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# A&B

May/June  
1984

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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration.

All submitted material should be typed, double spaced if possible, and any program submitted should be listed, a cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation and, where relevant, the structure; cassettes of the program should also be included so that screen photographs and printer dumps can be included to illustrate the article. (Cassettes will, of course, be returned in due course).

All submissions will be acknowledged and any published work will be paid for at competitive rates. All work for consideration should be sent to the Editor of A&B Computing at our Golden Square address.



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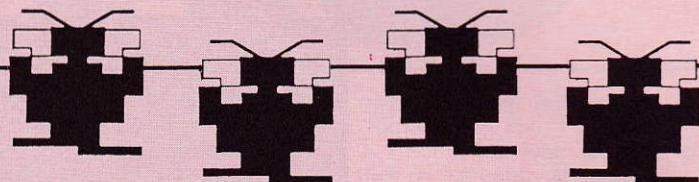
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E.H.T.	Minimum 19.5kv Maximum 22.5kv	Minimum 19.5kv Maximum 22.5kv
VIDEO BAND WIDTH	10MHz.	6MHz.
DISPLAY	80 characters by 25 lines	80 characters by 25 lines
SLOT PITCH	0.41mm	0.63mm
INPUT: VIDEO	R.G.B. Analogue/ TTL Input	R.G.B. Analogue/ TTL Input
SYNC	Separate Sync on R.G.B. Positive or Negative	Separate Sync on R.G.B. Positive or Negative
EXTERNAL CONTROLS	On/off switch and brightness control	On/off switch and brightness control



# Menu

The underlying theme of A&B this issue has to be the expandability of the BBC Micro and now the Electron. With commendable speed (the Electron was launched last August and has never been easy to get hold of) designers and manufacturers have got together to produce the interfacing hardware and software which make available many of the BBC associated products.

Our special Peripherals Roundup does not pretend to be comprehensive but is designed to give a good idea of the variety of products now available, with up to date prices and contact addresses. We also take an all too brief look at the new 6502 second processor and the Robocom Bitstik. We will give both a thorough going over in a future issue. The 6502 was a long time coming but looks to have been worth the wait.

Amongst all this talk of hardware we have the usual line up of games, educational, domestic and utility programs. Centre Court gives you two player tennis action, while the opposition in Skoogs consists of rather too many of these mischievous

marsh dwellers. Mind the marmalade!

For those who like to do their own programming, we offer advice in Advanced Graphics and Machine Code Capers plus a couple of handy programming utilities.

## NEWS

We leave you with news from Acorn that a substantial level of investment in advanced research and development projects in the UK is to be maintained as well as an extension into new areas at a new research centre based in Silicon Valley, USA.

Acorn, like other computer companies, is feeling the effects of a worldwide shortage of standard components but feels it can weather the storm and deliver new products resulting from its R and D investments. The Z80 second processor should be around in a month or so and will come with some specially commissioned business software, though nothing particularly stunning.

*The 6502 second processor and Robocom Bitstik*





# News

## BACK NUMBERS

Back numbers of *A&B Computing* are available from the Subscriptions address, *A&B Computing*, Infonet Ltd., Times House, 179 The Marlowes, Hemel Hempstead, Herts HP1 1BB.

Back issues currently cost £2.45. Subscriptions and binders are also available from this address.

## NETWORK NEWS

As well as launching the 6502 processor, Acorn have announced the corresponding upgrade of the Econet networking system. Steve Love (who is still on his PhD at Cambridge) was quick to announce on behalf of Acorn that Econet was definitely not being dropped by the company but would rather be the subject of future development.

The level 2 file server relies on the new 6502 processor and gives many of the facilities perhaps usually expected of a disc filing system. The level one had no random access, limited storage and no protection. All of these features are now incorporated. There is a log on password facility as well as individual file passwords. It supports up to 256 entries and is not restricted by the 31 files allowed per disc as is normal. Command words such as VIEW and REMOTE are available and the level 2 costs £249.

If the second processor is out of bounds to you for reasons of cost then Broadway Electronics, as well as announcing their new Electron add-ons, have launched a Super Level One. This clocks in at only £125 plus VAT and offers enhanced level one capability. It supports BASIC's random access capability and provides unlimited file length, also overcoming the 12K limit and allowing the use of programs like Wordwise and Beebcalc on Econet.

The Super Level One sounds like an interesting alternative and along with the Electron add-ons, Broadway Electronics had an excellent christening of their new premises, open-

ed by Ian McNaught Davis of television fame.

## ACORN NEWS

Acorn continue their expansion into foreign markets with considerable investment in the start up schemes in the United States and Germany. Their subsidiary, the Acorn Computer Corporation of Boston, Massachusetts, has already notched up over \$50 million worth of education orders for the BBC Micro system, including a prestigious order for networks from the Washington District School Board, Phoenix, Arizona. This was won in the face of stiff competition from Apple and Atari.

The American version of the BBC is tailor made for schools with disc interface, speech synthesis and word processing built in. It also includes Econet. List price is \$995. There are now over 1,000 dealers selling the BBC in Canada and in the

U.S.A. and public awareness of the machine has been helped by the previous showing of the BBC's 'Computer Programme'.

To emphasise Acorn's educational role, the corporation has created a 'National Educational Advisory Board'. This team of distinguished U.S. education experts vets all educational programs for the BBC Micro, of which there are now 200 offered in the U.S. Acorn also supply a 'learning system' to accompany the computer. This includes lesson plans, work books, teachers' support material and students' notes.

## BUSINESS BASE

As well as considerably updating their cassette system database, Gemini are on the verge of producing their Database in ROM, a 24K chunk of machine code which controls a disc based random access management system. The cassette update also benefits

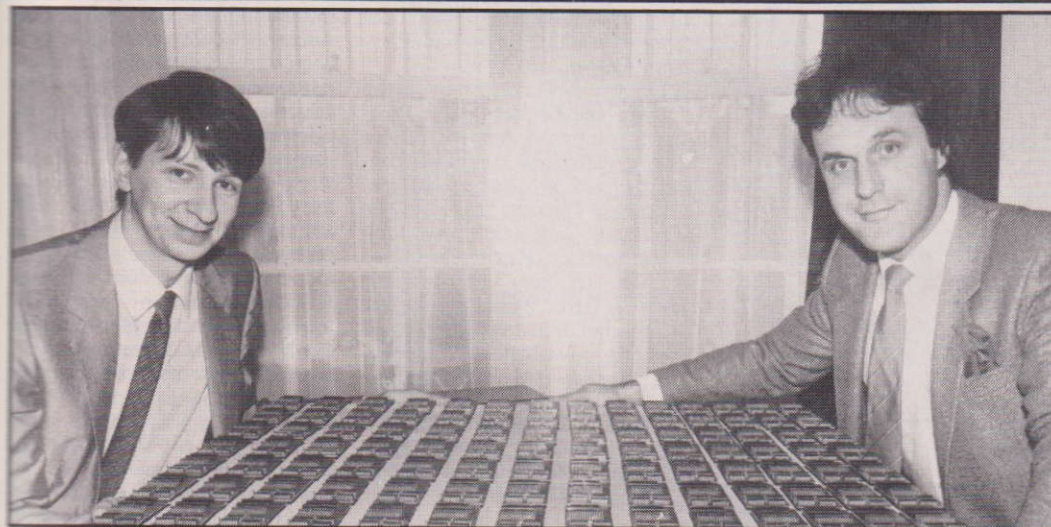
from a number of memory saving machine code routines.

Full details are not yet available but the original 16K version of the ROM has been extended to 24K due to considerable feedback from users. The intention is to later release a large range of inexpensive application 'masks' that will allow the immediate configuration of the data base for performing such tasks as invoicing, stock control, insurance broking and so on. Conversion work is also under way for the U.S. version. Gemini have got themselves a version of the U.S. MOS and are taking advantage of it.

Meanwhile they are also marketing a new integrated system of business software, which, like the MIRLE software, needs no second processor and which requires only 40 or 80 track discs. The small business package costs £99.95 per module and there will be substantial back up services offered by







Gemini and the originators, Home and Continental Services. An interface with the database ROM is planned as are disc based CAD/Stats and critical path analysis (PERT) packages.

## HAMA HELP BRIDGE THE GAP

Hama Systems of Norwich is launching into the specialised but growing field of Business Education. Computers are extensively used as desk top decision makers in business and it seems the logical step to educate the businessmen of the future on microcomputers. Hama intend to help bridge the gap between academic theory and business reality, and they intend to do it on BBC and Torch systems.

The software teaching units vary in price from £12.50 in the Micropax range to the complete Woodstock business game package, which will knock you back the cost of a double disc drive. Obviously Hama intend to find their market in higher education. Software of this kind relies heavily on documentation and the old Micropax packages left something to be desired in this area. It remains to be seen whether Hama's new strategy has taken this into account.

Certainly they seem to have the most comprehensive

catalogue of Business Education software available, including specialised software such as Time Series Critical Path, Linear Programming, Discounted Cash Flow and Business Statistics. Hama are to put an emphasis on user friendliness as well as 'What if?' facilities and dynamic graphics. This hopefully means an improvement on some of the early Micropax programs, for instance the Leaguemaster which predicted how many goals would be scored but did not round the fractions.

Further information about Hama's range of cassette and disc

based software is available from Hama Systems Ltd., 44-48 Magdalen Street, Norwich NR3 1JE.

## TREAT YOUR ELECTRON

The latest established BBC software house to bring out Electron versions of their favourite games is Superior Software. You can now treat your Electron to Centibug (néé Centipede), Alien Dropout, Invaders and Fruit Machine. For those who like the idea of programming their own

machine code games, Superior also have a Disassembler with some nice features, including the ability to output the disassembled code to memory.

Also in Superior's range is the rather conventional sounding World Geography but the star attraction could well be Constellation. This program allows you to view the stars from any point on the Earth's surface (not literally of course), on any date and at any time. The telescope can be moved and zoomed in or out. A total of 455 stars in 50 constellations can be looked at, either by constellation or magnitude. Just the job for any budding Patricks Moores.

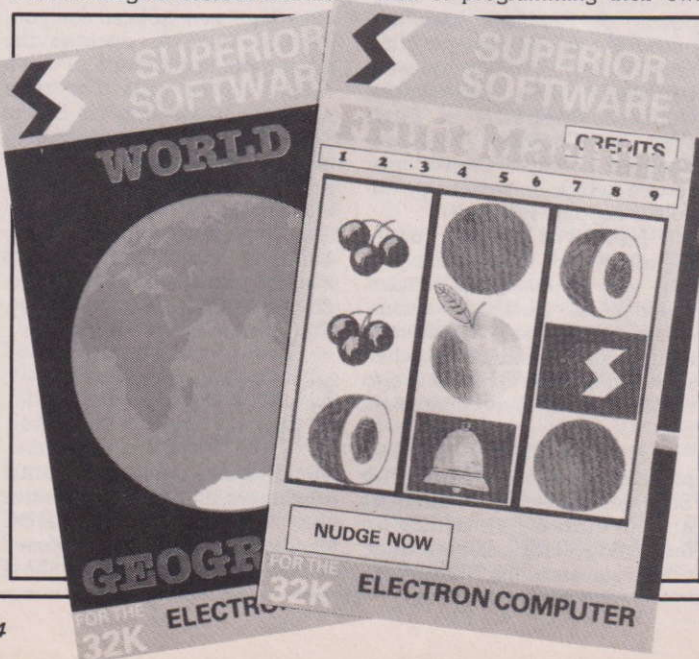
## EXPERT SYSTEM FOR THE PHARMACY

A certain Mr John Richardson, proprietor of a busy pharmacy has designed a software package which deals efficiently and comprehensively with all the stock control and drug control tasks carried out in chemists every day.

The software is offered as part of a complete system based around the BBC and including Epson printer and disc drives. Cassettes can however be used. John Richardson Computers Ltd. also offer a maintenance contract and two months trial period. Up to 2,000 drugs can be stored on the system (1,000 are supplied with the software) and the program deals with all codes, gives dispensing statistics for all drugs in memory, gives cautionary warnings on labels, prints repeat labels at high speed, prices automatically and instantly remembers items to be re-ordered. From a business point of view the system obviously offers considerable advantages over conventional systems and features like the Drug Interaction Alert give good safety precautions for the professional pharmacist.

Further information about the system from John Richardson Computers, Unit 337, Walton Summit, Bamber Bridge, Preston, Lancashire PR5 8AR.

**CONTINUED OVER**





## VS Me



## BODY LANGUAGE

Garland Computing can now be considered the foremost BBC Micro software company in the field of science and maths. Their schools software includes titles in human and plant biology, physics and chemistry and ecology. Their mathematics programs for the 9+ age range are now among a number of programs being made available to the home user.

Garland programs use animations and simple games to illustrate important principles of elementary maths. Also for the home market are three series entitled Understanding the Human Body, Understanding Physics and Understanding Chemistry. The programs include animated graphics and allow the user to perform simulated experiments at home — often safer than the real thing perhaps. The programs are ideal for 'O' and 'A' level studies.

Further details from: Garland Computing, 35 Dean Hill, Plymouth PL9 9AF.

## NORTHERN BREAKDOWN SERVICES

The North can now count itself among the best covered regions for repair services for BBC Microcomputers. Eltec Computers of Bradford have announced a dealer network of 52 retail outlets, all of which deal in hardware. More interestingly, Northern Computers of Frodsham in Cheshire, have announced a comprehensive repair service which enterprisingly involves regional ITECs.

Northern Computers themselves are offering one and four year maintenance contacts covering all parts and labour. Customers will self deliver their injured micros and return when servicing is done. There will also be a collection service at extra cost.

At the same time six ITECs providing Youth Training Schemes covering computers and related information technology for unemployed school leavers in the North West,

will join a computer repair pilot scheme in conjunction with Northern Computers.

The ITECs joining the scheme will be designated Northern Computers Agency Service Centres and will give the company wide geographical coverage. The first ITECs will be at Wigan, Lancaster, Liverpool, Warrington, Knowsley and Preston and they will carry out work on BBC Micros although it is intended that they should extend to cover other machines eventually. Much of the necessary equipment is already available at ITECs and Northern Computers will supply components, and any additional staff training required by ITC supervisors.

The ITECs see the venture as a much needed source of income while providing a service to the public and training young people for employment in local firms.

## MAD MOLECULE

Research scientist Kevin Lawrence had come up with a game for the BBC Micro involving the catastrophic effects of a new virus which is decimating the world's population. As usual the innocent computer game player is thrust into the unwanted role of 'world saviour'.

In 'Molecule' the deadly virus has been isolated for you, but you have to discover the structure of its molecule so that a vaccine can be made. The game is a logical extension for Bridge Software who are known for their range of scientific and astronomy programs for the Sinclair machines. The BBC version of 'The Night Sky' is now available. Molecule cost £6.90 and is available from Bridge Software, 36 Fernwood, Marple Bridge, Stockport, Cheshire SK6 5BE.

## COPYRIGHT CHASING

The BBC copyright department is continuing its battle to preserve the integrity of the BBC trademark, which is threatened by the irresponsible use of those

three influential letters. The Acorn BBC Microcomputer has been an outstanding success, partly at least due to Acorn's licensing agreement with the corporation. Now the Beeb is concerned that peripheral and software manufacturers are misusing the BBC trademark in their advertising. Some copy even seems to deliberately imply an association which does not exist.

Tom Rivers, the overworked lawman from the Beeb, whose job it has been to write letters to the various companies informing them of the situation, says that in most cases a genuine misunderstanding has occurred. It seems that many companies are ignorant of how far they are allowed to take the use of the BBC trademark. Mr Rivers believes that his campaign should soon see results in the sort of advertising copy appearing in BBC Micro related magazines and that the BBC should not have to pursue the matter further.

## SOCKET TO 'EM

Toad Educational Computing have decided to save wear and tear on BBC Micro lids. For £19.99 they will supply you with their ROM extension socket, dust cover and full fitting instructions.

The single socket sits on top of the Beeb keyboard and the idea (though doubtful practice) is to plug and unplug your favourite EPROMS. There is no soldering involved in the installation which is a big plus for the ham-fisted amongst us Beeb owners. The obvious application for the extension is a Wordprocessing or Spreadsheet application which is in use most or all of the time. I can't imagine that too many users will enjoy the prospect of pushing home all those pins correctly every time they switch software.

The extension is available from: Toad Educational Computing, Dept PR, 8 Westbourne Grove, Sale, Cheshire, M33 1RP.

## DISC BASED

Disc based databases seem to be this month's flavour but Silversoft have gone one further with



Viewbase. Yes, you guessed it, Viewbase is designed to work in conjunction with Acornsoft's View and will make a nice threesome with Viewsheet, which will be with us shortly.

The database does not rely on View but offers the ability to work with Acornsoft's word processing package if need be. The user will be able to transfer information from specific fields of all, or selected, records to a new file which can then be used by View. The combination is a step in the direction of 'integrated' software which businessmen require.

It is possible to store 1500 records per 100K disc and the sort is fast with 1000 records per 90 seconds. Viewbase is menu driven and a manual comes with the package to fully explain each option. The cost is £24.99 and is available through mail order from: Silversoft, London House, 271-273 King Street, London W6.

## APL ADVANCES

When Acorn finally release their Z80 processor (it should not be long after March), Acornsoft will be ready with their APL language for the business (CP/M) system. Developed by Inner Product, the specifications were announced to the UK APL User Group back in January to gauge reaction and to begin the creation of a network of consultants to support the product in the field.

All the clearing banks use APL as indeed do 23 of the major 25 companies in the UK. Now Inner Product are intent on bringing the combined power of the Z80 and APL to small business users, through the BBC Micro. The announcement at Imperial College was designed to spur the APL community into providing business software for the BBC.

Acornsoft APL interacts with the machine's own colour graphics and sound facilities. This version is also apparently 50% faster than any previous 8 bit APL. The price will be around the £100 mark and for newcomers to the language, this will include a book to introduce the advantages of APL. It looks as though the BBC is going to

find itself onto a few more management desktops in the near future.

## TURBO POWER

Salamander Software have a number of new releases lined up, including Turbo, a compiler for the BBC and Electron. There is a new version of the popular 737 Flight Simulator and one for the Electron. Eagle is arcade action involving Intergalactic Geology and future release Hovver Bover sounds just as strange. Also on their way are a number of adventures, from Mediaeval times to a WW2 scenario and the latest and last in the Dan Diamond trilogy, Fishy Business.

The most interesting release for programmers has to be the Turbo compiler, which takes BBC BASIC programs and turns them into machine code. The compiler has severe limitations on the sort of program you can compile. It only supports certain BASIC statements although some good documentation explains ways of implementing others. Programs have to be kept down to 255 lines in length (no multistatement lines) and input usually has to be in hexadecimal. Not too user friendly then but a compiler which results in pure machine code which can be CALLED by their own programs

will be of great interest to amateur programmers who write their own games and the Electron especially might benefit from a bit more speed. A&B will carry a full review in a future issue.

## LINKWORD FOR LINGUISTS

The Acornsoft Linkword language series utilises a new language learning method devised by psychologist Michael Gruneberg. Linkword dispenses with traditional listen and repeat methods used by schools and language laboratories. Instead, it applies a number of psychological principles to aid memory and recall. Time saving of up to 70% is claimed for the system when used to learn a basic vocabulary and grammar.

The Linkword system involves the use of visual images and is thus ideally suited to a computer application. The Acornsoft package includes both program and audio cassettes plus an instruction booklet. Languages available are French, German, Spanish and Italian. Thomson Holidays use the Linkword system for their staff and it looks like an ideal way to cram one of these European languages before a holiday or business trip. The price is £14.95 including VAT.

## BACK TO BASE

Clares Micro Supplies have come up with an impressive disc based database for the Beeb. The total size of the file is limited only by disc space. Beta-Base, as its called, can support 200 fields, fields of up to 254 bytes and records in excess of 2000. The program has the versatility to redefine and transfer within the file and calculations can be done on mathematical fields. There are a variety of printing options.

A couple of impressive specifications include the ability to search up to five fields and sort up to three at any one time. The program will sort a file of 500 records into alphabetical or numerical order in about 60 seconds. Beta-base is priced at £25 and comes with a fully comprehensive manual and demonstration program. Further information from: Clares Micro Supplies, 98 Middlewich Road, Rudheath, Horthwich, Cheshire, CW9 7DA.

## COMPUTER HOLIDAYS FOR THE HANDICAPPED

This year, thanks to the Kent Education Department and the Headmaster and staff of Valence School in Southampton, the Computer Holiday for the Handicapped, organised by Southampton University, will support 180 places. The microcomputer has created a whole new area of opportunities for handicapped people and the 'Holiday' is designed to help the handicapped both program and use a computer for every day living.

Facilities are being made available for teachers, care assistants and therapists and a whole range of hardware is provided for their use. The holidays cost £145 for the week for full board, tuition and the use of the computers. It is hoped that assisted places may become available.

**CONTINUED OVER**



# News

Meanwhile M.A.P.s Ltd who are organising the holidays, are compiling a catalogue of programs and hardware available to help the handicapped make use of a microcomputer. If anyone has developed such aids or knows of them perhaps they could get in touch with Dr Wardle at the address below. M.A.P.s are also setting up a Computer Graphics Service, giving advice and marketing software and hardware packages, including the latest in video/computer combinations.

More information on these services and the holidays for the handicapped from Dr Lionel Wardle, 37 University Road, Southampton SO2 1TL. Tel. 0703 558621. Please send a s.a.e. if communicating by post.

## BODY LANGUAGE

Tom Shipman (Supplies) Ltd has recently released four new educational programs for the BBC. They have been developed with the aid of young people who have only recently finished studying themselves. The company feels this gives their programs an advantage amongst the children whom the programs have to please as well as educate.

Europe Rally, Word Chaser and Magic Numbers cover familiar themes but the Biology sounds like a useful study for those taking 'O' level Biology. High resolution graphics are used in the description of organs and bones in the human body and a variety of tests, including multiple choice, are employed. All programs cost £7.95. They are available from Tom Shipman (Supplies) Ltd., Heron Trading Estate, Bruce Grove, Wickford, Essex SS11 8BP.

## BBC MEDICA

There is now a BBC Medical Group run by the Primary Health Care Group. The latter body is anxious to help coordinate the efforts of all those who are finding uses for personal com-

puters in General Practice and Primary Care. The BBC branch intends to try and prevent duplication of effort by setting up a library of programs, assist novices, and run meetings around the country. The library of programs will be available free to members.

The sort of programs envisaged are small practice accounting packages, morbidity analysers, rotas and small databases for vaccination recall. There will also be a special newsletter for the BBC medical group as well as the Primary Health Care Group's own publication. Anyone interested in joining or participating in the BBC group should contact Dr Ken Walton (BBC Primary Care Group Secretary), 141 Lancelot Road, Wembley, Middlesex. There is also a bulletin board available to members with a 300 baud modem with free terminal software.

## EDSOFT GOES DISC

Ed. Soft, based in Exmouth, Devon are making their programs available on 40 and 80 track discs. Now that many educational and home users are taking the plunge into disc systems, Ed. Soft felt it was time to move on to the disc format. Included in its new range is the LOGO type PROGO, which allows DRAW, MOVE, FILL, TURN and other BBC BASIC-like commands. The program costs £8.95 on cassette and £10.50 on disc.

A&B Computing owes Ed. Soft an apology for the review of 'Music' published in the March/April issue. The reviewer looked extensively at the first program of the suite of four contained on the cassette and gave the impression that this was the only program. The fact is that 'Music' also contains a program testing on 40 plus Italian musical terms and their English meanings. Music three and four test on relative note and rest values and all in all, the programs contain all of the information which is required to pass up to grade four of the A.E.B. written examinations.

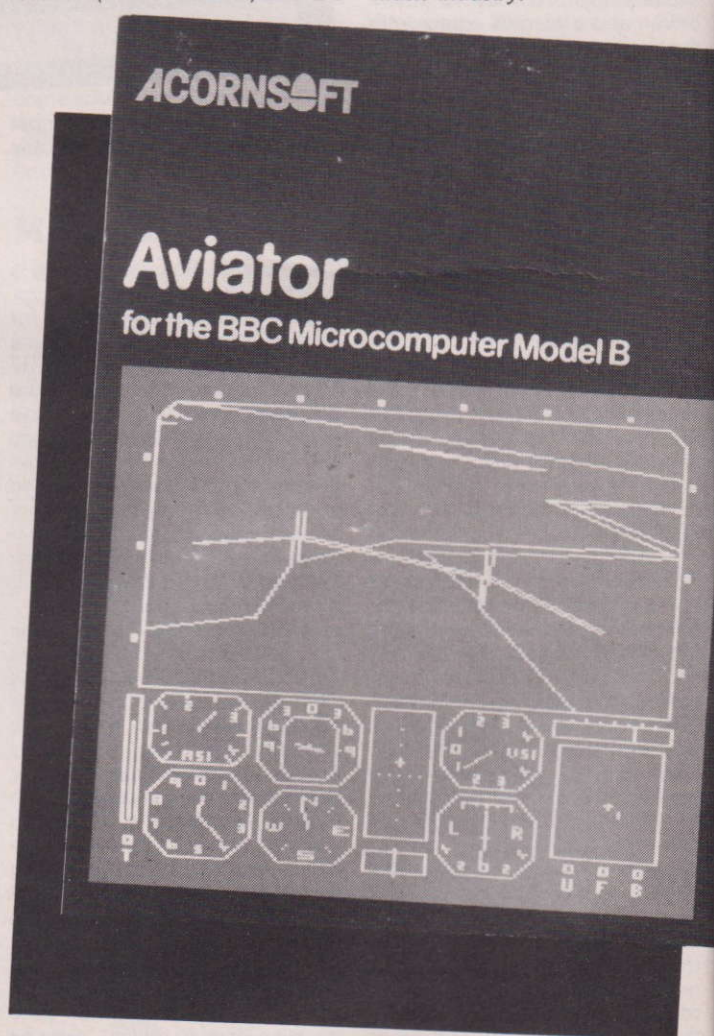
Error trapping which was not included in the preview copy of our reviewer's program, has now been included in the programs on the advice of teachers who took part in the initial testing. Music costs £9.95 and is available from Ed. Soft, 76 Woodville Road, Exmouth, EX8 1SW.

## IMAGINE GAMES AT £3.95

Imagine Software, gamers par excellence, have entered the BBC and Electron market with games called Pedro and Cosmic Cruiser (both machines) and BC

Bill (BBC only). This move coincides with Imagine's new price cutting exercise which means that the games will cost only £3.95 each including VAT, making them by far the cheapest BBC and Electron games on the shelves.

Imagine have done their market research and consider £4.00 to be the 'magic' figure above which their young customers find it difficult to pay. As Imagine point out, it also makes the illegal copying of games a waste of time. Let's hope that other software house follow suit and bring their prices into line with their counterparts in the music industry.



Acornsofts Spitfire simulation, Aviator





## NEW APPROACH FROM BEL TECH

BEL TECH Software have emerged from an engineering background in the Midlands to produce a range of programs for the BBC Model B. They range from Chemistry and Physics revision packages to 'O' level to Bel Gen, a unique database specifically written for keeping genealogical records, of either your own family or an historical figure or royal line.

Two further releases, available on disc as well as cassette, are the utilities Bel Base and Bel Graph. Both support comprehensive facilities including user defined formats and printer output. BEL TECH's sophisti-

cated programs are backed up by an excellent customer service which is reminiscent of that given by makers of business software. When you receive your software, you are invited to register as a user and a full support and advice service is then available.

Further information from BEL TECH Limited, Stanmore Industrial Estate, Bridgnorth Shropshire. WV15 5HP. Tel. 07462 5420.

## ADDENDA

Apologies to A&B readers who were frustrated by a couple of errors in the 'Hangman' listing of March/April. Lines 224 of listing one and 194 of listing two should have read `X=OPENIN fnm$`.

Readers of the Faster Basic

article by Peter Voke (Jan/Feb) were probably mystified by the lack of Program one. Well here it is.

Finally, to clear up any confusion

which may remain, the correct version of line 320 of Addsnap (Jan/Feb) reads: `UNTIL cards > 1 AND cards <= maxpos: PRINT TAB(36,7); cards.`

```

10 MODE 4
20 VDU 23;8202;0;0;0;
30 VDU19,3,1,0,0,0
40 A$=STRING$(8,CHR$255)
50 B$=STRING$(8,CHR$0)
60 FOR I%=&5800 TO &7FF8 STEP 8
70   $I%=A$
80   *FX19
90   $I%=B$
100  I%?9=0
110  NEXT
120 END

```



# Centre Court

Here is a simulation of a tennis singles match to whet the appetite for Wimbledon. It is a two player game and you have to use joysticks.

The top court player opens the serving automatically and you move your players around by pressing the fire button while manipulating the joystick. The program will make your player present either a backhand or forehand to the ball depending on which side of the ball you are, but you must be moving to achieve this. Just like the real game, the earlier you prepare for the ball the more likely you are to get your racket ready!

At the moment when you hit the ball you can control the direction of your stroke by the position of your joystick — it is better therefore not to be moving when you hit the ball if you want to control it well.

When the ball goes off screen, the computer will decide whether you hit the ball in or out and change the score accordingly. The receiver is positioned randomly for each serve and returning serve becomes pretty tricky.

You have a constant view of the game score and the number of games won. The server is shown by a bar next to the game points (there is no end changing).

## PROCOURT

350 Changes background colour from black to green.

360. The players and ball are deleted by using GCOL3 Exclusive OR printing, when a white player crosses a yellow line or net it creates red (2 EOR 3=1), so the colour red must be changed to white.

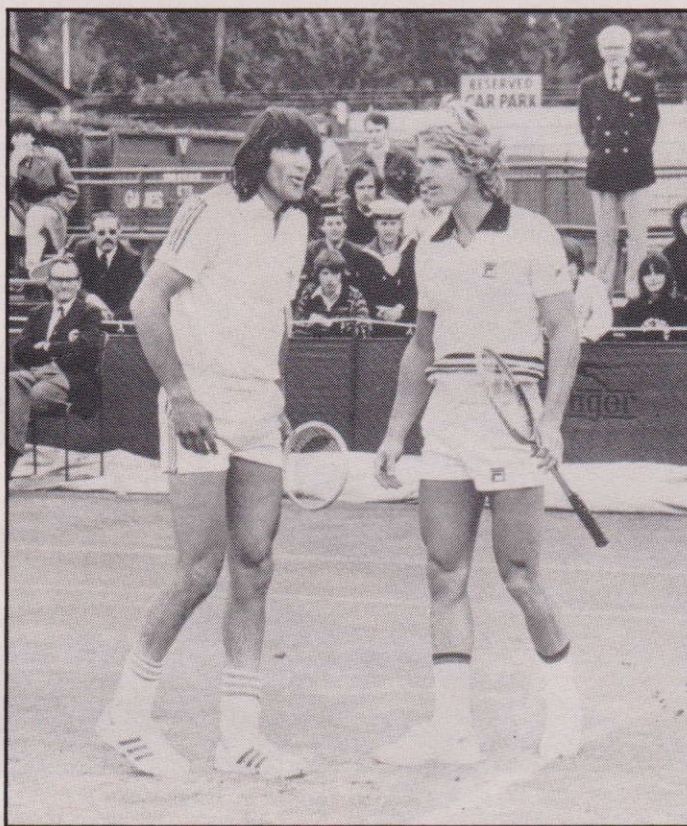
Note that white is obtained by logical colour number 7 even though in MODE 1 white is denoted by number 3.

370 — 530 Draws court lines and net, and prints 'Games' and 'Points' which had to be designed using VDU23 commands as the lettering in MODE 1 was too large.

## PROCSETUP

Initialises the main variables, sets

## Enjoy this exciting lawn tennis game, The Centre Court awaits.



flags, and dimensions the variables. The assignment of 2000 to (for example) OBX% is to ensure that the first deletion of the characters occurs off screen.

## PROCBALL

If either fire button is pressed, the procedure is entered to evaluate the players position from the joystick (PROCPLAYER) otherwise the program goes straight to printing the ball. A check is made on whether a hit is occurring only when the ball's vertical position coincides with the racket's vertical position (i.e. BY% = Y%-32. PROCBALL is therefore exited

on certain occasions and not on others so it varies in the length of time it takes to complete. The procedure is timed and a delay put in at line 820 which minimises the differences you see in the ball speed. It does not eradicate it completely as that slowed down the action too much.

## PROCHIT

This is entered when all the conditions in PROCHECK are met, and through the use of parameters is able to act for both players. The position of the joystick now affects the horizontal

rate of increase of the ball (i.e. whether you have hit it left, right or centre).

## PROSCORE

Deletes the players and ball in preparation for the next point and resets their positions. The receiver's position is randomised.

## PROCOUT

If the ball reaches the confines of the screen this procedure is entered which works out which way the ball was moving (SGN(IY%)) and whether the ball is deemed to have bounced in or out of court. It then works out the score.

## PROCASSEMBLY

The major problem in a program like this is maintaining speed. This piece of assembly language calculates the positions of the players and checks whether they have reached the limits of the screen. Although originally written in six lines of Basic, this conversion into assembly halved the time taken in these calculations and helped to smooth out the action.

However the main time consumer is the printing of the multi-character players and this is unavoidable when using VDU5 and the MOVE command.

## PROCPLAYER

If the player is not moving (indicated by the contents of memory location &8E being 0) this procedure is exited, otherwise the player is printed in its new position. 2390 and 2530 compute which side of the ball the player is and choose the player with the racket printed on that side.

## PROCHECK

Checks on the conditions for a hit. The game could be made easier by increasing the leeway allowed between the X-coordinates of the ball and the player.



## VARIABLES

Variable	Function
PLAYER\$(1)	Player figure — racket left.
PLAYER\$(2)	Player figure — racket right.
X%,Y%	Player coordinates.
OX%,OY%	Player's old coordinates (for deletion).
PT%	Game points won.
GAME%	Games won.
PS	String representation of game points.
IS	Type of player being printed i.e. index for PLAYER\$.
ot%	Type of player at previous printing.
HIT%	Flag set to TRUE when player has hit ball and reset to FALSE when opponent hits ball or point ends. This is to prevent a 'double hit'.
C%	Rate of movement for player.
IX%	Rate of movement of ball horizontally.
IY%	Rate of vertical movement of ball. With these rates or distances of movement, one usually starts optimistically low to give smooth movement and then has to increase them as the program becomes more involved and therefore slower. Thus it is better to express such a rate as a variable which can be easily altered just once instead of having to search through the whole program looking for every occurrence.
serve%	I find it advisable to express one object's rate in terms of another's (e.g. IX% = -C9/2) especially when the two objects are supposed to coincide at some time. This makes detection of collision a great deal simpler if detection is to be achieved by comparison of coordinates as it is here.
SERVE%	Flag set to TRUE if a player is serving. Indicates which player is serving and from which court.

## PROGRAM LISTING

```

10REM: LAWN TENNIS
20REM: by
30REM: Richard
40REM: Jones
70ON ERROR GOTO 3170
80*TV255
90MODE1
100VDU23;8202;0;0;0;
110PROCASSEMBLY
120PROCSETUP
130PROCCHARS
140CLS
150PROCINTRO
160VDU5
170PROCCOURT
200PROCSCORE
210serve%=TRUE
220GCOL3,3
230PROCPLAYER1
240PROCPLAYER2

```

```

250serve%=FALSE
260PROCWAIT(300)
270SOUND1,-15,100,1
300REPEAT:PROCBALL:UNTILserve%=TRUE
310GOTO200
320:
340DEFFPROCCOURT
350VDU19,0,2,0,0,0
360VDU19,1,7,0,0,0
370GCOL0,2
380FORN%=496TO544STEP12
390MOVE140,N%:DRAW 1136,N%
400NEXT
410FORN%=140TO1136STEP12
420MOVEN%,544:DRAWN%,496
430NEXT
440MOVE128,96
450DRAW228,896
460DRAW1052,896
470DRAW1152,96
480DRAW128,96
490MOVE640,696:DRAW640,296
500MOVE210,696:DRAW1075,696
510MOVE155,296:DRAW1130,296
520MOVE50,1000:VDU230,231,232
530MOVE1150,1000:VDU233,234,235
540PROCSCOREBOARD
550ENDPROC
560:
580DEFFPROCSETUP
590DIM PLAYER$(2),X%(2),Y%(2),OX%(2),OY%(2),PT%(2),GAME%(2),P$(2),t%(2),ot%(2),HIT%(2)
600t%(1)=1:t%(2)=2:ot%(1)=1:ot%(2)=2
610FORP%=1TO2:OX%(P%)=2000:OY%(P%)=2000:PT%(P%)=1:GAME%(P%)=0:P$(P%)="0":X%(P%)=2000:Y%(P%)=2000:NEXT
620SERVE%=1
630C%=32
640BX%=2000:BY%=2000
650OBX%=2000:OBY%=2000
660IX%=0:IY%=C%
670ENDPROC
680:
700DEFFPROCBALL
710TIME=0
720F%=ADVAL(0)AND3
730IFF%=1ORF%=3PROCPLAYER1
740IFF%=2ORF%=3PROCPLAYER2
750MOVEBX%,BY%:VDU254
760MOVEOBX%,OBY%:VDU254
770OBX%=BX%:OBY%=BY%
780IFBY%<0 OR BY%>1024 OR BX%<0 OR BX%>1
280PROCOUT:ENDPROC
790IFY%(2)-32=BY%:PROCCHK2

```

CONTINUED OVER



```

800IFY%(1)-32=BY%:PROCCHK1
810BX%=BX%+IX%:BY%=BY%+IY%
820REPEAT UNTIL TIME>10
830ENDPROC
850:
860DEFPROCCHRS
870VDU23,224,60,60,60,60,24,126,255,255
880VDU23,225,255,126,126,126,36,126,126,
102
890VDU23,226,102,102,102,102,102,96,96,9
6
900:
910VDU23,228,1,113,137,135,136,112,0,0
920VDU23,229,128,142,145,225,17,14,0,0
930VDU23,230,0,240,151,133,183,149,245,0
940VDU23,231,0,0,69,109,85,85,69,0
950VDU23,232,0,0,220,80,220,4,220,0
960VDU23,233,0,224,174,234,138,138,142,0
970VDU23,234,0,2,187,170,170,170,170,0
980VDU23,235,0,0,184,32,56,8,56,0
990VDU23,236,0,0,0,63,63,0,0,0
1000VDU23,254,0,0,0,24,24,0,0,0
1010PLAYER$(1)=CHR$224+CHR$8+CHR$8+CHR$10
+CHR$228+CHR$225+CHR$8+CHR$10+CHR$226
1020PLAYER$(2)=CHR$224+CHR$8+CHR$10+CHR$2
25+CHR$229+CHR$8+CHR$8+CHR$10+CHR$226
1030ENDPROC
1050:
1060DEFPROCHIT(a%,b%,c%,d%)
1070IFHIT%(a%)=TRUE:ENDPROC
1080HIT%(a%)=TRUE:HIT%(b%)=FALSE
1090SOUND1,-15,100,1:IY%=c%
1100IX%=0
1110V%=ADVAL(d%)DIV100
1120IFV%>600 IX%=-C%/2:ENDPROC
1130IFV%<20 IX%=C%/2
1140ENDPROC
1160:
1170DEFPROCSCORE
1180GCOL3,3
1190FORJ%=1TO2
1200MOVEX%(J%),Y%(J%):PRINTPLAYER$(t%(J%
):OX%(J%)=2000:OY%(J%)=2000
1210NEXT
1220MOVE BX%,BY%:VDU254:OBX%=2000:OBY%=20
00
1230t%(1)=1:t%(2)=2
1240?&74=31:?&75=6
1250HIT%(1)=FALSE:HIT%(2)=FALSE
1260IFSERVE%=1 ?&72=18:BX%=544:BY%=928:?&
73=20+RND(15):IX%=16:IY%=-C%:HIT%(1)=TRUE:
ENDPROC
1270IFSERVE%=2 ?&72=21:BX%=640:BY%=928:?&
73=0+RND(15):IX%=-16:IY%=-C%:HIT%(1)=TRUE:
ENDPROC

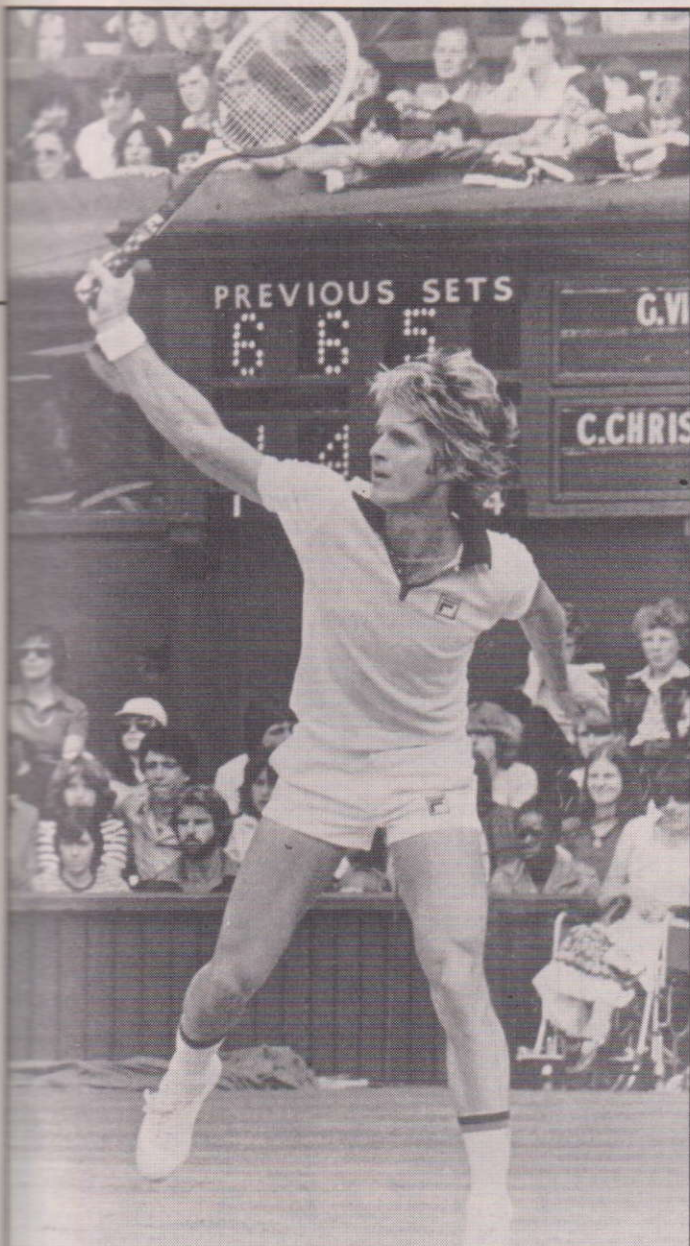
```

```

1280IFSERVE%=3 ?&72=3+RND(15):BX%=768:BY%
=192:?&73=23:IX%=-16:IY%=C%:HIT%(2)=TRUE:E
NDPROC
1290IFSERVE%=4 ?&72=20+RND(15):BX%=608:BY
%=192:?&73=18:IX%=16:IY%=C%:HIT%(2)=TRUE:E
NDPROC
1300ENDPROC
1320:
1330DEFPROCOUT
1340PROCSCOREBOARD
1350serve%=TRUE
1360IF(BX%<0 OR BX%>1280) AND BY%<900 AND
SGN(IY%)=1 PT%(1)=PT%(1)+1:PROCCALL:GOTO1
410
1370IF(BX%<0 OR BX%>1280) AND BY%>900 AND
SGN(IY%)=1 PT%(2)=PT%(2)+1:PROCCALL:GOTO1
410
1380IF(BX%<0 OR BX%>1280) AND BY%>100 AND
SGN(IY%)=-1 PT%(2)=PT%(2)+1:PROCCALL:GOTO
1410
1390IF(BX%<0 OR BX%>1280) AND BY%<100 AND
SGN(IY%)=-1 PT%(1)=PT%(1)+1:PROCCALL:GOTO
1410
1400IFBY%<=0 PT%(1)=PT%(1)+1 ELSE PT%(2)=
PT%(2)+1
1410SERVE%=SERVE%+1
1420IF SERVE%=3 SERVE%=1
1430IF SERVE%=5 SERVE%=3
1440IFPT%(1)>=5ANDPT%(2)<(PT%(1))-1 GAME%
(1)=GAME%(1)+1:PT%(1)=1:PT%(2)=1:PROCSERVE
CHANGE:GOTO1510
1450IFPT%(2)>=5AND PT%(1)<(PT%(2))-1 GAME
%(2)=GAME%(2)+1:PT%(1)=1:PT%(2)=1:PROCSERV
ECHANGE:GOTO1510
1460IF(PT%(1)=PT%(2))ANDPT%(1)=4 THEN PT%
(1)=5:PT%(2)=5
1470IF(PT%(1)=PT%(2))ANDPT%(1)=6 THEN PT%
(1)=5:PT%(2)=5
1480FORZ%=1TO2
1490IFPT%(Z%)>6 PT%(Z%)=5
1500NEXT
1510FORJ%=1TO2
1520ON PT%(J%)GOSUB1570,1580,1590,1600,16
10,1620
1530NEXT
1540IF(GAME%(1)>=6 AND GAME%(2)<=GAME%(1)
-2)OR(GAME%(2)>=6 AND GAME%(1)<=GAME%(2)-2
)PROCEND
1550PROCSCOREBOARD
1560ENDPROC
1570P$(J%)="0":RETURN
1580P$(J%)="15":RETURN
1590P$(J%)="30":RETURN
1600P$(J%)="40":RETURN
1610P$(J%)="40":RETURN
1620P$(J%)="A":RETURN
1630:

```





```

1650DEFPROC SERVECHANGE
1660IF SERVE%=1 OR SERVE%=2 SERVE%=3:ENDP
ROC
1670SERVE%=1
1680ENDPROC
1720:
1730DEFPROC CALL
1740IFBX%>1200THEN1770
1750GCOL0,3:MOVE10,532:PRINT"OUT!"
1760A=INKEY(200):GCOL0,0:MOVE10,532:PRINT
"OUT!":ENDPROC
1770GCOL0,3:MOVE1150,532:PRINT"OUT!"
1780A=INKEY(200):GCOL0,0:MOVE1150,532:PRI
NT"OUT!"
1790ENDPROC
1810:
1820DEFPROC WAIT(Q)
1830F=TIME+Q
1840REPEAT UNTIL TIME>F
1850ENDPROC
1870:
1880DEFPROC ASSEMBLY
1890REM:&70 &71=ADVAL READINGS

```

```

1900REM:&8E PRINT FLAG
1910REM:&8F X REGISTER VALUE
1920?&76=32:?&78=20:REM:PLAYER 1 UPPER,LO
WER LIMIT (*32)
1930?&77=16:?&79=3:REM:PLAYER 2 UPPER,LOW
ER LIMIT
1940?&72=16:?&74=30:REM:PLAYER 1 X,Y
1950?&73=16:?&75=5:REM:PLAYER 2 X,Y
1960DIMjoy%100
1970FOR PASS=1TO2
1980P%=joy%
1990OPT 0
2000.joystick
2010LDX&8F
2020LDA#0:STA&8E \ SET PRINT FLAG TO 'OFF'

2030.left
2040LDA &70:CMP#50:BCCright \ CHECK FOR L
EFT JOY
2050LDA &72,X:CMP#3:BEQheight\ BRANCH IF
AT LEFT LIMIT
2060DEC &72,X \ DECREASE X COORD
2070INC&8E
2080JMP height
2090.right
2100LDA #11:CMP&70:BCCheight\CHECK FOR RI
GHT JOY
2110LDA &72,X:CMP#38:BEQheight \ BRANCH I
F AT RIGHT LIMIT
2120INC &72,X \ INCREASE X COORD
2130INC&8E \ SET PRINT FLAG
2140JMPheight
2150.height
2160LDA&71:CMP#50:BCCdown\ JOYSTICK UP?
2170LDA&76,X:CMP&74,X:BEQdown \ UPPER LIMI
T?
2180INC&74,X \ INCREASE Y COORD
2190INC&8E \ SET PRINT FLAG
2200JMPout
2210.down
2220LDA#11:CMP&71:BCCout \ JOYSTICK DOWN?
2230LDA&78,X:CMP&74,X:BEQout \ LOWER LIMI
T?
2240DEC&74,X \ DECREASE Y COORD
2250INC&8E \ SET PRINT FLAG
2260JMPout
2270.out
2280RTS
2290J
2300NEXT
2310ENDPROC
2330:
2340DEFPROC PLAYER1
2350IFserve%=TRUE THEN2400
2360?&8F=0:?&70=ADVAL(1)DIV1000:?&71=ADVA

```

CONTINUED OVER

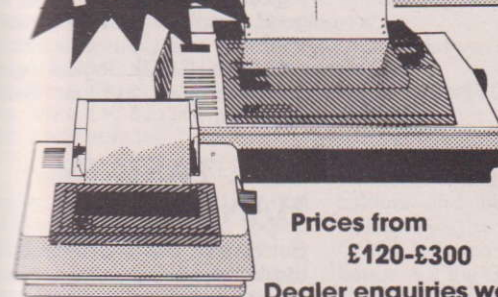


```

L(2)DIV1000
2370CALL joy%
2380IF?&8E=0 ENDPROC
2390IFX%(1)+16<BX%AND SGN(IY%)=1 t%(1)=2E
LSet%(1)=1
2400X%(1)=?&72*32:Y%(1)=?&74*32
2410MOVEX%(1),Y%(1):PRINT PLAYER$(t%(1))
2420MOVEOX%(1),OY%(1):PRINT PLAYER$(ot%(1))
2430OX%(1)=X%(1):OY%(1)=Y%(1):ot%(1)=t%(1)
2440ENDPROC
2460:
2470DEFPROCPLAYER2
2480IFserve%=TRUE THEN2530
2490?&8F=1:?&70=ADVAL(3)DIV1000:?&71=ADVA
L(4)DIV1000
2500CALL joy%
2510IF?&8E=0 ENDPROC
2520IFX%(2)+16>BX%AND SGN(IY%)=-1 t%(2)=1
ELSEt%(2)=2
2530X%(2)=?&73*32:Y%(2)=?&75*32
2540MOVEX%(2),Y%(2):PRINT PLAYER$(t%(2)):
MOVEOX%(2),OY%(2):PRINT PLAYER$(ot%(2)):OX
X%(2)=X%(2):OY%(2)=Y%(2):ot%(2)=t%(2)
2550ENDPROC
2570:
2580DEFPROCSCOREBOARD
2590GCOL3,2
2600MOVE75,950:PRINT;GAME%(1)
2610MOVE75,900:PRINT;GAME%(2)
2620MOVE1175,950:PRINTP$(1)
2630MOVE1175,900:PRINTP$(2)
2640IF SERVE%=1OR SERVE%=2 MOVE 1240,950:
GCOL0,2:VDU236:GCOL0,0:MOVE1240,900:VDU236
:ELSE MOVE 1240,900:GCOL0,2:VDU236:GCOL0,0
:MOVE1240,950:VDU236
2650ENDPROC
2670:
2680DEFPROCCHK1
2690IF (BX%>=(X%(1)-48))AND (BX%<=(X%(1)+16))
ANDt%(1)=1PROCHIT(1,2,-C%,1):ENDPROC
2700IF (BX%>=(X%(1)+16))AND (BX%<=(X%(1)-48))
ANDt%(1)=2PROCHIT(1,2,-C%,1)
2710ENDPROC
2730:
2740DEFPROCCHK2
2750IF (BX%>=(X%(2)-48))AND (BX%<=(X%(2)+16))
ANDt%(2)=1PROCHIT(2,1,C%,3):ENDPROC
2760IF (BX%>=(X%(2)+16))AND (BX%<=(X%(2)-48))
ANDt%(2)=2PROCHIT(2,1,C%,3)
2770ENDPROC
2790:
2800DEFPROCINTRO
2810U%=19:V%=20
2820FORT%=1TO30
2830COLOUR1:PRINTTAB(U%,T%)CHR$254;TAB(V%
,T%);CHR$254
2840A=INKEY(5):NEXT
2850COLOUR2:PRINTTAB(10,15)"L A W N T E
N N I S"
2860A=INKEY(500):CLS
2870VDU19,1,6,0,0,0,19,3,2,0,0,0
2880COLOUR1:PRINTTAB(0,0)"The top player
is controlled by the"
2890COLOUR2:PRINTTAB(0,2)"LEFT";
2900COLOUR1:PRINT" joystick, and the bott
om player by";TAB(0,4)"the";
2910COLOUR2:PRINT" RIGHT."
2920COLOUR3
2930PRINTTAB(0,6)"To move you must press
the fire button."
2940PRINTTAB(0,8)"The joystick also contr
ols the direction"
2950PRINTTAB(0,10)"of your hit, so it is
advisable not to""be moving when making
your stroke."
2960COLOUR2:PRINTTAB(0,16)"The computer w
ill position the racket"
2970PRINTTAB(0,18)"for a forehand or back
hand depending""on whether you are to th
e right or to""the left of the ball."
2980PRINTTAB(0,24)"NOTE** It will only do
this when you""are moving."
2990COLOUR3:PRINTTAB(0,30)"Press a key to
continue"
3000A=GET:CLS
3010COLOUR1:PRINTTAB(0,0)"You will play o
ne advantage set :i.e.""first player wit
h six games or over"and""an advantage of
at least two games."
3020COLOUR2:PRINT""The scoreboard shows
the top player's""score first.""Servic
e is shown by the bar to the""right of t
he points score."
3030COLOUR3:PRINTTAB(0,29)"Press a key to
START":A=GET:CLS
3040VDU20
3050ENDPROC
3060:
3070DEFPROCEND
3080PROCSCOREBOARD
3090IF GAME%(1)>GAME%(2)WINNER%=800ELSE W
INNER%=400
3100VDU19,1,9,0,0,0:GCOL0,1
3110MOVE500,WINNER%:PRINT"THE CHAMPION!"
3120VDU4
3130END
3140ENDPROC
3150:
3160:
3170REPORT:PRINTERL

```





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# Advanced Graphics

Bruce Smith

Last time we examined the manner in which the palette and GCOL command performed. Let us now extend that introduction and see how we can use this powerful logical operator to build up a picture consisting of three image planes, namely a background onto which items present in the midground and foreground can be placed. To start with though, a screen display that consists of two separate pictures of which only one can be seen at any moment in time!

We shall use MODE 5 for the picture switching display. This is a four colour mode, in which two bits are used per pixel and the state of these bits denotes the logical colour presented onto the screen thus,

Black = 0000 = 0  
Red = 0001 = 1  
Yellow = 0010 = 2  
White = 0011 = 3

To create dual screen display we first need two images that we can switch between. I have chosen to use a triangle and square as these are quite straightforward to implement as illustrated in the following two procedures which will form the bases of all the

## Programming techniques for image switching and multiple plane displays.

demonstrations.

The two procedures expect to have four and three values passed into them respectively, with the latter using two triangles to form a single square. Add the following lines and RUN the program to see a triangle plotted

```
10 REM ** GCOL DEMO V1 **
20 MODE5
30 key=GET
40 GCOL1,1 : REM OR with red
50 PROC_triangle (300,600,900,300)
60 END
```

roughly central on the screen. Adding the following lines will

```
60 A=GET
70 GCOL1,2 : REM OR with yellow
80 PROC_square (300,300,600)
90 END
```

overlay a square on the triangle. You will have noticed that where the triangle and square overlap the colour plotted is white. If you recall from last time, this is because we have logically OR'ed

physical red with physical yellow with the result being physical white. This is clearer if we work through the 'internal' binary.

red = 0001  
yellow = 0010  
GCOL 1,x = 0011

physical 3 being white in an unchanged four colour mode.

## SEEING DOUBLE

To create a two image plane we need to reprogram the palette using the VDU19 statement so that only one of these two images will be present on the screen visually at any one time. Note that we do not re-draw the shape each time we wish to see it, it is always on the screen, we program the palette such that the shape we do not wish to see becomes the same colour as the background. For example to remove the square from the screen but leave the triangle we must re-program the palette so that the square's plotted colour, yellow, becomes black. Therefore physical colour 2 (yellow) becomes logical colour 0 (black). Re-RUN the program and when the prompt reappears type in,

VDU 19,2,0;0;  
remember to use semi-colons after the last two zeroes. All being well the square will have been erased from the screen. To 'turn' it back on restore logical yellow to physical yellow with

VDU 19,2,2;0;

The purpose of this little

demonstration was to show, hopefully, that some thought is generally required as to the arrangement of colours within the palette. Quite often the four initial physical colours implemented with a particular graphics mode will suffice, but for the picture to operate correctly they need to be re-arranged within the palette; physical red may need to become logical yellow and vice versa. It is good practice in the long run to sit down and plan your colours and their GCOL logical results before arriving at your Beeb's keyboard.

## THE TASK IN HAND

But back to the task in hand. To display our two pictures we need to program the palette so that we have two image planes, with each image plane comprised of a background and a foreground. Some thought into the matter shows that there needs to be some 'overlap' between the two planes such that image plane 1 and image plane 2 can have both the same background and foregrounds, the non-overlapping portions are the two separate images themselves, the triangle and the square, and as these are plotted in the foreground and over the background their associated colours are available in the foreground colours only. Transferring this to hard binary facts produces:

Background of IP1 and IP2 = 00 = Physical 0  
Foreground of IP1 = 01 = Physical 1  
Foreground of IP2 = 10 = Physical 2  
Foreground of IP1 and IP2 = 11 = Physical 3

Examining the bit values of the associated planes will show that the combined foreground colour of image plane 1 and plane 2 was obtained by logically ORing the separate foreground colours together,

01 OR 10 = 11

which is performed using the GCOL 1,x command. These figures also show that we will need only three of the four col-

```
500 DEF PROC_triangle (left, right, apex, base)
510 REM left & right=X coords, base=Y coord
520 MOVE left,base
530 MOVE left+right,base
540 PLOT 85,left+(right/2),apex
550 ENDPROC
560 :
570 DEF PROC_square (Xcorner, Ycorner, length)
580 MOVE Xcorner,Ycorner
590 MOVE Xcorner,Ycorner+length
600 PLOT 85,Xcorner+length,Ycorner
610 MOVE Xcorner+length,Ycorner+length
620 PLOT 85,Xcorner,Ycorner+length
630 ENDPROC
```

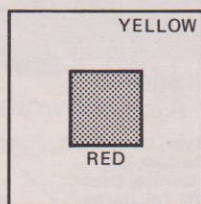
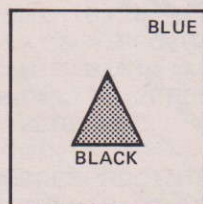


Fig 1



ours possible in MODE 5 and therefore one of the logical colours will need to be redefined. Bearing in mind that we need the square (image 2) to be set to the background colour when we are displaying the triangle (image 1) the four logical colours of the palette need to be programmed with the following physical colours.

```
700 DEF PROC_display_triangle
710 VDU 19,0,2;0; : REM background=yellow
720 VDU 19,1,1;0; : REM red=red
730 VDU 19,2,2;0; : REM yellow=yellow
740 VDU 19,3,1;0; : REM white=red
750 ENDPROC
```

Here we have set the background colour (logical 0=black) to yellow and logical white to physical red. The latter is necessary to avoid the combined effect of red+yellow=white as we saw earlier. Now red+yellow = red. The procedure also sets logical red=physical red and similarly logical yellow=physical yellow. This may seem superfluous at present but is required to reset them after they have been altered by the next procedure.

To display the square (image 2) and set the triangle (image 1) to the background colour the palette needs to be programmed as follows:

```
800 DEF PROC_display_square
810 VDU 19,0,4;0; : REM background=blue
820 VDU 19,1,4;0; : REM red=blue
830 VDU 19,2,0;0; : REM yellow=black
840 VDU 19,3,0;0; : REM white=black
850 ENDPROC
```

Now the background is set to blue as is logical red. Logical yellow and white become black.

To see the overall effect enter these two procedures into the original program. Delete lines 10 to 90 with DEL. 10,90 and enter the following lines

```
10 REM ** GCOL DEMO - 2 IMAGES **
20 MODE 5
30 GCOL 1,2 : REM OR with logical 2
40 PROC_triangle ( 300, 600, 900, 300)
50 GCOL 1,1 : REM OR with logical 1
60 PROC_square ( 300, 300, 600)
70 REPEAT
80 PROC_display_triangle
90 get=GET
100 PROC_display_square
110 get=GET
120 UNTIL 0
```

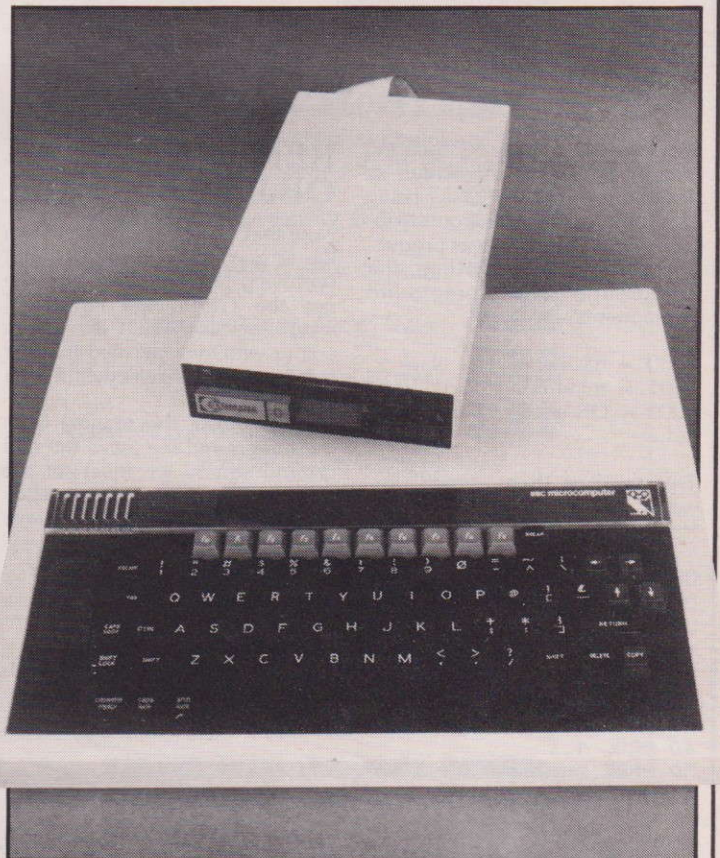
When run the program will produce two separate images on the screen which can be 'switched' between by pressing a key on the keyboard. Figure 1 shows the two images. The first is a blue background with a black triangle centrally on the screen, and the second a yellow background with a red square centrally on the screen. Try working through the

'internal' binary of the physical colours and how they are effected by the GCOL1,1 and GCOL1,2 commands. What happens if the GCOL commands in lines 30 and 50 are swapped over? No I'm not going to tell you, you try!

## PLANE TO SEE

To treat the screen as a three image plane requires the combined use of the GCOL1,x and GCOL2,x commands. This effectively allows us to draw shapes behind objects already present without affecting the original. In a similar manner this midground object could be removed without

affecting the foreground one. Likewise an object can be drawn in front of one already present on the screen obscuring only the portions it overlaps. To add objects to a picture we use the GCOL 1,x command and to remove them we use GCOL 2,x.



Because the foreground object will *always* be displayed in its entirety, ie it cannot be obscured, it must have the highest priority colour associated with it. In a normal four colour mode this will be white because its internal binary code is 0011. If the palette remains unchanged this is the greatest value possible. As everything we draw will be painted onto the background, black, we leave this with the lowest priority, 0000. Red and Yellow, 0001 and 0010, have equal priority in the foreground. Note that combining these will produce a foreground object in white because 0001 OR 0010 = 0011.

Some programming examples. Using the PROC\_triangle and PROC\_square routines defined earlier we can paint an object in the foreground using GCOL1,3; remember

physical 3 has the highest priority, thus

```
10 MODE 5
20 GCOL 1,3
30 PROC_triangle (300,600,
900,300)
90 END
```

We now have a white foreground triangle. This was obtained by logically ORing the background colour with the specified colour to produce the resultant colour.

```
0000 = background — black
0011 = foreground — white
0011 = OR result — white
= foreground
```

To place a red square behind the triangle we use the same operation but specify a midground colour ie red or yellow. Add the following lines to the program and RUN it.

CONTINUED OVER



```

10 MODE 5
20 GCOL 1,3
30 PROC_triangle (300,600,900,300)
90 END

```

Now the red triangle is obscuring a large portion of the screen or background, but is in itself being obscured by the foreground object. Again this effect was produced by logically ORing the background and foreground components with red.

0000 = background — black  
 0001 = midground — red  
 0001 = OR result — midground red.

This result is then 'carried' forward and combined with the foreground colour,

0011 = foreground white  
 0001 = midground red  
 0011 = OR result — foreground white.

Figure 2 illustrates the process.

```

40 GCOL 1,1
50 PROC_square (300, 300, 600)

```

## REMOVING OBJECTS

Now that we have two objects on the screen how do we go about removing just one of them? We use the GCOL 2,x command which logically ANDs the screen colour with that specified (see the last issue for a refresher if you need it!)

To delete the triangle from the foreground but leave the midground square we must set the GCOL 2 associated colour such that the AND operation will leave red or 0001

0011 = Foreground — white  
 0001 = midground — red  
 0001 = AND result — midground red

in programming terms this becomes,

To remove the triangle in addition to re-specifying the GCOL parameters we must also 'Replot' the shape. Figure 3 denotes graphically what has happened.

If we had wanted to remove the square instead of the triangle we must set the GCOL parameter so that the ANDing procedure leaves 0. The reason we require 0 to be resultant and not 3 as you may have expected is because the square is painted onto the background which is black or 0. Therefore the previous lines can

be edited to give the program Figure 4 depicts the operation.

Finally we can use the GCOL 3,x command, which performs an Exclusive-OR to draw or erase items on the screen that do not overlap, using the same parameters over and over again. Delete lines 10 to 90 once again and enter the following:

Next time we'll look at some simple animation techniques using these three image planes plus write a program that will design our own characters.

```

60 get=GET : REM press key to go
70 GCOL 2,1
80 PROC_triangle ( 300, 600, 900, 300)

60 get=GET
70 GCOL 2,2
80 PROC_square ( 300, 300, 600)

10 REM ** GCOL 3 DEMO **
20 MODE 5
30 GCOL 3,2
40 FOR loop=0 TO 10
50 PROC_triangle (300, 600, 900, 300)
60 TIME=0
70 REPEAT UNTIL TIME=1000
80 PROC_triangle (300, 600, 900, 300)
90 NEXT loop
100 END

```

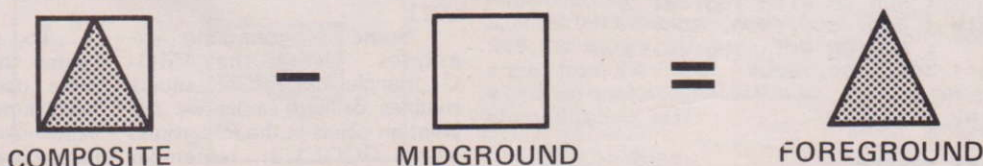
Fig 2



Fig 3



Fig 4



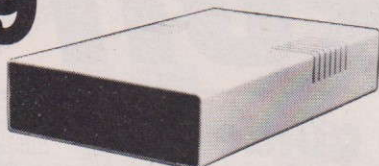


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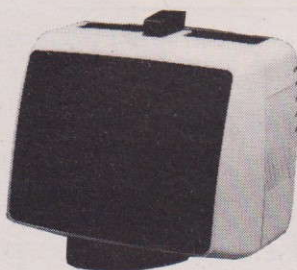
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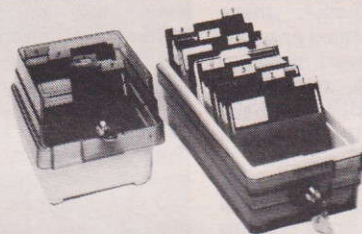
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# Walk Before You Run

Richard Ives

The command INPUT allows information to be entered into the computer's memory from the keyboard. The INPUT command is always followed by a variable name. This is to enable the storage of the information that the user will type in when the program is run. It is sensible to choose an easily remembered name for the variable, for example, if someone is to type in their age, use a variable called AGE. You will find that certain combinations of upper-case letters cannot be used as variable names. This is because if you used PRINT or PRINTED as a variable name, for example, the computer couldn't tell whether this was a command to PRINT something or whether these words were to be treated as variable names. However, print or even Print or PRINT, are perfectly O.K., because BBC BASIC doesn't accept commands written in lower-case letters.

For this reason some people suggest using lower case for all variable names; I don't do this myself, as I get confused going from lower to upper case, but you might like to try it, as it also makes programs more readable. If the input to the program is to be numeric (that is, it consists only of the digits 0 through 9, like your age, for example) you can use any combination of letters for your variable name that are not also BASIC commands. (This is called a numeric variable). However, if the input is to consist of characters, that is, letters or letters and digits mixed (such as your name) the variable is referred to as a 'string variable' ('cos it contains a string of letters and numbers) and MUST end with a dollar sign: \$.

A simple program to create a dialogue with a computer might read as follows:

```
5 C L S
10 PRINT "Hello, please tell me
   your name — type it in and
   press the RETURN key."
20 INPUT NAME$
30 PRINT "Hi", NAME$ "it's
   good to meet you!"
40 PRINT "How old are you"
50 INPUT AGE
60 PRINT "Gosh, that ancient,
```

## A beginners' guide to getting information into your computer, via the keyboard and from within a program.

huh! the BBC computer has only been around for a couple of years!"

If you wanted to ask these questions of a series of people, you would not need to type all these instructions in again, of course. You could just RUN the program again, and you could do this within the program by adding:

70 RUN

This would be fine except it wouldn't stop (to stop it, you'd have to press the ESCAPE key and not everyone who used the program would know that), but if you wanted to make the program stop easily you could have a special name to type in which the computer would know wasn't really a name, but was a signal to stop. So a line like.

```
25 IF NAME$ = "zz" THEN
   STOP
```

would do the trick. Each time you typed in a name the computer would test it to see if it was zzz. If it was anything other than zzz (even ZZZ won't do, so be careful!) then the computer ignores the rest of the IF . . . THEN statement and goes on to the next line. However, if NAME\$ is zzz then the instruction after THEN is carried out, and, in this case, the computer stops RUNNING the program. Notice that zzz is enclosed in quote marks; we are testing to see if NAME\$ contains the string of letters: zzz.

The IF . . . THEN statement is a very powerful one because it enables the computer to make choices. As well as just having an instruction after THEN, you can make the computer jump to a different part of the program. People

who are familiar with BASIC will think of using the GOTO statement for this; but I (and other teachers) don't recommend this. It is much better to jump to a procedure — the program is much easier to follow if you do this.

**EXERCISE:** Try and write a quiz on any subject you like using PRINT, INPUT, and IF . . . THEN Statements.

## OTHER WAYS OF GETTING INFORMATION INTO VARIABLES.

We've seen how to use the INPUT statement, together with a variable, to accept information from the keyboard and store it in the computer in a variable. There are several other ways of getting information into the memory, but, of course, all of them involve using variables, we can't store numeric values or strings of characters in the memory without having labelled "boxes" to contain the numbers or strings.

## PUTTING IN A LINE OF TEXT

Imagine we wish to our program to accept three numbers from the user; the BASIC statement:

```
3 INPUT "Pick three numbers",
   X,Y,Z
```

would do the trick, and the user could either type in each number pressing RETURN after each one, or they could be typed in separated by commas. The computer recognises commas as

separating the input of the three different variables. Although normally useful, this feature can be inconvenient if we want the user to type in a line of text (a sentence, for example) which may contain commas, which we want the computer to store in a single string variable. To do this we can use the BASIC statement INPUTLINE:

```
92 INPUTLINE FRED$
```

which will accept everything that is typed in before the RETURN key is pressed, including leading spaces and commas, and store it all in the string variable FRED\$.

## PUTTING IN A SINGLE CHARACTER

INPUT is used when we want to store a number of more than one digit or a string which has more than one character in it; after the user of our program has typed in their response, they press the RETURN key in order to signal the end of their response.

