT)
150 GOSUB 640:    'SetDat
160 SPAN = COUNT
170 WHILE SPAN>1
180       'Cut the Span wi
190       SPAN = INT(SPAN/
200       LIM = COUNT - SP
210       WHILE J <= LIM
220             LO = J
230             WHILE LO >=
240                   'Need to
250                   HI = LO
260                   IF ITEM$
270                   GOTO 320
280                         'The
290                         GOSU
300                         LO =
310                   GOTO 350
320                   '$001
330                         'Els
340                         LO =
350                   '$002
360             WEND
370             J = J+1
380       WEND
390 WEND
400 'Print the sorted array
410 GOSUB 740:    'DisplayData
```

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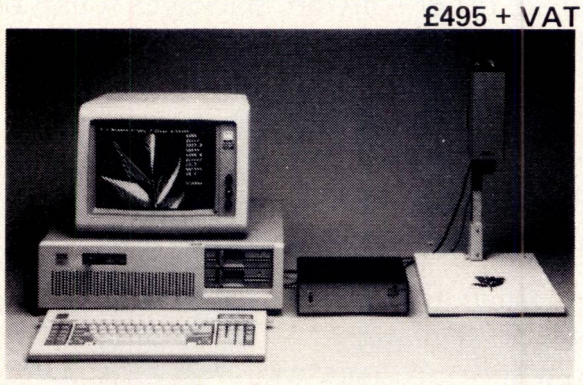

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The company was set up in late 1983 and has had its products under test in the Boston Bank and World Bank, to both of whom it has now sold very large multi-network networks.

The central box on which all this cleverness is based is a Unix-driven micro containing a Motorola 68000.

This is almost the ideal application for a Unix machine: it needs to be served by experienced programmers who can write their stuff in C and pass the job on to the next person.

The box includes an ordinary IBM PC bus, into which IBM network cards can be plugged.

The 'heart of the Virtual Networking Systems (VINES) software', as Banyan puts it, is the Street Talk 'location-independent naming system'. This 'provides an efficient way to identify objects within the network, such as information, applications, peripherals, protocols, or other computing resources distributed throughout single or multiple locations'.

The World Bank system apparently includes 32 Banyan boxes, each linked to each other, and each supporting a complex local network (already extant, in some cases) inside the organisation.

Banyan is contactable at 135 Flanders Road, Westboro, MA 01581, tel: (617) 366 6681.

To Banyan, the announcement by IBM of its PC Networks software was not even a surprise, let alone a challenge. To other micro networkers at Comdex, however, the IBM announcement was the talk of the show.

The pioneering 3Com, for example, which linked up with the Microsoft Networks announcement in late 1984, has now adopted the IBM version (which shares some central assumptions with the Microsoft product) as a 'strategic direction'. The company announced its Macintosh network, EtherMac, at the show, but rushed together a statement talking about 'product strategy' and its intentions to support IBM's '*de facto* standard' during this year.

The address for 3Com is 1365 Shorebird Way, Mountain View, CA 94039, tel: (415) 960 9451.

Low cost is the central feature of the **Racore-Net** announcement. The Racore network is unique — it's network hardware put together to run special software. The special software, of course, is IBM's PC Network software, plus PC-DOS 3.1.

The important point, however, is cost: a four-node Racore network should add a total of $1000 to the four PCs or XTs or ATs, or whatever.

Racore uses token-passing ring architecture, with a two-megabit-per-second data transfer rate, which is all fairly unexciting — and that's what the company planned.

'It's designed to teach network users the "control-alt-delete" of networking,' said the new company's boss, Rod Crisp, a reference to the way an IBM family machine is reset. 'It uses what will become a new standard of networking, and gives them a chance to start learning their way around it.'

His network controller fits into a long expansion slot in the PC and requires at least 256k, but, frankly, you need twice that for serious PC use. Up to 16 machines can be linked in a cluster, with 250 feet between each node.

Racore is at 10 Victor Square, Scotts Valley, CA 95066, just around the corner from Victor (Sirius), tel: (408) 438 7255.

A more ambitious network, the **ThinkLink** from Tangent Technologies, uses the enormously powerful Motorola 68010 (the bigger brother of the 68000, which in turn is the bigger brother of the Sinclair QL's 68008) to run very fast indeed.

However, Tangent's most impressive contribution to networking is a link between IBM micros and Apple's Macintosh-based AppleTalk.

The main thing about AppleTalk, on IBM micros, is that you (potentially) can use the wonderful Apple LaserWriter printer.

MacBridge not only connects a PC to the printer, but lets several PCs share it, in the same way that AppleTalk lets Macs share it. At the price of a printer that's essential, or no-one would ever buy one.

Even better, Tangent has produced a program to convert WordStar files into Post Script command files so that you can do wonderful things with WordStar. You can even take a WordStar document, instruct Post Script to slant it by 15 per cent, put a box round it, and print it over the top of another document.

Apple is planning a vaguely similar card, but it won't have the Post Script interface.

Tangent is at 5720 Peachtree Parkway, Suite 100, Norcross, Georgia 30092, tel: (404) 662 0366. But there's no panic about this until Apple gets the rocks out of the bag containing the LaserWriter and ships some over here to Europe.

There were many other networking announcements at Comdex, but they all failed to qualify for serious consideration because the people behind them clearly had no prior knowledge of IBM's PC Networks announcement, or even, for that matter, current knowledge. **END**

Guy Kewney can be contacted on electronic mail. His numbers are Source TCK 106, and Telecom Gold 81: JDS018. The Prestel mailbox number is 01-802 2679.



This magazine,* The Sunday Times *and Thames Television may seem like an unlikely bunch of collaborators, but they united as organisers of this year's British Microcomputing Awards. The winners were announced in June, although only products available before the end of January were eligible.

The independent panel of judges included industry figures such as David Fairbairn of the National Computing Centre and Robin Bradbeer, one of the founders of the Association of London Computer Clubs and now managing director of Intergalactic Robots.

ACT won two business awards — one sponsored by Computer People for the Apricot Xi, and the other for Business Micro of the Year with the Portable (one of the three awards* PCW *sponsored).

Sinclair collected two awards as well — one for its Logo in the educational software category (sponsored by our publishers VNU), and one for the QL as Home Micro of the Year (the second award* PCW *sponsored).

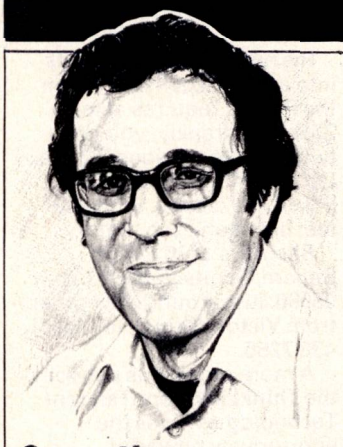
There was one other double-header, the Icon local area network from Torus Systems. This took the Business Software Award sponsored by* Micro Decision*, and the Business Software of the Year Award sponsored by the Thames Television programme* Database*. Psion's bunded QL package won the home version of this* Database *award.

What Micro? ***sponsored two categories: the Atari 800XL took its Home Micro Award, while Peripheral of the Year went to the Penman Plotter.***

In* PCW*'s third award, for home software, the judges couldn't decide between two packages, so the award was split between Triptych's Entrepreneur and White Lightning from Oasis Software. The games enthusiasts who judged the Game of the Year Award (sponsored by WH Smith) came in with a similar split verdict between Impossible Mission and the Hitch-hiker's Guide to the Galaxy.

Things were more clear-cut in the awards for the Best British Innovation of the Year (which was sponsored by the* Sunday Times *and went to Oberon's Omni-Reader) and for the Microcomputing Application in Established Industry (sponsored by Barclays Bank and won by Denford Machine Tools).

YANKEE DOODLES



If at first you don't succeed, attempt a comeback. David Ahl reveals the desk-top resurrection of DEC, and presents other American news and views.

Over the Rainbow

After a disastrous foray into the personal computer market with its Rainbow (over-designed, late, not IBM compatible, expensive, poorly distributed), DEC is attempting a powerful comeback — in more ways than one.

Replacing the Microvax I, the company has introduced the Microvax II, a desk-top version of the VAX 11/780, star of DEC's minicomputer line. Base price of the Microvax II is about $20,000, approximately one-fifth of a full-size VAX. The Microvax II is available as a low-end machine in the 32-bit VAX line and as a network workstation, and will support up to 16 users in a network at a performance level of about 90 per cent of a VAX 11/780.

The Microvax II uses two chips — a 32-bit 78032 microprocessor and a 78132 floating-point unit. The mpu uses pipelined architecture and has four gigabytes of virtual storage space.

Almost more interesting than the Microvax II is the announcement of a 600Mbyte read-only optical disk storage device — the first compact disk system to be marketed commercially.

The price is an attractive $2195 which includes the disk reader, controller and cables. At this point, DEC has no plans to market the system as a peripheral for other computers. Too bad.

Worms in the Apple

Amid growing dissatisfaction among its independent local retailers, Apple has decided to disband its three-and-a-half year old national accounts sales operation. Lately, the 100-man sales and support group has mainly been concentrating on trying to sell the Macintosh to large corporations in direct competition with IBM, and has scored some notable successes. But while 20 to 30 per cent of Apple's sales came through this unit, dealers felt betrayed due to their diminished margins and questions about Apple's market intentions following the withdrawal of the Macintosh XL.

Enzo Torresi, senior vice president of the Businessland chain of stores, expressed a common view among dealers. He said: 'Apple has laser technology, a local area network, integrated packages, a database server, and a lot of reasonable, well-done, user-friendly software. But is that sufficient in an IBM-dominated market?'

Apple's success, said Torresi, lies in how well it can motivate the existing dealer channel in presenting an alternative to IBM. 'That's the challenge where DEC, Xerox, TI and Burroughs failed.' With the disbanding of its national accounts program, Apple seems to have heeded these views and has again put its local dealers in the forefront of the market battle.

Also with Apple, the company announced it would kill a program to manufacture 20Mbyte 5¼in hard disk drives, and that it would postpone the release date on a Mac file server to the year end as opposed to the October availability promised earlier.

Jean-Louis Gassee, former general manager of Apple France, has been appointed as marketing director of the Macintosh division. He replaces Mike Murray who becomes director of business development, a new post.

Meanwhile, Apple chairman Steve Jobs will spend a month or so in France — on holiday, perhaps?

The second time around

Reorganised and directed by an entirely new management team recruited from Atari and NEC, SpectraVideo recently unveiled a series of CP/M and MS-DOS computers at a New York press conference.

The event marked the official re-introduction of the company since writing off and restructuring approximately $2.6 million of past debt, and becoming a majority holding of Bondwell Holding Ltd of Hong Kong. It's the Bondwell name that appears on all the machines, as it does in the UK where Barbitan is the importer.

The company has announced four entries in the CP/M arena. Most interesting is the Bondwell 2, an 11lb lap-top portable with built-in 3½in disk drive, 25-line × 80-character LCD display, and bundled software from MicroPro. The machine is priced under $1000 and is marked for September delivery.

Three other CP/M machines fall into the transportable category — the Bondwell 12, 14 and 16, all of which are currently available.

The Bondwell 34 and 36 are MS-DOS machines and are said to be IBM compatible. The 34 has 256k, dual 5¼in disk drives and the usual interfaces; price is $1795. The Bondwell 36 substitutes a 10Mbyte hard disk for one of the floppy drives in the 34, and is priced at $2995.

'Marketing,' explained John Constantine, president of the new company, 'will be largely locally based because our present dealer network is widely scattered throughout the country.'

To date, no Hong Kong manufacturer has been successful in the US market (except as a second-source OEM supplier). Will SpectraVideo be the exception? Much as I like the company, I would have to say 'not a chance'.

Coming soon

Next month will be my 18th month writing the Yankee Doodles column, and I hope you have all enjoyed it. If you have a comment or if there is something you would like me to cover, please drop me a line at 12 Indian Head Road, Morristown, NJ 07960, US.

In the coming months, I intend to go out on a limb and make some projections on those companies who will and will not make it in the personal computer market — not only in the US, but worldwide. I'm also going to give you my pick of the 12 worst computers that have ever been unleashed on an unsuspecting public. And if that isn't enough, I'll also make a prediction as to which countries will be most influential by the Year 2000. This is something that almost everyone else did in the magical year of 1984, but now, I'll give you the *real truth*. Stay tuned!

Random bits

In an effort to revive an ill-fated deal with Apple Computer, Cullinet Software has supplied Apple's MIS group with a program to connect Mac computers to Apple's IBM mainframe. Cullinet hopes that Apple executives will use the system and will like it enough to bring it to market . . . Informatics General also has a micro/mainframe link called Micro/Answer Toolkit, through which micros can access IBM mainframe files and databases . . . Data General has upgraded the LCD screen on the Data General One (for the second time), made available a five-slot expansion chassis, and cut prices by 15 per cent in an effort to boost flagging sales . . . Morrow has also upgraded the screen on its Pivot portable to a 25-line unit and dropped the price by $10000 . . . PC compatible vendors have introduced a tidal wave of new machines in an effort to take advantage of the shortage of IBM PC/AT computers. NCR has introduced the PC8; Compaq, the Deskpro and Portable 286; Zenith, the Z-200; ITT, the Xtra XP; and Corona, the ATP-6-QD . . . Acknowledging that the PC6300 has not sold well, AT&T's James Edwards said: 'We decided that going head-to-head with IBM was stupid.' AT&T's new strategy will focus on communications and local area networks . . . Microsoft has introduced Excel, a spreadsheet for the Macintosh that the company hopes will break Lotus' stranglehold on the spreadsheet market. It is said to have advanced capabilities in size, speed, interactivity, multiple window displays, graphics and formatting. END

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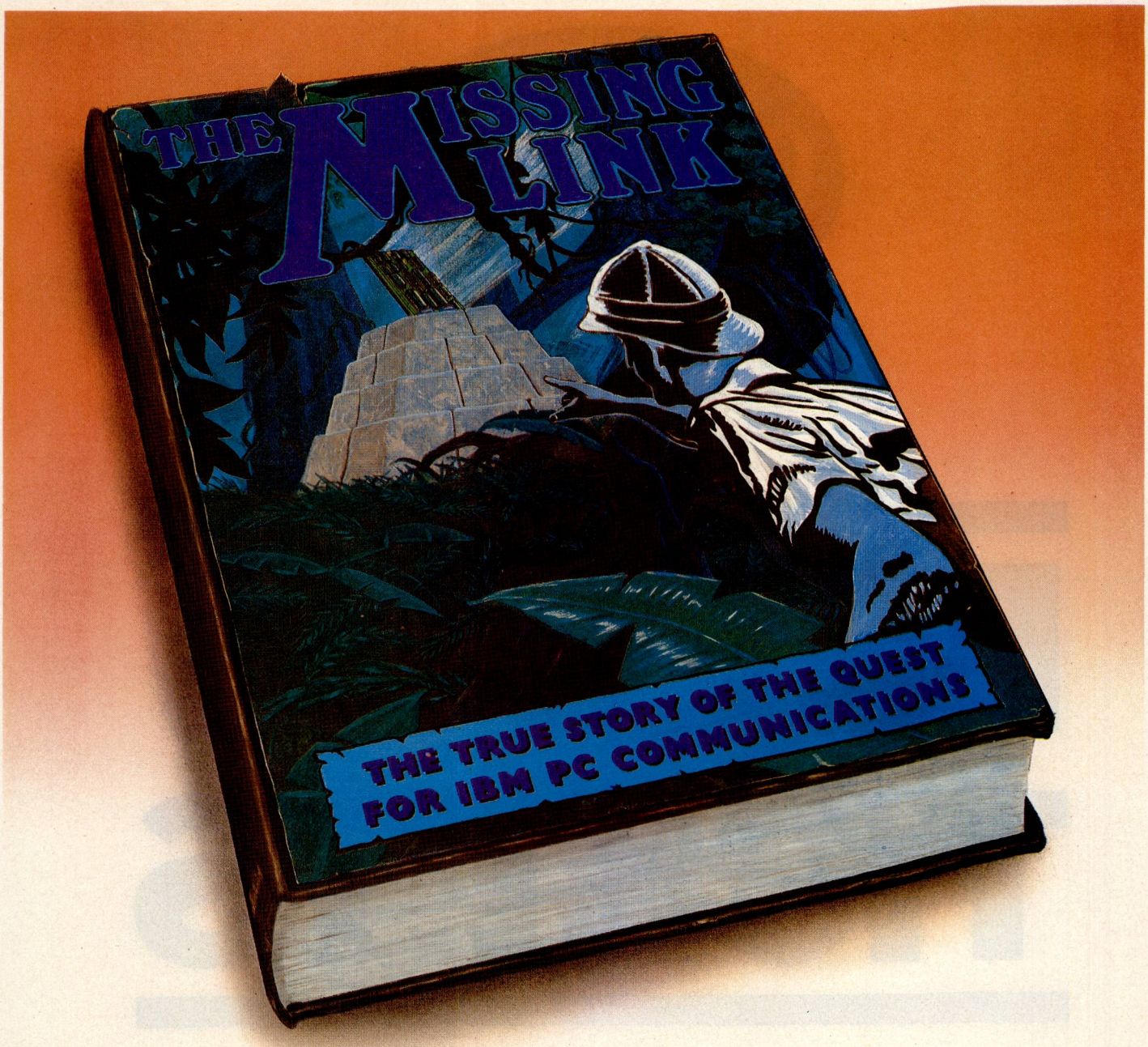

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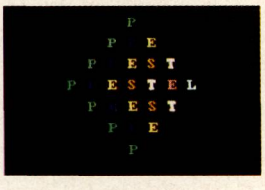

This British product plugs into any expansion slot and offers V21 300/300, V23 1200/75, 75/1200, Bell 103 full duplex and 1200/1200 half duplex with full error correction. An Asynchronous card is not required.

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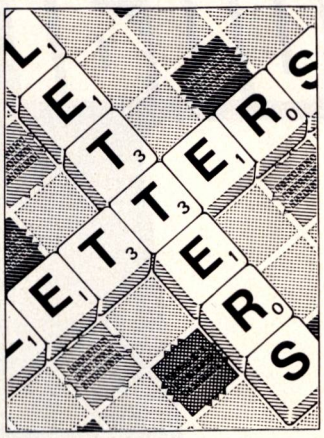

This is the chance to air your views — send your letters to Communications, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Calculating the mean

In the December 1984 issue of *PCW*, you published a review of an ISO Pascal package for the BBC Micro.

Some of your readers may be interested to know that an ISO package is also available for the OS-9 based Dragon 64 micro. The language follows the ISO level zero spec very closely and, as in the case of the BBC, includes a large number of (optional) enhancements. Fig 1 shows a Pascal Benchmark comparison between the Dragon and other micros which you have recently reviewed (notice how the Dragon and the BBC Micro are both penalised for their full 9.5 significant digit calculating accuracy in all maths functions).

The geometric mean, which I consider to be the only meaningful way of 'averaging' Benchmarks, summarises the results for each of the six micros listed. Clearly there is nothing to choose, in terms of speed, between the BBC or Dragon p-Code interpreters. OS9 Pascal does, however, include a native code translator which offers a very considerable increase in speed.

On the subject of Benchmarks, I feel I have to criticise your habit of printing the arithmetic mean at the end of your Benchmark tests. This value, in my view, imparts no useful information at all. As GT Childs pointed out (Letters, April), the geometric mean provides a more precise and meaningful summary of the eight Benchmarks, although even this figure could be misleading as it includes the controversial Benchmark 8.

Basic09, the Basic of the 6809, is a case in point. If this compiled Basic which runs on the OS9-based Dragon 64 (and Tandy Colour Computer) were to be included in your list of 68 computer systems (January issue), it would take twelfth place. However, taking its geometric mean of 3.08 seconds, it would rise to no less than second place with the Macintosh not far behind at 4.85 seconds (fourth place).

Jason Shouler, Poole, Dorset

Calculating the mean remains a bone of contention; it's better to work out which functions you're most interested in and then compare those. And don't lose sight of the fact that while the Benchmark figures are instructive, there's more to using a micro than the speeds they measure.

PASCAL BENCHMARK	Dragon ISO	BBC ISO	Apple USSD	QL Pcode	Dragon Native	Spectrum Native	Amstrad Native
magnifier	4.90	2.40	6.40	1.80	0.30	0.85	2.95
repeatloop	56.90	119.70	63.30	40.10	3.30	7.80	30.50
whileloop	71.60	120.00	70.90	45.10	4.80	8.90	33.80
forloop	58.90	29.60	74.30	11.00	5.00	7.10	29.50
literalassign	71.40	52.30	88.50	22.00	6.10	7.50	30.50
memoryaccess	72.80	53.10	91.00	20.70	6.40	7.80	30.40
unequalif	97.30	105.20	115.30	40.50	7.90	10.60	33.40
equalif	99.30	105.60	116.70	42.50	8.10	10.60	33.50
noparameters	33.60	30.70	50.20	15.30	11.20	6.50	18.60
reference	36.30	34.80	55.30	17.50	12.00	7.20	19.40
value	36.30	37.90	54.40	18.70	12.20	7.20	19.50
realalgebra	48.40	58.30	83.40	37.90	36.70	21.40	20.80
realarithmetic	62.70	61.20	93.00	43.00	50.00	20.70	19.90
vector	171.30	202.10	203.30	77.50	51.70	17.00	40.50
maths	332.40	346.10	66.00	10.20	321.20	9.30	9.00

Fig 1

Special software

PCW readers may be interested to know that Bardsoft (funded by Sinclair Research) contains information on a wide range of software for special needs, covering 40 micros including the Spectrum, the BBC, Apple and Commodore. This information is located by using keywords — descriptors. For the time being, printouts will mainly centre around 10 main descriptors, which are:

Assessment
Communication
Recreation
Numeracy
Training/Therapy
Cognition
Employment
Teaching
Perception/Motor
General

Searches can also be carried out on request for software for specific makes of micros, input switches, goals, and so on. There is a minimum charge of £1, with each subsequent record costing an additional 10p. All prices include postage and packing.

As we are continually updating and expanding the database, we would welcome information on relevant software. In return, we can help to publicise the information worldwide. We have found that some early learning and primary programs are suitable for inclusion.

For further details, contact: HPRU, Newcastle upon Tyne Polytechnic, Newcastle NE7 7TW, tel: (0632) 358211.

Peter Curran, Project Assistant, Handicapped Persons Research Unit

Taking it seriously

Perhaps you could ask the compiler of April's ChipChat to stick to computing subjects and not try to comment on other fields of expertise. I am referring to the comments regarding Nigel Searle's signature (*PCW*, April, page 296). While I am sure that many readers found it amusing, it showed total ignorance of a very serious matter. After all, how would you like Nigel Searle to suggest that you had spelt the word 'computer' wrong when you hadn't?

Nigel had not spelt his name wrong in the signature, but wrote it in a manner that to any half-competent graphologist would show many positive traits.

The fact that the letter 'e' looks like an 'i' shows mental keenness and agility. The fact that the 'i' is dotted ahead of its stem, so in this case it looked as though it was over the 'e', shows keenness and enthusiasm, as does the generally rising lines of his signature. Other indications, such as the open tops to his letters 'g' and 'a', show openess and generosity with his emotions, and the way he writes the capital letter 'N' shows pride and sensitivity. However, on the negative side there are signs that he blows his top fairly easily!

I hope this will clear up confusion in anyone's mind, and I would be happy to analyse your handwriting one day!

Brian A Watling, Belvedere, Kent

Thanks for the offer, but we'll stick to appearing purely in print for the time being. However, any readers with signature samples from the famous should rush to send them in.

All power to Amstrad

I have something to say to Amstrad — congratulations. Not for making it through the Christmas period, but for truly understanding your field.

Of the millions of micros sold worldwide, none has been worthy of the name 'home micro'. The millions sold have gone into the hands of hobbyists, gamesters and other vertical users' groups.

Not one computer manufacturer, until Amstrad, knew what a home computer should be like. Try explaining to someone how useful a Spectrum will be for keeping recipes or friends' phone numbers and addreses. They may be convinced at first, but

waiting for the cassette to load will put them off after the first go.

The Spectrum and Commodore 64 might be too slow, so tell them to buy a Beeb with a disk drive, a monitor and ROM software. You might as well pay the money for an IBM PC or a compatible.

Only now is it possible to utilise the power of a computer at home, now that the Amstrad 664 is here. The most important feature of a computer is speed, but that, however, is let down on cassette systems. It seems to have taken ages for someone to figure out that a disk drive was needed to make use of, and be an excuse for using a computer.

For £450, you can now have a usable home/office/school/games computer, thanks to Amstrad.

One thing is nagging me, however. Why did Amstrad choose a 'non-standard' 3in disk system? The 3½in has proved more popular and is the shape of things to come. I hope the company rectifies this soon.

Samer Shuli, Abu Shabi, UEA

This is a totally unconfirmed rumour, you understand, but we hear that Amstrad could get a much better deal on 3in drives than 3½in. And while we're less than keen on tapes and agree that the 664 is good value, we're not too happy to see the Americans getting CP/M version 3 first on the 6128. Still, if you accept that business must be business, then that's what Amstrad's good at.

Working out the winners

I read with interest the article in *PCW* June on blackjack ('Beating the system'). It surprises me that the author can have overlooked in his discussion two sources of information, one on each of the topics which he covers, although to be fair neither is particularly well known.

The whole topic of random number generation is dealt with comprehensively in a paper in the *SIAM Review* in the late 1960's or early 1970's. If my memory serves me correctly, the substance of it is that multiplicative congruential methods of the form:

$X_{(n+1)} = [(X_{(n)}*a) + c] \bmod m$

provide the longest period provided that the constants a and c are appropriately chosen, usually by ensuring that they are relatively prime to each other and to m. The simplest way seems to be to ensure that they are both prime numbers.

His second oversight is rather more serious. RA Epstein in *The Theory of Gambling and Statistical Logic*, published by Academic Press, 1977, devotes considerable space to an analysis of blackjack in which he estimates that under various conditions, a positive expectancy of up to about 13 per cent is attainable and I can do no better than to refer interested readers to this.

PR Wilkins, Camberley, Surrey

The easy way

In your May and July Letters pages, there are 'simple' formulae for Fahrenheit/Centigrade conversion and *vice versa*. For many years, I have used an even simpler conversion which seems adequate for non-scientific purposes.

To convert degrees Centigrade to Fahrenheit, double the Centigrade figure and add 30 to the result.

To convert degrees Fahrenheit to Centigrade, subtract 30 and halve the result.

Elizabeth White, MD, Newcastle upon Tyne

Calling all LEX users

I was very interested to read the article in the June issue of *PCW* on the use of macros in the Spellbinder word processing program. I use a program called LEX-11 on a VAX 11/750, which would seem to have similar abilities. To standard word processing features such as mailmerge and boilerplating it adds calculation facilities, column moving, a database, and keystroke storage of common phrases. However, the most interesting feature of LEX-11 is its ability to store any series of keystrokes an operator might perform, by means of a system of 'visible equivalents'. So macros can be written to perform applications such as invoicing.

I am a beginner in this area, but I have set up an invoice application, and (just for fun) a simple wages program 'translated' directly from one written in Basic by a colleague. These macros use the calculator facility, but there are many other applications involving text alone: for example, storing a letterheading that automatically prints the current date.

I would like to take this opportunity to ask whether any other users are interested in LEX's programming facility, and if so, whether they would like to contact me via *PCW*. I don't know whether there is a LEX user group. If there is, I should like to join it. If there isn't, perhaps we might start one.

Chrys Bavey, Hull

Stolen property

Our offices were burgled during the weekend of 8/9 June 1985, and among the items taken was an Apple Macintosh computer. Could you bring the serial number of the computer to the attention of your readers in case anyone chances upon it?

The serial number of the Mac is FG2110GM001 (it is a standard 128k Mac). An Apricot with two single-sided floppies was also taken.

We are offering a substantial reward for information which leads to the return of the machines and the conviction of the thieves. If you have any information which may be helpful, please write or telephone (01) 437 4343.

Duncan Scot, *Popular Computing Weekly*, 12/13 Little Newport Street, London WC2H 7PP

A fighting spirit

I am a Tamil from Sri Lanka, now living in India as a refugee after the ethnic troubles that erupted in July 1983.

I lost most of my possessions during the violence, but my Apple IIe computer with two disk drives and my Epson FX-80 printer which were installed in my office were saved. The vandals who ransacked my house destroyed my Z80 CP/M card and the 64k/80-column card, which I had bought only a week prior to the riots, along with most of my applications software manuals.

After 40 days of living in fear, I flew to Madras with my wife and our four children. Sympathetic friends in Airlanka and at the Customs helped me to send my computer system by air cargo to Madras.

I am now living in India in the southern-most part of Tamilnadu. After all the hardships and after having lost virtually everything I possessed, I have now dedicated myself to teaching computer programming to poor people.

I would be very pleased to get in touch with any serious Apple users among your readers.

TV Antony Raj, Tamilnadu

Just in case there's any problems, we haven't published the full address — any letters will be forwarded.

Sale or return

I am a sales assistant in a big computer shop in Ipswich, and I was curious about the 25 percentage of returns rumoured on Sinclair machines, because out of all the returns we get, the majority of them are for Acorn machines and that is allowing for the fact that we sell more of them than any other micro.

I have done my own survey of most of the shops in Ipswich and have come up



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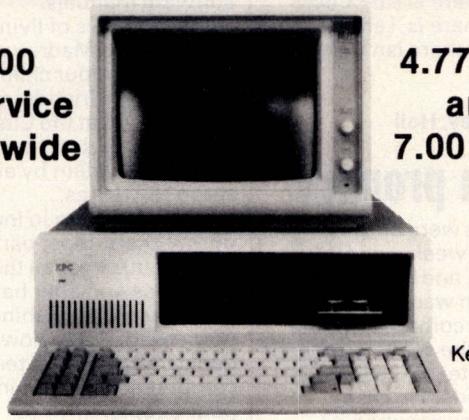

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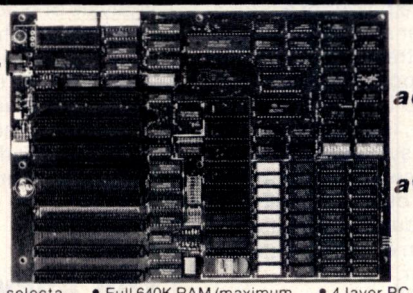

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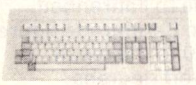

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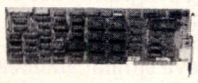

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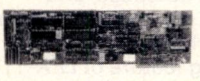

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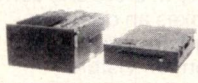

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LETTERS

with the following results:
Acorn 12 per cent
Sinclair 15 per cent
Amstrad 9 per cent
Atari 10 per cent

Now that is different to the last poll, isn't it?

Andrew Thomas, Ipswich

Communications correction

I read with interest the news story on page 110 of the June issue of *PCW*, and would like to correct a point raised regarding our communications capabilities.

Communications to Prestel, bulletin boards, Telecom Gold, and so on, is available via two pieces of currently available software:
1) Communications with Viewdata, available from ourselves or Kuma, rrp £39.95p.
2) Intext, available from Talbot Computers, rrp £113.85p.

To transfer data from one machine to another, an extremely easy-to-use piece of software is Hex-In Hex-Out, available from Crystal Research, rrp £50.

David Bell, AIDPM, software projects manager, Tatung (UK)

Architecture abounds

I am a student of architecture at Sheffield University.
I am very interested in architectural applications for personal computers, and would like to contact any other architecture students or architects with similar interests with a view to sharing ideas, programs and tips.

I have a BBC Micro system and have written a program for simple 3D (perspective) modelling of buildings on this system, and also have experience with larger systems on mini-computers.

If anyone is interested please contact me.

BC Bowden, 4 Whirlowdale Crescent, Millhouses, Sheffield S7 2NA.

We've also had a letter from Derek Burdekin of Slavedrive Software, 'a company set up by an architect to research into the whole business of architects and computers, and to promote the use of computers in architectural design'. Slavedrive's address is 19 Newlay Lane, Bramley, Leeds, tel: (0532) 560687.

Back by any other name

As software director of Multi Media Bureau of Language Enterprises, I believe I can offer some advice to Adrian Taylor (April Letters, page 117) on the delicate issue of language marketing. My company has to date published in excess of 200 languages, including over 40 computer languages. Our publications included five versions of English commissioned by Japanese manufacturers for producing technical manuals, versions of Pascal, Ada, Babbage and Pollock, variations on Bach, a Double Dutch, and all-Greek.

The problem with this type of software is that, once published, a language becomes public property, liable to be used or misused, abused and confused by anyone without the slightest obligation to the original designer. I'm afraid that no publisher will be able to guarantee your reader that his name will be preserved for posteriority. A few language designers have been lucky — Chaucer with his English readily springs to mind — but unfortunately most sink into oblivion. Even if Mr Taylor's Back makes it to fame and glory, he himself may remain a Mr Nobody — a great anymouse of computer science. The only way round this is for Mr Talyor to rename his Back Taylor, or Adrian, like Pascal did with Wirth, Fortran with Backus and Ada with herself.

Before Mr Taylor submits his Back to a publisher (and we at MMBLE will be more than happy to have a good look at it) he must carefully consider the following points:
1) Is it portable? That is, can he carry it all the way to the publishers' offices, or will they have to come over themselves? Will the users be able to carry it home? Will it crash their computers (this has been known to happen with languages which are not portable)?
2) Is it safe and user friendly? From Mr Taylor's descriptions I'd say the language is alarmingly dangerous — a 'steel spike on the top casing' is definitely against the country's safest regulations, especially as this language will be implemented on home computers. I suggest Mr Taylor redesigns this aspect of the language. I'm sure he can put the spike somewhere lower down his Back where it is not so readily accessible.
3) Does it support four-letter words? Most programmers like to have a good sprinkling of these when everything else fails, words such as GOTO and OFFF. Also, are the error messages meaningful, explicit, elaborate and uninhibited?

It isn't possible to go into more detail here, but perhaps Mr Taylor would like to give us a call in the near future and we'll be able to discuss matters in more depth. In the meantime, we at MMBLE wish Mr Taylor the best of luck, and may he be remembered in the annals of computing as the man who gave his Back to the public.

Andrew L Gol, Software Director, MMBLE

Was that your implementation of Double Dutch we saw the other day, or one that's passed into the public domain?

Office automation research

Could any of your readers help me with research for a TV programme? The programme is planned to investigate the ways in which office automation is changing people's jobs.

I am interested in hearing from people who have found their working lives changed — for good or bad — by the introduction of new technology into their office.

The programme will look at every area of office work, including secretarial and clerical workers, managers and professionals. All replies will be treated in strictest confidence and should be sent to me at the address below.

Lucie Hill, 27 Swinton Street, London WC1X 9NW END



'This is my son. He's going to be big in computers'

BLUDNERS

In June's Program File we missed the end of line 9140 in Alpha. The line should read as published, but with the addition of :ENDPROC at the end.

And going back to May, we've been told by HM Customs and Excise that using the 'M-Basic VAT Accounting' program will result in an incorrect VAT liability', and that 'the method does not fulfil the legal requirements of Retail Scheme D . . . Advice on the correct operation of the scheme should be obtained from local VAT offices'. It was an accountant who checked the program for us, but we don't feel up to disagreeing with the VAT people.



BANKS' STATEMENT

Bit wars

Big does not necessarily mean best: Martin Banks sounds a warning note on the advent of 32-bit processors.

They're right, of course, all those technology people. They would be, wouldn't they; after all, they invented it in the first place. Why have one, or even eight, when you can have 16 or 32 of them to play with?

Everyone wants 32, if only because the technology people have told them so forcefully that such a quota is necessary. It's just a little *passé* to have only 16 of them now, isn't it? So many of the common herd have got that many, so going for 32 at least marks one out as someone special, a connoisseur of things numeric and digital.

Those who have just eight to play with are, well, beyond the pale. They're the people who do it at home, behind closed doors, and generally only have, you know . . . small ones.

Yet there is a school of thought which suggests that 32 is brain-numbing, 16 is an overkill and eight is just enough for the majority of users, and they shouldn't be conned into wanting more by deceptive advertising and technological hype.

Before you ask the obvious question, I'll give you the answer — I'm talking about bits. Bits, you see, are all-important in this technological age, but I'm beginning to wonder whether there are too many of them and if we actually need them.

What prompted this train of thought was an article in an American electronics magazine which gave advance details of Intel's new 808386 microprocessor. This, for those who don't know, is a 32-bit device. What immediately struck me as strange was the fact that the company has barely got its existing 16-bit processor chips, the 80186 and 80286, out onto the market in anything like quantity, and half the world is still wondering what on earth to do with them.

Intel released the information because getting any new chip designed and into new systems and equipment is a long job. The designs for the next generation of personal computers are already under way. These machines are likely to be, whether we like it not, 32-bit machines, so the design engineers need to know what types of processor are going to be available and what their capabilities will be.

Intel has found it necessary to make its declarations as soon as possible because others, notably Motorola and National Semiconductor, already have 32-bit processors in the marketplace. These are now gaining design approval among users, and the Motorola device in particular could be a major threat to Intel's dominant position in the personal computer business.

The 68000 family has already made inroads at both the top and bottom ends of the market, scoring as a good engine for Unix-based systems and as the heart of the new generation of home/professional machines such as the QL and the Atari 520ST. The 32-bit version, the 68020, could, in theory at least, prove to be quite a threat to Intel's position, if only because its software compatibility across the whole product range means that computers aimed at very disparate market sectors can offer similar facilities. This in turn will provide users and manufacturers with a theoretical development path that incorporates considerable integrity and continuity.

All this begs an interesting and possibly significant question: do we really need 32-bit personal computers?

The short answer is 'yes', although there is a considerable caveat that should be attached to such a response. The answer is 'yes' for technological and applications-oriented reasons. Technologically, 32-bit devices offer the chance to work at much faster processing speeds. Instead of handling data a byte or two at a time, it can be taken in great lumps and chewed up in one go. This can be an advantage, especially when number-crunching or processing graphics, although for many textual applications it may not be too beneficial.

Such a device also provides the opportunity to gain access to a much bigger memory space within the system, (this is only the case if the processor has a large number of address lines as well as data lines). Large memories are a crucial factor in current personal computer design. They allow the new range of applications software and human interfaces to be run, which in turn means that more people will want to buy a system. These interfaces, such as Digital Research's GEM and Microsoft's Windows, provide a comprehensive graphics front-end for the applications programs which makes the programs easier to understand and use by the non-computer literate.

But (and this is the first of two warnings I want to attach to the affirmation of 32-bit systems), do the applications most PC users work with really need 32 bits? The graphics bits can be clever, and if designed right they can be very useful, but does the application actually need 32 bits.

I would contend that many users can get by quite happily with eight-bit machines, even in a work environment that includes word processing, spreadsheeting and communications work. Let's remember in this context that the Intel 8088 at the heart of the IBM PC is not a 16-bit processor, but an eight-bit device with ideas above its station.

The second caveat repeats a subject I covered here in June, namely, different ways of constructing computer systems. As has been pointed out many times before, the standard Von Neumann computer architecture has served us well, but is now outliving its usefulness. A central, single processor that is not only responsible for doing the prime job of processing data but also all the necessary housekeeping tasks will always be limited in its functional capabilities and power by the burden of its extra duties.

The typical solution to date has been to make the central processor ever bigger and more powerful in the hope that it will be able to keep pace. What normally happens, however, is that the housekeeping overheads increase as a function of Parkinson's Law. A good example of this is the current trend towards complex graphics facilities on applications programs, and the way they demand and get memory and processing power.

If Sinclair ever gets the money and starts making the waferscale circuits of Ivor Catt, perhaps this cycle will be broken. Robert Maxwell might represent the turning point. END

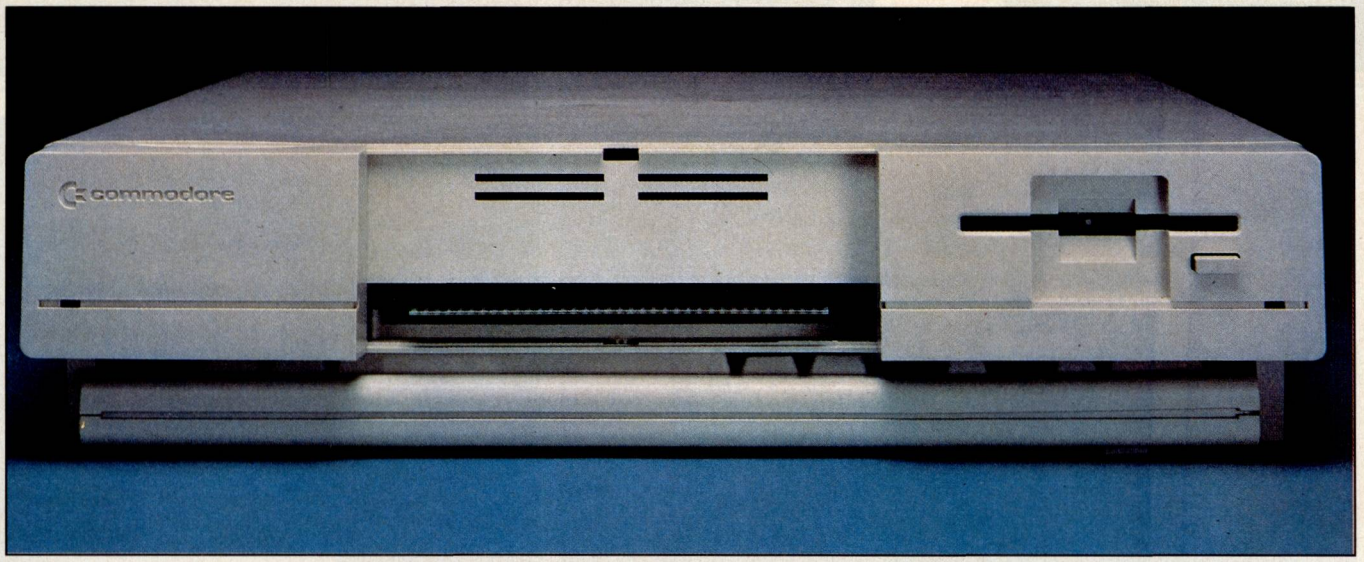


Illustration by Janet Good

Commodore Amiga

Come the revolution, there's going to be the definitive micro — low-cost, multi-tasking and the last word in business computing. Commodore's Amiga may be it. Guy Kewney conveys his very favourable impressions.





The front panel showing 3½in disk drive and expansion slot

I'm sure I'm in for a terrible disappointment with the Amiga, because no computer could quite live up to the effect this one has already had on me. Nonetheless, I've used it; I've asked all the questions I can think of, and on every count, it seems to be the machine I've been waiting for for the past two years, and which the industry stolidly refused to produce.

It does multi-tasking. It has colour. It uses a mouse and icons. It's fast. It has plenty of memory. It has cheap, large capacity disks. And it costs around $1200 (in the US) without display but including one disk.

It has to be admitted, right at the start, that I wouldn't have been given the chance to assess this micro if I hadn't been conspicuously excited about the early rumours of what I had heard.

Commodore executives kept the publicity lid tight closed on this really new machine, and they succeeded to an amazing degree. As little as a month ago, many people who you would expect to know about background information were still passing around wholly stupid rumours. And getting official information, which I had to have, wasn't easy.

In the end, officialdom and I played a funny little game in which the company would reveal a little more, and I'd make more excited squeaks of enthusiasm, and the company would open up a bit more, and I'd get more excited, until we agreed that, given my obviously positive attitude towards the Amiga, Commodore would be silly not to give me access to the machine.

That said, I'm sure this really *is* the micro I've been waiting two years for the world to produce. This is the business machine which any games programmer would give his eye-teeth to get hold of. This is the games machine which business software writers will be able to really make hum. And this is the machine which users will really love.

The Amiga is a multi-tasking micro (it can run several programs at once). It runs them very, very fast. It has graphics animation in colour, not just high-resolution pictures. It has sound capabilities the match of most synthesisers — it is Fairlight data compatible (if that means nothing to you, read on). It can have more useful memory than anyone will plug in for a couple of years, and it will be expandable.

And, to cap it all, it isn't expensive. It runs nearly 10 times as fast as the Macintosh for less than half the price.

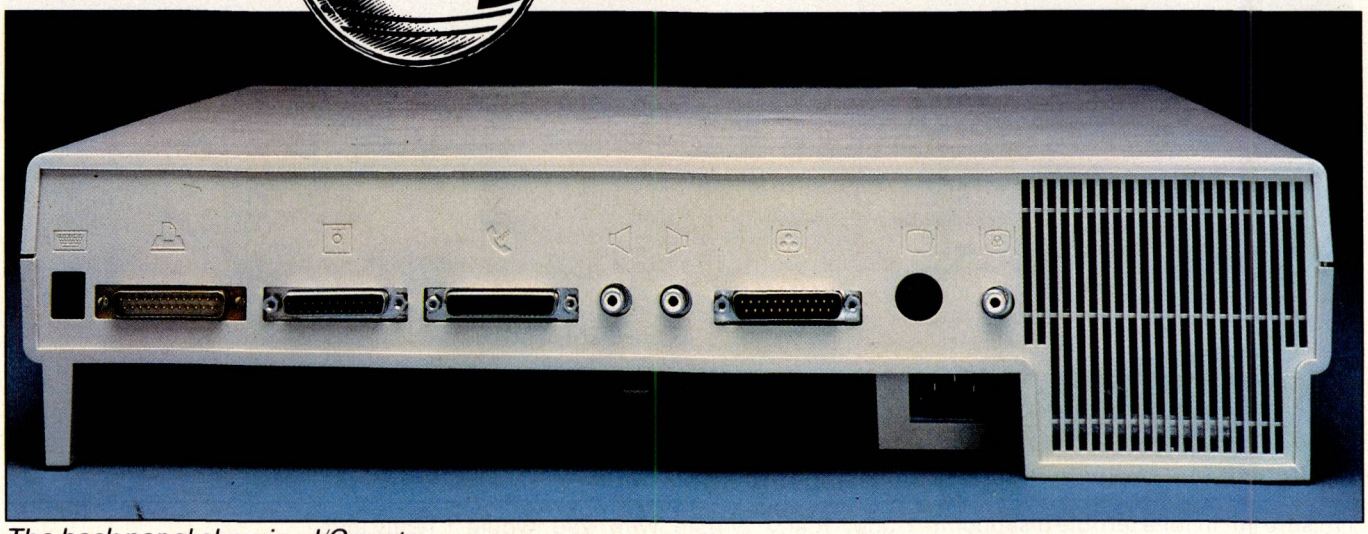
All we have to do now is wait for the software to roll in. I expect it to do so, but I have to add that other people are more cautious about software developers' plans.

Hardware

The Amiga is an icon micro like the Macintosh, with a colour display, mouse and keyboard.



The Amiga has a full-travel keyboard suitable for fast typing



The back panel showing I/O ports

The white system box is neat and compact, standing on four 2in-high feet. The top of the unit is 4.75ins above the table, making the unit a thin 2.75ins high. It goes back 13 inches, and the width from left to right is 17.5ins.

The keyboard is separate and includes cursor keys. It's a quality, full-travel keyboard, suitable for reasonably fast typing.

The mouse plugs into the main unit (the same socket can take two joysticks) and is a mechanical device, not an optical mouse. It has two buttons to save elbow grease. For anyone who has used a Macintosh, it will be sufficient to say that you use one button to pull down a menu, and then the other button to select various options, without letting the menu go. You don't have to pull it down five times to change five settings.

The 800k Sony-style (3½in) floppy disk drive is built in, another can be plugged in, and two more attached if they have their own power supplies. There is a memory expansion slot in the front to take 256k, bringing memory up to a 512k total, and the back panel includes all the standard slits and sockets with almost all of them capable of doing more than you would expect.

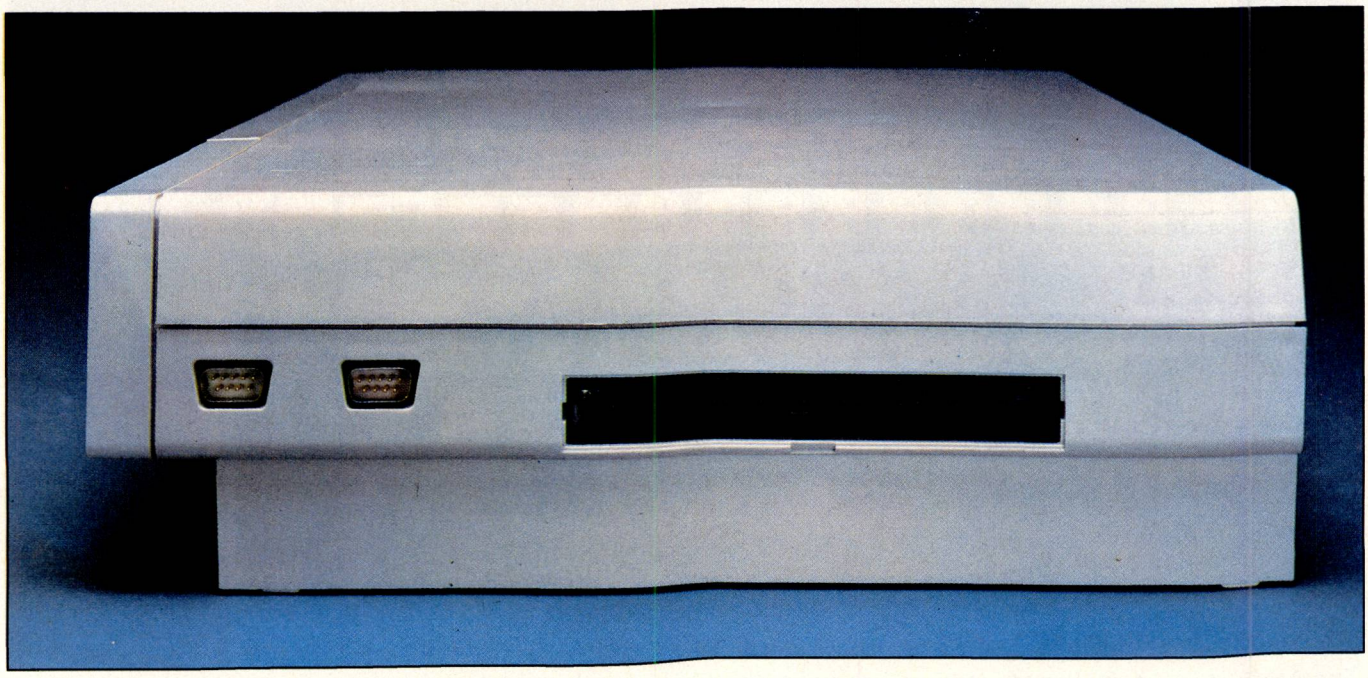
As it stands today it is expandable through a large interface slot, with options including a video frame grabber, a hard disk and extra memory. However, there is one special expansion feature planned for 'before Christmas', and that is a 5¼in disk for around $500 or less, including IBM PC emulation. This is actually done in software.

The display can be one of a range of Commodore devices, or a wide range of alternatives. Commodore's own top-of-the-range screen has very high resolution (640 x 400 pixels) and will sell for over $300 (and be well worth it), but cheaper ones will work. It will even drive a television. Video-out can be RGB, RGBI (TTL level, IBM style), and there is also 'video-in'.

The processor is a Motorola 68000 running at 8MHz. Don't make any assumptions about performance based on that fact, because you'll be wrong. You'll be ignoring the work done by three specialised chips — Daphne, Agnus and Portia, but here's a bit of background first before I go into those processors in detail.

In many respects, there isn't an ideal processor for tomorrow's micro — not if it has to be 'symmetrical' and also 'protected'. But worse, even if you could find a safe micro like the Intel 80286, which is very well suited for multi-tasking, and fit it with the Motorola 68000's nice, regular 32-bit registers, it would still have a simple problem: it would be arranged for data processing, not computing.

Computing involves lots of time-



The side panel has joystick and mouse ports

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wasting processes that have nothing to do with the processing of data. One of the most important of these is displaying enough information for the user to know what's going on. Daphne, Agnus and Portia handle most of this work, leaving the central 68000 to get on with its processing.

Daphne does display animation and sprites, Agnus does animation graphics, and Portia is a peripheral scheduler and interrupt handler which also takes a lot of the disk control work.

These three chips have a shared access to the Amiga's memory. One of the most important functions they have is that of 'bit blitter', an idea which (like icons and the mouse) came out of Xerox's Palo Alto Research Centre (PARC) in California.

It's hard to explain a bit blitter's performance, except to say that it's fast. One software producer working on it tried to compare its speed with other machines, in terms of pixels changed per second. He said: 'If you say that the Sinclair QL can alter 60,000 pixels per second, you'll find that the Macintosh can run around twice that speed, with 110,000 pixels per second. But the Amiga's blitter takes a microsecond to perform any function, at a million pixels per second — and altering a single pixel is just one of its many functions.'

A 'blitter' is bit-map image manipulator, a device which copies one large chunk of memory into another chunk of memory. While it is operating it doesn't block the memory from the processor, and the processor doesn't get in its way as they both have direct memory access through a multiplexer. The system clock makes sure that first the blitter, then the system components, can have access to the memory on alternate pulses.

Stripped of all this explanation, it means that the Amiga can draw a complex shape, fill it with colour and move it to a different place on the screen while changing its shape — and do it faster than your eye can see, at many times a second.

And all this time, your own Basic program can be running uninterrupted, at full speed, sorting through a database. And a complex tune can be played on dustbin lids, all in perfect tune.

Incidentally, no-one has been able to tell me anything definitive about the naming of the chips. beyond the fact that some people call Portia, Paula, and some call Daphne, Denise.

Portia (Paula) also handles the disk control for floppy disks, which does mean that you have to be careful, when writing programs, not to tie the blitter up for too long if you want to read large amounts of data into the system and *vice versa* — don't tie up the disk for too long if you expect to run graphics.

Agnus includes the 'bit image manipulator', or bimer, or blitter. Most of its work, besides that, involves making sure that it knows which bit of the system memory it is using. It has 8Mbytes to choose from, including the 512k at the low end of memory, used for the screen.

But it also has some parts of the graphics control: it has the memory logic for the sprites, including vertical position compare logic; and it also has the light-pen registers and the video sync counters.

Although much of the control logic for floppy disks is handled by Portia, the blitter is used for transferring disk data from disk buffers to program and data storage in memory.

The designers were talked into adding another feature to Agnus which was not in the text books: the ability to draw lines. They had the registers on the chip, said one of the team, so why not put line-draw logic in, too? They did, and it draws lines faster than the Pluto graphics machine can — without interrupting the 68000 for an instant.

Daphne is the chip which controls colour, most of the sprite information and most of the 'bit-plane' control. There are five bit-planes (plus a sixth, which is very complex to use and very powerful) on which sprites are handled.

The sixth bit-plane is a 'hold and modify' plane which controls the colour of the electron beam as it scans from

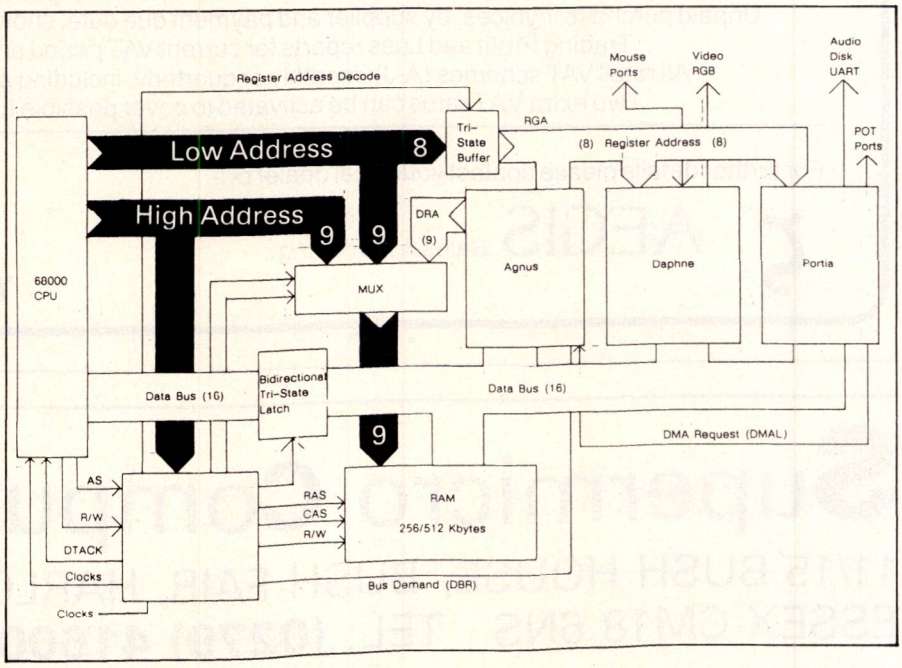

Fig 1 Lorraine

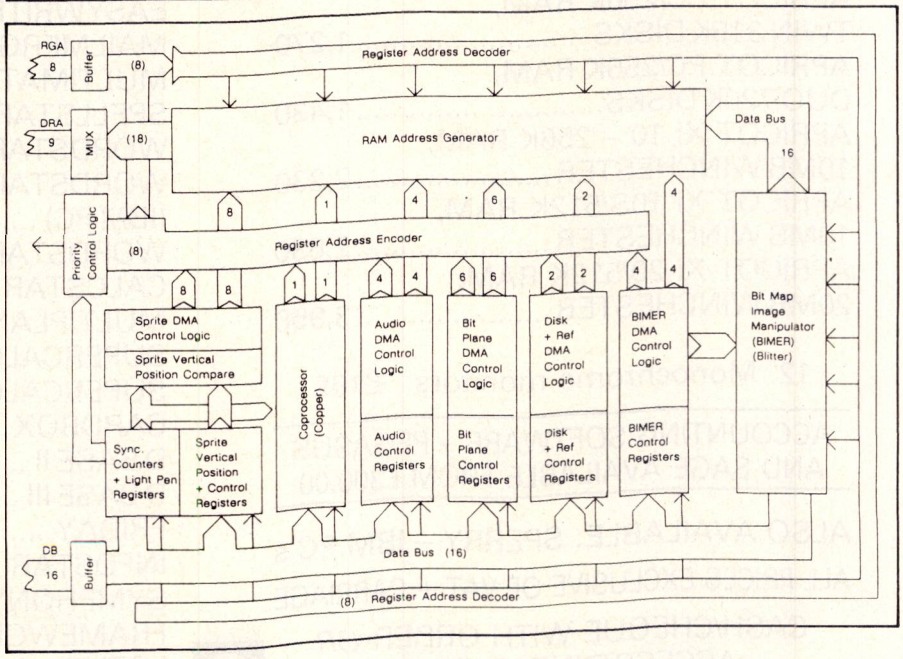

Fig 2 Agnus

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side to side in the video display. Using this bit-plane, it's possible to have something like 1000 colours onscreen simultaneously.

There are two types of sprite — the Vsprites and the Bobs. Daphne controls Vsprites. These are 'virtual' sprites, which are always 16 bits wide and as high as you care to specify. They move fast because they are in hardware, but there are restrictions on their use.

For really complex animation, the Bobs (blitter objects) come into their own. These are slower than Vsprites, but give more colour and more options on shape and size.

The power of these Vsprites and Bobs can be gauged from the fact that Amiga includes, in the Basic manual, a few lines of code that make King Kong snatch at an aeroplane buzzing him on top of his skyscraper, and Fay Wray jump out of his hands into a cockpit . . . and that's the simple animation potential.

There are other types of graphic elements (GELs) concerned with animation. They are beyond the scope of this review (and of this reviewer's comprehension, frankly) but I can say that they will allow transformations of the sort seen in TV commercials, where a word gradually changes shape to become a razor or a motor car, or an office block . . .

I did my best to understand how many sprites and bobs you can have, and in the end found that every restriction was meaningless. For example, you might think that you can have only eight sprites because there are eight sprite processors. But the sprite processors are the things that *draw* the sprites and not the things that keep track of them — and furthermore, that's only the limit per horizontal scan line! On the next line, you can have eight more as long as they don't interfere with each other. And if you are prepared to calculate what they look like going past each other, that doesn't matter, either.

You can always decide that you want other sprites there, but you just don't want the sprite processor to draw them in for the moment. Nevertheless, software will keep track of where they are and report their collisions.

Combined with the bit-plane manipulation ability and the management of different screen formats, plus the fact that there are 'rasters' bigger than the display and 'viewpoints' smaller than the rasters, it makes working out the limitations very difficult.

'The limitation is the size of video memory,' said one developer. 'That's restricted to half a megabyte.'

'. . . on every count, it seems to be the machine I've been waiting for, for the past two years . . .'

I suppose, in 10 years' time, that will possibly seem restrictive, but not to a world which regards the BBC's 32k of screen memory as extravagant.

In addition to handling floppy disks, the third chip, Portia, is also concerned with sound. Theoretically there are only four sound channels. In fact, it's almost infinite because the sound channels produce a waveform, not a frequency.

The sound generation of Portia is similar to that of the Fairlight synthesiser. It stores a digitised waveform in a section of memory, and each (stereo) sound channel plays that waveform back.

But it can also transform the waveform. It is possible, therefore, to get a digitised 'recording' of some sound or other, and process it, as the Fairlight does, to produce a whole scale of several octaves. The sound can be a trumpet, a clarinet, any instrument, or an orchestra, a choir, an organ with all the stops out, a dog barking, a bell, or anything with a definable pitch.

The chip takes that note and deduces all the others from it: you can hear a piccolo playing below the 16ft organ pipe, or a double bass playing at the upper limits of music, or a series of dustbin lids making beautiful harmony with the scratch of perfectly tuned tyres.

Speech synthesis is provided with this sound capability, and two ways of producing speech are offered. There is a pair of pre-recorded voices with American accents, male and female, which will turn text to speech. It's quite clever and, with software, can be persuaded to do realistic things such as raise and lower inflection as sentences are constructed.

Alternatively, there are phonemes. These are sufficient to generate almost any form of human speech from Russian to Xosa with quite convincing realism, but this does take more effort on the programmer's part.

The Amiga's expansion connector allows you to attach anything you like to the data and address lines of the multiplexer, up to a total of 8Mbytes. The system itself uses the other 8Mbytes of theoretical address space, but in such a way that it wouldn't be possible to have 8Mbytes of ROM. Several of the address lines are used directly for chip control.

Products to be launched with the machine are already under development. The obvious ones are extra disks (to plug in the floppy disk expansion port) and extra memory (to go on the expansion port).

Tecmar, the IBM peripheral add-on specialist, is apparently planning to launch a 20Mbyte hard disk which includes two megabytes of RAM, plus a real-time, battery-backed clock and a couple of other odds and ends for around $1000.

A genlock device is to be released by Commodore to read video signals in off video disk, or tape, or any video source, and match the sync of that video with the video display-out.

Apparently, this feature (automatic sync) is sophisticated enough on the bare micro: programmers report watching football on the display screen on which they're developing software (to the obvious detriment of the software project).

The genlock allows tilting of video frames, overlay, underlay and joint animation, along the lines of arcade games where a cartoon strip background plays and computer animated characters move around, blanking out the background. This is all done in hardware on the Amiga.

One other feature which the blitter makes possible is a RAM disk. Normally this isn't quite the advantage it might seem, because although a RAM disk is faster than a floppy disk (or a hard disk)

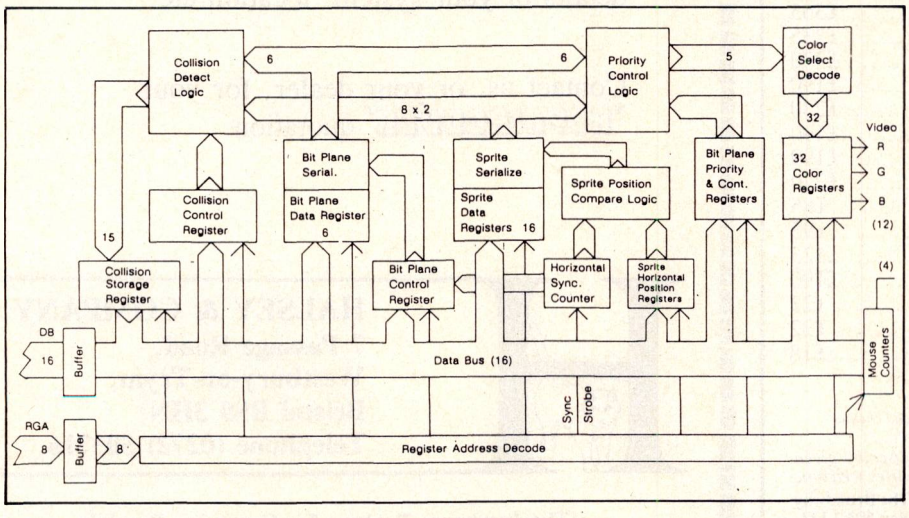


Fig 3 Daphne

it normally requires the attention of the processor.

With the blitter finding memory and transferring its contents around, however, the RAM disk works as though it were a separate computer with its own memory, just waiting to feed information into the system.

System software

The Amiga's operating system is a specially customised version of the Cambridge Tripos operating system. It was written for Commodore by Metacomco in Bristol, which licences the software on the 68000.

The advantages of this operating system are greater than you'd expect from an almost totally unknown piece of technology. Tripos, for those who missed that bit of history, means a three-legged stool, a stool such as Cambridge undergraduates sat on when taking examinations (a few centuries back). It then became the joke name for a three-part degree at Cambridge, and because it ends in OS, was stolen as the name for a network operating system.

The network is the Cambridge Ring, a token passing network of high speed and reportedly high reliability. Tripos, therefore, is a highly debugged system of message passing. It assumes a multi-tasking system, and merely passes messages from process to process in order of priority.

To operate Tripos, the programmer merely has to assign priorities to the processes in such a way as to ensure that no low-priority process (from the user's point of view) hogs the machine.

AmigaDos includes Tripos, plus a very complex structure of other bits of system software. It's clearly beyond the scope of a machine review to try to provide guidelines for applications programmers so I'll skimp on the highly complex way that all the different parts of AmigaDos talk to each other, but it is worth covering some of the details of what they are meant to do.

There are several unusual, innovative and powerful features of the disk filing system, but a few basics first: the floppy disk doesn't use sectors, but complete tracks; there is no 'directory track' as such; all storage 'blocks' are message packets; and there are no arbitrary limits to anything.

Having established those few ground facts, these are some of the implications. The DOS is an asynchronous filing system, suitable for a multi-tasking system. For every task it keeps a buffer for the disk, and writes to the buffer, not the disk. The buffer is in two parts: a track cache, and within that, block caches. Writing to the disk itself is a low-priority task, and will in any case wait for five seconds between buffer write and disk update.

This does make the system vulnerable to power failure, in theory at least. As far as an applications program is concerned, if it says 'close' a file, the DOS will report that it is closed as much as five seconds before the closed file is written to disk — or perhaps even longer if another higher priority application is doing disk work.

However, there are safety features built into the file structure which are based on the requirements of message passing. And in fact, on analysis, the system is actually safer than a conventional system. Consider the directory of an AmigaDos disk: the essentially cunning feature of the filing system is the fact that blocks do not point only to the next block of the file. A block has a header which points to the next blocks in the file, and (more important) points back to the previous block.

According the Metacomco's Tim King, who wrote the AmigaDos, this has one powerful advantage. 'It means that, given one good block, we can reconstruct most of the disk. From one block we can trace back to the core directory, in a central track on the disk (for safety), and from there can reconstruct all the pointers to all other blocks.'

'. . . the Amiga is the first low-cost, multi-tasking computer, introducing a new price level to business computing.'

In writing to disk, the DOS indicates whether a file has been modified, and un-closed files are flagged and usable. In contrast, of course, a disk file on a more conventional system which was being over-written at power-down would be lost forever, and worse, would be corrupted.

The drawback is that the system doesn't pop up with a list of files when asked to list the directory. It has to do a search, using a hashing algorithm to find them first, and this can take a few seconds, with the data coming off the disk surprisingly slowly by CP/M standards.

Don't grumble. On CP/M or MS-DOS directories, the contents of the directory, if scrambled, can mean you will never trace a single file again. The directory is a data stream, which can be altered by any careless programmer or user, and has no inherent relationship to the data on the disk at all. But on AmigaDos, the data *is* the directory. And if you use a RAM disk, the directory listing will take microseconds.

The fact that the disk controller reads in a whole track, without sectors, will probably have important consequences for copy-protection. The 'invisible' information between sectors is often used to confuse disk filing systems. On this disk it's part of the data, and that explains why a double-sided Sony floppy can hold 880k without speed tricks, as on the Macintosh.

Other points worth expanding on must include the fact that there are no arbitrary restrictions on anything. A directory can have as many sub-directories as you like, and each directory of a sub-directory can have as many entries as you like. A directory name can have up to 256 characters due to the name pointer being eight bits large, and that appears to be the only restriction. A file can be as big as the data in it: there isn't even a restriction on how many disks a file can be stretched over.

There are no 'types' of file. There is no end-of-file character, for example, because the file header blocks always specify exactly how long a file is. There are no 'sequential' or 'random' files — they can all be read sequentially or randomly.

Finally, a little quirk which I particularly like: DOS supports 'scatter loading'. This means that a 100k program can be loaded, even if there is no free block in memory bigger than 2k. As the program is loaded, all new jumps are calculated and inserted in the code. (This doesn't work, incidentally, with data space, which has to be allocated in contiguous blocks (unless an application is clever

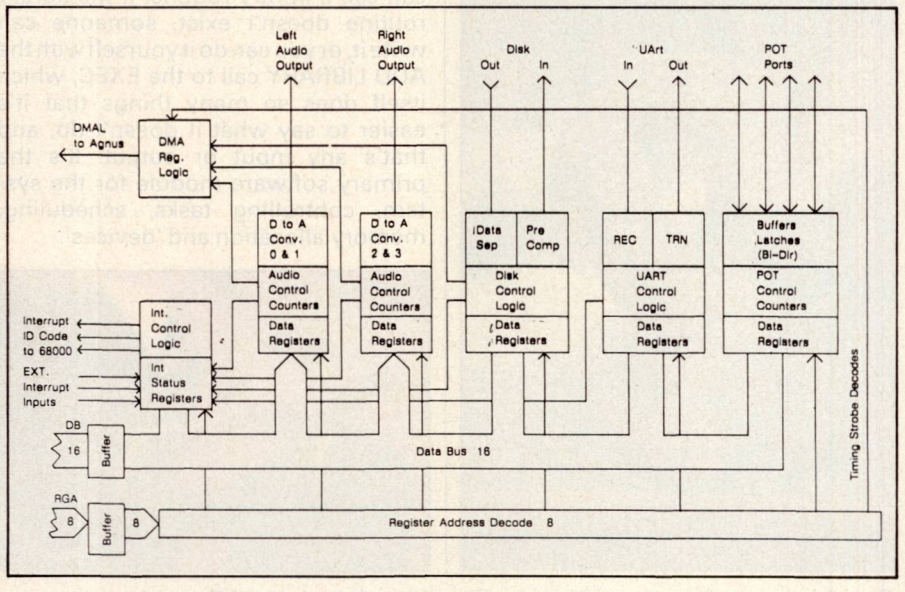


Fig 4 Portia

enough to do otherwise) by the operating system.)

When you switch on the Amiga it requests the 'kick-start' disk. This isn't a permanent feature, but a way of debugging the enormous (192k or possibly more) amount of operating code in ROM.

For the first six months or so, this ROM will be supplied on disk. Commodore argues that it isn't possible to produce the Amiga in a fully tested form without some public feedback, so the first thing the machine will do is fill up a special section of RAM memory with this code, and then it will turn off the write-enable line. The RAM will become read-only, and, until power-off, the code will remain there (unlike the Atari, where pressing RESET will require the operating system to be entirely loaded again) until power-down.

On the screen, after kick-start, will be a disk icon referring to the diskette you put in memory. There will also be a funny little icon with nothing on it but a 1> prompt. This is the 'command line interface' (CLI) option. Click on it with the mouse, and it turns the machine into an ordinary keyboard-driven micro, working rather like a Unix, or CP/M, or any ordinary computer system. To use this, you have to remember the system commands to get directories, start a program running, examine files, copy files, format disks, and so on.

Most users will never see this, and will drive the system with a mouse and the icons. But the option is there and is important, as you will realise when I describe the Basic.

The mouse-driven icons are collectively called the 'Workbench', and this is a program which can be loaded. It is possible to have the Workbench running as one task alongside another program, or several others, or several Workbenches. All you need is memory, and everything is optional.

The interface between application and user is a program called Intuition. Anyone who has seen a Macintosh working will recognised this at once as the way in which a programmer provides little command boxes, little response gadgets, and control bars. As with the Macintosh, Intuition can give you the ability to change the size or shape of a window. It gives scroll bars and put-away slots.

In addition, however, there is a 'gas tank' option, showing how much memory has been used from the free space available. There is also a new control gadget, the above-below gadget, which uses the hardware that keeps track of bit-planes. It can tell which window is visible and which is hidden, but, unlike normal windowing systems, this one keeps writing to invisible windows.

For the untrained user, this is bound to be confusing as one assumes, naturally, that the active window is the one on top. But it isn't. You can have an active input window, invisible, underneath another window displaying output. For example, you can order a word processor to load a file, then realise you don't have the right name. You open another window, ask for the directory, and as the right name comes past, type it in to the word processing window.

The Amiga is an 'open architecture' computer, with all information available from Commodore. Obviously some of the manuals will be cheaper than others, but one thing that will be well documented is the concept of a library.

Library functions exist in ROM, but you can create your own. These include all operating system control calls, which means that if a programming language doesn't have a feature, you can call a library routine. If the library routine doesn't exist, someone can write it, or you can do it yourself with the ADD LIBRARY call to the EXEC, which itself does so many things that it's easier to say what it doesn't do, and that's any input or output. It's the primary software module for the system, controlling tasks, scheduling, memory allocation and 'devices'.

EXEC is one of the library calls, and it is the one which is invoked at power-up. It's the only fixed-location routine in the whole system.

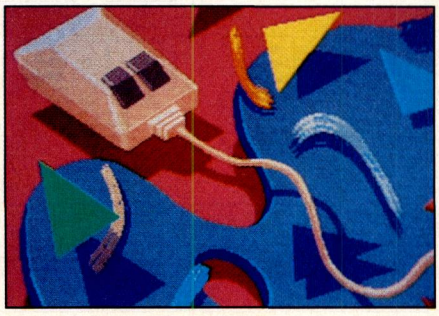
An understanding of the power of the EXEC is essential to the writing of serious software for the Amiga, but I suggest that you get the system documentation if the idea of tasks, processes and devices interests you. It's of purely academic interest to the average user. However, it is worth pointing out that no part of the operating system or ROM routines is essential. Apart from EXEC, every other piece of code can be dispensed with, and the simple bootstrap loader can be used to read in your own operating code. For such things as big games, this could save an enormous amount of memory space.

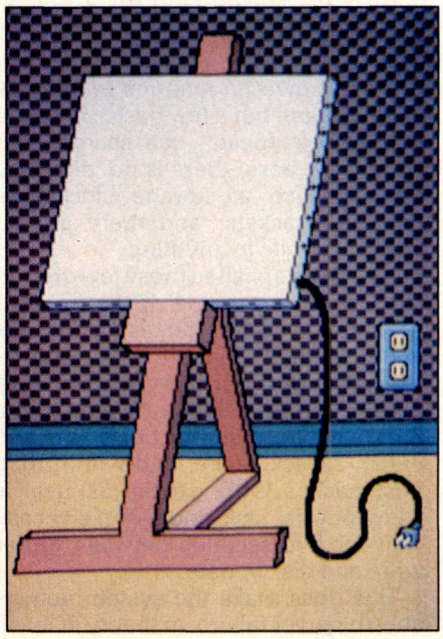
The previously mentioned command line interpreter has several interesting instructions which it will obey, which aren't found on other systems. Before listing some of these, it's worth pointing out that both the Workbench and the CLI are, like any other task, capable of running in parallel. One of the CLI commands is NEWCLI, which opens up a window with a new prompt. The first CLI window has a 1> prompt. The second has a 2>, the third a 3>, and so on.

But Workbenches can be started from the CLI, and CLIs from the Workbench, too. The only restriction, as with everything else on the Amiga, is the amount of memory you have plugged in. With that 20Mbyte disk, plus 2Mbyte memory coming from Tecmar, I don't expect many business users to be short of memory.

Commands which I like include SEARCH, EXEC, RUN, and COPY. SEARCH makes the question of long file names seem almost irrelevant. You can







Graphics created on a prototype Graphicraft by Island Graphics.

ask SEARCH to find a file in which a word, or phrase, or pair of disconnected words occur, almost as if you had a database manager. It would be foolish to search on a hard disk through all directories as it would take a while, but it will find it.

EXEC is the batch-file invocation. Unlike the .BAT or .SUB files we're used to, this includes complex IF and SKIP commands.

RUN invokes an application as a background task, which opens its own window and closes it when dismissed. To load an application normally, you'd type its name and it would run in the existing window.

But better than all these features is the help ability: type a command and a question mark, and the system will remind you of the inputs you have to put in and the ones you can leave out. Therefore, "COPY?" will give you FROM, TO/A, ALL/S, QUIET/SI, which will need the manual for interpretation the first time, but will be quite obvious thereafter. It's not the same as a pull-down menu, but it's close.

All commands, when specifying input and output, involve channel numbers (Amstrad users will recognise this) rather than hard devices. You can specify the printer as a channel and copy a file to it, or you can specify a particular window and copy it there.

Tripos is a network operating system. AmigaDos doesn't include a network operating section, but due to its structure, local networks of computers will need a trivial addition to the operating system, which already takes care of file-locking.

However, as there is no record-locking feature, any Amiga network will need a new version of the DOS, before multi-user networks are set up. Locking is controlled down to the block level, but for shared access, 'more granularity is needed,' conceded Tim King at Metacomco. This factor appears to be a simple oversight, and I gather it is correctable.

Multi-tasking is a problem for most operating systems, simply because it takes such a long time to get it debugged. Tripos, says Metacomco, has been around long enough to be stable, but is new enough not to be outdated. I suppose, in a way, the very fact that it wasn't rushed out for a new micro, but bought off the shelf, allowed the developers to mature it without the pressure of having to deal with hundreds of thousands of angry users who wanted Version Two.

Time alone will tell whether AmigaDos is capable of withstanding a software crash in one application. My cynical soul tells me it won't be in the first week of availability that this question is finally answered.

Applications software

The Amiga's Basic is Digital Research's Personal Basic. It was written for DR by Metacomco, and has now been upgraded to run on this machine and support its new features, so there are many new commands you won't find in Personal Basic any more than you would have found them in Microsoft Basic, of which Personal Basic is workalike.

Having said that it supports the machine's new features, I have given all the praise I am going to give. Microsoft, when it launched the Basic for the IBM, fell into a similar trap of rushing out a hopelessly inadequate, ill-prepared language. The company then had to sit down and write Advanced Basic (Basic-A) to take advantage of the steps the language had made since MBasic was written. So it is with AmigaBasiC (ABC). Its editor is ridiculous. There are obvious commands which it should have. It is at least two years out of date, and it isn't particularly fast.

The editor is a line editor. It's based on the Microsoft line editor, but it leaves out several of Microsoft's undocumented features. For example, control-A on Microsoft Basic will give you the previous command line, ready for editing. Not here: as with the CLI, you have to retype any command containing errors.

Metacomco says it wants a full-screen editor, and will do one. I can't wait. You can't even use the cursor keys when editing — very strange (undocumented) things seem to happen. This bug should be moved very soon.

Metacomco doesn't contest most of these objections, and says solemnly that this 'is the opportunity we've wanted for some time, to develop our Basic,' and that it is aware of what it wants to do. For example, the company agrees that line numbers are an option for labelling purposes, not a necessity. It agrees that a mouse-driven machine ought to have a mouse-driven Basic editor, and it concedes that a system with a real-time clock and calendar ought to be able to read it.

The saving feature of the Basic is the command SHELL "", into which any CLI command can be fed. The other is the library call command, which is available from every language on the system and looks infinitely more powerful than USR invocations. Between these two, the full power of the machine can be tapped from the silliest of programming languages.

The virtue of Basic, of course, is that it does give the beginner a chance to experiment with the sound and animation potential of the machine, but I hope the language will be improved very soon.

From Basic, all the Amiga's multi-tasking features are available to the user; the only restriction is workspace. However, one essential feature, if this isn't to be a problem for entry-level users, is control of the workspace size. At press time, it transpired that everyone thought it was possible to define the workspace, but no-one had actually done it.

The result is a 256k system with 40k of program space for Basic. That's irritating. What's annoying is that if you run four Basic tasks in four windows, you'll use up your memory because there's no way of telling Basic that you only need 2k for a silly little display routine — it gives you the full slab.

I understand that this will be corrected and Basic will get a parameter to set the workspace size.

Languages other than Basic which will be available for the machine at launch (at a price) will include Metacomco's assembler, Borland's Turbo Pascal, Lattice C compiler and a version of Logo. The system is heavily C oriented, with most of the systems software written in that language, or hand-coded.

As an optional peripheral, a 5½in disk can be plugged in. This can obviously read IBM diskettes. What isn't obvious, and may be regarded as over-ambitious, is a program, bundled with the drive, that emulates an IBM PC. Commodore swears that it's good — good enough to run Lotus 1-2-3. 'It won't be a substitute for the proper way of doing it,' the company says, 'but if you're working in an office with people who have 1-2-3 disks, at least you'll be able to take their outlines and change bits and put them back.'

Astonishingly, this should sell for under $500. I hardly dare to believe it. I can confirm, however, that the box will *not* contain an Intel 8088 chip.

At the time of writing this review, it unfortunately wasn't possible to obtain hands-on experience of the business packages expected to be available at the Amiga's launch. These packages include an entry-level word processor similar to MacWrite. For an entry-level system it's reported to be quite sophisticated, and many people have said that it is actually the nicest editor they've seen. I can only pass on their opinion — unbiased because they are not Amiga employees, but not necessarily informed because they aren't all word processing experts.

Also available at the launch will be an entry-level paint/draw package. This is said to work at many times the speed of MacPaint, and it should, shouldn't it? A music synthesiser program, a speech control and editing program, and a spreadsheet are also expected. A database, however, is still 'an area of

Benchmarks

B1	0.75
B2	2.07
B3	4.53
B4	4.87
B5	5.60
B6	10.39
B7	7.84
B8	11.33

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

weakness,' say the developers, and they are negotiating for one. Communications software is also likely. (None of these packages will be bundled in with the price.)

Games are also on the horizon, despite the fact that at $1200 minus the type of colour display you really need to appreciate this machine, you might think that it wouldn't really be used for games. Software producers aren't so sure of this. I've spoken to people who are doing games, and are simply totally wrapped up in the glory of what is possible.

The fact of the matter is that no games producer could resist the challenge or the opportunities offered by Amiga, and I expect them to come thick and fast in a year's time, when there should be a half million or so Amigas being used in the US.

Similarly, new types of software should appear. When the Macintosh first arrived, people laughed at the idea of a mouse. The Amiga does so many things so much faster, with so much more detail and with the added advantage of colour, that I expect it to generate similar innovation.

I expect to see much more sophisticated programs, too, because of the multi-tasking ability and because most business users will have 20Mbytes of disk and 2.5Mbytes of RAM, within a year. Integration becomes less important when you have multi-tasking, and individual word processing, spreadsheet, comms and other ideas packages can be more virtuoso in their design. A talking word processing package is an obvious start . . .

Technical specifications

Processor:	Motorola 68000 at 8MHz clock
ROM:	192k, possibly 256k
RAM:	256k minimum, expandable to 8Mbytes
Mass storage:	Internal 800k floppy, 3½in. External options include another 800k floppy using system power, and two more with exterior power. Hard disks fit on expansion slot
Keyboard:	Full-travel qwerty with cursor keys
Size:	4.75ins high × 17.5ins wide × 13ins deep
I/O:	Serial, parallel, video out and in, stereo sound, mouse
Dos:	Tripos, called AmigaDos
Bundled software:	Basic, Dos, Exec, no applications peripherals. Colour printers supported, video disk interface available

In perspective

The Amiga, at $1500 for a colour system, is obviously going to be a business machine first and foremost. Its massive memory capacity means that people with $3000 to spend will do so, getting a machine which spending $6000 on an IBM wouldn't match, and which comfortably out-performs the Macintosh.

Anyone who is comparing this with the Atari 520ST will quickly decide that the only reason for buying the Atari is the price. If you can afford the Amiga, that is the one you will want.

For the next six months, the Macintosh will have the clear advantage of a growing and impressive software base. However, the news from within Apple indicates a level of unjustified complacency about the Mac. The Fast Mac has been postponed; the Colour Mac, due out in February, is no longer being developed; and the Hard Mac, due in September, is also on ice.

This is not the time for Apple to go to sleep. The Amiga has the price advantage. It is an open architecture machine, onto which anyone can attach anything. All the system calls will be published, and it is nearly 10 times as fast and has genuine multi-tasking, which the Macintosh won't have for at least another 18 months.

The only other problem Amiga faces is: can IBM tart up the PC 11 and the AT, with windowing and icons, in time to match its facilities? The theoretical answer is yes, but in practice, is there any sign of it? IBM is fiddling around with TopView, which isn't even as good as the small-time Desq and doesn't have graphics. It grows each time I hear about it, and gets slower and slower.

Microsoft Windows on the PC is Microsoft's watershed — the time has come to put up or shut up. It may pose a serious threat, but it doesn't have the raw computing power or even a fraction of it. Perhaps it will be good enough to keep users loyal, but will it attract new ones?

In the end, it comes down to innovation. The Amiga does things that other micros can't do. In the past, the computer market has always shown that genuine innovation creates new sub-markets, and I'll be astonished if the Amiga doesn't do exactly that — and many of them.

Although there are few instant similarities between the Macintosh and the Amiga, both do use the 68000 and have high-level languages. I expect to see best-selling Macintosh programs coming onto the Amiga within weeks of its availability. Even programmers who have held aloof because of the non-disclosure requirements imposed by Commodore admit that it would normally take a matter of weeks, not months, to transfer new Macintosh programs to the new machine. I believe them.

Documentation

I hate to duck out of the important question of documentation, but so little was ready when I did the Benchtest that I don't feel I can honestly express an opinion. What I did see was lucid and helpful, but I think there's scope for books on the machine.

Prices

As the European version of the video chip isn't ready, the machine won't be available in Europe until January 1986. It isn't just a question of getting output to TV, but of getting input from the European video sources; this makes a PAL interface essential.

Traditionally, Commodore has priced in Europe along similar lines to the US. The machine is made entirely in the Far East and all the development work is paid for, so there isn't any real need to expect UK prices to be different from American ones. We can expect a naked, 256k system with a built-in disk but no display to sell for around £1000 — roughly comparable with the price of the Apricot F1.

The add-on memory should sell for £150 for 256k. The add-on Sony disks should be priced around the same, at £150. The Tecmar hard disk, at $1000, will probably cost around £1000 in the UK. At press time, software prices were still being fought about in California, and your guess is as good as mine.

The plan is to have the review model as just the first of a range of Amiga machines, and it looks likely that the price of this one will drop as the bigger ones appear — but that's some way in the future.

Conclusion

Although the Basic Benchmarks don't prove it, this machine runs upwards of 10 times the speed of any of its rivals. It adds hardware animation, video input, and stereo sound synthesis, including speech, to the icon-and-mouse family of designs which the market has come to expect, and offers it all at a price less than half of that of the competition.

To close as I began, the Amiga is the first low-cost, multi-tasking computer, introducing a new price level to business computing. END

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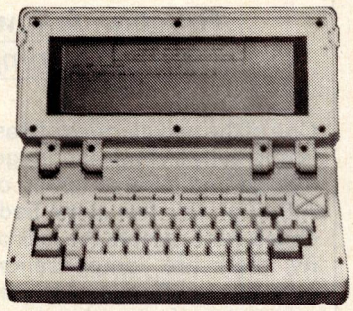

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Frankly functional

Function follows form, as functional programming takes up where structured programming leaves off. David Elworthy presents some Basic examples.

One of the peculiarities of Basic is that it is not really a single language at all, but a large and diverse family of dialects. Although this has some bad consequences, for example the lack of portability, there are compensations. Designers of new Basics can freely include good ideas from other languages by just bolting them onto the basic framework rather than having to create a complete language from scratch. The most important example of this is the inclusion of structuring which took off with BBC Basic.

The concept of structuring has been around since the 1960s, when the likes of Dijkstra and Wirth began to look at programming style. Their aim was to trade off execution speed against the ease of understanding and debugging programs, and their work led to such principles as top-down design, block structuring and the abolition of GOTOs. Structured programming caught on, and most modern general-purpose languages draw on such ideas.

But structured programming still has its problems, and there is at present research going on into a new type of programming, called 'functional programming', to further improve style. This is a rather speculative look at some of the new principles, and how they might be added into Basic. A number of the ideas can be simulated using a structured Basic, and I'll show how this can be done using BBC Basic as an example. Programs using this kind of simulation are rather inefficient, but I hope to illustrate just how clever and versatile functional programming is.

No more variables

Functional programming abolishes variables, and the obvious question is: 'Why bother?'. The problem with variables is one of scope: that is, knowing when they exist. In order to be able to understand what is happening in a program, it is useful to know exactly what any part of it does in terms of the effects and results it produces when certain values are applied to it. This is simply not possible in most languages because of what is called the 'side effects' problem. An example of this is a procedure which uses variables that are not mentioned in the arguments, poss-

