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Einstein reviews

YOUR

COMPUTER

SEPTEMBER 1984

BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE

Vol 4 No. 9

85p

HOW FRANKIE GETS TO HOLLYWOOD

Music and micros: two tribes in harmony

Spectrum Manic Climber

ZX-81 Sprites

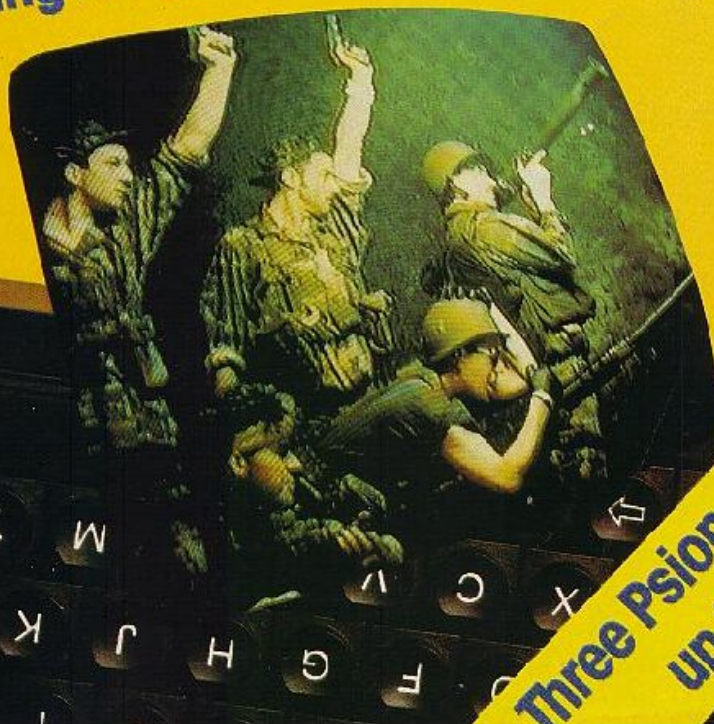
CBM-64 Bullion

BBC Backgammon

Amstrad Sky Drop

Hell's Bells and Filing for Dragon

Vic Robot Attack



Three Psion Organisers
up for grabs

KOKOTONI WILF



'Kokotoni Wilf is an arcade adventure whose undisguised intention is to steal the title of 'best arcade adventure program bar none' from Jet Set Willy'.

As Kokotoni Wilf you must recover all the pieces of the legendary Dragon Amulet (which has been scattered throughout time) for your master the great magician, Ulrich.

Throughout the quest Wilf comes up against many dangers from huge lumbering prehistoric dinosaurs, to hostile alien robots, but the reward for recovering all the pieces warrants the risk.

The 48K program features a number of major advances over Jet Set Willy. The games designer,

Elite, stresses that each of the games 60 plus screen settings is

genuinely high resolution, as opposed to

psuedo hi-res, and doesn't require a title to explain what you're looking at. Furthermore, the sprite characters are of cartoon quality and exhibit their own personalities.

Impressive claims. Jet Set Willy fans will no doubt feel both sceptical and intrigued.....

Watch this space!

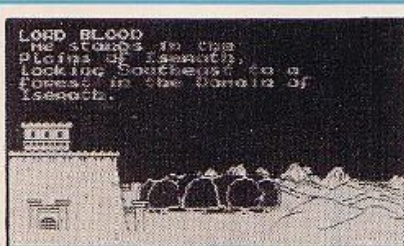
48K Spectrum and Commodore 64
available Sat. 15th September.

elite

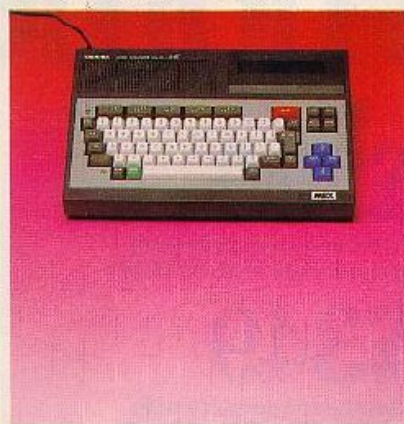
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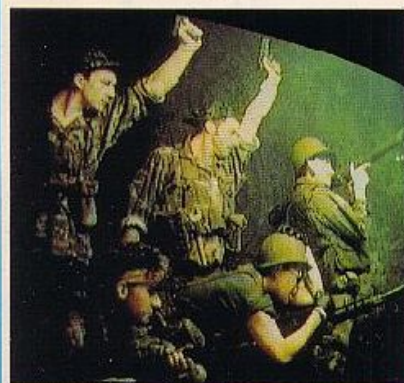
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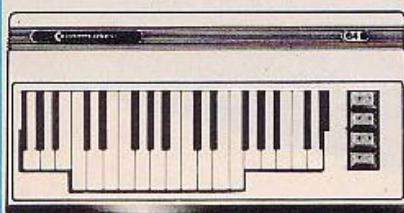
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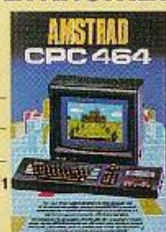
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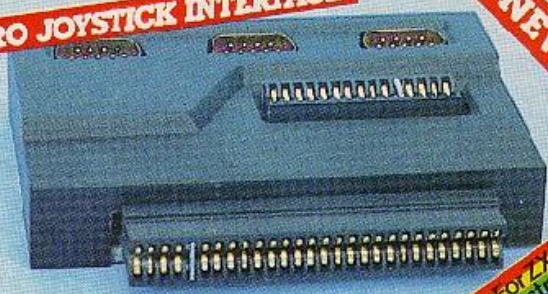
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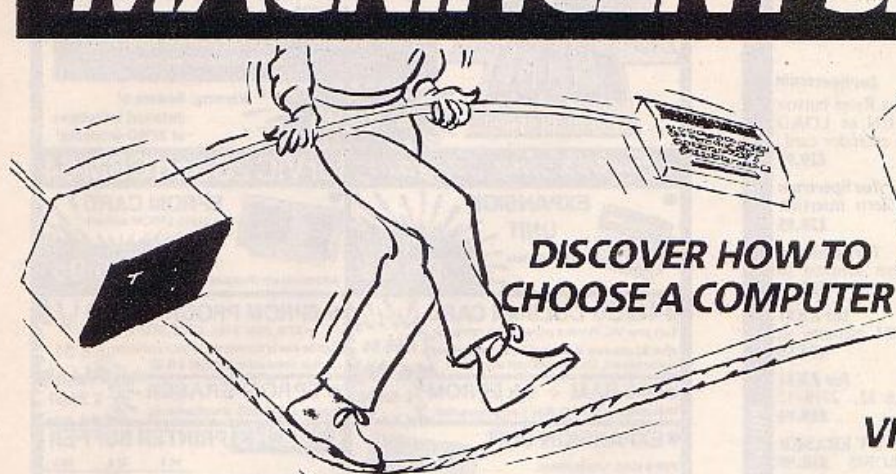
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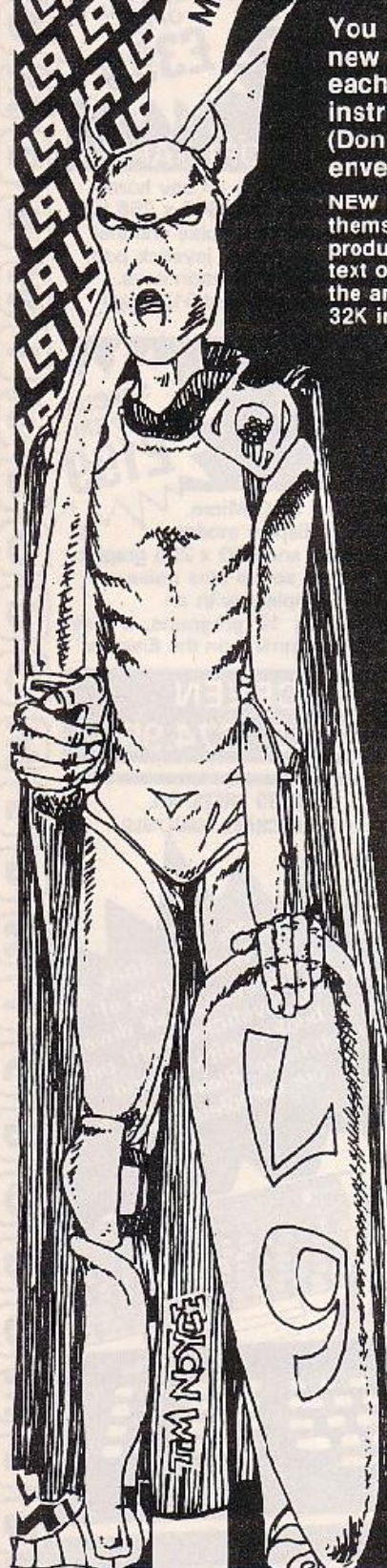
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This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

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You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal

Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely

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important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Acorn Electron can be found at local Acorn dealers and major high street stores. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.



Technical Specifications

Hardware.

2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

Software.

BBC BASIC.
Extensions include integer, floating point and string variables, multi dimensional arrays: IF... THEN... ELSE, REPEAT... UNTIL, procedures with local variables.
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The Acorn  Electron.

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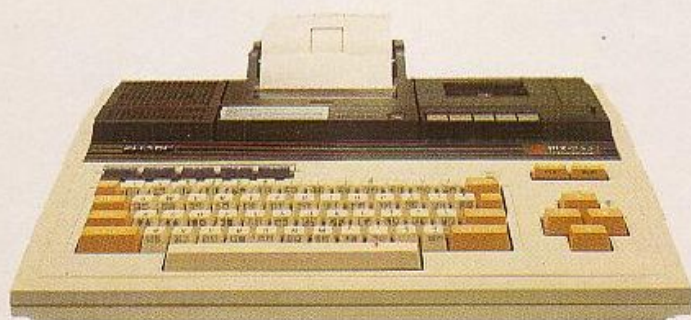
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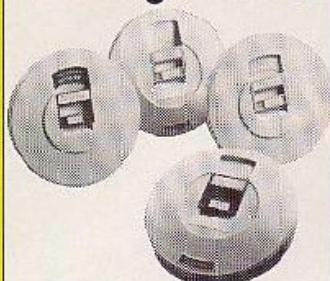


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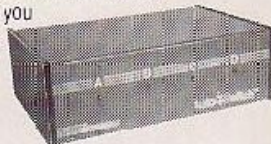
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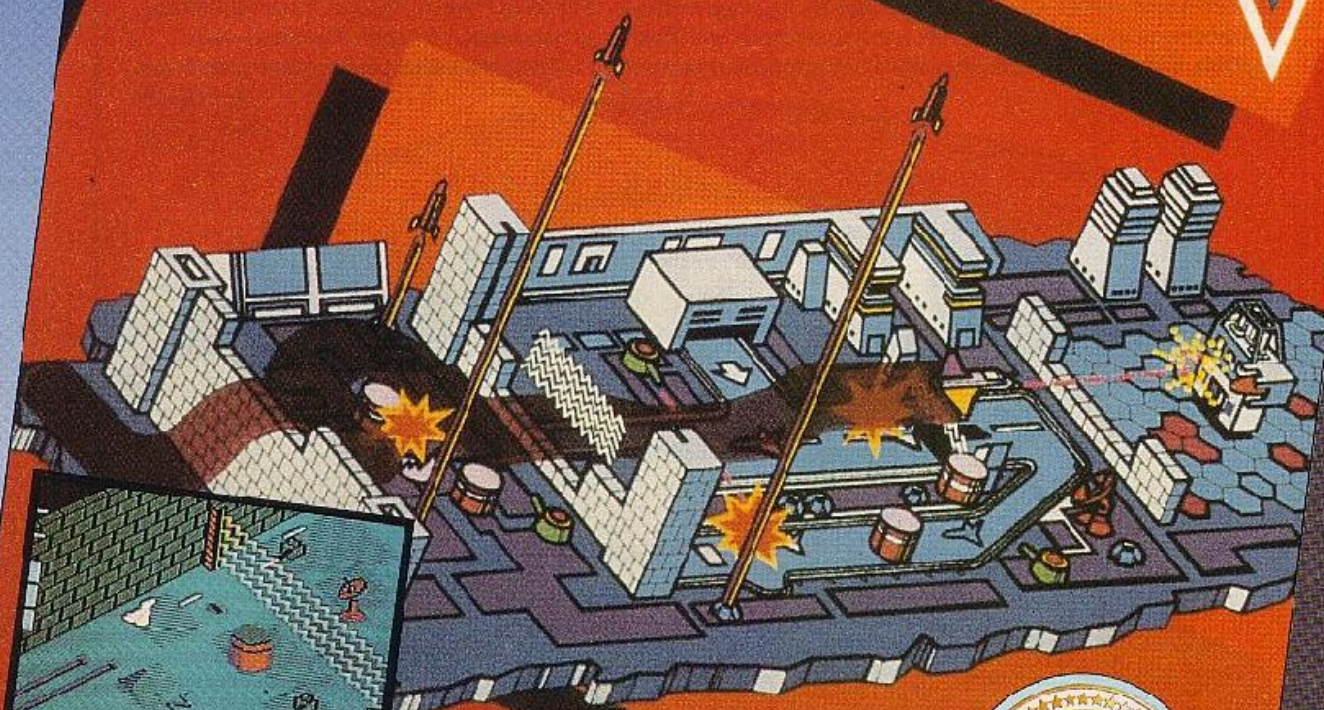
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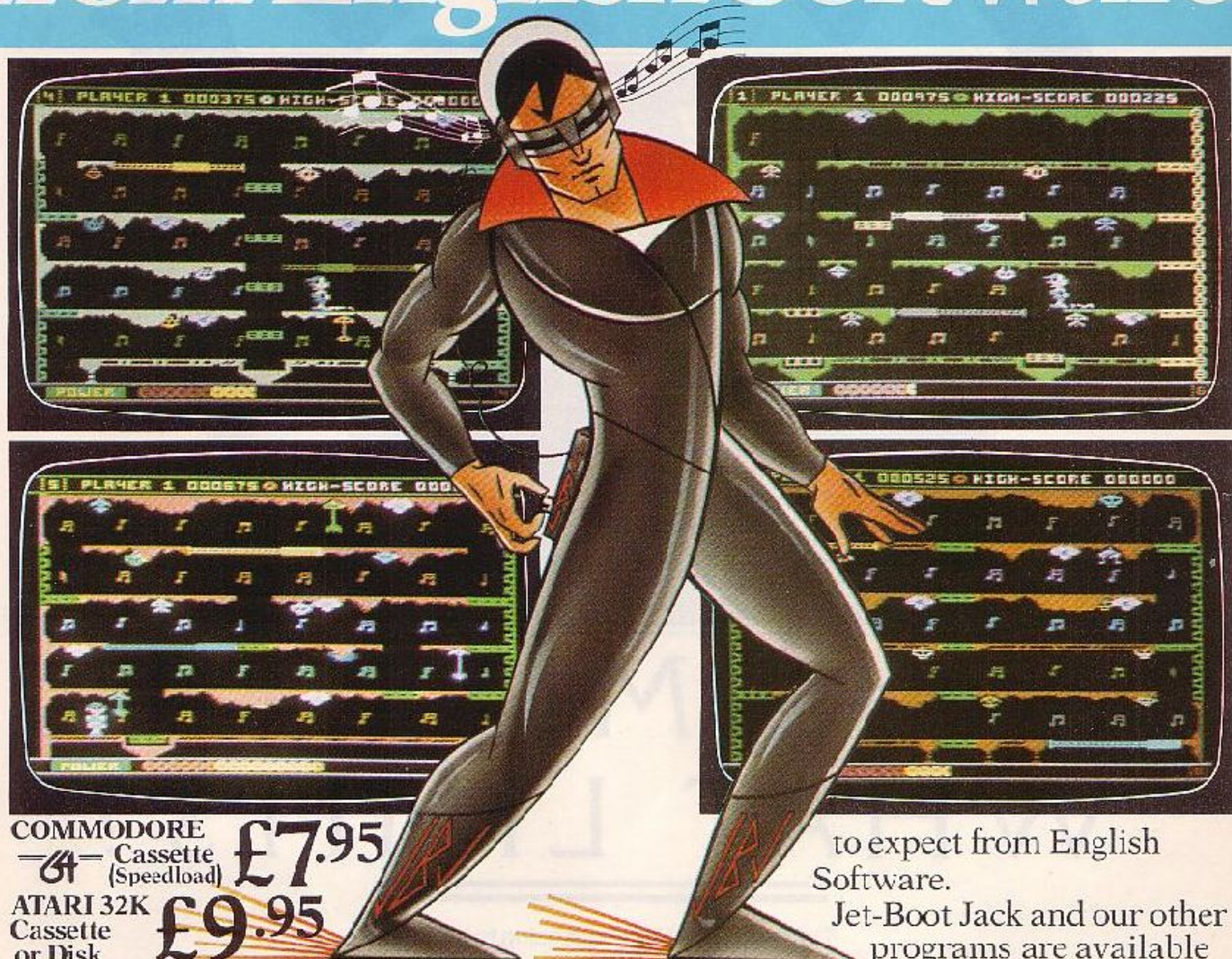
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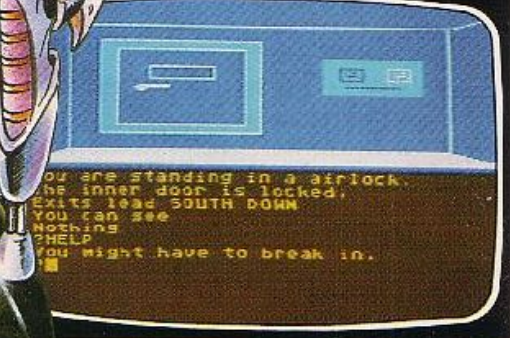
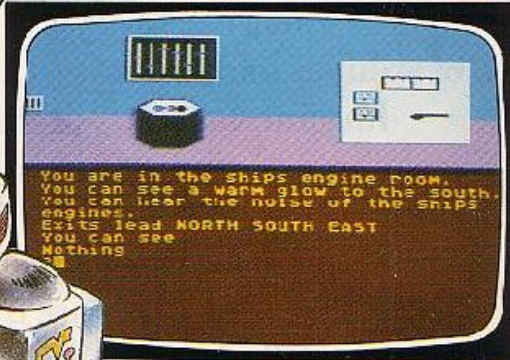
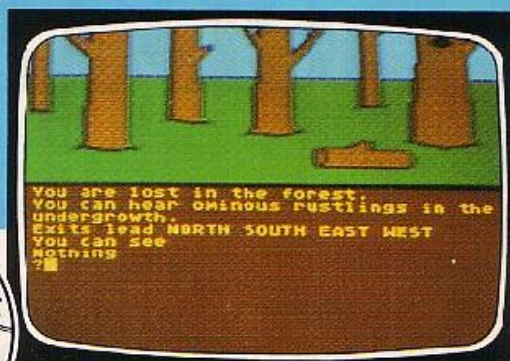
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The sheer size of ViewSheet makes it impossible for the whole sheet to be visible on the monitor at once.

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You can cross-reference sections, or even reposition them on the sheet, whenever you need to.

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By creating special disc files from ViewSheet, you can link two or more spreadsheets together. This means you can build models much bigger than the BBC Micro's considerable memory.

ViewSheet is also compatible with Acornsoft's View word-processing package. This enables you to produce reports and documents which combine text and figures.

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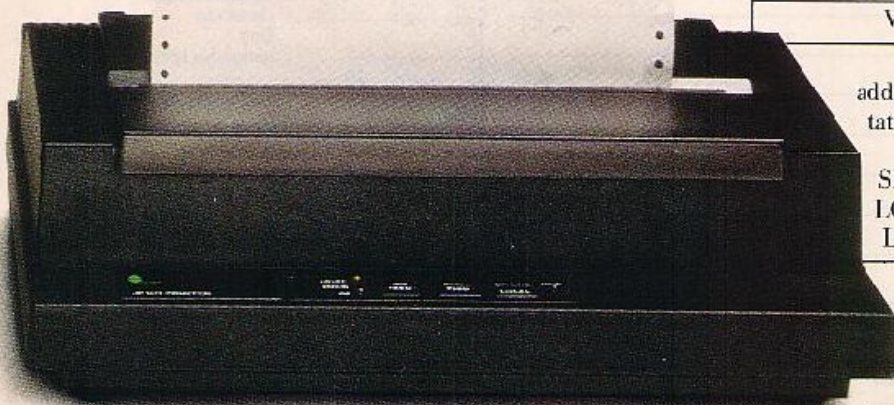
ViewSheet's operations and functions in brief.

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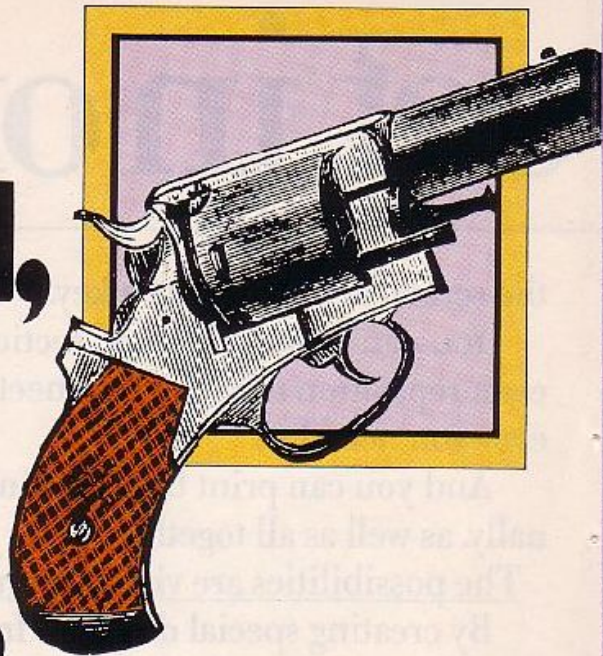
And the functions supported are: ABS, ACS, ASN, SIN, SGN, RAD, ATN, COS, DEG, EXP, INT, LN, LOG, PI, SQR, TAN, MIN, AVERAGE, MAX, CHOOSE, LOOKUP, COL, IF, READ, ROW and WRITE.

