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# BBC

# MICRO

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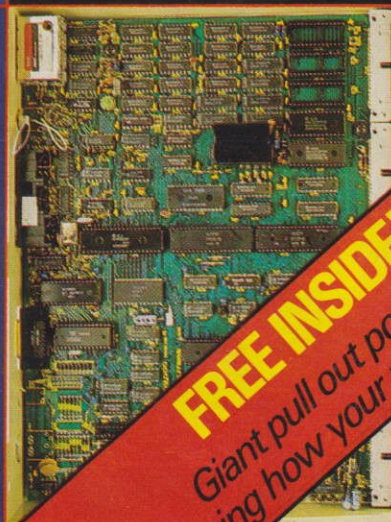


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# Announcing more exciting programs for the BBC.

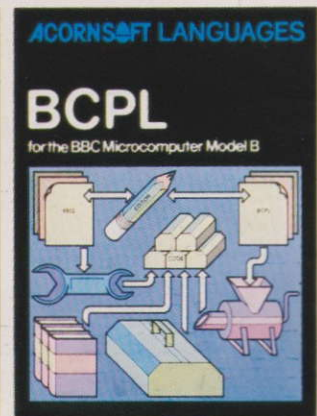
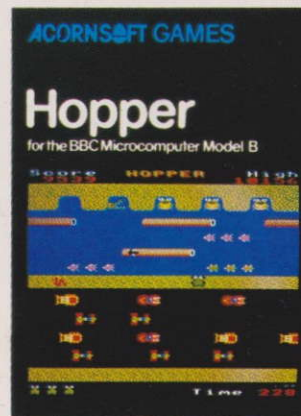
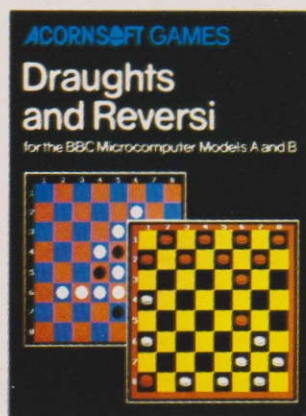
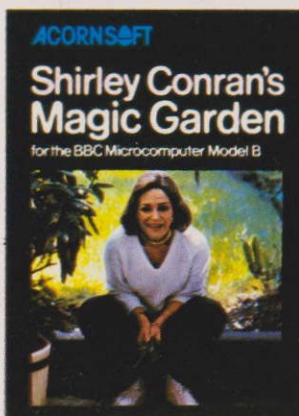
Acornsoft is the software division of Acorn Computers, the company that designed and built the BBC Microcomputer. Here are four more exciting programs, all designed to get the most from your BBC Micro.

**Magic Garden** (£9.95) is a cassette based on Shirley Conran's successful book. It's a problem-solving program which provides the complete beginner with instant answers to the questions of what to plant and where. Simply tell the computer whether you prefer a shrub or a flower, the type of soil, light and shade conditions and required flowering time and the computer will come up with a selection of possible plants.

**Draughts & Reversi** (£9.95) is a cassette containing two traditional board games for you to play against the computer. Both give a graphic display of the board on the screen and you can enter your moves with either keyboard or joystick. The games can be played at varying levels of difficulty and on the higher levels you will find the computer to be a very worthy adversary.

**Hopper** (£9.95) is a game on cassette which can be played with either keyboard or joysticks. Hop the frog across the busy motorway trying to avoid four lanes of fast-moving traffic. To get across the river to the frog's lair you must leap on to the logs and turtles' backs, but beware of the diving turtles, the crocodile and the snake.

**BCPL** (£99.65) is a flexible modern structured language that's very easy to learn. The package consists of a BCPL language ROM, a 40/80 disc and a 450 page User Guide. The disc contains the BCPL Computer, a Screen Editor and a 6502 Assembler. BCPL is particularly good at handling Input and Output and is ideal for writing utility programs and to develop games and commercial packages.



## How to get Acornsoft programs.

If you're a credit card holder and would like to buy the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the programs directly by sending off the order form below to:  
Acornsoft, c/o Vector Marketing, Denington Estate,  
Wellingborough, Northants NN8 2RL.

Also use this form if you would like to receive the current free Acornsoft catalogue.

Please allow 28 days for delivery.

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Hopper	£9.95			SBC23
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# ACORNSOFT



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## PERIPHERALS

Lots of add-ons for those of you keen to expand, enhance and improve your micro. Lots of photos, too.

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## GRAPHICS

Getting deeper into technology here, we delve into user-defining characters and all aspects of improving graphics displays on the BBC.

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Teaching would-be Hardy boys and Microkids the BASICS of computing.

## BUSINESS

Beebplot, Beebcalc & Beebcash — your complete office package for the um . . . ah . . . oh yes, the Beeb.

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A run-down of some of the best games out, plus Biorhythms, Sniper Ambush and Paypacket to tap into your micro.

## HeLP!

This is our section to help you further than our humble pages . . . books, clubs, dealers and suppliers comprehensively listed for your reference. And don't forget our free pull-out Commands poster!



# Atomic rise to fame

The history of the BBC Micro is a short one – a quick rise to fame and fortune.

## HISTORY

To those familiar with the Atom, the BBC micro is no stranger. The BBC micro uses the same microprocessor as the Atom, and BBC Basic evolved from Atom Basic.

When Acorn Computers heard of BBC television's interest in a micro-computer system to go with their computer literacy programme, we tendered for the contract, submitting a design for the Atom's successor.

In February 1981, the design, production and distribution of the BBC micro was awarded to Acorn Computers. Volume production was underway by the beginning of 1982.

How did it all start?

Acorn Computers was founded in 1978 by myself and Dr Hermann Hauser. I had spent the previous 13 years working for Clive (as he then was) Sinclair in Cambridge as a development engineer.

Hermann had obtained a PhD in physics at Cambridge University, then he joined forces with me at the Cambridge Processor Unit.

This was the forerunner of Acorn Computers.

The Cambridge Processor Unit was a consultancy specialising in microprocessor applications. The experience gained by it led naturally, in the spring of 1979, to the forming of Acorn Computers, and the launch of our first home micro – the Atom.

The Atom was sold originally in kit form for £210, and has since sold 30,000 units.

We are proud to be the developers of one of the best selling British micros. By May this year 100,000 BBC micros had been produced. Soon this figure will reach 150,000.

Many of these machines have gone into our country's schools. Indeed, 85 per cent of all machines ordered under the Department of Industry's primary schools scheme are for the

BBC micro.

We are also developing and producing expansion options, which are important to the BBC micro system. Of particular importance are the second processors, which will enable users to turn their BBC micros into 'fully-fledged' machines of business computer power.

There are, too, teletext and Prestel adaptors. Users will be able to download software from the television set or over the telephone line with these.

Then there are the new products being developed for the future. The first of these is the Electron. It is a smaller machine than the BBC micro, but it contains many of its powerful features. The Electron may prove to be as popular with the home user as the BBC micro.

*'85 per cent of all machines ordered under the Department of Industry's primary Schools scheme are for the BBC micro.'*

— Chris Curry

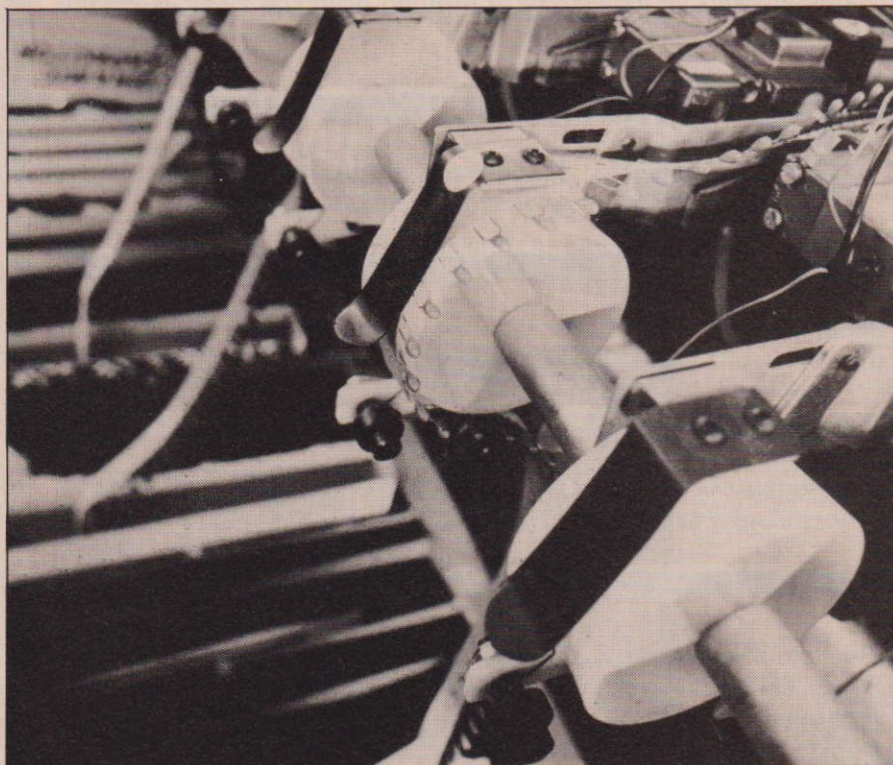
So what is Acorn Computers like as a company?

As the user of a BBC micro or an Electron, you probably have most contact with our customer services department. Behind that are more than 200 people, one-third of whom do nothing else but design and develop new Acorn products.

Most of the manufacturing is done by outside companies. Three are in this country and one in Hong Kong. We also have a team of Acorn 'auditors' who carefully monitor the factories to ensure that the high quality of their product is constantly maintained.

Distribution of all our products is carried out by Vector Marketing, a subsidiary of Acorn. The company is responsible for all deliveries to the dealers, overseas distributors and the public.

Another subsidiary – Acorn Over-



Belt fed components add to the automation.





Tony Sleep

*Workers at the Acorn factory take a close look.*

seas Limited – has been set up to sell the BBC micro and other products abroad.

This is particularly important now that BBC has sold the *Computer Programme*, the television series it made about computers, to countries that include Hungary, Ireland, Singapore, New Zealand, Australia, and the United States.

The design and development department pulls many of its staff from the University of Cambridge, in which city Acorn Computers is situated.

In this team is a group that specialises in the design of microchips for Acorn's own use. The group collaborates with the engineering laboratory of Cambridge University.

A very important subsidiary company of Acorn is Acornsoft. This company develops all Acorn operating software, and is responsible for marketing the application software designed by hobbyists and professionals for Acorn machines.

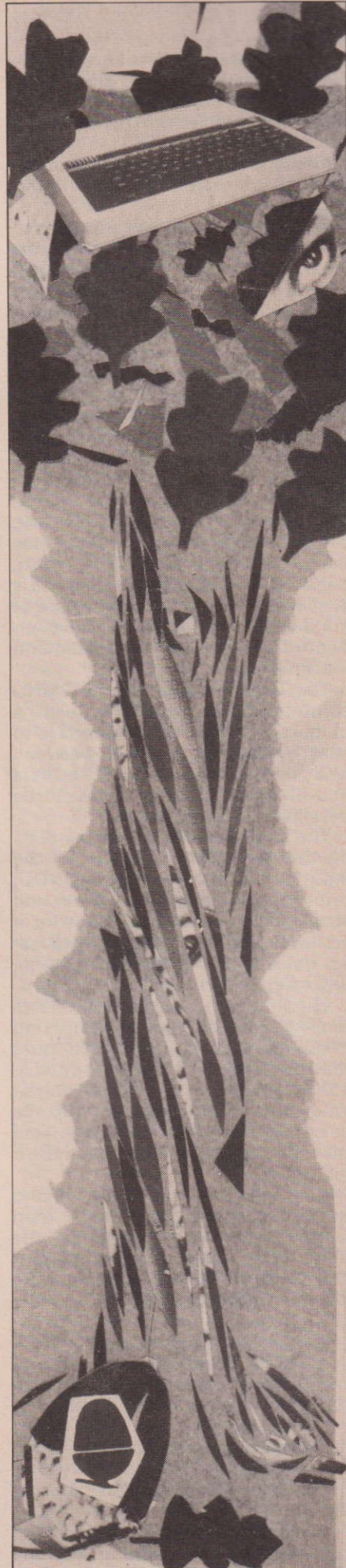
Many of these programs are written for use in schools.

The BBC micro's place in education is strengthened by the Econet local area network system. Econet enables up to 254 Acorn micros to communicate with each other, and to share expensive resources, such as printers and disk drives.

Perhaps it won't be long before we see entire schools wired for processing through such micros so that every classroom can communicate with any other, and with classrooms in other schools.

So that is what Acorn Computers is about. It is our objective to play an important role not only in school computing, but in computing for the home and business. We aim to provide easy-to-use, well designed machines that are familiar to all levels of user.

**Chris Curry is Joint Managing Director of Acorn Computers Limited.**





## MICROMETER

If you have been trying to sort out how the BBC computer works, either from a hardware or software point of view, you will probably have come to two conclusions.

Firstly, it is a very complex system. Second, it is extremely versatile and expandable.

Everything possible seems to have been done to ensure that this is not a 'dead-end' machine which you will have to throw away after a year or two when its basic technology is, inevitably, superseded. The basic computer is the starting point for connecting to many other systems.

The system supports all the usual peripherals, such as VDU, cassette, and disk. The most important single feature which ensures that this system will keep going much longer than most is the Acorn Tube. Other manufacturers could, and possibly will, come out with a machine which has the same feature as the BBC micro, but is only a fraction of the price and is available off the shelf. But beware of imitations. If it does not have an Acorn Tube then it will be a dead-end machine.

The Tube is a high-speed (2MHz) communication system. It needs a quite complex hardware interface to pass bytes back and forth between two processors. It uses FIFO buffers and interrupts, so it allows true parallel processing.

The arrangement is that the 6502 on the main board handles all the input and output — keyboard, VDU, printer, cassette, disk, user ports, and so on. These usually take quite a lot of computing time. The second processor deals with language processing, and calculations.

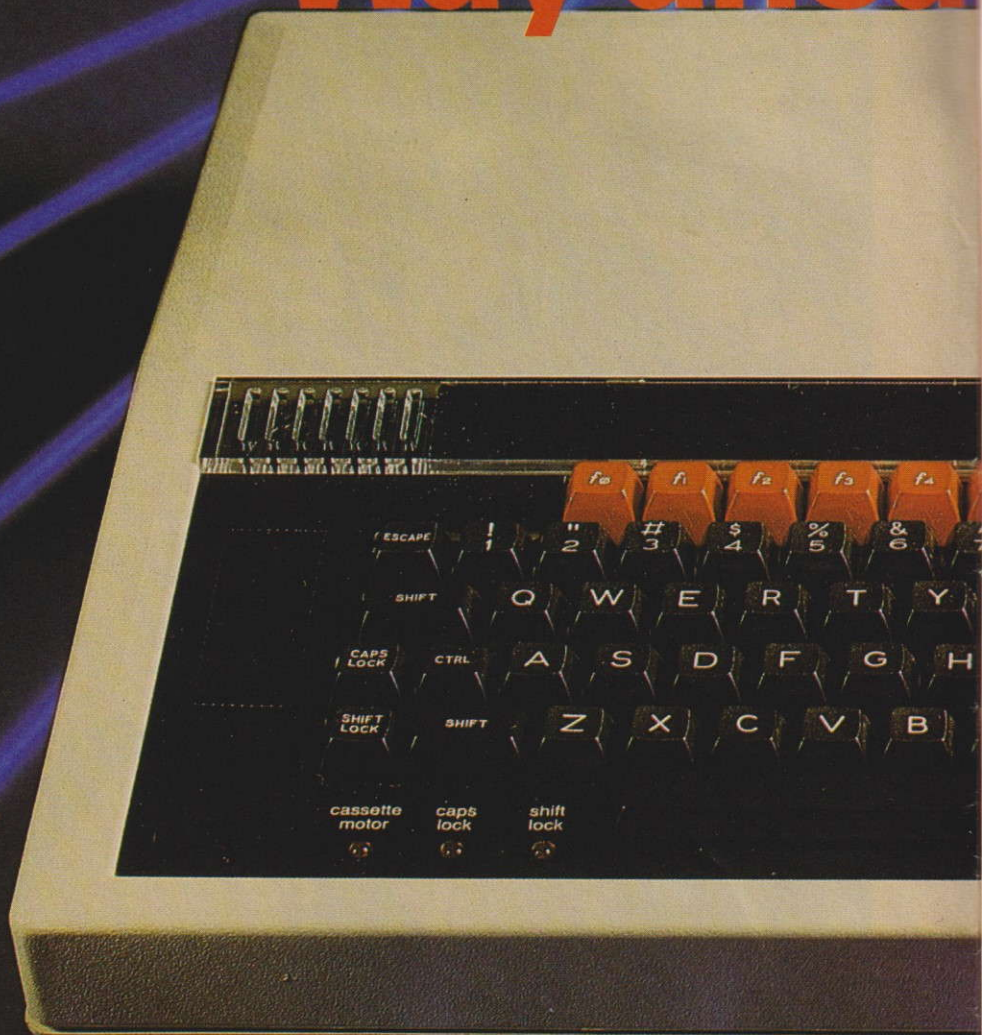
The first gain you get from this is that the processing speed, even using a 6502 as a second processor, is more than doubled. With only one processor, everytime you want to output data, the micro has to stop its calculations, output the data, and then pick up the calculations where it left off.

With two processors, the second one does some calculations, then simply shoots the data down the Tube. The input/output processor deals with it in its own time. And the second processor carries on with the calculations unhindered.

If you are not so keen on the 6502, you will be pleased to know that you do not have to use the same processor at both ends of the Tube. You could equally well use a Z80 as the language processor, so that you can take advantage of its suitability over the 6502 for data processing applications.

Also, choosing the Z80 second processor board is said to be 'fully CP/M compatible'. You obviously

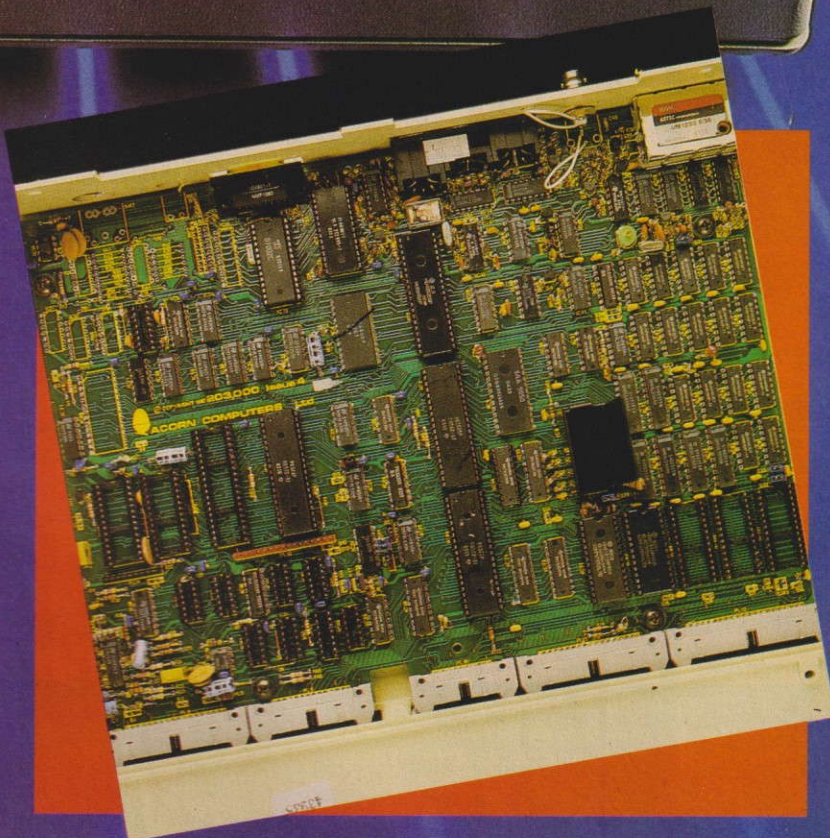
# Way ahead



*One of the key attractions of the BBC micro is its expandability. Essential to this is the Acorn Tube which ensures that the user does not end up with an obsolete machine as technology moves on. Paul Beverley reveals all.*



# d by Tube



cannot use any CP/M software which is machine-specific, so that rules out virtually all the Z80 software, for example.

The other factor giving an overall speed improvement is that both the Z80 and 6502 second processor boards will be working at a clock rate of at least 3MHz. Acorn is trying to push up the speed to 4MHz.

Acorn is also developing a second processor board using the National chip, the 16032. It is hoped this will also run at 4MHz.

UNIX, UCSD, Pascal, Fortran, Cobol and at least another half dozen other high-level languages should all be available by the end of 1983. That would give the machine a processing power similar to some of the present-day minicomputers at less the cost and, some would say, greater reliability.

Apart from the gain in speed achieved by using a second processor, there is also a gain in size and speed of memory access.

The maximum amount of memory which one 8-bit processor can address is limited to 65 Kbytes. This has to include ROM and memory-mapped input/output as well as RAM. The BBC Model B has 32Kbytes of ROM, memory-mapped input/output and 32 Kbytes of RAM.

To make use of the highest resolution of graphics, you need 20K of RAM. And nearly 4K is used up for operating system workspace, serial input/output buffers, sound buffers and soft-key buffers. So you are really down to about 8K for your program and variable storage.

One possible means of improving on this is the capacity for accessing an extra 64K of RAM, ROM, or input/output in a 'paged' mode via the 1 MHz extension bus.

You store up to eight bits of the auxiliary address in a special register, FCFFH. Then as you read and write to locations FDOOH to FDFH you will be addressing locations in the specified pages of the auxiliary RAM.

This is much slower than accessing the on-board RAM. This is because the access is at 1 MHz rather than the 2MHz at which the 6502 is running. It is also because of the time taken in setting up the paging register. Some thought would have to be given to the software implementation of this system.

If you have a second processor, even an 8-bit one, it will immediately provide an extra 64K of addresses. There will have to be a small 'bootstrap' ROM on the second board to start it on power-up. There is capacity for 60K of RAM on both the 6502 board and the Z80 board. This RAM is accessed at the full 3MHz or 4MHz at which the second processor is running.

If you then go to a 16-bit second





# BEEBUG FOR THE BBC MICRO

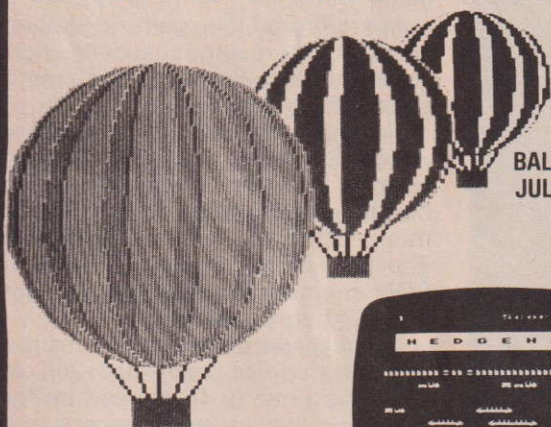
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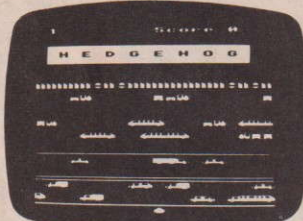
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### SCREEN SHOTS FROM PROGRAMS



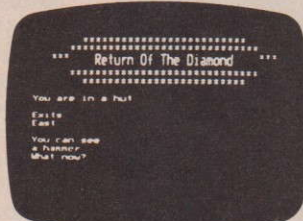
**BALLOONS**  
JULY 1983



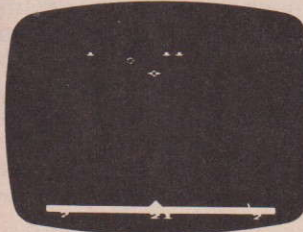
**HEDGEHOG** JUNE 1983



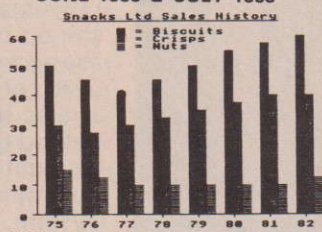
**ELLIPTO** JUNE 1983



**RETURN OF THE DIAMOND**  
JUNE 1983 & JULY 1983



**INVASION** APRIL/MAY 1983



**BARCHART** APRIL/MAY 1983

Magazine programs now available on cassette to members at £3.50 inc: VAT & p&tp—see April/May issue for details.

**February Issue: Program Features:** BEEBMAZE—Find your way through the random maze, guided by 3D views from inside the maze—an excellent game. FIVE-DICE—A Beeb implementation of YAHTZEE (R), a novel dice game. Also a listing of WINDY FIELD—a creation from Acornsoft, SPIROLOT screen doodler, and a complete memory display program in a user key. Plus Machine Code Screen Dumps for the Epson and Seikosha Printers; articles on USING FILES, IDEAS ON ANIMATION (Including a Rotating Cube program), an Introduction to the Use of Procedures, a Survey of Books on the BBC Micro, and a Roundup of Disc System Hints. PLUS a variety of HINTS, TIPS AND INFO, including a single VDU command to perform a SIDEWAYS SCROLL.

**March Issue: Program Features:** Life (32K), Artillery Duel (16K/32K), Square Dance: 3D Rotation (will rotate any object). Printers for the BBC micro—Review of Epson, Seikosha, Tandy and Olivetti. What to do with the new Operating System, Disc Formatter Program, and full Disc instruction set, Newcomers article on Text and Graphics Windows. PLUS How to get a new Operating System ROM and a special deal on Wordwise (members only).

**April/May Issue Special Anniversary Issue—Contains index to the whole of BEEBUG Volume 1.** Music Composer—create complex 3 part harmonies with this synthesiser Program. Colour bar chart generator program. Beeb implementation of the Connect-Four Game. Invasion—a 16k. Plus Review of Tape Recorders for the Beeb; a Basic Program Editor, which lists variables and procedures, and executes Find and Replace in a Basic Program; Reviews of Acornsoft Games and the Torch Z80 Disc Pack. Disc Menu Program. Newcomers introduction to Mode 7. How to save the unsavable; and a routine to print Double Height Characters in all modes.

**June Issue: Program Features:** 'Return of the Diamond' A 16k adventure game, 'hedgehog' a well implemented 'frogger' type game, and Ellipto. Create your own off the shelf sound effects with Sound Wizard. Plus articles on Using Files, Rotating and Expanding Characters, Using Printers, and How to multi-program the User Keys. Reviews of The Hobbit Floppy Tape System, Adventure Games, and a Comparative Review of Wordwise and View. Plus FX Call Update, Disc Program Auto-relocator, Wordwise Update, and more BBC Book Reviews.

**July Issue Games:** Robot Attack (32k) and Anagrams, a 16k word game. Watching the Beeb at work—a simple program to show your micro at work. An introduction to discs—what are they and are they worth getting. Balloons—a coloured animation. Make your micro speak like Kenneth Kendal. Bad Program Lister—lists programs even when the computer pronounces them 'bad'. Reviews of Epson and Seikosha's new printers. Five books of programs reviewed, plus more software reviews. Using Files Part 4. A full discsector editor program—to read and retrieve lost disc files. And how to modify Acornsoft's Planetoid. Plus hosts of useful hints.