```
>LIST
   10REM Program 1a - non functional factorial
   20X = 5
   30factorial = 1
   40FOR I = 2 TO X: factorial = factorial * I: NEXT I
   50PRINT factorial
>
>RUN
       120
>
>
>
>
>LIST
   10REM Program 1b - functional factorial
   20PRINT FNfactorial(5)
   30END
   40
   50DEFFNfactorial(x): IF x < 2 THEN = 1 ELSE = x * FNfactorial(x - 1)
>
>RUN
       120
>
>
>
>
>LIST
   10REM Program 2 - a more complex functional program
   20PRINT FNleftinsert("B","ACD")
   30END
   40
   50DEFFNleftinsert(char$,into$)
   60 IF ASC(char$) <= ASC(into$) THEN = char$ + into$
   70  = LEFT$(into$,1) + FNrightinsert(char$, MID$(into$,2))
   80
   90DEFFNrightinsert(char$,into$)
  100  IF ASC(char$) >= ASC(RIGHT$(into$,1)) THEN = into$ + char$
  110  = FNleftinsert(char$, LEFT$(into$, LEN(into$) - 1)) + RIGHT$(into$,1)
>
>RUN
ABCD
>
>
>
>
>LIST
   10REM Program 3 - functional Hanoi program
   20PRINT FNhanoi(4,"a","b","c")
   30END
   40
   50DEFFNhanoi(n,a$,b$,c$)
   60 IF n=0 THEN ="" ELSE =FNhanoi(n-1,a$,c$,b$)+CHR$(13)+CHR$(10)+"From "+a$+"
 to "+b$+FNhanoi(n-1,c$,b$,a$)
>
>RUN

From a to c
From a to b
From c to b
From a to c
From b to a
From b to c
From a to c
From a to b
From c to b
From c to a
From b to a
From c to b
From a to c
From a to b
From c to b
>
>
>
>
>LIST
   10REM Program 4a - IF in functional style
   20INPUT x,y
   30PRINT FNif("FNequal(x,y)", "SQR(x)", "EXP(y)")
   40REM i.e. if x=y, print the square root of s, else print e to the power y
   50END
   60
   70DEFFNif(cond$,then$,else$) = EVAL(EVAL(EVAL(cond$) + "(then$,else$)"))
   80
   90DEFFNtrue(a$,b$) = a$
  100DEFFNfalse(a$,b$) = b$
  110
```

Fig 1 Programs 1a, 1b, 2, 3, 4a, 4b, 5a and 5b

Fig 1 continued

```
  120REM Now a typical conditional. This uses the numeric values of
  130REM true (-1) and false (0) to make 0 or 1 copy of each string
  140DEFFNequal(a,b) = STRING$(-(a=b),"FNtrue") +STRING$(1+(a=b),"FNfalse")
>
>RUN
?2,1
2.71828183
>RUN
?2,2
1.41421356
>
>
>
>
>LIST
   10REM Program 4b - IF in functional style
   20INPUT x,y
   30PRINT FNif("FNequal(x,y)","x+y","FNif(""FNequal(x,0)"","SQR(y)"","EXP(y)"
")")
   40REM i.e. if x=y, print x+y; otherwise, if x=0, print sqr(y), else print exp
(y)
   50END
   60
   65REM The rest is the same as 4a
   70DEFFNif(cond$,then$,else$) = EVAL(EVAL(EVAL(cond$) + "(then$,else$)"))
   80
   90DEFFNtrue(a$,b$) = a$
  100DEFFNfalse(a$,b$) = b$
  110
  120REM Now a typical conditional. This uses the numeric values of
  130REM true (-1) and false (0) to make 0 or 1 copy of each string
  140DEFFNequal(a,b) = STRING$(-(a=b),"FNtrue") +STRING$(1+(a=b),"FNfalse")
>
>RUN
?2,2
             4
>RUN
?0,2
1.41421356
>RUN
?2,1
2.71828183
>
>
>
>
>LIST
   10REM Program 5a - lazy evaluation
   20REM >< means pair
   30PRINT FNlazy(">"<FNintegers(0)")
   40END
   50
   60DEFFNlazy(a$)
   70 IF a$="" THEN =""
   80 PRINT LEFT$(a$, INSTR(a$, "><") - 1)
   90 = FNlazy(EVAL(MID$(a$, INSTR(a$, "><") + 2)))
  100
  110DEFFNintegers(start%) = STR$(start%) + "><FNintegers(" + STR$(start% + 1) +
 ")"
>
>
>LIST
   10REM Program 5b - lazy evaluation without tail recursion
   20REM >< means pair
   30PRINT FNlazy(">"<FNintegers(0)")
   40END
   50
   60DEFFNlazy(a$)
   70 IF a$="" THEN =""
   80 PRINT LEFT$(a$, INSTR(a$, "><") - 1)
   90 a$ = EVAL(MID$(a$, INSTR(a$, "><") + 2)): GOTO 70
  100
  110DEFFNintegers(start%) = STR$(start%) + "><FNintegers(" + STR$(start% + 1) +
 ")"
>
```

ibly changing their value. When this is allowed, two calls of the procedure may give different results, even though the procedure call is the same. (For example: given DEFPROCnasty (x): A = A + 1: PRINT A: ENDPROC, then A = 0 : PROCnasty (0) : PROCnasty (0) prints 1 and then 2: that is, PROCnasty (0) is not equal to PROCnasty (0)!)

In structured programming, you can get round this by making sure all variables are either declared as local or are function parameters, but many languages don't force you to do this so the loophole is used either by accident or as a result of laziness.

It is often easy to remove variables from a program. Programs 1a and 1b (Fig 1) show the factorial function written in two styles: the first is conventional and uses variables; the second is purely as a function and doesn't. x in Program 1b may look like a variable, but might more accurately be called a parameter as it doesn't vary once it has acquired a value in the function call. As the function parameter is distinct from anything else with the same name (even in a different call of the same function), it is safe from side effects.

Program 2 is a functional program which tries to insert char$ into the ordered string into$ by chopping each end off it in turn (there are better ways of doing this). Again, there are no assignments. What each function does is to either yield a definite value or to invoke another function (this is where the name 'functional programming' comes from). The action of the program as a whole is just a call to a single function, which in turn calls others, and so on, until something comes up with a definite answer which can be passed up to higher levels.

There is an interesting consequence of this. Program 3 (Fig 1) is a function to solve the well-known Towers of Hanoi problem. a$, b$ and c$ are the names of the towers, and n is the number of discs which are initially all on tower 'a'. The program lists what moves to make, but it doesn't produce any output at all until it has worked out the whole of the answer. With the simple style of functional programming given so far there is no way round this, which is a bit of nuisance — no interactive programs, for example, as you don't see the prompts, and so on, until the end.

IF...THEN...ELSE

With a small addition, this style can be transformed into a remarkably powerful technique. For example, here's how the construct IF...THEN...ELSE could be added to functional Basic if the designer of the language had not included it.

The key is to allow a function to supply the name of another function as its result; the result can then be applied to further arguments. To do this, we need some means of invoking evaluation of a function, and BBC Basic provides this by means of EVAL. In real functional programming languages, the evaluation is often automatic; Lisp takes a similar approach.

Program 4a (Fig 1) uses the functional 'if'. For this we require a set of conditional functions, of which FNequal is an example; these return the name of a function as their result. FNif can then evaluate the condition, and EVALs the result of it applied to the arguments then$ and else$. The result of doing this is evaluated one more time, so that the then and else parameters can themselves be functions (in fact, anything at all, except string constants). An interesting point is that true and false, which are normally thought of as values, are now functions, albeit rather simple ones which just choose one of their arguments.

This form of if statement is completely general. then$ and else$ could themselves be if functions, or contain EVALs so that evaluation can be nested to any depth. Program 4b (Fig 1) is an example.

You might like to see what other parts of Basic can be thrown away using a similar approach. Real functional programming languages have very few built-in constructs.

Lazy evaluation

It is rather restrictive to have to wait until all the functions have been fully evaluated before producing the result. Not only does it eliminate interaction, but it could also mean that the program runs out of memory because of all the output that has to be saved until the program has finished.

A solution to this is to use what is called 'lazy evaluation'. (The opposite case, that is, evaluating everything, is called 'strict evaluation'.) Here, what we do is work out just as much as is necessary to print the first part of the result, and keep a record of what there is

left to do by passing around the name of a function and some arguments as before. In functional programming languages, this is normally done by defining some functions to be lazy and having an output routine that can spot unevaluated objects. The routine is then supplied with a pair of items, of which the second is only evaluated when the result of the first has been printed. The function that makes pairs can then be lazy.

Program 5a (Fig 1) shows how to do lazy evaluation in functional additions to Basic. FNlazy expects its argument to have the form:

"something-to-be-printed><next-thing-to-do"

where >< means 'pair'. If the first part of this is null, we stop. The program shows how to use this by producing the infinite list of natural numbers within the limits of the range of integers allowed. The print command is a bit of a cheat as it isn't a function, but unfortunately there's no easy way round this. (Input could be made functional by using GET$.)

The one remaining difficulty with FNlazy is that BBC Basic does not allow very deep recursion, so it soon gives a 'no room' error. This kind of recursion (known as tail recursion) frequently occurs, and can be eliminated as shown in Program 5b (Fig 1). Unfortunately, this violates both the 'no GOTOs' rule and the 'no variables' rule, although both are actually quite safe — the variable is known to be local and the GOTO is short-scope.

Many structures and functional programming languages specifically look for tail recursion and internally translate it into a construct like this. That way, the programmer isn't breaking the rules and the system can work efficiently.

You could now rewrite the Hanoi program using lazy evaluation and a functional IF.

Referential transparency

Referential transparency can't be easily written into Basic. It is never doing the same thing twice: that is, if at some stage you have evaluated a function with certain arguments and you then come to the same instance again, rather than work out the result a second time, you just look it up from before. This is not always possible to do completely, but the general approach is as follows.

The application of a function to some arguments is represented as values sitting around in memory. When another function wants the result of it, it looks at that area of memory and sees that the function has not yet been evaluated. Having carried out the evaluation, as well as taking the result away for its own use, it replaces the contents of that area of memory with the result, and an indication that it has already been evaluated. Next time something wants the result of that particular function application, it need only look up the result.

The two calls to the function must know that they are the same, otherwise there are simply two identical applications at different places in memory. This is where the main problem in implementing referential transparency arises — spotting when things will be the same.

'Structured programming caught on, and most modern general-purpose languages draw on such ideas. But structured programming still has its problems . . .'

Another difficulty is the input function. We don't want GET$ (or whatever) to have this kind of transparency: if it did, it would keep on giving back the character it had read the first time it was called. An elegant solution is to represent the input as an infinitely long list of characters, using a similar method to that for the infinite list of numbers in Program 5 (Fig 1). The program can manipulate the list freely, but the system need only read as much of it as is necessary to get to the character that is needed. The remainder can just be a reference to a function which gets more input (and which is hidden from the user).

The final program is written in a real functional programming language (see Program 6 (Fig 2)). It is written in Ponder, a language developed at Cambridge.

The program prints a histogram with line lengths taken from the list of numbers in the last line, together with an axis equal in length to the longest line. The only parts of this which are built into Ponder are the constructs Letrec, and functions such as head, null and >. The rest is defined in Ponder itself (in a separate prelude).

Conclusion

There are several aspects of functional programming languages which I cannot describe in detail here. For example, functional programs should be amenable to theoretical analysis of whether they are correct, without the need to run the program on all possible forms of the data. Another intriguing idea is that of using them on multiple processor systems: you let a separate processor loose on each function (at some level), and combine their results when they have finished.

Thanks to Jon Fairbairn for his (unwitting) help in the preparation of this article.

END

```
Letrec histoline == Int n -> Char c -> List[Char]:
    If (n=0)
    Then "'n"
    Else c :: histoline (n-1) c
    Fi;

Letrec histogram == List[Int] sizes -> Char symbol -> Int max  -> List[Char]:
    If null sizes
    Then histoline max '=
    Else append (histoline (head sizes) symbol)
            (histogram (tail sizes) symbol
             (If ((head sizes) > max)
             Then head sizes
             Else max
             Fi))
    Fi;

histogram (5 :: 10 :: 3 :: 17 :: 6 :: 1 :: 4) '* 0
```

Fig 2 Program 6

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Kaypro 286i vs Compaq 286

Is it worth buying a PC/AT lookalike? Peter Bright weighs up the respective merits of the Kaypro 286i and the Compaq Desktop 286, and identifies some distinguishing features that set them apart from other PC-compatibles.



Whatever happened to the IBM PC/AT? When it was launched it looked like a nice machine — it may even have been good value for money. Then we began to hear stories about hard disks that kept dying, and now IBM is said to be rationing dealers.

All this has got to such a stage that *PCW*'s editor is now having paranoid thoughts about the AT being in some way a hoax by IBM to fool the compatible manufacturers. If that's true, then the subjects of this Benchtest had better start worrying . . .

Kaypro 286i

Hardware

The 286i is very much an AT lookalike, the main difference being that where the PC/AT is cream, the Kaypro is black.

The main system unit is very large — too large, I would say, for the average desk. For this reason, Kaypro has provided extra-long monitor and keyboard leads so that you can place the main system box next to your desk rather than on top of it.

The main system box is constructed entirely of metal with none of the plastic facings of the Compaq or the PC/AT. This construction gives it a very square look which is only offset by a strip of rubber ribbing which runs along the joint between the top cover and the front panel.

The front panel itself is very reminiscent of the PC/AT. To the right-hand side are two half-height 5¼in floppy disk drives, and to the left-hand side is a lock and LEDs indicating power-on and hard disk access. The latter is included whether or not you have a hard disk fitted.

The lock is a copy of the type fitted to the PC/AT. You can disable the master keyboard to stop any unauthorised access to the machine. Unfortunately, unlike the PC/AT, it is perfectly possible to remove the lid and bypass the key even when the system is locked. This isn't possible on the AT because the lid is locked in place when you disable the keyboard.

The rear panel is also like that on the PC/AT, even down to the little plastic panel you can stick on to make it look nicer. To the left-hand side are power in and out, in the middle is a DIN socket for the keyboard, and to the right-hand side are removable covers for the eight expansion slots.

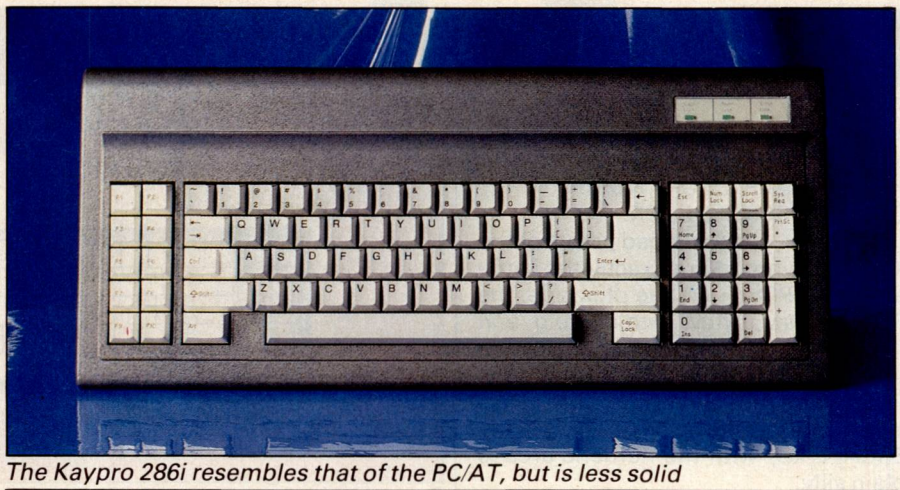
On the review machine two of these expansion slots were visible: one for colour video output, and one for a parallel printer and an RS232 port. The latter is extremely annoying because it uses a cut-down 9-pin D socket rather than the conventional 25-watt D plug. This means that none of the standard RS232 leads will fit.

Getting inside the Kaypro is achieved in exactly the same way as any IBM or compatible. You remove the five screws holding on the lid and then slide it off.

Inside there is a fair amount of empty space. To the right at the front are the cages to hold the floppy disk drives and the hard disk or disks. If a hard disk is fitted, it will be hidden from the user by the front panel as on the PC/AT.

To the right at the back is a very large fully-encased power supply/fan unit. The fan was quite noisy during the test and was certainly distracting in a quiet room. It also audibly slowed down when the disk drives were in operation. To the left of the power supply is a rechargeable battery pack providing power for the on-board clock/calendar.

The digital circuitry lives to the left and along the bottom of the main unit. The motherboard takes up three-quarters of the bottom of the casing; this houses the main Intel 6MHz 80286 processor, RAM, ROM, TTL logic circuitry and eight expansion slots.



The Kaypro 286i resembles that of the PC/AT, but is less solid

In its Kaypro implementation, the 80286 chip has sprouted a large heat sink on its back which I haven't seen on other machines, but it can't hurt. Next to the 80286 is a socket for an 80287 maths co-processor should you need it.

The review machine was supplied with 512k of RAM made up of 18 256kbit chips giving 512k with parity. Sockets are provided on the motherboard which allow the RAM to be increased to 640k by plugging in a further 18 64kbit RAM chips.

Almost all the chips on the motherboard were socketed. This is very unusual for a modern mass-produced machine due to the extra cost, but it does make it easier to replace faulty chips.

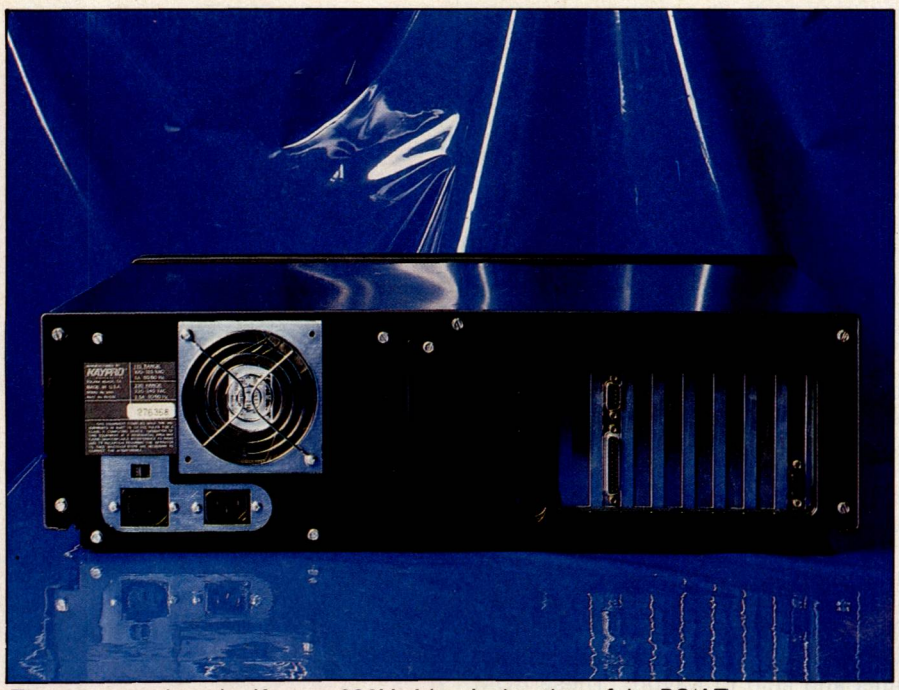
Of the eight full-length expansion slots, six are PC/AT-compatible enhanced slots and the remaining two are standard IBM PC slots. The basic system uses three slots, leaving five for future use. Of the three that are in use, one is taken by a half-length colour graphics card, one by a half-length parallel/serial card, and the third by a disk controller card.

The disk controller card is the only one to make use of the full addressing and data path provided by the enhanced PC/AT slots. This one card controls both hard disks and floppy disks, including the 1.2 Mbyte disks used in the PC/AT.

The review machine was supplied with twin 1.2 Mbyte 5¼in floppy disk drives, which use the same special disks as the PC/AT. Although Kaypro makes no guarantees about the drive's ability to write 360k IBM PC disks, I had no problems reading or writing to that format. Hard disks are not yet available.

As you would expect, the keyboard on the 286i is a straight copy of that on the IBM PC/AT; the main difference being that the quality of construction is generally lower than that on the AT. It connects to the main unit via a long coiled cable and a DIN plug.

The main qwerty typing area takes up most of the space on the keyboard. On the left-hand side are 10 programmable function keys, and on its right-hand side are a combination numeric keypad and editing/cursor keys. In the top right-



The rear panel on the Kaypro 286i is identical to that of the PC/AT

hand corner of the key board are three LEDs to indicate CAPS LOCK, NUM LOCK and SCROLL LOCK.

The main good and bad points of the Kaypro keyboard are exactly the same as for the PC/AT. On the plus side, the RETURN key is now nice and big, and the '/' key has been moved from beside the 'Z'. On the minus side, the combination of numeric keypad and cursor keys is still a mess, and the positioning of the ESCAPE key with the numeric area is plain silly.

The main criticism of the Kaypro keyboard is the quality of construction. While nothing actually fell off, it just didn't feel as solid as the IBM or even the Compaq unit.

The only problem I had with the keyboard was that it would sometimes mysteriously return upper-case letters instead of lower-case. The only way out was to hit CAPS LOCK which returned it to lower-case! Then, equally mysteriously, the fault would clear and I would have to release CAPS LOCK. I never did find out why this was happening.

The review machine was supplied with Kaypro's own colour monitor, but unfortunately the review unit came from the US and needed a 110-volt transformer which caused some screen flicker. Obviously, 240-volt units should be better.

The monitor itself is rather large and very deep, and takes up quite a lot of space. The front houses an on/off switch and controls for brightness, contrast and display centring. Underneath is a little bar which can be locked down to tilt the display at an angle.

Although the display from the monitor is quite good, no attempt has been made to make the screen anti-reflective. As far as graphics resolution is concerned, the story is just the same as for an IBM PC with a colour graphics card.

System software

Now here's a new idea. You've just bought your nice new Kaypro 286i, you open the box and discover that to make it work, you've got to go to your nearest IBM dealer and ask him to sell you a copy of PC-DOS version 3.0. Fun, huh?

Really, things aren't quite as bad as that. In the UK, the Kaypro will be supplied with MS-DOS version 2.11 as used by PC compatibles. This will at least get you going, but for AT compatibility you will have to buy PC-DOS version 3.0.

When you boot up the system, it transpires that none of the system software can be attributed to Kaypro. The ROM-based BIOS routines were written by Phoenix Software Associates and sold to Kaypro. These ROM routines are popular among compatible manufacturers; the Wyse PC, Tandy



The Compaq Desktop 286 keyboard has a more positive feel than the Kaypro

100 and Commodore PC10 all use the Phoenix routines.

The only piece of software attributable to Kaypro was a system set-up utility to set the system parameters in the machine's battery-backed CMOS RAM. The utility allows you to set the clock and tell the system about disk drives, hard disks, display drivers, and so on. It also lets you tell the system how much RAM it has (up to a maximum of 15Mbytes!).

The operating system is identical to that on the PC/AT, right down to the documentation. (The AT was reviewed in *PCW*, December 1984.)

Applications software

It's difficult to talk about applications programs in any depth. To the best of my knowledge, no-one has released an applications program specifically for the PC/AT, so I am restricted to describing software compatibility with the IBM PC rather than with the PC/AT.

In these terms, the Kaypro 286i ran everything I expected it to. It ran Lotus 1-2-3, SuperCalc 3.2 and the rest. It didn't run Flight Simulator, but then neither will the PC/AT (something to do with a bug in the 8088 which has been removed in the 80286, but which was used by Flight Simulator).

As with all Kaypro machines, the 286i comes with bundled applications software included in the price. In this case it is the MicroPro range, consisting of WordStar, Mailmerge, CalcStar, InfoStar and a menu-building package called Starburst. GW-Basic is also included in the package. If you look at the Benchmark timings, you will see that the Kaypro is marginally faster than the PC/AT.

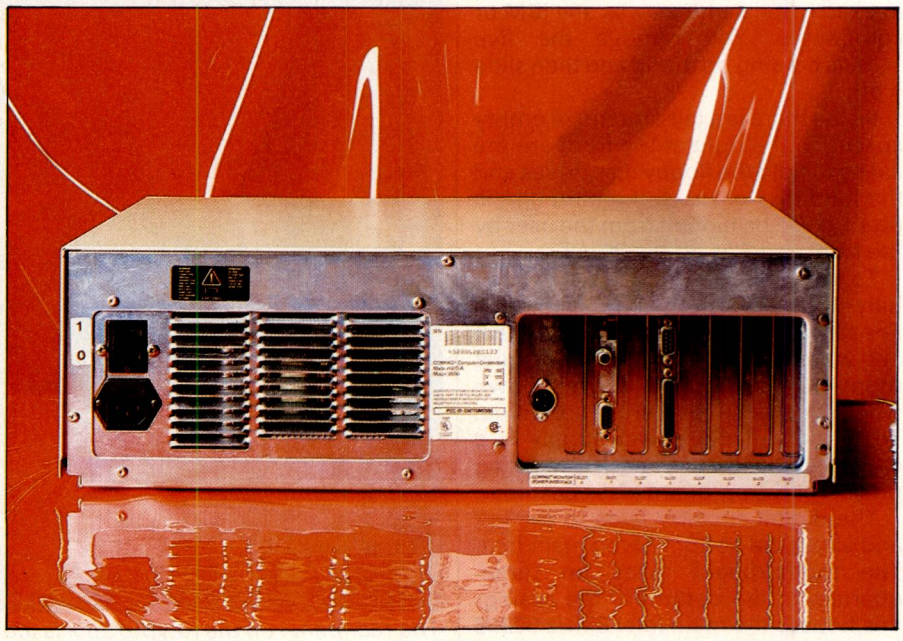
Documentation

The Kaypro 286i came with a boxful of manuals. This was most impressive until I looked closer and found that all bar one were manuals for the MicroPro applications programs and for GW-Basic.

The manual that referred to the machine was a scrawny-looking spiral-bound affair containing just 32 pages. I did find the manual quite useful, but I'm not sure how helpful it would be to a beginner.

Prices

The review system will sell for about £4136. A stripped-down version is also



The Compaq rear panel has a power supply socket for the Compaq monitor

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If you want to buy any hardware add-ons, these will be sold by SoftSel rather than by Kaypro direct.

Compaq Deskpro 286

Hardware

How about this specification for a modern desk-top micro: fast 8MHz 80286 processor, 2Mbytes of RAM, a 1.2Mbyte floppy disk, 30Mbyte hard disk and a 10Mbyte tape streamer — and all in a box smaller than the Kaypro 286i.

Unlike the Kaypro 286i, the Compaq Deskpro 286 bears little physical resemblance to the IBM PC/AT. It does, however, look very like the Deskpro, which is Compaq's IBM PC clone.

The Deskpro 286 can't be described as an attractive machine. The main casing is cream-painted metal with a plastic and rubber front panel, and various disk drives and streamers poke out of the front.

On the review machine, working from right to left, there is a full-height hard disk which looks like it should be removable but isn't, a half-height floppy disk drive, and a half-height micro tape streamer unit.

On the left is the keyboard-disabling lock which is a Yale-style lock that locks on the lid as well as disabling the keyboard. Finally on the front panel is a DIN socket for the keyboard connection.

The rear panel is just as boring as on the PC/AT but is laid out slightly differently. To the left is a power unit and on/off switch. In the middle are lots of ventilation slots, and to the right are the obligatory eight expansion plates. The Compaq also has a power output DIN socket designed specifically for the Compaq monitor which was supplied with the machine.

Of the expansion plates, two were visible in use: one for video output, and one for a parallel printer port and a cut-down RS232 port.

Getting inside the Compaq is more entertaining than getting into the Kaypro. The manual tells you to remove the three retaining screws, but forgets to tell you which of the eight screws on the back panel these are.

Removing the screws is fun. Compaq uses a special type of security screw which you really need a special screwdriver for. However, with a bit of effort, a flat-bladed screwdriver will do the job. After I had taken out the screws, I found that I had overlooked the special screwdriver supplied by Compaq!

When you have removed the lid, you can get at the inner workings of the Compaq. The immediate impression is that it looks more like a cat's cradle of wires than the Kaypro; the second impression is of very stout engineering.

About three-quarters of the front of the Compaq is taken up by a very stout-looking cage designed to house the disk drives, streamers and hard disks, all mounted on substantial rubber isolation mountings. It's the first time I've seen it done in this way, and it does mean that your delicate hard disk and floppy disks are as well insulated from shock as possible.

Behind the disk cage is the fully-encased power supply unit with a large fan set in the top.

The design of the digital electronics is slightly different from that of the Kaypro or the PC/AT. The motherboard is quite small — about a third of the available floor area. The reason it is so small is that it only houses the main processor, the discrete logic and controller circuitry, and the expansion slots. Memory is on an expansion card.

Although there are eight expansion slots, one is behind the disk cage and therefore only suitable for a half-length board. All the memory and outside-world communication is handled by add-on cards.

Unlike the Kaypro, most of the chips on the Compaq motherboard are soldered directly to the PCB rather than socketed. The main processor is the Intel 80286 (as used on the PC/AT or the Kaypro). However, the clock is slightly different. If you boot the system under MS-DOS version 3.0, the system sets to 8MHz and then goes off to see if there are any expansion cards installed that don't like that speed. If there are, the system slows down to 6MHz for PC/AT compatibility.

The clock speed can also be set under user control. To slow it down you can either hold down the CTRL, ALT and / keys, or you can enter MODE SPEED=COM at the DOS 'A>' prompt. If you boot the system under MS-DOS version 2.11, the system sets to 6MHz.

Both the RAM and the ROM are housed in a full-length expansion card. The memory board on the review machine was fully populated with 72 256kbit RAM chips giving a total of 2.2Mbytes.

In addition to the memory card, there were another three expansion cards installed in the review machine. One was a combined printer, RS232, floppy disk (1.2Mbyte and 360k) and tape streamer controller. Another was a hard disk controller, and the third was a display driver card. As it uses an extra card for memory, only four of the original eight expansion slots are available for use and one of these can only accommodate a half-length card.

While three-and-a-half slots will probably be OK for most people, some may find it restrictive, especially in multi-user mode.

The review machine was supplied with one 30Mbyte hard disk, one 1.2Mbyte floppy drive and a 10Mbyte tape streamer; other options are also available. All three worked well. The hard disk has a manual shipping lock to secure the read/write heads in place when you are moving the unit. Usually you run a program to park the heads out of harm's way rather than physically locking them; but the lock is probably safer as long as you remember to unlock the heads before you try to use the hard disk.

The floppy disk drive has a neat multi-coloured LED built in to show you which kind of disk it is accessing. If it is reading a 360k IBM PC disk, the LED glows red; if it is reading a 1.2 Mbyte AT floppy, the LED glows green.

The system is also nicely set up in that the operating system treats the one floppy disk drive as both drives A: and B:. This means that even though you only have one physical floppy drive, you can still run installation programs that assume you have two drives. The system prompts you to change disks.

The tape streamer is something of an oddity in a desk-top micro. In effect, a tape streamer is just a cassette of magnetic tape and is usually used for backing up hard disks. The great advantage of a tape streamer is its high capacity and speed, and until recently the disadvantages have been price and the size of streamer units.

The streamer is well-integrated into the Deskpro system. The system disk contains a utility which allows you to format the cartridge and transfer the contents of a disk to tape or *vice versa*. The only problem with the review system is that if the hard disk was filled with 30Mbyte of data, you would need three streamer cartridges to fully back it up. Having said that, it's still easier than using umpteen floppy disks.

The Compaq keyboard is slightly less deep than the PC/AT or the Kaypro. Although the layout of keys is the same as on the PC/AT, it still looks different.

The main qwerty typing area occu-

Benchmarks

	Kaypro	Compaq
BM1	0.6	0.4
BM2	2.0	1.5
BM3	4.2	3.1
BM4	4.4	3.3
BM5	4.7	3.5
BM6	8.4	6.1
BM7	12.7	9.4
BM8	12.9	9.0
Average	6.23	5.62

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

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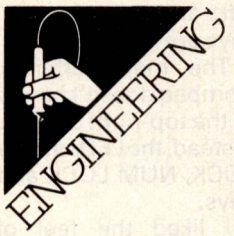











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pies the centre of the keyboard. The 10 function keys are arranged vertically to the left, and the numeric keypad/editing keys are to the right.

The main difference is that the Compaq doesn't have the bank of LEDs in the top-right corner of the keyboard. Instead, the LEDs are built into the CAPS LOCK, NUM LOCK and SCROLL LOCK keys.

I liked the feel of the Compaq keyboard. It felt more substantial than the Kaypro unit, and the action of the keys was light but positive.

The Deskpro 286 was supplied with the standard Deskpro amber monitor. Although this is only a black and white unit, the display adaptor drives it as if it were a colour monitor so you can get Lotus 1-2-3 graphics, run Microsoft windows and do all the things you would expect to do on a colour system.

The monitor worked well and was flicker-free.

System software

Instead of using IBM's PC-DOS, the Deskpro 286 uses its own version of MS-DOS version 3.0. However, as far as I could see, it was little different from PC-DOS version 3.0.

The review machine really showed up the shortcomings of PC MS-DOS version 3.0. The main problem with version 3.0 is that it doesn't make full use of the features offered by the 80286 processor. In fact, to all intents and purposes, it treats it as if it were a plain 8086.

One by-product of this approach is that the operating system can only access a maximum of 640k of RAM; the fact that the review machine has 2Mbytes of RAM makes no difference. If you type CHKDSK to ask MS-DOS how much RAM it has, it will say 640k, not 2Mbytes.

The problem occurs if the operating system can't see the extra RAM, as neither can the applications programs that run under it. The result of this was that I could load up Lotus 1-2-3, go to the last cell and still get an out-of-memory error! This will change, but only due to companies such as Lotus rewriting their programs to make them look for extra RAM.

This meant that the only thing I could do with all that extra RAM was to use it as a RAM disk, but even here the operating system limits you because the maximum RAM disk size using the MS-DOS 'VDISK' utility is 512k. The only way out was to set up multiple RAM disks.

The effect of this is that until Microsoft gets around to enhancing MS-DOS, or Digital Research releases Concurrent DOS 286, there isn't much point in buying a PC or AT with more than 640k of RAM unless you're a RAM disk fan.

Applications software

In terms of PC/AT compatibility, my views on the Kaypro are equally applicable here. The Compaq ran everything I expected it to, including Microsoft's Windows.

Documentation

The documentation for the Compaq was the opposite of that of the Kaypro in every way. The Kaypro had a boxful of manuals, the Compaq had one manual. The Kaypro had a 32-page typed system manual, the Compaq had a professionally-printed manual with extensive use of black and white and colour photographs as illustrations.

Prices

At the time of writing, the pricing of the Deskpro 286 range hadn't been finalised, but the packaging has been decided. The Deskpro 286 will be available in two versions—the Model 1 and Model 2. The Model 1 will have 256k of RAM, one 1.2Mbyte AT-compatible floppy disk drive, a serial/parallel card, graphics card, keyboard and monitor.

The Model 2 will have 512k of RAM, one 1.2Mbyte floppy, a 30Mbyte hard disk, a parallel/serial card, graphics card, keyboard and monitor. The tape streamer is optional on all models.

Conclusion

Reviewing IBM-compatible machines can be difficult. The problem is that as all the machines are so similar, what would normally be minor points grow in importance as you try to differentiate between the machines.

This is the problem I face with these two machines. Both do their jobs adequately, but I can't help preferring the Compaq. And if you ask me why, it comes down to things like the way the disk drives on the Compaq are rubber-mounted!

I wouldn't buy an AT or compatible until companies get around to releasing decent software for these machines. What's the point of using all that power to emulate an IBM PC? END

Technical specifications: Kaypro 286i

Processor:	Intel 80286 running at 6MHz
RAM:	512k
ROM:	32k
Mass storage:	Single or twin 1.2Mbyte PC/AT-compatible 5¼in floppy disk drives. No hard disk at present
Keyboard:	84 keys, IBM PC/AT-compatible
Size:	21ins × 17.5ins × 6.5ins
I/O:	Eight expansion slots (six AT-compatible, two PC-compatible). Optional serial/parallel printer interface, colour graphics card
DOS:	MS-DOS version 2.11, buy your own PC-DOS version 3

Technical specifications: Compaq Deskpro 286

Processor:	Intel 80286, selectable 6MHz or 8MHz operation
ROM:	32k
RAM:	256k expandable to 8.2Mbytes
Mass storage:	1.2Mbyte AT-compatible floppy, optional 30Mbyte hard disk and 10Mbyte tape streamer
Keyboard:	84 keys, AT-compatible
Size:	19.75ins × 16.5ins × 6ins
I/O:	Eight expansion slots (six AT-compatible, two PC-compatible), mono/colour graphics card, serial/parallel card
DOS:	MS-DOS version 3.0

In perspective

Both the Kaypro 286i and the Compaq Deskpro 286 are the first of what will undoubtedly be a flood of IBM PC/AT clones. Neither machine pretends to offer significantly better value than the PC/AT; instead, they are trading on the avilability problems of the AT.

Of the two, the Kaypro is visibly the most like the PC/AT. The Compaq offers the functionality while still retaining its own visual appeal.

Kaypro's approach of selling hardware add-ons such as graphics cards and hard disks through SoftSel is unusual. It is also a departure for SoftSel, which in the past has concentrated on software rather than hardware.

Compaq has much more of a reputation in the PC-compatible world than Kaypro, which is known primarily for its cheap 8-bit portables. On the whole, there isn't much to choose between either machine.

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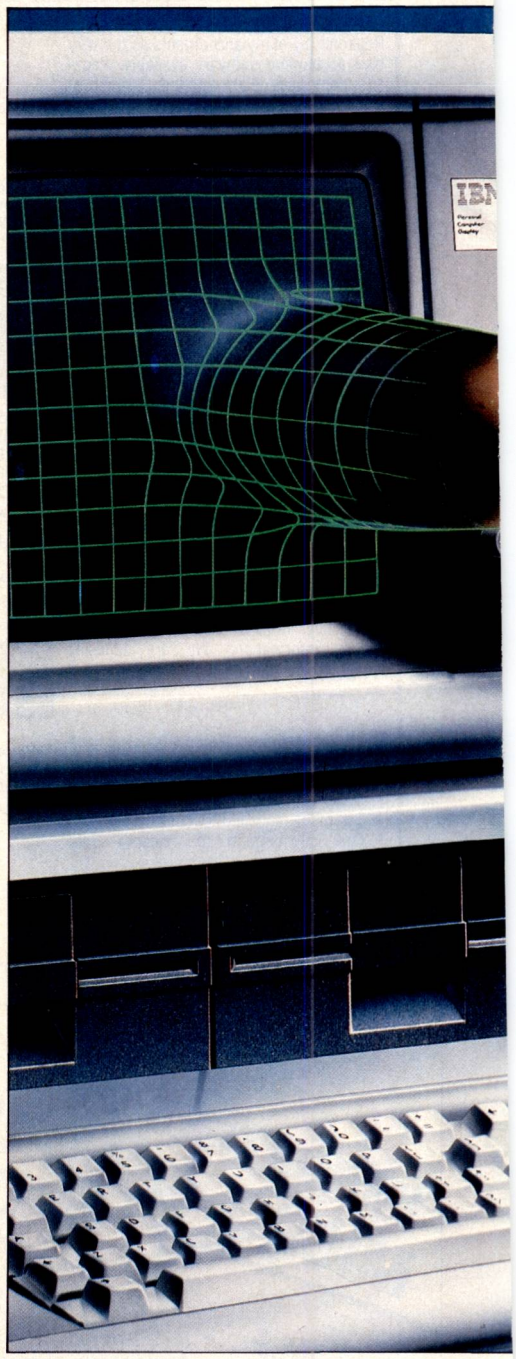

Computer simulation need not be a daunting task — it's rather like using a computer to play serious games. Instead of zapping aliens, you might like to simulate a car park, a cafe, a warehouse or even a factory. Ambitious types are advised to leave the universe until after lunch!

For simplicity, the examples here are written in Microsoft Basic. This is not the ideal language for simulation, but it's not too bad as long as you're careful. Regular readers of *PCW* should have their *PCW* Basic Converter Chart, and this will aid them in translating the programs into whatever dialect they choose.

Following orders

Despite all the talk of heuristic programs and artificial intelligence (AI), one thing computers are extremely good at is following orders — providing, that is, the orders (or instructions) are unambiguous. There is no particular need for the orders to be given in the vaguely mathematical terms of a language like Basic: they could be expressed in any form which the computer is able to accept. Once recognised, they will be obeyed as long as it is within the power of the computer to do so.

Although this slavish adherence to rules might be irritating to the AI community, it is very useful for others. If the behaviour of a system can be completely and unambiguously described as a set of rules, then a computer could be programmed to mimic that system. Computer simulation is possible.

Consider, for example, a car park controlled by automatic entry and exit barriers. Suppose that a car is only allowed into the car park if the correct coinage is inserted in a slot, and if there is a parking space free. We could say that the following happens to a car:

It arrives at the entrance and joins the queue if one exists.
When it reaches the barrier, the driver will put coins in the slot.
If there is a space available, the barrier will lift and the car will enter the park.
The driver will find the space and park the car.
The car remains in the park until the driver is ready to leave.
The car is driven to the exit barrier and joins a queue, if one exists.
When the car reaches the barrier, the barrier lifts and allows the car to leave.

As long as all cars obey these rules, we have a completely unambiguous description of what happens to the cars and spaces in the car park. It is then a simple matter to program a computer to obey the rules. To simulate such a system before it is built helps to ensure that it is being designed correctly.

Although computer simulation might not be much use for designing such a cheap and simple system as a car park, however, life is often not so kind. An army fighting a battle rarely gets a chance to fight a second time if it loses, so it makes sense to find an inexpensive and safe way of testing the various tactics. Battlefield simulations are not unknown in the military sphere.

To take another example, an airport authority may wish to know whether it's worth adding another runway. Simulated aircraft cause little damage when they fall from the simulated sky.

A computer simulation is useful when there is a need to carry out experiments on a system. The rules of the system are investigated and listed, and once agreed, they form the basis of a simulation model. The model is then programmed in an appropriate language and then the system is simulated on a computer. At this stage, another advantage appears — speed. Using powerful computers and slick programming, a year on the system could be simulated in a few seconds of computer time (or minutes on a personal computer). This speed allows quite sophisticated experiments to be carried out.

Before going any further, I will introduce discrete event simulation (some people wrongly call this Monte Carlo simulation). As the name suggests, in these simulations we are concerned with discrete changes. In particular, we simulate time as if it moved forward in discrete, jerky amounts. In real life, time may be like an everflowing stream, but in our simulations we simplify things a bit. The question is: 'How large should these jumps be?' What we could do is move time from second to second, or minute to minute, or hour to hour, or even from year to year. If we are simulating a system where everything occurs at

Illustration by Stuart McKay



regular intervals, then there is no problem. However, even timetabled systems such as railways rarely run exactly to schedule. More often, we need to simulate systems in which the activity occurs at irregular intervals.

Suppose we were simulating a car park by a commuter railway station. The activity in the car park will vary during the day. Most of the activity would occur in the morning and evening rush hours; there would be some activity during the intervening hours of daytime, but not much. During the night, there would be little or no activity.

Due to such variable activity being all too common, we use a variable time jump. Rather than deciding beforehand how big the jump should be, we let the computer program decide from the conditions within the simulation. We do this by making the program jump from state change to state change in the simulation. In the car park simulation, examples of such state changes might be the arrival or departure of a car; these state changes are usually called 'system events'. If nothing important is happening at any time, the program just ignores that time and moves to the next event. Thus we have the name 'discrete event simulation'.

The other decision to be made is, what do we mean by important? We consider the entities that make up the system which we are simulating. In the car park these might be cars, drivers, attendants, barriers, parking spaces and trains. Whenever something significant happens to one of these, then we have a system event.

To begin producing such a discrete event simulation model, we must identify the entities of the system and note how they change state: that is, define the rules by which the system operates.

Working simulations

The programs have to be written in such a way that they are easy to debug and validate, but being absolutely certain that your simulation program is bug-free is surprisingly difficult. It may be that the program only crashes when three cars arrive, two cars leave and a train comes late — all at the same time. More perversely, the program may not crash, but just start to do rather strange things which you may not notice! Any simulation analyst will tell you about one project or another in which, rather late on, he discovered that entities were mysteriously disappearing from the simulation. I heard of one simulation of an airport in which it was discovered that aircraft taking off seemed to disappear into a black hole at the end of the runway. Simulation programs *must* be well structured.

In the 1950's, Keith Tocher suggested a structure for simulation programs which would suit these problems. In those days, he was working with computers held together with string

and sealing wax, and the highest-level programming was done in assembler or autocode. Tocher suggested that a discrete event simulation could operate with a repeated cycle of three phases called A, B and C. To understand what he suggested, it might help to imagine our program maintaining a diary of future events. We might know that a train will arrive at 8am, and regard this type of event as type 'B' as it is **B**ound to happen at a particular time.

Other events cannot be scheduled in advance because they depend on what else goes on in the simulation. A car may only begin to park if a space is free. Such events are known as 'C' type as they depend on the **C**onditions in the simulation. To make things slightly confusing, Tocher called B and C 'activities', rather than 'events'. We'll just call them Bs and Cs.

'Despite all the talk of heuristic programs and artificial intelligence, one thing computers are extremely good at is following orders — providing the orders are unambiguous . . .'

When we come to program an example, you'll see that Bs and Cs are coded differently. The difference is that Cs have what is known as a 'test head' followed by actions, whereas Bs have only actions (Fig 1). In Fig 1, the B shown is one which might control the arrival of trains; the C is one governing the attempt by a car to park.

Tocher christened the diary entries needed to control the Bs and Cs 'time cells', giving one to each entity. Whenever a B can be reliably scheduled for an entity, we just place in the time cell the time when the B is due to occur. As the Cs depend on other things (that is Bs and Cs) we only need to see if these are possible whenever a B has happened, hence we get Tocher's three-phase approach:

A phase: examine all time cells. Pick out the B (or Bs) due next and move time to then. Hold time at that point.

B phase: execute all the Bs due at this new time.

C phase: now do all the Cs which are possible. Go back to the A phase until the simulation is over.

It wouldn't be sensible to do this for a large-scale simulation, but a simple way of implementing this A-B-C approach in Microsoft Basic is as follows. If there are n entities, create two vectors, each holding n items. Call the first vector TCELL() and the second NEXTACT$(). To find the time of the next state change of entity k, look in TCELL(k) and then look in NEXTACT$(k) for the activity due then. Thus, for entity k, if the next state change is to engage in activity B1 at time 201, we should find that:

TCELL(k)=201 and NEXTACT$(k)="B1".

If the entity is ready to engage in a C activity, then we can't say for certain which one it will be so we should find that:

NEXTACT$(k)="C".

Joe's Caff

Many discrete event simulations are of queueing systems, so let's consider such an example here. Firstly, we'll look at the structure of the Bs and Cs. Next, we'll work out some Basic code which will simulate the system.

Imagine Joe's Caff. Joe has no helpers, probably because he's bad-tempered and pays low wages. Customers arrive at the Caff and must queue for service (regulars feel that 'service' may not be the right term for Joe's attitude). When they reach the front of the queue, Joe asks what they want and goes off to make it. When served, the customer pays and goes to a table to eat. Joe's food is never likely to make the *Good Food Guide*, so he has more table space than customers. Periodically, Joe goes to clear the dirty tables.

For some unknown reason, suppose that we wish to simulate this system. Firstly, what are the entities of the system? Surprisingly, in such systems it is often best to ignore the product for which the system exists, so in this case we'll ignore the food. We are left with customers, Joe, and tables and chairs. Given that the chairs are by the tables, we can just think about the chairs as representing both.

Next, what about the system states? Customers arrive, queue for service, eat the food and leave. Joe is either idle, serving customers or cleaning tables. He never washes up! The chairs/tables are clean, in use, or dirty. Clearly some of these states coincide, we now think of the Bs and Cs that mark the state changes.

Customer service has a beginning and an end for each customer. It can only begin when a customer is waiting and Joe is idle (that is, ready to serve), therefore its start depends on these conditions within the simulation. Thus, 'begin service' is a C. When the service starts we might be able to predict how long it will take, depending on what food is wanted, so its end is bound to occur at some time. Therefore, 'end service' is a B.

'If the behaviour of a system can be completely and unambiguously described as a set of rules, then a computer could be programmed to mimic that system.'

A customer can only begin to eat once served and then only if a clean chair/table is free, so 'begin eat' is a C. The time taken to eat the food can be calculated and 'end eat' is a B.

Suppose that Joe cleans the tables whenever he is free, and there are three or more dirty tables to be cleaned. 'Begin clean' depends on the conditions in the simulation and is a C. Using the same argument as before, 'end clean' is a B.

We might position ourselves with a stopwatch outside Joe's Caff and note when his customers arrive. The result-

```
EXAMPLE B: TRAIN ARRIVES

                Begin
                Note that train n has arrived
   ACTIONS      Look up arrival time of train n+1
                Schedule arrival of train n+1
                End.
                Return to executive.


EXAMPLE C: BEGIN PARK CAR

                Begin
                IF car waiting AND IF space free
                THEN    Begin
                        Remove car from queue
                        Occupy space
                        Work out time for manoeuvre
                        Schedule end of manoeuvre
                        End
                End.
                Return to executive.
```

Fig 1 Program to show the different coding of B and C

```
1200 REM Schedule next activity
1210 TCELL(ENTITY)=DURATION+CLOCK
1220 NEXTACT$(ENTITY)=ACTIVITY$
1230 UTILISATION(ENTITY)=UTILISATION(ENTITY)+DURATION
1240 RETURN
```

Fig 2 Adding another subroutine

ing arrival data could be statistically analysed to show the typical intervals between successive customers, and we would then have a probability distribution or a histogram of the inter-arrival time. As customer 'n' arrives, we can take a sample from this probability distribution. Add this inter-arrival time to the current time, and we have the arrival time of customer n+1. As long as we know when one customer will arrive, we can say reliably when the next will come. As one customer actually arrives in the Caff, the next starts to arrive as if dragged along by his bootstraps by the predecessor. This bootstrapping approach allows us to treat the 'arrival' event as a B.

We now have the beginnings of a simulation model for Joe's Caff. It is very simple, but contains the skeleton of what could be a realistic simulation. The Bs and Cs are as follows:

B1: customer arrives — add customer to queue of those waiting for service. Note in diary when the next customer is bootstrapped to come.

B2: end cleaning chairs/tables — note the number of clean chairs/tables, set Joe idle.

B3: end service — note that customer is served, set Joe idle.

B4: end eat — note that chair/table is now dirty and customer gone.

C1: begin cleaning chairs/tables — if Joe is free and there are at least three dirty chairs/tables, *then* occupy Joe and note when this activity will end (that is schedule B2 in the diary).

C2: begin service — if Joe is free and there are customers waiting then occupy Joe, reduce queue by one and note when this activity will end (that is, schedule B3 in the diary).

C3: begin eat — if customer is served and clean table/chair available, then occupy chair/table and customer, schedule end of eating (that is, schedule B4 in the diary).

Program control

Having reduced Joe's Caff to a set of rules captured in four Bs and three Cs, we need to find some reliable way of programming its simulation. What we do is treat each B and C as an entirely separate subroutine ('procedure' in BBC Basic or Pascal), and these subroutines will not be allowed to communicate directly with each other. All such communication will be controlled by an 'executive', or control program.

The executive has two functions. Firstly, it must ensure that time in the simulation moves forward from event to event without missing any events (the A phase). Then it must ensure that the correct activity (that is, the correct Bs and Cs) occur at that time. It is the job of the executive to ensure that a continual cycle of A-B-C occurs throughout the simulation. Using the two vectors TCELL() and NEXTACT$() defined earlier, this turns out to be very simple. To illustrate it, we'll use Joe's Caff as an example.

To simulate the Caff, we have already specified four Bs and three Cs. We now need to consider the entities which are needed for the simulation. To keep things simple, we can manage with just three classes of entity, as follows:

Joe: a unique individual.

Chairs/tables: a number, say 10, are available for customers.

An arrival machine: this deposits customers in the Caff at irregular intervals.

For our purposes we can regard all customers as identical, at least until they reach the head of the queue.

We therefore have two vectors, TCELL() and NEXTACT$(), each with 12 elements. As we're using Microsoft Basic, for convenience we'll give each entity a numeric label. Entity one can be

```
2000 REM CUSTOMER ARRIVES (B1)
2010 QUEUE=QUEUE+1:NUMARR=NUMARR+1
2020 ENTITY=NEWCUST:ACTIVITY$="B1":DURATION=5*RND(6)
2030 GOSUB 1200:REM Schedule next arrival
2040 PRINT "Customer ";NUMARR;" arrives, queue now ";QUEUE
2999 RETURN

3000 REM END CLEANING CHAIRS/TABLES
3010 DIRTY=DIRTY-TASK
3020 FOR I=1 TO TASK
3030 TABLESTATE(TABLETASK(I))=CLEAN:TABLETASK(I)=0
3040 NEXT I
3050 PRINT "Cleaning of ";TASK;" tables complete, ";DIRTY;" still
dirty"
3999 RETURN

4000 REM END SERVICE OF CUSTOMER (B3)
4010 SERVED=SERVED+1:WAITING=WAITING+1
4020 PRINT "End of service number ";SERVED
4999 RETURN

5000 REM END EAT (B4)
5010 FED=FED+1:DIRTY=DIRTY+1
5020 TABLESTATE(ENTDUE-2)=FILTHY
5030 PRINT "Table ";ENTDUE-2;" now dirty, ";DIRTY;" tables dirty"
5040 PRINT FED;" customers now finished"
5999 RETURN

12000 REM BEGIN CLEANING 3 OR MORE TABLES/CHAIRS (C1)
12010 REM Testhead
12020 IF NEXTACT$(JOE)<>"C" THEN RETURN
12030 IF DIRTY<3 THEN RETURN
12040 REM Establish list of tables to be cleaned
12050 TASK=0
12060 FOR I=1 TO NUMTABLES
12070 IF TABLESTATE(I)=FILTHY THEN TASK=TASK+1:TABLETASK(TASK)=I
12080 NEXT I
12090 ENTITY=JOE:ACTIVITY$="B2":DURATION=TASK
12100 GOSUB 1200:REM Schedule end of cleaning dirty tables
12110 PRINT "Joe starts to clean ";TASK;" dirty tables/chairs"
12999 RETURN

13000 REM BEGIN SERVICE (C2)
13010 REM Testhead
13020 IF NEXTACT$(JOE)<>"C" THEN RETURN
13030 IF DIRTY>=NUMTABLES THEN RETURN
13040 IF QUEUE<=0 THEN RETURN
13050 REM Actions
13060 ENTITY=JOE:ACTIVITY$="B3":DURATION=3*RND(6)
13070 GOSUB 1200:REM Schedule end of service
13080 PRINT "Joe starts to serve customer ";SERVED+1
13090 QUEUE=QUEUE-1
13999 RETURN