However, if we (the programmers) only require of the user a single key depression as a response, we can program the computer so that it responds to this single character without requiring the user to press RETURN. To do this, we use the GET\$ statement. For example, this line of BASIC will accept a single key response and store the result in the variable CAMEL\$:

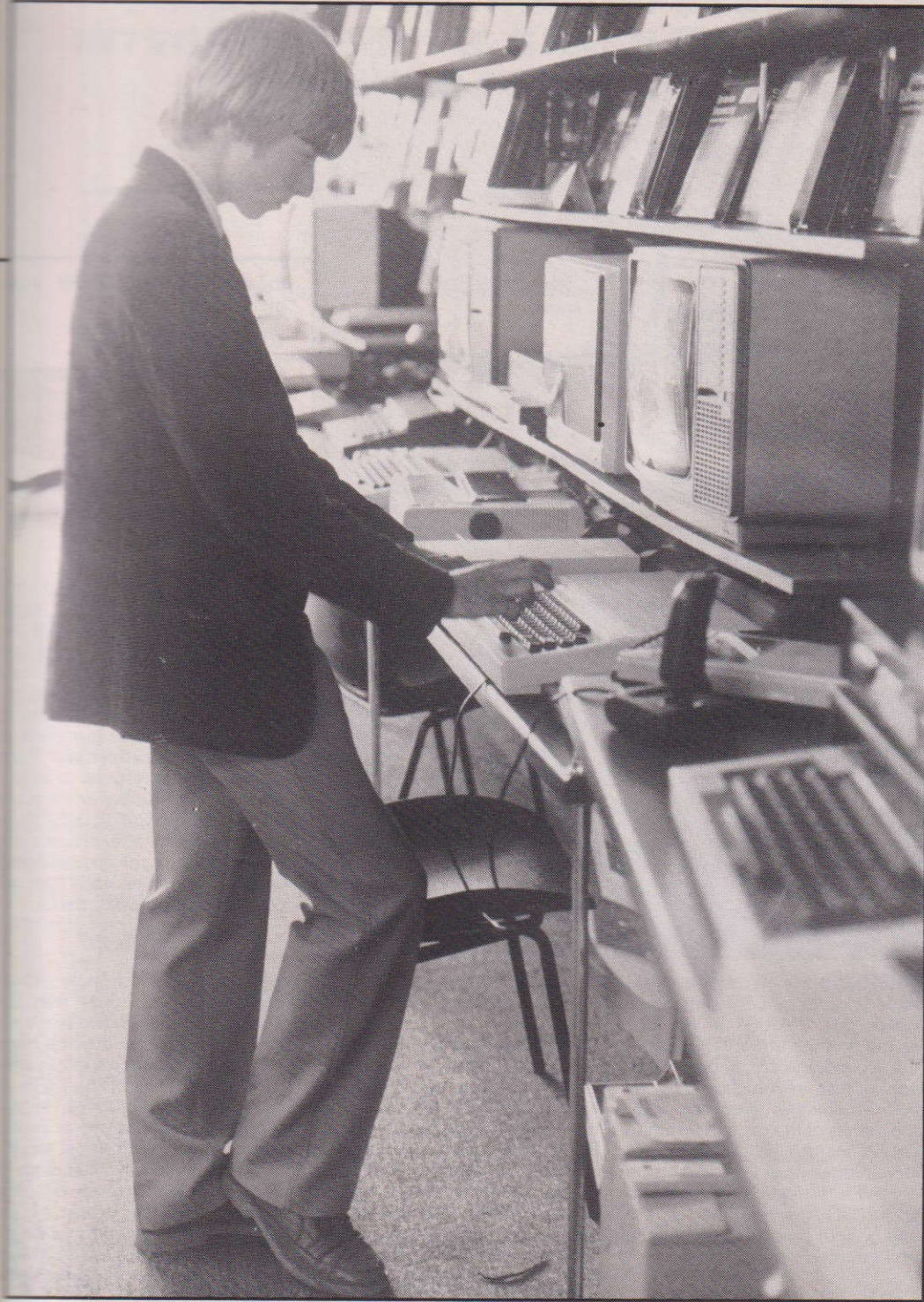
```
10 CAMEL$ = GET$
```

Notice the syntax: we have to make an assignment; think of it as 'take what you GET from the keyboard, and make the variable CAMEL\$ equal to it.' The key that is pressed will not appear on the screen, to make it to do that we would have to add a PRINT statement to our program:

```
20 PRINT "You pressed" :
   CAMEL$
```

You may have guessed that there is also a GET statement (no \$ sign) as well. and that it must be





pressed will be stored in the variable BEQUICK\$. If they are too slow, the computer will continue on to line 2040, and a 'null string' (which we represent by "") will be stored in BEQUICK\$. You will notice that the computer 'counts' in one-hundredths of a second, so 500 in the brackets would represent a five-second delay, 1000, a ten-second delay, and so on. The minimum delay is 0 and the maximum delay you can have is 327.67 seconds!

You won't be surprised to learn that there is also an INKEY function which waits for a specified time before storing the ASCII value of the key depressed in a numeric variable. If no key is depressed in the given time, then -1 is stored in the variable. However, INKEY has a rather wonderful extra feature: INKEY with a negative number in the brackets allows your program to test to see if a particular key is being pressed at the instant when that statement is being processed. The letter T would be tested by:

```
99 IF INKEY(-36) THEN PRINT
  "You pressed T"
```

the message would only be PRINTed if, when line 99 was reached, the key T was being pressed.

**EXERCISES:** (i) Write a BASIC program that draws a square when S is pressed and a triangle when T is pressed. The INKEY value for S is -82.

(ii) Write a BASIC program which displays a menu of options on the screen, any of which can be selected by typing a particular character, when appropriate action is taken by the computer. If the user does not respond in a reasonable time, the computer flashes something alerting and attention-grabbing on the screen and makes a beep (VDU 7), then displays the menu again.

## YET MORE WAYS OF GETTING INFORMATION INTO VARIABLES

Often, the programmer knows

**CONTINUED OVER**

used in conjunction with a numeric variable, e.g:

```
30 ANSWER = GET
```

but the value that is stored in the variable ANSWER is not the value of the digit typed, but its ASCII code. Typing a '1' would result in 49 being stored, since 49 is the computer representation for the character '1', and if the user typed a 'B' in response to line 30, the value stored in the variable ANSWER would be 66,

since 66 is the computer's way of storing the character 'B'.

**EXERCISE:** Write a BASIC program to enable a user to respond to a question with a single key depression, and make the computer take appropriate action depending on which key is depressed.

## WAITING FOR INPUT

A nice feature of BBC BASIC is

its ability to combine accepting keyboard input with a delay. This is achieved with the INKEY\$ function. For example, the lines:

```
2020 PRINT "You have one second to respond . . . . ."
2030 BEQUICK$ = INKEY$(100)
2040 REM this is the next line of the program
```

would cause the computer to wait for one second for the user to type a single key, and, if they manage to do so, the character



what values s/he wants in some of the variables used in the program. For example, in a quiz program we need to tell the computer the correct answers to the questions so that our program can use these to test the answers given by the user. We can, of course, do this using LET statements:

```
5 LET CAPITAL$ = "PARIS"
```

Remember that the LET statement is optional, we could write:

```
5 CAPITAL$ = "PARIS"
```

We could use the variable CAPITAL\$ over and over again, storing in it a new capital after each question, perhaps like this:

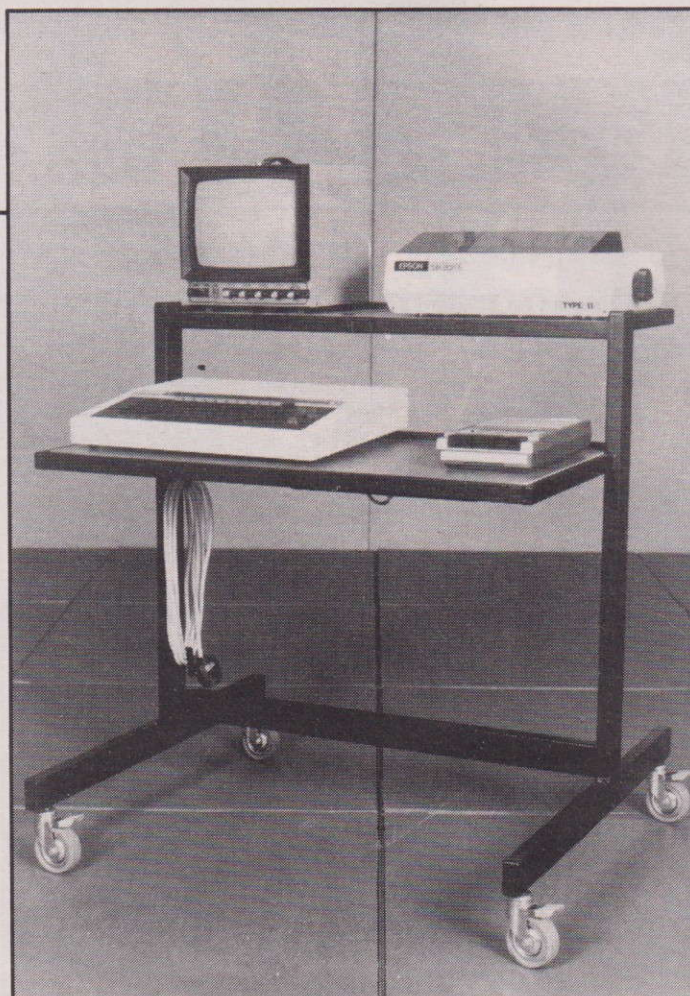
```
15 CAPITAL$ = "BONN"
20 PROCTEST
25 CAPITAL$ = "SYDNEY"
20 PROCTEST
```

but this way we only have one capital in the memory at any one time. There may be times when we want to store the whole lot, perhaps to print out a list of correct answers at the end. We could use a number of string variables to do this, and it would make sense to call them CAPITAL1\$, CAPITAL2\$, and so on, so we could remember, which was which.

Doing things this way would take much more of the computer's memory, but it would be jolly useful. So useful, in fact, that BASIC provides us with an easy way to describe a list of associated variables: they are called an array. Since they take a lot of memory, we must warn the computer in advance that we are going to use an array. We do this with a DIMension statement, which it's best to put at the beginning of the program:

```
10 DIM CAPITAL$(10)
```

The number in brackets refers to the number of elements in the array CAPITAL\$; in fact, there are 11 in this one, since there is a CAPITAL\$(0) as well as CAPITAL\$(1) through to



CAPITAL\$(10). Now, we could have a series of LET statements which put "PARIS" in the first element of the array, "BONN" in the second and so on, but this involves just as much typing as before. There is a quicker way; the names of the capitals form the DATA for our program, so let's store them somewhere in it inside a DATA statement (it's best to stick DATA statements at the end of your program, after all the procedures):

```
1000 DATA PARIS,
      BONN, SYDNEY,
      LONDON, WASHINGTON,
      BERIUT, ROME,
      MADRID, LISBON,
      LONDON
```

So each value for the array CAPITAL\$ is in this list, and each one is separated by a comma. But they are not yet stored in the array; to do this we can use a READ statement inside a loop of some kind:

```
20 FOR I = 1 TO 10
30 READ CAPITAL$(I)
```

```
40 NEXT I
50 REM next line
```

When the computer finds a READ statement it goes to the DATA statement and READs the first value in the DATA list into the variable associated with the READ statement (in this case, an array of variables: CAPITAL\$). In this case, it READs the first value, PARIS, into the 1st element of the array. As the variable I starts off with the value 1, PARIS is stored in CAPITAL\$(1). The computer then reaches line 40, and is sent back to line 20, where I is incremented by one, and then line 30 is executed all over again. This time I = 2, so the value from the DATA statement is read into CAPITAL\$(2). The computer has kept track of where it got up to in the DATA statement; it 'remembers' that PARIS has been used, so it takes BONN to store in CAPITAL\$(2). When I = 11 the computer goes on to line 50.

If you have more than one lot of DATA statements, you may need to tell the computer which one you want to use. You can do

this with the RESTORE statement, e.g.

```
100 RESTORE 300
```

means that READing data from line 300. RESTORE by itself sets the data pointer to the first DATA statement in the program.

## MULTI-DIMENSIONS ARRAYS

The array CAPITAL\$ had only one dimension (called a 'single dimension array'); we could imagine its 11 boxes as being laid end to end. Sometimes we may need two-dimensional arrays; imagine a hotelier who wanted to keep track of which guest was in which room on which floor. Each room could be referred to by giving it a floor number and a room number on that floor. So if there were five floors of bedrooms (the restaurant is on the ground floor!) with ten rooms on each floor we could set up an array thus:

```
5 DIM HOTEL$(5,10)
```

which would give us a five by ten array, that is, one with 66 elements in all (why?). When we wanted to refer to the fifth room on the fourth floor we would refer to the element HOTEL\$(4,5). If there is enough room in the memory, we can have three-, four-, and n-dimensional arrays.

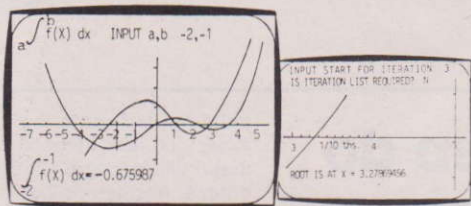
The same rules that apply to variable names apply to array names, and, of course, if we want to store numbers in an array, we can use numeric arrays, which have a variable name without a \$ sign.

**EXERCISES:** (i) Set up a string array to store friends' names, and a numeric array to store their telephone numbers. READ values into the arrays from DATA statements. Get your program to do searches, such as picking out the phone numbers of those friends whose names begin with a certain letter.

(ii) Rewrite the quiz program, using arrays and at the end of the quiz PRINT a table showing all the correct answers and the user's answers.



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# Multitasking

David Peckett

Multi-tasking is a facility which you normally only find in expensive (ie several thousand pounds plus) micros as well as virtually all large computers. At its simplest, it lets the computer do two or more things at once for a single user. For example, a computer may be printing out a large document (the "background task") while its operator is busy debugging a completely different program (the "foreground task"). Several people using a computer simultaneously is "multi-user" operation, which is very different.

Unfortunately, multi-tasking is usually conspicuous by its absence from smaller computers but, in this article, I will show how the BBC computer can easily be persuaded to do two or more things at once.

The key to the trick lies in the availability of "Events" in the Beeb, and so I will start with a brief description of these happenings. I will then go on to show how you can use Events to control a background task, while continuing to use the computer apparently normally as a foreground task. I must point out at the start that, like so many BBC goodies, Events are only available if you have OS 1.0 or later.

## EVENTS

First of all, though, what are Events? They are described vaguely on pages 425, 426 and 464 of the User Guide, but this outline does not really give much of a clue to their power. Their real value stems from the fact that the BBC computer is an interrupt-driven machine, and the Events are specific interrupts which may be responded to or ignored as you please.

An interrupt is something to which the computer must respond immediately, stopping whatever it is doing and picking up where it left off as soon as it has finished "servicing" the interrupt. The technique is widely used in larger computers; without it, they could not control systems ranging from nuclear power stations to machine tools.

Real life is interrupt-driven. Suppose I am standing in a bar,

## Making your Beeb do two (or more) things at once.

talking to a friend. Another friend comes up and asks me what I want to drink — that is an interrupt. I stop talking to my friend, say "Mine's a Pint." (I service the interrupt) and then pick up where I left off in the conversation. Later, there will be another interrupt when I start drinking the beer. A typical feature of handling interrupts is that they must be responded to promptly, and that the service action should not take too long. In my example, if I don't order the drink quickly I will probably never get it and, if I take too long chatting to the buyer, my other friend will go off in disgust.

## INTERRUPT

Whenever you press a key on the Beeb, use the sound generator, read an analogue input, press ESCAPE or one of many other, often invisible, things happen, an interrupt is generated. The computer responds to the interrupt, although you do not notice, and the system continues. Some interrupts, like Fault messages, are fatal, in that they cause the computer to come to a grinding halt until you do something about it.

Other interrupts, however, are a perfectly normal part of the computer's operations, but Events allow you to add your own routines to the OS' normal actions. In particular, it is easy to detect the occurrence of any or all of the following: a. An output buffer (eg printer, sound, RS423 — the full list is on p.428 of the User Guide) is empty — it has nothing left to print, sound, etc. b. An input buffer (eg keyboard, RS423) is full — it cannot accept any more characters, etc. c. A character has just entered an input buffer. Unless you are using the RS423 interface, this means that a key has been pressed. d.

An ADC has just finished a conversion. The number of ADCs in use is controlled by the "\*FX16,n" command, and the enabled converters take a sample, in sequence, every 10 mSecs. e. Start of "vertical sync" — this allows you to spot when the computer rewrites the screen. f. The interval timer (NOT the clock — this is a second "clock") has just counted up through zero. This gives a convenient way of setting a task to do something after any specified time interval. g. To give an extra signal if the ESCAPE key is pressed.

These Events are all switched off (disabled) when you switch the computer on, but you can select any or all of them to have effect by means of the "\*FX14,n" commands on p.426. The corresponding "\*FX13,n" commands will disable any Events which have previously been enabled.

## ADDRESS

You can see by the sort of things which produce Events that the computer must be responding to them all the time if it is to work at all. However, if an Event is enabled then, whenever the associated interrupt occurs, the computer looks first at addresses &220 and &221 and treats whatever is contained there as the address for a machine-code subroutine. It carries out that subroutine before it does whatever it was going to do anyway.

So, all you have to do to use Events is to write a suitable piece of machine code, put its address into &220, enable the appropriate Event, and you're off. It's as simple as that.

Well, maybe not quite that easy, because any Event-handling routine must observe a number of rules: a. The handler

must not last more than about 1 mSec, or else there is a danger that it will interfere with the computer's normal operation. b. It must save the 6502's registers at the start and restore them before it finishes. c. It must not enable 6502 "maskable interrupts" (via the command CLI). d. The routine must go back to the OS with a "Return from Subroutine" (RTS) command.

Let's have a look now at a simple example to show how we can use the Event facility. We will make the loudspeaker give a click every time that a key is pressed.

## KEY CLICK

The program, in fact, could make any sound you like when keys are pressed, but the following commands make a suitable noise:

```
ENVELOPE 1,1,0,0,0,10,
10,10,127, - 127,0, -
127,126,0
SOUND 1,1,145,1
```

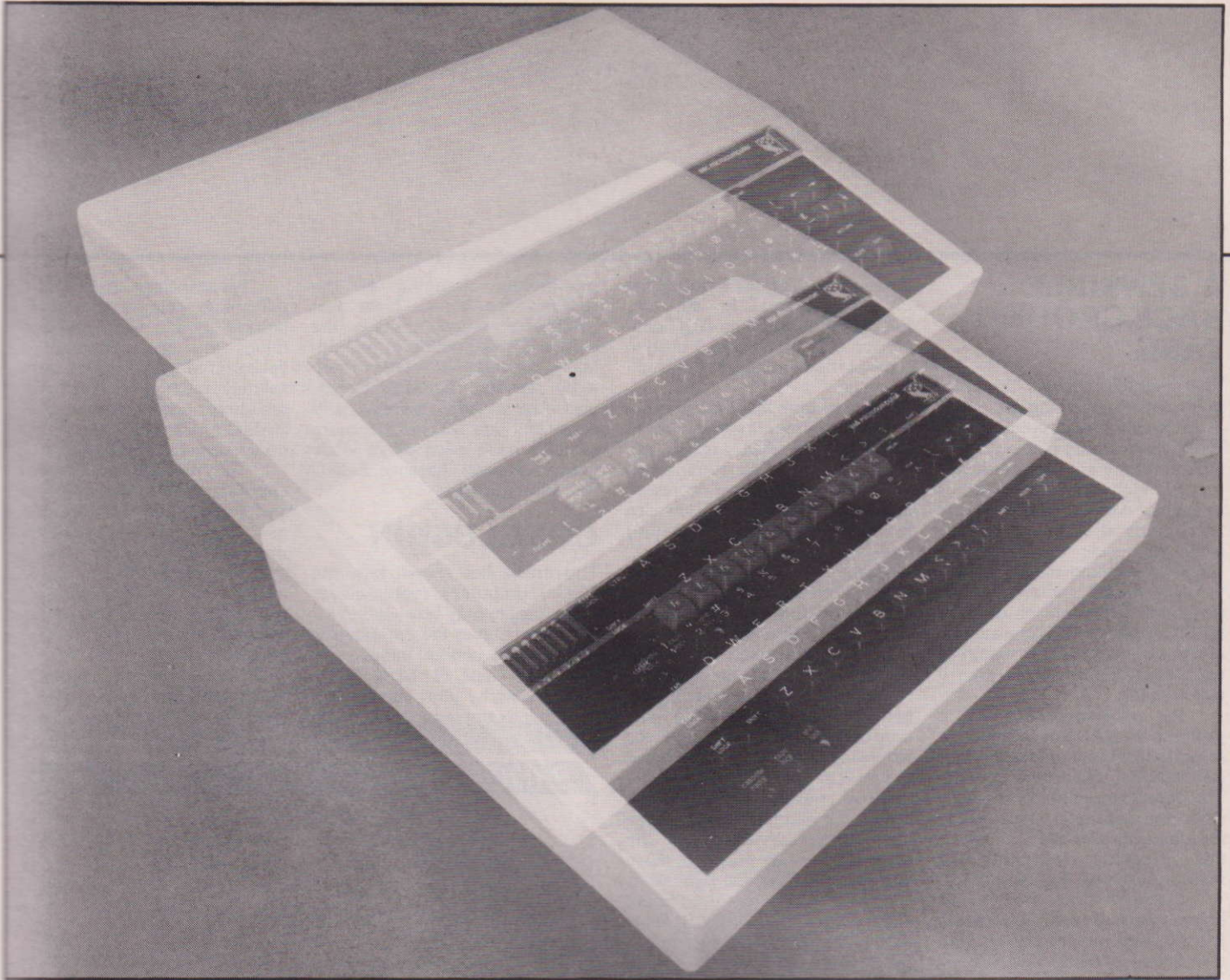
If you try those commands in immediate mode, you will hear a short, sharp, click.

If Event 2 is enabled by \*FX14,2, an interrupt will appear every time that a key is pressed. We therefore need a click routine to: a. Respond to the Event and ensure that it actually was no. 2; the number is passed to the routine in the micro's A register. We need the check to make sure that the routine does not respond to any other Events which may be active. b. If, and only if, it was that Event, make the sound; the OSWORD call with A=7 described on p.461 of the User Guide is just the job for this.

Listing 1 is a routine for the task: note that, before you type it in, you should set PAGE=&F00 in order to give the handler somewhere to live. If you take this approach, you can delete the program after you have RUN it, and the handler will remain in memory and active.

The routine first of all sets up a parameter block equivalent to the SOUND statement so that the OSWORD call will do its job. Similarly, the ENVELOPE is





defined and the PROCAssemble sets up the handler code. The code is straightforward, saving the registers checking the value in A, calling OSWORD if necessary and, finally, restoring the registers again. Note that, although the click itself will last 50 mSec, the routine is over in a few score microseconds and does not go anywhere near the upper time limit for an interrupt handler. This is because, once set up, the sound system runs on its own.

Key f0 will enable the clicks, first of all setting up &220 to point to the routine and then issuing \*FX14,2. Key f1 cancels the Event.

## DOING TWO THINGS AT ONCE

That was a simple example, just to set the feel of Events, and it did not attempt to make the computer do two things at once. Let's now go on to an example which

does just that. At least, it appears to, although the background and foreground task never take place exactly simultaneously; the micro actually switches between the two so quickly that it gives the impression of doing two jobs together.

A convincing way to demonstrate the idea of multitasking is to make the computer play a tune continually, with no intervention. Meanwhile, the operator can get on with whatever other jobs he wants to.

How to do this? We know that Event 0 indicates that an output buffer is empty, and the SOUND buffers count as outputs. We can therefore enable this particular Event and an interrupt will be generated whenever, say, sound Channel 1 has no notes left in it.

How to do this? We know that Event 0 indicates that an output buffer is empty, and the SOUND buffers count as outputs. We can therefore enable this particular Event and an interrupt will be generated whenever, say,

sound Channel 1 has no notes left in it.

We can "trap" this event, check that it actually was Channel 1 because all the output buffers will generate an interrupt, and issue notes from a table held in memory. Listing 2 does the job.

This time, you must set PAGE=&1000 before you start; this gives room for the machine code, on page &E, and the tune data on page &F. One page allows up to 127 notes; if you want more, increase PAGE.

The program follows a similar pattern to the last one but is a little more complex. PROC-Fill loads the note/duration data into the tune buffer — the notes and durations use the standard BBC codes — and, having done so, stores the total number of notes at address &74 for later use.

PROCAssemble then sets up the machine code, which will: a. Save the registers. b. Check that it was Event 0, and that it came

from Channel 1. As indicated by the \*FX21 list on p.428 of the UG, this channel has the code 5 which is stored in register X when the Event happens. If the Event or Channel are wrong, the handler gives up (Lines 390-430). c. Get the values for the next note and put them in the "SOUND" buffer (lines 460-520). d. Bump the tune pointer to the next note. If it has reached the end of the tune, reset it to the start (Lines 540-690). e. Sound the note and return (lines 710-800).

As before, Key f0 starts things off. This time, it sets the program pointers to their initial values and puts the address of the routine into &220. Since the Event is only generated when a buffer goes from not-empty to empty, the key also generates a dummy sound in Channel 1 and then sends \*FX14,0. Key f1 shuts things down with an \*FX13,0.

**CONTINUED OVER**



## A SENSIBLE BACKGROUND TASK

That example showed the computer apparently doing two things at once but it was pretty banal. Who wants a tune playing all the time that they are programming?

A much more useful task is to gather data from one of the ADC ports at defined intervals, while still using the computer. This sort of thing might be very valuable in a lab., where the conventional approach of using a BASIC program to take a sample every, say, two minutes would tie up the computer all the time it was running.

We will therefore look at a program to take any number of samples from any one of the four ADCs at any fixed time interval. The data is stored in low memory while the computer stays usable for whatever you like (as long as that does not clash with the memory used by the sampler).

Listing 3 does the job. As before, we start with PAGE set to &1000, and run the background task between &E00 and PAGE. The data will actually be stored from &F00 upwards, allowing a maximum of 128 samples (2 bytes each) before it starts filling above &1000; if you want more samples, simply set PAGE higher.

The BASIC part of Listing 3 first sets up the pointers to the various areas used by the program and then assembles it. The various sampling constants are put into the parameter area. &200 is set to the start of the routine and then the soft keys are set up. Key f0 will start the program, Key f1 stops it, and Key f9 simply displays the data as it is gathered.

The core of the background task is at lines 490-670 and saves the registers, checks which Events have occurred, calling subroutines as needed, and then passes control back to the normal OS.

The routine uses two Events running simultaneously. Event 5 which detects the interval timer

crossing zero, triggers the taking of each sample. In addition, Event 3 shows that an ADC conversion is complete and is used to prompt the reading of the sampled value.

Every time that the timer expires, the program ends up in subroutine SETADC, which triggers a sample. This routine first uses an OSWORD call to restart the timer on the countdown to the next sample (lines 720-750) and then uses "\*FX17, channel" to force a conversion on the selected channel. Having done so, it also issues an \*FX14,3 to enable ADC Events.

This approach is taken because the ADCs are normally running all the time and, if they generated an Event every time they completed a conversion, the whole system would be slowed down. On the other hand, the routine needs an interrupt because it cannot afford to wait the 10 mSecs needed for the conversion — it must go away and come back at the right time.

So, the program uses Event 3 to send it to SAMPLE (lines 840-1180). It checks first that it came from the correct channel (lines 860-880) because the event could still have come from one of the other 3 ADCs.

Assuming that it's the right one, the program reads the data, stores it and then increments the storage pointer by 2 to the next free space (lines 900-1020). ADC Events are then disabled until next needed and the sample counter adjusted. If it has dropped to zero, lines 1120-1170 clear all the Events and sound a warning note before returning control back through BGND to the OS.

The routine at Run is used just to start the task off. It initialises the system pointers, clears the data buffer and enables Event 5. It then calls BGND to force the first conversion; to do so, A is set to 5 (line 1510) to fool BGND into thinking an Event 5 had occurred.

If now you RUN the whole program and press Key f0, the sampling will start. You can watch it by pressing Key f9, which displays the start of the data buffer, and you will see the

parameters changing as the samples are taken. Note that PROCMon merely displays the data and has nothing to do with taking the samples. You can stop it by pressing the SPACE bar, wait a bit and then press Key f9 again and you will see that more samples have been taken while you were away, because BGND was still running.

## CONCLUSION

This article has shown how the BBC computer's very clever Event facility may be used to interrupt whatever the computer is doing when certain things happen. The value of the facility is limited only by your imagination and the examples I have given are only a starting point.

Nevertheless, it is not too difficult to get the computer to behave as if it were doing two things at once. Although the background task cannot be absolutely anything — it is hard to see how you would run two BASIC programs at once — it can do some very useful jobs.

The main limitation of the approach is that the background and foreground tasks must not use the same resources simultaneously. For instance, they must be in different parts of memory and, in the last example, any foreground task should avoid using the internal timer (the clock is OK) or ADC1.

I hope that my suggestions are useful and will give you some ideas for your own background tasks.

## PROGRAM LISTING 1

```

10 REM ** Program to use "Events" to
20 REM ** give key-clicks to a BBC
30 REM ** computer
40 REM ** By D S Peckett - 28/10/83
50 REM ** Set PAGE=&F00 before use
60
70 REM ** Set up a dummy SOUND....
80 !&E10=1:REM** Channel
90 !&E12=1:REM** Envelope
100 !&E14=145:REM** Pitch
110 !&E16=1:REM** Duration
120 REM** ...and, a suitable ENVELOPE
130 ENVELOPE 1,1,0,0,0,10,10,10,127,-1
140 PROCAssemble:REM** Set up the code
150 REM** Key f0 STARTS key-click...
160
*KEY0"?&220=&20:?"&221=&0E:*FX14,2:M"
170 REM** ...and Key f1 disables it
180 *KEY1"*FX13,2:M"
190 END
200
210 DEF PROCAssemble
220 OSWORD=&FFF1:REM** Gives access to
SOUND from m/c
230 TEMP=&70:REM** Temporary storage
240 FOR PASS=0 TO 3 STEP 3
250 P%=&E20:REM** Start above SOUND
Parameters
260 IOPT PASS
270 \Save all the registers
280 PHP
290 STA TEMP:PHA

```



```

300 TXA:PHA
310 TYA:PHA
320 LDA TEMP \Get back Event code
330 CMP #2 \Ensure it was Keyboard
340 BNE EXIT \Finish if not
350 \It was a key - make click
360 LDX #810 \Point to...
370 LDY #80E \..SOUND pars
380 LDA #7:JSR OSWORD \=SOUND
390 \Restore registers
400 .EXIT PLA:TAY
410 PLA:TAX
420 PLA
430 PLP
440 RTS \...and done
450 J
460 NEXT PASS
470 ENDPROC

```

## PROGRAM LISTING 2

```

10 REM ** Program to demonstrate BBC
20 REM ** multi-tasking by playing
30 REM ** a tune while the computer
40 REM ** carries on working normally
50 REM ** by D S Peckett - 28/10/1983
60
70 REM ** Set PAGE=&1000 at start
80
90 REM ** Set up pointers
100 Sound=&E10:CODE=&E20:TUNE=&F00
110 REM** Put tune data in low memory
120 PROCfill
130 REM** Set up the background task
140 PROCAssemble
150 REM** Set up fixed parameters for
SOUND
160 !Sound=1:REM** Channel
170 Sound!2=1:REM** ENVELOPE number
180 ENVELOPE 1,2,0,0,0,10,10,10,8,-1,0
,-20,50,30
190 REM** Key f0 enables tune...
200 *KEY0"?&72=0:&73=&0F:&220=&20:&8
221=&0E:SOUND 1,-5,0,0:*FX14,0!M"
210 REM** ...and Key f1 disables it
220 *KEY1"*FX13,0!M"
230 END
240
250 DEF PROCAssemble
260 OSWORD=&FFF1:REM** Used to access
SOUND
270 TEMP=&70
280 TEMPX=&71
290 Pointer=&72:REM** Place in music
300 Total=&74:REM** Number of notes in
tune

```

```

310 FOR PASS=0 TO 3 STEP 3
320 PX=CODE
330 IOPT PASS
340 \Save the registers
350 PHP
360 STA TEMPX:PHA
370 STX TEMPX:TXA:PHA
380 TYA:PHA
390 LDA TEMPX \Get Event code
400 BNE EXIT \If <>0 then not sound
buffer
410 LDA TEMPX \Get Channel number
420 CMP #5 \Channel 1?
430 BNE EXIT \Not tune if <>1
440 \Put next note in SOUND area
450 \Zero high bytes
460 LDA #0:STA Sound+5:STA Sound+7
470 TAY \Y=0 now
480 LDA (Pointer),Y
490 STA Sound+4 \Pitch
500 INY
510 LDA (Pointer),Y
520 STA Sound+6 \Duration
530 \Bump contents of Pointer by 2
540 LDA #2:CLC:ADC Pointer
550 STA Pointer
560 LDA Pointer+1:ADC #0
570 STA Pointer+1
580 ADC #0
590 STA Pointer+1
600 \Reached end of tune?
610 LDA Total
620 CMP Pointer
630 BNE NotEnd
640 LDA Total+1
650 CMP Pointer+1
660 BNE NotEnd
670 \If yes - reset to start
680 LDA #0:STA Pointer
690 LDA #0F:STA Pointer+1
700 \Now make the note
710 .NotEnd LDA #7
720 LDX #(Sound MOD 256)
730 LDY #(Sound DIV 256)
740 JSR OSWORD
750 \Restore registers
760 .EXIT PLA:TAY
770 PLA:TAX
780 PLA
790 PLP
800 RTS \...and done
810 JNEXT

```

CONTINUED OVER



```

820 ENDPROC
830
840 REM** Fill the data area with the
tune
850 REM** Max of 127 notes, stored in
860 REM** Pitch/duration pairs, and
870 REM** ending with 0,0
880 DEF PROCFill
890 I%=0
900 RESTORE 980
910 REPEAT
920   READ Pch,Durn
930   IF Pch THEN TUNE?I%=Pch:TUNE?(
I%+1)=Durn:I%=I%+2
940   UNTIL Pch=0
950 ?&74=(I%+TUNE)MOD 256:REM** Set
Total pointer
960 ?&75=(I%+TUNE)DIV 256:REM** to end
of data
970 ENDPROC
980 DATA 61,3,61,9,61,3,81,12,81,12,89
,12,89,12,109,18,97,6,81,6,81,3,97,9,81,
3,69,12,101,24,89,9,77,3,81,24
990 DATA 81,3,81,9,89,3,97,12,97,12,97
,12,101,9,97,3,97,12,89,12,89,9,97,3,101
,12,101,12,101,12,109,9,101,3,97,24
1000 DATA 109,9,109,3,109,12,97,9,81,3,
109,12,97,9,81,3,61,48,0,0

```

### PROGRAM LISTING 3

```

10 REM ** Routine to set up the BBC
20 REM ** computer to sample values
30 REM ** from an ADC port as a
40 REM ** background task while
50 REM ** still seems normal
60 REM ** by D S Peckett - 29/10/1983
70
80 REM ** Set PAGE=&1000
90
100 REM** Set up pointers
110 Time=&E04:Sound=&E0A:CODE=&E18:Sto
rage=&F00
120 PROCAssem
130 REM** Set up sampling Parameters
140 ?Channel=1:REM** ADC Channel
150 Period=200:REM** Sample period in
1/100sec
160 NSamples=100:REM** No of samples
170 REM** Put constants into program
180 !Time=-Period::Time!4=&FF
190 ?NTotal=NSamples MOD 256
200 NTotal?1=NSamples DIV 256
210 REM** Point to routine
220 ?&220=BGND MOD 256
230 ?&221=BGND DIV 256
240 REM** Start it with Key f0
250 *KEY0"CALL Run!M"
260 REM** Stop with Key f1
270 *KEY1"*FX13,5!M*FX13,3!M"
280 REM** Key f9 shows the action
290 *KEY9 "MODE7!M:PROCMon!M"
300 END
310
320 DEF PROCAssem
330 OSBYTE=&FFF4
340 OSWORD=&FFF1
350 TEMP=&70:REM** Temporary storage
360 Channel=&72:REM** Channel number
370 Pointer=&73:REM** To storage area
380 Total=&75:REM** Sample counter
390 NTotal=&77:REM** No of samples
400 REM** SOUND Parameters for end
410 !Sound=1:Sound!2=-10
420 Sound!4=60:Sound!6=15
430 FOR PASS=0 TO 3 STEP 3
440   P%=CODE
450   [OPT PASS
460   \
470   \Main, calline, segment
480   \Save registers
490   .BGND PHP
500   STA TEMP:PHA
510   TXA:PHA
520   TYA:PHA
530   LDA TEMP \Get event number
540   CMP #5 \Was it timer?
550   BNE NotTime
560   JSR SETADC \Start the conversion
570   JMP EXIT \and return
580   .NotTime CMP #3 \ADC Complete?
590   BNE EXIT \Must be something else
600   JSR SAMPLE \Read the ADC & store
610   \Restore registers
620   .EXIT
630   PLA:TAY
640   PLA:TAX
650   PLA
660   PLP
670   RTS
680   \
690   \Start the ADC going
700   \
710   .SETADC
720   LDX #(Time MOD 256) \Point to...
730   LDY #(Time DIV 256) \...interval
740   LDA #4
750   JSR OSWORD \Set timer running
760   \Start conversion going

```





```

770 LDX Channel:LDA #17:JSR OSBYTE
780 \Enable ADC Event
790 LDX #3:LDA #14:JSR OSBYTE
800 RTS
810 \
820 \Take and store a sample
830 \
840 .SAMPLE
850 \Check which channel gave Event
860 LDY #0:LDX #0:LDA #80:JSR OSBYT
E
870 CPY Channel \Correct?
880 BNE SampleDone
890 \Read the channel if correct
900 LDY #0:LDX Channel
910 LDA #80:JSR OSBYTE
920 TYA \Move hi byte
930 LDY #1
940 STA (Pointer),Y \Save it
950 TXA
960 DEY
970 STA (Pointer),Y \Save lo byte
980 \Bump Pointer to storage by 2
990 LDA #2:CLC:ADC Pointer
1000 STA Pointer
1010 LDA #0:ADC Pointer+1
1020 STA Pointer+1
1030 \Disable ADC Events
1040 LDX #3:LDA #13
1050 JSR OSBYTE \*FX13.3
1060 \Decrement sample total counter
1070 SEC:LDA Total:SBC #1:STA Total
1080 LDA Total+1:SBC #0:STA Total+1
1090 ORA Total \See if done
1100 BNE SampleDone
1110 \If finished, stop sampling
1120 LDX #5:LDA #13:
1130 JSR OSBYTE \*FX13.5
1140 \Done - sound tone
1150 LDX #Sound MOD 256
1160 LDY #Sound DIV 256
1170 LDA #7:JSR OSWORD
1180 .SampleDone RTS

1190 \
1200 \Routine to start things off
1210 \
1220 .Run LDA NTotal:STA Total
1230 LDA NTotal+1:STA Total+1 \Total
1240 \Double it
1250 ASL Total:ROL Total+1
1260 \Point to start of data area
1270 LDA #Storage MOD 256:STA Pointer
1280 LDA #Storage DIV 256:STA Pointer'
+1
1290 \Zero storage area
1300 .Clear LDA #0:TAY
1310 STA (Pointer),Y
1320 \Bump Pointer
1330 LDA #1:CLC
1340 ADC Pointer:STA Pointer
1350 LDA #0:ADC Pointer+1
1360 STA Pointer+1
1370 \Decrement Total
1380 SEC:LDA Total:SBC #1:STA Total
1390 LDA Total+1:SBC #0:STA Total+1
1400 ORA Total \See if done
1410 BNE Clear
1420 \Area now clear -reset p'ters
1430 LDA NTotal:STA Total
1440 LDA NTotal+1:STA Total+1 \Total
1450 \Point to start of data area
1460 LDA #Storage MOD 256:STA Pointer
1470 LDA #Storage DIV 256:STA Pointer
+1
1480 \Set Event 5
1490 LDX #5:LDA #14
1500 JSR OSBYTE-\*FX14.5
1510 LDA #5:JSR BGND \Force start
1520 RTS
1530 J
1540 NEXT
1550 ENDPROC
1560
1570 REM** Display data buffer
1580 DEF PROCMon
1590 CLS
1600 PRINT TAB(0,24) "Press SPACE to
stop":
1610 REPEAT
1620 FOR Y%=0 TO 20
1630 FOR X%=0 TO 3
1640 PRINT TAB(10*X%,Y%); (Storage!
(Y%*8+X%*2) AND &FFFF):SPC(4);
1650 NEXT
1660 NEXT
1670 REM** SPACE to finish
1680 UNTIL INKEY(-99)
1690 ENDPROC

```



# Silicon Graphics

Trevor Attewell

This ROM from Computer Concepts provides a number of commands which make complicated graphics easy and quick to produce. After installing it you may be worried (if you haven't read the instructions!) because neither is it listed when you type \*HELP, nor does it work! First it must be enabled with \*FX162, while \*FX162,128 disables it again — either state survives a hard BREAK. The reason for this arrangement is that when the Graphics Extension ROM is enabled it claims page &C00 as workspace. User-defined characters (which normally reside there) cannot then be defined until the ROM is disabled. This is no problem if the ROM is not in use, while characters can still be defined with the ROM enabled by a special command which relocates them (at the cost of one page of memory), as we shall see later. Alternatively the ROM can be disabled temporarily while previously saved character definitions are \*LOADED at &C00 and used. The ability to disable the ROM can also be handy if a command name clash occurs with another of lower priority. Incidentally, Computer Concepts can supply a 'reversed' version (ie cold-start enabled) on request. Standard version numbers begin with the figure 2, the others with 1.

## SQUEEZE

The 72-page (!) spiral-bound manual details 29 new 'star' commands, and \*HELP GRAPHICS produces the complete list with syntax (you need paged mode!). 'Star' commands are offered to all ROMs in turn until recognised, so time is saved, and graphics speeded up, if the Graphics ROM is placed in a high-priority socket. The usual rules apply to abbreviations (minimum two or three characters). Nearly all the Graphics ROM commands expect various arguments and, as with Disc Doctor, unacceptable or missing ones produce useful prompts, giving the correct syntax. Some arguments are optional, defaulting to sensible values. An important adjunct to

## Computer Concepts comprehensive Graphics ROM.

```

GRAPHICS EXTENSION 2.09
RESERVE <adr> <end adr>
DATA <<ID>>
DESIGN <ID> <Xs,Ys>
FILM <ID> <ann>
ALTER <ID> <<to ID>>
RESET <ID> <<to ID>>
PUT <fsp> <ID> <<to ID>>
GET <fsp>
IN <ID> <X,Y> <<frame>>
OUT <ID>
IMAGE <ID> <X,Y>
TURTLE <op> <<Xs,Ys>> <<col>>
POS <X,Y> <<angle>>
PENDOWN
PENUP
LEFT <angle>
RIGHT <angle>
FORWARD <dist>
BACKWARD <dist>
SCALE <X,Y> <X,Y>
ROTATE <<angle>> <<X,Y>>
PIXEL <X,Y> <<Xs,Ys>>
PRINT <str> <X,Y> <<Xs,Ys>>
CIRCLE <X,Y> <radius>
PATTERN <op> <X,Y> <Xs,Ys> <<step>>
ARC <op> <X,Y> <Xs,Ys> <stt,end>
FILL <X,Y> <col>
PLOT <op> <X,Y,Z>
GFX <fn> <<arg>> <<arg>>

```

OS 1.20

flexibility is that resident integer variables are accepted as numeric arguments. One facility not displayed by \*H. is an extra screen mode (Mode 8), which can be called in the usual way whenever the ROM is enabled. The resolution is only 80 x 256, with 10 x 32 characters — also wrap-round will occur if windows or plots go beyond the screen limits, but 16 colours in only 10K

of memory has to be a useful option. the commands fall into three distinct groups, and we shall look at each group in turn.

## WEE LITTLE GHOSTIES . . .

The first group (11 commands) concerns "Sprite Graphics". Hardware sprites, supported by a

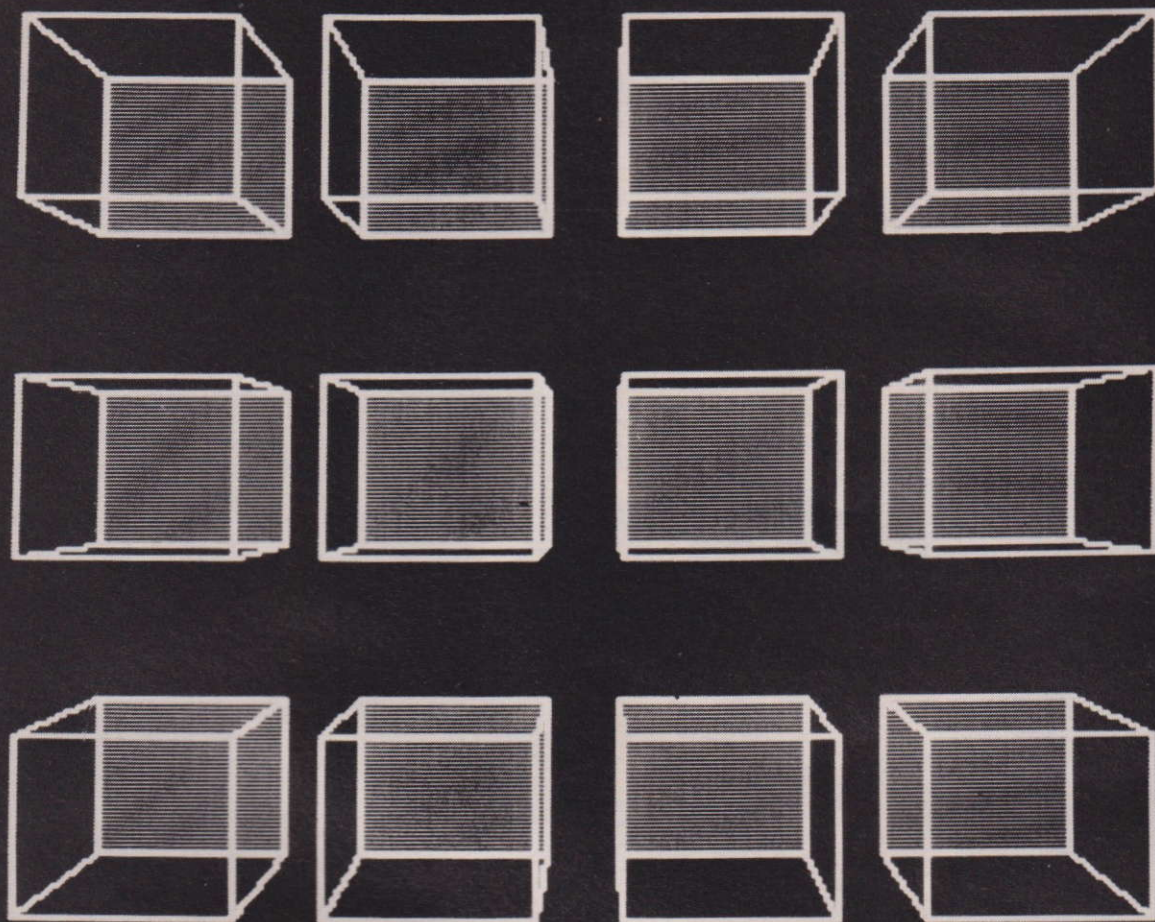
number of recent computers, are not available on the Beeb. The Graphics ROM offers software implementations in the form of user-defined patterns (not to be confused with user-defined characters), which can vary in height and width, and may be multi-coloured. Up to 32 sprites can be defined in modes 0, 1 or 2, and memory is set aside for them by \*RESERVE. The usual reserved area would be between &2000 and &2FFF, the start figure depending upon the expected number and size of the sprites. Having chosen a suitable mode, \*DESIGN, followed by an identification number (ID) and size parameters, produces a colour palette and an empty grid on which the sprite is designed, an actual-size copy appearing at the top right of the screen. Pressing RETURN deposits the sprite in memory, and clears the screen, while TAB also down-loads the sprite, updates the ID number, and leaves the previous image on the screen. This option is particularly useful when producing Films (see below).

## DETAILS

\*PUT saves an optional range of IDs on the current filing system, and \*GET reloads the file (if memory has been reserved). Sprites are placed where required on the screen by \*IN, and deleted by \*OUT, while \*IMAGE repeats a sprite without deleting previous copies. \*ALTER recalls a specified sprite for editing if the current mode is that in which it was defined. A 'No room' message follows a \*DESIGN command if insufficient room is left, in which case \*RESET will delete unwanted sprites to make more space. If there are no redundant sprites the complete set can first be saved and then deleted from memory. This frees \*RESERVE to allocate more space (it won't work with definitions still in memory), and the saved sprites can be reloaded.

\*FILM is used for sprite animation. The arguments are an ID number from 0 to 31, followed by a list of up to 47 other ID numbers, each being that of a





sprite used for one 'frame' of the film. \*IN is repeated to run the film, specifying the screen positions for successive frames. A completed sequence restarts from the beginning. Large sprites can be assembled from smaller ones, not all of which need necessarily be animated in a film sequence. Thus a walking 'man' utilise fixed sprites as head and body, with a film series of sprites giving different leg positions. It may not be necessary to modify every part of the 'leg' sprite — hence the handiness of the TAB function mentioned above. In a timed test in which a figure moved across the screen, 68 movements took 4 seconds, a frame rate similar to that of 8mm home-movies. While this is much slower than hardware-implemented sprites, it is perfectly adequate for many applications. To keep track of sprites and films \*DATA lists all used ID numbers, with the design mode, height and width for each sprite, together with the frame makeup of each film and all memory allocations (see also \*GFX below).

# TURNING TURTLE

The second group (8 commands) will be familiar to anyone who has used LOGO, the language of Turtle Graphics. The original robotic turtle is indicated by a triangle on the screen, and this can be moved forward, backward, turned through an angle or repositioned on the screen. The turtle's height, width and colour can be changed, or it can remain invisible, and it can be moved with or it can remain invisible, and it can be moved with or without leaving a 'trail' behind it, the trail taking any of the forms allowed by the normal BASIC plot options. The commands used have obvious meanings, and need not be detailed here. Several common LOGO functions (such as the ability to define sequences) can readily be implemented in BASIC, and are not needed on the ROM. This ROM is many times faster than software LOGO programs, and runs more than six times faster still if the turtle is not displayed.

Apart from its common use in education, LOGO can help in a wide range of pictorial, planning and design applications. A circuit diagram is shown here by way of example, using non-LOGO commands solely for the connection 'blobs' and the circle. It took 10.7 seconds to execute using the turtle, but only 1.6 seconds without it. This is merely a trivial illustration of just one of a great variety of possibilities.

## MAKE A SCENE!

The third group of 11 commands are described as 'General', and include some particularly useful facilities. One of the most powerful is \*PLOT, which draws three-dimensional structures in correct perspective, given arguments for X, Y and Z dimensions and for the usual Basic PLOT options (line, triangle etc). Our photograph example shows a cube drawn in 12 different positions, the far side of the cube being filled in to help reduce visual inversion. \*FILL uses a specified colour to fill practically any area, however complicated

its shape, including around lettering, as long as the shape has a closed boundary. It can even change the colour of one or more connecting lines if the starting point is located on one of them. This is an outstandingly useful command, condemning a number of ingenious software programs to instant obsolescence.

**\*PATTERN** draws different sized circles, spirographs or multiple patterns, with arguments for the plot option, pattern width and centre position, also the number of steps to be used. **\*ARC** will draw any part of the arc of an oval of specified height/width ratio, centred on selected coordinates (on or off the screen). **\*CIRCLE** performs the obvious function, given the coordinates of the centre and the radius. Rectangular blocks are handled by **\*PIXEL**, which plots of pixels of any required size starting from given coordinates. In the absence of any width and height arguments a single pixel is plotted.

**CONTINUED OVER**





\*SCALE and \*ROTATE increase the flexibility a great deal further. The first changes the screen coodinates (normally 0,0 at the bottom left corner to 1279,1023 at the top right), and sprite is on screen, or which frame of a film is being displayed), details of reserved memory, both used and spare, and the Turtle status (size, coodinates, angle, plot option and whether or not in use). Fast SIN and COS functions can return any multiple of the chosen function for any angle, and are very useful in drawing wavy lines. Another \*GFX call enables or above the OSHWM, and caters for 'exploded' definitions. PAGE is automatically raised accordingly. This option must be exercised before entering the program. The lat of the GFX functions converts a given (X,Y) coordinate to the actual screen values following

rotation and/or scaling, together with the appropriate colour. This gets around the difficulty that the Basic POINT command will not work after these operations because it is not itself subject to them.

The accompanying screen photograph of a pastoral scene (in glorious black-and-white!) illustrates the uses of some of these features. The background is taken from a Computer Concepts dealer's demonstration disc (sorry! NOT on public sale), into which I have taken the liberty of introducing some modifications.

The clouds, mountains and snow caps are drawn first with \*ARC and \*PATTERN, then the horizon is added. Next, the screen is \*SCALEd, and the road outlines are laid down, using the \*GFX fast sine function with a variable argument inside a FOR/NEXT loop. The trees are randomly laid out within the same loop, using \*PLOT to ob-

tain the 3-D effect of increasing size towards the foreground. After restoring normal scaling the various areas are \*FILLED with appropriate (?) colours. The hoarding and the 'man' are both composed of sprites, which are always EORed on the screen to allow them to pass in front of other objects without destroying them. This will not do for the hoarding, because the random tree background would show through, so \*PIXEL is used to make a black space with which to EOR it — this is not necessary in the case of the figure.

## CONCLUSION

The Graphics Extension ROM is a very comprehensive and highly flexible set of utilities which greatly extends the Beeb's already outstanding capabilities. Because it is so powerful it allows complex designs in high-resolution modes with very modest program

lengths. For example, the program and variables for the Mode 2 'picture' shown here occupied only 1772 bytes, including 132 unnecessary spaces, plus the area &2400 to &2E20 required for the nine sprites used. Inevitably some familiarisation time is required to get to grips with so many facilities, and I recommend the use of graph paper as a rough design aid until one acquires more knack. The paper should be large enough to take care of features such as arcs centred off-screen. The manual is very complete and helpful, with a considerable number of program examples. It groups the commands in logical order, which is inconvenient when looking for a particular command, but a revised version with an alphabetical layout and summary tables is in preparation. I can heartily recommend this ROM to anyone who makes more than the most casual use of graphics on the Beeb.





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# Bomb Run

Keith Miles

As an exercise in programming this game exhibits the structured nature of the BBC BASIC, consisting of a series of linked procedures. It also demonstrates the speed of BBC BASIC and is fun to play.

The aim of the game is to defuse the activated bombs whilst avoiding the pursuing boots. Unactivated bombs will explode if touched. Points are scored for defusing bombs, securing the yellow flags and luring the pursuing boot onto defused bombs (which will destroy them). Penalty points are deducted for going into the blue squares.

The game consists of successive sets of four levels. During each of these phases the number of bombs, flags and boots doubles. At the start of the next phase the speed of the count-

**A fast and furious arcade game with screens of increasing difficulty, High Score and Hall of Fame. Defuse the bombs but watch out for the boots.**

down of the bombs increases, as do the penalties.

The game starts with a title page with instructions, to which you return after each unsuccessful mission. The game also includes

a Hall of Fame and High-Score facility.

The game consists of a series of linked named procedures (subroutines) whose function is self-explanatory:

CHARACTERS, INIT, TITLES, BOARD, BOMB, boot, FLAG, TRIGGER, MAN, BOOT, bomb, DEFUSE, DEAD, EXPLODE and HISCORE. The program is controlled by the loop at line 230 to 250 i.e. 230 REPEAT:PROC TRIGGER:PROC MAN:PROC BOOT:250 UNTIL ---. Movement is achieved by use of PRINT TAB as a VDU command (VDU31) and contact by the POINT command to detect colour.

The game runs in Mode 2 to take advantage of the greater number of colours but, for the minority of BBC Micro owners with a MODEL A, could easily be converted to run in Mode 5. Some small amendments to the sound are all the Electron owner should have to worry about.

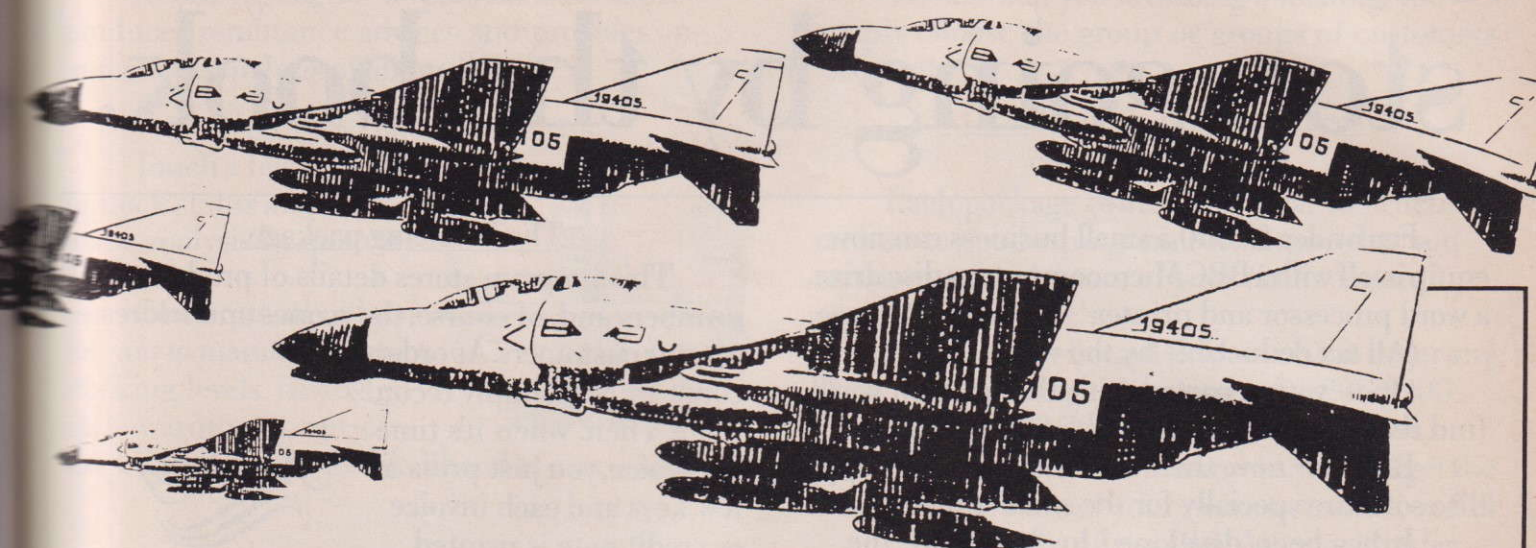
## PROGRAM DESCRIPTION

```

20 MODE2
30 ENVELOPE3,129,2,4,6,28,14,7,0,0,0,-80,80,80
40 ENVELOPE2,1,4,-4,4,10,20,10,127,0,0,-5,126,126
50 ENVELOPE1,1,0,0,0,0,0,0,0,0,0,-1,126,0
60 VDU23,1,0;0;0;0;
70 DIMX%(19),Y%(19),S1%(5),S2%(5),A$(10,1)
80 PROCCHARACTERS
90 PROCINIT
100 PROCTITLES
110 CLS:LV%=3:CO%=10:SC%=15:SP%=8
120 SC%=1000:LVL%=1
130 RA%=1:AL%=4:SP%=SP%
140 IFAL%>18 AL%=18
150 IFRA%>4 RA%=4
160 IFSP%<2 SP%=2
170 IFCO%<2 CO%=2
180 RX%=0:CX%=0:EX%=0:SX%=10:SY%=29:XS%=SX%:YS%=SY%:FL%=
-1:GO%=1:DL%=0:BT%=0
190 PROCBOARD
200 PROCBOMB
210 PROCboot
220 PROCFLAG
230 REPEAT:PROCTRIGGER:PROC MAN:PROCBOOT
240 IFSC%<=0 SC%=0:PROCDEAD
250 COLOUR3:PRINTTAB(14,1);SC%:" ";UNTIL CX%=AL%+1
OR EX%=1 OR SC%<=0
260 IFEX%=1OR SC%<=0 THEN300
270 LVL%=LVL%+1
280 IFCX%=AL%+1AND AL%=18:CO%=CO%-2:SC%=SC%+5:SP%=SP%-
2:LV%=LV%+1:GOTO130
290 RA%=RA%+1:AL%=AL%+5:SP%=SP%-2:GOTO140
300 IFLV%>0THEN160
310 PROCEXPLODE
320 COLOUR8:PRINTTAB(6,15)"BOMB-RUN":COLOUR3:PRINTTAB
(0,30)"ANOTHER BOMB-RUN? ";
330 *FX21,1
340 A$=GET$:IFA$="Y"OR A$="y" PROCHIScore:GOTO100
350 IFA$="N"OR A$="n" PRINTTAB(0,31);:END
360 GOTO340
370 DEFPROCBOARD
380 COLOUR3:PRINTTAB(0,0)"LEVEL"TAB(7,0)"LIVES"TAB(14
,0)"SCORE"
390 PRINTTAB(2,1);LVL%;TAB(9,1);LV%;TAB(14,1);SC%
400 COLOUR4:FORI%=0TO19:FORJ%=2TO29:VDU31,I%,J%,224:N
EXT:NEXT
410 ENDPROC
420 DEFPROCCHARACTERS
430 VDU23,224,0,126,126,126,126,126,0,23,225,15,1
1,15,11,255,255,255,171
440 VDU23,226,129,90,60,90,126,60,90,129,23,227,28,28
,8,62,28,28,20,54
450 VDU23,228,0,8,24,56,24,8,8,28,23,229,255,129,165,
153,153,165,129,255,23,230;146,84;198;84;146
460 ENDPROC
470 DEFPROCINIT
480 FORI=1TO10:A$(I,0)=STR$(I*1000):A$(I,1)="Bomb-run
":NEXT
490 ENDPROC
500 DEFPROCBOOMB
510 COLOUR6:FORI%=0TO AL%:X%(I%)=1+RND(18):Y%(I%)=1+R
ND(27):VDU31,X%(I%),Y%(I%),226:NEXT
520 ENDPROC
530 DEFPROCFLAG
540 FORI%=0TO AL%
550 X1%=RND(20)-1:Y1%=RND(28)+1
560 fg%=FNPT(X1%,Y1%)
570 IFfg%=4 COLOUR3:VDU31,X1%,Y1%,228 ELSE GOTO550
580 NEXT
590 ENDPROC
600 DEFPROCboot
610 FORI=1TORA%
620 S1%(I%)=RND(20)-1:S2%(I%)=RND(28)+1
630 bt%=FNPT(S1%(I%),S2%(I%))
640 IFbt%=4 COLOUR1:VDU31,S1%(I%),S2%(I%),225 ELSE
GOTO620
650 NEXT
660 ENDPROC
670 DEFPROCTRIGGER
680 IFFL%>-1 PROCbomb:GOTO730
690 IFRND(1)<.95THEN730
700 RX%=RND(AL%+1)-1
710 IFY%(RX%)=-32THEN700
720 FL%=10
730 ENDPROC

```





```

740 DEFPROCbomb
750 IFFL%=0 PROCEXPLODE:EX%=1:LV%=LV%-1:GOTO800
760 DL%=DL%+1:IFDL%=CO% DL%=0 ELSEGOTO800
770 FL%=FL%-1
780 COLOUR5:COLOUR130:VDU31,X%(R%),Y%(R%),48+FL%
790 COLOUR128
800 ENDPROC
810 DEFPROCman
820 VDU31,SX%,SY%,32
830 XS%=SX%:YS%=SY%
840 *FX21,0
850 *FX21,5
860 IFINKEY(-2)AND SX%<19 SX%=SX%+1:GOTO910
870 IFINKEY(-65)AND SX%>0 SX%=SX%-1:GOTO910
880 IFINKEY(-89)AND SY%>2 SY%=SY%-1:GOTO910
890 IFINKEY(-1)AND SY%<29 SY%=SY%+1:GOTO910
900 GOTO980
910 SOUND&11,2,50,1
920 mn%=FNPT(SX%,SY%):mno%=FNpt(SX%,SY%)
930 IFmn%=4 SC%=SC%-sc%:GOTO980
940 IFmn%=14 SX%=XS%:SY%=YS%:GOTO980
950 IFmn%=5 PROCDEFUSE: SX%=XS%:SY%=YS%:GOTO980
960 IFmn%=10R mn%=6 PROCDEAD:GOTO990
970 IFmn%=3 PROCBONUS
980 COLOUR2:VDU31,SX%,SY%,227
990 ENDPROC
1000 DEFPROCbonus
1010 SOUND&13,3,50,10
1020 SC%=SC%+100
1030 ENDPROC
1040 DEFPROCDEFUSE
1050 SOUND&1,5,1
1060 FORJ%=0TO AL%
1070 IFSX%<>X%(J%)ORSY%<>Y%(J%) THEN1100
1080 SC%=SC%+(100*LVL%):C%=C%+1
1090 Y%(J%)=-32
1100 NEXT
1110 COLOUR14:VDU31,SX%,SY%,229
1120 FL%=-1
1130 ENDPROC
1140 DEFPROCDEAD
1150 SOUND&1,5,1
1160 EX%=1:LV%=LV%-1
1170 VDU31,SX%,SY%,230
1180 FORL=1TO500:NEXT
1190 ENDPROC
1200 DEFPROCEXPLODE
1210 FORI=1TO10:SOUND&, -15,6,10:FORJ=1TO50:VDU19,0,RND
(6);0;:NEXT:NEXT
1220 VDU20
1230 ENDPROC
1240 DEFPROCTITLES
1250 CLS:COLOUR4:FORI%=0TO30:FORJ%=0TO19:PRINTCHR#224;
: NEXT:NEXT
1260 COLOUR1:PRINTTAB(6,0)"BOMB-RUN"
1270 COLOUR3:PRINTTAB(2,2)"RUN FROM BOMB TO"TAB(1,3)"B
OMB DEFUSING THEM"TAB(5,4)"AS YOU GO."
1280 PRINTTAB(2,6)"THEY CAN ONLY BE"TAB(0,7)"DEFUSED O
NCE ACTIVE"TAB(0,8)"OTHERWISE AVOID THEM"
1290 PRINTTAB(2,10)"YOU SCORE FOR"TAB(0,11)"DEFUSING B
OMBS.BONUS"TAB(1,12)"POINTS ARE AWARDED"TAB(2,13)"FOR S
ECURING THE"TAB(0,14)"FLAGS AND LURING THE"TAB(0,15)"PU
RSUING BOOTS ONTO"TAB(3,16)"DEFUSED BOMBS."
1300 COLOUR6:PRINTTAB(2,18)CHR#226" BOMB"
1310 COLOUR5:COLOUR130:PRINTTAB(2,19)"1":COLOUR128:PRI
NTTAB(3,19)" ACTIVE BOMB"
1320 COLOUR14:PRINTTAB(2,20)CHR#229" DEFUSED BOMB"
1330 COLOUR1:PRINTTAB(2,21)CHR#225" BOOT"
1340 COLOUR3:PRINTTAB(2,22)CHR#228" FLAG"
1350 COLOUR2:PRINTTAB(2,23)CHR#227" YOUR MAN"
1360 COLOUR3:PRINTTAB(1,25)"CONTROLS:"TAB(2,26)"CAPS-L
OCK LEFT"TAB(2,27)"CTRL RIGHT"TAB(2,28)"J
UP"TAB(2,29)"SHIFT DOWN"
1370 COLOUR1:PRINTTAB(3,31)"PRESS <SPACE>";
1380 I=0:REPEATI=I+1:SOUND&,-15,1,10:UNTILI=5
1390 IFINKEY#(100)=" THEN1400ELSE1380
1400 ENDPROC
1410 DEFPROCBOOT
1420 IFBT%=RAXTHEN1600
1430 GO%=GO%+1:IFGO%<>SP% THEN1600
1440 AX=AX+1
1450 IFAX>RAX AX=1
1460 IFS1%(AX)=-32AND BT%<>RAXTHEN1440
1470 *FX21,6
1480 *FX21,7
1490 COLOUR4:VDU31,S1%(AX),S2%(AX),224
1500 Q1%=S1%(AX):Q2%=S2%(AX)
1510 S1%(AX)=S1%(AX)+(S1%(AX)>SX%)-(S1%(AX)<SX%):S2%(A
X)=S2%(AX)+(S2%(AX)>SY%)-(S2%(AX)<SY%)
1520 mv%=FNPT(S1%(AX),S2%(AX)):mvo%=FNpt(S1%(AX),S2%(A
X))
1530 IFmv%=14 SOUND&,1,5,1:BT%=BT%+1:SC%=SC%+100:COLOU
R4:VDU31,Q1%,Q2%,224,31,S1%(AX),S2%(AX),224:S1%(AX)=-32
:GOTO1590
1540 IFmv%=2 PROCDEAD
1550 IFmv%=3 SC%=SC%-50
1560 IFmv%=60R mvo%=5 S1%(AX)=Q1%:S2%(AX)=Q2%
1570 SOUND&12,2,50,10:SOUND&3,3,50,1
1580 COLOUR1:VDU31,S1%(AX),S2%(AX),225
1590 GO%=0
1600 ENDPROC
1610 DEFPROCHIScore
1620 CLS
1630 IFSC%>VAL(A$(1,0)) PRINT"ENTER YOUR NAME.":A$(1,0
)=STR$(SC%):PRINTA$(1,0)";:INPUTA$(1,1)
1640 REPEAT:SWAP=0
1650 IX=0:REPEAT:IX=IX+1
1660 IFVAL(A$(IX,0))>VAL(A$(IX+1,0)) B=A$(IX+1,0)
:A$(IX+1,0)=A$(IX,0):A$(IX,0)=B:B=A$(IX+1,1):A$(IX+1,
1)=A$(IX,1):A$(IX,1)=B:SWAP=1
1670 UNTILI=9
1680 UNTILSWAP=0
1690 CLS:COLOUR1:PRINTTAB(3)"HALL OF FAME."
1700 COLOUR3:FORI=10TO1STEP-1:AX=LEN(A$(I,0)):PRINT
TAB(6-AX):A$(I,0);: "...":A$(I,1):NEXT
1710 COLOUR1:PRINTTAB(3)"PRESS <SPACE>":A%=GET#
1720 ENDPROC
1730 DEFFNPT(d%,e%)
1740 =POINT((d%*64)+32,1008-(e%*32))
1750 DEFFNpt(f%,g%)
1760 =POINT((f%*64)+32,1023-(g%*32))

```



# Small business can now stop going by the book.

For under £1,000 a small business can now equip itself with a BBC Microcomputer, a disc drive, a word processor and printer.

(All tax deductible by the way.)

Once you've parted with that money, you'll find that business has never been brisker.

Because now, there's a new series of floppy disc software specially for the smaller business.

It has been developed by Acornsoft, the software division of Acorn Computers who are the manufacturers of the BBC Micro.

For only £24.95, each disc can store volumes of vital bookwork which can be updated and amended in a fraction of the conventional time.

And there is a disc to cover most aspects of paperwork and book-keeping.

## The Invoicing package.

This program stores details of products, VAT numbers and, of course, the names and addresses of your customers. As orders come in, you simply record them. Then, when it's time to invoice, you just press a few keys and each invoice or credit note is printed automatically in seconds.



Allowing for variable terms of trading, the system calculates and prints discounts. And it should help to improve your cash flow dramatically.

## The Order Processing package.

With this program, you can confirm your customers' orders, prepare and print despatch notes and make fast analyses of individual orders or of all the orders stored on disc.



## The Accounts Receivable package.

Now, it couldn't be easier to keep your customer accounts under control.

In an instant, you can analyse debtors, produce statements, keep a check on any credit limit and calculate VAT output automatically.