**BEEBUGSOFT: BEEBUG SOFTWARE LIBRARY**  
offers members a growing range of software from  
£3.50 per cassette.

### BEEBUG NEW OPERATING SYSTEM OFFER

BEEBUG members can now obtain the new 1:2 OPERATING SYSTEM ROM at around **HALF PRICE**

See BEEBUG Magazine February, March or April for details.  
As a result of BEEBUG negotiations with Acorn the ROM now may also be offered by other user groups to their members.

1. Starfire (32K). 2. Moonlander (16K). 3D Noughts and Crosses (32K). 3. Shape Match (16K). Mindbender (16K). 4. Magic Eel (32K). 5. Cylon Attack (32K). 6. Astro-Tracker (32K).

Utilities: 1. Disassembler (16K). Redefine (16K). Mini Text Ed (32K).

Applications: 1. Superplot (32K). 2. Masterfile (32K).

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Make cheque to BEEBUG and send to: BEEBUG Dept 3, PO Box 109, Baker Street, High Wycombe, Bucks HP11 2TD

Send editorial material to: The Editor, BEEBUG, PO BOX 50, St. Albans, Herts AL1 2AR



processor, you are into the megabyte region, in terms of memory capacity. We don't yet know what Acorn will be providing in the way of Ram with the new board. The 16032 has an addressing range of 16 megabytes (24-bit address).

If you have already used the RML 380Z, you will appreciate the advantages of holding the high-level language interpreter in RAM instead of ROM. It makes the system very flexible, in that you can use Basic one minute and then, say, Pascal the next.

The cassette version of the RML 380Z, however, has disadvantages. It takes a long time to load 16K of high-level language every time you want to use the micro. And you can crash the machine by over-writing the interpreter through injudicious POLEing.

The BBC micro seems to take the best of both worlds. Resident in the machine at any one time you can have up to four different 16-Kbyte interpreters. See the software reviews in the centre of this magazine for more details.

Swapping languages is simplicity itself. When you first switch on the machine you find yourself in Basic or whichever language ROM you have in the default position. To change to another language, type \*PASCAL or \*LISP. This can be done either in immediate mode or from within a program. So you can change from one language to another even as the program is running.

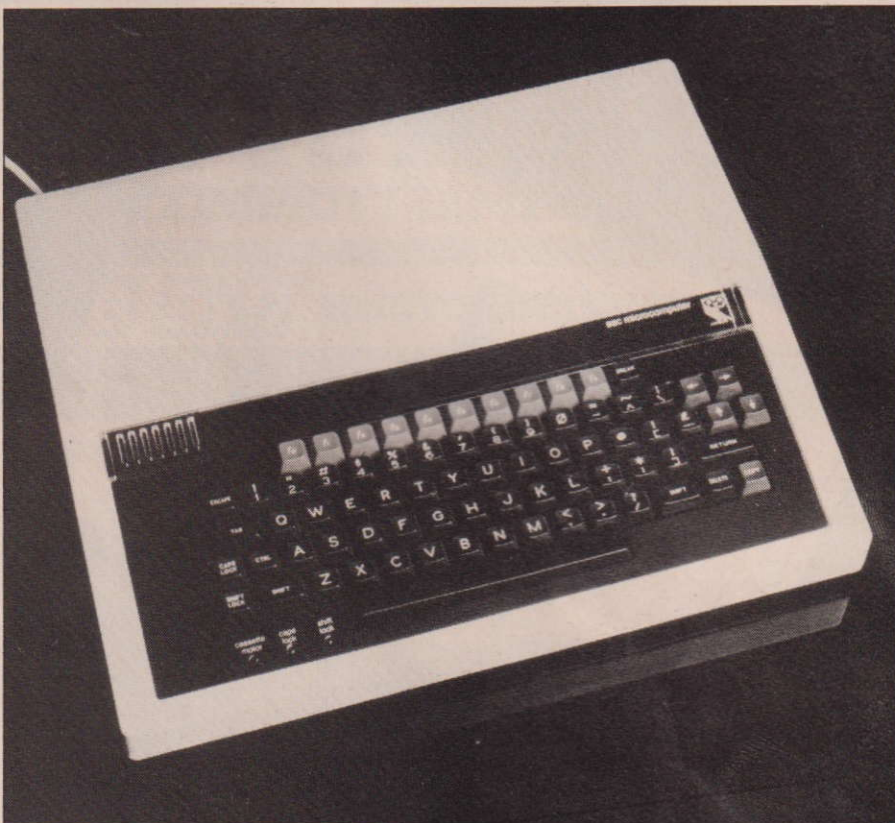
This is possible because, on power-up, the operating system interrogates each of the installed ROMs to find out how much 'private' workspace and how much 'public' workspace it needs.

It then reserves the requisite amount of private space for each ROM. It decides on the largest amount of public space needed by any one ROM. And it sets the value of PAGE accordingly. This ensures that the ROMs can work together without over-writing each other's private workspace. It also minimises the total amount of workspace by defining a public 'scratch-pad' area.

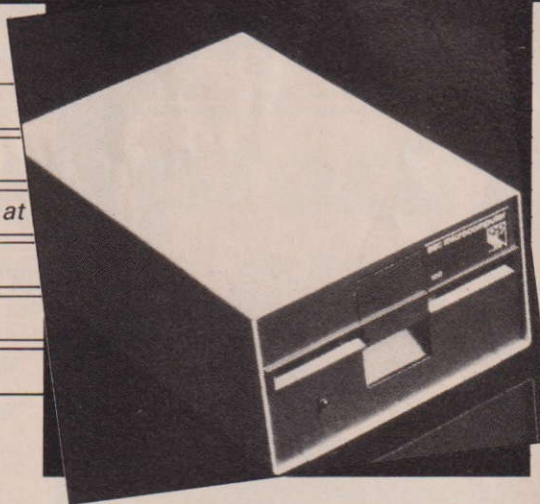
The other very important feature for software expansion is the command line structure. Any command which is prefixed by an asterisk is called a command line. It is 'offered' to each of the language ROMs in turn to see if they recognise it. If they do, they will execute it.

If it is not recognised by any of the language ROMs, it will be passed on to the service ROMs, such as graphics packages, voice synthesiser and user EPROMs. And if it is not on their list of commands, it is finally passed to the current file system, disk or net. If a file of that name exists, it will be loaded and executed.

Another form of expansion is the



*The BBC micro allows you to hold up to four different interpreters in main memory at any one time. This offers tremendous flexibility in switching languages.*



strange-looking hole at the left-hand side of the keyboard. This is where you plug in your Rom cartridges.

These could contain professionally-produced applications programs which, as a matter of interest, will be very difficult to copy as they could only be RUN and not LOADED. They could be used to provide an alternative character set or to give extra vocabulary to the voice synthesiser.

You can have up to 16 ROMs piggy-backed electrically on to the same connector. So when a command line is encountered which is not recognised by any of the language ROMs, it will be passed on to the ROMs in the cartridge to check.

A 16K machine operating system makes it easy to change high-level interpreters. So the things you need to do in any language—writing to the screen, reading and writing to cassette, disk, serial input/output printers—are provided as firmware sub-

routines.

Many of these routines are vectored. If you want to intercept them, you can redirect them to your own code by changing the appropriate vector. Changing filing systems from cassette to disk or net is just a matter of changing the vectors.

Many of the firmware routines have been provided with expandability. If you look at the VDU calls especially, you will see that many of them are followed by strings of zeros 'to allow for future expansion'.

To change logical colour 1 to actual colour 6, you use 'VDU19,1,6,0,0,0'. The last three zeroes are redundant to the call. Similarly, the so-called advanced graphics call, 'VDU23,0', has to have a total of 10 bytes in it. The third byte is the register in the 6845 CRT controller chip. The fourth is the data that you want to put in it. Then you follow it with six zeros.

Incidentally, if you want to 'see' the





FC20 – FC7F  
 FC80 – FC8F test hardware  
 FC90 – FCBF  
 FCC0 – FCFE user applications  
 FCFF – paging register for 64K pages  
 addresses  
 FC00 – FDFF access to paged  
 memory.

As you can see from the system plan, the bus will support Eurocards. Some are available from Acorn, but you will need a buffered pack-plane if you want to use more than one card.

The Eurocards available include a 'universal' interface for digital input/output, including 6522 and 8255 parallel I/O chips and a 6850 for serial I/O. There is a laboratory interface which has 16 I/O lines, optically buffered with an output drive capability of 3 amps at up to 48 volts.

There is an analog interface with two 12-bit DACs and an eight-channel 12-bit ADC with a conversion time of 100  $\mu$ s per channel, all controlled by a 6522 VIA. And there is a dynamic RAM card, accessible only in the paged mode at 1MHz.

Yet another powerful expansion facility is Acorn's Econet. This will be particularly useful in schools and colleges. It can also be put to good use in business applications.

Econet is a simple communication system using only a cheap four-wire telephone-type cable to link up to 254 computer stations. These can be Atoms, Systems, 3,4, or 5, or BBC micros. They should also link into the newly launched Electron.

Apart from allowing any machine to communicate with any other machine, a number of machines can share expensive peripherals such as disks or printers.

### Terminal

Another exciting prospect for schools and colleges is to use the BBC computer as a terminal to a mini or mainframe computer.

This is made possible by the RS423 interface and the programmable serial processor – ULA. These give bi-directional data flow with control through 'ready to send' and 'clear to send' lines. The RS423 standard is compatible with RS232, but has a superior drive.

The serial processor is programmable. It is an easy matter to select the baud rate for transmit and receive. These can be of the standard rates up to 9600 baud – at a push it will even go up to 19,200 baud. But Acorn doesn't guarantee operation at this speed.

It is worth noting that the transmit and receive baud rates are set separately so that split rates can be used. When you transmit from a keyboard, speed is limited and you would use a relatively slow transmission rate. Then the computer's replies can be relatively fast.

*An exciting prospect for schools  
 using the BBC micro and its  
 peripherals is the use of the  
 computer as a terminal linked to  
 a mini or mainframe.*



internal workings of the micro, try this:

MODE 4 (or any other two-colour mode)

VDU19,0,4,0,0,0 (change background colour)

### Addressing

VDU23;12;0;0;0 (use zero page upwards as video Ram).

You will then see what an 'interrupt driven machine' looks like.

The 1MHz extension bus has already been mentioned with reference to memory expansion. But much more can be hung on this bus than just 64K of paged addresses.

You could use some of the 64K addresses for memory mapped input/output – such as the 6522 versatile interface adaptor used for the printer and user ports on the basic machine. You could also address a number of ADC and DAC devices

such as the ZN427 and ZN428. These have tristate buffers so can be put directly on to the data bus. This would then make complex data acquisition systems a distinct possibility.

You could also make use of these addresses for your own machine code routines by storing them in EPROM.

Paged addressing only uses addresses &FCFF to &FDFF. Almost the whole of page &FC00 is still to be accounted for. The idea is that this should be used for memory-mapped devices that need only a small memory.

As you can see from the system plan, it is this bus on to which the teletext and Prestel acquisition units are connected. Here are the preliminary allocations which Acorn is suggesting:

FC00 – FC0F test hardware

FC10 – FC13 teletext

FC14 – FC1F Prestel



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## NEW

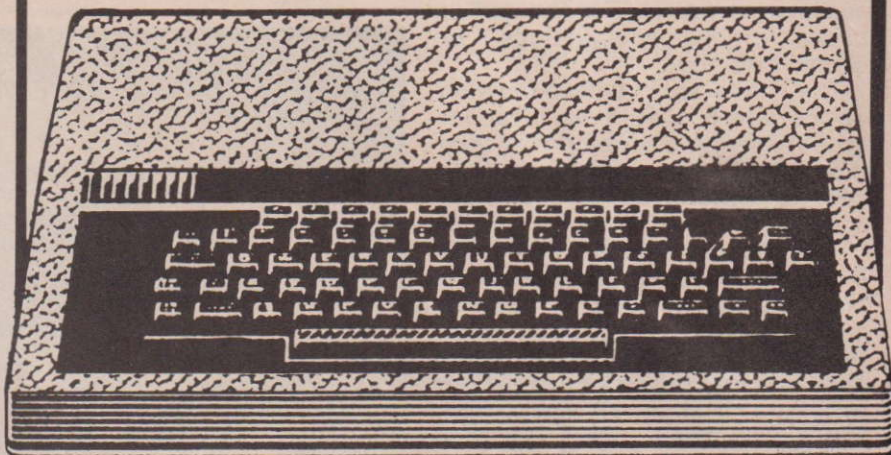
Shugart Single 100K Disc Drive (Fully compatible with BBC Micro) £195.00 + VAT  
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Supplied complete with all Connecting Cables, Utilities, Disc and Manual

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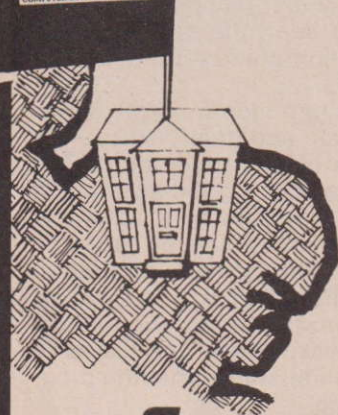
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BBC 26	5 Pin Din Plug	£ 0.60
BBC 35	Disc 1/0 Cable 34W 1DC to 2 x 34 way Card Edge	£12.00
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BBC 45	Joysticks (per pair)	£11.30
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## ACORN SOFTWARE FOR THE BBC

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SBL01	Forth Cassette	£14.65
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Wordprocessor View	£52.00
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## PERIPHERALS

Jossop Microelectronics, manufacturers of the 'Edinburgh Turtle' mechanical robot, has launched a new low cost version. The latest Turtle cuts the price from £350 to £165.

Part of the price reduction is due to minor changes in design and components. It was achieved by redesigning the computer interface so that it operates in a parallel mode, rather than serial RS232.

None of the changes however affect the operation or appearance of the Turtle. It takes simple commands. It can move around, draw a triangle and even a square. For forward or backward movements, just type 'F' or 'B' and a number.

The Turtle is a perfect drawing device which should be ideal for school children. The company hopes the price reduction will place the low cost Turtle within reach of all primary schools.

The package includes the RS232 interface, connection cable, two pens and software on disk or cassette which should be specified when ordering.

**Jossop Microelectronics** can be contacted at Unit 5, 7 Long Street, London E2. Tel: 729 1851.

Speech synthesisers have been around for a while, but most have an American accent. The reason is because most of the development on speech chips was carried out in the US.

Now, Acorn has encoded the vocal tracts of veteran newscaster Kenneth Kendall in a silicon chip. The speech system comes as a piece of firmware on two 40-pin ROMs. But these have to be fitted by an Acorn dealer — that is, it's not a do-it-yourself job.

The user can generate words on several different levels. Choosing the level involves a trade-off between time and versatility.

The synthesiser can produce words and sounds from a 'PHROM vocabulary' (Phrase Read Only Memory). To encode speech in a binary representation, the speech processor uses a linear predictive coding technique. The speech processor takes serial data provided by the PHROM integrated circuit and converts it into audible 'words' under the control of the main CPU.

You can manipulate the 165 words already stored in the PHROM quickly and easily. This can be done in Basic or assembly language.

The basic sound commands require four parameters. The first parameter is treated by the computer as a systems command, while the second parameter determines the word spoken. Parameters three and four do not affect the sound generated. But

# It speak it plays g



*A good printer to use with the BBC – Seikosha.*

they are expected by the system, so you have to include them.

The advantage of the system is that it allows you to incorporate the speech commands into your normal program. Doing this in Basic is fairly straightforward. It shouldn't take too long before you can write fairly complex programs.

If, on the other hand, you are after speed of operation, you have to revert to the machine code. It's a bit more involved than the Basic mode, but it's equally efficient.

The beauty of the system is it allows you to customise and form your own special words. However, the amount of raw number typing necessary to achieve this is considerable. To manufacture the word 'zero', for instance, you have to type close to 1,000 individual characters.

It should be possible to save the words on disk as data files. These can be called up by the program and used as, say, menu prompts.

The system doesn't depend on any high speed storage, but would make it much more attractive. It is possible to load the words onto tape, but the loading speed obviously precludes

the interactive use of a tape recorder with a program.

The speech processor responds to a number of commands sent by the CPU. Once sent, the processor executes the command without involving the CPU.

All the commands are explained in the manual, and their names are suggestive of their operations. The manual provides a good example of using the speech system in assembly language mode where you can write directly to the speech processor. Though this requires a reasonable grasp of programming, the manual gives a breakdown of the listing to help you understand what the program is doing.

Most of the words supplied with the system are useful and easy to get at. Forming sentences from compound words is also easy, once you get the hang of the commands, but some of the words need careful listening to to understand. The pitch of the voice is adjustable.

On the whole, it's good value for money. It cost £55. You can contact Acorn on (0223) 245200.

The Namal Supertalker is a talking



# s, it moves, ames too.

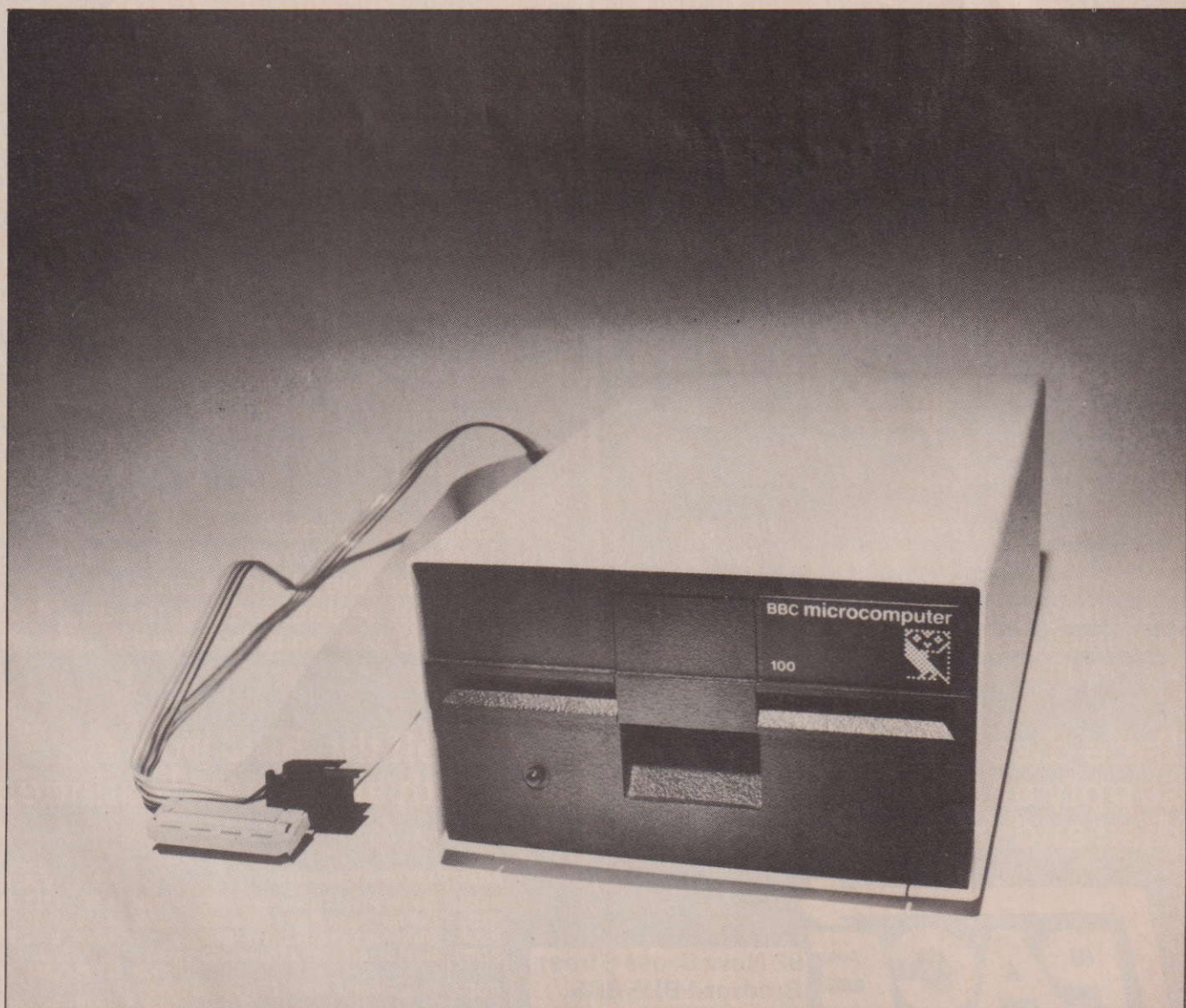
It seems you can never get bored with a BBC Micro. Apart from a host of software peripherals are popping up all over the place. We take a look at some interesting add-ons to help your micro at work and play.

computer with an extensive built-in dictionary ROM/RAM, and carries a standard RS232 interface. It seems the only product in the lower price range not limited either by fixed vocabulary or to a single model of micro.

The Supertalker uses an internal Z80 microprocessor to accept simple commands through the RS232 interface. This makes it easy to use, and allows it to be connected to most computers as if it were a serial printer. Two cheaper models for Sinclair ZX

users have most of the features of the RS232 version.

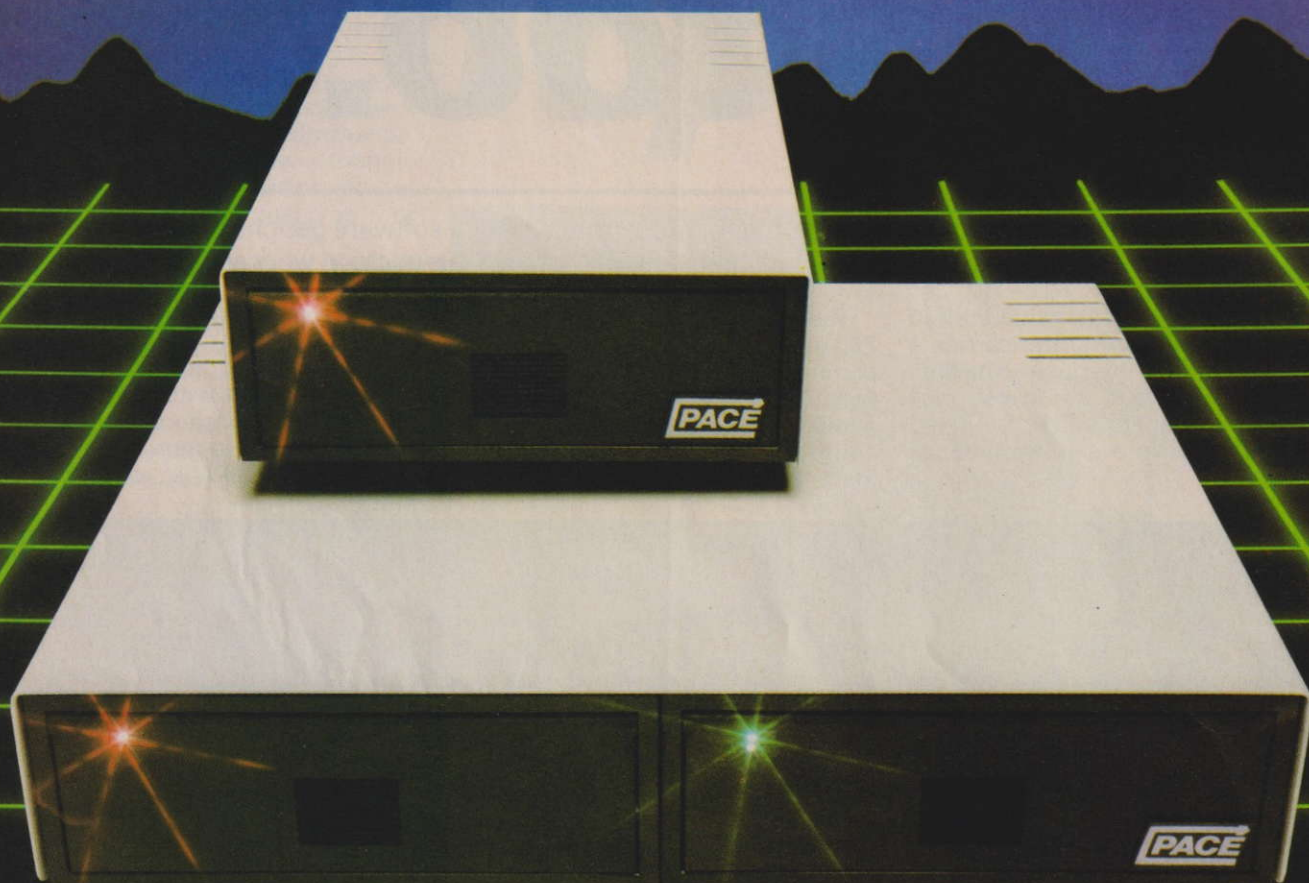
Words are pronounced by supplying the chip with a sequence of codes for the component sounds. For example, 'call' is represented by the phonemes 'K-AW-L', or 'judge' by



The Acorn disk drive – the rightful add-on to this system.



# BYTE YEARS AHEAD!



Now available for the BBC Microcomputer, this superb range of high performance, low profile disc drives which give more data storage, and use less space.

The Pace range of drives include two drives which are switchable between 40 and 80 tracks. As these drives are double sided they give a massive 400 k per drive in 80 track mode, whilst in 40 track mode they retain compatibility with Acornsoft

and other commercially available software. These dual track drives feature multi-colour LED's to indicate mode selection.

All Pace drives are capable of being used as double density drive so that, as and when, a new filing system and interface become available, the disc storage capacity will be doubled (eg. the dual 40/80 drive will have an unbelievable 1.6m of storage).

Pace disc drives are designed to run off the BBC power supply and are supplied complete with all cables, a utilities disc and manual.



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## Disc drives available:-

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PDD1	Dual Single Sided Drives (40 track)	200k	£338	£388.70
PDD2	Dual Double Sided Drives (40 track)	400k	£449	£516.35
PDD3	Dual 40/80 Switchable Drives	800k	£610	£701.50

"Carriage and insurance charge of £4.50 inc. V.A.T. to be added per drive"

Also available from:- Computer City, Widnes, Cheshire. Tel: 051-420-3333. Computerama, Stafford. Tel: 0785-41899.  
Computerama, Stoke on Trent. Tel: 0782-268620. G.T.M., Leeds. Tel: 0532-647474. Cate Computer Centre, Wigan. Tel: 0942-44382.



'D-J-UH3-UHI-D-J'. The advantage is that any word can be spelled out in sounds.

The Namal unit has a vocabulary of about 500 useful words. Each word can be spoken by giving its dictionary entry number. There is also space for 200-250 new words to be downloaded into the Supertalker RAM.

The Supertalker stores messages by sequencing dictionary numbers. This allows the unit to be set up for many different tasks. It helps make messages more natural.

The 23-page manual includes a seven-page article on the phonetic principles involved.

The RS232 interface is designed for easy use. This makes it compatible with a wide range of computer equipment, not just home micros. The Namal Supertalker clearly has a future. It leaves your options open. Schools and colleges should also find the flexibility of the RS232 interface helpful.

The Voltmace Delta 14 handsets system takes the strain of heavy button pushing off the keyboard. It comes in two parts: the handset itself which can be used on its own and an adaptor box which enables one or two handsets to be plugged in to the user port. The A-to-D input socket enables the use of 12-button func-

tions on each.