14000 REM BEGIN EATING (C3)
14010 REM Testhead
14020 IF WAITING<=0 THEN RETURN
14025 FOR TABLE=1 TO NUMTABLES
14030     IF TABLESTATE(TABLE)=FILTHY THEN 14070
14035     IF NEXTACT$(TABLE+2)<>"C" THEN 14070
14040     ENTITY=TABLE+2:DURATION=15*RND(6):ACTIVITY$="B4"
14050     GOSUB 1200:REM Schedule end of eating
14060     GOTO 14080
14070 NEXT TABLE:RETURN
14080 PRINT "Customer starts to eat at table/chair ";TABLE
14085 WAITING=WAITING-1
14999 RETURN
```

Fig 3 Bs, Cs, initialisation and finalisation

the arrival machine, entity two can represent Joe, and entities three to 12 are the chairs/tables. Our executive program has to be structured as follows:

1) A phase: note the value of the minimum TCELL() whose entity has a B scheduled next in NEXTACT$(). In Microsoft Basic, this simply means examining the first character of the string NEXTACT$() for equality with B and then checking the value of TCELL(). This minimum time cell then tells us the next value of the simulation clock.

2) B phase: for each entity whose time cell is equal to this new clock value, do the B indicated by the string value in NEXTACT$(). Do these Bs in whatever sequence is most convenient. Before each of the Bs, make sure that the NEXTACT$() of the relevant entity is set to C: that is, the entity is free unless otherwise committed in the B.

'Any simulation analyst will tell you about one project or another in which . . . he discovered that entities were mysteriously disappearing from the simulation.'

3) C phase: now try each of the Cs in turn, repeating the attempts until no more Cs are executed.

In Microsoft Basic, the B and C phases are easiest to control by using the 'On X Gosub' statement, where X is a key indicating which B or C is next.

For safety, avoid tampering directly with the TCELL() and NEXTACT$() vectors from within the Bs or Cs. It is sensible to add another subroutine, as shown in Fig 2. Whenever we wish to reschedule an entity, we will do so via this subroutine. This minimises the risk of wrongly altering a time cell or the next activity indicated. We should *never* alter the simulation clock; this is stored as CLOCK (line 1210) and records the current simulation time.

Our simulation program finally has six sections as follows:

1) The executive: this is general and can be used for any discrete simulation.

2) The scheduling subroutine: again, this is general.

3) An initialisation section: this gives initial values to the variables in the program.

4) The Bs: each an independent subroutine.

5) The Cs: each an independent subroutine.

6) A finalisation section: this summarises the performance of the system being simulated.

The Bs, Cs, initialisation and finalisation are shown in Fig 3 and described below.

B1 customer arrives: this is very simple. Line 2010 adds the new arrival to the queue and adds one to a counter for the number arrived so far. Lines 2020 and 2030 schedule the next arrival in something between 0 and 5 minutes time. Line 2040 provides screen display.

B2 end cleaning chairs tables: line 3010 reduces the number of tables still dirty. Lines 3020 to 3040 clear out the records that tell Joe which tables to clean. 3050 provides run time display.

B3 end service of customer: line 4010 adds 1 to counters showing how many customers have been served and how many are waiting for a table.

B4 end eat: in line 5010, 'fed' and 'dirty' are counters recording how many customers have been fed and how many tables are currently dirty. In line 5020, ENTDUE is a variable produced by the executive which shows which entity is causing this B to happen. As the chairs/tables are entities two to 12, ENTDUE-2 gives the number of the table just released. Its state is set to 'filthy'.

C1 begin cleaning tables: lines 12010 and 12020 are the the test head of this C. If these tests are failed, then control returns to the executive which will pass on to C2. Line 12020 checks whether Joe is free; if he is, then a C will be indicated as his next activity. Line 12030 checks to ensure that three or more tables are dirty.

Lines 12040 to 12080 find which tables are dirty and lines 12090 and 12100 commit Joe to clean these tables. As it takes him one minute per table, he will finish cleaning them (B2) in 'task' minutes.

C2 begin service: this time there are three tests to pass. Line 13020 checks whether Joe is free; line 13030 makes sure that a clean chair/table is available; line 13040 sees if any customers are waiting to be served. If these tests are passed, lines 13060 and 13070 commit Joe to end this service in something between 0 and 3 minutes time. Line 13090 reduces the queue by one.

C3 begin eating: this is rather more complicated. It begins with a simple test in line 14020 to check that there are customers waiting for a chair/table. Lines 14025 to 14070 examine all the chairs/tables in turn. They search for the first free, clean table and return to the executive if none is found. The first such table is assigned to the waiting customer and the end of eating (B4) is scheduled for anything up to 15 minutes hence. Line 14085 reduces the number waiting by one.

Initialisation: in this program, the executive occupies lines 1000 to 1199 and the initialisation section comes before it. As you might expect, it merely establishes initial values for the variables of the program. Strictly, some of these are parameters, such as the number of tables/chairs and duration of simulation; others establish that all the tables are initially clean and that Joe is idle. For convenience, it might also set up the time that the first customer arrives. The executive takes over from the initialisation section.

Finalisation: this section provides a report of the performance of the system. For Joe's Caff, we might wish to know how many customers came, how many were served and how many completed their meal. We also might need the percentage utilisation of all 12 entities. If you write your own executive to make this simulation work, you'll find that the customers could probably manage with, say, six tables. You'll also find that Joe is busy about 75 per cent of the time.

'A computer simulation is useful when there is a need to carry out experiments on a system. The rules of the system are investigated . . . they form the basis of the simulation model.'

The execution starts the finalisation when the specified simulation duration is exceeded.

Graphics

Watching text scroll past as the simulation runs is boring, and is not a good way of communicating the status of the program. To make things more interesting, you could try adding some graphics, which is impossible in standard Microsoft Basic but possible in GW-Basic. All you do is allocate graphical attributes to each entity.

Depending on your graphics system, this can be quite simple or rather difficult. Typical graphical attributes are shape, colour, scale, rotation and x/y coordinates for each entity. As an entity is rescheduled or freed, its graphical attributes are updated. Then at each A phase, the screen is re-drawn. This is painfully slow in GW-Basic, but quite fast in other systems.

When you get to this level of ambitious simulation, perhaps you ought to abandon Basic altogether.

Mike Pidd is a lecturer in Operational Research at Lancaster University and author of Computer Simulation in Management Science, *published by John Wiley.* END

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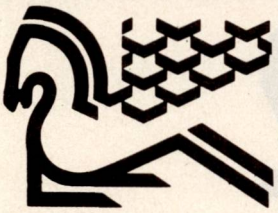

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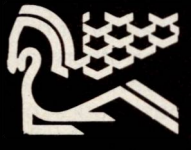

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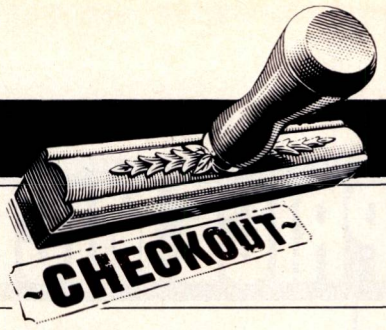


Zero 2

The Zero 2 is an attempt to clarify the actual functions and uses of a robot in the light of the Hollywood misconception. Stephen Applebaum directs operations.

Robotics is one of those frequently misunderstood areas of computing where, thanks mainly to the work of over-imaginative film makers and science fiction writers, a subject has been popularised more through fantasy than fact, leaving people with a jaundiced view as to what robots are and what they are realistically capable of. Robin Bradbeer of Intergalactic Robots (IGR) hopes, therefore, that his new Zero 2 robot cum turtle will help clear the mist to some extent, and give BBC, Spectrum and Commodore 64 owners an opportunity to discover what robotics involves at a basic level, for a relatively small outlay.

At £99.95 for an assembled model (£79.95 in kit form) the Zero 2 should come within the reach of most micro users' budgets. For your money you get the robot, interface cable, power supply, software and operating manual. As the little beast is machine independent, it can be used with any computer supporting a serial interface provided you have the appropriate connecting cable. People who prefer to buy the kit can obtain it from Maplin, but they will only get the robot and four metres of cable; the reason being that IGR believes anyone wanting to build the Zero 2 will probably already have a 9v~12va psu and could certainly build the interface at a lower cost than buying it direct from them.

The Zero 2 qualifies as a robot by virtue of the fact that it can be programmed to do a variety of different tasks, mechanically or otherwise. This does not mean, however, that it will relieve you of any housework or put the cat out — far from it. In fact, the Zero 2's ability seems extremely limited when compared to R2-D2 or C3-PO, but you must remember that it is a cheap and very real device, not an electronic prop created by a film studio's dream factory.

Design

Designwise the Zero 2 looks like a computerised jellyfish, its clear plastic case giving a good view of its internal workings. Inside the robot's shell is an aluminium chassis to which are attached three large stepper motors and a pcb. Two of the motors drive the device, each controlling a wheel in steps of half a millimetre, while the third raises and lowers a pen. Toward the front of Zero 2 is a 4 x 2½in pcb; this is the nerve centre of the machine. Not only does it include the firmware for communicating with the host computer, but also some nice little additions such as red and green turning lights (LEDs), a small hooter and a line follower.

A kind of complex simplicity is a major feature of Zero 2's design. Setting it up for use requires little more than having to plug the connecting cable into the micro's serial port at one end, and the robot's 'telephone' socket at the other. As the device does not take its power from the computer, a separate power supply is required which plugs into a small interface situated near the computer end of the connecting cable. When everything is linked together, you are ready to go.

In use

Communicating with Zero 2 can be done through Basic, machine code or Logo, but for most people, the easiest way to start will be with the bundled software.

A list processing program gives easy access to the robot's built-in features by allowing simple Logo-like instructions to be used to make Zero 2 perform a function. It is also possible to 'teach' the robot, say, a maze, using direct control from the computer keyboard or a joystick. This lets you guide the robot around the maze, place it back at the beginning, and then watch it go through the exact same procedure but this time unaided.

Also included is a series of machine code routines to interface the device to Logo. In the case of the Spectrum this means Sinclair Logo, and for the 64 it's Commodore's own Logo, while the BBC uses Logotron's implementation. At the time of writing Logotron had not finished interfacing its package to IGR's robot, although it should be ready by the time you read this. Other Logo interfacing routines are planned, such as for the Atari and Apple micros.

Most of the software packaged with Zero 2 is fun to use, but on the whole is quite limited. The more ambitious user will soon become tired of the building program and will want to move onto something more complex. This will usually take the form of instructing the device in either Basic, Logo or machine code.

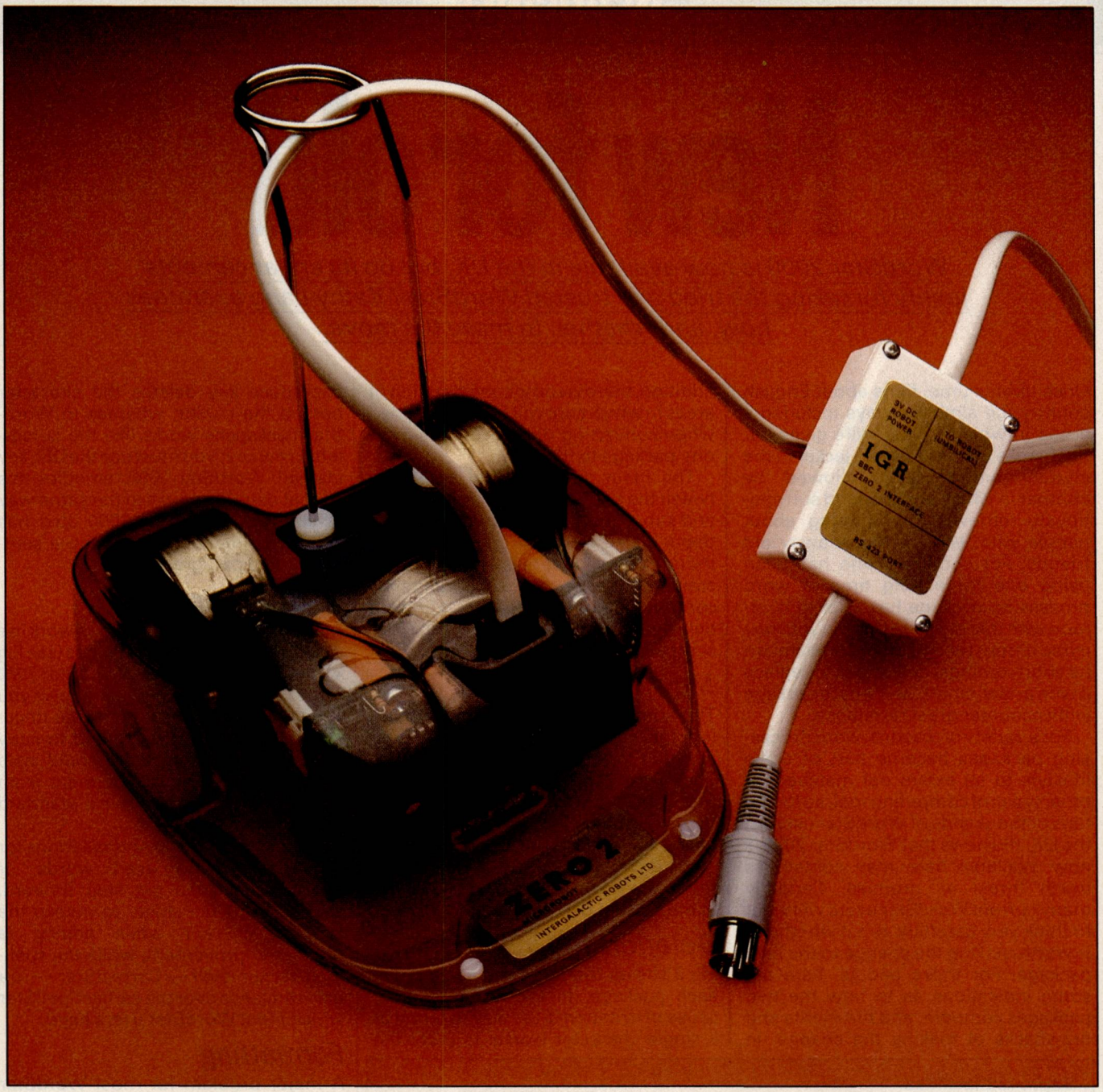
Each one of Zero 2's functions can be programmed by sending information through the computer's RS232 (RS423 on the BBC) to a specific address. As a serial port can function at different baud rates, the first part of any Basic program must set up parameters for sending data to the serial port at a required speed. There are many different addresses that can, and must be addressed to make the Zero 2 perform even a simple series of movements, but I'll only give a brief example here, as outlined in the machine's small and concise operating manual.

The following list shows a set of functions and their addresses:

Device	Address
Drive motors	0
Pen motor	1
Indicators	2

By sending a number between 0 and 15 to one of these addresses, the device at that location can be made to perform an action. In Basic, this is done by printing a byte containing information for both the address and data to the serial port. This takes the form: (byte value + 16) + data.

Each of the two motors driving Zero 2 can be controlled individually or simultaneously. The right-hand motor is controlled by a binary number between 0 and 3, the left-hand motor by the binary form of the numbers 0,4,8 and 12. To make either of the motors go backwards or forwards, these numbers must be sent in a specific order. All the other devices onboard the Zero 2 can be controlled in much the same way as the



motors, although there are less long-winded methods outlined in the manual. For more advanced programs, there are a group of files which provide various machine code calls for use from within Basic.

Programming Zero 2 through Basic is fine, but a better, more enjoyable method is to use Logo. To complement the comprehensive Logo implementations already mentioned, IGR has added its own primitives for more precise control of Zero 2. The following commands are for the Spectrum, but those for the BBC should be very similar:

SETSCAL — allows the distance the robot moves for each unit in the Logo commands to be set.

ADJUST — compensates for slippage on different surfaces.

SETSPD — varies the robot's speed.

SETPEN — makes sure that the pen is at the limit of its range after a PENUP instruction.

SETHORN — allows the horn to be programmed from within Basic.

SETLEDS — allows the LEDs to be turned on and off from within Logo.

In its basic form, the Zero 2 is quite a powerful beast whch can double as both a robot and a turtle, and is capable of running on a range of surfaces, from carpets to table-tops. However, IGR has plans to expand the system in a big way, and that means not only through extra software, but also several neat hardware add-ons.

On the pcb inside the Zero 2 is a small connector which allows further boards to be added. Two of IGR's major plans are to have a speech synthesis board/three-channel sound generator and an infra-red communications link. The latter will sit on top of the robot and should provide a distinct advantage over the umbilical cord which tends to get tangled while the Zero 2 is performing a circle, or whatever. A hole and edge detector, and an obstacle detector are also planned, although IGR does not know as yet the order in which each add-on will become available.

The uses for Zero 2 are (cue cliche) only limited by the user's imagination. As far as the hardware is concerned, IGR has left slots and holes for hobbyists to expand the system themselves, as well as leaving some spare input/output connectors on the pcb for directly expanding the system.

Conclusion

The Zero 2 is an interesting development in the low end of the robotics markets. At just under £100 for the assembled device, IGR should not have any problem in attracting users in both the home and educational markets, especially the hobbyist who wants a robot to build and expand upon. **END**

For further details contact: Intergalactic Robots, Unit 208, Highbury Workshop, 22 Highbury Grove, London N5. Tel: (01) 359 2536.

New for old

WordStar 2000 is now available in the UK, but do its enhancements justify forsaking the tried and trusted WordStar? Kathy Lang examines how, and whether, to make the move.

Once upon a time, films about English country life almost always included a scene in which a housewife gives her husband's old, threadbare jacket to the church jumble sale, followed by another in which her husband surreptitiously retrieves it, muttering about people who want to throw away old friends. For someone who has been using one for a long time, a word processing package has a lot in common with that old jacket. While you may curse it from time to time, and bemoan its shortcomings, any threat to replace it with a new, smart, up-to-date package will encounter great resistance.

For a variety of reasons, word processing packages become part of one's lifestyle to an extent not matched by other types of computing tool, so for the tens of thousands of WordStar users in the UK, the news that WordStar 2000 is now available here may contain as much threat as promise. Certainly many current WordStar users will want to think very carefully about whether it is worth making the change to the new package. For those people, here are some indications as to how the two packages compare, and the merits and drawbacks of making the change. In addition, there is some consideration of areas in which care will be most needed when converting document files from one package to the other.

The main differences of detail between the two are summarised in Fig 1, and subsequently discussed in greater depth. It is worth stressing initially, though, that whereas WordStar is supplied for a very wide range of computers, WordStar 2000 is at present only available for the IBM PC and close compatibles.

Moving around

The comparable commands for moving the cursor, and for moving text around the cursor, are shown in Fig 2. The major improvement is that WordStar 2000 allows direct movement to a particular page. The drawback is that, unlike WordStar, you cannot use the 'page down' feature (CTRL/C) to move the cursor down a screen when you are at the bottom of a document.

Deletion and insertion

Fig 3 shows the functions available in each package. In WordStar, a great cause of irritation is the way deletion of a single character works. In DOS, the backspace key deletes the character behind the cursor, whereas in WordStar backspace works like the cursor-left arrow key; you must use the DEL key instead. WordStar 2000 remedies this so that deletion works in the same way as in DOS. WordStar 2000 also has single commands for deleting a sentence and a paragraph.

File and block

Most file and block operations work in a similar way in the two packages (see Fig 4). A major advantage of WordStar 2000 is the window facility, which allows you to display parts of two or three documents onscreen at once, and to copy text between them; this could help when constructing a document from existing text, for example in a 'standard paragraph' application.

The ability to set up abbreviations for longer, regularly used words or phrases is also a big step forward. WordStar 2000's ability to invoke the spelling checker while editing is another improvement, while the spelling checker itself — CorrectStar — is a great advance over the earlier SpellStar which most WordStar users have.

Formatting

A major problem for most WordStar users is its inability to 'remember' the settings of margins and tabs used with a document. In WordStar 2000, every margin and tab change is automatically recorded in a ruler which is set up by the package, stored with the document and activated as the cursor is moved through it. The manual equivalent in WordStar involves setting up a 'picture' of each ruler as a comment line and remembering to activate it yourself.

Another change in WordStar 2000 is reformatting after editing changes. In WordStar, you have to remember to do this (with CTRL/B); WordStar 2000 does it for you automatically (although not always perfectly — it is possible to fool it in some circumstances into leaving gaps). This may be an advantage — much depends on how often you edit from a printed draft, as in that case automatic reformatting means that once one change has been made in a pagaraph, subsequent lines do not match the format of the printed draft.

Improved facilities
Undo
Stored rulers, tabs and indents
Windows — especially good for repeated text
Lots of extra function keys
Abbreviations
More direct cursor movement
Arithmetic
Column sorting
DOS directories usable through PATH command
Automatic reformatting
Emphasis shown onscreen
Excellent onscreen help
Better footer and header features
Footnotes
Conversion to and from WordStar

Drawbacks
Major changes to control keys
Reduced flexibility with line height and pitch
Mismatch between ruler and text on 12-pitch documents
No justification onscreen (although line endings are correct)
No indexing yet

Fig 1 WordStar 2000 for WordStar users



Illustration by David Simonds

Move Cursor

Description	WordStar	WordStar 2000	Command Name
Right one character	^D or →	^D or →	
Left one character	^S or ←	^S or ←	
Up one line	^E or ↑	^E or ↑	
Down one line	^X or ↓	^X or ↓	
Right one word	^F	^F or ^ →	
Left one word	^A	^A or ^ ←	
To top of screen	^QE or Home	^CH or Home	Cursor Home
To bottom of screen	^QX or End	^CX or End	Cursor bottom left window
To top of file	^QR	^CB	Cursor Beginning
To end of file	^QC	^CE	Cursor End
To right end of line	^QD	^CR	Cursor Right side of line
To left end of line	^QS	^CL	Cursor Left side of line
To top of block	^QB	^CA	Cursor to block beginning
To end of block	^QK	^CZ	Cursor to block end
To start of last find	^QV	^CO	Cursor to Old block position
Find/replace text again	^L	^N	Next locate
To marker 0-9	^Q0 – Q9	^C0 – ^C9	Cursor to marker
WordStar 2000 Commands Not in WordStar			
		^CN #	Cursor Note number
		^CP #	Cursor Page number
		^CT	Cursor To character
		^CW	Cursor Window

Move Screen

Description	WordStar	WordStar 2000	Command Name
Up one line	^W	W	
Down one line	^Z	^Z	
Up one screen	^R or PgUp	^CU or PgUp	Cursor Up
Down one screen	^C or PgDn	^CD or PgDn	Cursor Down

Fig 2

Delete and Insert

Description	WordStar	WordStar 2000	Command Name
Delete character	^G	^RC or Del	Remove Character
Delete character left	Del	Backspace	
Delete word	^T	^RW	Remove Word
Delete line	^Y	^RE	Remove Entire line
Delete to end of line	^QY	^RR	Remove Right side of line
Delete to beginning of line	^Q Del	^RL	Remove Left side of line
Delete a block	^KY	^RB	Remove Block
Insert On Off	^V or Ins	^OO or Ins	Option Overtype
Insert carriage return	^N	^CI	Cursor Insert a line
WordStar 2000 Commands Not in WordStar			
		^RS	Remove Sentence
		^RP	Remove Paragraph
		^RT	Remove To character
		^U	Undo last removed text

Find and Replace

Description	WordStar	WordStar 2000	Command Name
Find text	^QF	^L	Locate text
Find and replace text	^QA	^L	Locate and replace text
Find/replace text again	^L	^N	Next locate

Fig 3

WordStar 2000 does not, in any case, show text justified on the screen, but WordStar does.

Some other comparisons are shown in Fig 5, while others are considered under the next heading. A related change is the display of formatting controls, which can be hidden or displayed at will in WordStar 2000, to make it easier both to concentrate on the edited text when necessary, and to check formatting before printing. This checking is aided by WordStar 2000's extensive use of colour for those whose equipment allows them to exploit it.

The printed page

A major difference between the two is the use in WordStar 2000 of a format file to specify the major aspects of page layout, such as page length, header and footer margins, and so on. This makes it easier to set up a single format specification for a whole group of documents. In addition, you can change some page layout parameters within the text; of these, the most notable is line height as WordStar 2000 can take account of such changes in displaying page breaks onscreen. (WordStar allows you to change line height at any time, but cannot show page breaks correctly if you do.)

For users with standard printing requirements, WordStar 2000's method of setting up line height and character width through a format file or embedded commands will make life much easier. Unfortunately only a limited range of options is provided: text can be printed in 10, 12 or 15 pitch or proportionally spaced, while lines may be printed 2, 3, 4, 6 or 8 to the inch. This contrasts with the greater flexibility of WordStar, which gives access to the full capability of many letter-quality printers to offer character widths measured in 120ths of an inch, and line heights in 48ths of an inch. Many people will regard this as a small price to pay for the convenience of the format file approach (although this need not have precluded offering greater flexibility to those who need it), but if you have non-standard requirements you should check that WordStar 2000 can meet them.

Another distinction affects only those who use a character pitch other than 10. WordStar 2000 sets up its rulers in terms of tenths of an inch rather than characters per inch. In order to get, say, documents to be printed in 12-pitch to appear correctly, you must specify 12-pitch in the format file and then set up the ruler in terms of the text width in inches, assuming 10 characters per inch. Therefore, whereas in WordStar the text always appears in confirmation with the ruler line, in WordStar 2000, when typing 12-pitch documents, the text is displayed extending beyond the ruler line. In addition, there are some character positions in which tabs cannot be set as only 10 are available per inch. This won't be a problem if you always use 10-pitch, and you may not mind even if you frequently use 12-pitch, but those who are thinking of changing would be well advised to see the problem for themselves before deciding. And if you use tabs a lot, see the system used to type and print a table using 12-pitch.

A novel feature of WordStar 2000 is its Typewriter mode, which echoes directly onto the printer what is typed at the keyboard without the need for intermediate storage. The main use of this feature is for envelopes as it is then easier to line up the envelope correctly in the printer before the address is printed, nor do you have to save a file containing the address purely for this purpose.

Emphasis of text is handled in a similar way in both packages, with two major exceptions. Firstly, WordStar 2000 shows emphasis in a form which

File and Block Operations

Description	WordStar	WordStar 2000	Command Name
Column mode On/Off	^KN	^BV	Block Vertical
Mark/unmark block beginning	^KB	^BB	Block Begin
Mark/unmark block end	^KK	^BE	Block End
Hide/show marked block	^KH	^BD	Block Display
Copy block	^KC	^BC	Block Copy
Delete block	^KY	^BR	Block Remove
Move block	^KV	^BM	Block Move
Write block into another file	^KW	^BW	Block Write to file
Read file into document	^KR	^BI	Block Insert a file
Set remove marker 0-9	^K0-9	^CM0-9	Cursor Marker set 0-9
WordStar 2000 Commands Not in WordStar			
		^BA	Block Arithmetic
		^BS	Block Sort

Save Files

Description	WordStar	WordStar 2000	Command Name
Save and resume edit	^KS	^QC	Quit and Continue
Save and return to Opening Menu	^KD	^QS	Quit and Save
Abandon file without saving	^KQ	^QA	Quit and Abandon
WordStar 2000 Commands Not in WordStar			
		^QP	Quit and Print

Miscellaneous

Description	WordStar	WordStar 2000	Command Name
Set help level	^JH	^GG	Set menu display level
Repeat following command or character	^QQ	^OR	Option Repeat next key
Interrupt command	^U	Esc	
Get help	^J	^G	Get help
WordStar 2000 Commands Not in WordStar			
		^OS	Option Spelling check
		^OM	Option MailMerge commands

Fig 4

Format

Description	WordStar	WordStar 2000	Command Name
Paragraph tab	^OG	^TI	Tabs and margins In left
Center text	^OC	^OC	Option Center
Set left margin	^OL	^TL	Tabs and margins Left
Set right margin	^OR	^TR	Tabs and margins Right
Set margins and tabs from text line	^OF	automatic	
Set tabs	^OI	^TS	Tabs and margins Set tabs
Clear tabs	^ON	^TC	Tabs and margins Clear tabs
Justification On/Off	^OJ	^OJ	Option Justify
Set line spacing	^OS	Format or ^PH	Print Height
Page break display On/Off	^OP		
Ruler display On/Off	^OT	on in formatted files	
Word wrap On/Off	^OW	off in unformatted files	
Print control display On/Off	^OD	^OD	Option Display
Hyphen help On/Off	^OH	Format	
Soft hyphen entry On/Off	^OE	^O-	Option - (hyphen)
Re-form paragraph	^B	automatic	
WordStar 2000 Commands Not in WordStar			
		^ON	Option Note (footnote)
		^OW	Option Window
		^TB	Tabs and margins Both margins in
		^TD	Tabs and margins Decimal tab stop
		^TO	Tabs and margins Out left
		^TU	Tabs and margins Undo all indentation

Fig 5

does not affect formatting (no more embedded CTRL/Bs) and which is much easier to check to ensure there are no unmatched emphasis brackets. Secondly, if you really want to go on using underlining (despite the proven difficulty of reading underlined text), then WordStar 2000 will underline spaces for you if you wish (no more CTRL/POs between words to be underlined). That improvement went down very well in the US, so I'm told — one punter went so far as to applaud loudly when that feature was announced!

WordStar 2000 in use

A major drawback for most WordStar users will be the drastic changes made in the use of function keys and commands. Figs 2 to 7 show the correspondence between WordStar 2000 and WordStar commands, and from them it should be plain how great the changes are. As the keyboard implementation can be changed via the installation program, it would be possible to come close to emulating WordStar, but the absence of any ability to change the corresponding help features would make that a hazardous undertaking. For most people, the answer will be to grit one's teeth and make the change. In many respects, it will then become quicker and easier to use the word processor as there are more function keys. (The function key implementation is not shown in the figures, but most of the frequently used keys are available via the function key pad on the IBM PC, either alone or together with SHIFT, ALT or CTRL.) For those who prefer to use control key combinations, there are some circumstances where WordStar 2000 uses more keystrokes to do the corresponding operation.

For those of us who like, or think they would like, colour word processing, the greater flexibility of WordStar 2000 in this respect is a distinct advantage. In WordStar it is possible to use different colours for text, background and menus, but in WordStar 2000 the possibilities are much more extensive. Some people will regard that as a frill, but when you have tried it for a while it quickly becomes almost a necessity.

Converting files

WordStar 2000 has an option for converting WordStar document files to its own format, and for converting WordStar 2000 files to WordStar format. It is hardly suprising that this conversion is not complete, as many WordStar 2000 features are not available in WordStar, or are provided differently. Where conversion is impossible, the program will, where possible, insert comments to warn you, using the COMMENT feature in WordStar 2000 and the IG command in WordStar.

There are two main problem areas to watch out for. The conversion program cannot provide an appropriate format

file to correspond with dot commands in your WordStar file, so once-per-document commands such as page offset (.PO) and page length (.PL) cannot be translated in that direction. A warning is given through the COMMENT facility. Despite the fact that WordStar 2000 does allow you to change line spacing and character pitch within a document, these commands are not translated as the mapping between the two sets of commands is incomplete. (For example, WordStar allows you to set line heights for which there is no direct equivalent in WordStar 2000, and WordStar 2000 combines specifying character pitch with font name, unlike WordStar.)

Secondly, parameters which are interactively changed in WordStar, where the changes are not recorded with the document, cause problems in both directions, as when coming from WordStar the program cannot detect the options used, and when translating from WordStar 2000 there are no corresponding recorded options in WordStar to set up. These problems apply to such options as justification (set during editing by CTRL/OJ in WordStar) and hyphen-help (set by CTRL/OH in WordStar). They also affect the use of rulers, as in WordStar the 'comment' rulers are simply a reminder rather than a feature. For this second class of commands which cannot be converted, you will be given warning when translating from WordStar 2000 to WordStar but not in the reverse direction, as WordStar does not record these options in the stored document file.

Conclusion

WordStar 2000 is in many respects a more powerful package than WordStar, and should be easier to use when you have become accustomed to the differences. On the other hand, there are some areas in which WordStar retains a greater flexibility, notably over character pitch and line spacing. The pitch problem with WordStar 2000 should be seriously considered if you frequently use character widths other than 10.

As usual, there is no substitute for trying the package out for yourself to see how you like it. With the pointers in this article, and your own knowledge both of the weaknesses and the strengths of WordStar as they affect your word processing needs, it should be possible to construct a reasonable 'road test' to take with you to the demonstration.

WordStar 2000 is supplied by MicroPro Ltd (tel: (01) 879 1122), and costs £440 (or £200 as an upgrade from WordStar). The minimum system for operation is a 256k IBM PC with two 320k disk drives. END

Opening Menu Commands

Description	WordStar	WordStar 2000	Command Name
Change logged disk drive	L	D	Directory/drive
File directory On/Off	F	^V	View directory
Set help level	H	GG	Set menu display level
Open a document file	D	E	Edit/create a document
Open a non-document file	N	E unformatted	Edit/create a document
Print a file	P	P	Print a file
Rename a file	E	M	Move/rename a file
Copy a file	O	C	Copy a file
Delete a file	Y	R	Remove a file
Exit to system	X	Q	Quit
Run CorrectStar	S	S	Spelling check
WordStar 2000 Commands Not in WordStar			
		F	Format design
		K	Key glossary
		T	Typewriter mode
		Return	Use highlighted name as answer
		^T	Transfer name to answer line

Fig 6

Design the Printed Page

Description	WordStar	WordStar 2000	Command Name
Boldface	^PB	^PB	Print Boldface
Double strike	^PD	^PE	Print Emphasis
Underline	^PS	^PU	Print Underline
Strikeout	^PX	^PS	Print Strikeout
Subscript	^PV	^P–	Print Subscript
Superscript	^PT	^P+	Print Superscript
Strikeover	^PH	^PO	Print Overstrike
Nonbreak space	^PO	^PW	Print Word grouping
Strikeover line	^P Return	^PN	Print No new line
Alternate pitch	^PA	^PF	Print Font
Standard pitch	^PN	^PF	Print Font
Print pause	^PC	^PP	Print Pause
Ribbon color change	^PY	^PC	Print Color
WordStar 2000 Commands Not in WordStar			
		^PF	Print Font
		^PT	Print Tray

Dot Commands

Description	WordStar	WordStar 2000	Command Name
Page offset, left margin	.PO	Format	
Character width	.CW	^PF	Print Font
Comment	.IG or ..	^OU	Option Unprinted comment
Conditional page	.CP	^OK	Option Keep lines together
Footing	.FO	^OF	Option Footer
Heading	.HE	^OH	Option Header
Footing margin	.FM	^OF	Option Footer
Heading margin	.HM	^OH	Option Header
Line height	.LH	Format or ^PH	Print Height
Margin at top	.MT	Format	
Margin at bottom	.MB	Format	
New page	.PA	^OP	Option Page break
Omit page number	.OP	Format	
Page number	.PN	Format or ^OA	Option Assign page number
Page number column	.PC	Format	
Subscript, superscript roll	.SR	Format	
Paper length	.PL	Format	
Display message	.DM	^OMM	Message
Define file	.DF	^OMS	Select data file
Read variables	.RV	^OML	Load data
Ask for variables	.AV	^OMA	Ask for variable
Set variables	.SV	^OMU	Use value for variable
File insert	.FI	^OMI	Insert document
Repeat	.RP	^OMR	Repeat
Conditional command	.IF	^OMC	Condition
End command	.EF	^OME	End condition
WordStar 2000 Commands Not in WordStar			
		^OMN	Next copy
		^OMO	Otherwise

Fig 7

For IBM and APRICOT

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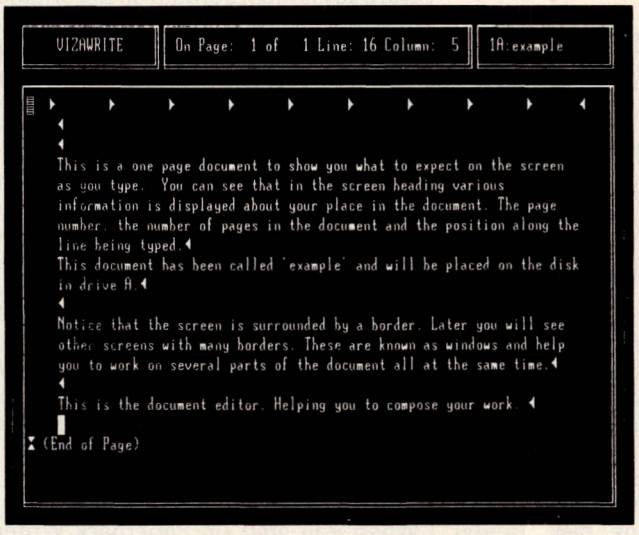
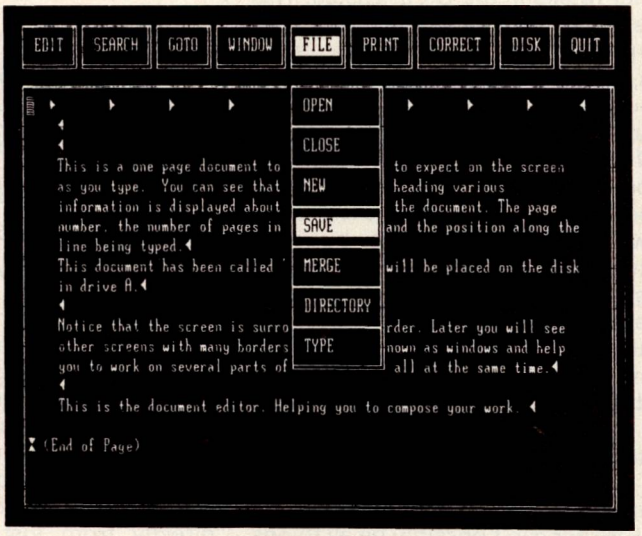


The Document Editor Screen



The Command Menu

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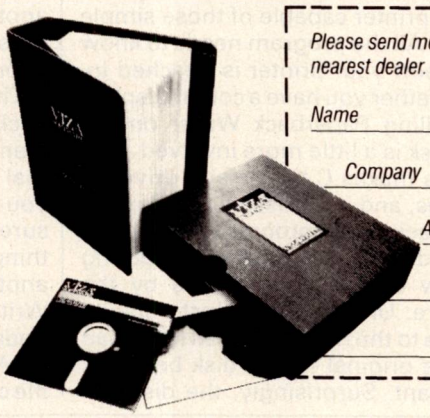

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SCREENTEST

Paperback Writer

Paperback Writer may be one of the cheapest word processing package around, but does it provide a full text editing service for the IBM PC user? Simon Craven weighs up price against performance.

Paperback Writer is a simple, straightforward text editing/word processing package with a big difference — the price. The IBM PC user normally expects to pay between £100 and £500 for word processing software, depending on the facilities required, but Paperback Writer retails in the UK at £33.80. This puts it in the same price range as quite a few packages written for home computers, many of which are completely unsuitable for serious use.

At this price level it is hard to take any IBM PC program seriously, but Adam Osborne, returning to the limelight with Paperback Software, intends to publish a wide range of serious business software for the IBM PC and compatibles, and talks with a perfectly straight face about selling software at prices related to the cost of production, not some artificial 'perceived value'.

This is all very well in theory, but if the £30 software turns out to be only one tenth as good as a £300 alternative, you will end up having to dig deeper into your pocket than you expected. Paperback Writer can't possibly be all things to all men, and fortunately it doesn't try. Rather than attempting to include all the facilities of a full-blown WordStar rival, cutting down on the power and usefulness of each module to keep it cheap and simple, Paperback Writer takes the attitude that not many people ever use more than half the facilities of sophisticated programs anyway. It dispenses with spelling checkers, word counters, mailmerge routines and other advanced features, leaving a core of features which work well and which should satisfy the requirements of many PC users.

The packaging of Paperback Writer is as unconventional as its price. Instead of the usual bulky ring binder with its loose-leaf pages, the package is a neat paperback book. The back cover is made of very thick cardboard, and is hollow. A small panel tears out to reveal the diskette lurking inside in a foil bag. The 100 pages of text include a reference guide and a brief tutorial.

Running Paperback Writer for the first time is much easier than with more complicated packages. A choice of two installation programs lets you set up the software to run using either a floppy or hard disk as the primary storage medium, and lets you install DOS on the master disk so you can boot the system directly from just one disk. Printer installation is not included as the only special printing effects allowed by the editor are bold and underlined printing, and Paperback Software expects you to have a printer capable of those simple effects. All the program needs to know is the port your printer is attached to, and whether you have a colour display.

'. . . Paperback Writer takes the attitude that not many people ever use more than half the facilities of sophisticated programs anyway.'

Installing Paperback Writer on the hard disk is a little more involved. This process makes C the default drive for text files, and it is possible to copy the Paperback Writer program files over to the hard disk to improve speed during the few disk accesses made by the software. Unfortunately, just copying the files to the hard disk does not mean that the original floppy disk becomes redundant. Surprisingly, the distribution disk contains a copy-protection scheme despite the low cost of the software. It would be hardly worth anyone's time to pirate a copy of this program, especially as any unofficial users would have to do without the documentation. Nevertheless, a software key is incorporated on the original disk, and no matter what disk or drive the software is running on, it looks at drive A to check the key at random intervals. If the original disk is not there the whole thing bombs out, losing any unsaved work into the bargain.

If the original disk meets its Waterloo at the hands of a cup of coffee or the household cat, you lose the ability to run the software. On the user registration form of the US edition, there is an invitation to buy a spare copy for $5 against the day when your original gets chewed up or just plain worn out. A similar scheme will be available for users in this country, where the package is being distributed by Softsel.

Setting up

When you start up Paperback Writer, the first thing you see is a menu offering three options — Directory, Editor and Quit. Selection is made by moving an inverse video box from one word to another with the left and right cursor keys, and hitting RETURN when appropriate.

The Editor option first makes you declare a filename, using any drive, filename and extender within the normal MS-DOS/PC-DOS restrictions. If you do use extenders, it is wise to make sure that the extender isn't the only thing distinguishing one filename from another. Like WordStar, Paperback Writer takes the last version of an updated file and holds it on disk as a *.BAK file, so if you make changes to a file called TEST.PCW and then edit a file

called TEST.SPC, the TEST.BAK file created by the latter will overwrite the back-up of the earlier file.

When you type in the filename it is opened on disk, or created if no previous file of that name can be found.

The main editing sceen is clear and uncluttered. A status line at the top of the display shows the current filename, and a line at the bottom shows the state of on/off toggles for boldface, underlining, insert/overwrite, and document or non-document mode. Document mode is set to *on* for writing ordinary text such as letters or articles, and set to *off* for editing program source files, which do not benefit from the insertion of printer control codes. In non-document mode, automatic wordwrap, justification, centring and paragraph reformatting are all disabled.

Below the lower status line are highlighted boxes containing the definitions of the PC's eight function keys. Some of the function keys have up to four different definitions, depending on whether they are used alone or in conjunction with SHIFT, CTRL or ALT. The legends in the highlighted boxes automatically change as appropriate when you press the ALT or SHIFT keys. Typing in a few lines reveals that with Paperback Writer, the correlation between screen appearance and printed version is not quite perfect. The left and right margins are faithfully reproduced onscreen, together with tabulations (which can be set at up to 20 stops along a line). The maximum document width is 132 characters, with automatic horizontal scrolling for widths in excess of the 80 characters that the screen can display at any one time.

Normally, anyone requiring a 132-column document would find it easier to write it in 80 columns and then carry out a global reformat upon completion.

When justification is selected it is reproduced onscreen, as are underlining and boldface. However, line spacing is selected at the print stage so does not appear onscreen.

The plain, unshifted function keys are used for functions you are likely to use all the time, such as the mode toggles already mentioned. Others include the setting of left and right margins, line centring, forcing a page break, and a WordStar-like paragraph reformat which shuffles text back into the appropriate margins after it has been disturbed by additions or deletions. One function key is devoted to a help facility which displays an explanation onscreen of any function key command. Oddly, the PRINT command is included as the final function key command; it would have been more conventional to put this facility on the opening menu. As it is, background printing is not possible.

Using the CONTROL key with a function key gives you one of the block commands. The start and finish of a block of text are marked with CTRL-F3 and CTRL-F4 (though logically, there really only needs to be one marker key, with the selected block being defined as the space between two markers). CTRL-F5 cancels a block selection. You can copy, move or delete a block, or change the whole thing to any permutation of bold and underlined text, and an 'oops' facility is provided by CTRL-F10 which restores the most recently deleted word, line or block under most circumstances.

The shifted function keys are concerned with search and replace operations. Paperback Writer only lets you search and/or replace moving forwards through the document, although you have a choice between one-off operations and global operations which can, if desired, ask for confirmation of each text replacement.

'If you don't want to do automatic mailshots, there seems to be little reason to buy a more expensive word processor . . .'

A useful and unusual feature is the ability to search for or replace special control codes as well as ordinary text. For example, if you want to remove all the hard carriage returns (those entered by the user at the ends of paragraphs) or forced page breaks, you can do so as easily as if you were searching for any other string of characters.

The final batch of function key commands are those signalled by ALT plus the function keys. These are commands which affect the whole file — a global reformat to new margins, saving a file, updating the disk record of a file while keeping it as the edit document (equivalent to^KS in WordStar), abandoning a file or looking at the directory.

Cursor movement around a document is very easy and quick, with a wide selection of possible commands. Anyone who learnt word processing with WordStar on an old CP/M machine with no cursor keys will be delighted to find that the same cursor movement sequences apply. CTRL-S moves the cursor back one character, CTRL-D moves it forward, and so on.

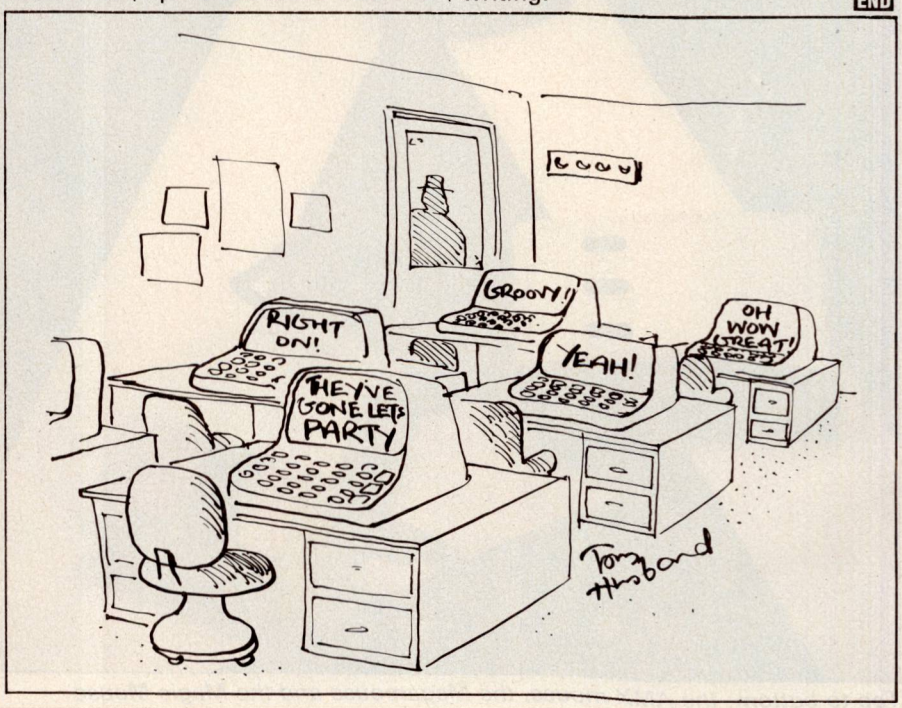
Most users will prefer to use the PC's cursor pad. CTRL with a cursor key moves the cursor a word at a time. Using the special keys in the cursor pad, HOME, END, PGUP and PGDN, you can move up and down the document in large or small increments as you wish. DEL deletes from the cursor forwards, and BACKSPACE deletes backwards. It is all very flexible and will be instantly familiar to the hordes of WordStar users, but manages to be easier to use.

One small niggle is that text entry normally has to be carried out in overwrite mode, rather than the insert mode preferred by many users. This is because wordwrap is disabled when text is being inserted.

The slender manual is very clear, with a comprehensive index and contents page making it easy to find any required information. The program's help facility and logical use of the keyboard makes it largely self-documenting anyway.

Conclusion

If you don't want to do automatic mailshots, there seems to be little reason to buy a more expensive word processor than Paperback Writer. If you want something more powerful, your needs might be fulfilled by a more sophisticated package due from the same publishers. Executive Writer, the deluxe version, will cost £59.25, but I had no further information at the time of writing. END



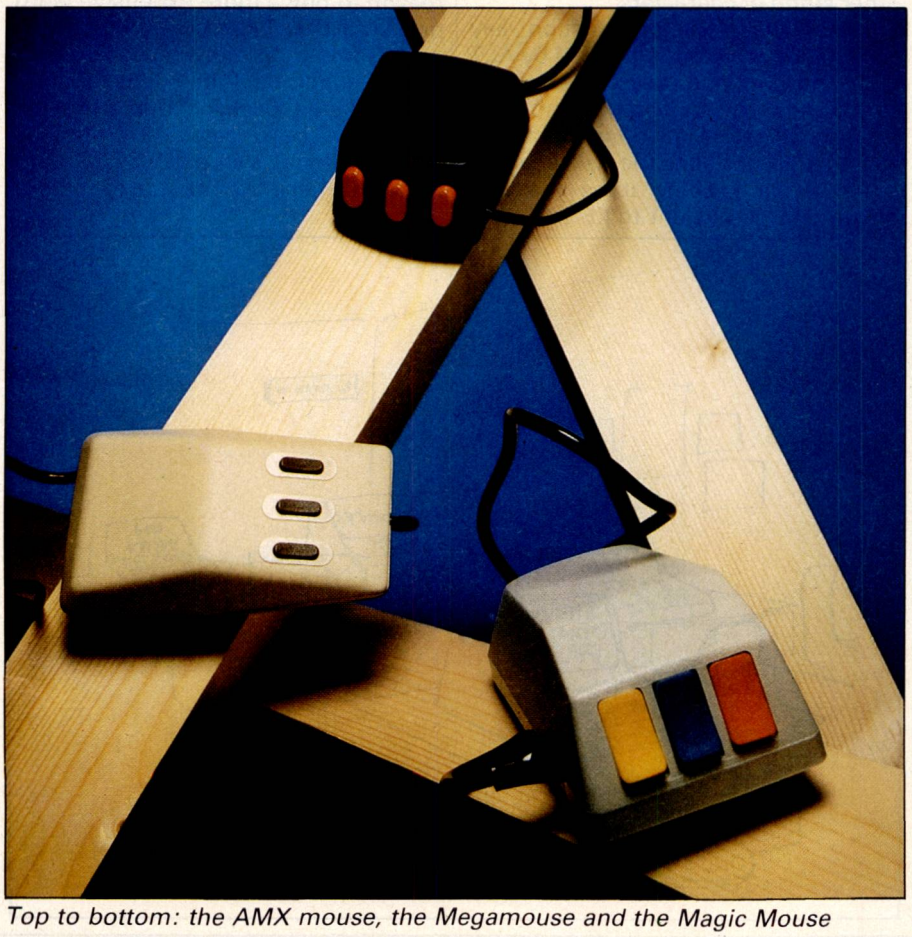


Of mice and graphics

The mouse is often seen as another superfluous peripheral, but Stephen Applebaum looks at a range of mouse-driven graphics programs that look set to nibble away at this concept.

Since the early days of micro mice, the beasts have gnawed their way through the market, making their mark on machines like Apple's Macintosh before coming to rest on some of the smaller micros, such as the BBC and Commodore 64. Not surprisingly, some of the first mouse-related software written for these machines was graphics-orientated, often bearing more than a passing resemblance to Apple's MacPaint.

The prime example of a mouse-based graphics package for a cheaper machine is Advanced Memory Systems' AMX Art package, at £89.95 for the BBC. This has been around for some time but has recently been enhanced by the introduction of two disk packages, AMX Utilities (£14.95) and AMX Desk (£24.95), for use with the mouse.



Top to bottom: the AMX mouse, the Megamouse and the Magic Mouse

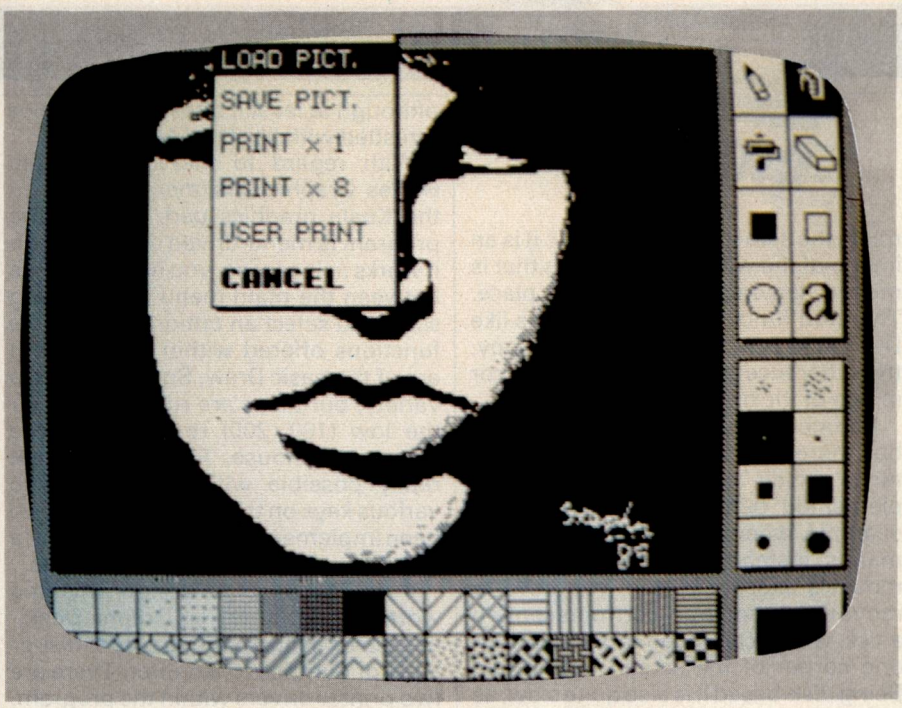
AMX Utilities is an extension to AMX Art, the MacPaint-like graphics package bundled with the AMS mouse. Although this set of tools extends the range of available functions, it does little to patch up the shortcomings of the mouse hardware (that is, the steel ball-bearing it uses as a tracking device). Unless the mouse is used on a matt surface the cursor often stops, and can only be recovered by vigorously spinning the ball-bearing.

Hardware aside, the AMX system is very neat, but you do need the original AMX ROM package before either suite will operate with your system.

The most appealing aspect of the AMX software is the freedom it offers first-time users. In this respect it is very close to the Macintosh operating system and GEM, and although not as versatile, it does introduce that air of user-friendliness made possible by a mouse and icons. For example, after loading AMX Utilities, the directory is displayed onscreen as a set of easily identifiable characters representing the various options available. Any of these programs can be loaded by simply moving the cursor over an icon and pressing a button on the mouse.

The utility that users will probably find themselves returning to most is AMX Art 2, which is virtually a debugged version of the original art program plus a few extra functions.

Macintosh owners who use AMX Art 2 are often impressed (and a little niggled) by its similarity to MacPaint. The screen display, although not identical, features the same white area reserved for pictures, bordered by the familiar icons which represent such things as an aerosol can, a rubber and a



The Door's Jim Morrison, one of AMX Art's 'countless possibilities'

paint brush. A series of boxes runs along the bottom of the screen, each containing one of 32 fill patterns, and this is where the difference between the old AMX Art program and the new one is apparent.

Unlike the original program which was limited to 32 fill patterns, the new one, using a LOAD FILLS function, utilises three times that number. Furthermore, you can create an unlimited number of new shadings with a pattern designer which is included on the same disk.

If you already have pictures saved from previous attempts with AMX Art, they can be loaded into AMX Art 2 with a command embedded in one of the latter's pull-down menus. This gives increased flexibility, as well as a chance to try out your new patterns on some old drawings.

Although there are countless possibilities in the number of patterns that can be produced, the BBC's limited memory confines them to black and white. AMS has provided a small, colour drawing package on the disk which is aimed at children, but nothing that will suit the serious designer.

Complementing AMX Art 2 are a host of smaller although no less useful routines, most of which were conspicuous by their absence from its predecessor. One of the most obvious oversights being the exclusion of a ZOOM command, this and other handy routines have now been included, many of which can be found in the Goodies menu of a program called Utils.

Also resident in the Goodies menu is COPY, a powerful command which makes use of an extensive set of special effects. Apart from being able to copy over, invert or wipe a picture, part or all of it can be duplicated and rotated through a number of different angles at almost any position onscreen. Two further routines allow ellipses and arcs to be drawn quickly and quite accurately, without the user having to do anything other than plot a few points.

If animation is your forté, a Slide utility lets you string together up to 25 AMX pictures and then view them consecutively, producing the illusion of movement in much the same way as a child's flick book. Scrolling between frames can be either manual or automatic. A time interval must be entered for the latter method but, as the manual warns, short intervals between slides can cause severe wear on the disk if used for long periods. As a countermeasure, AMS suggests that the minimum interval between frames should be 15 seconds, a period of time which will prevent damage to your disk but still produce some jerky animation.

AMX Art 2 contains a printer driver which allows any picture to be reproduced on hard copy, in formats of one or eight times the original size. In addition, a utility called XdGen gives users with screendump ROMs the option to create a program to dump pictures to non-Epson standard printers.

As much of the AMX mouse operating software is held in ROM, it is possible to incorporate the device into user programs. New commands can be accessed using the '*' prefix, two of which, *MOUSE ON and *MCURSOR ON, switch on the mouse and use it for cursor key functions respectively. Owners of Wordwise, Wordwise-Plus and View will be able to utilise the mouse instead of the BBC's four arrow keys. Another * command allows each of the mouse's three buttons to be programmed for a specific function (for example, set marker or move block), replacing the chore of having to fumble for a red function key with a single flick of the finger.

As Advanced Memory Systems' other program, AMX Desk, moves away from art programs into the world of desk-top environments, I won't go into it in detail here, but it does have interesting electronic equivalents of those little necessities like a memo pad, a diary, a telephone/address book and even a pull-down calculator.

If you are put off AMS software because of its lack of colour, you'll be pleased to know that Watford Electronics has produced colouring software designed to work with the AMX package. It's called Colour Art, it comes on disk and costs £14.95. And another



Add colour to your artistry with Wigmore Houses's Cadmouse



company, Wigmore House, has produced a mouse (or trackball) controlled package called Cadmouse, which offers many of the same functions as AMX Art 2 (as well as a few useful extras), plus the luxury of colour.

Wigmore House's mouse, immodestly named Megamouse, works on virtually any surface thanks to the use of a rubber rather than steel ball. It grips better and is quieter, a point which has led to it being dubbed the 'whispering mouse'. This rather chic and accurate (100 points per inch) mouse must be one of the few all-British peripherals to have earned the distinction of being used on several Japanese computers, including Epson's new QX-16 (Benchtested *PCW*, July).

Certain inevitable similarities crop up between Cadmouse and the graphics package looked at previously. However, ultimately they are each aimed at different markets; the AMX system being orientated toward the popular and, to a lesser extent, small business fields, while the Megamouse seems to be scuttling in behind the Bitstik as a low-cost piece of 'serious' design software — or so claims Wigmore House.

Cadmouse is well equipped for simple design work as it can operate in the BBC's high-resolution (640×256) mode 1. The number of colours in this mode is limited to two, but that is unlikely to worry the type of user the package is aimed at. Draughtsmen could find Cadmouse useful for making rough plans with as it features not only all the usual things such as rubber lines, circles, ellipses, arcs, polygons, and so on, but also technical symbols like centre lines, hatched fills and even dimension lines which can be drawn at angles of 0, 45 or 90 degrees. Text can also be added at the same three angles, allowing drawings to be fully annotated.

There are two types of fill-in Cadmouse — hatched and solid. Both these are quite simple fills, having been written in a way that forsakes accuracy for speed. The result is that, when trying to colour large areas, gaps are left and have to be filled separately, negating the original idea of saving time.

Cadmouse also operates in the low-resolution mode 2, but where resolution is lost, memory is freed, enabling four instead of two colours to appear simultaneously. This mode is perfect for general drawing, and users should find that the different functions available suit most of their needs.

Of all Cadmouse's tools, I found DRAG, DUPLICATE and INVERT to be the most powerful for manipulating parts of my drawings during both creation and editing. As it implies, DRAG allows specific areas of the screen to be windowed and then literally moved to another position. Its sister command, DUPLICATE, does much the same, except this time it is an image of the window's contents that is moved, leaving the original in place. The third function, INVERT, works like DUPLICATE in that it produces a copy, the difference being that it is a mirror image of the original.

Cadmouse is an impressive package, but there are several frustrating features which could have been implemented better, or differently. For example, when confirming some commands, instead of double-clicking the mouse's execute button, you have to move the cursor to an icon representing a tick, which can mean moving it from one corner of the screen to another. Being disk-based it is also quite slow, as you have to wait for data to be loaded each time a function is selected.

Users with printers other than an Epson or one of the compatibles have once again been left out in the cold. It is possible to integrate your own printer driver, but that could mean having to write it yourself.

None of these points is anything more than annoying, and I would recommend Cadmouse (£103.73 including mouse) to anyone who enjoys dabbling with graphic design on a computer. For those who are rather less ambitious, there's a cut-down art package called Mousepaint. This is more suitable for children and can be bought on its own with the mouse for £86.94 on tape or disk, or together with Cadmouse for £114.54. Further software, possibly including ROM-based applications, is planned, but as to what it could be, Wigmore House's door is staying shut.

Whereas the BBC Micro is becoming infested with mice, the little beasties seem to be thin on the ground where the Commodore 64 is concerned. A few are available, and I had hoped that they would provide another useful alternative for Commodore 64 owners. But the first I've seen, SMC's Magic Mouse, failed to live up to my expectations, as neither the software nor the hardware is really up to scratch.

Compared with the BBC packages, the Magic Mouse is cheap at £59.95 (including tape and disk versions), but you get what you pay for. Several things are wrong with SMC's mouse, the most obvious disadvantage being its size. Unlike the Megamouse which fits snuggly under the palm of the hand, the large, heavy, rat-like Magic Mouse feels bulky and uncomfortable. It's weight can be attributed to a rubber-coated ball-bearing which sits in a recess toward the back of the mouse's base. This odd positioning of the ball-bearing makes the Magic Mouse more difficult to control than Wigmore House's, although at least it does not have to be wrestled with like the AMX Mouse.

With regard to the software, the Hi-Res Graphic Designer is similar to the Koala graphics pad. Most of the program is menu-driven and, although it works using icons, you have to toggle between the main menu and drawing screen to select an option. Most of the functions offered within the program are of the basic Draw, Spray and Circle variety, but these are ruined by either the low (160×200) resolution or the inaccurate mouse. Fine work is not really possible with the mouse, so various keys on the 64's keyboard have been implemented to move the cursor a single pixel in one of eight directions.

If you manage to design anything worth saving, the Hi-Res Graphic Designer allows pictures to be saved to disk or tape, or dumped to a printer. There are two printer drivers within the program, one of which dumps a screen to a Commodore printer while the other works with a Centronics device.

Both the sprite and icon designer programs are very similar, each allowing characters to be drawn and used within user programs. In both cases, the sprite or icon is designed on a grid 24 × 21 characters in size. This can be saved, and then called back into a program using several special pokes.

The last program, the mouse controller, gives the user access to the interrupt-driven mouse control routines. In other words, it allows you to utilise the monster in your own programs, once again using the odd POKE.

Conclusion

The combination of a mouse and icons would appear to be a step toward making computers easier to operate, especially for those who dread the idea of having to tackle a keyboard. However, unless enough thought is put into the design of both the hardware and software, the result can be that the mouse is little more than just another peripheral hanging off your micro. Neither the AMX Mouse nor Megamouse fall into the category of superfluous equipment, although the usefulness of the Magic Mouse is debatable.

Of all the packages I looked at, Wigmore House's Megamouse manages to retain the best balance between the quality of the software and mouse hardware, but I still prefer the AMX software because of the cheeky way in which it reproduces many of the effects normally attributed to machines with bit-mapped screens.

For further details about the products reviewed, phone:
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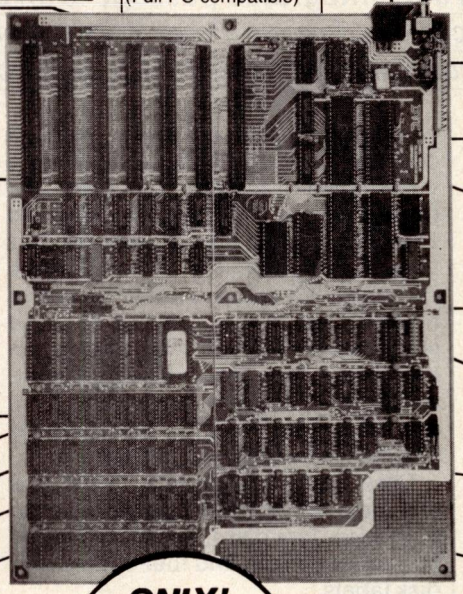

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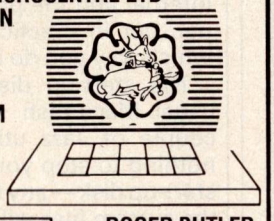



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Jazz

Lotus' long-awaited Jazz integrated package is an attempt to launch the Macintosh into executives' favour. Peter Bright tests the competence of this word processor/database/spreadsheet/comms software.

I can't think of a single piece of micro software that has been waited for longer or had more expected of it than Lotus' new Jazz integrated software package for the Macintosh.

Apple hopes it is the product to get the Macintosh on the executives' desks, something that Apple has always lusted after, and the press has been waiting for a heavyweight name other than Microsoft to throw itself behind the Mac.

Now it's here.

Packaging

Whenever an expensive piece of software arrives in the office, I always worry about how much of the punters' hard-earned cash is being spent on flashy packaging that gets thrown in a cupboard and is never seen again.

This is especially true of Jazz, where you have to peel off three layers of cardboard, plastic and rubber before you can get at the program disks. The first layer is a very flashy-looking red and black cardboard box with the Jazz logo plastered all over it. Take off the cardboard lid and you are faced with a black-ribbed rubber folder with a red stripe down the side which holds the manuals. I thought this looked quite trashy, but the art-conscious types in the office told me that black rubber ribbing is terribly trendy. C'est la vie.

Other little knick-knacks in the box include a small black plastic wallet to hold your Jazz disks, for which I could find no good use, and four snazzy Jazz disk labels.

Included in the box are no less than six manuals: a primer, a handbook, a quick reference guide, an update sheet, and leaflets on how to start up the system and convert data from other packages. The standard of production for the manuals is the highest I have ever seen, with very high-quality paper, glossy covers and liberal use of colour photographs. It must cost a fortune to produce. The quality of the text was generally good too, with plenty of screenshots to illustrate different points. But good as the manuals are, I can't help wondering if they are rather over the top for a Macintosh application. I only needed a manual on very rare occasions, usually just to confirm that what I was doing was right.

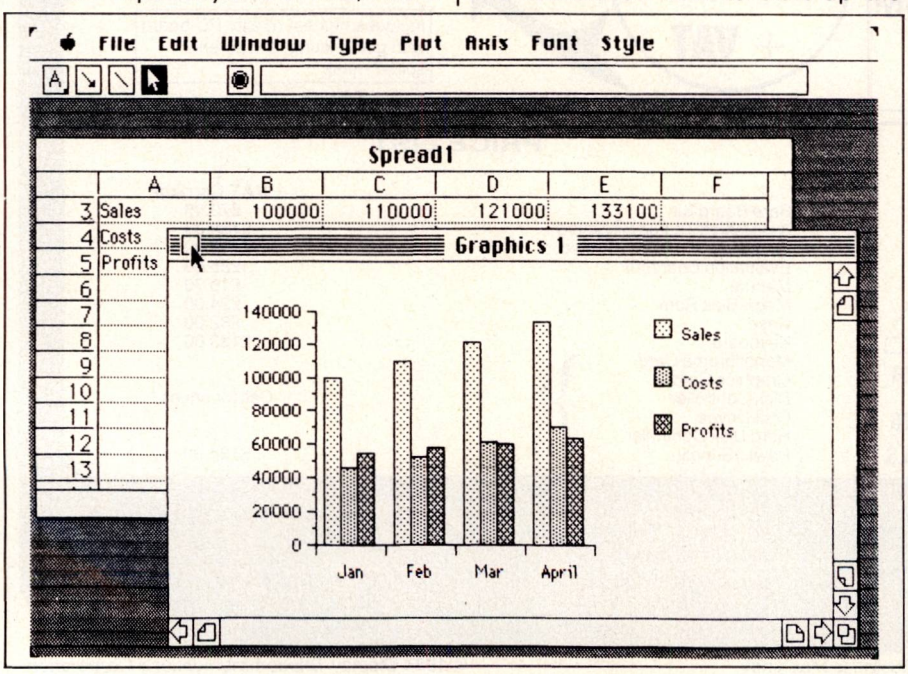


Fig 1 A graphics window with a spreadsheet window underneath

The program

The minimum system configuration needed to run Jazz is a 512k Mac with twin disk drives. Four disks are included in the Jazz box, marked 'Start-up', 'Program' and 'Back-up Disk'. A tutorial disk was also supplied.

To get Jazz running, you need to put the start-up disk in one drive and the program disk in the other. Lotus tells you to put the start-up disk in the internal and the program in the external, but in practice it doesn't matter which way you do it.

The start-up disk contains all the usual Macintosh system files and a couple of Jazz utility files. There is nothing to stop you making your own start-up disk — any Mac disk containing the system files will do. The only point to remember is that Lotus has customised the standard Mac 'system' file, so if you use the system from another disk, you will need to run the Jazz System Update utility which is supplied on the start-up disk.

The program disk is the one that actually holds the Jazz program files. This disk is copy-protected, but Lotus does provided a back-up should you mangle the original.

Starting Jazz is done in the traditional manner by double-clicking the Jazz

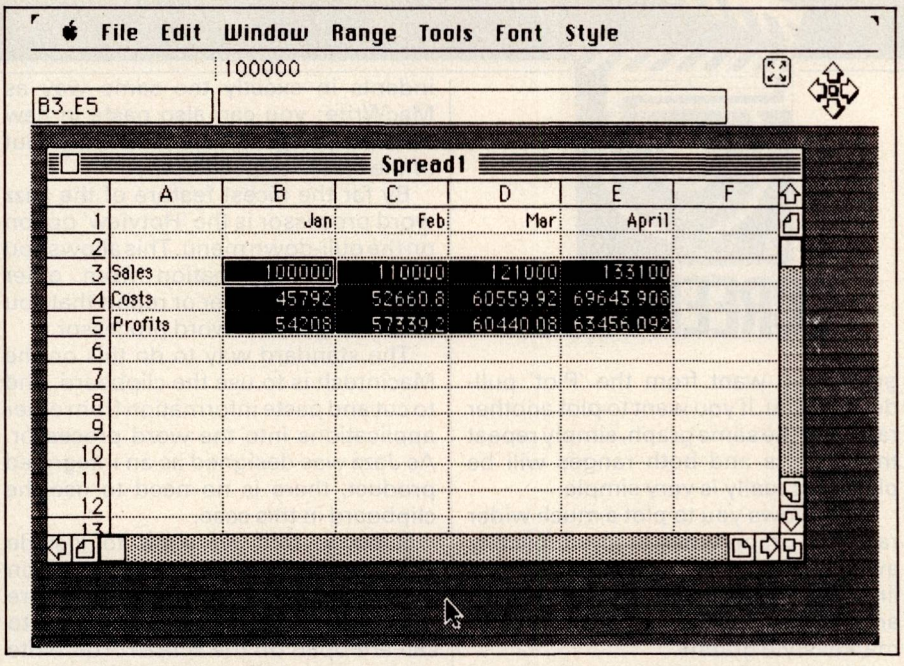


Fig 2 A worksheet window

icon on the Finder desk-top. When you have done this, you sit back and wait for the program to load. Eventually a blank desk-top is displayed, complete with 'File' and 'Window' pull-down menus. The two main options in the File pull-down menu are 'New' and 'Open'; New creates a new file, and Open allows you to load a previously saved file.

Windows

Assuming you want to create a new file, you select New. This then displays a window containing different icons for the different types of document you can create; worksheet, graphics, database, form, word processing or communications. To open a new document, you simply double-click the icon for the type of document you want. The system will then open a window on the screen containing a blank spreadsheet, word processor document or whatever, and you can start typing.

When a new window is opened by the system, it only takes up about half the screen. You can play around with the size and position of the window in normal Mac fashion, or you can zoom it up to full-screen size by using the 'Zoom Up' option from the Window pull-down menu.

One of the main features of Jazz is that it is possible to have many different documents open onscreen at the same time. Each document has its own window on the screen, which means that you could have, say, a word processor document, a spreadsheet and a graphics window all open and onscreen simultaneously. You can switch between the documents by simply selecting the appropriate window with the mouse.

There are two main limitations on the use of multiple windows. Firstly, the number of documents you have open on the screen depends on the amount of free memory in the Mac. With no documents open, the Mac has about 256k of RAM free. Each document you have open obviously takes up some RAM. If you only have small spreadsheet models, databases or word processing documents, you can obviously have more windows open than if you have large documents.

One drawback of Jazz is that it isn't virtual and is therefore totally RAM-bound; the other limitation is that Jazz isn't concurrent. This means that although you can have multiple documents open at the same time, the Mac is only processing the foreground document you are working on: the others are inertly sitting in RAM waiting to be worked on. This means that it isn't possible, for example, to print one word processor document while working on another, which is rather disappointing.

The best way to describe how Jazz works is to run through each of the different document types, and describe how they work and how they link to each other.

Worksheet

As you would expect from Lotus, the Jazz spreadsheet is quite comprehensive. Jazz includes a utility which will convert Lotus 1-2-3, Symphony and Multiplan SLYK files into the Jazz format. You can transfer the files from your IBM PC, either by using the built-in Jazz comms or by using a package such as PC to Mac and Back.

Nominally, the Jazz spreadsheet extends to 8192 rows by 256 columns, but as with Lotus 1-2-3 there is no way you can use all these cells. Even if you take a totally empty worksheet and try to enter one number into the last cell, you will get an 'out of memory' error from the system. The actual maximum, with no other windows open, is around 61,000 cells which can be arranged as you please, for example as a 240 × 256 grid.

When a worksheet is open, the screen can be divided into three separate areas: the top line is taken up by the standard Mac-style pull-down menu bar; the next two lines are taken up by the 'console' which contains control icons and editing boxes; and the rest of the screen is the normal Mac desk-top containing the document windows.

I must say that the Jazz spreadsheet is the easiest-to-use spreadsheet I have ever come across. You can use the mouse to do virtually anything bar enter the figures, and there are no less than three different methods of getting around the sheet. In addition to the usual scroll bars, there is an 'end navigator' which moves to the corners of entered data blocks, and a 'corner navigator' which allows you to move around a selected range.

Setting up a spreadsheet is very easy. If you don't like a column width, you just

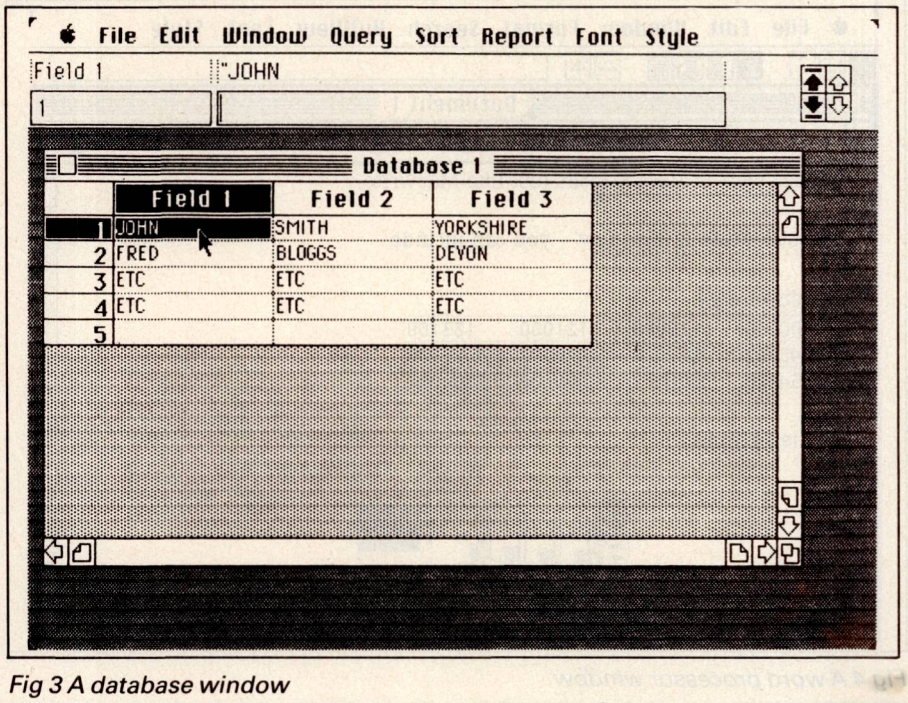


Fig 3 A database window



SCREENTEST

drag the column separation line around with the mouse until it is the right width. You can select a range of cells simply by dragging the cell selector box over the cells while holding down the button. Copying and moving blocks of cells is simplicity itself — just use the standard Mac 'Cut', 'Copy' and 'Paste' options from the 'Edit' menu. Replicating cell values and formulas is done in the same way, and is just as easy.

The great thing about the spreadsheet is that it has all the usual spreadsheet-type power, mathematical functions and 'What if?' type ability, but the Macintosh environment makes all this functionality much more accessible and easy to use.

The one disappointment I had with the spreadsheet is that although you can have multiple spreadsheets open at the same time, there is no way that the cell references can cross-reference each other from sheet to sheet. This means that the type of consolidation allowed by packages such as Ashton Tate's Framework isn't possible under Jazz, which is surprising given the integration facilities that are provided on the word processor.

Graphics

Unlike products such as Lotus 1-2-3 in which the graphics are part of the spreadsheet, Jazz graphics is treated as an independent document and given its own window.

Let's pretend that you want to make a graph of some of your spreadsheet data. Firstly, you need to open your spreadsheet document and then open a new graphics document in order that both windows are displayed onscreen. To make a graph, you highlight a range on the spreadsheet, switch to the graphics window, and select the type of graph you want from the 'Plot' pull-down menu. If you want to plot another range on the same graph, simply repeat the process and both ranges will be plotted. It really is very simple.

Jazz allows you to plot a much wider range of graph types than are usually available. In addition to the normal pie, line and bar charts, you can also plot area charts, scatter graphs and stock market style graphs.

When you've finished the basic graphing, you can make it look more interesting by entering legends and titles, and annotating any of the entries. All the usual Macintosh fonts and text sizes are available, so you can make your graph look quite pretty.

Word processor

The word processor contains some of the nicest and some of the nastiest features of Jazz. My first impression was that it looked very similar to MacWrite. The top line is the standard Mac pull-down menu, the second line contains icons very similar to MacWrite which allow you to set the line spacing, justification, and so on, and the rest of the document is a standard Macintosh window.

The top line of the word processor window contains a one-line ruler that looks very like MacWrite. You can use this to set margins, tabs and paragraph indents in exactly the same way as MacWrite; you can also paste in new rulers as you go along to alter the layout of the text in a specific way.

By far the nicest feature of the Jazz word processor is the 'Hotview' option on the pull-down menu. This allows you to include information from other documents in a letter or report that you are writing on the word processor.

The standard way to do this on the Macintosh is to use the clipboard, and to cut and paste information from other applications into the word processor. As Jazz was designed as an integrated product, there is no need to use the clipboard in this case.

Suppose that we want to include some spreadsheet data, and a graph on that data. Firstly, you have to make sure that all the documents you are going to call are open on the screen. You write your report until you get to the place where you want to insert the spreadsheet data, and you select the spreadsheet window and highlight the range you want to copy. Then you simply go back to the word processor document and select 'Include' from the Hotview pull-down menu, and an image of the spreadsheet appears in your text.

The same thing happens with the graph: you type some more text, select the graph and then Include it in the document. The great thing about the graphs is that they can be scaled, so you can play around with the size in the word processor document.

All this is fairly standard Macintosh. The neat part is that if at a later date you change the data in the spreadsheet, that change is automatically reflected in the word processor document. This is true even if you don't have the word processor document open when you make the change to the spreadsheet. The only time this can't be done is if the word processor document and the spreadsheet document are on different disks, in which case the system tells you that it can't update the data in the word processor.

Hotview also has a mailmerge-type facility which allows you to insert data from the spreadsheet or the database into merge-printed word processor documents.

Now for the not-so-neat features of the Jazz word processor.

Firstly, it crashes. Admittedly you have to get devious, but it definitely crashes. I was experimenting with the word processor one afternoon, and I kept my finger on the '.' button so that it auto-repeated to fill about three-quarters of the screen width. The first thing I found was that it wasn't possible to place the editing cursor anywhere in the middle of the line of dots, although it worked normally in the test of the text onscreen. Secondly, I put the cursor at the start of the line of dots and hit the space bar a few times. The system

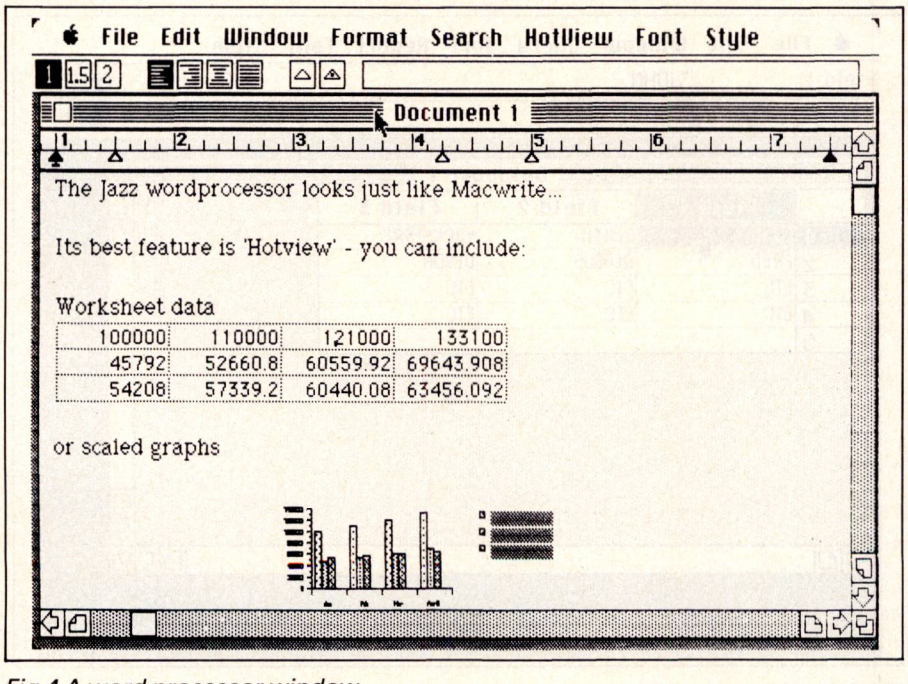


Fig 4 A word processor window

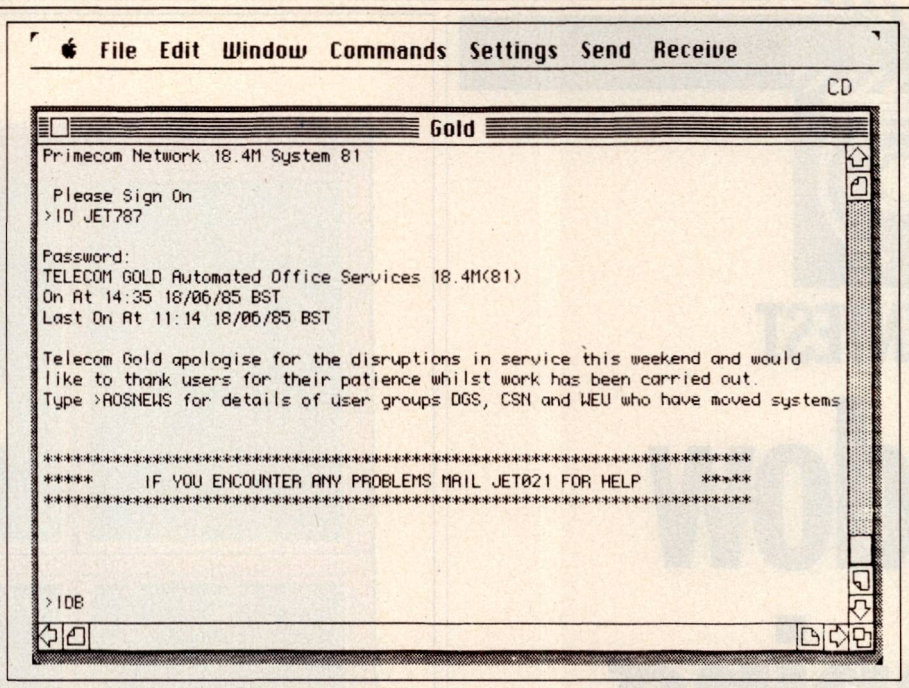


Fig 5 A communications document

completely crashed out, messed up the screen and started bleeping plaintively. The only thing to do was to reset.

This happened each time I repeated the process. When I phoned Lotus UK, the same thing happened on the company's machine and it said it would look into it. As far as I know, it is still looking into it. Although I must admit that the circumstances leading to the crash are slightly unusual, you must be worried by any system that crashes out completely without being caught.

Other assorted niggles include no page numbering, so you can't tell which page you're on. The editing procedure is inefficient: the system sometimes re-draws the entire screen when you make a small change. This generally leads to a very slow response time, which can get extremely bad if you are working at the end of a long document.

Finally, text seems to be stored internally in a very strange way. Although you begin with about 256k of RAM free, it runs out after 20-25 pages of single-spaced text. This could be a limitation if you write long documents.

Database

Kathy Lang will be looking at the Jazz database in more detail soon, so I'll just feature some of the highlights here.

Assuming that you are creating a new database, the first thing you have to do is to enter names and details for all the fields in the record. The field data you have to specify includes the display width, but Jazz can store up to 254 characters per field, regardless of the display width setting.

When you have finished setting up the fields for the database, Jazz displays a spreadsheet-type screen with the field names running along the top and records running down the side.

You can now enter data directly into the database simply by entering it into the spreadsheet-style cells. Although this works, it's rather strange entering data into what looks like a spreadsheet. If you don't like this, you can create a more traditional data entry form which sits on top of the sheet and enters data into the database.

To do this, you need to open up a form-type document. When this opens, Jazz automatically looks at the open database and transfers the field names to the data entry form, with data entry boxes next to them so that you can enter data. You can either take the form that Jazz creates for you, or customise it in some way. Data is entered by TABbing between fields plus the 'Add Record' option from the Edit pull-down menu, or by hitting COMMAND N from the keyboard.

When you have entered your data onto the 'spreadsheet', you can play around with fields and records in much the same way as a normal spreadsheet by highlighting them using the mouse, and so on. You can also set up calculated fields and formulas.

In addition to the spreadsheet-type operations, you can sort the records in the database and apply specific search criteria to the data. Reports can be set up in much the same way as a spreadsheet.

Communications

The final feature of Jazz is its communications abilities. Like the other features, communications is document-based so you just open it into a window.

The communications window can be set up to either emulate a DEC VT52 or VT100 terminal. VT52 will do for most dial-up services, with VT100 being very handy for accessing more specialised services.

Jazz communications can drive either auto-dial/auto-answer or regular modems. As supplied, it has drivers for Hayes or Apple auto-dial modems and provides full control over the auto-dial functions. I didn't have access to either a Hayes or an Apple modem during the test, so I tried it with a Miracle Technology WS2000 modem and dialled manually. This worked very well.

Jazz communications allows you to change all the settings you would expect for a comms program — baud rate, word length, parity, and so on. In addition, it has fairly comprehensive file transfer abilities. It can send and receive disk files as text with no protocol, or disk files using the XModem protocols or a special Jazz-to-Jazz protocol.

Besides being able to run incoming data to a disk file, you can send it directly to a word processor, spreadsheet or database document without having to go via a disk file.

Conclusion

Lotus has done a great job of integrating Jazz into the Macintosh environment. Although this is a very complex piece of software, it really is extremely easy to use. I liked the spreadsheet for its ease of use, the graphics for its range of abilities and the comms for its functionality.

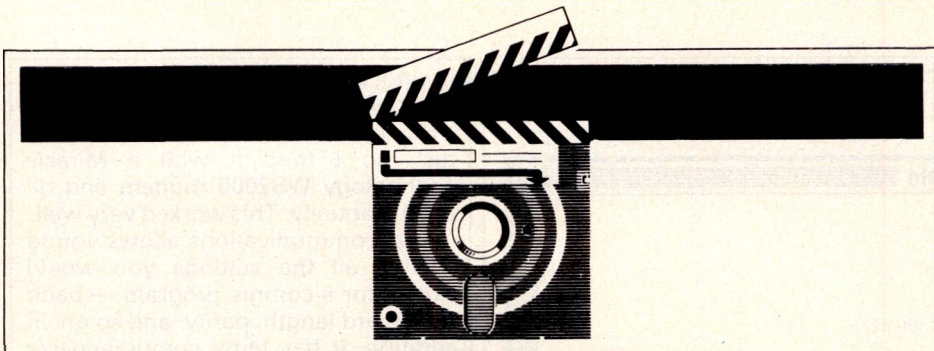
I initially liked the word processor, but as time went by its shortcomings started to iritate me. However, the Hotview facility is absolutely great and is a good example of integration at work, and the database is certainly an improvement over Lotus 1-2-3.

I was worried that I consistently crashed the word processor: that kind of thing shouldn't happen on a release version of a product. The second problem comes down to memory management. With only 256k of RAM to play with and each open document taking its chunk, you have to balance the number of open documents against the size of each document. This isn't helped by the use of what seem to be old-fashioned 1-2-3-style memory management techniques.

Having said all that, Jazz is still a very good general-purpose tool; whether you buy it depends on your outlook on the Mac. There are two ways to obtain multi-functionality on a Mac: one is to buy Jazz which does everything well but nothing wonderfully; or you could wait for the soon-to-be-released Switcher RAM partitioning software and build your own pseudo-integrated system.

The advantage of this approach is that you can choose a powerful program to do the frequent tasks and then integrate less powerful programs to handle the less important jobs. The advantage of Jazz are: a) that it has a higher level of integration than you could get with the Switcher; and b) Jazz is available now, the Switcher isn't.

If you think you need an integrated package, Jazz is the one for you. But if you don't need *all* the features, you might be better off building a DIY system. **END**



SCREENTEST

Window shopping

The best-dressed business micro is currently sporting an add-on windowing facility for increased user friendliness. Nick Walker tried the three main contenders in this field — Digital Research's GEM, Microsoft's Windows and IBM's Top View — on an IBM PC to find the perfect fit.

In many ways, the micro industry is akin to the fashion industry. Neither business is able to predict with any certainty what the consumer will buy this year or next year.

In the software industry, this has led to a series of software 'fads'. We've had the year of fancy business graphics, the year of the monolithic integrated package, and now we seem to be facing the year of the 'window'.

To be fair, the 'friendly' user interface movement has been around for longer than most people realise. Much of the development behind the concepts of windows and mouse-driven friendly interfaces was done at Rank Xerox in the US. Xerox, with its customary inability to recognise a good thing when it saw it, incorporated the ideas into a very expensive executive workstation called Star. Then came Apple — first with its unsuccessful Lisa, and then with the considerably more successful Macintosh.

One effect of the Macintosh has been to popularise the concept of mice, icons, windows, and so on, to the point where independent software manufacturers have now developed bolt-on packages to make other micros more friendly.

There are now three main players in the bolt-on friendliness stakes — Digital Research with GEM, Microsoft with Windows and IBM with TopView. GEM and Windows are attempts to establish a new graphics standard for writing applications packages — one which could apply to all micros running them. GEM is the closest to Macintosh standard, while Windows isn't quite as friendly but does add functions such as concurrency. TopView really stands apart from the others in that it is purely designed for the IBM PC family and its clones, and can best be described as an application integrator with the added advantage of multi-tasking.

It is important to realise that none of these products is a replacement for an operating system. They all sit on top of the host computer's operating system and try to provide a friendly, easy-to-use environment from which applications can be run and housekeeping functions can be performed.

While micro hardware has advanced considerably over the past 10 years, operating systems have lagged behind for the good reason of maintaining application software compatibility. For programmers of new applications this has been a severe restriction, forcing them to ignore the legal OS calls and program directly into the hardware, making the application once again machine specific. Windows and GEM are attempts to set a new graphics standard that sits above any operating system and gives the necessary power for writing advanced applications. These applications can then be easily transported from one machine to another, usually only requiring minor editing of the source code, a re-compilation, and inclusion of system files. GEM has already shown its ability to do this with some of its early applications appearing on Acorn, Atari and Apricot machines. Windows has been written with the same ability, and Microsoft has the advantage of the wide user base for its own 16-bit operating system, MS-DOS.

GEM has its roots in an earlier graphics interface called GSX, which was taken up by a number of manufacturers. To this they have added the pixel graphics operations that enable smooth movement of mouse pointers, icons and routines for easy window management, pull-down menus, and so on. Similarly, Windows has a graphics interface lurking in its depths,

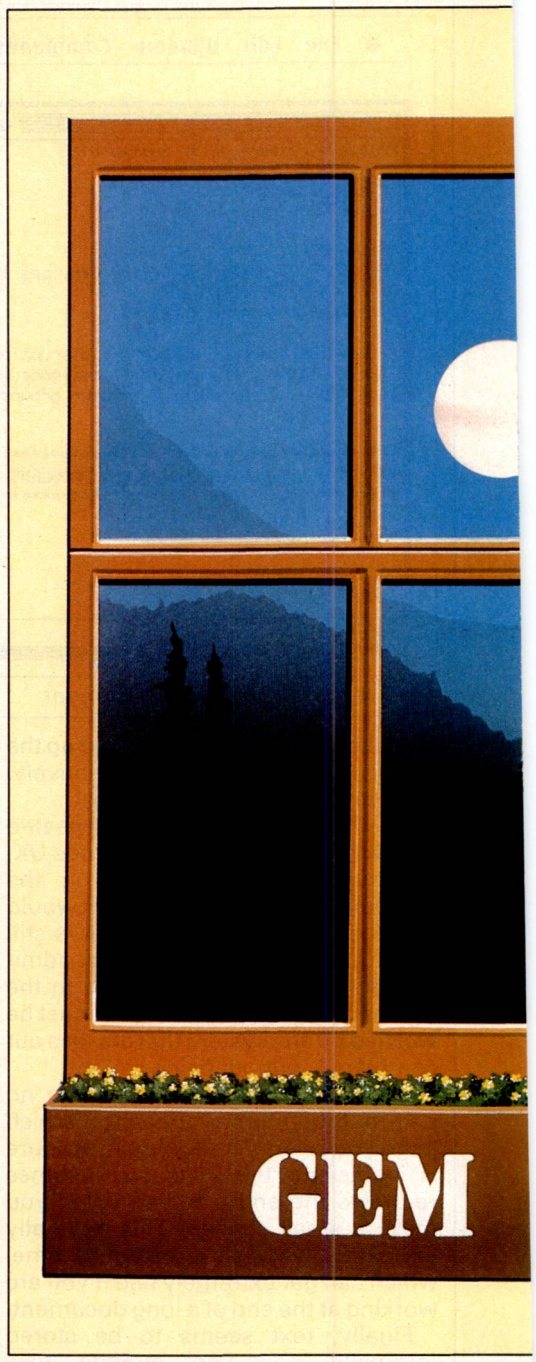
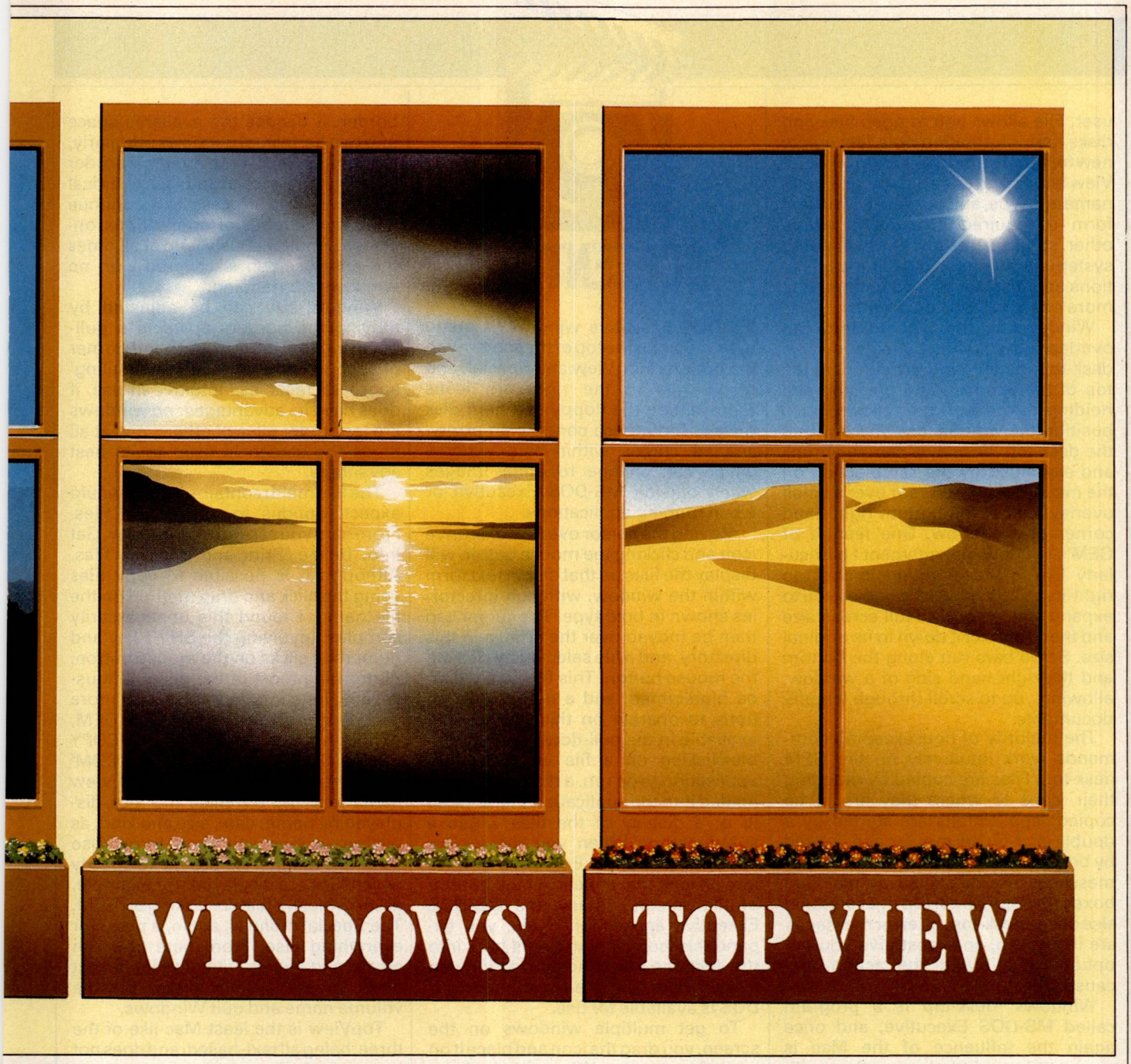


Illustration by Gavin MacLaud



the GDI (Graphics Device Interface), but this has never been commercially available by itself.

TopView sits outside this part of the battle, being designed to operate with standard (and preferably well-behaved) PC-DOS applications.

The desk-tops

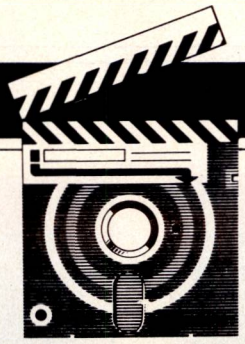
No matter how much power these packages give you and how well-written they are, it's a very small part of them — it's desk-top or user interface that is the most important. A good desk-top should be easy to use and yet unleash the full potential of the system underneath. In particular, it should shield you from the complexities of DOS, making actions such as copying and deleting files, starting applications and printing files easy and intuitive. In the case of GEM and Windows, the desk-top is itself an application running on the underlying system; it just happens to be the one that runs first and the one that's needed to operate the system. This approach has the advantage that, if a desk-top is universally disliked or a new wonder-feature is required, it is possible to re-write the desk-top as required. With TopView, the user interface is an integral part of the whole package.

The GEM desk-top is the most Mac-like of the three systems — anyone who has the Macintosh will immediately feel at home here. Along the top of the screen is a menu bar, down the left-hand side are icons for floppy disks and hard disks (if you have them), and below these is the ubiquitous 'trash-can'. The mouse's primary function is to control an arrow-shaped cursor, which is used to point to a relevant part of the screen. A full description of the GEM desk-top appeared in the February issue of *PCW*, so I'll just cover it briefly here for comparison purposes.

Most of the screen is shaded grey, upon which you can open and manipulate windows. A double click on the disk icon or a single click and selection of the appropriate option from the menu bar will result in a window opening, containing a graphic representation of the files on that disk. Documents are shown as a piece of paper with the corner folded down, applications as a box with a solid bar at the top and an appropriate icon within (typewriter for word processors, telephone for comms, and so on), and folders are shown as folders.

The menu bar contains pull-down menus labelled Desk, File, View and Options. As soon as the mouse-driven cursor approaches one of these labels a menu shoots down, listing the options under that heading. Initially this can be annoying — other systems usually require a click of the mouse button, but after a while it's quite usable.

The Desk menu contains two desk accessories, a calculator and a clock. Further accessories and applications can be installed into this menu by the



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user. File allows you to open files and disks, put information on a file, create new folders, format disks and quit GEM. View lets you arrange files by size, date, name and type, and display them in text form if required. Options is where other, sundry functions lie — changing system parameters, installing applications and disk drives, and entering the more obscure DOS commands.

Windows can be overlaid, they can overlap or sit side by side on the desk-top; positioning the cursor at the top of the window, and pressing and holding the mouse button allows you to position the window anywhere within the desk-top. Windows can be shrunk and expanded by the same action on the mouse with the cursor over a small overlay icon in the bottom right-hand corner of a window. One feature of GEM's window management I particularly like is the diamond in the top right-hand corner which enables you to expand any window to full-screen size and then contract it down to its original size. Scroll bars run along the bottom and the right-hand side of a window, allowing you to scroll through lengthy documents.

The majority of housekeeping commands work intuitively on the GEM desk-top. Files are copied by dragging their icons to where they are to be copied; applications are started by a double click on the mouse, and deleted by being dragged to the trashcan. Error messages are displayed as dialogue boxes that appear on top of everything else on the desk-top; all error messages are in English, and most give you the option of re-trying the action that caused the error.

Windows' desk-top is a program called MS-DOS Executive, and once again the influence of the Mac is apparent but a little less so than with GEM. When MS-DOS Executive is running, the screen is mainly white with a grey bar at the bottom, outside the MS-DOS Executive window. A menu bar runs along the top of the screen with the options File, View and Special, and below this to the right are icons representing the floppy and hard disk drives. The mouse controls an arrow-shaped cursor within this window which can change to other images when outside MS-DOS Executive or when running applications.

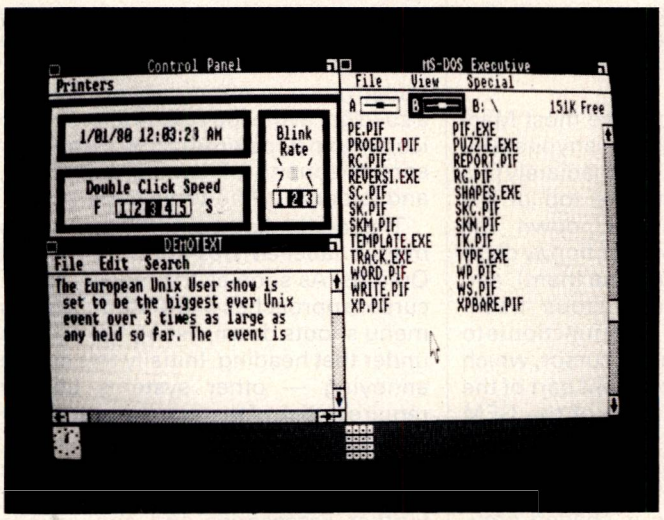
Moving the cursor over the disk drive icon and clicking the mouse button will display the files on that disk in text form within the window, with sub-directories shown in bold type. The cursor can then be moved over the entries in this directory, and a file selected by clicking the mouse button. This file would then be highlighted, and a number of options to operate on this file become available in the pull-down menu. Double-clicking on a file will cause an application to be run, a document to be loaded into the application that created it, or a display of the files within a sub-directory. When you run an application, MS-DOS Executive shrinks into an icon that appears at the bottom of the screen. To use the MS-DOS Executive application again, you expand this icon by dragging it back into the desk-top area; the application you started now forms an icon, and MS-DOS is available for use.

To get multiple windows on the screen, you drag the icon and place it on a window border. When this is done, the windows' size automatically changes to accommodate both applications. If you drag the icon onto a horizontal border, it divides the available space into two horizontal windows; similarly, dragging the icon onto a vertical border will split the screen into two vertical windows. This process can continue with any number of applications on-screen simultaneously, and at all times the entire screen is covered with no windows overlapping.

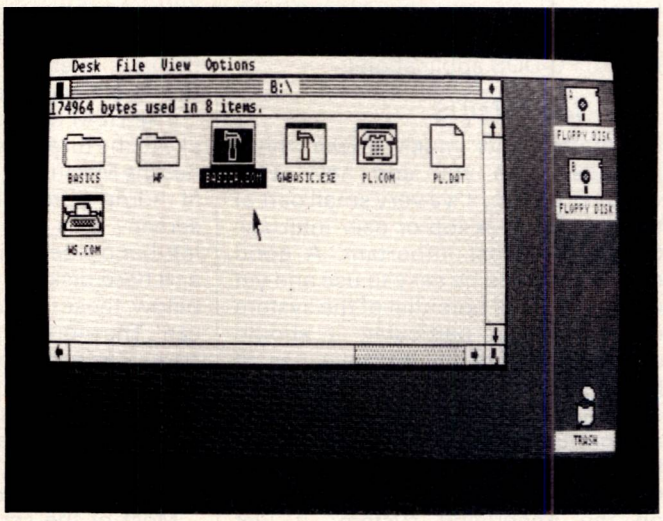
Window size can be adjusted by moving the borders or using a pull-down menu at the top right hand-corner of each window. Although this 'tiling' approach feels less intuitive in use, it does have its advantages: no windows are lost under piles of others, and at all times the screen is used to its best advantage.

The File menu contains, as you would expect, options to manipulate files. From here you can Run, Load, Copy, Get Info, Delete, Print and Rename files. Although it is possible to copy files using the click and drag method on the file name, I found this unnecessarily complex, involving the SHIFT key and numerous clicks on the mouse button. Performing most of the general housekeeping functions requires rather more knowledge of DOS than with GEM, although nowhere near the 'C>COPY PROG1.COM LEVEL1 PROG1.COM' level needed with PC-DOS. The View menu lets you organise the files displayed by name, date, size and kind, as well as in long and short form. Also from this menu it is possible to specify which files are displayed (for example, all .BAS files), a feature lacking on GEM. The Special menu is, again, a place for everything else. From here you can create and change directories, format disks, create system disks, set the volume name and quit Windows.

TopView is the least Mac-like of the three, being all text-based, and does not have a desk-top manager in the sense that the other two do. Basically, TopView allows you to run applications within windows and adds a number of



Microsoft's Windows running three applications



GEM's desk-top

menus to control this; options are chosen by using a mouse. Upon loading TopView, you are greeted by the 'Start-a-program' menu in the top right-hand corner of the screen. From this you can select and start any application you have informed TopView about, or alternatively select an option called DOS Services.

When an application is started, a click on the relevant mouse button (it varies depending whether you have a one, two or three button mouse) will bring up a small menu offering the following facilities: Scroll, Window, Scissors, Help, Suspend, Quit, Switch, Programs and Exit. Selecting Window will allow you to close in a window around the application, and here the first of TopView's bad points becomes apparent—the mouse control is awful. The window is really unstable, whether you're trying to move it or size it. To accurately position the window, you need good timing on the mouse button; press when you see the window where you want it and hope it doesn't flutter away. Perhaps I'm being unnecessarily critical, but after using Windows and GEM it does seem that bad.

The second problem I encountered was when scrolling a document within a window with the mouse. I thought I would have to pick up the document and move it around within the window, but TopView moves the window over the document so you move the mouse in the opposite direction that you would expect to go within the document. The Scissors option goes to a sub-directory from which you can cut, copy and paste text from one window to another, provided the applications to be utilised in this way display text in a normal manner. The options Scroll, Help, Suspend and Quit all operate on the current window in a similar fashion, sometimes through sub-menus, sometimes direct.

The options Switch and Programs are used to bring up multiple windows. To begin another application in a separate window, you select Programs with the mouse and click the appropriate button. TopView then overlays the Start-a-program menu onto your screen. You select the program you want to run and click the left-hand mouse button, the application starts and you can use it as normal. You can now either select the Switch option to flick back to your original application, or size the window of your new application to fit on the same screen.

DOS Services brings up a screen with two menus, one containing the commonly-used DOS commands and a second containing a directory. With this you can select a file from the menu and select one of the DOS commands to perform on it. Other DOS commands can be applied with a second menu, but I was a little perturbed to find some functions, such as CHECKDISK, missing. This menu-driven method doesn't really shield you from DOS, it just makes applying the command easier.

Applications software

All three packages, running on an IBM PC, should run your existing IBM software, and no application I tested totally failed on any one of them. The question to be asked is: how well do they cope with running them within their respective windowing environments?

GEM makes no attempt to support an existing application within its windows. Double-clicking on such an application results in the screen going black and your application taking over in its normal fashion. GEM then just sits there in the background, waiting patiently until your application finishes. However, at the time of writing, Digital Research had GEM Write, Paint, Draw, Graph and Wordchart available; all programs run to the GEM standard, and the two I've seen, GEM Paint and GEM Write, seem very near to the quality set by their Macintosh equivalents.

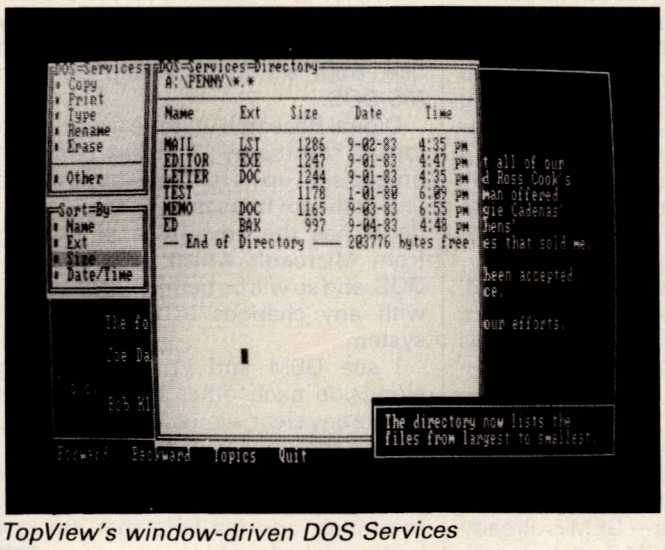
Before going on to the way TopView and Windows cope with current applications, it's worth explaining the dilemma they face. Applications software for the IBM PC has outgrown PC-DOS and IBM's original BIOS — the two areas where this is most critical is in handling the screen and the keyboard. Packages such as Lotus 1-2-3 and Flight Simulator write directly to the full screen and read directly from the keyboard, and obviously there's no way that a package that thinks it has the full screen to control directly can be forced to perform within a window. Packages such as these have been labelled 'badly behaved', and the best we can expect is to be able to switch from them to the desk-top, leaving the application inactive in RAM.

Both TopView and Windows approach this problem in the same way, by including PIF (Program Information Files) for most popular applications, as well as a general-purpose PIF that can be used to create your own for applications not included. If you have any doubts about an application of your own that you particularly want to run in a window, I advise you to see it running at a dealer's before buying either package, as these PIF files can get quite complex.

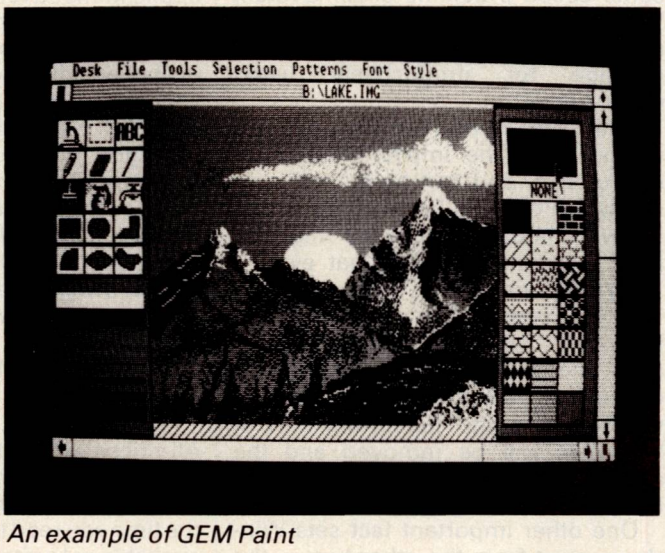
Both TopView and Windows claim to be able to run well-behaved programs within a window, but in fact TopView was the only one that I was able to do this on. This, I was told, is attributable to the pre-release version of Windows I was using, and will be correct on the final version. Both programs were able to run a well-behaved program on a full screen and then return to the desk-top with the application ticking away in the background. With badly-behaved programs, TopView refused to let me access any of its menus until I'd quit the application. Windows, however, returned to its desk-top with certain programs but not with others. My advice, therefore, is not to expect an old application to run other than by itself and by taking up the whole screen, and then you won't be disappointed. In fact an older package, Desq (reviewed in December 1983) is the best at integrating existing PC-DOS applications.

Concurrency

IBM's TopView and Microsoft's Win-



TopView's window-driven DOS Services



An example of GEM Paint



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dows both add concurrency of a sort to good old MS-DOS. GEM doesn't, but there is no reason why it won't work with a multi-tasking operating system, and it is planned to work with Concurrent DOS 286 when it becomes available from Digital Research.

Concurrency is the ability to run applications programs simultaneously. Many programs seem to do this, such as the current spate of desk-top managers (see *PCW* March), but when you call a desk-top manager the application underneath stops running while you use the desk-top facilities. True concurrency has a number of programs running at the same time, with the processor sharing its time between them, so you can be printing from a word processor, recalculating a spreadsheet and reading your electronic mail simultaneously. Although there is no doubt that a PC with 512k can do this, it really is all too much for the old 8/16-bit processor architecture and can't be regarded as smooth with Windows or TopView. To get the most out of this concurrency, you really need a PC/AT or one of its equivalent high-performance clones.

The sight of TopView trying to run just two applications simultaneously on a PC is pitiful. Even when running a single application, the overhead needed to support multi-tasking slows it down to an almost bearable level. And given the power of the AT, TopView is apparently not particularly spectacular. One user I spoke to said: 'It's slowed my AT down to the speed of the PC.'

Windows makes a better attempt at concurrency, and when it was running the small demonstration programs I was very impressed. Certainly the friendly environment of Windows makes it easy to use the power of concurrency, and having lots of 3D rotating cubes, clocks and graphic demonstrations looks impressive, but when running serious applications the same speed problems arise. Overall, Windows copes better, and given the power of an AT, it would be an excellent package for productively using concurrency.

Both TopView and Windows define a standard for the implementation of concurrency, and it will be interesting to see which one will be taken up by the software houses. Given the might of IBM, it seems probable that even if TopView doesn't catch on in a big way, it will set a standard for concurrency. On the other hand, Microsoft wrote PC-DOS and will shortly be releasing a concurrent version, Version 4. When this happens, the concurrent part of Windows will be removed and the system will be marketed to run under this new operating system.

One other important fact sets Windows apart from the other two — the use of a virtual memory system. The first versions of Windows gobbled up vast amounts of memory and ran very slowly, and although the speed problem was cleared up, the size of the thing required a different approach. Microsoft's solution was to make the memory management virtual in order that most of the system sits on disk and is only called when required. This virtual memory management system can now be used with applications written for Microsoft Windows, which means that there is effectively no limit to the amount of memory an application can use, thus breaking the 640k barrier that has previously existed for IBM applications. It also means that Windows consumes the least RAM of the three packages and will have most of it available for applications.

'A good desk-top should be easy to use and yet unleash the full potential of the system underneath. In particular, it should shield you from the complexities of DOS . . .'

Windows and GEM both run quite happily in 256k RAM, with a reasonable amount of space available for applications. TopView will run in 256k, but there is practically no space left for applications so I suggest a minimum of 512k. To get the most out of all three packages, I'd also recommend a hard disk — with floppies you really need to keep the system disk in drive A, leaving drive B for both data and the applications disk. All three will work without a mouse, which is an attempt to persuade users not to fork out the £150 needed to buy one, but you'll soon find keyboard operation infuriating.

With a higher-resolution colour card, GEM and Windows will both operate in colour; TopView has colour menus with the ordinary PC Colour Board.

Prices

All prices are for the IBM PC versions (which are the ones I tested), and all three packages should be available by the time you read this — GEM is already available as I write. GEM Desk-top costs £149.95 by itself, but is also available bundled in with GEM Draw at £129.95 and as part of the GEM Collection (including GEM Paint and GEM Word), also at £129.95. TopView costs £156 including a tutorial disk. A price for Windows hadn't been fixed at the time of writing, but it is expected to be under £100 including a bundled Paint program and other smaller utilities.

Conclusion

Notwithstanding the fact that IBM is the manufacturer of TopView, there is no doubt in my mind that it has lost this battle before it's begun. It could be argued that TopView was never intended to be a competitor, and to some extent those arguments are sound, but it does perform an essentially similar function to GEM and Windows, using windowing techniques and a mouse. TopView is the most expensive of the three, it needs the most from its host computer in terms of power, and offers the least back in return. TopView in no way makes the IBM PC as easy to use as a Macintosh: it merely adds concurrency to PC-DOS in a more friendly form.

A point in its favour is that it is designed to work with well-behaved PC-DOS programs, and doesn't rely for success on a graphics standard being accepted by software houses. But that old PC-DOS/IBM BIOS combination is looking old and jaded now, and most applications don't conform to it. Both GEM and Windows set new standards that are comprehensive enough to support advanced applications, and allow these applications to be easily transported between different machines.

It is much more difficult to choose between GEM and Windows — both packages are excellent and both have different merits. If you are a seasoned IBM user looking for more power and a friendly interface, I'd recommend Windows for its concurrency and virtual memory. If, however, you are a occasional or new user, you will probably find GEM the friendliest and easiest to use. Both are a great step up from MS-DOS.

Digital Research was the first to get a foot in the market, and has used the time to sign up as many manufacturers and software houses as possible. Windows has the advantage of coming from Microsoft which produces PC-DOS, and so will be better placed to deal with any changes in this operating system.

I see GEM and Windows selling alongside each other for some time before any clear winner will emerge. To make a real impact on the market, both packages need to sell to computer manufacturers to be bundled with machines, and it's here that the real battle will be fought. **END**

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All in the chip

Peter Van Linden and Steve Talbot reveal details of a previously secret Japanese project to develop a specialised compiler chip which acts as a language translator.

Over the last two years, the Japanese have mounted a major initiative aimed at establishing supremacy in advanced computer technology. This is the ICOT venture, a joint partnership between the Japanese government and organisations such as Mitsubishi, Fujitsu and Hitachi. ICOT is a concentrated research programme which the Japanese hope will put them far ahead in the fields of VLSI (Very Large Scale Integrated) circuits and software.

Every country that likes to think of itself as a major force in electronics, including the US, the UK, France and Germany, has put together a research effort in response. In the US there are several such programmes, including one directed at Very High Speed Integrated Circuits, while in the UK the Alvey research effort is being funded at the level of £350 million over five years. Such a response is all very well, but it remains to be seen whether our research efforts will produce better results than those of our competitors. Certainly our universities have been starved and cut off from desperately-needed funds over the past five years. Has a large enough supply been restored in time?

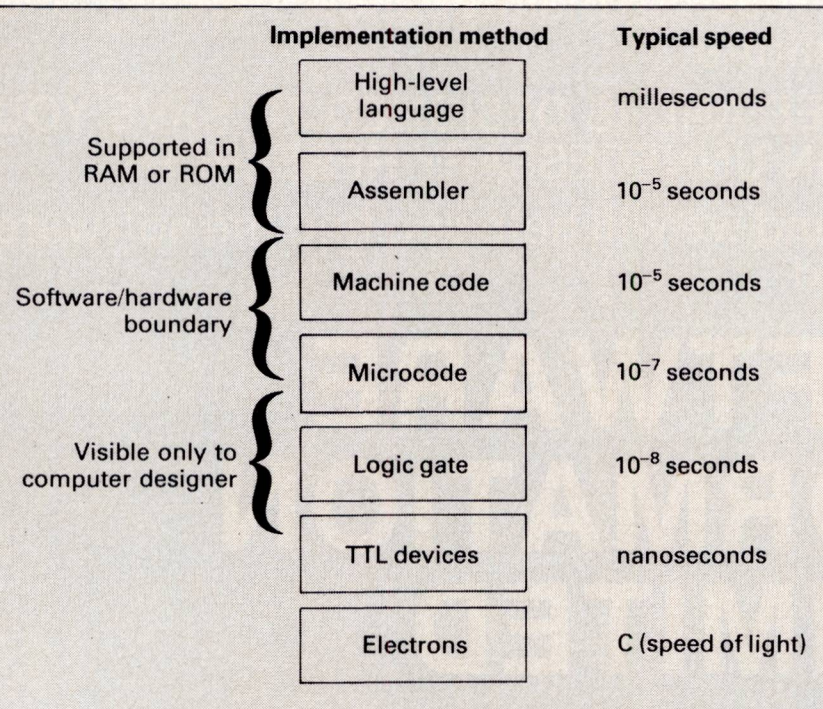
Japanese research

All research and development activities are usually shrouded in the utmost secrecy — there's no sense in letting your rivals have advance warning of your best ideas! Even so, there have been tantalising rumours of Japanese efforts to develop a compiler in hardware, on a single integrated circuit. Very little hard information has been previously available, but this article reveals some of the most important technical secrets of the project. A couple of Japanese engineers working on the project announced details of their work in an obscure and sparsely attended technical symposium last year. We have been able to piece together their approach from details of their presentation, a close knowledge of the subject, and information from other sources.

There are several reasons for developing a specialised chip which acts as a language translator. Specialised chips have always been used to supplement computer systems, often dealing with graphics, for instance. But up to now, the job of translating programming language statements into machine code has always been done by software, and that means it has all the attributes of software: compilers are slow, unwieldy, bug-ridden and easy to pirate. A hardware version of a compiler would be fast, compact, difficult to pirate, and perhaps even bug-free. If the Japanese were successful in making a compiler chip, it would convincingly demonstrate that they had achieved technological superiority in VLSI design over the Americans. It would confirm the trend of improving system architectures by putting more smartness into hardware. But most importantly, the compiler chip would help enormously to reduce the workload of ageing mainframes, minis and even micros.

Performance boost

Just imagine a compiler chip inside your workstation or personal computer. Resource-intensive compilations could be done without hogging the system, and these compilations would be speeded up by perhaps 1000 times. What's more, compilers are closely related to interpreters. If a Basic compiler chip can be built, then it would surely lead to the obvious development of an



Like any physical system, a computer system can be described in terms of layers. Each layer is complete and consistent in itself.

A layer builds more complex and powerful functions out of the operations available from the layer below it. This way of looking at computer architectures applies to all processors, from the Intel 8088 to mainframes like the Cray II.

The lower down the hierarchy you can implement a given function in a computer, the faster it will operate. But it also becomes much more costly to build, and much more difficult to change.

Fig 1 Hardware/software trade-offs

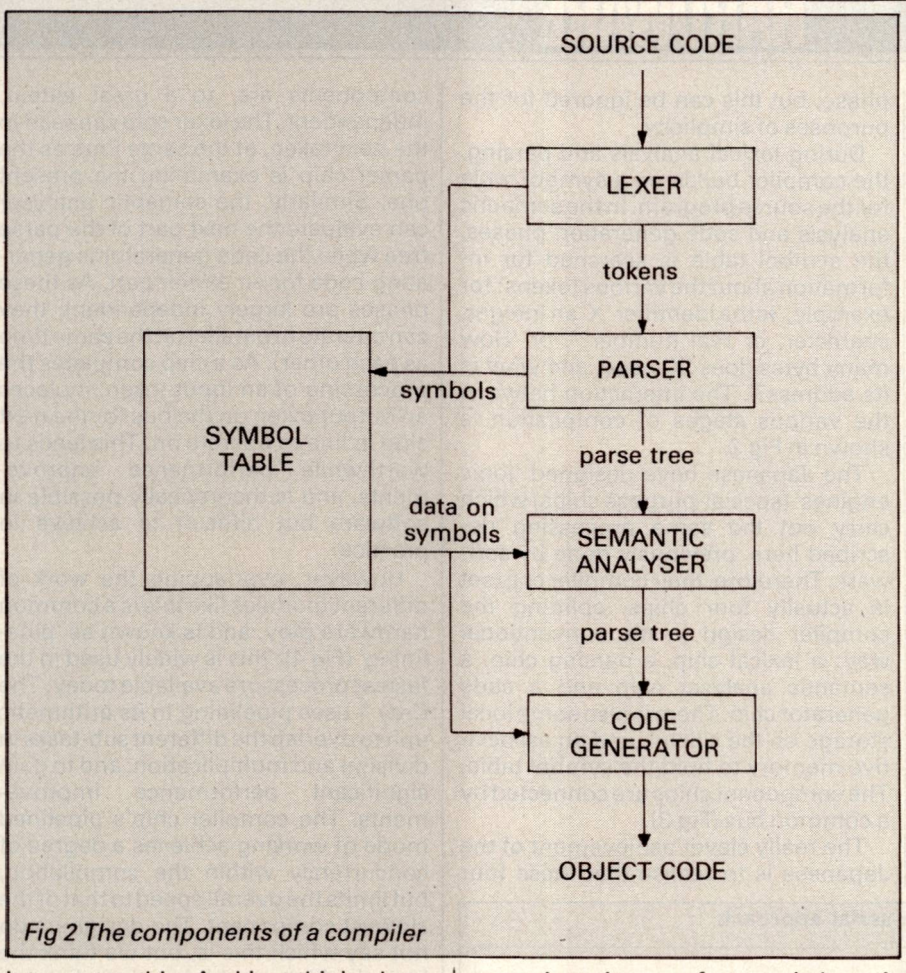


Fig 2 The components of a compiler

interpreter chip. And just think what a thousand-fold speed-up in execution would mean for your Spectrum or other popular micro.

The Japanese don't claim to have built such a device yet. What they have constructed is a detailed design of the compiler chip, together with a program which simulates its operation. When we first heard the rumours of the compiler chip, we guessed that it would probably rely heavily on microcoding: that is, the functionality would not be designed at the level of the logic gates which comprise integrated circuits. That would be like trying to build a house by mixing the cement in an egg-cup; theoretically it could be done but it would be very fiddly and take far too long. The Japanese design, we guessed, would be at the next implementation level, in microcode.

Microcode is a very low-level machine language which is normally only visible to the architects of a computer system, it differs from binary machine code in that it operates directly on the very low-level hardware. The instruction set of a computer is usually implemented by a series of microcode operations which are invisible to the user or programmer. For example, a single assembly language instruction 'load accumulator' might be implemented by a series of several microcode instructions, such as 'fill address register', 'enable address lines', 'latch memory buffer', 'fetch from memory' and 'transfer buffer to accumulator'. Each of these low-level operations is very fast, and there is scope for several of them to occur concurrently. A compiler implemented in microcode on an integrated circuit would thus be far faster than one implemented in assembler or other software. The microcode instructions would in turn be implemented by TTL logic circuits (Fig 1).

The prediction of a microcode rather than logic gate implementation for the compiler-on-a-chip turned out to be correct, although the engineers chose a programmable logic array design rather than extensive custom-designed firmware. That is, they tried to use existing hardware building blocks which were close to what they required, rather than design wholly original chip sets from scratch. The complexity of a true VLSI compiler, designed in logic gates, is still way beyond the current state of the art, so the chairmen of Intel, Motorola and Texas Instruments can sleep easy in their beds a while longer.

We also guessed that the compiler would probably translate one of the smaller programming languages, possibly a simple language of Japanese design, but in reality the Japanese engineers were rather ambitious and selected Pascal as the source input for their compiler. The object code output was a machine-independent pseudo-code, suitable for execution on a range of different hardware.

How a compiler works

The classic way to break down the work of a compiler is to split it into four functions, namely lexing, parsing, semantic analysis and code generation. The first two build up information about a program and store it a symbol table; the last two phases make many references to the symbol table and use the

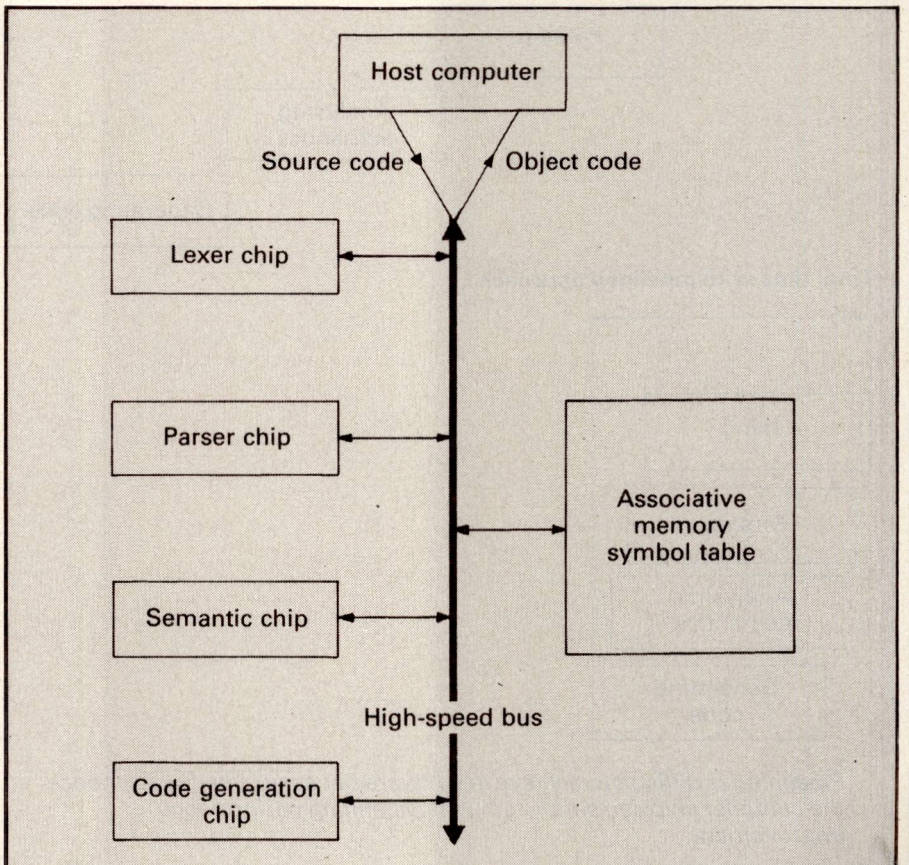


Fig 3 The compiler chip design

information stored there (Fig 2).

The lexer routines will read the file containing the source code and pass on tokens (individual words or symbols) to the parser. The parser's job is to examine the phrases passed to it by the lexer and check that the sequences form a legal program. In Basic, for example, you normally expect an identifier to follow the keyword 'LET' (as in 'LET A = 10'), so the parser would complain if it found anything else there (a constant or a keyword, for instance).

The parser builds up a large data structure of all the tokens and various information about each. This structure, often called a 'parse tree', is given to the semantic analyser to make sense of. The semantic analyser will check that the operations requested in the source code make sense in terms of the operands given, so LET A$ = A$ + 10.5 is obviously wrong as it doesn't make sense to add a floating point number to a string variable.

The code generator will follow on from the semantic analyser to create and output the machine code corresponding to the source. There may also be a separate code optimisation phase, but this can be ignored for the purposes of simplicity.

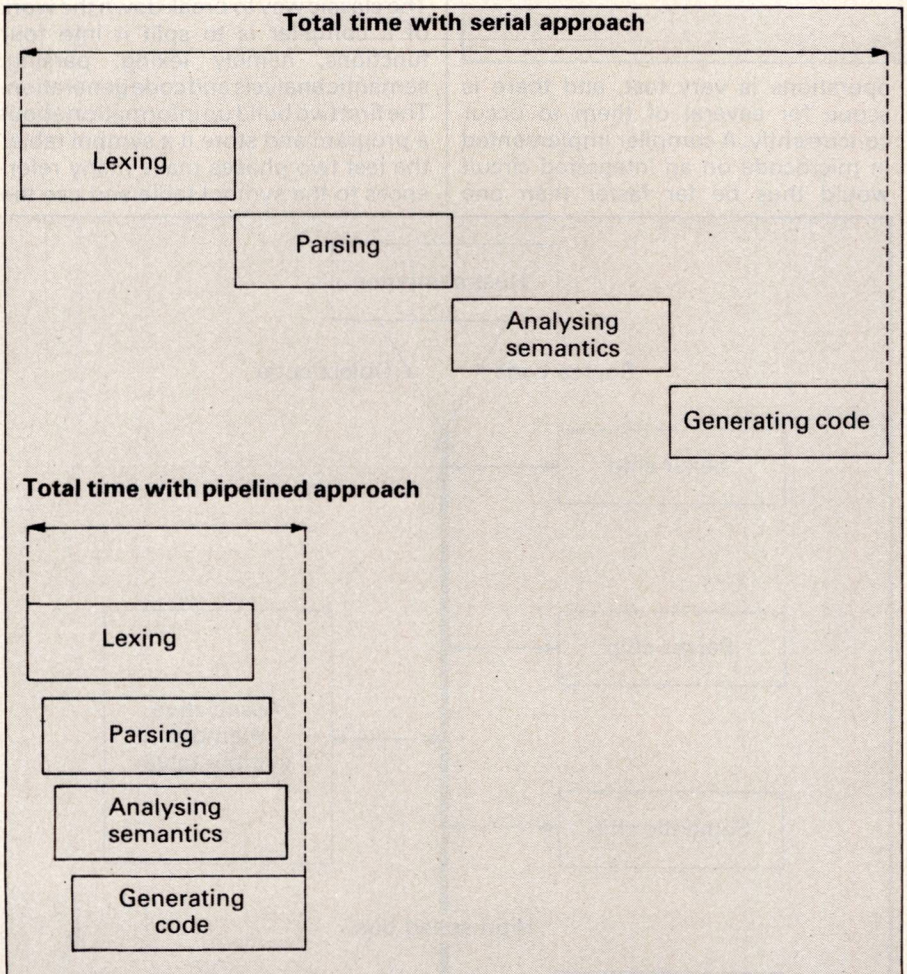
During lexical analysis and parsing, the compiler builds up a symbol table for the source program. In the semantic analysis and code generation phases, the symbol table is searched for information about the various tokens: for example, 'Is the identifier 'X' an integer, character, or real number?', or 'How many bytes does 'X' need, and what is its address?'. The interaction between the various stages of compilation is shown in Fig 2.

The Japanese have designed 'logic engines' (special-purpose chips) which carry out the same processing described here, previously done by software. Therefore, their compiler chip set is actually four chips, splitting the compiler design in the conventional way: a lexical chip, a parsing chip, a semantic analyser chip and a code generator chip. There is also some local storage on the silicon, and an associative memory to hold the symbol table. The component chips are connected by a common bus (Fig 3).

The really clever achievement of the Japanese is to realise that these four components are, to a great extent, independent. The lexer chip can read in the next token, at the same time as the parser chip is examining the present one. Similarly, the semantic analyser can evaluate the next part of the parse tree while the code generator is generating code for an earlier part. As these phases are largely independent, they can operate in parallel (at the same time as each other). As a chip completes the processing of an input token, it places an output token on the bus for the next chip in line to operate on. This leads to worthwhile performance improvements, and is theoretically possible in software but difficult to achieve in practice.

However, overlapping the work of different modules like this is a common hardware ploy, and is known as 'pipelining' (Fig 4); this is widely used in the fastest processors available today. The Cray 1 uses pipelining in its arithmetic unit to overlap the different sub-tasks in division and multiplication, and to gain significant performance improvements. The compiler chip's pipelined mode of working achieves a degree of concurrency within the compilation, but limits the overall speed to that of the slowest component. The designers do not say which this is, but we think the lexical chip would be the slowest; compilers are almost always I/O bound.

The integrated circuit areas described by the Japanese engineers were large, but not impossibly so. The parser chip (which was the biggest) required a die size of about 6.1mm by 7.8mm, and it is already possible to fabricate chips of this size using existing VLSI technology. Again, it is impressive to note the use of associative memory for a symbol table. Associative memory is a special form of memory in which the contents are retrieved by specifying their value rather than their address, thus you can make an enquiry in the symbol table by giving the name of an identifier and receive back all the corresponding data describing it very quickly. The individual components of the compiler-chip system are connected by a high-speed custom-made bus.



Pipelining is difficult to achieve in software but easy in hardware, hence the compiler chip can simply gain the pipelining performance improvement.

Fig 4 How pipelining speeds up a system

What next?

As the compiler produces pseudo-code output, it would certainly be fascinating to connect one up to the Western Digital micro-engine which runs pseudo-code directly as its assembly language. This would probably comprise a system which was phenomenally fast at both compiling and execution. Certainly the Japanese have demonstrated the feasibility of a compiler or interpreter in hardware, but they are characteristically coy about whether the project is being continued through to producing a working prototype. END

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Visicode revisited

Software transmission via your TV and micro continues this month as John Billingsley applies the Visicode receiver to the Spectrum 48k and the Amstrad CPC464.

Visicode allows text and software to be transmitted as part of a television picture, and then to be captured with the aid of a simple circuit with a photocell, two transistors and a cheap logic chip. In *PCW* July, the details and software were given for receiving Visicode on the BBC Micro and the Commodore 64. Now the Visicode receiver is to be applied to the Amstrad CPC464 and the Spectrum 48k, enabling users of these machines to pick up the television-transmitted software.

The software will be broadcast on *Database* on Thursday nights throughout July. The show goes out at 10.30pm on Thames TV, but transmission times vary from region to region so check local details. To celebrate these first Visicode broadcasts, Micronet 800 is providing £2000 worth of prizes consisting of 30 free yearly combined subscriptions to Prestel and Micronet 800. To win, you have to solve a puzzle which is being broadcast in text form during *Database* in four separate parts and all together at the end of the month.

Receiving transmissions

To receive the transmissions, you'll need a Visicode receiver unit and the receiving routines. In *PCW* July we published the software for the BBC and Commodore 64; this month it's the turn of the Spectrum 48k (Fig 1) and (with thanks to Jim Crowther) the Amstrad (Fig 2). I've also featured the Amstrad assembler version to encourage other Z80 implementations (Fig 3).

The receiver unit can be bought ready-built from Magenta Electronics, at £8.60 for the Amstrad and £13.98 for the Spectrum (or, for readers who missed last month's issue, £7.20 for the BBC and £7.10 for the Commodore 64). Full kits are also available from Magenta, including all components, case, drilled and tinned printed circuit board, and building instructions. These kits cost £6.96 for the Amstrad and £10.68 for the Spectrum (£5.52 for the BBC and £5.44 for the Commodore 64). For readers with construction experience, details of the components and circuitry are also included in this article.

The components should be available at your local electronics store, but Magenta can supply any that you have problems finding (its prices are shown in Fig 4). In fact, the Amstrad version uses the same components as the BBC and Commodore 64 units.

Magenta's service is mail order only, and 60p should be added to each order to cover postage and packing (VAT is already included). Payment is needed with each order — a cheque, a postal order, Access or Visa is acceptable. Magenta's address is 135 Hunter Street, Burton-on-Trent, Staffs DE14 2ST, tel: (0283) 65435.

The circuitry for the Amstrad's receiver unit is shown in Fig 5 — again it is the same as for the BBC and the Commodore 64. However, the Spectrum's circuitry needed some extensions (Fig 6) which I will describe in detail, but first a closer look at the Amstrad version.

The Amstrad CPC464

The original suggestion for the Amstrad was to use the printer strobe and busy lines for coupling the Visicode receiver unit to the computer. This would work, but obtaining a printout would involve first saving the code on cassette, or performing a rather risky 'hot swap' of the connectors. A further deterrent was the lack of a five-volt supply pin on the printer port.

The expansion port has the necessary supply, but can the standard receiver unit be connected without additional interfacing? With a certain amount of deviousness, the solution is simple. When the Visicode receiver detects a spot on the screen, a bistable latch is set. The computer must be able to read the state of this latch, and must also be able to reset it ready for the next scan line. Connected to pin 48 of the 50-pin expansion port edge connector is an input intended for detecting whether an expansion is really there, —EXP. This appears on bit 5 of input &F500. Nothing seems to go amiss