Using this package in conjunction with the invoicing package, you can also keep tabs on payments received against payments outstanding.

## The Accounts Payable package.

This package will keep you fully up-to-date on how much you owe and who to. In addition, it calculates





input VAT and, used with the Accounts Receivable package, produces instant VAT returns.

It also highlights settlement discounts, produces remittance advices and provides an immediate analysis of all creditors.

### The Stock Control package.

Touch a few keys and you have instant access to stock status and automatic analysis by quantity and value.

Consequently, it's easy for you to maintain correct stocking levels, having an early warning of out-of-stock situations or the likelihood of over-stocking.



Average value of the business they do with you, or whether they are good or bad payers.

Then, when you are doing a mailing, you simply choose the group or groups of customers you want.

At £24.95 each, these packages could be priceless.

Each package comes with clear instructions on how to get the program running so that you can devote much more of your time to more profitable activities.

If you're a credit card holder, you can order any or all of the packages by ringing: 01-200 0200 anytime. Or 0933 79300 during office hours.

(By ringing the same number, you can get the address of your nearest stockist, or full details of the BBC Microcomputer system if you don't already have one.)

Alternatively, you can order the packages by sending the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please allow 28 days for delivery.

☎ Credit card holders, phone 01-200 0200, anytime. Or 0933 79300, during office hours.



### The Purchasing package.

All your suppliers' names and addresses go onto the disc. Then they can be retrieved instantly for preparing and printing orders.

All order data can be recalled in seconds, allowing you to check on orders, and suppliers' invoices and to record all deliveries.



### The Mailing package.

Instead of the shotgun method of sending mailshots, this package enables you to refine each mailing down to the customers who are most likely to respond.

It gives you a rapidly accessible mailing file of your customers, according to any criterion you choose. Size of company, for instance, or type of business.



To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.  
Please send me the following business software packages at £24.95 each.

PROGRAM	QUANTITY	TOTAL	(Code Acornsoft use only.)
Invoicing			SNB 08
Order Processing			SNB 12
Accounts Receivable			SNB 10
Accounts Payable			SNB 13
Stock Control			SNB 11
Purchasing			SNB 14
Mailing			SNB 09
TOTAL			

I enclose PO/cheque payable to Acornsoft Ltd. Or charge my credit card.

Card Number

Amex/Diners/Visa/Access (Delete)

Please send me details of the BBC Microcomputer System ☐

Name

Address

Postcode

Signature

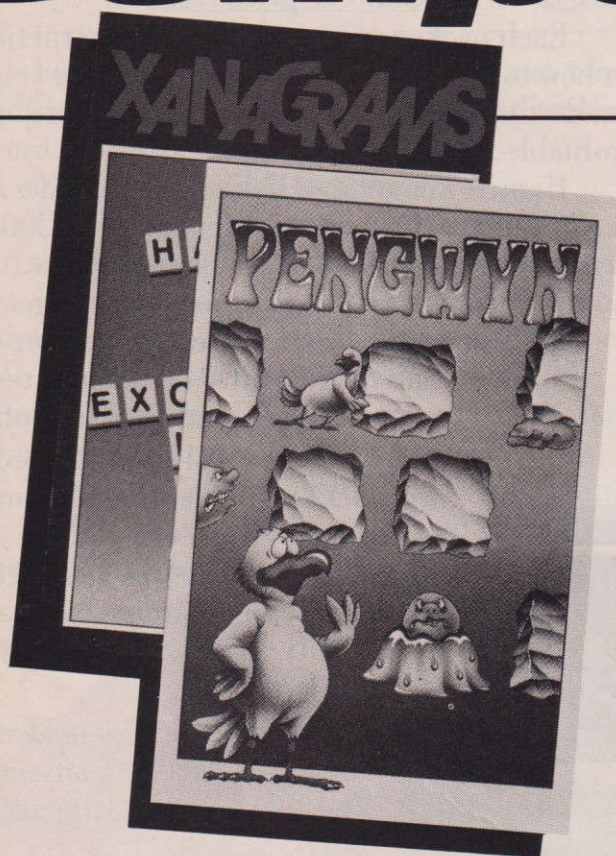
Registered No. 1524763

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# ACORNSOFT

AB5





## POSTERN PEOPLE

Postern began producing games for the BBC at an early stage, since it is Patricia's belief that it is the machine which most kids would like to own if they had the money. There is no doubt that there is a huge market for some other machines, but she feels that ultimately the greater

## THE COMPETITION

Mark on your envelope the number of words you think you

As long as the correct coupon is used for each entry, there is no limit to the number of entries per person. All entries must be postmarked before 20th June 1984. No correspondence will be entered into with reference to the results and it is a condition of entry that the editor's decision is accepted as final.

Name .....

Address .....

.....

.....

Postcode .....

## WINNERS

Note that you cannot assume that the sound is already turned on. To check the procedure works, add

```
10 REPEAT
20 PROCsoundchoice
30 VDU7
40 UNTIL FALSE
```

Winner: Kirkless Microelectronics Centre, Huddersfield.



```

1000 DEFPROCsoundchoice
1010 LOCAL G$,OK$
1020 OK$="YyNn"
1030 PRINT "Sound on? (Y/N)"
1040 *FX15,1
1050 REPEAT G$=GET$
1060 UNTIL INSTR(OK$,G$)<>0
1070 IF INSTR(OK$,G$)>2 THEN*FX210,1
1080 IF INSTR(OK$,G$)<3 THEN*FX210,0
1090 ENDPROC

```

Being a complete newcomer to computing has meant writing and running educational programs while still learning BASIC. As monitoring each child's progress proved difficult and I found that some children tended not to ask for help when stuck, I needed some way of making sure I was called to assist them. I therefore started writing programs and amending commercial software, where possible, to keep a percentage score. The next stage was to

add a procedure to prevent the child continuing without assistance if their score reflected a lack of understanding of the subject. The following procedure proves useful and is called at the end of the routine as follows:  
 1000 IF score% ( X PROC AID (X being the percentage score required by the teacher to indicate the minimum level of understanding.)  
 Winner: Mr Nigel Hunt, Bagshot, Surrey

```

10DEF PROC AID:REM defines procedure
re
20 ON ERROR PRINT "DO NOT PRESS ESCAPE, SCORE=";score%;"':REM prevents pupil from using Escape key to avoid procedure and keeps a record of the score obtained
30 REPEAT:REM sets up loop which requires action by teacher before pupil can continue
40PRINT TAB(8)" PLEASE CALL YOUR TEACHER"':REM tells pupil action to take
50 INPUT A$: REM waits for response from keyboard
60 UNTIL A$="XYLOPHONE": REM reads teachers password allowing the procedure to continue (note-choose a password that is difficult for the child to spell and substitute numerals for letters where possible eg:0 for o)
70 PRINT " PUPIL SCORED ";score%;"': REM displays pupil's score
80 INPUT "DO YOU WISH TO RUN THE PROGRAM AGAIN? (Y/N)" B$: REM asks t

```

each other if they wish to run the program again and waits for response  
 90 IF B\$<>"Y" END: REM actions teachers response by ending program or returning to main body of program (note-main program may require separate instruction to rerun entire program)  
 100ENDPROC:REM ends procedure

This program produces letters of any size in any graphics mode. Winner: Mr G. Trueman, Huddersfield.

```

200DEFPROCLETTER(X%,Y%,size%,colour%,L%):REM The co-ords of the required letter:size%=the size of the letter:colour%=the colour of the letter:L%=the ASCII code of the required letter

```

```

210FOR G%=49152+((L%-32)*8) TO 49159+((L%-32)*8):REM Finds the ROM position of the ASCII code of the required letter

```

```

220FOR TEST=7 TO 0 STEP -1:REM Sets the loop to examine the ROM positions

```

```

230IF (2^TEST%AND?G%)=2^TEST THEN GCOL0,colour% ELSE GCOL0,0:REM Checks the values in ROM and sets the graphics colour

```

```

240MOVE(X%+((8-TEST%)*2*size%))+2*size%,(Y%-(G% MOD 8*4*size%)):REM Moves cursor to first graphics position

```

```

250MOVE(X%+((8-TEST%)*2*size%))+2*size%,(Y%-(G% MOD 8*4*size%))+4*size%:REM Moves cursor to second graphics position

```

```

260PLOT85,(X%+((8-TEST%)*2*size%)),(Y%-(G% MOD 8*4*size%)):REM fills half of the rectangle in the letter making rectangle

```

```

270PLOT85,(X%+((8-TEST%)*2*size%)),(Y%-(G% MOD 8*4*size%))+4*size%:REM Completes the filling of the rectangle

```

```

280NEXT TEST%:REM Returns the loop for drawing then returns the loop for examining ROM
290ENDPROC

```







# Unicorn opens 5 new channels for the BBC.

The BBC Model B micro packs a lot of potential. As a basic computer, it is reliable, efficient and simple to use – but, more than that, it is the first step on the road to a complete computer system.

TORCH COMPUTERS have chosen the BBC micro as the heart of their open channel system – UNICORN. UNICORN means a wide choice of upgrade channels to transform your BBC into a complete business system, a fully communicating workstation, or a high-powered 32-bit data processor.

At the gateway to the Communications Channel is the UNICORN ZEP100 – a 64K processor board and the software needed to promote your Model B into a TORCHNET local area network station. Further along the channel, the UNICORN FDP240 will provide twin 400K floppy disc drives, which with the addition of the ZEP100 will result in a Z80 disc pack.

The UNICORN Business Channel develops the BBC micro into a flexible professional tool equipped to manage the most complex business requirements. Opening with the HDP240 – a simple but powerful disc drive, the channel provides for any level of upgrade from the well-proven ZDP240

(TORCH Z80 Disc Pack) up to the ultimate addition – the UNICORN – combining the HDP68K – a 32-bit 68000 processor with the UNIX® operating system.

And if you get lost in the by-passes and flyovers around your BBC, there is one simple route for you to follow – the straight channel to your nearest TORCH UNICORN dealer. He will assess your requirements, then recommend the ideal solution to cope with your present and future needs.

For full colour product brochure, price list and the name of your nearest TORCH UNICORN dealer, just clip the coupon.

## UNICORN

Open channels for the BBC micro.

---

To: Torch Computers Ltd., Abberley House, Great Shelford, Cambridge CB2 5LQ. Telephone: Cambridge (0223) 841000.

Please channel further details on the Unicorn range to:

Name \_\_\_\_\_

Address \_\_\_\_\_

AB 5 84 \_\_\_\_\_

Text and Graphics provided by BBC Model B.

Keyboard provided by BBC Model B.

Disc interfaces are necessary for use with the Unicorn range.

CP/M is a registered trademark of Digital Research Inc.  
Unix is a registered trademark of Bell Telephone Laboratories Inc.





# Pontoon

W. Edmunds

First of all, I would like it understood that this is the first completed program I have produced for the BBC micro (although I have had some previous experience with BASIC), and, therefore, I hope will provide inspiration to any novices reading this publication. Also, perhaps it will inspire the experienced programmers to make any obvious improvements, or write in with any recommendations.

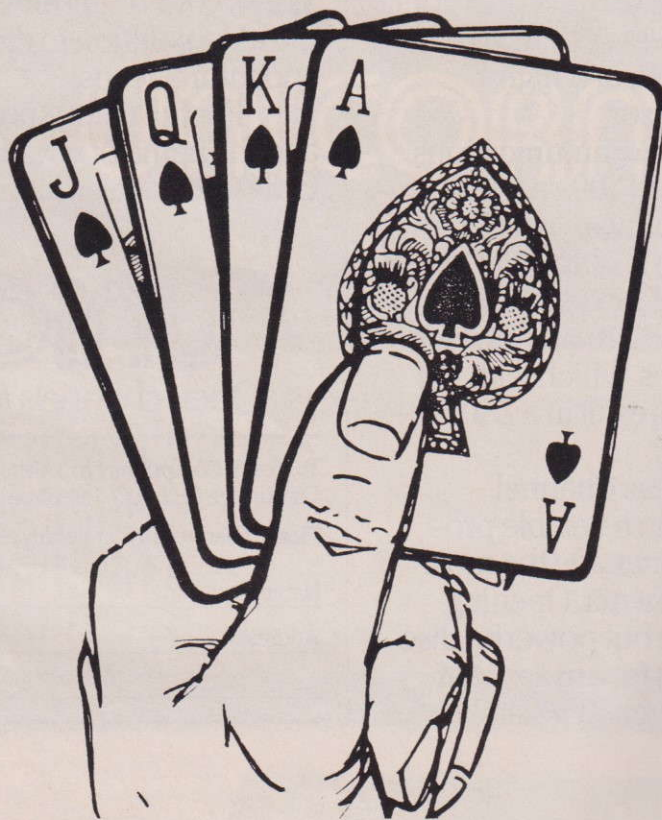
The game itself is designed for one player with the micro acting as banker. The program prints cards onto the screen in full colour. Standard rules apply, although 'burning' and 'splitting' are not implemented. The player states how much money he or she is prepared to risk when (s)he enters the casino, and the maximum bet per turn is decided from that. The player is dealt one card at a time, after which (s)he has to decide whether to stick, twist, or buy a card. The player must bet a minimum of £1 on the first card. He can then bet after each card providing that (s)he hasn't already twisted, he has enough money left, and he bets an amount less than or equal to his previous bet on that hand. The running totals of the amount bet, left, and the total of the cards are all displayed after each card is dealt. Two card totals are sometimes shown when the player holds an ace.

After the player is satisfied with his or her hand the bank will display its cards and a winner will result. Winnings are calculated at twice the amount bet, although double winnings are paid on attaining a successful PONTOON or FIVE-CARD TRICK. The player can leave the casino after any hand, but (s)he is forced to leave if he runs out of money.

## PROGRAM DESCRIPTION

The game is divided up into two programs. The first of which simply sets up a title page, gives instructions if required (PRO-INSTRUCT), and sets PAGE to &E00, where necessary, before running the second program "Pont2".

**Playing Pontoon on your BBC is just as much fun as the real thing. Perhaps a little easier on the pocket, definitely quicker and there's a certain thrill to be gained by beating your micro hands down.**



## ARRAYS

CARDS(52) — contains the pack of shuffled cards in the form of numbers 1 to 52.  
 PACK(52) — contains the unshuffled pack to facilitate shuffling.  
 AHAND(5) holds the player's uninterpreted hand.  
 AHND(65) — holds the player's interpreted hand.  
 MYHAND(5) and MYHND(5) same as two above, but for the bankers hand.

"Mode 1 Pont2" is written entirely in Mode 1 and consists of a number of procedures, which I have tried to give obvious names.

## VARIABLES

PONTOON and FIVECARD act as markers for special hands and decide when to pay double winnings.

CAMWIV and CASH contain the initial amount of money the player has the running total, respectively.

TBET and BET hold the total bet and the last bet on each hand. CUBET contains the amount the next bet must not exceed.

BETFLG indicates that the previous bet was illegal.

ATOTE, ATOT, MYTOTE and MYTOT contain the totals of each hand.

AFLAG and MYFLAG indicate if an ace is held in each hand.

ACARD, BCARD and CCARD hold the current card being interpreted.

SUIT and SUITS contain the suit of the card in numerical form and as a user-defined graphics character, i.e. a heart, diamond club, or spade.

BUST acts as a flag for when the player is bust.

The above are the essential variables. Others are used, but these generally take the form of counters, coordinates and temporary stores.

## THE MAIN PROGRAM

Lines 10-190 contain the main program, the rest is made up of the various procedures.

Lines 10,20 set the mode, initial variables and arrays.

Lines 30,90 ask how much money the player has come with and work out the maximum bet per card.

Line 130 sets all the variables for each hand.

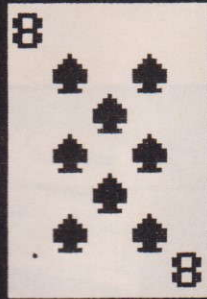
Line 150 resets the arrays containing the hands.

Line 160 is the most powerful program line calling all the procedures for each hand.

Lines 170-190 find out if the player can afford to continue, or wants to continue for another hand.

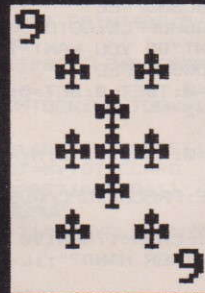
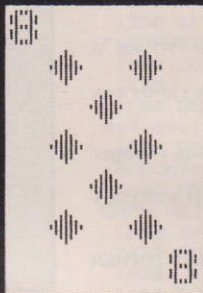
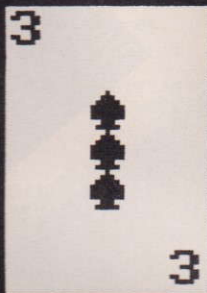
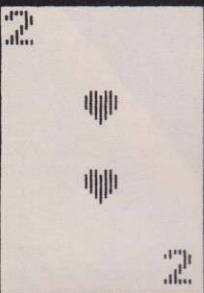


AMOUNT LEFT £125  
TOTAL BET £25



TOTAL IS 9 OR 19

DO YOU WANT TO STICK(S), BUY(B), OR  
TWIST(T)?



## PROCEDURES

PROCINITIAL sets up the user-defined characters for the symbols heart, club, diamond and spade. It also sets up characters for the face on the court cards, and a number ten for the corners of the four ten-cards.

PROCSHUFFLE shuffles the cards at the start of the game and also after the banker gets a PONTOON. The player has the option as to whether or not the cards are shuffled if (s)he gets a PONTOON.

The outlines of the cards and the shading are carried out by the procedures PROCBOX and PROCMYBOX. These call one or more of the following procedures: PROCONE, PROCTWO, PROCFOUR, PROCSIX, and PROCPICTURE; according to the number of symbols, or the picture to be displayed on each card. It is, perhaps, obvious that a picture of a card containing, say, three hearts can be drawn by combining PROCONE and PROCTWO. Similarly, PROCONE, PROCTWO and PROCSIX can be combined to produce a nine-card.

PROCDEAL deals the first two cards to each player, allows the player to bet and continue his hand until completion.

PROCDEALME decides if the banker wants further cards or whether to stick. If further cards are required they are dealt.

If the player gets a pontoon, under normal conditions the banker is shown. PROCPONTOON acts out this role by, first of all, figuring out if the banker holds a higher pontoon. If this is not the case, then the banker will try for a FIVE-CARD-TRICK when passed onto PROCDEALME.

PROCINTERPRET(ACARD) interprets each card as it is passed to it. Initially, it receives a number between 1 and 52. From this it calculates the value and suit of the card.

PROCCOUNT displays the cash totals at the top of the screen.

PROCSUMUP keeps a running total of each hand, and displays this information on the screen.

PROCCHCKBET keeps a close eye on the player's betting and makes certain that it is within the required bounds.

PROCWINNER ascertains the winner of each hand and makes the appropriate adjustments to the player's cash balance.

PROCFINISH occurs when the player runs out of money, or

when (s)he wishes to leave the game. A final message is printed on the screen giving the profit margin, or lack of it, on this run.

## PROGRAM LISTING 1

```
10REM*****
20REM* PONTOON by W.Edmunds *
30REM*****
40MODE1:COLOUR2:PRINTTAB(15,10)"PONTOON";TAB(15,11)"
";TAB(11,14)"by Bill Edmunds":COLOUR1:PRINTTAB(0
,30)"INSTRUCTIONS(Y OR N)?":L=GET:IFL=89PROCINSTRUCT
50MODE6:PRINT"Please wait a minute":COLOUR0
60IFPAGE=&E00CHAIN"Pont2":END
70*KEY0:MLOAD"Pont2":MFORJ%=PAGE TO TOP STEP 4:!(J%-
2816)='J%:NEXT:PAGE=&E00:MOLD:MRUN:M
80*FX138,0,128
90END
100
110DEFFPROCINSTRUCT:CLS:COLOUR2
120COLOUR2:PRINTTAB(12,1)"INSTRUCTIONS";TAB(12,2)"
":COLOUR3
130PRINTTAB(4,4)"These instructions assume a basic
knowledge of the game of PONTOON al- though 'burning
and 'splitting' are notpermitted."
140COLOUR1:PRINT" The pack is shuffled at th
e start of each game and also when the bank gets
a pontoon. If you get a pontoon, then you have the o
ption as to whether or not the pack is to be shuffled."
:COLOUR2:PRINT
150PRINT" A card may be bought at any stage duri
ng the game, providing you haven't already twisted. Yo
u will be asked to place a bet after your first card
is dealt. Any subsequent bets on that hand"
160PRINT"must be less than or equal to the prev
ios bet.":COLOUR1:PRINT:PRINT"Remember: ";TAB(4,25)"ACES
count as 1 or 11"
170PRINTTAB(4,27)"A 5-card-trick beats a pontoon":COL
OUR3:PRINTTAB(0,30)"PRESS ANY KEY TO CONTINUE":L=GET:E
NDPROC
```

CONTINUED OVER



## PROGRAM LISTING 2

```

10 MODE1:PONTOON=0:COLOUR2:X=RND(-TIME)
20 DIM CARDS(52),PACK(52),AHAND(5),AHND(5),MYHAND(5),MYHND(5)
30 CLS:PRINT"HOW MUCH CAN YOU AFFORD TO LOSE TODAY?"
40 PRINT:INPUT""CASH:IFCASH>0THEN60
50 PRINTTAB(0,5)"SORRY, YOU HAVE NOT BEEN ALLOWED IN TO THE CASINO.":END
60 MAXBET=CASH DIV4:CAMWIV=CASH:IFMAXBET<5MAXBET=1
70 IFMAXBET>5000MAXBET=5000
80 PRINTTAB(0,5)"MAXIMUM BET ALLOWED IS "MAXBET
90 PRINTTAB(25,10)"GOOD LUCK!";TAB(0,20)"PRESS ANY KEY TO CONTINUE":L=GET
100 CLS:PROCINITIAL:PROCSHUFFLE
110 IFPONTOON=2CLS:PROCSHUFFLE:GOTO130
120 IFPONTOON=1CLS:PRINT"DO YOU WANT THE PACK TO BE SHUFFLED?":L=GET:IFL=89PROCSHUFFLE
130 PONTOON=0:FIVECARD=0:TBET=0:BET=0:BUST=0:I2=0:X=64:I3=0:I4=2:I5=0:I6=2:I7=2
140 CLS:PROCCOUNT
150 FORI=1TO5:AHAND(I)=0:AHND(I)=0:MYHAND(I)=0:MYHND(I)=0:NEXT
160 PROCDEAL:PROCDEALME:PROCMIUPCARDS:PROCWINNER:BET=0:PROCCOUNT
170 FORI=1TO5000:NEXT:IFCASH<1THEN190
180 PRINTTAB(20,30)"ANOTHER HAND?":L=GET:IFL<>78THEN
110
190 FORT=1TO3000:NEXT:PROCFINISH:END
200
210 DEFPROCSHUFFLE:COLOUR1:PRINT"SHUFFLING"
220 FORI=1TO52:PACK(I)=I:NEXT
230 N=52:FORI=1TO52:CARD=RND(N):IFN=1THENCARD=1
240 CARDS(I)=PACK(CARD):IFCARD=52THEN260
250 FORI1=(CARD+1)TON:PACK(I1-1)=PACK(I1):NEXTI1
260 N=N-1:NEXTI:CLS:COLOUR2:ENDPROC
270
280 DEFPROCMIUPCARDS:I8=53-(I7+I2)
290 FORI=I7 TO1STEP-1:CARDS(I8)=MYHAND(I):I8=I8+1:NEXT
T
300 FORI=I2 TO1STEP-1:CARDS(I8)=AHAND(I):I8=I8+1:NEXT
:ENDPROC
310
320 DEFPROCMYBOX:COLOUR131
330 IFSUIT<238COLOUR1:ELSE COLOUR4
340 I5=I5+1:X1=X+160:MOVEX,450
350 DRAWX1,450:PLOT85,X1,220:DRAWX,220:PLOT85,X,450
360 PRINTTAB(I6,18)CHR$(PIC):TAB(I6+4,24)CHR$(PIC)
370 I4=I6:B=18:ONCCARD GOSUB470,480,490,500,510,520,530,540,550,560,570,580,590
380 COLOUR2:COLOUR128:I6=I6+7:X=X+224:ENDPROC
390
400 DEFPROCBOX:B=4
410 COLOUR131:IFSUIT<238COLOUR1:ELSE COLOUR4
420 I3=I3+1:X1=X+160:MOVEX,900
430 DRAWX1,900:PLOT85,X1,670:DRAWX,670:PLOT85,X,900
440 PRINTTAB(I4,4)CHR$(PIC):PRINTTAB(I4+4,10)CHR$(PIC)
)
450 ONCCARD GOSUB470,480,490,500,510,520,530,540,550,560,570,580,590
460 I4=I4+7:X=X+224:COLOUR128:COLOUR2:ENDPROC
470 PROCONE(I4,B):RETURN
480 PROCTWO(I4,B):RETURN
490 PROCONE(I4,B):PROCTWO(I4,B):RETURN
500 PROCFOUR(I4,B):RETURN
510 PROCONE(I4,B):PROCFOUR(I4,B):RETURN
520 PROCSIX(I4,B):RETURN
530 PROCONE(I4,B-1):PROCSIX(I4,B):RETURN
540 PROCTWO(I4,B):PROCSIX(I4,B):RETURN
550 PROCONE(I4,B):PROCTWO(I4,B):PROCSIX(I4,B):RETURN

```



```

560 PROCFOUR(I4,B):PROCSIX(I4,B):RETURN
570 VDU23,230,0,0,0,6,6,7,7:VDU23,231,0,0,0,0,0,255,255,255:VDU23,232,0,0,0,96,96,224,224,224:PROCPICTURE(I4,B):RETURN
580 VDU23,230,0,0,0,7,3,3,3,7:VDU23,231,0,0,0,231,255,255,255,231:VDU23,232,0,0,0,224,192,192,192,224:PROCPICTURE(I4,B):RETURN
590 VDU23,230,0,0,0,4,6,7,7,7:VDU23,231,0,0,0,24,60,126,255,255:VDU23,232,0,0,0,32,96,224,224,224:PROCPICTURE(I4,B):RETURN
600
610 DEFPROCINTERPRET(ACARD)
620 SUIT=(ACARD-1)DIV13+236:SUIT$=CHR$(SUIT)
630 ACARD=(ACARD-1)MOD13+1:PIC=ACARD+48
640 IFACARD=10THENPIC=240
650 IFACARD=11THENPIC=ASC"J"
660 IFACARD=12THENPIC=ASC"Q"
670 IFACARD=13THENPIC=ASC"K"
680 IFACARD=1THENPIC=ASC"A"
690 BCARD=ACARD:CCARD=ACARD:IFBCARD>10BCARD=10
700 ENDPROC
710
720 DEFPROCDEALME
730 IFPONTOON=0X=64
740 IFBUST=10R PONTOON>1ENDPROC
750 IFPONTOON=1THEN810
760 FORI=1TO2:PROCINTERPRET(MYHAND(I)):MYHND(I)=BCARD:PROCMIUPCARDS:NEXT
770 PROCMIUPCARDS
780 IFFIVECARD=1THEN810
790 IFMYTOTE>=16THEN870
800 IF(MYTOTE+10)>=16AND(MYTOTE+10)<=21ANDMYFLAG=1THEN870
810 I7=I7+1:MYHAND(I7)=CARDS(I)
820 FORI=1TO51:CARDS(I)=CARDS(I+1):NEXT
830 PROCINTERPRET(MYHAND(I7)):MYHND(I7)=BCARD:PROCMIUPCARDS:NEXT
840 IFFIVECARD=1ANDMYTOTE>21THEN870
850 IFI7=5FIVECARD=FIVECARD+2:GOTO870
860 GOTO770
870 PROCMIUPCARDS:ENDPROC
880
890 DEFPROCDEAL
900 REPEAT:I2=I2+1

```



```

910 AHAND(I2)=CARDS(1):MYHAND(I2)=CARDS(2)
920 FORI=1TO50:CARDS(I)=CARDS(I+2):NEXT
930 PROCINTERPRET(AHAND(I2)):AHND(I2)=BCARD:PROCBX:P
ROCSUMUP
940 REPEAT:IFI2=1PRINTTAB(0,14)BLANK$:TAB(0,14)"HOW M
UCH DO YOU WANT TO BET? ";:INPUT""BET:CURBET=MAXBET:PR
OCHECKBET:IFBETFLG=1FORI=1TO3000:NEXT
950 UNTILBETFLG=0
960 IFI2=1TBET=TBET+BET:PROCCOUNT
970 UNTILI2=2
980 IFBUST=1ORATOTE=21ENDPROC
990 IFATOTE=11ANDAFLAG=1ANDAHND(3)=0PROCPONTOON:ENDPR
OC
1000 PRINTTAB(0,14)"DO YOU WANT TO STICK(S), BUY(B), O
R";TAB(0,15)"TWIST(T)";
1010 REPEAT:L=GET:UNTILL=83ORL=66ORL=84
1020 IFL=83THEN1120
1030 IFL=84CURBET=0:GOTO1070
1040 REPEAT:PRINTTAB(0,14)BLANK$:TAB(0,14)"HOW MUCH DO
YOU WANT TO BET? ";:INPUT""BET:PROCHECKBET:IFBETFLG=
1FORI=1TO3000:NEXT
1050 UNTILBETFLG=0
1060 TBET=TBET+BET:PROCCOUNT
1070 I2=I2+1:AHAND(I2)=CARDS(1)
1080 FORI=1TO51:CARDS(I)=CARDS(I+1):NEXT
1090 PROCINTERPRET(AHAND(I2)):AHND(I2)=BCARD:PROCBX:P
ROCSUMUP:IFBUST=1ENDPROC
1100 IFI2=5PROCUMUP:FIVECARD=1:ENDPROC
1110 GOTO980
1120 PROCUMUP:IFATOTE>15ENDPROC
1130 IFATOTE>5ANDATOTE<12ANDAFLAG=1ENDPROC
1140 PRINTTAB(0,14)BLANK$:TAB(0,14)"TOTAL MUST BE 16 O
R MORE":FORT=1TO3000:NEXT:GOTO1000
1150
1160 DEFPROCCOUNT
1170 CASH=CASH-BET:PRINTTAB(0,0)BLANK$
1180 PRINTTAB(0,1)"AMOUNT LEFT ";:CASH
1190 PRINTTAB(0,2)"TOTAL BET ";:TBET
1200 ENDPROC
1210
1220 DEFPROCFINISH:CLS
1230 IFCASH>CAMWIV PRINTTAB(0,5)"CONGRATULATIONS! YOU"
;TAB(0,7)"LEAVE WITH ";:CASH;".":TAB(0,11)"A PROFIT OF
";:CASH-CAMWIV;".":GOTO1260
1240 IFCAMWIV>CASH PRINTTAB(0,5)"HARD LUCK! YOU LEAVE"
;TAB(0,7)"WITH ";:CASH;".":TAB(0,11)"A LOSS OF ";:CAMW
V-CASH;".":GOTO1260
1250 PRINTTAB(0,5)"HOW BORING! YOU HAVE";TAB(0,7)"RUN
EVEN AND LEAVE";TAB(0,9)"WITH ";:CASH;".
1260 PRINTTAB(0,15)"PLEASE COME AGAIN!":PRINT:ENDPROC
1270
1280 DEFPROCWINNER
1290 IFBUST=1PRINTTAB(0,20)"HARD LUCK! YOU HAVE";TAB(0
,22)"BUSTED!":ENDPROC
1300 IFPONTOON=2PRINTTAB(0,28)"SHAME! I WIN!":GOTO1470
1310 IFMYTOTE=11ANDMYFLAG=1ANDMYHND(3)=0ANDPONTOON<1P
ONTOON=2
1320 IFFIVECARD=2ANDMYTOTE<22THEN1440
1330 IFFIVECARD=3ANDPONTOON=1THEN1440
1340 IFPONTOON=1PRINTTAB(0,28)"PONTOON! YOU COLLECT DO
UBLE WINNINGS!":CASH=CASH+(3*TBET):GOTO1470
1350 IFFIVECARD=1THEN1460
1360 IFFIVECARD=3ANDMYTOTE<12ANDMYFLAG=1MYTOTE=MYTOTE+
10
1370 IFFIVECARD=3ANDATOTE<12ANDAFLAG=1ATOTE=ATOTE+10
1380 IFFIVECARD=3ANDMYTOTE>=ATOTE THEN1440
1390 IFFIVECARD=3ANDMYTOTE<22THEN1460
1400 IFMYTOTE<16ANDMYFLAG=1MYTOTE=MYTOTE+10
1410 IFMYTOTE>21THEN1450
1420 IFATOTE<16ANDAFLAG=1ATOTE=ATOTE+10
1430 IFATOTE>MYTOTE THEN1450
1440 PRINTTAB(0,28)"HARD LUCK! YOU LOSE THIS TIME!":GO
TO1470
1450 PRINTTAB(0,28)"WELL DONE! YOU WIN THIS TIME!":CAS
H=CASH+(2*TBET):GOTO1470
1460 PRINTTAB(0,28)"5-CARD-TRICK! DOUBLE WINNINGS THIS
TIME!":CASH=CASH+(3*TBET)
1470 PRINTTAB(0,26)"MY TOTAL IS ";:MYTOTE:ENDPROC
1480
1490 DEFPROCHECKBET:BETFLG=1:PRINTTAB(0,14)BLANK$
1500 IFCASH<1CURBET=0:BET=0:PRINTTAB(0,14)"YOU HAVE NO
MONEY. I ASSUME YOU TWIST!":FORI=1TO3000:NEXT:GOTO1560
1510 IFCURBET=0ANDBET=0THEN1560
1520 IFBET<>INT(BET) PRINTTAB(0,14)"PLEASE BET WHOLE
'S ONLY":ENDPROC
1530 IFBET>CASH PRINTTAB(0,14)"BUT YOU ONLY HAVE ";:CA
SH;":LEFT":ENDPROC
1540 IFBET<1PRINTTAB(0,14)"MINIMUM BET IS '1":ENDPROC
1550 IFBET>CURBET PRINTTAB(0,14)"BET MUST NOT EXCEED
";:CURBET:ENDPROC
1560 CURBET=BET:BETFLG=0:ENDPROC
1570
1580 DEFPROCPONTOON:PONTOON=1:FIVECARD=1:ATOTE=0:MYTOTE
=0:X=64:I6=2
1590 FORI=1TO2:PROCINTERPRET(MYHAND(I)):MYHND(I)=BCARD
:PROCMYBOX:MYTOTE=MYTOTE+CCARD
1600 PROCINTERPRET(AHAND(I)):AHND(I)=BCARD:ATOTE=ATOTE+C
CARD:NEXT:PROCSUMUP
1610 IFMYTOTE=11ANDMYFLAG=1ANDMYTOTE>=ATOTE PONTOON=2
1620 ENDPROC
1630
1640 DEFPROCSUMUP
1650 AFLAG=0:MYFLAG=0:ATOTE=0:MYTOTE=0
1660 FORI=1TO5:IFAHND(I)=1AFLAG=1
1670 IFMYHND(I)=1MYFLAG=1
1680 ATOTE=ATOTE+AHND(I):MYTOTE=MYTOTE+MYHND(I):NEXT
1690 IFPONTOON>0PRINTTAB(0,12)"TOTAL IS ";:ATOTE+10;":
":ENDPROC
1700 PRINTTAB(0,12)"TOTAL IS ";:ATOTE;":
1710 IFATOTE>21BUST=1:ENDPROC
1720 BTOTE=ATOTE+10:IFAFLAG=1ANDBTOTE<=21PRINTTAB(11,1
2)" OR ";:BTOTE
1730 ENDPROC
1740
1750 DEFPROCONE(X,Y):PRINTTAB(X+2,Y+3)SUIT$:ENDPROC
1760
1770 DEFPROCTWO(X,Y):PRINTTAB(X+2,Y+2)SUIT$:TAB(X+2,Y+
4)SUIT$:ENDPROC
1780
1790 DEFPROCFOUR(X,Y):PRINTTAB(X+1,Y+2)SUIT$:TAB(X+3,Y
+2)SUIT$
1800 PRINTTAB(X+1,Y+4)SUIT$:TAB(X+3,Y+4)SUIT$:ENDPROC
1810
1820 DEFPROCSIX(X,Y):PRINTTAB(X+1,Y+1)SUIT$:TAB(X+3,Y+
1)SUIT$
1830 PRINTTAB(X+1,Y+3)SUIT$:TAB(X+3,Y+3)SUIT$
1840 PRINTTAB(X+1,Y+5)SUIT$:TAB(X+3,Y+5)SUIT$:ENDPROC
1850 DEFPROCPICTURE(X,Y):PRINTTAB(X+1,Y+1)SUIT$:TAB(X+
1,Y+2)CHR$230;CHR$231;CHR$232
1860 PRINTTAB(X+1,Y+3)CHR$224;CHR$225;CHR$226;TAB(X+1
,Y+4)CHR$227;CHR$228;CHR$229;TAB(X+3,Y+5)SUIT$:ENDPROC
1870
1880 DEFPROCINITIAL:BLANK$=STRING$(60," ")
1890 VDU23,224,7,4,4,4,4,4,4,4
1900 VDU23,225,255,0,0,231,0,24,24,0
1910 VDU23,226,224,32,32,32,32,32,32,32
1920 VDU23,227,4,4,2,1,1,0,0,0
1930 VDU23,228,0,126,0,0,255,0,0,0
1940 VDU23,229,32,32,64,128,128,0,0,0
1950 VDU23,236,54,127,127,127,62,28,8,0
1960 VDU23,237,8,28,62,127,62,28,8,0
1970 VDU23,238,8,28,28,107,127,107,8,28
1980 VDU23,239,8,28,62,127,127,127,28,62
1990 VDU23,240,79,201,73,73,73,239,0
2000 ENDPROC

```



# TurtleTalk

Tony Self

In this issue I will explain the working of the rest of the program, which will convert the simple drawing program you ended up with in the last issue, into a fully interactive language in its own right.

But before we start on the program I must apologise to Micronet 800 members who have typed in the listing from the last issue, as this program has been made available free on Micronet since then. Unfortunately at the time the last issue went to press I had not finalised details with Micronet.

Now to the program. As in the last issue I will first explain briefly the operation of each new command to be added. I will then give details of the new procedures or program lines which need to be entered to achieve it and the line number which needs to be changed in line 5010.

We will start by adding a few more simple plotting commands before getting into the meat of this half of the program.

CR — CURSOR RIGHT — value required  
CU — CURSOR UP — value required

These commands allow you to move the cursor about without drawing lines or altering the direction the cursor is pointing. These commands will also cancel the fill flag if it has been set.

```
5160 K% = K% AND 175:
      PROCcursor: X = X
      + P * XL%:
      MOVEX, Y: PROCc-
      ursor: RETURN
```

Change No. 13 to line 5160

```
5170 K% = K% AND 175:
      PROCcursor: Y = Y +
      P * XL%: MOVEX,
      Y: PROCcursor: RETURN
```

Change No. 14 to line 5170

HM — Home Cursor

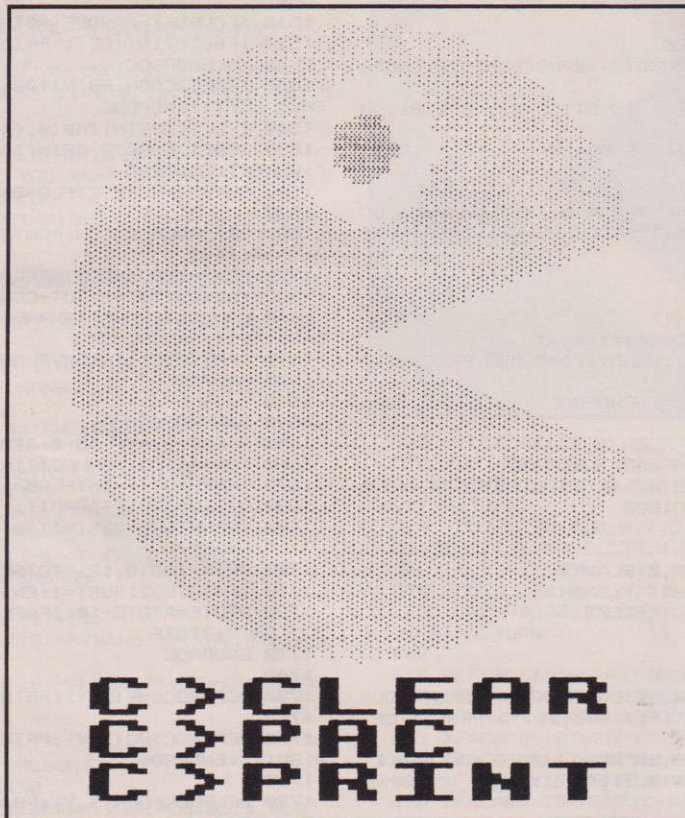
This command will return the cursor to its home position.

```
5040 PROCcursor
Change No. 3 to line 5040
```

AG — ANGLE — value required

This command allows direct control over the direction in which

## The second and final part of our Turtle Graphics program.



the cursor is pointing. The parameter should hold the new direction in degrees.

```
5220 PROCcursor: AG = P:
      IFAG 360 THEN
      AG = AG MOD 360
5230 IFAG 0 THEN AG =
      360 + (AG MOD 360)
```

```
5240 PROCcursor: RETURN
```

The checks in lines 5220 and 5230 are to ensure that the value of AG always remains within the range 0 — 360 no matter what parameter is entered.

Change No. 17 to line 5220

DF DEFINE — name required  
EF END DEFINE

part of PROCrepeat which was explained in the last issue. Firstly we set the define flag and increase the record of the number of user defined commands by one. We then put the name of the new command into our temporary store D\$(0,0) and clear the array element pointed to by D%. The command name is not put into it's array element until the user defined command has been completed. This is to avoid the possibility of calling the new command before it has been properly defined and ending up in an infinite loop (easily done!). We then build up the command using FNinput, like in PROCrepeat. If a Repeat command is entered we will enter PROCrepeat and the following commands will initially be added to the Repeat string. On ending the Repeat string with END REPEAT the Repeat string will be added to the current Command string, see line 11100. Once we have finished our definition with END DEFINE, we can assign the name of the definition to its correct array element.

5320 PROCdefine: RETURN  
Change No. 25 to line 5320

Having entered the procedure to define you own commands we must now enter the routine for interpreting them. If you remember from the last issue when FNfind returns the command number if sets bit 7 (i.e.) adds 128) if it finds a user defined command. PROCchoose then directs control to either PROCsysex or PROCdex depending whether this bit is set. So, before you start trying to define some commands, we must enter PROCdex.

PROCdex (C%) — This is recursive procedure and you will need a clear mind to follow your way through the thinking behind it.

L% reflects the current level of recursion. Each time PROCdex is entered it is increased by one, and each time it is exited it is reduced. We also use here four of the single byte arrays — W%, E%, R%, N% (see Table 2 — MAR/APR issue).

Let us use an example to follow through. Lets assume we have defined the following commands.

The Define command allows you to define your own routines, which one defined can be called just by entering it's name. These user defined commands can then be incorporated in later definitions.

End Define is used to flag the end of the user defined routine.

As an example to produce a routine to draw a square you need to enter the following commands: DEFINE SQUARE, REPEAT 4, FORWARD 20, RIGHT 90, END DEFINE. Having entered these commands, entering SQUARE on its own which draw a square of sides 20 units in length.

PROCdefine — This procedure is very similar to the first



```
DF SQUARE : RP 4 : FD 20 : RT
90 : ER
: EN
DF TRIANGLE : RP 3 : FD 20 :
LT 120 :
ER : EN
DF HOUSE : SQUARE :
TRIANGLE : EN
DF STREET : CR -75 : RP 6 :
PD :
HOUSE : PU : FD 25 : ER : EN
```

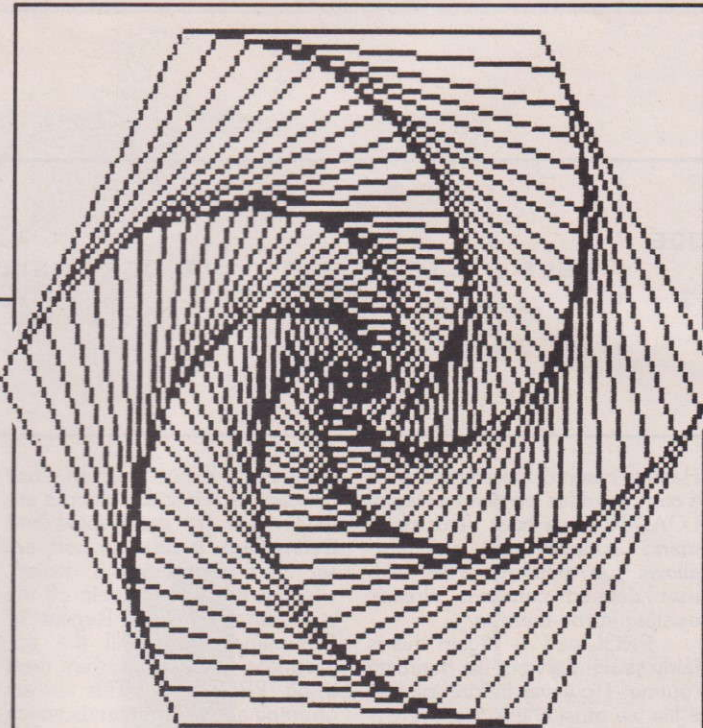
## FURTHER COMMANDS

Having done this we would clear the screen and enter STREET. PROCchoose will call PROCdefex for the first time, setting L% to 1. W%?1 will be set to 4 and E%?1 to 1. PROCextract will then return the first command in the Command string of STREET — CURSOR RIGHT -75. This will be executed by PROCsysex via PROCchoose. The next command extracted is REPEAT 6. Having encountered a Repeat command (no. 24) R%?1 is set to the current value of E%?1, which now points to the first command in the repeat loop — PEN DOWN. N%?1 is set to the parameter of the Repeat command (i.e. 6), we jump over PROCchoose.

The next command is PEN DOWN which will be executed by PROCsysex. This is followed by HOUSE, which is a user defined command, so PROCchoose will this time call PROCdefex for the second time. At this stage our level one pointers are set as follows:

W%?1 points to the Command string for STREET  
E%?1 points to the command PEN UP  
R%?1 points to the command PEN DOWN  
E%?1 points to the command PEN UP  
R%?1 points to the command PEN DOWN  
N%?1 shows the number of repeats to be completed as 4

On entering PROCdefex again L% is set to 2, W%?2 will point to the Command string for HOUSE and E%?2 is set to 1. PROCextract returns the first command in this string, which is yet another user defined com-



```
Command >CLEAR
Command >HEXS
Command >PRINT
```

mand — SQUARE. Again we drop down another level and L% is set to 3. SQUARE only consists of system commands so these will all be executed using PROCsystem. We then drop out of PROCdefex for the first time returning to PROCdefex at level 2. Our level 2 pointers have remembered where we were and the next command, TRIANGLE is extracted. This drops us straight back to level 3 for this to be executed. Having done this we revert to level 2 to finish executing HOUSE and find ourselves back at level 1 where we finish the first loop of STREET. The END REPEAT (No. 9) command causes N%?1 to be reduced and E%?1 to be reset to the value of R%?1 and the whole process is repeated another five times to complete the execution of STREET.

Having now incorporated the DEFINE command, we can now add some routines which support this command.

### LI — LIST

This command will list all the user defined commands currently present in the memory. You press any key to advance the list.

```
5380 CLS.FOR J% = 1 .TO
```

```
D%:PRINT D$(J%,0):G% =
GET:NEXT:RETURN
Change NO. 30 to line 5380
```

DS — DESCRIBE — name required

This command will display the individual commands which go to make up the user defined command named in the parameter. Again you press any key to advance the list.

PROCdescribe — This procedure uses POROCextract again to extract the individual commands from the Command string. The command number is then converted to the full command name and the parameter, if any, is printed using the MID\$ operator.

```
5350 PROCdescribe:RETURN
Change No. 28 to line 5350
```

DL — DELETE — name required

This command is used to delete the user defined command named in the parameter from the memory. The command will fail if you try to delete a command which is required by another definition.

PROCdelete — This procedure ended up being more complicated to write than I had originally anticipated. First we

have to check whether the command to be deleted is required by any of the other user defined commands. This is done by using INSTR. If you remember FNinput will set P to the command number of the parameter. Thus we can search for CHR\$P+CHR\$10. If we find the command an error message is printed and the procedure exited. Now that we are sure that the command can be deleted, we check to see if it was the last command defined, in which case we can simply clear the array elements and reduce D%. However if it was an earlier defined command we have to move all the later commands down one element of the array. Having done this the problems now begin. You will remember that the user defined commands are found by their command number rather than by their name when incorporated in other definitions. As we have just moved some of these commands we will have just moved some of these commands we will have to change any references to them in other user defined commands. We use POROCchange to reduce the value of the command number by one. Now that the house is in order again we can reduce D% and exit the procedure.

PROCchange (j%,t%,d%) — j% will hold the command number of the command we are checking. t% will contain the lower limit of the command numbers that have to be changed. d% holds the value of the change, with PROCdelete it is -1.

The procedure then checks each character of the command and if its higher than t%, it will add the value of d% to it using the string operators, LEFT\$ and MID\$;

```
5360 PROCdelete:RETURN
Change No. 27 to line 5360
```

Now that we can define our own commands we need to be able to save these in a file and load them back. The next two commands cover the file handling.

**CONTINUED OVER**



PRINT	MODE	MODE	HELP	LIST	PALETTE	VALUES	UNDO	CLEAR	DISPLAY
	1	2							

"Function Key Strip"

## FILE HANDLING

### QU-QUIT

This command grew as I developed the program. Originally it was just used to exit the program allowing you to save a file of the user defined commands if desired. The final version, first asks you whether you wish to save a file. Having done that you are asked whether you wish to carry on programming. If you do you are then asked which plotting mode you require. The command, therefore, gives you a way of changing mode without actually exiting the program.

**PROCquit** — The coding for this procedure is a straightforward file handling routine, so I will not dwell on the details. However one point worth mentioning, is the self validating input routine used in lines 17020 and 17100. As mentioned earlier, **INSTR** returns the character position of the string you are trying to find or returns zero. So, by making up a string of your input option characters and using **GET\$** to get a character from the keyboard, **INSTR** will return a positive number if it is found or zero if an invalid key was pressed. Now by using this function in an **ON X + 1 GOTO** construct the first line number returns control to the beginning of the line, i.e. an invalid key, the following line numbers direct control for the valid characters. This routine is very useful in menu driven programs. (Note — this routine as written will work on all OS's, however if you have OS1.0 or higher there is a neater way of writing the code using **ELSE** — 17020

```
INSTR('Yy,Nn',GET$)
GOTO17030, 17030, 17090,
17090 ELSE 17020)
```

```
5130 S% = 0:PROCquit:
RETURN
Change No. 36 to line 5130
```

**LO — LOAD**

Having entered the routine save a command file we need a way of **LOADING** one back. This command achieves that and also allows you to merge a file with user defined commands already existing in the memory.

**PROCload** — Again this is fairly straightforward file handling routine. However before loading a file we must check that there is enough room left in the memory to accept it. If there is not the loading is abandoned and an appropriate error message is reported. We also have to check to see if the file is being merged. If it is the command numbers have to be changed using **PROCchange**. This time the value of the commands will be increased depending on how many user defined words are already in the memory.

```
5490 PROCload:RETURN
Change No. 31 to line 5490
```

Also add any lines between 90 and 1070 which you have not yet typed in.

The next two commands will help you resolve those mistakes you will inevitably make when you are using the program.

**UD — UNDO**

In most cases this command will allow you to undo the last few plotting commands you have entered. There are obviously some commands which you just can't undo for instance **CLEAR**.

**PROCrecord** — This records all the information relating to the last plotting command that was entered, in a series of arrays. It also updates the pointer and the flag which records how many commands can be undone. The section on revolving stacks and pointers in the last issue explains the working in more detail.

**PROCundo** — First a check is made on the flag, **S%**, to see if it is possible to undo the

command. If not then an error message is reported. Checks are then made for the Repeat and Define flags. If either or both are set then **PROCdel** is called, which is a routine to strip off the last command of a Repeat or Command string. All the appropriate variables are then reset using **PROCreset**. This covers undoing all the commands which do not actually draw on the screen. A **WRITE** command (No.23) is undone by calling the command again as this is printed using **EOR** plotting. The **FORWARD**, **BACKWARDS** and **CIRCLE** commands are catered for in line 8070. First **PROCreplot** resets the fill array pointer. The undo plotting flag is then set. This has the effect of causing all further plotting to be in the background colour. **PROCchoose** then calls the command again, thus unplotting it. The undo flag is then cleared and **PROCrest** and **PROCreplot** are called again. Before leaving the procedure we reduce **S%** and change the pointer **T%**.

**PROCdel(DL%)**  
**PROCreset**  
**PROCreplot**

**ED — EDIT** — name required

This command allows comprehensive editing of the user defined commands.

**PROCedit** — First the screen is cleared then a menu of options is printed to the text window: **E**nter **D**elete **I**nsert **R**eplace. The Define and Edit flags are set and a smaller text window is created. The editing is achieved by transferring the individual commands from the Command string being edited to **D\$(0,1)**, which is used as a temporary store. The individual command is transferred by **T\$**, which is obtained using **PROCextract** again. This is first printed to the screen. While the command is in **T\$** the user is allowed to use the four options available. Entering

transfers **T\$** to **D\$(0,1)**. Deleting, effectively throws **T\$** away. Replacing, throws **T\$** away but allows the user to enter a different command to be added to **D\$(0,1)** by using **FNinput**. Inserting, operates in a similar manner to Replacing but before the next command is extracted by **PROCextract** the pointer **E%** is reset to extract the same command again.

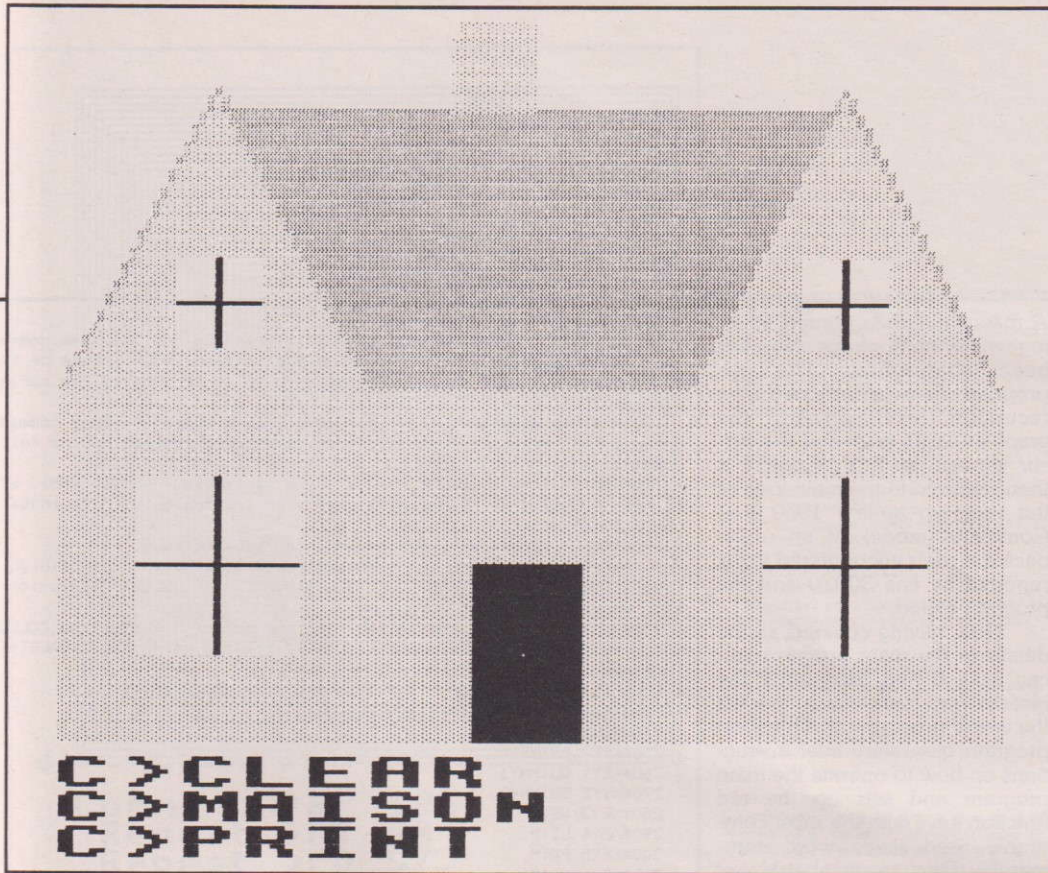
The construct **ON INSTR GOTO** is used here again in a self validating input routine. This time, however, we have to allow three possible sets of valid input, so we can implement the following rules: You can not leave Edit mode without completing a loop. 2 You can not delete or replace **END DEFINE**. Lines 13150-13170 are used to complete any Repeat loops that are in the Command string being edited. Because we are already using the level 0 pointers, in line 13160 we have to use a temporary variable to store the contents of **W%** and **E%**. On leaving the procedure our revised Command string is placed in its correct array element.

**NM — NUMBER** Value required  
**TR — TURN** — value required  
**SZ — SIZE** — value required

These commands allow you to set the value of the system variable of the same name. These variables can be used in commands using numeric parameters. As an example, in the definition for a **SQUARE**, which I mentioned earlier, if you substitute **FORWARD SIZE** for **FORWARD 20**, you will have a command which will draw a square of any size.

```
5280
NM = P:NUMBER = P:RETURN
Change No.20 to line 5280
5290 TR = P: TURN = P:
RETURN
Change No.21 to line 5290
5300 SZ = P:SIZE = P:RETURN
Change No. 22 to line 5300
```





#### VL — VALUES

This is another of the "Help" commands which will display the current value of the system variables and also the current plotting colour number.

```
5400 CLS:PRINT"NUMBER
(NM) = ";NM
5410 PRINT"SIZE (SZ) = ";SZ
5420 PRINT"TURN (TR) =
";TR
5430 PRINT
5440 PRINT"COLOUR (CO) =
";CO:RETURN
```

So far I have not mentioned colour. The next two commands will give you complete control over the colours you use.

**CO — COLOUR** — value required

This command will set the plotting colour to the logical colour nominated in the parameter. In Mode 1 only values of 0 and 1 are allowed, whereas in Mode 2 values ranging from 0 to 3 are allowed. When changing Mode the plotting colour is always set to white, which is colour number 1 or 3 respectively. Colour number 0 is always the background colour.

```
5140 CO=P:IFL%>0THEN
RETURN ELSE IF C<0
ORCO<3THEN5150ELSEIF
```

```
CO>1ANDM%=4THEN5-
150ELSERETURN
5150
PROCmsg(22," ");PROCmsg
(23," ");CO=V%:RETURN
Change No. 12 to line 5140
```

#### PA — PALETTE

The palette command gives you access to the full range of colours available on the BBC Micro. You will first be asked which plotting colour you wish to change. You are then given a menu of the eight steady colours, labelled A to H. Pressing the relative key will select the appropriate colour. You will not be allowed to have text and background colours the same. This is another of the "Help" commands which can be used when repeating or defining.

**PROCcolour** — The logical and actual colours chosen are put into the local variables 1% and A%. A check is then made to see if we are changing either the background or text colours. If we are then the, number of the logical colour we're not changing is put into the first byte of a parameter block pointed to by 0%. If we are changing the text we put 0 (background colour) into 0%. An OSWORD call is then made with the accumulator equal to &0A. This will return the value of the actual colour in the second byte of the parameter block. We can then check to see if the col-

our returned is the same as the new colour chosen for the text. If it is an error message is printed otherwise we change the colour using VDU19.

```
5390 PROCcolour:RETURN
Change No.33 to line 5390
```

#### WR — WRITE — name required

This command simply writes the text entered in the parameter to the screen at the current cursor position. This is done using EOR plotting, so the text will show wherever it is printed.

```
5480 PROCcursor:VDU5:
GCOL3,CO:PRINTP$:
VDU4:MOVEX,Y
:PROCcursor:RETURN
Change No.23 to line 5480
```

#### CI—CIRCLE — value required

Although it is possible to define your own command to draw a circle, however you did it, it would take sometime to be plotted. This routine enables you to plot circles very quickly, either in outline or filled. Filled circles are drawn by calling the FILL command and first. The circles are drawn, centring on the cursor with a radius specified by the parameter.

**PROCcircle(r)** — This is a fast circle drawing routine which uses trigonometry to calculate the

coordinates on the circumference. The values for SIN and COSINE for a forty five degree arc using steps of nine degrees were put into arrays S(N) and C(N) by PROCinit. All the other points on the circumference can be calculated using these figures by just altering the sign of the values or reversing the X and Y coordinates or both (note:  $\text{SIN}(80) = \text{COS}(10)$ ). Before entering the loop which performs the plotting, the graphics origin is moved to the current cursor position. The loop then assigns two adjacent points on the circumference to x,y and xx,yy, these being weighted by the radius and the scaling factor. These points are then plotted by moving to the centre, then to one of the points on the circumference and plotting to the second point. The plot command uses K% as a parameter so it will draw a line or a triangle depending whether the fill flag is set. This is done for the eight possible combinations of the coordinates. On leaving the procedure the origin is reset back to the centre of the plotting screen.

```
5120 PROCcursor:
GCOL3,CO:PROCcircle
(P):MOVEX,Y:
PROCcursor:RETURN
Change No. 11 to line 5120
```

This completes all the commands available apart from one. This is PR — PRINT. This command is designed to allow the user to call a screen dump routine for a printer. The command will call PROCdump, which as listed here does nothing very spectacular apart from advise that there is no screen dump available. It is left up to you to add your own dump routine for your particular make of printer. However I will make a few recommendations on how to add one. Firstly I would refrain from using a routine written in BASIC as this would take up valuable memory space which is required for the user defined commands. The best option is to use a machine code dump. This could be \*LOADED by PROCinit or by the Header program (see later). Alternatively, machine

**CONTINUED OVER**



code could be assembled by the Header program before the main program is CHAINED. PROCdump could then CALL this machine code routine.

Some machine code dumps rely on the graphics origin being at 0,0 and the graphics window covering the whole screen. I would therefore suggest that PROCdump sets these to their default values before the screen dump is called and resets them afterwards (see line 27510 for the programs requirements).

This now completes all the commands available in this language. As a final check you can compare what you have entered for PROCsysex against the listing of the procedure.

Before saving your final version of the main program a couple of small bugs slipped past in the listings printed in the last issue. Firstly the eleventh DATA item in line 26000 should read CIRCLE. Secondly in the Error routines in line 30030 change F% = F%AND190 to F% = F%AND188.

While mentioning the Error routines I did not fully explain how they work in the last issue. First a check is made for a "no such variable" error in line 18260. This traps numeric parameters which can not be evaluated by the EVAL function and prints out an error message and directs control to the flag clearing routine. Pressing the Escape key (ERR=17) also directs control to this routine, which checks which flags are set.

A message is then printed advising which mode of operation has been abandoned. The appropriate flags are cleared, the recursion level zeroed, the graphics origin reset and the cursor moved to X,Y. Control is then returned to the main loop of the program at line 1050 (i.e. Command mode). If an unexpected error is encountered this is reported by line 30020 and the program exited.

Now having covered all the details in the main program you can save it and then enter the Header program which finishes the whole program off. This short program gives very brief instructions on how to operate the main program and sets up the red function keys with the most commonly used single word commands. Disc users should set PAGE = &1500 in line 350. Having entered this program save it to a new tape with the name "TURTLE" and record the main program straight after it using the name "M.TURTLE". To run the program just enter CHAIN "TURTLE".

## IN CONCLUSION

I hope you will find that the effort in typing in this lengthy program was worthwhile and you get as much enjoyment for using it as I did from writing it.

A&B Computing would be very pleased to hear from readers who have developed their own demonstration files and will publish examples in future issues.