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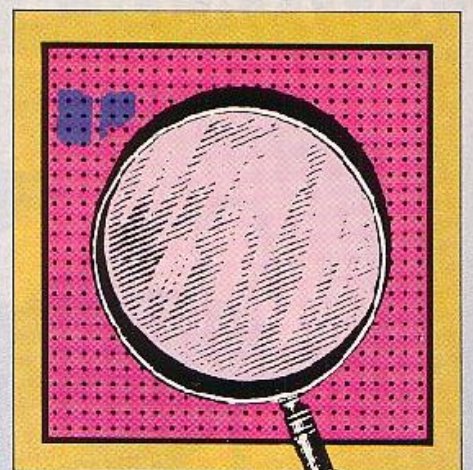
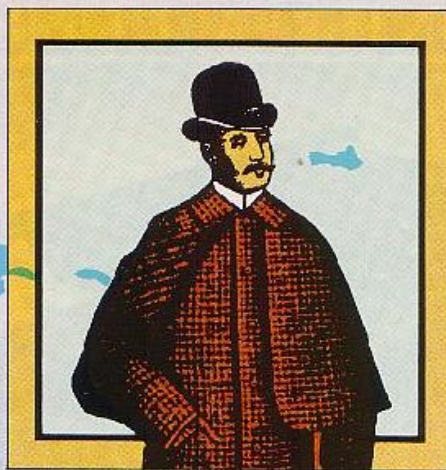
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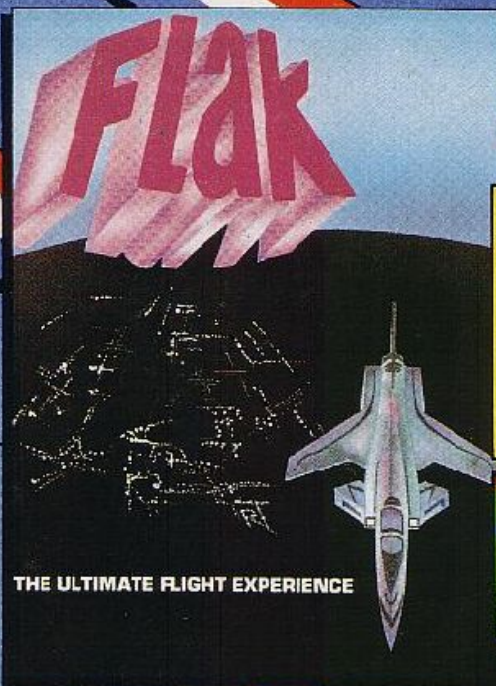
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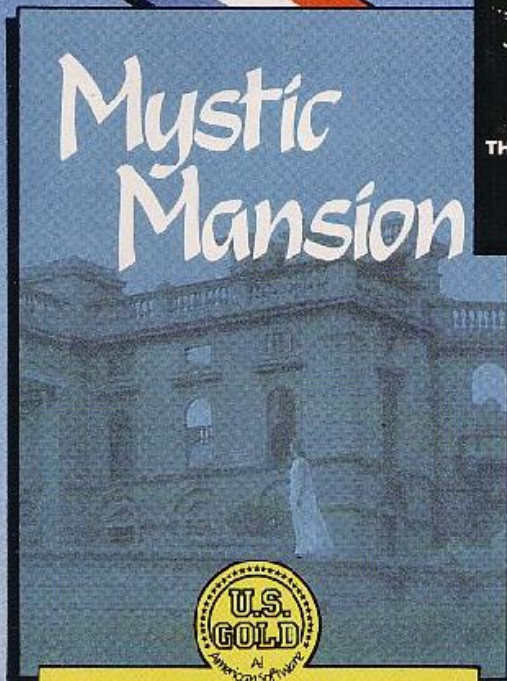


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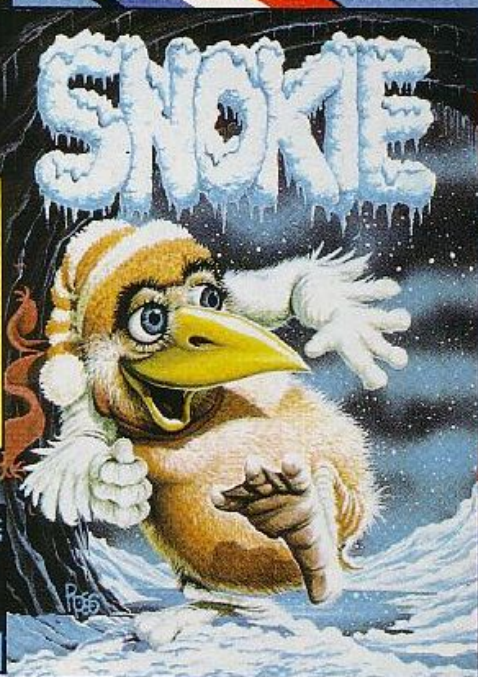
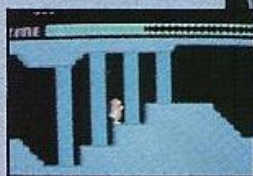


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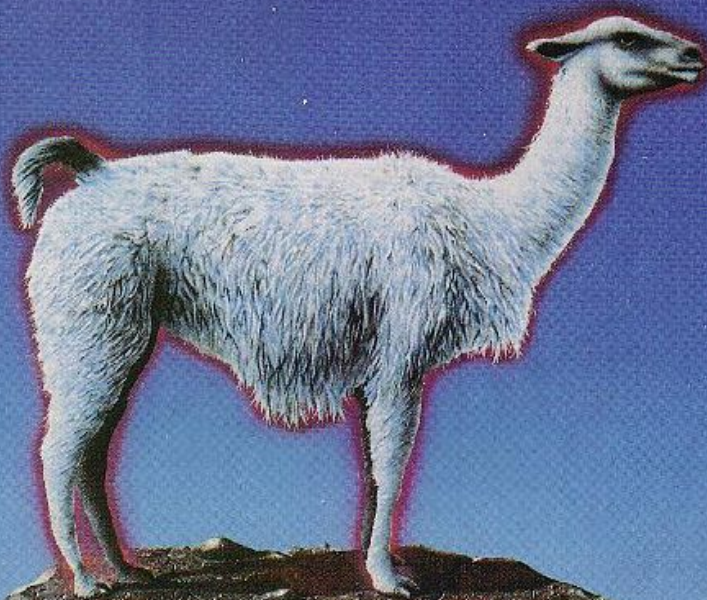
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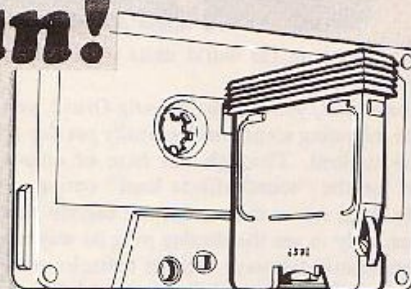
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YOUR LETTERS

LET AN EX-50 FIGHT FOR YOU



Oric-1 owners of the world unite — you have nothing to lose but your bugs!

If, like myself, you bought an early Oric-1, you will be familiar with the following scene: you've finally got Zap the exploding serial attribute to load. Through the haze of colour crawl, you go straight for the "sound effects loud" option. As the first alien gingerly floats across the screen, you eagerly hammer away at the spacebar, only to see the display ping its way into obscurity, and the alien shuttle sideways with its tentacles over its ears.

Before you can say "verify", the move-left button has stuck and the poor old 6502 has ducked under its shell like a One-Gun Turtle. With a sigh, you take out your pen and start another letter of complaint: to Oric, consoling yourself with the thought that at least you'll get a free issue of *Oric Owner* out of it.

For a year, this is how my hobby went. But then, something snapped. No, not the power supply cable, my patience. Armed only with a Form EX-50, free at any county court, I sued Oric for a refund on the grounds that it was a faulty machine which did not live up to the advertising. Within a few weeks, I was cashing a cheque after Oric made an out-of-court settlement.

After my experiences, I do not think I'll invest in an Atmos. However, if that had been my choice, I certainly found a much cheaper way of going about it than Oric's £60 upgrade. If other owners follow suit, this could prove to be very costly for Oric. Hopefully this will teach them a lesson, that they should not bombard the public with faulty and incomplete machines. I wonder if Clive Sinclair is reading this?

Peter Braham,
Wakefield,
West Yorkshire.

ZX PANEL

In the documentation of ZX Panel in the July issue, the final sentence in paragraph 4, page 124, should read "it is moved by typing shifted 6" referring to moving the register cursor.

Alan Lee,
Tring,
Hertfordshire.

BIPODS

The ZX-81 Bipods program in the July 1984 issue shows what can be done on what appears to be a very limited machine. However there was one small error which caused the program to crash every time that it was run: line 5 should be Rand USR 16595 instead of 16592. When this has been corrected the program will run correctly.

Another area in which improvement can be made is to set the high score to 000000 instead of 003780. This can be done by setting the bytes between addresses 17400 and 17405 to 19 decimal. I hope that you will continue to print programs for the ZX-81 as they are much appreciated.

Jonathan Casior,
London SW18.

SAVING BLOCKS

Owners of MTX micros may be a little perturbed by the fact that they cannot save and load blocks of data due to the lack of Basic commands. This problem can be overcome by a short machine-code routine which can be easily entered using the resident assembler:

```
LD HL, START OF BLOCK
LD DE, LENGTH OF BLOCK
LD A, DATA1
LD (#FD68), A
LD A, DATA2
LD (#FD67), A
CALL #0AAE
RET
DATA1 = 0 FOR SAVE, 1 FOR LOAD
OR VERIFY
DATA2 = 0 FOR SAVE OR LOAD,
1 FOR VERIFY
```

J Mallins,
Leeds,
West Yorkshire.

WILLY CHANGES

If you did not particularly like Matthew Smith's sneaky random hazards feature in Jet Set Willy which pulverises you after a visit to the attic, and you want an easier route and easier game proceed as follows.

Rewind the Jet Set Willy tape, and

```
1 DATA 162,110,150,30,134,4,132,5,32,45,27,162
2 DATA 198,160,32,134,4,132,5,32,45,27,162,30
3 DATA 160,31,134,4,132,5,32,45,27,162,118,160
4 DATA 31,134,4,132,5,32,45,27,96,165,4,133
5 DATA 6,165,5,133,7,198,4,160,22,177,4,201
6 DATA 10,240,8,201,12,240,4,136,208,243,96,169
7 DATA 32,145,4,145,6,136,240,19,177,4,201,15
8 DATA 240,13,201,16,240,9,169,10,145,4,159,11
9 DATA 145,6,96,169,32,145,4,160,22,169,13,145
10 DATA 4,56,0,0,32,90,25,32,144,26,96,0
11 DATA 0,0,0,0,0,0,0,0,162,0,160,30
12 DATA 134,2,132,3,32,145,27,230,3,32,145,27
13 DATA 96,163,255,177,2,201,11,240,8,201,13,240
14 DATA 17,136,208,243,96,169,13,145,2,136,169,12
15 DATA 145,2,200,76,157,27,169,11,145,2,136,169
16 DATA 10,145,2,200,76,157,27,0,0,0,0
17 DATA 162,6,254,112,28,202,208,250,162,0,160,30
18 DATA 134,0,132,1,32,215,27,230,1,32,219,27
19 DATA 96,234,234,160,255,177,0,201,15,240,8,201
20 DATA 16,240,11,136,208,243,96,169,16,145,0,76
21 DATA 231,27,169,15,145,0,76,231,27,96,96,0
22 DATA 96,0,0,0,0
90 PRINT "*****JET MAN PART 3*****"
95 PRINT "PLEASE WAIT...."
100 FORA=691207168:READN:T=T+N:IFN=0THENS=S+1
110 POKEA,N:NEXT
120 IF T<23502 THEN PRINT "DATA ERROR":END
130 IF S<27 THEN PRINT "ZERO MISSING ERROR":END
135 IF S>27 THEN PRINT "TOO MANY ZEROS ERROR":END
140 PRINT "NOW LOAD THE NEXT PART"
```

enter:

MERGE""

Press play on the cassette recorder. Once the first part of the program has loaded, stop the cassette and enter:

CLEAR 32767
LOAD ""CODE

Star: the cassette. After the main part of the program has loaded, enter:

POKE 60231,0
POKE 42183,11
POKE 59901,82

POKE 56876,4

If you would like to save the new version of Jet Set Willy, prepare a blank tape and enter:

SAVE "JETSET"LINE 10
SAVE "JSW"CODE 32768,32768

If not, to play the new version, enter:

GO TO 40

Remember when saving to change recorder leads.

Software Projects,
Walton,
Liverpool.

QUELLING THE QL BASHERS

One point overlooked by Kathleen Peel, and QL reviewers in general, is that QL machine code runs some two to three times faster than ZX Spectrum and other eight-bit CPU codes. Benchmark comparisons between one plodding Basic and another are as meaningless as comparing cars by their performance in first gear. Who needs to know? If you are talking speed, you are talking machine code, Forth or Pascal.

Now that the Sinclair bashing season is again in full swing, could I put in a plea for less cataloguing of bugs and more hard connector and interface layouts, interrupts, and documentation?

All computers have bugs and it takes more than a handful of reviewers to find them all. My own theory is that bugs exist in direct proportion to the complexity and versatility of the product. A near perfect computer would take so long to produce it would be obsolete before it hit the streets.

We now seem to be entering a new phase of computer journalism where computers are judged mainly on their freebie software. A case of "Never mind the hardware, just feel the programs". If Psion really has fallen down on the job, some other software house will be only too pleased to plug the gap with a superior and inexpensive product.

The Psion software should be seen for what it is, a plastic toy in the cornflake packet. Also, I cannot understand this fuss is about multi-tasking. You can do it on a ZX-81. If you run several programs, type, print, and Microdrive all at the same time, it will tie your brain in knots, and there would be no excuse to go and make a cup of tea, and have a good think. Multi-masochism I call it!

On a more optimistic note, the mind boggles at the market potential for software authors afforded by 125K plus, 16 bits, and user-friendly 68000 code. Let's face it, without Sinclair, many of us would be on the dole anyway, so why knock it?

Doug Bollen,
London N5.

JET SET ERROR

My letter in the June edition about the Spectrum program Jet Set Willy contains a mistake. Line 25 should be at line 36. Also the letter implied that the Pokes at line 25 would get round the code-checking problem altogether. This is not true.

The Pokes will reduce the number of squares that the program chooses from 180 to 2. The two squares that the program will choose are B2 and C2. So all the user has to do is write down the code for the two squares and then he will not need the card.

Mark Sanderson,
St Andrews,
Fife.

ROM PEEKER

To me, half the pleasure of owning a computer is pottering about, peering into the ROM. I was much saddened on discovering that my latest pride and joy, and brand-new Amstrad CPC-464, was better protected than Colditz. Try as I might, I could not peek into the ROM, and notes in the manual suggested that you could have access to such well guarded secrets as the operating system on paying the ransom for the Advanced User Manual — no doubt another £20.

Surely Mr Sugar you can take pity on such mere "Beginners" as I who have only owned three previous micros and yearn to know how we might examine his mysterious machine.

Matthew Leach,
Leeds,
West Yorkshire.

ATMOS SMASH

Here are some changes which allow my Oric Smash program published in the May issue to run on the Atmos.

First, type in the machine-code as normal then enter the following commands:

DOKE41583,6464
DOKE41647,6432C
DOKE41663,6432C
DOKE41679,6432C
DOKE42497,6427E
DOKE42509,6429E

Additionally, make line 10 of the screen-generating program read:
10DOKE634,4800C:POKE638,28

Finally, a reassuring word for owners of the Atmos who keep on setting the Errors Found message when loading programs. It does not mean that there are errors in the program just that the volume is probably too high.

M Dunlop,
Buckfastleigh,
Devon.

CORRECTIONS

In the July issue the following two lines were left out of listing 1 for the Spectrum Beanstalk program:

1300 DATA 64.255,192,255,64,
63,0,0
1500 DATA 1,3,7,14,28,56,112,32

The last eight lines of listing 3 for July's Vic program, Jetman, were missing. They are given above left.

THE OVERCOATED FIGURE advances into the floodlights. He drops a package in the middle of the barren strip that separates East from West and turns back quickly towards the barbed wire, the dogs and the Kalashnikovs. From the British side a representative of a leading U.K. software house edges forward to retrieve the parcel that contains the latest computer game written by his Warsaw Pact contact.

Not a setting for a new Cold War arcade game. In fact relations between British software companies and Hungarian programmers are particularly warm and cordial. Many of our firms have been reversing the controversy over technological exports to the Eastern Bloc by importing games software from behind the Iron Curtain.

In an attempt to inject some new life into a U.K. software scene which is rapidly running dry of original ideas, program publishers such as Virgin Games, K-tel, Ocean, Mirrorsoft and PSS have looked abroad. Perhaps because Hungarian programmers have not been subjected to decadent Western influences their games writing seems refreshingly original if sometimes a little too relaxed. Chinese Juggler, Bath Time and Felix the Cat are some of the better-known examples of the Hungarians' skill.

This desperate search for originality is an admission of failure. Behind the bankruptcies and belt-tightening that have made this a black summer for the software industry lies the fact that computer owners have grown tired of being sold thousands of variations on the same program themes.

Piracy and the slack summer months may have

taken the blame: the real culprit is the lack of genuinely new software ideas.

A survey of 12 to 17-year-olds by Gowling shows that they are becoming increasingly critical of commercial games. Arcade programs were all too similar.

One way out of the problem would be to make these programs more interactive so that the players could devise new variations of their own once the original structure became tedious. But that flexibility costs memory and many of the best games at the moment are already using the big-selling micros' memories to the full.

Over the last three years progress in software has been carried along on the back of the rapid development of new machines. Now that hardware innovation at the bottom end of the market has slowed to a trickle and the program writers' techniques push existing machines to their limits, imagination now seems to be the problem.

So, what new hardware could help them on? Larger memories and cheaper storage would be a good place to start but the real transformation will occur when the laser discs behind arcade smashes such as Firefox and Dragon's Lair become available to home micro users. The Japanese are already working on a single system which would incorporate laser data storage with video and compact audio discs.

Unless new software ideas come along soon computing will become a static fad and everyone knows that fads die. Locking the stable door and then shooting the horse is not the subtlest way of making sure that you keep your audience captive.

How to write for Your Computer

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

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Stranglers search for an ear in an Aural Quest adventure



THE STRANGLERS become the second bunch of punks from 1977 to stick a computer game on their new album. After Pete "Spiral Scratch" Shelley's XI.1 now The Stranglers are putting an adventure game for the 48K

Spectrum on Aural Quest, their new album which will be released in November.

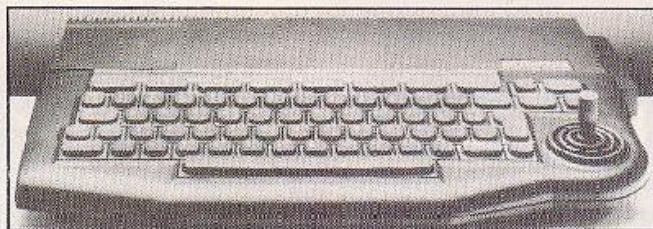
Dave Greenfield, whose keyboards on Rattus Norvegicus reminded so many people of The Doors, swaps a piano keyboard for a Qwerty when he gets home and becomes a made keen adventure player.

The game on Aural Quest will be search for pieces of the ear with

bursts of Stranglers music and lyrics providing some of the clues. Mike Turner of Star Dreams wrote the

program using Gilsoft's Quill — a sausage machine for making instant adventures.

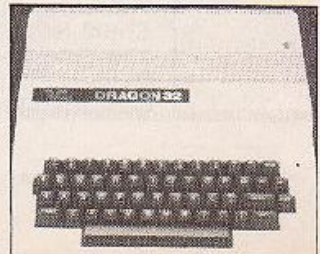
The search for the Enterprise — mission accomplished



ENTERPRISE computers may be in the shops by the end of September according to marketing manager Mike Shirley. "Unlike the others" says Mike "we're not making any silly claims." Enterprise should certainly know about silly claims — in September 1933 when the Enterprise then calling itself the Elvan was launched the company claimed that the first Enterprises would be in the shops by April 1984.

Dragon alive but in Spain

DRAGON DATA just lost the race to develop urgently needed new products before the company collapsed. While new machines including Dragons with built-in disc drives and OS-9 operating system were being demonstrated at shows in London over the summer the Receiver was on his way in. Now a Spanish firm, Eurohard SA, already producing Dragon components has bought Dragon for a million pounds and will start production in Spain this autumn.



Mike Shirley says "There's no product that's come out in the last 12 months which puts us in the shadow."

GEOFF HOLLINGTON who featured in our January 1984 issue as leader of the external design team for the Flan — sorry, Enterprise — has not been idle as he waited for his creation to finally go on sale. He has designed an infra-red joystick for the Spectrum which does away with the need for wires. The stick will be sold by Cheetan.

Big in Japan isn't big enough or Sega the Tokyo-based video games company which is now trying to find an importer for its

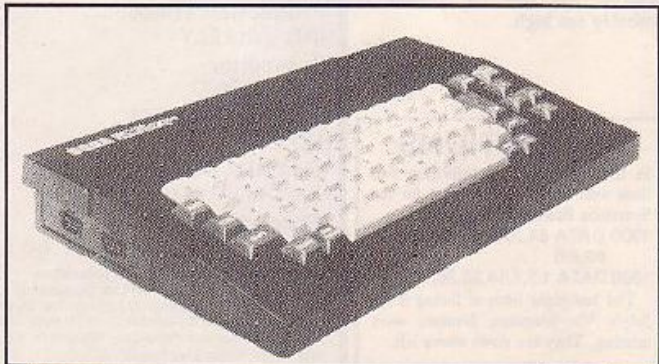


Dreams are made of this

ELECTRIC DREAMS is a simple tale of boy meets girl, boy meets computer, computer meets girl but the production company Virgin Films, "You've bought the record, you've flown the airline, you've pirated the computer game now see the film!" sees it as a story fit for our epoch.