```
  1 REM  ** VISICODE RECEIVER ROUTINE FOR ZX-SPECTRUM VERSION M1 **
 10 CLEAR 33791: REM top room
 20 LET mc=254*256: LET p=33794: LET q=mc-256: LET r=p: GO TO 200
 30 GO SUB 1000: PRINT "running"
 35 LET m7=255: LET ff=511: LET cu=341: LET tu=292: LET qu=63
 40 LET a=USR mc: LET a=USR mc: LET a$=INKEY$
 50 IF a<>tu THEN  PRINT AT 6,0;"not happy": GO TO 40
 60 IF a$<>"r" THEN  PRINT AT 6,0;"ok,              ": GO TO 40
 70 CLS : PRINT "ready to receive": LET a=USR mc
 75 LET a=USR mc: IF a<>cu THEN  GO TO 75
 80 LET a=USR mc: IF a>m7 THEN  GO TO 80
 90 FOR i=p TO q
100 POKE i,a: LET a=USR mc: IF a<=m7 THEN  NEXT i: GO TO 200
110 IF a<>ff THEN  LET a=qu: NEXT i: GO TO 200
120 LET r=i: LET i=q: NEXT i
150 CLS : FOR i=p TO r: PRINT CHR$ (PEEK (i));: NEXT i
200 PRINT : PRINT "RECEIVE,PRINT,SAVE,LOAD OR VIEW"
210 INPUT "R,P,S,L or V ?  ";a$
220 IF a$="p" OR a$="P" THEN  FOR i=p TO r: LPRINT CHR$ (PEEK (i));: NEXT i: LP
RINT
230 IF a$="r" OR a$="R" THEN  GO TO 30
240 IF a$="v" OR a$="V" THEN  GO TO 150
250 IF a$="s" OR a$="S" THEN  POKE p-1,INT (r/256): POKE p-2,r-256*PEEK (p-1):
SAVE "TEXT"CODE 33792,r-33791
260 IF a$="l" OR a$="L" THEN  CLS : PRINT : PRINT : PRINT "POSITION 'TEXT' TAPE
": PRINT : PRINT "AND PRESS PLAY": LOAD "TEXT"CODE : LET r=PEEK (p-2)+256*PEEK (
p-1)
270 GO TO 200
1000 RESTORE : LET i=mc: CLS : PRINT "loading machine code"
1005 PRINT : PRINT "when ok,press r to receive"
1010 READ c$: IF LEN (c$)<>16 THEN  RETURN
1015 FOR j=0 TO 7: LET a$=c$(2*j+1): LET b$=c$(2*j+2)
1020 LET a=CODE (a$)-48-39*(a$>":")
1030 LET a=16*a+CODE (b$)-48-39*(b$>":")
1040 POKE i+j,a: NEXT j
1050 LET i=i+8: GO TO 1010
2000 DATA "f3d37f1e08160815"
2010 DATA "ca32fedb7fb7f20b"
2020 DATA "fe0603cd3bfecd38"
2030 DATA "fefa07fecd38fef2"
2040 DATA "07fecd39fe1dc222"
2050 DATA "fecd39fecb11cb10"
2060 DATA "fbc9067f0efffbc9"
2070 DATA "05060a10fedb7fd3"
2080 DATA "7f17cb1979d3fec9"
2090 DATA "xxx"
```

Fig 1 The Spectrum receive routine

```
10 GOTO 10000
90 CLS:PRINT"Adjust photocell until OK":PRINT"Press <space> to receive VISICODE"
100 CALL mc:CALL mc:a$=INKEY$:SOUND 1,PEEK(by)/(1+PEEK(ct)),1
110 IF PEEK(by)<>tu OR PEEK(ct)<>1 THEN LOCATE 1,5:PRINT"NOT HAPPY":GOTO 100
120 IF a$="" THEN LOCATE 1,5:PRINT"OK,":GOTO 100
125 CLS:PRINT"Waiting for start code":CALL mc
130 WHILE PEEK(by)<>cu OR PEEK(ct)<>1:CALL mc:WEND
135 CLS:PRINT"Receiving":i=lo:CALL mc
140 WHILE PEEK(ct)>0:CALL mc:WEND
150 WHILE (PEEK(by)<>ff) OR (PEEK(ct)<>1):POKE i,PEEK(by):i=i+1:CALL mc:SOUND 1,
PEEK(by),1:WEND
160 r=i+1:POKE r,&FF
300 CLS:LOCATE 1,1
310 PRINT"1 Save text to tape"
320 PRINT"2 load text from tape"
330 PRINT"3 View text"
340 PRINT"4 Receive VISICODE transmission"
350 PRINT"5 Print text"
360 a$=INKEY$:IF a$="" GOTO 360
365 IF a$="" GOTO 360
370 IF a$="1" THEN INPUT"Filename ";f$:SAVE f$,B,lo,r-1:GOTO 300
380 IF a$="2" THEN INPUT"Filename ";f$:LOAD f$,lo:r=lo:WHILE PEEK(r)<>&FF:r=r+1:
WEND:GOTO 300
390 IF a$="3" THEN s=0:D=0:GOTO 430
410 IF a$="4" THEN GOTO 90
420 IF a$="5" THEN s=8:D=0
425 GOTO 300
430 FOR i=lo TO r-1:PRINT#s,CHR$(PEEK(i));:IF PEEK(i)=&D THEN PRINT:D=D+1:IF D=2
4 THEN WHILE INKEY$="":WEND:D=0
440 NEXT
450 GOTO 300
10000 p=lo:MEMORY &1FFF:mc=&2000:by=&2080:ct=&2081:lo=&2100:hi=&AB7F
10010 tu=&24:ff=&FF:cu=85
10020 i=mc:PRINT"Loading machine code"
10030 READ j:IF j<256 THEN POKE i,j:i=i+1:GOTO 10030
10040 GOTO 300
10100 DATA &F3,&11,&0B,&04,&21,&00,&C0
10110 DATA &01,&00,&7F,&3E,&85,&ED,&79
10120 DATA &15,&CA,&3F,&20,&06,&F5
10130 DATA &ED,&78,&CB,&6F,&28,&FA
10140 DATA &06,&01,&CD,&48,&20,&CD,&45,&20
10150 DATA &FA,&0E,&20,&CD,&45,&20,&F2,&0E,&20
10160 DATA &CD,&46,&20,&1D,&20,&FA
10170 DATA &CD,&46,&20,&CB,&15,&26,&00,&CB,&14
10180 DATA &22,&80,&20,&FB,&C9
10190 DATA &21,&7F,&7F,&C3,&3A,&20,&05
10200 DATA &06,&09,&00,&00,&00,&10,&FE,&06,&F5,&ED,&78
10210 DATA &46,&87,&87,&17,&CB,&1D,&C9,9999
```

Fig 2 The Amstrad receive routine

when the Amstrad is powered up with this pin pulled low, so half the problem is solved.

How can the latch be reset? On pin 42 of the connector is —ROMEN, which is pulled down to zero volts each time the ROM is accessed. This is every few microseconds when Basic is running, but a machine code program in RAM need not call the ROM at all until it exits. Now all that is needed is a memory read from ROM and the latch will be cleared, but unfortunately this is not quite so easy.

In order that the user's machine code can have plenty of space, the Amstrad system disables both halves of the ROM when executing a Basic CALL. To get the —ROMEN line to respond, it is thus first necessary to re-enable the top ROM — the work of a byte or seven of machine code. From then on it is plain sailing. Ground is found on pin 49 and —5 volts on pin 27. (Note that the connector has odd numbers on the top and even numbers below.) You need no more than the standard Visicode receiver unit and a 50-pin 0.1in edge connector — and of course the receiving software.

The Amstrad receive routine will automatically protect an area of memory above location 8191 in which it plants the machine code, and where the received text is stored. Each time the machine code is called, execution hangs up until the photocell receives a spot. It tests it for the right header stripe, reads the byte and saves the result in 8320. If there is an extra control stripe, 8321 is set to 1, while if the header is faulty 8321 is made 127.

When the program runs, it takes a couple of seconds to plant the code and then enters a test mode. Each time the spot is seen, its value is tested for &24 plus control stripe. A repeated 'ping' from the sound channel indicates the received code, and if it does not match &24 then the screen shows 'Not happy'. Only when 'OK' is shown will the computer accept a tap on the space bar, and move to the next stage.

The program now waits for a 'U' code with control bit set. In future, software can be sent in a succession of blocks for a variety of machines. Each machine will wait for its own code before loading — 'B' for BBC, 'A' for Amstrad, but 'U' indicates a text file which is universal. At last, the string of control codes comes to an end and the machine can start to load data.

To indicate that the data is being saved, the sound generator gives a pip as each byte is received, chirruping with a variable pitch. There is no test for buffer size, but the memory can hold over 10 minutes of continuous data. When a final &FF plus control is received, the captured text is listed to the screen.

The Spectrum 48k

And so to the Spectrum. First the good news — the Spectrum can receive Visicode. The bad news is that you will need a 48k version to do the job correctly. The trouble, as described last month, is in the timing of the loop which tests each line of the transmitted spot.

I owe Sinclair Research something of

```
Machine code for Amstrad.

Locate machine code at &2000 above HIMEM.
Save byte in &2080, control in &2081

Data is read through (exp) line of expansion port,
latch is reset by ROM select line.

2000  F3        START  DI              ;Disable ints
2001  11 08 04         LD  DE +0408    ;D=tries, E=count
2004  21 00 FF         LD  HL +FF00    ;L=result H=control
2007  01 00 7F         LD  BC +7F00    ;point to gate array
200A  3E 85            LD  A, +85      ;enable upper ROM
200C  ED 79            OUT (C),A       ;disable lower.
200E  15        AGAIN  DEC D           ;tries ?
200F  CA 3F 20         JP  Z, GIVUP    ;too many.
2012  06 F5            LD  B, +F5      ;For input
2014  ED 78     SYNCH  IN  A, (C)      ;read to bit 5
2016  CB 6F            BIT A, 5        ;test bit 5
2018  28 FA            JR  Z, SYNCH    ;wait until start bit.
201A  06 01            LD  B, +1       ;half line delay
201C  CD 48 20         CALL   DAWDLE   ;and clear latch.
201F  CD 45 20         CALL   GETSLO   ;line 2
2022  FA 0E 20         JP  M, AGAIN    ;was set, wrong.
2025  CD 45 20         CALL   GETSLO   ;line 3
2028  F2 0E 20         JP  P, AGAIN    ;not set, wrong.
202B  CD 46 20  LOOP   CALL   GETBIT   ;now for data.
202E  1D               DEC E           ;count bits
202F  20 FA            JR  NZ,LOOP     ;more
2031  CD 46 20         CALL   GETBIT   ;control?
2034  CB 15            RL  L           ;fix L
2036  26 00            LD  H, +00      ;H will be 0 or 1
2038  CB 14            RL  H           ;control to H b0
203A  22 80 20  SAVE   LD  (2080),HL   ;save result.
203D  FB               EI              ;enable ints
203E  C9               RET             ;back to Basic.

203F  21 7F 7F  GIVUP  LD  HL,+7F7F    ;error code
2042  C3 3A 20         JP     SAVE     ;go home

2045  05        GETSLO DEC B           ;dummy for timing
2046  06 09     GETBIT LD  B, +9       ;delay count
2048  00 00 00  DAWDLE NOP,NOP,NOP     ;timing fine tune
204B  10 FE     D1     DJNZ   D1       ;wait loop
204D  06 F5            LD  B, +F5      ;for input
204F  ED 78            IN  A, (C)      ;read latch bit 5
2051  46               LD  B, (HL)     ;ROM clears latch
2052  87               ADD A           ;to bit 6
2053  87               ADD A           ;latch to bit 7
2054  17               RLA             ;then to carry
2055  CB 1D            RR  L           ;mix with result.
2057  C9               RET             ;subroutine end.
```

Fig 3 Assembler version of the Amstrad receive routine (for reference only)

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SN74LS126 (Spectrum only)	£1.16 each
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BBC	£1.74 each
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Spectrum 48k	£2.25 each
0.1in plain perforated board 1in × 2ins (Amstrad)	26p each
2ins × 3ins (Spectrum)	78p each

(Prices quoted are from Magenta Electronics, which is also supplying complete kits and ready-built units — see text for full ordering details.)

Fig 4 Components list for the Amstrad CPC464 and the Spectrum 48k

an apology. Its suggestion that the software should be located in the upper 32k of memory was correct. Unfortunately, I had executed a CLEAR 25599 at the beginning of my first program to protect the text and machine code storage space against Basic variables and strings. This also forced the machine stack into the lower RAM, so that every subroutine call and return was subject to the slow-down of the screen display. The affect was not large, but was sufficient to throw out the timing by the critical 10 per cent. Some of the input and output commands are still stretched, but these are few enough that the variation is tolerable.

In the new program, the first line has become CLEAR 33791 — that is, &83FF. There is still plenty of room for received text above this and below the machine code at &FE00 upwards.

I have connected a 'standard' receiver unit as used for the BBC, the Commodore or the Amstrad into a special Spectrum interface. This, all two chips of it, plugs directly onto the back of the Spectrum. It was necessary to connect two 470nF capacitors and one 22R resistor on the interface card to prevent supply spikes causing spurious pulses from the detector.

The only other real changes are the use of the code control +255 to signal the end of the data (rather than relying on a repetition of the control +"$" tune-up signal), a slight change to the screen messages, and a bit of fine tuning in the machine code loop. Even with a badly degraded TV signal, large text files repeatedly transferred to a Spectrum plus without a single error.

I've also improved the Commodore 64 receiving software since the July issue. Apologise for any pound characters (£) that slipped through in that listing; these should obviously have been hash characters (#). These improvements have all been incorporated into the listings provided by Magenta.

As the previous listing stood, it would not display lower-case characters. To rectify the problem, and to also add options for saving the transmission to tape or disk, add or amend the following lines:

```
100 OPEN 1,D: PRINT#1,CHR$(14)
105 FOR I=P TO R-1:A=PEEK (I)
  :A=A-128* (A>64)+160* (A>96)
106 PRINT#1, CHR$ (A); :NEXT:CLOSE
  1:PRINT
110 INPUT "3 FOR SCREEN, 4 TO
  PRINT, 8 TO SAVE";D: IF D<8 THEN
  100
```

Disk owners should add:

```
115 INPUT "FILENAME";A$:OPEN
  1,8,2, (A$+"T,S,W"):GOTO 105
```

Tape owners should add:

```
115 OPEN 1,1,1, "TEXT":GOTO 105
```

END

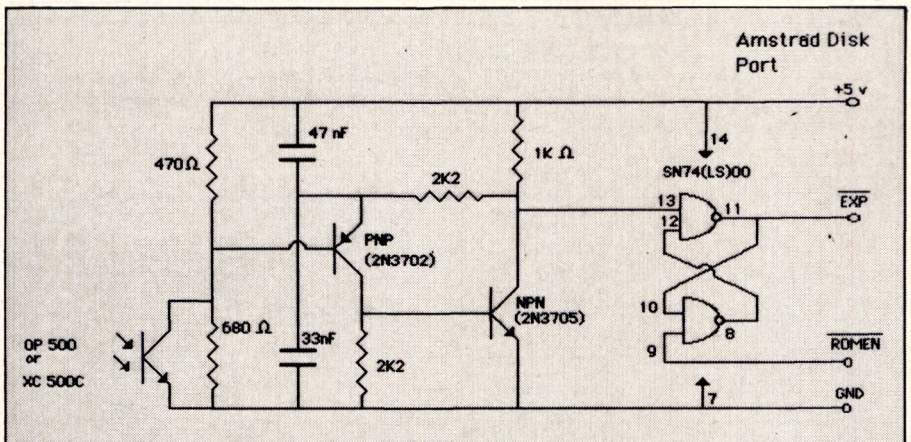

Fig 5 Circuitry for the Amstrad receiver unit

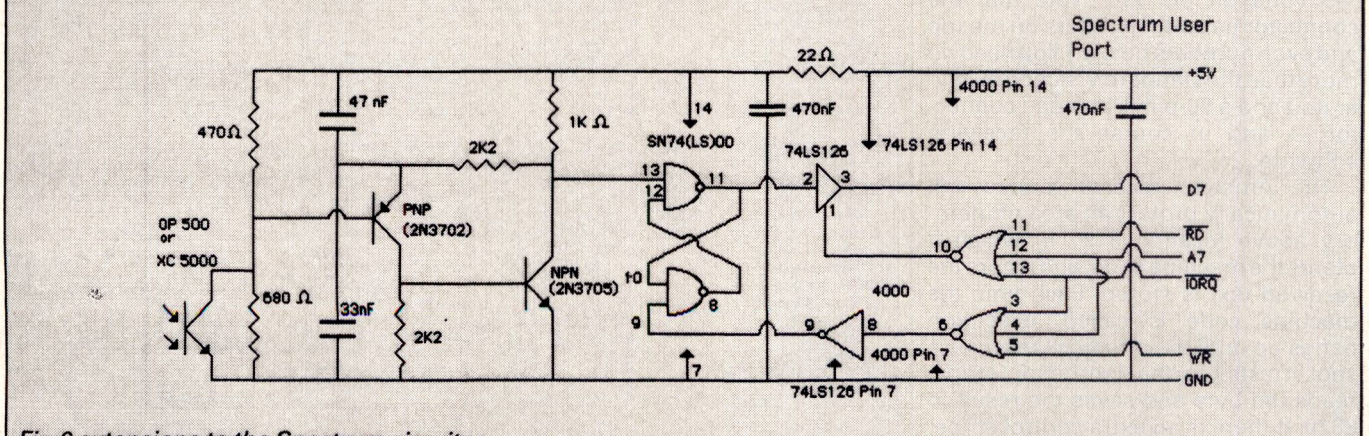

Fig 6 extensions to the Spectrum circuitry

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Logo lists

Harvey Mellar continues his Teach Yourself series with a look at Logo list processing.

In its very earliest form Logo didn't have any graphics, and was exclusively concerned with 'list processing'. In fact, turtle graphics was originally thought of as a sugar coating useful for introducing programming to students, rather than as an end in itself.

In this article I'll explain what list processing is, and why it's important. There are other languages that are based around list processing — Lisp is the most well-known example, but Logo provides the easiest and best introduction to the topic.

To show how lists are used, I'll apply them to the task of developing the basic commands of a text adventure game. Lists have much wider applications than this, and future articles will explore other possibilities.

What is a list?

In Logo there are only two kinds of objects — 'words' (numbers are included in this category) and 'lists'. A list can be defined as 'an ordered collection of objects'. We mark the fact that something is a list by enclosing it within square brackets, so [SWORD KNIFE BAG STONE JEWEL] is a list, it is made up of five words. The word 'ordered' occurs in our definition because [JEWEL BAG SWORD KNIFE STONE] would be a different list from [SWORD KNIFE BAG STONE JEWEL]: the order matters.

Lists are important because they can be used to represent many different types of data. The aforementioned list was the inventory of an adventurer during an adventure game; the list [X = Y * Y] represents a mathematical formula; the list [TO BE OR NOT TO BE] represents a line of prose.

I said that a list was a collection of objects, not just of words, although the examples so far have been lists of words. A Logo object, remember, is either a word or a list, so our list could be a collection of lists. [[EDDY GRUNDY] [GRANGE FARM] [CAMBRIDGE]] is a list of three lists, and it represents an address.

A more complex example is [[:SIDE] [REPEAT 4 [FORWARD :SIDE RIGHT 90]]]. This is a list of two lists: the first list consists of one word; the second list consists of two words together with a list (which in turn consists of four words). This list represents a Logo procedure for drawing a square.

These few examples should give you some idea of how useful lists can be for representing data. Logo provides a few simple primitives for manipulating lists, and with these you can write powerful programs working on complex structures of symbols.

A list (unlike an array in Basic) is not of any defined length, so you can add elements to it at any time until all the available memory in the workspace has been used up.

The Logo procedures using lists that we are going to develop could have been written in very different ways using Basic or assembly code, but using lists makes it easier to represent the data; this makes the data easier to think about, which in turn makes programming easier.

Taking lists apart

The basic operations for taking lists apart in order to examine them are FIRST and BUTFIRST.

FIRST [SWORD KNIFE BAG STONE JEWEL] returns SWORD, the first element of the list.

BUTFIRST [SWORD KNIFE BAG STONE JEWEL] returns [KNIFE BAG STONE JEWEL], the list without its first element.

One command needed in any adventure game is one to print out everything in the adventurer's possession — let's call this command INV for INVentory. We'll keep the possessions as a list, and assign it to the variable INVENTORY:

```
MAKE "INVENTORY [SWORD KNIFE BAG STONE JEWEL]
```

We could then define INV as follows:

```
TO INV
  PRINT [YOU ARE CARRYING]
  PRINT :INVENTORY
END
```

If the adventurer does not have anything in his possession, then the line PRINT :INVENTORY prints a blank line; the list INVENTORY is said to be 'empty' and its value is represented as []. Logo provides an operation to test for this — EMPTY? (EMPTYP in LCSI versions). Using this we can now improve on our procedure:

```
TO INV
  PRINT [YOU ARE CARRYING]
  TEST EMPTY? :INVENTORY
  IFTRUE PRINT [NOTHING]
  IFFALSE PRINT :INVENTORY
END
```

For some purposes it might be nice to have the possessions printed one under the other rather than along the same line. To do this, we need to replace the PRINT in the last line with a new procedure, PRINTVERT:

```
TO PRINTVERT :LIST
  PRINT FIRST :LIST
  PRINTVERT BUTFIRST :LIST
END
```

This procedure prints the first element of the list and then recursively calls itself, with the list minus its first element as its input. This causes each word to be printed one below the other. However, when the procedure gets to the end of the list, FIRST tries to find the first element of the empty list [], but there is no first element so Logo gives an error message. To overcome this problem, add a 'stop rule' to the recursive procedure:

```
TO PRINTVERT :LIST
  IF EMPTY? :LIST THEN STOP
  PRINT FIRST :LIST
  PRINTVERT BUT FIRST :LIST
END
```

PRINTVERT follows a pattern that is very common in recursive procedures. Compare it with this procedure which counts down from the input number to 0:

```
TO COUNTDOWN :NUMB
  IF :NUMB = 0 THEN STOP
  PRINT :NUMB
  COUNTDOWN :NUMB - 1
END
```

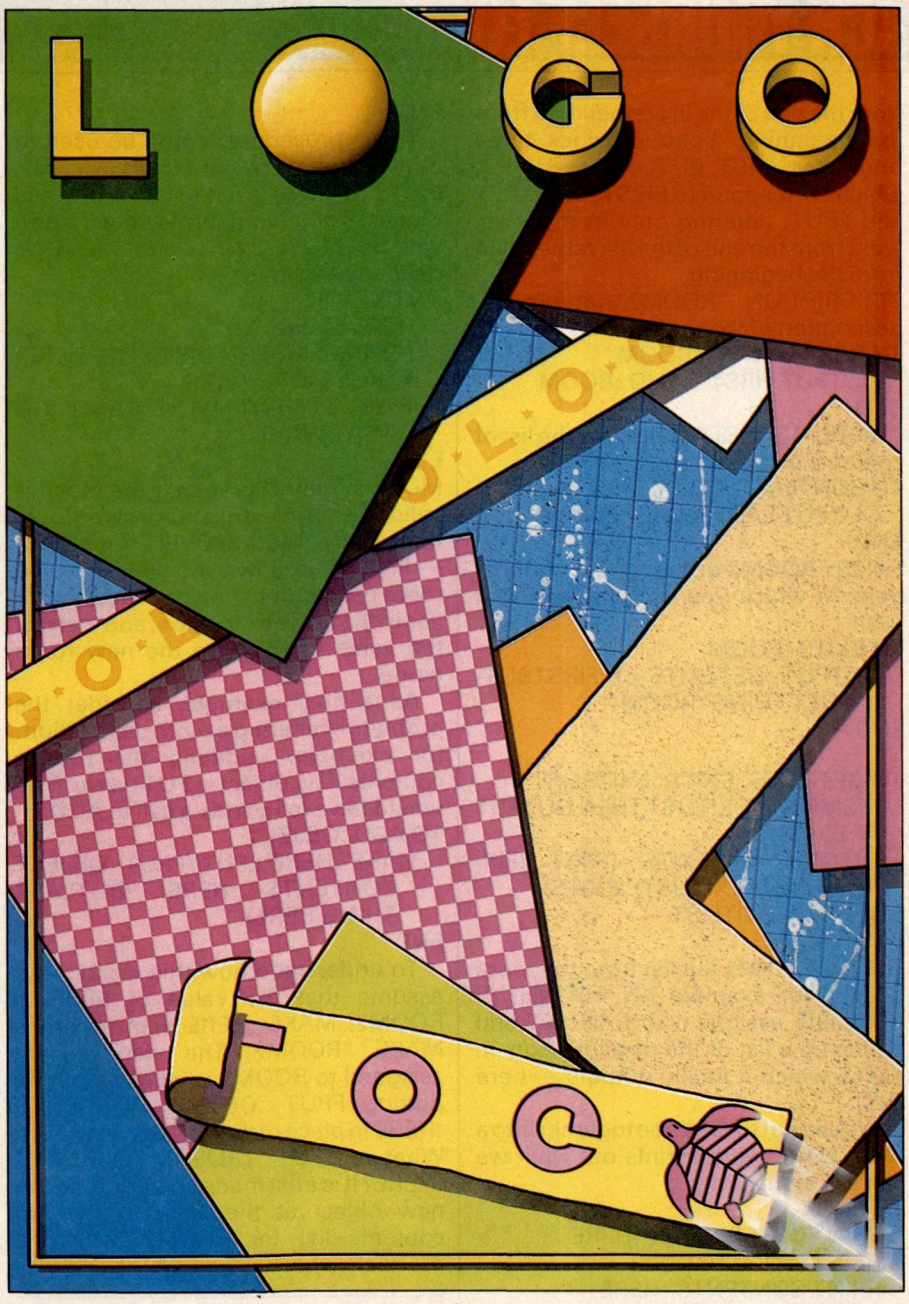
This procedure does not use list processing, but it shares the same pattern as PRINTVERT:

1) Test to see if the procedure is complete, if so then stop.
2) Deal with the easy case.
3) Call the procedure recursively to deal with a slightly simplified case.

This pattern is particularly common in list processing programs. It should not be surprising that many list processing programs use recursion, for even our definition of a list was recursive. Remember — we defined a list as a collection of objects, and yet we said an object was a word or a list!

Putting lists together

FIRST and BUTFIRST enable you to take



lists apart, to discover what is inside them. If you want to build up a list, the basic operation to use is FPUT:

FPUT "DAGGER [SWORD KNIFE BAG STONE JEWEL] returns the list [DAGGER SWORD KNIFE BAG STONE JEWEL].

Let's continue with the example of an adventurer's inventory. At the start of a game he would have nothing: MAKE "INVENTORY []. As he finds objects, he may choose to pick them up and keep them. Let's define a word GET, so that he can give commands such as GET "SWORD. Here's our first attempt:

```
TO GET :OBJECT
  MAKE "INVENTORY FPUT :OBJECT
    :INVENTORY
END
```

The trouble with this definition is that it does not check to see if the object is actually present in the room for the adventurer to pick up. One way to deal with this is to have a variable, let's call it CONTENTS, which contains a list of all the objects in the room. To find out whether an object is present we would then need to see if it was in the list CONTENTS, so what we really need is a procedure that checks whether an object is in a list. Most versions of Logo include a primitive, MEMBER? (or MEMBERP), that does just this, but it is instructive to see how it could be defined:

```
TO MEMBER? :OBJ :LIST
  IF EMPTY? :LIST THEN OUTPUT
    "FALSE
  IF :OBJ = FIRST :LIST THEN OUTPUT
    "TRUE
  OUTPUT MEMBER? :OBJ BUTFIRST
    :LIST
END
```

This procedure works down the list, checking each element in turn until it either finds a match or comes to the end of the list. It returns either the TRUE or FALSE value which can be used as the input to an IF, in Pascal terms MEMBER? is a Boolean function. We can now test whether an object is present:

```
TO PRESENT? :OBJECT
  IF MEMBER? :OBJECT :CONTENTS
    THEN OUTPUT "TRUE ELSE OUT-
    PUT "FALSE
END
```

With PRESENT? we can write an improved version of GET:

```
TO GET :OBJECT
  TEST PRESENT? :OBJECT
  IFTRUE MAKE "INVENTORY FPUT
    :OBJECT :INVENTORY
  IFFALSE PRINT [I CAN NOT SEE]
    PRINT :OBJECT
END
```

So much for picking up objects, but if our adventurer wishes to get rid of some of his possessions and put them down, we'll need a word PUT; he can therefore say PUT "SWORD.

```
TO PUT :OBJECT
  TEST MEMBER? :OBJECT :INVEN-
    TORY
  IFTRUE MAKE "INVENTORY DELETE
    :OBJECT :INVENTORY
  IFFALSE PRINT [YOU DON'T HAVE
    IT!]
END
```

That's a nice, simple definition, the only trouble being there is no primitive called DELETE. Here's how we might define DELETE in order to remove an element from a list:

```
TO DELETE :ITEM :LIST
  IF EMPTY? :LIST THEN OUTPUT []
  IF :ITEM = FIRST :LIST THEN OUT-
    PUT BUTFIRST :LIST
  OUTPUT FPUT FIRST :LIST (DELETE
    :ITEM BUTFIRST :LIST)
END
```

It is worth looking closely at this procedure for while it is short it is powerful, and illustrates a number of basic principles about writing list processing procedures. Notice that it is an operation: it outputs the value of the list without the given element. The three steps of the procedure translate into English as follows:

1) If the input list is empty it is not possible to remove anything, so output the empty list.

2) If the first element of the list is the object we are trying to remove, output the rest of the list without that first element.

3) Otherwise, output a list made by putting the first element at the front of the list you would get by removing the element to be deleted from the rest of the list.

The procedure works because step three is slighly easier than the original problem — the input list is one element less.

Lists of lists

So far we have kept our inventory as a simple list of words, but it might be useful in some games to have a more complex data structure.

If the game allocated a score according to the items in the adventurer's possession, then INVENTORY could consist of a list of lists, each sub-list consisting of the object's name together with its value. For example:

MAKE "INVENTORY [[SWORD 20] [KNIFE 10] [BAG 5] [STONE 2] [JEWEL 100]]

It is useful to define procedures which pick out the individual parts of the list. These procedures don't do anything very important, they simply enable us to write slightly more meaningful higher-level procedures:

```
TO NAME :ITEM
  OUTPUT FIRST :ITEM
END

TO VALUE :ITEM
  OUTPUT FIRST BUTFIRST :ITEM
END
```

So NAME [STONE 2] returns STONE and VALUE [STONE 2] returns 2.

In order to print out the inventory using INV, PRINTVERT would now need to be rewritten as:

```
TO PRINTVERT :LIST
  IF EMPTY? :LIST THEN STOP
  PRINT NAME FIRST :LIST
  PRINTVERT BUTFIRST :LIST
END
```

Assuming that our game only awards points for possessions, SCORE will print out the adventurer's score:

```
TO SCORE
  PRINT SCORE1 0 :INVENTORY
END

TO SCORE1 :SUM :LIST
  IF EMPTY? :LIST THEN OUTPUT
    :SUM
  OUTPUT SCORE1 ( :SUM + VALUE
    FIRST :LIST ) BUTFIRST :LIST
END
```

In this procedure, notice the way in which the value of the sum is built up. It is passed on at each recursive call, and eventually returned as the value of the operation.

Describing the room

We've discussed the adventurer's possessions, but the rooms could also be represented as lists. Here's a possible room:

Name: room2.
Description: this is a dark room about 20 feet square; exits: north to room 5 and south to room 8.
Contents: sword, bottle.

One way to represent this information is to define a variable ROOM2:

```
MAKE "ROOM2 [[THIS IS A DARK
ROOM ABOUT 20 FEET SQUARE] [[N
ROOM5] [S ROOM8]] [SWORD
BOTTLE]].
```

We could then do the same thing for each of the other rooms in the game. In order to keep track of where the adventurer is, we need a global variable HERE that contains the name of the room the adventurer is in at the time. We might begin with MAKE "HERE "ROOM2.

Having represented the data as lists, we now need to write some words to extract the various parts of the data, particularly the description, the contents and the exits. It is more convenient for some of these procedures to work from the end of the list rather than from the beginning. Logo provides three primitives, LAST, BUTLAST and LPUT, which correspond to FIRST, BUTFIRST and FPUT, differing only in that they work from the end of the list rather than from the beginning.

```
DESCRIPTION "ROOM2 outputs the
description of the room.
TO DESCRIPTION :ROOM
  OUTPUT FIRST THING :ROOM
END
CONTENTS "ROOM2 outputs the list of
contents of the room
TO CONTENTS:ROOM
  OUTPUT LAST THING :ROOM
END
EXITS "ROOM2 outputs a list of direc-
tions in which you can go from that
room.
TO EXITS :ROOM
  OUTPUT GETEXITS [] FIRSTBUT-
    FIRST THING :ROOM
END

TO GETEXITS :EXITS :EXITSLIST
  IF EMPTY? :EXITLIST THEN OUTPUT
    :EXITS
  OUTPUT GETEXITS (FPUT (FIR-
    STFIRST :EXITLIST) :EXITS)
BUTFIRST :EXITLIST
END
```

GETEXITS takes the list from the room details, for example [[N ROOM5] [S ROOM8]], assigns it to EXITLIST and builds up a list of the possible exits in EXITS which it finally outputs — here [NS].

We can put these three together into a word LOOK which prints out what we can see at the time.

```
TO LOOK
  PRINT DESCRIPTION :HERE
  PRINT [YOU CAN SEE]
  PRINT CONTENTS :HERE
  PRINT [YOU CAN GO]
  PRINT EXITS :HERE
END
```

These procedures could be used in other parts of the game: for example, EXITS might be used to check on valid moves. The command to move north will be MOVE "N, where MOVE is defined as follows:

```
s MOVE "N.
TO MOVE :DIR
  TEST (MEMBER? :DIR EXITS :HERE)
  IFTRUE MOVEIT :DIR
  IFFALSE PRINT [YOU CAN'T GO
    THAT WAY]
END
```

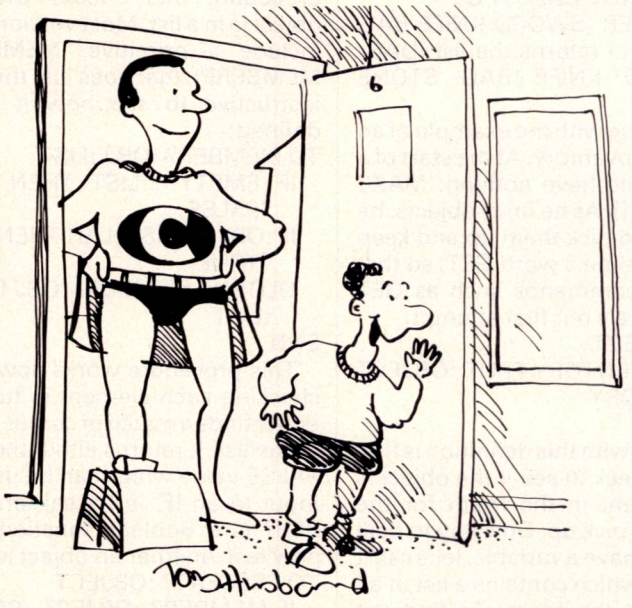
MOVE simply checks that the move is valid; if it is, then it passes the work over to MOVEIT. Write MOVEIT yourselves — it must go down the exit list in the room description, find out which room lies in the moved direction, and then set the value of HERE to the new room name.

As a final example, consider the problem of altering a room description: for example, updating the room's contents if an object is PUT down. PUT would have to include a call to ADD:

```
TO ADD :OBJECT
  MAKE :HERE LPUT (FPUT :OBJECT
    CONTENTS :HERE) (BUTLAST
    THING HERE)
END
```

To understand how this works, let's assume that the value of HERE is ROOM2; MAKE :HERE then becomes MAKE "ROOM2. The value to be assigned to ROOM2 is what we get by putting FPUT :OBJECT CONTENTS :HERE in place of the last item in the list. What is FPUT :OBJECT CONTENTS :HERE? It is a list made up by putting the new object at the front of the old contents list for ROOM2, which is precisely what we wanted.

This is part three of a six-part series. END



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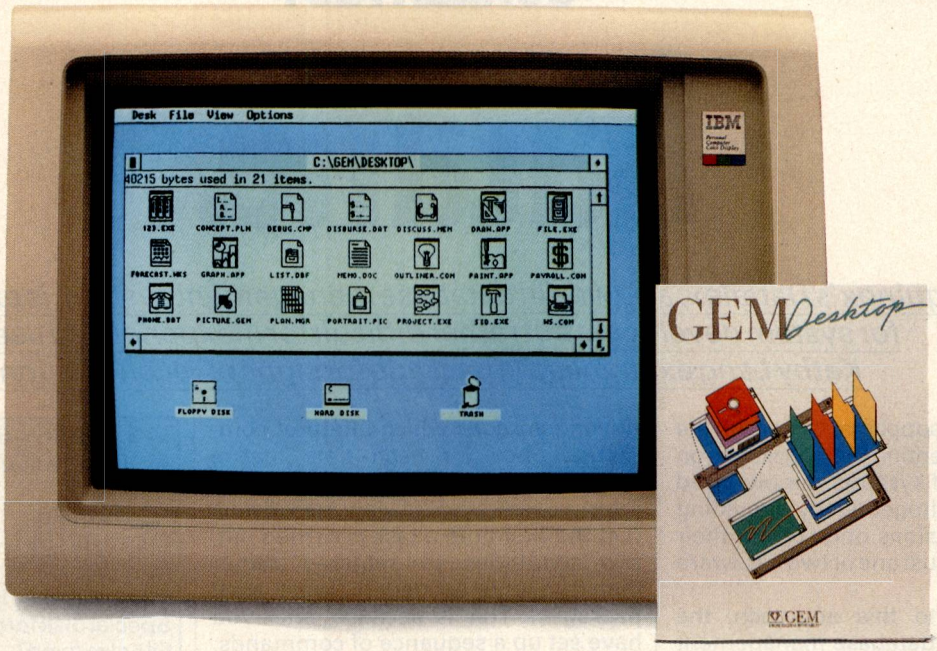



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SCREENTEST

Dataflex

Equinox's Dataflex, a powerful database management system, is excellent for system developers but rather difficult for inexperienced users. Kathy Lang examines the package for signs of reconciliation.

Most software suppliers, faced with the task of implementing their packages on a wide range of systems, simply avoid the problem altogether by providing single-user versions only, or put their packages onto just one or two hardware systems.

In contrast to this approach, the supplier of the database management system Dataflex, an American company called Data Access, has long made a point of providing its product on as wide a range of micros as possible, including a wide variety of systems which can be shared among several users. As a result it has achieved widespread popularity among system developers, and is increasingly being bought by computing services in large companies for use by a variety of users in client departments. It was a request from one such user, directed to me by *PCW*, which finally decided me to look in detail at a package which has long been a candidate for this series, but which I feared might be just too complex to interest less experienced users. Dataflex's power and flexibility are undoubted, but how easy would it be for those without previous computing experience to use it for simple applications? Here I'll concentrate on this aspect of the package, while adding just a flavour of the power Dataflex can provide for experienced users and system developers.

Dataflex stores its information in fixed length records; each record in a file has the same structure. Files may be related to one another through key fields, with the relationships being specified when the file is set up. The Dataflex philosophy is based upon what it calls 'configurations', which are basically sets of commands prepared for use on particular sets of files. To be used, configurations must be compiled, in contrast to most command-driven packages which interpret commands once for each time that a sequence of commands is executed. From a user's point of view, this means that the first time a task is carried out, two operations are required (rather than the one needed in most such packages). This is because, after you have set up a sequence of commands, you must first compile the source code and then execute it. When this has been done, you may re-execute the same sequence without recompiling.

In this respect Dataflex has much in common with program generators, which must go through a translation phase before being executed. Unlike most program generators, the output of this translation phase is always a compiled program, which may be faster to execute than a comparable set of interpreted commands. (From the Benchmarks, it would appear that for operations within Dataflex, the package is indeed relatively fast.) So you have a trade-off between taking a little longer to set up the commands needed to run a task, and the time taken to carry it out.

Dataflex provides two major aids to making this process reasonably easy for novices, and reducing to a minimum the dangers of rigidity in the two-stage approach. Firstly, a set of programs and utilities is provided to enable you to carry out the main data management tasks which most people require — setting up files, adding and amending records, displaying and printing simple reports. With this basic set of features, you can use Dataflex as a simple data management system without going near the individual commands of Dataflex itself. These utilities can be accessed from the menus supplied with Dataflex, so that a reasonable degree of power is available just through the use of menus. Better still, most of these programs and utilities actually create

Maximum file size	2 gigabytes
Max record size (ch)	ML (min 16000)
Max no fields	255
Max field size	255
Max digits	18
Max prime key length	NS
Special disk format?	N
File size fixed?	Y
Link to ASCII files?	YV
Data types	N,C,D
Fixed rec structure?	Y
Fixed record length stored?	Y
Amend rec structure?	CO
Link data files?	Y
No data files open	20 (min)
No sort fields	9+
No keys	9
Max key length (chars, fields)	NS,6
Subsidiary indexes kept up-to-date?	UTD
Data validation	G
Screen formatting	P,C
Unique keys	AM
Report formatting	P,D,C
Store calculated data	IN, ED, BA
Totals & statistics	Y
Store selecn criteria	P
Combining criteria	A,O,N
>1 criterion/field?	Y
Wild code selection?	SW
Browsing methods	AK
Interaction methods	M,C,FT
Reference Manual+	***
Tutorial Guide+	N
Reference Card+	****
Online Help+	**
Hot-line?	P

For a full explanation of abbreviations, see 'Database dossier', page 188, January issue

Fig 1 Features and constraints (for 16-bit systems)

Dataflex configurations. The advantages of this are two-fold: you get a ready-made set of examples of configurations to supplement those supplied with the system; and you have a basic set of configurations which you can adapt to add extra features, rather than starting from scratch to learn what is really a high-level programming language.

Secondly, there is one menu option which not only helps novices, but also goes a long way to offset the disadvantages of the two-stage approach. The area of application which suffers most from a totally compile/execute approach is *ad hoc* queries. The flexibility of Dataflex is such that it would be possible to write a complete configuration which offers all the options for querying you could think of, with parameters (such as selections to be performed) entered when the configuration is executed. This would take a long time and a lot of expertise, so Dataflex provides such a facility itself, called Query. I'll say more about its facilities under 'Selection & sorting'; for now, suffice it to say that Query is sufficiently flexible to allow you to meet most requirements for one-off lists and reports. In addition, due to Query being an executable program, it can be given the options needed and executed immediately, rather than setting up the query commands, compiling and then executing them. Another consequence of this approach is that Query can be used even with the Dataflex run-time system, to generate *ad hoc* reports within the framework of a tailored system.

For more experienced users, the two great advantages of Dataflex are its flexibility in providing the equivalent of a high-level language with special facilities for handling databases, and its multi-user features. The latter are provided in such a way that each user of a shared database can be provided with an accurate picture of the data which their actions will update, but the sequence of operations can be arranged so that records are locked for the minimum period of time necessary to protect data integrity. A further boon is that, unlike some of its competitors, Dataflex is not copy protected. For those who sell the results of their labours, the availability of a run-time system will be an additional recommendation.

Constraints

The main limitations are shown in Fig 1. The figures shown are the minimum which may be available on 16-bit systems; the restrictions may be greater for 8-bit systems, and less on 16-bit systems with more than the minimum amount of memory. For example, the maximum record size in 8-bit systems is at least 4000 characters, while the maximum record size in 16-bit systems is at least 16,000 characters. In 16-bit systems, the constraints are unlikely to impose any serious limitations on record processing.

Date fields may be American or European format, as determined when the system is installed. Validation features which come with the system include checking ranges or specified values, and forcing entry of a field.

File creation and indexing

The process of preparing a file to be used in a Dataflex configuration includes defining its format and the indexes to be used to access it, specifying the maximum number of records it is to hold (although this can be changed subsequently), and, where appropriate, creating a screen form to use when entering and updating records. The simplest approach to this process is to use the Dataflex program AUTODEF, which uses a series of menus and questions to lead you through the whole process. The file definition can most easily be accomplished by creating a screen 'image' which can subsequently be used for data entry, and which contains titles, captions and field labels as required, plus indicators of the field positions and lengths. This involves typing underscores to show where the fields will be — three underscores indicate a three-character field, four underscores followed by a decimal point indicate a five-digit integer, and so on. This screen image may be prepared either with a word processor (such as WordStar in non-document mode) or with Dataflex's own simple editor, which gives paint-a-screen features using cursor and function keys.

When the screen image has been set up, you can then run AUTODEF. You will be asked to give the name for each field (Dataflex cannot pick this up from the captions used, even where they are to be the same), and to specify the index fields. Index keys may consist of up to six fields (four on 8-bit systems); all indexes must be unique, but can be made so by attaching the record number as the last field in a key, a procedure which would, in practice, for fields with duplicate values, reduce the number of data fields in a key by one. A file may have up to nine indexes (four on 8-bit systems) in addition to the record number; these are kept up-to-date as data is entered and amended.

In addition, you may have a single *ad hoc* index, which is created as it is needed and need not be specified at this point so that it can be used to order the file in further ways for reports. Where two or more files are to be linked together, the relationships are based on indexes whose fields must be identical in type and size in the related files.

When indexes have been specified, you cannot change the specification without re-indexing either on the one key which has been changed, or on the whole set; this process is reasonably fast (see Fig 2 for Benchmark times). To change the format of the record without writing a Dataflex program involves copying the data file twice; you use Query to create a plain text version of the file, then use a Dataflex utility, FILEDEF, to amend the record format, and finally use another Dataflex utility, READ, to create a configuration to re-import the data into the new format. FILEDEF provides an alternative route for setting up and amending the formats of data files and indexes, which gives more control over the process than the automated route via AUTODEF.

Data input and updating

If you use the AUTODEF program to set up your files, it will automatically create the necessary program to allow you to enter and amend records. This allows you to add new records, to amend records retrieved by any key, and to delete records. The Enter supplied macro provides a more sophisticated approach to the same requirement, giving you the ability to have programs set up which carry out command processing within the data entry phase (for example, to supply calculated fields), and which include data from more than one file on a single screen image. You cannot, though, use ENTER to specify that several records be displayed for amendment on a single screen. For this kind of option you must set up a configuration yourself, or amend one created initially with ENTER.

BM1	Time to add one new record	3secs
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	Inst
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	56secs+
BM5	Time to access record using wild code	22secs+
BM6	Time to index 1000 records on three-character field	50secs
BM7	Time to sort 1000 records on five-character field	NA
BM8	Time to calculate on one field per record and store result in record	1min 43secs
BM9	Time to total three fields over 1000 records	1min 35secs
BM10	Time to add one new field to each of 1000 records	35mins 28secs

Time to import a file of 1000 records: 20mins 55secs

Notes: NT=Not tested NP=Not Possible +=including scrolling
Where two times are given, first is access to first record, second is access to each subsequent record

Fig 2 Benchmark times recorded on an IBM PC/XT/hard



SCREENTEST

Often in a more complex system you will want to automatically carry out certain updating operations — perhaps to summarise and archive records at the end of a month or year. This kind of 'batch' updating can be carried out by writing your own configuration, using Dataflex commands.

Screen display

The screen images which can be created for data entry and amendment have already been described. When records are retrieved in this way, you can scroll through them in order by the current index (that used to retrieve the record), using keys which request 'next' or 'previous' record. For reporting, you can use the Query facility which displays one record per line, and which allows you to determine the fields to be displayed but does not give you any control over formats. Output from the Report macro can be directed to the screen. You can use Dataflex's extensive repertoire of display commands to provide precise control over screen displays. These commands include the ability to show complete lines, and to place particular data at specified points on the screen using direct cursor control.

Printed reports

Simple printed reports can be produced using the Query facility, which permits output to the screen, a printer, or a file.

More sophisticated formatting is provided by the Report macro, which allows you to specify a report with header and sub-header, body, sub-total and total sections. Nine levels of sub-totals are available, as well as overall totals. Formatting is achieved by including an image of the format the report is to take, linked to commands which dictate what is actually printed.

Reports created in this way may include information from more than one file. Where the Report macro does not provide sufficient flexibility, you can use direct output commands which provide similar facilities to those outlined under 'Screen display'.

Selection & sorting

The Query facility allows you to select on a maximum of 10 criteria. If you want to select records which match one of several values on a single field, each test counts as a selection, but they are, of course ORed: that is, the record is selected if any one such test is passed. Selections on separate fields are ANDed: that is, only records which pass them all are met. You could therefore issue a selection which requested all those whose postcode shows that they live in Birmingham or London, and have blue eyes and fair hair.

When using the Report macro, you can request that tests be ANDed or ORed, or that records pass if a test is *not* true. All these tests can use the conventional range of comparison operators (less than, greater than, and so on) plus a 'containing' test for character fields. If these facilities are insufficient, there is a range of commands to carry out tests, including an IF...ELSE group.

No sorting facilities are provided; Dataflex allows you to order data using indexes. Most of these will be specified when the file is first defined, and if the specification is changed then the file must be re-indexed. A single temporary index is provided which can be set up on an *ad hoc* basis for particular reports; this saves having to alter the file definition simply to have a report printed in a particular order. It also saves the extra processing and space overheads of additional indexes.

Calculation

Dataflex provides three commands which aid calculation: MOVE (which allocates values to variables and fields); INCREMENT (which adds one to the value of a field or variable); and CALCULATE (which allows you to enter a simple arithmetic statement to carry out calculations on field or memory variables). Any variables (as distinct from fields in stored records) must be explicitly defined in the Dataflex program.

Multiple files

Many of the Dataflex facilities relating to multiple files have already been mentioned, including the ability to explicitly relate files by defining the key fields which dictate the correspondence between records. For example, if you are programming an accounting system, the invoice file might have links to the customer file by customer account code, and to the stock file by stock item code.

This method is more constricting than that used by many packages which construct relationships between files on an *ad hoc* basis, but equally this approach should make the development of more complex systems quicker and simpler.

At most points in the system, you can refer to fields from several related files. In configurations, fields are referred to by the convention 'filename.fieldname,' rather than by providing a dictionary to all fields and requiring uniqueness of field names within a single database.

Package	Cost (£)	Summary
Dataflex	695	Powerful, flexible database management system available on a wide range of single-user and networked systems. Excellent for system developers, good for novices prepared to apply themselves. Clumsy manual, excellent reference summary and examples.
dBaseIII	495	More advanced version of popular dBaseII package. Allows maximum 10 files open at once, which can be interrelated as you wish on a DIY basis. Flexible indexing. Command-based: can store sets of commands to get close to programming. Only on IBM PC and clones.
KnowledgeMan	545	Powerful data management system, few software limits on processing. Spreadsheet included, word processing and business graphics as add-ons, all loosely integrated. Features for experienced users and system developers excellent, rather complex for novices.
Sensible Solution	565	Powerful multi-user, multi-file system based on central data dictionary which holds all record definitions. Menu-driven for beginners but no default formats, so lots of work to do to get started. Tailoring powerful but tedious to implement.
Sycero	595	Powerful and flexible program generator, with good facilities for screen handling and processing, powerful command language, ability to incorporate Basic statements if desired. Rather complex for novices, better for software developers.

Fig 3 Comparison of similar data management packages

Tailoring

The full range of Dataflex commands allows you to program systems of a complexity comparable with those you can build in high-level languages such as Basic or Cobol. In fact, Dataflex is written in Pascal, and the approach of its command language is reminiscent of the flavour of Pascal itself (though without, I'm glad to say, the use of the dreaded semi-colon as statement separator). Space does not permit a full description of the facilities available, but they include some straightforward features for setting up simple control systems including menus for end users.

Quite sophisticated systems can be built from the basic building blocks which Dataflex provides, including the Enter and Report macros and the menu-building features, without the need to learn about Dataflex commands. Nevertheless, these commands do give system developers considerable power and flexibility to build configurations for other users. For example, Dataflex includes the ability to define your own commands, which can be executed with parameters, and to assign sets of commands to function keys through user-defined procedures. A surprising omission is the absence of any security features such as password protection for data files.

In view of its undoubted power and flexibility, the length of time it has been on the market, and its availability on a wide variety of machines, it is interesting — and surprising — that up to now Dataflex has not, in contrast to the market leaders, generated an extensive cottage industry of run-time system applications. I would expect to see this change quite rapidly. It may reflect the initial strategy of the UK distributor, Equinox, which was to market Dataflex alongside a range of other products. Dataflex distribution is now handled by an offshoot of Equinox called by the name of the product. There is already a users' group.

Housekeeping

Dataflex allows you to delete, rename and copy files within the package, to access the directory listing, and to run operating system commands with return of control to the current menu.

Links with outside

You can read and write ASCII text files using Dataflex utilities (Read and Query respectively). The text files may use commas or carriage returns to delimit fields. For more complex formats Dataflex provides commands to read and write sequential text files, so you could construct virtually any format you need with a configuration of your own. Unlike the Dataflex facilities using internal file formats, the commands to handle sequential files are not particularly fast in operation.

User image

At the simplest level, Dataflex can be used as a menu-driven system for setting up simple files, and handling the entry and reporting of data. Most people, however, would not be willing to pay so high a price for a system which they could otherwise obtain for less than £200. To get value for money you really need to go beyond the basic features, and use at least the supplied macros for entry and reporting, plus the utilities for changing record definitions, setting up menus, and so on. I was able to run all the Benchmarks save two with this approach, and I found the system quite easy to use. For example, to import the Benchmark file I used the Read utility, which sets up an appropriate configuration to import a text file into a predefined database file. This process rarely works first time, but on this occasion it did.

Beyond these supplied programs and utilities, you need to use the range of Dataflex commands, and may need to go on to use procedures and to reset the function keys. I found programming with Dataflex quite straightforward, and both the programs to run Benchmarks compiled and ran correctly first time. As with setting up screen images, I found it best to use my word processor to construct program source files and then re-invoke Dataflex — the package allows you to compile files from other directories, so that is relatively problem-free.

Dataflex would be even easier to use if, instead of key stickers to display the standard uses of the function keys — to carry out operations such as Find a record, Save a record or Query a definition — the package were provided with a template. You cannot make use of more than one set of stickers, so anyone who uses more than one package which does not have a template is stuck!

Documentation

The Dataflex documentation is both an aid and a hindrance to understanding. The package comes with a manual, a reference summary and a set of example configurations. I suspect that most experienced users would do better to use the reference summary (which is one of the best I've seen and includes a complete syntax definition of all commands), together with the example configurations, and largely ignore the manual. This is a curious mixture of the tutorial level and the terse reference style, and explains the Dataflex features in a very curious order. It is more useful if used purely for reference, using the reference summary as a kind of index (there is an index to the manual, but I didn't find it very helpful). This is perfectly feasible, as the reference summary has a feature I've often recommended but (I think) never before seen, and that's a reference to the page in the manual for every command.

Conclusion

Dataflex is a powerful and flexible system, available on a very wide range of both single and multi-user micros. It provides extensive facilities for relatively inexperienced users, as well as advanced tools for system developers. It is about as easy to use as a system of this power can be, but as you would expect, people with little experience will get the most out of the system only by undertaking a couple of days' formal training.

That said, I feel that on balance, Dataflex represents one of the best chances for users with enthusiasm and a little experience to get worthwhile results from a powerful database management system. For them and for experienced users, the breadth of function, combined with the availability of a run-time system which includes the relatively powerful Query facility, and the absence of copy protection, must make Dataflex well worth considering.

For some people, the constraints imposed by the need to compile source code before executing sets of commands will be a drawback, but it should be set against the potential improvements in performance which may be achievable with a compiled system. Where this last is a consideration, you should make sure you carry out some timing tests for yourselves. My Benchmarks suggest that Dataflex is considerably faster than most, but not all, of its competitors. END

Summary

Supplier	Equinox/Dataflex Systems
Telephone	(01) 729 4460
Cost	£695
Systems	80,86,MS,PC,MU
Version reviewed	2.1
Type	S,E
Features	Powerful multi-user, multi-file database management system. Full tailoring facilities for system developers. Maximum of nine indexes per file on 16-bit systems, kept up-to-date. Flexible screen display and reporting.
Drawbacks	All command sets must be compiled before use, so two-stage operation for everything except simple queries.
Ease of use	Quite good for experienced users (apart from need to compile). Macros and menus for novices, but still complex.

BIBLIOFILE

Happy hacking is the theme as David Taylor logs on to making money, plus all about Ada in this month's book selection.



Cloak and hacker

Title: The Hacker's Handbook
Author: Hugo Cornwall
Publisher: Century Communications
Price: £4.95 (paperback)

You've read the news, now read the book. It is wicked to hack; not very wicked, hacker Hugo protests, but a little bit wicked just the same. The FBI takes a very dim view. Blokes with suspicious-looking bulges under their armpits might come knocking at your door. Your ZX could be seized in the middle of the night.

It's all very well, provided we take hacking to mean only you and your modem messing about on more or less legitimate lines — a database here, a bulletin board there. That's an innocent educational sport, the way Hugo sees it. If now and again you're not, so to speak, *welcome* to look around — well, there's probably no harm done.

But logging on unscrupulously — where to hack is to poke your nose into other people's computerised business without their knowledge or permission — that's definitely wicked. It's usually tricky and long-winded, probably illegal and, of course, it sounds like tremendous fun.

Computerniks have been at it for years: relishing the tease of locating some remote system, defeating its protection and having a quick, unauthorised rummage. No-one knows how many succeed. Hackers would naturally like everyone to believe that they're surreptitiously re-programming the mainframe at Fort Knox or breaking into the Kremlin's electronic mailbox most evenings. Victims, on the other hand, are equally anxious to allay fears that their files could ever have been tampered with. Vested interests make the actual extent of hackers' mischief pretty hard to assess.

Public opinion tends to be in exaggerated awe of hackers. We're easily bemused by sensational reports of computerised crime or by such Hollywood hokum as *Wargames*, in which a schoolkid dials into the Pentagon and nearly starts World War III.

Reality is more prosaic. With a few spectacular exceptions, like 'The Great Prince Philip Prestel Hack', it is, as a rule, pretty dull. The satisfaction, so all hackers insist, is in the ingenuity (and persistence) needed just to fathom a good connection.

This book offers general guidelines and looks at methodology from some entertaining examples of hacks by pseudonymous Hugo himself (he's a professional computer security consul-

tant). It describes the first principles of developing hacker's intuition, and reveals that 95 per cent of successful hacks rely on simple password acquisition. It explodes the myth that virtuosity at the keyboard is all, and urges you to scour by the hour for random clues and disconnected information — everywhere from specialised publications to exhibitions and obscure libraries, even dustbins. Hugo cheekily demonstrates how such gleanings can be used, for example to build up a shrewd idea of what systems MI5 uses.

It's a lively if often superficial account, but despite Hugo's protestations that *anything* is still possible — that men will always boldly hack where no men have hacked before — the conclusion seems to be that the best days are now over. As the targets get smarter, hacking isn't what it used to be.

Cracking nuts

Title: Out of The Inner Circle — A Hacker's Guide To Computer Security
Author: Bill Landreth
Publisher: Microsoft/Penguin (paperback)
Price: £8.95

It's certainly all over now for Bill Landreth — The Cracker — who was one of America's most notorious teenage computer wizards until he was 'apprehended by the FBI', and indicted by a Federal Grand Jury.

Gee whiz, you guys, he was only having fun. He didn't mean no harm. He was just a kid. They were all teenage kids in California's 'Inner Circle' of computer freaks. All they seem to have done was to hack about in GTE Telenet's system.

Still, the FBI wasn't taking any chances — these kids could be Commies! Even the judge insisted Landreth be looked over by a psychiatrist before sentence was passed.

Now The Cracker is a reflective old-timer of 19. This is his life story and his summary of a reformed insider's advice to those who'd rather not become victims of insidious hacking.

It's stirring stuff . . . 'It's Sunday night and I'm in my room, deep into a hack. My eyes are on the monitor and my hands are on the keyboard, but my mind is really on the operating system of a super-minicomputer a thousand miles away — a super-mini with an operating system that does a good job of tracking users and that will show my activities in its user logs, unless I can outwit it in the few hours before the Monday-morning staff arrives for work.' It sure beats homework.

The Cracker then identifies five kinds of (American) hackers,from *novices* star-struck by *Wargames* (who are a nuisance), through *students* (who find hacking a whole lot more intellectually stimulating than school), *tourists* (who seem to come to hacking much as they might come to an occasional crossword), *crashers* (who are troublemakers out to cause havoc for kicks) and the out-and-out computer *thief.*

This book isn't so much stirring as rather depressing. It implies that hooligan hacking is reaching epidemic proportions in the US, and plays on paranoid fears that your precious data files will be next unless you're extra vigilant. I dare say there's some truth in it. The risk is that people can easily become obsessively cautious, living in fear of the sinister, suspecting constant conspiracy, becoming convinced that evil-doers are all out there and trying to get them. That, if you like, is the dark side of happy hacking and it does not make for an edifying read.

The money program

Title: Bulls, Bears & Microcomputers — Programming for Successful Investment
Author: GT Childs
Publisher: Sigma Press
Price: £6.95 (paperback)

There may be readers of this book, the author admits, who have bought it in the hope of becoming suddenly rich. Almost all readers will have had this in mind, I'd imagine.

The book is written in an unfortunate, patronising style which labours to imply that most micro users are stumped for things to do after they've tired of zap-kapow games. So why not take up small-scale investment as a hobby and run a few Basic programs to keep track of your market performance?

Why not, indeed, if your motive is merely to have a bit of fun and gain a better understanding of financial jargon, although it isn't half stretching it to suggest that *'The Financial Times* will hold no more mysteries' or that 'you'll soon be on equal terms with the professionals'.

Throughout this book I was reminded of Horace Batchelor who, when I was at school, used to hard-sell Radio Luxembourg listeners his infallible method for cleaning up on the horses. I wonder now what I used to wonder then: if it's all so simple, how come *everyone* isn't as rich as Croesus?

First Ada

Title: Programming in Ada
Author: Robert G Clark
Publisher: Cambridge University Press
Price: £22.50 (hardback), £8.95 (paperback)

There are two sides to this business. On the one hand Ada is exciting, state-of-the-art stuff: tomorrow's all-purpose programming language — vast, fast, flexible and reliable. On the other hand, Ada was devised by the US Department of Defence and its primary purpose is to program military hardware. It is a fair bet that much of President Reagan's 'Star Wars' anti-missile defence program will rely heavily on Ada, and the MoD also sees Ada as a likely successor to Coral.

The author takes a sanguine, academic view. Ada, he maintains, is better suited than Pascal (from which it derived) or Fortran for teaching university students the fundamental concepts of computerised problem-solving. Ada is named after the redoubtable Countess of Lovelace, Byron's daughter and assistant to Charles Babbage, whose 19th century 'analytical engines' are generally taken to have been the precursors of 20th century computers. The implication must be that today's Ada is a language which encourages thoughtful programming.

This is a textbook which provides a fascinating and lucid insight which, it is acknowledged, only dips one toe into the ocean of Ada's ultimate capacity. Yet it is pretty esoteric stuff and scarcely likely to grip the average home micro user. It isn't as if you can flick through the small-ads of *PCW* and find yourself tripping over Ada compilers!

Highly recommended for students, but it's likely to fox almost anyone else.

No, but Siriusly

Title: The Sirius and Victor 9000 Computer Book
Author: Dennis Jarrett
Publisher: Hutchinson
Price: £17.95 (paperback)

Technically superlative, commercially a nightmare: Victor's Sirius was ahead of IBM's PC in bringing the joys of 16-bit (Intel 8088) processing to the desk-top, but was haplessly out-dazzled by the Big Blue limelight. The Sirius also established ACT as a hardware distributor, but after a series of financial vicissitudes and protracted manufacturing wrangles, the Apricot emerged a hotter property. So who needs a handbook on a micro which is apparently over the hill?

About 60,000 users do, reckons the author, whose own deep affection for the beast is clear, even if he has previously written a similar tome on the PC.

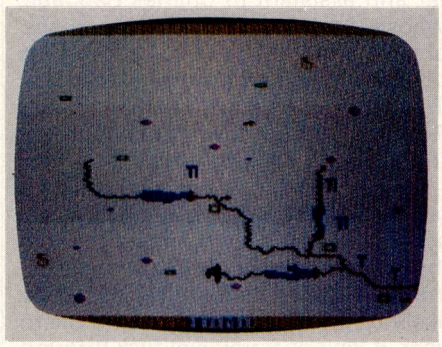
What readers get here is a comprehensive and beautifully presented guide to the hardware itself and to the jobs it can accomplish as well as, if not better than, many more fashionable rivals.

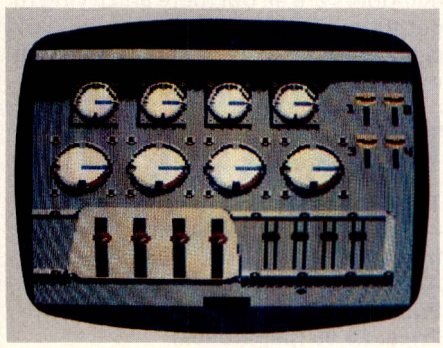
The book is a model of its kind: well-structured, well-written and well laid out — promoting all of the Sirius's many strengths and acknowledging its few shortcomings. It will, of course, be of absorbing interest to Sirius users and ought to persuade many others that, even in the age of the Macintosh, the Sirius is still a good buy. END

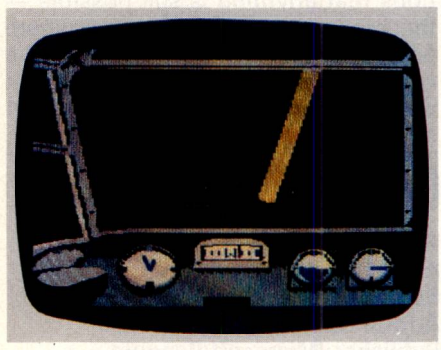
SCREENPLAY



From bouncing bombs to nuclear attack — Stephen Applebaum goes to war, joins MI5 and tiptoes down to the fairy dell in this month's selection of the best games for the Commodore 64, Spectrum and Apple Macintosh.







Bouncing bombs

Title: Dambusters
Computer: Commodore 64
Supplier: US Gold
Format: Cassette, disk
Price: £9.95, £14.95

US Gold's long-running love affair with the theme of war is still going strong, and by the looks of it, the UK release of Dambusters will keep the relationship blossoming.

If the title of the game rings bells, it is because it's based on the now legendary bombing raid on the German Moehne, Eder and Sorpe dams by Scampton-based 617 squadron during World War II. One of the most intriguing aspects of the operation was the bouncing bomb, designed by Barnes Wallis, and the precise manner in which it had to be dropped if each of the dams was to be breached successfully. Not only did this mean flying at very low level under the cover of night, but also at precise speeds and distances from the dam. All these points, and more, have been incorporated into US Gold's depiction of operation Chastise, as the mission was inappropriately code-named.

Dambusters the game is primarily a flight simulator, but thanks to some neat interweaving of arcade action and mind-bending strategy, the company has created a program which will keep you on the edge of your seat for hours.

The game begins with a view through the cockpit of a Lancaster bomber onto the runway at RAF Scampton. Seven men make up the aircraft's crew, but unfortunately you seem to be the only one who has turned up for duty. Not only do you have to fly the plane, but act as navigator, front gunner, rear gunner, first and second engineers, and bomb aimer too.

Each crew member's position is represented by a different screen, individually accessed by pressing a specific numeric key on the top row of the 64's keyboard. Three of these screens are used during take-off: one sets the aircraft's trim, another contains the engine throttles and boosters, while the third, the cockpit, gives your speed, height and forward view.

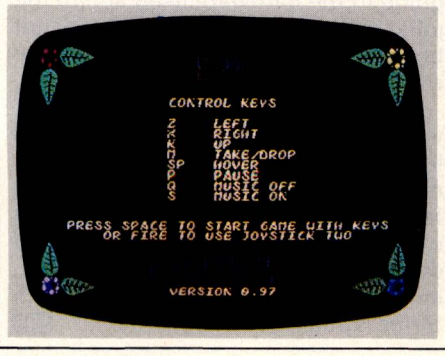
Once airborne, and believe me that's a feat in itself, you fly across the English Channel to the French coast. A map screen allows your heading to be set, as well as giving vital information on enemy ground positions.

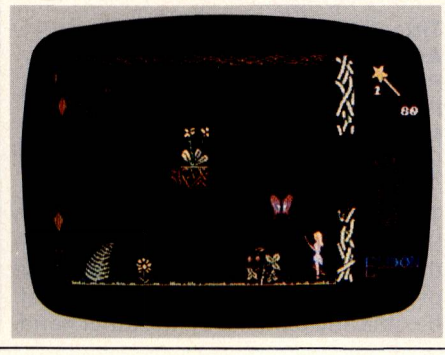
Nothing much happens until you reach French airspace. Searchlights suddenly pierce the darkness, and unless they're shot out with a swift bit of cannon fire, you become easy pickings for the highly manoeuvrable ME110 night fighters of the German Luftwaffe.

If you survive the night fighters, avoid the barrage balloons, dodge the flak, shoot out the searchlights and extinguish any engine fires that might have started during the flight, you can attempt a run at one of the dams.

While approaching the dam and setting your bomb spinning in its cradle dangled beneath the Lancaster's belly, several screens must be toggled between to check on your height and distance from the target. When everything is in order, a press of the fire button sends the bomb bouncing over the water's surface.

In the disk-based version of Dambusters, the bomb is actually shown in profile approaching the dam. After a fixed time interval the screen goes blank, and you are left with a nailbiting wait to see if your efforts have been a success. Tape users will not have this option, although they will have the excellent screen where the dam is smashed and water gushes out.





Fairy frolics

Title: Elidon
Computer: Commodore 64 (Amstrad, Spectrum and MSX versions planned)
Supplier: Orpheus
Format: Cassette
Price: £8.95

If you thought being a fairy was all fun and dancing round the flowers at the

bottom of the garden, Elidon will make you think again. In a world which turns Cicely Mary Barker's poem, *Where,* on its head, every day becomes a struggle for survival. Butterflies become butchers, and even the seemingly harmless flowers hold little solace for a flight-weary fairy.

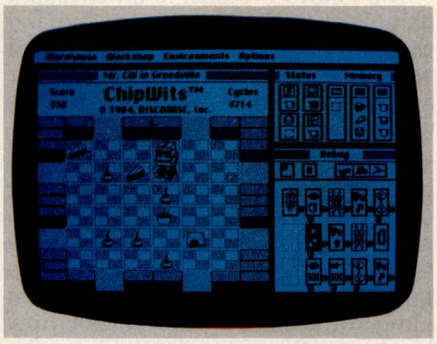
The Elidon of the title is a secret forest which is just emerging from the icy clutches of winter. The fairy queen rules over the forest, and is in need of a crown which must be a garland made from the seven flowers of Finvarra. Unfortunately the garland cannot be made until the flowers bloom, and that means exposing them to seven magical potions hidden throughout the forest. It is your task to find the mystical cordials, give your queen a crown, and win the privilege of sitting at her side.

In play, Elidon is very reminiscent of Sabre Wulf. The graphics are extremely pleasing to the eye, depicting various parts of the forest with its different flowers, pulsating butterflies, and other less recognisable creatures. Rather more disappointing is the fairy that you guide around the forest. Orpheus extols the virtues of her animation, but apart from the wings, she seems to be suffering from acute, and very early *rigor mortis*.

Moving around this strange world can be very painful indeed. Until you know what is and what isn't safe to touch, you find yourself constantly being sapped of fairy dust—the elixir of life.

To complete the game, you have to work out what effects the various objects lying around the different screens have. Only three can be carried at a time, but there are far more dotted about Elidon.

Elidon is a nice and quite original diversion from the usual search-and-pick-up type of game. Both the graphics and sound are good, and make up a program which should have a lot of appeal in the younger age bracket.



Chips with everything

Title: Chipwits
Computer: Apple Macintosh
Supplier: Brainworks Inc US
Format: Disk
Price: $49.95

According to the manual, 'Chipwits teaches . . . general problem-solving methods, both intuitive (right-brain) and logical (left-brain)'. Well, how can you expect to get on if your left brain doesn't know what your right brain is doing?

In spite of what the manual says, Chipwits is actually fun to use.

The basic ingredients are a little bespectacled robot called a Chipwit and eight different 'environments' that it has to negotiate. Each different environment consists of a number of rooms holding assorted good things and bad things. At the most basic level, the idea is to eat the good things and zap the bad. At higher levels, you have to negotiate a maze or pick up an object surrounded by exploding bombs.

In order to successfully negotiate the different environments, you need to develop individual programs to drive the little Chipwit. This is where the package is really clever — you build up the program by dragging little chips around the screen and combining them to form the program. Each chip has an arrow pointing out of it which you can set to point to the next chip.

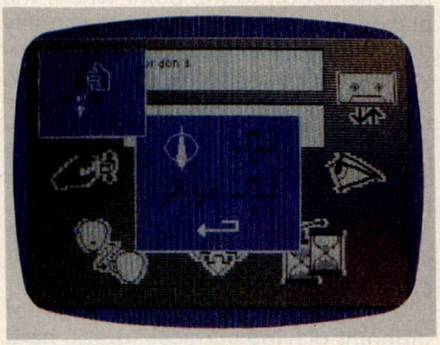
The basic Chipwit programming options allow you to Look, Feel and Smell the room for objects and move the Chipwit forwards, backwards, left or right. When the Chipwit has found something, it can either eat it or zap it. The graphics for eating are especially good — a little arm extends from the robot, grabs the object and brings it back for the robot to chomp on.

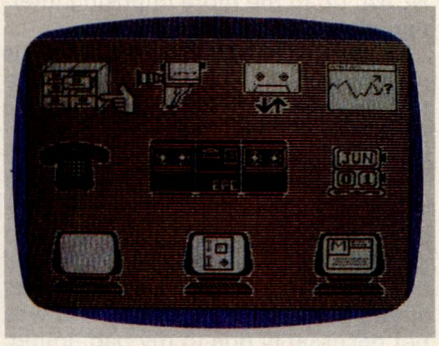
If you select the zap option, a little laser gun appears on the Chipwit's head and it vaporises whatever is in front of it.

Using these basic tools, you can make up an extremely dumb Chipwit which just blunders around aimlessly and eats or zaps everything it comes across.

When you get more adventurous, you can play around with pushing and poking data on and off stacks, and building much more intelligence into your Chipwit. You can have it rushing through the rooms remembering where it's been, and differentiating between good things and bad.

As an educational program, Chipwits is very good. Not only does it teach the fundamentals of programming, it is fun to use.





Tinker, tailor . . . mole

Title: The Fourth Protocol
Computer: Commodore 64, Spectrum 48k (used for screenshots)
Supplier: Hutchinson Computer Publishing
Format: Cassette, disk
Price: £12.95 (Spectrum and Commodore 64 cassette), £15.95 (disk)

Games based on books or films often tend to be smash-and-grab affairs, with little more than the most tenuous of threads linking the software to the original material. The Fourth Protocol, based on Frederick Forsyth's book of the same name, by no means falls into this trap, thanks to the programmer's eye for detail and obvious respect for the author's work.

Forsyth's explosive plot centres around the last few weeks leading up to a general election. Political advisors in the Kremlin want the Labour Party returned to power because they believe it could be duped into withdrawing Britain from NATO, so creating an opening for a Russian invasion and, ultimately, a Soviet take-over of mainland Europe. To try to ensure Labour's re-election, Moscow prepares plan Aurora — a scheme to explode a small nuclear bomb, following it up with a condemnation of the US whom it will blame for the atrocity. This, it is hoped, will coax people into voting for Labour, the only party advocating unilateral disarmament.

Hutchinson Computer Publishing's game is quite true to the book. There are three parts to the program, the first two of which are purely icon-driven, while the third is an arcade phase requiring both the nimble use of a joystick and some very fast typing.

Program one begins with you being appointed head of CI(A) (the MI5 section responsible for security of government buildings) and on the trail of a mole within the organisation. Positioned around the screen are several large icons, each of which provides a facility for either storing, retrieving or finding new information. Placing a cursor over any of the icons produces a menu from which a function can be selected.

One of the most often-accessed icons is a large telephone. This allows you to call up various computers, and talk to

other characters dotted throughout the government and the CI(A).

At the top of the screen is a video camera. This represents your surveillance team, or 'watchers', as they are called. A number of these super-snoopers can be sent out to keep watch and report back information on the person's whereabouts, personal life, and so on. Details acquired in this way can be filed for later reading.

Information gained from watchers and various other sources should lead you to the name of the traitor, and who he or she is working for. Unless you solve the puzzle within a 40-day (1 hour 20 minutes) time span, you cannot progress to the second challenge. A save option means that you don't need to complete the game in one sitting.

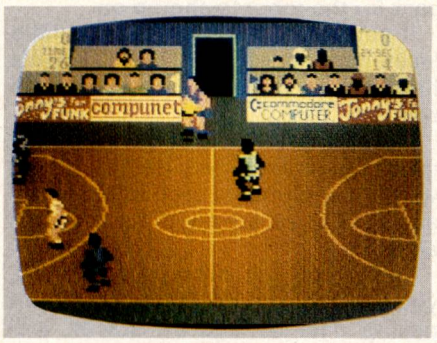
Game two is much the same as the first, except this time you are out of the office and wandering around the streets of London trying to locate the bomb. There are many locations to explore, so rather than hoofing round the capital, you can catch a bus, take a taxi, or sample the delights of the Underground.

Apart from getting run over by a London bus, there are many other obstacles that will impede you in your search. These range from the odd terrorist to the great British rail strike. Should you last long enough, you'll hopefully stumble across the password giving you access to part three.

Having found the bomb, it must be defused. In the Commodore 64 version, the screen depicts a room containing a filing cabinet in which the device is stored. As you try to open it, KGB agents rush in and must be dealt with before you are overpowered, leaving the bomb to go off.

The final part of the Spectrum version is quite different, featuring a shoot-out between agents from both sides. Not until all the KGB stooges have been killed can the cabinet be tackled and the bomb defused.

The Fourth Protocol is an excellent game — not only in its story line and execution but also its graphics, all of which go to make it a must for adventure enthusiasts who like a game with substance.



Sport for all

Title: International Basketball
Computer: Commodore 64
Supplier: Commodore
Format: Cassette
Price: £5.99

It has been a long time coming, but International Basketball has finally arrived and deserves to be as successful as its predecessor, International Football.

Purists and close *aficionados* of the sport might be offended by the amount of licence that has been exercised where International Basketball's accuracy is concerned, but this mainly amounts to scaling down a team's size from five to three players, and has little effect on the overall game — if anything, it makes it easier.

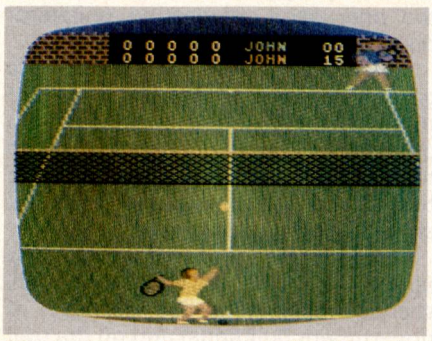
Before attempting to play an opponent, it is a good idea to get in some practice against the computer. There are nine different levels of proficiency, so there's plenty of opportunity to perfect your passing and shooting skills. You should be able to beat the computer every time at level one, although I found it almost impossible to even get the ball when playing it at the highest level.

Another factor affecting the difficulty of play is the rules. Three different sets are available from the NBA and the NCAA, up to the more imposing international rules.

In play, International Basketball is much the same as International Football in that only one man can be controlled at a time. The character under control changes from moment to moment, depending on which of the three is nearest to the ball at any one time. When he has the ball, a player can jump, dribble and throw the ball. How hard you throw it depends on the duration of time you hold the fire button down. A short press equals a short pass and *vice versa*.

International Basketball is graphically superior to International Football, and just has the edge on sound quality. The bouncing of the ball, for instance, sounds impressively realistic, while the clapping of the spectators is suitably enthusiastic.

It's not often that a game based on a sport manages to create the atmosphere of the real thing, but International Basketball goes past the stage of being a non-effective, two-dimensional representation to the point where the player almost feels that he is actually down there on the court. This is a marvellous game and one for everyone, not just sport addicts.



Anyone for tennis?

Title: On-Court Tennis
Computer: Commodore 64
Supplier: Activision
Format: Cassette
Price: £10.99

Tennis is a popular game for home micros. Usually I'm not very good at it because I either run to get the ball too early, too late, or not at all. On-Court Tennis, therefore, should have cured my ineptitude as the computer moves both players. However, once it had guided me to the ball, I messed everything up by swinging the racquet at totally the wrong moment. This was not necessarily due to my bad timing, but rather because there are so many different strokes at your fingertips.

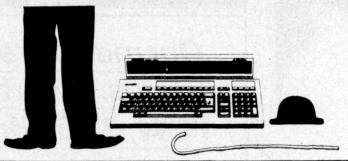
The game has been programmed so that the joystick can simulate five different shots. Moving the joystick forwards produces a flat shot — backwards, a lob — sideways right, a topspin shot — sideways left, a slice, and by pressing the fire button you can throw in a drop shot.

Confused? You will be when you play it. If that isn't enough, there are also five different modes of serve. Oh, for the days of Pong!

On-Court Tennis contains some very nice features, not least of which is the option each player is given to choose one of four top seeds. Each of the four has different playing characteristics, giving them all a margin of error on a specific stroke, an unpredictable temperament, or low endurance.

The game also has a series of different playing surfaces (grass, hard court and clay), plus what the manual terms a 'floating intelligence'. This means that during a man-versus-machine game, the computer can vary its skill level as you become increasingly more competent. As soon as you think you can win, the computer has a flash of inspiration and pummels you into the ground.

On-Court Tennis is certainly one of the better sport programs for the Commodore 64. Its graphics and sound are good, while the action is thick and fast. It's just a pity that Activision doesn't provide the strawberries and cream as well! END



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FAST BBC DISK FORMATTER

Although BBC disk operation is already quite fast, this routine increases it by up to 40 per cent. When disks are formatted by the Watford or Acorn disk filing systems, the sectors on all tracks are placed in the order 7, 8, 9, 0, 1, 2, 3, 4, 5, 6. This means that when the disk drive steps from one track to another, it misses the first sector of the next track because the head needs time to settle and so has to wait for the disk to make another revolution. The disk therefore needs to revolve twice in order to read or write one track.

This routine formats the disk so that sectors are placed in a different order and gives the head time to settle down. The first track has the sectors organised as 7, 8, 9, 0, 1, 2, 3, 4, 5, 6; the second, two further back: 5, 6, 7, 8, 9, 0, 1, 2, 3, 4, and so on, The routine was written for the Watford DFS and Shugart drives, and some experimentation may be needed for other set-ups by altering the separate variable in line 170. I suggest trying a step rate of 3 or 4, which should speed up disk operations by about 30 per cent.

To use the program, format all your new disks with it as usual. After this, all the normal disk operations will operate more quickly.

Note that the Acorn DFS cannot have 62 files, only 31. Do not just format your old disks if you want to speed them up as this will erase them. Copy the files from the old disk onto a newly formatted one.

Morten Tolboel

```
  10 REM ***************************************************
  20 REM ***** Disk-formatter program by Morten Tolboel 1985 *****
  30 REM ***************************************************
  40 REM
  50 REPEAT
  60   INPUT"Which drive ",driv
  70   UNTIL drive%>=0 AND drive%<=3
  80 REPEAT
  90   INPUT"31 or 62 files  ",files
 100   UNTIL files%=31 OR files%=62
 110 REPEAT
 120   INPUT"40 or 80 tracks ",nooftracks%
 130   UNTIL nooftracks%=40 OR nooftracks%=80
 140 PRINT'"Confirm formatting of drive "¡STR$(drive%)¡" : "
 150 PRINT STR$(nooftracks%)¡" tracks, "¡STR$(files%)¡" files"
 160 IF INSTR("Yy",GET$)=0 THEN END
 170 S0=7:osword%=&FFF1:steprate%=2
 180 DIM datablock% 1024
 190 REM *********************************
 200 REM ***** Formatting procedure *****
 210 REM *********************************
 220 FOR T%=0 TO nooftracks%-1
 230   T$=STR$(T%):IF LEN(T$)=1 THEN T$="0"+T$
 240   PRINT T$;"  ";
 250   FOR S%=0 TO 9
 260     ?(datablock%+S%*4)=T%
 270     ?(datablock%+S%*4+1)=0
 280     ?(datablock%+S%*4+2)=(S0+S%) MOD 10
 290     ?(datablock%+S%*4+3)=1
 300     NEXT
 310   ?&70=drive%:!&71=datablock%:?&75=5
 320   ?&76=&63:?&77=T%:?&78=21
 330   ?&79=&2A:?&7A=0:?&7B=16
 340   ?&7C=0
 350   X%=&70:Y%=0:A%=&7F
 360   CALL oswordX
 370   IF ?&7C<>0 THEN VDU7:PRINT'"Error track "¡STR$(T%):END
 380   S0=S0-steprate%:IF S0<0 THEN S0=S0+10
 390   NEXT
 400 PRINT
 410 REM *********************************
 420 REM ***** Setup data for catalogue *****
 430 REM *********************************
 440 FOR A%=0 TO 1023
 450   ?(A%+datablock%)=0
 460   NEXT
 470 IF nooftracks%=80 THEN !(datablock%+262)=&2003:!(datablock%+774)=&2003
 480 IF nooftracks%=40 THEN !(datablock%+262)=&9001:!(datablock%+774)=&9001
 490 FOR A%=512 TO 519
 500   ?(datablock%+A%)=&AA
 510   NEXT
 520 REM *************************
 530 REM ***** Step to track 0 *****
 540 REM *************************
 550 ?&70=drive%:!&71=datablock%:?&75=1
 560 ?&76=&69:?&77=0:?&78=0
 570 X%=&70:Y%=0:A%=&7F
 580 CALL oswordX
 590 IF ?&78<>0 THEN VDU7:PRINT"Error":END
 600 REM ***************************************************************
 610 REM ***** Write 2 or 4 sectors depending on number of files *****
 620 REM ***************************************************************
 630 ?&70=drive%:!&71=datablock%:?&75=3
 640 ?&76=&4B:?&77=0:?&78=0
 650 IF files%=31 THEN ?&79=&22 ELSE ?&79=&44
 660 ?&7A=0
 670 CALL oswordX
 680 IF ?&7A<>0 THEN VDU7:PRINT"Error ";E.
 690 PRINT"Formatted"
 700 END
```

QL MICRODRIVE BACK-UP

Making back-up copies of microdrive cartridges for the QL can be quite a problem. With a large number of files, all the old copies on the back-up cartridge have to be deleted and new versions copied across individually.

This routine does the job automatically by reading both directories, and establishing which are new files and which are existing ones to be replaced. It then performs all the required DELETE and COPY commands. The routine works from a working copy in MDV2_ to a backup copy in MDV1_.

Martin Ridgway

```
  90 REMark
 100 REMark ==========================
 110 REMark =   MICRODRIVE BACKUP     =
 120 REMark =                         =
 130 REMark =      by MARTIN RIDGWAY  =
 140 REMark ==========================
 150 REMark ALLOW A MAX OF 30 FILES
 160 DIM file1$(30,20)
 170 DIM file2$(30,20)
 190 REMark STORE THE DIRECTORIES INTO SEPARATE FILES
 220 OPEN_NEW £3,mdv1_dir1
 230 DIR £3,mdv1_
 240 CLOSE £3
 250 OPEN_NEW £3,mdv1_dir2
 260 DIR £3,mdv2_
 270 CLOSE £3
 330 REMark INITIALISE VARIABLES FOR PROCESSING OF DIRECTORIES
 350 LET current$ = ""
 360 LET direct% = 1:flcount% = 1:headline% = 0
 390 OPEN_IN £5,mdv1_dir1
 400 READFILES
 410 CLOSE £5
 420 DELETE mdv1_dir1
 440 LET flcount1% = flcount% - 1
 445 REMark ---------------------------
 446 OPEN_IN £5,mdv1_dir2
 450 LET direct% = 2:flcount% = 1:headline% = 0
 480 READFILES
 490 LET flcount2% = flcount% - 1
 500 CLOSE £5
 510 DELETE mdv1_dir2
 520 REMark NOW COMPARE THE TWO LISTS OF FILE NAMES
 540 FOR current2 = 1 TO flcount2%
 550     LET match = 0
 560     FOR current1 = 1 TO flcount1%
 570         IF file1$(current1) = file2$(current2) THEN
 580             LET match = 1
 590             EXIT current1
 600         END IF
 610     END FOR current1
 620     IF match = 1 THEN
 630         PRINT "Replacing ";
 640         DELETE "mdv1_" & file2$(current2)
 650     ELSE
 660         PRINT "Copying   ";
 670     END IF
 680     COPY "mdv2_" & file2$(current2) TO "mdv1_" & file2$(current2)
 690     PRINT file2$(current2)
 700 END FOR current2
 710 STOP
 720 REMark ---------------------------
 730 DEFine PROCedure READFILES
 740 REPeat readloop
 750 IF EOF(£5) THEN EXIT readloop
 760 LET a$ = INKEY$(£5)
 770 REMark TEST IF THE FIRST TWO HEADER LINES HAVE BEEN PASSED
 800 IF headline% = 2 THEN
 810     IF CODE(a$) = 10 THEN
 820         ADDNAME
 830     ELSE
 850         LET current$ = current$ & a$
 860     END IF
 870 ELSE
 890     IF CODE(a$) = 10 THEN
 900         LET headline% = headline% + 1
 910     END IF
 920 END IF
 930 END REPeat readloop
 940 END DEFine READFILES
 950 REMark ---------------------------
 960 DEFine PROCedure ADDNAME
```

```
980 IF direct% = 1 THEN
990    LET file1$(flcount%) = current$
1000 ELSE
1010    LET file2$(flcount%) = current$
1020 END IF
1030 LET flcount% = flcount% + 1
1040 LET current$ = ""
1050 END DEFine ADDNAME
```

ORIC POKES AND CALLS

Many machine code programmers want access to the graphics routines in ROM. The routines and their start and data addresses are listed in Fig 1.

Use of the command CURSET 120,100,1 will result in values being stored in locations #2E1 to #2E6 as follows:

#2E1:120
#2E2:0
#2E3:100
#2E4:0
#2E5:1
#2E6:0

To use the routines in your machine, store values in the appropriate locations as above and then call the ROM routine.

The POKEs and CALLs are also very useful for my programs.

Trevor Latham

Command	Start address	Data addresses
CURSET	#EBDF	#2E1 to #2E5
CURMOV	#EBE2	#2E1 to #2E5
DRAW	#EBE5	#2E1 to #2E5
CIRCLE	#EBE8	#2E1 to #2E5
CHAR	#EBEE	#2E1 to #2E5
FILL	#EBFA	#2E1 to #2E5
PAPER	#F17F	#2E1
INK	#F18B	#2E1
PATTERN	#EBEB	#2E1

Fig 1

```
DOKE 27,#F42D      Resets the machine when a program is
                   broken into
POKE #22B,64       Disables the reset button
POKE 805,N         Changes the repeat speed of the keys, with
                   N as the new speed
POKE 759,32        Puts the Oric into lower case
POKE 759,0         Puts the Oric into upper case
POKE #C3,65        Disables PEEK, DEEK and any other function
CALL #EF4D         Plot pixel at current hi-res cursor position
CALL #EF74         Invert pixel at current hi-res cursor
                   position
CALL #EF94         Erase pixel at current hi-res cursor
                   position
CALL #F72E         Switch caps message on
CALL #F735         Switch caps message off
POKE #2F1,128      Switch printer on
POKE #2F1,0        Switch printer off
CALL #E70E         Print ROM software designers message
CALL #CC95         Display 'redo from start message' and
                   continue with program
CALL #CDCF         Display 'extra ignored' message
CALL #FAFA         Produce key click
CALL #FB10         Produce return click
CALL #F64A         Toggle caps on/off
CALL #F888         Soft reset
```

HARNESSING THE 6845

Have you ever wondered how many of the advanced video tricks in the games for your BBC are produced? The answer lies in the 6845 CRTC chip which processes everything that is passsed to the screen.

This routine allows the user to intercept the commands to the 6845 and change them—this can have many interesting effects. The chip's 13 registers are directly POKEd to at the addresses &FE00 and &FE01. Lines 50-60 in the routine initialise the registers, and line 80 lists their function. You then enter three values: the register number, start, and final values to place in it. Tapping a key will increase the value by one, from the initial to the final. Fig 1 contains some sample values that show what the chip can do.

There are, of course, many other effects to be found.

Andrew Smith

Register number	Initial	Final	Function
13	1	1000	Smooth pixel scrolling
00	1	1000	Tuning effect on TV
01	40	128	Materialising screens
01	128	40	4× magnification
09	6	6	No line gaps
10	1	1	Very fat cursor
07	1	32	Scroll up

Fig 1

```
  10 REM Harnessing the  6845
  15 REM      Video Chip
  30 REM By Andrew.F.G.Smith.
  40 MODE 4
  50 *TV 255,0
  60 *FX12,2
  70 PRINT
  80 FOR E%=0 TO 13:READ E$:PRINT"No.";E%,E$:NEXT
  90 INPUT ''"Register to alter";X
 100 INPUT '"Start Value";S
 110 INPUT '"Final Value";L
 120 PRINT''''"PRESS A KEY....":A$=GET$
 130 FOR R%=S TO L
 140 REM      Set 1st 6845 byte
 150 ?&FE00=X
 160 REM      Set 2nd 6845 byte
 170 ?&FE01=R%
 180 A$=GET$:PRINTTAB(0,0);R%;
 190 NEXT
 200 *FX12,10
 210 DATA Total Cells,Horiz.Chars,Horiz.Sync,Sync Width,Size of lines,Screen Re
fresh,Vert.Chars,Vert.Sync,Interlacing,Vert.Lines,Cursor size & rate,Cursor line
,High byte for scrolling,Low byte for scrolling
```

ATARI TOUCH-TABLET

I have found a way to use my Atari touch-tablet in my own programs. The touch-tablet uses the paddle locations:

Paddle(0) for horizontal movement; and Paddle(1) for vertical movement. The two buttons are treated as Paddle buttons, Trigger 0 is the same as the left button and Trigger 1 is the right button. The touch-tablet buttons can also be read from Stick(0).

Stick(0)=15	No buttons pressed
Stick(0)=14	Touch-tablet stylus pressed
Stick(0)=11	Left button
Stick(0)=10	Stylus and left button
Stick(0)=7	Right button
Stick(0)=6	Stylus and right button
Stick(0)=3	Both buttons
Stick(0)=2	Stylus and both buttons

John Risby

MEMOTECH GRAPHICS SCREENDUMP

This routine dumps a copy of the Memotech graphics screen to an Epson printer. It produces a double-sized copy of the original which can either be black on white or *vice versa.*

The easiest way to read the graphics screen on the Memotech is to use Control-B. This, when sent to the screen, has the same effect as GR$(x,y,n), and expects three more bytes where x,y are the coordinates of the point to be read and n is the number of bits to be read down.

Before the routine is called. VS 4 or a graphics screen must be present or an error will occur.

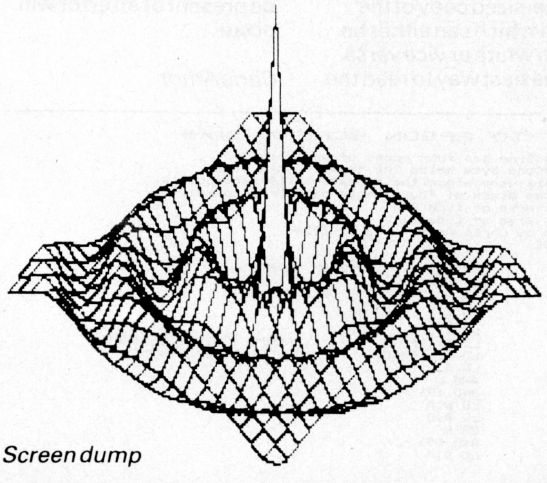
Chris Amor

```
MTX TO EPSON SCREEN DUMP
The routine has four modes of operation.
The second byte holds the type in this case.
(0) This uses algorithm to match alternate points.
(1) Uses block of four points per screem pixel.
(2) Inverse of type 0.
(3) inverse of type 1.
writen by Chris Amor.    July 1984.
50 CODE

864B        LD A,0      ;TYPE OF PRINT
864D        EX AF,AF'
864E        LD D,191    ;TOP OF DUMP
8650        LD B,0      ;BOT
8652        LD E,0      ;LEFT
8654        LD C,255    ;RIGHT
8656        LD IX,£FD75         ;PRORPL (OUTPUT DEVICE)
865A        LD HL,£03FC         ;ADJUST SIZE OF DUMP
865D        LD A,B
865E        AND L
865F        AND 191
8661        LD B,A
8662        LD A,D
8663        OR H
8664        AND 191
8666        LD D,A
```

```
8667            LD HL,BYTE
866A            LD (HL),0  ;CLEAR FIRST POSITION
866C            PUSH BC
866D            POP HL
866E            LD (IX+0),1          ;SELECT PRINTER
8672            RST 10
8673            DB £83,27,"A",8      ;SET LINE FEED FOR EPSON
8677            LD B,D
8678            JR INSTART
867A ROW:       DEC B          ;SET UP NEXT ROW POINTER
867B            DEC B
867C            DEC B
867D            DEC B
867E INSTART:   PUSH BC
867F            LD A,L
8680            SUB E
8681            LD B,0
8683            LD C,A
8684            INC BC
8685            SLA C
8687            RL B
8689            RST 10       ;SELECT EPSON GRAPHICS MODE
868A            DB £A5,10,13,27,"*",4,£C0  ; FOR (BC) BYTES
8691            POP BC
8692            LD C,E
8693 COL:       LD (IX+0),0          ;SELECT SCREEN
8697            RST 10
8698            DB £A2,27,"C",£E0,£81,4     ;GR$(X,Y,4) RESULT IN WKAREA
869E            LD A,(£FE1A)         ;BYTE RETURNED BY GR$
86A1            PUSH BC
86A2            CALL ABYTE ;DOUBLE SIZE
86A5            LD (IX+0),1          ;SELECT PRINTER
86A9            RST 10
86AA            DB £C0       ;SEND BC TO PRINTER
86AB            POP BC
86AC            LD A,C
86AD            CP L
86AE            JR Z,FINISH          ;IF LAST COLUMN
86B0            INC C        ;NEXT COLUMN
86B1            JR COL
86B3 FINISH:    LD A,B
86B4            SUB H
86B5            SUB 3
86B7            JR NZ,ROW   ;FOR NEXT ROW
86B9 TIDYUP:    RST 10
86BA            DB £86,10,13,27,"A",10,13  ;RESET LINE FEED
86C1            LD (IX+0),0          ;RESET SCREEN
86C5            RET          ;TO BASIC ?
86C6 ABYTE:     LD C,A       ;ENTER WITH BYTE IN A
86C7            PUSH DE      ;RESULT RETURNED IN BC
86C8            XOR A        ;ROUTINE DOUBLES HEIGHT AND LENGTH OF PLOT
86C9            BIT 0,C
86CB            JR Z,NEXT1
86CD            OR 3
86CF NEXT1:     BIT 1,C
86D1            JR Z,NEXT2
86D3            OR 12
86D5 NEXT2:     BIT 2,C
86D7            JR Z,NEXT3
86D9            OR 48
86DB NEXT3:     BIT 3,C
86DD            JR Z,NEXT4
86DF            OR 192
86E1 NEXT4:     PUSH HL
86E2            EX AF,AF'
86E3            BIT 1,A
86E5            LD H,0
86E7            JR Z,NOINV ;JUMP FOR BLACK INK
86E9            LD H,£FF
86EB NOINV:     BIT 0,A
86ED            JR NZ,TYPE1
86EF TYPE0:     EX AF,AF'    ;MATCHES INTERMEDIATE POINTS
86F0            XOR H        ;INVERSE BYTE IF H=£FF
86F1            LD B,A       ;ALGORITHM FOR INTERMEDIATE BYTES
86F2            LD A,(BYTE)
86F5            LD E,A
86F6            AND B
86F7            LD D,A
86F8            LD A,E
86F9            SRL A
86FB            AND B
86FC            OR D
86FD            LD D,A
86FE            LD A,E
86FF            SLA A
8701            AND B
8702            OR D
8703            LD C,A
8704            LD A,B
8705            LD (BYTE),A
8708            POP HL
8709            POP DE
870A            RET          ;BC HOLDS PAIR OF BYTES
870B TYPE1:     EX AF,AF'    ;NO MATCHING
870C            XOR H        ;INVERSE IF H=£FF
870D            LD B,A
870E            LD C,A
870F            POP HL
8710            POP DE
8711            RET          ;B AND C HOLD SAME BYTE
8712 BYTE:      DB 0
8713            RET
8714            RET

Symbols:
BYTE    8712    INSTART 867E
ROW     867A    COL     8693
ABYTE   86C6    FINISH  86B3
NEXT1   86CF    NEXT2   86D5
NEXT3   86DB    NEXT4   86E1
NOINV   86EB    TYPE1   870B
TYPE0   86EF    TIDYUP  86B9
```



Screen dump

EINSTEIN JOYSTICKS

Finding a lack of joysticks readily available for the Tatung Einstein, I set about discovering what input was required at the analogue ports and if it was possible to modify an existing pair of joysticks to meet this requirement.

The Einstein has two 7-pin DIN sockets as analogue ports on the right-hand side of the computer which are connected to an analogue to digital (A/D) converter. The connections from the socket to the A/D converter are shown in Fig 1. In the Introduction manual, the A/D conversion time is quoted as 40μsecs, and in the Basic manual it quotes the A/D converter as a μPD 7002; this A/D converter has a conversion time of 5msecs. I therefore investigated further and found that the A/D converter fitted, and the one the Introductory manual refers to is the ADC0844.

The main difference between the two is that the μPD 7002 can be configured as either an 8-bit or 10-bit converter under program control. It is also slower than the ADC0844 as previously detailed (although 5msecs is the time taken for 10-bit conversion at a clock frequency of 2MHz).

For use with the joysticks, and differences between the two can be ignored as the system software is designed to handle it. The input to the A/D converter needs to be a voltage swing of two volts, from analogue ground (which you connect to zero volts) and +2 volts (the value of V ref held internally at +2 volts). The computer also requires a switched five volts from the fire button. With reference to Fig 2, you can see how these voltages are achieved and how to connect the joystick to the 7-pin DIN plug.

My joysticks were fitted with 60-degree 100kohm potentiometers, and the values of R1 and R2 in Fig 2 reflect this value. If your joysticks are fitted with different values, then R1 and R2 need to be one and a half times the value of the potentiometers.

I've used the modified joysticks very successfully, and have added the following lines to the PICPEN program supplied with the Einstein (used to draw pictures on the screen) to stop the pen disappearing off the screen, whether using joysticks or the keyboard.

```
2805 IF X>254 THEN X=
  254:ELSE IF X<0 THEN X=0
2806 IF Y>191 THEN Y=
  191:ELSE IF Y<0 THEN Y=0
```

D Smith

1 0 volts
2 X channel
3 Fire button
4 Analogue ground
5 V Reference
6 Y channel
7 +5 volts

DIN socket

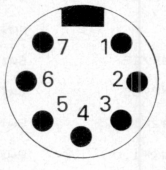


Fig 1

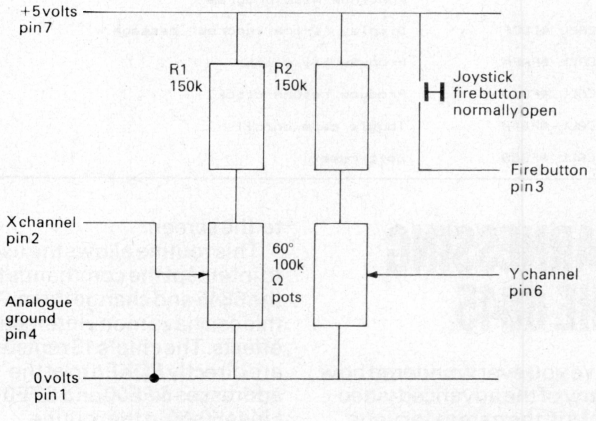


Fig 2 Note: X channel O/P to be 0 volts when joystick to the left, Y channel O/P to be 0 volts when joystick to the bottom

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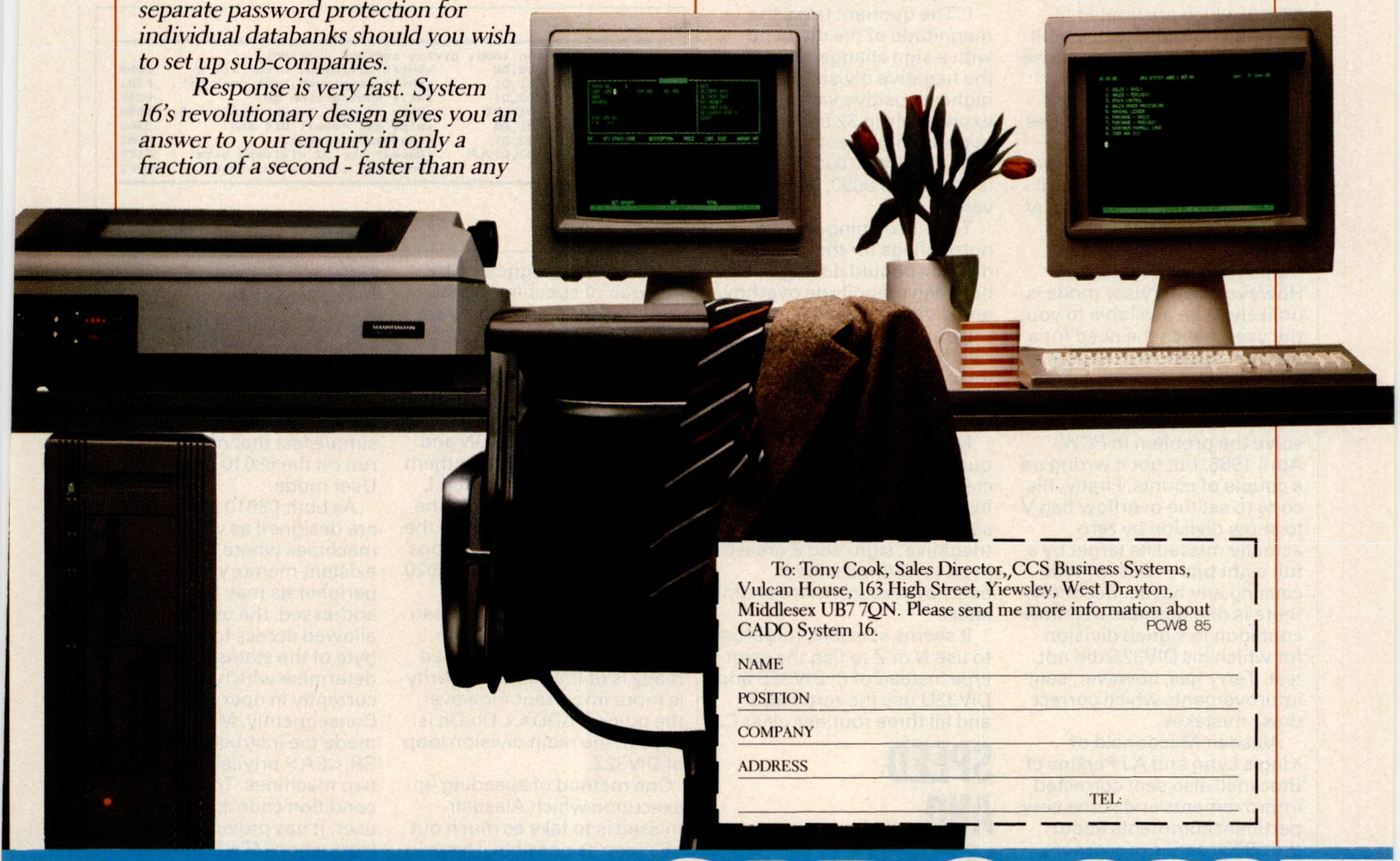

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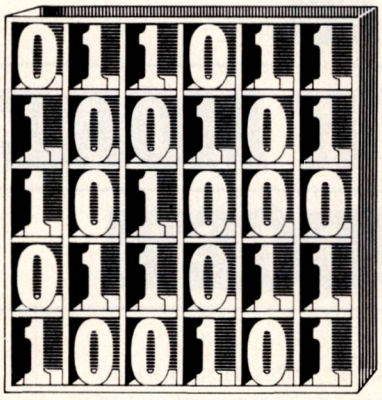


David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, *32-34 Broadwick Street, London W1A 2HG.*

UNTRAPPABLE DIVISION

In *PCW,* November 1984, I issued a challenge for a SubSet Class 1 signed 32-bit division routine for the 68000. The need for this is obvious in the 68000, the 68008 and the 68010, which are limited to 32/16-bit division, with a built-in error trap to catch out those zero divisors.

The 68020, which designs planets in its spare time, does have several forms of full 32-bit division, but it suffers from the (structurally sound) fact that attempts to divide by zero will be trapped and exception processing in Supervisor mode initiated. However, Supervisor mode is unlikely to be available to you, the user, hence the need for a division routine that cannot be trapped.

Terry Browning's DIV32S and DIV32U attempted to solve the problem in *PCW,* April 1985, but got it wrong on a couple of counts. Firstly, his code to set the overflow flag V to show division by zero actually missed its target by a full eight bits — but without causing any havoc. Secondly, there is one possible overflow condition in signed division for which his DIV32S did not test. Terry has, however, sent improvements which correct these mistakes.

Alasdair Macdonald of King's Lynn and AJ Perkins of Bracknell also sent corrected improvements and some very pertinent comments about the 68000 series processors. As no one version solved all the problems of implementing a Class 1 routine on all processors in the 68000 family, code and ideas from all three readers, along with some of my own concepts, are combined in this month's Datasheet, DIV32.

SIGNED OVERFLOW

Quotient overflow can occur in a signed division only if the dividend is the lowest negative value, that is −2,147,483,648 ($8000 0000 or −2^31), and the divisor is −1. The quotient takes the magnitude of the dividend with a sign change forced by the negative divisor, but the highest positive value expressible in 32 bits using two's complement notation is 2^31 − 1. $8000 0000 negated is still $8000 0000, a negative value.

Terry Browning thinks the output flags for the signed division should distinguish between magnitude overflow and division by zero.

He suggests that the overflow flag V be set to indicate error with the carry flag C set or reset to show which type.

Mr Perkins, however, points out that the C flag is always cleared by the division instructions of the 68000 series, whereas both N (negative, sign) and Z are left in an undefined state if overflow occurs (more on this later).

It seems sensible, therefore, to use N or Z to flag the error type instead of C. DIV32S and DIV32U use the zero flag Z and all three routines clear C.

SPEED AND LENGTH

Alasdair Macdonald notes that the business of stacking the SR is unnecessary in the April versions of DIV32S and DIV32U as the flags can be manipulated by the "MOVE #data, SR" instruction.

This produces quicker, shorter code, and Alasdair's routines at 38 bytes each were indeed the shortest submitted. Terry's improved versions logged in at 86 bytes (signed) and 64 bytes (unsigned), and those of AJ Perkins were 54 bytes and 44 bytes respectively.

```
;
;...Main division loop, giving correct quotient.
DIVLP   ADD.L   D0,D0       ;Shift dividend, clear bit 0,    D080
        ADDX.L  D1,D1       ;shift remainder, get next bit.  D381
        CMP.L   D2,D1       ;Will subtraction go?            B282
        BCS     DIVLPT      ;Skip if not, leave result = 0,  6504
        ADDQ.B  #1,D0       ;else set result bit and         5200
        SUB.L   D2,D1       ;subtract divisor.               9282
DIVLPT DBF      D3,DIVLP    ;Repeat for 32 dividend bits,    51CB
                            ;end with correct quotient.      FFF2
;
```

Fig 1

Other ways suggested by Alasdair of speeding up the routines' execution times are to use equivalent but faster instructions. ADD Dn,Dn and ADDX Dn,Dn shift and rotate data registers two or four clocks quicker than ASL #1,Dn and ROXL #1,DN and MOVEQ #0,Dn will clear them two clocks faster than CLR.L Dn. (These figures are for the 68000, 68008 and 68010 — the use of equivalent instructions has a complex effect on 68020 timing.)

Equivalent instructions can build confusion into your programs, and unless speed really is of the essence, clarity is more important. However, the quicker ADDX.L Dn,Dn is used in the main division loop of DIV32Z.

One method of speeding up execution which Alasdair missed is to take as much out of a loop as possible. I have done this in DIV32's division loop, which actually calculates the logical complement of the quotient. The terminating NOT instruction both corrects the result and sets the right exit flags. For comparison, Fig 1 shows Alasdair's main loop which still requires a TST D0 to set exit flags and thus will execute on the 68000 in 12 + 32 * (42-52) clocks. The loop in DIV32Z takes 18 + 32 * (44-50) clocks — best case timing has been traded for a quicker worse case to produce a more even timing.

UPWARD COMPATIBILITY

The main bugbear of the April routines for Mr Perkins is the simple fact that neither will run on the 68010 or 68020 in User mode.

As both 68010 and 68020 are designed as virtual machines where both non-existent memory and peripherals may be addressed, the user cannot be allowed access to the system byte of the status register to determine which mode is currently in operation. Consequently, Motorola has made the instruction MOVE SR,<EA> privileged on these two machines. To restore condition code access to the user, it has provided the new instruction MOVE CCR,<EA>, not available on either the 68000 or 68008.

So, in a series of very sophisticated processors, declared to be upwardly compatible, there is no way to program a move of condition codes to either data register or memory that is portable

across all processors in User mode. Any half-decent system software should, of course, deal with the problem and make the resulting illegal instruction or privilege violation processing transparent to the user program.

But system software writers are not noted for their love of low-level programmers, and exception processing could have drastic effects on time-critical user routines.

The best fully-portable method of putting the CCR on stack below a subroutine return address, ready for RTR exit, is awaited.

DIV32 FLAGS

Mr Perkins ventured that any Class 1 division should be portable and should return flag information of the same order as that returned by the 68xxx DIVS and DIVU instructions. This is basically the same reason why Terry Browning originally saved the Status Register to stack.

Essentially, N and Z should return the sign and zero status of the quotient, V should signal overflow when set, C should be clear and the extend flag X should be totally unaffected.

Overflow can be dealt with by preliminary tests, and N, Z, V and C are correctly set or cleared by a terminal TST of the quotient. X is more difficult as many instructions do affect it, but two methods of preserving it are given in DIV32.

The first, in DIV32S, is to rotate it into the top byte of stack. Restoration to the condition codes is achieved by a sequence of rotations into and out of the quotient, which also flag the quotient's status.

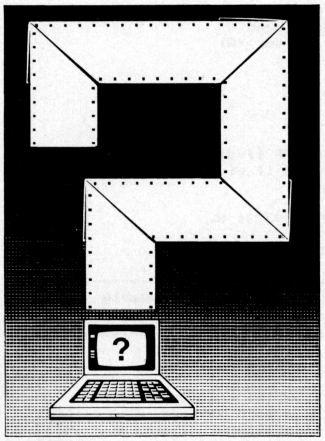
The second method, in DIV32Z, was originally used in Z80 code. By moving the result bits into the quotient one shift in arrears, the carry or extend flag can safely be rotated through the quotient register and back to the C or X bit of the CCR. **END**

DATASHEET 1