## PROGRAM LISTING

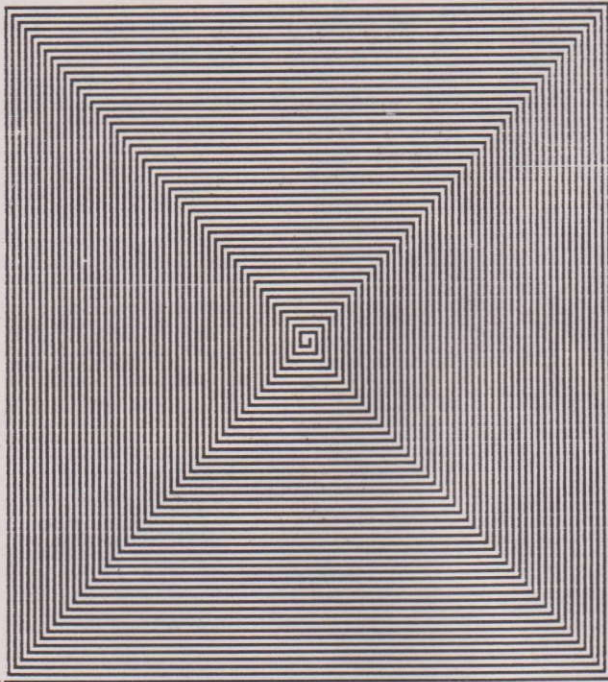
```
10REM*****
20REM**      TURTLETALK**
30REM**      BY A.J. SELF**
40REM**      Version 3.10**
50REM**      29 Dec 1983**
60REM**
70REM**      Header program**
72REM**
80MODE7
90PRINTTAB(11,3)CHR#130;CHR#157;TAB(28,3)CHR#156;
100FORH%=4 TO5:PRINTTAB(10,H%)CHR#141;CHR#130;CHR#157;CHR#129;" T
URTLETALK ";CHR#156;NEXT
110PRINTTAB(11,6)CHR#130;CHR#157;TAB(28,6)CHR#156;
120PRINTTAB(2,10)"An implementation of turtle graphics";TAB(5,12)
"for the 32k BBC Microcomputer";TAB(6,14)"by A.J.Self (c) April 19
83"
130G% = INKEY(500)
```

```
150VDU28,0,24,39,8
160CLS:PRINT" This version of turtle graphics has 35system comma
nds. These can be viewed by entering the command 'HELP'. Some of th
e commands require a parameter, either a value or a name. The param
eter should"
170PRINT"be separated from the command by a space"" Each comman
d has a two letter mnemonicwhich can be entered instead of the full
command."
180PRINT"" The system supports three variables, NUMBER (NM), SI
ZE (SZ) & TURN (TR) thesacan be used with a command that requiresa
numeric parameter."
190PRINT"" Press any key to continue.":G% = GET:CLS
200PRINT"" There are two plotting modes available"" 1)High
resolution & one plotting colour"" 2)Low resolution
& three plotting colours"
210PRINT"" You can change the plotting colour using the COLOU
R command. Your availablepalette can be changed using the""PALETTE
command."
220PRINT""Enter 1 or 2 for plotting mode required.":
230M% = INSTR("12",GET$)+3:IFM%<4THEN230
240VDU28,0,24,39,22
250*KEY0 PRINT:M
260*KEY1 QUI:MNY1
270*KEY2 QUI:MNY2
280*KEY3 HEIM
290*KEY4 LI:M
300*KEY5 FAIM
310*KEY6 VLIM
320*KEY7 UNDO:M
330*KEY8 CLEAR:M
340*KEY9 DISPLAY:M
350REM _ Disc users change PAGE to &1500 here
360CHAIN"TURTLE.M"
```

## MAIN PROGRAM LISTING

```
5 REM *****
10 REM **      TURTLETALK**
20 REM **      BY A.J. SELF**
30 REM **      Version 3.10**
40 REM **      9 Nov 1983**
50 REM **
60 REM *****
61 REM **      Main program**
62 REM *****
90 *KEY0 PRINT:M
110 HIMEM=&5800
120 PROCinit
130 *FX21,0
990 ON ERROR GOTO 30000
1000 PROCmode
1010 PRINT"Do you wish to load a file of previouslydefin
ed words ?"
1020 ON INSTR("YyNn",GET$)+1: GOTO1020,1030,1030,1040,104
0
1030 PROCload
1040 CLS
1050 C$=FNinput:IF C$="" THEN1050
1060 PROCchose
1070 GOTO1050
4997 REM *****
4998 REM **      PROCsysex**
4999 REM *****
5000 DEF PROCsysex:LOCAL x%,y%
5010 ONCX GOSUB5470,5030,5040,5060,5070,5080,5090,5120,5
340,5450,5120,5140,5160,5170,5190,5180,5220,5260,5250,528
0,5290,5300,5480,5310,5320,5330,5360,5350,5370,5380,5490,
5400,5390,5100,5460,5130
5020 ENDPROC
5030 SZ=0:CLG:GOTO5050
5040 PROCcursor
5050 K% = K%AND175:AG=0:X=0:Y=0:MOVEX,Y:PROCcursor:RETURN
5060 IFK%AND2THEN RETURN ELSE K% = K%AND174:RETURN
5070 K% = K%OR1:RETURN
5080 K% = K%AND175:RETURN
5090 IFK%AND80THEN RETURN ELSEK% = K%OR81:FORI=0TO7:fx(I) =
x:fy(I) = y:NEXTI:RETURN
5100 PROCcursor:FX = F%EOR16:PROCcursor:x% = POS:y% = VPOS:VDU
28,0,31,SW%,0,30:PRINT$PC(20*fx):IFF%AND64THENVDU28,0,31,
SW%,28:ELSEVDU28,0,31,SW%,26
5110 VDU31,x%,y%:RETURN
5120 PROCcursor:GCOL0,C0:PROCCircle(P):MOVEX,Y:PROCcurso
r:RETURN
5130 SZ=0:PROCquit:RETURN
5140 CD=P:IFLX%>0THEN RETURN ELSE IFCD<0ORCD>3THEN5150ELS
EIFCD>1ANDM%<4THEN5150ELSERETURN
```





```
Command >RP 186
Repeat >RT 90
Repeat >FD SZ
Repeat >SZ SZ+1
Repeat >ER
Command >PRINT
```

```
5150 PROCmsg(22,"");PROCmsg(23,"");CO=VX:RETURN
5160 KX=KXAND175:PROCCursor: X=X+P*XLX:MOVE X,Y:PROCCursor
:RETURN
5170 KX=KXAND175:PROCCursor: Y=Y+P*XLX:MOVE X,Y:PROCCursor
:RETURN
5180 P=-P
5190 PROCCursor:AG=AG+P:IFAG<0THENAG=360+(AG MOD 360)
5200 IFAG>360THENAG=AG MOD 360
5210 PROCCursor:AG=P:IFAG>360THENAG=AG MOD 360
5220 IFAG<0THENAG=360+(AG MOD 360)
5230 IFAG<0THENAG=360+(AG MOD 360)
5240 PROCCursor:RETURN
5250 P=-P
5260 PROCCursor: X=X+FNK(P,AG):Y=Y+FNK(P,AG)
5270 PROCplot:RETURN
5280 NM=P:NUMBER=P:RETURN
5290 TR=P:TURN=P:RETURN
5300 SZ=P:SIZE=P:RETURN
5310 PROCRepeat:RETURN
5320 PROCdefine:RETURN
5330 SZ=0:PROCCedit:RETURN
5340 IFLX=0THENFX=FZAND253:SZ=0:RETURN ELSE RETURN
5350 PROCdescriber:RETURN
5360 PROCdelete:RETURN
5370 CLS:FORJX=2TO36:PRINTMID$(COM$,JX#2-1,2); " - ";COM$
(JX);GX=GET:NEXT:RETURN
5380 CLS:FORJX=1TO36:PRINT$(JX,0):GX=GET:NEXT:RETURN
5390 PROCcolour:RETURN
5400 CLS:PRINT"NUMBER (NM) = ";NM
5410 PRINT"SIZE (SZ) = ";SZ
5420 PRINT"TURN (TR) = ";TR
5430 PRINT
5440 PRINT"COLOUR (CO) = ";CO:RETURN
5450 IFLX=0THENFX=0:RETURN ELSE RETURN
5460 PROCdump
5470 RETURN
5480 PROCCursor:VDU5:GCOL3,CO:PRINTP$:VDU4:MOVE X,Y:PROCC
ursor:RETURN
5490 PROCload:RETURN
5997 REM *****
5998 REM ** PROCdefex **
5999 REM *****
6000 DEF PROCdefex(CX)
6010 CX=CXAND127:LX=LX+1
6020 WX?LX=CX:EX?LX=1
6030 PROCextract
6040 IFCX=24THENRX?LX=EX?LX:NX?LX=ABS(INT(P)):GOTO6070
6050 IFCX=9ANDNX?LX>1THENEX?LX=RX?LX:NX?LX=NX?LX-1:GOTO6
070
6060 PROCchoose
6070 IFCX<>10THEN6030
6080 LX=LX-1:ENDPROC
```

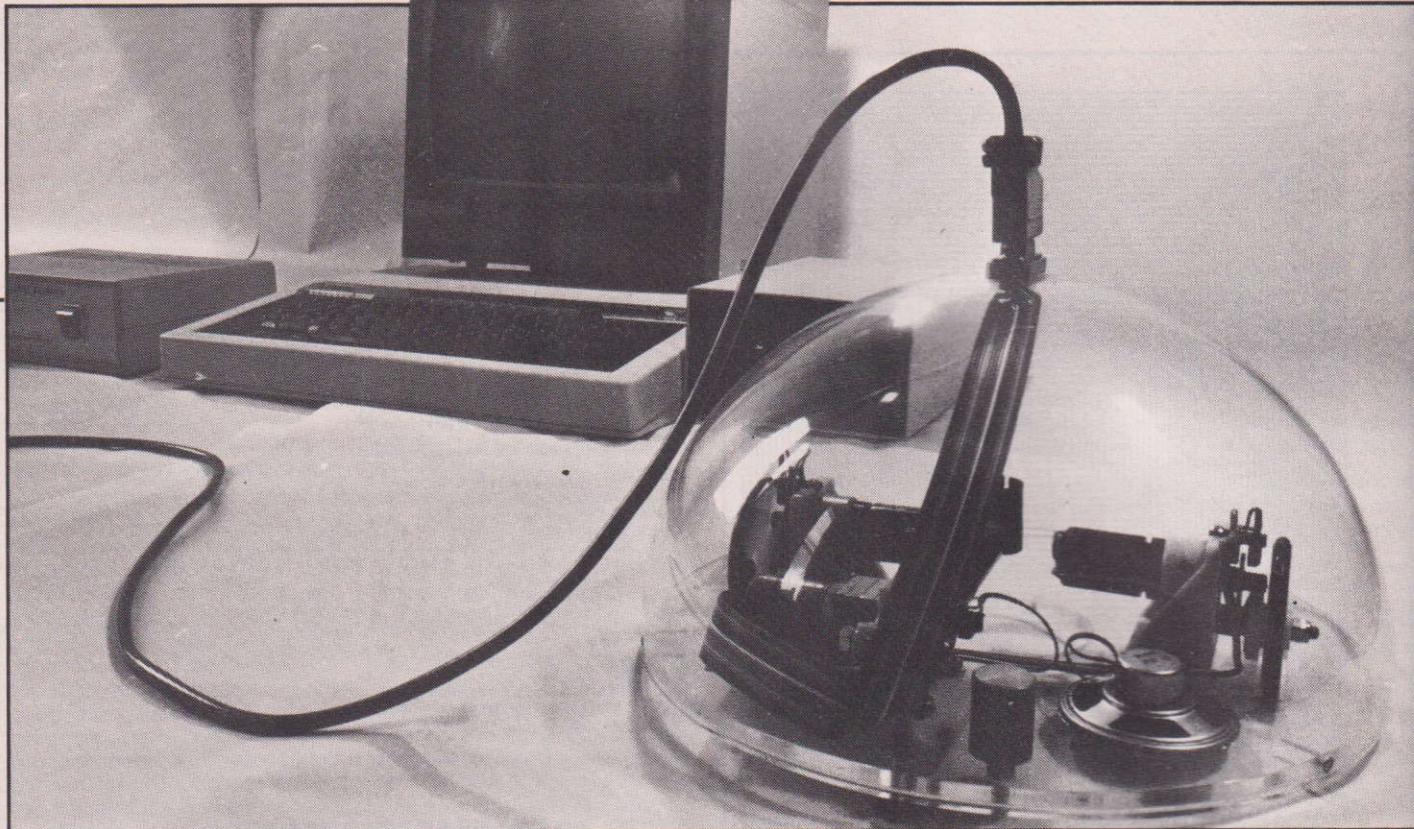
```
7997REM *****
7998REM ** PROCundo **
7999REM *****
8000DEF PROCundo
8010IFFX=0THENPROCmsg(14,"");PROCmsg(18,"");ENDPROC
8020IFFXAND2THENPROCdel(0):GOTO8040
8030IFFYAND1THENPROCdel(DX)
8040PROCreset
8050IFCX=23THENPROCchoose:GOTO8080
8070IFCX=11ORCX=18ORCX=19ORCX=128THENPROCRepeat:KX=Y*OP2:PROCchoose:K
X=KXAND253:PROCreset:PROCRepeat
8080SZ=SZ-1:TX=TX-1-5*(TX=0):ENDPROC
8200DEF PROCrecord
8210SX=5X+1+(SX=5):TX=TX+1+5*(TX=4)
8220CX=TX:AG=TX:AG=X(TX)=X:Y(TX)=Y:TR=TX:NM=NM(SZ(TX)=SZ:
P(TX)=P:FX(TX)=FX:KX(TX)=KX:CO(TX)=CO:P(TX)=P:ENDPROC
8400DEF PROCreset
8410PROCCursor
8420CX=CX(TX):AG=AG(TX):X=X(TX):Y=Y(TX):TR=TR(TX):TURN=TR(TX):NM=NM(TX
):NUMBER=NM(TX):SZ=SZ(TX):SIZE=SZ(TX):P=P(TX):FX=FX(TX):KX=KX(TX):CO=CO
(TX):P=P(TX)
8430MOVE X,Y:PROCCursor:ENDPROC
8600DEF PROCdel(DLX,1)=LEFT$(D$(DLX,1),LEN(D$(DLX,1))-1):UNTILRIGHT$(D$
(DLX,1,1)=CHR$10 OR LEN(D$(DLX,1))=0
8620ENDPROC
8800DEF PROCRepeat
8810GX=GX-1-7*(GX=0):ENDPROC
```

```
9597 REM *****
9598 REM ** PROCcircle **
9599 REM *****
9600 DEF PROCcircle(r):LOCAL x,y,xx,yy
9610 VDU29,642+X,610+Y
9620 FORIX=0TO4
9630 xx=C(IX)*r*XLX
9640 yy=S(IX)*r*XLX
9650 x=C(IX+1)*r*XLX
9660 y=S(IX+1)*r*XLX
9670 MOVE0,0:MOVExx,yy:PLOTX,x,y
9680 MOVE0,0:MOVExx,-yy:PLOTX,x,-y
9690 MOVE0,0:MOVE-xx,yy:PLOTX,-x,y
9700 MOVE0,0:MOVE-xx,-yy:PLOTX,-x,-y
9710 MOVE0,0:MOVEyy,xx:PLOTX,y,x
9720 MOVE0,0:MOVEyy,-xx:PLOTX,y,-x
9730 MOVE0,0:MOVE-yy,xx:PLOTX,-y,x
9740 MOVE0,0:MOVE-yy,-xx:PLOTX,-y,-x
9750 NEXT:VDU29,642,610:ENDPROC
```

```
11997 REM *****
11998 REM ** PROCdefine **
11999 REM *****
12000 DEF PROCdefine
12010 FX=FZOR1:DX=DX+1
12020 D$(0,0)=P$:D$(DX,1)="
12030 REPEAT
12040 CS=FNinput
12050 IFCX=25THEN12140
12060 IFCX=" THEN12040
12070 IFCX>28 ANDCX<35 THEN12090
12080 D$(DX,1)=D$(DX,1)+CS
12090 PROCchoose
12100 UNTILCX=10
12110 D$(DX,0)=D$(0,0)
12120 FX=FXAND254
12130 ENDPROC
12140 UNTILCS="":DX=DX-1:ENDPROC
12997 REM *****
12998 REM ** PROCedit **
12999 REM *****
13000 DEF PROCedit
13010 GOSUB5030:CLS:PRINT"E nter","D elete","I nsert","R
eplace"
13020 FX=FZOR65
13030 VDU28,0,31,SWX,28
13040 D$(0,1)="":?WX=F AND127:?EX=1
13050 REPEAT
13060 PROCextract
13070 IFCXAND128THENPRINT$(CXAND127,0):ELSEPRINTCOM$(C
X);
13080 PRINT" ";MID$(T$,2):CHR$13;
13090 AS=GET$:IFCX=10 AND (FXAND2)=2 ON INSTR("EI",AS)+
160TO13090,13120,13140
13100 IFCX=10 ON INSTR("EI",AS)+160TO13090,13130,13140
13110 ON INSTR("EDIR",AS)+160TO13090,13130,13170,13140,
13140
13120 PROCmsg(132,"still"):PRINT:GOTO13070
13130 D$(0,1)=D$(0,1)+T$:GOTO13150
```

CONTINUED OVER





```

13140 D$(0,1)=D$(0,1)+FNinput:PRINT:IFA$="I"THEN?E%=?E%
-P%
13150 PROCchoose:IFC%=24THEN?R%=LEN(D$(0,1))+1:?N%=ABS(
INT(P))
13160 IFC%=9THENZ%=?W%:Z%=?E%:W%=0:FORJ%=2TO?N%:Z%
=?R%:REPEAT:PROCCextract:PROCchoose:UNTILC%=9:NEXT:?W%=Z%
?O:Z%=Z%?1
13170 UNTILC%=10
13180 D$(?W%,1)=D$(0,1)
13190 VDU28,0,31,SW%,26,12:F%=F%AND190:ENDPROC
13997 REM *****
13998 REM ** PROCdescribe **
13999 REM *****
14000 DEF PROCdescribe
14010 CLS
14020 ?W%=P AND127:?E%=1
14030 REPEAT
14040 PROCextract
14050 IFC%AND128THENPRINT$(C%AND127,0):ELSEPRINTCOM$(C
%)
14060 PRINT" ";MID$(T$,2):CHR$13;
14070 G%=GET
14080 UNTILC%=10
14090 ENDPROC
14997 REM *****
14998 REM ** PROCdelete **
14999 REM *****
15000 DEF PROCdelete
15010 FOR J%=1TOD%:IF INSTR(D$(J%,1),CHR$(P+CHR$10)) THENPR
OCmsg(13,"");PROCmsg(81,D$(J%,0)):J%=D%+10
15020 NEXT
15030 IFJ%>D%+10 THEN ENDPROC
15040 P=P AND127:IF P=D%THEND$(D%,0)="" :D$(D%,1)="" :GOTO1
5080
15050 FORJ%=P TOD%-1:D$(J%,0)=D$(J%+1,0):D$(J%,1)=D$(J%+
1,1):NEXT
15060 P=P OR 128:FOR J%=1TOD%:PROCchange(J%,P,-1)
15070 NEXT
15080 D%=D%-1:ENDPROC
15497 REM *****
15498 REM ** PROCchange **
15499 REM *****
15500 DEF PROCchange(j%,t,d%)
15510 LOCAL l%
15520 FOR l%=1TO LEN(D$(j%,1))
15530 IF ASC(MID$(D$(j%,1),l%,1))>t% THEN D$(j%,1)=LEFT
$(D$(j%,1),l%-1)+CHR$(ASC(MID$(D$(j%,1),l%,1))+d%)+MID$(D
$(j%,1),l%+1)
15540 NEXT:ENDPROC
15997 REM *****
15998 REM ** PROCcolour **
15999 REM *****
16000 DEF PROCcolour:LOCAL l%,a%
16010 CLS:PRINT"Enter No. of colour to be changed (0 if b
ackground) : ";
16020 G%=GET:PRINTCHR$(G%);l%=G%AND15
16030 G%=INKEY(50):CLS
16040 PRINT"A-black", "B-red", "C-green", "D-yellow", "E-blue
", "F-magenta", "G-cyan", "H-white"

```

```

16050 PRINT"Enter letter of new colour required : ";
16060 a%=GET:IFA%<65ORa%>80THEN16060ELSEPRINTCHR$a%:a%=(
a%AND31)-1
16070 IF1%=0THEN?O%=V%:GOTO16110
16080 IF1%=V%THEN?O%=0:GOTO16110
16090 G%=INKEY(50)
16100 VDU19,1%,a%;0;12:ENDPROC
16110 CALL OSWORD:IFA%=0?1THENVDU12,7:PRINT"Text and bac
kground colours can't be thesame":G%=INKEY(150):GOTO 1603
0 ELSE GOTO16090
16997 REM *****
16998 REM ** PROCquit **
16999 REM *****
17000 DEF PROCquit:LOCAL q%,a%
17010 CLS:PRINT"Do you wish to save your defined words?"
17020 ON INSTR("YyNn",GET$)+1 GOTO17020,17030,17030,17090
,17090
17030 INPUT"Enter file name "a%
17040 q%=OPENOUT(a%)
17050 PRINTq%,D%
17060 FORJ%=1TOD%:PRINTq%,D$(J%,0),D$(J%,1):NEXT
17070 CLOSEq%
17080 PRINT"Data file saved"
17090 PRINT""Do you wish to carry on programming?"
17100 ON INSTR("YyNn",GET$)+1 GOTO17100,17110,17110,17150
,17150
17110 PRINT"Which mode? 1 or 2"
17120 M%=INSTR("12",GET$)+3:IF M%>4THEN17120
17130 PROCmode
17140 ENDPROC
17150 CLS:PRINTTAB(6,2)"GOODBYE" GOODBYE"
17160 G%=INKEY(200)
17170 VDU22,7,12:END

```

```

23997 REM *****
23998 REM ** PROCload **
23999 REM *****
24000 DEF PROCload:LOCAL q%,d%,a%
24010 CLS:PRINTTAB(0,2)
24020 INPUT"Enter file name "a%
24030 PRINT"Position data file"
24040 q%=OPENIN(a%)
24050 INPUTq%,d%
24060 IFDX+d%>50THENPRINT""s sorry, no room""LOADING AB
ANDONED":VDU7:CLOSEq%:ENDPROC
24070 FORJ%=DX+1TOD%+d%:INPUTq%,D$(J%,0),D$(J%,1)
24080 IFDX>0 THEN PROCchange(J%,128,D%)
24090 NEXT
24100 D%=D%+d%:CLOSEq%
24110 PRINT"Data file is loaded"
24120 G%=INKEY(200):ENDPROC

```

```

30100 REM *****
30110 REM ** PROCdump **
30120 REM *****
31000 DEF PROCdump
31010 VDU7:PRINT"" screen dump""s not available"
31020 ENDPROC

```



# Computalab

Mark Webb

If the idea of learning or teaching in an air-conditioned, ergonomically designed and technology packed classroom appeals to you, then you want to know about Computalab. This vision of the future combines the networking capabilities of the BBC Microcomputer and the construction and design talents of Elliot-Medway. The idea came originally from Graphic Support, who represent Elliot-Medway and has received the full co-operation of Acorn Computers and the MEP (Microelectronics in Education Programme).

Elliot-Medway already produce 90% of the mobile classrooms used by schools and Computalab is the very latest in design. The windows are large and porthole shaped with tinted glass, the sort of glass you couldn't throw a brick through if you tried. Naturally with all the expensive equipment around, security has to be taken into account. There is also an infra-red alarm which gives an exceptionally audible warning should unauthorised persons try and break in.

## FLEXIBLE

Inside, the layout of the workstations can take almost any required form. Originally the layout was a traditional formal arrangement of desks but the MEP, on seeing the prototype, advised that some flexibility be built in. The power and network cables run beneath grids in the floor and there are numerous points for connection. The cabling is sensibly colour coded and each connection point has a light indicating whether power is on. The system completely avoids what Tony Ibbotson of Graphic Support described as 'Knitting gone wrong'. There will be no tripping over cables in Computalab.

The hardware consists of a dozen BBC Microcomputers and monitors which are intended to be manned by two pupils each. These workstations are connected to a master computer at the teaching station. The network allows the teacher to choose from a variety of control options. The

## Computers are becoming increasingly valuable pieces of equipment in schools. Computalab shows the way.



class can work together or as individual stations. There is a high level monitor in one corner so that the attention of the whole class can be engaged, and we mustn't forget the low-tech blackboard. A teacher can also monitor individual progress and communicate with single groups.

Other centralised facilities include video recorder (video disc interfaced with the computer is an obvious option for the future), disc drives and a printer. Hardware can be a matter of individual choice but at the moment Computalab uses Acorn discs and the Olivetti printer. A future possibility might be to use the Electron with Econet as a cheaper terminal.

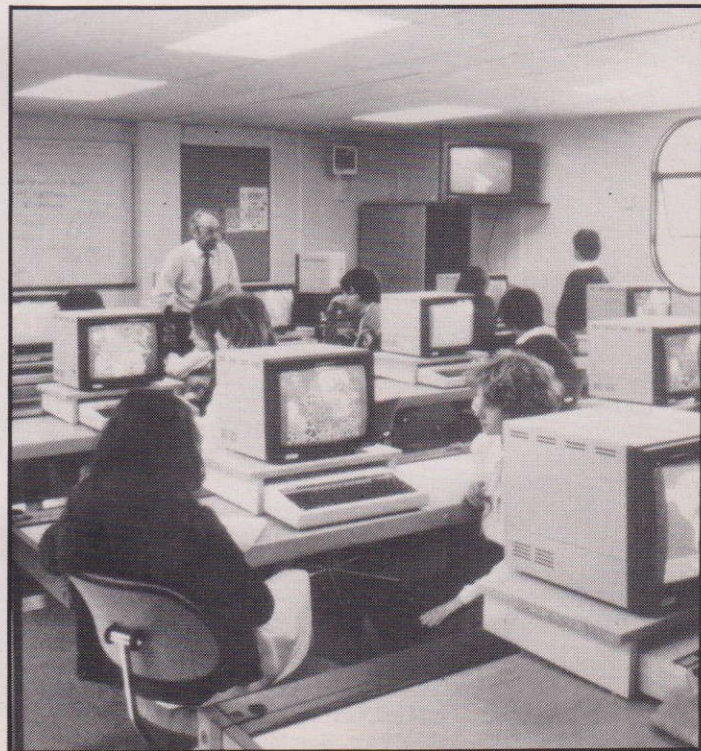
Computalab is intended to provide the learning and teaching tools for subjects right across the board, not just computer science. The 'lab' will provide facilities for all pupils to learn the keyboard skills that will be important for, among other things, work prospects in the future. Nor will Elliot-Medway unload the three sections that make up Computalab and then drive away. Full consultation and backup will be provided. The ideas and aims of the schools involved will be discussed and help provided for their implementation. A starter software pack will also be included with the package to set the

new users on their way. The building has a telephone for making connection via a modem to national databases carrying educational software.

It is recognised that although some ten percent of all teachers

have had some training in the use of computers, there is still a credibility gap, a slight fear of the new. The makers of Computalab believe that by supplying the training support and provision for teachers to get started, they will persuade teachers to join with their pupils in turning over page one of the manual together. The whole project has been a search for the complete and professional touch which will encourage the cooperation of teachers and the respect of young people learning in the 'lab'. From the engineering back up of a Vision-hire subsidiary (including maintenance contracts out of warranty) to the neat plastic plinths which replaced the original chipboard, everything has been done to make Computalab functional and credible.

Computalab doesn't come cheap but one can only hope that the encouraging response of education authorities is followed up by orders and that these marvellous facilities become available to schools, ITECS and evening classes everywhere.





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# Down to Business

John Vogler

"Integrated software" is the trendiest term in personal computing for businessmen these days. Two years back, harassed company executives were delighted to have a personal micro on their own desk plus a wordprocessor on their secretary's. While they saved hours preparing and revising budgets, logging customer details or analysing statistics their letters and reports were typed more rapidly, with economies of effort whenever material was repeated.

"Now I want to move on" says Robin Cleveland, sales manager for a small Midlands machinery maker. "When I have crunched the sales statistics I need to feed them into my budgets; then present them in graph form as targets for my reps;

## Integrated software for Beeb businessmen? Acornsoft's Viewsheet is the first step.

then feed the whole caboodle into the wordprocessor for my monthly report to the Board. Having them all in separate packages is as Victorian as ledger-clerks on high stools."

### INTEGRATION

Jim Riddle, marketing manager for a new Croydon security firm added. "We do a monthly

newsletter to clients about new security devices, how many burglaries in the area and so on; to show we care more than the big firms. The word processor is great for this but to produce really personal letters I need to merge our mailing list with the letter text and the graphs of burglaries. At present we key all this in by hand. If we could afford an IBM or LISA "mini-computer" we could

integrate them, so that one file feeds into another. Why can't we do that on the BBC?"

Jim is clearly on the ball although short of cash. Integration reaches its peak in "report writer" packages which enable records from a data base to be fed into a spreadsheet, calculated and analysed, presented not only as tables but also as graphs and pie or bar charts and the whole thing incorporated in a word-processed document. Personal computer business software is now judged largely on the speed with which data from any one of these functions can be fed into any of the others. Hitherto the micro, which costs a few hundred pounds compared with a few thousand for a mini-computer,

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12	VIEW	SHEET		
13	HOW	IT	ALL	STARTS
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CONTINUED OVER



## ViewSheet

Bytes Free 22601  
Editing No File  
Screen Mode 7  
Printer default

=>PRINT\_

has been a long way from achieving this desirable integration. Only when equipped with extra memory, such as the Torch add-on to the BBC, has this been even approachable and the software prices run into hundreds of pounds.

Otherwise BBC business users like Jim and Robin have had to be content with separate diskbased software such as the GEMINI range. This is a range of a dozen modestly priced diskbased programmes, each designed to perform a single function. While GEMINI have made some effort to link them (for example the files from BEEBCALC spreadsheet can be graphed or charted using BEEBPLOT) these can be extremely frustrating because laboriously keyed-in data cannot be fed from one to another: for example names and addresses from MAILIST cannot be used when wordprocessing.

## VIEWSHEET

Now enter Acornsoft's VIEWSHEET: an important milestone for BBC business users! Not just because it is an excellent ROM-based spreadsheet but, far more significant, because it is integrates with the VIEW word-processor (and that means, fortunately, with Computer Concepts' WORDWISE also). You build up your pricelist, timetable, budget or table of data on VIEWSHEET and neatly fit it into the report you are wordprocessing on VIEW. Nor do you have to insert the whole of the spreadsheet: you can select a number of windows onto it, such as headings and final totals for example, include them and leave out all the boring figures used to obtain them.

Likewise you can read an array of data from a disk file into a separately prepared (and, for example, half completed) spreadsheet. While the guide does not enlarge on this it is an obvious invitation to the intelligent user to create a suitable database, and indeed Acornsoft are promising to follow VIEW and VIEWSHEET with a complete, integrated set of business software.

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0 .....	ITEM	1 .CONTRACT...	PRICE	COST	6 RATE%	GRANT
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..3	ROOF	..3	MORLEY	1100.00	1265.00	75 948.75
..4	CHIMNEYS + SCAFFOLD	..4	GUARD	545.00	626.75	75 470.06
..5	RENDER FRONT DORNER	..5	GUARD	92.00	105.00	75 79.35
..6	POINTING	..6	GUARD	1040.00	1196.00	75 897.00
..7	GABLE WALL BRICKWORK	..7	GUARD	72.00	82.00	75 62.10
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..9	AREA RETAINING WALL	..9	GUARD	330.00	379.50	75 284.62
..10	REAR DORNER RENDERING	..10	GUARD	141.00	162.15	75 121.61
..11	GUTTERS	..11	GUARD	397.00	456.35	75 342.41
..12	SOIL PIPE	..12	GUARD	70.00	80.50	75 60.37
..13	DRAINS	..13	GUARD	72.00	82.00	75 62.10
..14	SUB-TOTAL REPAIRS	..14		4074.00	4685.10	75 3513.82

2 .ITEM	3 ....COST
..26 TOTAL	..26 8435.25
..27 TOTAL GRANT	..27 6125.19
..28 TOTAL OWNER	..28 2310.06

## EXAMPLE OF VIEWSHEET

## CALCULATION OF HOUSING REPAIR GRANT

## OTHER VIRTUES

VIEWSHEET has other goodies as well as integration. It is a huge sheet; in theory up to 255 rows by 255 columns. In practice available memory would be used up before this grid could be filled, even though, being a ROM, the program itself does not consume significant memory.

The process of reading data from this huge spread is made sheer pleasure by the use of screen windows. In the example given (of grants for repairs to a house), the individual items of

repair form 'window 1', the various costs associated with each form 'window 2', which is arranged to scroll in harmony with 'window 1'. The grand total remains static and always visible in 'windows 3 and 4', leaving convenient space for 'window 5' to display the title. Similar arrangements can be made for printing although the layout of print windows can be quite different from those on the screen, as the illustrations show.

Data entry is very easy. Text has no irritating need for inverted commas and replication of one

slot or column by another is deliciously simple. Column and row headings can be switched on or off and the data can be formatted within a slot in any way: as money or to the left or right margin and to a defined number of decimal places.

It is as easy to file data as to enter it. You can either save the entire sheet or individual windows or (to enchant accountants and those who produce monthly reports) the overall format with selected totals. Thus one month's figures can be carried forward as the input to the next month's.



## EXAMPLE OF VIEWSHEET

## CALCULATION OF HOUSING REPAIR GRANT

. ITEM	....COST
TOTAL	8435.25
TOTAL GRANT	6125.19
TOTAL OWNER	2310.06

.....ITEM	.CONTRAC	...PRICE	....COST	.G	RATE%	...GRANT
..3 ROOF	MORLEY	1100.00	1265.00		75	948.75
..4 CHIMNEYS + SCAFFOLD	GUARD	545.00	626.75		75	470.06
..5 RENDER FRONT DORMER	GUARD	92.00	105.80		75	79.35
..6 POINTING	GUARD	1040.00	1196.00		75	897.00
..7 GABLE WALL BRICKWORK	GUARD	72.00	82.80		75	62.10
..8 MASTIC DOOR & WINDOW	GUARD	215.00	247.25		75	185.44
..9 AREA RETAINING WALL	GUARD	330.00	379.50		75	284.62
..10 REAR DORMER RENDERING	GUARD	141.00	162.15		75	121.61
..11 GUTTERS	GUARD	397.00	456.55		75	342.41
..12 SOIL PIPE	GUARD	70.00	80.50		75	60.37
..13 DRAINS	GUARD	72.00	82.80		75	62.10
..14 SUB-TOTAL REPAIRS		4074.00	4685.10		75	3513.82
..15 GRANT CONTRIBUTION			3513.82			
..16 OWNERS CONTRIBUTION			1171.28			

.....ITEM	.CONTRAC	...PRICE	....COST	.G	RATE%	...GRANT
..18 FIRE RESISTANCE	GUARD	1790.00	2058.50		75	1543.87
..19 ALARM	HANCOCK	771.00	886.65		75	664.99
..20 EMERGENCY LIGHTING	HANCOCK	540.00	621.00		50	310.50
..21 EXTINGUISHERS	NOT LET	160.00	184.00		50	92.00
..22 SUB-TOTAL FIRE WORK		3261.00	3750.15			2611.36
..23 GRANT CONTRIBUTION			2611.36			
..24 OWNER'S CONTRIBUTION			1138.79			

Notice how the use of windows enables printing of a layout quite different from that on the screen.

## NOT LEARNED IN AN AFTERNOON!

The instructions are excellent: a hefty manual, split into two: an explanatory step-by-step guide plus a compact and complete definition of all facilities. The very weight of this document will indicate that using VIEWSHEET is not something you can learn in an afternoon. Although it only takes five minutes before you start compiling a table, complete mastery will probably not come

until twenty or thirty hours have been spent on a live example. However any businessman faced with budgeting, pricing, timetableing, stock control, wages calculations or arithmetic on research data will find the time extremely well spent.

## SHORTCOMINGS

VIEWSHEET does have some. The worst is the absence of menus for such functions as creating, loading or saving files, printing, protecting data from erasure or turning headings on or

off. This omission was irritating on VIEW; it is infuriating on VIEWSHEET. For example to turn the headings off one has to type in no less than thirteen keystrokes. In practice the resourceful user can define the red user-programmable keys, with commonly used or lengthy commands, because although full use is made of them in "sheet mode" they are not engaged in "command mode", which is just where these commands are needed.

The second criticism is of the bar chart function. I had not ex-

pected a spreadsheet programme to draw bar charts but my glee in finding this facility was marred when it proved feeble. Firstly the bars are mere rows of asterisks, which look amateurish, and secondly they only run horizontally. Most bar charts, for example monthly weather data or share prices on a one-year axis, run vertically.

These are of course comparatively minor criticisms which should not deter any would-be purchaser from an excellent and highly professional piece of software: first class value at £52.



# Edsoft

**Title:** Mr. T Tells time  
**Publisher:** Ebury Software  
**Machine:** Model B  
**Price:** £12.95

Mr. T Tells the Time is one of six titles in the Good Housekeeping Software range. It comes in an impressive looking plastic wallet with a good looking parent's handbook. It has the added distinction of being the only cassette ever to refuse to load on my recorder/computer combination. It proved to be very temperamental on a number of combinations but eventually it was loaded.

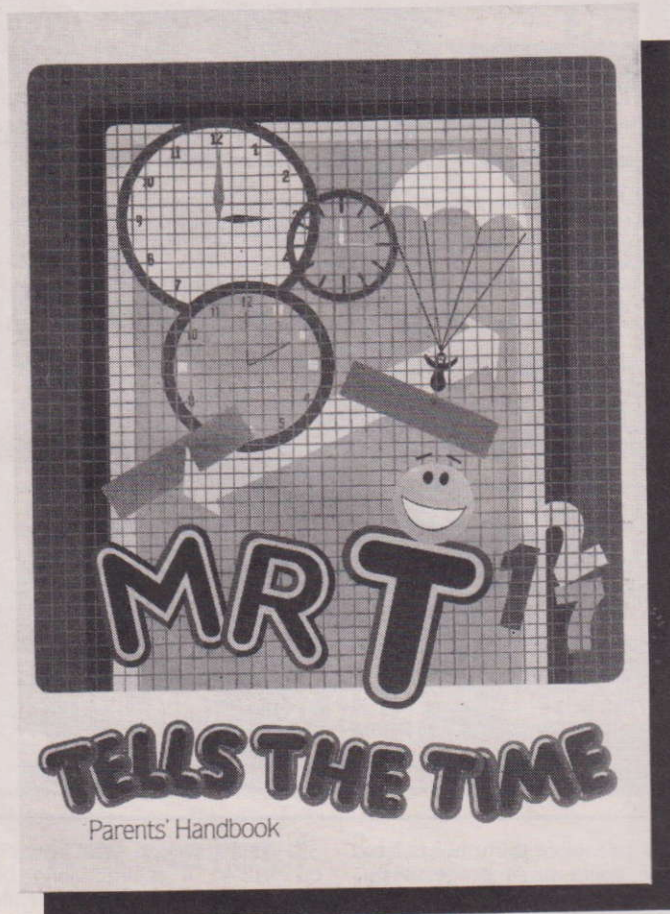
There are three programs on the cassette, one on side one, and the other two on side two. Loading takes quite a time, with one program acting as a loader for a second.

Before playing any of the games the parent can set a number of parameters using the parent screen. The degree of difficulty, sound or silence, colour or monochrome, and who varies the degree of difficulty — Mr. T or the parent — are all user selectable.

Side one starts with a demonstration of a working clock. A clock face is drawn on the screen and the hands move to show the passing of time. The clock chimes on the hours, which only take a few seconds to pass, and continues until the space bar is pressed. This leads to the main activity on the first side, Matching Hours. Two clock faces are shown on the screen, one has its time fixed and the other varies. When the two faces show the same time the user presses the space bar. The game is played at three levels; firstly the fixed clock cycles through the hours sequentially, secondly it sets times at random, and finally it adds half and quarter hours.

The second side of the cassette contains two games that also have three sections. Clock Numbers shows a clock face with missing numbers. These are situated on the right hand side of the screen, and when Mr. T. points to the right one for a particular place, a press on the space bar moves the number to its correct location. The three sections

## Programs for schools and homes which juggle numbers and language for the young and not so young.



increase in difficulty by not going sequentially through the empty places, and finally by taking out all the numbers.

The final game is called O'clock, and an amount of preparation is recommended in the parent's guide. A clock face is shown, and below it the time in words. As the hands on the clock move round, so the words change to indicate the time. The game itself starts in the words

below the clock change. When the correct words are displayed the space bar is pressed. In part three, the words stay fixed while the clock face changes.

The individual programs show a number of good features. Sound and graphics, though basic, are used effectively. A symbol showing a hand with a finger pointing at a bar is a much better way of indicating the expectation of a press on the space

bar than the usual 'press space to continue'. The visual incentives given in the games had both my five year old son and my wife in fits of laughter. The use of a parent screen is very good, the level of difficulty reflected in the speed of the game.

If any criticism can be levelled at this product, it is that with the exception of one part of game one, only the exact hours are used. The extension to quarter and half hours, and everything in between is so important that its omission is puzzling.

### Ratings Table

SOUND	70%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	65%
OVERALL	70%

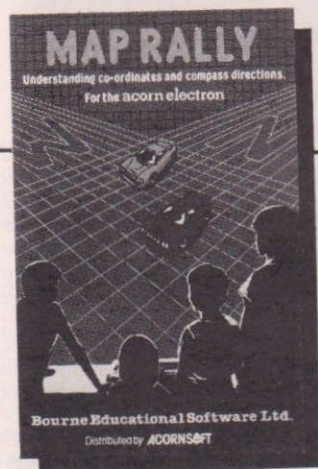
**Title:** Map Rally  
**Publisher:** Bourne Educational Software  
**Machine:** BBC B  
**Price:** £8.97

The aim of this package is to teach the use of both compass points and co-ordinates to find points on a grid system. The game element consists of a car rally in which the first player to get to all checkpoints and then finish is the winner. The game can be played by two children at a time, one driving the red car whilst the other steers the blue one. For the teacher there is the possibility to see the performance of each child who has played the game via the monitor facility provided.

The first program uses compass points to steer the car. With a clue, such as NORTH and EAST, you are expected to input N followed by the number of kilometres (squares) to move and then repeat this for the EAST movement. If you land on a checkpoint then a tune plays and you have to check in before being sent into the next one. This seems reasonably good practice and has few problems.

Unfortunately the second program suffers a very serious flaw making it, in my opinion, worse than useless! As you may remember from your schooldays





all map and co-ordinate systems work on Eastings before Northings, this in mathematical terms means that the x co-ordinate comes before the y value. This is a universal rule which is never departed from, except by this program. I take it that the idea is to get compatibility between the two parts of this package but this is not acceptable if it means that the child is learning a concept which then has to be unlearned later. This makes the second program unusable and I would advise the company to change this as soon as possible if they expect the package to be taken seriously as having educational value. A mistake of this type is most surprising from a company of this calibre but goes to show that you should examine educational programs very carefully before you buy and use them.

#### Ratings Table

SOUND	60%
GRAPHICS	57%
DOCUMENTATION	70%
VALUE FOR MONEY	20%
OVERALL	0%

**Title:** Ollie Octopus' Sketchpad  
**Publisher:** Storm Software  
**Machine:** BBC B  
**Price:** £6.95

Screen drawing programs are becoming almost as popular as regular a feature of a software house's catalogue as space games but this is a little unusual in that it is aimed at children and meant for them to use. This would be great if the program was, indeed, easy to use but it isn't! As an example of its deficiencies there is not way to move the 'paintbrush' (cursor) from one position to

another without changing to background colour so that it doesn't leave a trail. This means of course that it leaves a trail over the foreground unless you change to that colour at the appropriate moment. There are other commissions too, there is no abstract or non-regular area facility only the filling of circles, squares & triangles is possible.

The enlarge and contract facility is however very well done with good 'rubber-banding' on screen. The colour change system is also neat and easy to use. There is a screen save facility (taking four and a half minutes) if anyone should want to use it but no screen dumping command for hard copy. There is a demonstration of its facilities (also used for the cover illustration) which seems impressive until you analyse the way the picture is built up. There is no way that a child can think in such a complex manner. Whilst it may be a good idea to have simple drawing programs for children I'm sure that the lack of features in this one make it a non-starter and this is a case where a more complex program would actually be easier to use.

#### Ratings Table

SOUND	60%
GRAPHICS	50%
DOCUMENTATION	60%
VALUE FOR MONEY	30%
OVERALL	45%

**Title:** Eye  
**Publisher:** Longman Micro Software  
**Machine:** BBC B  
**Price:** £14.50

This is a program meant for secondary school use in either Physics or Biology lessons and is not available for home use. Although it could be used in the home I think its use would be very limited indeed. The avowed aim of the package, consisting of two programs and a manual, is to demonstrate how the eye works, but I am not sure this is what it does at all. I would expect a program aiming to do this would have some content on rods/cones and nerve transmis-

sion but what these programs do is show how light travels through the various parts of the eye and the resultant image on the retina. They do show this very clearly however.

I suppose the best description is that they provide an animated model of the eye and the paths of light through it. You can change almost all the parameters of distance from object, lens, thickness, iris opening, sight defects and in the second program insert various lenses to see their effect on the eyes focus. The model is clear and very simple to use but I'm not convinced the cost of the software, for such a narrowly aimed product, is justified. I also have reservations about the documentation which is very strong on description but not on applications. There are a few suggested but they seem far from enough to make the package worthwhile. The best use of the programs may be to test the understanding of pupils who have already covered this area by setting it up to an unknown sight defect which by experiment they have to both correct and identify. I feel that overall the package is adequate but disappointing. (Incidentally the package will work on disc systems, despite the warnings that it will not, if a relocation routine is used.)

#### Ratings Table

SOUND	N/A
GRAPHICS	90%
DOCUMENTATION	50%
VALUE FOR MONEY	50%
OVERALL	60%

**Title:** Alphabet  
**Publisher:** J.B. Software  
**Machine:** BBC B  
**Price:** £4.95

This program has the avowed aim of teaching the alphabet to children in an amusing and interesting way. In short it is an aural and animated (of a fashion) alphabet book. The letter appears at the top of the screen followed by a word starting with that letter and a picture to illustrate the word and, if appropriate, some kind of sound effect. The pictures

are very cleverly constructed but do take rather a long time to appear in some cases due to the slow circle filling on the BBC.

There is another way of using the program also. You can opt to have the program test a child's knowledge of the alphabet by asking them to press the key matching the one on screen. This seems a good idea until you realise that the keys are upper case whilst the letters on screen are lower case. This means that you are asking for translation also and young children can find this very difficult (would you match Q and q if you didn't know them to be related?). I believe that a better course to follow is to provide lower case key stickers as some companies now do. What makes the matter more difficult is the use of Mode 2 for the display which are poor letter formations for children anyway.

I am not fully convinced that this program is educationally sound but I am impressed by the standard of the graphics and my 5 year old liked them enormously despite finding the program boring. Even the addition of a random order option would be a step forward. The program is well priced however and may be worth a second look if you need a program of this type.

#### Ratings Table

SOUND	60%
GRAPHICS	90%
DOCUMENTATION	70%
VALUE FOR MONEY	90%
OVERALL	80%

**Title:** Geography of France  
**Publisher:** Corona Software  
**Machine:** Model B Electron  
**Price:** £5.00

The program is supplied on disc or cassette, and the intended audience is for children from 8 onwards.

Once loaded the program displays the French flag and plays the French national anthem, all bar a little programming 'Hic-up' right in the middle.

**CONTINUED OVER**



The main menu displays a map of France, and a list of all the tests available. These range from towns, to rivers, sea areas, and mountains, each is numbered, and once the choice is made the map is redrawn with the relevant information on it. Once the child is happy, there then follows a test on the topic, which includes a test for correct spelling!

At the end of each section the program returns to the menu page, so either another topic, or the exit may be chosen.

The program is extremely well 'crash-proofed' with both the Escape and Break keys re-starting the program and the only way to escape is via the menu.

The display is both clear and colourful, and individuals, as well as groups should have no problem using this program. A few children whom I asked to have a go of it, found it most enjoyable, and stimulated some rivalry into who knew the most.

#### Ratings Table:

SOUND	70%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	75%

Both Arnold and Wheaton have been serving educational establishments for many years, and it's good to see that they've remembered this fact on their entry to the micro software market. Not only do they encourage users to make a back-up copy of their programs, where necessary they provide a menu program. (Unfortunately, there is a small error in this routine which I pointed out to Arnold Wheaton several months ago, without response. Line 40 requires TAB (15,5) between the first "MENU"; and CHR\$(141)) to facilitate the running of multi-part programs on discs. Competitors who charge 50% of cost to exchange and those who ignore all requests for help, please note! Hopefully, colleagues will ensure that Arnold's continue to trust us!

All the programs are excellently documented and well

packaged in plastic 'book' format. I wonder how much this packaging adds to the cost of the program and whether schools would prefer a cardboard box and a discount? Most schools will, I suspect, standardise their cassette filing system on the cassette box for convenience and there'll be a lot of plastic books surplus to requirements!

Most of the user guides recommend that the programs are used with groups of children rather than individuals and that the learner should have had experience of the topic before attempting it on the computer. Whatever the concept being taught, it's important to remember that concrete experiences must come before use of the computer and that the interaction between children using the program is usually more important than that between the individual and the computer.

<b>Title:</b>	<b>Angle Turner</b>
<b>Publisher:</b>	<b>Arnold Wheaton Software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£14.00</b>

The concept of angles is introduced by showing that they are a measurement of turn and in each

of the three modes in which Angle Turner works, the user can opt to work in 90 degree, 45 degree, 10 degree and single-degree intervals and the parameters can be set by the teacher. It is, therefore, a program that can be used profitably by children of a wide range of age and ability.

If the program is run on a cassette system, each mode is a separate program and loaded individually; if used with a disc system, the user is taken straight to a menu from which the option required can be selected. 1. Demonstration Mode: This allows the teacher to specify an angle, which is constructed on the screen, with or without the caption which shows the value of the angle being drawn. 2. Practice Mode: a) The computer displays a randomly selected angle (within the option selected) and invites the user to estimate the angle. b) A randomly computed angle is displayed on the screen in digital form. The user is invited to stop the computer drawing the sector when it has reached the size specified by the digital reading. The teacher can: i) set the acceptable margin or error; ii) specify number of goes

before changing from mode a) to b); iii) specify number of incorrect tries before computer provides assistance. 3. Tutorial Mode: This is intended as a revision program with little need for teacher assistance.

The computer draws a sector and the user is invited to clear the screen when the computer will start to redraw the sector. The user has to stop the drawing when the sector is the same as the original. After each attempt they are given the option of trying to refine their answer.

This is a good example of a structured reinforcement type program offering flexibility, which means that it would make a useful addition to any school's collection of mathematics programs. Two small criticisms: the explanation of the use of the T key (for teachers!) I found a little woolly and the value selection page might have been simpler.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	80%
EDUCATIONAL VALUE	80%
OVERALL	80%

<b>Title:</b>	<b>Alpha Graph</b>
<b>Publisher:</b>	<b>Arnold Wheaton Software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£14.00</b>

Schools encourage the children to record their experiences but are not so good at asking them to analyse what their results mean and to think about relationships between different observations. This is certainly the case with much of the work done in early statistical work — the drawing of the histogram is frequently the end of the story.

Making a tally and drawing a bar graph of frequency of letters is a task often given to upper junior children. Alpha Graph allows the user to type in up to 500 letters. The screen is then cleared and the text replaced by a histogram displaying the frequency of each character in the extract. Individual letter totals can also be called up by pressing the appropriate letter key. The pro-



gram then offers another option of selecting a further piece of text and histogram so that the user can compare the two.

The user guide suggests that the program can be used in many tallying activities where data-fields can be represented symbolically by a letter, e.g. a traffic survey, where a letter can stand for a type of vehicle, and the two-graph facility used to compare two sites or the same site at two different times of day.

This program certainly enables more time to be spent on the discussion of the completed bar-chart and is a useful introduction to simple statistics. Unfortunately, it is limited by the fact that the maximum individual letter frequency score on the graph is 40. Above that the user has to rely on the key count. A print out procedure would be a useful addition to the program so that more work could take place away from the screen. It would be more acceptable if the program had an adjustable scale facility. A good, flexible pictorial representation program would give better value for money.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	60%
DOCUMENTATION	70%
VALUE FOR MONEY	45%
EDUCATIONAL VALUE	45%
OVERALL	50%

<b>Title:</b>	<b>Microbug</b>
<b>Publisher:</b>	<b>Arnold Wheaton Software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£14.00</b>

Microbug is an hierarchical type of datafile, i.e. the Tree type. In this kind of database, the information is stored on pages which are linked together. By selecting the option, you move from general to more specific information.

Microbug is intended to stimulate children to detailed observations of some of the more common forms of invertebrates — such as they might find around the school grounds. By asking the child a number of questions about the creatures, the program

attempts to produce an identification. Each response from the child narrows down the range of possible identification. When sufficient possibilities have been excluded a suggestion is made as to what the creature might be.

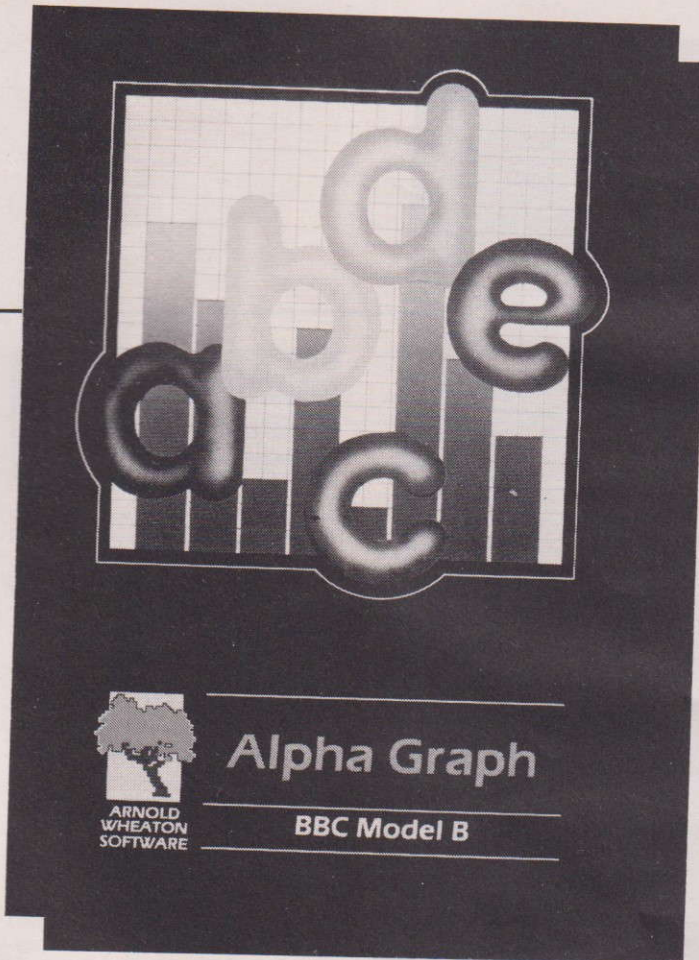
At this point the user can see all the decisions made — which is helpful when it is obvious that the computer has made a wrong identification! If more information is required, the program provides a list of suitable books.

While teachers not used to this type of database program may find Microbug a useful introduction, I believe most will prefer to spend the money on a good database program, which will enable them (and the children) to make many datafiles.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	50%
EDUCATIONAL VALUE	50%
OVERALL	50%

Also available are Weather Station, a dedicated database designed for the storage and analysis of weather information and a comprehensive time telling tutorial, Beat the Clock.



<b>Title:</b>	<b>Tense French</b>
<b>Publisher:</b>	<b>Sulis Software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£9.95</b>

Tense French opens up with a brief rendering of the Marseillaise and the display of a BBC Micro Tricolour. This seems now to be the conventional start to any French language tutorial in BBC software. Witness the Microaid "French Abroad". This is a verbs only pack and it covers twenty common verbs. The two tapes supplied provide all the tenses, conditional and present subjunctive. Quite enough to be going on with.

The options are quite impressive. As well as testing on the various parts of speech, with pronoun prompts, ils... nous... etc, it also tests on meanings. The main menu controls the current tense and whatever other test or list option you choose, this is overriding. An especially sensible feature in the English/French or French/English meanings test, is the listing of the twenty possibilities rather than just leaving it to memory.

The screen presentation is blue or red on white and is extremely clear and uncluttered, a definite plus. Although the documentation gives clear warn-

ing, I still rather resented the fact that the computer would not accept upper case entries. For younger children there is a nice line in joyous sounds for successful attempts and the menu offers the choice to change the volume setting. The function keys are set up to produce lower case vowels with the appropriate accents and children could have fun producing an overlay for these keys. All in all, a flexible and friendly introduction to French verbs and their tense forms.

#### Ratings Table:

SOUNDS	80%
GRAPHICS	80%
DOCUMENTATION	75%
VALUE FOR MONEY	70%
OVERALL	75%

<b>Title:</b>	<b>Time Traveller</b>
<b>Publisher:</b>	<b>Sulis Software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£9.95</b>

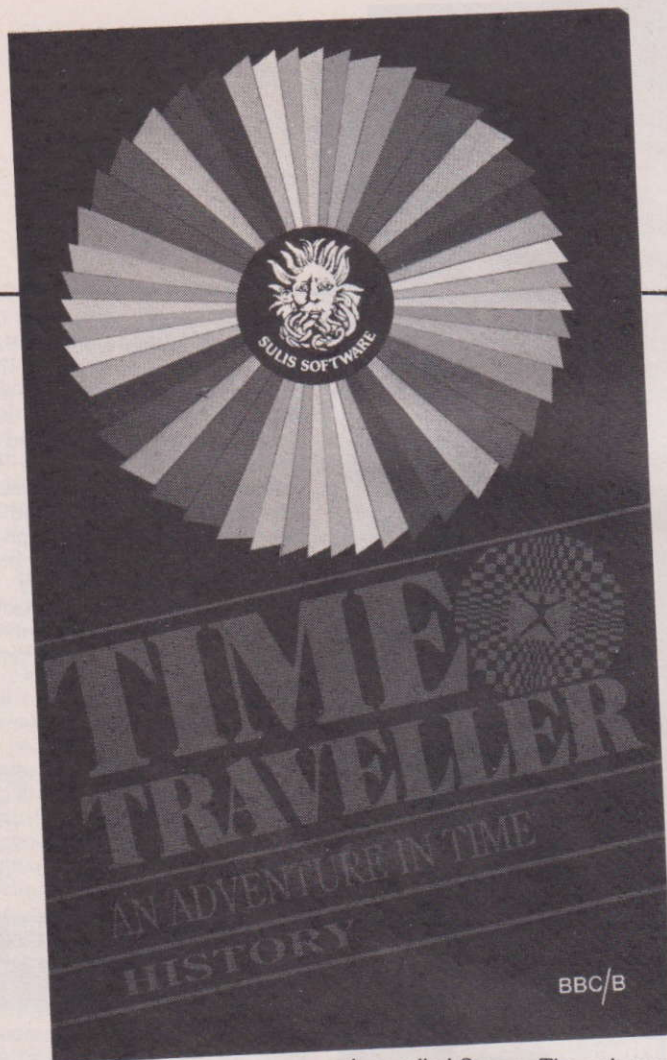
Time Traveller is a fascinating idea for a program on any microcomputer. The idea is to move through various periods in British history, scoring points as you go and finally amassing a total that admits you to the 20th century.

One of the first things you find about program operation is that almost any key press will shoot you through to the next stage, so be wary of tapping thoughtfully on the keyboard. Each period offers a number of multiple choice questions and finally a form of maze game to finish. The range of questions is small and naturally as you play again and again, the questions do repeat themselves although it is rare to get an exact correspondence of choices for the answer. I thought that the questions for each period were well chosen and they succeeded in destroying some myths about the time in question.

The games which finish off each section are all in Mode 5 and are similar in style because they have to use the same routines (the miserly Beeb's

**CONTINUED OVER**





memory again, roll on the Aries or second processors). The variation in content comes from different locations and characters. The bronze age involves, rather unimaginatively, a forest and a pack of wolves. The Romano-British period makes use of a crude Roman fort (corners like a playing card). At the start of this game it would be nice if a teacher or parent could induce a pause in the action for a discussion about the different elements making up the fort, to make up for the lack of labelling in the display. Similarly with the 11th century bishops in the cathedral and the 16th century courtiers.

When you finally get the necessary 200,000 points, this time gate welcomes you to the 20th century. If you make it through to Victorian England without the necessary points then you can choose which age to return to in order to get the required 200,000. If you want to start all over again, the Break key does the trick and re-initialises all but the imaginary high scores of a

chap called Simon. The only way to get rid of the program entirely is to turn off the computer. The program cleverly uses the available memory space, changing HIMEM about, using Mode 7 for text and Mode 5 for games. There are lots of GOTOs and abbreviations which make it difficult to follow or make personal amendments. I couldn't even list the DATA after line 18.

Time Traveller is a very successful attempt to make the learning of some basic historical facts a lot of fun. The games are light relief and are justified despite the restrictions they place upon the 'educational' content. As I said earlier, roll on the memory expansions. On disc, with separate files for each period, this program would become greatly more useful but in the meantime it rates as an excellent attempt.

#### Ratings Table:

SOUNDS	60%
GRAPHICS	80%
DOCUMENTATION	75%
VALUE FOR MONEY	85%
EDUCATIONAL VALUE	80%
OVERALL	80%

<b>Titles:</b>	<b>Options / Blockfit</b>
<b>Publisher:</b>	<b>SYSTEM software</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£23.00/£46.00</b>

South Yorkshire Systems for Training, Education and Management Ltd., has been developing computer-based training and learning, both for industry and education, since June 1982. Their work in industry has involved companies like ICI and BP and SYSTEM are behind many of the education programs now being published under other names.

The four directors, David Ellis (Programming Manager), Keith Shaw, Sue Shaw and Stephen Swallow all have wide experience of using and creating software aids for training and education. SYSTEM'S main approach in the education field is to develop low cost, complete teaching packages and to market direct to schools. The ideas for these developments originate with teachers in schools who remain closely involved in the development of the packages until publication. In this issue of Edsoft we look at, among others, SYSTEM's administrative package for schools.

The two programs discussed here are the first two of a proposed series which is intended to deal with many of the administrative tasks met in running a school. OPTIONS is a program which takes in subjects chosen by a pupil and correlates them. BLOCKFIT carries the process further by setting up option blocks and checking their suitability, the process of checking being carried out so speedily that blocks can be changed until the most suitable subsets of the subjects available are found.

### OPTIONS

In its present form, the explanatory booklet does not begin by telling you what to do first (apart from switching on!). This is to be corrected, I understand, which will help with the first steps.

It is first necessary to set the environment, e.g. detail whether a printer is to be used, its type, and give the number of the disc drive. This process has to be completed each time one of the programs is used, such as when changing from OPTIONS to BLOCKFIT.

This done, the list of subject options is entered, and this list becomes a reference to check whether subjects entered from a pupil record are available as options. Individual records can then be entered for each pupil, containing form, name, sex and subjects chosen. Records are available for amendment, and once the user is accustomed to the system of control codes, the entries and alterations are simple to carry out.

It is possible to obtain lists by form and subject, to extract a single record or to list all data held on the disc. Having provided myself with a mythical list of pupils and subjects to use, I was a little horrified at the amount of paper which was rushing through the printer, so I reverted to using the screen for trial purposes. This had its problems, even when questions were being asked for which I had to provide the answer. The trouble stemmed from the TV which was being used. I often need to use the command \*TV 255 to move the screen down, but once the OPTION program was loaded, the screen returned to its original position, and the questions were off the screen at the top! Presumably this would not happen with a monitor, but one does need to see the question or the heading on the screen, even when the lists are to be printed on the printer.

### BLOCKFIT

The second disc assumes that the subjects available are grouped in blocks. The options in each block (a subset of the original options list) are timetables at the same time, and assume that a pupil may choose only one subject from each block. This caused me some problems, because the introductions to the OPTIONS disc stated that the option blocking would work however many selec-



tins were made from each block, and this is not the case.

Once I had realised my mistake, the system works well. The blocks are set up to a maximum of 14 in the trial copy. The program then assumes that the first subject entered on a pupil's record is from the first block and so on.

Subject clash tables are available for each subject option against all others, and lists are available of pupils taking each subject in each block. Here I found a problem which I was unable to resolve, but no doubt there is an easy explanation. Being unable to use E1 and E2 for English language and literature, I used EA and EB. For some reason, the program would not list pupils taking EA although every other subject was available. EA was on the list of options, and on the appropriate block lists, but the program would not admit to the fact that it had been chosen by any pupils, whereas all had chosen it.

There were two known bugs in the trial version, one of which could be dealt with easily, but the second bug, during a return to the main menu from the print/view menu could only be resolved by using the BREAK key, which meant starting-up again.

The blocks can be edited easily, and the clash/fit tables, etc., are quickly available for the new subsets of options, which makes the process of finding the best subsets quite a friendly one.

There is space to include a teacher's reference with the subject, and up to 3 sets within a subject.

## SUMMARY

Assistance with the mammoth task of fitting hundreds of pupils into a timetable every year is something to be desired by anyone who has experience of the time taken in carrying out this essential part of school life. This pair of programs seems to carry out the process efficiently and speedily.

The faults are minor ones, which are mainly in the text provided with the discs. I did make one or two false starts, and spent

a frustrating time trying to allow pupils to choose two subjects from a block, with quite disastrous results. (Such choices are sometimes required!)

The use of numerous controls becomes automatic with practice, which suggests that the average timetabler would soon find that the program was saving time. Undoubtedly, the opportunity to change one's mind about the composition of blocks, and to see the results almost instantaneously is a real asset.

At all stages there is a wide-ranging variety of lists and tables available. If the format of some of the tables, e.g. tables of fits and clashes, is unfamiliar at first, then time and practice remedy that difficulty. Other common usages such as E1 and E2 for English language and English literature cannot be used, because E1 means English, set 1, so abbreviated forms of subject names have to be prepared with care. Abbreviations are vital, since there is a considerable amount of typing involved, and, although it is not mentioned in OPTIONS, the second program BLOCKFIT requires subject names to be less than seven letters in length and recognisable in the first four letters.

If you live in an environment where eager hands love to 'tinker' with programs in the computer, then the security password which is necessary to gain access to the data disc will be most useful.

Overall, the pair of programs seem to be very useful and efficient, and should be welcome additions to the software in general use in schools. The later programs to be issued are planned to cover exam entry requirements for the various examining boards and Form 7, as well as staffing timetables.

**Title:** Easywrite  
**Publisher:** System Software  
**Machine:** Model B  
**Price:** £10.00

Easywrite is a reading and writing tool for the pupil who is just embarking on the first stages of learning vocabulary and sentence structure. Using the program could not be more simple. The

two outermost keys of the keyboard (Copy and Shift Lock) are used for moving from word to word on the screen and other functions performed by pressing the appropriate letter for Changing a word, Loading and Saving the wordset and Printing.

The control keys can be learned by the child but are not essential for operation of the program. The display offers functions such as 'rub out', 'display', 'print out' and 'space'. These functions, like the letters and words on the screen, are obtained by moving the flashing cursor to the correct column with the RH(Copy) key and to the correct row with the LH(Shift Lock) key. A second press of the RH key selects the chosen option. If a word or individual letter is selected then that page is shown. If a function is chosen then the function is performed.

In use Easywrite is quickly mastered and enjoyed by young children. Pre-school children may even benefit from playing with it and with two keys doing all the work it doesn't take long to get used to the mode of operation. The other option which is catered for is joysticks and in my opinion they greatly enhance the program. If it's good enough for high flying executives then it's all right for young children and Easywrite becomes even easier to use and even more fun.

Finally and very usefully, you are able to use the command key N to create New text for Easywrite. This enables you to tie up the current vocabulary in use with the current reading of the child. The program remains flexible in this way to cater for older children and to encourage further literacy. The common words of the home page can become slightly less common. The colouring and display of Easywrite is clear and uncluttered. The right keys are disabled and operation runs smooth. The documentation is helpful and gives examples of how to use the program and hints on teaching techniques. I think it is implied in the manual, but should be made clear, that the program is intended to be used by children but with the help of adults.

## Ratings Table:

SOUNDS	60%
GRAPHICS	90%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
EDUCATIONAL VALUE	80%
OVERALL	85%

**Title:** U.S.A.  
**Publisher:** Corona  
**Machine:** Model B/  
Electron  
**Price:** £6.00 cassette,  
£9.00 disc

Yet another excellent geography tutor in the Corona range, this time taking on the expanse of the U.S.A. There can of course be no detailed studies but this proves an adequate introduction to the general geographical layout of the U.S.A.

The screen layout is very nice, with a window on the right hand side of the screen displaying the map of the U.S.A. and the various area maps into which this metamorphoses during the question and answer session. The left window displays the relevant names with a number which corresponds to a position on the map. Below is the area for prompts and entering answers. The yellow on blue colouring is extremely clear and is reflected on the card insert. Although wrong answers can be marked if they result from only a spelling mistake, the test for this is not very sophisticated and possible mistakes which were not in the first part of the answer were marked entirely wrong although they represented a very small slip.

Basically this is a memory test, with questions about what you have just seen on the screen and thus it is probably more suitable as an introduction with not too much emphasis put upon the ability to remember place names but more on discussing the area displayed by the map.

## Ratings Table:

SOUNDS	50%
GRAPHICS	75%
DOCUMENTATION	60%
VALUE FOR MONEY	65%
EDUCATIONAL VALUE	60%



# EUROK

## A 100k BBC-drive for £99 + VAT

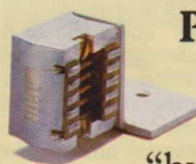
We've done it! We've built a mass storage system for your BBC Micro with the power and convenience of a floppy disk drive, but at a fraction the price. Get to know PHLOOPY, the remarkable new 100k drive that costs only £99 plus VAT, and a further £26 plus VAT for the interface to your BBC, operating system and connecting cables.

### How PHLOOPY does it

PHLOOPY does not use disks to store data, but a 12-foot loop of professional-quality quarter-inch magnetic tape contained in a robust cartridge. The drive has only one moving part, the motor which drives the tape loop – hence the low price and high reliability. As the loop is driven round, each file of data it contains passes across the magnetic head which reads it or writes to it. Other people have produced tape loop micro-drives, but they've not been very reliable. They lacked PHLOOPY's special secret.



### PHLOOPY's special secret



The heart of the invention is a brilliantly designed "byte-wide" magnetic head, made by Phi Magnetronics who build multi-track heads for professional use. PHLOOPY's head records and reads nine tracks across the width of a quarter-inch tape. That means the tape loop can be much shorter, so the typical time to access a file is reduced to a mere 3 seconds. If you're used to waiting for a cassette tape to trundle programs into your BBC, you'll be amazed at PHLOOPY's performance.

### Getting it right every time

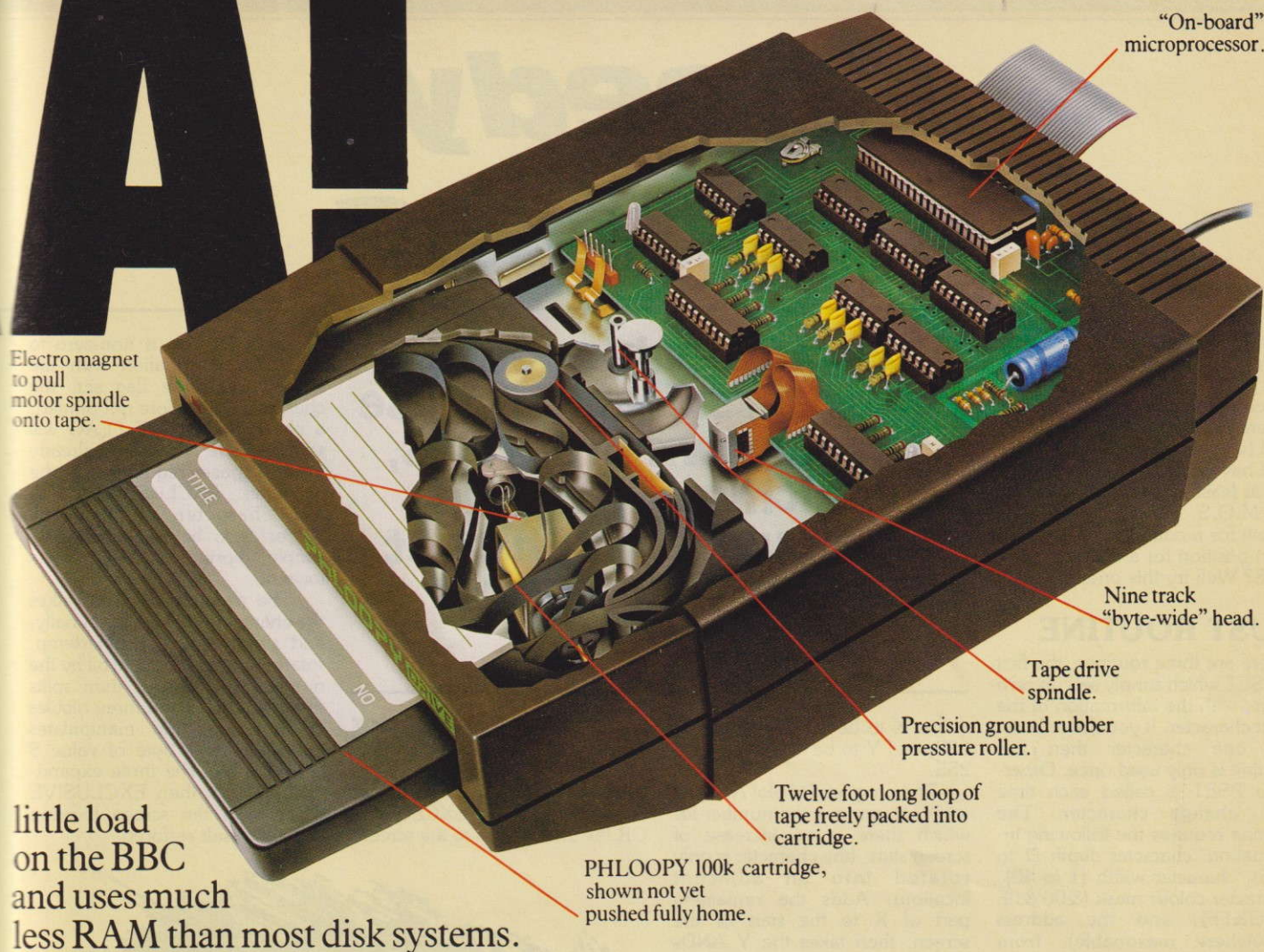
In addition, we've included a feature we know you will appreciate. PHLOOPY has full error detection and correction, so you can be certain you will get back what was originally written onto the tape.

### Talking to your PHLOOPY

PHLOOPY's own software, contained in ROM, responds to standard BBC filing system and Basic commands. Most programs written to run on disk or cassette should run on PHLOOPY without problem.

And because PHLOOPY contains its own intelligent microprocessor – a second computer which does most of the hard work – PHLOOPY puts very





little load  
on the BBC  
and uses much  
less RAM than most disk systems.

### Installing PHLOOPY on your BBC

You'll be amazed how simple it is to install PHLOOPY. Just plug in the interface cut two resistors (clearly marked in the instructions) and the job is done. If you should have problems our engineers are waiting to help you.

### Making a PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data or programs. Two of them come free with the drive and extra ones cost £3.75 each plus VAT. They are moulded of high impact polymers for protection and store easily on a bookshelf. Many programs will be available to purchase on PHLOOPY.



**Phi Mag Systems Ltd.**  
PO Box 21, Falmouth,  
Cornwall TR11 3TD.  
Telephone: (0326) 76040.

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David from the Retro Computer  
Museum, Leicester





# Speedy Graphics

Brian Clarke

Would you like a simple to use series of graphics routines, which will allow you to:

Place a character of any size, any where on the screen.

Still have the same resolution.

Still have colour.

Be at least three times as fast as the M.O.S.

Allow for a complete scan of the next position for a collision.

YES? Well try this one.

## JUST ROUTINE

There are three routines, the first is PSET which simply sets up zero page, with the information of the next character. If you are only using one character then this routine is only used once. Otherwise PSET is called each time you change character. The routine requires the following information, character depth (1 to 255), character width (1 to 40), character colour mask (&00 &0F &FO &FF), and the address (anywhere reasonable), from which the character information is stored.

The program for PSET is straight forward, it takes the variables A% B% C% and D% from page &400 and places them where needed in zero page.

The second routine is PLOT, which calculates the first address from which the character will be

**An invaluable set of routines, suitable for use in your own programs, which monitor and manipulate graphics at faster than normal speeds.**

quires X to be in the range 0 to 639, and Y to be between 0 and 255.

The program for plot ANDs X with 7 to remove the number for which there is no increase of screen start, (the character is only rotated into an adjacent location). Adds the remaining part of X to the start of the screen, then takes the Y ANDs with 7 again and adds that value to the screen, then multiplies the number by &280 and adds that to the screen to obtain the final address.

The final routine is PRINT which places the character information from the address calculated. This requires a flag to be clear in order to EXCLUSIVE OR the information to the screen,

or when the flag is non-zero to AND the information with the screen. With the flag set, the character is therefore not printed, a check on the HIT FLAG will show if there is anything already in the space required for the character. EXCLUSIVE ORing the character enables the character to be blanked out by simply reprinting at the same location.

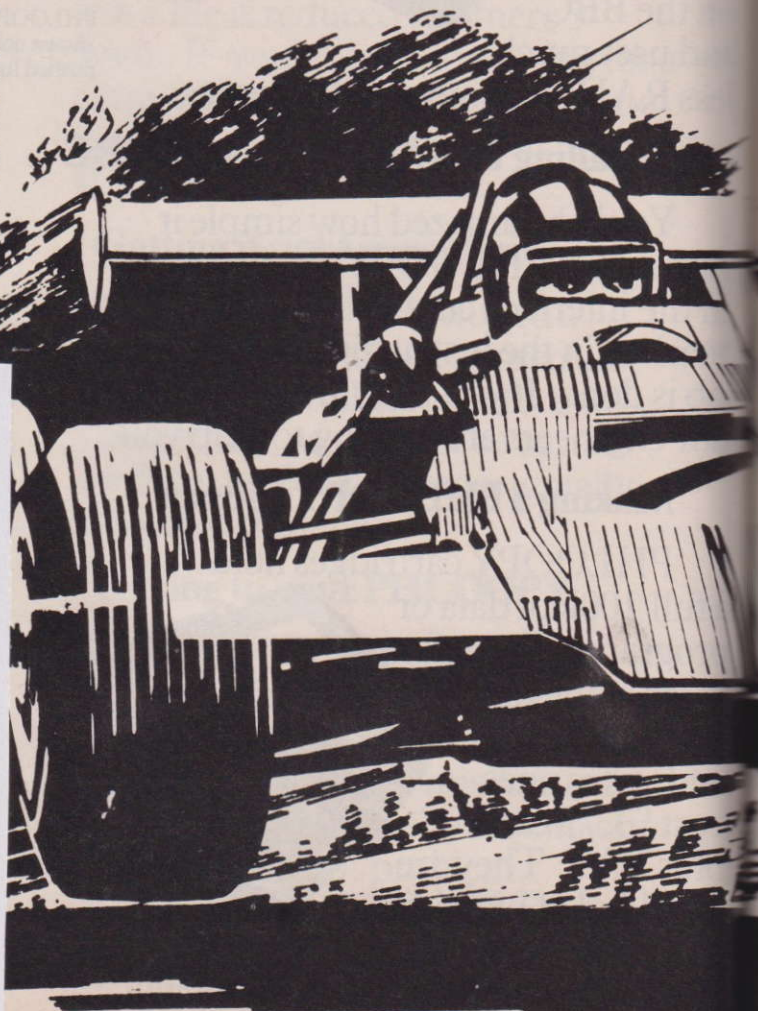
The program for print takes the character information serially, and stores it in Charactertemp, rotates it into Characterroll by the number of Shifts. It then splits these two bytes into three nibbles of four bits, and manipulates them so that a byte of value 8 becomes 88. The three expanded bytes are then EXCLUSIVE ORED with the screen location and the result restored.