Each handset has 14 push buttons made of silicon rubber with separate plastic caps for each button, and the adaptor box has two 15-way sockets for left and right handsets. The handsets are identical and can be used in either socket.

You can use one handset and the second part of the A-to-D and the user port to control a robot or keep a graphic plotter on line by plugging the joystick into the rear socket.

**Voltmace Limited** can be contacted at Park Drive, Baldock, Herts SG7 GEW. Tel: 0462 894410.

The Hobbit from Ikon is a tape recording unit as well as a cassette operating system. It bridges the domestic cassette/floppy disk price gap for the BBC owner.

The Hobbit comes in two parts — the cassette unit and an EPROM which contains the operating system to drive the Hobbit. The ROM must be inserted into one of the three sockets within the BBC machine before the cassette unit can be used.

Once installed, the Hobbit will provide a faster, more efficient and flexible way to store data and programs than a conventional cassette recorder.

Although the Hobbit provides many powerful commands to enable

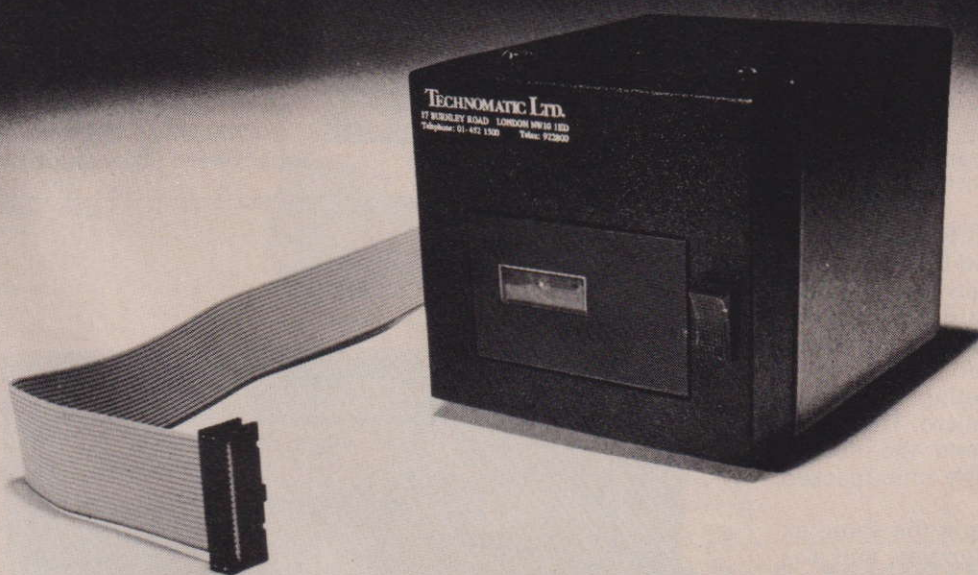
the saving and loading of data or programs, it is not a complete alternative to disk drives. The Hobbit is a super efficient, fast and flexible means of storing and retrieving data and programs. It supports the tape commands and it would be possible to use random access files.

Setting up the Hobbit can however be tricky especially if you are inexperienced. It must be carried out precisely. But it can be installed by Ikon for as little as a fiver plus. After installation, the BBC micro can easily be turned on.

Files can now be created just as you would if using an ordinary cassette recorder. But the big difference is that the Hobbit is completely under software control. No need to use rewind, fast forward, record, play, or align the tape to the next program/data file; the Hobbit does all that for you.

The Hobbit comes in a tiny 'black box,' weighs about 2lbs and measures approximately 3½in wide x 3¾in high x 4in deep, and cost £135 plus VAT.

The BBC Expandable Console not only gives your micro the professional computer look, it protects and encloses your micro with room for your disk drives, teletext, adapter, second processor, cassette and video monitors. It also raises your TV/



Ikon's Hobbit — faster, more efficient and flexible than cassette.



monitor to eye level to minimise eyestrain.

With the console, your micro and disk drives can be mounted in a single unit with all the interconnecting wires completely hidden — safely out of reach of children.

You could even fix to the rear of the console a four-way socket adaptor, with the mains input the only wire visible.

The Console also enables you to move your micro around the house, school or office in a complete assembly without disconnecting the various parts from each other. Its dual role shelf can take drives up to 10cm high and even 11.5cm high. It also takes full, half and even dual half height drives.

Silent Computers, manufacturers of the Console, have come up with a special 'anti theft' bracket, which, once installed within the console, the micro cannot be removed. This acts as a very good theft deterrent.

The Console costs £39.99 plus £4.00 postage and packing and can be ordered from **Silent Computers**, 27 Wycome Road, London N17. Tel: 801

Memory Services of Warrington have taken the plunge and followed BASF and Cuman into the 3in market.

The complimentary disk drive is made to give increased versatility to the BBC micro. Described as a super precision disk, by the company, Pace Software Supplies, it costs £338, plus VAT, is compact and measures a mere 217mm x 303mm x 64mm.

**Pace Software Supplies** can be contacted at 130 Clayton Road, Bradford BD7 2LY. Tel: 0274 575973.

Flight Link's range of potentiometer joysticks use a different method of sending information to the computer.

Unlike the spring-loaded stick which mechanically closes one of four circuits to instruct the computer, the potentiometer gives you more accurate control over the screen object.

The latest joystick has two potentiometers positioned at right-angles, which are simultaneously manipulated by the stick through a joint mechanism,

Instead of the normal spring-load stick, the potentiometer joystick

moves smoothly and the object on the screen goes through the same manoeuvres.

It can instruct a program in true two-dimensional movement. You can, for instance, move the stick cross-wise in a desired direction, and both potentiometers will send information to the computer indicating between them the desired movement.

The sticks should be ideal for the Dragon and BBC micros. The Dragon uses a five-pin DIN plug, while the BBC uses the D-plug. Flight Link may soon release versions for the Vic, Atari, ZX81 and Spectrum.

The Flight Link joysticks have a quality feel, are just over an inch long, and glide smoothly from side to side. They are also made to withstand heavy use.

Joystick Control Unit J6, for the Dragon 32 or BBC micro, price £15.95 and £17.95 respectively, is available from Flight Link Control Ltd on (0420) 87241.

The BBC Microsecure is an effective security device specially made to protect your micro from theft. It's an easy and convenient means of securing your BBC micro to a desk, table or working surface.

It's also simple to assemble: an upper frame is bonded to the micro which then locks securely into the lower frame fixed to the working surface. Once locked, it can only be removed by the authorised keyholder.

The steel frames are finished in an attractive brown while the edges have plastic moulding so that there is no danger of scratching working surfaces if the computer is used outside its Microsecure base. Provision is also made for peripheral cables.

If you are concerned about space, then try the 'space saving' Monitor shelf. The shelf provides the user with a choice of heights, forward and backward tilt positions with anti-slip



*Expandable console made by Silent Computers.*

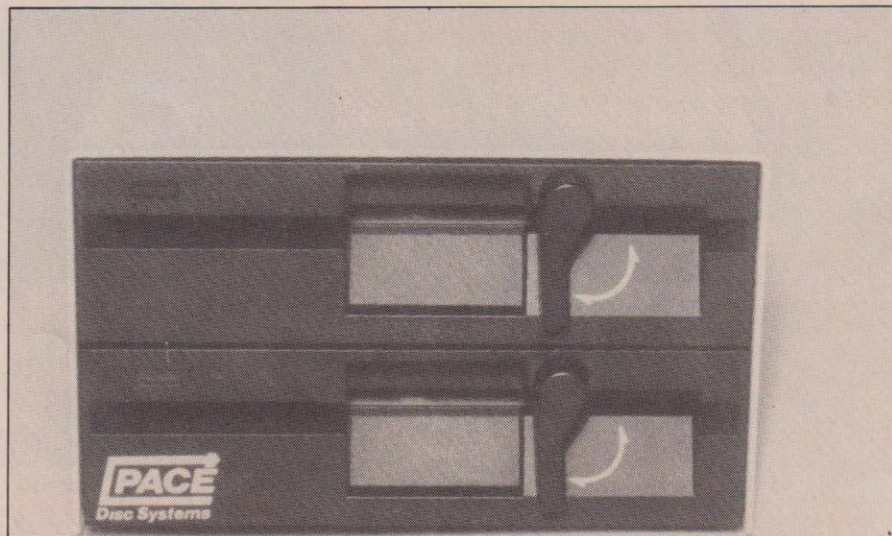
3014.

The Torch system is basically an elaborately packaged BBC micro, so correspondences between the two are hardly surprising. But Torch, with CPN, the CP/M look-alike, has moved in a different direction.

Hitachi are marketing three disk drives for the BBC micro. The single drive costs £225, and the double version £399 with the units packed side by side.

The disk interface is the same as that used for 5 1/4" floppies, and it is claimed files can be copied between the two sizes.

Acorn had planned to market microfloppies, but backed out because of standardisation problems between manufacturers of the new microfloppies. However, Advanced



*Pace's new disk system — up to 400K per drive.*



# DISC USERS

## — IF YOU USE DISCS YOU NEED "THE KEY"

A suite of disc utility programs:

1. FORM 40 — Format 40 track discs.
2. FORM 80 — Format 80 track discs.
3. BACKUP — Allows your valuable discs to be backed-up, including most protected discs.
4. EDITOR — Allows the user to alter and customise programs, even those which are not listable.
5. RETRIEVE — Enables the user to recover data or programs that have been accidentally erased.

The real workhorse of the package is EDITOR which allows the user to see a sector in HEX and ASCII, and to then alter that sector and write it back to disc. There is provision for automatic and manual searches of the sector and the instructions contain useful tips on what to look for, and where to look for it. The sector can also be dumped to printer for in-depth analysis.

The program is very easy to use and control is mainly through the function and cursor keys, whilst on-screen prompting provides all the necessary information. One recovered program or a back-up copy that is actually needed will pay for this package, and will continue to show its worth time and time again.

This is the sort of utility that should be provided with every disc drive sold as it becomes indispensable once used. At a price of £12.95 "THE KEY" represents very good value when compared with the many formatting programs being sold for around £10.00

**THE KEY — £12.95** (state 40 or 80 track discs)

*It is a condition of sale that this program will not be used illegally.*

### C.A.D. SOFTWARE

Ideal for teachers, designers, artists, technical drawing and numerous other applications including your own form and stationery design etc.

This program must be seen to be appreciated — your imagination is the only factor to limit its individual applications.

- Modes 0,1,2,4,5 (can be changed when program is running).
- Multiple display of arrays enables infinite complexity.
- **FUNCTIONS:** Line, rectangle, triangle, circle, text (upper and lower case) and colour pallet (8 colours and flashing).
- **DRAWING AIDS:** Alignment grid, circle copy, delete, free memory, purge memory, variable cursor speed, clear screen and redraw.
- Shapes can be filled or outlined (no need for Fill Routines).
- Save and load to tape in about 20 seconds, or to disc in 2 seconds.
- **SPECIAL FACILITY** — Rubber band mode — A very flexible and variable line drawing facility — must be seen.
- Free "redraw" routine to enable the pictures created to be displayed in your own programs.
- The disc version allows screen saves, which take approx. 3 seconds.
- **Recommended by BBC Micro User.**
- **GRAFKEY** (keyboard and joystick cassette version) **£7.95**
- **GHAFDISC** (disc version) **£12.95**

### REPLICA

(Another disc utility program to make your life easier)

This program allows most of the popular machine-code and Basic programs on cassette to be uploaded onto disc and run. The program is very user friendly and almost does away with the need for human intervention. It is presented in such a way that the user does not need to know what it going on, he simply inserts the tape and presses a few buttons when prompted. The programs will be presented in a menu, which is created by the replica and will auto-boot, just leaving the user to select the required program. Many types of program can be handled with this utility and it is particularly suited to programs that load in several stages or sections. The disc will allow approximately 8-10 programs of similar length to the Acornsoft arcade game to be stored. If additional program space is required, a further disc must be purchased.

**REPLICA £9.95**


(state 40 or 80 track)

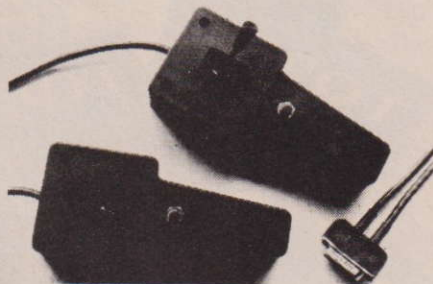
### SYNTHESISER PACKAGE (requires 1.2 O.S)

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Allows up to 16 envelopes to be defined and saved using a very sophisticated, yet easy to use defining program. Alter the values and hear the effect instantly. Then use the envelopes in Part 2.

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Turns your keyboard into a musical instrument. Lets you play 3-note chords (not just single notes). Use cursor keys to change octaves etc, etc.

Become the Rick Wakeman of the Computer Age.

THIS SUPER PACKAGE COSTS  
JUST  **Cassette £7.95**  
**Disc £10.95**



### JOYSTICKS

Pair of fully proportional joysticks of compact and handy size  
**£17.95**

### JOYSTICK UTILITY

Converts most non-joystick programs to run with joysticks. Works with any program using the INKEY (-), which applies to most games. Compatible with most Acornsoft arcade games. Very easy to use — just press the keys you wish to transfer to the joystick.  
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(for the 5-11 age group)

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### PROGRAMMERS

We are constantly seeking new and interesting programs. Why not send yours for appraisal? Do not worry if the presentation is not to professional standards — we are looking for new ideas and we will advise and assist in bringing your program to the required standard. You have got nothing to lose but much to gain — So why not send your program today? 40 Track disc if possible or two copies on cassette. In some cases we will even provide disc drives against future royalties.

### CLARES MICRO SUPPLIES



Dept. P.C.F., Providence House,  
222 Townfield Road, Winsford,  
Cheshire CW7 4AX.  
Tel: 06065 51374

All prices inclusive of  
VAT + Carriage — No Extras.





bars at front and rear.

These products — along with the Mobile Computer Stand, can be obtained from Selmor (Engineering) Industries Limited at 24 Mulberry Street, Tower Hamlets, London, E1

input or output. Up to 1Mbyte of paged memory can be addressed, or 256 bytes using the card. A larger version designed for rack-mounting, costs £41 and will hold 14 connectors. Racks start at £72.

puts BBC files at your disposal. In effect it runs the disk filing systems of both machines in parallel.

Users will be given a wider choice, says Torch. And features of the BBC machine — particularly its file hand-



Chris Bell

The Torch disk pack, fully compatible with the BBC.

1EH. Tel: 247 3344.

The development of other security devices — DiscSecure and Monitor Secure — is also planned by the company.

The Microsecure comes in complete sets at just £26 plus VAT or the lower frame on its own at £18 plus VAT.

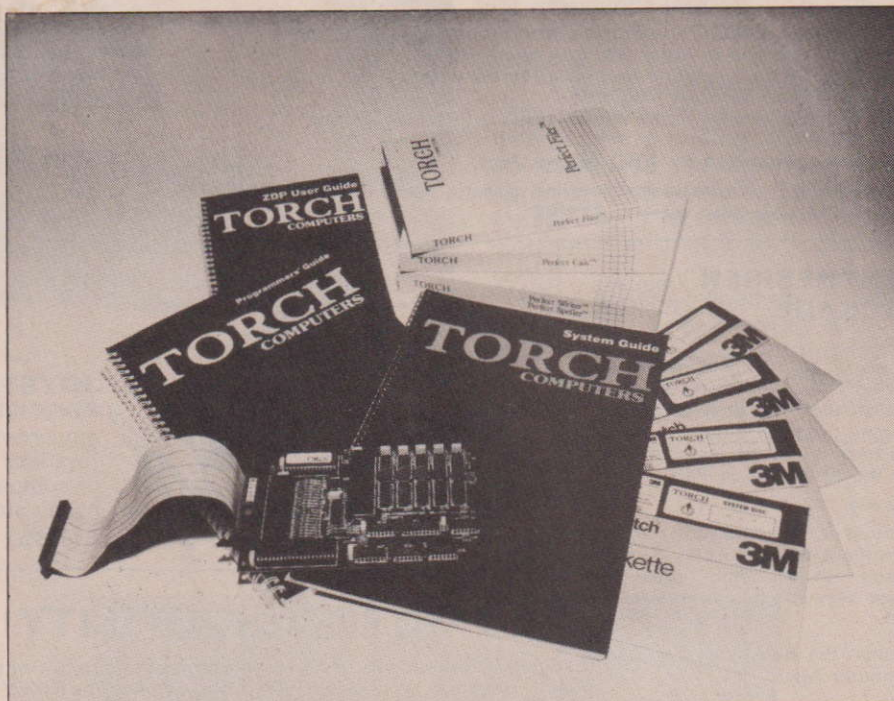
Students at Tabor High School, Essex, are cashing in on the software shortage — by writing software themselves. The school markets the programs for the students, and shares in the profit.

Nine programs have been produced, and 12 more are planned. The nine — for 'O' and 'A' level biology — cover blood circulation, digestion, heart, classification, heart and circulation, digestion and enzymes, breathing, photosynthesis and simulation of radioactive decay. All run on a Model B.

The software sells at £2.50 and £3.50. Outside writers can also distribute their ideas through the school. The person to contact is: Christopher Smith, Courtauld Road, Braintree, Essex.

Beebex is an interface card aimed at linking the BBC micro's 1MHz bus to Eurocards. It costs £49, and holds up to four cards from its own Cube range, or from Acorn's.

Applications include extra memory, analog interfacing, and digital



A complete set of extras is included with the Torch.

Also available is a paged ROM to enable BBC Basic to talk directly to I/O devices.

You can plug a ROM chip into your Torch to use programs and files designed for the BBC micro — for just £25.

The ROM enables you to load and store BBC programs on the Torch. It

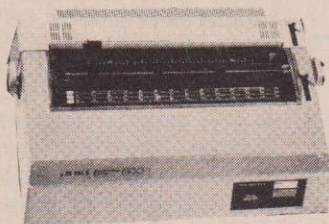
ling will be performed more efficiently.

Both 40- and 80-track disks can be handled, although the restrictions of the BBC filing system apply — 31 files per disk or 31 files by surface. But running under CP/M offsets some of the limitations where efficiency is concerned, says Torch.



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**JUKI 6100 + Cable +  
24HR Delivery & VAT £440.00**

## STAR DP 510



One Year Warranty  
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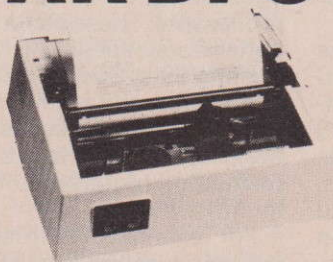
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# Searching out some software

A micro is only as good as its software. But, fortunately, says Geof Wheelwright, there's a whole family of stuff for the BBC.

## SOFTWARE

There are two real questions to answer in discussing applications for the available Micro:

1. What applications does the BBC Micro have, and how well is it suited for those applications? . . . . and . . .
2. What software and what hardware is available for those applications?

Both are difficult questions to answer—the first because there are so many applications, and the second because the bank of both hardware and software for specialist applications is growing all the time.

Perhaps the best way to look at applications for the BBC is in the form of a 'family tree' showing the various major tasks to which the Beeb can be assigned, and then the offshoots of those tasks as the applications become more and more specific.

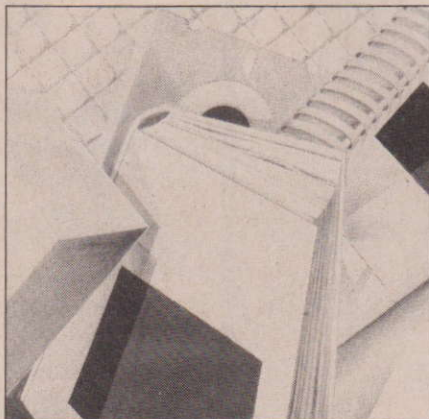
Figure 1 shows what I call the 'BBC Micro Tree of Applications, showing some of the various uses the machine can be called on to carry out. Like a tree, the applications for this machine are constantly branching off, developing new shoots.

### Programming

At the bottom of the tree, the first branch on the left-hand side falls under the general heading of 'programming'. Aside from the obvious fact that all applications packages for the machine are a result of programming, the BBC offers several languages in addition to the much praised BBC Basic.

Acornsoft — Acorn's official software house, offers both Lisp (an artificial intelligence language), and Forth (a reverse Polish notation language that includes the ability to define your own words). Acornsoft, as well as several independent software houses, have also developed several versions of Logo, and these are available in sideways ROMs to plug inside the BBC.

Most people, of course, will program first in BBC Basic — which offers several useful graphics commands including COLOUR, MODE, PLOT and DRAW. There are also some nice additions to standard Basic like REPEAT . . . UNTIL, IF . . . THEN . . . ELSE, PROC, and ENVELOPE.



### Word-processing

The lowest branch on the right-hand side represents the BBC's word-processing function. Although it may seem at first rather specialized, the BBC's capacity for word-processing suggests that a Beeb with a good W/P program and a printer could easily make the household typewriter obsolete.

In terms of its layout, the construction of the keyboard, and the feel of its keys, the BBC can easily take the title for being the best suited word-processor in its class.

The top row of 10 function keys forms the nucleus of most BBC word-processing programs. Acornsoft's View, for example, offers 29 functions (including block moves, insertion and deletion of characters, words, and lines, formatting and cursor control) using the red function keys in combination with the CONTROL and SHIFT keys.

Because the function keys are entirely programmable, they allow word-processing packages to include all kinds of commands that are available with only one or two keystrokes — as opposed to the multi-layered commands of something like MicroPro's popular Wordstar.

The BBC's built-in 80-column screen capacity also gives authors of word-processing packages the ability to easily develop proper full-width screens, and so preview pages exactly as they will be sent to the printer — easily switch between the 80- and 40-column modes — so that even on a standard TV you can write a letter in the 40 column mode and switch to 80-column mode to see what it will look like when printed.

The BBC has also dedicated delete and copy keys, along with independent cursor control keys. The availability of these keys makes it much easier to control the cursor and do minor editing with the minimum number of keystrokes. They also make word-processing packages much easier to write — with the benefit that there should be far more to choose from in the software showroom.

Text editors are the next most complex form of 'word-processor'. They usually don't have the level of sophistication to give you proper word-wrap, text formatting, or any decent form of deletion or insertion. But a good text editor will usually let you write short letters, memos, or notes.

After the text editors come the simple file-card and report generation programs. These have word-processing capabilities, but only for certain dedicated tasks. For example, in a typical cardbox-type program you get a representation of a simple blank card and fill it out using the BBC's built-in editing keys.

Report generation works on the same principle, although report generators are usually sophisticated enough that their editing functions begin to approach those of full-blown word-processors.

The next step is obviously dedicated word-processing programs, with the traditional word-wrap, formatting, block moves, insertion and deletion functions.

There are then a number of packages designed to work with word-processors. These include form letter generators, spelling checkers, and mailing lists. Such packages usually use all the editing functions of the host word-processor and dedicate themselves to the task of specialized formatting required for their particular function.

For example, Wordstar has two programs called Spellstar and Mailmerge for checking the spelling of documents, and developing mailing lists, respectively.

### Robotics

Moving to the left-hand side of the applications tree again, you'll see at least three entries coming off the Robotics branch, the first two of which have already been developed. The ready robots at the time of writing are the Edinburgh Turtle and the BBC Buggy — both education-related machines.

Edinburgh Turtle is made up of a small plastic bubble with wheels, a pen in the centre, and a long chord coming out the top which connects to an interface box and thence to the BBC. The Turtle is controlled by a program resident on a small plug-in



EPROM. It's essentially a small robot whose movement can be controlled by a computer – including the pen at the centre which can be made to move up and down and so draw various geometric shapes.

The Turtle is commonly controlled by some version of the Logo educational program for children.

The BBC Buggy is perhaps one step further in Robotics as it's built from Fischer Technik parts, and can be fitted with a grab or additional sensors. The Buggy drives on wheels like the Turtle, but also has two separate stepper motors, a micro-switch collision detector, a light detector, and an infra-red receiver for reading special bar codes or following a prescribed line.

Again, the Buggy's movements are controlled by the BBC using English-language type commands.

Given the falling price of Robotic components and the increasing competition among producers of peripherals for the BBC Micro, there will undoubtedly be many more Robotic devices produced for the BBC – and they fall in the third category, the shape of robots yet to come.

### Scientific and mathematical applications

Looking to the right of the tree again, you'll find the BBC moving into the science and maths field. This shouldn't come as too surprising an application given the origins of computing – however some of the scientific applications may surprise you.

For example, did you know that the BBC Micro could be used as a limited digital oscilloscope as long as information is put through the machine's analog-to-digital converter at the right speed?

The analog-to-digital converter is a good starting point for looking at scientific applications, since it allows the BBC to take measurements of electric currents and convert them into the kind of results that can tell you something about a scientific experiment.

The BBC's joystick works on the same principles as do scientific measurements – multiplexing four inputs into the machines' analog-to-digital converter, and then providing values for that input.

Aside from the obvious uses for the analog-to-digital converter in dealing with measurements, the BBC can also take a good run at Computer Aided Design (CAD). It can do geometric calculations, run spreadsheet programs, and do scientific experiment simulations.

Computer Aided Design makes use of the graphics capabilities of the BBC to draw objects in three-dimensional perspective, and then move and rotate them. A good computer-aided

design program would allow you to, for example, plug in all the variables about building materials for constructing a boat, and then producing an image of what all parts of the completed boat would look like.

Spreadsheets are a familiar enough application – giving you an electronic ledger which does all the calculations for you. VisiCalc is the most famous of these, and it uses an ordinary spreadsheet-type format to allow you to design your own ledger.

Simulations can also be performed using the BBC Micro. By programming the various parameters involved in a given experiment, scientists can assess the results and probable outcome before they actually carry it out. A simple example of this can be shown in the 'Moonlander' type arcade game where you plug in the various fuel, thrust, and descent parameters to land a lunar module on the moon.

A scientific simulation takes this process many steps further, using all the parameters in an experiment to get an idea of results.