"Gone with the Wind added romance to the depression-defeated 30's John Wayne's pugnacious patriotism reflected the war-torn 40's Doris Day and Sandra Dee movies symbolised the innocence of the 50's. While Woodstock and Easy Rider caught the beat of the 60's, Star Wars and Raiders of the Lost Ark delivered the heroes missing in the real life of the 70's. An apt film for the mid 80's is Electric Dreams, a contemporary fairytale about a computer who falls in love." Try telling that to the average ZX-81 owner.

SC-3000 home computer in Britain The 32K machine has a real keyboard and cartridge slot with a price tag of £150.



YOUR COMPUTER TOP 20

Game	Company	Machine
<input type="checkbox"/> Arabian Nights	Interceptor	CBM 64
<input type="checkbox"/> Beachhead	US Gold	CBM 64
<input type="checkbox"/> Blue Thunder	Foundry System	Spectrum
<input type="checkbox"/> Cuthbert in the Jungle	Microdeal	Dragon
<input type="checkbox"/> Decathlon	Activision	CBM 64
<input type="checkbox"/> Football Manager	Addictive Games	BBC
<input type="checkbox"/> Fortress	Amcom	BBC
<input type="checkbox"/> Frak	Aardvark	BBC
<input type="checkbox"/> Hulk	Adventure International	CBM 64
<input type="checkbox"/> Jet Set Willy	Software Projects	Spectrum
<input type="checkbox"/> Lords of Midnight	Beyond	Spectrum
<input type="checkbox"/> Matchpoint	Pision	Spectrum
<input type="checkbox"/> Mugsy	Melbourne House	Spectrum
<input type="checkbox"/> Sabre Wulf	Ultimate	Spectrum
<input type="checkbox"/> Squirm	Mastertronic	CBM 64
<input type="checkbox"/> Sub Commander	Creative Sparks	Vic 20
<input type="checkbox"/> Tornado	Vortex	Spectrum
<input type="checkbox"/> Low Level		
<input type="checkbox"/> Trashman	New Generation	Spectrum
<input type="checkbox"/> Zaxxon	Starzone	Spectrum

More new ROM antics

SINCLAIR ARE NOW SENDING ROM refit vouchers to all customers who have received the early EPROM QLs with FB, PM or AH operating systems. Those very early customers with FB or PM versions must also return the software package for an upgrade.

A prepaid parcel label is supplied and a turn round time of 10 days of receipt at Camberley is promised. In order to achieve the fast turn round, customers may not receive back their own machine but the guarantee period will commence from the time of the ROM upgrade. A Sinclair spokesperson said those customers who would find it difficult to be without the QL for a short period of time could apply for the ROM set in lieu, each case would be treated sympathetically.

The QLs will be given the JM ROM set which is AH with what is described cosmetic change to tidy things up. For those still unaware of the JM bug state, the major problems are Pi, which causes overflows on some 0° and 90° trigonometric calculations. Solutions use Rads instead, and the RS-232 interface where there appears to be a timing problem with many of the other less expensive printers which do not work with the QL.

The one that got away

IF YOU ARE still looking for the August issue of *Your Computer* it seems only fair to tell you that there wasn't one. We weren't on holiday but on strike. Subscribers will have an extra issue added on at the end of the year.

England search for fast bowlers spreads to Iceland



DESPERATE MEASURES are being taken in the wake of England's 5-0 drubbing by the West Indies. Peaksoft is exporting Tim Love's Cricket for the Commodore 64 and Dragon to Iceland in the hope of encouraging the Norsemen to put together an Eleven which Gower and

the boys would have a chance of beating. Aha you say if this is supposed to be Iceland why are there penguins running around in the picture? "The penguins" say Peaksoft "normally confined to the Antarctic, had escaped from Reykjavic Zoo."



The vending machine with a difference

THIS IS WHAT the software shop of the future may look like if Program Express has its way. Eventually you could see them on street corners like cash vending machines outside banks although the first units are being

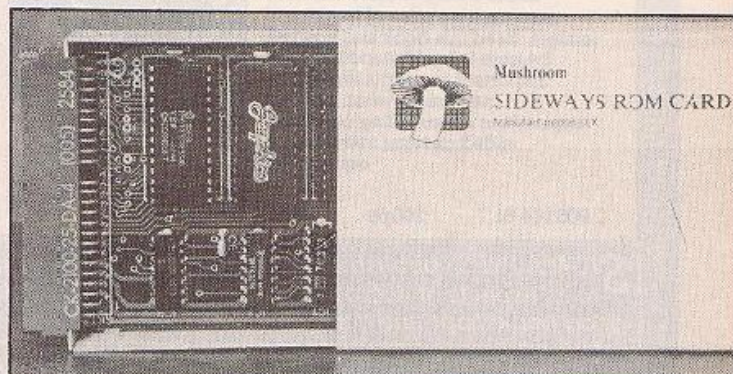
installed inside branches of John Menzies. Each unit has a stock of blank cassettes, cartridges and floppy discs and a telephone link to a central computer which stores the programs.

CRL's Magic Roundabout

BOING! said Zebedee, and well he might on finding out that Clement Chambers of CRL had signed up the Magic Roundabout along with Thunderbirds and Terrahawks. CRL has six full-time programmers including Richard Taylor who learnt his trade writing articles for *Your Computer* plus a large number of part-timers and freelancers.

The programs will be available this autumn — first on the Spectrum then on the Commodore 64. In Magic Roundabout Dougall has to build a house of sugar while facing raids by Ermintrude the cow, Mr McEnry and all the other characters. "Time for bed" said Zebedee BOING!

The struggle to turn the Electron into a BBC continues with Broadway Electronics £30 Mushroom sideways ROM card. This allows you to plug in word processing, graphics or spreadsheet ROM chips as you can on the BBC.



You just ask for the game or piece of business software you want and the shop assistant runs off a copy for you. The claimed advantage is that the shop can never run out of stock.

Cheap at the price

BARGAINS ARE THIN on the ground this autumn but some shops have been selling Dragons for as little as £93, Electrons for £170, and BBC Bs for £350. Ring up and tell us if you see any cheaper prices. Officially, Sinclair and Acorn are discouraging discounting but going for added value offers instead.

Sinclair is offering £56 of free software with every 48K Spectrum sold — and for once this includes some of the best programs around including Scrabble and Chequered Flag. Chess, Survival, Make a Chip and Horace Goes Skiing make up the rest of the bundle. Acorn is offering a free data recorder with five free programs with every BBC sold.

NEW TITLES FROM Sigma Press

Sinclair QL User Guide

Lionel Fleetwood



Sinclair QL: User Guide

by Lionel Fleetwood

Whatever your requirements, the Sinclair QL User Guide will help you to get the most out of your new purchase - or to decide if you should purchase a QL. It shows how to produce letters, keep records, prepare accounts and draw useful graphs. Examples are drawn from real life and each section can be used independently. Throughout the book the language is clear and jargon-free.

0 905104 92 7 180pp £7.50

Microcomputer Speech Synthesis and Recognition



Microcomputer Speech Synthesis and Recognition

by Adrian Poulton

Computerised speech synthesis and its counterpart, speech recognition, are emerging as one of the most important technologies of the mid-1980s. This book explains the origins of artificial speech and shows you how to make your micro speak to the world and how you can speak back to it!

0 905104 39 C 202pp £7.95

Programs That Write Programs

by Chris Naylor

In this thought-provoking book Chris Naylor explains exactly what a program generator is and exactly what it can and cannot do. With the emphasis on the business user, he examines the situations commonly found in any programming project and shows the interaction between the problem to be solved and the software tools available to implement any solution.

0 905104 43 9 226pp £7.95



Practical COBOL for Microcomputers

by Kevin Sullivan

BASIC is a fine language, but most business applications use COBOL, which is now widely available for all popular microcomputers. And, it's not a difficult language to learn: Kevin Sullivan takes you from writing the simplest possible COBOL program, through the use and design of screen layout, right up to handling all types of file.

0 905104 60 9 160pp £6.95



Operating Systems

~a user friendly guide

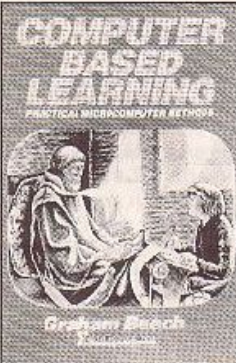


Operating Systems: A User Friendly Guide

by Alan Trevinnor

A 'friendly' guide that uses the widely-used Digital Equipment Corporation's operating systems for its examples and spans the range of large minicomputers, all the way down to the new micros. After describing the major components of all operating systems, the author describes how files are handled, error handling, hardware features and optimisation of hardware and operating systems.

0 905104 66 8 180pp £8.50



Computer Based Learning: Practical Microcomputer Methods

by Graham Beech

This is a definitive but practical book for all those wishing to educate, learn or train with the help of a microcomputer. To instil confidence, there is a comprehensive review of existing successful applications. These all use affordable microcomputers, and so can you!

0 905104 45 5 302pp £8.50

All About Computer-Aided Design and Manufacture

by James Fellows

Confused about CAD/CAM? Then, this is where to start. No more seminars, no piles of books and leaflets. Read this book and you will be able to understand all of the important concepts that are so necessary when you are responsible for installing computer aided design/manufacture equipment.

0 905104 61 7 200pp £9.95

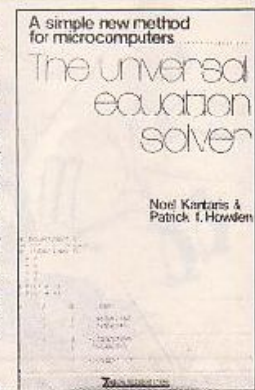


The Universal Equation Solver

by Noel Kantaris and Patrick F. Howden

Equation solving is an art or science needed by many categories of people. This book proposes, in simple terms, a new easy to understand method which will solve equations encountered in any field of endeavour. The new method is presented with a series of program listings for Apple and BBC computers.

0 905104 40 4 120pp £6.80



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The key to better computing

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I could do that...

June's problem drew such a disappointing response that we decided to give you another chance. Do not be intimidated by the term Artificial Intelligence. We are simply looking for a program which allows you to have a conversation with the computer. What we have in mind is a dialogue along the lines of "who's there?" — "John" — "go away, John", but the wittier or more intelligent the computer's responses the better. The program should not be longer than 20 single statement lines. June entries will be held over.

We will award the £15 prize to the program whose questions and responses are judged to be the most amusing, or apparently intelligent.

BEGINNERS

First bytes

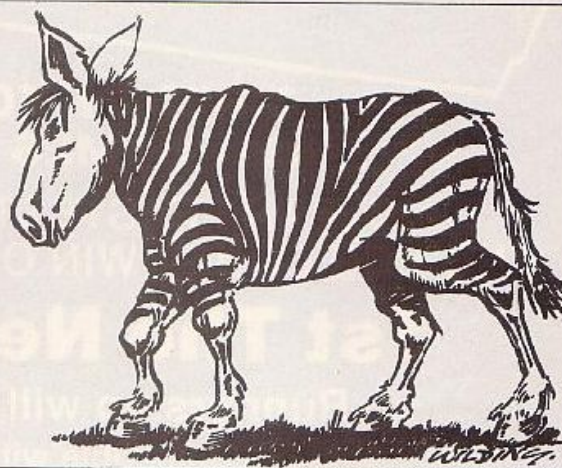
Starting out in home computing? First Bytes is for you. Just write to
Your Computer with any hardware or software problems, no matter how small or simple.

Artificial Intelligence

THE IDEA THAT one day a computer brain may be more intelligent than you may seem unlikely as you struggle with the funny keys on your Spectrum. But when the first computers were built in the 1950s, many programmers believed that the dream of artificial intelligence or AI was not only realisable, but also just a matter of time.

It still is, but rather more time than they thought. Nowadays we are a little bit more realistic in what we expect from our bits of silicon.

(continued on page 39)



How to design and produce structured programs

YOU ARE THE PROUD new owner of a microcomputer. You've tried the "Welcome" tape, and perhaps typed in the programs in the manual and one or two listings from *Your Computer*. Now it's your turn: you've got a great idea and off you go, charging through the program using all those neat tricks you saw in the manual.

However, if the program is any more than about 10 lines long, the chances are that it won't run first time. What a disaster, your program is doing all the wrong things and you can't understand why.

When you look back at your program you find it's got more tangles than a plate of spaghetti. Frankly the chances of untangling it all are so slim that you might just as well pull the plug and start again.

So what is the answer? Right from the start you must develop a disciplined approach to your programs. Professional software writers use "structured programming" techniques.

They first express the problem they must solve in terms of functional blocks and then dissect these blocks into individual procedures and decisions. Only after all this do they get down to the relatively easy task of turning this plan into code that the computer will actually execute.

Perhaps this is asking too much of the amateur, after all, all he wants to

do is get a result out of his program as quickly as possible. He is not interested in winning points for neatness and style. However, if a little of this sort of discipline is used, you may find that your programs become easier to write, and above all, easier to put right when things go wrong.

Try to write some sort of flowchart for your program. This will allow you to see what the program is going to do next. Hopefully you will be able to work out how things should look as you go from one part of your program to another. Now you come to actually writing the code.

Since you will probably be using Basic, at least to start with, what should you look for in a well structured program? Well, there should be a series of subroutines, each corresponding to one of the boxes on your flowchart. This means that the pieces of your program are small, and so you should be able to list the whole routine on your screen at the same time.

The routine should perform a clearly defined function, and it should be possible to test it independently of the main program; you put test values in, of the sort you expect, and you make sure that when the subroutine has been run, the results are what you expected.

To take a simple example. Suppose your program needed to calculate the area of a circle. The subroutine to do

this would look something like this:

```
999 REM CALCULATE AREA OF
    CIRCLE RAD US R
1000 A=3.14159*R*R
1010 RETURN
```

Although rather trivial it demonstrates the principle. The subroutine performs one simple function and could easily be tested. You would simply type in:

```
R=3:GOSUB 1000:PRINT A
```

With a bit of luck, it should come back with 28.274 or thereabouts. Once that is done, you can forget about that module. A further refinement would be to check that the value of R was within a certain range. If it was not then a suitable error message could be printed or a flag set so that the main part of the program knew that a mistake had been made.

So what should a more sophisticated subroutine look like? Obviously, since you must use the Return statement to return to the part of the program the routine was called from, control must pass in an orderly fashion from the first statement to the last.

There should be no jumps from the subroutine, except to other subroutines, and there should be no loose ends when you have finished the routine. This means there should be no For-Next loops still uncompleted. In this way the subroutine can be easily pulled apart should anything go wrong.

Basic is perhaps not the best language for developing this disciplined approach to programs. It lets you get away with too much. The For-Next loop is often a source of trouble. For instance the following seems reasonable enough.

```
100 FOR I=1 TO 100
110 GET KPS
120 IF KP$<>" " THEN 130
130 NEXT I
```

This is a simple reaction test routine. It gives the player a certain length of time to press a key. If the player does then the program goes on to find out which key was pressed, if not the program continues with the routine.

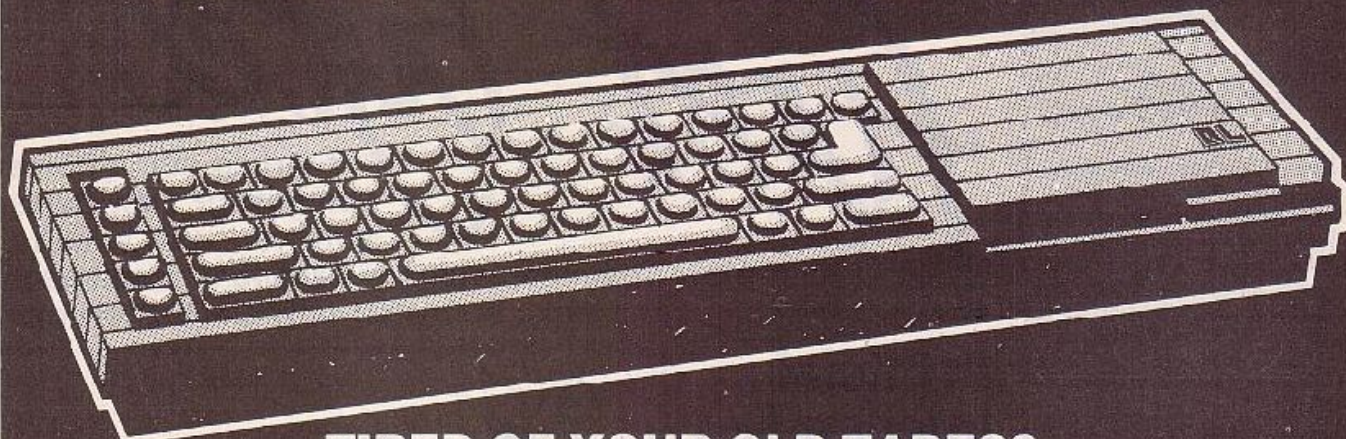
However, you have just jumped out of the middle of the loop. Better to use a Repeat-Until structure. If your Basic does not have this command, then you will have to make do with the following fudge.

```
99 REM KEY PRESSED?
100 FOR I=1 TO 100
110 GET KPS
120 IF KP$<>" " THEN I=100:
    KP=1
130 NEXT I
140 IF KP=1 THEN GOSUB 1000:
    REM KEYPRESS ROUTINE
150 RETURN
```

In line 120, I is set to its limit value and a flag is set. As I has reached 100, the computer exits from the loop and, by looking at the value of KP, now tests to see if a key has been pressed. If it is 1, then the computer

(continued on page 39)

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Artificial Intelligence

(continued from page 37)

Instead of trying to copy some vague concept like "intelligence" which includes everything from perception, recognition, logic, intuition, and guesswork to commonsense, wisdom and perhaps even emotions, AI limits itself to very tiny specific areas.

These are often called expert systems because, like a human expert, they have detailed knowledge but only in a limited area. For example programs have been written that "know" as much as anybody about blood diseases, chemical analysis or oil prospecting, and which can be used by anyone who understands the technical terms.

Expert systems are becoming increasingly common in hospitals, laboratories and industry.

It is a strange fact that it is much easier to program a computer to be a world expert on obscure diseases than it is to get it to understand an English sentence. But it is precisely in these everyday activities that the secret of our intelligence seems to lie.

Recognising people and places, being able to pick out one conversation when several people are talking at once, or even just moving across a room without falling over or hitting something are things we take for granted but which, so far, have defeated the most sophisticated programs on the largest computers.

Part of the problem is finding the right way of programming. In Basic you tell the computer what to do at every point in the program: it is an imperative language. But to recognise some rare blood disease or a badly pronounced word we can hardly spell out to the computer how it should find the answer; if we could, then we would not need the computer. Instead, programming languages and techniques have to be developed that enable the computer to find its own way to the solution.

One of the first languages used in AI was Lisp, short for List Processing. This grew out of the idea that a lot of our knowledge is based on lists of things — words, facts, ideas. So, the language is built around the easy handling of lists.

More recently, the language Prolog has been gaining in popularity. The name comes from Programming in Logic and moves a step closer to intelligence by building in the same ideas of logic that we use.

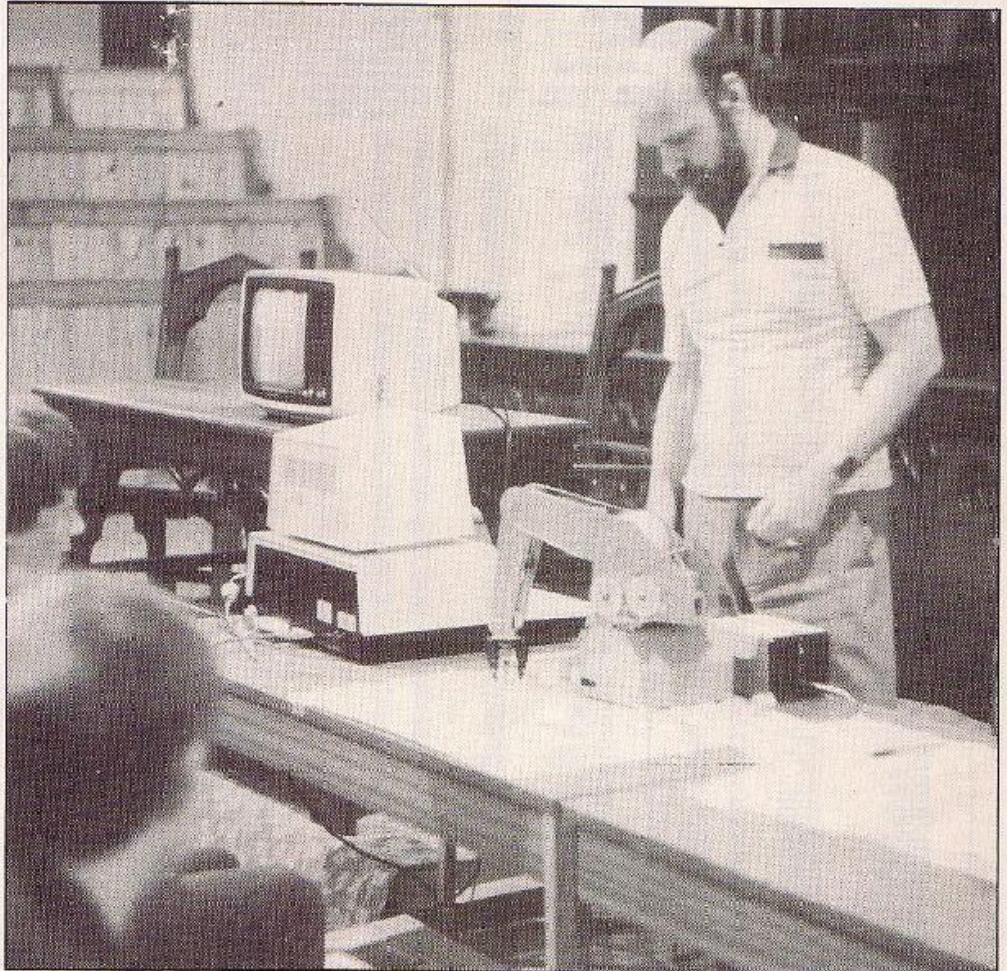
If you want to try your hand at turning your micro into some expert system, Lisp is available for a number of home machines including the BBC. Prolog is still limited to the more expensive professional micros, but will doubtless filter down eventually. Another language that is becoming increasingly popular in the AI field is Logo, better known for its turtle graphics.