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the page was cut out

David from the Retro Computer  
Museum, Leicester



[www.retrocomputermuseum.co.uk](http://www.retrocomputermuseum.co.uk)









# How to turn a BBC Micro into 14 lab technicians. For only £325.

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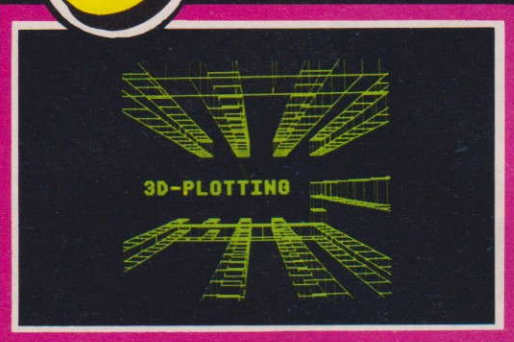
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# Find

Jeffery J Bagnall

Find is a machine code utility for the 1.2 OS. An explanation of the program is given for those interested in Machine Code programming. If you are not, then pass on to the last paragraph which explains how the program may be used.

## INITIALIZATION (lines 10-100)

Once the variables for the Machine Code have been set up (10-70), the Machine Code starts with an initialization routine so that if it is \*RUN it will automatically be ready for use. The Code uses the 256 locations below PAGE. The set-up routine does two things: it redirects the USERVector and displays a message. The vector is at &200 (and &201); it is that used by \*LINE and \*CODE (the OS 1.2 commands which have been in the limelight lately). The vector is redirected from the "Bad Command" message to the BEGINning of the main program. The display is effected by a JUMP to a prepared location (see lines 50 and 60) which causes a BReak back to BASIC and the message to appear. The author is acknowledged and the syntax for using the facility recalled. The &6F doubles as part of this mechanism and as a mask (binary 01101111) to set the oVerflow flag (see line 420).

## THE BEGINNING OF THE PROGRAM (lines 100-180)

At the BEGINning of the main program advantage is taken of the fact that \*LINE (string) returns the location on the screen of the start of the string, in the X and Y registers. So these registers are stored at the two placed where the string-to-be-found is addressed. Places for them have been preserved by the dummy address &ABCD (210 and 230). Once this is done, X and Y are set to zero and PAGE is stored at PROGLOC. The MSB of PAGE is drawn from &1D as it is not always &E or &19.

## A string finding utility which will prove invaluable to anyone engaged in finding out how their favourite game really works or developing a substantial program of their own.

Before the BASIC program's line can be searched the LINUMber and line length are read and stored respectively at LINO and OVSET (150-180). The MSB of the line number is checked against &FF which would indicate the end of the BASIC program — the search would be DONE (see line 310). OVSET is used to indicate the end of each BASIC line.

## THE CENTRAL SEARCH (lines 190-260)

This routine progresses byte by byte through the BASIC program by incrementing Y, which is used as an index. If it equals OVSET then a branch is made to the NEXt line number (see 270) before the SEARCH can start again. If it is not the end of the BASIC line, the contents of each location are LoAded into the Accumulator indirectly via PROGLOC and compared with the Xth character of the string-to-be-found. If the two are DIFFerent (250), as long as X is zero the search is continued at once. If the two are the same and X is zero (220), then the first letter has been found and Y is preserved at YSTORE. With the two that same there is HOPE, and by incrementing X the next letter of the string can be examined: if it proves to be a Carriage Return (&D) then the whole string has been found and the line number must be printed (LINPRINT),

otherwise the SEARCH goes on. Because Y and X have been incremented the next BASIC value is compared with the next letter of the string. If after this HOPE (when X is more than zero) the two are DIFFerent then a return to the location after the HOPE began must be made, so Y is regained from YSTORE and X is set to zero before the SEARCH continues.

## THE NEXT LINE OF BASIC (lines 270-300)

The move to the NEXt line of BASIC is called for from the central routine when Y reaches the value at OVSET. The move is enabled by adding its value (the line length) to the LSB of PROGLOC and incrementing the MSB if necessary. The X and Y registers are set to zero and this very operation is used to trigger a relative branch to the LINUMber routine again.

## PRINTING NUMBERS IN DECIMAL (lines 320-500)

Because the largest possible line number occupies five places in decimal notation, the storage area for each of these DIGITs is prepared by being filled with ZERO (320-330). The MSB of the 16 bit line number is dealt

with first (340-370). When it is zero a branch is made to the LSB. Since every unit in the MSB is, in fact, 256 units, for every unit in the MSB half of 256 (&80) is sent to the TEN subroutine twice — it can't deal with more than a byte-ful at a time. When the number is distributed throughout the DIGITs by this subroutine, the MSB is decreased by one. The process is repeated until the MSB is empty, then the LSB is dealt with by a single run through the TEN routine.

The TEN subroutine is the work-horse of LINPRINT. Y is used as an index to work through each of the five DIGITs. For the least significant and first DIGIT approached, what is already there is added to the accumulator (440). If the result is 10 or more then the accumulator has 10 subtracted from it and one is added to the next significant DIGIT (the ten is carried). Thereafter the accumulator value is regained and the loop (LOOP2) is repeated for each DIGIT. When the accumulator is less than 10 this carrying is PASSed over.

The short subroutine to display on the screen the numbers from the DIGITs, using the Y register again, starts at the most significant one — writing from left to right. The oVerflow flag has been cleared (380) and the loop (LOOP1) to cope with each DIGIT ensues. If the number in a DIGIT is zero and the oVerflow is still clear the loop is repeated without any display. When a number higher than zero is encountered then it is WRITtEn by adding &30 to convert it to the ASCII code of the number and OSASCII is used (&FFE3). Using the mask (see line 50), the oVerflow is set so that any further zeros in the DIGITs will be WRITtEn to the screen. When all the DIGITs are FINISHED a space is left (430) and the program continues with the next line of BASIC.

## USING THE PROGRAM

Once the BASIC LISTing has been typed in and RUN without any errors, then CALL P (Car-



riage Return) will initialize the code. A message will appear on the screen "By J Bagnall. Use \*LINE (string)". There must be a space before the string which is to be found; try entering \*LINE DIGIT (Carriage Return). The line numbers in which the word DIGIT occurs should be PRINTed: List each of them just to check.

SAVE the BASIC program as a back-up or to make a new machine code program if you change PAGE permanently on your machine (e.g. by installing ECONET). For ordinary use it is better SAVED as machine code so that it can be brought into the computer at any time without interfering with any BASIC program that is present. To SAVE the machine code you need to know the start of it (in Hexadecimal): to get this enter PRINT PAGE-&100 (Carriage Return) the symbol will appear as -, it makes the computer PRINT the number in Hex. Now enter \*SAVE "FIND" (number) +FF (Carriage Return) and proceed as for SAVING any program. Here is an actual example:-

\*SAVE "FIND" DOO + FF  
(Carriage Return).

Now \*RUN will LOAD and in-

italize the program and prompt on the syntax for its use. If Break is pressed it will have to be initialized again

## PROGRAM LISTING

```
10 P=PAGE -&100
20 START=P: YSTORE=&8E
30 OVSET=&8D: PROGLOC=&8B
40 LINO=&89: DIGIT=&80
50 ?(P+&DB)=0: ?(P+&DC)=&6F
60 $(P+&DD)="By J Bagnall. Use *LINE (string)"
70 FOR Q=0 TO 1: P%=START: LOPT Q*3
80 LDA# BEGIN MOD 256: STA &200
90 LDA# BEGIN DIV 256: STA &201
100 JMP P+&DB) \ SET-UP COMPLETE
110 BEGIN STX (P+&3E): STY (P+&3F)
120 STX (P+&4A): STY (P+&4B)
130 LDY# 0: STY PROGLOC
140 LDA &1D: STA PROGLOC+1: LDX# 0
150 LINUM INY: LDA (PROGLOC), Y
160 STA LINO: CMP# &FF: BEQ DONE
170 INY: LDA (PROGLOC), Y: STA LINO+1
180 INY: LDA (PROGLOC), Y: STA OVSET
190 SEARCH INY: CPY OVSET: BEQ NEX
200 LDA (PROGLOC), Y
210 CMP &ABCD, X: BNE DIFF
220 CPX# 0: BNE HOPE: STY YSTORE
```

```
230 HOPE INX: LDA &ABCD, X
240 CMP# &D: BEQ LINPRINT: BNE SEARCH
250 DIFF CPX# 0: BEQ SEARCH
260 LDY YSTORE: LDX# 0: BEQ SEARCH
270 NEX LDA PROGLOC: CLC: ADC OVSET
280 BCC CONT: INC PROGLOC+1
290 CONT STA PROGLOC: LDY# 0
300 LDX# 0: BEQ LINUM
310 DONE JSR &FFE7: FIN RTS
320 LINPRINT LDY# 5: LDA# 0: ZERO
330 STA DIGIT, Y: DEY: BNE ZERO
340 MSB LDA LINO: BEQ LSB
350 LDA# &80: JSR TEN
360 LDA# &80: JSR TEN
370 DEC LINO: BNE MSB
380 LSB LDA LINO+1: JSR TEN: CLV
390 LOOP1 INY: CPY# 6: BEQ FINI
400 LDA DIGIT, Y: BNE WRITE: BVC LOOP1
410 WRITE CLC: ADC# &30: JSR &FFE3
420 BIT (P+&DC): BVS LOOP1
430 FINI LDA# &20: JSR &FFE3: JMP NEX
440 TEN LDY# 5: CLC: ADC DIGIT, Y
450 LOOP2 CMP# &A: BCC PASS
460 SEC: SBC# &A: PHA: LDA# 1
470 CLC: ADC DIGIT-1, Y
480 STA DIGIT-1, Y: PLA: BCC LOOP2
490 PASS STA DIGIT, Y: DEY: BEQ FIN
500 LDA DIGIT, Y: JMP LOOP2
510 JNEXT
520 END
```



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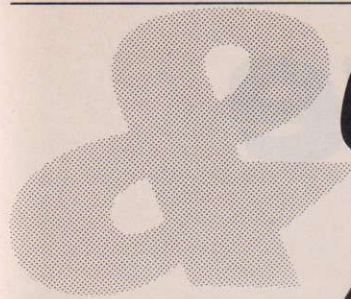
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Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.





# Questions & Answers

Bruce Smith

Q&A is back with a mixed mailbag this month after an issues absence while I took some well earned (?) rest in warmer climates over the Yul tide period. So a belated Happy New Year! Several letters have brought answers from the question I threw out to you last time regarding the mystery of the 'unknown error messages. Joachim Fleury from Amsterdam and S. J. Howard from Bolton both supplied the answer to the Bad Key error. This occurs when you try to give a non-existent function key a task to perform. For example \*KEY 999 LIST M will produce the message. I'm still looking for the correct definitions of 'Bad string', 'Bad ROM' and 'Bad Address'. Anybody got the answer?

, : Nick Ellis of London writes, 'I bought an OKI Microline 82A printer some six months ago but have been unable to obtain a replacement ink ribbon for it. Could you possibly supply me with an address in this country for OKI and tell me where I might be able to get a replacement ribbon from!'

A: The distributor for OKI in Great Britain are X-Data Ltd, who can be reached on Slough 723331. They should be able to supply your ribbons, if not then contact Trent 3000 Ltd, House of Trent, Hilltop, Eastwood, Nottingham. Telephone 07737 67312.

Q: I have created a program for my BBC Micro to store private information. My dilemma is finding some way to stop the user listing out the program after pressing CTRL-BREAK. I have now tried for many months to find a solution and hope you can give some advice.

A: There are several ways in that you can protect your programs from unlawful listing, unfortunately as with most production methods these days none are simple and most can be broken by anyone who has a knowledge of how the Beeb operates. The simplest method is to imbed a series of control codes into a first line REM statement. For example the ASCII codes 3 and 21 can be used to turn a printer and the

## Bruce is back. A&B readers air their problems.

screen off respectively. After entering your program add a 'first' line such as,

— OREM . . . . . (RETURN)

the six full stops are important, these ensure that six bytes are reserved in memory after the REM statement, also note that the REM follows 'immediately' after the line number. Now enter, ?(PAGE+5)=2

?(PAGE+6)=21

On LISTing these two ASCII characters will be 'printed' and the printer and screen disabled so that the rest of the listing is not produced. Because the VDU commands are after a REM statement they will be ignored when your program is subsequently RUN. Inserting two delete characters (CHR\$(128)) before these control codes will stop the first part of the REM statement being listed as well.

?(PAGE+5)=128 :

?(PAGE+6)=128:?(PAGE+7)=2

:?(PAGE+8)=21

If you really want to cause havoc if your program is listed then you can insert control codes to reprogram the 6845 CRT video controller so that it sends the screen 'crazy' when a program is listed. More bytes beyond the REM statement are required this time, about 36 in fact, so enter OREM (followed by 36 spaces) again no spaces between the line number and REM. In immediate mode enter the following 9 lines. ! (PAGE+5)=&17001603 ! (PAGE+9)=&10000 ! (PAGE+13)=0 ! (PAGE+&11)=4001700 ! (PAGE+&15)=&1 ! (PAGE+&19)=17000000 ! (PAGE+&21)=0 ! (PAGE+&25)=0

Now anybody trying to list the program will be presented with an absolutely blank screen that will only respond to the BREAK key. As added protection it is worth incorporating several of these type of inhibiting REM statements into various parts of the program to ensure

protection throughout and prevent specified areas from being listed with statements such as LIST 20,40.

For further information on the CRTC see the User Guide.

Q: I disagree with the answer you gave in the Nov/Dec Q&A regarding interfacing an electric typewriter to a BBC Micro. If your correspondent wants good quality print to send to non-computing publishers then this can only be got from a daisy wheel printer. I have brought a Silver Reed Ex 44 and interface (410) and have found it useful. It may be slow in printing compared to a dot matrix but it can print a lot quicker and more accurately than I can touch type!

A: Thanks for your welcome comments Mrs Sanders. Indeed I am sure that you are quite right but as I stated in my answer, for anybody producing a large amount of copy regularly the slow printing speed would be a hinderance simply because it would take the same amount of time to reproduce the text as it did to enter it in the first place.

Q: Mr O. Stanley of Leeds says: "May I refer to your interesting answer to the problem of transferring programs from Tape to Disc (A&B Nov.). I have a machine code program that I wish to load from disc into memory and then relocate from &E00 so that it will run correctly. In your answer you used a three line BASIC program to relocate the main program. How can I implement this in machine code so that I can use it? The details of my program are. Length=&22A0, Run address=&E02

A: There is actually no need to rewrite the downloader in machine code. The BASIC program can be placed into a function key that carries out the work. Assuming your program is called "CODE" enter the following, 100 \*KEY0 \*LOAD "CODE" 2000

!!M \*TAPE !!M FORK % = 0 TO &42A0 S.4:

K % !&E00 = K % !&2000 : NEXT !!MPAGE&E00!!M CALL &E02!!M 110 \*FX138,0,128

Save this on disc with a suitable title, DCODE for example. In case your wondering, the &42A0 was obtained from adding the program length &22A0 to the first load address &2000. To download CODE type CHAIN "DCODE". This will load and run the first program which will program Key0 as per line 100. Line 110 places the key code into the input buffer thereby executing it. The main program should now load and relocate.

Q: Could you please clear up a point concerning the \*OPT1,2 command.

If the following is returned, 25 2599 0E00 3282 am I right in assuming that these correspond to block number, length, load address and run address respectively?

A: Yes your right, remember that these values are in hexadecimal

Q: Mr A. Moore writes from Bristol. We have a model B micro with twin discs. Our problem is how to copy machine code programs to cassette to enable us to carry the programs around to other machines that do not have disc interfaces. Our aim is to work on and modify some of the earlier games produced by Acornsoft, but at present we are unable to gain access to them. We realise that much software is 'protected' but we must be able to get at it somehow!

A: The simple answer to your question is in a word Copyright. I draw your attention to the copyright notice that accompanies all software in that it cannot be 'reproduced, stored, transmitted etc'. This unfortunately means even for personal use. In answer to the second part of your question, yes it is possible to break the protection methods used by software houses as a recent monthly magazine showed by publishing just how to do it. They had to pay £60,000 compensation to the company involved!



# Language Lab

Clive Grace

One of the newset of the 'old' languages to be implemented on the BBC micro is PASCAL, there are at present only two major releases one as a software pack from Acornsoft and the other as an EPROM from HCCS associates, there are some distinct advantages to each system; both are subsets, but this does not limit the complexity or usefulness of the packages under review.

The first widely recognised implementation of PASCAL was on a CDC 6600 computer at the Zurich High School back in 1969 and was developed in America on similar machines which were the descendants of the old Cyber Mainframes. There have been numerous updates and enhancements (although many have been short lived), for those who are interested in the history of the language and to what standard implementations adhere to, I would recommend the definitive 'PASCAL user manual and report' by Jensen and Wirth, although this can hardly be considered a tutorial in PASCAL Programming.

The two implementations reviewed here are both similar in their way, the HCCS version is only for the BBC micro and resides in an EPROM; Acornsoft's product boasts compatibility with both the BBC Micro and the Electron.

## PASCAL-T

Like other products to come from the HCCS stable, the packaging is in a rather unassuming white/brown box with a label stuck on the front for good measure, the manual and EPROM are both wrapped around a small piece of styrofoam; the package could adequately take the rigours of the British Postal Service.

The manual is a slim one, spiral bound within sheets of approximately A5 size which appear to be reduced photocopies; I immediately thought that I had been given a pre-release copy of the manual and was half expecting a page full of erratum notes, but to my surprise there was not a single error in sight, although a little more professionalism could

## We kick off a new series of long looks at languages with versions of Pascal for both BBC and Electron.

```

++LISTO 21
0 PROGRAM recur;
1 VAR
2   n,x : INTEGER;
3 PROC factr1(inn : INTEGER);
4 BEGIN
5   IF inn = n THEN
6     x := 1;
7   IF inn = 0 THEN
8     x := 1
9   ELSE
10    BEGIN
11      x := x * inn;
12      IF inn > 1 THEN
13        factr1(inn - 1)
14      END
15    END;
16 BEGIN
17   WRITE('Enter a no. : '); READ (n);
18   factr1(n);
19   LN; WRITE(factorial is : ',x); LN
20 END.
21

```

Fig 1

have gone in the presentation of the manual, the information contained within was of a sound and informative kind; I call it a manual in very loose terms. Since it is no more than a reference guide and clearly lays out the features and limitations of PASCAL-T. It is aimed fairly and squarely at the beginner and this is quite reasonable. There is a comprehensive contents section, augmented by an accurate Index, the text is managed in the manner of a loose tutorial, although I would recommend a separate text for those who feel it necessary.

The manual starts with installation notes and fitting instructions for the chip, there are no internal modifications required as the whole Pascal-T environment is housed within the single chip and all accesses are made via

keyboard commands. It presents the information in a fairly straightforward manner; there is ample information here to install the chip and get it running and there are also some sample program listings to get you started. Indeed the writers encourage the user to try them out. Also included is a 'Lunar Lander' type game and shows how to get different screen Modes more suitable for the purposes of writing games and using graphics. A final point for those used to PASCAL is that the manual employs the standard representation for syntax commonly known as BNF or Backus-Naur Form which is found in many of the standard texts on PASCAL Programming.

To conclude on the manual I was disappointed with the overall appearance of the rather messy photocopy, mine deteriorated in

a short period of time and when considering the price of the product with the manual, I feel more should have been offered. That in mind, I do feel that the content is excellent and that the user should find it invaluable as a compliment to a programming book.

## PASCAL-T SUPPORT AND HARDWARE

The chip is a 16K EPROM and is housed in a plastic shell sealed at both ends for transit only; This method of storage has proved to be cheap and effective especially when one realizes how sensitive they are to such conditions as weather change and even static! It is clearly marked and presentation although Spartan was tidy and presentable. Installing the chip was easy although probably harrowing for a first time user, it will invalidate an existing warranty so I would suggest the chip be fitted by an authorised dealer if there are any misgivings.

## PASCAL-T IN USE

PASCAL is normally a compiled language, that means the code is first written in PASCAL source and then turned into something very much like Machine code by use of a software utility, this has it's obvious advantages and I can imagine many aspiring games programmers are already reaching for their cheque books, firstly as PASCAL-T is only a subset of a much larger and more flexible language, the writers have had to tackle the compiler in a different way, compilers are usually big and complicated beasts to write, and would severely limit the quality of the program if the compiler were poorly written. HCCS have cleverly used the nucleus to their FORTH compiler which generates a threaded-interpreted code which is very compact and runs typically only 10 to 15 per cent slower than pure machine code, the disadvantage is of course that the code is not stand



alone and thus will work only on machines with the PASCAL chip fitted.

Pascal-T supports three standard 'types', all variables and constants can be either BOOLEAN, CHAR or INTEGER, this is obviously going to be one of the most major limitations of PASCAL-T as it does not support the types REAL or USER defined, but instances where other types are required can be avoided in all but the most stringent cases, if care is taken.

## DISC SUPPORT

PASCAL-T is configured for use with Disc-based BBC's although it can work on cassette systems as well. It is advisable to use separate discs for PASCAL-T programs and data storage, there is a special process involved when configuring floppy discs, the commands:

40TR (CR) (or)  
80TR (CR) (and)  
IDISC (CR)

will configure the discs to either 40 or 80 track systems and initialise them for use with the PASCAL environment; this does not replace the FORM40/80 utility given with the Acorn disc pack, but makes the disc readable for PASCAL-T files and programs. Communication is made to the Acorn Machine Operating System (MOS) via the 'SYS' keyword, this should be placed before the command and is useful for changing the various user-options and 'star' commands.

The PASCAL-T environment has replaced the DFS with a 'Simple but effective' alternative, I have not been able to assess its flexibility under any DFS' other than Acorn's but I cannot see any problems there, all of PASCAL-T's workspace is entirely legal and I don't envisage any problems with future updates of the MOS or DFS. PASCAL-T has made a number of improvements over the rather limiting 31 catalogue files even when 80 track options are used, the problem is solved by the PASCAL-T environment taking priority when in disc Read/Write mode and increases the number of single 2K

files to 49 and 98 in 40 and 80 track drives respectively, these are allocated as ASCII files in 8 sector blocks, saving compiled code is possible but not recommended unless the user has a good idea of what the memory map of the BBC is like.

## CASSETTE SUPPORT

Cassette Systems are also accommodated for although there must be a great deal of care involved in SAVEing files as the exact length of the program must be known, this is given after successful compilation. To save the code you must:

SYS SAVE (filename) 73B0 + X where X is the end address of the program, this has some repercussions on the PASCAL-T environment such as manual clearing of all input buffers from tape to keyboard, this would normally involve a host of 'SYS \*FX' calls but thankfully an 'EMPTY' command does this all for the user. There is a method of creating and saving a potential 60K bytes of PASCAL-T code in a mere 20K by use of 'windowing' 2K of free memory, this section is then compiled and immediately stored in memory, this is called Mass-memory and even though I haven't tried this method out (try writing a 60K program) the manual gives ample information for those attempting this.

All run time and compilation errors are displayed in English with the back arrow sign denoting the place in which the error occurred and the 'Expected' keyword which was to follow, this feature I found particularly user friendly and useful, there is a whole section dedicated to error messages and their possible causes in the manual, there is also some useful addresses for Compiled codes and procedures.

Normally PASCAL and its derivatives do not include GOTO or equivalent branch to numeric label statements and PASCAL-T is no exception as block structures are rigidly enforced, there is no real need in having line

numbers other than editing and thus all procedures are called by name only, and are therefore not necessary in listings. Figure 1 shows a short listing typical of PASCAL-T. Newcomers will find strong echoes of BASIC and similar syntax structure and design.

Editing programs proved to be simple, using a special window for the current line highlighted in yellow and a blank line for writing to, there are four commands: 'S' inserts a blank line at a specified line and 'ER' erases that specified line but leaving it blank, whereas 'DL' will delete a line moving each line down, 'CH' allows the user to change the contents of a line, the user may feel free to list the current screen by LISTO (this can be abbreviated simply by L.). PASCAL rigidly adheres to the concept of 'top down' or stepwise refinement in program structure and design, good programming habits are enforced which has led to fairly stiff opposition in some circles but in the long run the advantages of PASCAL programming far outweigh the possible disadvantages and deficiencies.

## STRUCTURE

As I said earlier, PASCAL-T uses the FORTH nucleus as the heart of the compiler. FORTH is very much a stack-orientated language and as you might expect it does have a number of repercussions on the overall structure of PASCAL-T. This does not however make the program any harder to use, PASCAL stacks have in general the enviable ability to be as invisible as the user requires (so fast stack arithmetic like in FORTH is possible). Array storage is also available.

A very useful feature of PASCAL-T is a procedure OSWORD whereas FX and SYS FX allow the user to communicate with the MOS, OSWORD allows the user to support further operating system calls thus making parameter passing relatively painless. It is associated with an array declaration, but it is advisable to keep array declarations as small as possible when using OSWORD, as it

directly alters values stored in the Accumulator; a declared procedure to define an envelope and make a noise is shown in figure 2.

To conclude I think that many BBC users will find a genuine use for this language. The compiler is well written and although 2K of text storage at one time may appear feeble, the prospect of huge 60K PASCAL-T programs is never the less eminently possible.

I feel it might be fair to say that PASCAL-T lies between worlds; it is not standard enough nor large enough to make it a full implementation but it does offer some extremely useful features, more advanced than can be safely fitted into a subset. At £59.00, Pascal-T is also fairly expensive for just a ROM and a Manual but if you have a use for PASCAL-T for learning or even making use of its excellent compiler or perhaps even for teaching structured programming techniques, then PASCAL-T may fit the bill.

## ACORNSOFT'S S-PASCAL:

Acornsoft have decided to tackle the implementation of PASCAL in a very different way. Their product is very much like the other language packs on the BBC and although I received a cassette version as a pre-release to review, much if not all of the details will remain in the production version.

S-PASCAL exists as a program on either disc or cassette, and are both the same implementations although the disc system will be more flexible for reasons discussed later. There is a manual supplied with the pack and although it is thinner than the FORTH and LISP manuals, all the information contained within was neat and presentable; the format was very clear and was written for the beginner (to PASCAL) in mind. It will work with all BBC micros including 6502 second processors and Econet.

Loading the program from cassette takes about five minutes,

**CONTINUED OVER**



```

Declare OSWORD array as:-

VAR
  osarray : ARRAY [9] OF INTEGER;
CONST
  sound = 7;
  channel = 1;
  amplitude = -15;
  pitch = 200;
  duration = 20;
BEGIN
  :
  osarray[0] := channel;
  osarray[1] := amplitude;
  osarray[2] := pitch;
  osarray[3] := duration;
  OSWORD(sound);
  :
END.

```

Fig 2

selecting suitable files for each type of machine you have (there are five files in all but only three are loaded). I found the tape annoying at first but it gave enough time to make an essential cup of tea. Once the program is loaded the screen clears and the user is greeted with:

#### S-Pascal

To start typing in an S-Pascal program you have to \*NEW in order to set PAGE to the right level but this also has the effect of clearing memory from &6F00 to &7C00. Your text may now be typed in. An S-Pascal program is very similar to the HCCS Pascal-T in that there are only three data types allowed. INTEGER, CHAR and BOOLEAN and most of the features included on the HCCS system are here on the S-Pascal implementation, but there are a few major differences.

Firstly the compiler is written in BASIC, this resides (invisible to the user) in locations &2F00 to &6000 and all compilation is visible including a disassembly of the various stages. The second and more important difference is that the compiler generates a stand alone code for the BBC to execute. This feature is very useful for those who want to write speed critical routines and it is not impossible to write small sections for games purposes although the user must have a very good idea of what is going on (a good knowledge of assembler is important if you are considering to use the compiler in this way); also the code is not relocatable to any means and thus the user is forced to use code from &1F00 to &2F00. Programs can only be a maximum of 3.5K long on the BBC Machine and 1.6K long on the Electron, this is a serious

limitation for any one wanting to write big complex PASCAL programs, but the pack was designed for the complete beginner in mind and to this purpose S-Pascal gives a very good learning base.

For a beginner, the idea of using BASIC commands such as LIST is a good one, I would not expect this to be available in other implementations as an Editor is normally used to write in the source but again this is a subset very much like PASCAL-T and liberties are usually taken. If the prospect of only having 3.5K of program space is limiting I would imagine you to be surprised as I was to see a full coloured 'Towers of Hanoi' program supplied as one of the example programs with the pack. With a little care, good code can be written and for the user, graphics are available. There is however a problem when using graphics and that is the Screen mode used will overwrite the compiler and source text leaving the compiled code alone, but the user cannot use this code, he can only execute it, so the long process has to be repeated of loading the Compiler and then the Source program if an error occurs. If the user has discs, then this is of course no problem as the whole program takes about three seconds to load so for the purposes of writing graphical programs (not essential in the learning process) I would recommend using Disc drives.

## GOOD DOCUMENTATION

The manual is also a self contained tutorial in PASCAL programming and is very useful for learning from. The manual is in the

typical style of Acornsoft's previous releases and there was nothing I could fault it on, the manual worked for the BBC and the Electron side by side and where there was a difference, the difference was clearly made. There are useful syntax diagrams at the back of the manual and in all it was a pleasure to read. The style was friendly and informative and for the beginner I could not imagine a better start in Pascal Programming.

A majority of the S-Pascal commands are standard and as such need no further discussion, there are a host of 'Star' commands included which deal with editing and compiling, a few of these commands clashed with some of my sideways ROMs but thankfully S-Pascal's commands are given priority here and override previous calls.

## S-PASCAL IN USE

In general S-Pascal is very easy to use, there are a host of friendly messages and clever use of flashing arrows to denote errors. This is not standard but serves a useful purpose in highlighting errors, and also serves as a good teaching aid as it shows where the errors are and offers some (albeit sometimes cryptic) error message. The nearest parallel I can make is that of Micro QUERY which uses a similar system (eg.)

Error found near 'write' in:  
100 if x = 0 write ('zero')

The Electron has had to conserve space and thus prints a suitable error number, a reference card is supplied with Electron packs. S-Pascal has its obvious limitations, mainly the fact that the program takes up a lot of space and that there is only 3.5K left for programming. The Compiler can as a result be overwritten and corrupted by the screen quite easily. Secondly, the Program takes so long to load; this is of course alleviated if you have a disc drive but for cassette users it is a slow and cumbersome method. S-Pascal is however excellent for learning a language; it is a subset and thus traditionally has less

features; it generates stand alone code visibly and is executable by a single command; the documentation is excellent in typical Acornsoft tradition. The user should learn a fair deal of the syntax, structure and design of good PASCAL programs from the more than helpful error routine.

As a comparison between the HCCS and Acornsoft release, it would be difficult to assess which is the 'best'. HCCS's version is more durable and should stay with the user for a long while as there are features which allow fairly advanced programs to be written. Acornsoft's is however strictly a beginners language and should thus be only used to learn the basics of PASCAL programming. Pricewise it would be cheaper to buy the cassette version as it would retail about £12.00 or more, but once the user has grasped the essential techniques and understood the philosophy behind writing Pascal programs, then the user is left rather up in the air.

It may be that Acornsoft are planning a release of a full Pascal system in line with the users who have just learned the Subset; there is already a Pascal system for Torch Disc packs, and there is a P Code system shortly on its way for the 6502 second processors (P code is already available on 6809 FLEX discs); the Z80 system already has access to CP/M Pascal, so what about the standard BBC Micro? after all there is a time when users will require full implementations and not subsets to learn from.

Here the BBC user is spoilt for choice: there are two very good beginners' implementations available, one being compatible with the Electron and both having their individual advantages. If you are only mildly interested in learning a new language then S-Pascal is probably the best bet as it is cheap and portable and easy to use, if you want to take PASCAL further then HCCS' Pascal-T might be better suited to your needs but this is in ROM and is naturally more expensive although more reliable. It is nice to see this powerful language become available at last for BBC users.



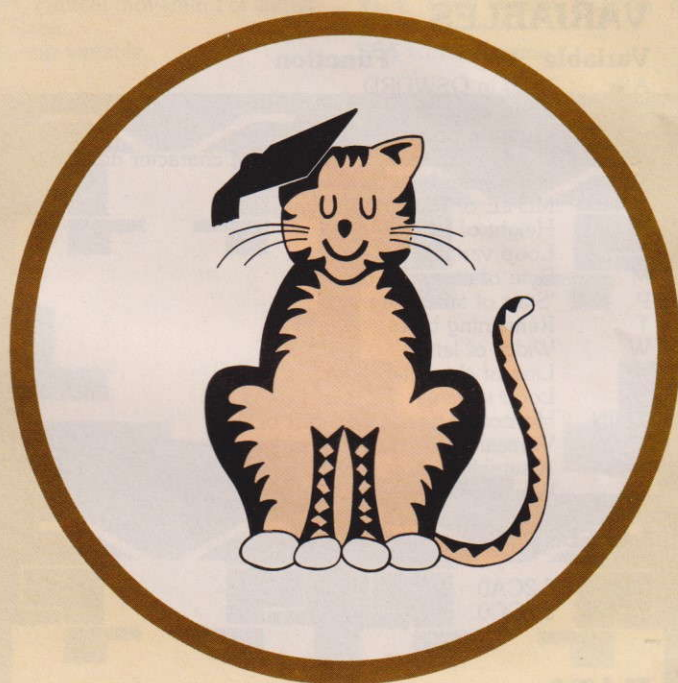
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# Skoogs

Margaret Stanger

This is a variation on the classic Swamp game. The human character is dressed as an athlete as he spends most of his time running around the screen.

He is chased by giant green earwigs called SKOOGS, he can only avoid capture by enticing them into traps. These traps are large pools of marmalade which can drown the unwary man or monster.

He starts with one skoog, and 10 pools, to make it easy. When the first skoog sinks without trace, it is replaced by another three; when they go they are replaced by another five.

When these have been dispatched, the next wave starts with fewer pools, and only one skoog to start with, as before. There are higher scores for each new wave, and the prospect of a fourth life if vast numbers of skoogs are drowned.

Normally there are only three lives, after the last life has been lost there is a fairly standard top five routine before the game restarts.

## POKING FUN

To improve the presentation, the man, pools, and skoogs have been designed in multicoloured graphics, POKEd to the MODE 2 screen a byte at a time.

The skoogs are first POKEd with their feet in one position, then after a short delay POKEd again with their feet in the other position.

The man has one stationary character defined, and a 'moving character for each direction. The movement was contrived by defining two leg positions for each character, one in colour 8 and the other in opposition in colour 15. The flash rate was speeded up until the scuttling movement looked right. There were now 32 items of data for each half character (448 altogether) each taking up 4 bytes of memory, which did not leave enough space to run a MODE 2 game as well.

I decided to put the program into two parts. The first part 'SKOOGS' reads each item of data, and puts it into a single byte of memory to be used in the se-

## Multicoloured arcade action and the thrill of the chase. The Skoogs are out to get you.

### VARIABLES

Variable	Function
A%	Used in OSWORD
I%	Loop variable
P%	Program pointer
X%	Used in OSWORD. Location of character definition.
Y%	High order byte of X%
G	MOVE or PLOT flag
H	Height of letter
L	Loop variable
M	Byte of character definition
P	'Start of letter' flag
T	Remaining bytes
W	Width of letter
X	Line of character definition
Y	Loop variable
XMIN	Horizontal position of start of letter
YMIN	Vertical position of start of letter
PASS	Assembly option
A\$	Word to be plotted

### LABELS

PIC &2CA0  
BLANK &2CC0

### DATA

1000	2D20	POOL 1
1040	2D40	POOL 2
1080	2D60	SKOOGS TOP
1120	2D80	SKOOG FEET1
1160	2DA0	SKOOG FEET2
1200	2DC0	MAN(UP) TOP
1240	2DE0	MAN(UP) FEET
1280	2E00	MAN(D) TOP
1320	2E20	MAN(R) TOP
1360	2E40	MAN(R) FEET
1400	2E60	MAN(L) TOP
1440	2E80	MAN(L) FEET
1480	2EA0	MAN(STOOD) TOP
1520	2EC0	MAN(STOOD)FEET

cond part 'Skoogs'.

The machine code is assembled in SKOOGS, and envelopes and user defined characters are defined. A title and instructions are displayed before 'Skoogs' is CHAINED in.

## MAIN PROGRAM

80 Accesses initialisation procedure  
90 Displays header  
120 Displays instructions  
130 Chains next part

## PROCEDURES

### 160 PROCSCRIPT

This procedure plots the title in very large letters.  
170-190 Uses OSWORD to read the character definition of each letter being plotted.  
200 Divides each letter into 64 square sections, starting with the top left hand corner.  
210-220 Sets the flag to zero (background colour) for the start of a new vertical line.  
230 Moves to position  
240 Plots the square  
250 Next byte of character definition  
260 Updates horizontal position to start of next letter

### 300 PROCINIT

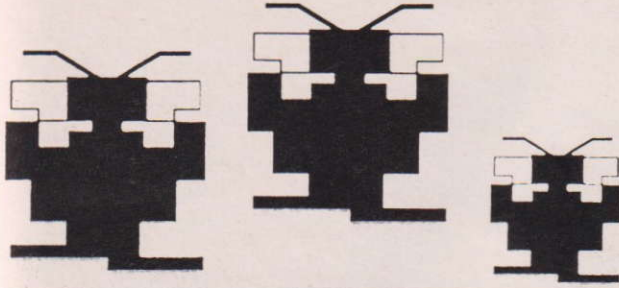
310 Sets Hiscore to zero for part 2  
320-340 Sets up user defined characters  
350-370 Sets up envelopes  
380-410 Reads in graphics data  
420 Accesses assembly procedure

### 450 PROCASP

This assembles a short machine code routine PIC at &2CA0 to POKE a picture (one character size) to the screen, and a similar routine BLANK at &2CC0 to erase the picture.

460 Two pass assembly. The options are set to ignore errors on the first pass only, to allow for forward branching. The option is not to print, although I usually print the assembly during program development.  
470 Sets the program counter to the location chosen for the start of the machine code.  
490 For 32 bytes  
500 Load a byte from the picture base address in &70 (+index)  
510 Decrease index  
520 Store byte in screen location address in &80 (+index)  
530 Check for last byte  
540 Return from subroutine  
580 Sets program counter  
600 For 32 bytes  
610 Loads zero  
620 Decreases index  
630 Blanks the screen location base + index  
640 checks for last byte  
650 Return from subroutine



**700 PROCHEADER**

This procedure prints the title, and can be altered or omitted without disturbing the rest of the program.

The register for the characters per line is altered, so that when the letters are plotted in PROCSCRIPT, it leaves bits of the letters all over the screen until the register is reset after the plotting is finished.

710-730 Sets the colours

740 Dimensions for the title word

750-760 Disturbs the number of character per line

770 Plots the title (slowly)

780 Resets the register so the tile falls into place

**920 PROCINST**

This procedure prints the instructions so that they can be read while waiting for the rest of the program to load. This procedure can be altered or omitted if preferred.

**SKOOGS ARRAYS**

P(18,13) The screen available for the game is divided into rectangles two characters deep. After allowing for borders there are 18 across the screen, and 13 down. There is a code for each place:

0 Empty

1 Pool

2 Skoog

3 Man

SC(5) The top 5 scores

SC\$(5) the top 5 names

XS%(5) Horizontal skoog positions

YS%(5) Vertical skoog positions

**VARIABLES**

A% Base for top half of picture

B% Base for lower half of picture

H% Hiscore

G% Number of skoogs available

I% Loop variable

J% Loop variable

K% Code for active skoog

S% Dead skoogs

W% Wave

X% Horizontal position in array

Y% Vertical position in array

A Sound pitch.

B Sound duration.

BASE2 Base for second half of picture.

DXM% Horizontal movement of man.

DYM% Vertical movement of man.

DEL Delay factor.

DX Horizontal movement of skoog.

DY Vertical movement of skoog.

F Rank.

I Loop variable.

L Remaining lives

SCORE% Score.

SC% Current score value for dead skoog.

SCREEN Current screen location for start of picture.

X Horizontal position in array.

XM% Vertical position of man.

YM% Vertical position of man.

XL% Last horizontal position of skoog.

YL% Last vertical position of skoog.

SC\$ Current name.

**LABELS**

PIC &2CA0

BLANK &2CC0

Although the machine code will remain until it is overwritten, or the computer switched off; the labels need redefining after another program has been loaded.

**MAIN PROGRAM**

80 Instructs the user to press return to continue so that the game does not start too quickly.

90 Sets mode, removes cursor, accesses initialisation and the procedure that sets the scene.

100 Plays the game, with two man moves to one skoog move. These odds can be adjusted, or made to vary with the wave.

**PROCEDURES**

130 PROCINIT

140 Defines the labels.

150 Dimensions arrays for the screen, and the top five scores and names.

160 Initialises variables, dimensions skoog positions.

170 Initialises variables, sets top five names to maximum length.

180 Sets name to maximum length.

230 PROCP(L%,B%,BASE2)

240 Puts base of first half of picture in &70, screen location in &80.

250 Calls routine to POKE first half of picture.

260, 270 Puts base of second half of picture in &70, screen location for second half of picture in &80.

270 POKES second half of picture.

310 PROCU(L%)

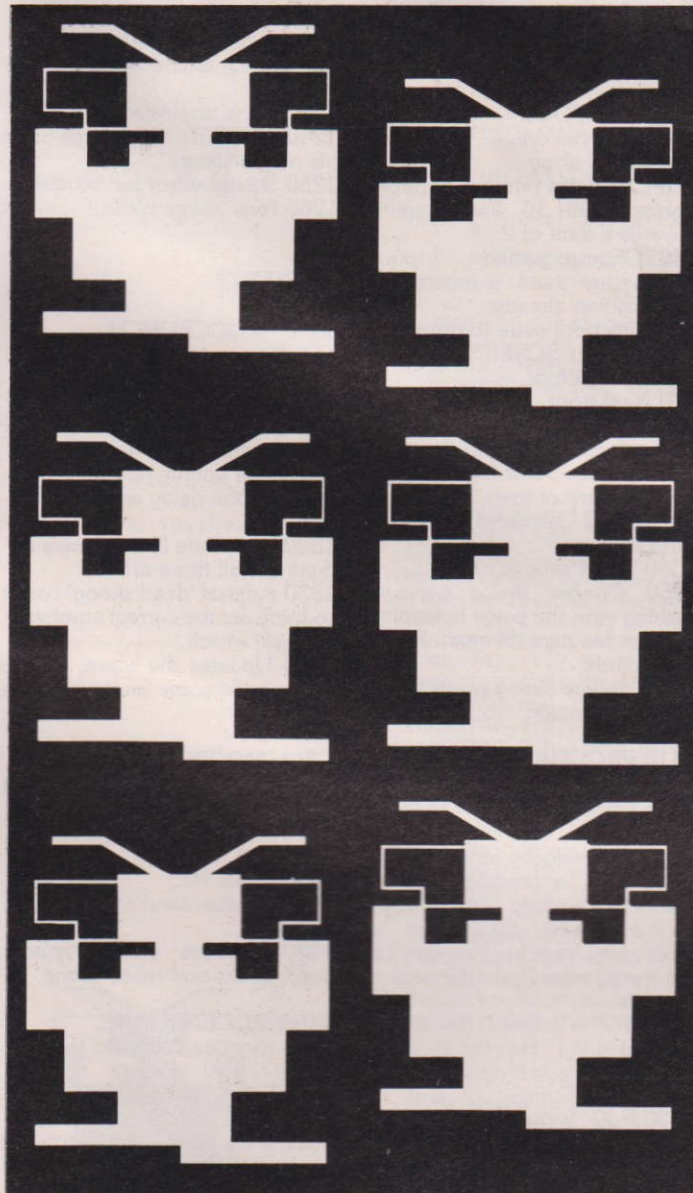
320 Puts screen location into &80.

330 Blanks top half of picture.

340 Updates screen location.

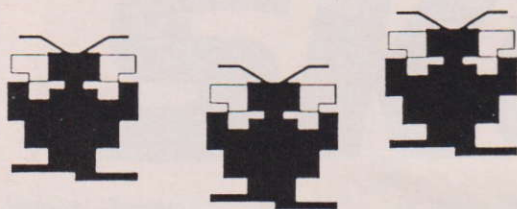
350 Blanks second half of picture.

380 PROCSKOOG



CONTINUED OVER





390 Accesses procedure to choose which skoog is to move. I found that the game was slowed down too much if they all moved.  
 400 Sets value of SCREEN to chosen skoog position.  
 410 clears array element  
 420 The skoog 'chases' the man instead of moving randomly. The horizontal part of the movement is calculated towards the man. If the horizontal movement is zero, and the skoog is close to the man a random horizontal part is added, enabling the skoog to go round the occasional pool.  
 430 Calculates new horizontal position. Improves skoog cunning on higher waves.  
 440, 450 checks for horizontal limits.  
 460 Vertical part of the chase.  
 470 Calculates new vertical position.  
 480, 490 Checks for vertical limits.  
 500 If the skoog 'eats' the man, the last skoog position is blanked, the SCREEN updated, and PROC CRUNCH accessed.  
 510 Puts code in array if position is unchanged.  
 520 checks for other skoog in same position.  
 540 Arranges for skoog to sink if he is in a pool.  
 550 Updates SCREEN and chosen skoog position.  
 560 Picture of skoog. Two steps, with short delay.

## SUNK!

590 PROCSINK  
 600 Updates SCREEN to mans position.  
 610 Picture of man, stood.  
 620 Updates SCREEN to skoog position.  
 630 Picture of top half of skoog, and second half of pool. Sound effect.  
 640 Calculates and updates score, replaces pool.  
 650 accesses PROCVICTORY for every 36 skoogs killed.  
 660 Finishes game if the scoreboard is full.  
 670 Checks for end of wave.  
 680 Checks for remaining skoogs

in same wave.  
 690 Clears skoog position.  
 700 Update, sound effect, delay.

730 PROCUPDATE  
 740 Prints score in flashing yellow on blue background. Calculates and prints total score.  
 750 Calculates and prints remaining lives.  
 760 Prints hiscore.

790 PROCDELAY  
 Delays for chosen interval.

830 PROCCLEAR  
 Clears space for game, deliberately slowly.

880 PROCPPOOL  
 900 Prints hiscore.  
 910 Clears array.  
 920 Calculates number of pools, starting with 10 and working towards a limit of 2.  
 930 Choose position of pool, makes sure there is not one in that position already.  
 940 Puts pool code to array.  
 950 Updates SCREEN.  
 960 Pool picture.  
 970 Next pool.  
 980 Calculates position of man, and puts him into array.  
 990 Updates SCREEN.  
 1000 Picture of man, stood.  
 1010-1030 Calculates number of skoogs.  
 1040 for all skoogs.  
 1050 Choose skoog position, making sure the place is empty, and not too near the man. POKE the picture.  
 1060 Update skoog position.  
 1070 next skoog. Sound effect.

1110 PROCMAN  
 1120 Empties keyboard buffer.  
 1130 Updates SCREEN to man's position.  
 1140 Puts velocity to zero.  
 1150 If 'A' is pressed, and the man is not already at the top, his vertical velocity is -1, and he faces away from us. You can just see the number '1' on the back of his vest.  
 1160 If 'Z' is pressed, the vertical velocity is +1. He now faces us, but his legs have the same picture as the man running upwards.  
 1170 If 'O' is pressed, horizontal

velocity is -1, and the picture faces left.  
 1180 If 'P' is pressed, horizontal velocity is +1, and the man faces right. Note that if the man moves diagonally he faces the side.  
 1190 Clears last position, calculates new position.  
 1200 If he bumps into a skoog, his last image is blanked, SCREEN updated to his new position, and PROC CRUNCH accessed.  
 1210 If he falls into a pool, his image is unplotted, and PROC DROWN accessed.  
 1220 If he is in the same place, the picture is changed to stand still.  
 1230 He is unplotted.  
 1240 SCREEN is updated with his new position.  
 1250 Sound effect for 'scuttle'.  
 1260 New image plotted.

## OOPS!

1290 PROC CRUNCH  
 The man is eaten by the skoog, and loses a life.  
 1300 The skoog is plotted, and his green colour changes to flashing green and magenta.  
 1310 The colour returns to normal after the delay and sound effect.  
 1320 Loses one life, accesses endgame if all three are lost.  
 1330 Adjusts 'dead skoog' count so there are the correct number in the next attack.  
 1340 Updates the score, clears, and sets the scene for the game to continue

1370 PROCDROWN  
 1380 Updates SCREEN to mans position.  
 1390 Picture of top half of man, lower half of pool.  
 1400 Loses life.  
 1410 Adjusts 'dead skoog' count, as before.  
 1420 Updates score, replaces pool, clears and resets scene.

1450 PROCENDGAME  
 1460 Empties keyboard buffer.  
 1470-1490 Prints 'GAME OVER', Updates hiscore.  
 1500 Clear, final update, delay.  
 1510 If the score is in the top five accesses PROCMESSAGE and PROC SORT.

1520 Displays scoreboard and scores.  
 1530 Initialise constants for new game.  
 1540 Clears skoog positions.

1580 PROCSELECT  
 This procedure randomly chooses which skoog is to move. It could be altered so that the nearest skoog always moves, if the game is too easy.  
 1590 Checks for more than one skoog.  
 1600 Selects the skoog and checks to see if it is still alive.  
 1610 Updates skoog coordinates.

1640 PROCVICTORY  
 1650-1660 Adds one life if the game has not finished and there are no more than six lives already.  
 1670-1740 Plays 'Rule Britannia'.  
 1770 PROCMESSAGE  
 1780 Empties keyboard buffer.  
 1790 Takes auto repeat off the keyboard.  
 1800-1840 Prints message.  
 1850 Input name and check for maximum length.

1880 PROC SORT  
 This sorts the score and name into the right place in the top five.  
 1890-1910 Finds the rank, F.  
 1920-1960 Puts score and name at rank F.

1990 PROCSCOREBOARD  
 Prints a scoreboard with border and message.

2080 PROCDISPLAY  
 2090 Prints heading.  
 2100-2150 Prints the rank, name and score for each score greater than zero.  
 All scores are in yellow, and the latest score flashes.  
 2160 Puts rank and score to zero, empties keyboard buffer.  
 2170 Pauses until space bar is pressed.

The DATA at 2190 is the pitch and duration for each note of the tune.

In conclusion the game is too long to convert to run on a BBC A model without rewriting it completely. If the speed is too slow, the delay between steps in PROCSKOOG can be altered or omitted.

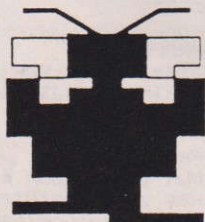


## PROGRAM LISTING

```

10REM*****
20REM*
30REM*      SKOOGS      *
40REM*      *
50REM*      M.STANGER 1982 *
60REM*****
70MODE2
80PROCINIT
90PROCHEADER
100WAIT=INKEY(200)
110MODE7
120PROCINST
130CHAIN"Skoogs"
140END
150:
160DEFPROCSCRIPT(XMIN,YMIN,W,H,A#)
170A%=10:Y%=X%/256
180FORL=1 TO LEN(A#):?X%=ASC(MID$(A#,L,1))
190CALL&FFF1
200FORX=8 TO 1 STEP-1:T=X%X:M=128:FORY=1 TO 8
210P=INT(T/M):T=T MOD M
220G=0:IF P=0 G=2
230MOVE(XMIN+W*(Y-1)),(YMIN+H*(8-X))
240PLOT65+G,W-1,0:PLOT81+G,-W+1,H-1:PLOT81+G,W-1,0
250M=M/2:NEXT:NEXT
260XMIN=XMIN+8*W:NEXT
270WAIT=INKEY(50)
280ENDPROC
290:
300DEFPROCINIT
310HX=0
320VDU23,224,&10,&38,&10,&7C,&FE,&FE,&BA,&BA
330VDU23,225,&FF,&FF,&FF,&FF,&FF,&FF,&FF,&FF
340VDU23,226,&BA,&BA,&28,&28,&28,&28,&28,&28
350ENVELOPE2,2,0,0,0,1,1,1,120,-120,-120,120,0
360ENVELOPE3,2,-1,-1,-1,255,255,255,120,0,0,-120,120,
120
370ENVELOPE4,3,0,0,0,1,1,1,120,-5,-5,-10,120,0
380FOR X%=1 TO 448
390READ VX
400?(&2D20+X%)=V%
410NEXTX%
420PROCASP
430ENDPROC
440:
450DEFPROCASP
460FOR PASS=0 TO 2 STEP2
470P%=&2CA0
480C OPT PASS
490.PIC LDY#32
500.LOOP LDA (&70),Y
510DEY
520STA (&80),Y
530BNE LOOP
540RTS
550J
560NEXTPASS
570FOR PASS=0 TO 2 STEP2
580P%=&2CC0
590C OPT 0
600.BLANK LDY#32
610.LOOP2 LDA #0
620DEY
630STA (&80),Y
640BNE LOOP2
650RTS
660J
670NEXTPASS
680ENDPROC
690:

```



```

700DEFPROCHEADER
710COLOUR 130:CLS:REM SETS BACKGROUND COL
720VDU23,0,10,32,0;0;0;:REMOVES CURSOR
730GCOL0,3:COLOUR 0
740DIM X% 9
750?&324=32
760VDU23,0,1,90,0,0,0,0,0,0
770PROCSCRIPT(0,250,15,50,"S K O O G S")
780VDU23,0,1,80,0,0,0,0,0,0
790PRINTTAB(4,29);"(C) M.Stanger"
800ENDPROC
810:
820DEFPROCINST
830FORI%=1 TO 2:PRINTTAB(11,I%);CHR#131;CHR#141;"S K
O O G S":NEXT
840PRINTTAB(10,3);CHR#132;CHR#141;STRING$(13,"~")
850PRINT:PRINTCHR#131;"Your task is to lure the SKOOG
S into"
860PRINTCHR#131;"pools of marmalade where they will s
ink";
870PRINTCHR#131;"without trace. Of course if you fall
in";
880PRINTCHR#131;"you will perish too. Use 'O' and 'P'
to";
890PRINTCHR#131;"control left and right movement of y
our";
900PRINTCHR#131;"little man and 'A' and 'Z' to contro
l"
910 PRINTCHR#131;"his up and down movements."
920PRINT:PRINTCHR#131;"Be careful,they have a nasty h
abit of"
930PRINTCHR#131;"enlisting the aid of their friends w
hen";
940PRINTCHR#131;"they are losing. Your high score,"
950PRINTCHR#131;"current score and remaining lives wi
11"
960PRINTCHR#131;"be displayed,so off you go..."
970PRINT:PRINTTAB(14);CHR#132;"GOOD LUCK"
980 ENDPROC
990:
1000DATA0,0,5,1,7,11,7,11
1010DATA5,11,7,11,7,11,7,11
1020DATA7,11,7,11,7,11,7,11
1030DATA0,10,2,10,7,11,7,11
1040DATA7,11,7,11,5,1,0,0
1050DATA7,11,7,11,7,11,7,0
1060DATA7,11,7,11,7,11,7,11
1070DATA7,11,7,11,2,10,2,0
1080DATA8,4,0,195,195,65,8,8
1090DATA0,0,8,12,12,12,4,12
1100DATA0,4,8,73,73,73,0,8
1110DATA8,0,0,130,130,0,8,8
1120DATA12,12,4,4,4,0,0,12
1130DATA12,12,12,12,12,12,4,8
1140DATA12,12,12,12,12,12,8,12,0
1150DATA8,8,0,0,0,0,8,0
1160DATA12,12,4,4,4,0,12,0
1170DATA12,12,12,12,12,12,12,0
1180DATA12,12,12,12,12,12,8,0,12
1190DATA8,8,0,0,0,0,0,8
1200DATA0,0,0,0,21,85,85,85
1210DATA5,47,5,43,3,3,3,48
1220DATA15,15,15,43,3,43,43,48
1230DATA0,42,0,42,63,66,66,96
1240DATA85,0,0,64,64,0,0,0
1250DATA48,48,21,21,149,85,85,85
1260DATA48,16,21,21,21,64,64,64
1270DATA96,32,0,85,255,0,0,0
1280DATA0,0,0,0,21,85,85,85
1290DATA5,63,21,43,3,3,3,48

```

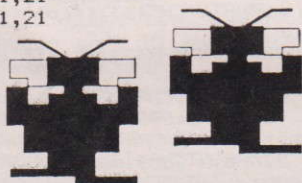
CONTINUED OVER



```

1300DATA15,63,63,43,3,3,3,48
1310DATA0,42,0,42,63,66,66,96
1320DATA0,0,0,0,21,42,213
1330DATA5,5,21,1,43,1,1,16
1340DATA10,63,42,2,3,3,3,48
1350DATA0,0,0,0,0,0,0,0
1360DATA128,0,0,0,0,64,64,0
1370DATA186,16,16,0,64,128,0,0
1380DATA48,48,48,42,127,42,42,63
1390DATA0,0,0,0,170,170,255,0
1400DATA0,0,0,0,0,0,0,0
1410DATA5,63,21,1,3,3,3,48
1420DATA10,10,42,2,23,2,2,32
1430DATA0,0,0,0,0,42,21,234
1440DATA0,0,0,0,0,85,85,255,0
1450DATA48,48,48,21,191,21,21,63
1460DATA117,32,32,0,128,64,0,0
1470DATA64,0,0,0,0,128,128,0
1480DATA0,0,0,0,21,21,21,21
1490DATA5,63,21,43,3,3,3,48
1500DATA15,63,63,3,3,3,3,48
1510DATA0,42,0,42,63,23,23,53
1520DATA21,0,0,0,0,0,0,0
1530DATA48,48,21,21,21,21,21,21
1540DATA48,16,21,21,21,21,21,21
1550DATA53,32,0,0,0,0,0,0

```



## PROGRAM LISTING

```

10REM*****
20REM*   Skoogs   *
30REM*   by       *
40REM*   Margaret *
50REM*   Stanger  *
60REM*   (C) 1983 *
70REM*****
80PRINTTAB(10,23);CHR$131;"Press RETURN to continue"
:REPEAT:UNTIL GET=13
90MODE 2: !&FE00=&10200A:PROCINIT:PROCPPOOL
100REPEAT:PROCMAN:PROCMAN:PROCSK00G:UNTIL FALSE
110END
120:
130DEFFPROCINIT
140PIC=&2CA0:BLANK=&2CC0
150DIM P(18,13):DIM SC(5):DIM SC$(5)
160SCORE%=0:L=2:SC%=0:W%=1:S%=0:G%=1:DIMXS%(5):DIMYS%(5)
170DYM%=0:DXM%=0:H%=0:FOR I%=1 TO 5:SC$(I)=STRING$(1
0," "):NEXT:
180SC$=STRING$(255,"*")
190*FX9,8
200*FX10,8
210ENDPROC
220:
230DEFFPROCP(L%,B%,BASE2)
240!&70=B%: !&80=L%
250CALLPIC
260L%=L%+640:B%=BASE2
270!&70=B%: !&80=L%
280CALL PIC
290ENDPROC
300:
310DEFFPROCU(L%)

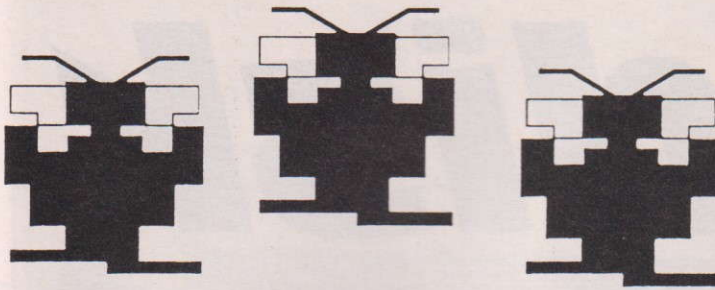
```

```

320!&80=L%:CALL BLANK
330L%=L%+640
340!&80=L%
350CALL BLANK
360ENDPROC
370:
380DEFFPROCSK00G
390PROCSELECT
400SCREEN=HIMEM+32*X%+1280*Y%:XL%=X%:YL%=Y%
410P(X%,Y%)=0
420DX=-SGN(X%-XM%):IFDX=0 AND ABS(Y%-YM%)>1 DX=2-RND(
3)
430X%=X%+DX:IF W%>5 AND DX=0 AND ABS(X%-XM%)>0 GOTO4
20
440IFX%<0 X%=0
450IFX%>18 X%=18
460DY=-SGN(Y%-YM%):IF DY=0 AND ABS(X%-XM%)>1 DY=2-RND
(3)
470Y%=Y%+DY:IF W%>5 AND DY=0 AND ABS(Y%-YM%)>0 GOTO4
60
480IFY%<1 Y%=1
490IFY%>13 Y%=13
500IFY%=YM% AND X%=XM%:PROCU(SCREEN):SCREEN=HIMEM+32*
X%+1280*Y%:PROCCRUNCH
510IFX%=XL% AND Y%=YL% P(X%,Y%)=2:ENDPROC
520IFP(X%,Y%)=2 ENDPROC
530PROCU(SCREEN)
540IF P(X%,Y%)=1 PROCSINK:ENDPROC
550SCREEN=HIMEM+32*X%+1280*Y%:XS%(K%)=X%:YS%(K%)=Y%
560P(X%,Y%)=2:PROCP(SCREEN,&2D60,&2D80):FORQ=1 TO4:NE
XT:PROCP(SCREEN,&2D60,&2DA0)
570ENDPROC
580:
590DEFFPROCSINK
600SCREEN=HIMEM+32*XM%+1280*YM%
610PROCP(SCREEN,&2EA0,&2EC0)
620SCREEN=HIMEM+32*X%+1280*Y%
630PROCP(SCREEN,&2D60,&2D40):SOUND3,3,50,35
640SC%=W%:PROCPUPDATE:PROCP(SCREEN,&2D20,&2D40):P(X%,Y
%)=1
650S%=S%+1:IF S% MOD 36=0 PROCVICTORY
660IFSCORE%>9950 PROCVICTORY:END
670IFS% MOD 9=0 W%=W%+1:PROCCLEAR:PROCPPOOL:ENDPROC
680IFS% MOD 9=1 OR S% MOD 9=4PROCCLEAR:PROCPPOOL:ENDPR
OC
690XS%(K%)=0:YS%(K%)=0
700PROCPUPDATE:SOUND3,1,50,20:PROCDELAY(20)
710ENDPROC
720:
730DEFFPROCPUPDATE
740COLOUR 3:SCORE%=SCORE%+SC%:PRINTTAB(9,1);SCORE%:IF
SC%<>0 COLOUR 11:PRINTTAB(2,1);SC%:PROCDELAY(300):SC%=
0:COLOUR 4:PRINTTAB(2,1);CHR$225;CHR$225;:GOTO760
750COLOUR 4:PRINTTAB(13,0);STRING$(5,CHR$225);:PRINT
TAB(13,1);STRING$(5,CHR$225);:IF L>0 FOR I%=1 TO L:COLO
UR 3:PRINTTAB(12+I%,0);CHR$224;:PRINTTAB(12+I%,1);CHR$
226:NEXT
760COLOUR 3:PRINTTAB(11,29);"HI ";H%
770ENDPROC
780:
790DEFFPROCDELAY(DEL)
800COLOUR 3:TIME=0:REPEAT:UNTIL TIME=DEL
810ENDPROC
820:
830DEFFPROCCLEAR
840FOR I%=2 TO 27:FOR J%=0 TO 19
850!&80=HIMEM+32*J%+640*I%:CALL BLANK:NEXT:NEXT
860ENDPROC
870:
880DEFFPROCPPOOL
890COLOUR 132:COLOUR 4:IF SCORE%<1 PRINTTAB(1,0);STRI
NG$(18,CHR$ 225);:PRINTTAB(1,1);STRING$(18,CHR$ 225);:P
RINTTAB(1,28);STRING$(18,CHR$225);:PRINTTAB(1,29);STRIN

```





```

G#(18,CHR#225);
900COLOUR 3:PRINTTAB(11,29);"HI ";HZ
910COLOUR 3:FOR X=1 TO 18:FOR Y=1 TO 13:P(X,Y)=0:NEXT
:NEXT
920FOR I=1 TO 2+INT(2*(4/WX^0.75))
930X=1+RND(16):Y=RND(13):IF P(X,Y)<>0GOTO930
940P(X,Y)=1
950SCREEN=HIMEM+32*X+1280*Y
960PROCP(SCREEN,&2D20,&2D40)
970NEXT
980XM%=RND(18):YM%=RND(13):IF P(XM%,YM%)=0 P(XM%,YM%)
=3 ELSE GOTO980
990SCREEN=HIMEM+32*XM%+1280*YM%
1000PROCP(SCREEN,&2EA0,&2EC0):PROCDELAY(50):IFSCORE%<1
PROCUPDATE
1010IFS%MOD 9=1 G%=3
1020IFS%MOD 9=4 G%=5
1030IFS% MOD 9=0 G%=1
1040FOR I=1 TO G%
1050X%=RND(18):Y%=RND(13):IF P(X%,Y%)=0 AND(ABS(X%-XM%
)>3 AND ABS(Y%-YM%)>3) P(X%,Y%)=2:SCREEN=HIMEM+32*X%+12
80*Y%:PROCP(SCREEN,&2D60,&2D80) ELSE GOTO1050
1060XS%(I)=X%:YS%(I)=Y%
1070NEXT: SOUND3,1,50,20
1080PROCDELAY(20)
1090ENDPROC
1100:
1110DEFFPROC MAN
1120*FX 15,0
1130SCREEN=HIMEM+32*XM%+1280*YM%
1140DXM%=0:DYM%=0
1150IF INKEY(-66) AND YM%>1 A%=&2DC0:B%=&2DE0:DYM%=-1
1160IF INKEY(-98) AND YM%<13 A%=&2E00:B%=&2DE0:DYM%=1
1170IF INKEY(-55) AND XM%>1 DXM%=-1:A%=&2E60:B%=&2E80
1180IF INKEY(-56) AND XM%<18 DXM%=1:A%=&2E20:B%=&2E40
1190P(XM%,YM%)=0:YM%=YM%+DYM%:XM%=XM%+DXM%
1200IF P(XM%,YM%)=2 PROCU(SCREEN):SCREEN=HIMEM+32*XM%+1
280*YM%:PROCCRUNCH:ENDPROC
1210IF P(XM%,YM%)=1 PROCU(SCREEN):PROCDDOWN:ENDPROC
1220P(XM%,YM%)=3:IFSCREEN=HIMEM+32*XM%+1280*YM% A%=&2E
A0:B%=&2EC0:GOTO1260
1230PROCU(SCREEN)
1240SCREEN=HIMEM+32*XM%+1280*YM%
1250SOUND1,2,200,1
1260PROCP(SCREEN,A%,B%)
1270ENDPROC
1280:
1290DEFFPROC CRUNCH
1300PROCP(SCREEN,&2D60,&2D80):VDU 19,2,10,0,0,0
1310SOUND1,3,170,10:PROCDELAY(200):VDU 19,2,2,10,0,0,0
1320L=L-1:IF L<0 PROCENDGAME:ENDPROC
1330IF S% MOD 9>4 S%=S%-(S% MOD 9)+4 ELSE IF S% MOD 9<
>0 S%=S%-(S%MOD 9)+1
1340PROCUPDATE:PROCCLEAR:PROCPPOOL
1350ENDPROC
1360:
1370DEFFPROC DDOWN
1380SCREEN=HIMEM+32*XM%+1280*YM%
1390PROCP(SCREEN,&2EA0,&2D40):SOUND1,3,170,4:PROCDELAY
(100)
1400L=L-1:IF L<0 PROCENDGAME:ENDPROC
1410IF S% MOD 9>4 S%=S%-(S% MOD 9)+4 ELSE IF S% MOD 9<
>0 S%=S%-(S%MOD 9)+1
1420PROCUPDATE:PROCP(SCREEN,&2D20,&2D40):PROCCLEAR:PR
OCPOOL
1430ENDPROC
1440:
1450DEFFPROC ENDGAME
1460*FX 15,0
1470PRINTTAB(1,29);"GAME OVER";
1480IFSCORE%>HZ HZ=SCORE%
1490PRINTTAB(11,29);"HI ";HZ
1500PROCCLEAR:PROCUPDATE:PROCDELAY(200)

```

```

1510IFSCORE%>SC(5) PROCMESSAGE:PROCSORT ELSE F=0
1520PROCSCOREBOARD:PROCDISPLAY
1530L=2:SC%=0:W%=1:S%=0:G%=1:SCORE%=0
1540FOR I=1 TO 5:XS%(I)=0:YS%(5)=0:NEXT
1550PROCPPOOL
1560ENDPROC
1570:
1580DEFFPROC SELECT
1590IFG%=1 K%=1:GOTO1610
1600K%=RND(6):IFXS%(K%)=0 AND YS%(K%)=0 GOTO1600
1610X%=XS%(K%):Y%=YS%(K%)
1620ENDPROC
1630:
1640DEFFPROC VICTORY
1650IFSCORE%>9950 GOTO1680
1660IFL<6 L=L+1
1670PROCUPDATE
1680FOR I=1 TO 10
1690READA:READB
1700SOUND2,-15,A,2*B
1710SOUND2,0,0,2
1720NEXT:RESTORE
1730SOUND2,0,0,4
1740PROCDELAY(50)
1750ENDPROC
1760:
1770DEFFPROC MESSAGE
1780*FX 15,0
1790*FX 11,0
1800COLOUR3:COLOUR132:CLS
1810PRINTTAB(1,5);"YOUR SCORE IS IN "
1820PRINTTAB(1,7);" THE TOP FIVE"
1830INPUTTAB(1,9)"NAME,PLEASE """" "SC#
1840VDU 7
1850IFLEN(SC#)>10 PRINTTAB(1,9);"SHORT NICKNAME!":PROC
DELAY(200):FOR I=9 TO 28:PRINTTAB(0,I);STRING$(20," "):
NEXT:COLOUR3:GOTO1830
1860ENDPROC
1870:
1880DEFFPROC SORT
1890FOR I=5 TO 1 STEP-1
1900IFSCORE%>SC(I) F=I
1910NEXT
1920IF F=5 GOTO1960
1930FOR I=4 TO F STEP-1
1940SC(I+1)=SC(I)
1950SC$(I+1)=SC$(I):NEXT
1960SC(F)=SCORE%:SC$(F)=SC$
1970ENDPROC
1980:
1990DEFFPROC SCOREBOARD
2000COLOUR132:COLOUR3:CLS
2010PRINTTAB(0,1);STRING$(20,"*")
2020PRINTTAB(0,26);STRING$(20,"*")
2030FOR I=1 TO 26
2040PRINTTAB(0,I);"";TAB(19,I)"*":NEXT
2050PRINTTAB(1,28);"Press SPACE BAR to";TAB(6,30);"con
tinue"
2060ENDPROC
2070:
2080DEFFPROC DISPLAY
2090PRINTTAB(4,1);"THE TOP FIVE"
2100FOR I=1 TO 5
2110IFI=F COLOUR11 ELSE COLOUR3
2120IF SC(I)=0 GOTO2150
2130PRINTTAB(1,2+4*I);I;" ";
2140PRINTSC$(I);:PRINTTAB(15,2+4*I);SC(I)
2150NEXT
2160F=0:SCORE%=0:*FX 15,1
2170REPEAT:UNTIL GET=32:CLG:ENDPROC
2180:
2190DATA 69,3,69,2,73,3,73,2,69,2,73,2,69,2,61,2,53,2,
49,4

```



# Solidisk

Gordon Taylor

Perhaps the worst feature of the Beeb is the limited amount of user RAM available. This is especially true in hi-res modes or more filing systems installed. Hence it is real pleasure to review a family of add-ons which does a great deal to overcome this limitation — and more. Moreover, they are actually available, fit inside your Beeb and are affordable. You can buy an entry-level system for just under £40 and progress in two steps to the top level for £100 more.