Geometric calculations can also

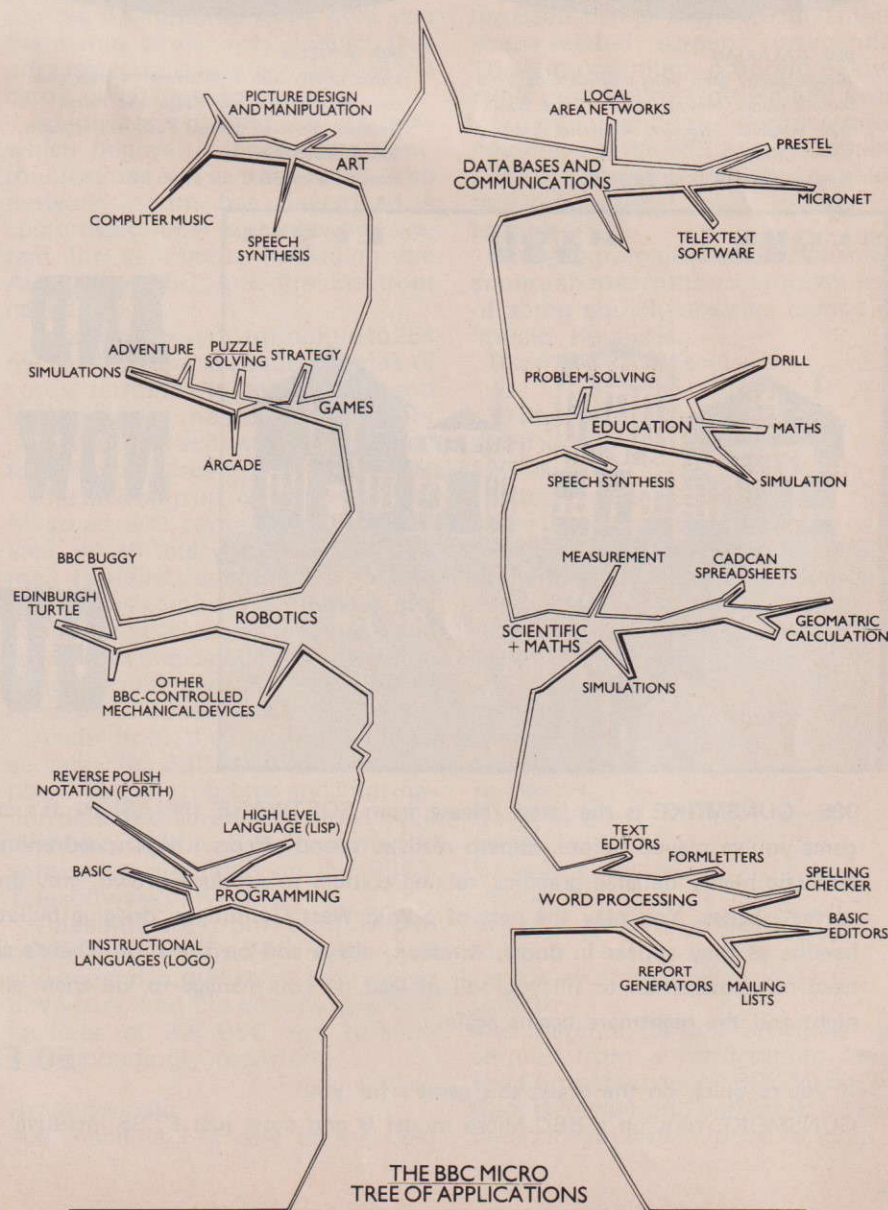
easily be made with some of the Basic keywords in BBC Basic: ACS, ATN, SIN, COS, TAN, RAD, DEG – and the PLOT command can be used in combination with MOVE, DRAW and POINT to draw many geometric shapes.

### Education

Education applications are related very closely to mathematical and scientific. Firstly, simulations can play an important part in educational software as they can in science labs.

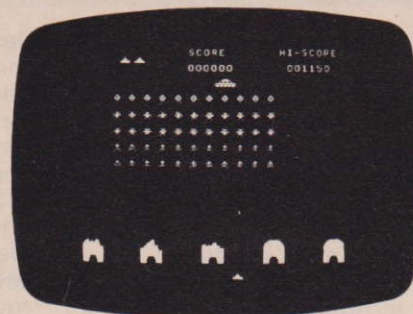
Simulations to teach physics, biology, and chemistry are all possible with the BBC Micro – using the 3D graphics facilities of the machine to show the various aspects of chemical compounds, and using the 'action' aspect of graphics often employed in computer games to show how various physical laws work.

The Maths applications are obvious as the computer is, in its most basic form, simply an overblown calculator. A few simple PRINT statements with the appropriate mathematical operators will perform most common classroom math tasks, and can be a boon in dealing with subjects



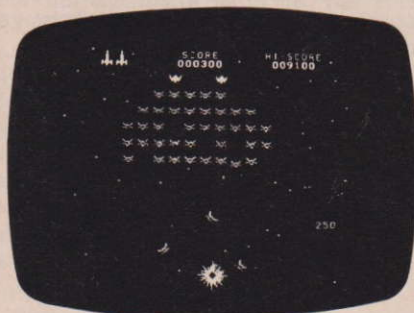


# SOFTWARE INVASION



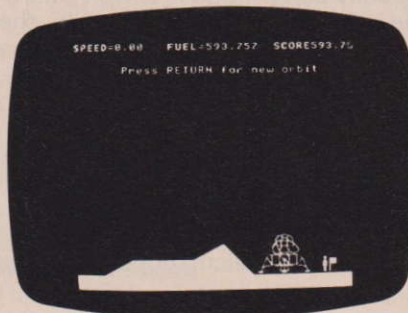
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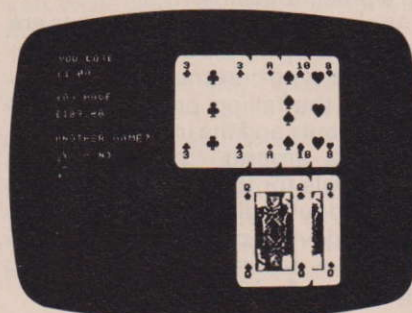
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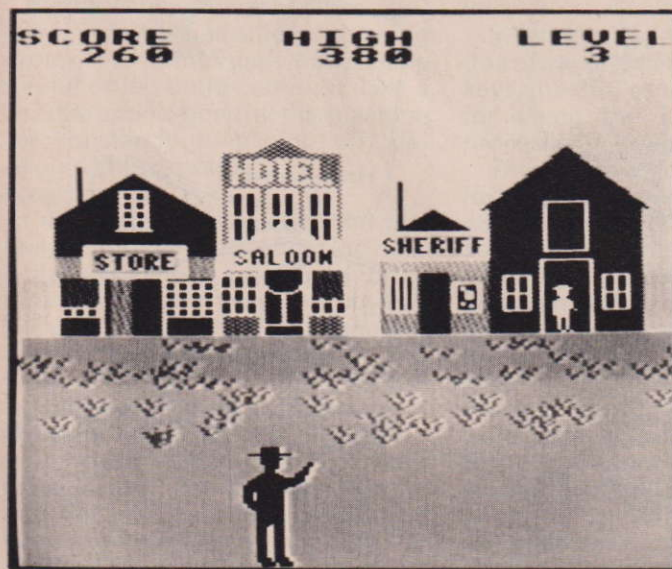
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If you're quick on the draw, this game's for you!  
GUNSMOKE runs on a BBC Micro model B and costs just £7.95 inclusive.

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where either physics or chemistry equation form the bulk of the work.

The logical extension of that is the 'drill' type of educational application, where you use the BBC Micro to ask you questions until you get them right. For example, the program below would test you in a drill-type fashion for the provincial capital of British Columbia, Canada.

```
10 PRINT "What is the capital of British  
Columbia, Canada?"
```

```
20 INPUT A$
```

```
30 IF A$="Vancouver" OR  
A$="VANCOUVER" THEN PRINT "Yes,  
that's right" ELSE CLS:PRINT "Sorry,  
that's not right - try again": GOTO 10
```

And that's with only three lines of programming. If you wanted to test yourself for the answers to 20 questions, you'd need only about a 60 line program.

The text within the PRINT of A\$ in Line 30 (here, it is programmed to accept either upper or lower case answers).

To add another question to this quiz, we'd merely say CONTINUE, after "Yes, that's right" in Line 30. The next question goes in Line 40, with Line 50 for input and Line 60 being identical to Line 30 except for a different answer and the GOTO statement.

You could also condense the program by combining Lines 10, 20 and 30 to a single line.

While drill programs can be helpful, they often don't reach much beyond the level of electronic flash-cards. Most educational software has been of the drill type - simply because it's quick and easy to write (particularly on the BBC with the option of ELSE statements and user-defined procedures).

Problem-solving moves one step beyond the drill-style programs and actually requires you to figure the best way of accomplishing a task rather than simply testing your recall. These problems are of the style:

Jim and his brother are racing from London to Glasgow in two separate cars. Jim is travelling in a Mini at an average of 50 miles an hour, while his brother Don moves at average of 75 miles an hour in an MGB. They both start at the same time, but after driving for an hour, Don takes a half-hour off to have lunch. How far from London do the two cars meet?

An algorithm to solve this problem is, of course, pretty easy. We can tell that after an hour and a half Don will have travelled 75 miles and be just about to hit the road again after lunch - but if he's not careful he'll hit Jim who will pass by at the exact moment that Don leaves.

### Databases and communications

Moving to the top right-hand branch of the BBC tree, you'll see the database and communications application of the BBC. Although this

application is in many ways still in its infancy, communications and substantial databases can be developed on the BBC.

First, a little background. A database is a collection of computer data filed and organized in such a way that the computer can easily and quickly retrieve it. A relational database is a more sophisticated form of the same thing and allows cross-referencing between files, sorting and searches.

Small databases are usually of the 'cardbox' type in which the computer acts as a glorified miniature filing box. (There is some overlap here with the cardbox-type word-processing functions mentioned earlier).

In a simple cardbox, such as Torch's Cardex program for the Torch (or a BBC with a Torch Z80 Disk Pack), you are offered the opportunity to look through or create various 'boxes' with cards in them that contain about a half-screen full of information.

The cards are arranged in alphabetical order within a box, and can be sorted by simple string comparison. For example, by asking the program to do a search for the phrase 'Acorn', Cardex will automatically give you the names of all cards in which that phrase occurs and let you look at the cards, or list them to a printer.

A bigger sort of database - and one which begins to incorporate communications - is the local area network. Acorn has developed a customised local area network system for its micros (including the Atom, the BBC, and the Electron) called Econet.

Econet allows you to hook up to 254 micros together through a series of cords, terminators, and clocks, and lets you send messages to another machine, look at its screen, and even take over its screen.

The next step up from Econet is the Micronet 800 communications service, which lets you use electronic mail facilities, download software, and access some of the many Prestel computer services. Acorn has plans for its own dedicated Prestel adaptor, which would give access to all of Prestel and its services.

Aside from the telephone-based services, the BBC Micro also has the power to pull programs and information directly off the airwaves, with the teletext adaptor. It will download software transmitted on the BBC's Telesoftware service.

Telesoftware, from both Micronet/Prestel and the BBC, will grow and expand immensely over the next few years, and the communications facilities of the BBC will become correspondingly important.

### Art and music

The machine has one of the best

music facilities of any medium-priced, home micro with two easily used sound commands to introduce you to music. The commands are SOUND and ENVELOPE. The former controls the channel number (the BBC has four sound channels), loudness, pitch, and duration, while ENVELOPE is devoted to controlling pitch.

The example program below shows how those commands can be combined to produce a "police siren" noise.

```
5 FOR X=20 TO 65 STEP 2
10 SOUND 1, -10, X, 1
20 ENVELOPE 2, 45, 0, -15, 15, -15, 10, 10,
10, 1, 0, 0, 100, 50
30 NEXT X
40 FOR X=65 TO 20 STEP -2
50 SOUND 1, -10, X, 1
60 ENVELOPE 2, 45, 0, -15, 15, -15, 10, 10,
10, 1, 0, 0, 100, 50
70 NEXT X
80 GOTO 5
```

Given the right instructions, the BBC can mimic anything from a flute to a drum, can play chords, and can handle both eighth-notes, treble clefs, and rests.

Pictorial art can also be created on the Beeb, using PLOT, DRAW, and other shape-related screen commands. The demonstration program below, while unorthodox (some might even say oddly-written), demonstrates how some of the BBC's sound capabilities can be combined with graphics to produce what might loosely be termed art.

The program draws some abstract square shapes to the accompaniment of some equally abstract computer 'music'. Here is is:

```
10 c=1: d=-10: e=1
cls
30 for x=0 to 400 step 10
40 if x=400 then goto 190
50 let y=x
60 for n=20 to 65 step 10
if y=0 and x=410 goto 200
85 vdu5: if y=1024 and x=400
then vdu19,3,9,0,0,0:PRINT TAB (0,0)
"WELL DONE"
90 SOUND C, D, N, E
100 ENVELOPE 2, 45, 0, -15, 15, -15, 10,
10, 10, 1, 0, 0, 100, 50
110 MOVE X, Y
120 DRAW 2*X, X
130 DRAW 2*X, 2*X
140 DRAW X, 2*X
150 DRAW X, X
160 NEXT N
170 NEXR X
180 END
190 FOR X=1280 TO 410 STEP -10: GOTO
60
200 FOR X= TO 400 STEP 10: Y=1024:
GOTO 60
```

*The material for this article is excerpted from a forthcoming book The Companion to the BBC Micro, by Geof Wheelwright, published by Pan Books in November, price £4.95.*



# The language to suit the problem

Basic isn't the only language for your BBC. And others suit particular problems best.

## LANGUAGES

If you have a problem, you try to solve it. You try to solve a problem using different methods. This is universally accepted. Of all the problems in the world, one of the biggest must be communicating with each other.

The biggest barrier, (besides differences of opinion), must be that the different societies speak different languages. To overcome this problem, we can either learn the language of the person or persons we wish to talk to, or we can use an interpreter.

Note that once the problem of understanding the other language has been solved, it doesn't mean that we can solve each others' problems. To do that, we must *understand* exactly what the problem is, and how

we can go about solving it.

The above applies as much to computers as to human communication. Here we have a machine which we wish to communicate with, with the hopeful result of solving a given problem, (yes, playing Space Invaders is a problem).

Now, the language of computers is quite different from our own, and the computers are not going to try to understand us, (not yet anyway). We must communicate with the computer in a language that the machine can interpret and act upon, the language must also be understood by the person who wishes to solve the problem.

That is why we have programming languages. They are a means to communicate with the computer at a

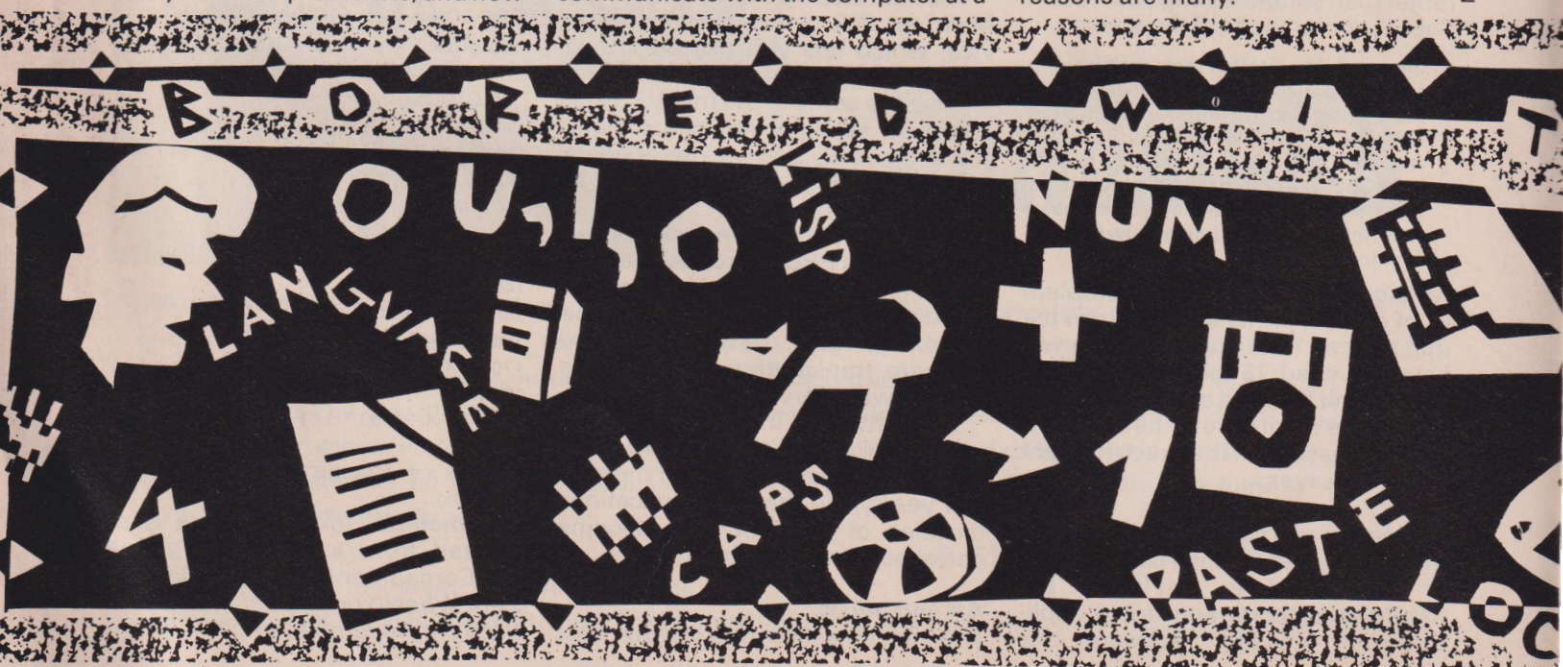
level the human can also understand.



## Programming languages

There is a further problem. People use computers for a wide variety of reasons. Some to do scientific programming and problem solving, some use them for business applications, and some use them for learning. The reasons are many.

Mark Goddard





Good old Basic, (Beginners All-purpose Symbolic Instruction Language), is a general purpose programming language and it was not designed to solve all the problems in the world.

To solve a particular problem, it is wise to use a computer language that was designed to facilitate the task of solving the particular. That is why we have many languages in computing. Some examples of the languages and their applications are listed below.

**Cobol** Common Business Orientated Language:

Used in data processing more than any other language.

If you have to manipulate files and records, do basic calculations and such like then this is the language for you.



### Fortran

Used widely in the scientific field, this the first high level programming language used for number crunching.

**Pascal** (named after the French mathematician)

Designed to be a structured modular language, Pascal is used in many educational establishments to teach students programming.

**Forth** (named because its author thought it brought programming into the fourth dimension)

Originally designed by one man to enable him to program for control

applications. This language is very fast and is now being used in other areas such as game writing.

### Pascal

It is hard to accept this, but Pascal is generally a lot easier to learn than Basic. It was designed to enable people to learn how to program in a structured manner, although it doesn't always turn out that way! The designer of Pascal, Nikolas Wirth, used many ideas from his Algol 60 programming language which is similar in structure.

There are numerous versions of Pascal available, each one with its slight differences. For a language that was designed to be portable, it has been messed about with a lot, and as a result a Pascal program written on one machine may not run on another. But this is true of most languages that have been tailored to work on a particular system.

The language is not a line-orientated language such as Basic. Instead, Pascal is a procedure-based language which passes control to parts of the program by means of procedure and function calls. It is also a 'typed' language in which it is possible to create different data structures from the four main ones; integer, real, boolean and char.

The Pascal program is normally indented, and this gives an idea to the user of the main or smaller blocks that make up the language.

Pascal has been used in education for some time now but it is making an appearance in business as well.

The two main complaints about the language are that its file handling is very limited and that it is not strongly typed. For example, if I created a data structure called months which had the elements Jan, Feb and so on, then I couldn't have another data type

which incorporated some of the elements of months.



### Lisp

Looking at a Lisp program can be quite confusing, there are lots and lots of parenthesis. This can lead to confusion when writing a Lisp program, but many Lisp interpreters will inform the user that they have missed out on a couple of brackets, its normally up to you to find out where!

Lisp is one of the oldest high-level computer languages that is still being used frequently today. Many mainframes and micros support Lisp, and as a result there are many dialects of the language going around.

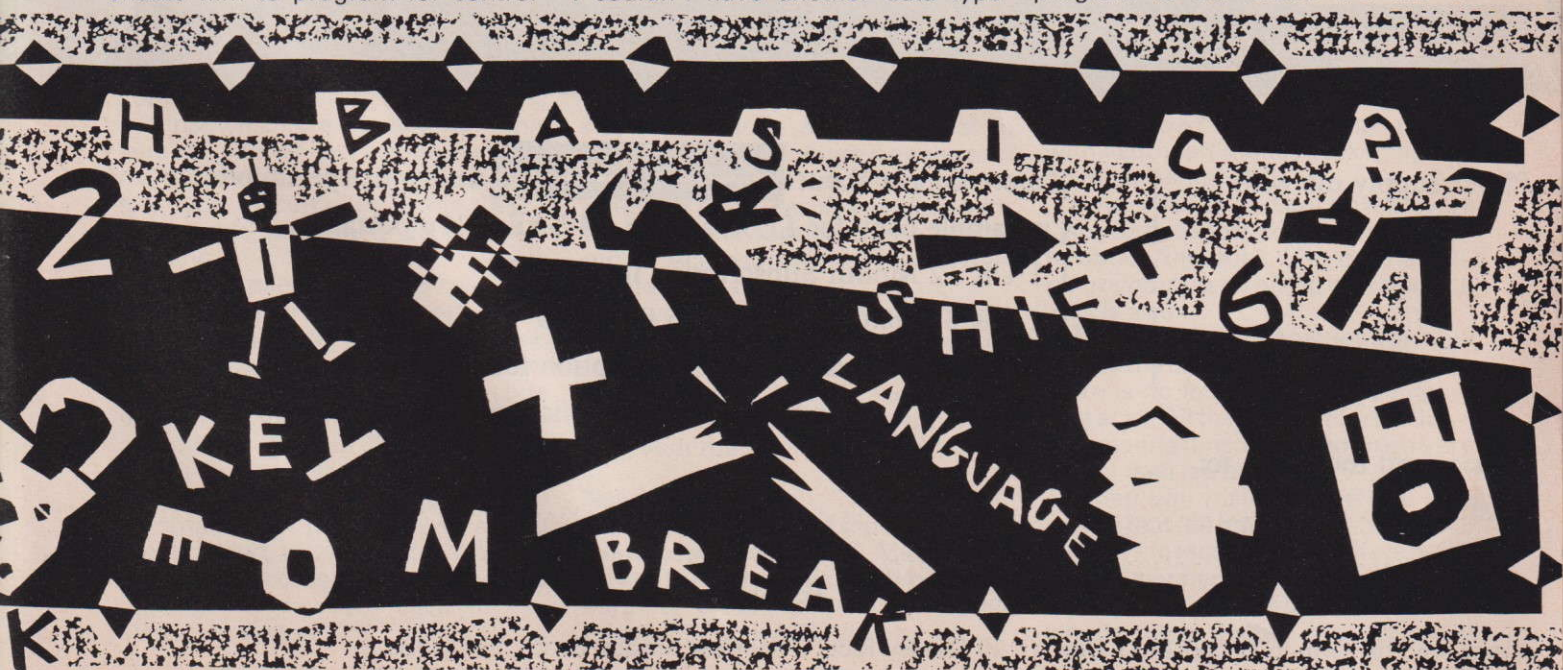
Unfortunately, there is no 'real standard', and it is left to the individual software houses and programmers to incorporate their own functions. Many say that it is a 'portable' language, but this is not to be taken too seriously.

Lisp has been talked about a lot recently because it is used a lot by the people who design artificial intelligence systems and expert systems. Its main contender in this area is another language called Prolog, which also has its following.

Many who use Lisp, use it to write systems tools (in Lisp) and utilities which are used as part of a Lisp base.

It is an integer based language which normally operates on 16-bit integers, but some versions of Lisp allow the user to use infinite precision integers.

The most basic element of a Lisp program is the atom. It's like a





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variable in Basic, but more flexible, it can hold any data type at all. Therefore to assign 'David' to the atom name I would enter: (SETQ NAME 'David), or I could enter (Setq Name 22).

When using Lisp you will come across the lack of a particular function. Here, all you do to remedy this is to write the new function. This means that structured programming can be applied to the language.



### HCCS Pascal for the BBC model B

Pascal is very much in vogue lately. It is constantly argued that it should be taught as the first language, (programming), instead of good old Basic. This, I believe to be true, but only if the Pascal meets certain criteria.

The Pascal T compiler from HCCS Associates is a tiny Pascal, and although I would be happy to use it myself. I wouldn't teach anyone the language using this package, because there is a lot missing from the Jensen & Worth defined standard.

HCCS Pascal-T is a subset of the Pascal programming language, and it is a ROM based language which is best used if you have a disk-based BBC. Saving and loading can be done from tape, but the process is very difficult indeed.

Pascal-T is situated on a 16K EPROM which is fitted into one of the spare language/utility ROM sockets within the Beeb. It's an integer based Pascal, and it doesn't support files or records.

For those of you who may be interested, this compiler is the result of 62K source code, which is written in Forth. There are many features of the original which are missing from this version, and whilst I can understand the fact that it is pretty difficult to fit any type of compiler within 16K, I can't understand why so much is missing.

The compiler – as HCCS call it – is very fast in operation and it offers text editing similar to the Beeb's Basic editor. There is also control over disks, where source or object code may be dumped or loaded from. The compiler is tailored from the Beeb, and it is possible to make FX and OSWORD within your programs. No commands for graphics and sound are included, but it shouldn't be too difficult to access these facilities by making the relevant calls to the operating system.

A 93-page reference manual is supplied with the ROM, and this gives details of Pascal-T and what it can do. It doesn't however, give details of what it can't do insofar as the lack of standard functions and procedures. This is an important omission, since it would be handy for the user to pick up the manual, look at some sort of reference page, and see at a glance whether he could do a particular job.

The manual does give a clear explanation of how the Pascal-T operation as far as files and memory are concerned, and a memory map is included in the manual.

Setting it up is little more difficult than inserting a cassette into a recorder and pressing play. HCCS don't give much advice as to how the eprom should be inserted. If you can't do it, then they recommend you find a 'competent dealer' who no doubt can, for a price.

After the EPROM is inserted, you can enter Pascal-T from Basic by entering '\*PASCAL' or '\*P'. When the Pascal-T is entered you are greeted with a logo and the system prompt of '++'.

From this point, you can enter the editor with the command NEWTEXT, enter a Pascal program directly from the keyboard (not recommended), or use one of the disk or monitor commands. It should be noted that when using disks, a disk has to be especially set up for use by Pascal-T only.

This is done by the command IDISC, and what it does is allow maximum use of 40- and 80-track disks by allowing up to 49 and 98 2Kbyte files respectively. This is a worthwhile feature.

What is not so good is that you cannot tell what type of file you have on the disk when you have used the CAT facility. This is important as with Pascal-T you can have source or object files as well as procedures, and it would have been handy if it were possible to tell which was which.

After using the compiler for a while, I found it quite easy to adjust to integer Pascal, although it does seem a little daft does it not. There will no doubt be other Pascals available for the BBC within the near future, (watch out for Acornsoft), and if I were you I would shop around.

However, for what it claims to do, Pascal-T does it very well, and I would recommend the potential buyer to make enquiries as to the facilities the package has to offer before parting with your money.

**Name;** Pascal-T

**Produced by;** HCCS Associates.

**System required;** BBC Micro, disk drive(s) are strongly recommended.

**Format;** 16K EPROM

**Price;** £59.00 + VAT



### Acornsoft Lisp

Artificial Intelligence and Expert Systems seem to be very much in fashion amongst the computing fraternity. Also, there are two programming languages that are extensively used for these areas; they are Prolog and Lisp. As one of their additions to their programming language series, Acornsoft have opted for Lisp, which at present is only available on cassette.

Looking at the 197-page manual *Lisp on the BBC Micro* which is sold separately to the cassette I read that Lisp is also available on disk and ROM. At the time of writing, this is not the case.

Acornsoft's Lisp has been specifically written for the BBC micro, and it has some machine dependent features that 'ordinary Lisp doesn't'. It also lacks many functions that you would expect to find on mainframe Lisp.

The Lisp interpreter has been customised to work with the BBC operating system by the addition of a VDU function.