```
:=============================================================================
:= DIV32     32-bit trap-proof division suite.
:> DIV32S    32-bit signed trap-proof division.
:> DIV32U    32-bit unsigned trap-proof division.
:> DIV32Z    32-bit unsigned division with zero divide.
:=============================================================================
:JOB         DIV32S - To divide one signed (two's complement)
:              32-bit number by another, returning 32-bit signed
:              quotient and remainder, or unchanged operands with
:              division by zero or quotient overflow information.
:            DIV32U - To divide one unsigned (absolute) 32-bit
:              number by another, returning 32-bit unsigned
:              quotient and remainder, or unchanged operands with
:              division by zero information.
:            DIV32Z - To divide one unsigned (absolute) 32-bit
:              number by another, returning 32-bit unsigned
:              quotient and remainder, or "high-values" quotient
:              on division by zero.
:ACTION      DIV32S:-
:              IF divisor = 0:
:              THEN:
:              [ Set division by zero error flags. ]
:              ELSE:
:              [ IF dividend = -2^31 AND divisor = -1:
:                THEN:
:                [ Set quotient overflow error flags. ]
:                ELSE:
:                [ Compute quotient & remainder signs.
:                  Compute absolute dividend & divisor.
:                  Call absolute value division, DIV32Z.
:                  IF quotient sign negative THEN:
:                  [ Negate quotient. ]
:                  IF remainder sign negative THEN:
:                  [ Negate remainder. ]
:                  Flag quotient status. ] ]
:            DIV32U:-
:              IF divisor = 0:
:              THEN:
:              [ Set division by zero error flags. ]
:              ELSE:
:              [ Call absolute value division, DIV32Z. ]
:            DIV32Z:-
:              Clear remainder register.
:              FOR 32-bit count:
:              [ Shift last result bit to dividend\quotient,
:                shifting next dividend bit into remainder.
:                Subtract divisor from remainder.
:                IF subtraction went (C = 0):
:                THEN:
:                [ Skip, result = 0. ]
:                ELSE:
:                [ Add divisor to remainder, result = 1.] ]
:              Shift final result bit into quotient.
:              Complement quotient, flagging quotient status.
:-----------------------------------------------------------------------------
:CPU         68000, 68008, 68010, 68020
:HARDWARE    None.
:SOFTWARE    DIV32Z is a subroutine of both DIV32S and DIV32U.
:-----------------------------------------------------------------------------
:INPUT       DIV32S: D0 = 32-bit 2's complement signed dividend,
:                    D1 = 32-bit 2's complement signed divisor.
:
:            DIV32U: D0 = 32-bit unsigned (absolute) dividend,
:            DIV32Z: D1 = 32-bit unsigned (absolute) divisor.
:OUTPUT      DIV32S:
:              X  unchanged     X  unchanged     X  unchanged
:              N  quot. sign    N  0             N  0
:              Z  quot. state   Z  1             Z  0
:              V  0             V  1             V  1
:              C  0             C  0             C  0
:              D0 quotient      D0 dividend      D0 dividend (-2^31)
:              D1 remainder     D1 divisor (0)   D1 divisor (-1)
:            DIV32U:
:              X  unchanged     X  unchanged
:              N  quot. sign    N  0
:              Z  quot. state   Z  1
:              V  0             V  1
:              C  0             C  0
:              D0 quotient      D0 dividend
:              D1 remainder     D1 divisor (0)
:            DIV32Z:
:              X  unchanged
:              N  quot. sign
:              Z  quot. state
:              V  0
:              C  0
:              D0 quotient  (= $FFFFFFFF if divisor was zero.)
:              D1 remainder (= dividend if divisor was zero.)
:ERRORS      None.
:REG USE     A7 (USP), D0, D1, CCR
:STACK USE   DIV32S: 14. DIV32U: 12. DIV32Z: 8.
:RAM USE     None.
:LENGTH      128 (DIV32S: 82. DIV32U: 12. DIV32Z: 34).
:CYCLES      Not given.
:-----------------------------------------------------------------------------
:CLASS 1     *discreet      *interruptable     *promable
:******      *reentrant     *relocatable       *robust
:=============================================================================
:
DIV32  :Suite of three trap-proof division routines.
:
:...Signed division returning overflow information.
DIV32S TST.L   D1           :Test for a zero divisor,          4A81
       ORI     #$02,CCR     :set V flag without affecting      003C
                            :any other flags and exit          0002
       BEQ     D32SX        :Z = 1 if division by zero.        6748
:
       CMPI.L  #2^31,D0     :Test for other possible           0C80
                            :overflow, when dividend is        8000
                            :$80000000                         0000
       BNE     D32SOK       :(okay if it isn't)                660C
       CMPI.L  #-1,D1       :and divisor is $FFFFFFFF          0C81
                            :giving invalid +$80000000         FFFF
                            :quotient.                         FFFF
       EORI    #$06,CCR     :Set V always and clear Z          0A3C
                            :only if D1 = -1 then exit         0006
       BNE     D32SX        :Z = 0 if overflow error.          6634
:
D32SOK CLR.W   -(A7)        :Clear stack word for flags.       4267
       ROXR    (A7)         :Save entry X flag state.          E4D7
:
       TST.L   D0           :Test for negative dividend,       4A80
       BPL     DRTST        :skip, okay, if positive,          6A04
       NEG.L   D0           :else make absolute and set        4480
       ORI.B   #%11,(A7)    :sign flags, quotient (bit 0)      0017
                            :and remainder (bit 1).            0003
:
DRTST  TST.L   D1           :Test for negative divisor,        4A81
       BPL     ABSDIV       :skip, okay, if positive,          6A06
       NEG.L   D1           :else make absolute and            4481
       EORI.B  #%01,(A7)    :correct quotient sign flag        0A17
                            :for changed sign result.          0001
:
ABSDIV BSR     DIV32Z       :Do absolute value division.       6128
:
       BTST    #0,(A7)      :Test quotient sign flag           0817
                            :and skip, okay, if result         0000
       BEQ     REMSGN       :should be positive, else          6702
       NEG.L   D0           :change to negative.               4480
:
REMSGN BTST    #1,(A7)      :Test remainder sign flag          0817
                            :and skip, okay, if result         0001
       BEQ     RESTX        :should be positive, else          6702
       NEG.L   D1           :change to negative.               4481
:
RESTX  ROXL    (A7)+        :Restore stored X flag and         E5D7
       ROXL.L  #1,D0        :rotate in and out of quotient     E390
       ROXR.L  #1,D0        :to flag quotient status but       E290
       ANDI    #$FE,CCR     :preserving X, then clear C        023C
                            :leaving X N Z & V unchanged.      00FE
:
D32SX  RTS                  :Exit information correct.         4E75
:
:...Unsigned division with division by zero error information.
DIV32U TST.L   D1           :Test for a zero divisor,          4A81
       ORI     #$02,CCR     :set V flag without affecting      003C
                            :any other flags and exit          0002
       BEQ     D32UX        :Z = 1 if division by zero.        6702
       BSR     DIV32Z       :Do absolute value division.       6102
D32UX  RTS                  :Exit information correct.         4E75
:
:...Unsigned division returning $FFFFFFFF for zero division.
DIV32Z MOVEM.L D2/D3,-(A7) :Save working registers,            48E7
                            :D2 and D3 to user stack.          3000
       MOVE.L  D1,D2        :Put divisor in D2 and             2401
       MOVEQ   #0,D1        :clear D1 for remainder.           7200
       MOVEQ   #31,D3       :Set 32-bit counter.               761F
:
:...Division loop - the complement of the last result bit is
:...looped round in the X flag to be shifted into the quotient,
:...(initially the input X flag is shifted into the quotient).
DIVLP  ADDX.L  D0,D0        :Shift in last result, shift       D180
       ADDX.L  D1,D1        :next d'dend bit to remainder.     D381
       SUB.L   D2,D1        :Subtract divisor and skip,        9282
       BCC     DIVLPT       :C = X = 0 = result if gone,       6402
       ADD.L   D2,D1        :else add it back, C = X = 1.      D282
DIVLPT DBF     D3,DIVLP     :Repeat for 32 bits, sending       51CB
                            :result bit to loop start.         FFF4
:
:...One more shift moves final complemented result bit in to
:...quotient bit 0, and input X back to X flag. NOT complements
:...quotient to correct it, clears V and C, puts sign and zero
:...status of quotient in N and Z, leaving X unaffected.
       ADDX.L  D0,D0        :Get last result, restore X.       D180
       NOT.L   D0           :Correct quotient, set flags.      4680
       MOVEM.L (A7)+,D2/D3 :Restore working registers,        4CDF
                            :D2 and D3, from user stack.       000C
:
       RTS                  :Exit information correct.         4E75
:=============================================================================
```

COMPUTER ANSWERS

Simon Goodwin takes his toolkit to your problems. The address to write to is Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Fully covered

Could you tell me the names and addresses of any insurance companies which offer policies covering maintenance, and so on, for micros? My equipment is not an essential part of my business, therefore a repair time of up to seven days would be acceptable.
Glyn Taylor, South Kyme, Lincoln

The best choice of insurance depends to a great extent on the value of the equipment and its intended use. There are really two questions here — one about insurance policies, which offer you money if your computer is lost or damaged, and one about maintenance — prompt repair of a faulty computer.

If you want to insure a small system for personal use, you may be able to include it under your house contents or personal possessions insurance. In such a policy, the computer is treated like any other 'consumer durable' — washing machines, TV sets, record players, and so on. Some policies require that you list such items, with their serial numbers. An additional premium may be required if the computer is worth more than a certain amount, but this varies from one policy to the next.

Many house-contents policies will also cover your computer in transit to and from temporary sites, such as computer clubs. All reputable computer clubs should have their own insurance; the Association of Computer Clubs offers a range of schemes to member clubs at low prices. For more information, contact Rupert Steele through *PCW*.

You should carefully check the small print of house-contents policies to make sure that your computer is covered. Some policies specifically exclude cover on software or equipment used for business rather than leisure; you may also have trouble arranging insurance cover for recorded data. In such cases, you have to rely on the broker to suggest an alternative.

High Street insurance brokers are only slowly becoming aware of the home computer market. Make sure they understand exactly what type of cover you require before you buy a policy, and get the brokers to confirm the cover with the company that actually issues the policy if there seems to be any doubt. Most brokers will phone and check at once if they are not sure whether a policy is appropriate.

As with car insurance, you are covered for different contingencies depending upon the amount you pay. 'All risks' cover generally provides insurance against accidental damage or breakdown, but cheaper policies may only cover fire and theft.

Computers used in offices may be covered under existing policies for typewriters, desks, coffee machines, and so on, but you should not assume that this is the case. Again, serial numbers and details of valuable items will be required by the insurers. Commercial Union Insurance and Eagle Star Engineering offer computer-specific policies for equipment worth more than a few hundred pounds. Halsey and Company is described as 'the Insurance Brokers for Computer People' — phone (0272) 503716 for details of their Repaircover and Datacover policies.

Of course, insurance may not fill your needs. It can take a while to get your money after equipment fails or is stolen; the insurance company will need to make enquiries before it pays out, and that could leave you computer-less for some time.

You should insure your computer as a matter of course, in case it is stolen, but there are a number of other actions which you might take if your policy does not provide for a prompt replacement.

Probably the best idea is to come to some agreement with your supplier. Many big manufacturers (such as IBM, ACT and DEC) offer maintenance agreements which cover personal computers, but some of these are quite expensive — perhaps 20 per cent of the equipment value per year. The most expensive schemes offer same-day replacement of faulty machines, while others may only guarantee repair or replacement within a few days.

Most of the more professional computer dealers offer similar services for computers which they have supplied. Such cover can be convenient and cost-effective, especially if you are based close to the dealer's offices, but it is up to you to satisfy yourself that the dealer can be relied upon.

If you use a small computer it can be cost effective to buy more than one system, keeping one as a 'back-up', especially as the value of software and data soon outstrips that of hardware when a computer is in serious use. Some firms (including Mancomp (061) 224 1888 and Video Vault (04574) 66555) offer a 24-hour turn-round on small computer repairs (the BBC Micro, and so on). If you live near one of them, or can afford postal delays, you may be able to get by without a maintenance agreement.

Repairs to obscure machines, printers and disk drives tend to be slower, and it is often hard to find firms with the required specialist expertise. Your dealer may be able to advise you — local help is very valuable in such circumstances.

The best option for many business users will be leasing. Rather than buy your computer outright, you hire it from a specialist firm. If it breaks down, you are supplied with a replacement while the original is repaired (the arrangement is similar to TV rental). Leasing can seem fairly expensive, but it is convenient and often has tax advantages compared with the outright purchase of equipment. Micro leasing firms exist in most big cities — check *Yellow Pages* or magazine small ads for details.

Structured Basic

In the April issue of *PCW*, Brian Heywood pointed out that rational program control can be maintained by the judicious use of procedures and functions, and the risk of data corruption can be reduced by the use of local variables.

Could you publish a short list of computers that have such a Basic?
B Nesbit, Chopwell, Newcastle upon Tyne

The best 'structured Basic' is called Comal (COMmon Algorithmic Language). Comal is available for the BBC and most Commodore computers, including the 64.

BBC Basic on the BBC Micro, the Electron and the Tatung Einstein, has many structured features but some annoying limitations. For example, you can't return parameter values from a procedure (even functions only allow one value to be returned). Selection facilities are poor — IF..THEN..ELSE cannot be properly nested, and there is no CASE statement to resolve choice between more than two alternatives.

The Basic interpreter of the Enterprise is better in this respect; SuperBasic on the Sinclair QL is excellent, although it has a few bugs; RML Basic, for Research Machines computers, is worth examining, as is Apple's wonderful (but costly) Macintosh Basic.

As a last resort, you can buy programs which add a smattering of structured features to a built-in Basic. Popular choices are Simon's Basic for the Commodore 64 and MegaBasic for the Spectrum.

All structured Basics have a common weakness — they may allow you to structure your program, but they offer little in the way of facilities to represent data in a structured way. The records, sets, pointers and sub-range types in a full implementation of Pascal are invaluable if you really want to develop good programming habits.

Precise display

How do you quantitatively relate the resolving capability

of a domestic TV with aerial input, a domestic TV with RGB input, and computer monitors of medium, high and low resolution? Presumably you count the number of pixels across and down the screen.

Perhaps you could expand on this point, as it appears that there is little available to provide meaningful comparison between the above. Some figures (in pixels?) for the above types of set would be useful.
DS Gladwell, Camborne, Cornwall

The resolution of a display is not easily expressed as a single statistic, which is probably why you can't find the comparative figures you describe. The resolution varies depending on several factors, including the brightness setting of the display (and thus, the ambient light level), the relative compatibility of the computer and display, the source of the signal and the information being shown.

A monitor should outperform a TV set, and a high-resolution display should give greater clarity than a low-resolution one. An RGB or composite video signal should give better resolution than a signal conveyed through a TV aerial socket, as less processing (and concomitant degredation) is needed to convert the signal into a form which can drive the display tube.

TV engineers measure resolution in terms of bandwidth, a measure of the number of changes which can be processed in a second. A respectable TV will have a bandwidth of at least 6MHz. Monitors range in bandwidth from 5MHz to 15MHz and beyond. The greater the bandwidth, the greater the precision. You can't make absolute statements about pixels (display dots) as different computers use different proportions of the screen area for a single pixel. The Sinclair QL, for example, uses twice the area used by the Spectrum. There is no standard size (or even shape) of pixel; as a very rough guide, a display with a bandwidth of 6MHz will blur information if it is asked to display more than about 300 pixels across the screen. You generally need a bandwidth of 10MHz or more to crisply display 80-column text.

When you examine a display, you should check that the 'white' display is even, with a rectangular border, and make sure that characters near either edge of the display are not unacceptably distorted (or missing altogether). It is possible to adjust sets to reduce this type of distortion, but you should get the supplier to do this — there are potentially lethal voltages inside a TV set or monitor.

So far, this applies to black and white displays. When colour is added, the picture becomes even less clear. The format of television signals was decided before colour TV appeared, so PAL was invented to add colour information to a black and white signal. In the US and Europe, similar but incompatible systems are NTSC and SECAM.

All the colour encoding systems used in broadcasting suffer from weaknesses because they try to cram the colour information into a small bandwidth. Electronics in the receiver extracts the information, but this process is imprecise. Fringes of colour to one side of graphics on many micro displays are caused by inaccurate synchronisation between the brightness or 'luminance' information and the colour or 'chrominance' signal.

This problem occurs on all computers and TVs to some extent — it also crops up on video monitors connected via a composite video lead. Its severity depends upon the relative adjustment of the display and computer; the only way to avoid it is to try before you buy. There is a lot of variation in the performance of micros and displays — especially cheap models — so it is important to take your computer to the shop and leave with the particular display you found satisfactory.

It is possible to find a second-hand colour TV that will perform almost as well as a monitor if you shop around carefully, but you are unlikely to find a TV that performs as well as an RGB monitor. Colour TV pictures are built up from dots of three colours — red, green and blue (hence the name RGB). These displays require a separate feed to each of the 'guns' which produce coloured dots. The tubes are independently controlled, reducing interference problems and, in theory, giving the best possible display.

There are two types of RGB display — analogue and digital. Digital displays only allow one level of control over each gun, either on or off. This simplifies the electronics but restricts you to eight colours — the eight permutations of three binary values.

With an analogue monitor the intensity of each gun can be set to any value, so you can use a potentially infinite variety of hues. In practice your computer will restrict you to a certain palette, but you will generally be able to use more than eight colours.

An analogue display is only useful if the computer has an analogue RGB output. You should check with your supplier if you are in any doubt about this.

Any colour display can suffer from alignment problems. In such a case, the relative positions of dots in each primary colour is skewed so that coloured shapes have borders in other, unwanted colours, and white displays will appear to be off-colour. These effects can be concealed if you test a display with text in primary colours on a black background, so you should also look at a range of colours on a white background. If the guns are misaligned, the white may look off-colour and there may be coloured fringes around some shapes.

Character study

I read with interest the article on the Oberon Omni-Reader in the April issue of *PCW*. Is there a machine that can read printed or photocopied text (with no limitation of typefaces), and read dot-matrix printing? What exactly is the 'learn mode'? What interface software is available?
Jesus Maria Boccio, Brussels, Belgium

We've had quite a few letters on this subject. Unfortunately, I know of no reasonably-priced machine that can read 'any' text, regardless of size or style. In essence, the problem is that there's so much variation between typefaces that the differences between one style and the next outweigh the similarities between identical letters.

Computers find distorted or patchy text hard to read, while humans can compensate for such errors without much effort. However, people often confuse characters which are mirror images of each other — 'b' and 'd', for example — while computers see such distinctions as clear cut.

Even the Omni-Reader, which can only read one typeface at a time, makes an occasional mistake. There's little doubt that more general reading machines will be developed, but it will take some time.

Generalised character recognition will certainly benefit from the availability of new microprocessors and algorithms (such as those used in speech and vision analysis), but it will be some years before the system you describe becomes available at a price comparable to that of a small computer. You should also bear in mind that such systems become less reliable as they are progressively made more flexible — a machine that can handle a mixture of four typefaces has more scope for error than one which confines itself to a single size and style.

Experimental systems to read handwriting are costly and unreliable at present, although simpler 'pattern-matching' systems which can recognise signatures are creeping onto the market.

Even the most expensive character readers (used by banks and large businesses) are restricted in the character sets they can recognise. In fact, the Omni-Reader performs well in comparison with many such devices, which often require special OCR character sets — letter-shapes which have been re-designed so that their differences are accentuated. The oldest and tattiest of these shapes is called OCR A, the blotchy, rectangular style of lettering used along the bottom of UK bank cheques.

Oberon hopes to add a learn mode to future models of the Omni-Reader, which will allow you to 'teach' the machine a new typeface by presenting it with each symbol, and by telling the machine (probably via your computer keyboard) the corresponding character.

This is likely to be a fairly intricate process, and it will take care to get results as good as those for the pre-programmed typefaces, but it should allow you to process, for example, documents printed in a specific dot-matrix typeface.

The Omni-Reader uses a standard two-way RS232 interface, which means that it behaves very much like a remote terminal or telephone modem. You'll need to find a cable to link the reader to your computers — the device has a standard 25-pin D plug, then almost any communications package should allow you to copy data from the device to a disk file on your computer.

Oberon can supply specially-written software to link the reader with some common business computers. For further details, telephone (0442) 3803. END

Paging Prestel

Improved access to Prestel and the low-down on PSS are covered by Peter Tootill in this month's round-up of networks news.

BT is introducing new equipment which will give improved access to systems such as Prestel and Telecom Gold. It will extend local call access to 96 per cent of telephone users, and provide a quicker connection. Most people call Prestel by dialling a three-digit code (often 618) but it can still take several seconds for the Prestel modem tone to appear. The new equipment is claimed to make the connection in half a second, and installation should be completed next year.

The local call access will include access to the Prestel editing computer, which is a big advance if you want to edit Prestel pages. At present you have to call a London telephone number.

The ClubSpot pages in the Prestel Microcomputing area should benefit from this. These pages are run by the ACC (Association of Computer Clubs) and are open to local computer clubs to edit. The club can put up details of its aims, programmes of meetings, and so on. One of the problems has been that many clubs have been unwilling to contribute because of the cost of the telephone calls involved. If your club is interested, contact the ACC at the address given in End Zone, page 230.

The new system will also provide 2400 bits/sec full duplex (CCITT V.22bis) access. This will be of academic interest to the average home user for the time being, as suitable modems are still uncommon and cost well over £500. However, prices should come down eventually — it's not long since a simple 300 bit/sec modem was expensive. Users with 300bit/sec modems will also be able to use Prestel, in the same way as can now be done via PSS.

PSS

PSS (Packet Switch Stream) is British Telecom's packet-switching data network. It is basically a network for data communication, in the same way that the ordinary telephone system is a network for voice communication. And, just as it is only worth having a telephone if other people you want to talk to have one, so it is only worth having a PSS account if the online systems you want to communicate with are connected to it. It isn't like Prestel, which is a system that you call for its own sake.

What will you find on PSS? There aren't many systems that are open to the public, most are for subscribers only. Indeed, to use many (such as Telecom Gold, Dialog, and so on) you don't even need to have your own PSS account; you just dial your local PSS access point (a local call for most people) and use the appropriate account number. One of the best-known systems that can be used by anyone who has a PSS account is Essex University's MUD, but this is only available during restricted hours. (There were rumours at the time of writing that Essex's MUD will be closing down, and that British Telecom has bought a new version (Son of MUD?) which I assume will be available on Telecom Gold where BT already has a number of games (see Chipchat *PCW* July).

Prestel can be used via PSS, and this enables people who haven't got 1200/75 modems (or who can't use them because their computer won't allow split baud rates) to use Prestel. The relevant PSS address (the PSS equivalent of the phone number) is A21920100620. Apparently, there is also a PSS address that gives you Prestel without the graphics, so you don't even need special software to use it. If you want to see what Prestel is like, there's a demonstration ID available — you use account number 4444444444, password 4444.

One of the advantages of PSS is that it is linked to other international packet networks, and you can communicate with systems in other countries much more cheaply than if you were to dial direct. For example, a phone call to the US works out at £35/hour (+ VAT) at cheap rate, and £43/hour at peak rates. PSS charges would come to between £10 and £15 per hour, depending on how much data is transmitted. In this way, you can use systems in the US such as The Source and CompuServe.

A PSS account costs £25 plus £6.25 a quarter. On top of this, there are time charges for inland calls of around £1 an hour and data charges of 15-25p per kilosegment (PSS insists on measuring data in 'segments' — one segment is 64 bytes). International calls cost from £1.32/hour and £1.20 per kilosegment (Europe) to £6/hour and £4 per kilosegment for intercontinental calls. The costs work out at about £1.50 an hour for inland calls and £10 an hour for the US. Add about 50 per cent if you use a 1200/75 or 1200/1200 modem, as you can shift more data in the same time. On top of these, you still have ordinary telephone charges for the call to your local packet-switching exchange (PSE).

Why 'packet switching'? The name comes from the way the system works: it breaks your data into chunks, adds details such as who sent it, where it's going and how it fits together with the other blocks you send. These blocks are called 'packets'. Each packet, along with those from everyone else using the system at the same time, is sent independently on the network to the destination — your packets may not all go by the same route. At the other end, they are reassembled into your original data and passed to the system you are calling.

The thing that does the breaking up and reassembling of the data is called a 'PAD' (packet assembler/disassembler). The system is standardised internationally so that a British PAD can talk to an American PAD, and so on. The protocols used are specified by the CCITT X.25 standard (the CCITT is an international standards organisation).

Expensive calls

I have recently discovered that British local phone call charges are among the world's highest, but this may come as no surprise to you. What may come as a surprise is that our long distance and international calls are some of the cheapest in the world!

For example, a three-minute standard rate local call costs 11p in Britain, 6.5p in the US, and 6-7p in other European countries (in Canada, local calls are free!). A similar long distance call would cost 43-54p in the UK, 30-90p in Europe and around £1.20 in the US or Canada. International calls vary depending on distance, but from the UK, say £2-£3 for three minutes and £4 from the US or Canada. Germans would pay around £6! It can cost you less to call a US bulletin board from the UK, than an American calling long distance in his own country. END

UK free networks

Bulletin Board	Phone Number	Notes
Aberdeen ITEC	(0224) 641585	V.23
BABBS-Bath	(0225) 23276	300/300 baud rate; 9pm-8am weekdays, 9pm-noon weekends; Atari-based system, ring-back system
BABBS-Felixstowe	(0394) 276306	300/300 baud rate; 24 hours daily; Apple users' group
BABBS TWO-Basildon	(0268) 778956	300/300 baud rate; 24 hours daily; Apple users' group with special area for queries to Apple UK
Basildon ITeC	(0268) 22177	Prestel type service
	(0268) 25122	Atari based 300 baud. 24 hour
BASUE	(01) 373 6337	24 hour
Blandford Board TBBS	(0258) 54494)	300/300 baud rate; 24 hours daily
CABB TBBS	(01) 631 3076	300/300 baud rate; 24 hours daily + 1200/75
CBBS SW	(0392) 53116	300/300 baud rate; 24 hours daily
CBBS Surrey (Woking)	(04862) 25174	1200/75 and 300/300 baud rates; 24 hours daily; jokes, jobs, reviews, news
Chatham (Kent)	(0634) 815805	6pm/9am daily + weekends 7 bits, even parity; sales and wants — cars, houses, computers
CNOL Lancaster TBBS	(0524) 60399	300/300 baud rate; 24 hours daily; Clinical Notes Online service, mainly for medical users; works in conjunction with a database on the Datastar network
Computers Incorporated Newcastle (CBBS)	(0207) 543555	300/300 baud rate; 24 hours daily; primarily business-oriented
Forum 80 Hull	(0482) 859169	300/300 baud rate; 5-11.30pm weekdays, noon-11.30pm Sundays, Bell 103 standard, midnight-8am daily; international electronic mail, library for up/downloading
Forum 80 SPA	(0926) 39871	300/300 baud rate; 11pm-midnight daily; TRS-80 and Genie users' group
Forum 80 Wembley	(01) 902 2546	300/300 baud rate; 7-10pm weekdays, midday-10pm weekdays; electronic mail, library for down loading; ring and ask for Forum 80
Fido Compulink	(06286) 63571	24 hour
Fido Fastnet	(051) 260 5607	10pm-8am BELL 103/212a tones only at present
Fido Fore TBBS	(01) 301 4110	Fido 1am-8am
Hackney BBS	(01) 985 3322	V.23 Password: PUBLIC
Hamnet Hull	(0482) 497150	300/300 baud rate; 6pm-8am daily
Livingstone, Scotland	(0506) 38526	Atari, 24 hours daily
London Underground	(01) 863 0198	24 hours V.21/V.23 (Viewdata coming soon) BBC Based (colour for BBC users)
Liverpool Mailbox TBBS	(051) 4288924	300/300 baud rate; 24 hours daily; sponsored by INMAC; electronic mail, program downloading, TRS-80 information; messages for *PCW* can be left on the board and will normally be read by us within 24 hours
Mactel (Nottingham)	(0602) 289783	V.21/V.23 Macintosh users 24 hours daily
Mailbox-80 W Midlands Stourport TBBS	(0384) 635336	300/300 baud rate; 6pm-8am daily
Manchester Open Bulletin Board TBBS	(061) 7368449	300/300 baud rate; 24 hours daily + 1200/75
Marctel	(01) 346 7150	10am-10pm daily (24 hour coming, watch for announcement on Marctel) BBC based system (FBBS) with colour for Commstar users
MBBS-Mitcham	(01) 648 0018	300/300 baud rate; 24 hours; BBC-based system with jokes, graffiti, electronic mail, and Atari and BBC sections
MG-Net CBBS London	(01) 399 2136	300/300 baud rate; 5-10pm Sunday; electronic mail, program downloading
Microweb Manchester TBBS	(061) 4564157	300/300 baud rate; 24 hours daily; *Micro User* magazine, mainly for BBC users
NBBBS-North Birmingham TBBS	(0827) 288810	300/300 baud rate; 24 hours daily
NBBS-E BBC Micro	(0692) 630186	BBC Based 24 hours daily
NBBS Lutterworth	(04555) 4798	Mon-Fri 8pm-11pm; Sat 9pm-10pm; Sun 9am-12.30pm
NKABBS	(0795) 842324	9.30pm-midnight
OBBS Manchester	(061) 4271596	300/300 baud rate; weekdays except 7pm-9pm, weekends except 10am-10pm
Octopus RAS	(0272) 421196 (Bristol)	6pm-8.30am V21 using public domain Octopus software
PIP-Sheffield TBBS	(0742) 667983	300/300 baud rate; 24 hours daily. Bell 9pm-8.00am
REACT UK	(0376) 518818	24 hours. Mainly Dragon
SABBS Glasgow	(0698) 884804	Atari, 24 hours daily
SBBS Southern	(0923) 676644 (Watford)	11pm-8.30am daily; BBC based V.21/V.23
Southern BBS	(0243) 511077	300/300 baud rate; 8pm-2am daily; ring-back system (dial the number, let phone ring once, and then ring back); messages, downloading
Stoke ITEC	(0782) 265078	300/300 baud rate; 24 hours daily; remote CP/M system
Teletrieve (CTC)	(0484) 657299	6pm-8am
TBBS London	(01) 348 9400	300/300 baud rate; 9am-7pm daily
TYNESIDE BBS	(091) 251 4271	V.21 BBC based
VISA	(01) 958 7098	8am-11pm daily V23 Prestel type
WABBS-Worthing	(0903) 42013	300/300 baud rate; 24 hours daily; ring-back system (dial the number, let phone ring once, and then ring back); Atari-based

UK subscriber commercial/business systems

Bulletin Board	Phone Number	Notes
Comet	(0527) 28515	Message handling system: Details from Istel Ltd, Grosvenor House, Prospect Hill, Redditch, Worcs
Micronet 800	(01) 278 3143	Prestel database information for micro users. Details from Micronet 800, 8 Herbal Hill, London EC1R 5EJ
Prestel	Freefone 100 Prestel sales	Subscribers only
Telecom Gold	(01) 403 6777	All information from Sales Admin, 60-68 St Thomas Street, London SE1 3QU

TRANSACTION FILE

Your chance to buy, sell or swap equipment.

● BBC "B" DFS, £250. Torch CP/N card and Perfect software, £200. Dual TEAC 40/80 DS Drives, £200. Green monitor, £50. Epson FX100, £300. The lot £950. Will split. Tel: (0256) 75717 (Tozer).

● SHARP MZ80A 48k. Immaculate condition. Built-in monitor and cassette deck. Over £150-worth software, £250 ono. Tel: Andrew on (0706) 343791. 36 Great Howarth, Smallbridge, Rochdale (after 6.30pm).

● COMMODORE 3032, switchable 80-column board, Basic 4, £250. Easyscript for 64, £20. 3M photocopier, £50. Will exchange BBC/Tandy or anything interesting (plus cash). Tel: John on (0429) 34346 or 74318.

● EPSON HX20. Microcassette drive, expansion unit, H020 display adapter, documentation, some software. Needs new battery pack, £350. TF20 dual disk drive. As new, £400. Tel: Crowthorne (0344) 771395.

● MICRO FOCUS Cobol for the Sirius 1. Complete with manual, £25. Tel: Bordon (04203) 7194.

● APPLE system ITT 2020, 48k, twin disk drives, matching TV/monitor, colour card, paddles, four boxes, disks, manuals, magazines, £400. Tel: Warrington (0295) 827649 (eves).

● SINCLAIR SPECTRUM. Interface one, two microdrives, printer, £250. Software, books, £250 ono. Acorn Electron, £75 ono. WANTED BBC Model B, plus interface and disk drive. 6 Queens Road, Camberley, Surrey, GU15 3AN. Tel: (0276) 65275.

● SANYO MBC555. 256k RAM, WordStar, CalcStar, DataStar, and some other software, £700 ono. Tel: Hartlepool (0429) 61667 (anytime).

● ACT SIRIUS. 80 card CP/M-80 for the Sirius. made by Sirius Systems Technology, £50. Tel: 021-350 3531.

● VIDEO GENIE EG3003. 16k, built-in cassette, 12in green vdu, Sekoshia GP 100A printer. Computer desk, catalogue books, lots of programs. Galaxy Invaders, Nova, Inventory, Typing, £400. Tel: Durban on Wokingham (0734) 775192.

● MSX 64k Toshiba, boxed, 3 months old, £146. Any demonstration. Original software, printer lead, joystick, word processor. All below half price or negotiate deal. All perfect condition. Tel: Luton (0582) 32365.

● GENIE 364k. CP/M2.2, twin 80-track 600k drives, detachable 88-key keyboard, RS232 parallel interfaces, runs TRS-80 programs, CP/M software, WordStar, Cardbox, Accounts, various languages, utilities, games, manuals, £850. Tel: Davies on Wolverhampton 23735.

● EPSON HI-80 plotter, £360 ono. Can be also used as a printer. Still under guarantee (9 months). Used for software development, now surplus to requirements. Tel: Slough (0753) 683854 (eves after 7pm)

● SHARP MX-80A personal computer. Built-in Hi-Res screen, tape, superb keyboard, pure 48k. Runs M/code, Basic, Pascal, Forth. Immense graphics/music capability, universal printerface, lots software, manuals, £225. Tel: (0734) 788300/871142.

● LISA APPLE software. Nine disks Office System I, Office System II, Draw, Project, Write, List, Graph, Calc, Guide. £30 each. £200 the lot. Tel: 041-637 4418 (after 6pm).

● XEROX 820. With dual 240k disk drives and boxed WordStar and SuperCalc, £500. Tel: St. Albans (0727) 58031.

● ZX MICRODRIVE and lead for QL! Boxed, hardly used, also will give 6 cartridges, £25. Tel: Richard on (0772) 58044 (day), (0772) 713941 (night).

● CLEAROUT. 40 used Apple II+ disks, many with programs on, £20. Tel: Richard on (0772) 58044 (day), (0772) 718941 (night).

● DAISYSTEP 2000 d/wheel printer. Fully WordStar compatible. Qume daisy and ribbon, ideal for BBC or any with Centronics port. Never used, selling due to imcompatibility with NewBrain, £190 ono. Tel: 01-794 7030 (after 6pm).

● APPLE III software, Orbit System, General Ledger, Purchase Ledger, Sales Ledger, Plus Sprite and manuals. Also Apple Writer II . Offers please. Tel: 01-249 5881 (pm or w/ends).

● LEAR SIEGLER ADM-3A video terminal, £135. Memory chips: 64k Dynamic 200 NS, £20 for 8. 16k Dynamic 200 NS, £5 for 8. Golfball typewriter/RS232 terminal (with documentation), £135. Tel: 01-451 0520.

● SIRIUS I, 128k, 1.2Mb floppy disks, plus MT80 printer, CPM 86, MS-DOS, Async, SuperCalc, WordStar, leads, £1,000. Tel: 01-788 3583.

● MZ-80A 48k. Integral monitor and cassette, Centronics interface card, Basic interpreter, compiler, toolkit, assembler, Pascal, Reportwriter, games, books, manuals, £250 ono. Seikosha GP100A printer, £125. Tel: 01-346 1527 (eves).

● FOR SALE Apple II+ Copy, Disk II, RAM card, CP/M Comcard, monitor, Pascal, mags, etc, £480 ono. May split, also semiworking 80-col card, £20. Tel: Farnborough (0252) 549481 (eves).

● ZX SPECTRUM 48k, Cover, interface, 2 microdrives, 5 cartridges, Hisoft Pascal, Valhalla, 2 books, £180. Tel: (0454) 612487.

● ORIC-1 48k. In very good condition, boxed with manual, back issues of Oric Owner magazine, tapes, book, £75. Computer compatible cassette recorder (used with above), £15. Tel: Harrogate (0423) 863726.

● BBC B and DFS and 800k disk drive, Kaga KP810 and Wordwise Plus and £500-worth of software, disks, books, magazines, joysticks, etc. Worth £1,500, only £850 ono. Tel: Jonathan on (0992) 57805 (after 4pm).

● NEW Hewlett-Packard 110 portable. Totaly unused, £2,500 ono. Tel: Southampton 223607, (Ron, Flat 12, after 6pm).

● CP/M add-on for Atari computers, Z80, Serial parallel I/Os, built-in power supply fully encased, complete with CP/M MyDos plus many CP/M programs. Brand new, £250. Tel: Luton (0582) 32752.

● COMMODORE CBM 2001. Small keyboard, integral cassette, new ROMs, 64k memory board, sound box, £175 ono. Petchess disk and manual, runs on any CBM machine including 8000 series. Tel: Cannock 4835.

● SHARP MZ80A. Vgc. Expansion unit, Sharp P6 printer, 6 languages, 160 programs, manuals, £450. Tel: Sunbury 86490 (eves).

● WANG PC with 10 megabyte internal hard disk. Epson FX100 15in printer. Lots of software, wordprocessing, database, business graphics, Multiplan, Asynchronous Communications, Basic. Tel: 01-672 1255 ext 5104 (day).

● VIDEO GENIE EG3003, with lowercase mod, £50. Green screen monitor EG101, £30. Centronics interface EG3016, £20. Scripsit word processor, £25. Tel: Hatfield (07072) 61397.

● MICROVITEC CUB 653, £249. QL Centronics interface, £29. Typing course, £12. Eleven microcartridges with Transform Box, £14, etc. Two months new! Tel: 01-407 8989 ext 2383 (day), 01-289 1404 (eves) Swee Lip.

● COMMODORE 8k PETS (2) 2001 series, small keyboard, cassette and monitor, old ROM or new. Books include Pet Revealed and Graphics, Raeto West, etc. Offers? Will separate. Tel: Worthing (0903) 203358.

● TANDY/GENIE Basic and m/c books. Worth £90, sell £40. Video Genie sound box, lowercase, matching vdu, Jupiter Ace 16k RAMpack plus £300 software, all £120. Tel: Wakefield 252228 (eves).

● COMMODORE PET 32k, 12in screen, full size querty keyboard, Basic 4.0, complete with manual. Only £170, or nearest offer. Tel: Bradford (0274) 637972.

● CBM 700. 128k RAM, RS232C IEEE user ports. With monitor or without. All leads and manuals included. For details call Coventry 461627 (after 4pm).

● COMMODORE 4032, 8050 disk drive, Epson MX80F/T, wordprocessor and spreadsheet programs. Offers around £995. Ex-VAT. Tel: (0206) 564832 (day), 45667 (eves). Buyer collects.

● ACT SIRIUS. 1.2 meg, boxed, Pegasus Accounts (4 modules), DBase II, hardware manual, £2,495. Ex-VAT. Tel: (0206) 564832 (day), 45667 (eves).

● EPSON HX-20. Expansion unit, no manuals or charger. Good condition. offers over £200. Brand new Amstrad CPC464 (colour), software worth £60, database, spreadsheet, games, £300 ono. Tel: Leon on 01-881 3435 (day or eve).

● SHARP MZ80K. 48k, several Basics, wordprocessor, spreadsheet, database, and some games. Hardly used. Excellent condition. Dust cover, £225. Tel: (0892) 27322.

● CBM 4032 PET. Complete with monitor, cassette deck and full manual, plus Strathclyde Basic course. £300 ono. Tel: (073687) 500.

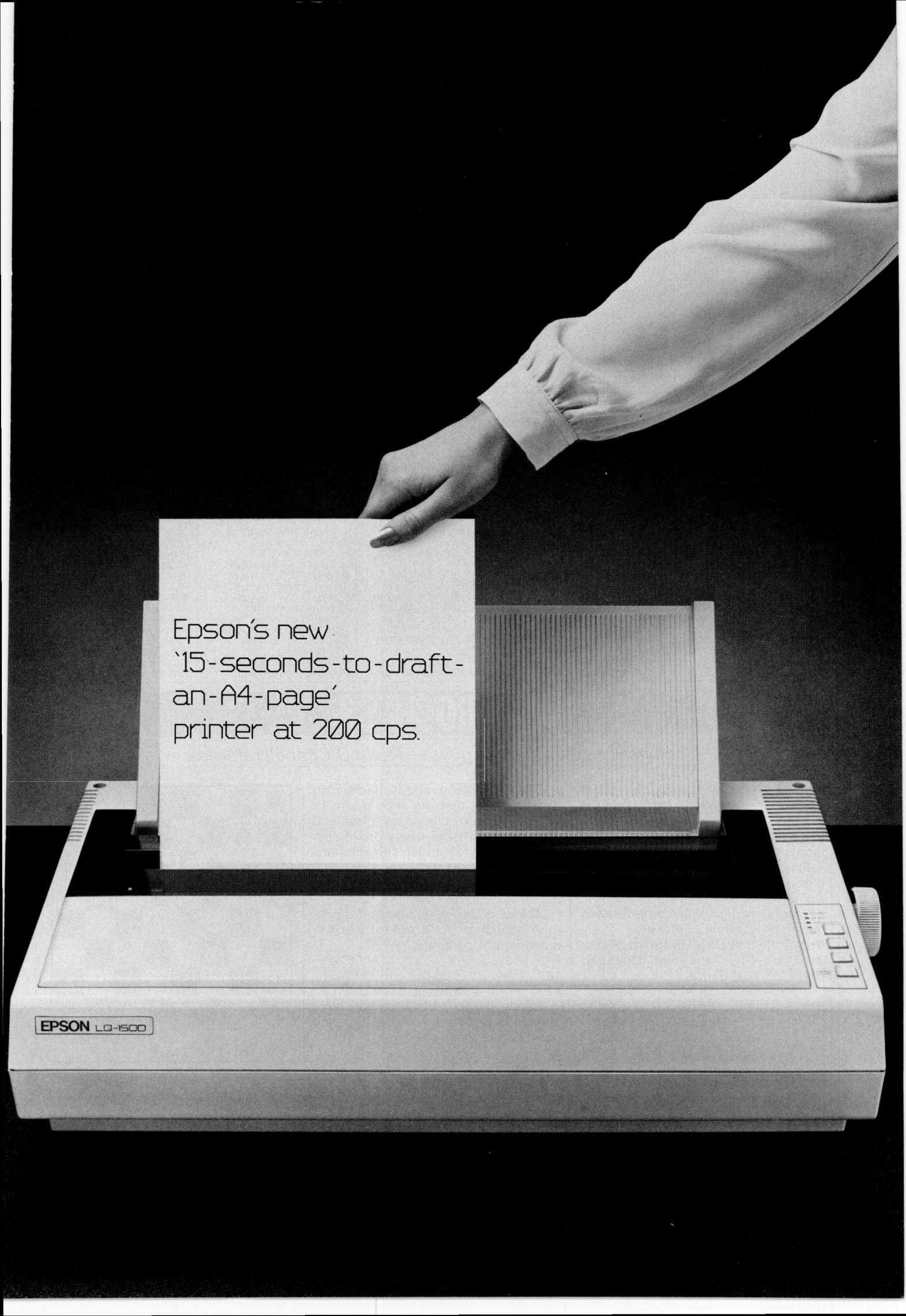
● APRICOT PC. 256k, 2×720k drives, 9in monitor. SuperPlanner, SuperWriter, SuperCalc, File'N'Find, database. Purchased October 1984, still under guarantee. Offers around £1,325. Tel: (0506) 412162.

● SANYO MBC555. Dual 160k drives, Hantarex monitor. 12 months June. Unused 1985, original software, manuals. Everything in mint condition, £800 ono. Tel: Barnsley (0226) 711316, K. Hirst, 2 Woodland Villas, Grimethorpe, Barnsley, Sth Yorks.

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photocopy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to *Personal Computer World*. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send your completed form to: Transaction File, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.


Epson's new
'15-seconds-to-draft-
an-A4-page'
printer at 200 cps.
EPSON LQ-1500

TRANSACTION FILE

● SUPERBRAIN II QD. 64k RAM, RS232C, software and manuals for CP/M, SuperCalc, WordStar, SuperSort, DataStar, CBasic and WordMaster, £300. Tel: Boyce on 01-644 3546.

● CANON P115GA. 132 col printer, parallel interface, 160 CPS. Hardly used (original ribbon), £300 inc. Tel: Hogarth Watford (0923) 31289.

● APRICOT 256k computer, 2 × 720k drives. 12 in monitor and stand. Canon PW1156A 15in printer. Sage, Accounts, Payroll, Superwriter, Supercalc, Superplanner software, 20 spare disks. Cost over £3500. Unused in boxes, £2,950. Tel: 01-886 3268 (London).

● OSBORNE 1 required. 52 column, double density version. Tel: Dave on Aberdeen (0224) 724291.

● PROGRAM SET — version 1.00. Perfect Writer, Speller, Calc, Filer for IBM-PC. Unused. What offers? Also latest IBM-PC version Flight Simulator. Cost £55, accept £30. No offers! Tel: Sid on 0438-736030.

● IBM PC: Basic compiler £160 — list £280, APL program £110 — list £190, 8087/8088 diagnostics £145 — list £246, Basic program development system £70 — list £120; no VAT! Tel: Hayling Island (0705) 468778.

● SINCLAIR QL, including all leads, user guide latest issue, software and microdrive cassettes, plus QL14 colour monitor, £395. Will split. QL £260, monitor £135. Tel: Abergele 0745 823101.

● COMMODORE 64 120. Toshiba HX10 MSX, £190. Both new and boxed. Tel: 01-952 0687.

● FOR SALE. COMMODORE MPS801 printer. Brand new, never used. Unwanted gift, bargain at £175. Will post. Tel: (0427) 873-832 (anytime).

● IBM PC Compatible business computer. Complete with monitor and printer. Twin disk drives, large memory, manuals and all cables. Some software included, £1,595. Tel: (028 373) 3574.

● APPLE II Europlus 48k. Monitor, 2 disk drives, paddles, 80 column, colour, language, Centronics cards, Pascal, Logo, format 80, utilities, Applewriter I, Bit Copier, Books, £750 ono. Tel: (0304) 830790.

● IBM-PC Bits Multiplan, £70 — cost £140. Easywriter, £60 — cost £150. Basic compiler, £100 — cost £240. Math coprocessor, £100 — cost £215. APL, £90 — cost £175. Tel: Bob on (0705) 523859 (after 6pm).

● TORCH-BBC monitor, Perfect software, MBasic, BBC Basic Z80, DBase 2, Wordwise, Micronet, roms. Modem, mint condition, £1,100 ono. Tandy 3 48k dual drives, RS232, wordprocessor, mailer, database, Newdos-80, disc games (50+), £450. Tel: (07072) 65466.

● SEIKOSHA GRAPHIC PRINTER. — GP100A — for sale. Picture and graph output capabilities, input/output connector for Osborne/BBC. Excellent condition, £75. Tel: 01-789 2922 (eves and weekends).

● GEMINI BOARDS: GM813 cpu/RAM, £150, GM812 IVC, £100. GM829 FDC, £90. 8in drives, £100 each; or above as working system with cp/m, £450. Tel: (0689) 32344 (after 7pm).

● BBC: nine cassettes (games, utilities, music etc), nine books (programming, listings etc). All unused. Retail £150 approx, will accept £70 ono. 7 copies 84/85 Acorn User included free. Tel: Bennett on Newmarket 720619.

● WANTED. SHARP MZ700 floppy disc I/F and disc Basic, RS232 or Centronics I/F, software and compilers. Tel: (0604) 830399 (eves/weekends).

● APPLE II Green Screen Monitor. New and unused, in packing, with warranty card, £85. Beebug mags, vols 1-2 (20 issues) in binders. Cost £27, accept £12. Tel: 01-444 6244 (eves, N.London).

● EPSON QX-10 plus Epson FX80 printer, barely used. 192k RAM, 2 × 320k floppies. Complete system including manuals and Peachtree software, £1,700 ono. Tel: 01-337 5663 (after 6pm).

● TWO SINGLE SIDED Micropolis 96tpi drives and two double sided 48tpi disk drives, each £35, in good working order. Tel: Douglas on Letchworth 79663 (eves only).

● COMMODORE 64 PLUS Datassette, plus software including 20 games. Boxed as new, £150. Also Mikro 64 cartridge, £45. Microvitec colour monitor, 6 months old, £195. Tel: 01-876 7250 (after 6pm).

● NOVEX hi-res, amber tube monitor. Boxed, hardly used, £74. Also Brother EP22 typewriter/printer A/C adaptor, roll thermal paper, boxed, mint, £74. Tel: Haydn-Davies on Nottingham 203564.

● WANTED. Assembler program on cassette for Newbrain. Write, 74A Felpham Road, Felpham, Bognor Regis, West Sussex or Tel: (0243) 865264 (weekdays before 5pm).

● APRICOT 2 × 315k drives, Supercalc, Superwriter, etc. Plus Epson FX80 printer, other software, spare disks, all as new, £1,800. Tel: Fareham (0329) 221970.

● SIRIUS WANTED! Any model will do but must be in good working order. (Could offer F1 Apricot in part exchange). Tel: Linda on (0908) 310737 (days) or 318270 (eves).

● 'HALF PRICE' BBC B. Over 500 cassette programs and original supporting manuals etc. Acoustic Coupler, Thorn EMI 2000, Micronet in ROM, VS IV cassette and disc. Software/ROMS: Wordwise Plus, Addcomm, G.Dump. Tel: (0278) 684116.

● BBC B OS1.2 Watford DFS, Cumana CS100 disk drive, Microvitec, RGB colour monitor. All manuals including Advanced User Guide. Immaculate condition, £600. Tel: Sevenoaks (0732) 453744.

● WANTED. Software for Sirius 1, anything considered especially Basic compiler. Also any books on the operating system software. Tel: Mr Ward on Bradford (0274) 590824 (day) or 567570 (eves).

● ADVANCE 86a with 128k. Good working order plus cassette recorder and leads. 8086 programming book (IBM comp), £195. Tel: Dave on Stevenage (0438) 356404.

● TI PROGRAMMABLE 59 CALCULATOR. Program storage up to 960 instructions, reads and writes magnetic cards, reciprocal keys, powers and roots, logarithms, angular mode keys and trigonometric keys. Including charger and personal programming manual, £25. Tel: Bordon, Hants (04203) 7194.

● BBC MODEL B. OS1.2 with Cumana 100k single disk drive. Also Phillips cassette recorder and lots and lots of software on tape and disk, £400. Tel: Barry on (0446) 743534 (after 5pm).

● SHARP MZ-80k. 48k integral display and cassette, with Basic Plus, manuals, dust cover. Perfect condition, £89. Tel: Bolton (0204) 45246.

● APPLE II+. All peripheral cards (80-col, CP/M, PAL etc), monitor, two brand new drives, sixty disks of software, Wordstar, Visicalc, Supercalc, Pascal, tools, games, etc. Manuals, £970. Tel: 01-527 3294 (eves).

● HITACHI COLOR PC. MS-Dos, Microsoft, Cobol. Wordstar Professional, Calcmaster, Nucleus, plus other software books. All manuals, cables etc, still warranted, £1,595 ono. For details tel: Caterham (0883) 47320 (eves).

● BBC MODEL B. Kaga green screen with Torch Z80 disk drives plus Perfect software and manuals. Wordwise ROM, Prism modem, plus ROM, £600 ono. Tel: Chris Clinch on Chichester (0243) 789915.

MICROCHESS

Good guys versus the bad guys — Kevin O'Connell referees.

Intelligent Software, includes chess programs among its range. Much time is spent testing them against other chess programs. Some of those test games deserve to see the light of day. Here is one of them that was played at 'blitz' speed — approximately five seconds per move for each program. I leave you to guess which program was written by Intelligent Software.

White: the Bad Guys' Program. Black: the Good Guys' Program. Opening: King's Indian Defence.

1	d2-d4	Ng8-f6
2	c2-c4	g7-g6
3	Nb1-c3	Bf8-g7
4	e2-e4	d7-d6
5	f2-f3	O-O
6	Bc1-e3	c7-c6
7	g2-g4	

(The 'Bayonet Attack', so-called because the thrust of the g-pawn, often backed up by the forward march of the h pawn, frequently proves fatal to Black.)

7	...	e7-e5

(The most sensible answer to a flank attack is a central counter.)

8	d4xe5?!	

(If White is serious about attacking on the king-side, then he should aim to keep the centre closed by playing 8 d4-d5. Flank attacks rarely prove successful if the defender can counter-attack in the centre.)

8	...	d6xe5
9	Be3-c5?	

(This is a completely wasted move, merely forcing Black's rook to move to a more central location.)

9	...	Rf8-e8
10	g4-g5	Nf6-d7
11	Bc5-e3	Qd8-e7

(Nicely judged. Black is now way ahead in development and has the more secure pawn structure.)

12	Qd1-a4	

(Another irrelevancy, which further helps Black's development.)

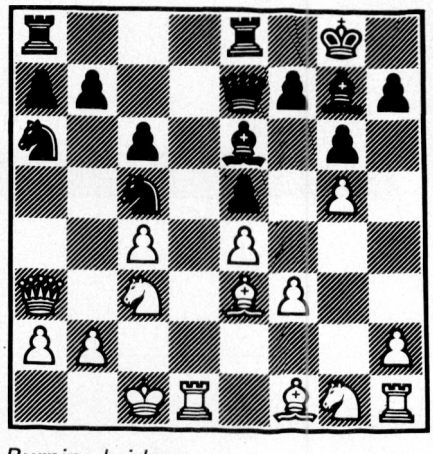
12	...	Nd7-c5

(Gaining still more time.)

13	Qa4-a3	Nb8-a6
14	O-O-O?!	

(White should only castle on the queen-side if his king-side attack is really going somewhere, which it is not, but he has already burnt his bridges.)

14	...	Bc8-e6



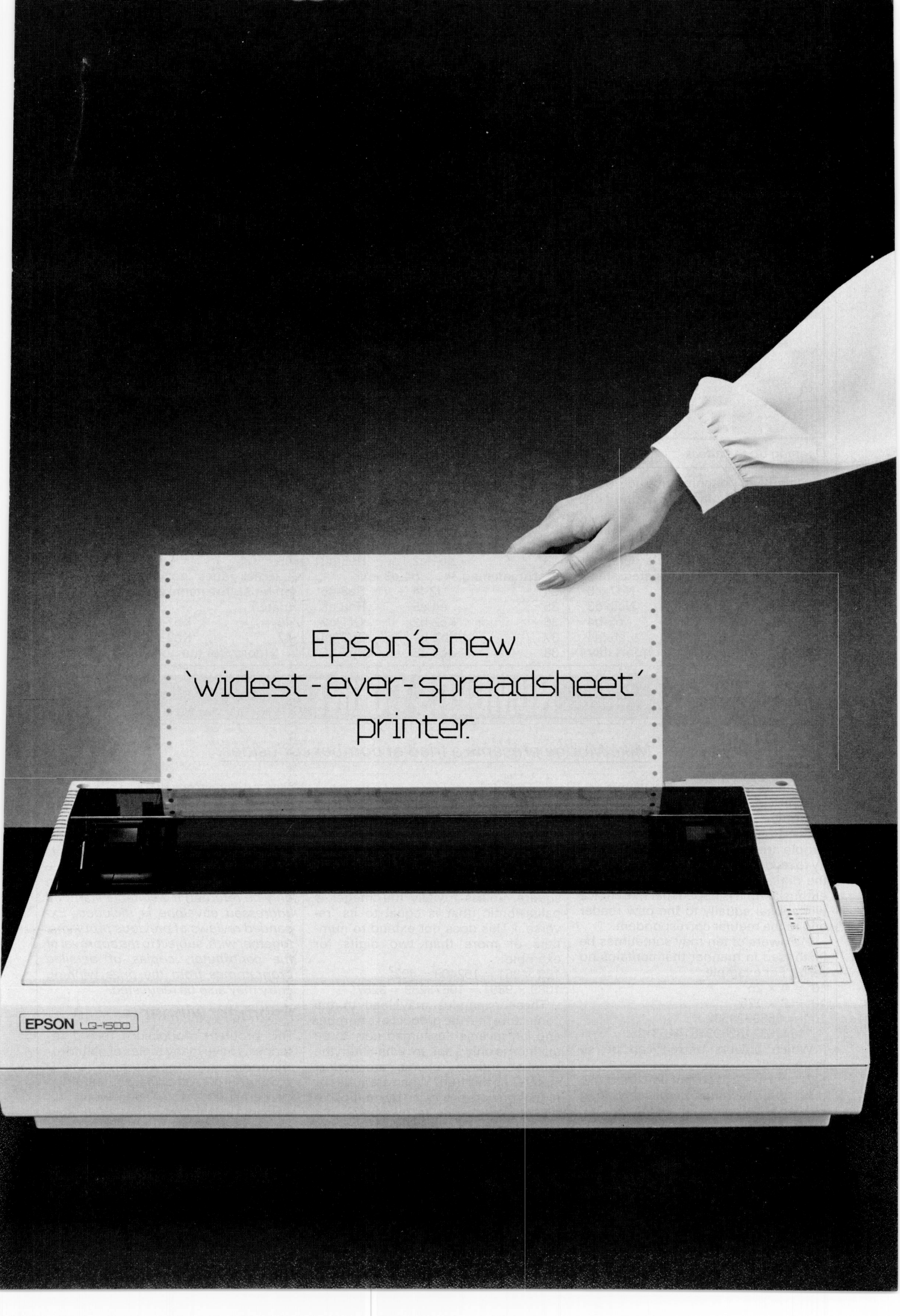
Burning bridges

15	b2-b4?	

(Asking for even more trouble. Black has completed his development and has his king in safety so now White, with few pieces developed and his king comparatively in the open, decides to open up the game still more ... oh dear!)

15	...	Nc5-d7
16	c4-c5	Na6-c7!

(Very nicely played.)

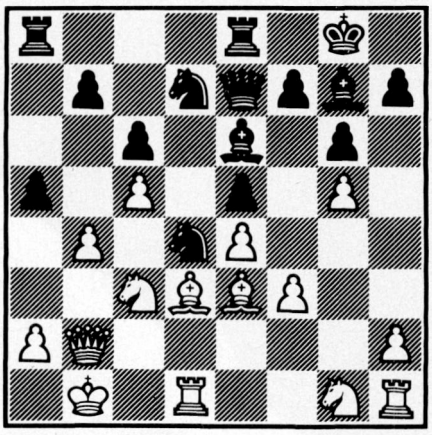

Epson's new
'widest-ever-spreadsheet'
printer.
EPSON LQ-1500

MICROCHESS

17	Bf1-e2	a7-a6
18	Qa3-b2	Nc7-b5

(Black continues to make steady progress.)

19	Kc1-b1	Nb5-d4
20	Be2-d3	a6-a5!



Opening up the attack

(Definitively opening up the queenside and lines of attack against the white king.)

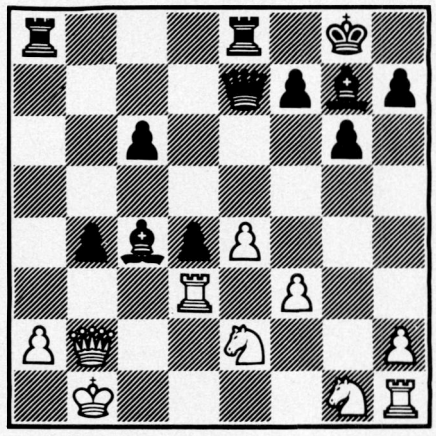
21	Nc3-a4	a5xb4
22	Qb2xb4	b7-b5!

(Winning a pawn, White's 'defences' in front of his king now disintegrate.)

23	Na4-c3	Nd7xc5
24	Qb4-b2	Nc5xd3
25	Rd1xd3	b5-b4
26	Be3xd4	e5xd4

(26. . . b4xc3 also wins comfortably.)

27	Nc3-e2	Be6-c4



A touch of steel

(Who has the bayonet now?)

28	Qb2-c2	

(If the rook moves, then 28 . . . d4-d3.)

28	...	Bc4xd3
29	Qc2xd3	Qe7xg5

(So much for the 'cold steel' of this Bayonet Attack.)

30	h2-h4	Qg5-g2
31	Rh1-h3	c6-c5
32	Qd3-c4	Qg2-f1+
33	Kb1-c2	Re8-d8

(Threatening 34 . . . d4-d3+.)

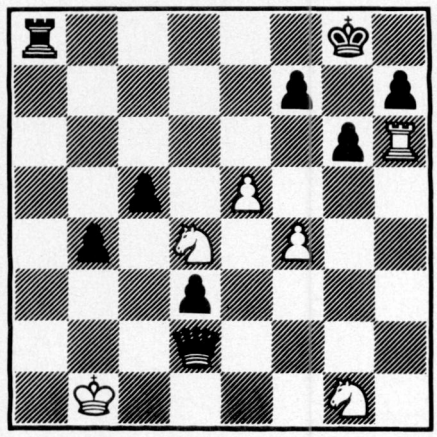
34	f3-f4	Ra8-a5
35	e4-e5	Rd8-a8
36	Kc2-b2	Qf1-g2
37	Kb2-b1	Qg2-g4
38	Qc4-d5	Bg7-h6

(Forcing the gain of further material.)

39	Rh3-f3	Qg4xh4
40	Rf3-h3	Qh4-e1+
41	Kb1-b2	Qe1-d2+
42	Kb2-b1	Ra5xa2

(White is dead, now it is merely a matter of playing on for as many moves as possible.)

43	Qd5xa8+	Ra2xa8
44	Rh3xh6	d4-d3
45	Ne2-d4	



Just a formality

45	...	Qd2-e1+!

(Black does not need any more material. The name of the game now is mate.)

46	Kb1-b2	Qe1-a1+
47	Kb2-b3	Qa1-a2 mate

(Hooray for the good guys.)

NUMBERS COUNT

Mike Mudge presents a triad of number curiosities.

The following triad of number curiosities provides an opportunity for the computer user to explore untrodden paths. Requiring only a knowledge of simple arithmetic operations, the ability to recognise certain patterns among the digits of an integer and a certain enthusiasm; it is hoped that this choice will appeal equally to the new reader and to the regular correspondent.

1) Powers of ten may sometimes be factorised in manner that contains no zeros. For example:

$10^2 = 4 \times 25$

$10^3 = 8 \times 125$

$10^{33} = 8589934592 \times$
116415321826934814453125

Which powers of ten can be so factorised?

2) It can be proved that powers of two exist which contain arbitrarily long sequences of zeros. For example:

$2^{10} = 1024$

$2^{53} = 9007199254740992$

The first string of eight zeros is found in 2^{14007} and starts at the 729th decimal digit reading from right to left.

Which are the smallest powers of two containing a string of zeros of a given length? Where does that string occur? Do similar results occur when the zero is replaced by another integer?

3) It can be proved that when a two digit decimal integer is multiplied by its 'reverse' the result is never a perfect square, unless trivially the integer is palindromic (that is equal to its 'reverse'.) This does not extend to numbers of more than two digits for example:

$169 \times 961 = 162409 = 403^2$

$1089 \times 9801 = 10673289 = 3267^2$

These examples may lead to the conjecture that the product of a number and its 'reverse' (assumed now to be distinct) is only a square when both the number and its 'reverse' are perfect squares. Is this true? When are cubes or higher powers produced by multiplication of a number by its 'reverse'?

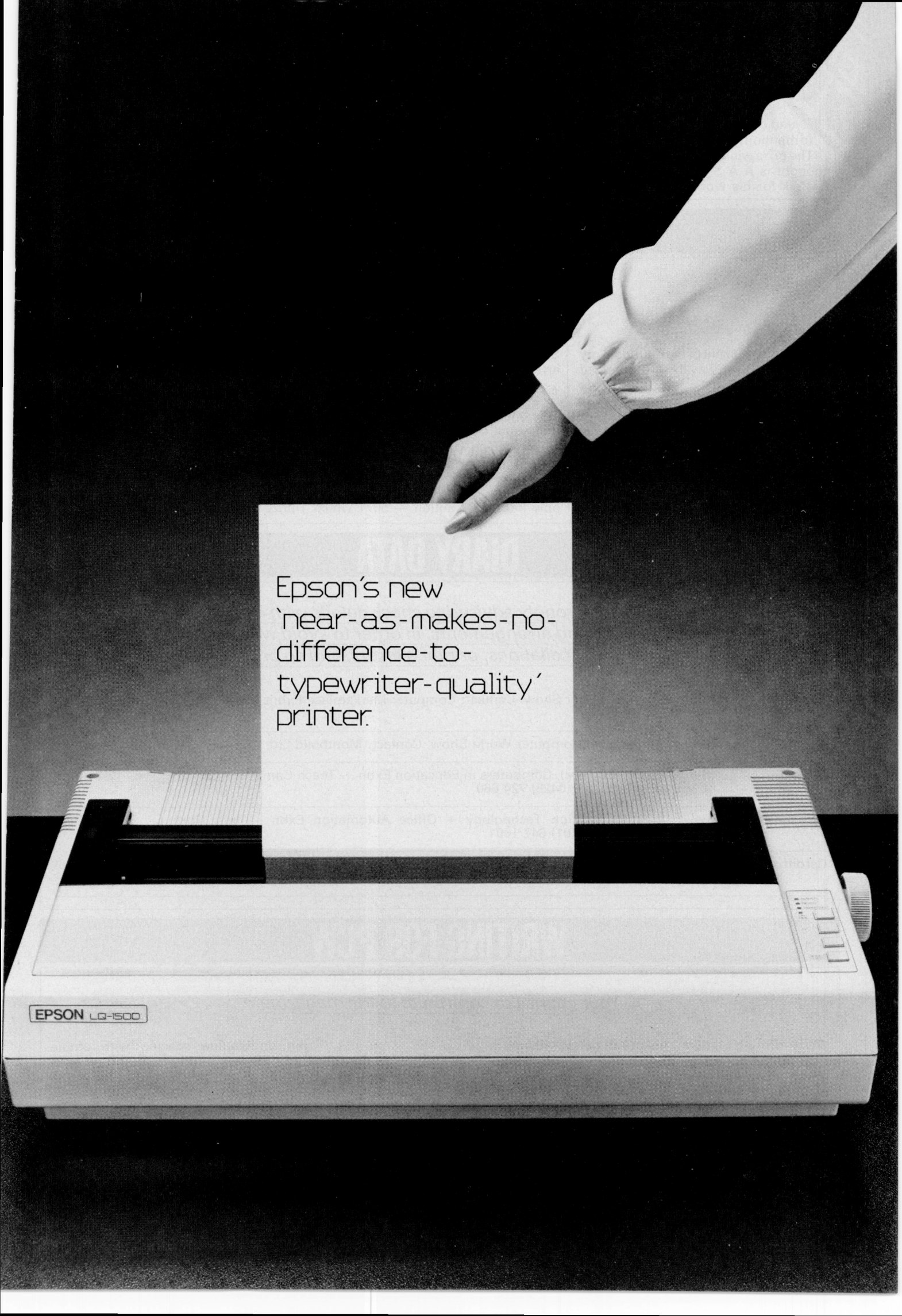
Readers are invited to submit their thoughts (preferably accompanied by computer related material!) relating to this triad of problems to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF. Tel: (0902) 892141. A suitable prize will be awarded to the 'best' entry received by 1 November 1985. Criteria will include accuracy, originality and efficiency, not necessarily in that order.

Please note that submissions can only be returned if a suitable stamped addressed envelope is included. Expanded reviews of previous problems, together with, subject to the approval of the contributor, copies of detailed programmes from the prize winning entry may also be requested.

February winner

This problem produced a record response. I have many tables of palindromic primes and n^{th} powers both base 10 and numerous other bases; enquiries for particular sets of data would be welcome and all programmers suitably acknowledged. The mystery of the palindrome attempt function applied to 196 has remained unsolved.

Additionally much empirical evidence on palindromic geometrical numbers has been produced and very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NUMBERS COUNT

efficient routines in languages, and on machines far too numerous to mention.

The prize winner, after a great deal of thought is A A S Randall, Lowestoft, Suffolk for his work on a Dragon 32 using both Basic and machine code written and run using DASM/DEMON assembler and monitor from Compusense Ltd.

Steve concentrated his efforts on squares, cubes, fourth powers, pentagonal numbers and of course the palindrome attempt function all in a range of number bases; leaving primes out of his study but presenting a well-documented and efficient set of results and programs.

LEISURE LINES

Brain-teasers from J J Clessa

Quickie

If I spend 25 per cent of the pounds in my wallet, and give away three-quarters of the rest, I'll have £6 left. How many pounds have I got?

Prize Puzzle

A bit easier than usual — but you will need your micros for it. What number when divided by 11 and multiplied by 13 gives the original number in reverse? Answers on postcards only (or backs of envelopes) to *PCW* Prize Puzzle, August 85 Leisure Lines, 32-34 Broadwick Street, London W1A 2HG. Entries to arrive not later than 30 September 1985.

May Prize Puzzle

This one must have been a bit harder than usual, since only about 110 entries were received. One reader said he gave up on his own PC and used the larger machine at work.

At the time of setting the problem I only had one solution — 5671 which splits into 2701, 1485, and 1485. As many of you pointed out, 5886 is also a solution — forming 1596, 2145 and 2145.

Both of these solutions can be deemed to be 'well over 5000 birds . . .' and therefore I accepted either for prize eligibility (the next solution was in excess of 12000 so was disqualified).

The winning entry came from Andrew Norris of Bridgwater, Somerset. Congratulations Andrew, your prize is forthcoming.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer's errors, and so on.

London	(Barbican), Acorn User Show. Contact: Computer Marketplace Exbns Ltd, (01) 930 1612	25-28 July
London	(Olympia), Personal Computer World Show. Contact: Montbuild Ltd, (01) 486 1951	4-8 Sept
Esher	(Sandown Exbn Centre), Computers in Education Exbn — Teach Computer. Contact: TCM Expositions Ltd, (0428) 724 660	12-14 Sept
Manchester	(Belle Vue), Information Technology + Office Automation Exbn — Info North. Contact: BED Exbns, (01) 647 1001	17-19 Sept
Cardiff	(Nat Sports Centre), Technology Wales Exbn, Contact: Future Exbns Ltd, (0222) 490 355	18-20 Sept

WRITING FOR PCW

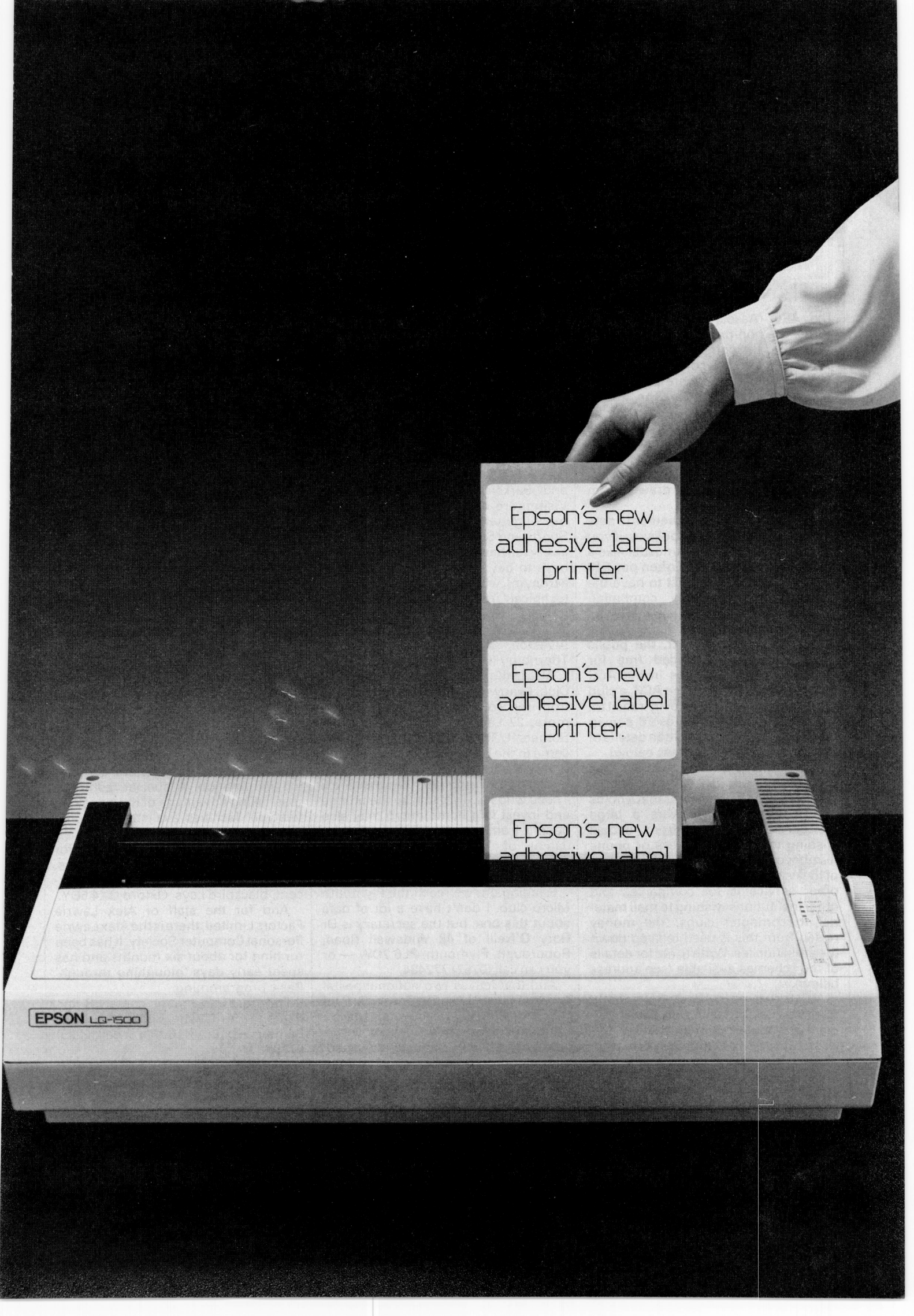
Your chance to contribute to the magazine.

We're offering readers a chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well. We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well for reference.

Bear in mind that it's worth taking a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WRITING FOR PCW

look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

ACC NEWS

Rupert Steele rounds up the clubs in the West.

The ACC (Association of Computer Clubs) is a non-profit organisation run by and for the computer clubs, which provides a way for computer clubs to make contact, and where practical to gain from joint schemes. The ACC is governed by a council consisting of representatives of all the affiliated clubs, although day-to-day matters are delegated to a committee. The ACC aims to be a truly national organisation, and its committee is drawn from around the country.

The most successful schemes to date have been the insurance policies. If you want to insure anything unusual (like a computer club), you can often pay £10 for the cover and £40 just to have the policy written out. By combining almost 200 clubs in a single scheme, the Association has been able to cut the cost dramatically. In fact, the public liability cover is included free for eligible (nearly all) clubs in the ACC affiliation fee. Through the ACC, a club can insure equipment at, or in transit to, its meetings for as little as £8 a year. Contact John Bone for written details of these schemes (see address below).

The ACC also provides two services to non-members, based on the national database of computer clubs that it holds and maintains. It answers a large number of enquiries from people wishing to find the address or phone number of their local computer club, or of the user group for their machine. The other service is for companies and other institutions wishing to mail material to computer clubs; the money raised from this is used to keep down the affiliation fee. Write to me for details of the schemes available (see address below).

ACC news goes West this month, starting with Shropshire. William Kitching writes to tell me of the Telford BBC User Group. For more information contact him at 1 Greenacres, Ketley Bank, Telford TF2 0DU. The Computer Programmers Club does not appear to hold meetings, but is a mail based club, run by John Bee Computer Programmers Club, PO Box 20, Salisbury, SP4 7JD. The idea is that budding software authors can have their creations marketed by the club in return for 80 per cent of the proceeds. If your idea is a real winner, it's a rotten deal, but if your program has a 'more selective appeal', then its a good way to get it publicised and distributed. Of course, you may join the club simply to buy the software, the membership fee is £5 a year.

Moving on to Bristol, we come to a computer club that glows in the dark, The Nuclear Sports & Social Club — Personal Computer Group. The club is mainly for CEGB employees at Berkeley Power Station, Oldbury Power Station, and Berkeley Nuclear Laboratories. Visitors are, however, welcome at most meetings, which are held at the Nuclear Sports and Social Club, Berkeley. It has a very full newsletter called EMU (you'll have to get a copy to understand the acronym), which contains lots of useful technical information and software reviews. For more information contact Mr W N Walker, 53 Wolfridge Ride, Alveston, Bristol, BS12 2PR or call Thornbury (0454) 414262.

Also in the West is Taunton Computer Club. I know very little about this apart from the contact: Christopher Blackmore, 27 Laburnum Street, Taunton, Somerset, TA1 1LB. Further west, we come to the Exeter & District Computer Club, which is open to everyone interested in computers in the area. Those who have yet to take the plunge and invest in a home micro may also benefit from the club. Contact Robert James of 13 Colleton Hill, Exeter, Devon, EX2 4AS or call him on (0392) 215134.

Heading on, we reach the Plymouth Micro club. I don't have a lot of data about this one, but the secretary is Dr Rory O'Neill of 48 Widewell Road, Roborough, Plymouth, PL6 7DW — or you can call (0752) 772484.

And that leaves two national/postal groups that are based in Cornwall. Paul Hills runs the 6809 User Group, and is a frequent correspondent. The group is hardware/software engineering based, with emphasis on the 6809 microcomputer chip; members get a quick reference card with all the 6809 assembler code instructions. Paul has asked me to point out that the membership fee has gone down; each issue of the mag is now 50p, with a year's membership being £3 (you can also get half-year membership for £1.50). Paul's address is 28 Woburn Road, Launceston, Cornwall PL15 7HH.

The other national group based in Cornwall is The Cuthbert Club, run by John Symes, of Microdeal Limited, 41 Truro Road, St Austell, Cornwall PL25 5JE. It is aimed at users of the Dragon micro, and it is offering free enrolment for any Dragon owner who has sent money to another so-called Dragon User Group, and received nothing. You get a free badge among the usual goodies.

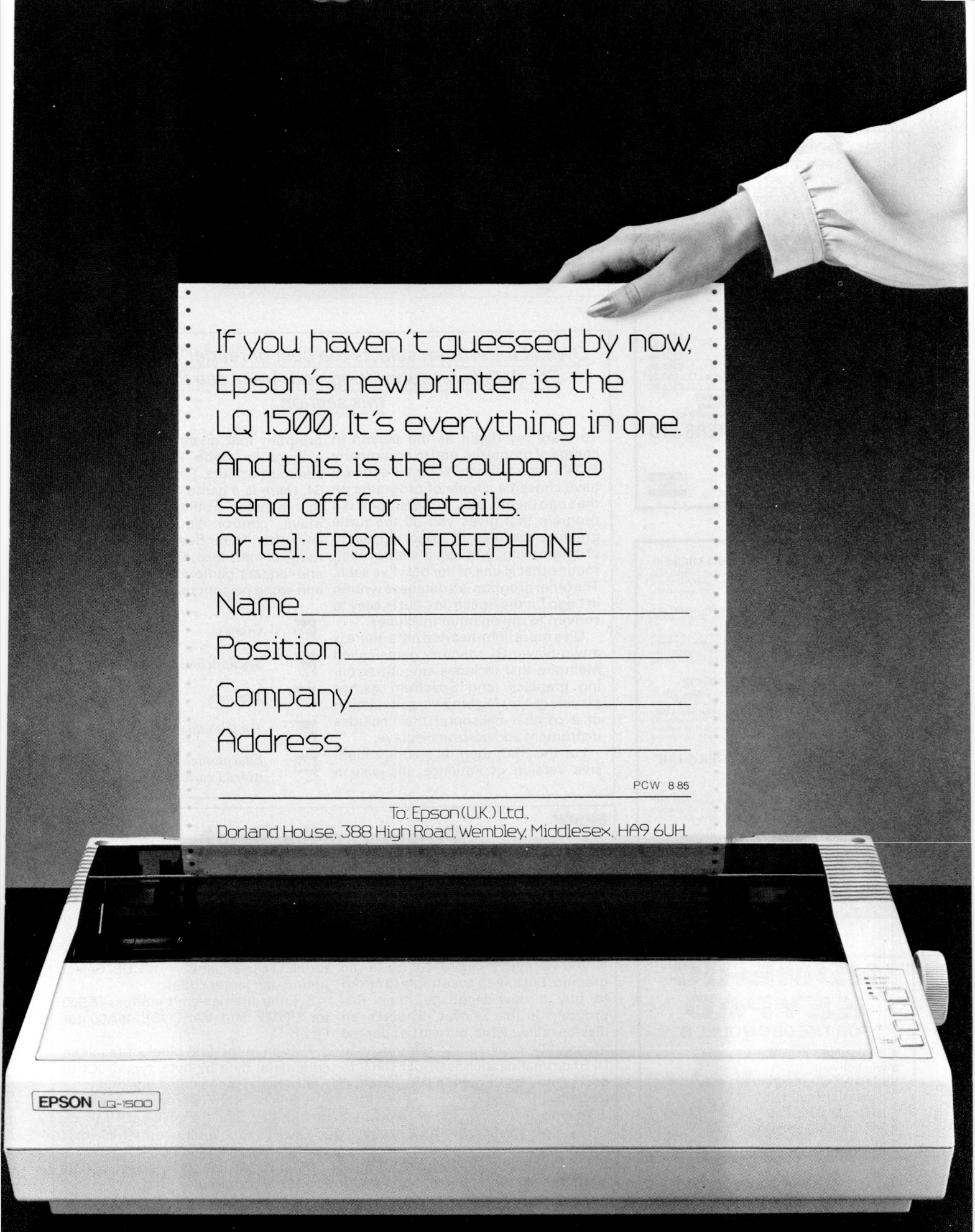
Finally, three clubs from the Oxford area have written to me. An old favourite is the Oxford Personal Computer Club (OPeCC), which caters for all computer enthusiasts in the Oxford area. Meetings are held twice a month at the Donnington Community Centre, near Townsend Square, Oxford. Everyone is welcome at the meetings. For more information, contact the treasurer, Sebastian Linfoot, Flat 10, Pembroke Court, Rectory Road, Oxford OX4 1BY.

Also in Oxford is Oxon TI Users group for owners of Texas Instrument 99/4 and 99/4A home computers in Oxfordshire. There is a monthly newsletter called TI-Lines. The magazine contains information on all aspects of TI computers, with some more general computing information. A special feature is that, taking advantage of the 'speaking teletype' facilities available on some Texas models, a version of the newsletter, read onto audio tape, is available for blind or partially sighted TI owners. Contact: Peter Brooks, 29 Kestrel Crescent, Blackbird Leys, Oxford OX4 5DY.

And for the staff of Alex Lawrie Factors Limited, there is the Alex Lawrie Personal Computer Society. It has been running for about six months and has spent early days 'ploughing through' Basic programming.

For more information contact Robin Peers at Alex Lawrie, Beaumont Road, Banbury, Oxon OX16 7RN or call (0295) 67788.

For more information, write as follows: (for a mention in this column, to notify the ACC of a new or existing club, or to obtain club address labels): Rupert Steele, 12 Philbeach Gardens, London SW5 9DY. (Any other enquiry, including the address of your local club): John Bone, ACC Chairman, 2 Claremont Place, Gateshead, Tyne & Wear NE9 1TL or call 091-477 0036. END



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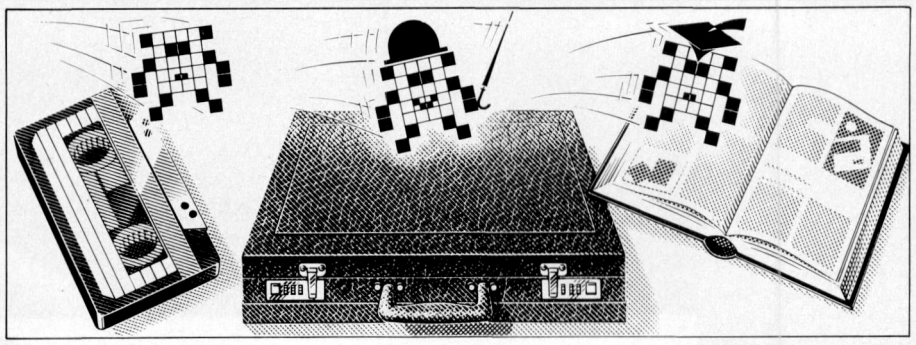

Owen Linderholm selects the best of reader's programs. For details on submitting your own, see the end of this section.

To mark my debut as the person in charge of programs, and to accompany *PCW*'s latest Teach Yourself series, I have chosen a couple of programs on the Logo theme. BBC Turtle Graphic is a program that gives you all the turtle graphics facilities of Logo, including programming, and has a shape-filling routine that is one of the best I've seen. The other program is a database written in Logo for the Spectrum, but is easy to convert to run on other machines.

On a more light-hearted note, there is a two-player QL memory game called Memoire that includes smooth-scrolling graphics, and Spectrum games players can try Nighthawk, a simulation of a combat helicopter that includes instrument and horizon displays.

For the BBC, there is a comprehensive version of Patience and also a program that gives you an extra 28 colours in mode 2 by mixing the standard colours. For the Commodore 64, there is a game called Nest of Evil that includes a utility to allow you to move control sprites easily and smoothly from Basic. For the MSX range of machines, there is a 'platform-and-ladders' game which features Chas and some poisonous spiders.

 *Games*

 *Scientific/mathematic*

 *Business*

 *Toolkit/utilities*

 *Educational/Computer Aided Learning*



Program of the Month
BBC Turtle Graphic
by Christopher Rowett

If you've ever wanted to try turtle graphics but haven't been able to afford to buy a new language, then this program is the answer. It works on disk-based systems, but can be adapted for cassette by changing references to DFS commands such as OSCLI 'DIR $' in line 10, and by removing line 70 of the loader.

To type in and save the program:

1 Type in the first program and save it as TURTLE.

2 Type in the main program, exactly as shown and without extra spaces or there will not be enough room. Save it as TURTLE1.

3 Type in and run the third program. It will save a file called DATA.

4 To enter the machine code data, type in the fourth program and save it separately.

5 Run this program to enter the data for FILL, DUMP, and VARCODE. Select option one (enter code).

6 Enter the hex start address (&900 for DUMP and VARCODE, &A00 for FILL).

7 Type in the first block of machine code data, byte by byte, typing XX to return to the menu when finished.

8 Select option three (save code), giving the filename FILL, DUMP or VARCODE, depending on which one you have been typing in.

9 To check the code, select option two from the menu.

10 Type in the hex start address.

11 The location and byte will be displayed. Hit any key to go on to the next location, or correct mistakes by typing X (to return to the menu), and then select option one and give the location of the mistake as the start address, correcting the byte and return-

ing to the menu. Save the corrected version as before.

12 Repeat steps six to eight for the other blocks of machine code data. The three are called FILL, DUMP and VARCODE respectively.

13 Now all you should need to do is run TURTLE.

The program supports all the turtle graphics commands given in Logo, and a list of these and their syntax can be obtained by typing HELP when the program has been run.

Variables must be single-letter lower-case letters, and everything else must be upper-case. Basic functions may be used in expressions, as may variables. There should be a space between commands and their arguments, otherwise an error will be reported: FORWARD 50 is valid, but FORWARD50 is not. Recursion is supported, but not very far due to problems with the lack of space. Up to 10 nested repeats are allowed. When entering procedures, the editing commands are given by typing HELP.

Here is a sample program:

```
TO SQUARE n
REPEAT 4
FORWARD n
RIGHT 90
ENDREPEAT
END
```

This draws a square of size n when SQUARE n is typed.