For the real enthusiast who wishes to make AI do something there is always the micro-mouse competitor which combines AI and robotics. An

independent microcomputer-controlled device has to find its way to the centre of a maze in the shortest time. It is allowed several tries and can therefore gradually learn the plan and use its intelligence to work out the quickest route. This is all good fun but clearly AI has rather a long way to go before we produce the all-singing, all-dancing intelligent android.

BEGINNERS

first bytes



How to produce structured programs

(continued from page 37)

goes to the keypress subroutine. Of course KP would have to be set to zero before this routine was used again.

So much for the subroutines, what about the main program. This should start at the beginning, go to the end, and there stop. Control should flow from the first line to the End statement calling subroutines as it goes. Avoid Goto like the plague, especially the computed Goto.

You may think this is a recipe for a very dull program; if you can not change the direction of the flow of the program how will it do anything different? That is simple, your main routine will call subroutines according to what happens, just like the keypress example given above.

The beauty of subroutines is that as long as they have been written correctly, they always pass control

back to the point they were called from, preserving the linear flow of the program.

Ideally all these subroutines should be placed after the main program, fenced off from it by an End statement. However, as I am sure you are aware, Basic interpreters look for lines from the top down. So if you require speed, your most often called subroutines will have to be at the beginning of your program. This means that the very first line of your program will have to be a Goto statement which will skip the subroutines and start executing the main program. Hardly pretty, but effective.

There is so much more that can be said about good programming technique; this article has concentrated on just one aspect: making sure you know where your program is going. Tracing the path

taken through your program when it is being executed is vitally important, a task made a lot easier if you have some sort of trace command in your Basic vocabulary.

It cannot be emphasised enough that if you jump around all over the place and leave loose ends hanging around, sooner or later you are going to be tripped up. Perhaps you will get away with it to start with, but as your programs become more involved the problem will get worse. You may also have a tough time if you want to add a bit to your program at a later date to enhance it. You will have forgotten exactly how you wrote it.

Should you start to use machine-code, exactly the same principles apply, only more so. Losing control of a machine-code routine will usually result on the machine hanging up as the processor blindly blunders on through your code.

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If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Harrow

LUG is the acronym for Lynx Users Group. It takes over from NILUG, as Mr R Poate is closing down operations. Are you a Lynx user feeling out in the cold? Contact Mr R B Jones, 209 Kenton, Harrow, Middlesex. Telephone: 01-907 3406.

Burnley

The International Sinclair User Group was formed in August 1983, following the closure of Tim Hartell's National ZX User Group. ISUG now boasts members in Elre, Germany, Spain, Malaysia and Saudi Arabia. Membership brings a monthly newsletter and 20 per cent discounts on a wide range of software. Contact ISUG, 189 Rosehill Road, Burnley, Lancashire.

Truro

The Truro and St Austell Colour Genie User Group keep the flame burning in the Tandy Shop, St Austell, Cornwall on the first Friday of every month except May and July. 50p per meeting to cover expenses. For more details, contact Janine Allen, Flogholeth, Point Road, Carnon Downs, Truro, Cornwall.

Shrewsbury

The 32K Vic-20 Users Club shies away from gross commercialisation, but has been set up to give more to this minority group of users. Anyone who wishes to join can submit and request programs, just paying the postage required. There will also be a regular newsletter. Contact M Valentine, 101A Underdale Road, Monkmoor, Shrewsbury, Shropshire SY2 5EF.

COMPUTER

club

If Shakespeare had been born 400 years later, would he have been a printed circuit bard? Paul Bond goes in search of micros in the great man's birthplace.

IF ALL THE YEAR were playing holidays, to sport would be as tedious to work. Thus the great bard of Avon, on moderation in recreation; nevertheless, since it is that time of the year when most computer clubs experience a slight drop in attendance, due to the "playing holidays", it was understandable that the Stratford-upon-Avon computer club should have less than a full house when *Your Computer* paid its visit.

John Williams, editor of the club newsletter, was in control of things on the evening of our visit, as club secretary Chris Parry was occupied with technical rehearsals at the local Shakespeare Theatre, where he is in charge of stage lighting.

The club was formed in May 1983 to promote greater interest in personal computing and to help its members use, learn about and understand personal computers in general.

There were 98 members at the last count, encompassing machines ranging from Nascom IIIs to TI-99/4As to ones which have enjoyed greater commercial success on the open market.

John Williams has about 33 RML 480Zs in his care at the South Warwickshire College of Further Education, where he is a computer technician. Nevertheless he has managed to avoid being roped in to the teaching events which the club runs apart from its regular meeting on the second Wednesday of every month at the Wesley Hall, opposite Trinity Church, Stratford-upon-Avon.

A Methodist minister from Wellsbourne, the Reverend Farthing, has been giving a series of exhaustive lectures on Z-80 machine code, and other members teach Basic at various levels.

John Williams had given a talk about Pascal: "Most people have



seen a bit of Basic, but very few get opportunities to glimpse any other language."

Stratford-upon-Avon is becoming a bit of a haven for would-be computer users, it would seem. There are summer schools at the aforementioned South Warwickshire College of Further Education, attended by people from all over Great Britain, who want to revel in the local scenery and cultural heritage at the same time.

Sisters Caroline and Julia Tate had the advantage of a BBC Micro at home and had to admit that they were keen games players, though they didn't subscribe to any of the popular myths about girls particularly liking Pac-Man. Neither did Caroline's computer class at school find it necessary to segregate boys and girls in order to make sure that girls get a fair chance.

Adam Tate, who denied any familial connections with the previous two was the proud owner of

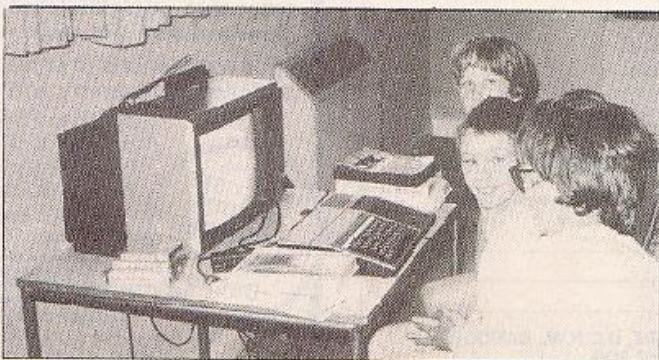
a TI-99/4A. He was more than happy with the implementations of Space Invaders and Wumpus on this machine, and spoke of rumours of the machine's coming back into production in much the way NewBrain owners are known to do.

An exalted use for the humble BBC, not immediately thought of as a laboratory too, was revealed by Barry Lancashire from the National Vegetable Research Station, at Wellsbourne. Nevertheless, this is the micro recommended by the Agricultural Food Research Council (AFRC). The NVRS uses it for image analysis of crops photographed from the air by a radio controlled video camera suspended by gimbals from aeroplanes, kites, balloons, balloons-cum-kites. "We've tried everything except Microlites," said Mr Lancashire.

The BBC is also used for transient waveform analysis of information from pressure transducers.

As far as image analysis goes, Mr Lancashire said. "It's not the image, but the way of getting it. Colour and tone can be confused: pale green foliage might be confused with pale dry soil, for example. Infra-red photography seems most successful." Despite its cost-cutting exercises the NVRS, whose work is valuable to third world countries, finds itself facing the axe from a government more concerned with defending people than with feeding them.

The club itself also looks forward to a more hi-tech approach: facilities for control projects are to be provided by a local company, SI-Plan Electronics. Club info from Chris Parry on Stratford-upon-Avon 68080.



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■ Interceptor Micros

★ ★ ★

AT THE START of Arabian Nights a voice through the TV speaker sets the scene for the opening screen: "Imrahil began his quest on Sinbad's ship, sailing the perilous waters of the Red Sea." In all there are eight different screens and each is introduced by a few lines of computer-generated speech. Sounding rather like someone speaking under water, the voice is notably indistinct but it adds considerably to the enjoyment of this Manic Miner style game.

In the first screen you have to work your way round a galleon, collecting golden jugs by climbing the masts and jumping from platform to platform. At the same time there are hazards to be avoided in the form of octopuses, cannonballs, and a large flying bird — possibly a roc. Following this you find yourself on a raft floating down a crocodile-infested river.

Later screens include a fortress, a desert landscape, and an Arabian city. Since the game draws inspiration from the Arabian Nights, naturally there are also palm trees, flying carpets and turbaned genies.

The interest in this sort of game

lies in working out the correct route, in finding the right sequence of objects to be collected and jumps to be taken. In this respect Tales of the Arabian Nights is fairly demanding although it does not require the degree of accuracy and tortuous attention to detail that make Manic Miner so engrossing.

Nor are the graphics as firely drawn or as wittily original as they are in Manic Miner. Nonetheless — comparisons aside — the game has a high entertainment value.



Invasion

■ 48K Spectrum

■ £6.99

■ Argus Press Software

★ ★ ★

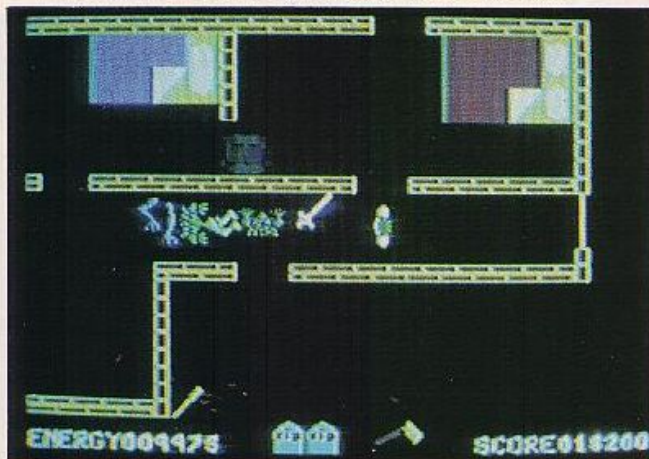
IF YOU ARE fed up with zapping aliens in real time with amazing graphics, sound the works, then here's something that might be more up your street. The Reds are coming and it's up to you to defend your homeland.

The invading hordes enter from the top of your 8-by-12 grid which represents the homeland. You have eight armies under your command with which to attempt to repel the foreign hordes. Scattered over the map are 14 cities which you must defend, lose the lot and it's the firing squad for you. The unkindest cut of all is also meted out if you allow any of the invaders to march off the bottom of the map — presumably because they then threaten something vital, like the Presidential Country Retreat.

Each turn you are given 10 resource points per town under your control. These can be used to build new units or allow ones you already have to attack. Attacking seems to be a good idea in this game, so these supplies are vital. You can then give each army one command, either change its strength or move it. The effectiveness of an army is affected by its morale: if it gets badly mauled, its morale sinks; an easy victory and its morale and effectiveness rise.

All this leads to some tricky decisions for would-be Patons. Trying to defend every inch tends to be an expensive and morale-sapping exercise.

However, the choices and strategies open to you seem somewhat limited and once the right mix of the two mentioned above has been discovered, I doubt if the game has that much more to offer.



Evil Dead

■ CBM-64

■ £6.99

■ Palace Software

★ ★ ★

A WHILE BACK THERE was a flurry of concern at the possibility that video nasties would spawn a generation of equally unpleasant computer games — computer nasties.

At the time you might have wondered if home computer graphics were capable of the sort of gory special effects video nasties trade in.

The Evil Dead would confirm your doubts. It is a spin-off from the horror film of the same name but there is nothing here to keep even the most unworldly 12-year-old awake at night.

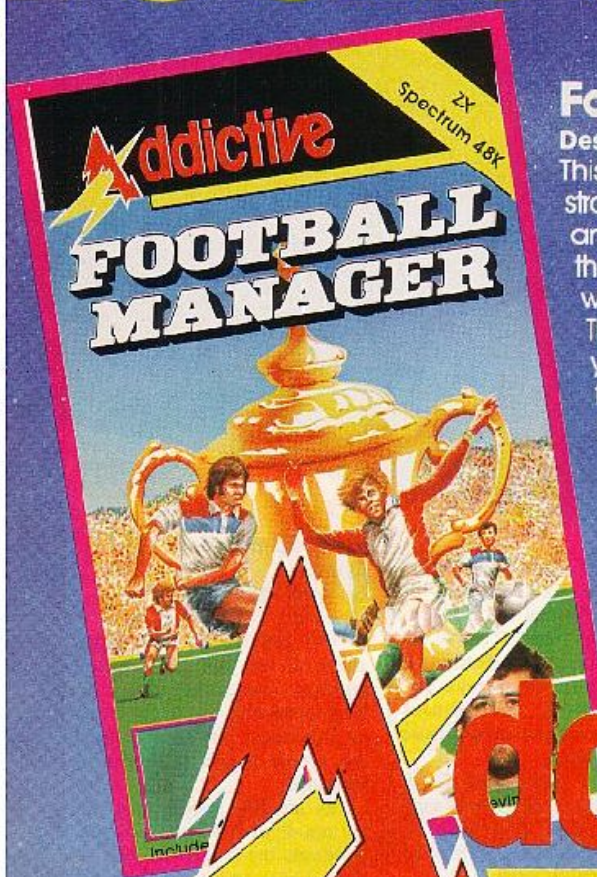
The computer version is said to follow the plot of the film. Ashley, a naive teenager, together with four chums is trapped in an isolated house inhabited by the spirits of the undead.

Translated to the computer screen the game turns out to be a distant

(continued on page 45)

The No.1 Football Game

ZX81 16K,
Spectrum 48K



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Kevin Toms

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- ★ Injury problems ★ Full league tables
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- ★ As many seasons as you like
- ★ Managerial rating
- ★ 7 skill levels
- ★ Save game facility

Addictive

*ZX81 Chart,
Home Computing Weekly 16.8.83

Comments about the game from press and our customers

"FOOTBALL MANAGER is the best game I have yet seen on the Spectrum and my personal favourite of all the games on any micro ... To the ordinary person it is an excellent view of what can be done in the field of computer games ... The crowning glory of this game is the short set pieces of match highlights which show little stick men running around a pitch, shooting, defending and scoring ... It is a compulsive game but people who cannot take game sessions of 9 hours or so, which happened on one happy Sunday, will be grateful to know that there is a 'save to tape' option. FOOTBALL MANAGER has everything it could ... The

originalator, Addictive Games, certainly deserve the name." Rating: 19/20 (Practical Computing – August 1983).

"When I first received this game I spent the best part of the weekend playing it. Since then I have returned to it more often than any other. The truly addictive quality of this game is the remarkable way it mirrors the real football manager's problems ... (Personal Computer Games – Summer 1983)

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Star★ chart

Gravitar

Oric-1/Atmos 48K:

Eat-em-up.

£7.50:

Severn Software

★ ★ ★

With four controls: rotate left, right, thrust and tractor beam, you have to guide your intrepid spaceship around the screen picking up fuel pods, avoiding the gunfire from enemy emplacements, and avoiding a low flying spaceship. If this wasn't bad enough, you've got momentum and gravity to cope with. The game calls for patience and very delicate control.

Crusoe

48K Spectrum:

Adventure:

£6.00:

Automata

★ ★ ★

In this graphics adventure you take the part of the well-known castaway trudging round a desert island with 75 items to track down. The program is nicely presented with several screens for you to explore. William Bones has left plenty of clues strewn around the place for you to solve. The text appears in Treasure Island script, with suitably rustic messages.

Classic Racing

Oric-1/Atmos 48K:

Boardgame:

£7.95:

Salamander

★ ★ ★

For one to six players, each player has a stable of 16 horses of unknown form. Your job is to attempt to find out which horses are most suitable for what sort of going — and which are most suited to the glue factory — in time for the big meetings at the end of the season. With less than six players, the computer plays the other stables. A whole season of 16 meetings can provide a long and absorbing game. Fortunately you can load and save games at any point.

relation of Atic Atac, in which you have to move from room to room fighting off hostile beasts. The difference between this and Atic Atac is that there is no ultimate goal: your object is simply to stay alive for as long as possible.

To cope with the monsters in your path you have a supply of destructive energy which can be replenished by picking up a weapon. Alternatively, you can attempt to shut them out by closing windows and doors.

Once attacked the monsters split into parts which in turn enter the fray. As your four friends are also likely to mutate into monsters you find the house soon fills up with a variety of Evil Spirits, zombies, pink things and dismembered limbs. Clearing the screen becomes uphill work.

The Evil Dead sports some excellent graphics particularly in the way the characters are animated. A computer nasty it is not: anyone who fears, or hopes, that it might be a real sickener will be disappointed. But there is enough variety in it to keep the interest alive for a good few playing hours.

Lords of Midnight

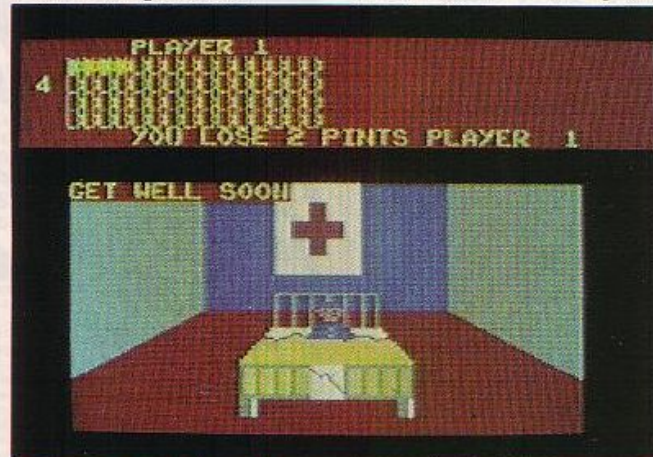
48K Spectrum

£9.95

Beyond

★ ★ ★

THE LORDS OF MIDNIGHT is a graphics adventure based loosely on Tolkien's *Lord of the Rings*. Saying this is rather like saying a Porche 924 is a motor car based on the Model T Ford. This program is simply in a different league from graphic adventures that have gone before.



Bozo's Night Out

CBM-64

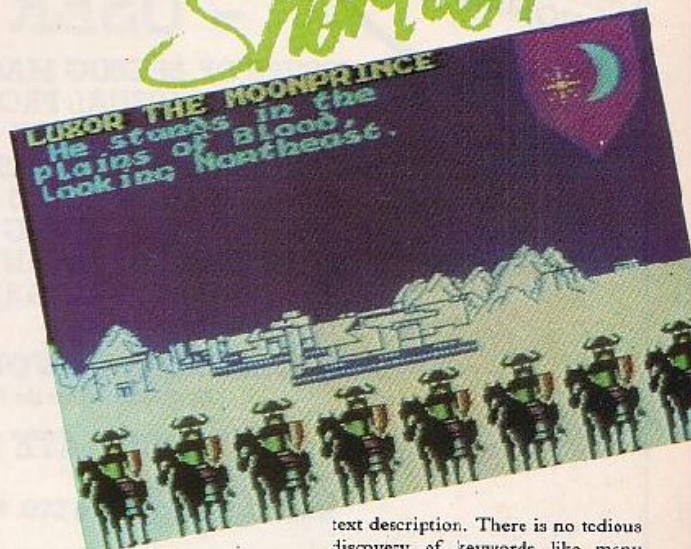
£6.90

Taskset

★ ★ ★

BOZO'S NIGHT OUT puts you in charge of Bozo, an inveterate drinker. It is your responsibility to guide him home after a hard night in the pub. Getting him safely home racks up a score of five pints, whereupon you can pick him up at the pub

SOFTWARE Shortlist



At the start of the game, you, Luxor, the Moon Prince, are standing with your three chams surveying the Land of Midnight; the forces of Doomdark the Witchking are preparing to give the land of the free — the good guys — a hard time. If you've read *Lord of The Rings*, the rest of the plot will be fairly familiar to you. There are two ways that you can defeat Doomdark: capture his ring of power, or defeat him in battle; neither is a picnic.

Beyond claim to have crammed 30,000 locations into the game. The effect is truly breathtaking. While at any of these locations you can look in eight directions and the computer quickly draws the view and gives a

text description. There is no tedious discovery of keywords like many adventures, the whole thing is menu driven, different options being available depending on location.

The game proceeds by you giving instructions in turn to the various characters under your command. As you are moving them, you can find objects, recruit men and other leaders, which you can then in turn move, and of course you can do battle with the forces of midnight.

Once you have completed a character's actions for the day, you go on to another. When all your characters have been moved, you press the Night button, and the computer sets to work moving the forces of darkness around and working out the outcome of battle.

Gems of Stratus

Amstrad CPC-464

£7.95

Kuma

★ ★ ★

GEMS OF STRATUS is one of the first independent software releases for the new Amstrad computer. The game is an adventure with graphics which uses the Amstrad screen windows to good effect: you put your commands into one window and the machine's replies come back on two others and the view of your present location is in a fourth.

Movement is by use of cursor keys and full use is made of the keyboard buffer which, once you have made a map, allows you to move very rapidly around the maze of rooms: you simply hit the appropriate cursor keys the required number of times, and sooner or later the machine catches up with you.

Your object is to find the hidden trove room and "the hidden wealth of AM". Well we have to admit we never found them.

The game is rather frustrating, but if the clues were too easy the game would soon lose its value.

door the following night.

Bozo has a choice of two routes, along the street or a shortcut through the park. On the pavement he is threatened by policemen, muggers and ladies of the night, while the park contains an assortment of unpleasant creatures and malevolent plants. Using the joystick you need to steer Bozo.