This allows the user to interface to the operating system of the Beeb. Some other additions are LOOP and WHILE and UNTIL, which are not standard Lisp, although you may find a form of LOOP on some other systems, its not guaranteed to work the same way. The Lisp has a number of built in functions, and those that are not included can be defined using the DEFUN function.

For your hard-earned cash, you receive a cassette which contains the Lisp interpreter and a demonstration program, (of which I haven't managed to load). The cassette comes with Acornsoft's fancy packaging and no documentation.

If you wish to find out how to work Lisp you have to fork out more money to obtain the book *Lisp on the BBC microcomputer*. This, to be frank with you, is a con.

There are only instructions on how to load the Lisp with the cassette case, there is no information on anything else at all. All the useful information – commands functions, and so on – are within the Lisp book.

When you realise this you also realise that the book is not so optional after all – in fact it is a must, if you wish to get anywhere with the package.

The manual itself is 197 pages in length and is written in a sequential



manner. I would have preferred to have seen more examples within the text. As it is, the authors show the reader what Acornsoft Lisp can do. More on *how* to do it would have been welcome.

Setting up the Lisp can be a confusing task, the Lisp is in fact several overlays, and you have to watch out for the end of the program when loading. I tried to transfer the cassette based Lisp to my disk drives (after all, that's what mass storage is for), but failed.

Asking help from Acornsoft will get you no joy, since they don't like people doing naughty things like that.

When Lisp is loaded, you are asked what mode you wish to work in. This can be changed at a later time if wished and it is useful as you can save a lot of memory by working in mode 7, for example. After the mode has been entered the message, (or prompt if you wish), 'Evaluate:' is displayed. Lisp has a lot of parentheses, and it is quite easy to lose track of how many are outstanding.

Acornsoft Lisp gets round this problem by displaying the outstanding parenthesis as left-arrows to the left of the input line. So if I entered the first line of an assignment as:

```
(SETQ MONTH)
```

and hit the return key, the next line would display a left-arrow and I would know that there was an outstanding bracket. To complete this assignment I would enter;

```
← 'January)
```

```
Value is: JANUARY
```

```
Evaluate: (PRINT MONTH)
```

```
January
```

```
Value is: January
```

```
Evaluate:
```

Local editing is achieved by using the cursor keys and copy keys as used in Basic. A listing of an editor is included in one of the chapters.

As mentioned before, it is possible to access the graphics of the BBC by using the VDU. Keeping the Beeb's user manual with you when entering VDU codes would be handy as there are quite a lot. There is also a sound command which is the same as the Beeb's Basic one.

**Name:** Lisp

**Produced by:** Acornsoft, 0223-316039

**System Required:** BBC models A or B

**Format:** Cassette

## BCPL

This certainly must be one of Acornsoft's biggest software projects so far. BCPL on a micro? Yes, and what's more you also get lots of goodies to go with it such as editors, assemblers, debugging tools and so on.

This version of BCPL is designed to be compatible with the proposed definition of the programming language BCPL, which was published in October 1979. The only thing missing from the proposed standard is that direct access is not supported, but other than that, you have here a fully fledged BCPL, also used on mainframes.

Before buying this package consider carefully, do you really need it. Ask yourself specifically the following questions. Why do I need it? What will I use it for? What benefits will I get from using this package? Go to your local dealer and ask for a demonstration of the package and obtain a book about the language, read it, and think!

The worst thing that could happen is you ending up with something that is of no use to you at all. Remember, this language guide to the BBC programming languages is only meant to be an introduction and not a decision maker.

The BCPL software package is housed in a nice box which contains the language ROM, a 40/80 track disk, the BCPL user guide, installation instructions and a function key underlay. All the components of the package are listed with the contents sheet which is also supplied. Using this, you can check that you have got all the bits necessary.

The BCPL language ROM contains the BCPL commands, as well as a store filing system. The interpreter, and many of the library routines are within the ROM as well. The disk that is supplied with the package is formatted for 40- and 80-track disk drives - giving two copies of all the files on each side.

The disk holds the BCPL compiler with all its associated overlays. Also included are a screen editor 'ED', and over a dozen other utilities such as debuggers, example program and so on. As you may have gathered, you are not going to get far without the disk!

The manual indicates that BCPL is also available on cassette, but I haven't seen this around, and it may be released in the near future.

I am pleased to report that, for the price of the package you *do* get the user guide with the language ROM and cassette. This hefty book is 448 pages in length, and it will tell you all you need to know about BCPL on the Beeb. The user guide is very well written, and from the start it gives advice on how to read it.

The designers of this all important guide have done a good job, yet here and there, vital information is scattered about. Reading the book took me three whole nights, so don't expect to unwrap the package and start coding!

Setting up the system is a job that should be done properly. There is a sheet of instructions within the package that clearly give details of how the language ROM should be inserted.

If you have any doubts, get the ROM inserted by a dealer, but beware, this will cost you more money.

The master disk containing the compiler and so on, should be copied using the \*Backup command. Then you will find that you will have to split the files over a couple of disks as there is no more room on the disk to hold any files. The book suggests two disks to be made, one called the source disk which would hold the compiler and so on, and the other called the test disk which would hold the debugging and test utilities.

When the system has been set up, you can run BCPL from Basic by entering \*Bcpl. Alternatively, it is possible to situate the language ROM so that BCPL is the default language. When entered, you are in the command state which is indicated by an '!' at the start of each command line.

From here it is possible to enter the name of a program of BCPL command to be executed. Source files can be created by using the text editor, or, an existing program can be inspected and amended by using one of the utilities. The text editor which is simple yet powerful, can be used to write letters. The result of an editor file is ASCII, so this can be read by other word processors.

You are dealing with a compiler when you are using BCPL, and the result of compilation is CINTCODE which is interpreted by the BCPL ROM. Several stages have to be got through before your program, or, application is ready to run, but with the support of some professional utilities, the trouble is worth it.

**Name:** BCPL

**Produced by:** Richards Computer Products & Acornsoft Ltd.

**System required:** BBC Model B Filing system cassette or disk. Printers etc are optional and will work with BCPL.

**Format:** ROM and disk.

**Price:** £90.00







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# Drawn to it?

You can use the excellent graphics facilities of the BBC micro to create your own characters. Ian Grieg tells you how:

## GRAPHICS

The BBC microcomputer allows us to program a number of characters in all screen modes apart from mode 7 (teletext). In this article we will look at the way in which characters are stored, how we can create our own set, and see how those characters can be changed in a variety of ways.

First, we will look at the standard characters, and find where they are stored in memory, so that we will be able to use and manipulate these as well as our own creations.

The ASCII standard character set must be stored somewhere in the ROM of the BBC, which starts at memory location 32768 or in hexadecimal 8000 (&8000). From the explanation given about character creation, we know that each character is stored in eight bytes, and the values assigned to each byte are shown in Figure 1. (In order to find where these are stored in ROM, we will take a simple character early in the ASCII list and inspect the ROM locations to find it. The first recognisable character is the "!" — character 33.

If we work out what the value is for the eight bytes, we can see from figure 2 what the values are.

To find the locations in memory that hold these values, we can use *program 1*, which goes relentlessly through the ROM memory addresses until it finds our "!".

To do this we start at &8000 by using the indirect operator "?" I we can inspect every memory location, and the seven beyond it by I?1, I?2... I?7.

```
5 REM "ASCSRCH"
10 REM TRY TO FIND ! IN ROM
20 :
```

128 64 32 16 8 4 2 1

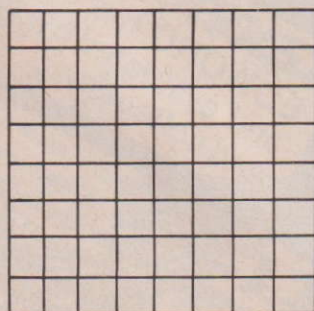


Figure 1

```
30 MODE6
40 I = &8000
50 :
60 REPEAT
70 PRINTTAB(0,0);*I;
80 IF ?1 <> 24 THEN 170
90 IF ?1 <> 24 THEN 170
100 IF ?2 <> 24 THEN 170
110 IF ?3 <> 24 THEN 170
120 IF ?4 <> 24 THEN 170
130 IF ?5 <> 0 THEN 170
140 IF ?6 <> 24 THEN 170
150 IF ?7 <> 0 THEN 170
160 I = 0
170 I = I+1
180 UNTIL I > &FFFF OR I = 1
190 :
200 VDU7
210 IF I = 1 THEN PRINT " ! FOUND"
    ELSE PRINT " NO ! THERE"
220 :
230 END
```

Program 1

The program looks rather inelegant at first, but the BBC won't allow us to put more than six "AND"s in a row (IF ?1 = 24 and I?1 = 24 etc.) — which allows us to do it without reporting an error, but does not test beyond the sixth condition! — a Beeb bug?

This might take some time, and to prove that the computer is actually doing something, the values of the memory locations being inspected are printed at the top left of the screen in Hex.

After about 2½ mins the computer will bleep (VDU7) and print the memory location where the exclamation mark is stored — it should stop at &C008. This is interesting, as the start of the operating system (OS) is defined from &C000, and that the

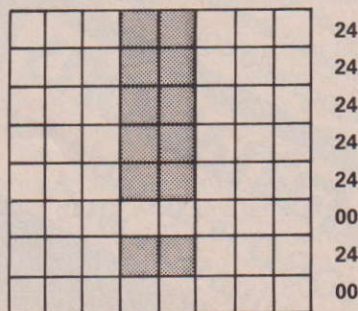


Figure 2

first character is not our "!", but in fact the space (ASCII 32).

The BEEB will allow us to enter numbers in decimal or hexadecimal, but we cannot get directly at the individual bits that make each byte.

We will be wanting to deal with the bits, and see them in our journey towards character improvement, so we will need a program to convert any number (less than 255 — the maximum number an eight bit byte can contain), to bits. The simplest way of doing this so that we can see what is going on is by manipulating strings.

Try program 2. Type in numbers between 0 and 255, and A\$ will be assembled to produce the bit pattern for the byte you have typed. The principle is simple, the number is checked to see if it is odd or even, by seeing if there is a remainder when divided by two (MOD 2). If there is, then it is odd, and an asterisk "\*" is placed in A\$, else a "." is put in the relevant position. The string is then printed.

```
5 REM BINARY
10 MODE4
20 REPEAT
30 INPUT "NUMBER " B
40 N=B
50 A$=""
60 I=7
70 REPEAT
80 IF B MOD 2 THEN A$="*"+A$
    ELSE A$="."+A$
90 B=INT(B/2)
100 I=I-1
110 UNTIL I<0
120 PRINT A$,"N,N
130 UNTIL FALSE
```

Program 2

## CHECK OUT

The next program, *program 3*, tries this out to make sure that we are on the right track, and will go through the characters stored from &C000 on. When you are bored with it press escape! — but first try and see the relationship between the hexadecimal numbers and the bits that make up the character. Note down the eight bytes in hex and their pattern, for quick reference. An example of the letter "B" is shown in figure 3.

Adding 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 to get a particular value for a byte is prone to error, and hexadecimal numbers provide a much easier way of doing this, which is simple to use, and relates directly to the characters.

```
5 REM "ASCHK"
10 MODE 1
20 I = &C000
30 CHR=32
40 :
50 REPEAT
```



```

60 J = I
70 PRINT;"J,"ASCII ";CHR'"
80 REPEAT
90   PROCBIN (?J)
100  PRINT A$;
110  IF?J<17 THEN PRINT"0";"?J
    ELSE PRINT;"?J
120  J=J+1
130  UNTIL J = I+8
140  G = GET
150  I = I+8
160  CHR=CHR+1
170  CLS
180 UNTIL CHR=127
190 :
200 END
210 :
220 DEFPROC BIN(B)
230 LOCAL I
240 A$=""
250 I=7
260 REPEAT
270  IF B MOD 2 THEN A$="1"+A$
    ELSE A$="0"+A$
280  B=INT(B/2)
290  I=I-1
300 UNTIL I<0
310 ENDPROC

```

Program 3

```

***** 7C
***** 66
***** 66
***** 7C
***** 66
***** 66
***** 7C
***** 00

```

Figure 3

If you try *program 4*, which will print the bit pattern of all numbers between 0 and 15 (&O to &F) with the same routine that we used in *program 3*, and then compare this list with the left and right halves of the bit pattern that you noted from the last program, you will find a direct relationship between the two.

All we have to do to find the correct value for a byte is to inspect the left and right halves of the byte and find the pattern for each half in the table produced by *program 4*. If we then put these two numbers together to form a hexadecimal number then we will have the byte we want.

### CHARACTER CREATION

If we try a simple example, say to create a helicopter, we first fill in on the eight by eight grid the parts we want, as in *Figure 4*, and then look at table 1, and we find the pattern for the left and right halves, and write these beside it. We can then write a VDU 23 statement (the character creation command) to make that character. If

```

5 REM HEX
10 MODE4
15 N=0
20 REPEAT
40  B=N
50  A$=""
60  I=3
70  REPEAT
80  IF B MOD 2 THEN A$="1"+A$
    ELSE A$="0"+A$
90  B=INT(B/2)
100 I=I-1
110 UNTIL I<0
120 PRINTA$;"N";N
125 N=N+1
130 UNTIL N>15

```

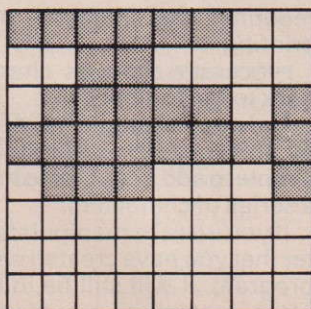
Program 4

```

***** 0
***** 1
***** 2
***** 3
***** 4
***** 5
***** 6
***** 7
***** 8
***** 9
***** A
***** B
***** C
***** D
***** E
***** F

```

Table 1



```

FC ***** FC
30 ***** 30
79 ***** 79
FF ***** FF
71 ***** 71
00 ***** 00
00 ***** 00
00 ***** 00

```

Figure 4

we take the first character that we can program, 224, the statement will be: VDU 23, 224, &FC,&30,&79,&FF,&71,&00,&00

We are now in a position to write a program that will do all the hard work of character definition for us.

*Program 5* does just this, but some explanation is needed, so we will take it bit by bit – one byte at a time – or even line by line.

```

5 REM "CHAREAT"
10 DIM L$(8), H$(8)
20 MODE 6
30 INPUT"ENTER CHARACTER NO. "CH
40 IF CH < 32 THEN END
50 IF CH > 223 THEN 90
60 VDU7
70 CLS
80 GOTO 30
90 B=(CH-224)*8+&C00
100 X=0
110 REPEAT
120  PROCBIN(?X)
130  L$(X-Q)=A$
140  PROCHEX(L$(X-Q))
150  H$(X-Q)=H
160  PRINTTAB(5,(X-Q)+10)L$(X-Q)" ";
170  IFH<16THENPRINT"0";"?H
    ELSEPRINT;"?H
180  X=X+1
190 UNTIL X>Q+7
200 :
210 PRINTTAB(5,19)CHR$(CH)
220 PRINTTAB(5,10);
230 X=0
240 Y=1
250 L$=""
260 R$=L$(X)
270 #FX4,1
280 :
290 G=GET
300  IFG=136ANDY>1THENY=Y-1:
    PRINTTAB(Y+4,X+10);G=0
310  IFG=137ANDY<8THENY=Y+1:
    PRINTTAB(Y+4,X+10);G=0
320  IFG=138ANDX<7THENX=X+1:
    PRINTTAB(Y+4,X+10);G=0
330  IFG=139ANDX>0THENX=X-1:
    PRINTTAB(Y+4,X+10);G=0
340  IFG=13THEN490
350  IFG<>32THEN290
360 :
370 L$=LEFT$(L$(X),Y-1)
380 R$=RIGHT$(L$(X),8-Y)
390 CH$=MID$(L$(X),Y,1)
400 IFCH$="." THENL$(X)=L$+"."+R$
    ELSE L$(X)=L$+"."+R$
410 PRINTTAB(5,X+10)L$(X)" ";
420 PROCHEX(L$(X))
430 IFH<16THENPRINT"0";"?H

```

Cont'd



```

ELSE PRINT;*H
440 HX(X)=H
450 VDU23,CH,HX(0),HX(1),HX(2),HX(3),
    HX(4),HX(5),HX(6),HX(7)
460 PRINTTAB(5,19)CHR$(CH)
470 PRINTTAB(Y+4,X+10);
480 GOTO290
490 *FX4,0
500 PRINTTAB(0,20)
510 CLS
520 GOTO30
530 :
540 DEFPROC BIN(B)
550 LOCAL I
560 A$=""
570 I=7
580 REPEAT
590 IF B MOD 2 THEN A$="1"+A$
    ELSE A$="0"+A$
600 B=INT(B/2)
610 I=I-1
620 UNTIL I<0
630 ENDPROC
640:
650 DEFPROC HEX(Z$)
660 B=1
670 H=0
680 I=8
690 REPEAT
700 IF MID$(Z$,I,1)="" THEN H=H+B
710 B=B*2
720 I=I-1
730 UNTIL I<1
740 ENDPROC

```

Program 5

The user guide tells us that characters 224 to 255 are available for us to create – that is 32 of them. We need to keep at any one time the 8 bytes and their string representation, so we will set up an array to hold these – L\$ for the string and HX for the numbers.

Having got a valid character number, that is one above 223, we calculate its start position in memory in line 90. The equivalent of the byte with PROCBIN allocates them to the appropriate string, (if it hasn't already been defined, then we get zeros). We then calculate the hex value of the byte with PROCHEX and print the result next to the string on the screen.

The main variables for manipulating the strings are then set in lines 230 to 260, and the cursor keys disabled with a \*FX 4,1, so that we can read them as ordinary keys (ASCII values 136 to 139 inclusive).

The creation routine occurs in lines 290 to 480. The GET statement reads the keys, and if a cursor key has been pressed the cursor is moved in the relevant direction, and the X (left to

right) and Y (up and down), counters adjusted and the cursor moved. There is a check built in to ensure that we do not move out of the area of the character 8 x 8 grid.

If the space bar is pressed then the bit under the cursor is changed from a 0 to a 1 or vice versa. The left and right sides of the line are adjusted, and placed in L\$ and R\$ respectively, the new bit ("\*" or ".") printed. Then the HEX value is calculated and printed and the character updated with the VDU 23 statement, using the HEX values, and it is printed below the grid.

If return is pressed, then the cursor keys are enabled, and we return for another character creation.

Entering a number below 32 will end the program.

Try it out first with our helicopter.

### CHARACTER MANIPULATION

Now we are able to create characters, we can obviously print them where we want on the screen, but we can do quite a lot more. If we wanted to make a mirror image of a character, rotate it, or make it white on black or the reverse, then we would have to create several characters to do this, which would be laborious, and take up a lot of our valuable 32 characters. An easier way would be to make the changes to our actual character, and replace it in the same memory location. Also this would be much simpler than having to draw a grid each time we wanted to work out a different version of the character.

We will develop a number of procedures to do these manipulations, as well as doubling the size of characters. These can be used in your own programs, and we will assemble them into a short demonstration program – *program 6*.

The first part is essentially the same as program 4, except that we set up more arrays – O\$ holds the "old" values while the character is being changed, and is kept as the point of reference, so that we can get back to the original character. Changes from any of the manipulations are held in the "new" character array N\$. The hex values are stored in the HX array.

As before we input a character number (ASCII value), but this time we can also manipulate the standard set, the program checks for validity, and looks up the character in memory starting at either &C00 (user defined) or &C000 (standard set).

If you leave out line 160, which changes the value of the character if it is in the standard set to one that can be defined in the user set, you will actually redefine the standard set!

Listings with horizontal letters are amusing! – but it will all go haywire after a bit.

The character and its values are then printed on the screen, and the various manipulations performed.

If you want to try each manipulation as you enter them, leave out the calls to the procedures that you have not entered. The program could well be modified by creating a menu from which a series of successive manipulations could be performed.

```

20 DIM O$(8),N$(8),HX(8)
30 MODE 1
40 REPEAT
50 INPUT"ENTER CHARACTER NO. "CH
60 IF CH<32 THEN END
70 IF CH>126 AND CH<224
    THEN VDU7:CLS:GOTO50
80 IF CH<127 THEN Q=(CH-32)*8+&C000
    ELSE Q=(CH-224)*8+&C000
90 X=Q
100 REPEAT
110 PROCBIN(?X)
120 O$(X-Q)=A$
130 N$(X-Q)=A$
140 X=X+1
150 UNTIL X>Q+7
160 IF CH<127 THEN CH=224
170 PROCPRINT
180 :
190 PROC MIRROR
200 :
210 :
220 PROCROT
230 :
240 PROCINVERSE
250 :
260 PROCDOUBLE
270 PRINT" B$
280 G=GET
290 PROCRESET
300 :
310 CLS
320 UNTIL FALSE
330 :

```

Program 6a

The first three procedures are similar to the ones that we have seen in the previous program. PROCBIN and PROCHEX, PROCPRINT is a development of the main part of program 4. It simply prints the binary representation of the character on the screen with its HEX values, and redefines the character, as well as printing it.

PROCRESET changes character 224 back to its original value.

Only one character (224) is created by this program, but it would be simple to add a counter to manipulate a series of characters.

If you want to manipulate a character that you have created with the last program, it will still be in its correct place in memory, provided you have not turned the computer off – other-



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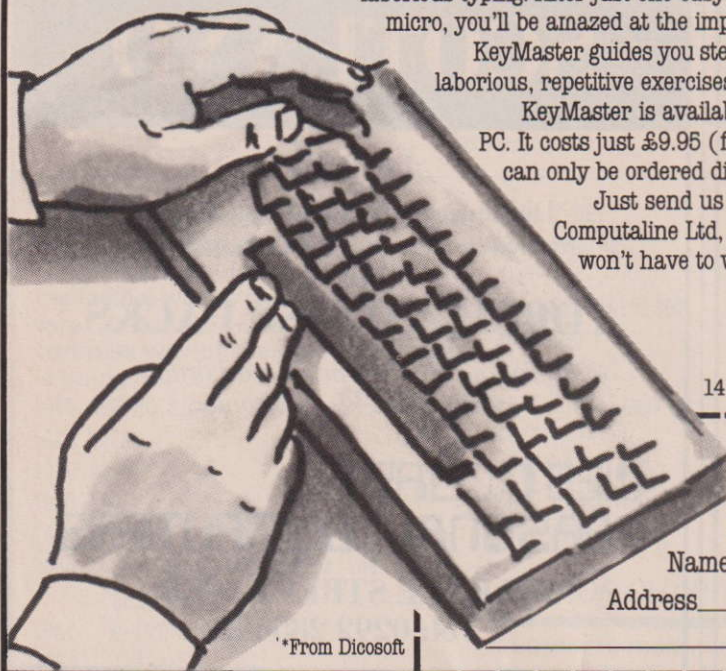
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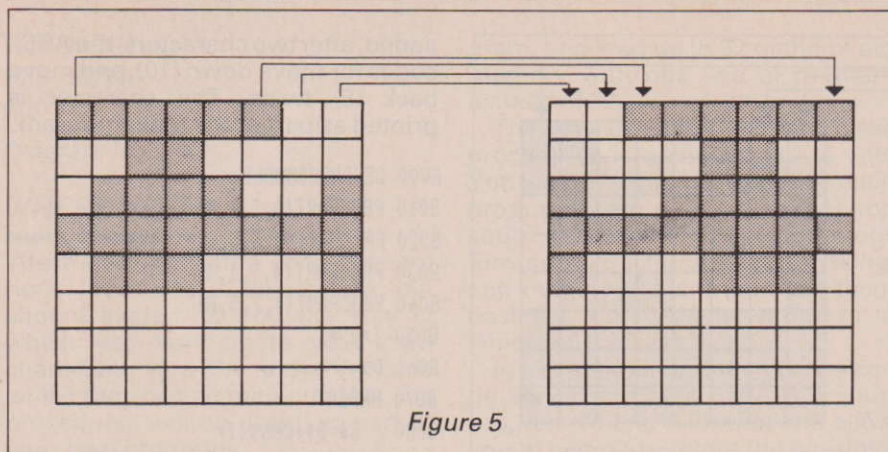


Figure 5

wise you will need to create it again with the CHARSET program.

While manipulating strings is not the fastest way to change the characters, it is the clearest and least complex way of seeing exactly what is going on.

```

1000 DEFPROC BIN(B)
1010 LOCAL I
1020 A$=""
1030 I=7
1040 REPEAT
1050 IF B MOD 2 THEN A$=" "+A$
      ELSE A$="." +A$
1060 B=INT(B/2)
1070 I=I-1
1080 UNTIL I<0
1090 ENDPROC
1100 :
2000 DEFPROC HEX(Z$)
2010 LOCAL I,B
2020 B=1
2030 H=0
2040 I=8
2050 REPEAT
2060 IF MID$(Z$,I,1)="#" THEN H=H+B
2070 B=B*2
2080 I=I-1
2090 UNTIL I<1
2100 ENDPROC
2110 :
3000 DEFPROC PRINT
3010 CLS
3020 PRINT "CHARACTER ";CH;"
3030 LOCAL X
3040 X=0
3050 REPEAT
3060 PROCHEX(N$(X))
3070 HX(X)=H
3080 PRINTN$(X) " ";
3090 IF H<16 THEN PRINT "0";~H
      ELSE PRINT "~H
3100 N$(X)=""
3110 X=X+1
3120 UNTIL X>7
3130 VDU23,CH,HX(0),HX(1),HX(2),HX(3),
      HX(4),HX(5),HX(6),HX(7)
3140 PRINT "CHR$(CH)
3150 PRINT "PRESS SPACE BAR FOR NEXT "

```

```

3160 G=GET
3170 ENDPROC
3180 :
4000 DEFPROC RESET
4010 I=0
4020 REPEAT
4030 N$(I)=O$(I)
4040 I=I+1
4050 UNTIL I>7
4060 PROCPRINT
4070 ENDPROC

```

Program 6b

### MIRROR CHARACTERS

In order to make a mirror image of a character that we have created, all we have to do is turn the 8 strings holding the character back to front. Figure 5 illustrates what is involved, and PROC MIRROR does this for us, translating O\$(I) into N\$(I). This could be useful if we want to change ASCII characters so that they can be read in a mirror – for bedridden people for example – but is even more so if we have a character that we wish to move across the screen in one direction, and then return it in the opposite direction.

The way to do this is to build up N\$ for each of the eight bytes by working backwards through the related O\$, so the last bit of O\$ becomes the first bit of N\$ and so on.

```

5000 DEFPROC MIRROR
5010 LOCAL I,J
5020 I=0
5030 REPEAT

```

```

5040 J=8
5050 REPEAT
5060 N$(I)=N$(I)+MID$(O$(I),J,1)
5070 J=J-1
5080 UNTIL J<1
5090 I=I+1
5100 UNTIL I>7
5110 PROCPRINT
5120 ENDPROC

```

Program 6c

### ROTATED CHARACTERS

Rotation with characters is limited to turning them through 90° – smaller angles would be hard to handle within the space allocated for one character! The simplest way of doing this is to re-allocate all the particular bits in any position in the byte to the appropriate position in the new string. This is demonstrated in figure 6, where the last bit of all the old strings are allocated progressively to the new string.