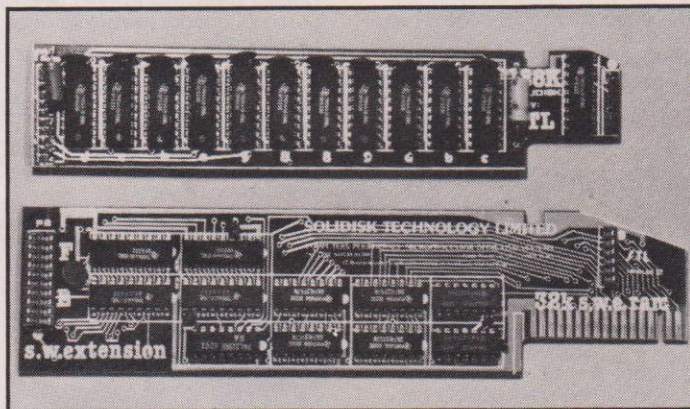
The Solidisk Sideways Systems consist of additional RAM memory which can occupy the "sideways" area (&8000 to &BFFF) in the Beeb's memory map (See Fig 1 (a)). This is the area occupied by any one of the four sideways ROM sockets built-in to the standard machine — each capable of holding up to 16K. Thanks to Acorn's clever design, their number may be increased to 16 — for a total capacity of 256K — and yet all be available by means of "paging". The additional capacity may be in ROMs or EPROMs — as with the several ROM Expansion boards on offer at around £40 — or in RAM — as with the Solidisk Sideways Systems.

## GETTING STARTED

The entry-level system — SWR16 — provides a single bank of 16K, together with the connections that enable it to be 'paged' automatically (as opposed to switched manually — as in some earlier systems), along with the built-in sideways ROM sockets.

The second-level system — SWR32 — provides two such banks and the top level system — SWR128 — up to eight such banks, Fig 1 (b). The hardware under review was this last, in order to show the potential of the full Sideways System. Most notably, with  $8 \times 16 = 128K$ , this may also be configured as a single sideways RAM bank plus a 100K RAM Disc (or Solidisk) Fig 1 (c). The systems come with some exciting software — including (for the SWR128) a program which enables 64K files

## The Solidisk Sideways Systems offer the opportunity to break the RAM barrier.



with WORDWISE and a very fast spelling checker for any text file.

The hardware for all three levels is designed to be fitted by the user and no soldering or track cutting is required. If you can install a Sideways ROM or a Disc Interface, you should have no problem with fitting the Sideways Systems. Basically, they only require the plugging in of components and the connecting of some control wires. Full fitting instructions are given in the user notes — and a trouble shooting guide is provided in case things go wrong. It is comforting to read that "the computer cannot be damaged by wrong connections" — though this should not be taken to ridiculous extremes. If you prefer, you can take or send your computer to Solidisk in Southend for fitting the Sideways System — as I did. They are also most helpful in sorting out problems, either by you calling personally or over the telephone.

## SIDEWAYS SOFTWARE

The software is supplied on a single utility disc — common to all three levels — of 40-track format, which is considered to be the most useful. However, the sideways RAM banks can also be

loaded from (and saved to) tape — albeit much less quickly. While loading or saving a 16K file takes only two to three seconds with disc, a typical 8K language takes about one minute with tape. If you require media in other formats (e.g. 80-track and/or double density discs), Solidisk will either provide it for a nominal charge or advise you how to make the necessary changes.

Another important point for disc users is the disc filing system: the Sideways System software is designed to work with the standard Acorn 0.90 DFS — notably by "patching" it to enhance its functions. Some of the software can be modified to enable the basic actions of loading to, and saving from, sideways RAM to be effected using other DFS's. However, the enhancements provided by Solidisk upgrade Acorn DFS to match or better most others (as we shall see later).

For the sake of the hundreds who have bought Sideways Systems since their introduction in September 1983, it is worth noting that the software has undergone rapid evolution. It now presents a very friendly user interface as well as including several powerful new programs. Existing owners are encouraged to exchange their earlier discs (or

to buy new ones for a nominal, media-only charge).

Hence start-up is by the now classic method of inserting the utility disc and pressing SHIFT & BREAK. This automatically CHAINS the MENU program — from which all the present options may be selected. The program is in BASIC and is unprotected, so that it may easily be modified to suit your own circumstances, if required.

## HOW IT WORKS

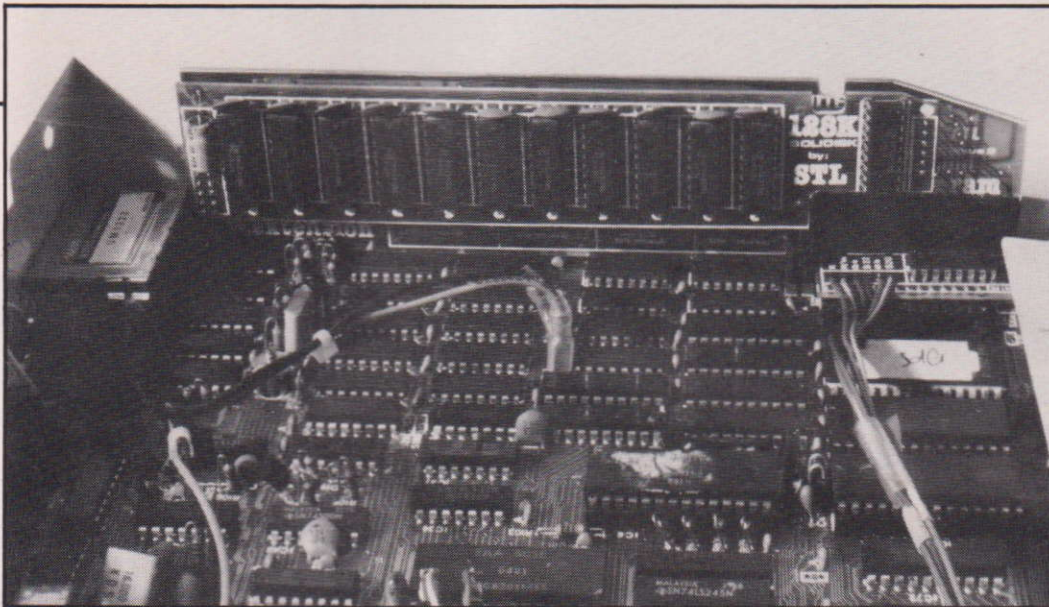
Under the heading "Sideways Firmware Installed", the ROMs and EPROMs present in the machine are shown — by name, against their bank numbers (in hex, from 0 to F). Although the Solidisk Base Unit has taken the rightmost socket, 15 (F hex), those who know their machine well may be surprised to see that their remaining firmware has apparently moved from banks 12 to 14 (C to E hex), which it formally occupied, to banks 0 to 2. This shift — effected electronically — is the result of installing a Sideways System (or indeed, of a Sideways ROM Expansion board).

The MENU program also "surveys" your machine to determine the number of sideways RAM banks available. It initially shows 0 for a standard machine (or a faulty installation), 1 for a SWR16, 2 for a SWR32 and 8 for a SWR128. The RAM banks available all range up to 15 F hex — thus just 15 for a SWR16, 14 and 15 for SWR32 and from 8 to 15 for a SWR128 — and are shown in the topmost section (labelled in hex).

The third part of the display is the Disk Directory — from which your current file requirements may be selected. This directory is created automatically by scanning the disc (both sides, if it is double-sided in a double-sided drive) and then sorting the files into alphabetical (actually ASCII) order.

Many sideways (ROM) files are what Acorn calls "languages". These may be programming languages (e.g. BCPL, PASCAL) or other wholly machine code programs such as





### Full Sideways System

word processors (e.g. VIEW, WORDWISE) and spreadsheets (e.g. BEEBCALC).

Another class of sideways files are utilities, such as toolkits, monitors and screen dumps.

Yet another class of sideways files are the various filing systems, such as NETWORK, Teletext, IEEE and Winchester. These each take additional workspace from user RAM after switch-on or BREAK. Thus, while a DFS normally sets PAGE=&1900, DFS+ NFS sets PAGE=&2200 and DFS+ Teletext sets PAGE=&2600. Hence it can be particularly worthwhile to hold these on disc and "install" them only as required into Sideways RAM.

Solidisk recommends that you create your own disc(s) to carry such sideways files. This may be done by saving from your existing ROMs — using the mini-ROM carrier provided — during and after fitting the Sideways System. Such a sideways file disc may then be inserted after the utility disc for use by the MENU program, or better, copies of the IBOOT and MENU programs may be added to your sideways file disc(s).

Whenever the MENU program is running and a new disc is inserted, it may be scanned to update the Disk Directory by the press of a single key. Sideways files may be selected by pressing the key shown before their name in the Disk Directory. This causes

their name to appear in the top part of the display, under "Sideways Firmware Installed", in the appropriate box. The responses are "intelligent" — in that a sideways file is loaded into sideways RAM, a text file is TYPED in (to main memory), a BASIC program is CHAINED and a machine code program RUN. After pressing the BREAK key to leave the MENU program, sideways files are enabled by typing \* filename — as usual.

### PATCHING UP DFS

Another major utility program which may be selected from the MENU program is STL150. This enhances the Acorn DFS by copying the firmware version (which is only 8K) into Bank 15. Part of the "patch" relocates the five channels alongside it and PAGE is then set at &E00 — as for a tape system. This is very useful for running "maximum-tape-length" programs and with word processors — especially in 80-column mode. For example, it increases the space for text in VIEW using a DFS in Mode 3 from 9726 to 12542 characters — i.e. by 29%.

As suggested by its name, this DFS enhancement also offers a catalogue for up to 150 user files. It uses 10 sectors (instead of the standard two) for five partial catalogues of 30 files each and

then manages them all for you without you being aware of it. Of course, a special 150 file formatter is required — and this is provided for both 40- and 80-tracks, along with a verifier, as part of the enhancement. In addition, STL150 has a command which enables any one of the five partial, 30-file catalogues to be readable by the standard DFS.

Such an extended catalogue is again very useful to a word processor user, since ordinary letters can give rise to very many short files. These often fill the catalogue long before the disc is filled — particularly when using 80-track discs of 200K per side.

The remainder of the programs on the utility disc are intended for use with the SWR28. One — STLDISC — also enhances the standard Acorn DFS and automatically configures the SWR128 as one Sideways RAM bank — 15 (F hex) — plus a 100K RAM Disc (or Solidisk). It provides only the standard 31 file catalogue but includes a number of extra facilities for use with the RAM Disc.

One of these allows the spooling of data (e.g. graphics screen files) to disc for later printing "in background". This enables processing to continue as a foreground task, while your latest screen masterpiece is being dumped to your printer. (This is similar to the \*SPOOLing and then \*TYPEing of text on a standard machine — but this can-

not handle data or print in background).

### TOP END

Top level, SWR128 Sideways System offers a great deal to users of word processors. Even by itself, the RAM Disc can be used with VIEW to hold the "file-in" and "file-out" for "continuous processing". Although both must be present on the one drive, thus limiting either one to 50K maximum, the file operations are much faster and quieter than with a mechanical drive. However, such processing can still only go forward in steps of "MORE".

Forwards and backwards pagewise processing is already a notable feature of the Merlin SCRIBE (ROM) word processor, using one or more mechanical disc drives. Again, this action would be greatly improved by the speed and silence of the RAM Disc, while the maximum file size with SCRIBE could be almost 100K.

The utility disc also contains two application programs of particular interest to word processor users.

### THE WORD64 PROGRAM

This is an enhancement for the WORDWISE word processor, enabling it to use the RAM Disc as a buffer for a (single) text file, providing 65251 characters free — almost 64K.

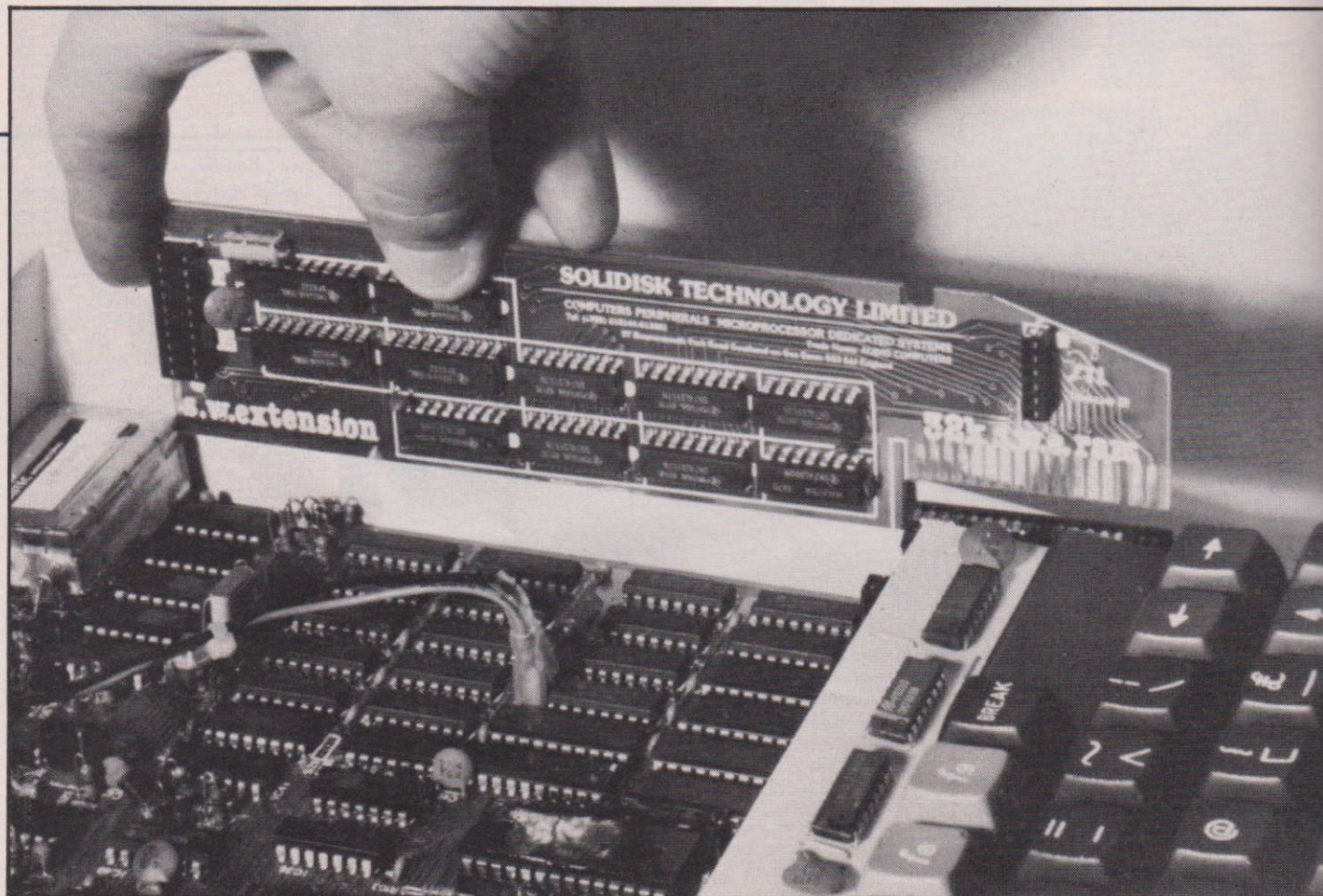
After loading STLDISC, selecting WORD64 causes WORDWISE to be copied into Sideways RAM bank 15 from your firmware version, together with a "patch" which enables "overlay" operations to and from the RAM Disc. This allows continuous stepwise processing, both forwards and backwards, and also search and replace throughout the whole file.

### THE SILEXICON PROGRAM

Named after Silicon (Disc) and Lexicon, this is a spelling

**CONTINUED OVER**





### Second level, 32K

checker, which is amazingly fast when used with the Solidisk RAM Disc. (It can be used without the RAM Disc but with two mechanical drives but its use with just one double-sided drive is definitely not recommended). After loading STLDISC, the dictionary is copied onto the RAM Disc and the main program — SILEX — into the main user RAM — again with just one function key. Text is read in blocks from the disc in the mechanical drive and scanned at more than 1000 words per minute, with all the unrecognised words being put into a buffer. On reaching the end of the text or filling the buffer with about 330 words, it offers you each stored word in turn to accept into the dictionary, pass over or mark (with #). You can then use your word processor to search for, and correct each #-marked word. To avoid the words added to the dictionary being lost, the RAM Disc should be

BACKED UP to a floppy disc.

The maximum capacity of any one dictionary on a 100K disc (without SILEX itself) is about 15,000 words. However, multiple dictionaries can easily be created, possibly for specialist subjects (e.g. law, medicine, engineering) and also foreign languages.

As many Beeb users already know, it is possible to use a word processor to create and edit programs — both assembler and BASIC. While machine code programs may already be assembled directly from word processor files (using \*EXEC), Solidisk hope soon to offer a utility to run long BASIC programs held on the RAM Disc. If realised, this will make the SWR128 (or Solidisk) even better value, since it would become an alternative to a second (6502) processor. However, processing from the RAM Disc would be at around half the normal speed, whereas that with the second processor would be at around twice it. Even

so, running from the RAM Disc should be quite fast enough in most cases and the programs could be longer (at up to 64K) than for the second processor (at up to 44K). Moreover, in neither case would the programs be competing with the screen for memory.

The current Solidisk user notes consist of 14 A5 pages. They cover the installation of the hardware, the 3 utility programs and the 2 application programs mentioned above. There are also a couple of help/info files included in the software. An extended manual is being written and is promised for an early date.

The lower level Solidisk systems are already viable alternatives to ROM expansion boards, while the top level system can also save you having to buy a second disc drive (to which it is in many ways superior). Likewise, the Solidisk enhancements to the standard DFS are alternatives to other enhanced DFSs. The power of the Solidisk Sideways

RAM/RAM Disc software is already considerable — with its friendly user interface, its two DFS enhancement programs and two valuable application programs. Moreover, it is growing rapidly, helped by an enlightened policy of encouraging the creation of such software and then making it available at only nominal charge. With the prospect of being able to run long BASIC programs, the top level Sideways System could also be an alternative to buying a second 6502 processor for many users.

Even now, the Solidisk Systems offer excellent value, both to the user much concerned with managing filing systems, utilities and "languages" more flexibility and to those using their Beeb for business purposes, like word-processing. Beyond this, there are exciting future possibilities of running long BASIC programs and of extending the RAM Disc "overlay" techniques to spreadsheets and databases.











# Microdisc vs. Phloopy

Mark Webb

The most rapidly changing area in the personal computing field is that of data storage media. From a price point of view, the change is in the right direction, downwards. Gone are the days when you paid out for your BBC Micro and then as much again for a disc drive. The drive manufacturers are now subject to the same sort of competitive market that saw the rapid drop in prices of home computers.

The time also seems right for innovation. The Hitachi 3" floppy disc has proved a popular newcomer and the software houses are now taking the hint. In the computing world at large however, the Sony 3" format looks like becoming 'standard' (as near as you can get in computing terms anyhow). Electronequip, a south coast distributor of Acorn and Torch products from the early pioneering days, have now

## Two brand new data storage systems breaking down price and performance barriers.

begun to distribute the Microdisc, a drive based on the 3" Sony format. It is the smallest drive on the market, not much wider than the hard cased disc itself, and it is priced at a lowly £129.95.

The alternative to floppy disc, for most BBC owners, is tape, good old 1200 Baud, not so reliable audio cassette tape. But what about high quality quarter inch instrumentation tape at 15 inches per second — that's 80,000 baud. The new Phloopy data storage system offers such speeds as well as most of the facilities found with a typical disc

filing system. The Phloopy's method of storing data and its speed set it apart from previous tape drives (Ikon's improvement on the Hobbit, the Ultradrive, offers 1200 characters per second). The obvious parallel is Uncle Clive's Microdrive and one wonders whether someone, somewhere, is beavering away at a Microdrive/BBC interface.

### FAST PHLOOPY

Phloopy plugs into the disc port. The Loop Filing System ROM and a couple of plugs go into the

BBC board. One worry is the necessity to cut two resistors. In practice it's a simple operation but BBC owners may have reservations about permanently changing links on the PCB, or indeed about taking the lid off at all.

The LFS is compatible with BBC OS Filing commands except for OSGBP. The interface can apparently run up to eight drives which might come in handy in an Econet set up. The filing system uses up less memory than conventional DFSs and PAGE is moved from &EOO to &1600.

The most interesting aspect of the Phloopy is the way it stores data on the tape, in parallel. A special head records nine tracks side by side on quarter inch tape. Bytes of data are stored across the tape and the ninth track deals with error checking. The micro processor, which rides on board



Microsize

CONTINUED OVER





*Phloopy with on board microprocessor*

#### LFS commands

the unit, controls an error checking system which spots and corrects errors without bothering the user, a feature which disc drive users might cherish.

Each cartridge holds up to 100K data on a continuous tape loop which is 12 feet long. The design removes any need for tape lubricant which fouls heads and is often the cause of tape system failure. The Phloopy drive takes between three and four seconds to find a file and load or save it and the data transfer rate is around the 10K bytes per second mark.

Phi Mag Systems clearly see Phloopy as the next step up for BBC owners currently using cassette systems.

If the software backup emerges to support the hardware performance then Phloopy could prove an excellent buy at £99 plus VAT. With the necessary interface (£26 plus VAT), cost comparison with a single disc drive and DFS gives Phloopy a considerable edge.

### DRIVETTE

The complete Micro Disc Drive upgrade for a BBC Micro will cost £198.95 including VAT. If an

Acorn DFS is already fitted to your machine Electronequip will swap a Micro DOS (MIDOS) for your Acorn ROM plus £13.80. They will also sell you a MIDOS EPROM for £25.00 if you prefer to hold on to the Acorn ROM. MIDOS supports all the Acorn DFS calls and also offers the \*MICRO and \*MINI (5¼") commands to switch between the two types if necessary and \*SHOW to display the currently selected system.

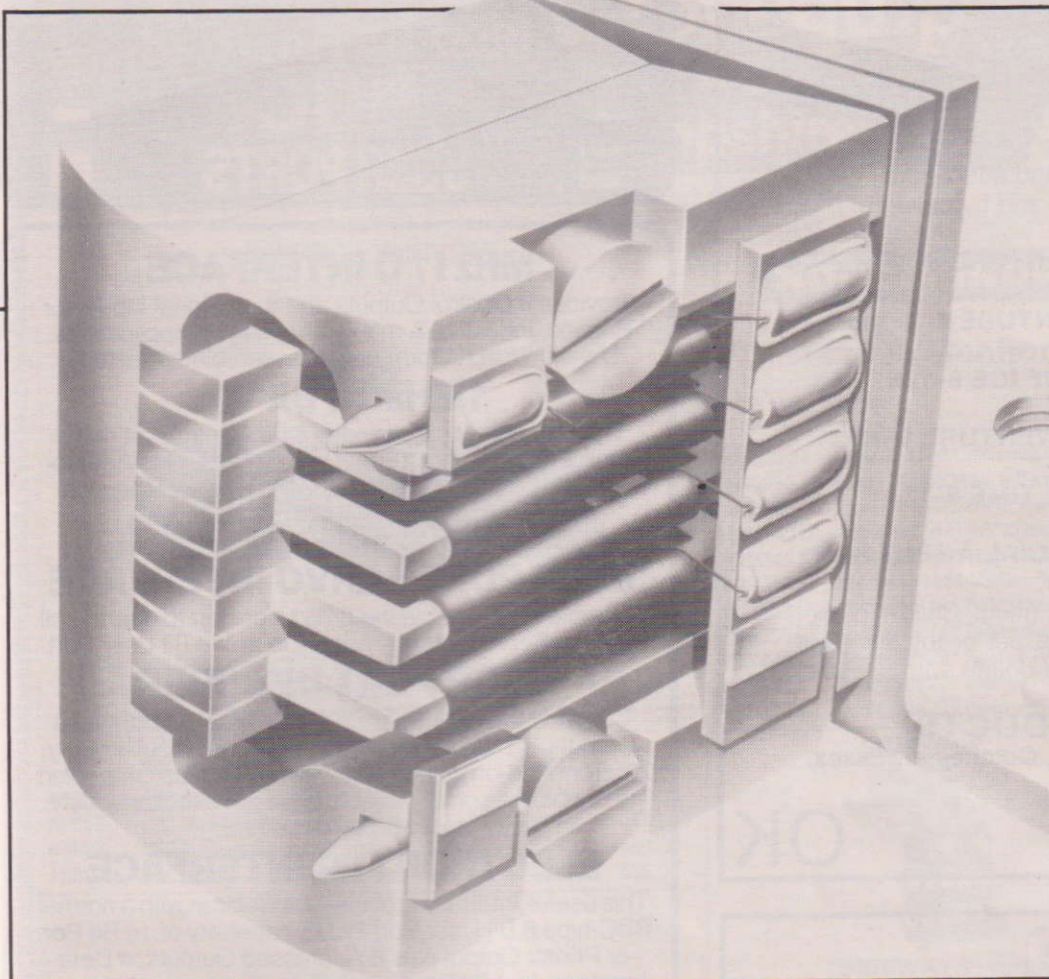
The \*FORM utility offers the ability to format with 45 tracks, &00 to &2C. (The 3" diskettes offer 80K storage formatted). \*VERIFY is the

equivalent command to check on the serviceability of discs. The Sony discs have easily switchable write protect tabs. The Micro Disc Filing System and utilities are explained in considerable detail in a users guide soon to be available from Electronequip.

### DRIVE CAREFULLY

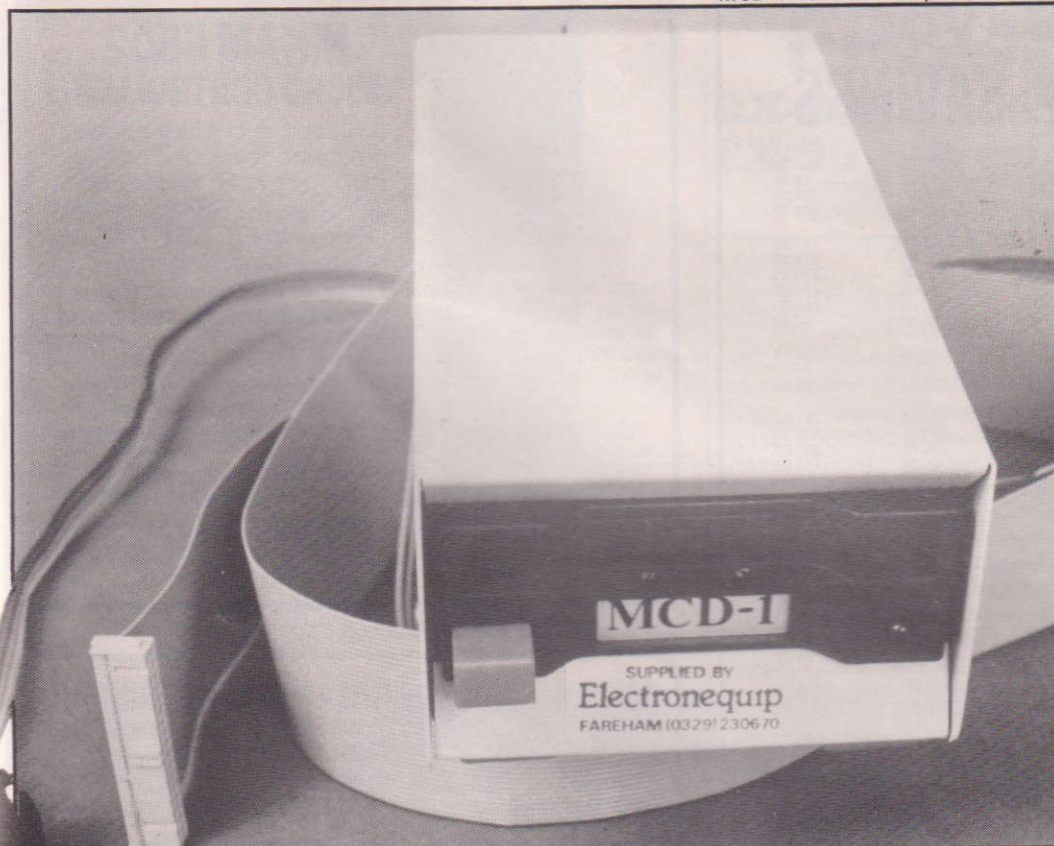
Undoubtedly with brand new systems like the Micro Disc Drive and the Phloopy, it is necessary to weigh up the advantages and disadvantages compared with the conventional media of the mo-





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ment. Five and a quarter floppy discs dominate the supply of quality software, especially in education and business. Microdisc offers the option of working in conjunction with a 5 1/4", but \*BACKUP is not available to transfer software across to your 3". You will have to connect up both drives or load into memory, disconnect the 5 1/4", change to Microdisc with \*MICRO, connect the 3" and save to disc — a very risky and time consuming business. Physical connection seems the only practical possibility. Phloopy uses the disc interface so disc copying is out. Backing up from unprotected cassette software should prove no problem.

Much depends on the willingness of software houses to get involved with these new systems. Both offer considerable advantages of cost and physical characteristics over the 5 1/4" drives. Both use cartridge type storage which survives the rigours of use in the classroom or lounge much better than floppies. The Microdisc Filing System offers the standard DFS commands and the utilities are necessary to deal with the 45 track format. The Phloopy's Loop Filing System offers the essential filing system commands with no frills.

The Microdisc scores in being able to plug straight into an already existing interface with a new EPROM all that is needed. Phloopy's cartridges cost £3.50 (£3.00 each in packs of five), whereas a 3" diskette will knock you back £4.95. The Phloopy tape technology is a big step forward and the high performance coupled with attractive pricing promises a rosey future for an all British product. The Microdisc Drive will find a market amongst the growing number of BBC owners moving over to 3" disc drives and who naturally want a low cost, robust system. Further information can be obtained from: Phi Mag Systems, Tregonigge Industrial Estate, Falmouth, S Cornwall TR11 4RY. (Phloopy) and Electronequip, 36-38, West Street, Fareham, Hampshire PO16 0JW. (Microdisc Drive).



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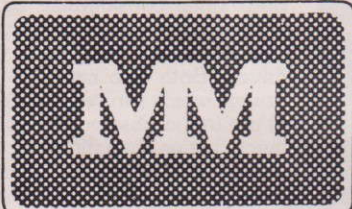
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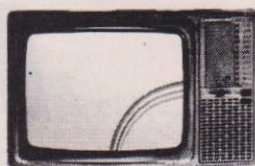


#### Micro Disc Drive for the BBC Micro

The Micro disc drive offers a method of low cost quick access to programs. The drive is essentially a small version of a 5¼" disc drive and offers similar features to the larger drive. The data is stored on a 3" disc, this is enclosed in a protective hard plastic cassette which features a write protect switch. The micro drive requires the standard Acorn disc interface, but a new disc filing system rom. Acorn DFS may be exchanged for the micro DFS for £12.00. The new micro disc filing system allows 60 files per disc surface and it can read and write to Acorn DFS discs. Thus if a 5¼ inch and a micro floppy were connected on the same cable files could be transferred between them.

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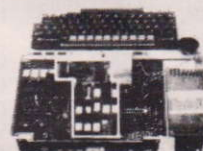
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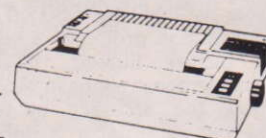
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# Peripherals' Roundup

Since the BBC offers so much circuitry designed to link it to other pieces of equipment it is not surprising that there exists a thriving industry of 'add-on' manufacturers. We thought we would take a look at a wide range of their products, from modems to monitors and from plotters to pens and pads. And we haven't forgotten the new Electron add-ons either.

## HI-RES JVC COLOUR MONITOR

The JVC monitor is not the most attractive monitor in the world but the price tag is reasonable at £279.39 including carriage and VAT. The cream plastic casing just about matches up with your BBC (nearer the Electron actually) but you have to put up with the television style surround with on/off and brightness controls on the right panel.

The most important act however is that the 580×470 pixel resolution produces a very sharp picture indeed. Hi-res graphics demonstrations in Mode O show the accuracy of the display but as usual it is rather hard on the eye with 80 characters and word processing applications should consider the medium resolution alternative.

## A special look at peripheral products for the BBC Micro and Electron.

One thing you do discover with the JVC Hi-Res is how lurid the BBC colour palette really is, no autumnal colours here but more a plastic cleanliness. This is ideal for graphical displays, maps and Mode 2 games but a bit of an eyefall when handling text or even reading instructions for a program. The JVC then offers fairly cost-effective high resolution if your software needs a hard-hitting display.

The JVC is available from Opus Supplies Ltd., 158 Camberwell Road, London SE5 0EE. Price £279.39 (hi-res inc. VAT, lead and carriage), £187.39 (med-res inc. VAT, lead and carriage).

## ELECTRON USER PORT AND CENTRONICS INTERFACE

As the BBC expands into second processors, new operating systems and languages, it is also the turn of the Electron to upgrade an already excellent

specification.

Broadway Electronics of Bedford have a printer interface and user port combination in production with an analogue to digital joystick port on the way. Designed by Andy Wiczorek, senior electronic engineer of Oakley Designs, these two products will be followed by a sideways ROM board and possibly disc interface — though this is unlikely to be a straight copy of Acorn's version. The modules are designed for individual use or as part of a rack system — each board has its own edge connector.

Essentially the interfaces use the same combinations of components found on the BBC Micro board, although the design has had to deal with the strange operation of the Electron clock — associated with its method of reading and writing to and from RAM. The A to D driving software proved a particular difficulty because Acorn have left out some vital routines. Broadway have been able to take advantage of an improved NEC 12 bit binary A/D converter with .1 resolution.

From a user's point of view, it looks like the start of an excellent range of add-on products which will bring the Electron nearer to BBC specification. The modular system also means that Electron owners can pursue their own particular hardware requirements at reasonable cost. The Centronics interface means that if the wordprocessing software becomes available (Aligata and Gemini have suitable packages on tape), the Electron will be ready for it.

The A to D must be of interest to the new breed of robotics enthusiast as well as the games fanatic, who can now play the Centre Court tennis game in this issue of A&B. Digitisers and light pens also become a possibility. The user port opens up the Electron to the fast tape drive and some of the available robots. Where to next? Well how about an Econet to make the Electron a cheap networked terminal for schools.

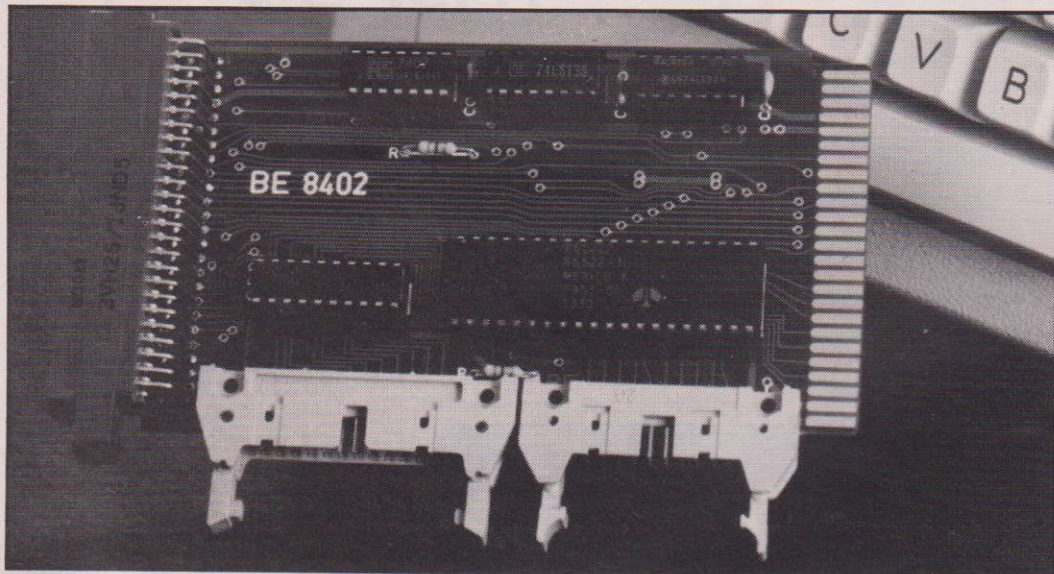
The printer interface and user port is available now, price £39.95 plus VAT from Broadway Electronics at Unit 3c, Aston Road, Bedford. Tel. 0234 58303

## ELECTRON JOY

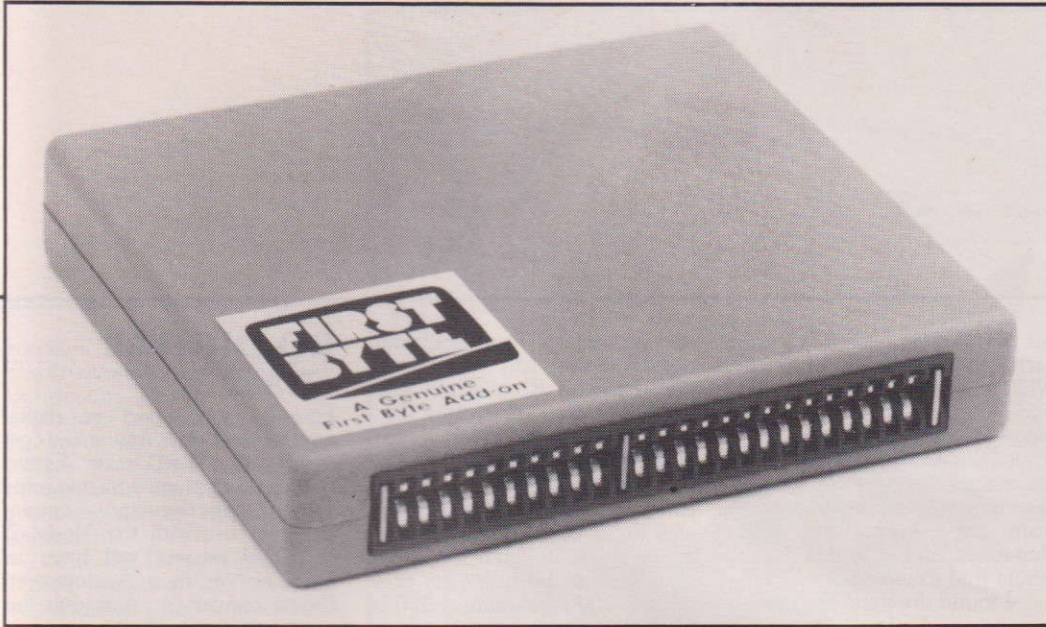
FBC Systems have made themselves very popular with Electron game players by bringing out a switched joystick interface. The First Byte add-on is a plug-in cartridge for the rear edge connector of the Electron and takes all standard 'Atari style' joysticks. Game players often prefer this type and they are going to benefit from an interface which can be read considerably quicker than normal keyboard input, or reading from A to D converter. All the major software houses have been contacted and we can apparently expect a host of games based around the First Byte Joystick. It costs £24.95 inclusive and further information is available from: First Byte Computers, 10 Castlefields, Main Centre, Derby.

## MICROTALKER

This speech synthesiser is intended for use with the BBC Micro-







computer and plugs directly into the user port on the front underside of the machine. Explicit instructions accompany the hardware and ensure that safely setting up the Micro Talker should prove no problem.

The Micro Talker unit has one other connection port, a standard five pin DIN (much more useful than some of the jack connections on its rivals). This enables the unit to be linked to the amplifier in your hi-fi system or wherever, so that you can broadcast electronic speech to

your neighbours.

There are three main methods of creating computerised speech currently available. Digitised speech is what you get when you buy Kenneth Kendall's voice in ROM. Linear Predictive Coding is a complex mathematical method which also involves prerecording and storing a set of words. Micro Talker uses neither of these means, but the third method, which is generally preferred by manufacturers at this end of the market: allophone synthesis.

Allophones are the basic sounds of human speech and they can be combined to form words. The hardware that goes to make up Microtalker is an electronic model of the human vocal tract. It is up to the programmer (you, the user) to put the words into its mouth.

The main advantage of this method are the low data rate (ideal for low memory micros) and the theoretically unlimited vocabulary. This of course depends on the stamina of the user and how good the supplied software is. This is where Microtalker really scores. The documentation is comprehensive and includes advice on using the allophone set as well as listing the address table with sample words and duration for each sound. This table can be used in association with the R.P.S. Wordmaker program which assembles the allophones which you input (and it will accept X rated language so make sure your Mum is out of the house) and creates a dictionary.

A more advanced piece of software comes in the form of a Speaker program, which has a precompiled word table (which is fairly comprehensive if you are always talking about computers). This enables sentences and speeches (more stamina) to be entered using the supplied combination of pauses. The software is supplied on cassette.

The price given is for mail order direct from R.P.S and includes postage and packing. The Micro Talker is now also available from shops.

R.P.S. Electronics' Microtalker, Unit C200, Saltaire Workshops, Ashley Lane, Shipley, West Yorkshire BD17 7SR. Tel. (0274) 588310.

## SMARTMOUTH SPEECH SYNTHESISER

Smartmouth plugs into the user port of the BBC and provides allophone speech synthesis. This relies on using parts of speech to make up whole words and gives much greater flexibility than the standard Acorn product. The quality of the voice is perfectly acceptable but rather robotic. The unit comes with six sheets of A4 documentation and a demo tape. The documentation is useful and contains a list of allophones and example combinations.

The most striking thing about Smartmouth is how quickly you can get to grips with it. Quite a short string of numbers will produce an understandable sentence. The use of 60 allophones to produce all the sounds required by the English language means that it is very efficient in terms of memory. Defining a word on the Acorn speech synthesiser can be very complicated but gives a better end result.

The demonstration tape contains a program to help you develop your own speech and a demo program to allow the Smartmouth to show off by saying things like "To be or not to be" and "Beam me up Scotty".

A peripheral like a light pen of speech synthesiser relies very much on software support from people other than the manufacturers. There are not many commercial programs about which use the Acorn speech chip which is the obvious first choice for a software house, so Technomatic may be able to persuade the likes of Superior Software, Bug Byte and so on to adopt Smartmouth. One stumbling block to this is the fact that all Acorn's BBCs sold in America have the speech synthesiser as standard thus making it a better export bet.

Smartmouth costs £42.55 and is available from Technomatic Ltd., 17 Burnley Road, London NW10 1ED. Tel: 01-452 1500.

CONTINUED OVER





## STACK LIGHTPEN

The Stack light pen is rather a Jekyll and Hyde product. A good piece of hardware spoiled by poor documentation.

The pen itself is very much a pen. Five inches long and  $\frac{3}{8}$ ths inch in diameter, it sits comfortably in the hand. A touch switch is implemented by two metallic bands. One, at the base of the pen, fits naturally in the crook between thumb and index finger, the other, at the pen's tip, is contacted by the index finger. Using the pen is very much like writing.

The pen communicates with the BBC micro through the analogue port at the rear of the machine. Connection is through a length of sprung-coiled cable attached firmly to the pen at one end, and to a D-plug at the other. Although the coiled cable extends when stretched, using the pen on a screen situated on a plinth above the computer causes the cable to pull back on the pen. This gives the feel of continually having to pull against the cable, which would have been avoided if the cable were a little longer.

The user manual supplied with the pen is labelled 'preliminary'. I hope it is. The seven sides of A5 photocopying do not do justice to the hardware. The manual contains a description of the non-interleaved television scan; how the light pen 'sees' the display; how to use the touch contact; and how to adjust programs to use the light pen with your particular computer/display set up. The information is presented in a clear manner, but contains a number of omissions and errors. An error in the sample program contained in the manual, results in incorrect information being given in a table of set-up conditions.

Using a corrected version for the sample program on a television display, the pen was able to resolve to a single character on a  $40 \times 32$  display. With my usual intensity settings the pen correctly worked with all colours except red. Increasing the brightness led to red being correctly detected,

but at the expense of a grey background instead of black. White characters worked with all colour backgrounds, but the full range of foreground/background combinations was not explored. On a black background accurate detection was successful  $\frac{1}{2}$  inch from the screen for white characters, and at  $\frac{1}{4}$  inch for the others (red excepted).

I found the pen easy both to program and use. With a corrected, more presentable, version of the user manual, the Stack light pen will be a useful accessory to many BBC systems.

## R H LIGHT PEN

The R H Lightpen features a pressure responsive microswitch and an LED lamp to indicate data transmission. Most importantly for a lightpen is the range of R H Electronics software which is available in disc or cassette format. The Lightpen costs £45.95

and is available from R H Electronics (Sales) Ltd., Chesterton Mill, French's Road, Cambridge CB4 3NP. Tel. 0223 311290.

## GRAPHPAD

British Micro's Graphpad is now well known as a low-cost computer aided design tool and is ideal for use by hobbyists or in school. The resolution of 320 by 256 pixels is limiting but good enough accuracy can be obtained with the help of the C.A.D. program to achieve remarkably good results.

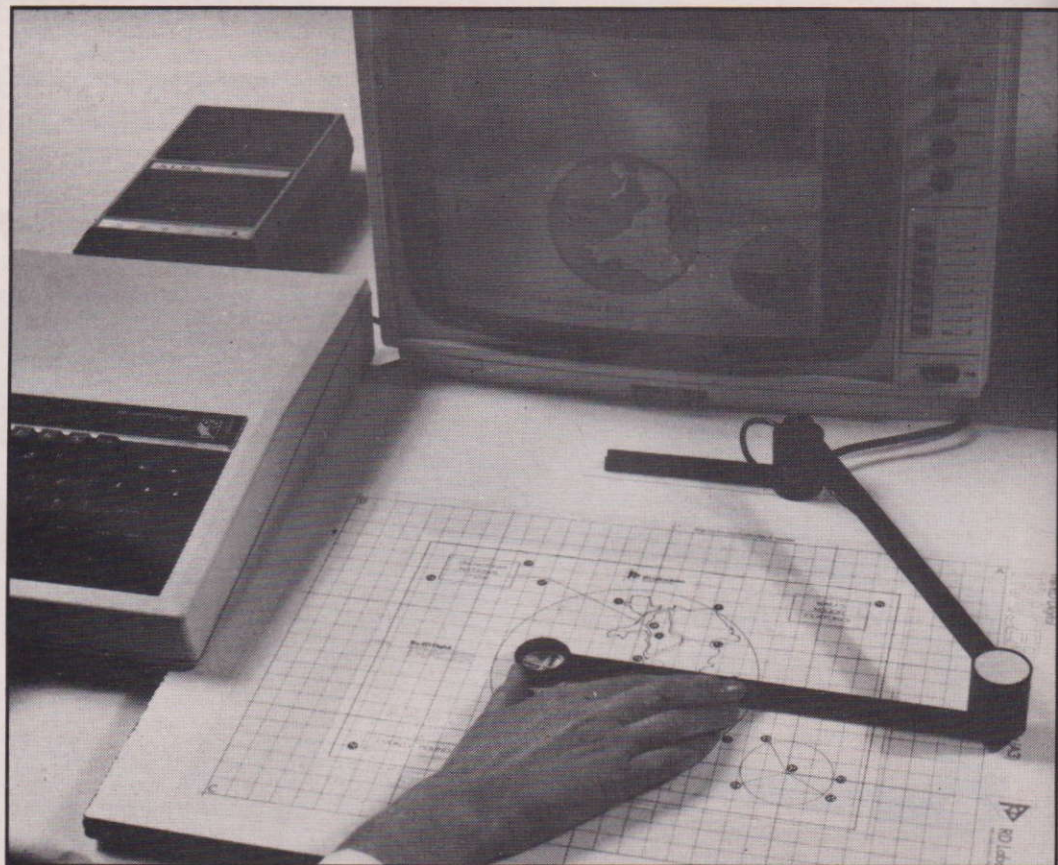
Graphpad offers a very user friendly interface with the BBC Micro especially for children and at £143.75 is a fair investment for the home user as well as schools and clubs. The CAD Software costs a further £20.75. Further information from: British Micro, Unit Q2, Penfold Works, Imperial Way, Watford, Herts. WD2 4YY.

## RD DIGITAL TRACER

Entering the world of digital graphics tracing is now a low cost reality with the RD tracer. Essentially it is two pivoted tracing arms with all the necessary connections for use with the Model B (Electron owners will have to hang on for their Analogue to Digital converter). Although the arms are exposed, the tracer is designed to stand up to a fair battering from school children in use.

Accurate copying is ensured by the use of very high grade potentiometers, giving reproduction over an A3 tracing area. Obviously all such devices take a bit of getting used to but the tracer is fun and gives good results.

Such devices benefit greatly from good controlling software. This is available on cassette for cassette and disc systems. There are straightforward drawing





routines, sampling of geometrical constructions, colour fill and rub-out options. Designs can be saved to tape or disc and retrieved for later use. The manual goes further into advanced graphics manipulation routines, including retracing, scaling inversion and animation.

The RD Digital Tracer costs £69.95 including VAT and can be obtained direct from RD Laboratories Limited, 20 Court Road Estate, Cwmbran, Gwent. Tel. 06333 74333.

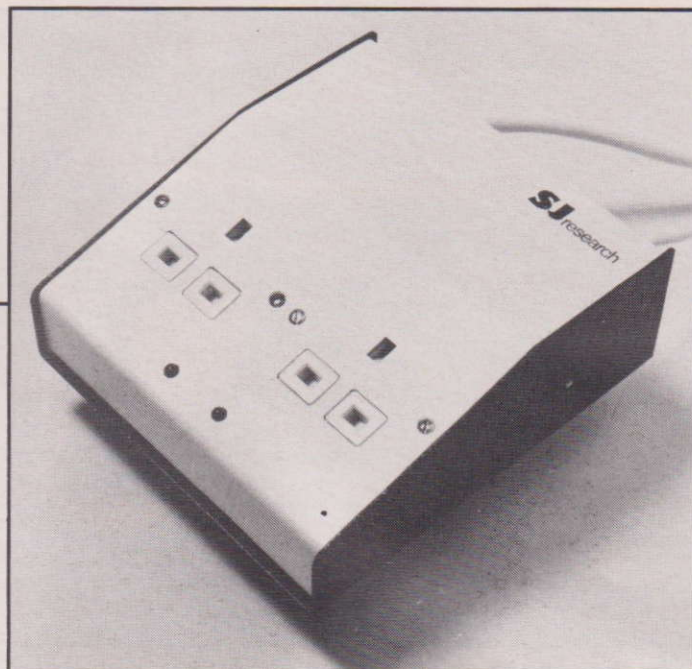
## EXTERNAL LOUDSPEAKER

Capital City Electric have produced the external speaker system par excellence for the BBC Micro — and it works on the Electron too if you are willing to have the wires trailing through the UHF connector. The actual addition of an external speaker is not difficult and has been documented by, among others, A&B Computing in the July/August 1983 edition. This version however, makes light of the connecting up and offers a very high quality speaker plus that all important volume control.

The whole thing is connected through plug PL15 on the circuit board (actually easier to get to on the Electron). A sheet with full instructions is supplied with the package and I cannot envisage any problems with installation. The connection ends with a jack plug which can drive the supplied speaker or, if you really want the neighbours to think they are being depth charged or strafed, into an amplifier. Games certainly benefit from the improved sound and parents may be happy to have such fine control over the volume at which they are sometimes played. The system is available from Capital City Electric, 124 Arthur Road, London SW19. Tel. 01-947 5198. The External Loudspeaker kit costs £16.50 inclusive.

## ECONET PRODUCTS

File Server level one from Acorn has now been superseded by



level two, to be used in conjunction with the 6502 second processor. There is also a Super Level One from Broadway Electronics (see this issue's News). S.J. Research also produces a file server with a high capacity hard disc and integrated tape back up. They have also developed Econet interfaces for other educational computers such as the RM380 and 480Z.

SJ also produces a socket box which can come under software control from your BBC Micro. The R2 can be used to control any number of electrical appliances by turning on or off the two sockets with commands from the user port.

## THE MIGHTY MODEM

There are quite a few modems to choose from these days and A&B will be taking a more detailed look at this exciting area of home computing in the near future. Here for the moment however are some of the products

available for your BBC.

O.E. Limited have a device called the Telmod 2 which costs around the £84 mark and is a direct connect V23 modem. It comes with integral power supply and sits beneath the telephone, connected at one end via the new BT module extension socket and at the other via the RS232 port.

The Viewdata package for the BBC includes appropriate interface and full instructions. There is a user to user capability at 1200 baud which may appeal to small business set ups for exchanging messages and programs instantly over the telephone.

The Telmod 2 is available from O.E. Limited, North Point, Gilwilly Industrial Estate, Penrith, Cumbria CA11 9BN.

## IT'S A MIRACLE

One of the most flexible modems currently available is the WS2000 Modem designed and manufactured by Ipswich based firm Minor Miracles.

The WS2000 is switchable

to 300 baud full duplex, 600 half duplex, 1200 half duplex and 1200/75 back-channel plus BELL (USA) and CCITT (UK/EURO) standards. The reverse 1200/75 Baud operation allows communication with dedicated Prete/Micronet and Viewdata terminals. The WS2000 comes with all the necessary telephone and RS232 plugs and sockets and the full documentation means that it will require no miracles for a BBC user to become quickly familiar with the WS2000 operation.

Minor Miracles will soon have an optional plug-in Auto-Dial/Auto-Answer Board (£39.00) and a special control lead set (£9.50). This Modem can be set up to answer the telephone line, scan the incoming carrier and set itself to that standard before putting the computer on-line. Sounds like an interesting prospect for anyone involved in accessing dial-in databases or bulletin boards and other terminals. The versatile hardwired WS2000 costs £99.95. Further information from Minor Miracles Ltd., PO Box 48, Ipswich IP4 2AB. Tel. 0473 50304.

## COMFORTABLE COMPUTING

New Technology brings with it some awkward design questions which have to be answered by manufacturers of office, school and now home equipment for use with microcomputers.

Lowland designs produce a wide range of mobile work stations under the Tutormate label and supply to authorities and individual schools. The Model 900 illustrated here is the bottom of the range with a single monitor shelf. It costs £78.54 plus VAT. The range extends upwards to the Model 1200/D which is larger and has a double monitor shelf the cost £89.20 plus VAT.

There is no doubt that in the school environment the mobile station has many advantages associated with the sharing of



CONTINUED OVER





resources. Lowland Designs produce the two different heights to suit different age groups and the stations are finished to match BBC colours. Further enquiries to: Lowland Designs Ltd., Well Road, Lockerbie, Dumfriesshire DG11 2EZ. Tel. 05762 3399.

Of course the home user may prefer something which approximates the normal furniture found in the house. If that is the case then Marcol of Southampton have the answer with a range of wood veneer cabinets which are purpose built to house the family computer. Although the

component parts go together like standard self-assembly furniture, the design incorporates a number of necessary features for the BBC or Electron owner.

The basic units priced from £39.99 have plinths to support monitors and adequate room for the bits and pieces equipment associated with computing. The computer shelf is at the right height to allow knee room and avoid the deadly programmer's back ache. The top of the range starts at £79.95 and is well worth the buy if you like to get the computer out of sight (and out of

mind perhaps). This cabinet has sliding and lockable shelves which allow the user to tidy everything back into the unit and to close the doors. This has the added advantage of keeping valuable equipment dust free and the chances of snagging on an all important lead are diminished. Full product details from Marcol, P.O. Box 69, Southampton SO9 7EQ. Tel. 0703 731168.

Store Stock Systems of Altrincham also offer a range of computer workstations designed for use in schools. The Salford Computers Workstation is of the mobile trolley type with different levels of working surface. Especially nice are the two wire-basket cradles, one for printer paper and the other for a multi-

way mains plug. Stock have been involved with close consultation with the MEP and this shows in the features provided.

The Salford is priced at £57.59 excluding VAT and represents the middle of the range. At the top end is the Lincoln which offers correct working heights, 15" deep monitor shelf and many other well thought-out features.

Also of interest is the Klick Microlock, a security device to prevent theft or accidental upset. This costs £9.95. Also available are a number of accessories, safety guards, shelves, trays and so on. Full price and product details from Store Stock Systems Ltd., Unit 2B, Stag Industrial Estate, Atlantic Street, Altrincham, Cheshire WA14 5DD.

## 6502 SECOND PROCESSOR AND BITSTIK

Acorn's new 6502 second processor is housed in the rather low key unit already familiar from the Teletext Adaptor but underneath the bonnet, so to speak, lies a pretty powerful array of processing power. The second 6502







runs at 3MHz and has its very own 64K of user memory.

The second processor needs its own power supply and connects to the BBC through the high speed data channel, the Tube. This effectively turns the host BBC into an input/output handler, taking care of the screen display and sound, file handling and so on. This leaves the second processor free to run the application program. Of its initial 64K RAM, 16K is taken up by BBC BASIC and 4K by the operating system. This leaves 44K for BASIC programs and up to 60K for assembler programs.

The Tube asynchronous interface plays its part in utilising the extra speed of the 3MHz chip and in general terms programs will run about 50% faster than on an ordinary BBC Micro. Acorn feel able to make the claim that this is now the fastest home/personal micro (including 16 and 32bit machine) currently on the

market with the exception of the Sage II which is a mite more expensive.

The second processor requires software in the host machine in the form of a Hi-BASIC ROM. This allows the 44K of user memory for BASIC programs and also allows the full character set to be redefined without using any program memory. I can just see the incredible games Beeb owners may be playing in the very near future. A second ROM is provided to update and replace the user's disc filing and/or Econet filing systems with a single combined chip.

The complete 6502 unit with User Guide, cost £199 and is available direct from Vector Marketing Ltd., Dennington Estate, Wellingborough, Northamptonshire NN8 2RL.

Launched alongside the second processor is the Acorn BitStik, developed by Robocom

previously available for Apple computers and successful seller with over 12,000 units worldwide. The all important graphics software appears undiminished from the Apple version and indeed has some further features unique to the BBC.

The heart of the CAD/CAM system is the Bitstik itself. This is a 3-axis joystick (rotation and X-Y) with three push buttons which select functions from the screen and leaves the user almost entirely independent of the keyboard. The graphics software is held in a ROM (you are going to need a board at this rate) and the system master utilities discs and drawing 'buffer' disc come in 80 track form.

The Bitstik is used to draw freehand or with various draughtman's tools and the resulting screens are stored in library form on the discs. The software is very powerful and allows a vast number of

sophisticated manipulations of any page or individual drawings. The speed of the colour fill (user defined and composite) has to be seen to be believed and the 'zoom' facility offers countless possible applications. Indeed this can be said for the package as a whole. The Acorn Bitstik System costs £375 and includes a comprehensive manual with 'hands on' tutorial throughout.

## EXTRON KEYPAD

A new keypad designed to make data entry into your BBC easier, has been announced by Extron. The keypad gets round the often inconvenient layout of numbers on the BBC keyboard and the frequent need for shifted keys to enter such common operators as +, \* and =.

**CONTINUED OVER**





Keypads 25 keys include all the numerals and arithmetic operators, together with 9 commonly used, shifted characters. All keys operate with a single keystroke, avoiding the need for the SHIFT key. The pad connects to the BBC keyboard via a ribbon cable and Extron say that the normal operation of the computer remains unaffected. The unit costs £50 inclusive and comes with full fitting instructions. Further details from: Extron, 16 Prior Park, Bradford on Avon, Wiltshire BA15 1QU.

## HEAVY DUTY TAPE RECORDER

The new Bell & Howell/LVL audio and data recorder has been developed from a heavy-duty machine widely used in schools and now has the additional input/output connections for loading and saving programs with the BBC and Electron. The audio performance remains unaffected if you like computing to music.

## ULTRA DRIVE

Ikon Computer Products have improved on their Hobbit fast cassette system and renamed it

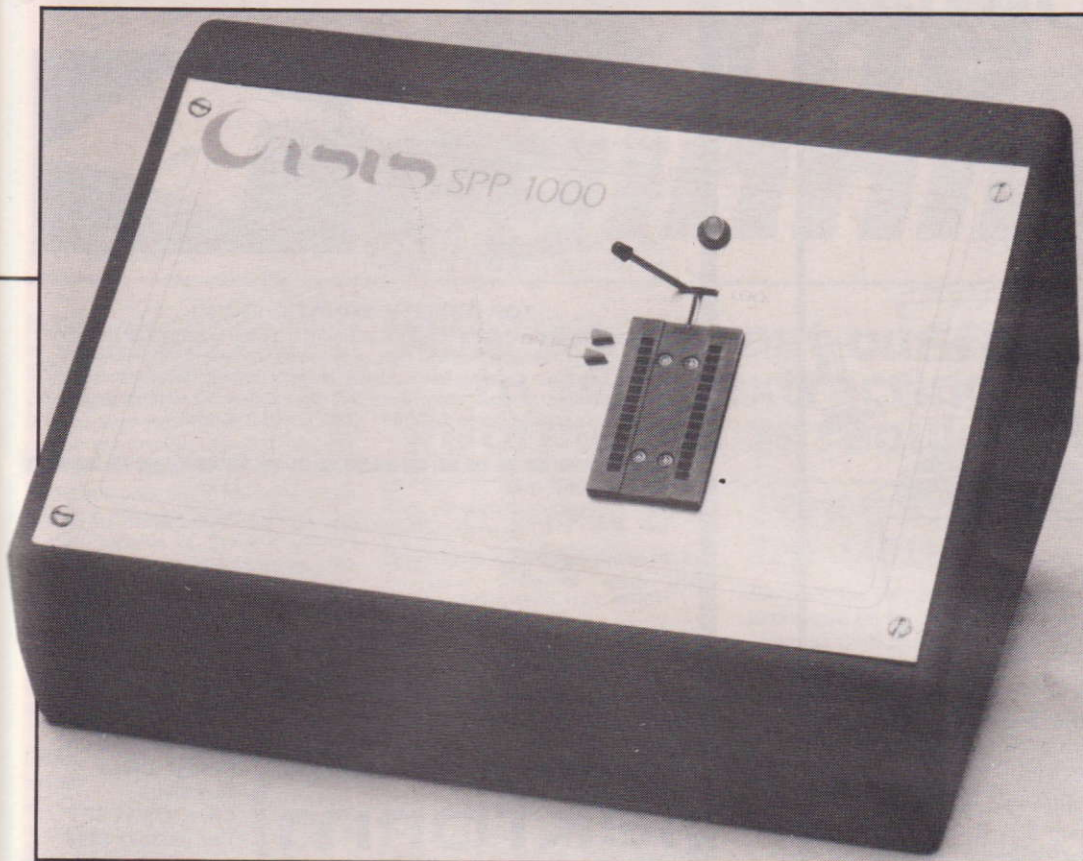
the Ultra-drive. This digital cassette system offers a read/write speed of 1200 characters a second (ten times as fast as a domestic cassette recorder) and a capacity of ap-

proximately 200K per cassette. The system is based on the Phillips mini digital cassette recorder and comes with interface, cables, operating sygem, and micro cassette. The Ultra

Drive costs £79.95 as is available from Ikon Computer products, Kiln Lake, Laugharne, Dyfed SA33 4QE. If ordering direct then there is a charge of £3.45 postage and packing.







## 6809 SECOND PROCESSOR

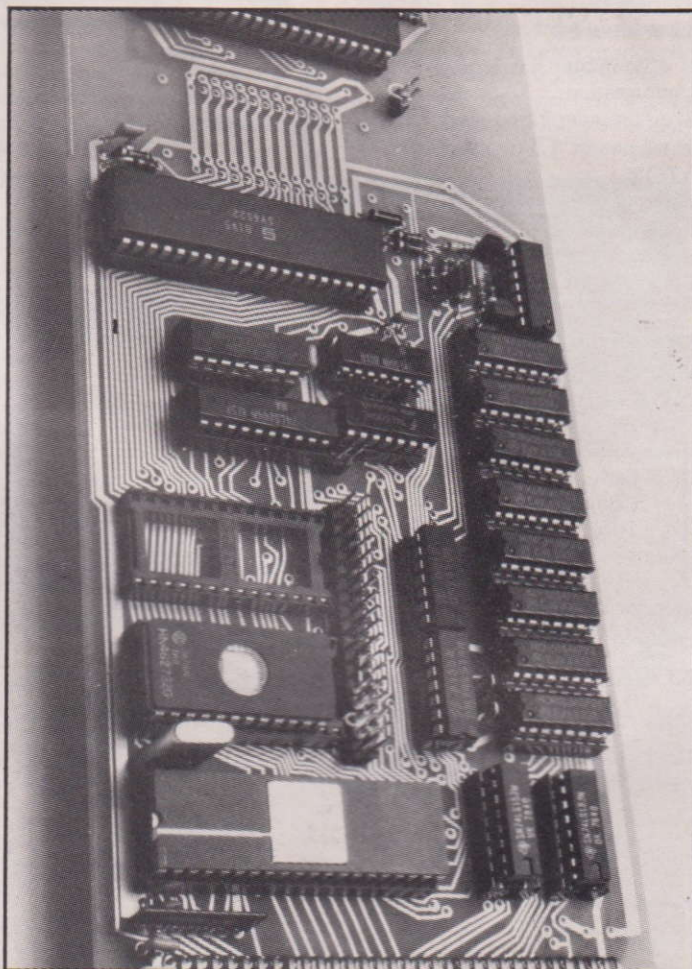
Cambridge Microprocessors Systems Ltd have introduced the first single board 6809 second processor for the BBC. It enables the use of the BBC in industrial development by the engineer designing his own hardware. A range of cross assemblers make it possible to use the system to develop software for different processors. This may prove of interest to Technical Colleges and Universities. The C.M.S. board uses FLEX which in turn supports a range of high level languages. The board sits inside the BBC lid and connects to the Tube interface. Details from Cambridge Microprocessor Systems Ltd, 11 St. Margarets Road, Girton, Cambridge CB3 0LT. Tel.0223 276 791.

## AT THE OASIS

Oasis Electronics, one of the BBC related firms based at the Norwich University Village, have two important hardware products for the BBC Micro. Their EPROM programmer is designed for disc based systems and cleverly uses the computer itself to apply the operation of processing EPROMs.

The programmer offers advanced facilities, including comprehensive protection against operator misuse. The software includes a powerful Memory Manager for organising data content, the EPROM blower itself and a Personality Editor for adding new device types to the library. Price including disc based software, connectors, interfaces and 12 months' warranty is £199.

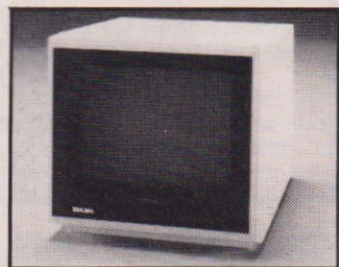
Oasis also produce what must be the most sophisticated data acquisition system for the BBC. Both the high performance analogue data collecting hardware and the menu driven control software are specifically designed for the scientist and further software packages are under development. The full unit including extensive operating manual costs £399. Further information about these products from Oasis Electronics, University Village, Norwich NR4 7TJ. Tel. 0603 503275.



## NEW RANGE

A new range of monitors and printers is now available from Data Efficiency Ltd., The KAGA/TAXAN monochrome monitor with green display starts the range at £119+VAT. The 12" RGB clocks in at £215+VAT. If you use your system for business and need 80 column you will have to be prepared to pay £285+VAT for the K12R2 version.

Of interest to the BBC owner in the market for a dot matrix printer, is the KP810, an Epson compatible printer for £299+VAT. The KP810 offers easy paper handling, high density graphics and NLQ printing as standard. It is also pretty fast at 140 characters per second. Details from: Data Efficiency Ltd., Maxted Road, Hemel Hempstead, Herts. HP2 7LE. Tel. 0442 60155.





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# In The Beginning

G W Gallagher

If you have begun to make the file as designed in the previous articles, it is time to develop the program which will extract those lists of students which are a part of the mountains of paper which are in evidence in any school. Whether you want lists of pupils taking a subject, from a particular feeder school or from a certain catchment area, the lists may be obtained easily as long as the information is stored in the file, it may be extracted painlessly.

Some of the PROCs used are already available from the first and second programs.

PROCWAIT (1000-1030) as before.

PROCnumber (1040-1090) makes sure that the roll number is the correct length.

PROCfeeder (1150-1240) is the list of feeder schools and their references.

PROCcatchment (1250-1350) is the list of catchment areas and their references.

PROCform (1800-1850) ensures

## Now we can put our files to work, extracting information as required.

that the form reference has the correct format.

PROClista (2600-2720) — lists of A level subjects and their references.

PROClisto (2730-2840) — lists of O level subjects and their references.

PROClistc (2850-2890) — lists of CSE subjects and their references.

These lists should be in the form in which you have used them in the other programs, because extracting lists depends on the ability to match references.

The process of extracting a single pupil by name is not included here, but will be in the program which amends individual records.

## EXTRACTING THE LISTS

Because the program is not long, each type of extraction has been given its own PROC to open the file and search for the information. The various searches could have been combined into one general search, but in a situation where each establishment has slightly different requirements, the method is easier to follow if the types are separated. "number" is used as a counting device in each, to give the total number of names in the list being produced.

It is most probable that a printer will be used, as lists are usually required for distribution or references, and a screen list is

rarely suitable. The addition of VDU2 at the beginning of line 80 will enable the printer before the list is started. VDU3 could then begin line 900. If the printer is used, then CLS should be removed from line 110, or else paper will rush through the printer every time the program returns to line 110.

## MALE OR FEMALE

PROCsexM (2090-2190) opens the file, and checks each record in turn, using the MID\$ string function to check whether the 29th byte in the record is 'M'. If it is, then the name is printed, together with the roll number and the form reference. The variable 'number' is counting the number of names printed, so that when the EDF statement is reached, the number of male students is printed out at the end of the list. (listing 1).

PROCsexF (2200-2310) carries out the same process, checking for 'F'. (listing 2).

## FEEDER SCHOOL

'feeder\$' is the variable which is sent from the main program to search for a particular feeder school.

PROCfeeder list (2320-2440) opens up the file, and checks each record to see whether the letter in the 36th position is equal to feeders. If it is, the name, roll number, and form reference are printed out, and 'number' is used to total the names extracted. (listing 3).

## CATCHMENT AREA

'catch\$' is the variable sent to the PROC which searches for the correct feeder school.

PROCcatchlist (2450-2570) opens up the file, and checks each record to see total is counted using 'number' as before. (listing 4).



CONTINUED OVER



## SUBJECT LISTS

The variable S\$ represents the subject reference, chosen from the subject lists used previously. Each subject reference consists of 2 letters, and, as the program has been developed, could be anywhere in the string from the 42nd position. This is dealt with by using a loop, variable J: to test the sections MID\$(A\$,J,2) as J increases from 42 to 67.

It is at this stage that alteration should be made if your file includes a set number, thus using three bytes for the subject references, which means that J must increase by three instead of two. If you are looking for the set as well as the subject, then the subject variable should include it, e.g. S\$ = "EN1" would look for A level English, set 1, using MID\$(A\$,J3).

PROCwhich (2900-2920) takes in the subject reference which becomes S\$. (listing 5).

PROCsearch (2930-3070) is the PROC which carries out the search, two bytes at a time, for the subject reference, and prints out name, roll number, and form reference when S\$ is found. (listing 6).

## BY FORM REFERENCE

The way in which this section is approached is entirely dependent on the type of form reference which has been used. The four bytes used in the example which has formed the basis of this program were as follows:

1 byte for a division, which could be A,B,C or D.

2 bytes for a tutor group, which ranged from 1 to 47.

1 byte which described whether the pupil was taking an O-level or CEE course, or in the first or second year of an A-level course, remembering that it was for use in a sixth form college.

Students could therefore be listed by division, group or academic year. All three possibilities are included, as well as any combination of the one, two or three of them. This is

made possible by the use of a variable X, when all divisions, or all groups of all years are required. Other variables used here are:

FR1 which is 0 when all divisions are required, 1 when a particular division is wanted.

FR2 which is 0 when all groups are required, else it is 1.

FR3 which is 0 when all academic streams are required, else it is 1.

PROCformlist (3100-3320) opens up the file for reading, and checks each record for each section of the form reference in turn. When a record is found which satisfies the required conditions, the roll number, name and form reference are printed out. 'number' is again used to count the number of students on the list. (listing 7).

I hope that it will be possible to adapt this section to suit individual needs.