This scenario is illustrated by some amusing cartoon-style graphics.

It might have been more realistic and exciting if Bozo were given a chance to defend himself.

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NEWS

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The crystal ball

The Adventurer's Notebook is a new volume from Duckworths. Priced at £3.95, it includes ready made maps and notepads for use when playing, a history of adventures, a personal list of the best, and a useful set of synonyms and suggestions for when you're stuck.

Salamander Software are bringing out their Dan Diamond trilogy in a single package for the Spectrum. The trio consists of Dan Diamond, Lost in Space and Fishy Business.

If you've a disc drive, look out for Infocom's Sorcerer — the second in the Enchanter series — and Seastalker — the latest Tale of Adventure. Retailing at around £40 each, they're worth going into the red for.

Commcore have secured the publishing rights to the magnificent Zork trilogy, Infocom's earlier masterpieces. Disc only but well within your pocket at the new low price of £11.95 each.

A helping hand

Hobbit players now have the excellent Melbourne House "Guide to Playing The Hobbit" (£3.95) so no help from me as well — fair's fair!

For fans of Micrograf's BBC Adventure, Flint's Gold:— At the platform but can't cross the lake? LLEB GNIR:IAOG PORD

In the Gloomy Room but can't locate a hidden treasure map?

KOOL:GELGEP
TEG:KOOL:LOTSIP:ERIF

For Phipps' Colditz Prisoners:— Hacksaw breaks trying to open grate?

(REVIRDWERCS HTIW)
ETARG WERCNU

Yours in flame and frustration,
HUGO NORT

QUEST

Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

Wizard's Challenge

- BBC B
- £7.95
- Program Power

WITH A TITLE like that and a mission to recover 12 treasures for an evil wizard, you might think you'd be plunged straight into a mystic wood or into an eerie underground labyrinth. In fact you start off on some school playing fields. Exploring this rather unusual jumping off point, you'll find, among other places, a tack shop, changing rooms and dining hall. What on earth can you do with a school dinner (except perhaps to use it as a weapon, if mice were anything to go by).

Further searching may result in you getting wounded — it may be only a cut finger but it could finish you off before you've barely begun your quest.

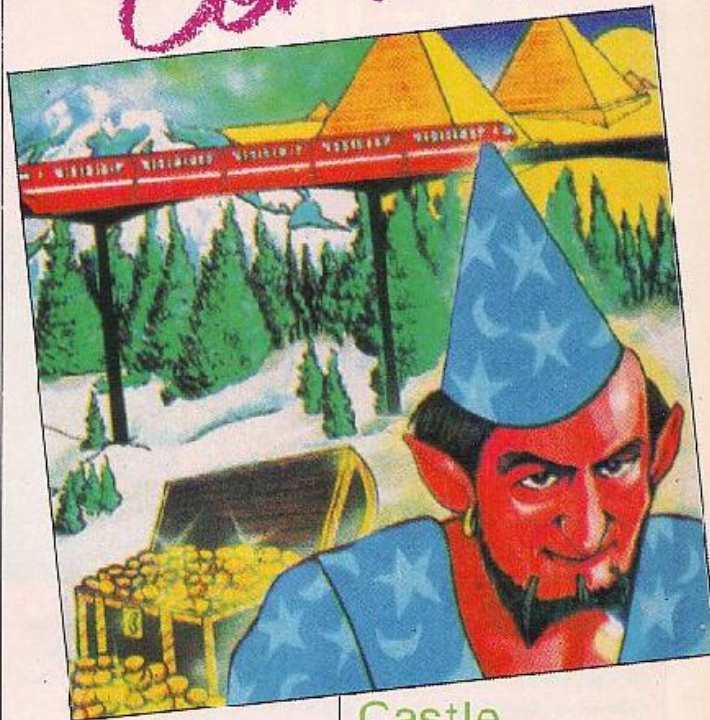
A lamp is soon located which can only be used at night — you'll shortly be going to places deep, dark and dangerous. However, when you do go down, things are not at first what you might expect. A Brutish Rail (yes, Brutish) underground station is the first of several surprises.

There are over 100 locations and some 50 problems to solve in this enjoyable text adventure. Response to input is immediate and although there are one or two spelling errors, it doesn't mar what is an entertaining program.

Paradox

- Spectrum 48K
- £7.50
- Runscft

THERE HAS BEEN a surge in the number of Spectrum adventures, due mainly to the availability of Gilsoft's



Castle Blackstar

- Spectrum 48K
- £8.95
- SCR Adventures

FOR THOSE WHO like their text adventures meaty, Castle Blackstar should prove toothsome fare. It is a complex, puzzle-rich quest that challenges you to score a maximum of 240 points which are gained by finding and returning treasures, performing certain actions and accomplishing the main objective of your mission — to find and return the lost orb to the Lady Artemis.

You start your journey in the vale of Castle Blackstar. Wander too far from the path and you'll be lost in a forest maze. Experienced adventurers will be well aware that the best way to map out a maze is to drop objects along the way so make sure you find some before going on a forest jaunt.

There are plenty of intriguing and unusual objects and puzzles, many of which will undoubtedly have you reaching for the aspirins. As a small taste of what's in store, difficulties along your way include an invisible hand, eagle eggs and a water-logged boat.

Original and challenging puzzles, fast response, a comprehensive vocabulary and plenty of atmosphere make Castle Blackstar a worthy contender for your hard won gold.

"The Quill" adventure generator Paradox is such a Quill produced program, and a pretty interesting one it is too.

The environment you are invited to roam is divided up into four main areas: the Tunnel — where you start — the Gamesboard, the Crystal Palace, and the Magicians' Rooms. One feature of this adventure is that it only tells you of exits other than the one that leads back to where you have just come from — and even then, you can't always guarantee that you'll be able to return the way you came.

The Tunnel is what you would anticipate — various interconnected chambers where you'll find useful objects or sudden death. You can't afford to fiddle around too long — a raging thirst drives you to find water.

The Gamesboard will provide clues and riddles — unless you solve them, you won't gain access to the Crystal Palace.

With 150 different locations and puzzles and paradoxes aplenty, this text adventure may well keep you occupied until Christmas.

TOSHIBA HX-10

Graham Bland looks at what the vanguard of the MSX invasion has to offer

IN A BID TO REPEAT their success in Japan, a number of manufacturers recently announced their intention to launch MSX systems in the U.K. Toshiba has emerged as the pace setter in the race to customise a micro for the more sophisticated British market. The HX-10 Home Computer seems likely to beat Sanyo's Wavy 10 and Sony's Hit-Bit to a place on the MSX shelves this month, albeit by a narrow margin.

Toshiba's machine is unexciting when compared with other systems from the land of the rising sun. The HX-10 does not have any of the goodies promised with some other MSX micros such as video interfacing, robot arms, and music synthesizers. But what it will have is a more competitive price tag.

Cosmetically, the HX-10 appears functional rather than glamorous — a slab-like dark-brown box, not exactly ugly, but it is hardly inspiring either. The overall construction is very workmanlike, a solid heavy micro that looks as if it could take a good bashing and has the endearing habit of staying put while you are typing.

Interfacing made easy

Communication with the outside world is relatively simple. At the back of the machine are phono socket connections for output to TV set or monitor, and a DIN socket to hook up a cassette recorder. Also hidden round the back is the bus connector which is ominously marked "For Only Toshiba Use". This expansion bus connector will come into use when disc interfaces become available, as well as RS-232 drivers and the like. On the side of the machine are two D-type joystick sockets and a Centronics printer socket.

The all-important cartridge slot is accessed from above. How often this slot is used will depend on how many U.K. software houses opt for cartridge media in favour of cheaper



and more popular cassettes.

As keyboards go, the HX-10's is a long way ahead of those found on the Sord M-5 and the Spectrum, but not quite in the league of the BBC model B or Electror. As such, it represents a reasonable compromise between low-cost and usability. Of the 73 keys, five are programmable function keys — or soft keys as they are sometimes known.

A rich set of foreign characters are available from the keyboard using the Code key, including French, Spanish and Greek, as well as graphics characters which are produced using the bright-green Graph key. The minor points which annoyed me while using the HX-10's keyboard were the tiny backspace key, the cramped cursor keys and the absurd colour scheme adopted, green, blue, brown and white.

In Japan, Toshiba was one of the few companies to offer a 64K machine. Seemingly, Tokyo's man-on-the-street is quite happy with a measly 16K computer. Of the two systems that Toshiba had available in Japan, they wisely adapted the 54K version instead of the 32K model.

If the promise of 64K seems mouth-watering, prepare for a sudden loss of appetite when you switch on the HX-10. After the copyright

message you are informed that there is only about 28K available to MSX-Basic programs. Graphics support immediately claims 16K and the rest of the missing memory is squirrelled away for some undisclosed purpose — perhaps lying dormant awaiting the arrival of a disc-operating system.

Displayed at the bottom of the screen are the values of the first five function keys. The second five values may be displayed simply by holding down the Shift key. To remove this display, the command Key Off will do the trick. You can assign your own character strings to any of the function keys. For example:

KEY 1,"? FRE(0)" + CHR (13)

will print out the amount of free memory every time function key number 1 is pressed.

MSX-Basic is very nearly an 8-bit IBM PC Basic, offering a nice spread of arithmetic functions, good graphics and sound and a few other elegant touches which must make it one of the best home micro Basics around.

All arithmetic is calculated to double precision — up to 14 decimal places — which does tend to slow programs down a bit, but this trade-off is acceptable if accuracy is the most important consideration. Data types can be declared as binary, hexadecimal and octal as well as the standard characters, integers etc.

Entering programs displays both a weakness and strength in the Basic. Unfortunately, the interpreter does not check lines as they are entered. To compensate, there is an excellent full-screen editor. It is a shame that the designers could not combine both these features in the way Atari has on the 800XL.

As mentioned earlier, the HX-10's character set is fairly complete. There is a full range of scientific symbols, a music note, signs for



REVIEW



integration and differentiation and so forth. These characters, plus the foreign ones, point to the possible educational uses that MSX systems might have.

Program output can be formatted using the Print Using statement. This is a fairly flexible and powerful statement which is particularly useful for making numeric output look nice. If, for example, the results of a tax calculation are to be displayed to two decimal places, the following statement will ensure a uniform output:

```
10 PRINT USING "#.#", TAX
```

Other options allow field fillers, + or - signs, and the insertion of a string variable into a constant string.

Powerful sound chip

The sound available from MSX Basic is also quite impressive. At the heart of every MSX micro lies a dedicated sound chip — General Instruments AY-3-8910 — the same chip used by the Oric Atmos and Memotech MTX series, in fact. It is capable of producing three notes simultaneously over a range of eight octaves with an optional noise channel to produce helicopter and explosion noises. To kick this chip into life, you can use one of two Basic commands: Sound or Play.

Sound is the most flexible of the two but much harder to use. It is little more than a specialised Poke instruction; values are sent to one of the sound chip's 13 registers accessible from the Basic. Not having a manual available

you will have to study the sound chip quite fully.

The Play command is much more straightforward. You are restricted to musical notes in this case, with instructions being given to the sound chip via the Music Macro Language. Music is set out in a character string, with letters like C, F and G# corresponding to the same notes as musical notation.

Note length, octave, tempo and other features will, with practice, allow most tunes to be played. All music played using this command is placed in a music queue for summary execution. So once told what it is to play, the HX-10 can continue to perform some other task.

With 16K of your precious memory dedicated to graphics support, you get the feeling that the graphics capabilities of this machine ought to be quite good. Though not in possession

with the HX-10, I can only hope that this feature is well documented. There are no equivalents of the Oric's Zap and other sound commands. If you want these from MSX Basic, an ultra-high resolution screen like the Beeb's, the HX-10 can squeeze quite a lot from its fairly moderate 256 by 192 resolution screen. The nicest thing about MSX Basic's graphics statements is that they are very easy to use, and due to the allocated video RAM, reasonably quick too.

There are commands to draw circles, lines and boxes, a Paint command, and 16 colours available. Best of all, you can declare up to 32 sprites. Fortunately, there are no Poke instructions required to set up a sprite thanks to the provision of a special variable called Sprite\$. Sprites are placed on the screen using the Put Sprite command. A number of these graphics statements such as PSet, Circle, and Put Sprite have the option to specify absolute or relative co-ordinates.

By putting the word Step in front of a set of co-ordinates, the shape or point is placed relative to the last point addressed on the graphics screen. This speeds up the movement of sprites etc. across the screen as there is no need to waste time calculating the object's next position.

Text and graphics

There is, however, no easy way to put text into a graphics screen. What you have to do is: open the graphics screen as a named file (GRP:) and use a Print# statement to send a character string to the screen. This is hardly convenient particularly as the character string will be placed at the last point addressed on the screen.

Possibly the best feature of this Basic is its interrupt statements. Rather than polling for an event such as the spacebar being pressed, you can set an interrupt which will cause a branch to a subroutine when the event occurs. The following short program will print out the product of 100 by 100 repeatedly until the spacebar is pressed, when it will print out "HELLO":

```
10 string(0) on
20 on string gosub 40
30 print 100 * 100 : goto 30
40 print "HELLO" : return
```

Interrupts may be set up to monitor the function keys, sprite collision, time intervals, and trap events such as errors and the production of a Ctrl-Stop signal. This feature of the language makes up for the omission of a While-Wend statement.

CONCLUSIONS

- Overall, the Toshiba HX-10 is a pleasurable system to use. It does have its drawbacks but these are generally too few to worry about. It is much better than the ill-fated Spectravideo — almost an MSX computer but not quite — being curiously faster with the obvious advantage of a full-pitch keyboard.
- It will be a long time before the full impact of MSX is realised in the U.K. The standard promises cheaper and

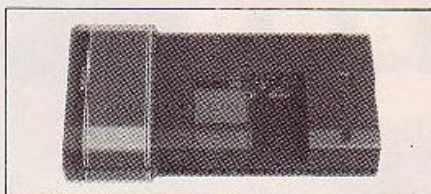
plentiful software, lower-cost systems and peripherals, every micro owner's dream in fact. It will probably be next year at the earliest before software houses have the courage to reduce MSX software prices, depending, of course, on whether MSX takes off in the U.K.

- Judging by the Toshiba MSX system, the decision to purchase one manufacturer's system against another may well rest on a single factor — price.

Database:	
Name:	
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Pocket-sized	
Re-usable datapacks	
Own program language	
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PSION ORGANISER

Competition



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Not least of the Organiser's merits is the fact that the datapacks are inexpensive and can be re-used up to 100 times.

In this month's competition Psion is giving us three Organisers as prizes. Each comes with a Utility Pack and a 16K datapack. In addition the winners will be able to choose one of four program packs: Finance, Maths, Science or

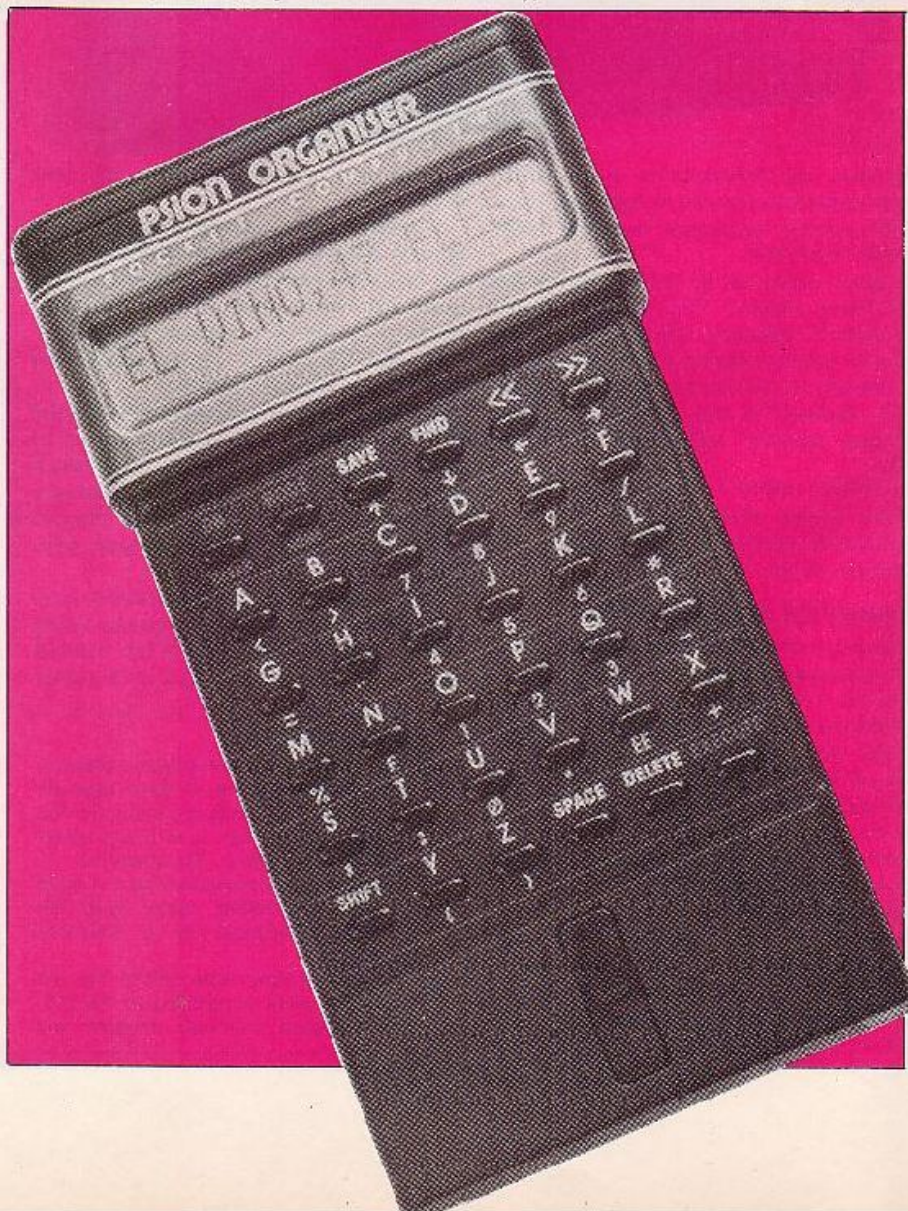
Link-Up Communications.

To enter you need to put eight of the Organiser's features in order of importance. Then as a tie-breaker we would like you to suggest an original way of using the database facility — what sort of information would you store in the Organiser's datapack?

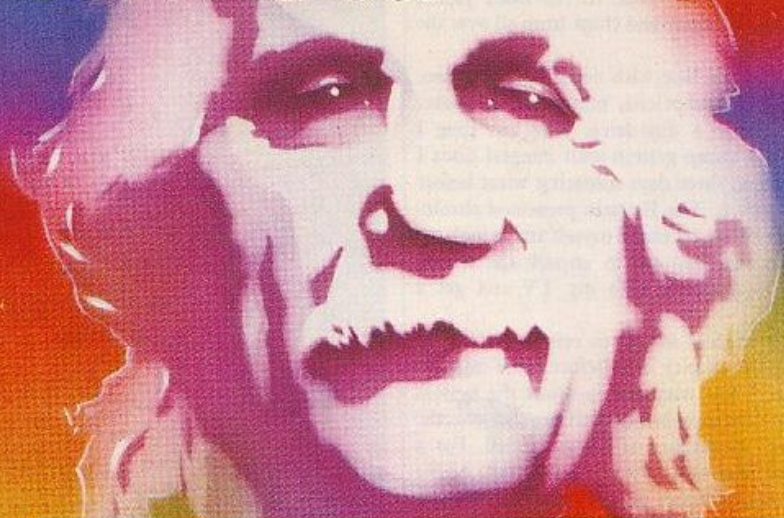
Put a 1 against the feature you consider most important, a 2 against the second most important and so on until you have filled all the boxes. Now think of an original database and send this coupon to Your Computer, L-221, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS.

RULES

- The winners of the competition will be the people who number the Organiser's features correctly and, in the view of the editor, make the most original suggestion on the use of the database.
- The names of the winners will be printed in the November issue of Your Computer.
- All entries must arrive at the Your Computer offices by the last working day in September 1984.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employee of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
- No correspondence on the result of the competition will be entered into.
- Business Press International assumes no responsibility or liability for any complaints arising from this competition.



A COMPLETE COLOUR MICRO WITH NO HIDDEN EXTRAS FOR AROUND £499.



The title of 'genius' is not bestowed lightly on man or machine: those extraordinary qualities and powers of intellect are rare.

Einstein had them in full measure. And so now does the new micro computer from Tatung, designed and built in Britain and appropriately named - Einstein.

Einstein was created by Tatung, one of the world's leading electronic companies, and given the capacity and the remarkable capabilities to compete with computers costing far more.

Its simplicity of operation will appeal to the first time buyer and to businessmen who don't want to lose staff to expensive and time-consuming training courses. At the same time its operating system is both powerful and sophisticated to satisfy the most advanced requirements.

For those who have outgrown their existing primitive machine, the speed and capacity of the 500K built-in disc drive will make all the difference. And for the small businessman, the ability to store and retrieve all information in seconds will be as important as Einstein's built-in flexibility, which allows the system to grow as the business develops.

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Total memory capacity 80K RAM divided into 64K 'user' memory and 16K for colour graphics production.

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500K 3" compact floppy disc drive. Potential for massive extra storage with a second 500K disc drive internally.

BUILT-IN 16 COLOUR GRAPHICS High resolution graphic animation from 32 sprites (definable shapes), 16 vivid colours.



BUILT-IN EXPANSION PORTS

Connection to both TV and optional colour monitor, most printers and other computers via RS232C interface. Also twin joystick ports, 8 bit user port, exclusive Tatung Pipe.

BUILT-IN FLEXIBILITY

Powerful Crystal BASIC. Multi-lingual plus ability to run CP/M.*

BUILT-IN VERSATILE SOUND

Sound synthesiser facility includes chromatic music with three voices. Substantial speaker with volume control. Provision for speech synthesiser.

Einstein has them all. Feature for feature, it meets the needs of the novice and the experienced operator, both at home and in the office.