We could use this in games – to make our helicopter dive or climb, or if we used the ASCII characters, we could then turn our TV or monitor on its side, and have a format that was more closely related to a normal page.

In PROCROT this is carried out in two repeat loops, which work backwards through the bits in each position of every old string and place them successively in the 8 new strings.

```

6000 DEFPROC ROT
6010 LOCAL K,I,J
6020 K=8
6030 I=0
6040 REPEAT
6050 J=0
6060 REPEAT
6070 N$(I)=N$(I)+MID$(O$(J),K,1)
6080 J=J+1
6090 UNTIL J>7
6100 I=I+1
6110 K=K-1
6120 UNTIL I>7
6130 PROCPRINT
6140 ENDPROC
6150 :

```

Program 6d

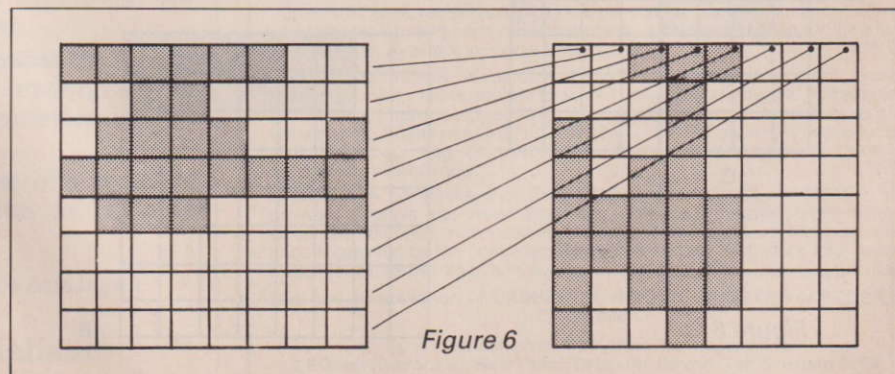


Figure 6



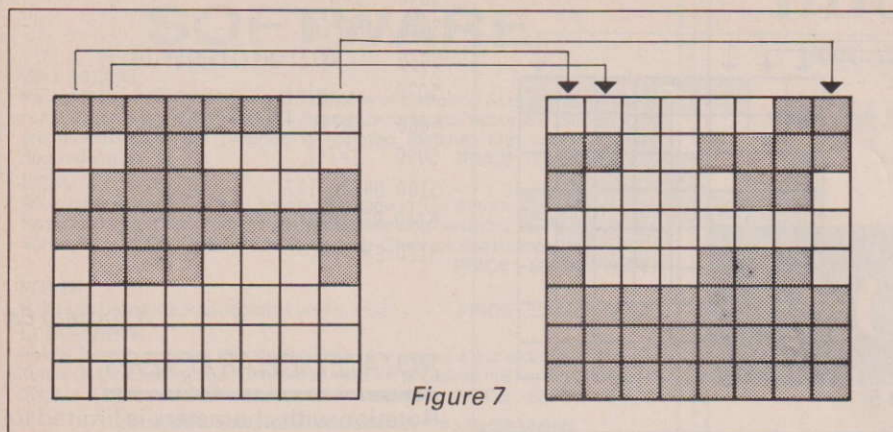


Figure 7

## INVERSE CHARACTERS

Inverting characters means turning each bit that is on to off, and each bit that is off to on. All we have to do is read each bit in the old string, and if it is an "\*" place a "." in the correct position in the new string and vice versa. Figure 7 explains this, and the procedure is shown in PROCINVERSE.

```

7000 DEFPROCINVERSE
7010 LOCAL I,J
7020 I=0
7030 REPEAT
7040   N$(I)=" "
7050   J=1
7060   REPEAT
7070     IF MID$(O$(I),J,1)="*"
       THEN N$(I)=N$(I)+"."
       ELSE N$(I)=N$(I)+"*"
7080     J=J+1
7090   UNTIL J>8
7100   I=I+1
7110 UNTIL I>7

```

```
7120 PROCPRINT
```

```
7130 ENDPROC
```

```
7140 :
```

Program 6e

## DOUBLE CHARACTERS

To make a character twice the size is a more complex problem. If you look at Figure 8, we need to divide the character into four, and allocate each of the four parts to a separate character. Each bit needs to be used four times, twice horizontally, and twice vertically.

To do this in PROCDOUBLE, we call another procedure, PROCPART, to which are passed both the start and end of the character that we need to enlarge. The first quarter "A" goes from string 0 to string 3 vertically, and character positions 1 to 4 within the string.

The character number is increased for each of the four parts, and four are defined (224 to 227).

Once this has been done, they are assembled into B\$, to which are also

added, after two characters, the ASCII codes for move down (10), and move back (8) twice. The character is printed as part of the main program.

```

8000 DEFPROCDOUBLE
8010 PROCPART(0,3,1,4)
8020 PROCPART(0,3,5,8)
8030 PROCPART(4,7,1,4)
8040 PROCPART(4,7,5,8)
8050 I=224
8060 B$=""
8070 REPEAT
8080   B$=B$+CHR$(I)
8090   IF I=225 THEN
       B$=B$+CHR$(10)+CHR$(8)+CHR$(8)
8100   I=I+1
8110 UNTIL I>227
8120 ENDPROC
8130 :
8140 DEFPROC PART(A,B,C,D)
8150 LOCAL I,J
8160 I=A
8170 REPEAT
8180   P=(I-A)*2
8190   N$(P)=" "
8200   N$(P+1)=" "
8210   J=C
8220   REPEAT
8230     N$(P)=N$(P)+
       MID$(O$(I),J,1)+MID$(O$(I),J,1)
8240     N$(P+1)=N$(P+1)+
       MID$(O$(I),J,1)+MID$(O$(I),J,1)
8250     J=J+1
8260   UNTIL J>D
8270   I=I+1
8280 UNTIL I>B
8290 PROCPRINT

```

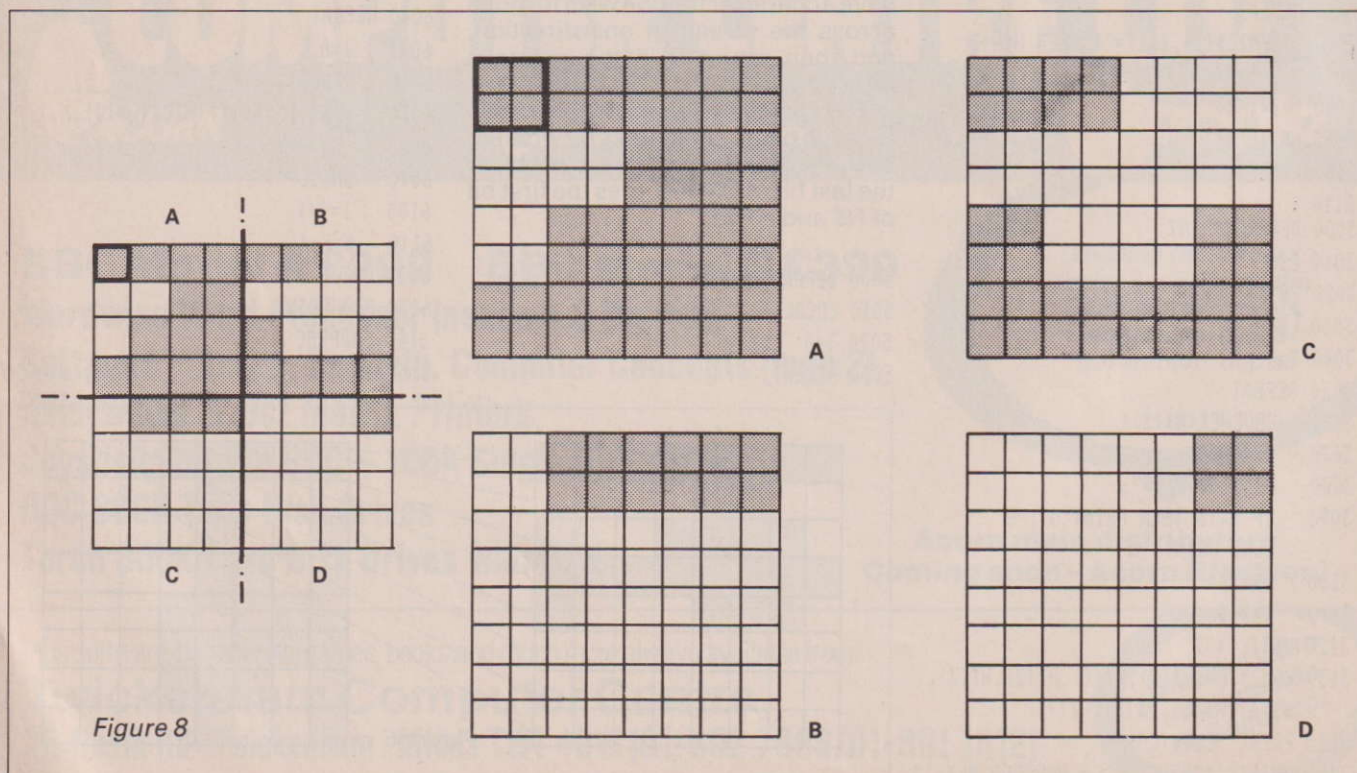


Figure 8



```

8300 CH=CH+1
8310 ENDPROC
8320 :

```

### Program 6f

### WHERE NEXT

These demonstration programs are not a lot of use in themselves, but should explain to you the way in which you can create your own characters, and the basic ways in which they can be manipulated. The procedures will be useful as part of your own programs.

Once you have created a particular set of characters for a specific application, you could save them and load them into memory with the \*SAVE and \*LOAD commands. The commands would be:-

\*SAVE CHARSET COO +FF

\*LOAD CHARSET COO

\*SAVE requires a file name: in this case CHARSET, which does not have quotation marks, the start address in memory which is to be saved and the length of the file. This can be stated as either the end address (CFF) or as a length, as shown above (+FF).

\*LOAD, in the same way needs the file name and the start address.

The advantage of using this method is that you can create a set of characters separately from your pro-

gram, and load up to 32 of them into memory with one line of program instead of 32.

The way in which you use these procedures is obviously up to you. You could combine the two main programs with a menu, so that you could create and inspect various forms of characters you were making, and then save them, and call them back for the particular program in which you will use them.

In animation these techniques can be very useful, and here is a short program to end with that will allow you to begin to explore the possibilities.

```

10MODE2
20 VDU23,224,&FC,&30,&79,&FF,&71;&0,&0
30 VDU23,225,&3F,&0C,&9E,&FF,&8E;&0,&0
40 CH=225
50 VDU 5
60 #FX4,1
70 X=0
80 Y=500
90 REPEAT
100 G=INKEY(0)
110 IFG=136 THEN X=X-8:VDU127:CH=224
120 IFG=137 THEN X=X+8:VDU127:CH=225
130 IFG=138 THEN Y=Y-8:VDU127
140 IFG=139 THEN Y=Y+8:VDU127
150 MOVE X,Y

```

```

160 VDU CH
170 UNTIL G=32
180 VDU4
190 #FX4,0

```

### Program 7

If we take our little helicopter and its mirror image, we can define two characters - 224 and 255. We will use mode 2, so that we can have a reasonable size of character.

The program then moves the text cursor to the graphics cursor with VDU 5 and, as in our create program, disables the cursor keys so that we can read them.

We then set up the X and Y starting co-ordinates and read the keyboard. If the cursor keys have been pressed, the helicopter is moved in the same direction, by changing the X or Y co-ordinates, deleting the previous character with VDU 127, and changing the direction of the helicopter if a left or right arrow key has been pressed.

The MOVE command is used to set up the new position before it is printed.

The program is stopped by pressing the space bar, which resets the cursor keys and returns the cursor to the text cursor.

Fly a helicopter for a bit while you think of how you can further improve your character!



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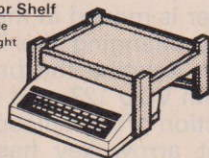
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## EDUCATION

Already the BBC Micro has been adopted by around half the schools in the country as the machine they have – or would like to have – their children using.

For £399 it provides facilities which would have cost £250,000 in 1963.

For parents, youngsters, and teachers it is tempting to dive straight in and write educational software. This article is designed to ensure that if you step down this path you avoid the pitfalls of the early poorly presented software. Writing good software is not just a matter of knowing how to program.

There are three main considerations in writing educational software:

- a** make the software as entertaining as possible;

- b** make certain that the software is robust and cannot be crashed;

- c** structure the learning and make certain that all the entries from the user are reasonable.

Of these, the first is definitely fun. We can all remember the difference between 'boring' teachers, and those that we really enjoyed learning from. The lively teachers always had a trick up their sleeves, were full of praise, were full of life, knew you personally and cared for your success. The same is true of software.

Entertaining software will always have the odd 'special' feature. There will be the monster that crawls across the screen and puts the 'i' before the 'e' in spelling tests. Not easy to implement – it will entrance youngsters, and is well worth the effort.

Entertaining software will always make you feel you're doing well – even when you aren't. You will make sure that every success has its own little message: FANTASTIC!!, BRILLIANT!!, Well Done!!

There is of course a place for the sarcastic remarks. A maths program on 'angles' using a snooker game comes up with the advice 'Play darts!! You might do better,' if you take more than 10 goes to get the ball angles correct.

As long as it gets a 'giggle' it is fine, but do not let your BBC Micro be used to make the user feel small. The user may be intimidated already by the machine, and doesn't need you to add to the misery.

But a word of warning. Timed 'educational games' against the clock are leading to a return of the old 'speed learning by heart' when you showed your success not by an understanding of what you learnt, but in how fast you could regurgitate it. I have seen enough 'maths testers' – a new one will need to be very entertaining.

# Software – a tough lesson

Learning to program the correct way



Entertaining software will always treat you as a human. It will want to know your name. It will ask you how you feel. When you are congratulated, it will always remember who you are.

It'll ask you if you wish to re-play and if the questions or game was hard enough. It'll make you feel the computer is 'human' as well.

Though entertaining software will guarantee its continued use in the classroom or at home is the software any 'use' at all? One thing that falls into my third category: structure the learning and make certain that the program vets the data entry from the user to see it is reasonable.

Your job is catch out the 'prankster' who thinks he/she knows more about the machine than you do!! (It might be true, but we won't admit it).

The problem for the writers of educational software is that youngsters love to experiment – even with those simple (and dreadful) addition programs. You are asked to choose two numbers. The first time you obey the instructions and choose two

'reasonable' numbers. The next time you choose two very large numbers with lots of noughts in them. The answer miraculously appears or does it?

Type in:  
PRINT 1234567890 + 345600000000  
The answer appears:  
3.46834568E11

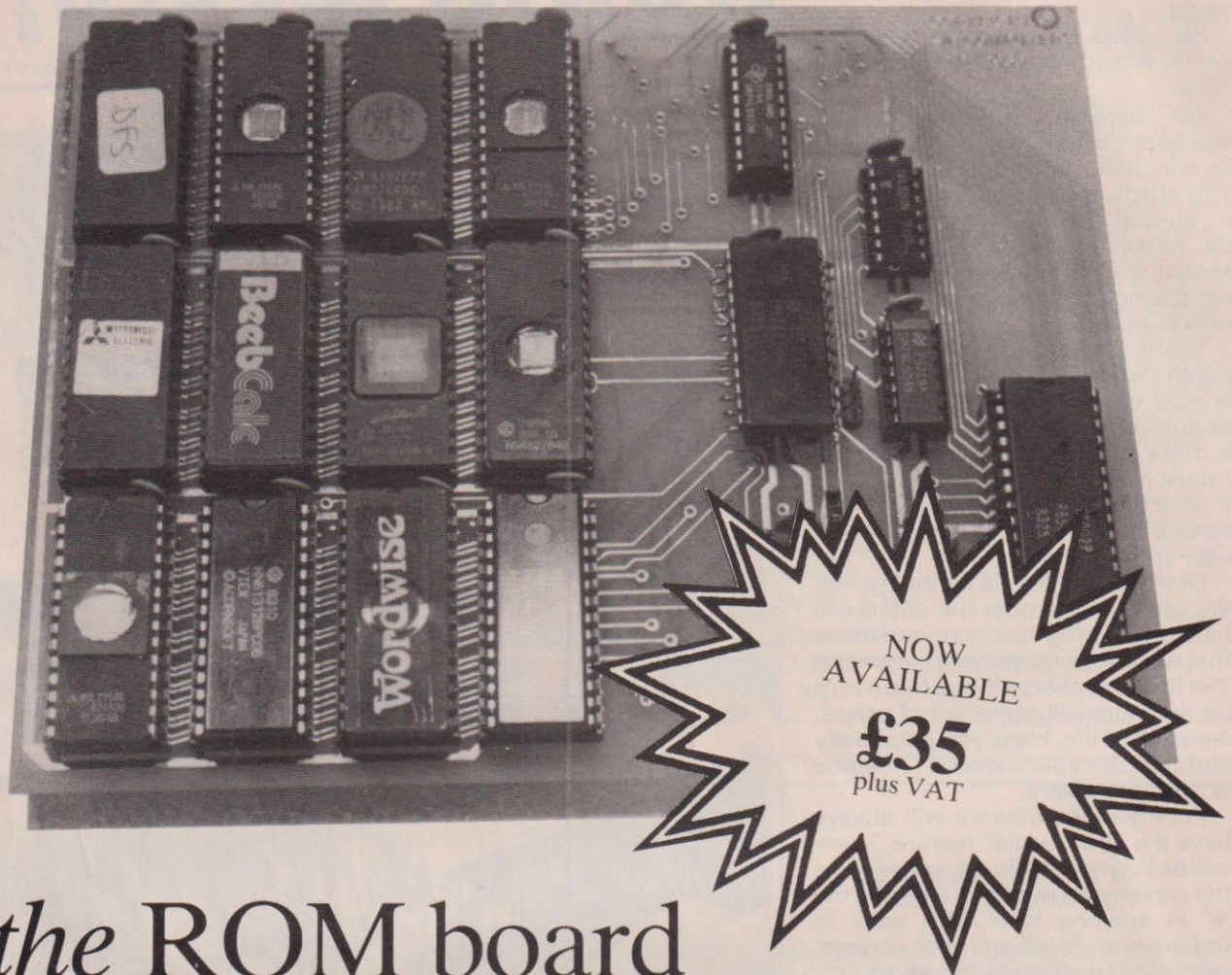
The answer is in exponential format because the machine cannot handle very large integers. But the user of the program will immediately assume that the program has an error. I would side with the user. But the user should never have been able to type in the above numbers!

The desire to experiment with the extremes of the machine can cause yet further havoc. The screen display may collapse or be insufficient for the answer despite the answer being correct. Type in the following and see what happens:

```
10 CLS
20 VDU 28,10,20,16,19
30 INPUT A
40 INPUT B
50 PRINT A+B
```



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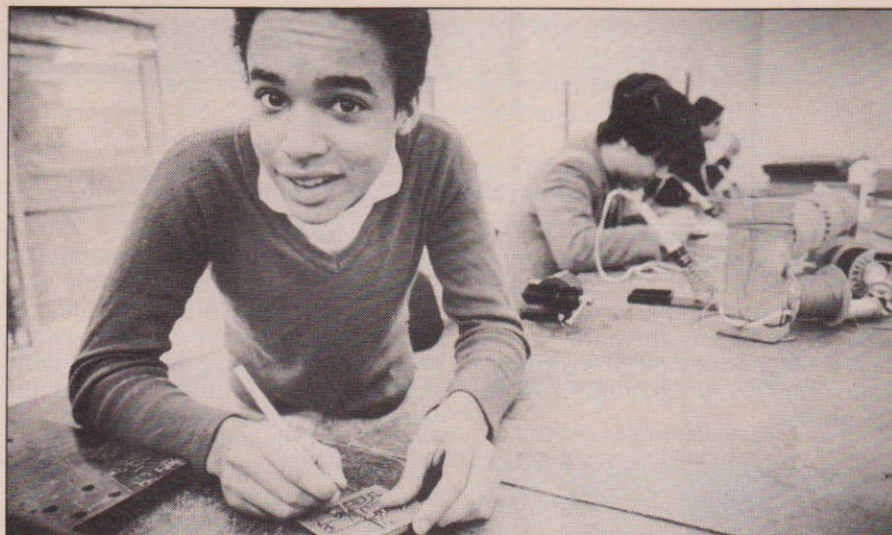
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Run the program with two sensible numbers like 23 and 47. The result, 70, appears. Now run the program with 3456 and 1234567. The answer you see is 023. This is correct??? What has happened is that the `VDU 28` statement is the command for defining a text window, and the window is not large enough for the whole answer.

This may be a trivial example but I have seen it several times in educational software. Once the screen display 'collapses' it is often impossible to get it back without reloading the software completely.

A young person using any software that you might write will go to extraordinary lengths to experiment not with the lesson, but with the software teaching the lesson. He/she wants to know whether you can be 'tricked' or he/she can get the better of the machine though, for some reason, girls seem to be more trusting of the software.

The job of structuring and limiting the range of possible replies by the youngster is called 'validation'. Good validation is the secret to good software. Bad validation either gives us £00.00 in our wage slip or a gas bill of £200,000.00 when we have been on holiday for two weeks.

The object of validation is not only to make software 'robust', but also to direct the learning of the student. Look back at the trivial addition example above. You may not want the youngster to discover that there is a valid method of writing numbers which includes the letter 'E'.

It may lead to 'running before walking' or even the young person being frightened off numbers by concepts which are beyond him/her.

Your validation will therefore include, not only 'length of input checks' and 'number range of answers' checks, but also 'character checks' to see that the correct type of keyboard character has been used.

As all validation is expensive on memory, you will need to develop

general purpose procedures to perform the checks – and an example is given below. Note, however, that on the BBC Micro there is a conflict between the amount of memory space given over to clever program ideas and validation of those ideas particularly in higher screen modes.

You have to decide in the last screen shape is worth the possibility of the program crashing. My general view is that with younger children **THE PROGRAM MUST NOT CRASH!**

The following program, deliberately overdocumented, is the kind of validation routine you will need. Specify on entry to the function the highest and lowest letters acceptable and how many you will allow and the routine acts as an input routine to those specifications.

Last but not least, we must deal with the prospect of the software 'crashing'. Crashing is when the dreaded 'syntax error' message or something similar creeps in to wreck the continued use of your software.

Many teachers writing educational software find that their software works happily in the school they work at, but when they let others use it, all sorts of problems arise. This is because they are on hand to help – or they have taught their youngsters to avoid the pitfalls in the program.

Always 'dodo' test your software. Give it to the 'slowest' or most 'frightened' member of the class and let him/her play with it for as long as possible. Tell them they can do ANYTHING they like to the machine provided they don't drop it on the floor, or turn it off.

In general I have found that 90 per cent of commercial educational software can be broken into within five minutes. There are a few notable exceptions but when software companies work so hard on 'games' software making it robust, there is no reason why you and educational software companies should not work equally hard on classroom software. So, to deal with the obvious:

You must stop the `BREAK` key from its usual function. Type into the machine:

**\*KEY 10 OLD MRUN M**

The youngsters will quickly learn that the only effect of hitting `BREAK` is for the program to restart – in itself

```

10 CLS
   A$ = FNinput ("Z", "A", 6)
30 PRINT A$
40 END
100 DEF FNinput (High$, Low$, Num)
110 LOCAL High, Low, Counter, Entry, Delete
120 LOCAL Return, Temp$, Entry$
130 LET Delete = 127: LET Return = 13
140 LET High = ASC (High$): LET Low = ASC (Low$)
150 LET Counter = 0
160 REPEAT
170   REPEAT
180     Ok = FALSE
190     LET Entry$ = GET$
200     Entry = ASC (Entry$)
210     IF Entry >= Low AND Entry <= High THEN Ok = TRUE
220     UNTIL (Counter = 0 AND Entry >> Delete) OR Counter = Num
230     OR (Counter = Num AND NOT Ok)
240 UNTIL Ok OR Entry = Delete OR Entry = Return
250 LET Counter = Counter + 1
260 IF Entry = Delete THEN Counter = Counter - 2
270 IF Entry = Return THEN Counter = Counter - 1
280 LET Temp$ = Temp$ + Entry$
290 LET Temp$ = LEFT$ (Temp$, Counter)
300 IF Entry <> Return THEN PRINT Entry$;
310 UNTIL (Num = Counter AND Entry = Return)
320 PRINT
330 = Temp$

```



quite useful. Unfortunately there is nothing you can do about CONTROL BREAK (v1.2) or repeated BREAK (v0.1). If the youngsters have BBC Micros at home they will have learnt that these commands perform a 'cold start' on the machine. Therefore it is important that the program can be restarted easily after such 'accidents' – and I suggest you refrain from joining the 'clever tricks' brigade who move the 'pseudo' variables PAGE, HIMEM and LOMEM. The chances are that you will not then get a 'Bad Program' error message.

The ESCAPE key is the next most

important to deal with. The simple solution is to use the 'ON ERROR' command and look for character code '27', which is the code for the ESCAPE key, and re-start the program when found. For an example see the box above.

```
10 ON ERROR GOTO 10000
10000 IF ERR = 26 THEN RUN
10010 PRINT "Apologies – there is a programmer's error"
10020 PRINT; "at line "ERL" It is:"
10030 REPORT
10040 PRINT "Please record how you 'crashed' this
10050 PRINT "program and contact the author."
```

Lines 10010 to 10050 are essential!!! When developing your software you will not always be around while it is being tested – and you need to know why it failed. When you are confident you may leave it out of the finished version. But the Inner London Education Authority often leaves such messages in their software after release because they expect the unexpected – so should you!

The ESCAPE key can be dealt with in a different fashion. You can (with v1.2 OS) turn it off completely so that the key does nothing. Type in:

```
10 PRINT "Hi there"
20 GOTO 10
*FX 299,1
```

Now run the program and press escape. How sad!! You will have to press BREAK to get out of that one. In face \*FX 299,0 will bring back the escape function. What has happened is that this \*FX call allows the escape key to generate its ASCII character rather than be used to interrupt a program. But it will protect your keyboard from prying hands.

You do not have to go this far. You may want a 'secret' escape key only known to you, the programmer. Type \*FX220,0. It looks as if the escape key has been disabled. In fact, if you type CONTROL , then the escape function reappears on that key. It is your choice which you prefer. To get back the normal escape key, type: \*FX 220,27.

You will also need to check the actual keys used on the keyboard very carefully, so that the youngster is restricted to precisely those keys you find acceptable. You should make certain that the red function keys only have something in them which will enhance the program. You ought (v1.2 only) to disable the copy key and cursor move keys – because these can also disrupt the screen display.

In this short article, I hope I have given some clues as to what makes 'good' software good. Clever ideas alone are not good enough. You must be competent and thorough in your programming. Expect the worst – youngsters will always do things to your programs that you would not have dared – even if you had thought of them. Don't be over-ambitious. Two short programs done well are better than one done moderately well.

Ian Murray, Head of Computing  
Holloway School





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# What's the best system for you?

Matching software to machine is vital to achieving the best results for your business needs. There are vast numbers and types of packages to choose from – but it really is a case of horses for the right courses.

## BUSINESS

The advent of the micro has given benefit to many people. They are used for entertainment, education and maybe most importantly business applications. The BBC micro is no exception, with many different types of 'serious software' available for it. Some are good, but some of it is a lot rubbish.