## THE MAIN PROGRAM

Lines 110-900 (see listing 8) contain the main program, which consists of directing the action to the correct PROCs to provide the lists wanted.

10-180	option menu
200-260	lists of male or female students
300-330	lists by feeder school
350-380	lists of catchment area
400-490	lists by subjects
500-620	lists by form reference
900	END

## USING 'OPENUP' IN THE PREVIOUS PROGRAMS

At the end of the previous article, I mentioned that, if the command 'OPENUP' was available, it would offer an alternative method for opening up a file to add subjects to individual records. The main difficulty arising from using the 'RENAME' command is that it uses twice as much space, in copying a file. This can cause difficulties when the files are long, as is probably the case with the type of school file with which we are dealing.

When BASIC II is available

the 'OPENUP' command enables us to move the file pointer to any record required and put back into the file an amended version of that record. The combination of OPENIN and OPENUP seems to offer a useful method for our requirements.

## THE FIRST PROGRAM

In the program which made the original file, the filing process is much simpler, and makes it more attractive to add each record separately, instead of adding a batch at a time. To erase two files each time a record was added seemed excessive wear for disc, even if the life of the disc is guaranteed! But with 'OPENUP' all that is needed is to open the file and add the record.

The revised program removes all mention of the 50 items from lines 10-900. (Listing A). The array is no longer needed. The filing PROCs are amended as follows:

PROCnewfile (1400-1430) opens the file for the first time. (Listing B).

PROCrecords (1620-1660) opens up the file to find how many records are already added. To do this, the value of EXT#X is found. This gives the length of the file, and the number of records on the file (N) is the value of EXT#X DIV 70. This value, N, is then used to place the next record on the file. (Listing C).

PROCadd (1540-1610) The file is opened and the pointer, PTR#X, is moved to the point N\*70 bytes along the file. The new record is added, and the pointer moved to the end of that record, which also makes EXT#X that value. (Listing D).

One other alteration is made, and that is to the section from 2000 - , which was the temporary means of checking the entries made.

Line 2060 becomes:  
UNTIL PX EXT#X

## THE SECOND PROGRAM

Of the 'subject' program listed in the last issue, the following lines are involved in making such an

amendment. The alterations are mainly concerned with keeping the numbering of the records correct. Delete 270-adding 270-285 (listing E). Delete 330-adding new 330 (listing F). Delete 420-adding new 420 (listing G). Delete DEFPROCfileroll (1140-1330). Delete DEFPROCfilename (1400-1590). Delete DEFPROCfileform (1600-1790).

These last three PROCs are replaced by new ones. Whichever way we look for a record, by name, roll number or form reference, we can extract the record number and use it to replace the amended record. There are therefore four new PROCs, one for each method of extraction, and one to replace the record in the file as follows.

PROCfileroll (1140-1250) The file is opened, and each record checked until the required roll number is found. I is used as a counter which provides the value of 'number' which is the record number. (listing H).

PROCadd (1260-1320) The variable 'number' is used to replace the record once amended by moving the pointer to the beginning of the correct record. (listing I).

PROCfilename (1400-1520) The file is opened to find a record which has the name required. (listing J).

PROCfileform (1600-1790) As in the original program, the program should find each member of the required form, and produce each one in turn for subjects to be added or amended. (listing K).

If you compare the filing PROCs, it will be seen that the command REPEAT-UNTIL is no longer used. The use of this command is limited, in that, if the program comes out of the REPEAT loop more than 20 times, an error is generated. Since we wish to look through the file only until the required record is found, it is important that we should be able to jump out of the process when that point is reached. Checking for the end of the file is therefore done by checking the position of the pointer by the value of the 'length of the file' (EXT#X).



**PROGRAM LISTING 1**

```

2090 DEFPROCsexM
2100 X=OPENIN("List84")
2110 PX=PTR#X:number=0
2120 REPEAT
2125 PTR#X=PX
2130 INPUT#X,A$
2140 IF MID$(A$,29,1)<>"M" THEN 2160 ELSE 2150
2150 PRINTLEFT$(A$,4);TAB(10);MID$(A$,38,4);TAB(16);
MID$(A$,5,24)
2155 number=number+1
2160 PX=PX+70
2170 UNTIL PX>EXT#X
2180 CLOSE#X
2190 ENDPROC

```

**PROGRAM LISTING 2**

```

2200 DEFPROCsexF
2210 X=OPENIN("List84")
2220 PX=PTR#X:number=0
2230 REPEAT
2235 PTR#X=PX
2240 INPUT#X,A$
2250 IF MID$(A$,29,1)<>"F" THEN 2280 ELSE 2260
2260 PRINTLEFT$(A$,4);TAB(10);MID$(A$,38,4);TAB(16);
MID$(A$,5,24)
2270 number=number+1
2280 PX=PX+70
2290 UNTIL PX>EXT#X
2300 CLOSE#X
2310 ENDPROC

```

**PROGRAM LISTING 3**

```

2320 DEFPROCfeederlist
2330 X=OPENIN("List84")
2340 PX=PTR#X:number=0
2350 REPEAT
2360 PTR#X=PX
2370 INPUT#X,A$
2380 IF MID$(A$,36,1)<>"feeder$" THEN 2410 ELSE 2390
2390 PRINTLEFT$(A$,4);TAB(10);MID$(A$,38,4);TAB(16);
MID$(A$,5,24)
2400 number=number+1
2410 PX=PX+70
2420 UNTIL PX>EXT#X
2430 CLOSE#X
2440 ENDPROC

```

**PROGRAM LISTING 4**

```

2450 DEFPROCcatchlist
2460 X=OPENIN("List84")
2470 PX=PTR#X:number=0
2480 REPEAT
2490 PTR#X=PX
2500 INPUT#X,A$
2510 IF MID$(A$,37,1)<>"catch$" THEN 2540 ELSE 2520
2520 PRINTLEFT$(A$,4);TAB(10);MID$(A$,38,4);TAB(16);
MID$(A$,5,24)
2530 number=number+1
2540 PX=PX+70
2550 UNTIL PX>EXT#X
2560 CLOSE#X
2570 ENDPROC

```

**PROGRAM LISTING 5**

```

2900 DEFPROCwhich
2910 PRINT"Please give the subject reference":INPUT S$
2920 ENDPROC

```

**PROGRAM LISTING 6**

```

2930 DEFPROCsearch
2940 X=OPENIN("List84")
2950 PX=PTR#X:number=0
2960 REPEAT
2970 PTR#X=PX
2980 INPUT#X,A$
2990 J=42
3000 IF MID$(A$,J,2)=S$ THEN 3020 ELSE 3010
3010 J=J+2:IF J<68 THEN 3000 ELSE 3040
3020 PRINT:LEFT$(A$,4);TAB(6);MID$(A$,38,4);TAB(12);MID$(A$,5,24)
3030 number=number+1
3040 PX=PX+70
3050 UNTIL PX>EXT#X
3060 CLOSE#X
3070 ENDPROC

```

**PROGRAM LISTING 7**

```

3100 DEFPROCformlist
3110 X=OPENIN("List84")
3120 PX=PTR#X:number=0
3130 REPEAT
3140 PTR#X=PX
3150 INPUT#X,A$
3160 IF FR1=0 THEN 3180
3170 IF MID$(A$,38,1)<>"D$" THEN 3290
3180 IF FR2=0 THEN 3200
3190 IF MID$(A$,39,2)<>"G$" THEN 3290
3200 IF FR3=0 THEN 3270
3210 IF MID$(A$,41,1)<>"AS$" THEN 3290
3270 PRINT:LEFT$(A$,4);TAB(6);MID$(A$,38,4);TAB(12);MID$(A$,5,24)
3280 number=number+1
3290 PX=PX+70
3300 UNTIL PX>EXT#X
3310 CLOSE#X
3315 IF FR1=0 AND FR2=0 AND FR3=0 THEN number=number-1
3320 ENDPROC

```

**PROGRAM LISTING 8**

```

110 CLS:PRINT""Type 1. for lists of male students"
120 PRINT"" 2. for lists of female students"
130 PRINT"" 3. for lists by feeder school"
140 PRINT"" 4. for lists by catchment area"
150 PRINT"" 5. for lists by subject"
160 PRINT"" 6. for lists by form reference"
165 PRINT"" 7. to end"
170 INPUT C:IF (C-1)*(C-2)*(C-3)*(C-4)*(C-5)*(C-6)*(C-7)<>0 THEN 170
180 ON C GOTO 200,250,300,350,400,500,900
200 PROCsexM:PRINT"TOTAL NUMBER OF MALE STUDENTS IS "
:number
210 PROCWAIT:GOTO 110
250 PROCsexF:PRINT"TOTAL NUMBER OF FEMALE STUDENTS IS "
:number
260 PROCWAIT:GOTO 110
300 CLS:PROCfeeder
310 PRINT""Which feeder school?:INPUT feeder$
320 PROCfeederlist:PRINT"TOTAL NUMBER OF STUDENTS IS "
:number
330 PROCWAIT:GOTO 110
350 PROCcatchment
360 PRINT""Which catchment area?:INPUT catch$
370 PROCcatchlist:PRINT"TOTAL NUMBER OF STUDENTS IS "
:number
380 PROCWAIT:GOTO 110
400 PRINT""Type A for A-level

```

CONTINUED OVER



```

O      O-level      C      C.S.E
"
410 INPUT S$:IF S$="A" THEN 440 ELSE 420
420 IF S$="O" THEN 450 ELSE 430
430 IF S$="C" THEN 460 ELSE 410
440 PROClista:GOTO 470
450 PROClisto:GOTO 470
460 PROClistc
470 PROCwhich:PRINTS$:PROCsearch
480 PRINT "THE NUMBER OF STUDENTS IS ":number
490 PROCWAIT:GOTO 110
500 PRINT "Division A,B,C or D, or X for all
divisions?"
510 INPUT D$:IF D$="X" THEN FR1=0 :GOTO 540
520 IF D$<>"A" AND D$<>"B" AND D$<>"C" AND D$<>"D" THEN
510 ELSE 530
530 FR1=1
540 PRINT "Which group?(X for all groups)"
550 INPUT G$:IF G$="X" THEN FR2=0 :GOTO 570
560 FR2=1
570 PRINT "Which academic stream?(X for all
streams)"
580 INPUT AS$:IF AS$="X" THEN FR3=0 :GOTO 600
590 FR3=1
600 PROCformlist
610 PRINT "THE NUMBER OF STUDENTS IS ":number
620 PROCWAIT:GOTO 110
900 END
1000 DEFPROCWAIT
1010 PRINT "Press the space bar to continue"
1020 IF GET = 32 THEN 1030 ELSE 1020
1030 ENDPROC
1040 DEFPROCnumber
1050 IF LEN(N$)> 3 THEN 1090
1060 IF LEN(N$)= 3 THEN N$=" "+N$:GOTO 1090
1070 IF LEN(N$)= 2 THEN N$=" "+N$:GOTO 1090
1080 IF LEN(N$)= 1 THEN N$=" "+N$:GOTO 1090
1090 ENDPROC
1150 DEFPROCfeeder
1160 CLS:PRINT "A St Andrews      V Davison"
1170 PRINT "B Bedford      P Pringle"
1180 PRINT "D Durrington      O Others"
1240 ENDPROC
1250 DEFPROCcatchment
1260 CLS:PRINT "N North"
1270 PRINT "S South"
1280 PRINT "E East"
1290 PRINT "W West"
1350 ENDPROC
1800 DEFPROCform
1810 IF LEN(N$)>3 THEN N$=LEFT$(N$,4):GOTO 1850
1820 IF LEN(N$)>2 THEN N$=LEFT$(N$,1)+" "+RIGHT$(N$,2)
:GOTO 1850
1830 IF LEN(N$)>1 THEN N$=LEFT$(N$,1)+" "+RIGHT$(N$,1)
:GOTO 1850
1840 N$=N$+" "
1850 ENDPROC
1860 DEFPROCarray
1870 FOR I=0 TO 50
1880 A$(I)=""
1890 NEXT
1900 ENDPROC
2600 DEFPROClista
2610 PRINT "AH Ancient History GL Geology"
2620 PRINT "AR Art      GP G.P.S."
2630 PRINT "BI Biology      GR German"
2640 PRINT "CH Chemistry      HI History"
2650 PRINT "CO Computer Stud. LA Latin"
2660 PRINT "DT Design/Tech      MA Mathematics"
2670 PRINT "EC Economics      MF Further Maths."
2680 PRINT "EN English      MU Music"
2690 PRINT "ES Env.Studies      Ph Physics"
2700 PRINT "FR French      RS Religious Stud."
2710 PRINT "GE Geography      TD Tech.Drawing"
2720 ENDPROC
2730 DEFPROClisto
2740 PRINT "ar Art      gr German"
2750 PRINT "bi Biology      hb Human Biology"
2760 PRINT "ch Chemistry      hi History"
2770 PRINT "co Computer Stud. ma Mathematics"
2780 PRINT "ec Economics      ph Physics"
2790 PRINT "e1 English Lang. rs Religious Stud."
2800 PRINT "e2 English Lit. ru Russian"
2810 PRINT "fr French      sp Spanish"
2820 PRINT "ge Geography      td Tech.Drawing"
2830 PRINT "gl Geology"
2840 ENDPROC
2850 DEFPROClistc
2860 PRINT "C1 Social Studies"
2870 PRINT "C2 Mathematics"
2880 PRINT "C3 Environmental Studies"
2890 ENDPROC

```

## PROGRAM LISTING A

```

30 CLS:PRINT "Is this a new file?(Y/N)"
40 INPUT N$:IF N$="Y" OR N$="y" THEN 60
50 IF N$="N" OR N$="n" THEN 70 ELSE 40
60 PROCnewfile:N=0:GOTO 100
70 PROCrecords:PRINT "There are ":N;" records in th
e file.":PROCWAIT
100 CLS
110 PRINT "The following information is required"
120 PRINT "for each addition to the file:"
130 PRINT "1. Roll number"
140 PRINT "2. Name"
150 PRINT "3. Male or female"
160 PRINT "4. Date of birth"
170 PRINT "5. Feeder school"
180 PRINT "6. Catchment area"
190 PRINT "7. Course year"
270 PROCWAIT
280 CLS:A$=""
290 PRINT "Next student"
300 PRINT "Type = if you have finished."
310 PRINT "School number"
320 INPUT N$:IF N$="" THEN 560 ELSE 330
330 PROCnumber:A$=A$+N$
340 INPUT "Name,e.g. SMITH JONATHAN",N$:PROClength
350 A$=A$+LEFT$(N$,24)
360 INPUT "Male or female,M or F",N$
370 A$=A$+LEFT$(N$,1)
380 INPUT "Year of birth,e.g.83",N1
390 INPUT "Month of birth,1 to 12",N2
400 INPUT "Day of the month,1 to 31",N3
410 PROCdate:A$=A$+N$
420 PROCfeeder:INPUT "Feeder school",N$
430 A$=A$+N$
440 PROCcatchment:INPUT "Catchment area",N$:A$=A$+N$
450 INPUT "Which year group",N$:PROCform
460 A$=A$+N$
470 CLS:PRINT "":A$
480 PRINT "Is this correct?(Y/N)":INPUT N$
490 IF N$="y" OR N$="Y" THEN 550
500 IF N$="n" OR N$="N" THEN 520 ELSE 480
520 PRINT "You will have the opportunity to redo thi
s":FOR I=1 TO 2000:NEXT:GOTO 280
550 PROCadd:N=N+1:GOTO 280
560 CLS:PRINT "Do you wish to add more names?(Y/N)"
570 INPUT N$:IF N$="y" OR N$="Y" THEN 280
580 IF N$="n" OR N$="N" THEN 900 ELSE 570
900 END

```





### PROGRAM LISTING B

```
1400 DEFPROCnewfile
1410 X=OPENOUT("List84")
1420 CLOSE#X
1430 ENDPROC
```

### PROGRAM LISTING C

```
1540 DEFPROCadd
1560 X=OPENUP("List84")
1570 PX=N*70
1580 PTR#X=PX
1590 PRINT#X,A$
1595 PTR#X=PTR#X+70
1600 CLOSE#X
1610 ENDPROC
```

### PROGRAM LISTING D

```
1620 DEFPROCrecords
1630 X=OPENIN("List84")
1640 N=EXT#X DIV 70
1650 CLOSE#X
1660 ENDPROC
```

### PROGRAM LISTING E

```
270 number=1:E=0
280 PROCfileform:IF E=1 THEN 790 ELSE 282
282 PROCsubjects
285 number=number+1:GOTO 280
```

### PROGRAM LISTING F

```
330 PROCfileroll:PROCsubjects:GOTO 790
```

### PROGRAM LISTING G

```
420 PROCfilename:PROCsubjects:GOTO 790
```

### PROGRAM LISTING H

```
1140 DEFPROCfileroll
1150 X=OPENIN("List84")
```

```
1160 PX=PTR#X:I=1
1170 PTR#X=PX
1180 INPUT#X,A$
1190 IF VAL(LEFT$(A$,4))=roll THEN 1240 ELSE 1220
1220 PX=PX+70:I=I+1
1230 IF PX>EXT#X THEN 1240 ELSE 1170
1240 CLOSE#X
1250 ENDPROC
```

### PROGRAM LISTING I

```
1260 DEFPROCadd
1270 X=OPENUP("List84")
1280 PX=PTR#X+(number-1)*70
1290 PTR#X=PX
1300 PRINT#X,A$
1310 CLOSE#X
1320 ENDPROC
```

### PROGRAM LISTING J

```
1400 DEFPROCfilename
1410 X=OPENIN("List84")
1420 PX=PTR#X:I=1
1430 PTR#X=PX
1440 INPUT#X,A$
1450 IF MID$(A$,5,L)=name$ THEN 1510 ELSE 1490
1490 PX=PX+70:I=I+1
1500 IF PX<EXT#X THEN 1430 ELSE 1510
1510 CLOSE#X
1520 ENDPROC
```

### PROGRAM LISTING K

```
1600 DEFPROCfileform
1610 X=OPENIN("List84")
1620 I=number:PX=PTR#X+(I-1)*70
1630 PTR#X=PX
1640 INPUT#X,A$
1650 IF MID$(A$,38,4)=form$ THEN 1760 ELSE 1730
1730 PX=PX+70:I=I+1
1740 IF PX<EXT#X THEN 1630 ELSE 1750
1750 E=1
1760 CLOSE#X
1790 ENDPROC
```



# Mailsort

£5

Dear Editor,  
Having just 'browsed' through the Advanced Graphics article in the Mar./April issue of **A&B Computing**, I think I have convinced myself that I know naff all about BBC Graphics. Either that or the contributor responsible has got his Operating System hung up! Or can we blame the Proof-Reader for this one?

At a slightly more than cursory (no pun intended) glance, I made it about six errors — but who's counting! On the subject of cursors, what has VDU10 got to do with re-assigning logical colours?

I was amazed at 20 GCOL0,120 REM 128+1 — though... Wicked sense of humour.

In Mode 1/5, logical red, is 0001 (if you like). But when you NOT it, this becomes 1110 (denary 14). This is contrary (I'm trying not to use the word NOT) to the 1100 you had written. Even more confusing as the bit-pattern is actually 0000111.

Fourth column, page 21, — GCOL2,2 replaces Line 60 (GCOL 1,2) NOT (that damn word again — well, it is a 'logical' argument) Line 70.

First column, page 22 — 00001111 is Decimal 15. You obtained 5!

Taking my tongue out of my cheek (and the knives out of my back), let me say that what promised (?) to be an interesting article turned out to be a bit of a shambles. One can only speculate at the probable effect it must have had on anybody who is just pulling themselves up, by their fingernails, from the depths of Hyper-space and Photon torpedoes in the hope of trying to learn the more 'serious' side of BBC Graphics. I'm afraid the article was more confusing than an Acorn official Press Release!

Just to let you see that I'm not a miserable sod, I've dug out some of my old progs (I keep all my efforts — I like a good laugh now and again) and enclosed a few you might like to peruse. Basically, they give the results that your Program 2 promised — namely, varying degrees of Orange. they can (and have been) be adapted to give any col-

## A&B's regular spot for feedback from the writers among our readers.

our.

Why your prog only assessed screen memory up to &7F3F I just can't imagine. Screen memory goes up to &7FFF.

In my Prog 1, lines 20 and 35 put Red and Yellow in SUCCESSIVE Bytes — set up by lines 15 and 30. Playing with the value of STEPn just gives "pretty" patterns. Try STEP1.5 (line 15) and STEP2.5 (line 30).

Program 2 was actually my 'prototype' effort at obtaining "unofficial" colours on my Beeb. Line 15 re-assigns Red for Black and Yellow for White. Notice the difference between lines 25 and 40 in this program and lines 20 and 35 in the previous one. Again I'm filling alternate bytes with the respective colours — lines 20 and 35. It may not be perfect but it's effective — in a way.

Prog 3 was derived from prog 2. I feel that it's the most effective result. Line 20 sets the bit-pattern, for the odd bytes. Line 35 sets same for the even bytes. this gives the overall ratio of Red to Yellow. ANDing &00 with &55 is not as silly as it seems. The AND function provides a 'mask' (protection) for the "1" bits already present. Whilst the resulting "0"s provide 'holes' to allow the Red to show through. ORing would change most of the "0" bits to "1" and result in too much Yellow saturation. I have left the colour re-assigning to line 45, as one can observe the 'setting up' of the bit-patterns to better effect in black and White. Just for interest, for line 35, substitute ?byte% = &03 AND &55.

When working with HEX numbers I have gotten into the habit of retaining the 'format', even with small numbers. Though, of course the leading 0 is not necessary.

Program 4 was a recent attempt at trying to better the results of Prog 3. You may be able to judge better if you're bless-

ed with a colour monitor. Line 20 "paints" the whole screen white. Line 30 changes this to Yellow. Notice the new 'pattern' to line 35; it returns over the same ground as line 15. Line 40 puts

'holes' in our Yellow screen. the pattern is set by &FF AND &AA. Line 50 fills these 'holes' with Red paint.

I hope you will feel that these progs illustrate better the principle of POKEing screen memory directly. There's a lot of fun to be had messing about like this.

Mr Poynter  
Derwent Training Centre,  
St. Mary Cray,  
Orpington. KENT.

```
10REM*****
20REM PROGRAM 1 *
30REM*****
40 MODE1 : REM or Mode 5
50FOR byte%=HIMEM+1 TO &7FFF STEP 2
60?byte% = &0F : REM Red
70NEXT
80FOR byte% = HIMEM+2 TO &7FFF STEP 2
90?byte% = &F0 : REM Yellow
100NEXT
10 REM*****
20 REM PROGRAM 2 *
30 REM*****
40MODE0
50VDU19,0,1;0;19,1,3;0;
60FOR byte%=HIMEM+1 TO &7FFF STEP 2
70?byte%=1: REM Red
80NEXT
90FOR byte%=HIMEM+2 TO &7FFF STEP 2
100?byte%=3: REM Yellow
110NEXT
10 REM*****
20 REM PROGRAM 3 *
30 REM*****
40MODE0
50FOR byte%=HIMEM+1 TO &7FFF STEP 2
60?byte%=&AA
70NEXT
80FOR byte%=HIMEM+2 TO &7FFF STEP 2
90?byte%=&00 AND &55
100NEXT
110VDU19,0,1;0;19,1,3;0;
10 REM*****
20 REM PROGRAM 4 *
30 REM*****
40MODE0
50FOR byte%=HIMEM+1 TO &7FFF
60?byte%=&FF
70NEXT
80VDU19,1,3;0;
90FOR byte%=HIMEM+1 TO &7FFF
100?byte%=&FF AND &AA
110NEXT
120VDU19,0,1;0;
```



Dear Editor,

In the January/February edition of *A&B Computing* you invited the submission of solutions to the Brain Teaser "Flagger" (page 109).

My best solution to this entertaining puzzle was achieved in 9 moves.

As an extension to the puzzle I tried changing the resultant Dutch flag to an all-red flag, which took 8 moves. Changing the all-red to an all-white took 10 moves, all-white to all-blue 10 moves, and from all-blue back to the French flag, 8 moves.

As a matter of interest, as well as the above solutions, I append my analysis of the A, B and C moves which I arrived at by observation, since I am too inexperienced to be able to understand from the listing what calculations are taking place.

I look forward to seeing more Brain Teasers in future editions of the magazine.

Mrs R. Oliver

Cranleigh  
Surrey

Move C affects 2 rectangles. If they are both the same colour then they will both be changed to the next colour in the sequence red, blue, white, red. If they are different colours, then only one will be changed to the next colour in the sequence:

R W W B B R R W (lower value column)

B B R R W W B B (higher value column)

eg If rectangle 1,2 is red and 2,1 is white.

Move 1,2,C will change 2,1 to blue. Repeating move 1,2,C will change 1,2 to white.

Move B operates in a similar fashion, but the sequence is reversed

R R B B W W R

B W W R R B B

Where two rectangles are the same colour or where a move affects only one rectangle (1,1 2,2 3,3 4,4) the change will be made according to the sequence white, blue, red, white.

Move A in every case affects two rectangles and simply exchanges the colours.

Dear Editor

Over Christmas my father typed in the Data Store programme on page 67 of Jan/Feb 1984 magazine. After using the program a little I made two modifications. One allows you to resave a data file under a same name as you loaded it by just pressing (S) to save and (RETURN).

The other stops the "can't extend" error on any named file unlike listing 2 which only works with file name "DATA". This second programme uses the command OSCLI in BASIC II.

Yours faithfully

I.A. Knox  
Clevedon  
Avon

```
345 FS1$=F$
350 VDU31,10,20:INPUT"Save
as what file ",FS$:IF FS$
="AND FS1$=" THEN FS$="DA
TA"
351 IF FS$=" THEN FS$=FS
1$

356FS1$="D."+FS$
358err=0
359ON ERROR IF ERR=214 er
r=1:GOTO394ELSE REPORT:END
360 PRINT:FS1=OPENOUT (F
S1$)
370 PRINT#FS1,J: A=LEN(ST
R$(J)):FOR R=1 TO J: PRINT#
FS1,C$(R):A=A+LEN(C$(R)): N
EXT: PRINT#FS1,L$: A=A+LEN(
L$)
380FOR R=1 TO N:PRINT#FS1
,A$(R):A=A+LEN(A$(R)): NEXT
: IF A MOD256=0 PRINT#FS1,"
?"
390CLOSE#FS1
392OSCLI("A. "+FS$)
393OSCLI("DEL. "+FS$)
394OSCLI("REN. "+FS1$+"
"+FS$)
395OSCLI("A. "+FS$+" L")
400PRINT"CHR$7:FS$;" Fil
e saved.":A=INKEY100:IF er
r=1 THEN 120 ELSE ENDPROC
```

Dear Editor,

I am writing to say how much I enjoy playing the program "Spacewar" that appeared in the Nov/Dec edition of *A&B Computing*.

To my mind, however, I feel that the game is much more suited to the use of joysticks. They give the player a more immediate response to the game and the poor little keyboard (especially the ubiquitous "Z" and "X" keys) gets the treatment it deserves, rather than having some fever-crazed gamer attempt to shove the keys through the circuit board!

And now to the necessary alterations to the program The "repeat delay" and "repeat rate" commands in lines 353 and 357 are not required and should be deleted. The following lines are replacements for existing lines.

```
295 *FX16,2
770 XDZ=ADVAL(1): IFXDZ>2
0000 AND XDZ<50000 X1Z=0: G
OTO 790
780IF XDZ<2000 X1Z=16 ELS
E X1Z=-16
790YDZ=ADVAL(2): IFYDZ>16
000 AND YDZ<40000 Y1Z=0: GO
TO 810
800 IF YDZ<15000 Y1Z=-8 E
LSE Y1Z=8
920 fireZ=ADVAL(0)AND3:IF
fireZ=1 PROCfire
1367 *FX16,4
```

I have found that disabling the right joystick improves the speed of response for the joystick in use.

The limits in Lines 770 and 790 give a fairly wide "dead band" in the centre-position of the joystick and allow the Laser Crosshairs to be stopped at will. Individual users may like to alter these values to suit their own preference.

I would like to thank D. Huf-ton for a splendid game and congratulate him on his excellent use of graphics and sound.

As a postscript, it is interesting to note that zero page memory locations &02 and &03 hold the pointer to the first free space for variable storage by BASIC. As usual these numbers are stored in reverse order but to discover how much memory is available above the variable store, all that is required is the following: PRINT HIMEM - (!2 AND &FFFF).

This will give the free space in decimal (the logical AND masks out the contents of locations &4 and &5 which have been accessed by the pling in-direction operator). It is of course possible to program a function key to do this task and, for anyone who prefers Hexadecimal numbers, a tilde inserted before the word HIMEM will do the trick.

Yours faithfully  
S.M. Blinkhorn,  
Read,  
Lancashire.

#### Solution to "Flagger"

You have solved it in 9 moves

44C 11A 43C 31C 24B 21C 24B 34B 12B

Dutch to all red

32C 22C 12C 42C 43C 13C 23C 33C 8 Moves

Red to white or white to blue

11B 22B 33B 44B 14B 13B 12B 23B 24B 34B 10 Moves

Blue to French

21C 12C 23C 24C 22C 11C 14C 13C 8 Moves

#### Move A

1,1	changes with	4,4
1,2		4,3
1,3		4,2
1,4		4,1
2,1		3,4
2,2		3,3
2,3		3,2
2,4		3,1

#### Move B

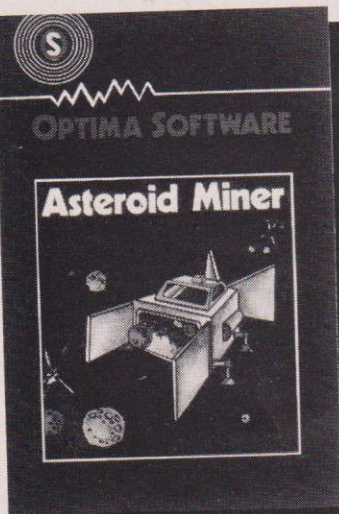
1,1	affects	1,1	3,1	affects	1,3	3,1
1,2		1,2	2,1		3,2	2,3
1,3		1,3	3,1		3,3	3,3
1,4		1,4	4,1		3,4	3,4
2,1		1,2	2,1		4,1	1,4
2,2		2,2			4,2	2,4
2,3		2,3	3,2		4,3	3,4
2,4		2,4	4,2		4,4	4,4

#### Move C

1,1	affects	1,1	2,4	3,1	affects	3,1	4,4
1,2		1,2	2,1		3,2	3,2	4,1
1,3		1,3	2,2		3,3	3,3	4,2
1,4		1,4	2,3		3,4	3,4	4,3
2,1		2,1	3,4		4,1	1,4	4,1
2,2		2,2	3,1		4,2	1,1	4,2
2,3		2,3	3,2		4,3	1,2	4,3
2,4		2,4	3,3		4,4	1,3	4,4



# Software Reviews



**Title:** Asteroid Miner  
**Publishers:** Optima Software  
**Machine:** Model B  
**Price:** £8.95

This game written by Christopher Price is different to any game I have seen before. The objective of the game is to collect up valuable green asteroids by means of a cargo ship and return to your base with them, and so score as many points as possible. The cargo ship is moved with the Z key for acceleration and the » and « keys for rotation to the right and left respectively.

The game is made more interesting by the addition of a second cargo ship. This cargo ship also collects the green asteroids and for each one that he collects the score is reduced. You can, therefore, find yourself with a negative score. Another feature of this second ship is that it plants time bombs in the red asteroids making them look green. Now should you collect one of these asteroids, unless you press the key displayed in the corner in the time, you will be destroyed and lose one of your four lives and this will also be the case if one explodes near you.

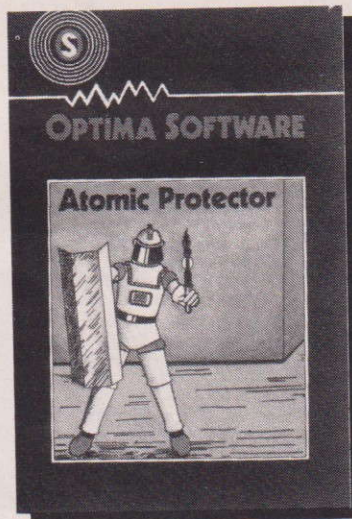
After an initial title page there is a page of introduction telling you about the game. This is followed by a page giving the keys to control your ship and telling you that you can play the game at ten levels. You choose

the level at which you play by pressing one of the number keys between zero and nine, nine being the easiest. Finally, once you have finished the game you may enter your name into a top ten table of highest scores, although you cannot have a negative score here. The table also gives the level at which the game was played.

This is a nice game with some new ideas and good use of sound and graphics. The only thing that I think would improve the game is that the size of the asteroids be made bigger making the game a little easier.

## Ratings Table:

SOUNDS	70%
GRAPHICS	75%
DOCUMENTATION	70%
VALUE FOR MONEY	75%
OVERALL	77%



**Title:** Atomic Protector  
**Publishers:** Optima Software  
**Machine:** Model B  
**Price:** £8.95

Atomic protector is an interesting and continuously fast moving game. It is a variation on the "Pacman" theme and a good one with many differences.

You are a robot, placed in a maze with lots of dots which are uranium deposits. One to four alien robots, it's your choice, one by default, are in the maze with

you. These aliens aim to take the uranium deposits which are your means of life support, and you must stop this happening. You may achieve this by blocking the way, using yourself or a radioactive wall. You only have one wall and you drop and retrieve this with the "space bar". If the alien robots take all the dots you lose one of your three lives.

Points are scored by the capture of radioactive objects that appear to appear totally at random and move around the maze. These must be caught before a warning sound stops, or you lose a life. Each object has a value of 200 points. Bonus points of 50 are given for each dot left when a timer at the bottom of the screen reaches zero.

The first 4 pages give all the necessary information about the game and how your robot is moved. This is by the use of the Z and X keys for left and right, and the / and : keys for up down. At this point it is also possible to make other changes. These are, sound yes or no, your robots speed 1 or 2, 1 fast, 2 slow, alien robot 1 to 4, and speed of the game 1 to 9, 1 being the fastest.

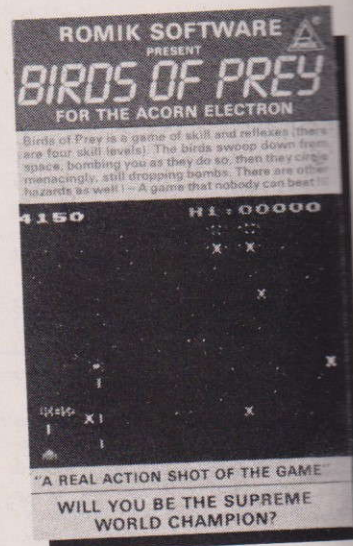
The game has been put together in a professional manner. The graphics are of a reasonable standard, with good layout and use of colour. There is also good use of sound. The only two disappointments that I have are that there is no top ten scores page, which I feel will detract from game, and that there is no choice for the use of joy-sticks. But despite this, I had quite a lot of fun playing the game.

## Ratings Table:

SOUNDS	80%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	80%

**Title:** Birds of Prey  
**Publisher:** Romik  
**Machine:** Model B  
**Price:** £7.95

When I first saw the cover of the cassette for "Birds of Prey," I thought "Oh no, not another Pseudo Galaxians Space Invaders Blow 'em all to Kingdom



Come game!" Then I saw the top of the cassette insert — Model A or B. For some reason or other, I have had something against software which works on both the A and B Models of the Beeb. I think that it's because the first game I ever bought (back in the good old days of OS 0.1) was not worth the price of the cassette, and that was for both models. Still, I put the tape into my cassette recorder, and sat back while I waited for the thing to load. Nothing. The computer went from stem to stern of the tape without even a "Data?". Undeterred, I got a different cassette recorder, and the game went in first time. This just shows how temperamental some recorders are.

First of all, the computer loaded the instructions program, which just reminded you of the instructions that were printed in the cassette insert. It describes the different types of alien in the game, and tells you the number of points scored for each type. The alien line-up consists of the Swoopers, who fly in circles below the main body of aliens, the Kamikaze birds, who dive bomb you (and if they miss keep trying to hit you) and the death bombs, which, if not shot by the time they reach the bottom of the screen, knock one of your precious lives off. Then, the main program is loaded. If you haven't





got a set of joysticks, this is the game to make you buy some, as the choice of keys is horrendous. You move left and right with "A" and "D" respectively, and fire with "S", the key between "A" and "D". This is fine if you like to drink coffee while you are playing — you can dispense with the straw, but I found that the choice of keys extremely poor, and there was no facility to change them. There are 10 skill levels in the game, ranging from "easy" to "horrendous". The later lives up to its name, and the graphics are very fast. The sound is average, and the use of colour is limited by the fact that the program uses mode 5, to enable it to fit into a model A.

To sum up then, I was proved wrong about model A software. The game was fast and enjoyable, and the game is one of the few that is improved by the use of joysticks. All in all, I would recommend this game to all those shoot 'em up vidiots who want a change.

#### Ratings Table:

SOUNDS	75%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	75%

**Title:** Plankwalk  
**Publisher:** Virgin Games  
**Machine:** Model B  
**Price:** £7.95

Plankwalk is a game written in BASIC. It is LISTable, and therefore looks rather unprofessional. The game itself is original, and is quite good fun to play.

The cassette contains two programs: A loader which prints the Virgin games Logo in superb high resolution graphics, and the game itself which is CHAINED by the loader. Neither the loader nor the main program would convert to disc (the loader was written mainly in machine code, and the game was too long as it used a high resolution graphics mode: even setting PAGE to &1100 was no use).

When the game is first run, you are introduced to the objects you will meet in the game, and

you are shown the little man you control. He is a little stick man (how unoriginal!), and is called "Sid"! You are given the choice of selecting levels 1-4, and then the game begins.

When the game starts, Sid has to walk left and right along planks, which are forever scrolling up the screen. Sid can jump off the end of the planks, and he drops down the screen either on to another plank, or, to his doom at the bottom of the screen. These planks sometimes have cherries on them (which look as though they have come straight out of Pac-man) which can be walked over in Donkey Kong style to gain extra points. Little white blocks also have extra points in store, but you have to fall through these. A little black monster (which looks uncannily like a Space Invader) chases Sid over the planks, and, like Sid, the monster can be killed by hitting the top of the screen or the edge. While you are playing the game, there is a terrible sound of blips, bangs and crashes, worthy of a building site. It drives you MAD! As if you haven't got enough on your plate without somebody hammering a drum kit while you are playing. However, this can be turned off by typing \*FX 210,255 before loading the game.

To conclude, Plankwalk is an original game, but with all the items borrowed (?) from other arcade favourites, I expect the next game from this author will be written from jail, as he'll be "doing time" for breach of copyright. The continual barrage of sound is enough to drive you to the BREAK key, and the graphics are quite jerky as they are called from BASIC. However, the game makes a welcome change from the usual, and is quite good fun to play.

#### Ratings Table:

GRAPHICS	60%
DOCUMENTATION	85%
VALUE FOR MONEY	70%
OVERALL	70%

**Title:** Noc-a-Bloc  
**Publisher:** Virgin Games  
**Machine:** Model B  
**Price:** £7.95

Noc-a-bloc is a version of the arcade game Pengo. Some of the characters have been changed, but the principle remains the same.

You control a big, fat, red, lanky-legged bird by using keyboard or joysticks, and you move it around a maze formed from boxes (or blocs!). He is chased by bug-eyed monsters, called Splods, who kill him if they catch up with him. The bird (who really deserves a name, but is not given one in the instructions — more imagination, please, Virgin!) has the ability to noc the blocs (!) around the screen, thus changing the maze. These blocks stop only when they hit another block or a wall. Using this facility, you can squash the nasties by sandwiching them between blocks and walls. If movement in the direction in which the block is pushed is prevented by another block or a wall, the block disintegrates, and the bird gets a double hernia. If the bird tries to push a wall (?) the wall turns yellow, and any nasties by the wall are stunned for a few seconds enabling the bird to gobble them up.

Also featuring in the game are three blocks with stars on them. These have to be manoeuvred around the screen, and placed in a row. This gives the player bonus points as follows: If the blocks are along one of the edges: 5000 points. If the blocks are away from the edges: 10000 points.

When you have killed all the Splods from one game, you then get bonus points depending on how long you took. You then get another screen, with another Splod to kill, although there are only ever four Splods chasing you at any one time. You get a

bonus man at 50,000 points, if you ever survive that long.

Noc-a-bloc is written in machine code, and so the quality of the graphics is very good. The sound effects are above average, and there is a very good use of colour throughout. The instructions supplied with the game were written on the cassette insert, and were of better quality than most. All in all, this game is good value for money.

#### Ratings Table:

SOUNDS	70%
GRAPHICS	85%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	80%



**Title:** Transistors' Revenge  
**Publisher:** Softspot  
**Machine:** Model B  
**Price:** £6.95

Transistors' Revenge by SOFT-SPOT is a game based inside the computer. Your Beeb is under attack from eight different components such as resistor, transistors (of course), l.e.d.'s, fuses not to mention the tools! It's your job to protect your C.P.U. against these meanies who are trying to overthrow the C.P.U. and control the computer themselves. Your only chance to pre-

**CONTINUED OVER**



vent this is to fire electrical impulses down the C.P.U.'s data lines.

After every four attacks a trickier pattern appears to make things more difficult. At the start of each game you're awarded three pointers, and an extra life at 50,000. At the end of the game (which is when the components successfully enter and overthrow the C.P.U.) you're given the option to either continue or start again from the beginning. Each component is worth 100 points and a bonus of 500 points is given if one of the tools is destroyed. If you're struggling to defend your C.P.U. you may use your ZAP. This will destroy everything on the screen. Once the ZAP is used you must wait 30 seconds for the ZAP to recharge.

The graphics aren't breath taking but are well used. The screen display is set out with the C.P.U. sitting proudly in the middle. Sixteen thin data lines cover the screen with the meanies travelling at various speeds along the data lines. At the bottom of the screen you're given the score, level, ZAP's and how many meanies are left.

The game itself is well thought out but unfortunately there's not much skill involved in massacring the meanies and after a short time, it becomes dull and boring.

#### Ratings Table:

SOUNDS	45%
GRAPHICS	60%
DOCUMENTATION	65%
VALUE FOR MONEY	40%
OVERALL	40%

<b>Title:</b>	<b>The Kingdom of Klein</b>
<b>Publisher:</b>	<b>Epic</b>
<b>Machine:</b>	<b>Model B/ Electron</b>
<b>Price:</b>	<b>£7.95</b>

This is number three in Epic's new BBC 32K adventure series. It will also run on an Electron. Disc users will be glad to know that, as the program is only 25K! it can be loaded from disc. The idea of the game is to find the Magic Klein bottle, which has

been stolen from its pedestal in the king's castle by the "wicked witch of the mountain." She swore that anyone (this means you) who was foolish enough to recover it would be cursed for ever. Basically, she's got to go. Once she is destroyed, you are relatively free to finish the adventure.

The loading consists of three parts, the title, the instructions (pretty good) and the &60 blocks of program code.

You begin in the palace. You can see the pedestal in one corner; it is empty. After a short wander, you may find stables and a needle. Not all objects appear to be useful at first. There is a bible, a safe not too far away, and a little hut by a lake.

Having crossed the lake, you will find a mountain and a dangerous pile of rocks and . . . well play it yourself.

If you wish to cheat, look at the ASCII values from &2C80 to &2D30. Yes well . . .

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	65%
VALUE FOR MONEY	70%
OVERALL	85%

<b>Title:</b>	<b>Pool</b>
<b>Publisher:</b>	<b>Dynabyte Software</b>
<b>Machine:</b>	<b>Model B/ Electron</b>
<b>Price:</b>	<b>£7.95</b>

Fancy a machine code game of pool in Mode 1? It's not quite the same as an evening on the table at the pub but this game by Dynabyte is a very fair representation of the bar-room game. The choice of Mode 1 means that we get high resolution but only four colours including green for the table and red (filled and unfilled) for the balls. The movement of the balls is smooth and accurate. You don't get the impression that the pockets are attracting the balls like black holes as you do in some games. You have to hit the target or no deal.

The game allows for two players with two sets of keys on the bottom two rows of the keyboard. The direction and



force of shot are controlled, as in Acornsoft snooker, with a graphics cue which is manipulated into position and lined up before taking the plunge.

While loading, the program actually plays a fairly good version of the 'Entertainer' and lists two full screens of instructions (not on the Electron). There are also some nice sounding clicks for colliding balls, although these are by no means realistic and a sorrowful groan when you inevitably pot an opponents ball or forfeit a free shot in some other fashion. This is not a full version of pool and some may find the smaller number of balls detracts from the game but in general it is possible to enjoy a little hustling in front of the television.

#### Ratings Table:

SOUNDS	95%
GRAPHICS	90%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	85%

<b>Title:</b>	<b>Simonsoft Sprites</b>
<b>Publisher:</b>	<b>Simonsoft</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£10.95</b>

This utility package allows a programmer to define multicoloured characters or sprites, and move them around the screen at speed with ease.

Usually one's BASIC programs are slowed down by printing characters on the screen using VDU calls. A sprite is printed using direct screen addressing and is much faster. Also, one can define the colour of individual pixels within the sprite and obtain much finer detail than with VDU 23, without having to resort to colour overlaying. 'SIMONSOFT SPRITES' consists of a character

definition program, a machine code routine which controls sprite movement, a very comprehensive 12-page manual, and a demonstration game.

On entering the program, you can either define a single sprite or a block of sprites. A grid system is used, and by using the cursor keys one can build the sprite using any of the 16 MODE 2 colours. The character is displayed simultaneously. A left and right image can be defined for each sprite which, if they are different, will give automatic animation when the sprite is moved horizontally. Other methods of animation are also described. There are 12 single sprites which can be defined in this way, each of which can have three 'clones' giving a total of 48 sprites.

Having defined the sprites, one has memory between &1400 and &3000 to write a BASIC program in: the program must run in MODE 2. Each sprite has two variables ascribed to it into which one puts its screen coordinates e.g. A% = 500; B% = 700. To move a sprite one puts the sprite identification number into the variable Y% and accesses the machine code movement routine with CALL Z%. The sprite is automatically erased from its old position and placed in its new one, EORing with anything else on the screen (so with manipulation of the colour palette one can make the sprites move behind or in front of objects). Screen boundaries are automatically crossed (not always something you may want) and all sprites including clones can be individually moved, removed, or replaced.

The speed at which the sprites can travel is truly amazing. Moving the most complex shapes is no problem, and I found it easier to write movement procedures using the sprite routine than by well-tried other methods.

The manual is excellently clear giving many examples, and taking one easily and slowly through the possibilities of the program.

The only major drawback I can see is that I can't effectively list my latest game for you to see



how well this package works, since the character definitions are hidden away somewhere in my machine!

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	90%

**Title:** Kamikazi  
**Publisher:** A&F Software  
**Machine:** Electron  
**Price:** £7.90

Kamikazi (box), Kamikaze (screen title) or Kamie (file name) is one of the new breed of Electron games. You perform the role of a ship's gunner blasting away at waves of aircraft which break off from the ranks and dive galaxian style at your gun base. The planes are not very good at chasing you and merely hold their diagonal course (Kamikaze style I suppose).

You don't have to destroy all the aircraft to move onto the next stages which involves helicopters and bombers which you have to shoot down more than once. Bullets freeze in mid air when they hit each other and it is fairly easy to dodge oncoming bullets since the whole display movement slows down somewhat when you move your base to the side. This means that you have to be more careful about running into bullets from the side than being hit head on. When bullets freeze at the end of a screen they do not disappear from the display but continue on their way as soon as the next screen begins. Hard luck if you happen to be in the way.

Similarly unlucky is the way your base can get stuck beneath an attacking aircraft (usually in the left hand corner of the screen) at the end of a screen. Your three lives don't count for much in this situation. You may as well press Escape and return to the choice screen. This use of Escape is nowhere documented and this could prove frustrating to those new to such games and unaware of some of the conventions of games programming.

There is an attractive high score table which scrolls up the



screen. Whether you get to put your name on it is a different matter. The right handed key option is Z, X, Return. Obviously as the 'Game Over' message appears you are still blasting away on the fire button, which is Return. Since A&F have not bothered to clear the keyboard buffer you go shooting through to the hi-score table but without the chance to enter your name. We then get the message 'Ready to try again'. The slightest touch of the keyboard, even a N for 'no thanks', gives you another game.

The options screen gives you the choice of left or right handed combinations of keys and a Slow/Fast option. There are a few features which detract from the overall value of the game but it is fun to play, colourful and noisy. I think I could sit happily in front of Kamikaze for a number of hours but a more professional attention to detail is to be expected from an established company.

#### Ratings Table:

SOUNDS	70%
GRAPHICS	65%
DOCUMENTATION	50%
VALUE FOR MONEY	60%
OVERALL	65%

**Title:** Abyss  
**Publisher:** Cases Computer Simulations  
**Machine:** Model B, Electron  
**Price:** £6.95

Imagine a rickety bridge with a lattice of walkways criss-crossing a terrible abyss. Each point of intersection reveals a test to pass, with failure resulting in death, the tests being a mixture of action, mental or aptitude tests. Perhaps it is merely coincidence or maybe the author has a superstitious streak, for there are thirteen such

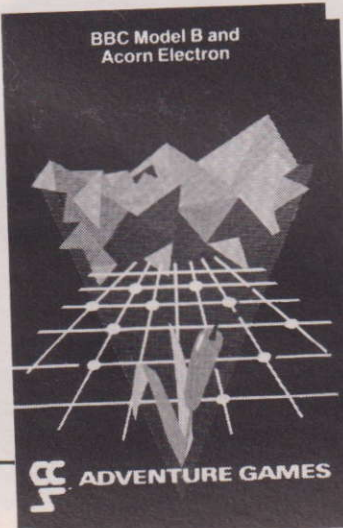
problems stored within the program, and these appear totally at random. The cassette claims that the tests include 'arcade games', but I've seldom seen the term used so loosely, for none would stand comparison with even the most modest such game.

The majority of the tests would be well within the capabilities of most children, although the speed of reading required is occasionally rather fast. In most cases, only a moderate level of thought and/or speed is required but the level of excitement is correspondingly low. The graphics and sound are rudimentary, a pity in a game designed for such a sophisticated machine. Whether an adult would find the game at all interesting is a matter of some doubt to me.

The only game I found at all challenging was one encountered at a pair of Obsidian(!) doors. On these are written a series of numbers, and the adventurer has to enter the next number in the sequence. Hardly stimulating, I hear you shout, but it's better than most of the others! No, this tape is pretty simple fodder which is not even particularly well programmed. There are a couple of errors in spelling and grammar, and the whole gives the impression of a pretty poor package.

#### Ratings Table:

SOUNDS	40%
GRAPHICS	25%
DOCUMENTATION	30%
VALUE FOR MONEY	40%
OVERALL	35%



**Title:** Vocab Tester  
**Publisher:** Beebugsoft  
**Machine:** Model B  
**Price:** £10.00 cassette, £12.00 disc

The Vocab Tester is the obvious solution to the restrictions placed on the user of a language program designed around a specific language. The tester comes with a starting vocabulary of 300 words in French, German, Spanish, Italian and English but the number of entries in any language is restricted only by your ability to type in entries from the dictionary.

Setting up new vocabularies is merely a typing exercise and once the files have been created, they can be SAVED to tape and LOADED back by answering a couple of simple prompts and typing in a file name. The vocabulary at present in memory can be searched, listed and changed by straightforward selection from the menus. When setting up tape files, don't forget to make accurate records of where the date is being recorded.

The function keys are set up to produce some of the European characters (mainly accents) which will be required, but if your interest is Russian or Greek, you may need a more specialist program. The Tester however is not protected and some minor modifications might allow its use with less conventional languages.

In all, the Vocab Tester does its job efficiently with clear displays and sensible prompts. Its all purpose nature does not allow for any human weakness in the actual language being tested and this could be discouraging for children. Testing is allowed in either of the two languages current in memory or in combination. Thus it offers just the sort of facilities you might need for learning this year's holiday vocabulary.

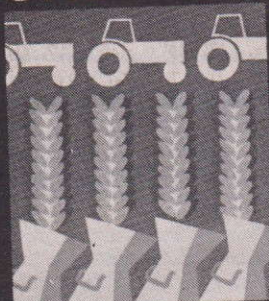
#### Ratings Table:

SOUNDS	40%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	65%

CONTINUED OVER



# CORN CROPPER



ACORN ELECTRON  
STRATEGY GAMES

**Title:** Corn Cropper  
**Publisher:** Cases Computer Simulations  
**Machine:** Model B, Electron  
**Price:** £6.95

Corn Cropper, long a best-seller on the Spectrum has now been modified to run on the Electron. This is perhaps rather a mixed blessing. It is true that the game is tried and tested already, with any bugs adapted as necessary. Yet their conversion from the rather untidy Sinclair BASIC still leaves a programming style which lacks the tight structured look that Acorn BASIC allows. A glance through the listing will reveal several dubious habits! In addition, the conversion seems to have been made via a BBC, and there is a call to Mode 7 here.

These minor criticisms aside, the simulation provides a challenging, stimulating change to zapping PacInvaders as they hop across main roads on their way to Mario's scaffolding! Your working capital of £100,000 bound up in the wheat within a period of time determined by the level of difficulty. Each month the weather forecast is presented (and we all know how reliable they are!), along with information on the state of your crops and your bank balance. Three commands from the menu can also be input each month, and these might for instance be to hire extra farmhands, buy seeds and to plant a certain number of acres. There are of course natural hazards to upset all your plans, and I found myself facing drought, frost, rats and insects to add to those problems which were of my own making.

It is an interesting game which can best be tackled slowly and steadily, although eventual success is not easy to attain. I especially liked the theme tune of the Archers, but otherwise I found the sound to be gimmicky and distracting, so I was glad to see the invitation to turn the sound effects off. There are some limited graphics, mostly included on the farm map, which are useful guides to quick recognition of the current state of affairs. The colours of the machine are used to good effect, and the program is well recommended. Also available for the BBC Model B.

## Ratings Table:

SOUNDS	50%
GRAPHICS	70%
DOCUMENTATION	70%
VALUE FOR MONEY	80%
EDUCATIONAL VALUE	80%
OVERALL	80%

**Title:** Airline  
**Publisher:** Cases Computer Simulations  
**Machine:** Model B, Electron  
**Price:** £6.95

In the days of pre-history (pre-computers that is), the number of us who could run our own airline to challenge British Airways was somewhat limited. Now, thanks to C.C.S. Electron and BBC owners may fly their machines into battle! You take the role of Chairman of L-AIR, with capital of £3M and seven years to take

over B.A. (if you last that long). It really is a strange feeling to make a profit or loss running into tens of millions of pounds each year, with adrenalin levels running high.

Decisions to be made each year include chartering aircraft, or perhaps buying to build up your own fleet, and employing enough people to run the line efficiently. There are unexpected troubles ranging from hijacks to strikes over tea breaks, although suitable insurance cover can cushion the financial blow of some of these events. The necessary information is clearly presented in graphical or written form, with a superb implementation of a video-printer used for newflashes.

This may sound a little finicky, but I do not like to find spelling mistakes in commercially produced software, and Julian Jiggins should have checked *procede* and *unservable*. Leaving this small point aside, Airline is a good simulation requiring luck, planning and shrewd hunches to reach the necessary thirty million pounds. I commend this tape to anyone wishing to exercise their brain rather than fingers, or indeed to anyone wishing to show the power of the Electron for rapid and accurate use of data.

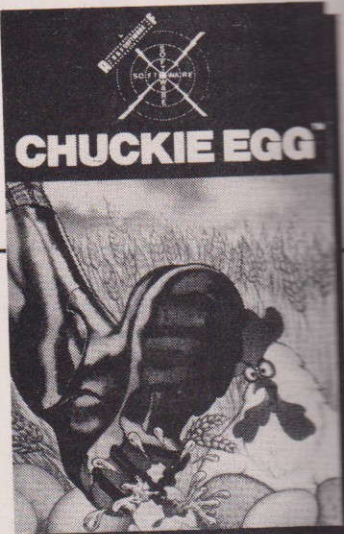
## Ratings Table:

SOUNDS	70%
GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	70%

**Title:** Chuckie Egg  
**Publisher:** A&F  
**Machine:** Model B  
**Price:** £8.00

Chuckie Egg is something of a poor man's cross between Program Power's 'Killer Gorilla' and Acornsoft's 'Monsters'.

The object of the game is to climb ladders and clamber across brick walls in the attempt to collect a dozen eggs which are individually spaced around the screen. On your trail are some hostile ostriches, out to peck you into submission. These look quite impressive as they strut loftily



about the place searching for food, piles of which are to be found near to the eggs. If they find these comestibles, they bend their heads and swallow it down: all very neatly depicted.

Meanwhile, as your rotund figure works his way through the task at hand, he discovers various features, some of which are borrowed from Chuckie Egg's aforementioned ancestors. Gaps in the walls are not too much of a surprise but one cannot help chuckling when the elevators appear third time through, (the procedure and the screen appearance are unchanged from one screen to the next.) These, unfortunately resemble yellow bats (animals, not cricketing apparatus) rather than the intended object.

Despite their optical peculiarities, it is the elevators that provide most of the problems — and this is as far as I got.

So that I do not convey a totally bleak picture of this game, I ought to highlight a few of its good features.

Firstly, there is the facility to define your own movement keys — this really should be part of any game, for it takes so little trouble to implement it. Particularly impressive is what occurs when you jump off a wall. Instead of falling dead immediately, you may move down to a lower level and continue. As well as this, it is possible to rebound yourself off the side of walls and even to bounce off the edge of elevators in order to attain your desired position. This, complete with no less than a four player option, completes a trio of novel features that greatly improve the playability of the game.

In concluding, I feel that the course taken by this review is quite a typical sequence of reac-





tions to this game. At first it appears to be old territory re-visited but as proceedings get more familiar, it grows on you and establishes itself as quite a good program in its own right.

#### Ratings Table:

SOUNDS	45%
GRAPHICS	65%
DOCUMENTATION	45%
VALUE FOR MONEY	50%
OVERALL	60%

<b>Title:</b>	<b>Daredevil Dennis</b>
<b>Publisher:</b>	<b>Visions</b>
<b>Machine:</b>	<b>BBC/Electron</b>
<b>Price:</b>	<b>£7.95</b>

Daredevil Dennis is a variably talented but unshakeable stunt bike rider who makes a living from stunt riding Evil Knieval style. This game gives you the chance to control Dennis's fate on the film set. There are three 'takes' and Dennis depends on your skill to successfully complete the increasingly difficult stunts and avoid the dreaded 'You are fired' message.

The first few screens are fairly straightforward and give you a chance to get used to the controls of whichever mode of transport Dennis happens to be employing this time. It could be a motorbike, waterbike or even skis. Dennis has to perform feats of daring like leaping over houses, avoiding ambulances, snowballs and helicopters, as well as a jolly looking spider who hangs about at the

end of the screen. The Shift key is used to accelerate Dennis and the Space Bar sends him leaping into the air. Return brings about a rather shocking halt to proceedings.

As Dennis progresses past the initial dangers of bumping into yachts or snowmen he comes up against an increasing number of objects and holes in his path, plus some extremely awkward and light footed policemen, who float up and down and make any sort of progression painfully difficult. This part of the game teaches you some more subtle techniques, like stopping in mid air, than the earlier hell for leather dashes to the end of a screen.

The graphics are smoothish and the game colourful. The sounds for bikes, boats and skis are also very attractive if not wholly realistic. Daredevil Dennis himself does a wonderful dive over the handlebars and kicks his feet in the air when toppled off his transport for the nth time. Like the comic original, he's a game character. And you have got to keep playing unless you pull the plug because even CTRL BREAK has been disabled.

#### Ratings Table:

SOUNDS	80%
GRAPHICS	90%
DOCUMENTATION	75%
VALUE FOR MONEY	80%
OVERALL	85%

<b>Title:</b>	<b>Castle Frankenstein</b>
<b>Publisher:</b>	<b>Epic</b>
<b>Machine:</b>	<b>Model B/ Electron</b>
<b>Price:</b>	<b>£7.95</b>

This is the first adventure in the Epic trilogy of Beeb and Electron games. Like both the other two, it needs 32K in BBC form, but can be used on a disc system. There is a save status facility which is fairly quick even on cassette. The adventure has 230 locations and a full description can be given because compressed code has been used.

The idea is to explore the ruins of Castle Frankenstein, in order to find and destroy the monster which he has created. It

is 20 years since the monster was last seen or heard of. A series of gruesome murders have recently taken place which are as yet unsolved. The people of the village believe that the monster is on the loose, even though it was thought to have been destroyed in a fire. Of course, you are the chosen one to end all the trouble that has been caused. You will have to explore secret passages, sulphur pits and dark tunnels to find the Monster.

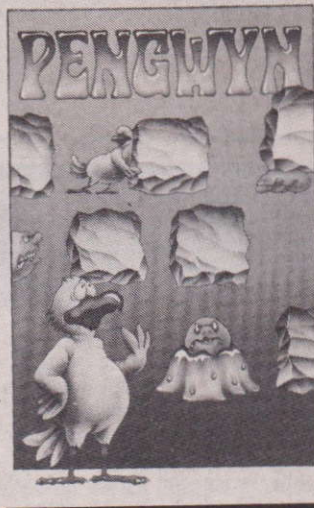
You are placed in an inn. Nearby is a shop but first some money may be useful. You can buy a map or a sword. In the woods, I've found a log cabin with some paraffin in it but as yet no lamp. As you can see, the game is good fun to play and quite entertaining. You may even find yourself dropping off at the computer in your attempts to make good.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	75%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title:</b>	<b>Pengwyn</b>
<b>Publisher:</b>	<b>Postern</b>
<b>Machine:</b>	<b>Model B/Electron</b>
<b>Price:</b>	<b>£6.95</b>

Not a spelling mistake but a cute little creature from Antarctica. The game is set somewhere near Pengwyn's abode amidst ice and snow. Scattered throughout a maze of ice-blocks are three multi-coloured, flashing squares. At a touch of the Return key, Pengwyn can push these blocks around the screen in pursuit of his aim which is to line them up in a row. If he touches an ice-block, he does not suffer frost-bite but instead melts the block in question. If you think it sounds easy, you've reckoned without the two rather bulbous blobs which masquerade under the title, 'monsters'. These are extremely speedy across the ground and have a tendency to devour the poor bird before he's even had a chance to plan his strategy (at least that's what happened in my games). The monsters can also



plough their way through the blocks and can only be destroyed if struck by a moving block, propelled by Pengwyn.

The whole proceedings are very similar to those in PSION'S 'Saloon Sally'. However, this program has none of the special features nor the appeal of its predecessor. The main reason for the lack of playability is that it is almost impossible to avoid being snared by the monsters within ten seconds of the commencement of the game — they home in on you and leave you with little chance. Hence, the manoeuvring of the blocks scarcely enters the game and thoughts of actually posting them in a line are no more than optimistic speculation.

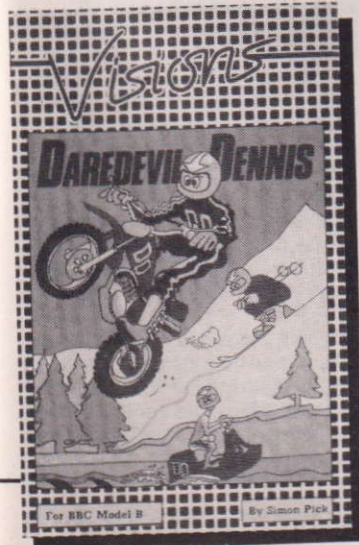
The Graphics used in the program are fairly ordinary apart from Pengwyn who is nicely created although the choice of red to colour him is baffling, the white ice blocks have tiny patches of cyan in the corner to create a gleam but this effect is hardly convincing.

Overall, a most disappointing game; a great pity to, for with a little more work and effort, Pengwyn would have captured the hearts of BBC owners in much the same way as the hero of Psion's 'Hungry Horace' enraptured Spectrum games players.

#### Ratings Table:

SOUNDS	50%
GRAPHICS	65%
DOCUMENTATION	55%
VALUE FOR MONEY	55%
OVERALL	55%

CONTINUED OVER





<b>Title</b>	<b>Laser Command</b>
<b>Publisher</b>	<b>Program Power</b>
<b>Machine</b>	<b>Model B, Electron</b>
<b>Price</b>	<b>£7.95</b>

Laser Command is a very good version of the Missile Command arcade game. When the program has been loaded, there are many options to be set. These are: one or two players, skill level, type of bombs, a special "page mode" that waits until you are ready, spaceships, joystick/keyboard control, and full or half speed. This last option appears to be undocumented. Once you have selected your options, the game begins. Control of your sight is using joysticks or W, E, O, P on the keyboard; DELETE fires a missile; N and V lay and detonate mines. You can even store the mine pattern using f0 - f9! This is a very powerful function. You may also pause using Shift.

The idea of the game is to defend six cities. To do this, you have a missile dump and a sight. You position the sight to fire at bombs falling from the sky. If your laser base is hit, then you lose ten missiles. Worse than that, you must wait until it is rebuilt before you can fire again. Every 10,000 points you score you are awarded a bonus city to defend. The game ends when all your cities are destroyed. There is no hi-score table in this game.

The graphics are fairly good, but then again there are not opportunities to show off the good graphics of the Beeb in this sort of game. A medium resolution has been used as this is ample, although there are some quite violent colour clashes at times.

Also good is the sound quality. There is not a very wide variety of sounds, but those included are different if not completely original.

The instructions are adequate as little explanation is really necessary in this game. You are told of (nearly) all the options and even how to load the program (not standard).

Altogether it is a good game.

#### Ratings Table:

GRAPHICS	70%
SOUNDS	65%
DOCUMENTATION	70%
VALUE FOR MONEY	75%
OVERALL	70%

<b>Title</b>	<b>Killer Gorilla</b>
<b>Publisher</b>	<b>Program Power</b>
<b>Machine</b>	<b>Model B, Electron</b>
<b>Price</b>	<b>£7.95</b>

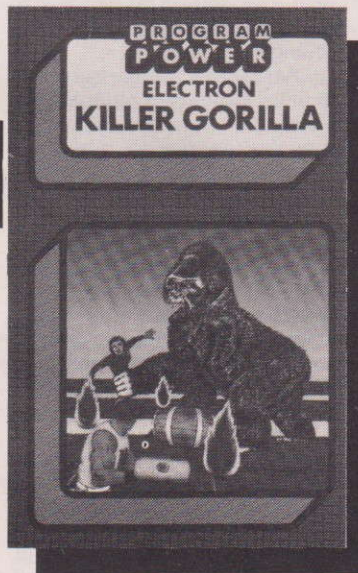
Killer Gorilla is an excellent version of the arcade game "Donkey Kong" by Nintendo. The idea of the game is to help Mario (the hero) to save his girlfriend who is being held by a mean-looking gorilla before his bonus runs out. To do this he must negotiate iron beams, ladders and lifts, and jump over barrels thrown from the top of the screen by the gorilla. Fireballs also appear from time to time.

There are four sections to the game. In each section except the third, there is a hammer with limited life. If Mario jumps and gets it he may smash the barrels, fireballs, etc., but not climb or descend. Once the hammer has disappeared from his hand he is free to climb and jump again.

The first section has just ladders and iron beams, fireballs and barrels. When Mario has completed this he goes on to the next section. This has three conveyor belts as well as the stationary beams. There are no barrels here, but the fireballs are still around, as are what look like bowls of custard. Also in this and the next two sections are bonus objects which are worth between 300 and 900 points if Mario runs over them or hits them with the hammer.

The third section provides more of a challenge. As well as the fireball problem, there are no proper walkways, just lumps of iron and the odd ladder. You have to be very precise in moving and jumping to get across. Also there are two lifts which you have to use. Add to this the iron bars that keep falling, and this section is really quite hard to master.

The fourth and final section is the hardest. There are five parallel girders with connecting



ladders. Four of them have two yellow blocks which must all be knocked out. To do this, Mario has to run over them. There are a lot of fireballs in this section! Upon completion of the fourth section the game starts all over again, this time on the next skill level which has even more hazards, e.g. holes in the ironwork, faster conveyor belts, etc.

The game's graphics are absolutely superb. Much care and time has gone into the visual side of the game. It really has to be seen to be believed. The girl and Mario are both realistic, the ape is almost perfect, and the girl's heart even breaks when the ape comes to get her at the end of each section.

The sound is also far above average; there are four tunes and many good effects.

You may use either keys or joysticks for this game. It really is excellent, and full credit must go to the person who wrote it.

#### Ratings Table:

GRAPHICS	95%
SOUNDS	80%
DOCUMENTATION	85%
VALUE FOR MONEY	90%
OVERALL	95%

<b>Title</b>	<b>Five mind bending programs for the BBC model B</b>
<b>Publisher</b>	<b>Ganymede Systems Ltd.</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>Disc £11.95 Cassette £9.95</b>

The first of the five programs on this package is the SLIDING BLOCKS PUZZLE, a slant on the little games we used to get in christmas crackers. The idea is to rearrange a jumble of letters into some sort of order, but this can only be achieved by sliding one block at a time within a framework.

You have the option to choose the size of the block, ranging from a 3x3 block up to a 6x6 block. After this you can instruct the computer to shuffle the tiles any number of times, between the limits of 3 and 100. When completed, you then use the cursor control keys to shift the blocks about until they are in order, if you can not do it, and believe me that's not hard, by pressing the copy key, it will show you how to actually solve it!

With clever use of colour, and a clear screen layout, this program is very playable, and is something of a challenge, even on the small blocks with not many shifts!

The second program of the package is DRAUGHTS, now this is a game that I cannot for the life of me remember how to play properly, and I could not get any help from the program, as there were no instructions, a bit of a shame this as everyone can't know how to play it.

The game itself is laid out on a net red and black chequered board with a clear indication of whose pieces are whose. A very nice feature of the program, is that when a move is made, all the pieces concerned with that particular move, are 'flashed' on and off for a couple of seconds, so as there is no doubt as to what was moved.

Not being very good at the game, it is very difficult for me to judge the quality of the computer's play, however, it did seem to be very intelligent in its strategy, not allowing itself to fall



into many traps, and if it did, it recovered well and still went on to win by a comfortable margin.

Moves are entered by grid co-ordinates, the grid being marked in numbers and letters around the board, and are easy to enter, the computer not allowing you to enter an illegal move, and giving you another go.

All in all a very good game can be had with this program, and it does seem to be of a fairly high standard.

NOUGHTS & CROSSES is the favourite. The grid is a large blue framework drawn in the centre of the screen, and after you have chosen your marker (the noughts or the crosses) it asks you who is to go first.

Like draughts, the moves are entered by grid co-ordinates, entered at the keyboard. Once entered the shape is drawn in the box, it seems very easy to stop the program beating you, and at the first, and second levels of skill, it is not very hard to beat the computer quite convincingly, but at the hardest level, level three, to get a draw was average, but to beat it was quite hard, but for it to beat you, was quite rare. This one does not really live up to the package title, of mind bending.

Program four is the best on the tape, this is called MASTER-BRAIN, and is based on the code breaking game known as Mastermind.

The final program is called SIMON'S GAME, and, yes, you've guessed it, it's based on the game Simon!

The idea, for those who have been living in caves for the past six years, is that the screen is divided up into a number of different coloured blocks, each numbered, and the computer will flash a colour, with it will be a tone, and the idea is for you to mimic the computer. This goes on, and the number of colours and tone build up, and at the same time gets faster. This goes on until you can no longer keep up with the computer.

In addition to playing just you against the computer, you also have the option of playing the party game version, known as knockout, where up to 50 named players can play and are knocked

out as they can no longer keep up. The winner being the last player to still be playing.

This package seems to provide a 'thinking' game for the whole spectrum (Whoops! — sorry) of ages. For this alone it must be worth it if your BBC is a family item.

#### Ratings Table:

SOUND	60%
GRAPHICS	70%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	70%

<b>Title</b>	<b>3 Deep Space</b>
<b>Publisher</b>	<b>Postern</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

Although this game is a good one and the programming excellent, the talking point has to be the gimmick. With this game you get a pair of 3D spectacles so that you can zap the aliens in one more dimension than usual. By a clever combination of red, blue and magenta graphics, two dimensional images on the screen can appear to be two sets of superimposed pictures of one thing. With the 3D spectacles, the two images merge into one.