Einstein, designed and built in Britain, is a complete colour micro computer with no hidden extras.

And for under £500 is sheer genius.

TATUNG
Einstein
SHEER GENIUS: AT WORK, AT HOME.

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*CP/M is a trade mark of Digital Research Inc

YOU WOULD NEVER guess it from the name, but the Tatung Einstein is a British micro. Made by a Taiwanese company based in Shropshire and named after a German, Jewish, American scientist, the Einstein is the usual electronic cocktail of exotic components from around the world. Disc drives from Japan, Basic from Torquay and chips from all over the shop.

I opened the box with some apprehension. Here was a mid-priced, mid-range computer complete with a disc-drive. The last time I looked at a cheap system with integral discs I had to spend three days soldering wires before it would work. The Einstein presented absolutely no problems. I timed myself and it took me less than two minutes to unpack the micro, plug it in, connect it to my TV and get a picture.

It took slightly longer to retune the TV to optimise the display but, before three minutes were up, I had managed to insert the system disc that comes with the machine, and load the directory. A number of things helped. For a start the plug was already connected. Many micros come without plugs so you have to hunt around for one to "borrow" for the computer. But, most of all, the integral disc saves worrying about cables, interfacing and the like.

Albert Einstein would never have won a beauty competition and neither would his computer ramesake. However, the design of the machine is elegantly utilitarian. It is moulded out of a fairly tough-gauge plastic so you can comfortably sit a monitor or TV on top. I would not recommend this though as you would have to sit much nearer to the screen than is good for you.

Above the keyboard are two LEDs that do little more than tell you that the computer is working and what mode the keyboard is in. Next to this is the disc unit. It accepts the little 3 in. Hitachi-style microfloppies which are posted into the slot like letters into a pillar box. A button below the slot unposts the discs for you when you need to swap them.

There is a space on the right-hand side of the machine to add an extra disc unit. This would be almost essential if you were using the Tatung as a workaday business computer but a bit excessive for the home user. Between the disc and the potential disc is a grill which I thought was probably there to help aircool the insides. It turned out to be a loudspeaker, loud being the operative word.

I thought that the Oric was a touch strident with its built-in speaker but the Einstein is positively in the Motorhead class. In front of this is the keyboard. Topped by a row of seven function keys, the keyboard contains no surprises. I don't like to see the graphics characters printed on the front of the keys, it looks messy, and most people only use them occasionally anyway. However, it does seem to be de rigueur in micro circles. I doubt if anyone will miss the Tab key, which the Einstein doesn't have.

Along the rear of the micro are a number of interfaces. If you are going to make use of them I would suggest that you find a permanent home for the micro. They are not the sort of things that take kindly to being constantly plugged in and unplugged. There is, of course, a printer port, an interface for more disc units, up to a total of four drives and a user input

TATUNG

Single 3in. disc, 64K, colour and sound for £499: Bill Bennett meets Einstein and talks relativity.

output port. Just what you need to run a power station or a cruise missile launcher.

Right in the middle of all these ports is something called the Tatung "pipe". It sounds like a copy of the Acorn "tube", but is much nearer in concept to the port on the back of the humble Spectrum. Like Sinclair's port, the pipe is not much more than a simple extension

of lines from the Z-80.

Down the right-hand side of the machine are two more ports. Ostensibly these are for joysticks, but are actually analogue to digital converters. If the Tatung Einstein has one obvious application, it is in the science laboratory. With all these ports around the machine it would be excellent for the control and monitoring of experiments. It is a pity the micro is named after a theoretical scientist, when it has so many

G'S EINSTEIN

REVIEW



practical features

Next to the analogue ports is the almost obligatory RS-232 port, though it uses a DIN socket so you will have to worry about soldering your own cables to make use of it. And, best of all, a volume control knob. Until I found this, I actually had a neighbour come round and complain about the noise.

Nobody will be surprised to discover the TV output on the right-hand side of the micro's case, but I was disappointed to find that there is no monitor output. A computer with as many user ports as the Tatung Einstein could do with a simple RGB output as well. There is a special Tatung colour monitor to go with the Einstein, costing £240, but because there is no RGB output you cannot easily use any other manufacturer's monitor.

The Einstein is a "soft machine", that is its resident language and operating system are not actually resident at all. They come on disc and are loaded into the machine in a ritual the user must perform each time he or she uses the micro. Yet there is an 8K ROM which includes the machine-code monitor system. This makes the Einstein an attractive micro for the enthusiast but hardly ideal for the beginner.

Should you want to develop machine-code software, you could do so without ever entering the disc operating system. But most people will want to use Basic at some time and it has to be loaded from disc. To do this you must first load the disc operating system or DOS.

XtalDos is the operating system used by the Einstein. Because it comes supplied on disc, there is no reason why you couldn't use another operating system. No others are available at the moment, but should XtalDos mark II appear, or should some enterprising programmer devise a version of CP/M for the micro, you will only have to pay for that disc.

XtalDos is remarkably similar to CP/M, so much so that I managed to get started knowing only CP/M and not XtalDos. But XtalDos — pronounced crystal-dos — is not CP/M and will not run all CP/M software. This is a bit naughty because on the computer's box is the boast: "Ability to run CP/M software". There are more than 5,000 CP/M software packages available so you could be forgiven for thinking that buying an Einstein gives you access to a huge back catalogue of programs.

The Einstein does have the ability to run some CP/M software, it is just that you cannot buy genuine CP/M for it yet. What is more, it will not be cheap when it is available — CP/M system discs generally cost around the £50 mark. Further to this is the fact that, as yet, there is no CP/M standard for 3 in. discs. This means that even if there was a true implementation of CP/M for the Einstein, you would not be able to stroll down to your neighbourhood store and buy a software package off the shelf with any confidence that it will run on your micro.

I hope that someone does implement CP/M just as soon as the 3 in. standard is decided because, quite frankly, XtalDos is a minority operating system. There will never be enough

(continued on page 55)

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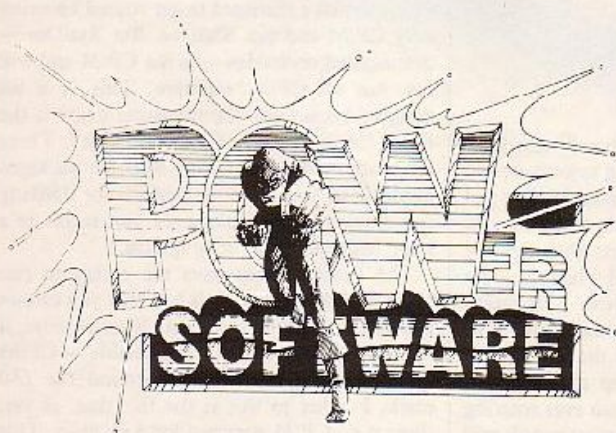
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(continued from page 53)

XtalDos systems in circulation to justify a large software base.

There is one other possibility. The Einstein is physically able to run MSXDos. The micro has most of the right hardware and it would be a logical direction for Tatung to move in.

Despite my severe reservations about minority operating systems, XtalDos is jolly neat. So is Xtal Basic, the native language of the Einstein. It has met with a degree of acclaim from programmers but is not a good language for beginners. I found that it contained a lot of commands that could be found elsewhere but are not standard.

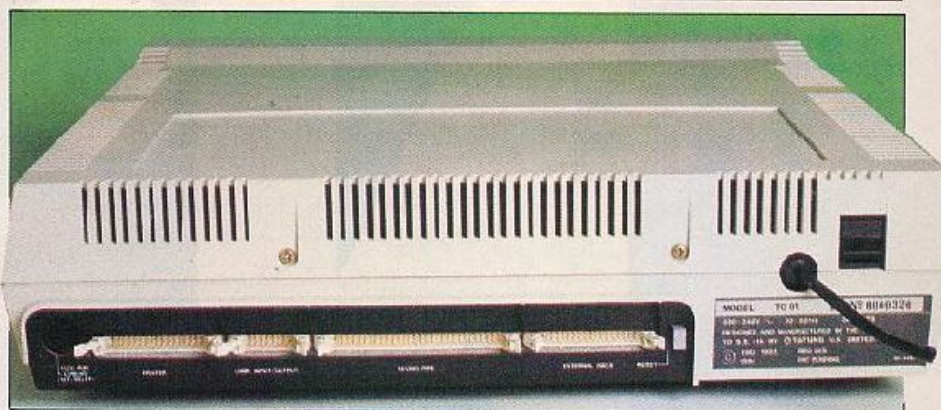
Xtal Basic may be better than other Basics but there will be precious few games listings published in it and there will be hardly any good books about it. But, again, because Xtal Basic comes on disc and not ROM, it is an option. There is no reason why standard Microsoft Basic could not be implemented on the Einstein or, for that matter, Forth, Pascal, Prolog or Logo. Any versions of these languages developed for CP/M could be adapted fairly easily, though it might not be an economic proposal.

The system disc comes with a few example programs which don't show the Einstein off to its best advantage. I realise that Tatung must have bent over backwards to trim the costs to achieve the sub-£500 price tag, yet it would have been so much better if the supplied software was more imaginative. The Othello game was easy to beat and the snakes game downright boring.

I may be asking a lot but for this price I would like to have a second disc containing a word processor and a spreadsheet. This way you would be able to buy a complete system, ready to work or and for a good price.

Xtal Basic is not new, I remember seeing a version ages ago on the Sharp MZ-80K. It has a lot more commands than common or garden Basic, complete with things like Peek and Poke which are two-byte versions of Peek and Poke, strictly for the enthusiast. However, Xtal Basic is very good at handling the sound and graphics of the Einstein.

Sound is often the Cinderella feature on a computer, so my heart naturally warms to Tatung's serious treatment of it. The Basic commands and the sheer volume and the flexi-



bility of the hardware are all plus points for Tatung. Unfortunately, the other half of the sound and vision equation is not so good.

For a start, the colours are dingy. The red is more like a washed out pinky orange than the colour of the people's flag and the blue just isn't true blue at all, but a weedy purple tint.

The Basic commands controlling graphics are extensive and flexible enough and 32 sprites should keep most zappers in aliens for days. Apparently, the Einstein uses the same video chip as MSX machines. If that is the case then the Japanese invasion will be nothing to fear because the high resolution isn't all that high, the colour not very colourful and the sprites none too spritely.

Maximum resolution of the screen gives 192 by 256 pixels — hardly high resolution for a £500 micro. There are 16 colours but, because they are so dull, it is difficult to tell some of them apart. Although they are easy to control from Basic it isn't enough for 1984's model.

While the graphics might be a little disappointing from the point of view of the games player, they are not all that useful for the business user either. You can select either 40 or 32 columns across the width of the screen, but both sets of characters do not look as attractive as those to be found on other micros. More importantly, I found my eyes were feeling the strain after about an hour's use. So word processing — which anyway should really have 80 columns — on the Einstein might not be a serious proposition.

The colour resolution of the Einstein is only to the nearest character position. That is colours are defined on a 32 by 24 or 40 by 24

grid. This is about the same as on the Spectrum — hardly impressive. Drawing a diagonal line results in the chunkiest graphics you have ever seen because the lit pixels fill the whole of their row within a character space.

The manuals don't help much either. They are so unbelievably boring that I thought they must have been written by Jeffrey Archer.

The "DOSMOS" booklet, now there's a name to conjure with, is much more useful than the introduction book yet every bit as dull. It contains information about the machine code monitor and how to use the disc operating system. A third book is supplied with the machine called the Basic Reference Manual. It is the programmer's bible, yet suffers from the same shortcomings as the other two books; it is dull, contains no index, and no sensible appendices. It should at least contain a section full of memory map diagrams, screen address diagrams and the like.

I was impressed by the inclusion of a quick reference card, similar to that sent out with the Dragon 32. However, it turned out to be not as useful as I expected with no adequate description of the Basic keywords. This would be especially useful as certain Xtal Basic keywords are slightly exotic.

Although I have reservations about this micro, it does compare favourably with other systems in the same price range. The machine sits uncomfortably between computers like the BBC Micro, which is definitely a home computer with business possibilities, and the £700 ACT F1 which is a business computer with home possibilities. You can now buy a BBC for around £350 or less. It has better graphics than the Einstein, similar sound, better Basic and better manuals. But it doesn't have discs, nor does it have as much memory as the Einstein which comes with a full 64K plus 16K of video RAM. In practice this means a 64K memory, because the video RAM lies parallel to the main RAM.

Although the BBC has a wide user base and all the advantages that brings, add-ons are expensive. The Einstein will be able to use standard add-ons thus reducing costs considerably. If you want compatibility with educational users the BBC would be a better buy, but hackers might choose the disc-based system.

Compared with the Sinclair QL, the Einstein is not very fancy, but its 3 in. discs are a sight more standard than Sinclair's Microdrives. They are also more useful, more likely to last and can hold more — 190K per side as opposed to 100K per cartridge. If you want to play games the QL will be a better bet, but for serious use the Tatung should win.

CONCLUSIONS

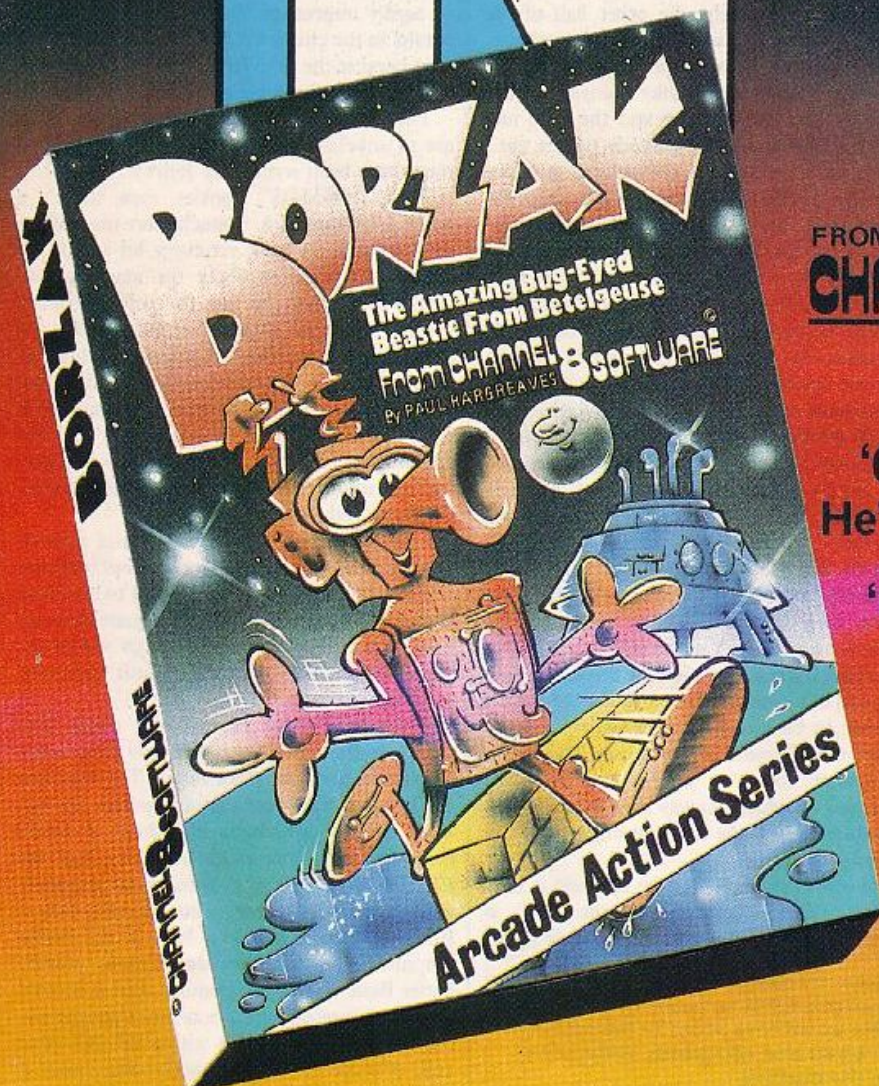
- The Einstein does not fit into the current spectrum of available micros very well being neither a good enough games machine nor a powerful enough business system. The cop-out answer is that it is an educational computer but that is one role it is particularly unsuited to fill.
- Anyone purchasing the Einstein may have to reconcile themselves to owning a ghetto machine. I cannot see the dedicated software base ever getting large enough to be anything else. And as for CP/M compatibility, someone is going to have to copy each package across into the Einstein disc format and, in many cases, rewrite the software for the 40- or 32-column screen.
- In my opinion there is a serious design fault. Had the disc drive been a standard 5 1/4 in. unit, then users would

have immediate access to all the available CP/M software. I realise that this would have added to the cost but it would also add greatly to the utility of the machine.

- There is one other problem that will be familiar to owners of the Sharp micros which have a lot in common with the Einstein, thanks to versions of Basic not stored in ROM. Should Tatung ever be tempted to make changes to Xtal Basic — the installed version is 1.11 — then software may no longer be transferable between machines.
- All these reservations aside, the Einstein is a very low-cost way of buying a disc-based system. It is built from reliable tested technology and is unlikely to have the teething troubles of the QL. It is especially suited for control purposes and will thrill the hacker with its Xtal Basic and extensive machine-code monitor.

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PSION

PSION, THE SOFTWARE COMPANY that produces much of the Sinclair Spectrum official software and the bundled software — Quill, Archive, Abacus and Easel — for the new Sinclair QL, has branched out into the computer hardware business, an area that has seen many recent failings by both large and small companies.

The excursion into the apparently risky hardware manufacturing side of the business comes about by the desire to produce what Psion describe as a new type of computer product called the Psion Organiser.

The Psion Organiser is a calculator-sized pocket computer featuring a 16-character LCD display, a 36-key keyboard and an 8K plug-in Eprom memory pack or datapak. The calculator-type keys are protected while in the pocket by a sliding cover which, when withdrawn, exposes the plug-in memory underneath the keyboard and the display contrast adjuster control on the right-hand side of the display. Complete withdrawal of the cover gives access to the PP3 9 volt battery compartment.

The computer is based on the Hitachi 63C1X CMOS 8-bit processor, which contains 4K of on-chip ROM. This is supported by 2K of RAM for the calculator working registers, system variables and an 8K Eprom for program and/or data storage.

For £100 the user gets a bare bones calculator with a 16-character alphanumeric LCD display — no scientific functions with parenthesis limited to a depth of two — and a built in database facility, capable of searching the 10K of character storage — 8K Eprom — for a specific number or character string within five seconds.

The Organiser is activated by using the On/Clear key and powers up with the display showing the time, date and month. The time may readily be adjusted as indeed it needed to be. The machine provided for review stopped

ORGANISER

the real-time clock from running when the machine was switched off, the replacement machine had no such problems.

The Mode key selects the current operating mode, that is:

Enter for general purpose free format database entries and editing.

Calc for performing calculations.

Off which the user Executes to switch off.

Each individual process is performed by use of the Execute key — calculations are entered in the normal manner and the Execute key pressed instead of the more usual calculator = or Enter key.

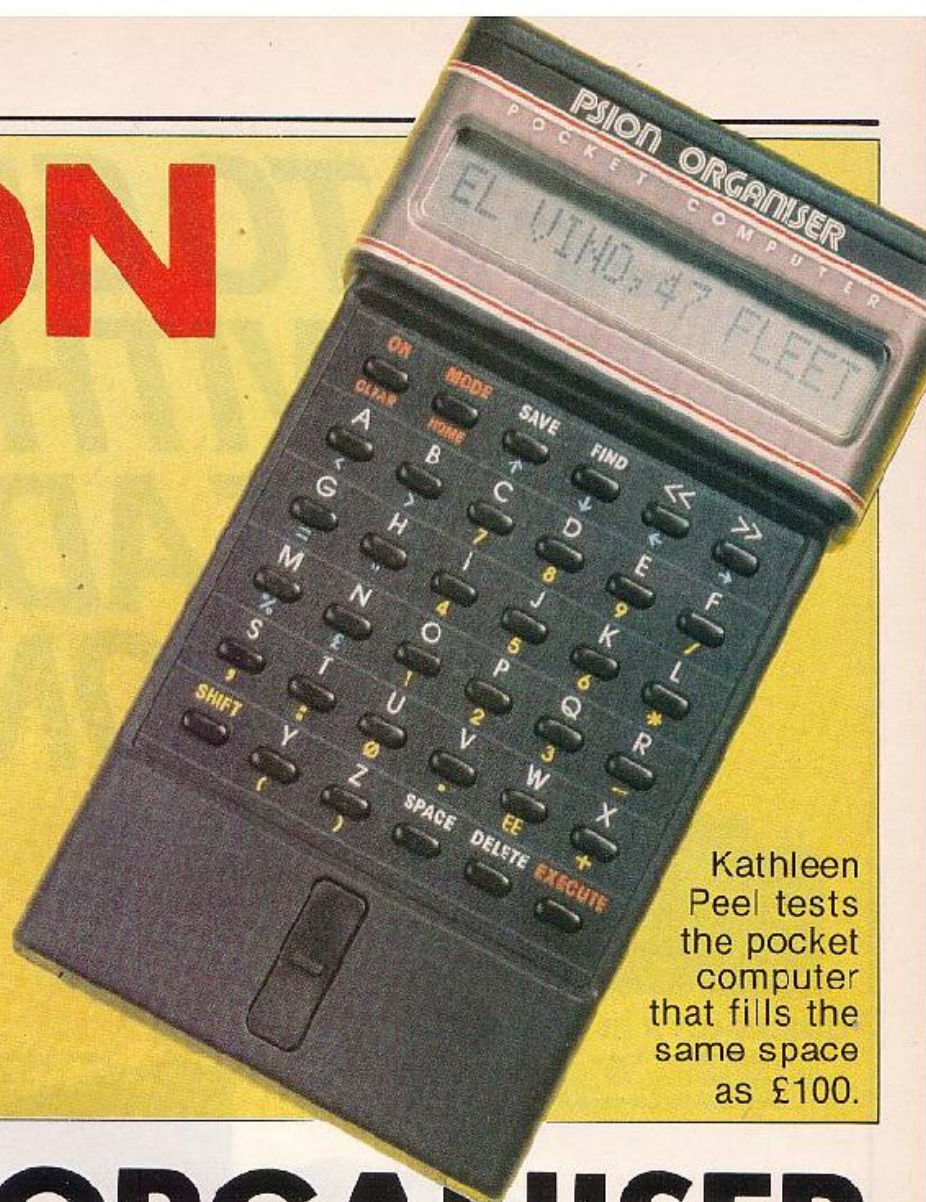
Data is simply typed while in the Enter mode using the alphanumeric keyboard, each file being saved using the Save key with the display indicating whether the data is saved in datapak 1, or 2 if two datapaks are installed, according to the user's choice.