This statement is true of most types of software, but when you are dealing with business ie pounds and pence, then a piece of software that is not up to standard can cause havoc, with the possibility of someone losing a lot of money.

The BBC micro is rather a strange machine, one the one hand it cannot be called a toy because of its price and facilities, but on the other it cannot be called a fully-fledged business machine since it lacks facilities that you would expect from a business micro — such as more RAM, integral VDU and so on.

But for the humble user, the Beeb can be used in the small business environment quite successfully — provided the right software is chosen.

There are many types of business software, but the main ones are a database, spreadsheet, payroll, ledger, and a wordprocessor. If you intend to buy any of these programs, then shop around. There are lots of software houses producing business software at lots of different prices, so beware!

### **Beebcalc a spreadsheet processor**

The spreadsheet and the micro go well together. Tabulating large amounts of figures within set rules manually can be both tiresome and prone to error. It's just the job for a spreadsheet.

Imagine you have a set of data for a small business, with say, figures for income, expenditure, and so on, for a period of a year. You can enter this data into a spreadsheet, define formula such as gross income-tax, press a key, and the whole sheet for the year is calculated.

Gemini Marketing offer 'Beebcalc' for the 32K BBC micro. This spreadsheet will allow you to do the above, and some more.

Features of the package include the ability to set up to 26 columns and 50 rows of text. Then you enter data and formula which mathematically relate cells within the table. Each column (of figures, for example) may be individually set to a desired width, from one to 32 characters, and formula may include scientific functions.

The package comes in a large box, which contains the cassette or disk, plus the instructions. The instructions are well printed but a little vague. Even though a demonstration application is included in the manual, and on the tape, I would have liked to have seen more examples of how to use Beebcalc.

Once loaded, you are asked some questions, which allow you to load a set of data, define the pound sign, and set up the spreadsheet. Once this is done, the display changes to show part of the sheet, and you are in edit mode.

In edit mode it is possible to move to any part of the spreadsheet by using the BBC's cursor keys. As you move about the screen, the column and cell position is displayed, and on the bottom of the screen the cell contents are displayed. It should be noted here that Beebcalc is written in Basic, and this means that, while there is a fair amount of room for data, you should be careful. The amount of room available is displayed on the top line of the sheet. If you go off the screen to the next column for example, then the screen takes a moment to redraw, but this is easily got used to.

Entering '/' while in edit mode should bring you to a selection of commands. I say should because it didn't always work, and the machine would crash.

For the price, Beebcalc is not bad value. It has its good side and its bad side. If you feel up to it, you could no doubt amend the program for your own needs. But if not, then I suggest

you get a demonstration before you part with your cash. Dealers will be delighted to do this at no cost.

### **Beebplot, a data portrayal program**

Beebplot, from Gemini Marketing, provides an easy way of displaying numerical data graphically. The benefits of doing this are quite important—it allows you to get a visual idea of 'whats going on'. To achieve this, Beebplot offers the user three ways of displaying data: as a pie chart (or two), as an histogram (one of 10 sizes), or as a graph (formula plot or point plot).

All three programs allow you to do a high resolution screen dump on to a bit-image printer.

There are two versions available for the Beeb, one on cassette and on disk. The only difference between the two is that the screen-dump routine is held as a separate file on the disk version — which saves some memory. Also, it is a lot easier to load data files with disks than cassettes.

All three programs worked quite well, but at first it was a little difficult to get things going. Gemini say that their Beebplot programs are fully de-bugged and tested, but I found it amazingly easy to crash all three by simply entering bad data.

This was especially true with the first program on the cassette, PIE. With this, you have the option of having one or two pie charts displayed. After you have made the selection, you enter the reference for each segment, together with a value. What happened was that I accidentally entered numbers prefixed by the pound sign. The program didn't mind, but after I had completed the entries the machine hanged up, and a hard reset was necessary.

On the positive side of things, the displays were excellent, with high resolution and good colour co-ordination being employed throughout. I was particularly impressed with the histogram program, where it is possible to set up the size of the graph as well as defining names for the x and y axis.

The facilities offered by Beebplot



are simple yet sophisticated. Data files can be loaded from your own programs or from Gemini's Beebcalc and Cashbook programs if wished. This is certainly a program worth looking at.

**Memo-Calc a database for the 32K BBC micro**

It is recognised that one of the most handy business programs you can have in the office is a database. Databases can have such a wide

variety of uses, and because they are normally flexible in the applications they are used for, they have become very popular with the business micro user.

The ability to store, edit, manipulate, and retrieve data, be it text or numeric, is a powerful one, and that is what databases are used for. Some databases even act like spreadsheet programs, and allow the user to perform arithmetical calculations on

the records that make up a database file.

For the BBC micro, there are two ways in which a database can be implemented. First, by tape, and second, by disk. It is desirable that the database you have is a disk-based one. This is because the loading and saving of data will be that much quicker, and some databases save memory by swapping out parts of the program that are not needed, and





swapping them in again when they are.

Memo-Calc from Micro-Aid is a very powerful database system for the BBC model B. It is supplied on disk and tape in two versions: a user friendly one, and one where there are less instructions. The reason for this is because the version without the instructions uses less memory and therefore allows more room for records.

The database is written in Basic, and therefore you will have problems with data storage. Yet a unique feature about Memo-Calc is the facility to define up to 255 columns. This however means that the more columns the less amount of records.

Once Memo-Calc is loaded, a main menu is displayed with several options. From this point it is possible to create a new file, search for a record, search a column, and so on. It is interesting to note that when you enter the data for a file, you don't have to specify what type it is. By this I mean, the program seems to make no distinction between alphabetic and numerical data. The only time when this is obvious is when calculations are made.

At this stage of using the program, I have one grumble. You must specify a column of data which will be used as

a key field. The field is number one, and this cannot be changed. I would have liked to have seen the facility of user-defined key fields with the possibility of a secondary field.

An interesting feature which I haven't seen on other databases is the facility to examine the database array. This is achieved by entering a submenu where the display changes. A small 'window' on the array is shown, together with several other options relating to record and file maintenance.

When in this mode, it is possible to use the cursor keys to move about the array and change any data within it with minimum effort. Very nice indeed!

What is not so nice is the range of options available in the column-search option. Here you have the normal options to search for numerical data greater than, less than or equal to whatever, but this doesn't apply to alphanumeric data where you can only perform a test for equality.

A whole range of mathematical functions can be performed on the data within the file.

This is achieved in several ways. First, whole columns or rows can be mathematically manipulated; second, individual cells can be com-

puted. So it would be possible to assign a cell with a new value which is calculated by its previous value—for example  $(X+X/3)*X$ .

I was particularly impressed with the error trapping and screen layouts of Memo-Calc. It does have its shortcomings as far as record interrogation and column searching are concerned, but taking this into account, it's one of the best database type programs you can get for the Beeb.

Name: Memo-Calc. Application: Database. Format: Cassette or disk. System required: BBC model B, disk-drive and/or cassette and printer optional. Produced by: Micro-Aid, 25 Fore St, Praze-an-Beeble, Cambourne, Cornwall, TR14 0JX.

Name: Beebplot. Application: Business graphics. Format: Cassette or disk. System required: BBC model B, disk-drive or cassette, bit-mapped printer optional.

Name: Beebcalc. Application: Spreadsheet processor. Format: Cassette or disk. System required: BBC model B, disk-drive or cassette, printer optional. Beebcalc and Beebplot are produced by Gemini Marketing Ltd, 18a Littleham Road, Exmouth, Devon.

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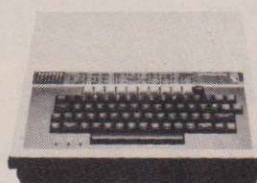
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Here are two games to entice the adventurous heart in any BBC explorer.

**Name:** Alien Dropout  
**Application:** Game  
**Price:** £7.95  
**Publisher:** Superior Software

Software companies use the word 'alien' far too loosely. There are probably quite a few around who would market a regular chess package with the title 'Alien Chess' if they thought it would boost sales.

This observation is prompted by the fact that the aliens in Alien Dropout are nothing more than moths, admittedly of a particularly vicious mutant strain.

This is another vertical shoot-up game. Above you lies a set of tubes into which the moths fly and collect. When a tube is full, newly arrived moths cannot be accommodated, so the bottom moth is discharged and

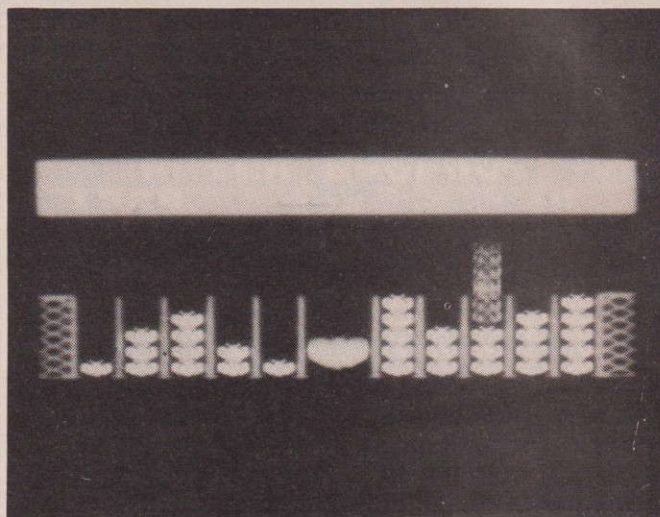
swoops down on you, dropping bombs in the galaxian fashion.

The thing to do is to move left and right, picking off the moths as they collect. But it is not that simple.

In the centre of the tube array sits a huge monster moth. This must continuously dump bombs on you. It is indestructible until 200 small moths are notched up. Then it will begin to float down – a nice and lucrative target.

The game has seven levels. Level one seems initially quite easy, almost relaxing. But things hot up after that. The moths start collecting like flies (sic), and the monster moth in the middle offers no let-up in his interminable drop-pings.

If you keep the left-hand tubes clear, you will find the right-hand tubes teeming, and you will won-



der how things could so rapidly have got out of hand.

Vertical shoot-up games are almost all variations of the same theme. The formula has been used time and time again because it is addictive. Alien Dropout is better than average in the

field because of its pace and its sound effects. The latter are satisfyingly weird.

Shooting moths is in itself a satisfying activity and has little to do with the alien factor in the game's title: a better name would have been Mutant Moth Massacre.

**Name:** Space Adventure  
**Application:** Game  
**Price:** £7.95  
**Publisher:** Virgin Games

Not so long ago, adventure games were limited to a set of tortuous questions on the screen. There were no graphics, no sound effects and no score.

Thankfully, this is changing. Virgin's Space Adventure is one of the best of the new generation of adventures I have seen.

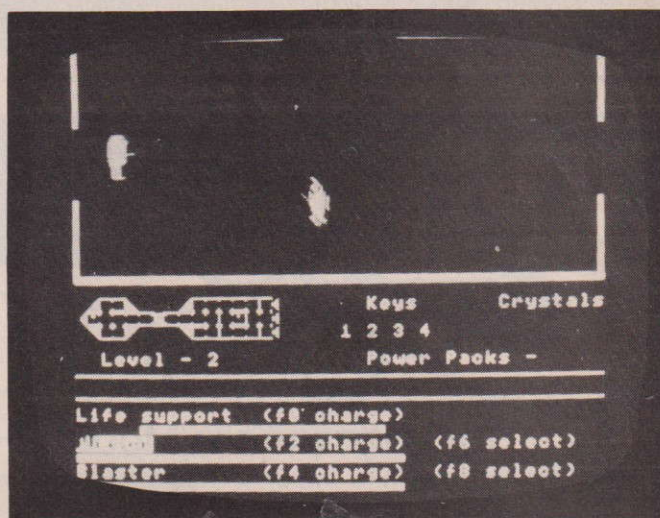
To begin with, the story sounds familiar: you board an apparently abandoned alien spaceship, and must search through its chambers for the elusive power crystals. During the course of your search, you find that some of the doors are locked. Luckily, you have picked up some keys you have found.

Androids appear in some rooms and must be destroyed by phasers or blasters before you can leave. The energy in your power packs may run down, so you must also keep an eye out for that.

The graphics in this program lift it beyond the typical adventure. The astronaut can be powered through rooms with up, down, left, and right movements.

And many chambers are far from empty. Androids materialise in them, blurs of localised static, like being beamed down from the Starship Enterprise. These androids are drawn in detail and are very menacing.

Shooting the androids is no easy task – a mere five shots of phaser or three of blaster will do it. But, infuriatingly, you can only shoot in the direction of



your motion. You may well find yourself eyeball-to-eyeball with Fatso, your weapon pointing impotently upwards. All the while, Fatso or one of his colleagues will be merrily

pumping shots into your stomach.

The game is challenging and exciting. It has excellent graphics and – rare for any micro game – it has a real sense of atmosphere.

NO.	TITLE	MODEL	LANGUAGE	PRICE	GRAPHICS	PLAYABILITY	ORIGINALITY	SUPPLIER/REFERENCE
1	Planetoid	A/B	MC	9.95	9	9	9	Acornsoft Ltd., C/O Vector Marketing Ltd., Dennington Industrial Es. Wellingborough, Northants NN8 2RL.
2	Arcadians	B	MC	9.95	9	8	8	
3	Meters	B	MC	9.95	9	9	8	
4	Painter	B	MC	8.00	9	7	8	A. & F. Software, 830 Hyde Road, Manchester M18 7JD.
5	Frogger	B	MC	7.95	10	10	9	Superior Software 69 Leeds Road, Bramhope, Leeds.
6	Space Fighter	B	MC	7.95	9	8	8	



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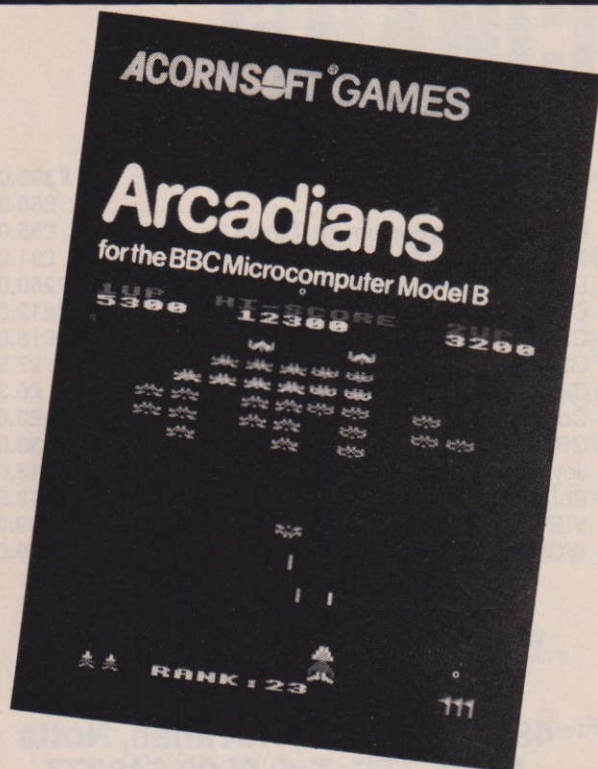


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## GAMES



Since the launch of the BBC micro computer many software houses have produced a vast array of arcade style games to fulfil the growing demands of BBC micro owners.

The games reviewed below are but a small fraction of the high quality 'arcadia' currently available from some of the leading software houses in the UK today.

As Acorn actually manufactures the BBC micro it is a natural extension to produce its own software for it.

**Planetoid** from Acornsoft is the authoritative version of Williams Defender from the arcades.

This must rate as one of the most compulsive arcade games for the BBC micro, as it is a full feature 'clone' with good clear, but comparatively low resolution graphics and sound.

All the usual aliens are there (albeit with different names), and raiders attempt to steal your life forms and drag them off into space. If the raider reaches the top of the screen with your life form, it will turn into a mutant with a fast 'homing' attack rate.

Other dangers include bombers which lay mines in their trail and must be avoided, and the megacyte

('pod' in the arcade version) which holds many spores ('swarmers') which are released when the megacyte is destroyed.

These spores will home in on your craft, firing as they do so.

The greatest danger comes from the cruiser ('baiter'), which (in the early waves) appears if you delay in clearing the aliens. The cruiser moves faster than your ship and will quickly destroy you unless hyperspace or a quick reversal of direction, coupled with rapid fire, is used to destroy it.

The game requires use of the keyboard which does make for confused and frantic key play until the gameplay 'feel' is achieved. The only real criticism that can be levelled at this game is that to destroy the aliens there is very little margin for error, since they must be hit 'spot on' to ensure their destruction.

The scrolling routine and reversal of your ships direction are excellent and far surpass the Atari version of *Defender* (which, admittedly, is far superior in all other respects).

And there is also a high score table allowing the top eight scores and names, respectively, to be recorded.

**Arcadians** is a very tough and skilful arcade copy of *Galaxians*. To survive any appreciable amount of time you must blast the aliens as they break off and actually come down at you. Initially, this is very off-putting since survival is short, but a little dedicated play allows the grasp of this basic principal of survival and addiction soon follows.

The graphics and sound are very close to the original *Galaxian* (barring the introduction tune at game start) although it must be admitted it has a very different 'feel' as you are forced to concentrate your energies on destroying the aliens as they swoop down at you, rather than biding your time and picking them off as they move across the screen invader style.

Overall this is definitely a game to be included by all arcade enthusiasts and particularly *Galaxian* fans.

**Painter**, if you ever enjoyed painting by numbers in your younger days, is certainly for you. You control a 'painter' and must move around different shaped grids, filling in the 'squares' by running your painter around their entire perimeter.

The hazard in so doing is the 'fizzers', which in the early levels roam at random around the grid, and which at higher levels 'home in' on you, and some fancy 'doddlng' is required to out manoeuvre them.

The game has a good, clean graphics, the basic minimum of sound and a curious simplistic, appeal that will endear game players of all ages.

The only criticism of this game is that on the higher levels, where a fast response is crucial, the movement of the painter at a 'crossroads' can be frustrating, since it has to be perfectly aligned to the desired line before you can move in that direction.

**Spacefighter** takes the best elements from *Defender* and *Scramble* and combines them to great effect, producing a curious blend of very controlled arcade action.

The aim is to destroy the

various waves of aliens whilst maintaining your fuel level. You control a fighter moving left to right, and have to destroy the mutants, swarmers, trimorts, baiters, baryons, and asteroids. Your craft has a lazer gun and three 'smart' bombs at its disposal.

Each alien has its own attack pattern, for example, the mutant moves randomly around the screen and a baiter will 'home in'.

After a set number of aliens are destroyed you advance to the next level with more aliens and greater attack speeds, a bonus ship is given at 10,000 and 20,000 points.

The graphics and on-screen action make for very fluid play which, on balance, will favour the scramble enthusiast rather than the multi-key/hazard *Defender* player.

**Frogger** from Superior Software is the closest to the arcade original I have seen to date. The aim is to get five frogs into holes in a river bank at the top of the screen.

To do this, the frogs must first cross a busy road, avoiding the traffic. Then they must cross a multi-current river by jumping on logs, crocodiles, and turtles (which tend to dive at the most inopportune moment!).

You get 10 points per jump up or down, 50 points for every frog safely home, and 200 points for landing on a fly. Extra frogs are given at 1,000 and 2,000 points.

With some of the most sophisticated graphic and sound capabilities currently available, the BBC micro has some of the finest arcade games written for it. The games are generally of a high standard which from my point of view is very pleasing (being an avid arcade enthusiast myself). It could be said that the price of an average game, around £8/9 is rather expensive, but when viewed in relation to the quality received, it (in most instances) is more than justified.

See page 45 for suppliers.



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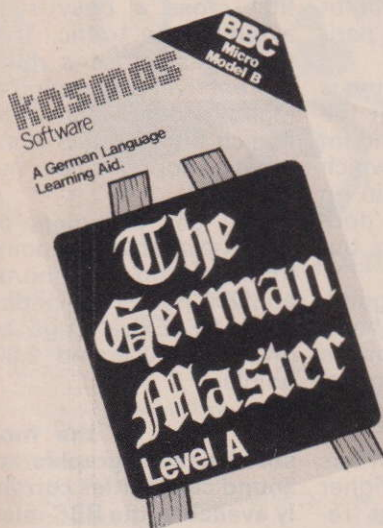
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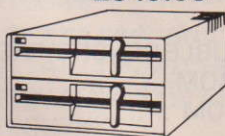
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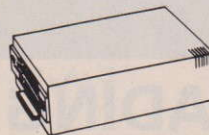
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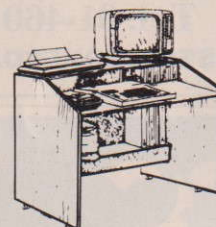
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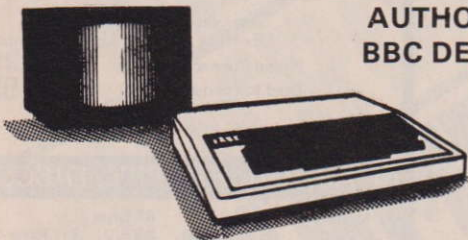
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>L.

```

5 REM**SNIPER AMBUSH**BBC VERSION BY IAN
  THOMAS FROM ORIGINAL BY M.BEWSE
  10 DIMP(5,5),L(11,2),S(5,2),S$(2)
  20 TB=5000:TM=0:K$="0000000000":MN=0:AI=0:
FR=0:MX=RND(27)*8
  30 GOTO520
  40 TM=TM+1:COLOUR3:PRINTTAB(28,15);TM
  50 A=INKEY(2):IFA<0 GOTO130
  60 COLOUR0
  70 IFA=65 PRINTTAB(10,13)R$:MN=1:GOTO130
  80 IFA=90 PRINTTAB(10,13)Q$:MN=0:GOTO130
  90 IFA=66 AND MN=1 FR=1:GOTO130
  100 IFA=78 MX=MX-8:GOTO130
  110 IFA=77 MX=MX+8:GOTO130
  120 GOTO40
  130 IFMX<0 MX=0
  140 IFMX>220 MX=220
  150 IFFR=0 GOTO350
  160 FR=0
  170 Y=23
  180 IFMX<42 Y=Y+32:GOTO230
  190 IFMX<70 Y=Y+7:GOTO230
  200 IFMX<124 Y=Y+8:GOTO230
  210 IFMX<164 GOTO230
  220 Y=Y-8
  230 GCOL3,3:PLOT69,328,288
  240 PLOT1,(MX-60)*4,Y*4
  250 SOUND&10,-15,5,3:SOUND0,-12,6,3
  260 PLOT69,328,288
  270 PLOT1,(MX-60)*4,Y*4
  280 COLOUR2
  290 IFMX>29 AND MX<35 AND MID$(K$,1,1)>"0"
PRINTTAB(4,5)CHR$241;CHR$242;:COLOUR0:PRINTCH
R$230;CHR$231:K$=LEFT$(K$,5)+"1"+RIGHT$(K$,4)
:GOTO340
  300 IFMX>61 AND MX<67 AND MID$(K$,2,1)>"0"
PRINTTAB(8,8)CHR$241;CHR$242;:COLOUR0:PRINTCH
R$230;CHR$231:K$=LEFT$(K$,6)+"1"+RIGHT$(K$,3)
:GOTO340
  310 IFMX>101 AND MX<107 AND MID$(K$,3,1)>"0"
" PRINTTAB(13,8)CHR$241;CHR$242;:COLOUR0:PRIN
TCHR$230;CHR$231:K$=LEFT$(K$,7)+"1"+RIGHT$(K$,
2):GOTO340
  320 IFMX>144 AND MX<155 AND MID$(K$,4,1)>"0"
" PRINTTAB(19,9)CHR$241;CHR$242;:COLOUR0:PRIN
TCHR$230;CHR$231:K$=LEFT$(K$,8)+"1"+RIGHT$(K$,
1):GOTO340
  330 IFMX>185 AND MX<195 AND MID$(K$,5,1)>"0"
" PRINTTAB(24,10)CHR$241;CHR$242;:COLOUR0:PRI
NTCHR$230;CHR$231:K$=LEFT$(K$,9)+"1"
  340 IFRIGHT$(K$,5)="11111" GOTO850
  350 K=RND(5)
  360 IFMID$(K$,K+5,1)="1" GOTO40
  370 IFMID$(K$,K,1)="4" COLOUR2:PRINTTAB(S(K

```



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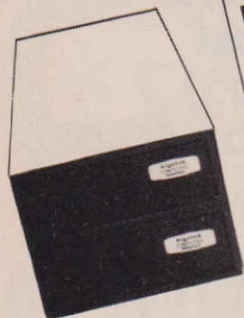
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```

,2),S(K,1))S$(2)
380 IFMID$(K$,K,1)="5" OR (MID$(K$,K,1)="7"
AND MN=0) GOSUB420
390 K$=LEFT$(K$,K-1)+CHR$(ASC(MID$(K$,K,1))
+1)+RIGHT$(K$,10-K)
400 IFMID$(K$,K,1)="7" COLOUR0:PRINTTAB(S(K
,2),S(K,1))S$(1):K$=LEFT$(K$,K-1)+"0"+RIGHT$(
K$,10-K)
410 GOTO40
420 N=RND(P(K,4))
430 NX=N-P(K,3)
440 GCOL3,3:PLOT69,P(K,1)*4,P(K,2)*4
450 PLOT1,NX*4,-P(K,5)*4
460 SOUND&10,-15,4,3:SOUND0,-12,5,3
470 PLOT69,P(K,1)*4,P(K,2)*4
480 PLOT1,NX*4,-P(K,5)*4
490 IFMN=0 RETURN
500 IFP(K,1)+NX>78 AND P(K,1)+NX<86 COLOUR0
:PRINTTAB(10,13)Q$;TAB(9,15)P$:GOTO820
510 RETURN
520 MODE7:PRINT'CHR$141;CHR$&81;SPC(14)"Amb
ush." 'CHR$141;CHR$&81;SPC(14)"Ambush."
530 PRINT''' "You have been ambushed by gun
men in a forest. The only safe place is a l
ow wall behind which you can take cover."
540 PRINT'' "You must try to kill all gunmen
by aiming over the top of the wall,but
the snipers are quite good shots!"
550 PRINTTAB(0,20)"How long can you survive
?....."
560 F$=STRING$(29,CHR$9)
570 G$=STRING$(31,CHR$9)
580 FORX=0TO7:FORY=0TO8:READA:?(&C00+Y*8+X)
=A:NEXT,
590 FORX=0TO7:READA,B:?(&C00+72+X)=A:?(&C
00+80+X)=B:NEXT
600 FORX=1TO11:READL(X,1),L(X,2):NEXT
610 FORX=0TO7:READA:?(&C00+88+X)=A:NEXT:W
$=STRING$(32,CHR$235)
620 T$=CHR$224+CHR$225+CHR$226+F$+CHR$227
+CHR$228+CHR$229+F$+CHR$230+CHR$231+CHR$232
630 S$(1)=CHR$230+CHR$231:S$(2)=CHR$233+C
HR$18+CHR$0+CHR$234
640 FORX=0TO7:READA:?(&C00+104+X)=A:NEXT
650 FORX=0TO7:READA,B:?(&C00+136+X)=A:?(&
C00+144+X)=B:NEXT
660 FORX=0TO7:READA,B:?(&C00+152+X)=A:?(&
C00+160+X)=B:NEXT
670 Q$=" "+G$+CHR$235+G$+CHR$236:P$=CHR$2
41+CHR$242
680 R$=CHR$243++G$+CHR$244+G$+" "
690 FORX=1TO5:READS(X,1),S(X,2):NEXT
700 FORX=1TO5:FORY=1TO5:READP(X,Y):NEXT,
710 INPUTTAB(0,22)"Press <RETURN> to fi
nd out!!!!"X$
720 MODE1:COLOUR129:VDU28,4,27,35,4,19,
1,2;0;29,128;192;:CLS
730 COLOUR0:FORX=10TO26STEP4:PRINTTAB(X

```

PROGRAMS





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# SNIPER AMBUSH