The awkward points are that the television must be finely tuned; you must sit exactly the right distance from the screen and at the right angle and you can't wear your own spectacles. The game itself involves shooting down oncoming waves of alien ships in time honoured fashion, with your ship not only moving up and down the screen and from right to left but also travelling at variable distances 'inside' the screen. Your gun can move up and down and in and out by using a sensible combination of keys (\*, ?, Z, and X).

The game is quite playable without 3D in the early stages because you can estimate the distance of the aliens by their size. However in the later stages the ships have 'image-distorters'. Roughly speaking this means that their size on screen does not change but the 3D representation does. You'll need the specs.

The sound is quite dramatic

and gives the necessary arcade flavour. It is a personal choice whether the 3D is a sufficiently exciting novelty. Essentially this is a conventional alien-blasting game.

#### Ratings Table:

GRAPHICS	80%
SOUNDS	80%
DOCUMENTATION	70%
VALUE FOR MONEY	75%
OVERALL	75%

<b>Title</b>	<b>Utilities</b>
<b>Publisher</b>	<b>Salamander</b>
<b>Machine</b>	<b>Software</b>
<b>Price</b>	<b>Model B</b>
	<b>£9.95</b>

Four excellent utilities in the Salamander package, especially if you are writing your own programs and if you have a Epson printer to document them with. Even if you are a more passive user of your BBC then playing with the Sound and Teletext programs should prove most enjoyable and the Disassembler interesting if not too informative to the untrained eye.

The documentation is excellent and includes a cassette index for you to fill in and a template for the function keys which are made use of in the Mode 7 Editor.

Sound Shaper is a fairly friendly sound creation device with two main sections, one devoted to the SOUND statement parameters, the other dealing with the 16 ENVELOPE parameters. In this latter section the graphical display is most helpful. The ENVELOPE ID is difficult to visualise without this sort of display. All the parameters are reviewed one by one, corrected or confirmed with Return. This makes small changes easy and quick to make. You can often do this while the sound chip is still carrying out the last set of instructions.

When the desired ENVELOPES have been established these can be called by the SOUND section. Once again, it is very easy to change or confirm the channel envelope, pitch and duration parameters. When selecting the Chords option, four

SOUND statements appear. The full hexadecimal form of the "C" parameter may be entered. The Epson screen dump is a multi-shade dump for pictures in any graphics mode. First of all it is essential to set up a text window to avoid the various messages that come on screen corrupting the picture you are dumping to the printer. After this, everything is straightforward. Various densities, invese and plotter modes are all simply selected, or confirmed by default. It is also possible to remove the picture around and change its height, width or overall size.

The teletext screen editor is an extremely useful piece of software and I can imagine a few title pages being drawn using it. The function keys access the different colours and flashing characters. Using the CTRL key with various others (D for double-height, G for graphics and so on) enables the various Mode 7 possibilities.

Naturally it remains necessary to insert a control code for each line of text but background colour is set simply with CTRL X. A graphics character menu is available, from which it is simple to locate and choose the character required. The ASCII code and appropriate keyboard character is given and it's surprising how easy it becomes to flick between screens, inserting and deleting characters. Combined with some previous planning on teletext graph paper, this program should make for quick and effective picture creation.

Most importantly there is a loading and saving routine for development purposes and instructions on how to use the pictures in your own programs.

The Disassembler is standard but quick. It allows examination of the complete memory address range, either using full 6502 mnemonics or in hexadecimal and ASCII format.

#### Ratings Table:

GRAPHICS	80%
SOUND	60%
DOCUMENTATION	90%
VALUE FOR MONEY	75%
OVERALL	85%



# Software Listings

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien destroying, treasure seeking, path-finding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions of the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC and Electron owners need despair no longer

## Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

— help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for these machines. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, whether it is for the BBC or the Electron, the company which produces it, the

form in which it is available, the supplier code and price; all are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business
Ut	Programming utility
Do	Domestic

Ed  
A  
B  
E  
C  
D()  
R

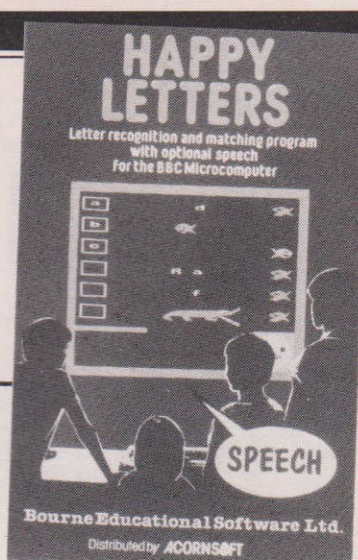
Educational  
Model A BBC  
Model B BBC  
Electron  
Cassette  
Disc (40 or 80)  
Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not assume that there is no such item as the one you are looking for, if it is not included in the following list. Remember that much BBC software is being converted for the Electron and to avoid disappointment it is best to wait for a specifically written program. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

### SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
ABC	Ed	Bryants	B C HW		£4.85
Abductor	Gm	Salamander	A,B C NZ		£7.95
ABM	Gm	Alligata	A,B C AG		£4.95
Action of the Heart	Ed	Garland Comp.	B C JX		£11.76
Accounting Ratios	Bs	Microplex	B C MP		£7.95
Accounts Receivable	Bs	Acornsoft	B D AL		£24.95
Accounts Payable	Bs	Acornsoft	B D AL		£24.95
Accurate	Ed	MP Software	B C,D		£11.00/ £14.00
Add-Tabs and Mul-Tabs	Ed	Cottage Soft	A,B C CT		£7.50
Ade	Ut	System	B C SY		£60.00
Adventure	Gm	Program Power	A,B,E C GK		£7.95
Adventure 1	Gm	Odyssey	B C OG		£4.50
Adventure 2	Gm	Odyssey	B C OG		£4.50
Adventure	Gm	Micro Power	B C GK		£6.95
Adventure	GM	Program Direct	B C NP		£5.99
Adventure Quest	Gm	Level 9 Computing	B C CU		£9.90
Adventure Quiz	Ed	Dial	B C,DL		£4.95, £6.50
Airline	Gm	Cases	B C CE		£6.95
Algebraic Manipulation	Ut	Acornsoft	B C AL,G		£9.95
Alien	Gm	FBC	B C FB		£6.00
Alien Break-in	Gm	Romik	B,E C RO		£6.99
Alien Destroyer	Gm	Beebug	B C BE		£7.50
Alien Destroyers	Gm	Program Power	B C GK		£7.95
Alienswirl	Gm	Amcom	B C AO		£5.95
Alien Swirl	Gm	Program Power	B C GK		£6.95
Airlift	Gm	Bug Byte	B C KP		£5.50
Allaboard	Ed	Arnold-Wheaton	B C AW		£9.95
Android Attack	Gm	Computer Concepts	B C GJ		+ VAT £7.80
Anagram	Ed	Ed.Soft	B C ES		£4.95
Angles Navigate	Ed	Primary Programs	B C PP		£3.95
Angle(4)	Ed	Chalksoft	B C KT		£6.95
Anglezap	Gm	Gem	B C GM		£7.50
Animal/Vegetable/Mineral	Ed	Bourne	B,E C BO		£8.97
Apollo	Gm	Software Invasion	B C IS		£6.95
Append It	Ut	Aztec S/W	B C IB		£3.00
Alien Dropout	Gm	Superior Software	B C SE		£7.95
All Fingers Go	Ed	NEC	B C NC		£14.95
Alpha	Ed	Golem	B C OB		£8.05
Alphachopper	Ed	Sulis	B C SU		£9.95
Alphabet	Ed	J B Software	B C JS		£4.95
Alphabeta	Bs	H and H Software	B C HH		£28.50
Android Attack	Gm	Computer Concepts	B C GJ		£8.95
Animated Arithmetic	Ed	Ludinski CAL	B C/ KA D		£6.50/ £7.50
Apocalypse	Gm	Red Shift	B C RS		£9.95
Arcadians	Gm	Acornsoft	B C AL		£9.95
Arcade Action	Gm	Acornsoft	B C GA		£11.90
Arcade 1	Gm	Odyssey	B C OG		£3.00
Arcade Games	Gm	Ganymede Systems	B C GY		£9.95
Area Radar Controller	Gm	Software For All	B C KN		£6.95
Arrow of Death (1)	Gm	Digital Fantasia	B C JT		£6.95
Arrow of Death (2)	Gm	Digital Fantasia	B C NT		£8.95
Asteroid Storm	Gm	Program Power	B,E C GK		£7.95
Asteroids/Frong	Gm	Aardvark Software	B C IU		£4.00
Asteroid Belt	Gm	Electronics Applied	B C IF		£11.50
Asteroid Belt	Gm	Computer Concepts	B C GJ		£7.80
Asteroid Miner	Gm	Optima	B C OP		£8.95
Astro Navigator	Gm	Micro Power	B C GK,		£6.95
Atlantis	Gm	IJK Software	B C IT		£6.95
Atomic Protector	Gm	Optima	B C OP		£8.95
Atom Smasher	Gm	Romik	B,E C RO		£6.99
Awari	Gm	Foikade	B C NR		£5.95
Backgammon	Ut	Bug Byte	B C BB		£8.00
Bailiff	Ed	Sulis	B C SU		£9.95
Balance Your Diet	Ed	Cambridge Micro	B C,D CM		£13.95 + £1.62
Ballard	Ed	Ed.Soft	B C ES		£3.00
Balloons	Gm	C J E Micros	B C NV		£6.00
Bandits at 3 O'Clock	Gm	Program Power	B,E C GK		£6.95
Barrage	Ed	Program Power	B C GK		£7.95
Base 10	Ed	Dial	B C,D DL		£4.95, £6.50
Basic Goodies	Ut	Simonsoft	A,B C MS		£5.95
Basic Maths	Ed	Aztec S/W	A,B C IB		£3.00
Basic Statistics	Bs	Micropak	B C MP		£7.95
Battlezone Six	Gm	Kansas	B C KA		£9.50
Battlezone 2000	Gm	Lothlorien	B C LO		£6.95
BBC Kaleidoscope	Ed	Dial	B C DL		£8.50
BBC Logo	Ed	Dial	B C,D DL		£6.50, £8.00
BBC Octuplet	Ed	Dial	B C DL		£8.50
Beebart	Ut	Quicksilva	B C QS		£14.95
Banner	Do	Micro-Aid	A,B C IZ		£2.95
Beeb-Chase	Gm	Database Software	B C NU		£7.50
Beebmunch	Gm	I.J.K. S/W	B C IJ		£5.95





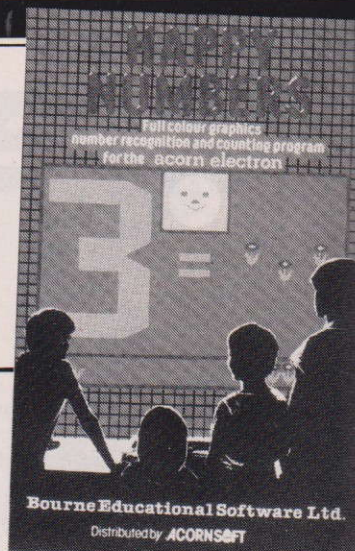
Beebtek	Gm	Software for All	A,B C KN	£7.95
Bells	Ed	Dial	B C,D DL	£4.95, £6.50
BEEP-BEEP	Gm	IJK	B C IJ	£3.95
Beep-Beeb (Super Simon)	Gm	IJK Software	B C IJ	£4.50
Beebcalc	Bs	Gemini	B C GM	£19.95
Beebmon	Ut	Program Power	A,B C GK	£7.95
Beebplot	Bs	Gemini	B C GM	£19.95
Beeboids	Gm	Odyssey	A,B C OG	£2.75
Beebon Mon	Ut	McKeran	A,B C MK	£2.00
Beebsynth	Ut	Clares	A,B C CL	£7.95
Beeb-Tote	Gm	Program Power	B C GK	£5.95
Beefearer	Ed	Sulis	B C SU	£7.95
Bertie Bear	Ed	Dial	B C,D DL	£4.95, £6.50
Besieged	Ed	Sulis	B C SU	£9.95
Beyond Basic	Ed	BBC/NEC	A,B C KB	£7.25
Billiards	Gm	H and H Software	B C HH	£8.50
Birds of Prey	Gm	Romik	B,E C RO	£6.99
Blackjack/Textpro	Gm	Software Invasion	B C IS	£6.95
Bomb Alley	Gm	Software Invasion	B C IS	£7.95
Bomber Scramble	Gm	Kansas	B C KA	£9.50
Bounce	Gm	Computercat	A,B C CC	£4.95
Bouncers	Gm	A&F	B C GE	£8.00
Bounty Pirates	Gm	Aztec S/W	A,B C IB	£5.50
Brain Teasers	Gm	Dynabyte	A,B C DB	£5.95
Break-Up	Gm	Miking S/W	B C KC	£3.95
Breakout	Gm	I.J.K. S/W	A,B C IJ	£3.95
Breakout	Gm	Bryants S/W	B C HW	£3.75
Brick 'em in	Gm	Software For All	B C KN	£6.95
Bridge to the East	Gm	Ixion	B C IN	£8.05
Bridgeman	Gm	Bridge S/W	B C KJ	£7.90
Budget	Bs	Micropax	B C MP	£7.95
Budget-Multiproduct	Bs	Micropax	B C MP	£12.95
Budget-Multiproduct	Bs	Micropax	B D MP	£25.00
Bug Bomb	Gm	Virgin Games	B C VG	£7.95
Business Game	Ed	Acornsoft	A,B C AL	£9.95
Bun Fun	Gm	Squirrel Software	A,B C SS	£6.50
Canyon	Gm	BBC Pubs	B C KB	£10.00
Capitals and Punctuation	Ed	RJE Software	A,B C RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	B C JX	£18.24
Carousel	Gm	Acornsoft	B C AL	£9.95
Car Race	Gm	Kingfisher	B C KF	£6.90
Cashbook Accounts	Bs	Gemini	B C GM	£59.95
Cashbook	Do	Micro-Aid	B C IZ	£5.95
Cashbook	Do	Micro-aid	A,B C IZ	£13.95
Cassette 99	Ed	Ludinski CAL	A,B C KA	£5.00
Castle of Riddles	Gm	Acornsoft	B C AL	£9.95
Catalog	Bs	Dialog	B C/ D DG	£19.50
Catalogue	Ut	Baksoft	A,B C BK	£4.00
Cat and Mouse	Ed	Kingfisher	A,B C KF	£6.90
Cat & Mouse	Gm	Micro Power	A,B C GK	£4.95
Catchapple	Ed	Kingfisher	A,B C KF	£6.90
Caveman Adventure	Gm	Program Power	B C GK	£6.95
Caves of Anoran	Gm	FBC Systems	B C FB	£7.00
Cells and Serpents/ Stockmarket	Gm	ASP Software	A,B C AS	£11.45
Cells & Serpent	Gm	Hexagon S/W	A,B C JA	£5.00
Centipede	Gm	Superior S/W	B C KH	£7.00
Cesil	Ed	Dial	B C,D DL	£6.50, £8.00
CESCIL	Ed	Eduquest	A,B C NW	£19.95
Centipede	Gm	Superior Software	B C SE	£7.95
Cesil Interpreter	Ed	Computersmith	B C LC	£15.00
Challenger	Gm	Joe the Liar	B C JL	£7.45
Character Shapemaker	Ut	Square	B C SQ	£7.00
Chargen	Ut	Busco	A,B C BU	£3.95
Chargen and Demo	Ut	Rainbow Research	B C RR	£8.50
Character Builder	Ut	Davensoft	A,B C NX	£4.95
Character Enlarger	Ut	Ratco Soft	A,B RA	£1.50

## SOFTWARE SUPPLIERS

Supplier Code		
AA	Anthony Aspitel Software Systems 56 London Road Harleston Norfolk IP20 9BZ	NU Database Software 97 Defoe Drive Park Hill Stoke-on-Trent
AB	ABC Primary 19 Crumstone Court Longmeadow Estate Killingworth Newcastle Upon Tyne	NV CJE Microcomputers 25 Henry Avenue Rustington West Sussex BN16 2PA
AD	Dial Software 72 Downend Road Downend Bristol	NW Eduquest Thames Avenue Windsor Berkshire SL4 1QP
AG	Superior Systems Ltd 178 West Street Sheffield W51 4ET	NX Davansoft 1 Delapoe Drive Haverfordwest Dyfed SA61 1HX
AJ	Molimex Ltd 1 Buckhurst Road Town Hall Square Bexhill-on-sea East Sussex	KA Kansas City Systems Unit 3 Sutton Springs Wood Chesterfield S44 5XF
AK	A.S.K. Ltd London House 68 Upper Richmond Road London SW15 2RP	KB BBC Publications British Broadcasting Corporation 35 Marylebone High Street London W1M 4AA
AL	Acornsoft Ltd 4a Market Hill Cambridge CB2 3NJ	KF Kingfisher Computer Services Durley Lane Keynsham Bristol BS18 2AQ
AM	Microplus Software 6 Litton Way Leeds	KH Superior Software 69 Leeds Road Bramhope Leeds
AO	Amcom 23 Hivings Hill Chesham Bucks HP5 2PG	KM Kosmos 1 Pilgrims Close Harlington Dunstable Bedfordshire LU5 6LX
AP	Processor Applications 22 Mercer Close Basingstoke Hants	KN Software for All 72 North Street Romford Essex
AS	ASP Software Number One Golden Square London W1R 3AB	KU Kudusoft 130 Main Street Tweedmouth Berwick-upon-Tweed TD15 2AW
AS	ASD Ltd 30 West End Launton Bicester Oxon	FB FBC Systems 10 Castlefields Main Centre Derby
AV	A J Vision Service Ltd 61 Jeddo Road London W12 9ED	FM 4MAT Educational Software Linden Lea Rock Park Barnstaple Devon EX32 9AQ
AW	Arnold-Wheaton Software Software Publishing Division Parkside Lane Leeds LS11 5TD	FY Wida Software 2 Nicholas Gardens London W5 5HY
NC	National Extension College 18 Brooklands Avenue Cambridge	GC Gem Software Unit D The Maltings Station Road Sawbridgeworth Herts
NP	Program Direct 37B New Cavendish Street London W1M 8JR	GD 70 Stoke Road Bletchley Milton Keynes
NR	Foilkade Dept PR14 66 Littledean Yate Bristol BS17 4UQ	GE A&F Software 83 Hyde Road Gorton Manchester M18 7JD
NT	Digital Fantasia 24 Norbreak Road Norbreck Blackpool	

CONTINUED OVER





# SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Character Orientating	Ut	Ratco Soft	A,B C RA		£1.50
Character Generator	Ut	MP S/W	B C JZ		£3.00
Character Generator	Ut	Software for All	B C KN		£4.95
Characters	Ut	Computer Concepts	A,B C GJ		£6.67
Characters & Envelope Definer	Ut	Electronics Applied	B C IF		£5.50
Chard	Ut	System	B C St		£9.00
Chargen	Ut	Odyssey	A,B C OG		£4.50
Chemical Analysis	Ed	Acornsoft	B C AL		£13.80
Chemical Collisions	Ed	Cambridge Micro	B D CM		£15.00
Chemical Simulations	Ed	Acornsoft	B C AL		£13.80
Chemical Structures	Ed	Acornsoft	B C AL		£13.80
Chemistry	Ed	Program Power	B,E C GK		£6.95
Chess	Gm	Program Power	A,B C GK		£5.95
Chess	Gm	Program Power	B,E C GK		£7.95
Chess	Gm	Acornsoft	B,E C AL		£9.95
Chess	Gm	Bug Byte	B C EA		£11.50
Children From Space	Ed	A.S.K.	B AK		£9.95
Childs Play Pack	Ed	Dial	B C,D DL		£6.50
CHI-Squared	Bs	Micropax	B C MP		£8.00
CHI-Squared, contingency tables	Bs	Micropax	B C MP		£7.95
Chords	Ed	Aztec	B C MP		£7.95
Christmas Carols	Do	Ega Beva	A,B C AZ		£6.50
Circus	Gm	Digital Fantasia	B C EB		£9.95
City Defense	Gm	Bug-Byte	B C NT		£8.95
Claws	Ed	Bryants S/W	B C BB		£7.50
Clone Ranger	Ut	J.C. Software	A,B C HW		£3.75
Cloze	Ed	GED Software	B D JS		£11.60
Cloze Procedure	Ed	Bryants S/W	B C GD		£4.50
Cobra / Robo-Swamp	Gm	Software for All	A,B C KN		£4.85
Cobra / Robo-Swamp	Gm	Software for All	B C KN		£6.95
Code Breaker	Gm	Program Power	A,B C GK		£6.95
Code-Breaker	Ed	RJE Software	A,B C RJ		£4.95
Collectors Catalogue	Do	Acornsoft	B C AL		£9.95
Code Race	Ut	Computer Concepts	B C GJ		£6.67
Colditz Adventure	Gm	Superior Software	B C SE		£7.95
Colossal Adventure	Gm	Level 9 Computing	B C CU		£9.90
Colour Snap	Ed	Ega Beva	B C EB		£11.95
Comatch	Ed	Clares	A,B C CL		£4.95
Commercial Accounts	Bs	Gemini	B C GM		£19.95
Community	Gm	Ixon	B C IX		£6.90
Compass	Ed	GED Software	B C GD		£4.50
Compendium	Gm	Computercat	B C CC		£5.95
Connect 4	Gm	Database Software	B C NU		£5.90
Constellation	Ed	Program Power	B C GK		£6.95
Contribution Analysis	BS	Micropax	B C MP		£7.95
Cookbook Wizardry	Do	Database Software	B C NU		£7.50
Corn Cropper	Gm	Cases	A,B,EC CE		£6.95
Corporate Climber	Gm	Dynabyte	B,E C DB		£7.95
Cosmic Asteroids	Gm	Alligata	B C AG		£4.95
Cosmic Fighters	Gm	Kansas	B C KA		£9.50
Coucapcur	Ed	Ed. Soft	B C ES		£4.95
Countdown to Doom	Gm	Acornsoft	B C AL		£9.95
Counting	Ed	Clares	A,B C CL		£4.95
County (SW/SM)	Ed	Bryants	A,B C HW		£4.85
Cowboy Shoot-out	Gm	Micro Power	B C GK		£5.95
Cranky	Ed	A.S.K.	B C AK		£9.95
Crazy Painter	Gm	Superior Software	B C SE		£7.95
Creative Graphics	Ut	Acornsoft	B,E C AL		£9.95
Cricket	Gm	SJG Soft	B C SJ		£7.50
Crime and Detection Quiz	Do	Acornsoft	B,E C AL		£12.65
Croaker	Gm	Program Power	B,E C GK		£9.95
Crocodiles	Ed	Bryants	A,B C HW		£4.85
Crossed Words	Ed	Aztec S/W	A,B C IB		£6.50
Crunch	Ed	Oxhey Tutors	B C OT		£6.50
C. Rules	Ed	Ed. Soft	B C ES		£5.95
Cube Master	Gm	Acornsoft	B C/AL		£9.95
Curse of the Middle	Gm	Merlin	B C MN		£7.95
Curve Stitch Planner	Do	Dial	B C,D DL		£4.95
Cut 'n' val	Ed	MP Software	B C,D MP		£6.50
Cybertron Mission	Gm	Micropower	B C		£14.50
Cylon Attack	Gm	A&F	B C GE		£17.50
Dallas	Gm	Cases	A,B,EC CE		£7.95
Danger! UXB	Gm	Program Power	B,E C GK		£8.00
Dare Devil Dennis	Gm	Visions	B C VI		£6.95
Database	Ut	Computercat	B C CC		£7.95
Database	Bs	Gemini	B C GM		£12.95
Data-Quiz	Ut	Bryants S/W	B C HW		£19.95
Database	Ut	R. H. Electronics	B C RH		£4.88
Database	Bs	Acornsoft	B C AL		£12.95
Database	Ed	Ed. Soft	B C ES		£11.90
Database	Bs	Primasoft	B C CT		£19.95
Database	Bs	Computercat	A,B C IJ		£9.95
Database	Bs	Software for All	A,B C KN		£11.95
Data File	Do	Kansas	B C KA		£9.95
Datat	Ut	Optima	B C OP		£12.50
Dating Game	Do	Acornsoft	B C AL		£9.95
Defchr	Ut	Micro-Aid	A,B C IZ		£2.95
Demon Decorator	Gm	Program Power	B C GK		£6.95
Density and Circuit	Ed	Acornsoft	A,B C AL		£11.90
Descender	Gm	FBC Systems	B C FB		£7.50
Design	Ut	Beebug	B C,D BE		£10.00
Desk Diary	Bs	Acornsoft	A,B C AL		£19.00
Detective	Gm	Computersmith	B C LC		£9.95
Devil's Causeway	Gm	Anirog Computers	A,B C OA		£5.50
DFM Database	Bs	Dialog	B C/D DG		£6.00
DFM Mail Labels	Bs	Dialog	B C/D DG		£24.00
Dictator	Gm	D. K. Tronics	B C DK		£10.00
Disassembler	Ut	Simonsoft	A,B C MS		£6.95
Disassembler	Ut	Micro Power	A,B C GK		£6.95
Disassembler	Ut	Program Direct	A,B C NP		£5.95
Disassembler	Ut	Davansoft	A,B C NX		£3.00
Disassembler	Ut	C J E	A,B C NV		£5.95
Distances	Ed	Microcomputers	B C IZ		£5.00
Dissembler	Ut	Rainbow S/W	B C KS		£3.95
Digital X-Word Compiler	Gm	N. Darwood	A,B C JB		£2.50
Dmon	Ut	Alligata	A,B C AG		£6.00
Dmove	Ut	FBC Systems	B C FB		£7.95
DNA Replication	Ed	Garland Comp.	B C JX		£12.50
Dracula Island	Gm	Kansas	B C KA		£17.65
Dragon Rider	Gm	Salamander Software	B C SA		£9.50
Dragon Quest II	Gm	Bug Byte	B C KP		£7.95
Dragon Quest	Gm	Bug Byte	B C KP		£11.50
Draughts/Reversi	Gm	Acornsoft	B C AL		£11.50
Draw	Ut	Program Power	B,E C GK		£9.95
Drawing	Ut	B.B.C.	A,B C KB		£10.00
Drawing Pictures and Puzzles	Ed	Ega Beva	B C EB		£9.95
Dr. Who: The First Adventure	Gm	BBC Pubs	B C KB		£10.00
Dungeon Adventure	Gm	Level 9 Computing	B C CU		£9.90
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	B C MW		£3.95
Early Learning	Ed	B.B.C.	A,B C KB		£10.00
Early Numbers	Ed	Bryants S/W	B C HW		£4.80
Early Warning	Gm	A&F Software	A,B C GE		£4.80
Easycalc	Bs	Zero Software	B C AZ		£6.00
Easy Graphics	Ut	Hexagon Software	B C HX		£12.95
Easywrite	Ed	System Software	B C SY		£13.50
Ecological Simulations	Ed	Garland	B C JX		£10.00
E.D.G. Graphics Package	Ut	Salamander	B SA		£16.50
Ed-master	Ut	R. H. Electronics	B C RH		£19.95
Educare's 50	Ed	Educare	A,B C EU		£12.95
Education (1)	Ed	Microplus	A,B C AM		£7.95



Educational (1)	Ed	Golem	A,B,EC	OB	£8.00
Educational (2)	Ed	Microplus	A,B	C AM	£5.25
Educational (2)	Ed	Golem	A,B,EC	OB	£8.00
Education (3)	Ed	Microplus	B	C AM	£5.25
7 Educational Games	Gm	Micromail	B	C OE	£5.75
Eiffel Tower	Ed	Chalksoft	B	C CH	£9.25
Eldorado Gold	Gm	Program Power	B	C GK	£6.99
Electric	Ed	Database Software	A,B	C NU	£5.50
Electricity	Ed	Primary Programs	B	C PP	£3.95
Electron-Aid	Ut	Dynabyte	E	C DB	£6.95
Elem-add and Elem-sub	Ed	Cottage Soft	B	C CT	£7.50
Envelope Generator	Ut	System	B	C SY	£7.00
Equation Balance	Ed	RJE Software	B	C RJ	£7.95
Escape From Moonbase Alpha	Gm	Program Power	B,E	C GK	£7.95
Essential French Verbs	Ed	Carsondale	B	C CD	£11.50
European Studies	Ed	Aztec S/W	B	C IB	£6.50
Escape from Pulsar 7	Gm	Digital Fantasia	B	C NT	£8.95
Exmon	Ut	Beebug	B	CE BE	£10.00
Extended Colour Fill Graphics	Ed	Gaelsett Software	B	C GS	£10.00
Experiments in Artificial Intelligence	Ed	Ganymede Systems	B	C GY	£9.95
Eye	Ed	Longman	B	C LM	£14.50
Facemaker	Ed	A.S.K.	B	C AK	£9.95
Factfile	Ed	Cambridge Micro	B	C,D CM	£20.08
Family Games	Gm	I.J.K. Software	A,B	C IJ	£4.50
Fantasy Adventure	Gm	Dial	B	C,D DL	£6.50
Fairground	Gm	Superior Software	B	C SE	£7.95
Fairytales	Gm	Molimerx	B	C AJ	£10.06
Feasibility Experiment	Gm	Digital Fantasia	B	C NT	£10.29
Female Reproductive Cycle	Ed	Garland	B	C JX	£12.00
Felix and the Fruit Monsters	Gm	Program Power	B,E	C GK	£7.95
Felix In The Factory	Gm	Program Power	B,E	C GK	£7.95
F For Freddie	Gm	Kansas	B	C KA	£9.50
Fighter Pilot	Gm	Kansas	B	C KA	£9.50
File Handler	Ut	Dial	B	C,D DL	£6.50
Finance Pack	Bs	Dial	B	C,D DL	£4.95
Filer	Bs	Micro Power	A,B,EC	GK	£8.95
Final Accounts Program	Bs	Gemini	B	C/GM	£59.95
First Steps in Algebra	Ed	Small School	B	C SM	£6.95
Firehawks	Gm	Postern	B	C PT	£6.95
FIZZ BUZZ	Ed	G.E.D. Software	B	C GD	£4.50
Fizz Buzz	Ed	Bourne	A,B	C B	£4.50
Flags	Ed	IJK Software	B	C IJ	£4.50
Flags	Ed	Micro-Aid	B	C IZ	£3.95
Flinders	Ed	Focusplan	A,B	C FP	£5.95
Flexibase	Dm	Alligata	B	C AG	£9.95
Floater	Bs	Dial	B	C,D DL	£4.95
Flush	Ed	Cambridge Micro	B	D CM	£15.00
Football Pools Predictor	Ut	Micro-Aid	A,B	C IZ	+ VAT
Footer	Do	Mayday Software	A,B	C IX	£1.00
Forecast	Gm	Program Power	B	C GK	£4.99
Forecasting-single exponential	Bs	Acornsoft	B	C AL	£7.95
Forecasting-double exponential	BS	Micropax	B	C MP	£11.90
Forth	Bs	Micropax	B	C MP	£4.95
Forth	Ut	Aztec	B	C MP	£7.95
Forth	Ut	H.C.C.S.	B	C HC	£16.85
Forth Toolkit	Ut	Level 9 Computing	B	C CU	£34.72
FORTH	Ut	Level 9 Computing	A,B	C CU	£15.00
Four-in-a-Row	Ut	Acornsoft	B	C CU	£12.00
Fraction Chase	Ed	Dial	B,E	C AL	£16.85
Fractions	Gm	Dial	B	C,D DL	£16.85
Fractions	Ed	GED Software	B	C GD	£4.95
Fracts	Ed	Garland	B	C JX	£4.00
Freefall	Ed	Cottage Soft	B	C CT	£7
French Connections	Gm	Acornsoft	B	C CT	£7.50
French Vocabulary	Ed	Cambridge Micro	B	C AL	£9.95
French Irregular Verbs	Ed	Dial	B	C DL	£15.00
French Mistres 1 2	Ed	Carsondale	B	C CD	+ VAT
French Vocabulary	Ed	Kosmos	B	C KM	£8.50
French Text Fill	Ed	Hargreaves	B	C HG	£18.86
French Tutor	Ed	Carsondale	B	C CD	£9.95
Fractions Illustrated-1	Ed	Salamander	B	C SA	£6.50
Fractions Illustrated-2	Ed	RJE Software	B	C RJ	£9.95
Frenzy	Gm	RJE Software	B	C	£9.95
		Persoft	A,B	C IY	RJE5.95
					£5.75

## SOFTWARE SUPPLIERS

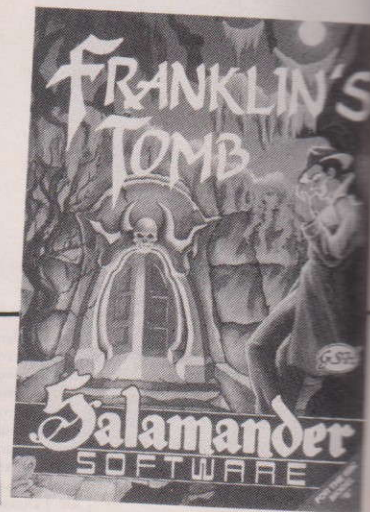
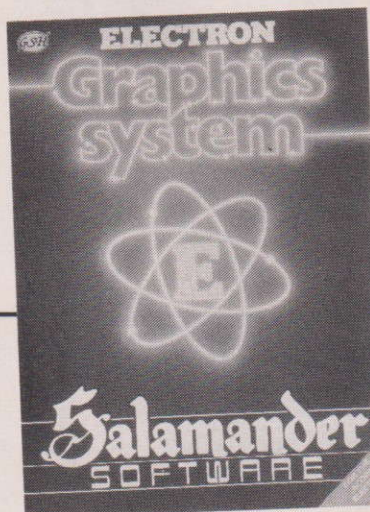
<b>GJ</b>	<b>Computer Concepts</b> 16 Wayside Chipperfield Hertfordshire WD4 9JJ	<b>IS</b>	<b>Software Invasion</b> 50 Elborough Street Southfields London
<b>GK</b>	<b>Micro Power Ltd</b> 8/8a Regent Street Chapel Allerton Leeds LS7 4PE	<b>IU</b>	<b>Aardvark Software</b> 15 Queensberry Avenue Hartlepool Cleveland TS26 9NW
<b>GM</b>	<b>Gemini</b> 9 Salterton Road Exmouth Devon EX8 2BR	<b>IV</b>	<b>James Hager</b> 7 Basset Street Camborne Cornwall TR14 8SW
<b>GR</b>	<b>Griffin Software</b> 285 Ealing Road Alperton Wembley Middlesex HA0 1HJ	<b>HS</b>	<b>Simon Hessel Software</b> 15 Lytham Court Cardwell Crescent Bershire
<b>GS</b>	<b>Gaelsett Software</b> 44 Exeter Close Stevenage Herts SG1 4PW	<b>IX</b>	<b>Mayday Software</b> 181 Portland Crescent Stammore Middlesex HA7 1LR
<b>GY</b>	<b>Huntsman Walk</b> Rugeley Staffs WS15 2SN	<b>IY</b>	<b>Persoft</b> Freepost Baildon Shipley West Yorkshire BD17 5SX
<b>HC</b>	<b>H.C.C.S. Associates</b> 533 Durham Road Low Fell Gateshead Tyne and Wear NE9 5EY	<b>IZ</b>	<b>Micro Aid</b> 25 Fore Street Paze Camborne Cornwall TR14 0JX
<b>HG</b>	<b>J Hargreaves</b> Updown Pewley Way Guildford Surrey	<b>JL</b>	<b>Joe the Lion</b> 213/215 Market Street Hyde Cheshire SK14 1HF
<b>HN</b>	<b>Hutchinson</b> 17-21 Conway Road London W1P 6JD	<b>JS</b>	<b>J.B. Software</b> 57 Meadow Crescent Carlton Poulton-le Fyde Lancashire FY6 7QX
<b>HW</b>	<b>Bryants (Educational) Software</b> 1 The Hollies Chalcroft Lane North Bersted Bognor Regis PO21 5SX	<b>JA</b>	<b>Hexagon Software</b> 17 Cambridge Grove Otley
<b>HX</b>	<b>Hexagon Software</b> 17 Straits Road Gornal Dudley West Midlands DY3 2UR	<b>JB</b>	<b>N Darwood Ltd</b> Halfacres Stroud Petersfield Hampshire GU32 3PJ
<b>IB</b>	<b>Aztec Software</b> 25 St Mark Road Deepcar Sheffield S30 5TS	<b>JC</b>	<b>Futura Software</b> 63 Lady Lane Chelmsford Essex CM2 0TQ
<b>IC</b>	<b>Ian Copestake</b> 23 Connaught Crescent Brookwood Woking Surrey GU24 0AN	<b>JS</b>	<b>J.C. Software</b> 124 Woodlands Way Southwater West Sussex RH13 7DR
<b>IF</b>	<b>Electronics Applied</b> 4 Dromore Road Carrickfergus County Antrim BT38 7PJ	<b>JX</b>	<b>Garland Computing</b> 35 Dean Hill Plymouth PL9 9AF
<b>IJ</b>	<b>I J K Software</b> 9 King Street Blackpool Lancs	<b>JY</b>	<b>Corona Software</b> Corona House 21 Tennyson Avenue London E11 2QN
<b>IN</b>	<b>Ixon Software</b> 10 The Crescent Lympsham Weston-Super-Mare Somerset BS24 0BN	<b>JZ</b>	<b>MP Software &amp; Services</b> 165 Spital Road Bromborough Merseyside L62 2AE
		<b>OA</b>	<b>Anirog Computers</b> 26 Balcombe Gardens Horley Surrey

CONTINUED OVER



# SOFTWARE LISTINGS

Title	Type	Manufacturer	Memory	Software Supplier	Price
Frogger	Gm	Superior Software	B C SE		£7.95
Frogjump	Gm	Sapphire	B C SH		£5.95
Frogger (Machine Code)	Gm	A&F Software	B C GE		£8.00
Fruit Machine	Gm	Superior Software	B C SE		£7.95
Fruit Machine	Gm	Bug Byte	B C KP		£5.50
Fruit Machine	Gm	Alligata	B C AG		£4.95
Fruit Machine	Gm	Computersmith	B C LC		£5.50
Fruit Machine + Honest Joe	Gm	Beebug	B C BE		£7.50
Fruity	Gm	Odyssey	B C OG		£3.00
Fun to Learn	Ed	Shards Soft	B C SH		£6.95
Fun Pack	Gm	Sapphire	B C SH		£5.95
Fun Sums	Ed	Kosmos	A,B C KM		£4.95
Fun with Numbers	Ed	Golem	B,E C OB		£8.00
Fun with Words	Ed	Golem	B,E C OB		£8.00
Fun Games	Gm	B.B.C.	A,B C KB		£10.00
Galactic Commander	Gm	Micro Power	B,E C GK		£6.95
Galactic Firebird	Gm	Kansas	B C KA		£9.50
Galactic Wipeout	Gm	R. H. Electronics	B C RH		£8.95
Galaxians	Gm	Superior Software	B C SE		£7.95
Galaxy Wars	Gm	Bug-Byte	B C BB		£7.50
Games Compendium B1/3	Gm	Salamander	B C NZ		£6.95
Games Pack 1/2	Gm	Processor	B C AP		£5.95
Games Pack 1	Gm	Applications			
Games Tape 1	Gm	Computersmith	B C LC		£5.50
Games Pack 1	Gm	Pro Software	A,B C SP		£7.95
Game of Logic	Gm	Computersmith	A,B C LC		£5.50
Games of Logic and cunning	Ed	N. Darwood	A,B C JB		£8.00
Games of Strategy	Gm	Golem	A,B,EC B		£4.95
Games Pack II	Gm	B.B.C.	A,B C KB		£10.00
G.B. Graph6	Ed	Micromail	B C OE		£6.75
GCE Maths (O) 1/2	Ed	Primasoft	B C PR		£6.95
Genetic Code	Ed	Bryants	A,B C HW		£9.50
Geography Map	Ed	Garland Comp.	B C JX		£17.65
Geography / France / Germany / Italy / U.S.A. / Spain / India	Ed	Bryants	B C HW		£4.85
German Irregular Verbs	Ed	Corona	B C JY		£5.00
Get it Right	Ed	Carsondale	B C CD		£13.80
Get Set	Ed	Sulis	B C SU		£9.95
Get the Message	Ed	Griffin	B C GR		£9.95
Ghost / Diamonds	Gm	Dial	B C,D DL		£4.95, £6.50
Ghost Maze	Gm	A Lane	A,B C OC		£3.00
Gideon's Gamble	Gm	Software for All	B C HN		£6.95
Glooper	Gm	Superior Software	B C SE		£7.95
Glycolysis - TCA Cycle	Gm	Microplus	B C AM		£6.95
Gobbler	Ed	Garland	B C JX		£15.00
Golf	Gm	M G B	B C MG		£5.45
Golf	Gm	Microplus	B C AM		£4.95
Golf	Gm	Computersmith	B C LC		£5.50
Golforama	Gm	Dial	B C,D DL		£4.95, £6.50
Grand Prix	Gm	Software for All	B C HN		£5.95
Grand Prix	Gm	Microplus	A,B C AM		£4.25
Graph Capers, Junior	Ed	Gem	B C GM		£7.50
Graph Capers Senior	Ed	Gem	B C GM		£8.50
Graphs	Ed	Bryants	A,B C HW		£4.85
Graphics Aid Pack	Ed	Microwave NW	B C MW		£8.95
Golf	Gm	Bryants S/W	B C HW		£4.88
Golf	Gm	Bug Byte	B C BB		£7.00
Golf	Gm	Computersmith	B C LC		£5.50
Gomoku	Gm	Micro Power	A,B C GK		£3.95
Graphics Package	Ut	Salamander Software	B C NZ		£24.95
Graph and Charts Pack	Bs	Acornsoft	B,E C AL		£9.95
Graphics Pack	Ut	Bug-Byte	B C BB		£9.50
Graphs (Arithmetical)	Ed	Bryants	B C HW		£4.85
Great Britain Ltd	Gm	Hessel	B C HS		£5.95
Grid Blitz	Gm	Computercat	B C CC		£5.95
Group Statistics	Bs	Micropax	B C MP		£7.95



Guided Discovery	Ed	Etna Software	B C ET		£9.95
Gunsplode	Gm	Software Invasion	B C IS		£7.95
Guzzler	Gm	Computersmith	B C LC		£5.50
Handwriting 1/2	Ed	Chalksoft	B C CH		£9.95
Hangdroid	Gm	Micromode	B C MO		£4.00
Hangman	Ed	Micro Aid	B C IZ		£7.95
Hangman Player	Ed	Square	A,B C SQ		£7.00
Hangman	Gm	Micro Aid	B C IZ		£7.95
Hangman	Gm	Aztec S/W	A,B C IB		£5.50
Hangman	Gm	MP S/W	B C JZ		£4.00
Happy Letters	Ed	Boune	B,E C BO		£8.97
Happy Numbers	Ed	Boune	B,E C BO		£8.97
Harmony	Ut	Doctor Soft	B C DS		£6.95
Heist	Gm	Softspot	B C SF		£6.95
Helicopter Rescue / Tunnel / Roadrace	Gm	A Lane	A,B C OC		£4.00
Hell Driver	Gm	Program Power	B,E C GK		£7.95
Hide and Seek	Ed	A.S.K	B C AK		£9.95
History Quiz	Do	Acornsoft	B,E C AL		£12.65
Hitch Hiker	Gm	Computer Concepts	B C GJ		£7.80
Home Accounts	Do	Diamondsoft	B C DS		£14.95
Home Accounts	Bs	Gemini	B C GM		£19.95
Home Accounts	Do	Persoft	B C IY		£12.50
Home Finance	Do	B.B.C.	A,B C KB		£10.00
Hooked on Numbers	Ed	Acornsoft	B C AL		£9.95
Hopper	Gm	Acornsoft	B C AL		£9.95
Horror Castle	Gm	A&F	B C GE		£8.00
Horseshoe	Gm	Dynabyte	B,E C DB		£6.95
Hot Cakes	Ed	Private Tutor	B C,D PT		£7.95, £8.95
Howzat	Gm	A&F	B C GE		£6.90
Human Blood Groups	Ed	Garland	B C JX		£15
Hunchback	Gm	Superior Software	B C SE		£7.95
Hydraulics	Ed	Database Software	A,B C NU		£5.50
Hyperdrive	Gm	IJK	B C IT		£6.50
'...I Do'	Do	Acornsoft	B C AL		£12.65
Index	Ut	Microwave NW	B C MW		£6.95
Index Numbers-Basket	Bs	Micropax	B C MP		£7.95
Index Numbers-Changer	Bs	Micropax	B C MP		£7.95
Inheritance	Gm	S.W. Hessel S/W	B C IW		£5.95
Inheritance	Ed	Garland Comp.	B C JX		£34.70
Inkosi	Gm	Chalksoft	B C KT		£5.95
Intervention commercial	Gm	System	B C SY		£345.00
Intervention educational	Ed	System	B C SY		£115.00
Intro	Ed	Clares	A,B C CL		£7.95
Introducing Map Skills 1/2	Ed	Cambridge Micro	B C,D CM		£13.95, £1.62
Introduction to Microcomputing in Teaching	Ed	Hutchinson	B C HN		£17.25
Invaders	Gm	Software Invasion	B C IS		£6.95
Invaders	Gm	Superior Software	B C SE		£7.95
Invaders	Gm	Software for All	A,B C KN		£6.95
Invaders	Gm	Hexagon S/W	A,B C JA		£6.00
Invisible Man	Ed	Chalksoft	B C KT		£5.95
Invoicing	Bs	Acornsoft	B C AL		£24.95
Invoices and Statements	Bs	Gemini	B C GM		£19.95
Janeplus	Ed	Longman	B C LM		£14.50
Jars	Ed	Acornsoft	B C AL		£11.90
JCB Digger	Gm	Acornsoft	B C AL		£9.95
Jigsaw Puzzle	Ed	Ega Beva	B C EB		£9.95
Johnny Reb	Gm	Lothlorien	B C LO		£6.95
J.R.	Gm	Software for All	B C KN		£6.95
Jumbles	Ed	Bryants S/W	B C HW		£4.88
Jumbo	Gm	Molimerx	B C AJ		£17.25
Jungle Ambush	Gm	Kindsoft	B C KU		£6.50
Junior Maths	Ed	Aztec	A,B C AZ		£3.00
Junior Maths Pack	Ed	Program Power	B C GK		£6.95
Junior Word Splits	Ed	Sulis	B C SU		£9.95
Just a Mot	Ed	Sulis	B C SU		£9.95



Katakomb	Gm	Golem	B	C	OB	£5.95
Keyrecog	Ed	Ed. Soft	B	C	ES	£4.95
Kidney	Ed	Garland	B	C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	B	C	AL	£9.95
Killer Gorilla	Gm	Program Power	B,E	C	GK	£7.95
Konexion	Gm	M and M Software	A,B	C	MM	£5
Kopfjäger	Ed	Cambridge Micro	B	D	CM	£15.00
Kremlin	Gm	Doctor Soft	B	C	DO	+ VAT
Kubla Khan	Gm	Blue Moon	B	C	BM	£6.95
Labyrinths of La Coshe	Gm	Program Power	B	C	GK	£8.95
Landfall	Gm	Virgin Games	B	C	VG	£7.95
Language Tutor	Ed	Rainbow Research	B	C	RR	£7.95
La Princesse (French)	Ed	Aztec S/W	B	C	IB	£5.00
Language-Lab	Ed	M and M Software	A,B	C	MM	£6.50
Landfall & Serpent	Gm	GT Software	B	C	JW	£7.50
Laser Command	Gm	Program Power	B,E	C	GK	£6.50
Laser Zone	Gm	Salamander	B	C	NZ	£7.95
Launching Logic	Ed	Shiva	B	C	SV	£14.95
Learn Addition	Ed	ABC Primary	B	C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B	C	AB	£6.50
Leap Frog	Gm	IJK Software	B	C	IJ	£6.50
Learning Compendium I	Ed	Ega Beva	B	C	EB	£7.50
Learning Compendium II	Ed	Ega Beva	B	C	EB	£11.95
Ledger	Bs	Micro Aid	B	C	IZ	£9.95
Letters	Ed	Chalksoft	B	C	CH	£5.95
Let's Count	Ed	A.S.K	B	C	AK	£6.95
Library Classification	Ut	Aztec	A,B	C	AZ	£9.95
Library Dewey Classification	Ed	Aztec S/W	B	C	IB	£6.50
Life	Gm	Ixion	A,B	C	IN	£6.50
Life Plus	Gm	Mayday	A,B	C	IX	£4.75
Lift	Ed	Cambridge Micro	B	D	CM	£4.49
Lift off with Numbers	Ed	Shiva	B	C	SV	£15.00
Linear Programming	Bs	Micropax	B	C	MP	+ VAT
Linear Regression, Correlation	BS	Micropax	B	C	MP	£14.95
Lines and Angles	Ed	4MAT	B	C	FM	£12.95
Link-4-Plus	Gm	ABC Software	A,B	C	KR	£7.95
Lisp	Ut	Acornsoft	B,E	C	AL,GA	£5
Lisp	Ut	Aztec	B	C	AZ	£6.95
Logo-Forth	Ut	H.C.C.S.	A,B	E	HC	£16.85
Logo 2	Ut	Computer Concepts	B	C	GJ	£16.85
Longitudinal Waves	Ed	Heinemann	B	C	EH	£59.00
Look it up	Ed	GED Software	B	C	GD	£10.00
Lorry/Farm	Gm	Primary Programs	B	C	PP	£12.50
Lords of Time	Gm	Level 9	B	C	CU	£4.50
Lost City	Gm	Superior Software	B	C	SE	£3.95
Lunar Rescue	Gm	Alligata	B	C	AG	£9.90
L. Trap	Gm	Gem	B	C	GM	£7.95
Lunar Lander	Gm	A&F Software	B	C	GE	£7.95
Magic Adventure	Gm	Kansas	B	C	KA	£8.50
Mailer	Ut	ASD Ltd	B	C	AS	£6.90
Mailing List	Bs	Gemini	B	C	GM	£8.50
Mailing B	Bs	Micro-Aid	A,B	C	IZ	£5.75
Mailing System	Bs	Acornsoft	B	D	AL	£19.95
Map Rally	Ed	Bourne	B,E	C	BO	£7.95
Making Ends Meet	Ed	Cambridge Micro	B	C,D	CM	£8.97
Mansion Murders	Gm	Challenge Games	B	C	CG	£15.00
Mark Book	Ed	Carvells	A,B	C	CA	+ VAT
Mark Book	Ed	BBC	A,B	C	KB	£6.95
Martian Attack	Gm	Micropower	B	C		£5
Masterbard Hamlet	Ed	Sulis	B	C	SU	£15
Master Copier	Ut	Aztec	A,B	C	AZ	£7.95
Master Copier	Ut	Aztec S/W	A,B	C	IB	£12.95
Masterfile	Ut	Beebug	B	CD	BE	£6.50
Mastermind	Gm	Micro Power	A,B	C	GK	£6.50
Maths Invaders	Ed	Stell	B	C	ST	£10.00
Maths Man	Ed	GED Software	B	C	GD	£19.00
Maths Pack	Ed	Ega Beva	B	C	EB	£3.95
Maths Pack	Ed	Dial	B	C,D	DL	£7.95
Maths Topics 1	Ed	Cambridge Micro	B	C,D	CM	£4.00
Maths Topics 2	Ed	Cambridge Micro	B	C,D		£4.95
Mathspell	Ed	Diamondsoft	B	C	DS	£6.50
Maths Topics 1	Ed	CUP	B	C	UP	£13.95
Maths Translation	Ed	Corona S/W	B	C	JY	+ VAT
Maths Tutors, Graphs	Ed	Salamander	B,E	C	SA	£15.00
Maths Tutors, Vectors	Ed	Salamander	B,E	C	SA	£7.95

## SOFTWARE SUPPLIERS

<b>OB</b>	Golem Ltd 77 Qualitas Bracknell Berkshire RG12 4QG	<b>BE</b>	Beebugsoft PO Box 109 High Wycombe Bucks HP11 2TD
<b>OC</b>	A Lane (Software) 12/316 Seaside Eastbourne East Sussex BN22 7RH	<b>BK</b>	BAKsoft 34 Humberstone Road Cambridge
<b>OD</b>	ASP Software 145 Charing Cross Road London WC2H 0EE	<b>BM</b>	Blue Moon Software Co. Freepost Suanley Kent BR8 7UY
<b>OE</b>	Micromail PO Box 34 Leighton Buzzard LU7 8SJ	<b>BO</b>	Bourne Educational Software Headbourne Worthy Winchester Hants SO23 7SQ
<b>OF</b>	Swift Link Software 118-120 Wardour Street London W1V 4BT	<b>BU</b>	Busco 16 Colwill Walk Mainstone Plymouth
<b>OG</b>	Odyssey Software 8 Greenbrook Avenue Hadley Wood Barnet Herts EN4 0LS	<b>DB</b>	31 Topcliffe Mews Wide Lane Morley Yorks
<b>OH</b>	Edu-CAL 28 Ingersoll Road Shepherds Bush London W12 7BD 01 743 1579	<b>DC</b>	D.A.C.C. Ltd 23 Waverly Road Hindley Greater Manchester WN2 3BN
<b>OT</b>	Oxhey Tutors 19 Tudor Walk Watford Herts WD2 4NY	<b>DK</b>	DK Tronics Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX
<b>CA</b>	Carvells 3/7 Bank Street Rugby	<b>DG</b>	Dialog 19 Short's Gardens London WC2H 9AT
<b>CR</b>	Carswell Computers Carswell Barn Faringdon Oxon SN7 8JN	<b>DO</b>	Doctor Soft 258 Conygree Road Peterborough PE2 8LR
<b>CD</b>	Carsondale Enterprises Ltd 44 Kingsway Stoke-on-Trent Staffordshire ST4 1JH	<b>DS</b>	Diamondsoft Ltd Cheadle Hulme Cheadle Cheshire SK8 5YB
<b>CG</b>	Challenge Games 64 Ferndale Road London E11	<b>EB</b>	Ebury Software National Magazine House 72 Broadwick Street London W1V 2BP
<b>CH</b>	Chalksoft Ltd 37 Willowslea Road Worcester WR3 7QP	<b>EG</b>	SESS Ltd Central Trading Estate 275-277 Bath Road Bristol BS4 3EH
<b>CS</b>	Stable Software Compton Street Compton Nr Winchester Hants	<b>EH</b>	Heinemann Computers in Education 22 Bedford Square London
<b>CT</b>	Cottage Software Heather Cottage Selly Hill Whitby North Yorkshire	<b>EJ</b>	Logic Systems 85 Hemingford Road Cambridge
<b>CU</b>	Level 9 Computing 229 Hughenden Road High Wycombe Buckinghamshire HP13 5PG	<b>EL</b>	ECL Software 29 Richmond Close Ware Herts SG12 0EN
<b>CX</b>	Contex Computing 15 Woodlands Close Cople Bedford MK44 3UE	<b>ET</b>	Eina Software West End House West End Lane Marshchapel Lincs
<b>BB</b>	Bug-Byte Mulberry House Canning Place Liverpool L1 8JB	<b>EU</b>	Educare 139a Sloane Street London SW1X 9AY

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# SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Matching	Ed	Clares	A,B C CL		£5.95
Maze Invaders	Gm	Micro Power	B C GK		£4.95
Maze Man	Gm	C J E	B C NV		£6.00
		Microcomputers			
Micro Budget	Do	Micro Power	A,B C GK		£6.95
Meditor	Ut	MED	B C MD		£9.50
Medmon	Ut	MED	A,B C MD		£9.95
Membership Manager	Do	Acornsoft	B C AL		£9.95
Memocalc	Bs	Microaid	B C IZ		£9.95
Mental Arithmetic Tests	Ed	Small School	B C SM		£6.95
Mercy Mission to Mars	Gm	D.A.C.C.	B C DC		£5.95
Meteors	Gm	Acornsoft	B,E C AL		£9.95
Metrics (5)	Ed	Chalksoft	B C KT		£9.95
Microbial Pop. Dynamics	Ed	Microwave NW	B C MW		£7.00
Micro Man	Gm	Pro S/W	B C LD		£8.00
Micro Maths	Ed	LCL	A,B C KA		£24.50
Middle Kingdom	Gm	Pro Software	A,B C		£7.95
Microtext	BS	Acornsoft	B C AL		£49.85
Microtype	Ed	Kansas	B C KA		£12.50
Mined Out	Gm	Quicksilva	B C QS		£6.95
Miner	Gm	Ixon	B C IN		£6.90
Minefield	Gm	Eduquest	A,B C NW		£5.95
Minefield	Gm	A&F Software	A,B C GE		£6.00
Missile Base	Gm	Acornsoft	B C AL		£9.95
Missile Control	Gm	C J E	B C NV		£9.00
		Microcomputers			
Missing Signs	Ed	Acornsoft	A,B C AL		£11.90
Mission Impossible	Gm	Aztec S/W	A,B C IB		£6.50
Mitosis	Ed	Garland	B C JX		£15
Mixed Games	Gm	I.J.K. S/W	A,B C IT		£3.95
MMaths	Ed	Ed. Soft	B C ES		£4.95
Model A Invaders	Gm	I.J.K. S/W	A,B C IT		£4.95
Model B Invaders	Gm	I.J.K. S/W	B C IT		£6.95
Moments + Van	Ed	RJE Software	B C RJ		£4.95
Money Box	Ed	Bryants	A,B C HW		£4.85
Monster Maze	Ed	Kingfisher	A,B C KF		£6.90
Monsters	Gm	Acornsoft	B,E C AL		£9.95
Monster Battles	Gm	Bryants S/W	B C HW		£4.80
Moon Raider	Gm	Program Power	B,E C GK		£7.95
Morse Code	Ed	Philip Dodderidge	B C PD		£6.50
Morse Code Fun	Ed	Aztec	A,B C AZ		£3.00
Moving Molecules	Ed	C.U.P	B C CP		£13.95
Mr T's Alphabet Games	Ed	Ebury	B C EB		£12.95
Mr T's Measuring Games	Ed	Ebury	B C EB		£12.95
Mr T's Money Box	Ed	Ebury	B C EB		£12.95
Mr T's Number Games	Ed	Ebury	B C EB		£12.95
Mr T's Shape Games	Ed	Ebury	B C EB		£12.95
Mr T Tells The Time	Ed	Ebury	B C EB		£12.95
Multi-Aid	Ut	Dynabyte	A,B C DB		£7.95
Multifile	Bs	Bug Byte	A,B C BB		£25.00
Multiple Choice	Ed	Eduquest	B C NW		£25.00
Multiply and Divide	Ed	Cottage Soft	A,B C CT		£7.50
Munchyman	Gm	Micro Power	A,B C GK		£5.95
Music	Ed	Ed. Soft	B C ES		£9.95
Music	Do	B.B.C.	A,B C KB		£10.00
Music Editor	Ed	System	B C SY		£9.00
Music Maker	Gm	Rainbow S/W	A,B C KS		£3.50
Music Synthesiser	Ut	Bug-Byte	B C BB		£9.50
Music Master	Ed	Merlin	B C MN		£6.95
Music Processor	Gm	Quicksilva	A,B C QS		£14.95
Music Quiz	Do	Acornsoft	B C AL		£12.65
Musictools 1	Ut	Musicsoft	B C MS		£5.75
Musical Numbers	Ed	Bryants S/W	B C HW		£4.88
Musical Number Box	Gm	Bryants S/W	A,B C HW		£3.75
Mutant Invaders	Gm	I.J.K. S/W	A,B C IT		£5.95
MX 80 Type 3 Screen Dump	Ut	Software for All	A,B C KN		£6.95
1914	Ed	Cambridge Micro	B C,D CM		£15.00
		+ VAT			
Nominal Ledger	Bs	Micropower	B C GK		£7.99



Note Invaders Package	Ed	Chalksoft	B C CH	£9.25
Number Balance	Ed	Acornsoft	A,B C AL	£11.90
Networks-Basic	Bs	Micropax	B C MP	£12.95
Networks-Pert.	Bs	Micropax	B C MP	£17.95
Networks-Big Part	Bs	Micropax	B D MP	£75.00
Number Bond	Ed	Primary Programs	B C PP	£3.95
Number Chaser	ED	A.S.K	B C AK	£9.95
Number Fun	Ed	Griffin	B C GR	£9.95
Number Lang	Ed	Dial	B C,D DL	£4.95, £6.50
				£9.95
Number Puzzler	Ed	A.S.K	B C AK	£9.95
Number Gulper	Ed	A.S.K	B C AK	£9.95
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Odds on Inventors	Ed	Dial	B C,D DL	£4.95, £6.50
Odds on Monarchs	Ed	Dial	B C,D DL	£4.95, £6.50
Odds on Musicians	Ed	Dial	B C,D DL	£4.95, £6.50
Odds on Writers	Ed	Dial	B C,D DL	£4.95, £6.50
Oblivion	Gm	Bug-BYte	B C BB	£7.50
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Oil	Gm	Computersmith	B C LC	£5.50
One to Nine	Ed	Acornsoft	B C AL	£9.95
1-2-3 Snap	Ed	Ega Beva	B C EB	£11.95
Optimon	Ut	Optima	B C OP	£9.95
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Options	Ed	System	B C SY	£23.00
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Othello	Gm	Computer Concepts	A,B,EC GJ	£8.95
Othello	Gm	Computercat	B C CC	£8.95
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Pengwyn	Gm	Postern	B C PT	£6.95
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Picasso GS	Ut	Odyssey	B C OG	£4.50
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Punc-Man	Ed	Chalksoft	B	C	KT	£7.95	Snake Pit	Gm	Postern	B	C	PT	£6.95
Punctuation	Ed	Bryants S/W	B	C	HW	£4.88	Snapper	Gm	Acornsoft	B,E	C	AL	£9.95
Purchasing	BS	Acornsoft	B	D	AC	£24.95							
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<b>LM</b>	<b>Longman Group</b> Longman House Burnt Mill Harlow Essex	<b>MS</b>	<b>Musicsoft</b> 12 Fallowfield Amphill Beds
<b>LO</b>	<b>Lothlorien</b> 56a Park Lane Poynton Cheshire SK12 1AE	<b>MW</b>	<b>Microwave NW</b> 24 Belford Road Stretford Manchester M32 0DL
<b>MA</b>	<b>MP Software and Services</b> 165 Spital Road Bromborough Merseyside L62 2AE	<b>OP</b>	<b>Optima Software Ltd</b> 36 St. Petersgate Stockport SK1 1HL
<b>MB</b>	<b>Microbyte Software</b> Freepost Newquay TR7 2BR	<b>OT</b>	<b>Oxley Tutors</b> 19 Tudor Walk Watford Herts WD2 4NY
<b>MD</b>	<b>MED</b> 640 Melton Road Thurmaston Leics	<b>SE</b>	<b>Superior Software</b> 69 Leeds Road Bramhope Leeds
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<b>MK</b>	<b>David McKeran</b> 23 Warwick Drive East Herrington Sunderland Tyne and Wear	<b>SI</b>	<b>Simonsoft</b> Front Street Topcliffe North Yorkshire YO7 3RJ
<b>MM</b>	<b>M and M Software</b> 1391 Leek Road Abbey Hulton Stoke-on-Trent Staffs ST2 8BW	<b>SJ</b>	<b>S.J. Grist</b> 127 Waxwell Lane Pinner Middlesex
<b>MN</b>	<b>Merlin Computer Products</b> 18 Mansel Street Swansea SA1 5SG	<b>SL</b>	<b>Silverlind Ltd</b> 156 Newton Rd., Burton-on-Trent Staffordshire DE15 0TR

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Sortbas	Ut	Micro-Aid	A,B C IZ		£1.00
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Spacehawks	Gm	Computer Concepts	B C GJ		£7.80
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Spell 7/Spell 9+	ED	Primary Programs	B C PP		£3.95
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Starship Command	Gm	Acornsoft	B,E C AL		£9.95
Star Trader	Gm	FBC Systems	B C FB		£9.50
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Star Trek Adventure	Gm	Superior Software	B C SE		£7.95
Star Trek	Gm	Program Power	A,B C GK		£5.95
Star Maze	Gm	Database Software	B C NU		£7.50
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Startrek/Candy Floss	Gm	I.J.K. S/W	A,B C IT		£5.95
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Statpack	Ed	Micro-Aid	B C IZ		£9.95
Starter Word Splits	Ed	Sulis	B C SU		£9.95
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Story 'A'	Ed	Chalksoft	B C KT		£6.95
Story A - Spanish Gold	Ed	Chalksoft	B C CH		£7.95
Storybuilder	Ed	Bryants S/W	B C HW		£4.85
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Super Invaders	Gm	Acornsoft	B C AL		£9.95
Superlife	Ed	Golem	B,E C OB		£6.90
Superplot	Ut	Beebug	B C BE		£10.00
Super Spell	Ed	Aztec	A,B C AZ		£5.50
Supergolf	Gm	Squirrel Software	B C SS		£7.50
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Survivor	Gm	MP Software	B C MP		£6.50
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Swoop	Gm	Micro Power	B C GK		£6.95
Tables Test	Ed	Bryants S/W	B C HW		£4.88
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Teacher's Toolkit	Ed	Wida Software	B C FY		£30.00
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Ten Little Indians	Gm	Digital Fantasia	B C NT		£10.29
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The Frog	Gm	James Hager	B C IV		£6.50
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3-D Maze	Gm	Hexagon S/W	A,B C JA		£6.00
3D Maze	Gm	Earthshock S/W	A,B L KI		£3.00
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The Basic Lesson	Ed	Ega Eva	B C EB		£11.95
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The Computer Programme	Do	B.B.C.	A,B C KB		£10.00
Programs Vol 1	Gm	Digital Fantasia	A,B C NT		£10.29
The Golden Baton	Ed	Ega Beva	B C EB		£11.95
The Graphics Lesson	Ed	Quicksilva	B C QS		£6.95
The Generators	Gm	Dynabyte	B,E C DB		£7.95
The Lemming Syndrome	Gm	Software For All	B C KN		£7.95
The Frog	Gm	D.A.C.C.	B C DC		£7.95
The Guns of Navarone	Ed	Small School	B C SM		£6.95
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Toolkit	Ed	Computercat	B C CC		£9.95
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# Machine Code Capers

Peter Voke

The most interesting programming on the BBC micro — or any other, come to that — involves manipulating the screen. Graphics is on one side of the coin, while text is on the other. All of these activities, from outputting one character to setting up a graphics window, clearing it, and drawing something in it in a particular colour, are handled in the BBC micro operating system by a large set of routines called the VDU drivers.

This arrangement makes access to all screen handling routines in the BBC micro particularly easy. In BASIC, the VDU command essentially just feeds a sequence of bytes to the VDU drivers. Many of the most commands such as PRINT, PLOT, MODE, CLS, MOVE, DRAW and so on are simply more convenient ways of accessing particular VDU sequences.

## LAND OF OS

From machine code, the same sequence of bytes can be passed to the VDU drivers by loading

## Peter Voke lifts the lid of BBC BASIC and looks at the machine code mechanics below.

them into the accumulator one at a time and calling the address OSASCI (or OSWRCH), which points through a vector in Page 2 to the VDU driver entry point. By storing the sequence of bytes as data in memory, a simple and efficient routine can perform all these tasks.

To illustrate the principles, let's work from a short BASIC program that uses a variety of common screen commands, and see how a machine code subroutine can do it. Program 1 is the starting point in BASIC, and it is just about 100 bytes long.

I shall assume everyone knows that all these commands go through the VDU drivers, and can be performed using the VDU command. The proof, if needed, is in program 2. The sole difference is that MODE 2 resets HIMEM, while VDU 22 does not. Notice the way that the words

"VDU DEMO" have been turned into a sequence of bytes. This is quite simple; the command line REPEAT A\$=GET\$:PRINT A\$ "ASC (A\$): UNTIL FALSE may prove useful.

The third version of the program has gone one further step towards machine code. The VDU sequences have been run together, and the numbers in the MOVE and DRAW commands that have to be sent as two bytes have been split up into the two bytes. For instance 1200; has become 176,4, since 1200 DIV 256 is 4 and 1200 MOD 256 is 176. Notice the "low" byte comes first.

Version 4 is as close to the method used in machine code as BASIC can get. The bytes are stored somewhere, read in one at a time, and passed to the VDU driver routines. An "end-of-sequence" byte is used to tell the

computer when to stop. A zero byte would be an obvious choice, but occurs in the sequence of bytes naturally and is therefore no good. I have chosen to use 255 (&FF).

Finally, a machine code version is assembled in program 5. The VDU sequence is first put into memory one byte at a time, at location &C00. (If you have BASIC II, you may prefer to use the byte indirection pseudo-operations EQ to do this.) Any locations would do, so long as they do not interfere with the action of the assembler or the program when it finally RUNS. For instance, &C00 is not suitable if user-defined characters are to be set up (VDU 23...), since they are stored in page &C.

## REAL CODE

The machine code is then assembled. Notice the use of the byte 255 (&FF) to check for the end of the sequence. An extra couple of op-codes are included to allow the sequence of bytes to run over the end of a page.

```
10 REM PROGRAM 1
20 MODE2
30 GCOL0,1
40 MOVE100,400:MOVE1200,400:PLOT85,100,600:PLOT85,1200,600
50 COLOUR132:COLOUR6
60 PRINT TAB(5,16) " VDU DEMO "
70 END
```

```
10 REM PROGRAM 2
20 VDU22,2
30 VDU18,0,1
40 VDU25,4,100,400:VDU25,4,1200,400:
50 VDU25,85,100,600:VDU25,85,1200,600:
60 VDU17,132:VDU17,6
70 VDU31,5,16,32,86,68,85,32,68,69,77,79,32,13
80 END
```

```
10 REM PROGRAM 3
20 VDU22,2,18,0,1,25,4,100,0,144,1,25,4,176,4,144,1
30 VDU25,85,100,0,88,2,25,85,176,4,88,2,17,132,17,6
40 VDU31,5,16,32,86,68,85,32,68,69,77,79,32,13
50 END
```

```
10 REM PROGRAM 4
20 REPEAT
30 READIX:IFIX(255 VDUIX
40 UNTILIX=255
50 END
60 DATA22,2,18,0,1,25,4,100,0,144,1,25,4,176,4,144,1
70 DATA25,85,100,0,88,2,25,85,176,4,88,2,17,132,17,6
80 DATA31,5,16,32,86,68,85,32,68,69,77,79,32,13,255
```

```
10 REM PROGRAM 5
20
30 DATA22,2,18,0,1,25,4,100,0,144,1,25,4,176,4,144,1
40 DATA25,85,100,0,88,2,25,85,176,4,88,2,17,132,17,6
50 DATA31,5,16,32,86,68,85,32,68,69,77,79,32,13,255
60
70 PX=&C00
80 REPEAT
90 READIX:PX=IX:PX=PX+1
100 UNTILIX=255
110
120 OSASCI=&FFE3
130 FOR0=1TO3STEP2
140 PX=&C00
150 I
160 OPT 0
170 .GRAF
180 \ ROUTINE TO OUTPUT VDU SEQUENCE
190 STX &71 \ ADDRESS HIGH BYTE
200 LDA #0
210 STA &70 \ PAGE LOW BYTE = 0
220 .LOOP
230 LDA(&70),Y \ LOAD CHARACTER
240 CMP #&FF \ CHECK END OF SEQUENCE
250 BEQ RTN
260 JSR OSASCI \ OUTPUT CHARACTER
270 INY \ INCREMENT THE INDEX
280 BNE LOOP \ CHECK PAGE BOUNDARY
290 INC &71 \ INC PAGE IF BOUNDARY CROSSED
300 JMP LOOP
310 .RTN RTS
320 J
330 NEXT 0
340
350 XX=&C:YX=0:CALL&C00
360 END
```



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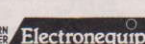
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