The database needs to be fairly static, data changes simply overwrite the existing data in memory to make it unreadable and the new file is written into a clean area of memory. Fast changing databases will become extremely wasteful of memory.

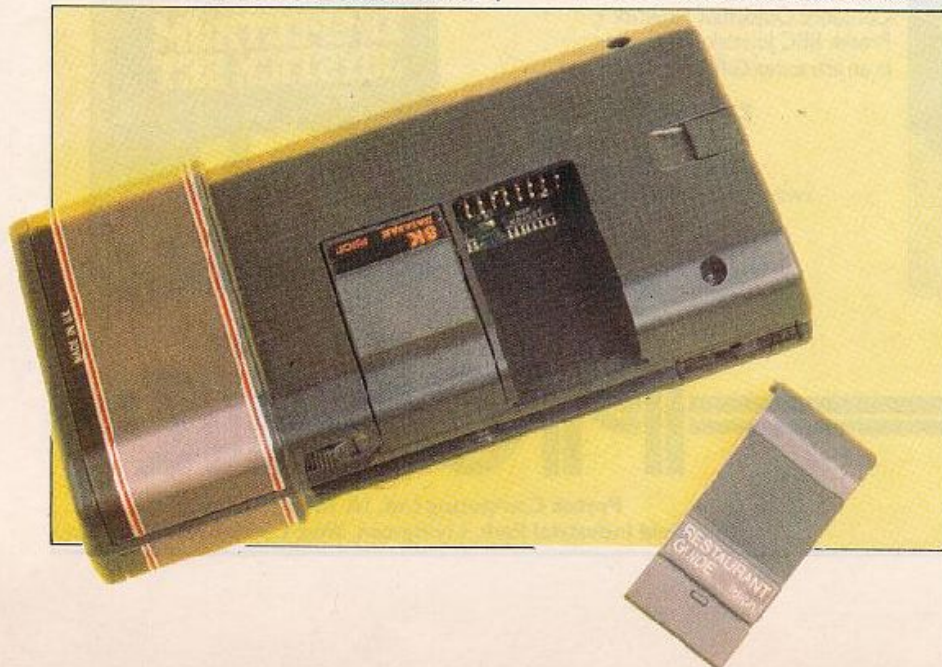
The database in each datapak must be consistent; the user can store telephone numbers, train timetables and appointments together within one datapak but there is no way of restricting a search to a specific segment or groups of files in an individual datapak.

Find2 string\$ will find every occurrence of string\$ within all the databases in datapak2. Therefore as an electronic notepad, the user is required to keep with the Organiser all the necessary databases separately which could

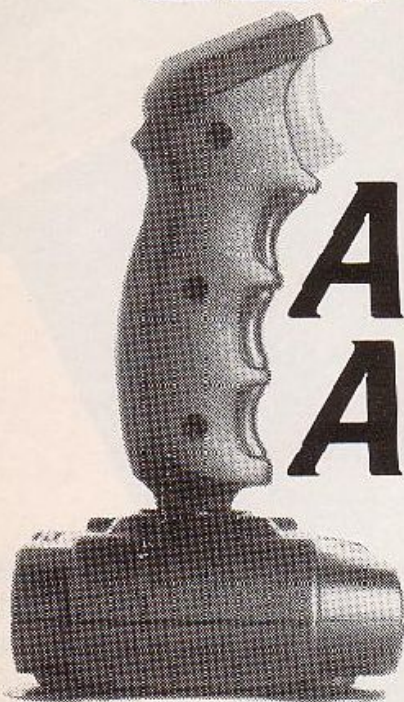
(continued on page 59)



Kathleen Peel tests the pocket computer that fills the same space as £100.



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Protek

Protek Computing Ltd, 1A Young Square,
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(continued from page 57)

become expensive in terms of datapak cost, and add considerably to the amount the user has to carry around.

The 8K Eprom can store about 200 names, addresses and telephone numbers. A search may be conducted using the Findn string\$ function, every record containing string\$ will be displayed, otherwise the computer keeps searching for a match. If there is no match, the message "not found" is displayed. If a string\$ is not given for the search, the computer will step through every file within the database.

By adding a program pack — £30 Finance, Mathematics or Science Packs are available — the Organiser is provided with further modes of operation:

Copy for copying between datapaks.
Cat used to access programs.

The Organiser is also capable of performing the same trigonometrical and scientific functions as found in the more comprehensive calculators.

And lastly a procedural language POPL is added. Each procedure is limited to a length of 200 characters, with an individual line not exceeding 100 characters. POPL supports 26 variables and can pass parameters between procedures — there is Goto a label and looping facilities.

Under normal conditions, rewriting code is not a problem as the program storage media is reusable. With the Eproms it is not and once written to, that space cannot be re-used until the datapak is re-formatted which clears the

whole of the datapak ready for a fresh start.

The Organiser may be expanded to incorporate two 16K Eprom datapaks, these cost £20 each but increases them in memory storage capacity up to 40,000 characters. The user may install 8K Eprom datapaks which cost £13, but either way strikes me as being pretty expensive for storing data.

The datapaks may be reused up to 100 times by reformatting — wiping clean all of the Eprom; remember you cannot selectively erase. This will cost £3.50 if done by your local stockist or the large user may purchase a Formatter for £45 which can reformat two datapaks in 30 minutes.

The manual supplied is 1/4 A4 size of about 50 pages of text and diagrams. Most details are explained twice but for those who so far have shown no interest in computing, the documentation will be difficult to understand. The average computer user will find no problems other than the programming requirement of learning yet another language, POPL, which can hardly be of use in any other context.

The RS-232 expansion unit, which costs £25, permits the user with a modem to download load data via a telephone line to a remote computer. Computer to computer data transfer is also possible.

CONCLUSIONS

- Although very simple to operate as a database with a single integrated data file, the Organiser cannot handle separate databases residing on the same datapak.
- The database being searched needs to be fairly static, if it is going to change daily as a stores inventory might do, then the necessary changes to the database are going to use up the available memory space extremely quickly.
- Program development is likely to suffer the same fate. It is not possible for a user to write and enter a program without faults, and the Organiser will allow the user to work on only one procedure in RAM at any one time.
- The Organiser is going to be very expensive to run as a computer. The development of software which is

always subject to change and revision does not lend itself to the type of storage media employed in this computer design.

- The use of Eproms as the storage media imposes restraints on the programmer, a requirement for a local Eprom formatting service and fairly substantial power requirements on the hardware designer.

- The Organiser appears to fit those types of market where data security is essential and, of course using Eproms gives a very high level of security, but logistically I'm not sure. The data typed in is secure, but whether it can be entered correctly using the calculator-type keyboard and very small screen display without a lot of careful checking at the time of data entry, which the average person is unlikely to perform, is doubtful.

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With this Forth, David Husband has provided the BBC Micro with capabilities never before realised. And being 16K rather than 8K is twice the size of other versions. Multi-Forth 83 is supplied with an

extensive Manual (170 pages plus) and at £45 + VAT it is superb value.

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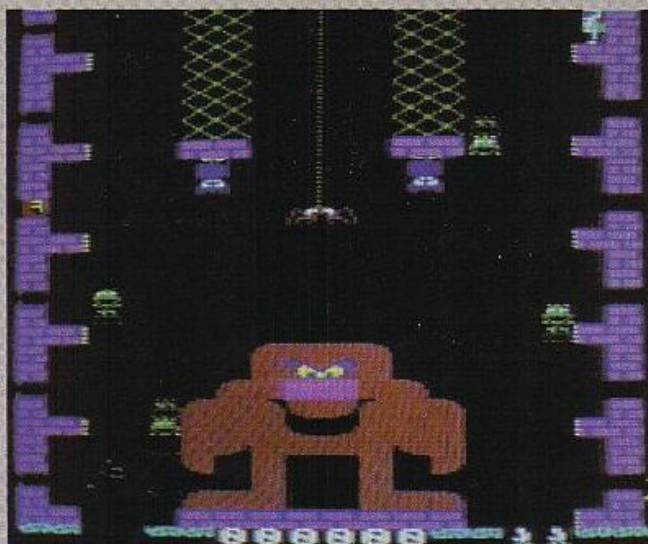
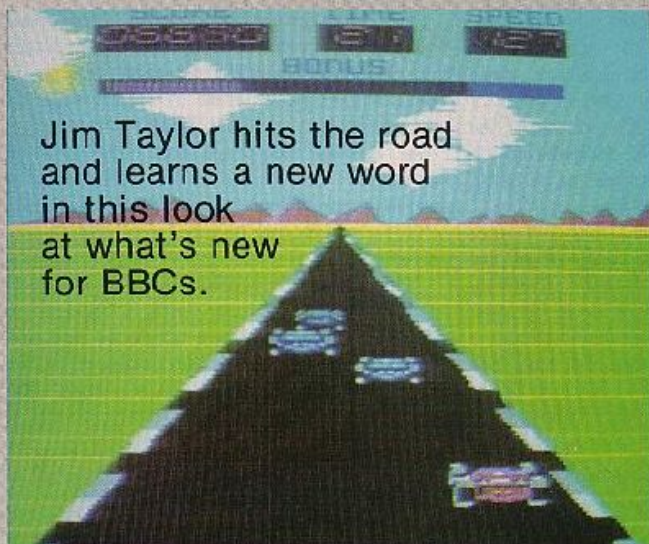
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MULTI-FORTH 83 FOR THE BBC MICRO

Jim Taylor hits the road and learns a new word in this look at what's new for BBCs.



BBC SOFTWARE

FRAK! A NEW WORD enters the English language, courtesy of Orlando and Aardvark Software. Use it when you're frustrated, when you drop your toast jam side down or simply when you lose yet another life playing the compulsive new game with the title *Frak!*

It's a bold change for Orlando, the programmer who brought you the classic shoot'em-up *Zalaga*. There's no frenzied and murderous action in this latest offering, just superb graphics and a witty variant of the platform game.

You are cast in the role of Trogg, a cavemar-

with a belly worthy of a champion darts player. Trogg's forte, though, is the yo-yo, with which he can knock the various monsters off their perches.

On the first screen his opponents are the Scrubbies, large purple creatures who just get in the way without being at all aggressive. On the second screen, should you ever get there, you will find Poglets squatting on logs and on the final screen are Hooters which have the prominent facia feature suggested by their name.

Throughout the game there is danger in the

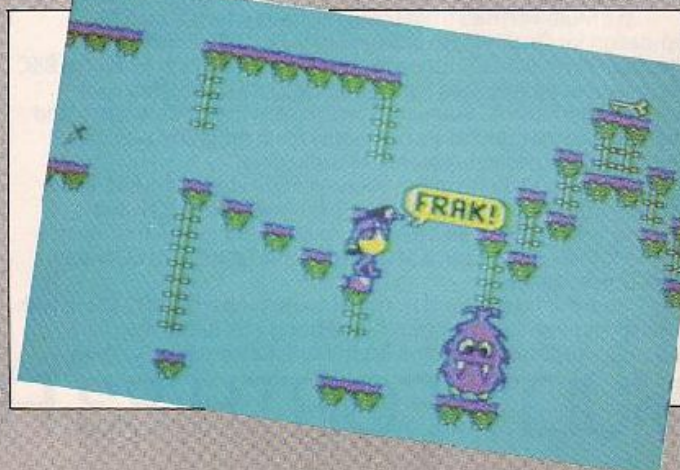
form of balloons floating up and daggers drifting diagonally across the screen. As you climb ladders and hop along platforms it's difficult to avoid them. Each time you lose a life a cartoon-style balloon emerges from your mouth as you utter the fatal word 'Frak!'

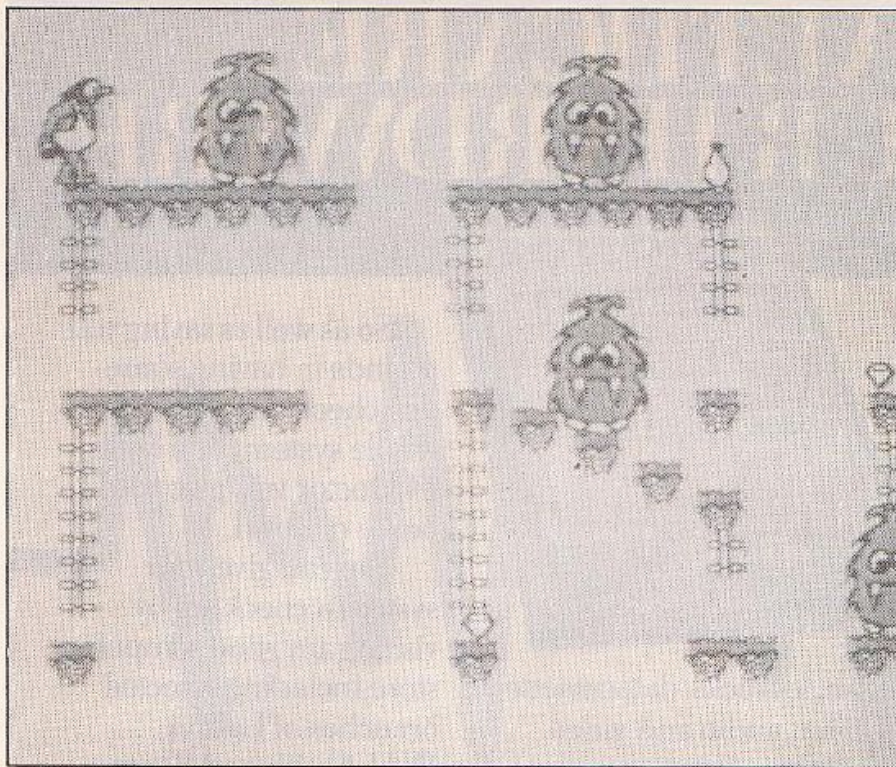
The gameplay in *Frak!* is consistently entertaining and, although quite a simple idea, provides a real challenge. But the game is remarkable chiefly for the quality of its graphics — they are undoubtedly superior to anything else currently available on the BBC.

Trogg is drawn in great detail even down to the stubble on his Neanderthal chin. The monsters are original and colourful and the game scrolls with exceptional smoothness. *Frak!* makes most other games look prehistoric.

For instance, Microdeal's *Arena 3000*. This is supposed to take place in 3000 AD, but games don't seem to have come along much in all that time. What you get is a version of *Robotron*, the rush-your-little-man-around-the-screen-shooting-everything-in-sight game.

As such, it's not bad. Everything happens quickly enough, the graphics are reasonable even if the figures are a little small and the





movement is pretty smooth. But it's completely unoriginal and, ultimately, pretty boring.

If that other arcade classic, *Pengy*, is more your style then you will be spoilt for choice: there are no less than three versions in the recent releases. In *Pengy* you are a penguin who must push around ice-blocks to crush your enemies the Sno-Bees, as well as performing other tasks such as lining up special blocks.

Visions' Pengi is a very good version of the game. 'Poor old Pengi is locked up in the freezer again!', and your job is to line up the ice diamond blocks and crush the nasty Snow Bees, rotund monsters with large noses.

Pick up a penguin

A bonus in this version is that the perimeter of the screen is electrified so that Pengi can fry Snow Bees if he can lure them onto it. The game has good colourful graphics and moves very smoothly. The music is sprightly, keys are user-definable and there are up to 30 screens.

Competition comes in the form of Percy Penguin from Superior Software. The idea is virtually the same, but the execution lacks the sophistication of the *Visions* version.

The Sno-Bees are again blobbish creatures, but they now have large floppy ears which give them an incongruously cuddly appearance. There's no electrified fence, the colours are not so vibrant and the movement is slightly jerky.

Better than both these versions, though, is Program Power's *Rubble Trouble* which represents a great leap forward in the theory and practice of *Pengy*.

In this game there are no penguins and no Snow Bees. Instead, the post-holocaust

scenario gives you a caveman battling it out with the Krackats, 'mutated turtle-like creatures' who hatch from the rocks which have replaced ice-blocks.

The principle is the same — crush your enemies — but the innovation is that the boulders bounce back if they don't get a Krackat. They move so quickly that you're likely to splat yourself if you're not careful.

The graphics are excellent, with a bland caveman and very nasty green Krackats. Movement is very smooth and when you lose a life you ascend to heaven with a halt. It doesn't take too much imagination to turn a tired old game into something which seems almost original.

Original is not an adjective which could be applied to Simonsoft's *Super Fruit*. It is, of course, a one-armed-bandit simulation, and a very good one at that. It provides all the expected options and has excellent graphics and sound. The main virtue of this program, though, is that it moves particularly smoothly. If, for whatever obscure motive, you want to play a fruit machine on your BBC, you are unlikely to find anything better than this.

There haven't been too many motor-racing games available on the BBC, but Superior Software has just brought out *Overdrive* while Program Power is now offering *Stock Car*.

Overdrive is a multi-stage 3D race through ice, snow, desert and riverside. You must first qualify for the race by finishing in the top 12 — no easy task to begin with. You begin on the black track heading straight: as an arrow through the green fields to the red mountains in the distance. Accelerate quickly or you'll get flattened by the other vehicles coming from behind.

Graphics are good and the motor noises are most convincing. The game is challenging

enough to keep you at it for quite some time.

Stock Car's graphics are much cruder — blobs on a track seen from above — but the fun of the game is a little more robust. As in the real thing you try to get round the track first while causing as much damage as possible to other competitors.

There is a choice of six tracks and you can also get optional hazards such as oil slicks and skids. Playing against the computer can be a bore, but competition with another humanoid is much more exciting.

Ghouls, from Program Power, is not only exciting but infuriating as well. You have to rescue your power jewels from a creepy mansion on top of a hill. There are four spooky screens to battle through, although I have yet to meet the man who has successfully completed this game.

Ghoul dodging

You are required to jump over gaps, walk on magic platforms and dodge the ghouls. It is all pretty difficult. Although your little yellow man is plucky enough he's really up against it. The grotesque red blob of a ghoul descends slowly from the top of the screen; when you snuff it he actually smiles while the sound produces a derisive whine. Everything about this excellent game is calculated to have you making frequent trips to the keyboard and the drinks cabinet.

Jet Power Jack, also from Program Power, is just as well made, with excellent graphics and sound, but is not such a compulsive game.

Your task is to collect fuel pods scattered around the space garage in which Noglob the Terrible has imprisoned you. On your back is a turbopack which allows you to thrust around and avoid, if you're lucky, such opponents as the "nasty space Googlies".

There are five screens and a great variety of creepy space monsters to overcome until you get through to Wilfrid the hideous Yugg monster at the very end. Inventive and colourful graphics give this game its high quality, but you should be warned that the thrust controls take a considerable time to master.

Landscape with tanks

In Dynabyte's *3D Tank Zone* colour has been sacrificed for high-resolution — to good effect. The game is a *Battlezone* variant. Through the windows of your command centre you scan the landscape for enemy tanks, get them in your sights and then blast them to bits. Very satisfying when it comes off. But there are also aerial invaders to cope with.