```

,1)T$:NEXT
740     FORX=1TO11:PRINTTAB(L(X,2),L(X,1))T
$:NEXT
750     COLOUR2:FORX=3TO11:PRINTTAB(L(X,2)+
2,L(X,1)+2)CHR$232:NEXT
760     COLOUR0:PRINTTAB(0,15)T$:TAB(3,17)T
$
770     PRINTTAB(0,14)W$
780     PRINTTAB(23,15)"TIME:      "
790     PRINTTAB(0,22)"Shoot snipers as the
y fire. Keys'A&Z'(Up/Dn)'N&M'(Aim)'B'(Fire)";
800     PRINTTAB(10,13)Q$
810     GOTO40
820     PRINTTAB(0,22)SPC(63);TAB(0,22)"You
have been shot! in time:";TM;TAB(0,23)"This
is the one that shot you";
830     FORI=100TO600STEP-1:SOUND1,-15,I,1:N
EXT
840     FORI=0TO10:COLOUR2:PRINTTAB(S(K,2),
S(K,1))S$(2):FORJ=0TO500:NEXT:COLOUR1:PRINTTA
B(S(K,2),S(K,1))S$(2):FORJ=0TO500:NEXT,:GOTO8
80
850     IFTB>TM TB=TM
860     PRINTTAB(0,22)SPC(63);TAB(0,22)"Y
ou shot all snipers in time:";TM;TAB(0,23)"Be
st time so far:";TB;
870     FORI=60TO100:SOUND1,-15,I,1:NEXT
880     *FX15
890     FORI=0TO7000:NEXT:COLOUR2:INPUTTA
B(0,22)"Press <RETURN> for next game."SPC(34)
X$
900     MX=RND(27)*8:K$="0000000000"
910     TM=0:MN=0:FR=0
920     GOTO720
930     DATA3,15,0,127,255,252,0,60,8,3,2
55,192,63,255,188,0,60,0,15,255,240,55,247,24
8,0,60,138,15,255,248,31,63,248,0,60,40,126,2
55,126,31,60,240,0,60,138,127,255,254,24,60,4
8,0,60,162,255,255,252,0,60,0,0,60,160,127,22
3,252,0,60,0,0,60,32
940     DATA0,252,63,252,2,124,3,252,0,12
4,1,252,1,124,3,60
950     DATA2,4,1,18,3,6,2,20,3,24,4,11,4
,29,6,10,6,15,7,21,8,26
960     DATA51,255,219,255,253,255,183,25
5
970     DATA249,113,113,33,255,113,123,21
9
980     DATA0,0,0,0,0,0,0,0,160,0,247,224
,255,241,247,255
990     DATA248,115,113,255,115,251,118,2
55,38,253,250,251,254,247,112,255
1000    DATA5,6,8,10,8,15,9,21,10,26
1010    DATA47,127,10,50,54,79,110,39,70,
37,119,110,60,60,37,167,102,127,80,29,207,94,
200,120,21

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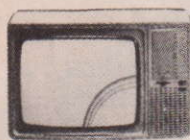
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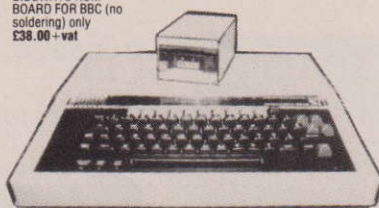


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```

IST 5 REM **BIORHYTHMS**BBC VERSION**CONVERS
ION BY IAN THOMAS**ORIGINAL BY R.ERSKINE**
10 MODE7:GOSUB590
20 TTAL=0:TTAL2=0:PRINT'CHR$141;CHR$&82;CH
R$157;CHR$&84" Biorhythms.
"CHR$156'CHR$141;CHR$&82;CHR$157;CHR$&84"
Biorhythms. "CHR$156
30 PRINT"" Birth Year:""" Birth Month
:""" Birth Day:"
40 PRINT"" Year Required:""" Month
Required:""" Day Required:"
50 PRINTTAB(0,4)CHR$136:INPUTTAB(14,4)Y:PR
INTTAB(0,4)" "
60 PRINTTAB(0,6)CHR$136:INPUTTAB(15,6)M:PR
INTTAB(0,6)" "
70 PRINTTAB(0,8)CHR$136:INPUTTAB(13,8)D:PR
INTTAB(0,8)" "
80 PRINTTAB(0,12)CHR$136:INPUTTAB(17,12)Y1
:PRINTTAB(0,12)" "
90 PRINTTAB(0,14)CHR$136:INPUTTAB(18,14)M1
:PRINTTAB(0,14)" "
100 PRINTTAB(0,16)CHR$136:INPUTTAB(16,16)D1
:PRINTTAB(0,16)" "
110 TTAL=(Y-1)*365.25
120 TTAL2=(Y1-1)*365.25
130 IFM>1 TTAL=TTAL+M(M-1)
140 IFM1>1 TTAL2=TTAL2+M(M1-1)
150 IFM-1>1 AND Y/4=Y DIV4 TTAL=TTAL+1
160 IFM1-1>1 AND Y1/4=Y1 DIV4 TTAL2=TTAL2+1
170 TTAL=TTAL+D:TTAL2=TTAL2+D1
180 DAY=TTAL2-TTAL
190 IFM1=M AND D1=D GOSUB520
200 MODE5:VDU29,0;512;
210 GOSUB420
220 P=DAY-(23*(DAY DIV23))
230 E=DAY-(28*(DAY DIV28))
240 I=DAY-(33*(DAY DIV33))
250 COLOUR1:GCOL1,1:PRINTTAB(0,29)"Physical
cycle."
260 MOVE0,400*SIN(P*C/(5*11.5*PI))
270 FORN=P*C TO (P*C)+1280 STEP4
280 DRAWN-(P*C),400*SIN(N/(5*11.5*PI))
290 NEXTN
300 COLOUR2:GCOL1,2:PRINTTAB(0,30)"Emotiona
l cycle."
310 MOVE0,400*SIN(E*C/(5*14*PI))
320 FORN=E*C TO (E*C)+1280 STEP4
330 DRAWN-(E*C),400*SIN(N/(5*14*PI))
340 NEXT
350 COLOUR3:GCOL0,3:PRINTTAB(0,31)"Intellec
tual cycle.";
360 MOVE0,400*SIN(I*C/(5*16.5*PI))
370 FORN=I*C TO (I*C)+1280 STEP4
380 DRAWN-(I*C),400*SIN(N/(5*16.5*PI))
390 NEXT
400 PRINTTAB(0,0)"Biorhythm for "
410 REPEATUNTILGET=32:RUN

```



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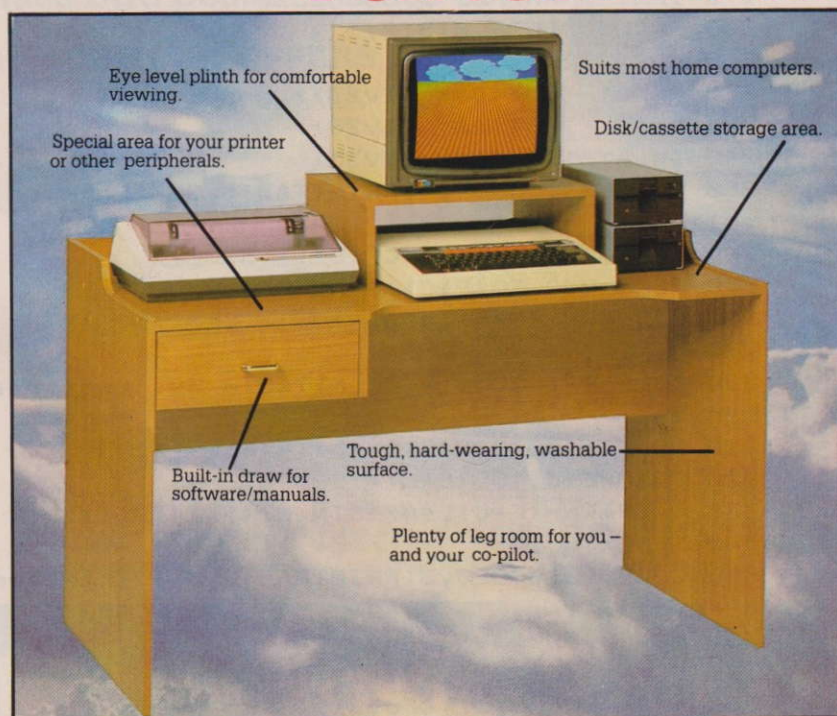
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```

420 REM
430 C=49.3478261
440 COLOUR2:PRINTTAB(0,0)"Divisions=Days"
450 FORX=1TO25
460   MOVEC*X,-16:DRAWC*X,16
470   NEXT
480 MOVE0,-400:DRAW0,400
490 PRINTTAB(0,1);D1"/";M1"/";Y1"+"
500 MOVE0,0:DRAW1280,0
510 RETURN
520 RESTORE540:FORI=0TO24:READA,B:SOUND1,-1
5,A,B
530   SOUND1,0,0,2:NEXT
540 DATA101,3,101,3,109,5,101,6,121,6,117,1
0
550 DATA101,3,101,3,109,5,101,6,129,6,121,1
0
560 DATA101,3,101,3,137,5,121,6,117,6,117,6
,109,10
570 DATA141,4,141,4,137,5,121,5,129,7,121,1
2
580 RETURN
590 RESTORE630:DIMM(11)
600 FORX=1TO11
610   READ M(X)
620   NEXTX
630 DATA31,59,90,120,151,181,212,243,273,30
4,334
640 RETURN

```

## PAYPACKET

Paypackets is a short utility program from *60 Programs for the BBC Micro* by Erskine, Walwyn, Stanley and Bews, four top software writers. This one sorts out the problems of deciding how many units of what currency you need to make up a total amount. Any number of different amounts can be handled.

```

1 REM *** BBC VERSION ***
2 REM *** PAY PACKETS ***
10 REM PAYPACKETS.....WALWYN
20 REM C*(X)=NAME OF CURRENCY
30 REM CV(X)=CURRENCY VALUE IN POUNDS
40 REM CA(X)=AMOUNT OF UNITS REQUIRED OF T
HIS CURRENCY
50 REM CB(X)=TOTAL AMOUNT OF UNITS REQUIRE
D OF THIS CURRENCY
60 DIM C*(10),CV(10),CA(10),CB(10)
70 FOR J=1 TO 10 : READ C*(J),CV(J)
80   C*(J)=LEFT$(C*(J)+".",21)
: NEXT J
90 DATAONE PENCE,0.01,TWO PENCE,0.02,FIVE
PENCE,0.05
100 DATATEN PENCE,0.1,TWENTY PENCE,0.2,FIFT
Y PENCE,0.5
110 DATAONE POUND,1,FIVE POUND,5,TEN POUND,
10
120 DATATWENTY POUND,20
130 SR=0 : XX=0 : @%=&20209
140 R2*=CHR$(157)+CHR$(129) : R1*=CHR$(157)
+CHR$(135) : R*=CHR$(135)+R2*
150 MODE 7 : VDU 23,1,0;0;0;0;
160 PROCTable
170 PRINT TAB(0,2);R*'R*;"PRESS "R1*"+0 "R
2*"TO INPUT A NEW PAYMENT"

```



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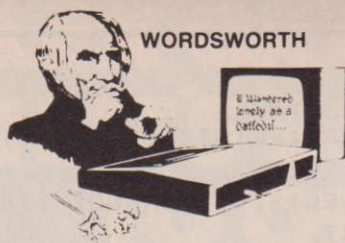
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```
180 PRINT R$'R$;"PRESS "R1$"+1 "R2$"+TO GIV
E TOTAL AMOUNT"
190 PRINT R$'R$;"PRESS "R1$"+9 "R2$"+TO CAN
CEL ALL DATA"
200 PRINTR$
210 REPEAT : KEY=0
220 REM CHECK FOR INSTRUCTION KEY
230 XX=0 : SR=1
240 IF INKEY(-33) THEN PROCpacket : KEY=1
250 IF INKEY(-114) THEN XX=1 : KEY=1
260 IF INKEY(-120) THEN RUN
270 UNTIL KEY
280 GOTO 150
290
300 DEF PROCpacket
310 PRINT TAB(0,0);CHR$(134); : INPUT "CASH
AMOUNT IN PACKET ",A$
320 A=VAL(A$):A1=A
330 PRINT CHR$(134); : INPUT "NO OF PACKETS
",B$
340 B=VAL(B$):B1=B
350 PROCcalculate
360 ENDPROC
370
380 DEF PROCTable
390 AT=0 : PRINT TAB(0,9);CHR$(148);"*****
....."
400 PRINT TAB(0,10);CHR$(134);"CURRENCY"TAB
(15)"NO. OF UNITS"TAB(31)"AMOUNT"
410 FOR J=1 TO 10
420 PRINT C$(J);
430 IF XX=1 THEN C$=STR$(CB(J)) ELSE C$=S
TR$(CA(J))
440 PRINT SPC(4-LEN(C$));C$;
450 IF XX=1 THEN A=CB(J)*CV(J) ELSE A=CA(
J)*CV(J)
460 AT=AT+A
470 PRINT CHR$(130),A
480 NEXT
490 PRINT TAB(20);CHR$(148);"*****"
500 PRINT TAB(20);CHR$(130);"TOTAL:";AT
510 IF SR=0 THEN ENDPROC
520 IF XX=1 THEN PRINT R$"THIS IS THE RUNNI
NG TOTAL" : ENDPROC
530 PRINT CHR$(131);STR$(B1);" x £",A1;
540 PRINTCHR$(131);"THIS IS A SUB-TOTAL";
550 ENDPROC
560
570 DEF PROCcalculate
580 REM CALCULATE CA(X)
590 X=0 : A%=A*100
600 FOR J=10 TO 1 STEP -1
610 CA(J)=0
620 REPEAT
630 IF A%>=CV(J)*100 THEN A%=A%-CV(J)*1
00 : CA(J)=CA(J)+1
640 UNTIL A%<CV(J)*100
650 NEXT J
660 FOR J=1 TO 10 : CA(J)=CA(J)*B : NEXT J
670 FOR J=1 TO 10 : CB(J)=CB(J)+CA(J) : NEXT
680 ENDPROC
```





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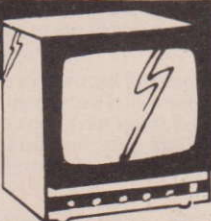
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Beeb books lean towards learning this month. As the man said, "Beginners Assembly Language Programming for the BBC" by Tom De Havas and Peter Holmes makes the subject elementary.



**Beginners Assembly Language Programming for the BBC**

by Tom De Havas and Peter Holmes.  
Honeyfold  
£14.95 with cassette.

This is part of the Dr Watson Computer Learning Series, so maybe it's appropriate that one of the authors is called Holmes. Forming a learn-at-your-own-pace course, it unravels the Great Assembly Language Mystery even for those who have previously found it about as impenetrable as the fogs said to have covered London in the Victorian sleuth's day.

The gentle, painstaking, first chapter sets the tone for the rest of the book. Every new point is illustrated in an example program, and the first time round every line is explained. Each new mnemonic is clearly shown with a description, and the reader's grasp of each new point is tested by an exercise — answers at the back, no cheating.

Because it does add up to a course rather than a text book, the reader ought not to get to a point and feel stuck. Repeating the previous chapter and exercise should solve the problem. Not only does this make life easy for the beginner, it should also help anyone who tried assembly language once, didn't get far, and gave up. Time for another go.

Binary, binary-coded decimal and hexadecimal numbers are introduced at easy stages. In the early chapters only decimal

numbers are used. This sensibly allows the reader to get to grips with assembly before having to sort out new number systems.

The accompanying cassette contains a tutor program to help with learning binary, binary-coded and hex, and also a disassembler. With the book's glossary, appendices and many diagrams, this package should stay useful long after the reader has become quite proficient.

If a bit high-priced, this book is good value for anyone seriously wanting to move on from Basic to assembly. The authors say they tried it out on a novice, and it shows that it is written with the novice's problems in mind.

Elementary, my dear Watson.

Mark Smulian

**Easy Programming for the BBC Micro**

by Eric Deeson.  
Shiva Publishing  
£5.95.

**Further Programming for the BBC Micro**

by Alan Thomas.  
Shiva Publishing  
£5.95.

Eric Deeson is clearly a fan of the BBC Micro — he calls it 'marvellous' in his first line — and his enthusiasm shows throughout the book. As you might expect from a school teacher, each point is taken slowly and in a clear order, with enough easy-to-follow examples to drum the points into even the least receptive student. Each example is usually a short complete program rather than an odd line or two, so it is easy to see what is going on.

The book aims squarely at the beginner, starting with advice on connecting the BBC to a TV set and cassette recorder. From this it moves through fundamentals like 'What is a program?' to printing, creating characters, loops, number crunching, subroutines, strings, sound and graphics, finishing with arrays. Useful explanations of flowcharting, debugging and differences between

Basics are included, and it is written for the Model A throughout.

Despite the somewhat schoolmasterly tone it would be difficult to read this and not grasp the points made, so it is a good introduction for any age group. The cartoons are fun, too.

Alan Thomas' book contains some 90 sample programs. It makes a logical follow-on but takes a different approach, relying mainly on the programs. The explanations are clear but brief, so the reader needs some experience of the BBC before starting on this book. The sample programs range from simple games like Hangman and Duck Shoot to the somewhat more educational Algebra and Hexadecimal.

My only gripe is that the index is unnecessarily difficult to use, being listed either by program name or titles like Basic II or Print III. This makes it hard to track down particular points. That said, this is a useful post-beginner stage book, and should give readers the confidence to explore the BBC's possibilities for themselves.

Mark Smulian



**Functional Forth for the BBC Computer**

by Boris Allan.  
Sunshine  
£5.95.

Boris Allan never actually says this is a beginner's book, but his introduction seems to aim at the newcomer. Unfortunately, Allan knows his stuff so well

that he does not get down to the novice's level sufficiently to make this easy going.

The back cover says that 'this is not a manual' and that it is more concerned with the use of Forth in 'analysing its logical implications and in the use of graphics than with more mundane numerical applications'.

Well, fair enough. If you want a manual, buy a manual; but this approach has led to a surfeit of advanced detail and a scarcity of example programs. This makes it hard for the reader to learn by seeing and doing.

Allan begins with an explanation of the composition of a Forth word, while leaving his explanation of reverse Polish notation and logic to chapter 6. Most similar books cover these topics the other way round, and he does seem to throw the reader in at the deep end.

In the middle of the reverse Polish notation we get, without further comment or explanation, a sudden reference to the Lisp language. This is confusing and further clutters what ought to be a clear explanation.

This approach appears again in his chapter on turning turtle graphics, where we go off suddenly into Logo with hardly a word. A whole lot of new words and ideas appear, leaving the reader less than clear about what is going on. One of the major attractions of Forth is its speed for graphics — many arcade games use it — and graphics gets an appropriately long treatment.

A friend who professionally uses Forth found parts of this book 'incomprehensible', but said it would make an interesting buy for the enthusiast seeking a third book after buying an introduction and a manual. Approach with care, but if you have an interest in logic and computer workings this may be right up your street.

Mark Smulian



# THE ULTIMATE UTILITY ROM

## Disc Doctor

This ROM started life as a few disc utility routines. However it has steadily been extended to include very many new commands and features, some of which have nothing to do with discs.

There follows a list of all the commands in this ROM. These can be entered from the keyboard or can be combined into the user's program. They are also accessible from other language ROMs such as WORDWISE.

### \*DIS

This is a very powerful disassembler. Special options allow 'offset' disassembly (which makes the disassembly appear to have come from another address), following of jumps and branches and skip calls to the MOS or BASIC. Output can be directed to file or the printer.

### \*DISCTAPE

This command will automatically transfer files, machine code and BASIC programs from a disc to tape.

### \*DOWNLOAD

Loads a file from tape or disc and moves it to any address. The normal address is &E00 allowing programs to be run on Disc systems without any loss of memory.

### \*DSEARCH

Will search the current disc for a string of characters or any sequence of bytes. The search starts from any track. When found the disc editing routine (DZAP) is entered.

### \*DZAP

This is a disc editing routine that displays any sector of the disc. The cursor may be moved around the sector and new values can be entered in hex, decimal or binary or as ASCII text.

### \*EDIT

Displays the contents of any function key for editing, so that long and complicated \*KEY definitions do not have to be entered from scratch every time any alteration is needed.

### \*FIND

Allows a BASIC program to be searched for any string, such as variable or procedure names, displaying all line numbers in which that string occurs.

### \*FORM

Formats blank discs to any number of tracks. Options allow only specific tracks to be formatted. One special option will format discs that can have dual catalogues allowing 60 files per side of the disc.

### \*JOIN

This will join one or more disc files together as one file. It may also be used for making copies of any file on the disc.

### \*MENU

Typing \*MENU or pressing M-BREAK will display a menu of all files on the disc saved under a special directory. Simply selecting one of the menu options will load and run the program.

### \*MOVE

Moves a BASIC program from any page to any new page in memory. Amongst many other uses this allows programs on disc machines to be moved to &E00.

### \*MSEARCH

Searches memory starting at the given address for any string or sequence of bytes. If the string is found, the area of memory is displayed with the memory editor (MZAP).

### \*MZAP

Very much like the disc editor, this displays a window into memory. Once the cursor has been moved to the correct byte, new values may be entered in hex, decimal, binary or as ASCII characters. The window may be scrolled up or down through memory.

### \*PARTLOAD

Allows any part of a file to be loaded into memory. This would allow a very large file to be split up into more manageable units.

### \*RECOVER

Any number of sectors can be loaded from the disc into memory with this command. Allows the recovery of any data from the disc such as deleted programs etc.

### \*RESTORE

The opposite of the above command. Puts back directly onto the disc any section of memory.

### \*SHIFT

Used to move any section of memory to any other address.

### \*SWAP

This swaps catalogues on special dual catalogue discs, allowing up to 60 files per side of a disc — almost twice the normal.

### \*TAPEDISC

The opposite of DISCTAPE, this will automatically transfer files from tape to disc.

### \*VERIFY

Verifies that the disc specified is readable.

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## Termi

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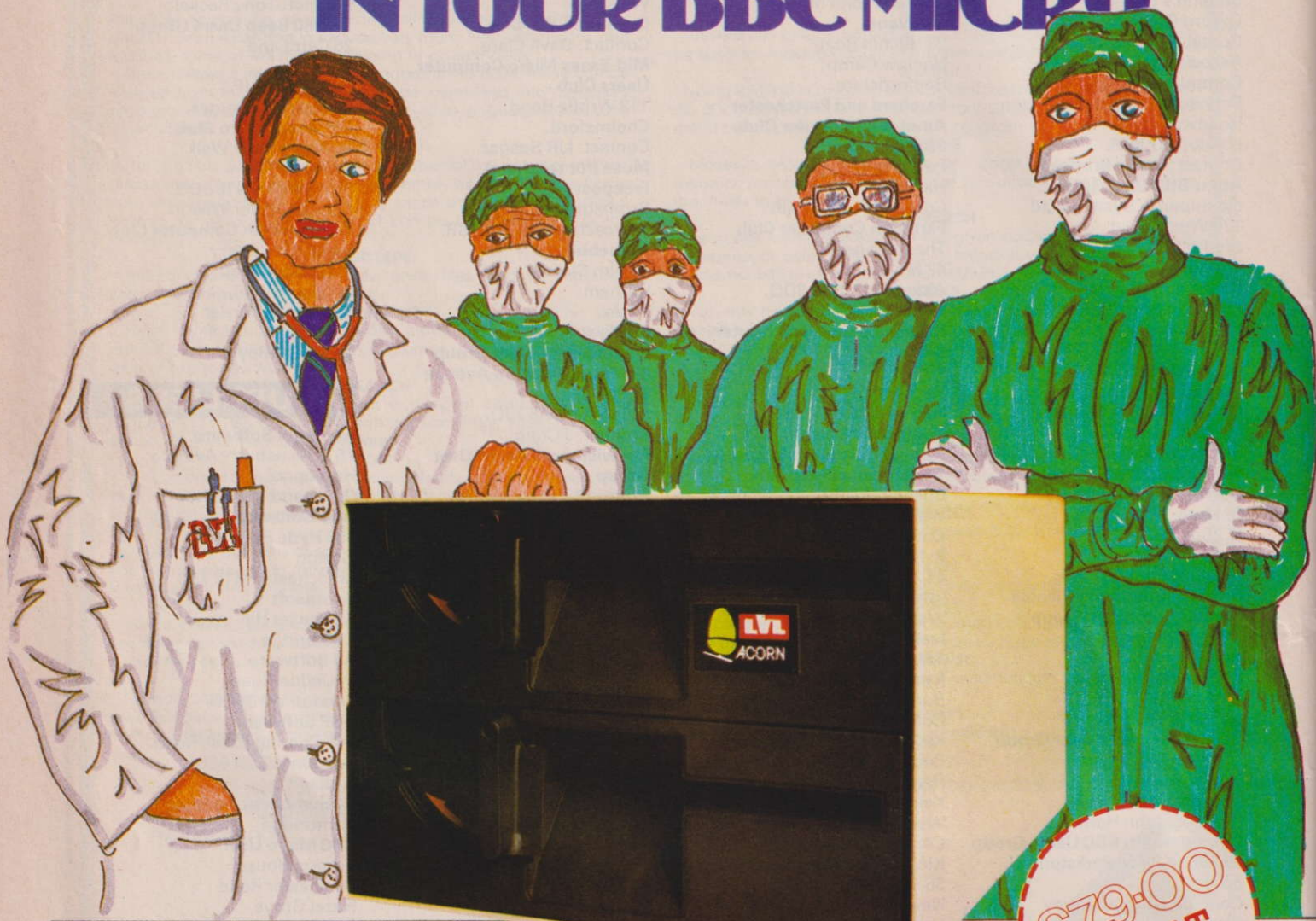
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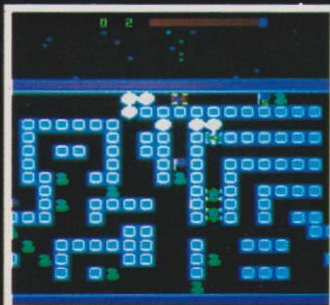
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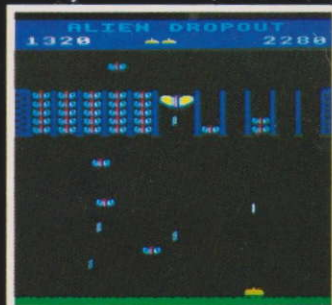


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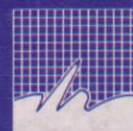
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