```
   10 MODE7:VDU23;8202;0;0;0;
   20 FORA%=9TO16:PRINTTAB(35,A%)CHR$156;TAB(3,A%)CHR$132CHR$157;:NEXT
   30 PRINTTAB(10,10)CHR$141;"TURTLE GRAPHICS"TAB(10,11)CHR$141;"TURTLE GRAPHICS
"
   40 PRINTTAB(5,15)"(C) 1985 Christopher Rowett"
   50 PROCkeys
   60  PRINTTAB(14,13)" LOADING"
   70 PAGE=&1300
   80 CHAIN"TURTLE1"
   90 DEFPROCkeys:*FX18
  100 RESTORE:FORA%=0TO9:READA$:OSCLI"KEY"+STR$A%+A$:NEXT:ENDPROC
  110 DATA"FORWARD ","BACK ","LEFT ","RIGHT ","REPEAT ","ENDREPEAT ","PENUP ","P
ENDOWN ","SHOWTURTLE ","HIDETURTLE "
```

```
   10 OSCLI"DIR $":OSCLI"LOAD VARCODE 900":OSCLI"FX21,0"
   20 MODE4:HIMEM=&5600:m=0
   30 ONERRORGOTO220
   40 DIMH$(33),C$(79),K$(33),A$(33),q1$(19),b(9),c(9),V(26),d$(19,79),12$(20),1
2(20),e2(20)
   50 PROCe
   60 OSCLI"TV0,1":OSCLI"FX12,5"
   70 REPEAT:FORA%=0TO79:C$(A%)="":NEXT:PROCf
   80   R%=FALSE:PROCg
   90   IFd2 d2=FALSE:GOTO80
  100   IFh ANDNOTi PROCh
  110   UNTILi
  120 MODE4:HIMEM=&5600:GOTO50
  130 DEFPROCh:PRINT"Ready.":h=FALSE:ENDPROC
  140 DEFPROCe:PROCj:CLS:PRINTTAB(6)"TURTLE GRAPHICS VERSION 1.23":os=TRUE:d2=FA
LSE:p2=0:k=FALSE:i=FALSE:PROC1:PRINT:h=0:n=7:S%=0:X%=640:Y%=576:Z%=0:T%=TRUE:P%=
TRUE:F%=TRUE:XY%=FALSE:a%=&2020A:PROCo:PROCh:ENDPROC
  150 DEFPROCf
  160 REPEAT:PROCp:UNTILA$<>""
  170 12$=A$
  180 PROCq(A$):IFr GOTO160
  190 ENDPROC
  200 DEFPROCj:VDU26:GCOL0,7:MOVE0,128:DRAW0,1023:DRAW1279,1023:DRAW1279,128:DRA
W0,128:VDU23;24586;0;0;0;28;10015;6172;4;132;1275;1019;:COLOUR131:COLOUR0:ENDPRO
C
  210 DEFPROC1:X=OPENIN"DATA":FORA%=0TO33:INPUT#X,K$(A%):NEXT:FORA%=0TO33:INPUT#
X,H$(A%):NEXT:FORA%=0TO33:INPUT#X,A$(A%):NEXT:CLOSE#X:ENDPROC
  220 REPORT:PRINT:GOTO70
  230 GOTO70
  240 OSCLI"FX21,0":END
  250 DEFPROCq(A$):r=TRUE:IFRIGHT$(A$,1)=" "A$=LEFT$(A$,LENA$-1)
  260 IFLEFT$(A$,1)="*"ANDos OSCLIA$:ENDPROC
  270 r=FALSE:PROCs(A$):ENDPROC
  280 DEFPROCs(A$):LOCALA%,B%
  290 A%=INSTR(A$," "):IFA%=0C$(B%)=A$:C%=B%:ENDPROC
  300 C$(B%)=LEFT$(A$,A%-1):A$=RIGHT$(A$,LENA$-A%):B%=B%+1
  310 GOTO290
  320 DEFPROCg:A%=0
  330 A$=C$(A%):PROCt(A$):IFNOTt PROCk(A$):IFNOTk PRINT"Mistake: ";A$:ENDPROC
  340 IFk GOTO1650
  350 IFb%A$=a$
  360 PROCw(A$)
  370 A%=A%+1:IFA%>C%h=TRUE:ENDPROC
  380 GOTO330
  390 DEFPROCt(A$):t=FALSE:LOCALA%:b%=FALSE
  400 IFA$=K$(A%)t=TRUE:ENDPROC
  410 IFA$=A$(A%)t=TRUE:b%=TRUE:a$=K$(A%):ENDPROC
  420 A%=A%+1:IFA%<34GOTO400
  430 ENDPROC
  440 DEFPROCk(A$):k=FALSE:LOCALA%
  450 IFA$=q1$(A%)k=TRUE:a%=A%:ENDPROC
  460 A%=A%+1:IFA%<20GOTO450
  470 ENDPROC
  480 DEFPROCv:PRINT"TURTLE GRAPHICS 1.23":VDU15:LOCALA%,A$:FORA%=0TO33:PRINTK$(
A%);" ";H$(A%);:A=GET:PRINT:NEXT:ENDPROC
  490 DEFPROCw(A$)
  500 IFA$="HELP"PROCv
  510 IFA$="CLEARSCREEN"CLG:PROCo
  520 IFA$="FENCE"F%=TRUE
  530 IFA$="WINDOW"F%=FALSE
  540 IFA$="PENUP"P%=FALSE
  550 IFA$="PENDOWN"P%=TRUE
  560 IFA$="SHOWTURTLE"ANDNOTT%T%=TRUE:PROCo
  570 IFA$="HIDETURTLE"ANDT%PROCo:T%=FALSE
  580 IFA$="HOME"PROCx
  590 IFA$="RESET"i=TRUE:A%=C%:ENDPROC
  600 IFA$="FORWARD"PROCy
  610 IFA$="LEFT"PROCz
  620 IFA$="RIGHT"PROCa1
  630 IFA$="PRINT"PROCb1
  640 IFA$="BACK"PROCc1
```

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	11 colours	DS/DD 48	24.25	21.83	21.22	20.61
	to choose	SS/DD 96	24.25	21.83	21.22	20.61
	from	DS/DD 96	32.06	28.86	28.05	27.25
5.25"	CUMANA	SS/DD 48"	16.25	14.63	14.22	13.82
5.25"	DYSAN	SS/DD 48"	17.00	16.31	15.86	15.41
		DS/DD 48"	25.00	23.85	23.19	22.53
		SS/DD 96"	25.00	23.85	23.19	22.53
		DS/DD 96"	31.50	30.26	29.42	28.58
5.25"	NASHUA	SS/DD 48"	11.00	10.48	10.19	9.90
		SS/DD 48"	12.00	11.20	10.88	10.57
		DS/DD 48"	14.00	13.27	12.90	12.53
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		DS/DD 96"	24.00	22.50	21.88	21.25
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8" DYSAN		FROM 22.10	8" SCOTCH-3M			FROM 14.34

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PROGRAM FILE

```
  650 IFA$="SETPOS"PROCd1
  660 IFA$="COORDINATES"PROCxy
  670 IFA$="REPEAT"PROCe1
  680 IFA$="ENDREPEAT"ANDR%c(S%)=c(S%)-1:IFc(S%)>0A%=b(S%) ELSEIFA$="ENDREPEAT"A
NDR%S%=S%-1:IFS%<1R%=FALSE:S%=0
  690 IFA$="SAVE"PROCf1
  700 IFA$="LOAD"PROCg1
  710 IFA$="MAKE"PROCh1
  720 IFA$="SETX"PROCi1
  730 IFA$="SETY"PROCj1
  740 IFA$="SETHEADING"PROCk1
  750 IFA$="BACKGROUND"PROCl1
  760 IFA$="PENCOLOUR"PROCm1
  770 IFA$="PENREVERSE"h=4:n=7
  780 IFA$="PENERASE"h=0:n=0
  790 IFA$="FILL"PROCn1
  800 IFA$="TO"OSCLI"FX229,1":os=FALSE:PROCto:os=TRUE:OSCLI"FX229,0"
  810 IFA$="EDIT"OSCLI"FX229,1":PROCo1:OSCLI"FX229,0"
  820 IFA$="END"ANDp2>0 C%=e2(p2):A%=12(p2):12$=12$(p2):PROCq(12$):12$(p2+1)="":
12(p2+1)=0:e2(p2+1)=0:p2=p2-1
  830 IFA$="PRINTDUMP"OSCLI"RUN DUMP":OSCLI"LOAD VARCODE 0900"
  840 ENDPROC
  850 DEFPROCo:XCOR=X%:YCOR=Y%:HEADING=Z%:IFNOTT%ENDPROC
  860 GCOL3,3:MOVEX%+FNx(32,Z%),Y%+FNy(32,Z%):Z%=Z%+140:IFZ%>359Z%=Z%-360
  870 MOVEX%+FNx(32,Z%),Y%+FNy(32,Z%):Z%=Z%+80:IFZ%>359Z%=Z%-360
  880 PLOT85,X%+FNx(32,Z%),Y%+FNy(32,Z%):Z%=Z%+140:IFZ%>359Z%=Z%-360
  890 GCOLh,n:ENDPROC
  900 DEFPROCy:PROCp1:PROCo:MOVEX%,Y%:X%=X%+FNx(M%,Z%):Y%=Y%+FNy(M%,Z%):PROCu1:G
COLh,n:IFP%DRAWX%,Y%ELSEMOVEX%,Y%
  910 PROCo:PROCr1:ENDPROC
  920 DEFPROCp1:A%=A%+1:IFA%>C%M%=0:M=0:M$="":ENDPROC
  930 LOCALT$:T$=C$(A%):U%=ASC(T$)-96:PROCvars(C$(A%))
  940 M=EVAL(C$(A%)):M$=C$(A%):M%=M:C$(A%)=T$:ENDPROC
  950 DEFPROCvars(A$)
  960 $&A00=A$:CALL&900:IF?&70=0C$(A%)=A$:ENDPROC
  970 PROCs1(?&70,A$,?&71-96)
  980 GOTO960
  990 DEFPROCs1(t1,B$,r):A$=LEFT$(B$,t1-1)+"V("+STR$(r)+")"+RIGHT$(B$,LENB$-t1):
ENDPROC
 1000 DEFPROCx:PROCo:MOVEX%,Y%:GCOLh,n:IFP%DRAW640,576ELSEMOVE640,576
 1010 X%=640:Y%=576:Z%=0:PROCo:PROCr1:ENDPROC
 1020 DEFFNx(A%,B%)=FNv1(A%*SIN(RAD(B%)))
 1030 DEFFNy(A%,B%)=FNv1(A%*COS(RAD(B%)))
 1040 DEFFNv1(A):IFA-INTA>=.5:=INTA+1ELSE=INTA
 1050 DEFPROCz:PROCp1:PROCo:Z%=Z%-M%:IFZ%<0Z%=Z%+360
 1060 PROCo:ENDPROC
 1070 DEFPROCa1:PROCp1:PROCo:Z%=Z%+M%:IFZ%>359Z%=Z%-360
 1080 PROCo:ENDPROC
 1090 DEFPROCm1:PROCp1:h=0:n=7:VDU19,1,M%,0,0,0:ENDPROC
 1100 DEFPROCb1:PROCp1:PRINTM:ENDPROC
 1110 DEFPROCp:B$="":LOCALA%:A%=FALSE
 1120 A$=GET$:IF(A$<" "ORA$>CHR$127)ANDA$<>CHR$13ANDA$<>CHR$21GOTO1120
 1130 IFA$=CHR$21ANDB$=""GOTO1120
 1140 IFA$=CHR$21PROCw1:GOTO1120
 1150 IFA$=CHR$13A$=B$:PRINT:ENDPROC
 1160 IFA$=CHR$127ANDB$=""GOTO1120
 1170 IFA$=CHR$127C$=RIGHT$(B$,1):B$=LEFT$(B$,LENB$-1):PRINTCHR$127;:GOTO1220
 1180 IFA$=" "AND(B$=""ORA%)GOTO1120
 1190 IFA$=" "A%=TRUE ELSEA%=FALSE
 1200 IFLENB$>158VDU7:GOTO1120
 1210 B$=B$+A$:PRINTA$;:GOTO1120
 1220 IFC$=" "A%=FALSE
 1230 GOTO1120
 1240 DEFPROCc1:PROCp1:PROCo:MOVEX%,Y%:X%=X%-FNx(M%,Z%):Y%=Y%-FNy(M%,Z%):GCOLh,n
:IFP%DRAWX%,Y%ELSEMOVEX%,Y%
 1250 PROCo:PROCr1:ENDPROC
 1260 DEFPROCd1:PROCo:MOVEX%,Y%:GCOLh,n:PROCp1:X%=M%:PROCp1:Y%=M%:IFP%DRAWX%,Y%E
LSEMOVEX%,Y%
 1270 DEFPROCi1:PROCo:MOVEX%,Y%:GCOLh,n:PROCp1:X%=M%:IFP%DRAWX%,Y%ELSEMOVEX%,Y%
 1280 PROCo:PROCr1:ENDPROC
 1290 DEFPROCj1:PROCo:MOVEX%,Y%:GCOLh,n:PROCp1:Y%=M%:IFP%DRAWX%,Y%ELSEMOVEX%,Y%
 1300 DEFPROCk1:PROCo:PROCp1:Z%=M%:PROCo:ENDPROC
 1310 PROCo:PROCr1:ENDPROC
 1320 PROCo:PROCr1:ENDPROC
 1330 DEFPROCxy:PROCp1:XY%=M%:ENDPROC
 1340 DEFPROCr1:IFXY%A%=&10:PRINT"X=";X%,"Y=";Y%:A%=&2020A
 1350 ENDPROC
 1360 DEFPROCw1:LOCALB%,C%:C%=FALSE:B%=LENB$:IFRIGHT$(B$,1)=" "B$=LEFT$(B$,LENB$
-1):PRINTCHR$127;:IFB$=""A%=FALSE:ENDPROC
 1370 IFRIGHT$(B$,1)<>" "ANDB$<>""B$=LEFT$(B$,LENB$-1):PRINTCHR$127;:GOTO1370
 1380 A%=TRUE:ENDPROC
 1390 DEFPROCe1:PROCp1:IFM%=0ENDPROC
 1400 S%=S%+1:R%=TRUE:c(S%)=M%:b(S%)=A%:ENDPROC
 1410 DEFPROCf1:A%=A%+1:IFA%>C%M$=""ELSEM$=C$(A%)
 1420 X=OPENOUT(M$):LOCALA%,B%:FORA%=0TOm-1:PRINT#X,q1$(A%):B%=0:REPEAT:PRINT#X,
d$(A%,B%):B%=B%+1:UNTILd$(A%,B%-1)="END":NEXT:PRINT#X,"FINISH":CLOSE#X:ENDPROC
 1430 DEFPROCg1:A%=A%+1:IFA%>C%M$=""ELSEM$=C$(A%)
 1440 X=OPENIN(M$):LOCALA%,B%,A$:m=0
 1450 INPUT#X,A$:IFA$="FINISH"CLOSE#X:ENDPROC
 1460 m=m+1:q1$(A%)=A$:B%=0:REPEAT:INPUT#X,d$(A%,B%):B%=B%+1:UNTILd$(A%,B%-1)="E
ND":A%=A%+1:GOTO1450
 1470 DEFPROCh1:LOCALD%:PROCp1:D%=U%:PROCp1:V(D%)=M:ENDPROC
 1480 DEFPROCl1:PROCp1:VDU19,0,M%,0,0,0:ENDPROC
 1490 DEFPROCn1:PROCo:IFPOINT(X%,Y%)<>0PROCo:ENDPROC
 1500 GCOL0,7:?&76=X%MOD256:?&77=X%DIV256:?&78=Y%MOD256:?&79=Y%DIV256:OSCLI"FILL
":OSCLI"LOAD VARCODE 900":PROCo:ENDPROC
 1510 DEFPROCu1:IFNOTF%ENDPROC
 1520 IFX%>1275ORX%<40RY%<132ORY%>1019X%=XCOR:Y%=YCOR
 1530 ENDPROC
 1540 DEFPROCto:IFm=20PRINT"No more room":A%=C%:ENDPROC
 1550 A%=A%+1:IFA%>C%PRINT"Missing name":ENDPROC
 1560 q1$(m)=C$(A%):V%=0:LOCALG$,H$
 1570 PROCp1:IFM$=""GOTO1590
 1580 d$(m,V%)=M$:H$=MID$(M$,2,LENM$-1):G$=G$+CHR$(96+EVALH$)+" ":V%=V%+1:GOTO15
70
 1590 PROCx1("DEFINING "+q1$(m)+CHR$13+CHR$10+G$)
 1600 PROCf
 1610 d$(m,V%)=A$
 1620 V%=V%+1
 1630 IFC$(C%)<>"END"GOTO1600
 1640 PROCj:CLS:CLG:PROCo:PRINTq1$(m);" DEFINED":m=m+1:ENDPROC
 1650 O%=0
 1660 IFLEFT$(d$(a%,O%),2)="V("THENQ%=EVAL(RIGHT$(d$(a%,O%),LEN(d$(a%,O%))-1)):P
ROCp1:V(Q%)=M%:O%=O%+1:GOTO1660
 1670 p2=p2+1:12$(p2)=12$:12(p2)=A%:e2(p2)=C%:A%=0
 1680 12$="":REPEAT:12$=12$+d$(a%,O%)+" ":O%=O%+1:UNTILd$(a%,O%-1)="END"
 1690 PROCq(12$):k=FALSE:d2=TRUE:ENDPROC
 1700 DEFPROCo1:A%=A%+1:IFA%>C%PRINT"Missing name":ENDPROC
 1710 PROCk(C$(A%)):IFNOTk PRINT"Undefined word":ENDPROC
 1720 LOCALU%,V%:PROCx1("EDITING "+q1$(a%)):a%=&10
 1730 IFLEFT$(d$(a%,V%),2)="V("V%=V%+1:GOTO1730
 1740 s%=V%
 1750 IFd$(a%,V%)="END"e%=V%-1:GOTO1770
 1760 PRINT;U%;" ";d$(a%,V%):U%=U%+1:V%=V%+1:GOTO1750
 1770 PROCh:PROCf:IFLEFT$(A$,6)="CHANGE"GOTO1840
 1780 IFLEFT$(A$,4)="HELP"PRINT"Edit mode"''"CHANGE <line no.>"''"DELETE <line no.
```

PROGRAM FILE

```
>"'"HELP"'"INSERT <before line no.>"'"LIST"'"QUIT":GOTO1770
 1790 IFLEFT$(A$,6)="DELETE"GOTO1870
 1800 IFLEFT$(A$,4)="QUIT"PROCj:CLS:CLG:PROCo:k=FALSE:ENDPROC
 1810 IFLEFT$(A$,4)="LIST"GOTO1900
 1820 IFLEFT$(A$,6)="INSERT"GOTO1910
 1830 PRINT"Mistake":GOTO1770
 1840 IFLENA$=6 INPUT"Which line:" A%ELSEA%=EVAL(RIGHT$(A$,LENA$-6))
 1850 IFA%>(e%-s%)DRA%<0PRINT"No such line":GOTO1770
 1860 PRINTd$(a%,s%+A%):PROCf:d$(a%,s%+A%)=A$:GOTO1770
 1870 IFLENA$=6 INPUT"Which line:" A%ELSEA%=EVAL(RIGHT$(A$,LENA$-6))
 1880 IFA%>(e%-s%)DRA%<0PRINT"No such line":GOTO1770
 1890 FORB%=s%+A%TOe%:d$(a%,B%)=d$(a%,B%+1):NEXT:d$(a%,B%)="":e%=e%-1:GOTO1770
 1900 U%=0:FORB%=s%TOe%:PRINT;U%;" ";d$(a%,B%):U%=U%+1:NEXT:GOTO1770
 1910 IFLENA$=6 INPUT"Which line:" A%ELSEA%=EVAL(RIGHT$(A$,LENA$-6))
 1920 IFA%>(e%-s%)DRA%<0PRINT"No such line":GOTO1770
 1930 IFe%=78 PRINT"No room":GOTO1770
 1940 FORB%=e%+2TOs%+A%STEP-1:d$(a%,B%)=d$(a%,B%-1):NEXT:e%=e%+1
 1950 PROCf:d$(a%,s%+A%)=A$:GOTO1770
 1960 DEFPROCx1(V$):CLS:PRINTV$:PROCo:CLG:VDU28,1,26,38,1:COLOUR128:COLOUR7:ENDP
ROC
```

```
   10 X=OPENOUT"DATA"
   20 RESTORE
   30 REPEAT
   40   READA$
   50   PRINT#X,A$
   60   UNTILA$="WD"
   70 CLOSE#X
   80 DATABACKGROUND,BACK,CLEARSCREEN,COORDINATES,EDIT,END,ENDREPEAT,FENCE,FILL,
FORWARD,HELP,HIDETURTLE,HOME,LEFT,LOAD,MAKE,PENCOLOUR,PENDOWN,PENERASE,PENREVERS
E,PENUP,PRINT,PRINTDUMP,REPEAT,RESET,RIGHT,SAVE,SETHEADING,SETPOS,SETX,SETY
   90 DATASHOWTURTLE,TO,WINDOW
  100  DATA<numeric>,<numeric>,"",<0/1>,<name>,"","","","",<numeric>,"","","",<n
umeric>,<fsp>,<letter> <numeric>,<numeric>,"","","";"",<numeric>,"",<numeric> és
tatementè ENDREPEAT,"",<numeric>,<fsp>,<numeric>,<numeric> <numeric>
  110 DATA<numeric>,<numeric>,"",<name> éstatementè END,""
  120 DATABG,BK,CS,CO,ED,"",ER,FE,FL,FD,HL,HT,HM,LT,LD,MK,PC,PD,PE,PR,PU,PT,PDP,
RE,RS,RT,SV,SETH,SETP,SX,SY,ST,"",WD
```

```
   10 MODE7:PRINT'" 1 Enter code"
   20 PRINT'" 2 Check code"
   30 PRINT'" 3 Save code"
   40 PRINT'" Select option";
   50 A$=GET$:IFA$<"1"ORA$>"3"GOTO50
   60 IFA$="1"PROCenter:GOTO10
   70 IFA$="2"PROCcheck:GOTO10
   80 INPUT'"Enter filename:" A$
   90 OSCLI"SAVE "+A$+" "+STR$~S%+" "+STR$~E%
  100 GOTO10
  110 DEFPROCenter
  120 INPUT'"Enter start address &" A$:A%=EVAL("&"+A$)
  130 IFA%>&AFFORA%<&900 VDU7:PRINT"Illegal start":GOTO120
  140 S%=A%
  150 PRINT A%;":&";:INPUT" V$
  160 IFLENV$<>2 VDU7:PRINT"Error":GOTO150
  170 IFV$="XX"ENDPROC
  180 V%=EVAL("&"+V$)
  190 ?A%=V%
  200 A%=A%+1:E%=A%:GOTO150
  210 DEFPROCcheck
  220 INPUT'"Enter start address &" A$:A%=EVAL("&"+A$)
  230 IFA%>&AFFORA%<&900 VDU7:PRINT"Illegal start":GOTO220
  240 PRINT A%;":&"; ?A%
  250 A$=GET$:IFA$="X"ENDPROC
  260 A%=A%+1:IFA%<&AFFGOTO240
  270 ENDPROC
```

```
>
0000 A9 01 85 71 A9 00 85 70 ...q...p
0008 20 DE 0A 20 93 0A A4 71  .. ...q
0010 B9 00 56 85 72 B9 00 57 ..V.r..W
0018 85 73 B9 00 09 85 74 B9 .s....t.
0020 00 0C 85 75 E6 71 A5 72 ...u.q.r
0028 85 76 A5 73 85 77 A5 74 .v.s.w.t
0030 18 69 04 85 78 A5 75 69 .i..x.ui
0038 00 85 79 20 93 0A A5 72 ..y ...r
0040 85 76 A5 73 85 77 A5 74 .v.s.w.t
0048 38 E9 04 85 78 A5 75 E9 8...x.u.
0050 00 85 79 20 93 0A A5 72 ..y ...r
0058 18 65 7B 85 76 A5 73 69 .eé.v.si
0060 00 85 77 A5 74 85 78 A5 ..w.t.x.
0068 75 85 79 20 93 0A A5 72 u.y ...r
0070 38 E5 7B 85 76 A5 73 E9 8.é.v.s.
0078 00 85 77 A5 74 85 78 A5 ..w.t.x.
0080 75 85 79 20 93 0A A5 70 u.y ...p
0088 18 69 01 C5 71 F0 03 4C .i..q..L
0090 0E 0A 60 A2 76 A0 00 A9 ..`.v...
0098 09 20 F1 FF A5 7A C9 00 . ...z..
00A0 F0 01 60 A9 19 20 EE FF ..`.. ..
00A8 A9 45 20 EE FF A5 76 20 .E ...v
00B0 EE FF A5 77 20 EE FF A5 ...w ...
00B8 78 20 EE FF A5 79 20 EE x ...y .
00C0 FF 20 C5 0A 60 E6 70 A4 . ..`.p.
00C8 70 A5 76 99 00 56 A5 77 p.v..V.w
00D0 99 00 57 A5 78 99 00 09 ..W.x...
00D8 A5 79 99 00 0C 60 A9 87 .y...`..
00E0 20 F4 FF B9 E9 0A 85 7B  ......é
00E8 60 02 04 08 00 04 08 00 `.......
00F0 00 ** ** ** ** ** ** ** ........
```


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```
0000 A9 02 20 EE FF A9 01 20 .. .... 
0008 EE FF A9 1B 20 EE FF A9 .... ... 
0010 01 20 EE FF A9 41 20 EE . ...A . 
0018 FF A9 01 20 EE FF A9 08 ... .... 
0020 20 EE FF A9 0D 20 EE FF  .... .. 
0028 A9 F8 85 71 A9 00 85 70 ...q...p 
0030 85 7A A9 01 20 EE FF A9 .z.. ... 
0038 1B 20 EE FF A9 01 20 EE . .... . 
0040 FF A9 4B 20 EE FF A9 01 ..K .... 
0048 20 EE FF A9 40 20 EE FF  ...à .. 
0050 A9 01 20 EE FF 20 EE FF .. .. .. 
0058 A9 00 85 72 85 73 85 79 ...r.s.y 
0060 A5 71 85 7B A5 7B 18 65 .q.é.é.e 
0068 79 85 71 A9 00 85 74 85 y.q...t. 
0070 76 85 75 85 77 A2 00 A5 v.u.w... 
0078 74 18 65 70 85 74 A5 75 t.ep.t.u 
0080 65 7A 85 75 E8 E0 04 D0 ez.u.... 
0088 EE A2 00 A5 76 18 65 71 ....v.eq 
0090 85 76 A5 77 69 00 85 77 .v.wi..w 
0098 E8 E0 04 D0 EE A2 74 A0 ......t. 
00A0 00 A9 09 20 F1 FF A5 7B ... ...x 
00A8 F0 0A A4 73 B9 0D 0A 18 ...s.... 
00B0 65 72 85 72 E6 79 E6 73 er.r.y.s 
00B8 A5 73 C9 08 D0 A6 A5 7B .s.....é 
00C0 85 71 A9 01 20 EE FF A5 .q.. ... 
00C8 72 20 EE FF A5 70 18 69 r ...p.i 
00D0 01 85 70 A5 7A 69 00 85 ..p.zi.. 
00D8 7A A5 70 C9 40 F0 03 4C z.p.à..L 
00E0 58 09 A5 7A C9 01 F0 03 X..z.... 
00E8 4C 58 09 A9 00 85 70 85 LX....p. 
00F0 7A A9 01 20 EE FF A9 0D z.. .... 
00F8 20 EE FF A5 71 38 E9 08  ...q8.. 
0100 85 71 90 03 4C 32 09 A9 .q..L2.. 
0108 03 20 EE FF 60 01 02 04 . ..`... 
0110 08 10 20 40 80 ** ** ** .. à.... 
```

```
0000 A0 00 84 70 B9 00 0A C9 ...p.... 
0008 0D F0 16 85 71 38 E9 61 ....q8.a 
0010 90 0C A5 71 18 69 85 B0 ...q.i.. 
0018 05 84 70 E6 70 60 C8 D0 ..p.p`.. 
0020 E3 60 ** ** ** ** ** ** .`...... 
```



MSX Chas in the Castle

by A Sidgwick

This is a typical platform-and-ladders game for all MSX computers. In it, you take the part of Chas, a likeable short, fat, thief working for a higher authority by stealing toxic spider eggs. Naturally, the spiders protect their eggs and are extremely poisonous.

To try the game, simply type in the listing, save it and then run it. You can skip the REM statements to save typing and memory.

```
100 REM   ******************
110 REM   *                *
120 REM   *      CHAS      *
130 REM   *      ----      *
140 REM   * IN THE CASTLE. *
150 REM   * -------------- *
160 REM   *                *
170 REM   * BY A, SIDGWICK *
180 REM   *                *
190 REM   *    11/4/85     *
200 REM   *                *
210 REM   ******************
220 REM
230 REM
240 REM  ---------------------
250 REM
260 REM  *** TITLE SCREEN ***
270 REM
280 REM  ---------------------
290 KEYOFF
300 COLOR 11,1,1
310 CLS
320 SCREEN 2,0
330 COLOR 11,1,1
340 OPEN"grp:"FOR OUTPUT AS #1
350 GOSUB 4840
360 PSET(20,30),1
370 PRINT #1,"            CHAS"
380 COLOR 5
390 PSET(20,37),1
400 PRINT #1,"            ____"
410 PSET(20,65),1
420 PRINT #1,"       IN THE CASTLE"
430 COLOR 11
440 PSET(20,72),1
450 PRINT #1,"       _____________"
460 REM
470 REM  -------------------------
480 REM  *** COPY WRITE SPRITE ***
490 REM  -------------------------
500 REM
510 SPRITE$(1)=CHR$(60)+CHR$(66)+CHR$(189)+CHR$(161)+CHR$(161)+CHR$(189)+CHR$(66
)+CHR$(60)
520 FOR L=240 TO 40 STEP -1
530 PUT SPRITE 1,(L,48),6,1
540 NEXT L
550 FOR D=48 TO 138 STEP 1
560 PUT SPRITE 1,(40,D),6,1
570 NEXT D
580 FOR R=40 TO 50 STEP 1
590 PUT SPRITE 1,(R,138),6,1
600 NEXT R
610 PSET(70,140),1
620 COLOR 11
```

```
630 PRINT #1,"A.SIDGWICK."
640 PSET(163,140),1
650 COLOR 6
660 PRINT #1,"1985."
670 IF PLAY(2) THEN 670
680 REM
690 REM  ********************
700 REM
710 REM  *** GAME PROGRAM ***
720 REM
730 REM  *** STARTS HERE  ***
740 REM
750 REM  ********************
760 REM
770 PSET(32,168),1:COLOR 5:PRINT #1,"Do you want to see the"
780 PSET(32,181),1:PRINT #1,"instructions ?   <y/n>"
790 A$=INKEY$:IF A$=""THEN GOTO 790
800 IF A$="Y" OR A$="y" THEN BEEP:GOSUB 5050
805 CLOSE
810 IF A$="N" OR A$="n" THEN BEEP
820 KEY OFF
840 OPEN"GRP:"FOR OUTPUT AS #1
850 COLOR 3,1,1
860 SCREEN 2,2,0
870 REM
880 REM  ------------------
890 REM  *** VARIABLES ***
900 REM  ------------------
910 REM
920 SC%=0
930 MX=30
940 MY=137
950 MS=6
960 L=3
970 FOR I=1 TO 6
980 READ AX(I)
990 NEXT I
1000 DATA 50,100,70,120,10,60
1010 AY=145
1020 AS=3
1030 REM
1040 REM  --------------------
1050 REM  ** SET UP SCREEN **
1060 REM  --------------------
1070 REM
1080 GOSUB 3120
1090 REM
1100 REM  --------------------
1110 REM  ** DISPLAY SCORE **
1120 REM  --------------------
1130 REM
1140 GOSUB 3880
1150 REM
1160 REM  --------------------
1170 REM  ** DISPLAY LIVES **
1180 REM  --------------------
1190 REM
1200 GOSUB 3970
1210 REM
1220 REM  ----------------------
1230 REM  ** DEFINE SPRITES **
1240 REM  ----------------------
1250 REM
1260 REM
1270 REM  --------------------
1280 REM  ** CHARLIE HERO **
1290 REM  --------------------
1300 REM
1310 REM ----------------------
1320 REM ** STEPPING  RIGHT **
1330 REM ----------------------
1340 REM
1350 RESTORE 1430
1360 FOR I=1 TO 16
1370 READ A$
1380 B$=B$+CHR$(VAL("&B"+LEFT$(A$,8)))
1390 C$=C$+CHR$(VAL("&B"+RIGHT$(A$,8)))
1400 NEXT I
1410 SPRITE$(1)=B$+C$
1420 REM
1430 DATA 0000000011000000
1440 DATA 0000000111101000
1450 DATA 0000001111110000
1460 DATA 0000011111010000
1470 DATA 0000011000101000
1480 DATA 0000001000010000
1490 DATA 0000001111100000
1500 DATA 0000111111111000
1510 DATA 0001111111111100
1520 DATA 0011101111101110
1530 DATA 0011001111100110
1540 DATA 0000011111100000
1550 DATA 0000111111110000
1560 DATA 0001111001111110
1570 DATA 0011100000111100
1580 DATA 0001110000010000
1590 REM
1600 REM
1610 REM  --------------------
1620 REM  ** FACING  RIGHT **
1630 REM  --------------------
1640 REM
1650 RESTORE 1730
1660 FOR I=1 TO 16
1670 READ D$
1680 E$=E$+CHR$(VAL("&B"+LEFT$(D$,8)))
1690 F$=F$+CHR$(VAL("&B"+RIGHT$(D$,8)))
1700 NEXT I
1710 SPRITE$(2)=E$+F$
1720 REM
1730 DATA 0000000011000000
1740 DATA 0000000111101000
1750 DATA 0000001111110000
1760 DATA 0000011111010000
1770 DATA 0000011000101000
1780 DATA 0000001000010000
1790 DATA 0000001111100000
1800 DATA 0000011011110000
1810 DATA 0000011011110000
1820 DATA 0000011011110000
1830 DATA 0000011011110000
1840 DATA 0000001111100000
1850 DATA 0000000111000000
1860 DATA 0000000111000000
1870 DATA 0000000111000000
1880 DATA 0000000111100000
```

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PROGRAM FILE

```
1890 REM
1900 REM
1910 REM
1920 REM  ----------
1930 REM  ** FACING LEFT **
1940 REM  ----------
1950 REM
1960 RESTORE 2040
1970 FOR I=1 TO 16
1980 READ G$
1990 H$=H$+CHR$(VAL("&B"+LEFT$(G$,8)))
2000 I$=I$+CHR$(VAL("&B"+RIGHT$(G$,8)))
2010 NEXT I
2020 SPRITE$(3)=H$+I$
2030 REM
2040 DATA 0000001100000000
2050 DATA 0001011110000000
2060 DATA 0000111111000000
2070 DATA 0000101111100000
2080 DATA 0001010011100000
2090 DATA 0000100001000000
2100 DATA 0000011111000000
2110 DATA 0000111101100000
2120 DATA 0000111101100000
2130 DATA 0000111101100000
2140 DATA 0000111101100000
2150 DATA 0000011111000000
2160 DATA 0000001110000000
2170 DATA 0000001110000000
2180 DATA 0000001110000000
2190 DATA 0000011110000000
2200 REM
2210 REM  ----------
2220 REM  ** STEPPING LEFT **
2230 REM  ----------
2240 REM
2250 RESTORE 2330
2260 FOR I=1 TO 16
2270 READ J$
2280 K$=K$+CHR$(VAL("&B"+LEFT$(J$,8)))
2290 L$=L$+CHR$(VAL("&B"+RIGHT$(J$,8)))
2300 NEXT I
2310 SPRITE$(4)=K$+L$
2320 REM
2330 DATA 0000001100000000
2340 DATA 0001011110000000
2350 DATA 0000111111000000
2360 DATA 0000101111100000
2370 DATA 0001010011100000
2380 DATA 0000100001000000
2390 DATA 0000011111000000
2400 DATA 0001111111110000
2410 DATA 0011111111111000
2420 DATA 0111011111011100
2430 DATA 0110011111001100
2440 DATA 0000011111100000
2450 DATA 0000111111110000
2460 DATA 0111111001111000
2470 DATA 0011110000011100
2480 DATA 0000100000111000
2490 REM
2500 REM  ----------
2510 REM  **  SPIDERS  **
2520 REM  ----------
2530 REM
2540 RESTORE 2610
2550 FOR I=1 TO 8
2560 READ M$
2570 N$=N$+CHR$(VAL("&B"+M$))
2580 NEXT I
2590 SPRITE$(5)=N$
2600 REM
2610 DATA 00000000
2620 DATA 00111100
2630 DATA 01011010
2640 DATA 01111110
2650 DATA 01000010
2660 DATA 01111110
2670 DATA 01011010
2680 DATA 10100101
2690 REM
2700 REM  ----------
2710 REM  * PUT CHAS ON SCREEN *
2720 REM  ----------
2730 REM
2740 GOSUB 6230
2750 REM
2760 REM ----------
2770 REM ** ON COLLISION GOSUB **
2780 REM ----------
2790 REM
2800 SPRITE ON
2810 ON SPRITE GOSUB 4710
2820 S=STICK(0)
2830 STRIG(0) ON
2840 ON STRIG GOSUB 5460
2850 REM
2860 REM ----------
2870 REM **  LEFT & RIGHT  GOSUBS **
2880 REM * UP & DOWN LADDER GOSUBS *
2890 REM ----------
2900 REM
2910 IF POINT(MX,MY)=4 THEN LINE(MX-4,MY-4)-(MX+10,MY+10),1,BF:SC%=SC%+373:GOSUB
 3880
2920 IF POINT(MX,MY)=10 THEN GOSUB 3780
2930 IF POINT(MX+4,MY+20)=1 AND POINT(MX+8,MY+20)=1 THEN GOSUB 6300
2940 IF S=7 THEN PUT SPRITE 1,(MX,MY),11,4:FOR X=1 TO 60:NEXT:GOSUB 4370
2950 IF S=3 THEN PUT SPRITE 1,(MX,MY),11,1:FOR X=1 TO 60:NEXT:GOSUB 4450
2960 IF S=1 THEN GOSUB 4530
2970 IF S=5 THEN GOSUB 4620
2980 REM
2990 REM  ----------
3000 REM  * PUT SPIDERS ON SCREEN *
3010 REM  ----------
3020 REM
3030 GOSUB 4060
3040 GOTO 2820
3050 REM
3060 REM  **********
3070 REM
3080 REM  ***  SET UP SCREEN  ***
3090 REM
3100 REM  **********
3110 REM
3120 LINE(9,13)-(246,179),6,B
3130 REM
```

PROGRAM FILE

```
3140 REM  ---------------------
3150 REM  *** DRAW FLOORS ***
3160 REM  ---------------------
3170 REM
3180 A=50
3190 FOR N=1 TO 3
3200 FOR W=1 TO 2
3210 Y=W*5+A
3220 FOR B=1 TO 34
3230 X=B*7+3
3240 LINE(X,Y)-STEP (5,3),14,BF
3250 NEXT B
3260 NEXT W
3270 A=A+50
3280 NEXT N
3290 REM
3300 REM  --------------------
3310 REM  **  DRAW STEPS  **
3320 REM  --------------------
3330 REM
3340 LINE(10,38)-(25,44),14,BF
3350 LINE(10,43)-(33,49),14,BF
3360 LINE(10,48)-(41,53),14,BF
3370 REM
3380 REM  ----------------------
3390 REM  ** POSITION HOLES **
3400 REM  ----------------------
3410 REM
3420 LINE(102,52)-(119,63),1,BF
3430 LINE(42,102)-(59,113),1,BF
3440 LINE(202,103)-(219,113),1,BF
3450 LINE(152,53)-(169,63),1,BF
3460 REM
3470 REM  ----------------------
3480 REM  *** DRAW LADDERS ***
3490 REM  ----------------------
3500 REM
3510 RESTORE 3630
3520 FOR N=1 TO 2
3530 READ T:READ Q:READ F
3540 LINE(T,Q)-(T,Q+F)
3550 LINE(T+10,Q)-(T+10,Q+F)
3560 FOR R=T TO T+10
3570 FOR V=Q+1 TO Q+F STEP 7
3580 LINE(R,V)-(R,V)
3590 NEXT V
3600 NEXT R
3610 BEEP
3620 NEXT N
3630 DATA 138,106,50
3640 DATA 230,56,50
3650 REM
3660 REM  ------------------
3670 REM  **  DRAW BELL  **
3680 REM  ------------------
3690 REM
3700 PSET(15,140),1
3710 DRAW"C10S2RBD2R1U2R8U2L2U8H5L4"
3720 DRAW"G5D8L2D2":PAINT(17,139),10
3730 REM
3740 REM  --------------------
3750 REM  ** DRAW SPHERES **
3760 REM  --------------------
3770 REM
3780 CIRCLE(18,22),5,4:PAINT(19,23),4
3790 CIRCLE(135,38),5,4:PAINT(136,39),4
3800 CIRCLE(25,88),5,4:PAINT(26,89),4
3810 CIRCLE(230,138),5,4:PAINT(232,139),4
3820 RETURN
3830 REM
3840 REM  --------------------
3850 REM  ** DISPLAY SCORE **
3860 REM  --------------------
3870 REM
3880 LINE(65,0)-(115,8),1,BF
3890 PSET(20,0),1
3900 PRINT #1,"Score ";SC%
3910 RETURN
3920 REM
3930 REM  --------------------
3940 REM  ** DISPLAY LIVES **
3950 REM  --------------------
3960 REM
3970 LINE(225,0)-(250,8),1,BF
3980 PSET(180,0),1
3990 PRINT #1,"Lives ";L
4000 RETURN
4010 REM
4020 REM  ----------------------
4030 REM  ** POSITION ALIENS **
4040 REM  ----------------------
4050 REM
4060 SOUND 7,&B00111110
4070 SOUND 0,2
4080 SOUND 1,15
4090 SOUND 8,5
4100 PUT SPRITE 2,(AX(1),AY),4,5
4110 PUT SPRITE 3,(AX(2),AY),6,5
4120 PUT SPRITE 4,(AX(3),AY-50),15,5
4130 SOUND 7,&B00111110
4140 SOUND 0,7
4150 SOUND 1,25
4160 SOUND 8,5
4170 PUT SPRITE 5,(AX(4),AY-50),11,5
4180 PUT SPRITE 6,(AX(5),AY-100),4,5
4190 PUT SPRITE 7,(AX(6),AY-100),13,5
4200 IF AX(1)<50 THEN AX(1)=240
4210 IF AX(2)<50 THEN AX(2)=240
4220 FOR I=1 TO 6
4230 IF AX(I)<10 THEN AX(I)=240
4240 AX(I)=AX(I)-AS
4250 NEXT I
4260 RETURN
4270 REM
4280 REM  ------------------------
4290 REM  *** SUBROUTINE  FOR ***
4300 REM  ***   MOVING CHAS   ***
4310 REM  ------------------------
4320 REM
4330 REM  ----------------------
4340 REM  *** CHAS GO LEFT ***
4350 REM  ----------------------
4360 REM
4370 MX=MX-MS:PUT SPRITE 1,(MX,MY),11,3:IF MY=37 AND MX<41 AND MX>33 THEN GOSUB
5230
4380 IF MX<10 THEN MX=10
```

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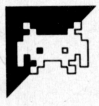
PROGRAM FILE

```
4390 RETURN
4400 REM
4410 REM  ----------------------
4420 REM  *** CHAS GO RIGHT ***
4430 REM  ----------------------
4440 REM
4450 MX=MX+MS:PUT SPRITE 1,(MX,MY),11,2:IF MY=19 THEN GOSUB 5340
4460 IF MX>230 THEN MX=230
4470 RETURN
4480 REM
4490 REM  --------------------
4500 REM  *** CHAS GO UP ***
4510 REM  --------------------
4520 REM
4530 IF MY=137 AND MX>131 AND MX<145 THEN MY=87
4540 IF MY=87 AND MX>223 AND MX<237 THEN MY=37
4550 PUT SPRITE 1,(MX,MY),11,3
4560 RETURN
4570 REM
4580 REM  ----------------------
4590 REM  *** CHAS GO DOWN ***
4600 REM  ----------------------
4610 REM
4620 IF MY=37 AND MX>223 AND MX<237 THEN MY=87
4630 IF MY=87 AND MX>131 AND MX<145 THEN MY=137
4640 PUT SPRITE 1,(MX,MY),11,2
4650 RETURN
4660 REM
4670 REM  --------------------------
4680 REM  ** LOOSE LIFE ROUTINE **
4690 REM  --------------------------
4700 REM
4710 SOUND 8,0
4720 MX=30:MY=137:PUT SPRITE 1,(MX,MY),11,2
4730 PLAY"T255V804BAGFE8D8C8","04GFEDC803B8A8","04EDC03BA8G8F8"
4740 L=L-1
4750 GOSUB 3970
4760 IF L<1 THEN GOSUB 4930
4770 FOR X=1 TO 600:NEXT X
4780 RETURN
4790 REM
4800 REM  --------------------------
4810 REM  ** TITLE MUSIC ROUTINE **
4820 REM  --------------------------
4830 REM
4840 A1$="O3T120E8D8C4E8F8G4A8B8O4C4O3B8A8G8A8G8F8E4D8C3"
4850 A2$="O3T120G8F8E4G8A8B4O4C8D8E4D8C8O3B8O4C8O3B8A8G4F8E3"
4860 PLAY A1$,A2$
4870 RETURN
4880 REM
4890 REM  ----------------------
4900 REM  *** LOOSER SCREEN ***
4910 REM  ----------------------
4920 REM
4930 SCREEN 0
4940 PRINT"You lose... you have scored ";SC%
4950 LOCATE 0,21:PRINT"Do you want to play again <Y/N> ?"
4960 A$=INKEY$
4970 IF A$="N" OR A$="n" THEN CLS:PRINT"SO LONG FOR NOW.":END
4980 IF A$="Y" OR A$="y" THEN CLEAR:GOTO 840
4990 GOTO 4960
5000 REM
5010 REM  ----------------------
5020 REM  *** INSTRUCTIONS ***
5030 REM  ----------------------
5040 REM
5050 SCREEN 0:COLOR 4,1
5060 PRINT"1.              INSTRUCTIONS"
5070 LOCATE 3,4:PRINT"Use the CURSOR keys to move Chas  around the screen."
5080 LOCATE 3,8:PRINT"You must help Chas prove he is notas yellow as he looks by
 helping him destroy the giant blue radio-active  spider eggs."
5090 LOCATE 3,14:PRINT"Jump over the spiders, which try  to protect the eggs, by
 pressing the SPACE BAR."
5100 LOCATE 3,20:PRINT"PRESS  ANY  KEY  TO  CONTINUE."
5110 IF INKEY$="" THEN 5110
5120 CLS
5130 PRINT"2.              INSTRUCTIONS"
5140 LOCATE 3,10:PRINT"After you have helped him destroy all the eggs on the scr
een return to the bottom level, ding the bell and  more eggs will appear."
5150 LOCATE 3,20:PRINT"PRESS  ANY  KEY  TO  CONTINUE."
5160 IF INKEY$=""THEN 5160
5170 RETURN
5180 REM
5190 REM  ----------------------
5200 REM  ** GO UP STAIRS  **
5210 REM  ----------------------
5220 REM
5230 SPRITE STOP
5240 FOR SU=1 TO 3
5250 MY=MY-6
5260 GOSUB 6210
5270 MX=MX-7
5280 NEXT SU
5290 SPRITE ON
5300 RETURN
5310 REM  ----------------------
5320 REM  ** GO DOWN STAIRS  **
5330 REM  ----------------------
5340 SPRITE STOP
5350 FOR D=1 TO 3
5360 MX=MX+7
5370 GOSUB 6230
5380 MY=MY+6
5390 NEXT D
5400 SPRITE ON
5410 RETURN
5420 REM  ----------------------
5430 REM  **  JUMP OVER GAP  **
5440 REM  ----------------------
5450 REM
5460 IF MY=87 AND MX>25 AND MX<35 THEN GOSUB 5820:RETURN
5470 IF MY=87 AND MX>185 AND MX<195 THEN GOSUB 5820:RETURN
5480 IF MY=37 AND MX>85 AND MX<95 THEN GOSUB 5820:RETURN
5490 IF MY=37 AND MX>135 AND MX<145 THEN GOSUB 5820:RETURN
5500 IF MY=87 AND MX>50 AND MX<60 THEN GOSUB 6040:RETURN
5510 IF MY=87 AND MX>210 AND MX<220 THEN GOSUB 6040:RETURN
5520 IF MY=37 AND MX>110 AND MX<120 THEN GOSUB 6040:RETURN
5530 IF MY=37 AND MX>160 AND MX<170 THEN GOSUB 6040:RETURN
5540 REM
5550 REM  ----------------------
5560 REM  ** JUMP OVER SPIDERS **
5570 REM  ----------------------
5580 REM
5590 SPRITE STOP
5600 FOR UP=1 TO 6
5610 MY=MY-3
```

```
5620 GOSUB 6230
5630 GOSUB 4060
5640 NEXT UP
5650 FOR D=1 TO 6
5660 MY=MY+3
5670 GOSUB 6230
5680 GOSUB 4060
5690 NEXT D
5700 SPRITE ON
5710 RETURN
5720 REM
5730 REM  ----------------------
5740 REM  ** JUMP GAP ROUTINE **
5750 REM  ----------------------
5760 REM
5770 REM
5780 REM  --------------------
5790 REM  ** JUMP TO RIGHT **
5800 REM  --------------------
5810 REM
5820 MY=MY-6
5830 GOSUB 6230
5840 MX=MX+8
5850 GOSUB 6230
5860 MY=MY-6
5870 GOSUB 6230
5880 MX=MX+8
5890 GOSUB 6230
5900 MX=MX+8
5910 GOSUB 6230
5920 MY=MY+6
5930 GOSUB 6230
5940 MX=MX+8
5950 GOSUB 6230
5960 MY=MY+6
5970 GOSUB 6230
5980 RETURN
5990 REM
6000 REM  --------------------
6010 REM  ** JUMP TO LEFT **
6020 REM  --------------------
6030 REM
6040 MY=MY-6
6050 GOSUB 6210
6060 MX=MX-8
6070 GOSUB 6210
6080 MY=MY-6
6090 GOSUB 6210
6100 MX=MX-8
6110 GOSUB 6210
6120 MX=MX-8
6130 GOSUB 6210
6140 MY=MY+6
6150 GOSUB 6210
6160 MX=MX-8
6170 GOSUB 6210
6180 MY=MY+6
6190 GOSUB 6210
6200 RETURN
6210 PUT SPRITE 1,(MX,MY),11,3
6220 RETURN
6230 PUT SPRITE 1,(MX,MY),11,2
6240 RETURN
6250 REM
6260 REM ---------------------------
6270 REM * YOU'VE BEEN VAPOURISED *
6280 REM ---------------------------
6290 REM
6300 PUT SPRITE 1,(MX,MY),4,3
6310 FOR X=1 TO 60:NEXT X
6320 PUT SPRITE 1,(MX,MY),15,3
6330 FOR X=1 TO 50:NEXT X
6340 PUT SPRITE 1,(MX,MY),11,3
6350 FOR X=1 TO 60:NEXT X
6360 PUT SPRITE 1,(MX,MY),15,3
6370 FOR X=1 TO 50:NEXT X
6380 PUT SPRITE 1,(MX,MY),6,3
6390 FOR X=1 TO 50:NEXT X
6400 PUT SPRITE 1,(MX,MY),15,3
6410 FOR X=1 TO 50:NEXT X
6420 PUT SPRITE 1,(MX,MY),13,3
6430 GOSUB 4710
6440 RETURN
```



QL Memoire

by AWH Perkins

This is a memory game for two players using joysticks or cursor keys. A 'board' consisting of 10 x 9 blocks is set up, representing 45 pairs of picture cards. You take turns to turn up two cards, keep them if they match, and then get another turn. At the end of the game, the player with most cards wins.

It is recommended that you play the game using joysticks. If you use the keyboard, then press the space bar to select a card. Turns are indicated by a red or blue joystick on either side of the screen.

```
100 REMark QL Memoire By A W H Perkins
110 REMark A "text-less" Memory Game...
120 REMark Should run in TV & Monitor Modes...
130 REMark Containing 45 different, full colour pictures!
140 REMark Version 1.0
150 MODE 8:RANDOMISE RND(1TO 10000)
160 WINDOW 512,256,0,0:PAPER 0:CLS
170 WINDOW 320,185,95,0:BORDER 1,7:INK 7
180 WINDOW#2,320,185,95,0:PAPER#2,0:INK#2,7:BORDER#2,1,7
190 OPEN#4,con_320x70a95x185:PAPER#4,0:INK#4,7:CLS#4
200 OPEN#5,con_68x68a145x187:SCALE#5,68,0,0
210 OPEN#6,con_68x68a285x187:SCALE#6,68,0,0
220 OPEN#7,con_60x255a33x0:PAPER#7,0:CLS#7:SCALE#7,255,0,0:OVER#7,-1
230 OPEN#8,con_60x255a416x0:PAPER#8,0:CLS#8:SCALE#8,255,0,0:OVER#8,-1
```

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PROGRAM FILE

```
240 udg:DIM gr(10,9),ca(45),pik(2),sc(2):play=2
250 FOR f=1TO 45:ca(f)=0
260 REPeat Loop1
270 xx=RND(1TO 10):yy=RND(1TO 9)
280 IF gr(xx,yy)<>0:GO TO 270
290 rr=RND(1TO 45):ca(rr)=ca(rr)+1:IF ca(rr)>2:GO TO 290
300 gr(xx,yy)=rr
310 FOR k=1TO 45
320 IF ca(k)>=2:NEXT k:EXIT Loop1
330 k=45
340 END REPeat Loop1
350 fills:sc(1)=0:sc(2)=0
360 stick(7)
370 REPeat main_loop
380 play=(NOT(play-1))+1:xxx=0:yyy=0
390 FOR pick=1TO 2
400 OVER -1:CURSOR 0,0:CSIZE 1,1:x%=1:y%=1:CURSOR (x%-1)*32+9,(y%-1)*20
+2:PRINT CHR$(33)
410 REPeat s_loop
420 k%=KEYROW(1)
430 IF k%=0:NEXT s_loop
440 CURSOR (x%-1)*32+9,(y%-1)*20+2:PRINT CHR$(33)
450 IF k%&&2:x%=x%-1
460 IF k%&&4:y%=y%-1
470 IF k%&&16:x%=x%+1
480 IF k%&&128:y%=y%+1
490 IF x%>10:x%=10
500 IF x%<1:x%=1
510 IF y%>9:y%=9
520 IF y%<1:y%=1
530 IF k%&&64
540 IF gr(x%,y%)=0OR (xxx=x% AND yyy=y%):BEEP 10000,1000:GO TO 560:ELSE
 EXIT s_loop
550 END IF
560 CURSOR (x%-1)*32+9,(y%-1)*20+2:PRINT CHR$(33)
570 END REPeat s_loop
580 OVER 0:BLOCK 27,15,(x%-1)*32+3,(y%-1)*20+3,0
590 card pick+4,gr(x%,y%):pik(pick)=gr(x%,y%):IF pick=1:xxx=x%:yyy=y%
600 NEXT pick
610 IF pik(1)=pik(2)
620 gr(xxx,yyy)=0:gr(x%,y%)=0
630 sc(play)=sc(play)+2:OVER#(play+6),0
640 FOR k=1TO sc(play)
650 INK#(play+6),(k MOD 2)+1:LINE#(play+6),0,(k-1)*2TO 50,(k-1)*2
660 NEXT k:OVER#(play+6),-1
670 IF sc(1)+sc(2)=90:end_game
680 play=(NOT(play-1))+1
690 END IF
700 FOR kk=1TO 2000:NEXT kk
710 FOR kk=1TO 160:SCROLL#4,1
720 fills
730 IF pik(1)=pik(2):GO TO 750
740 stick(7):stick(8)
750 END REPeat main_loop
760 DEFine PROCedure fills
770 FILL 0:FOR aa=1TO 10
780 FOR bb=1TO 9
790 IF gr(aa,bb)=0:BLOCK 27,15,(aa-1)*32+3,(bb-1)*20+3,0:GO TO 810
800 BLOCK 27,15,(aa-1)*32+3,(bb-1)*20+3,1,2
810 NEXT bb:NEXT aa
820 END DEFine fills
830 DEFine PROCedure udg
840 ob=PEEK_L(167722):nb=RESPR(875)
850 FOR m=0TO 875STEP 4
860 POKE_L nb+m,PEEK_L(ob+m):NEXT m
870 POKE_L 167722,nb:RESTORE 900
880 READ a:cb=nb+10+(a-32)*9
890 FOR d=1TO 9:READ e:POKE cb+d,e
900 DATA 33,124,68,68,84,68,68,124,0,0,0
910 END DEFine udg
920 DEFine PROCedure end_game
930 stick(play+6)
940 IF sc(1)<sc(2):ss=sc(1):c=8 :ELSE ss=sc(2):c=7
950 ss=ss*2:IF ss<=0:GO TO 970
960 FOR k=1TO ss:SCROLL#7,1:SCROLL#8,1
970 flag(c)
980 CSIZE 0,1:AT 5,0:PRINT"Enter for another game ..."
990 INPUT i$:IF RND>.5:RUN :ELSE RANDOMISE RND(1TO 4000):RUN
1000 END DEFine end_game
1010 DEFine PROCedure flag(v)
1020 IF v=7:v=137482 :ELSE v=137578
1030 RESTORE 1100
1040 FOR k=0TO 12
1050 FOR j=0TO 11
1060 READ a
1070 POKE (j+(k*128)+v),a
1080 NEXT j:NEXT k
1090 v=v-257:FOR k=0TO 45:POKE (k*128)+v,15:POKE (k*128)=128,0:NEXT k
1100 DATA 32,181,0,85,128,232,0,0,0,0,0,0,8,173,0,85,130,235,0,0,0,0,0,
0
1110 DATA 0,106,128,213,130,235,0,64,0,0,0,0,0,86,8,173,136,237,0,64,0,
0,0,0
1120 DATA 0,170,0,170,128,229,0,0,0,0,0,0,0,85,160,250,32,180,0,0,0,0,0
,0
1130 DATA 8,94,8,173,8,173,0,85,128,233,0,85,130,235,0,85,2,168,8,94,32
,181,0,80
1140 DATA 0,0,0,0,32,202,0,168,0,85,0,0,0,0,0,2,32,182,0,170,0,168,0,0
1150 DATA 0,0,0,2,32,211,32,122,128,229,0,0,0,0,0,0,8,94,2,87,2,171,0,8
0
1160 DATA 0,0,0,0,2,43,0,85,32,122,128,229
1170 END DEFine flag
1180 DEFine PROCedure stick(z)
1190 INK#z,(z-6):LINE#z,2,226TO 2,222TO 40,222TO 40,228:ARC#z,40,226TO
32,231,2:LINE#z,32,231TO 10,231:ARC#z,2,226TO 10,231,-2
1200 LINE#z,15,232TO 24,255TO 31,255TO 26,232
1210 INK#z,z-3
1220 END DEFine stick
1230 DEFine PROCedure card(ch,cc)
1240 INK#ch,7:FILL#ch,0
```

PROGRAM FILE

```
1250 SELect ON cc
1260 =1:RESTORE 1560:=2:RESTORE 1610:=3:RESTORE 1630:=4:RESTORE 1670
1270 =5:RESTORE 1710:=6:RESTORE 1730:=7:RESTORE 1760:=8:RESTORE 1780
1280 =9:RESTORE 1810:=10:RESTORE 1830:=11:RESTORE 1860:=12:RESTORE 1880
1290 =13:Memoire:GO TO 1510:=14:RESTORE 1970:=15:RESTORE 2000:=16:RESTO
RE 2020
1300 =17:RESTORE 2040:=18:RESTORE 2060:=19:RESTORE 2080:=20:RESTORE 210
0
1310 =21:RESTORE 2120:=22:RESTORE 2140:=23:RESTORE 2160:=24:RESTORE 219
0
1320 =25:RESTORE 2210:=26:RESTORE 2230:=27:RESTORE 2260:=28:RESTORE 228
0
1330 =29:RESTORE 2300:=30:RESTORE 2320:=31:RESTORE 2350:=32:RESTORE 237
0
1340 =33:RESTORE 2390:=34:RESTORE 2410:=35:RESTORE 2430:=36:RESTORE 245
0
1350 =37:RESTORE 2470:=38:RESTORE 2500:=39:RESTORE 2520:=40:RESTORE 254
0
1360 =41:CLEF:GO TO 1510:=42:RESTORE 2650:=43:RESTORE 2670:=44:RESTORE
2700:=45:pass:GO TO 1510
1370 END SELect
1380 REPeat loop
1390 READ a:IF a=8:FILL#ch,1:NEXT loop
1400 IF a=11:READ b,c,d,e,f:CIRCLE#ch,b,c,d,e,f:NEXT loop
1410 IF a=88:FILL#ch,0:NEXT loop
1420 IF a=999:EXIT loop
1430 READ b,c,d,e
1440 IF a=9
1450 INK#ch,b:POINT#ch,c,d:NEXT loop
1460 END IF
1470 IF a=10:READ f:ARC#ch,b,c TO d,e,f:NEXT loop
1480 INK#ch,a:LINE#ch,b,c TO d,e
1490 END REPeat loop
1500 IF cc=1:INK#ch,3:CURSOR#ch,10,8:PRINT#ch,"CHAD"
1510 BORDER#ch,1,1:BORDER#ch:PAPER#ch,0
1520 IF cc=44:RECOL#ch,1,2,3,4,5,6,7,0
1530 END DEFine card
1540 REMark DATA for pictures...
1550 REMark Chad
1560 DATA 8,2,0,0,50,0,2,50,0,50,25,2,50,25,0,25,2,0,25,0,0,88,7,0,0,50
,0,7,0,5,50,5,7,0,10,50,10,7,0,15,50,15,7,0,20,50,20,7,0,25,50,25
1570 DATA 7,0,0,0,25,7,50,0,50,25,7,40,0,40,5,7,30,0,30,5,7,20,0,20,5,7
,10,0,10,5,7,5,5,5,10,7,15,5,15,10,7,25,5,25,10,7,35,5,35,10,7,45,5,45,
10
1580 DATA 7,10,10,10,15,7,20,10,20,15,7,30,10,30,15,7,40,10,40,15,7,5,1
5,5,20,7,15,15,15,20,7,25,15,25,20,7,35,15,35,20,7,45,15,45,20,7,10,20,
10,25,7,20,20,20,25,7,30,20,30,25,7,40,20,40,25
1590 DATA 2,15,26,15,31,2,35,26,35,30,10,15,30,35,30,-3.142,8,0,21,25,2
1,19,10,21,19,29,19,3.142,0,29,19,29,25,0,29,25,21,25,88,9,5,20,32,0,9,
5,30,32,0,999
1600 REMark Red Cross
1610 DATA 8,7,0,20,50,20,7,50,20,50,50,7,50,50,0,50,7,0,50,0,20,8,2,22,
20,27,20,2,27,20,27,50,2,27,50,22,50,2,22,50,22,20,8,2,0,32,50,32,2,50,
32,50,37,2,50,37,0,37,2,0,37,0,32,88,999
1620 REMark Tank
1630 DATA 8,4,15,40,32,40,4,32,40,32,37,4,32,37,35,37,4,35,37,35,32,4,3
5,32,32,32,4,32,32,32,30,4,32,30,15,30,4,15,30,15,32,4,15,32,12,32,4,12
,32,12,37,4,12,37,15,37,4,17,37,15,40,88
1640 DATA 5,35,35,50,35,4,5,29,0,26,4,0,26,0,20,4,0,20,5,16,4,5,16,5,21
,4,5,21,45,21,4,45,21,45,16,4,45,16,50,20,4,50,20,50,26,4,50,26,45,29,4
,45,29,5,29
1650 DATA 4,10,19,40,19,4,42,18,42,15,4,40,14,10,14,4,8,15,8,18,2,12,16
,38,16,999
1660 REMark Harry
1670 DATA 8,6,15,52,15,62,6,15,63,18,68,6,18,68,32,68,6,32,68,35,62,6,3
5,62,35,52,6,35,52,43,52,6,43,52,43,50,6,43,50,7,50,6,7,50,7,52,6,7,52,
15,52,6,15,52,15,63,8,6,16,48,25,48,6,25,48,25,45,6,25,45,33,45,6,33,45
,33,40
1680 DATA 6,33,40,30,36,6,30,36,20,36,6,20,36,16,40,6,16,40,16,48,8,6,1
2,32,17,35,6,17,35,27,35,6,27,35,37,30,6,37,30,37,15,6,37,15,30,10,6,30
,10,18,10,6,18,10,12,15,6,12,15,12,32
1690 DATA 8,0,20,28,17,22,0,17,22,23,15,0,23,15,26,17,0,26,17,21,29,0,2
1,24,20,28,88,0,23,27,20,21,999
1700 REMark QL
1710 DATA 7,5,10,5,55,7,5,55,20,55,7,20,55,20,10,7,20,10,5,10,8,7,25,5,
20,5,7,20,5,12,18,7,12,18,15,14,7,15,14,25,5,88,7,28,55,28,10,7,28,10,4
0,10,999
1720 REMark House
1730 DATA 8,4,0,0,50,0,4,50,0,50,20,4,50,20,0,20,4,0,20,0,0,8,1,50,20,5
0,68,1,50,68,0,68,1,0,68,0,20,1,0,20,50,20,8,7,10,5,40,5,7,40,5,40,30,7
,40,30,10,30,7,10,30,10,5,8,2,5,30,44,30,2,44,30,40,37,2,40,37,10,37,2,
10,37,5,30
1740 DATA 8,0,20,4,20,15,0,20,15,28,15,0,28,15,28,4,8,0,12,20,12,27,0,1
2,27,20,27,0,20,27,20,20,8,0,28,20,28,27,0,28,27,36,27,0,36,27,36,20,88
,999
1750 REMark road
1760 DATA 8,4,0,0,50,0,4,50,0,50,25,4,50,25,0,25,4,0,25,0,0,8,5,0,25,50
,25,5,50,25,50,68,5,50,68,0,68,5,0,68,0,0,8,0,15,0,22,25,0,22,25,26,25,
0,26,25,32,0,0,32,0,15,0,88,999
1770 REMark Ghost
1780 DATA 7,0,0,0,0,10,5,40,45,40,-3.142,7,5,40,5,17,10,5,17,12,17,3.14
,10,12,17,19,17,3.14,10,19,17,26,17,3.14,10,26,17,33,17,3.14,10,33,17,4
0,17,3.14,10,40,17,47,17,3.14,7,45,17,45,40
1790 DATA 8,10,11,40,24,40,3.14,10,24,40,11,40,3.14,8,10,28,40,41,40,3.
14,10,41,40,28,40,3.14,8,0,0,0,0,0,10,15,40,20,40,3.14,10,20,40,15,40,3
.14,8,10,32,40,37,40,3.14,10,37,40,32,40,3.14,88,9,0,0,0,0,999
1800 REMark Skull
1810 DATA 8,6,17,27,17,35,10,17,35,30,35,-5.4,6,30,35,30,27,6,30,35,17,
35,88,0,38,55,38,30,8,11,19,47,4,1,PI,8,11,31,47,4,1,PI,8,0,21,38,24,43
,0,24,43,27,38,0,27,38,21,38,88,0,17,27,17,35,999
1820 REMark Castle of Terror
1830 DATA 1,5,5,5,25,1,5,25,0,25,1,0,25,0,38,1,0,38,16,38,1,16,38,16,25
,1,16,25,11,25,1,11,25,11,5,1,11,5,5,5,1,40,5,40,25,1,40,25,34,25,1,34,
25,34,38,1,34,38,50,38,1,50,38,50,25,1,50,25,45,25,1,45,25,45,5,1,45,5,
40,5,1,11,8,39,8,8,1,21,8,21,16
1840 DATA 10,21,16,27,16,-3.14,1,27,16,27,8,1,27,8,21,8,1,21,16,27,16,8
8,1,16,32,34,32,999
1850 REMark Axe
1860 DATA 8,3,0,0,50,0,3,50,0,50,68,3,50,68,0,68,3,0,68,0,0,88,5,0,0,0,
0,10,20,57,30,50,2,10,20,35,30,44,-2,10,21,57,20,35,2.4,9,3,21,57,0,8,2
```


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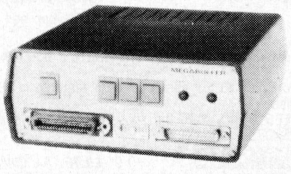

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PROGRAM FILE

```
,27,55,27,5,2,27,5,31,5,2,31,5,31,55,2,31,55,27,55,88,4,30,44,30,50,999
1870 REMark Circles1
1880 DATA 8,1,0,0,50,0,1,50,0,50,68,1,50,68,0,68,1,0,68,0,0,8,6,0,0,0,0
,11,26,33,20,1,PI,8,2,0,0,0,0,11,26,33,14,1,PI,8,5,0,0,0,0,11,26,33,8,1
,PI,8,3,0,0,0,0,11,26,33,4,1,PI,88,999
1890 REMark Memoire
1900 DEFine PROCedure Memoire
1910 RESTORE 1950:FOR k=1TO 7
1920 READ a$:INK#ch,k:CURSOR#ch,2+k+(k-1)*7,2+(k-1)*9:PRINT#ch,a$:NEXT
k
1930 INK#ch,7
1940 END DEFine Memoire
1950 DATA "M","E","M","O","I","R","E"
1960 REMark Blocks
1970 DATA 8,4,0,0,50,0,4,50,0,50,68,4,50,68,0,68,4,0,68,0,0,8,2,25,0,50
,0,2,50,0,50,57,2,50,57,25,57,2,25,57,25,0,8,5,0,0,20,0,5,20,0,20,16,5,
20,16,0,16,5,0,16,0,0,8,1,11,10,30,10,1,30,10,30,22,1,30,22,11,22,1,11,
22,11,10
1980 DATA 8,3,34,0,50,18,3,50,18,22,62,3,22,62,6,50,3,6,50,34,0,88,999
1990 REMark Sword
2000 DATA 8,2,20,68,26,68,2,26,68,26,55,2,26,55,33,55,2,33,55,33,50,2,3
3,50,13,50,2,13,50,13,55,2,13,55,20,55,2,20,55,20,68,8,6,18,48,22,0,6,2
2,0,28,48,6,28,48,18,48,88,6,22,0,22,40,999
2010 REMark Club
2020 DATA 8,4,0,0,50,0,4,50,0,50,68,4,50,68,0,68,4,0,68,0,0,8,0,19,10,3
2,10,0,32,10,28,24,0,28,24,23,24,0,23,24,19,10,8,11,26,52,11,1,PI,8,11,
37,32,11,1,PI,8,11,14,32,11,1,PI,88,999
2030 REMark Heart
2040 DATA 8,2,25,4,10,35,2,10,35,40,35,2,40,35,25,4,8,10,10,35,25,33,-4
,8,10,25,33,40,35,-4,88,999
2050 REMark Spade
2060 DATA 8,3,0,0,50,0,3,50,0,50,68,3,50,68,0,68,3,0,68,0,0,8,0,20,10,3
0,10,0,30,10,25,30,0,25,30,20,10,8,0,26,67,10,35,0,10,35,40,35,0,40,35,
26,67,8,10,10,35,25,37,4,8,10,26,37,40,35,4,88,999
2070 REMark Diamond
2080 DATA 8,2,25,4,45,30,2,45,30,25,59,2,25,59,5,30,2,5,30,25,4,88,999
2090 REMark Star of David
2100 DATA 8,6,5,10,50,40,6,50,40,17,40,6,17,40,5,10,8,6,0,40,45,10,6,45
,10,32,40,6,32,40,0,40,8,6,25,57,5,10,6,5,10,37,30,6,37,30,25,57,88,999
2110 REMark Diode
2120 DATA 8,5,0,0,50,0,5,50,0,50,68,5,50,68,0,68,5,0,68,0,0,8,0,15,20,3
5,20,0,35,20,35,25,0,35,25,15,25,0,15,25,15,20,88,0,15,40,35,40,0,35,40
,25,25,0,25,25,15,40,11,25,31,18,1,PI,0,25,0,25,68,999
2130 REMark Box
2140 DATA 8,5,5,10,35,10,5,35,10,35,20,5,35,20,10,20,5,10,20,10,40,5,10
,40,5,40,5,5,40,5,10,8,3,35,10,40,20,3,40,20,40,50,3,40,50,10,50,3,10,5
0,5,40,3,5,40,35,40,3,35,40,35,10,8,2,10,21,35,21,2,35,21,35,39,2,35,39
,10,39,2,10,39,10,21,88,999
2150 REMark Tennis
2160 DATA 8,7,24,0,26,0,7,26,0,26,30,7,26,30,24,30,7,24,30,24,0,88,11,2
4,50,17,PI/5,0,88,9,7,23,31,0,9,7,26,31,0,2,18,35,18,64,2,25,34,25,67,2
,31,33,31,64,2,17,60,34,60,2,16,50,34,50,2,18,42,31,42,2,21,38,29,38
2170 DATA 2,17,46,33,46,2,17,55,33,55,2,21,64,31,64,2,22,66,22,36,2,28,
66,28,36,999
2180 REMark Boat
2190 DATA 8,4,1,30,50,30,4,50,30,36,15,4,36,15,7,15,4,7,15,1,30,8,2,19,
30,19,68,2,19,68,22,68,2,22,68,22,30,2,22,30,19,30,8,5,24,55,24,38,5,24
,38,37,38,5,37,38,24,55,8,5,17,65,17,38,5,17,38,2,38,5,2,38,17,65,88,99
9
2200 REMark Pale
2210 DATA 6,10,34,17,8,11,25,34,15,.2,PI/2,10,17,8,33,8,1.2,6,33,8,40,3
4,10,10,34,40,34,-3.4,999
2220 REMark Arrows
2230 DATA 3,22,45,28,45,3,28,45,28,51,3,30,51,25,58,3,25,58,20,51,3,22,
51,22,45,3,35,32,40,32,3,40,30,47,35,3,47,35,40,40,3,40,38,35,38,3,35,3
8,35,32,3,15,32,10,32,3,10,30,3,35,3,3,35,10,40,3,10,38,15,38,3,15,38,1
5,32
2240 DATA 3,22,25,28,25,3,28,25,28,20,3,30,20,25,13,3,25,13,20,20,3,22,
20,22,25,999
2250 REMark Longbow
2260 DATA 2,25,60,42,33,2,42,33,25,5,10,25,60,26,5,2,8,4,37,34,44,34,4,
44,34,44,32,4,44,32,37,32,4,37,32,37,34,88,4,38,33,6,33,8,4,6,33,12,36,
4,12,36,12,30,4,12,30,6,33,88,999
2270 REMark Muncher
2280 DATA 6,0,0,0,0,8,10,6,45,41,25,-3.2,6,6,45,41,25,8,10,6,25,41,45,3
.2,6,6,25,41,45,0,0,0,0,0,8,11,28,44,5,1,PI,88,999
2290 REMark Globe
2300 DATA 5,0,0,0,0,11,25,34,20,1,PI,11,25,34,20,.7,PI/2,11,25,34,20,.3
,PI/2,11,25,34,20,.6,PI,11,25,34,20,.3,PI,999
2310 REMark Rainbow
2320 DATA 8,1,0,34,50,34,1,50,34,50,68,1,50,68,0,68,1,0,68,0,34,0,0,0,0
,0,8,11,25,34,23,1,0,8,1,0,0,0,0,11,25,34,11,1,0,88,11,25,34,13,1,0,3,0
,0,0,0,11,25,34,15,1,0,4,0,0,0,0,11,25,34,17,1,0,5,0,0,0,0,11,25,34,19,
1,0
2330 DATA 6,0,0,0,0,11,25,34,21,1,0,1,0,0,0,0,11,25,34,23,1,0,8,4,0,32,
50,32,4,50,32,50,0,4,50,0,0,0,4,0,0,0,32,88,7,4,56,4,46,7,8,56,8,50,8,1
1,11,61,8,.4,PI/2,999
2340 REMark Dice
2350 DATA 4,2,20,23,20,4,23,20,23,45,4,23,45,2,45,4,2,45,2,20,4,26,20,4
8,20,4,48,20,48,45,4,48,45,26,45,4,26,45,26,20,5,0,0,0,0,8,11,13,32,2,1
,0,8,8,11,32,40,2,1,0,8,11,44,40,2,1,0,8,11,32,25,2,1,0,8,11,44,25,2,1,
0,88,999
2360 REMark Sine Wave
2370 DATA 6,7,20,7,45,6,0,32,50,32,4,0,0,0,0,10,8,31,28,31,-3.4,10,28,3
0,49,30,PI,999
2380 REMark Traffic Lights
2390 DATA 7,18,20,32,20,7,32,20,32,60,7,32,60,18,60,7,18,60,18,20,7,24,
0,24,20,7,26,0,26,20,2,0,0,0,0,8,11,26,52,5,1,0,6,0,0,0,0,8,11,26,40,5,
1,0,4,0,0,0,0,8,11,26,28,5,1,0,999
2400 REMark Uneven Road
2410 DATA 8,2,0,10,25,55,2,25,55,51,10,2,51,10,0,10,8,7,8,14,25,47,7,25
,47,42,14,7,41,14,7,14,8,0,15,18,35,18,0,35,18,35,21,0,35,21,15,21,0,15
,21,15,18,8,10,17,20,23,20,-3.5,8,10,27,20,33,20,-3.5,88,999
2420 REMark TV
2430 DATA 8,7,0,10,50,10,7,50,10,50,45,7,50,45,0,45,7,0,45,0,10,8,0,8,4
2,30,42,10,30,42,29,14,-1.2,0,29,14,8,14,10,8,14,9,42,-1.2,8,2,37,14,37
,30,2,37,30,47,30,2,47,30,47,14,2,47,14,37,14,999
2440 REMark Shapes
2450 DATA 8,1,0,0,50,0,1,50,0,50,68,1,50,68,0,68,1,0,68,0,0,8,5,10,60,1
```

PROGRAM FILE

```
0,30,5,10,30,50,10,5,50,10,50,40,5,50,40,10,60,8,0,0,0,0,0,11,32,56,15,
1,0,8,3,19,54,40,4,3,40,4,5,23,3,5,23,19,54,999
2460 REMark Door
2470 DATA 8,4,0,0,50,0,4,50,0,50,10,4,50,10,0,10,4,0,10,0,0,8,5,0,10,50
,10,5,50,10,50,68,5,50,68,0,68,5,0,68,0,10,8,7,10,10,38,10,7,38,10,38,6
0,7,38,60,10,60,7,10,60,10,10,8,0,13,13,36,13,0,36,13,36,32,0,36,32,13,
32,0,13,32,13,13,8
2480 DATA 0,13,40,36,40,0,36,40,36,58,0,36,58,13,58,0,13,58,13,40,8,11,
33,35,3,1,0,999
2490 REMark Transistor
2500 DATA 11,25,35,15,1,0,8,7,21,27,25,27,7,25,27,25,45,7,25,45,21,45,7
,21,45,21,27,8,7,25,30,29,30,7,29,30,27,25,7,27,25,25,30,88,7,25,30,32,
23,7,20,35,0,35,7,32,23,32,0,7,25,41,34,48,7,34,48,34,68,999
2510 REMark Ok!
2520 DATA 7,22,35,22,44,10,22,44,27,44,-3,7,22,35,18,35,10,19,35,18,30,
3,10,19,30,18,25,3,10,19,25,18,20,3,10,19,20,18,15,3,7,18,15,50,20,7,18
,30,23,30,7,18,25,23,26,7,18,20,23,21,7,18,15,23,17,9,0,16,30,0,7,27,44
,27,35,7,27,35,30,31,7,30,31,50,31,999
2530 REMark Jaws!!!
2540 DATA 4,50,40,17,60,10,17,60,11,55,3,4,11,55,44,25,4,44,25,10,10,10
,10,10,13,5,3,4,13,5,50,13,2,0,0,0,0,11,46,34,2,1,0,999
2550 REMark Treble Clef
2560 DEFine PROCedure CLEF
2570 PAPER#ch,5:CLS#ch:INK#ch,0:PAPER#ch,0:SCALE#ch,25,0,0:LINE#ch,9,10
2580 ARC_R#ch TO 0,4.5,-PI
2590 ARC_R#ch TO 0,-6,-PI TO -3,7,-3*PI/4
2600 LINE_R#ch TO 5,7:ARC_R#ch TO -2,0,PI
2610 LINE_R#ch TO 0,-18
2620 FILL#ch,1:CIRCLE_R#ch,-1,0,1:FILL#ch,0:SCALE#ch,68,0,0
2630 END DEFine CLEF
2640 REMark Key
2650 DATA 8,5,0,0,50,0,5,50,0,50,68,5,50,68,0,68,5,0,68,0,0,8,2,0,0,0,0
,10,20,40,25,40,-5.8,8,5,0,0,0,0,11,22,50,6,1,0,8,2,20,40,20,5,10,20,5,
25,5,4,2,25,5,33,5,2,33,5,33,10,2,33,10,27,10,2,27,10,27,15,2,27,15,33,
15,2,33,15,33,20,2,33,20,25,20,2,25,20,25,40,88,999
2660 REMark Numero Uno
2670 DATA 8,3,5,3,45,3,3,45,3,45,10,3,45,10,30,10,3,30,10,30,65,3,30,65
,20,65,3,20,65,10,55,3,10,55,20,55,3,20,55,20,10,3,20,10,5,10,3,5,10,5,
3,88
2680 DATA 5,5,3,45,3,5,45,3,45,10,5,45,10,30,10,5,30,10,30,65,5,30,65,2
0,65,5,20,65,10,55,5,10,55,20,55,5,20,55,20,10,5,20,10,5,10,5,5,10,5,3,
999
2690 REMark Tick!!!
2700 DATA 4,0,0,0,0,10,5,25,23,5,-1.2,10,23,5,50,58,-.7,10,50,58,19,22,
1.2,10,5,25,20,22,-2,999
2710 REMark Passage
2720 DEFine PROCedure pass
2730 BORDER#ch,7,2:PAPER#ch,3:CLS#ch:BORDER#ch,5:PAPER#ch,4:CLS#ch:BORD
ER#ch,10:PAPER#ch,5:CLS#ch:BORDER#ch,15:PAPER#ch,6:CLS#ch:BORDER#ch
2740 END DEFine pass
```

Spectrum Nighthawk

by Richard Whitfield

Nighthawk is a game for the 48k Sinclair Spectrum that involves flying a combat helicopter to destroy tanks before fuel runs out.

Full instructions are included in the program, which includes a high-score table and is written entirely in Basic.

```
  0>REM      Nighthawk                    1985 by R.Whitfield
                  Any transmitting,copying,      lending,hiring or broad-
    casting of this program          without the author's          written co
nsent is                  STRICTLY PROHIBITED.
  1 BORDER 0: PAPER 0: INK 7: BRIGHT 1: CLS
  5 LET scorepos=14
  6 REM DEFINE CHARACTERS
  7 FOR f=0 TO 7: READ a: POKE USR "m"+f,a: NEXT f: DATA 60,2,57,72,16,32,64,12
8
  8 FOR f=0 TO 7: READ a: POKE USR "l"+f,a: NEXT f: DATA 0,0,16,10,141,89,41,24
7
  9 FOR f=0 TO 7: READ a: POKE USR "k"+f,a: NEXT f: DATA 200,81,105,36,5,0,16,2
07
 10 FOR f=0 TO 7: READ a: POKE USR "j"+f,a: NEXT f: DATA 52,72,128,0,0,26,36,19
5
 11 FOR f=0 TO 7: READ a: POKE USR "i"+f,a: NEXT f: DATA 24,60,24,24,60,36,102,
24
 12 FOR f=0 TO 7: READ a: POKE USR "h"+f,a: NEXT f: DATA 60,24,129,195,195,129,
24,60
 13 FOR f=0 TO 7: READ a: POKE USR "g"+f,a: NEXT f: DATA 252,2,249,72,16,32,64,
128
 14 FOR f=0 TO 7: READ a: POKE USR "f"+f,a: NEXT f: DATA 255,0,255,102,153,153,
102,255
 15 FOR f=0 TO 7: READ a: POKE USR "e"+f,a: NEXT f: DATA 0,0,127,3,0,0,0,48
 16 FOR f=0 TO 7: READ a: POKE USR "d"+f,a: NEXT f: DATA 63,64,159,18,8,4,2,1
 17 FOR f=0 TO 7: READ a: POKE USR "c"+f,a: NEXT f: DATA 28,62,242,251,59,31,25
5,252
 18 FOR f=0 TO 7: READ a: POKE USR "b"+f,a: NEXT f: DATA 24,60,126,126,126,126,
60,24
 19 FOR f=0 TO 7: READ a: POKE USR "a"+f,a: NEXT f: DATA 6,9,9,9,6,0,0,0
 20 REM GOTO INTRODUCTION SEQUENCE
 21 GO TO 9500
 30 PLOT 54,77: DRAW 179,0: DRAW 0,13: DRAW -179,0: DRAW 0,-13: PRINT AT 11,7;
INK 7; PAPER 2; FLASH 1; BRIGHT 1;" PREPARE FOR TAKE-OFF "
 35 FOR F=0 TO 40: BEEP 0.1,20: BEEP 0.1,15: NEXT F
 40 CLS
 41 REM SET UP VARIABLES & SCREEN DISPLAY
 45 LET jat=0: LET time=0: LET enembe=INT (1+(359*RND)): LET enemrng=INT (30+20
0*RND): LET k=0: LET damr=0: LET x1=70: LET x2=70: LET up=0: LET j=2: LET can=0:
 LET rock=0: LET be=0: LET alt=0: LET power=0: LET spe=(power/20): LET cannon=60
00: LET missile=30: LET track=0: LET fuel=1000000-(power/2000): LET dam=0: LET d
$="NONE": LET kill=0: LET hikill=0: LET type=0: LET found=0
 46 LET powerpos=8+(power/100): LET spepos=8+(spe/5): LET fuelpos=8+(fuel/10000
)
 47 LET dcol1=0: LET dcol2=0: LET dcol3=0: LET dcol4=0: LET dcol5=0: LET dcol6=
0: LET dcol7=0: LET dcol8=0: LET dcol9=0: LET dcol10=0: LET hozx=0: LET hozy=70
```


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PROGRAM FILE

```
  48 LET prec=0: LET swe=0: LET zone=0: LET zoneh=0: LET tpx=12+INT (3*RND)
  49 LET q$="Adolf H.": LET q=30: LET w$="Whit Jnr.": LET w=24: LET e$="BuLLiT": LET e=17: LET r$="F R E D": LET r=11: LET t$="Whit Snr.": LET t=7: LET y$="P.B.H": LET y=1
  50 PLOT 85,10: DRAW 2,-1: DRAW 1,-1: DRAW 84,0: DRAW 1,1: DRAW 2,1: DRAW 0,116: DRAW -1,1: DRAW -2,1: DRAW -84,0: DRAW -2,-1: DRAW -1,-1: DRAW 0,-116
  55 PLOT 13,7: DRAW 10,0: DRAW 0,103: DRAW -10,0: DRAW 0,-103
  56 FOR n=29 TO 70: PLOT  INK 4; OVER 0;91,n: DRAW  INK 4;76,0: NEXT n
  57 PLOT 207,7: DRAW 46,0: DRAW 2,2: DRAW 0,46: DRAW -2,2: DRAW -46,0: DRAW -2,-2: DRAW 0,-46: DRAW 2,-2
  60 LET x$="P O W E R": FOR n=1 TO LEN x$: PRINT AT 9+n,0; BRIGHT 1; INK 5;x$(n): NEXT n
  65 PRINT AT 8,3;"10";AT 14,3;"5";AT 20,3;"0": PRINT AT 6,1;"RPM";AT 7,1;"x1000"
  70 PLOT 49,7: DRAW 10,0: DRAW 0,103: DRAW -10,0: DRAW 0,-103
  75 LET x$="S P E E D": FOR n=1 TO LEN x$: PRINT AT 9+n,5; BRIGHT 1; INK 5;x$(n): NEXT n
  80 PRINT AT 8,8;"50";AT 14,8;"25";AT 20,8;"0": PRINT AT 6,7;"KPH";AT 7,7;"x10"
  81 LET x$="F U E L": FOR n=1 TO LEN x$: PRINT AT 9+n,23; BRIGHT 1; INK 5;x$(n): NEXT n
  85 PLOT 192,7: DRAW 10,0: DRAW 0,103: DRAW -10,0: DRAW 0,-103
  90 PRINT AT 21,11; PAPER 2; INK 7; BRIGHT 1;"DAMAGE:";d$
  91 PRINT AT 3,20; INK 7; PAPER 2;"Alt:";alt;"ft"
  95 PLOT 206,90: DRAW 35,0: DRAW 0,-28: DRAW -35,0: DRAW 0,28
 100 PRINT AT 11,26; INK 7; PAPER 2; BRIGHT 1;"30mm";AT 12,26; INK 7; BRIGHT 1; PAPER 2;"RNDS"
 105 PLOT 182,138: DRAW 60,0: DRAW 0,-21: DRAW -21,0: DRAW 0,8: DRAW -39,0: DRAW 0,12
 110 PRINT AT 5,23; INK 7; PAPER 2; BRIGHT 1;"ROCKETS"
 120 LET a=0: FOR n=0 TO 13: INK 1: PLOT 7+a,152+a: DRAW 95-a,10: DRAW 50,0: DRAW 95-a,-10: LET a=a+1: NEXT n: INK 7
 130 PRINT AT 3,2; INK 7; PAPER 1; BRIGHT 1;"TARGET BEAR:";enembe;"  ";AT 4,2; INK 7; PAPER 2; BRIGHT 1;"BEAR:";be;" "
 131 FOR n=7 TO 107: PLOT  BRIGHT 1; INK 7;194,n: DRAW  INK 7; BRIGHT 1;5,0: BEEP 0.01,50: NEXT n
 139 REM MAIN GAME LOOP
 140 FOR n=0 TO 1000000000000000000000000000000000000
 141 LET powerpos=8+(power): LET spepos=8+(spe)
 142 IF IN 64510=190 AND power>5 AND alt>0 THEN  LET alt=alt+10
 143 IF IN 31=8 AND power>5 AND alt>0 THEN  LET alt=alt+10
 144 IF enembe>360 THEN  LET enembe=enembe-360
 150 IF power>=5 AND x1<100 AND x2<100 AND IN 31=8 THEN  PLOT  OVER 0; INK 4;91,hozy: DRAW  OVER 0; INK 4;76,hozx: LET k=1: LET x1=x1+1: LET x2=x2+1: LET hozy=hozy+1: LET hozx=hozx: LET alt=alt-10: LET be=be
 151 IF power>=5 AND x1<100 AND x2<100 AND IN 65022=190 THEN  PLOT  OVER 0; INK 4;91,hozy: DRAW  OVER 0; INK 4;76,hozx: LET k=1: LET x1=x1+1: LET x2=x2+1: LET hozy=hozy+1: LET hozx=hozx: LET alt=alt-10: LET be=be
 152 IF power>=5 AND x1>29 AND x2>29 AND IN 64510=190 THEN  PLOT  OVER 1; INK 4;91,hozy: DRAW  OVER 1; INK 4;76,hozx: LET k=1: LET x1=x1-1: LET x2=x2-1: LET hozy=hozy-1: LET hozx=hozx: LET alt=alt+10: LET be=be
 153 IF power>=5 AND x1<100 AND x2>29 AND IN 57342=189 THEN  PLOT  OVER 1; INK 4;91,hozy: DRAW  OVER 1; INK 4;76,hozx: LET k=1: LET x1=x1: LET x2=x2-1: LET hozy=hozy: LET hozx=hozx-1: LET be=be-1
 154 IF power>=5 AND x1>29 AND x2<100 AND IN 57342=190 THEN  PLOT  OVER 0; INK 4;91,hozy: DRAW  OVER 0; INK 4;76,hozx: LET k=1: LET x1=x1: LET x2=x2+1: LET hozy=hozy: LET hozx=hozx+1: LET be=be+1
 155 IF power>=5 AND x1>29 AND x2>29 AND IN 31=4 THEN  PLOT  OVER 1; INK 4;91,hozy: DRAW  OVER 1; INK 4;76,hozx: LET k=1: LET x1=x1-1: LET x2=x2-1: LET hozy=hozy-1: LET hozx=hozx: LET alt=alt+10: LET be=be
 156 IF power>=5 AND x1<100 AND x2>29 AND IN 31=2 THEN  PLOT  OVER 1; INK 4;91,hozy: DRAW  OVER 1; INK 4;76,hozx: LET k=1: LET x1=x1: LET x2=x2-1: LET hozy=hozy: LET hozx=hozx-1: LET be=be-1
 157 IF power>=5 AND x1>29 AND x2<100 AND IN 31=1 THEN  PLOT  OVER 0; INK 4;91,hozy: DRAW  OVER 0; INK 4;76,hozx: LET x1=x1: LET x2=x2+1: LET hozy=hozy: LET hozx=hozx+1: LET be=be+1
 158 IF be<0 THEN  LET be=be+360
 159 IF be>360 THEN  LET be=be-360
 160 IF enembe>360 THEN  LET enembe=enembe-360
 161 IF enembe<0 THEN  LET enembe=enembe+360
 162 IF be>=0 AND be<=90 THEN  LET zoneh=1
 163 IF be>=91 AND be<=180 THEN  LET zoneh=2
 164 IF be>=181 AND be<=270 THEN  LET zoneh=3
 165 IF be>=271 AND be<=360 THEN  LET zoneh=4
 166 IF enembe>=0 AND enembe<=90 THEN  LET zone=1
 167 IF enembe>=91 AND enembe<=180 THEN  LET zone=2
 168 IF enembe>=181 AND enembe<=270 THEN  LET zone=3
 169 IF enembe>=271 AND enembe<=360 THEN  LET zone=4
 170 IF zoneh<>zone AND power>1 THEN  LET enemrng=enemrng+INT (1+spe*5/(60))
 171 IF zoneh=zone AND power>1 THEN  LET enemrng=enemrng-INT (1+spe*5/(60))
 172 IF enemrng<=0 THEN  LET enemrng=1-enemrng: LET swe=5: PRINT AT 3,14; INK 7; PAPER 1; BRIGHT 1;"    ";AT 3,14; INK 7; PAPER 1; BRIGHT 1;enembe;" "
 173 IF enembe>360 THEN  LET enembe=enembe-360
 193 IF IN 65022=187 THEN  LET damr=10: LET jat=0: GO TO 6000
 194 PRINT AT 16,26; INK 7; BRIGHT 1; PAPER 2;"E.rng";AT 17,26;enemrng;" ";AT 18,26;"km"
 195 PRINT AT 4,7; PAPER 2; INK 7; BRIGHT 1;be;"    ";
 196 IF IN 65022=189 THEN  GO TO 6030
 197 IF IN 31=1 AND power>1 AND alt>5 THEN  LET be=be+1
 198 IF IN 31=2 AND alt>5 AND power>1 THEN  LET be=be-1
 199 IF enemrng<15 THEN  PRINT AT 17,26; PAPER 2; OVER 1; FLASH 1; INK 7; BRIGHT 1;"  "
 200 IF enemrng>15 THEN  PRINT AT 17,26; PAPER 2; OVER 1; INK 7;"      "
 201 IF IN 57342=190 AND power>5 AND alt>5 THEN  LET be=be+1
 202 IF IN 57342=189 AND alt>5 AND power>1 THEN  LET be=be-1
 203 IF IN 57342=187 AND powerpos<108 THEN  LET power=power+1: PLOT  INK 7; BRIGHT 1; OVER 0; PAPER 8;15,powerpos: DRAW  INK 7; BRIGHT 1;5,0: LET j=1
 204 IF IN 57342=183 AND powerpos>8 THEN  PLOT  BRIGHT 1; PAPER 9; INK 9; OVER 1;15,powerpos-1: DRAW  OVER 1; BRIGHT 1; PAPER 9;5,0: LET power=power-1: LET j=0
 205 IF j=1 AND spepos<108 AND spepos>=8 THEN  LET alt=alt+2: LET spe=spe+1: PLOT  INK 7; BRIGHT 1; OVER 0; PAPER 8;51,spepos: DRAW  INK 7; BRIGHT 1;5,0: LET j=2
 206 IF j=0 AND spepos<=108 AND spepos>=8 THEN  LET alt=alt-2: PLOT  INK 9; PAPER 9; BRIGHT 1; OVER 1;51,spepos-1: DRAW  PAPER 9; OVER 1; BRIGHT 1;5,0: LET spe=spe-1: LET j=2
 207 IF spepos>107 THEN  LET spepos=spepos-1
 208 IF power>10000 THEN  LET power=10000
 209 IF power>1 AND fuelpos>8 THEN  LET fuelpos=fuelpos-0.1-power/2000000: FOR n=fuelpos TO fuelpos STEP -1: PLOT  INK 9; PAPER 9; OVER 1;194,n: DRAW  INK 9; PAPER 9; OVER 1; BRIGHT 1;5,0:: NEXT n
 210 IF spe>500 THEN  LET power=500
 211 IF damr=0 THEN  GO TO 215
 212 IF damr=10 THEN  GO TO 6000
 213 IF missile=0 THEN  LET missile=0
 215 IF fuelpos<=8 THEN  GO TO 9000
 216 IF power<=0 AND alt>=1 THEN  LET alt=alt-10: PRINT AT 20,5; INK 2; BRIGHT 1; PAPER 0; FLASH 1;" ";AT 20,0; INK 2; BRIGHT 1; PAPER 0;" ": LET hozy=hozy+1: LET hozx=hozx: BEEP 0.1,20
 217 IF power=1 AND alt>=1 THEN  PRINT AT 20,0; INK 2; BRIGHT 0; PAPER 0;" ";AT 20,5; INK 2; PAPER 0; BRIGHT 0;" "
 218 IF alt>=1 THEN  LET up=6
 219 IF power=0 AND up=0 THEN  LET alt=0
 220 PRINT AT 13,26;cannon
 225 IF alt>370 AND alt<390 THEN  PRINT AT 19,12; FLASH 1; INK 6; BRIGHT 1;"max
```

PROGRAM FILE

```
radar": BEEP 0.1,40: PAUSE 10: PRINT AT 19,12;"          "
 226 IF alt>400 THEN  PRINT AT 6,12; PAPER 2; INK 7; BRIGHT 1; FLASH 1;"enemy AA
M";AT 7,13; INK 7; PAPER 2; FLASH 1; BRIGHT 1;"launch ": FOR n=0 TO 9: BEEP 0.1,
50: NEXT n: GO TO 8950
 227 IF hozy<=29 THEN  LET hozy=29
 228 IF hozy>=100 THEN  LET hozy=100
 230 PRINT AT 6,28;missile
 235 IF alt>0 THEN  PRINT AT 3,24; INK 7; PAPER 2;alt;"ft "
 240 IF alt<=0 AND up>3 THEN  PRINT AT 3,24; INK 7; PAPER 1; FLASH 1;"Oft   ": P
AUSE 20: BEEP 1,30: GO TO 7900
 245 IF dam=100 THEN  GO TO 9350
 250 PLOT  OVER 0; INK 4;91,hozy: DRAW  OVER 0; INK 4;76,hozx
 255 IF enemrng<15 AND enembe=be THEN  PRINT AT 6,12; PAPER 2; INK 7; FLASH 1; B
RIGHT 1;"C.S. ON ": BEEP 0.05,40: GO TO 260
 259 PRINT AT 6,12; PAPER 2; INK 7; BRIGHT 0;"C.S. OFF": GO TO 140
 263 REM PRINT TANK & SET UP COMBAT SEQUENCE
 264 LET hozy=70: LET hozx=0: LET x1=70: LET x2=70: LET alt=alt
 265 LET at=0: PRINT AT 8,12; INK 2; BRIGHT 1;"NSight on"
 266 FOR n=9 TO 18: PRINT AT n,11; PAPER 8;"          ": BEEP 0.001,60: NEXT n:
LET dur=8+INT (8*RND): LET tpx=12+INT (3*RND): LET a=0: LET b=30: LET cx=16: LET
 cy=14: LET can=0: LET rock=0: LET a$="   ": LET b$="    "
 267 LET tpy=11+INT (6*RND)
 268 PRINT AT tpy,tpx+1; INK 2; PAPER 0;a$;AT tpy+1,tpx; INK 2; PAPER 0;b$
 269 REM PRINT CROSSHAIRS
 270 IF IN 64510=183 THEN  LET rock=1: LET can=0
 271 IF IN 65278=183 THEN  LET rock=0: LET can=1
 272 IF IN 63486=175 AND cx>12 THEN  PRINT AT cy,cx; PAPER 8;" ": LET cx=cx-1: L
ET cy=cy: LET a=a-8: PRINT AT cy,cx; INK 4; PAPER 8; OVER 1;" "
 273 IF IN 61438=175 AND cy<17 THEN  PRINT AT cy,cx; PAPER 8;" ": LET cx=cx: LET
 cy=cy+1: LET b=b-8: PRINT AT cy,cx; INK 4; PAPER 8; OVER 1;" "
 274 IF IN 61438=183 AND cy>9 THEN  PRINT AT cy,cx; PAPER 8;" ": LET cx=cx: LET
cy=cy-1: LET b=b+8: PRINT AT cy,cx; INK 4; PAPER 8; OVER 1;" "
 275 IF IN 61438=187 AND cx<19 THEN  PRINT AT cy,cx; PAPER 8;" ": LET cx=cx+1: L
ET cy=cy: LET a=a+8: PRINT AT cy,cx; INK 4; PAPER 8; OVER 1;" "
 276 IF enembe<>be THEN  LET dur=0
 289 REM CANNON FIRE ROUTINE
 290 IF IN 61438=190 AND can=1 AND cannon>0 THEN  LET at=10: LET cannon=cannon-1
00: PRINT AT 13,26;"    ";AT 13,26;cannon: FOR n=0 TO 6: PLOT  INK 4; PAPER 8; O
VER 1;131,30: DRAW  INK 4; PAPER 8; OVER 1;a,b: BEEP 0.001,50: NEXT n: PLOT  INK
 4; PAPER 8; OVER 1;131,30: DRAW  INK 4; PAPER 8; OVER 1;a,b
 291 REM MISSILE FIRE ROUTINE
 292 IF IN 61438=190 AND rock=1 AND missile>0 THEN  LET at=10: LET missile=missi
le-1: PRINT AT 6,28;"  ";AT 6,28;missile: FOR n=17 TO cy+1 STEP -1: PRINT AT n,c
x; INK 7; BRIGHT 1;" ": BEEP 0.005,45: PAUSE 4: PRINT AT n,cx; PAPER 8;" ": NEX
T n
 293 IF at=10 AND cy=tpy AND cx=tpx+2 THEN  LET dur=0: BEEP 1,-40: BEEP 0.5,-35:
 PRINT AT tpy,tpx+1; PAPER 8;"   ";AT tpy+1,tpx; INK 3;"    ": LET kill=kill
+1: PRINT AT 10,12; INK 4; BRIGHT 1;"TARGET";AT 11,12; INK 4; BRIGHT 1;"DESTROYE
D": PAUSE 80: PRINT AT tpy,tpx+1; PAPER 8;"   ";AT tpy+1,tpy; PAPER 8;"    ";AT
10,12; PAPER 8;"      ";AT 11,12; PAPER 8;"          ": FOR n=0 TO 30: BEEP 0.01,
20: BEEP 0.01,24: NEXT n: GO TO 301
 294 LET at=0
 298 LET dur=dur-1: LET enemrng=enemrng-1
 299 IF dur>0 THEN  PRINT AT tpy,tpx+1; INK 2;a$;AT tpy+1,tpx; INK 2;b$: GO TO 3
09
 300 IF dur=0 THEN  FOR n=tpy+1 TO 17: PRINT AT n-1,tpx+1; INK 2;a$;AT n,tpx; IN
K 2;b$: BEEP 0.01,0: PRINT AT n-1,tpx+1;"   ";AT n,tpx;"    ": NEXT n
 301 FOR n=30 TO 70: PLOT  INK 4;91,n: DRAW  INK 4;76,0: BEEP 0.001,60: NEXT n:
LET enemrng=enemrng+17: PRINT AT 17,26; INK 7; PAPER 2; BRIGHT 1;enemrng
 302 LET enembe=enembe+180
 303 IF enembe>360 THEN  LET enembe=enembe-360
 304 PRINT AT 3,14; INK 7; BRIGHT 1; PAPER 1;"    ";AT 3,14; INK 7; BRIGHT 1; PA
PER 1;enembe;"  "
 305 PRINT AT 8,12; PAPER 0;"          "
 306 LET jat=0
 307 GO TO 140
 308 REM FLAK DAMAGE
 309 LET flak=INT (100*RND)
 310 IF flak=10 THEN  LET dcol1=2: LET dam=dam+10
 311 IF flak=20 THEN  LET dcol2=2: LET dam=dam+10
 312 IF flak=30 THEN  LET dcol3=2: LET dam=dam+10
 313 IF flak=40 THEN  LET dcol4=2: LET dam=dam+10
 314 IF flak=50 THEN  LET dcol5=2: LET dam=dam+10
 315 IF flak=60 THEN  LET dcol6=2: LET dam=dam+10
 316 IF flak=70 THEN  LET dcol7=2: LET dam=dam+10
 317 IF flak=80 THEN  LET dcol8=2: LET dam=dam+10
 318 IF flak=90 THEN  LET dcol9=2: LET dam=dam+10
 319 IF flak=100 THEN  LET dcol10=2: LET dam=dam+10
 320 IF dam>=100 THEN  GO TO 9350
 321 PRINT AT 21,18; INK 7; PAPER 2; BRIGHT 1;"    ";AT 21,18; INK 7; BRIGHT 1;
PAPER 2;dam;"%"
 322 IF IN 65022=187 THEN  LET damr=10: LET jat=10: GO TO 6000
 350 GO TO 268
 400 GO TO 140
5999 REM DRAW HELICOPTER AND SHOW DAMAGE FOR DAMAGE REVIEW
6000 IF damr=10 THEN  FOR n=15 TO 20: PRINT AT n,26; INK 0; PAPER 0; OVER 0;"
  ": NEXT n: INK 7: BRIGHT 1
6001 PLOT 210,27: DRAW 2,1: DRAW 2,1: DRAW 2,1: DRAW 3,4: DRAW 2,1: DRAW 3,0: DR
AW 2,1: DRAW 0,2: DRAW 3,0: DRAW 1,-2: DRAW 2,-1: DRAW 2,-3: DRAW 0,-1: DRAW 7,-
1: DRAW 3,4
6002 DRAW 1,1: DRAW 2,0: DRAW -1,-6: DRAW 1,-5: DRAW -2,0: DRAW -3,3: DRAW -11,-
1: DRAW -2,-1: DRAW -8,-1: DRAW -2,-2: DRAW -3,0: DRAW -1,1: DRAW 0,2: DRAW -4,0
: DRAW -2,1
6003 PLOT 209,38: DRAW 36,2
6004 PRINT AT 18,26; PAPER dcol1; OVER 1;" "
6005 PRINT AT 18,27; PAPER dcol2; OVER 1;" ":
6006 PRINT AT 18,28; PAPER dcol3; OVER 1;" ":
6007 PRINT AT 18,29; PAPER dcol4; OVER 1;" ":
6008 PRINT AT 18,30; PAPER dcol5; OVER 1;" ":
6009 PRINT AT 17,26; PAPER dcol6; OVER 1;" ":
6010 PRINT AT 17,27; PAPER dcol7; OVER 1;" ":
6011 PRINT AT 17,28; PAPER dcol8; OVER 1;" ":
6012 PRINT AT 17,29; PAPER dcol9; OVER 1;" ":
6013 PRINT AT 17,30; PAPER dcol10; OVER 1;" ":
6014 BEEP 1,20: FOR n=15 TO 20: PRINT AT n,26; INK 0; PAPER 0;"      ": NEXT n: L
ET damr=0
6015 IF jat=0 THEN  GO TO 140
6016 IF jat=10 THEN  GO TO 270
6020 BEEP 1,20: FOR n=15 TO 20: PRINT AT n,26; INK 0; PAPER 0;"      ": NEXT n: L
ET damr=0: GO TO 140
6029 REM DIRECTION-FINDER ROUTINE
6030 FOR n=15 TO 20: PRINT AT n,26; INK 0; PAPER 0; OVER 0;"      ": NEXT n
6031 CIRCLE 229,32,16: PLOT 229,46: DRAW 0,4: PLOT 243,32: DRAW 4,0: PLOT 229,18
: DRAW 0,-4: PLOT 216,32: DRAW -4,0
6032 IF enembe>0 AND enembe<90 THEN  PLOT 229,32: DRAW 9,9
6033 IF enembe>91 AND enembe<180 THEN  PLOT 229,32: DRAW 9,-9
6034 IF enembe>=181 AND enembe<270 THEN  PLOT 229,32: DRAW -9,-9
6035 IF enembe>271 AND enembe<360 THEN  PLOT 229,32: DRAW -9,9
6036 IF enembe=180 THEN  PLOT 229,32: DRAW 0,-9
6037 IF enembe=0 THEN  PLOT 229,32: DRAW 0,9
6038 IF enembe=90 THEN  PLOT 229,32: DRAW 9,0
6039 IF enembe=270 THEN  PLOT 229,32: DRAW -9,0
6040 BEEP 1,20: FOR n=15 TO 20: PRINT AT n,26; INK 0; PAPER 0; OVER 0;"      ": N
EXT n: GO TO 140
```


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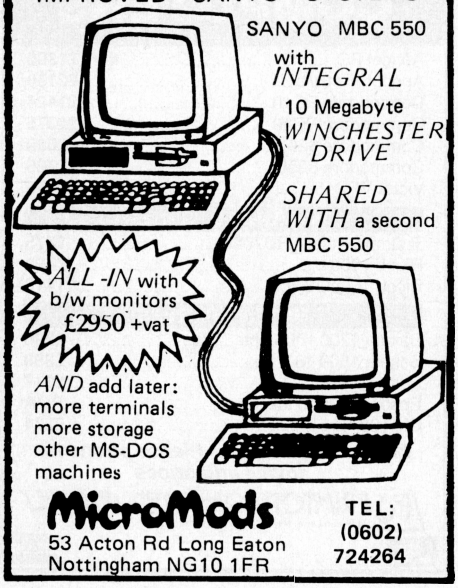

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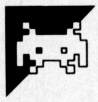
PROGRAM FILE

```
7899 REM  CRASH ROUTINE
7900 FOR n=0 TO 21: PRINT AT n,0; INK 0; PAPER 0; OVER 0;"
          ": BEEP 0.5,-30: NEXT n
7901 FOR N=0 TO 30: PRINT AT 9,0; INK 7; PAPER 2; BRIGHT 1; FLASH 1;" YOU CRASHE
D INTO THE GROUND!          NightHawk DESTROYED!      "
7902 BEEP 0.02,20: BEEP 0.02,24: NEXT N: CLS : GO TO 9600
8949 REM MISSILE ROUTINE FOR WHEN YOU EXCEED MAX.RADAR HEIGHT
8950 LET g=INT (3*RND)
8951 IF g<2 THEN  PRINT AT 6,12; INK 7; PAPER 2; FLASH 0; BRIGHT 1;" missile ";A
T 7,12; INK 7; PAPER 2; BRIGHT 1; FLASH 0;" avoided ": PAUSE 30: PRINT AT 6,12;"
          ";AT 7,12;"          ": GO TO 140
8952 IF g>=2 THEN  BEEP 1,-30: PRINT AT 16,12; INK 7; PAPER 2; BRIGHT 1; FLASH 1
;"   HIT    ": PRINT AT 21,18; INK 7; BRIGHT 1; FLASH 1; PAPER 1;"100%": PAUSE 30
: GO TO 9400
8999 REM CRASH ROUTINE FOR WHEN NIGHTHAWK RUNS OUT OF FUEL
9000 FOR n=0 TO 21: PRINT AT n,0; INK 0; PAPER 0; OVER 0;"
          ": BEEP 0.5,-30: NEXT n
9001 FOR N=0 TO 30: PRINT AT 9,0; INK 7; PAPER 2; BRIGHT 1; FLASH 1;" NightHawk
HAS RUN OUT OF FUEL          MISSION ABORTED          "
9002 BEEP 0.02,20: BEEP 0.02,24: NEXT N: CLS : GO TO 9600
9101 GO TO 9600
9349 REM CRASH ROUTINE FOR WHEN DAMAGE EXCEEDS 100%
9350 FOR n=0 TO 21: PRINT AT n,0; INK 0; PAPER 0;"
  ": BEEP 0.5,-30: NEXT n
9351 FOR n=0 TO 30: PRINT AT 9,0; INK 7; PAPER 2; FLASH 1; BRIGHT 1;" DAMAGE=100
%.TOTAL LOSS OF       CONTROL...                                NightHawk DESTROYED!
  "
9352 BEEP 0.02,20: BEEP 0.02,24: NEXT n: CLS : GO TO 9600
9399 REM CRASH ROUTINE FOR WHEN DESTROYED BY AN ENEMY MISSILE
9400 FOR n=0 TO 21: PRINT AT n,0; INK 0; PAPER 0; OVER 0;"
          ": BEEP 0.5,-30: NEXT n
9401 FOR N=0 TO 30: PRINT AT 9,0; INK 7; PAPER 2; BRIGHT 1; FLASH 1;"    YOU WER
E HIT BY AN ENEMY          MISSILE...
          NightHawk DESTROYED.      "
9402 BEEP 0.02,20: BEEP 0.02,24: NEXT N: CLS : GO TO 9600
9499 REM TIILE ROUTINE...DRAWS   "NIGHTHAWK"+HAWK MOTIF
9500 PLOT 1,100: DRAW 0,25: DRAW 3,0: DRAW 7,-22: DRAW 0,22: DRAW 3,0: DRAW 0,-2
5: DRAW -3,0: DRAW -7,22: DRAW 0,-22: DRAW -3,0
9501 PLOT 19,100: DRAW 0,12: DRAW 3,1: DRAW 0,-12: DRAW -3,-1: PLOT 19,117: DRAW
 3,1: DRAW 0,2: DRAW -3,-1: DRAW 0,-2
9502 PLOT 27,103: DRAW 0,8: DRAW 5,3: DRAW 10,0: DRAW 0,-30: DRAW -3,-3: DRAW -8
,0: DRAW -3,3: DRAW 0,3: DRAW 3,0: DRAW 0,-3: DRAW 3,-3: DRAW 2,0: DRAW 3,3
9503 DRAW 0,16: DRAW -6,0: DRAW -5,3: PLOT 30,106: DRAW 0,4: DRAW 3,1: DRAW 6,0:
 DRAW 0,-8: DRAW -6,0: DRAW -3,1: DRAW 0,2
9504 PLOT 47,100: DRAW 0,20: DRAW 3,1: DRAW 0,-10: DRAW 7,0: DRAW 3,-1: DRAW 0,-
9: DRAW -3,-1: DRAW 0,7: DRAW -7,0: DRAW 0,-6: DRAW -3,-1
9505 PLOT 65,100: DRAW 0,20: DRAW 3,1: DRAW 0,-7: DRAW 5,0: DRAW 0,-2: DRAW -3,-
1: DRAW -1,0: DRAW 0,-8: DRAW 2,0: DRAW 3,1: DRAW 0,-3: DRAW -3,-1: DRAW -5,0
9506 PLOT 252,101: DRAW -3,-1: DRAW -6,8: DRAW 0,-7: DRAW -4,-1: DRAW 0,20: DRAW
 4,1: DRAW 0,-8: DRAW 6,4: DRAW 0,-4: DRAW -4,-3: DRAW 7,-8
9507 PLOT 230,100: DRAW 3,15: DRAW -3,0: DRAW -3,-12: DRAW -3,12: DRAW -6,0: DRA
W -3,-12: DRAW -3,12: DRAW -3,0: DRAW 3,-15: DRAW 6,0: DRAW 3,12: DRAW 3,-12: DR
AW 6,0
9508 PLOT 203,100: DRAW 0,16: DRAW -12,0: DRAW -4,-3: DRAW 0,-10: DRAW 4,-3: DRA
W 12,0
9509 PLOT 200,103: DRAW 0,10: DRAW -8,0: DRAW -2,-1: DRAW 0,-8: DRAW 2,-1: DRAW
8,0
9510 PLOT 180,100: DRAW 0,25: DRAW -3,0: DRAW 0,-10: DRAW -8,0: DRAW 0,10: DRAW
-3,0: DRAW 0,-25: DRAW 3,0: DRAW 0,11: DRAW 8,0: DRAW 0,-11: DRAW 3,0
9511 PLOT 145,100: DRAW -3,2: DRAW -1,4: DRAW -1,8: DRAW -2,4: DRAW -3,5: DRAW -
3,2: DRAW -10,0: DRAW -6,-1: DRAW -3,-2: DRAW -2,-1: DRAW -1,-1: DRAW 0,-1: DRAW
 2,-4
9512 DRAW 2,-1: DRAW 4,-2: DRAW 2,-1: DRAW 1,-2: DRAW -1,1: DRAW -10,1: DRAW -3,
-1: DRAW -1,-3: DRAW 1,-1: DRAW -3,5: DRAW -2,3: DRAW 2,1: DRAW 4,2: DRAW 1,2
9513 PLOT 114,117: DRAW 1,2: DRAW 3,1: DRAW 4,1: DRAW 3,0: DRAW 3,-1: PLOT 118,1
20: DRAW 0,-3: DRAW 2,-2: DRAW 2,0: DRAW 2,2: DRAW 1,2
9514 PLOT 122,119: PLOT 116,110: DRAW 2,-4: DRAW -1,-3: DRAW -2,-6
9515 PRINT AT 10,31;"
9516 PRINT AT 13,2; INK 7; BRIGHT 1;"Probably the meanest machine              in
the World       "
9520 INK 2: PLOT 105,155: DRAW 2,1: DRAW 2,1: DRAW 2,1: DRAW 3,4: DRAW 2,1: DRAW
 3,0: DRAW 2,1: DRAW 0,2: DRAW 3,0: DRAW 1,-2: DRAW 2,-1: DRAW 2,-3: DRAW 0,-1:
DRAW 7,-1: DRAW 3,4
9521 DRAW 1,1: DRAW 2,0: DRAW -1,-6: DRAW 1,-5: DRAW -2,0: DRAW -3,3: DRAW -11,-
1: DRAW -2,-1: DRAW -8,-1: DRAW -2,-2: DRAW -3,0: DRAW -1,1: DRAW 0,2: DRAW -4,0
: DRAW -2,1
9522 PLOT  INK 2;100,165: DRAW  INK 2;22,2: PLOT  INK 2;123,167: DRAW  INK 2;22,
2
9523 REM WAITS FOR KEY PRESS THEN SCROLLS SCREEN
9524 LET a$="Press any key": FOR n=0 TO 7: PRINT AT 20,10; INK n;a$: BEEP 0.01,n
: PAUSE 5: NEXT n
9525 PAUSE 0: FOR n=0 TO 21: LET a=USR 3280: BEEP 0.001,50: NEXT n
9529 REM ASKS WHETHER INSTRUCTIONS ARE REQUIRED
9530 PRINT AT 9,0; INK 7; PAPER 2; BRIGHT 1;"Press'I'for Instructions or      Pre
ss'S'to Start the game       "
9535 POKE 23658,8
9536 IF INKEY$="I" THEN  GO TO 9540
9537 IF INKEY$="S" THEN  CLS : INK 7: GO TO 30
9538 GO TO 9530
9539 REM BACKGROUND & INSTRUCTIONS
9540 CLS : POKE 23658,0: INK 7: PRINT AT 1,10;"The Setting..."
9545 PRINT AT 3,0; INK 4;"You are the pilot of the Air    Force's latest combat
chopper,  NightHawk.                War has broken out in Europe  and yo
ur ground forces are beingpushed back by a surge of enemy tanks.Your mission is
to fly as many sorties as you can before  your dwindling fuel stocks run  out.
                "
9546 PRINT AT 13,0; INK 2;"    THE ENEMY TANKS MUST BE                DESTROYED!
  "
9547 PAUSE 1000: CLS
9549 REM INSTRUCTIONS ON CONTROLS
9550 PRINT AT 1,12;"Controls"
9551 PRINT AT 3,0;"Up-Q                              Down-A
   Bank left-O                    Bank right-P
                Increase power-I                Decrease power-U
                                Cannon selection-C              Rocket select
ion-R            "
9552 PRINT AT 13,0;"                                Crosshair up-7
    Crosshair down-6              Crosshair left-5                Crosshair ri
ght-8          Fire-0
    Damage review-D               Target finder-S                 "
9553 PAUSE 0: CLS : GO TO 30
9599 REM HIGH SCORE TABLE.ASKS FOR PILOT'S NAME,etc
9600 CLS
9601 INPUT "Pilot's name:";g$
9603 IF kill>=0 AND kill<=5 THEN  LET scorepos=14: LET y$=g$: LET y=kill
9604 IF kill>=6 AND kill<=10 THEN  LET scorepos=12: LET t$=g$: LET t=kill
9605 IF kill>=11 AND kill<=15 THEN  LET scorepos=10: LET r$=g$: LET r=kill
9606 IF kill>=16 AND kill<=20 THEN  LET scorepos=8: LET e$=g$: LET e=kill
9607 IF kill>=21 AND kill<=25 THEN  LET scorepos=6: LET w$=g$: LET w=kill
9608 IF kill>=26 THEN  LET scorepos=4: LET q$=g$: LET q=kill
9610 PLOT 78,161: DRAW 0,-11: DRAW 107,0: DRAW 0,11: DRAW -107,0: PRINT AT 2,10;
 INK 7; PAPER 2; FLASH 1; BRIGHT 1;"Hi-Kill Table"
9620 PRINT AT 4,5; INK 7; BRIGHT 1;q$;"    ";q;AT 6,5; INK 2; BRIGHT 1;w$;"    "
;w
```

PROGRAM FILE

```
9625 PRINT AT 8,5; INK 3; BRIGHT 1;e$;"    ";e
9630 PRINT AT 10,5; INK 5; BRIGHT 1;r$;"    ";r
9635 PRINT AT 12,5; INK 4; BRIGHT 1;t$;"    ";t
9640 PRINT AT 14,5; INK 1; BRIGHT 1;y$;"    ";y
9650 PRINT AT 20,11;"Press any key": GO TO 9525
9700 REM LINE 9650 TAKES YOU BACK TO THE LINE THAT ASKS YOU WHETHER OR NOT YOU R
EQUIRE INSTRUCTIONS.THE GAME CONTINUES AS NORMAL FROM THERE ONWARDS
```



BBC Patience

by Pete Telfer

This is the standard game of patience, faithfully transferred to the BBC Micro. As it disables the BREAK key, you are strongly advised to save the program before running it—you won't be able to afterwards. If you don't have a disk system, don't type in lines 60 to 110 of the second part. The first part sets up graphics and display instructions.

```
  10 REM ***************************
  20 REM *       Program 1          *
  30 REM * Loader,Inst. & Graphics *
  40 REM * (c)PyroSoft(Pete Telfer *
  50 REM *       (c)1985            *
  60 REM ***************************
  70 *FX200,2
  80
  90
 100
 110 ONERRORRUN
 120 MODE7:PRINT
 130 PRINT"   ";CHR$131;CHR$157;SPC(32);CHR$156
 140 FORCZ=1 TO3:PRINT"   ";CHR$131;CHR$157;CHR$148;CHR$154;:FORAZ=1 TO28:READBZ
:PRINTCHR$BZ;:NEXT:PRINT"   "CHR$156:NEXT
 150 PRINT"   ";CHR$131;CHR$157;SPC(32);CHR$156'
 160 FORCZ=1 TO2:PRINTCHR$146 CHR$154"      ";:FORAZ=1 TO27:READBZ:PRINTCHR$BZ;:
NEXT:PRINT:NEXT
 170 PRINT
 180 FORCZ=1 TO3:PRINTCHR$145 CHR$154;:FORAZ=1 TO37:READBZ:PRINTCHR$BZ;:NEXT:PR
INT:NEXT
 190 PRINTSPC(14)"INSTRUCTIONS"'SPC(14)"____________":VDU28,0,24,39,15:PRINT
 200 PRINTCHR$141"Do You Wish To See The Instructions ?"
 210 PRINTCHR$141"Do You Wish To See The Instructions ?"
 220 VDU23,222,68,238,254,254,124,124,56,16
 230 VDU23,223,16,56,124,124,254,254,238,84
 240 VDU23,224,0,16,56,124,254,124,56,16
 250 VDU23,225,0,56,56,16,214,254,214,16
 260 VDU23,226,0,34,101,37,37,37,37,114
 270 REPEAT:K$=GET$:UNTILK$="Y"ORK$="N"
 280 IFK$="N"GOTO670
 290 CLS:RESTORE480
 300 FORAZ=1 TO35:READA$:IFA$="#" PRINT:NEXT
 310 FORBZ=1 TOLENA$:B$=MID$(A$,BZ,1)
 320    IFB$=" " PRINT" ";:GOTO340
 330    PRINTB$;:SOUND1,-10,20,1:W=INKEY(10)
 340    NEXT:PRINT:NEXT
 350 PRINTCHR$141 CHR$132"     Do You Wish To See Again"
 360 PRINTCHR$141 CHR$132"     Do You Wish To See Again"
 370 REPEAT:K$=GET$:UNTILK$="Y"ORK$="N"
 380 IFK$="N"GOTO670ELSEGOTO290
 390
 400 DATA255,175,244,224,254,253,176,175,255,175,170,239,191,165,255,175,175,23
4,245,234,181,248,191,244,234,191,175,165
 410 DATA255,252,167,234,189,238,181,32,255,32,32,234,181,32,255,175,165,234,19
1,255,181,255,32,32,234,191,175,32
 420 DATA255,32,32,234,181,234,181,32,255,32,232,254,253,180,255,252,252,234,18
1,234,181,171,253,167,234,253,252,180
 430 DATA154,96,36,54,96,52,119,115,36,117,112,53,119,115,36,96,55,33,54,96,36,1
17,112,53,96,55,33
 440 DATA101,112,36,101,112,37,53,32,32,32,53,32,53,34,52,112,117,48,101,115,37
,53,32,53,32,53,32
 450 DATA255,175,244,234,191,175,165,175,255,175,234,191,175,165,32,170,175,255
,175,165,255,175,175,234,181,32,32,255,175,175,234,191,175,165,255,175,244
 460 DATA255,175,161,234,183,161,32,32,255,32,234,183,161,32,32,32,32,255,32,32
,255,163,32,234,181,32,32,255,163,32,234,183,161,32,255,247,161
 470 DATA175,32,32,170,175,175,165,32,175,32,170,175,175,165,32,32,32,175,32,32
,175,175,175,170,175,175,165,175,32,32,170,175,175,165,175,162,173
 480 DATA"OBJECT OF THE GAME                    ____________________","#"
 490 DATA"To Move All The Cards From The Seven    Decks And The Twist Pack To F
orm Four   New Decks (Hearts , Spades , Diamonds   And Clubs) , By Moving Cards
Around"
 500 DATA"The Different Decks. The Only Valid     Moves Are:","#","1.Move A Red
 Card (Hearts & Diamonds) To  A Black Card (Clubs & Spades) Whose"
 510 DATA"  Face Value Is One Less Than The Value   Of The Black Card.","#"
 520 DATA"2.Move A Black Card (Clubs & Spades) To   A Red Card (Hearts & Diamon
ds) Whose   Face Value Is One Less Than The Value   Of The Red Card.","#"
 530 DATA"3.Move A Card To One Of The New Decks."   ____________________________
 540 DATA"                                          ","#","INSTRUCTIONS
------------                  ____________","#"
 550 DATA"1.To Turn The Next Card Over From The     Deck (To Twist) Hit 'RETURN
'.","#"
 560 DATA"2.To Move A Card From One Deck To         Another First Type In The V
alue Of The  Card To Be Moved Then Its Suit."
 570 DATA"  Next Type The Value Of The Card It's    To Go Next To Then That Car
ds Value.","#"
 580 DATA"  N.B. To Move A King  Type 'K'               To Move A Queen Type '
Q'                To Move A Jack  Type 'J'               To Move A Ten   Type '
T'                To Move An Ace  Type 'A'","#"
 590 DATA"3.To Move A Card Out From The Twist Pack  Or From One Of The Decks To
 One Of The  Four Suits   (Hearts,Spades,Diamonds   or Clubs)."
 600 DATA"  First Type In The Value Of The  Card    To Be Moved Then Its Suit F
ollowed     By Hitting 'RETURN'.","#"
 610 DATA"  N.B. The First Card You Move To The          Suit Decks MUST BE AN
ACE                          --------------            Followed By Their Next
In Value.","#"
 620 DATA"4.If One Of The Seven Decks Is Cleared    Of All Its Cards ie.None On
 Display     And None Hidden."
 630 DATA"  You May Move Any Availible KING To      That Space By Typing 'K' Th
en The      Suit Of The King Followed By 'RETURN'.","#"
 640 DATA"5.When All The Cards Have Been Moved To   The Suit Decks The Game Is
Over And    You Will Be Told The Time Taken For    The Game And The No. Of Err
ors Made.","#"
```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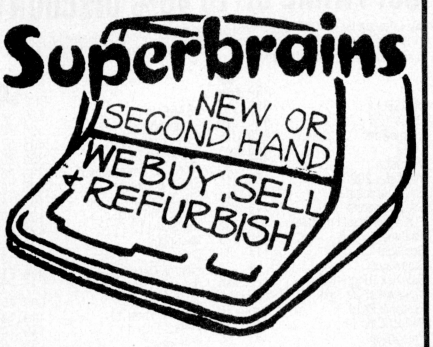

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PROGRAM FILE

```
  650 DATA"6.At Any Time You May Quit The Game By    Pressing 'ESCAPE'."
  660 DATA"#","7.You May Only Go Through The Twist Pack  Three Times.After Which
The Game Is     Over."
  670 CLS
  680 CHAIN"CARD2"
  10 REM (c)PyroSoft-Feb,1985
  20
  30
  31 ONERRORRUN
  40 *FX200,2
  50 IF PAGE=&E00 THEN110
  60 *K.0 *FX3,0ûM CLS:*FX3,6ûM SO.1,-15,150,3ûM *T.ûM D%=PAGE-&E00: FOR L%=PAG
E TO TOP STEP 4:!(L%-D%)=!L%: NEXT:PAGE=&E00 ûM OLD ûM DEL.50,100ûM RUNûM
  70 *FX 138,0
  80  PRINT'CHR$141"PRESSfoTO RUN"'CHR$141"PRESSfoTO RUN";
  90 *FX3,6
 100 END
 110 *FX3,0
 130 MODE1:VDU19,128,4,0,0,0;:DIMP$(8),S$(3),O$(6):PROCSHU:VDU28,1,30,38,27:COL
OUR129:TIME=0:IV%=0:ER%=1
 140
 150 ONERRORGOTO2050
 160 *FX21,0
 170 IFER%>3 GOTO2100
 180 VDU4:CLS:PRINT''SPC(7)"Press 'RETURN' To Twist"'SPC(12)"Or Move ? To ?"
 190 IFLENS$(0)=26ANDLENS$(1)=26ANDLEN S$(2)=26ANDLENS$(3)=26 GOTO1990
 200 M$="":REPEAT:K$=GET$:UNTILK$="K"ORK$="Q"ORK$="J"ORK$="T"ORK$="A"ORVALK$>1
ORASC(K$)=13
 210 CLS:PRINT'" ";:IFASC(K$)=13 PRINTSPC(13);"* TWIST *":PROCT:FORW%=0TO3000:N
EXT:GOTO160
 220 *FX21,0
 230 M$=M$+K$:PROCP1:REPEAT:K$=GET$:UNTILK$="H"ORK$="S"ORK$="D"ORK$="C":PROCP2:
PRINT" To ";:M$=M$+K$
 240 *FX21,0
 250 REPEAT:K$=GET$:UNTILK$="K"ORK$="Q"ORK$="J"ORK$="T"ORK$="A"ORVALK$>1 ORASC(
K$)=13
 260 IFASC(K$)=13 PRINTCHR$8;CHR$8;CHR$8;"Moved Out":PROCo:FORW%=0 TO2000:NEXT:
GOTO160
 270 PROCP1:M$=M$+K$
 280 *FX21,0
 290 REPEAT:K$=GET$:UNTILK$="H"ORK$="S"ORK$="D"ORK$="C":PROCP2:M$=M$+K$:PROCmov
e:W%=INKEY(50):GOTO160
 300 END
 310
 320 DEFPROCSHU
 330 VDU5:MOVE390,990:GCOL0,3:PRINT"(c)Pyrosoft 1985":MOVE395,995:GCOL0,1:PRINT
"(c)Pyrosoft 1985"
 340 C$="AH2H3H4H5H6H7H8H9HTHJHQHKHAS2S3S4S5S6S7S8S9STSJSQSKSAD2D3D4D5D6D7D8D9D
TDJDQDKDAC2C3C4C5C6C7C8C9CTCJCQCKC"
 350 FORA%=1TO2
 360   D$="":REPEAT:L%=LEN(C$)-1:IFL%=1 D$=D$+C$:C$="":GOTO400
 370     R%=RND(L%)
 380     T$=MID$(C$,R%,1):IFT$="H"ORT$="S"ORT$="D"ORT$="C" R%=R%+1:GOTO380
 390     D$=D$+T$+MID$(C$,R%+1,1):C$=LEFT$(C$,R%-1)+RIGHT$(C$,L%-R%)
 400     UNTILC$=""
 410   C$=D$:NEXT:D$=C$:C$=""
 420 X%=20:L%=1:FORD%=1 TO7:FORA%=D%TO7:T$=MID$(D$,L%,2):L%=L%+2:IFA%=D% Y%=930
ELSEY%=950
 430     IFA%=D% PROCCA(0):PROCSOU ELSEPROCCA(1)
 440     IFA%=D% O$(A%-1)=T$ELSEP$(A%-1)=P$(A%-1)+T$
 450     X%=X%+128:NEXT:PROCX:NEXT
 460 X%=1000:Y%=500:REPEAT:T$=MID$(D$,L%,2):L%=L%+2:P$(7)=P$(7)+T$:UNTILL%=105:
PROCCA(1):D$="":ENDPROC
 470
 480 DEFPROCCA(F%)
 490 IFF%=1 GCOL0,1
 500 IFF%=0 GCOL0,3
 510 IFF%=10 GCOL0,0
 520 MOVEX%,Y%:MOVEX%+115,Y%:PLOT85,X%+115,Y%-150:MOVEX%,Y%:PLOT85,X%,Y%-150
 530 IFF%=1 GCOL0,2:FORB%=X%+10 TOX%+109 STEP 12:MOVEB%,Y%:DRAWB%,Y%-150:NEXT
 540 IFF%<>0 ENDPROC
 550 T1$=LEFT$(T$,1):T2$=RIGHT$(T$,1)
 560 IFT2$="H"ORT2$="D" GCOL0,1ELSEGCOL0,0
 570 IFT1$="T" T1$=CHR$226
 580 IFT2$="H" T2$=CHR$222
 590 IFT2$="S" T2$=CHR$223
 600 IFT2$="D" T2$=CHR$224
 610 IFT2$="C" T2$=CHR$225
 620 T3$=T1$+T2$+CHR$10+CHR$10+CHR$10+CHR$8+T2$+T1$
 630 VDU5:MOVEX%+10,Y%-12:PRINTT3$:MOVEX%,Y%:GCOL0,0:DRAWX%+115,Y%:T3$=""
 640 ENDPROC
 650
 660 DEFPROCT
 670 L%=LEN(P$(7))
 680 IFL%=0 AND P$(8)="" CLS:PRINT'SPC(10);"NO CARDS LEFT !!!":FORA%=1 TO4:SOUN
D1,-7,50,2:FORW%=1 TO1000:NEXT:NEXT:FORW%=1 TO2000:NEXT:ENDPROC
 690 IFL%=2 X%=1000:Y%=500:PROCCA(10)
 700 IFL%=48 X%=1000:Y%=320:PROCCA(10):W%=INKEY(20):Y%=500:PROCCA(1)
 710 IFL%=0:P$(7)=P$(8):P$(8)="":X%=1000:Y%=320:PROCCA(10):Y%=500:PROCCA(1):ER%
=ER%+1:GOTO670
 720 T$=RIGHT$(P$(7),2):X%=1000:Y%=320:PROCCA(0):P$(8)=T$+P$(8):P$(7)=LEFT$(P$(
7),L%-2):PROCSOU
 730 ENDPROC
 740
 750 DEFPROCo
 760 PROCFI(M$):D1%=D%:IFF0%=0 GOTO1710
 770 T1$=RIGHT$(M$,1):T2$=LEFT$(M$,1):PROCs:IFT2$="K"ANDOK%=0 PROCoK:ENDPROC
 780 IFOK%=0ANDT2$<>"K" GOTO1710
 790 IFD%<8 L%=LEN(O$(D%))-1:IFC%<>L% GOTO1710
 800 IFD%=8 GOTO840
 810 IFLEN0$(D%)=2 O$(D%)="":PROCOTOP(D%):GOTO830
 820 O$(D%)=LEF1$(O$(D%),LEN0$(D%)-2):T$=RIGHT$(O$(D%),2):D%=D1%:PROCX:Y%=1005-
(25*C%)-50:PROCCA(10):Y%=Y%+50:PROCCA(0)
 830 GOTO860
 840 IFLENP$(8)=2 P$(8)="":X%=1000:Y%=320:PROCCA(10):GOTO860
 850 P$(8)=RIGHT$(P$(8),LENP$(8)-2):T$=LEFT$(P$(8),2):X%=1000:Y%=320:PROCCA(0)
 860 T1$=RIGHT$(M$,1):T2$=LEFT$(M$,1)
 870 IFT1$="H"ORT1$="S" X%=1000 ELSEX%=1150
 880 IFT1$="S"ORT1$="D" Y%=750 ELSEY%=950
 890 N$="":T$=M$:PROCCA(0):S$(P%)=S$(P%)+M$:PROCSOU:ENDPROC
 900
 910 DEFPROCoK
 920 OK%=10:FORA%=6TO0STEP-1:IFP$(A%)=""ANDO$(A%)="" OK%=A%
 930   NEXT
 940 IFOK%>6 GOTO1710
 950 D1%=D%:IFD%=8 GOTO990
 960 PROCX:PROCCLEAR(930):MO$=O$(D%):O$(D%)="":O$(OK%)=MO$:Y%=930:D%=OK%:PROCX:
```

PROGRAM FILE

```
FORA%=1TOLENMO$STEP2:T$=MID$(MO$,A%,2):PROCCA(0):Y%=Y%-50:PROCSOU:NEXT
  970 PROCOTOP(D1%)
  980 ENDPROC
  990 X%=1000:Y%=320:IFLENP$(8)=2 O$(OK%)=P$(8):P$(8)="":PROCCA(10):GOTO1010
 1000 O$(OK%)=LEFT$(P$(8),2):P$(8)=RIGHT$(P$(8),LENP$(8)-2):T$=LEFT$(P$(8),2):PR
OCCA(0)
 1010 T$=O$(OK%):Y%=930:D%=OK%:PROCX:PROCCA(0):PROCSOU
 1020 ENDPROC
 1030
 1040 DEFPROCmove
 1050 T1$=MID$(M$,2,1):T3$=MID$(M$,1,1):T2$=MID$(M$,4,1):T4$=MID$(M$,3,1)
 1060 E%=0:IFT1$="H"ANDT2$="C" E%=1
 1070 IFT1$="H"ANDT2$="S" E%=1
 1080 IFT1$="D"ANDT2$="S" E%=1
 1090 IFT1$="D"ANDT2$="C" E%=1
 1100 IFT1$="C"ANDT2$="H" E%=1
 1110 IFT1$="C"ANDT2$="D" E%=1
 1120 IFT1$="S"ANDT2$="D" E%=1
 1130 IFT1$="S"ANDT2$="H" E%=1
 1140 IFT3$="T"ANDT4$<>"J" E%=0
 1150 IFT3$="J"ANDT4$<>"Q" E%=0
 1160 IFT3$="Q"ANDT4$<>"K" E%=0
 1170 IFT3$="9"ANDT4$<>"T" E%=0
 1180 IFE%=0 GOTO1710
 1190 IFT3$="9"ORT3$="T"ORT3$="J"ORT3$="Q" GOTO1220
 1200 V1%=VAL(T3$):V2%=VAL(T4$)
 1210 IFV2%<>V1%+1 GOTO1710
 1220 T5$=LEFT$(M$,2):T6$=RIGHT$(M$,2):PROCFI(T5$):IFF0%=0 GOTO1710
 1230 D1%=D%:C1%=C%:PROCFI(T6$):IFF0%=0 GOTO1710
 1240 D2%=D%:C2%=C%:IFC%+1<>LENU$(D%) GOTO1710
 1250 IFD%=8 GOTO1710
 1260 IFD1%=8 PROCmove8:ENDPROC
 1270 D%=D1%:PROCX:Y%=980-(C1%*25)-25:PROCCLEAR(Y%):C3%=LENO$(D1%):C3%=C3%-C1%+1
:MO$=RIGHT$(O$(D1%),C3%):D%=D2%:PROCX:Y%=905-(C2%*25)
 1280 FORA%=1 TOLENMO$STEP2:T$=MID$(MO$,A%,2):PROCCA(0):Y%=Y%-50:O$(D2%)=O$(D2%)
+T$:PROCSOU:NEXT
 1290 IFC3%=LENO$(D1%) O$(D1%)="":PROCOTOP(D1%):ENDPROC
 1300 O$(D1%)=LEFT$(O$(D1%),LENO$(D1%)-C3%):T$=RIGHT$(O$(D1%),2):D%=D1%:PROCX:Y%
=980-(LENO$(D1%)*25):PROCCA(0):ENDPROC
 1310
 1320 DEFPROCmove8
 1330 X%=1000:Y%=320:PROCCA(10):T$=LEFT$(P$(8),2):D%=D2%:PROCX:Y%=905-(C2%*25):P
ROCCA(0):O$(D2%)=O$(D2%)+T$
 1340 P$(8)=RIGHT$(P$(8),LEN P$(8)-2)
 1350 PROCSOU:IFP$(8)="" ENDPROC
 1360 X%=1000:Y%=320:T$=LEFT$(P$(8),2):PROCCA(0):ENDPROC
 1370
 1380 DEFPROCFI(CA$)
 1390 F0%=0:D%=0
 1400 IFD%=7 GOTO1460
 1410 L%=LEN(O$(D%)):C%=1
 1420 IFL%=0 D%=D%+1:GOTO1400
 1430 T1$=MID$(O$(D%),C%,2)
 1440 IFT1$=CA$ F0%=1:ENDPROC
 1450 L%=L%-2:C%=C%+2:GOTO1420
 1460 D%=8
 1470 L%=LENP$(D%)
 1480 IFL%=0 ENDPROC
 1490 T1$=LEFT$(P$(D%),2)
 1500 IFT1$=CA$ F0%=1
 1510 ENDPROC
 1520
 1530 DEFPROCs
 1540 OK%=0:ND%=-1
 1550 IFT1$="H" TL%=LEN(S$(0)):P%=0
 1560 IFT1$="S" TL%=LEN(S$(1)):P%=1
 1570 IFT1$="D" TL%=LEN(S$(2)):P%=2
 1580 IFT1$="C" TL%=LEN(S$(3)):P%=3
 1590 IFTL%=0ANDT2$<>"A" ENDPROC
 1600 T3$=MID$(S$(P%),TL%-1,1)
 1610 IV%=VAL(T3$):V%=VAL(T2$):IFTV%=V%-1 OK%=1
 1620 IFT3$="9"ANDT2$="T" OK%=1
 1630 IFT3$="T"ANDT2$="J" OK%=1
 1640 IFT3$="J"ANDT2$="Q" OK%=1
 1650 IFT3$="Q"ANDT2$="K" OK%=1
 1660 IFT3$="A"ANDT2$="2" OK%=1
 1670 IFTL%=0ANDT2$="A" OK%=1
 1680 V%=VAL(T2$):IFTV%=V%-1 OK%=1
 1690 ENDPROC
 1700
 1710 CLS:PRINT'TAB(13);"*INVALID MOVE*":SOUND1,-7,10,7:SOUND1,-7,0,7:W%=INKEY(2
50):IV%=IV%+1:ENDPROC
 1720 DEFPROCP1
 1730 IFK$="T" PRINT"10";
 1740 IFK$="A" PRINT"ACE";
 1750 IFK$="J" PRINT"JACK";
 1760 IFK$="Q" PRINT"QUEEN";
 1770 IFK$="K" PRINT"KING";
 1780 IFK$<>"T"ANDK$<>"J"ANDK$<>"Q"ANDK$<>"K"ANDK$<>"A" PRINTK$;
 1790 PRINT" Of ";:SOUND1,-7,200,2:ENDPROC
 1800
 1810 DEFPROCP2
 1820 IFK$="H" PRINT"HEARTS";
 1830 IFK$="S" PRINT"SPADES";
 1840 IFK$="D" PRINT"DIAMONDS";
 1850 IFK$="C" PRINT"CLUBS";
 1860 SOUND1,-7,200,2:ENDPROC
 1870
 1880 DEFPROCX:X%=20+128*D%:ENDPROC
 1890
 1900 DEFPROCOTOP(deck%)
 1910 D%=deck%:PROCX
 1920 IFO$(D%)=""ANDP$(D%)="" Y%=930:PROCCA(10):ENDPROC
 1930 IFLENP$(D%)=2 O$(D%)=P$(D%):T$=P$(D%):Y%=950:PROCCA(10):Y%=930:PROCCA(0):P
$(D%)="":ENDPROC
 1940 T$=LEFT$(P$(D%),2):O$(D%)=T$:P$(D%)=RIGHT$(P$(D%),LENP$(D%)-2):Y%=930:PROC
CA(0):ENDPROC
 1950
 1960 DEFPROCCLEAR(top):GCOL0,0:MOVEX%,top:MOVEX%+115,top:PLOT85,X%+115,160:MOVE
X%,top:PLOT85,X%,160:ENDPROC
 1970
 1980 REMWIN
 1990 T%=TIME/100:CLG:X%=200:FORA%=0 TO3:Y%=930:FORB%=1 TO13:SOUND1,-10,B%*A%*2,
1:T$=RIGHT$(S$(A%),2):PROCCA(0):S$(A%)=LEFT$(S$(A%),LENS$(A%)-2):Y%=Y%-50:NEXT:X
%=X%+250:NEXT
 2000
 2010 VDU4:CLS:PRINT" Congratulations You Have completed"?" The Deck. ";
 2020 H%=T%/3600:T%=T%-(H%*3600):M%=T%/60:T%=T%-(M%*60)
 2030  PRINT"Time Taken:";M%;"mins.";T%;"secs."?" You Made ";IV%;" Mistakes"'SPC
(8);"Play Again (Y/N)";:GOTO2120
 2050 IFERR<>17 REPORT:PRINT"AT ";ERL:ONERROROFF:STOP
 2060 VDU4:CLS:PRINT'" Do You Really Want To Quit (Y/N)";
 2070 *FX21,0
 2080 REPEAT:K$=GET$:UNTILK$="Y"ORK$="N":IFK$="Y" PRINT" YES":GOTO2100 ELSEGOTO1
50
```


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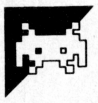
PROGRAM FILE

```
2090 DEFPROCSOU:SOUND0,-7,5,1:W=INKEY(10):ENDPROC
2100 VDU4:CLS:PRINT'SPC(15)"GAME OVER":FORA%=1TO6:PROCSOU:NEXT:FORW=1TO2000:NEX
T
2110 CLS:PRINT'SPC(10)"Play Again (Y/N)";
2120 *FX21,0
2130 REPEAT:K$=GET$:UNTILK$="Y"ORK$="N":IFK$="Y" RUN
2140 CALL !-4
```



Logo Database

by Alan Mynett

The procedures listed here allow the implementation of a simple database and suggest how Logo could be used for serious applications. Although written in Sinclair Logo, this is similar enough to the LCSI/SOLI Logos that it should run on other machines with minor modifications.

The whole package supports a number of database functions, and has an 'intelligent' HELP facility which prints out the functions currently available in the machine. Due to memory space being limited, if some of the functions are not needed, then a version of the database could be saved without these functions to leave more room for data.

Notes on the procedures are given below, grouped according to function.

HELP — the subprocedure MENU uses the primitive DEFINEDP to see whether a calling procedure is present or not. The procedures used by this command are HELP, MENU and PRINTBRIGHT.

SETUP — this requires a single Logo word for input. When called, the subprocedure GETLIST constructs the fieldlist for the database. The procedures used for this command are SETUP and GETLIST.

ADD — this group of procedures adds records to the database. Each record is held as a list of lists. There is no limit other than memory size as to the number of characters in a field. The new record is inserted into the database by the ASCII order of its first field. The subprocedure GTR? compares two Logo words and indicates whether the first is 'greater' than the second. The procedures in this group are ADD, INSERT, GETDATA, GTR?, SPACE, FINISH? and READWORD.

FIND — this command searches the database and prints out any record containing all the entries specified. The procedure GETLIST is used to compile the list of items to be searched for. The procedures in this group are FIND, SEARCHALL, SEARCHLIST. ANDALL and PRINTRECORD.

PRINTALL —this command prints out all the records in order. It consists only of the procedure PRINTALL.

RECORD — this command takes a number as input and prints out that record. It consists only of the procedure RECORD.

DELETE—this takes the number of a file as input and then deletes that file. The two procedures DELETE and WIPE make up this command.

SAVEFILE — there is no direct way of saving just the variables in Sinclair Logo. This can be achieved by using the DEFINE procedure to set up a dummy procedure using the variables holding the fieldlist and file. Once defined, this procedure called FILE can be saved as usual. Note that most Logos do not allow the saving of a single global variable. The command only uses the procedure SAVEFILE.

LOADFILE — this loads in a previously saved database file by loading in the dummy FILE and 'unpacking' it, using the TEXT primitive to generate the file and fieldlist. It consists only of the procedure LOADFILE.

```
;
TO SEARCHLIST
CT PRINTBRIGHT [FIND] PR []
PRINT [TYPE THE SEARCH ITEMS] PR [PRESS ENTER AFTER EACH ITEM] PR [ENTER # TO ST
OP]
OP GETLIST
END

TO ANDALL :LIST :INLIST
IF EMPTYP :LIST [OP "TRUE]
IF NOT MEMBERP FIRST :LIST :INLIST [OP "FALSE]
OP ANDALL BF :LIST :INLIST
END

TO PRINTRECORD :L1 :L2
IF EMPTYP :L1 [PR [] STOP]
PRINT FIRST :L1
REPEAT 5 [TYPE CHAR 32]
PRINT FIRST :L2
PRINTRECORD BF :L1 BF :L2
END

TO SEARCHALL :ITEM :DBASE
MAKE "RECORD :RECORD + 1
IF :DBASE = [] [STOP]
IF ANDALL :ITEM FIRST :DBASE [PRINTBRIGHT SE [RECORD NUMBER] :RECORD PRINTRECORD
 :FIELDS FIRST :DBASE IF FINISH? [TOPLEVEL]]
SEARCHALL :ITEM BF :DBASE
END

TO READWORD
MAKE "INPUT RL
IF :INPUT = [] [OP "]
OP FIRST :INPUT
END
```

PROGRAM FILE

```
TO FINISH?
PRINT []
PRINTBRIGHT [STOP to end:ENTER for next]
IF READWORD = "STOP [OP "TRUE]
OP "FALSE
END

TO GTR? :W1 :W2
IF OR EMPTYP :W1 EMPTYP :W2 [IF EMPTYP :W1 [OP "FALSE] [OP "TRUE]]
IF NOT ( ASCII ( FIRST :W1 ) ) = ( ASCII ( FIRST :W2 ) ) [OP ( ASCII ( FIRST :W1
 ) ) > ( ASCII ( FIRST :W2 ) )]
OP GTR? BF :W1 BF :W2
END

TO SPACE
RECYCLE
PRINT ( SE "SPACE= NODES "Nodes )
END

TO GETDATA :FIELDS
PRINT []
IF :FIELDS = [] [OP []]
TYPE SE FIRST :FIELDS CHAR 32
MAKE "INPUT RL
IF :INPUT = [] [MAKE "INPUT [* * *]]
OP FPUT :INPUT GETDATA BF :FIELDS
END


TO INSERT :INPUT :INLIST
IF EMPTYP :INLIST [OP LPUT :INPUT :INLIST]
IF GTR? FIRST :INPUT FIRST FIRST :INLIST [OP FPUT FIRST :INLIST INSERT :INPUT BF
 :INLIST]
OP FPUT :INPUT :INLIST
END

TO GETLIST
MAKE "INPUT RL
IF :INPUT = [#] [OP []]
OP FPUT :INPUT GETLIST
END

TO PRINTBRIGHT :MESSAGE
BRIGHT 1 PRINT :MESSAGE BRIGHT 0
END

TO HELP
CT
SETCUR [12 0] PRINTBRIGHT "DATABASE
PRINT []
PRINT  A.MYNETT APRIL 1985]
PRINT []
PRINT [Facilites available:]
PRINT []
MENU [[SETUP "title] [ADD] [PRINTALL] [RECORD no] [DELETE no] [FIND] [SAVEFILE]
[LOADFILE] [HELP]]
PRINT []
PRINTBRIGHT [TYPE YOUR CHOICE AND PRESS ENTER]
END

TO LOADFILE
PRINT "FILENAME?
MAKE "TITLE FIRST RL
LOAD :TITLE
MAKE "INPUT BF TEXT "FILE
MAKE "FIELDS FIRST :INPUT
MAKE :TITLE FIRST BF :INPUT
ER "FILE ERN "INPUT
END

TO SAVEFILE
DEFINE "FILE ( LIST [] :FIELDS THING :TITLE )
SAVE :TITLE [FILE]
ER "FILE
PRINT SE [SAVED AS] :TITLE
END

TO FIND
MAKE "RECORD 0
SEARCHALL SEARCHLIST THING :TITLE
PRINTBRIGHT [END OF SEARCH]
END

TO RECORD :NO
IF :NO > ( COUNT THING :TITLE ) [PRINT ( SE [ONLY] COUNT THING :TITLE [RECORDS O
N FILE] ) STOP]
PRINTRECORD :FIELDS ITEM :NO THING :TITLE
END

TO PRINTALL
CT PRINTBRIGHT [PRINTING ALL RECORDS]
MAKE "RECORD 0
SEARCHALL [] THING :TITLE
PRINTBRIGHT [NO MORE RECORDS]
END


TO ADD
CT PRINT []
BRIGHT 1 PR :TITLE BRIGHT 0 PRINT []
PRINT SE [RECORDS HELD] ( COUNT THING :TITLE )
PRINT []
MAKE :TITLE INSERT GETDATA :FIELDS THING :TITLE
PRINT [] SPACE
IF FINISH? [STOP]
ADD
END

TO SETUP :DBASE
MAKE "TITLE :DBASE
TS
( PRINT [SETTING UP DATABASE :] :TITLE )
PRINT []
PR [ENTER EACH FIELD TITLE:# TO END]
MAKE "FIELDS GETLIST
MAKE :TITLE []
( PRINT "Database :TITLE [set up] )
END

TO MENU :OPTIONS
IF EMPTYP :OPTIONS [STOP]
IF DEFINEDP FIRST FIRST :OPTIONS [PRINT SE CHAR 32 FIRST :OPTIONS]
```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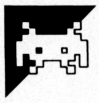
```
MENU BF :OPTIONS
END

TO DELETE :ITEMNO
MAKE :TITLE WIPE :ITEMNO THING :TITLE
END

TO WIPE :NO :INLIST
IF OR :NO = 0 :NO > ( COUNT :INLIST ) [OP :INLIST]
IF :NO = 1 [OP BF :INLIST]
OP FPUT FIRST :INLIST WIPE :NO - 1 BF :INLIST
END
```



Commodore 64 Nest of Evil

by D Talbot

This game shows off a utility that allows you to move sprites around simply and smoothly from Basic.

The routine forms lines 60000 to 63120 of the program, and is initialised by GOSUB 60000. This should be done after all the data for the Basic program has been read in. When initialised, all sprite movement is controlled by one SYS command:

SYS 49152,N,XV,YV,XD,YD

N — number of sprites (0 to 7)
XV — X velocity (0 to 255)
YV — Y velocity (0 to 255)
XD — X displacement (−128 to 127)
YD — Y displacement (−128 to 127)

```
1 REM ***************************
2 REM ****  NEST OF EVIL     ****
3 REM **** (C) D.TALBOT 1985 ****
4 REM ***************************
10 PRINT "■":POKE 53281,0:POKE 53280,0
20 PRINT TAB(5);"■                              "
30 PRINT TAB(5);"■   N E S T   O F   E V I L   "
40 PRINT TAB(5);"■                              "
50 PRINT:PRINT:PRINT "■  HOW LONG CAN YOU SURVIVE THE ONSLAUGHT";
60 PRINT "FROM THE BEASTIES THAT SPRING FORTH FROM";
70 PRINT "THE NEST OF EVIL?"
80 PRINT:PRINT:PRINT "■THE LONGER YOU SURVIVE, THE MORE POINTS YOU SCORE."
90 PRINT:PRINT:PRINT TAB(7);"■USE A JOYSTICK IN PORT 2."
100 PRINT:PRINT:PRINT "■    H A P P Y   D O D G I N G ! ! !"
110 FOR I=0 TO 127:READ A:POKE 12288+I,A:NEXT
120 V=53248:FOR I=0 TO 7:READ A:POKE V+39+I,A:NEXT
130 C=0:S=60:M=49152:SC=0
140 PRINT TAB(7);"■■■■■  PRESS ANY KEY TO START  "
150 GET K$:IF K$="" THEN 150
160 PRINT"■■■         N E S T   O F   E V I L         ";
170 PRINT"■■■■■■■■■■■■■■■■■■■■"TAB(34)"■●●●●●●"
180 FOR I=1 TO 4:PRINT TAB(34);"■●     ●":NEXT
190 PRINT TAB(34);"■●●●●●●■"
200 GOSUB 4000
210 GOSUB 60000
220 C=C+40:S=S-.1:SC=SC+1
230 J=15-(PEEK(56320)AND15)
240 SYS M,0,1,1,-(JAND4)/4+(JAND8)/8,-(JAND1)+(JAND2)/2
250 IF PEEK(V+30)AND1 THEN 1000
260 XD=INT(RND(0)*3-1):YD=INT(RND(0)*3-1):IF XD=0 AND YD=0 THEN 260
270 SYS M,C/1000+1,1,1,XD,YD
280 IF C=6000 THEN C=0
290 POKE 56325,S
300 GOTO 220
1000 FOR I=0 TO 7:SYS M,I,0,0,0,0:NEXT
1010 POKE V+21,254:POKE V+23,254:POKE V+29,254
1020 PRINT "■■■■■■";TAB(12);"■ WE WIN AGAIN! "
1030 PRINT "■■■■■■";TAB(12);"YOU SCORED:-";SC
1040 PRINT "■■■■■■■";TAB(5);"PRESS ANY KEY FOR ANOTHER GAME"
1050 POKE 56325,55
1060 FOR I=0 TO 6:SYS M,I,1,1,RND(0)*3-1,RND(0)*3-1:NEXT
1070 FOR I=0 TO 1000:NEXT
1080 GET A$:IF A$="" THEN 1060
1090 FOR I=0 TO 7:SYS M,I,0,0,0,0:NEXT
1100 POKE V+23,0:POKE V+29,0:POKE V+21,0:RUN
4000 FOR I=V+3 TO V+15 STEP 2:POKE I,208:NEXT
4010 FOR I=V+2 TO V+14 STEP 2:POKE I,52:NEXT
4020 POKE V,50:POKE V+1,150
4030 FOR I=2041 TO 2047:POKE I,192:NEXT:POKE 2040,193
4040 POKE V+37,1:POKE V+38,0:POKE V+16,254:POKE V+28,255:POKE V+21,255
4050 I=PEEK(V+30)
4060 RETURN
5000 DATA64,0,1,16,170,4,6,170,144,10,170,160,42,170,168,41,105,104,169,235,106
5010 DATA169,235,106,169,235,106,170,170,170,170,170,170,170,170,170,170,170,170
5020 DATA166,170,154,169,85,106,170,85,170,42,170,168,10,170,160,1,0,64,1,0,64
5030 DATA5,0,80,0
7000 DATA0,168,0,0,168,0,10,170,128,10,170,128,42,170,160,42,170,160,85,85,84
7010 DATA68,68,68,85,85,84,42,170,160,42,170,160,10,170,128,10,170,128
7020 DATA0,168,0,0,168,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8000 DATA5,7,10,4,14,13,8,12
60000 FOR I=49152 TO 49361:READ A:POKE I,A:NEXT
60010 SYS 49254
60020 RETURN
61000 DATA32,253,174,32,158,183
61010 DATA224,8,144,3,76,8,175
61020 DATA138,10,133,253
61030 DATA32,253,174,32,158,183
61040 DATA164,253,138,153,167,2,153,183,2
61050 DATA230,253,32,253,174,32,158,183
61060 DATA164,253,138,153,167,2,153,183,2
61070 DATA198,253,164,253,200,200,132,254
61080 DATA32,253,174,32,138,173,32,170,177
61090 DATA201,255,240,7,152,201,128,176,24
61100 DATA144,7,192,128,144,18
61110 DATA152,73,127,166,253,157,199,2
61120 DATA166,253,232,134,253,228,254,208,215,96
61130 DATA76,8,175
62000 DATA120,169,125,141,20,3,169,192,141,21,3,88,169,0,162,47,157,167,2
63000 DATA202,16,250,96,162,15,169,128,133,252
63010 DATA133,251,189,167,2,240,56
63020 DATA222,183,2,208,51
63030 DATA189,167,2,157,183,2
63040 DATA189,199,2,16,19
63050 DATA41,127,133,2,230,2
```

PROGRAM FILE

```
63060 DATA189,0,208,56,229,2
63070 DATA157,0,208,144,11,176,21
63080 DATA24,125,0,208,157,0,208
63090 DATA144,12,165,251,208,8,165,252
63100 DATA77,16,208,141,16,208
63110 DATA165,251,208,2,70,252,73,128,133,251
63120 DATA202,16,182,76,49,234
READY.
```

Apricot RS232 Status Test

by NHG Deacon

This is a program for the Apricot PC which acts as a fault finder when communicating with other computers over the RS232 serial link. It interrogates the read registers of the Z80 SIO serial interface chip, and displays messages which relate to their functions. If a character is available in the receive buffer, it is read and displayed after the appropriate message.

Direct addressing of the SIO chip as demonstrated can be used to transmit and receive information at speed from the RS232 port under Basic control. The equivalent command for outputting a character is OUT DTA, char.

```
100 REM ** RS232 status test
110 REM ** SIO channel A port locations
120 DTA=&H60:STATUS=&H62
130 REM ** read registers 0 and 1
140 OUT STATUS,16:RR0=INP(STATUS)
150 OUT STATUS,1:RR1=INP(STATUS)
160 X=RR0 AND 1:IF X THEN PRINT" received char. available...";:C=INP(DTA)
:PRINT CHR$(C)
170 X=RR0 AND 4:IF X THEN PRINT" transmitt buffer empty "
180 X=RR0 AND 8:IF X THEN PRINT" DCD pin active "
190 X=RR0 AND 32:IF X THEN PRINT" CTS pin active"
200 X=RR1 AND 16:IF X THEN PRINT" ** parity error **"
210 X=RR1 AND 32:IF X THEN PRINT" ** receiver overrun error **"
220 X=RR1 AND 64:IF X THEN PRINT" ** crc/framing error **"
```

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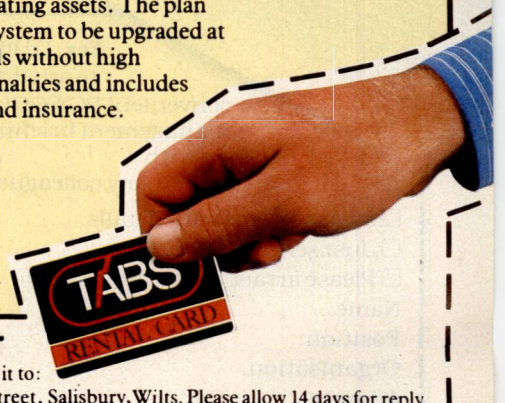

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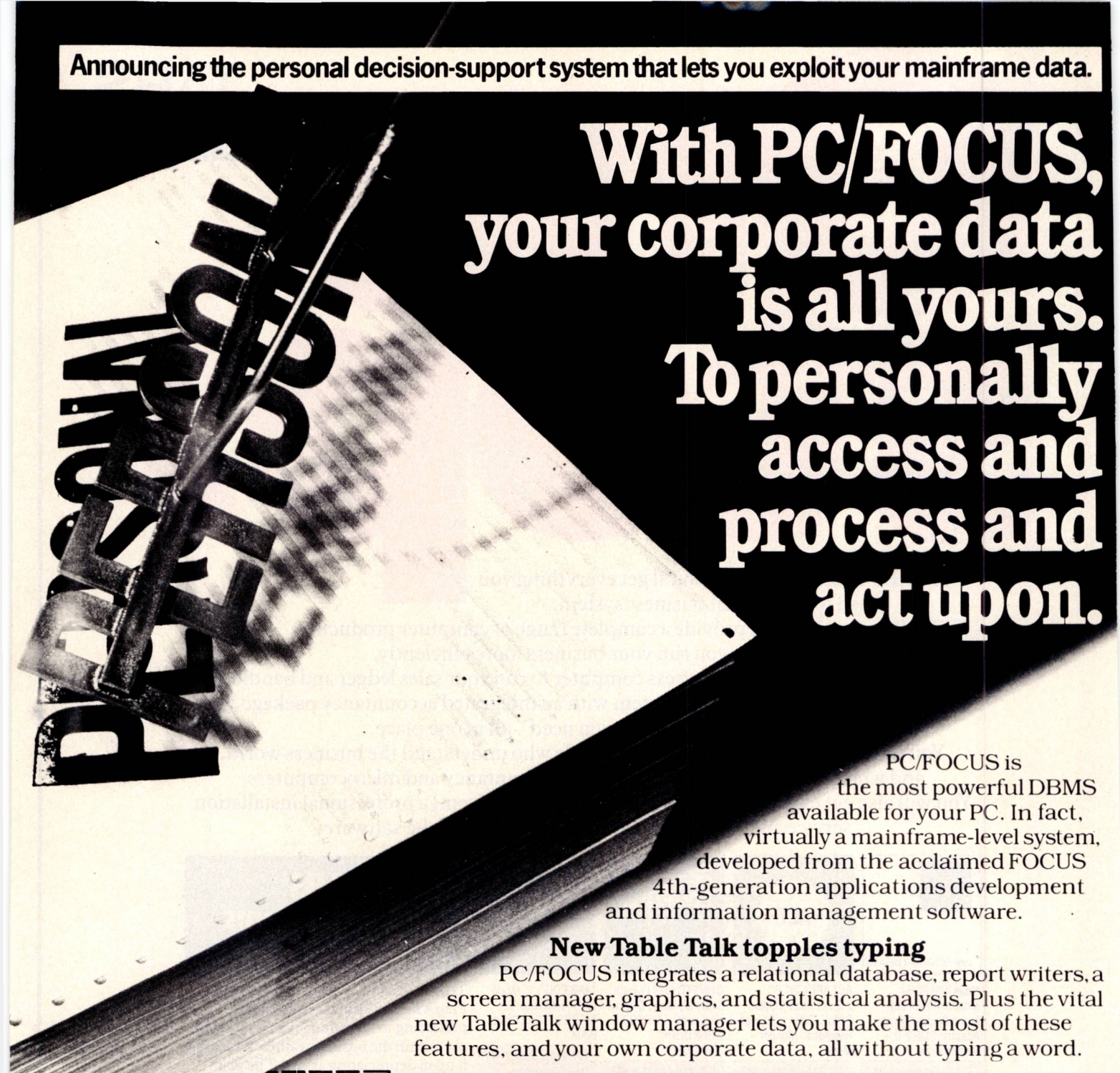

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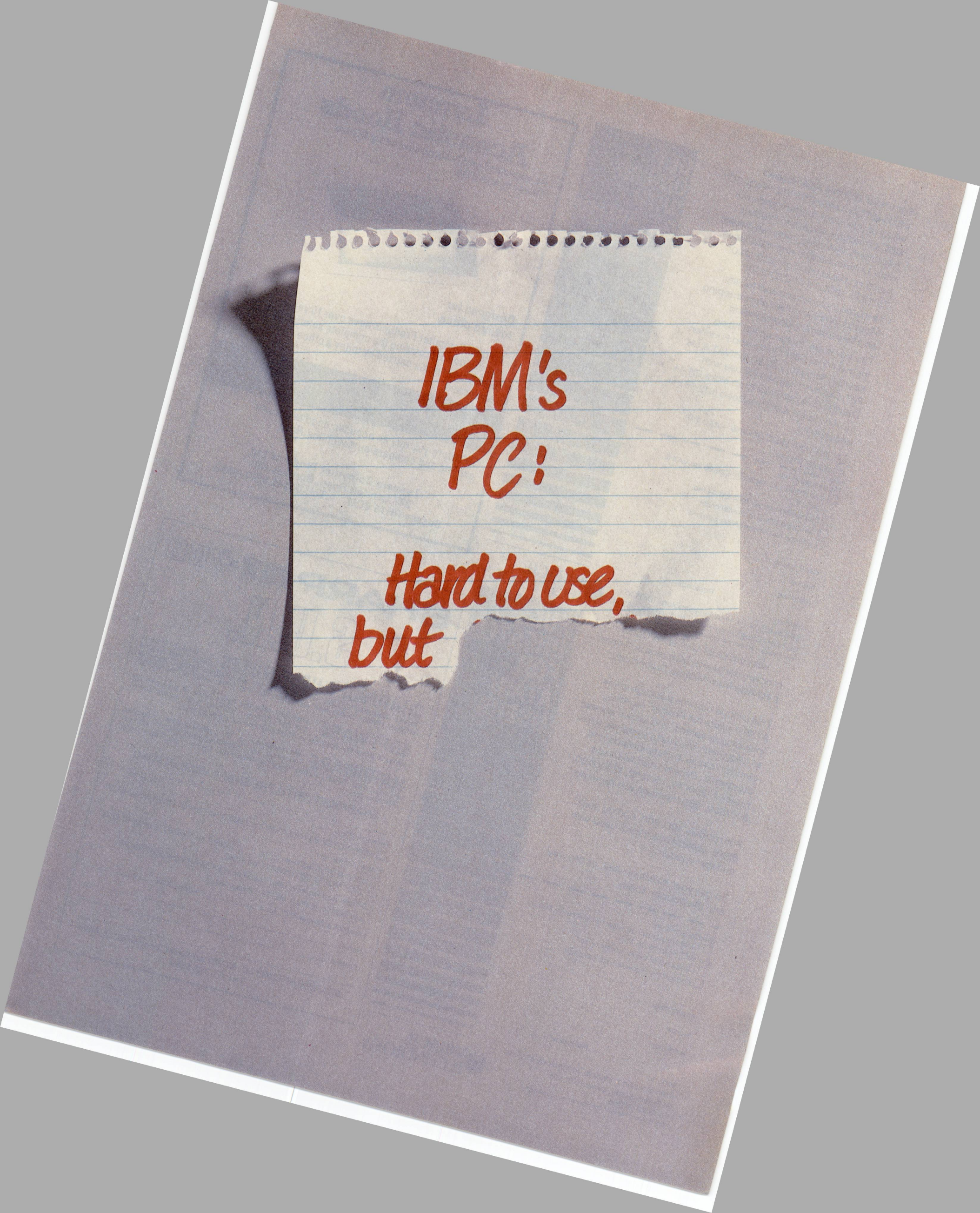
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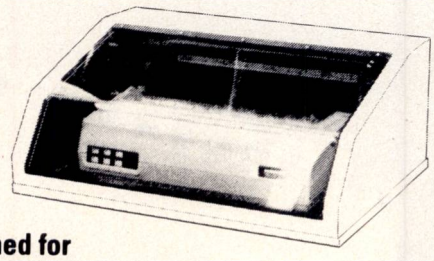

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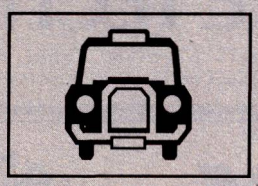

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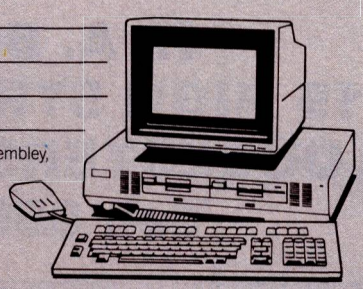

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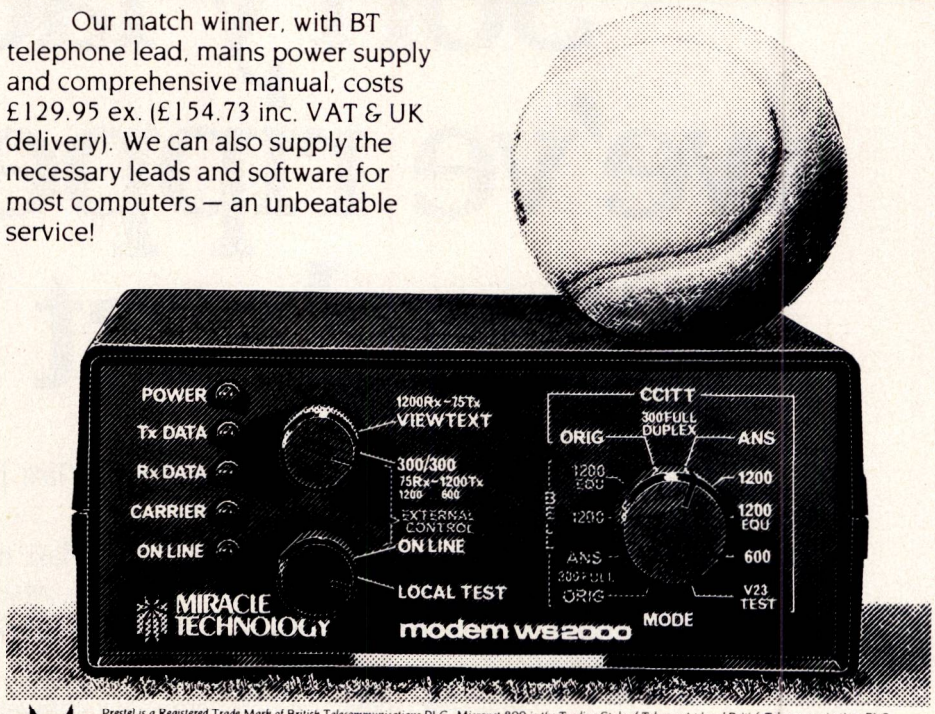

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The new version 3.0 of TURBO Pascal is here. Some Microsoft & DR products are at bargain prices. We also have a selection of Pascal Libraries and Toolboxes not shown here.

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Monday, July 15, 1985 FORWARD WITH BRITAIN

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WORLD EXCLUSIVE

MIRROR Publisher Robert Maxwell last month mounted a dramatic £12 million rescue bid for Sir Clive Sinclair's home computer company. Mr Maxwell said: "I was glad to have been able to help in the survival of Sinclair Research, one of Britain's great national assets. I look forward to working with Sir Clive — a man of brilliant inventive genius."

Mr Maxwell and Sir Clive talked for nine hours with their advisers at the headquarters of Mr Maxwell's company, Pergamon in Oxford, before making the announcement.

Sir Clive said: "I am quite delighted to be associated with Mr Maxwell, whom I have long admired and who has been a friend for many years. I am very pleased that Sinclair Research will be in such good hands with its future assured."

A statement from Downing Street added: "The Government has been aware that these talks have been going on, and it welcomes any move to put the Sinclair business on a firm footing."



SIR CLIVE: "Which way's Oxford?"

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