Helicopters and fighters come zooming in to blast you with their rockets. So you have two sets of controls; one for your anti-tank guns and another for anti-aircraft cannon. Both at the same time can be pretty hectic, but the program does allow you to practice on each one separately. The game is by no means original, but is implemented skilfully. ■

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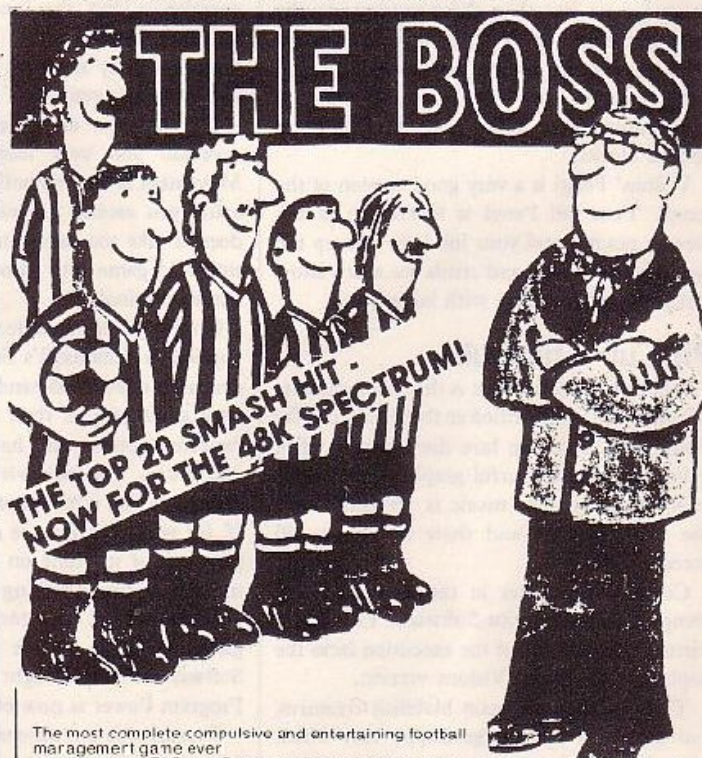
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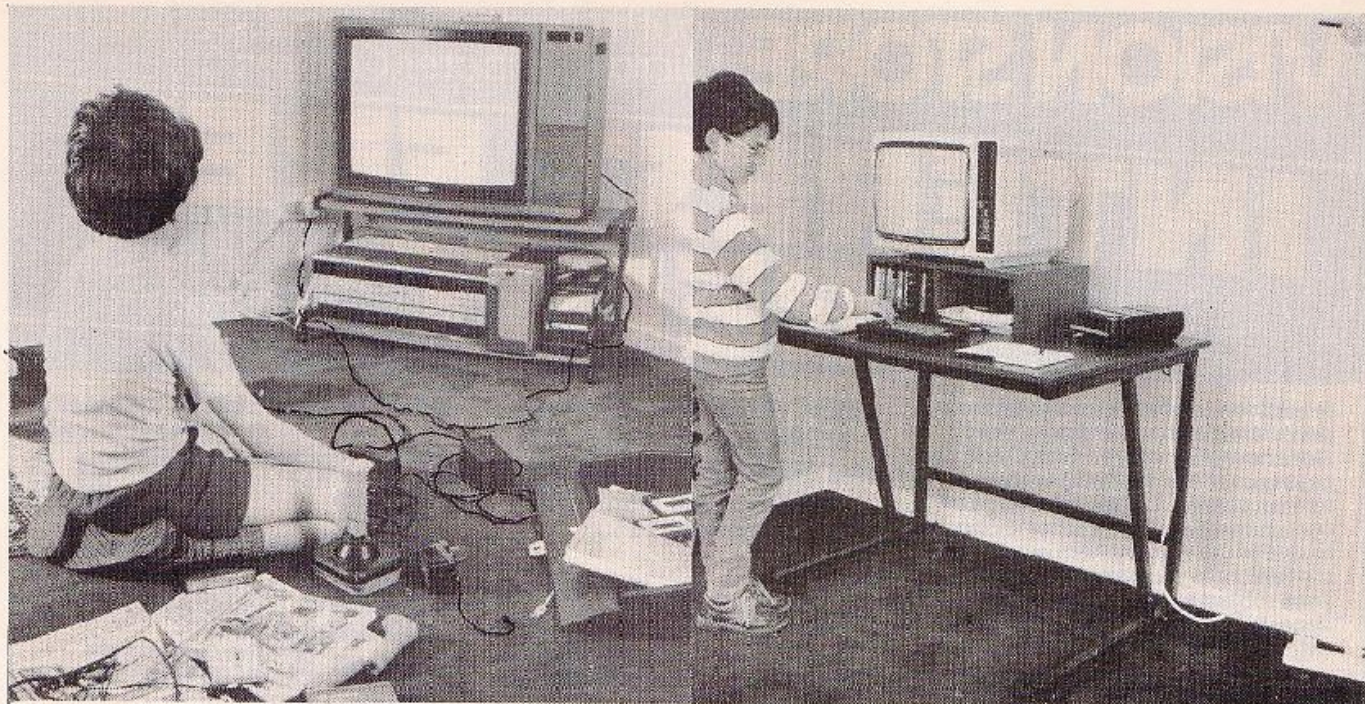
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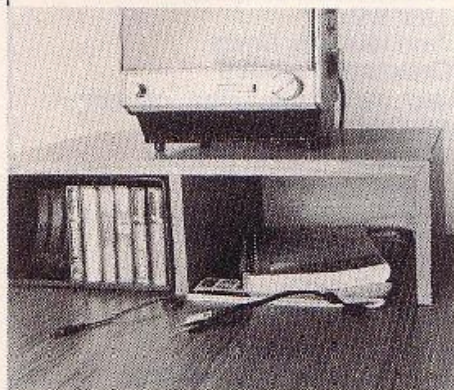
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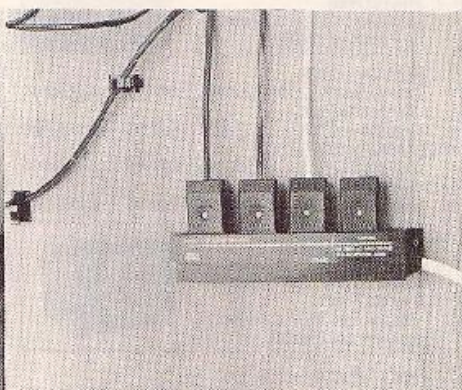
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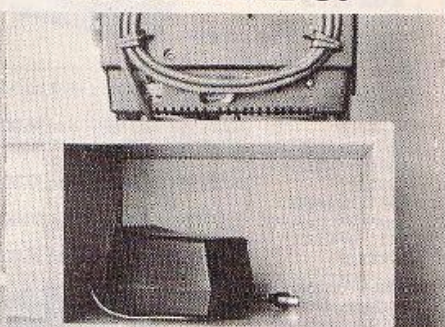
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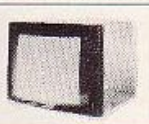
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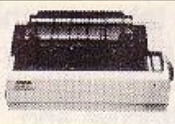


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MUSIC HARDWARE



Kendall Wrightson opens the lid on electromusic.

MAJOR ELECTRONIC MUSICAL instrument manufacturers such as Yamaha, Roland and Sequential Circuits have not been slow in incorporating the latest technology into their machines. The rate at which synthesizers, sequencers and drum machines appear is almost as staggering as the facilities they offer.

Most home computers have sound facilities. The better ones, musically speaking, like the CBM-64 can produce reasonable results if you have the patience and aptitude to write your own programs.

Dedicated synths involve a lot of clever hardware as well as software and the more professional musical home computer packages either include extra hardware such as voice cards to transform the micro into a synth, or use the micro to control a dedicated synth as we shall discover.

Synthesizers utilise many techniques to create imitative sounds. The most common method, known as subtractive synthesis, involves control of the frequency of one or more oscillators from a music keyboard, guitar or computer.

The oscillators produce wave forms of complex harmonic structure, like triangle, sawtooth and square waves. These wave forms are then modified by a sort of special tone control called a filter.

Varying the filter's cut-off frequency removes harmonics of the complex wave form — hence the term subtractive. However harmonics may also be greatly emphasised by increasing the filter's resonance or Q.

The filtered tone then enters an amplifier, Below: CBM-64 and Drumtrax.

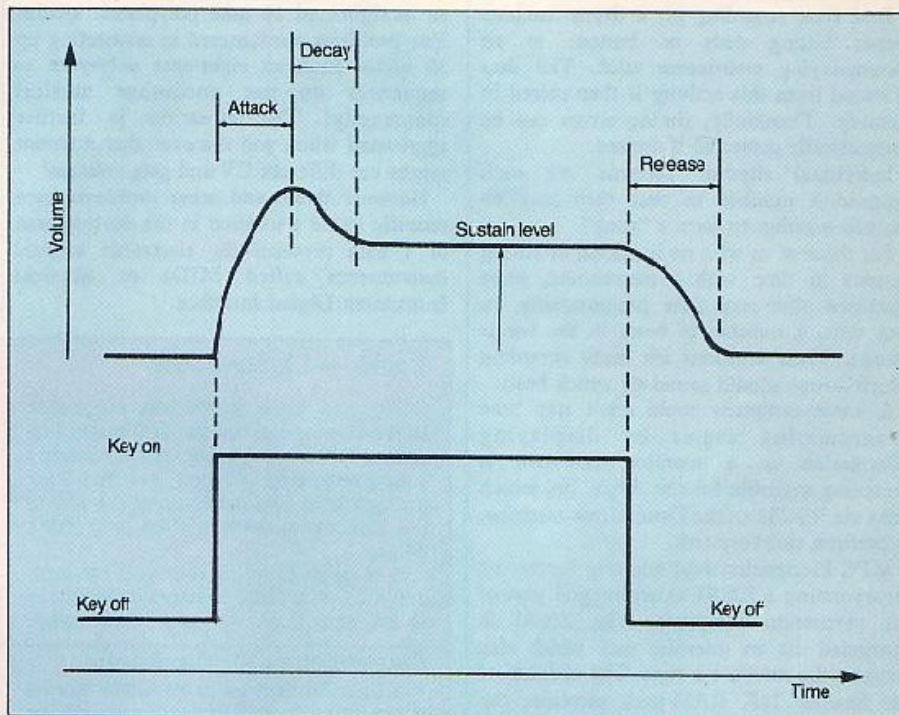


Figure 1. ADSR envelope.

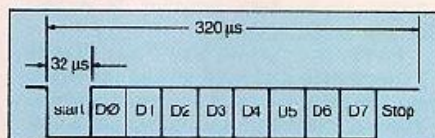


Figure 2. MIDI serial.

but will sound uninteresting to the human ear, because it is static. This is overcome by generating modulation signals which can be routed to the filter, the amplifier and the oscillators. These modulating signals may be

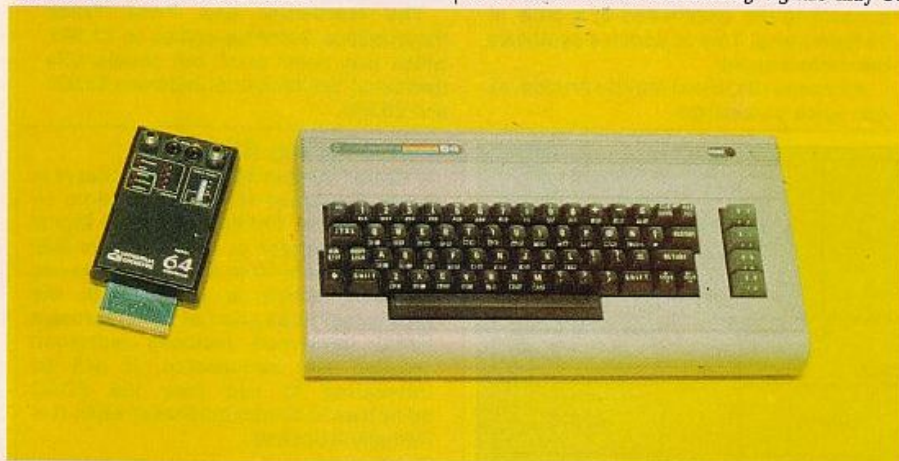
generated by low frequency oscillators or LFO's, velocity and pressure sensors fitted to the keyboard, and by performance controls.

One special kind of modifying signal is an envelope — so called because of the way it shapes sound. The envelope's parameters, attack decay, sustain and release — ADSR — are set up by the user. When applied to the amplifier, the envelope shapes the volume of the sound applied to its input in the following way — having played a note, the attack rate controls the time taken for the sound to reach a maximum level. Decay is the time taken for the sound to reach a sustain level. The sound will remain at this sustain level until the key is released whereupon the sound will die away at a rate dependent upon the release setting — see figure 1.

A collection of control settings is called a patch. Before the advent of the micro-processor and cheap memory, a change of patch involved twiddling all the control knobs to their appropriate positions — a somewhat time consuming activity, particularly during a live performance!

These days life is made easier because patches are stored in memory and may be instantly recalled. Modern synths also allow patches to be saved to and loaded from tape.

(continued on next page)



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Other methods of synthesis include frequency modulation techniques or FM, additive synthesis and more recently, the sampling of real sounds. However, the terminology described above may be applied to any method of synthesis.

Simulating drum sounds electronically is extremely difficult. For this reason contemporary drum machines use samples of real drum sounds. The sounds are digitised through an analogue to digital converter — ADC — and stored in Eprom. So when you hit the trigger pad or press the button, the Eprom's contents are clocked out through a digital to analogue converter, or DAC, under microprocessor control.

Real time recording on a drum machine means hitting pads or buttons to an accompanying metronome click. The data provided from this activity is then stored in memory. Thankfully, timing errors can be automatically corrected if desired.

Individual rhythm patterns are each assigned a number so that they may be chained together to form a "song".

For those of us with no intention of hitting buttons in time with a metronome, some machines offer step time programming. In step time, a number of beats to the bar is chosen. Then decisions are made regarding which drums should sound on which beats.

A home computer could make step time programming easier by displaying information on a monitor. Software is becoming available for the Apple IIe, which links via RS-232 to the Drumulator machine, to perform this very task.

MPC Electronics went one step further by incorporating a ZX-81 as an integral part of the percussion computer. The ZX-81 is connected via an interface unit which also contains the software it runs. The addition of the Sinclair 16K RAM-pack increases the machine's memory, while the software allows the loading and saving of patterns, as well as acting as a visual aid to composing.

Sequencers, like drum machines, record data with respect to time. The difference is that sequencer data represents keyboard depressions and the length of time that keys are held down, so why not make a conventional analogue recording?

Well, first, a sequencer can play back at different tempos, without affecting pitch. Secondly, the sequence may be played back using a different pitch to the one it was programmed with. Thirdly, sequencers offer the non-musician the chance to compose music through step time note entry, where pitch and timing information is entered

separately.

Again, like drum machines, sequences can be chained together to form "songs". The sequence order can be changed if it is unsatisfactory.

Originally, synthesisers used to generate a control voltage or CV — proportional to the pitch played, and a gate signal — proportion to the length of time a key was held down. It was these signals, after analogue to digital conversion, that sequencers used to record. This was fine for synths which were capable of playing only one note — monophonic — since it would require only four cables to connect a synth to a sequencer for record and playback.

Modern integration developments have led us to eight and 16 note polyphonic synths. The problems encountered in connecting up 32 cables from an eight-note polysynth to sequencer do not encourage musical spontaneity! The situation is further aggravated when you discover that different synths use different CV and gate voltages!

However these, and other problems have recently found a solution in the development of a data protocol for electronic musical instruments called MIDI or Musical Instrument Digital Interface.



Casio — ZX Spectrum

Casio has been producing electronic keyboards by the million in the last few years. Indeed a recent survey asking young people to list their favourite toys, had portable keyboards up at the top of the list along with micros and BMX bikes.

It is good to know that you can now link a Casio MT-200 portable keyboard to a ZX Spectrum — and most other

popular micros — via the Casio PA1 interface. The software, listed in the MT-200 manual turns the Spectrum into a sequencer with editing facilities.

Alternatively the software is available on cassette from Micro Musical Limited, which is also working on a system called Microlink 2. This will allow the linking of two existing Casio models — the MT800 and PT-80 — to the Spectrum to provide a sequencer which can also turn the Casio auto-rhythms on and off.

Soundchaser for the Apple

The Soundchaser turns an Apple II or IIe micro into a dedicated synth, through the insertion of three cards into the Apple's magic slots. Also provided is a four octave music keyboard.

Passport Design's Four Track Performance Software makes the Apple act like an eight voice polyphonic synth. There are two soft oscillators per voice, each with independent ADSR's and one LFO which can independently frequency modulate either oscillator.

Because the oscillators are soft, you can edit existing waveforms or waves on the VDU, using a joystick or create your own. You can also build up a wave by controlling the amplitudes of a table of 16 harmonics. This is additive synthesis mentioned earlier.

All waves displayed may be printed, as can voice parameters.

The Soundchaser also provides a filter, and although you cannot control it dynamically with the ADSR envelopes, its possible to type in the cut off frequency then see as well as hear the result. It is this combination of both additive and subtractive synthesis which makes the Soundchaser produce such a wide variety of sounds.

Also included in the software is a four track real time polyphonic sequencer, although step time editing software is available. The sequencer allows four different patches to play up to eight notes simultaneously. All voice and sequencer information can be stored on disc as wave or track files.

The Hardware and Four Track Performance Software costs to £1,369, which may seem a lot, but comparable dedicated systems cost between £3,000 and £8,000.

PDSG for the BBC

A similar system to the Soundchaser is being developed for the BBC Micro by Clef Products. The Programmable Digital Sound Generator or PDSG, allows 8-32 note polyphony from a five-octave music keyboard which is included in the provisional retail price of £400. Software being developed includes waveform creation and sequencing. It will be interesting to see how the PDSG compares to the Soundchaser when it is formally launched.

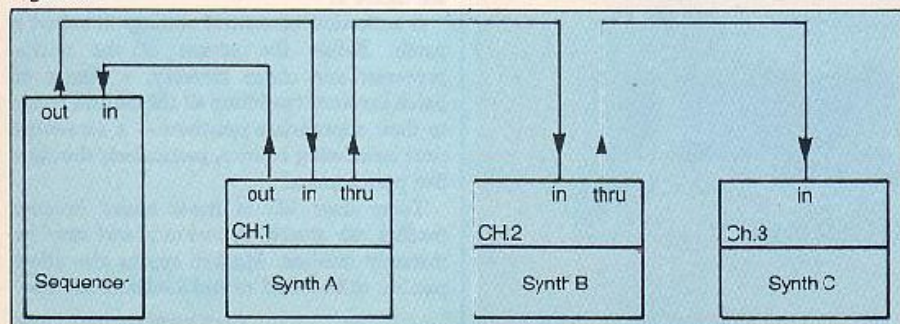


Figure 3.



Above: CBM-64 and Sixtraks.

MIDI is a new word to add to your vocabulary of computer-speak. It came about, like MSX, out of a need to standardise a very non-standard world. Things begin to get very exciting when synths, drum machines and sequencers operate together as an integrated unit. However, before MIDI was agreed by the major synth manufacturers, it was difficult to get excited about such things due to the inherent non-compatibility of products. Each drum machine had its own way of telling the outside world it had started, then there's the sequencer problem mentioned earlier.

MIDI cures such problems, as well as allowing the transfer of much more specific messages.

Physically, MIDI appears as two or three 5-pin 180 deg. DIN sockets on a synth, drum machine or sequencer — MIDI In, Out and Through. The MIDI Through socket outputs a direct copy of data entering the MIDI In socket. A manufacturer does not have to fit a MIDI Through facility. Only two of the five DIN pins are used, so MIDI transmits and receives data serially.

This particular facet of MIDI was heavily debated because it was felt by some manufacturers that a serial link would be too slow. In practice there have been complaints of noticeable delays when transmitting keyboard data to more than three synths at once. However, the convenience of using single 5-pin DIN leads rather than multicore cables must have tipped the balance for the supporters of serial transmission.

MIDI runs at 31.25 Kbaud asynchronous. The word format is shown in figure 2. So, to MIDI-fy your micro, wire up an asynchronous communications interface adaptor or ACIA, like the Motorola 6850 to the expansion orifice of your micro. Address the ACIA nicely and tell it to transmit and receive as in figure 2, i.e., one stop bit, one start bit and no parity.

Wire the ACIA transmit output and input to

appropriate 5-pin DIN sockets.

Don't forget to opto-isolate the MIDI In input otherwise nasty earth loops could develop. Now write some brilliant software and make lots of money! Seriously though, for anyone considering designing their own interface, the MIDI hard and software specification is available from the MIDI Users Group, 8426 Vine Valley D.R. Sun Valley, CA91352, U.S.A.

The MIDI data format is divided into two categories — channel commands and system commands. The channel command format allows for 16 unique channels for communication between instruments.

One of the most fundamental tasks MIDI must allow is for one synthesiser to play another. The channel command structure gives three ways or modes of performing this task.

In omni mode, all synthesisers connected together will transmit and receive on all channels. In poly mode each synth is set by the user to receive on only one channel. The synth will therefore ignore any incoming data which is not on its assigned channel. Figure 3 shows a typical poly mode set up. Note that Synth A. is used as the MIDI transmitter.

Mono, the third possible mode, allows the allocation of different MIDI channels to individual voices within one synth. This opens up the exciting opportunity of one synth playing different patches on each voice. However, at the time of writing, the only reasonably priced synth capable of mono mode operation is the Sixtraks made by Sequential Circuits.

Let's take a meaningful example — suppose a middle C is played on a synth. In the MIDI scheme of things this is called a note on event. Three bytes will be transmitted from the synth's MIDI Out socket to represent this:

First Byte — 1001 nnnn

Where 1001 means note on event and nnnn



is the MIDI channel number (0 to 15).

Second Byte — 0kkk kkkk

Where kkk kkkk is the key number — 0 to 127 in semitones.

Third Byte — 0vvv vvvv

Where vvv vvvv is the velocity at which the note was played (0-127 levels). So, if you delicately stroked the key, you would generate a velocity byte equal to 1. If, however, you hit the key with a large mallet, you would generate a velocity of 127 — this practise is not advised.

Synths which do not have velocity sensitive keyboards transmit a velocity byte of 64 (decimal) as a de-fault value. So, if a middle C was played on a non-velocity sensitive synth set to MIDI channel 1, the data transmitted would be:

144,60,64. (decimal)

90,3C,40. (hex)

10010000, 00111100, 01000000 (Binary)

Other channel commands include note off event — 3 bytes — and patch change request — 2 bytes.

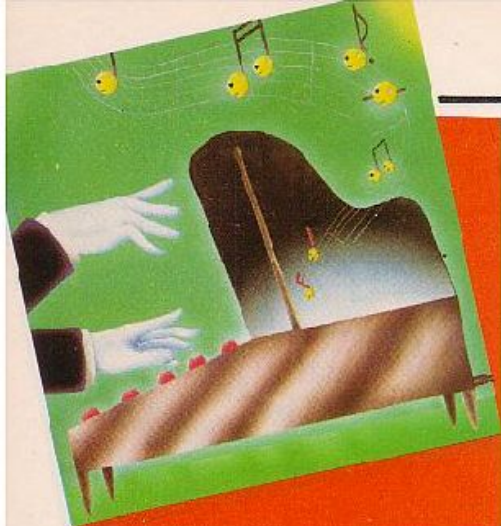
The second category of commands, system commands, is divided into three types: system common; system exclusive and system real time.

System common commands are those intended for all devices in the system. An example is asking synths to tune their oscillators, a tune request — 1 byte.

System exclusive commands are those applicable between instruments of the same internal design. The system exclusive command, 240 (decimal) is therefore followed by a number representing the manufacturer —

(continued on next page)





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Sequential Circuits' number is 01.

The number of bytes which follow is dependent on the nature of the data to be transmitted. An end of system exclusive is flagged by transmitting 247. Examples of system exclusive information are patch dumps and specific control knob changes.

The third category of system commands,

system real time, are those messages concerned with synchronisation. They can be transmitted at any time by sequencers or drum machines. Examples are, Start, Stop, Reset and Timing Clock. The timing clock pulses are sent at a rate of 24 clocks per quarter note. Most MIDI drum machines and sequencers have Trigger, Clock or Sync outputs like their non-MIDI counterparts so as not to alienate customers with pre-MIDI equipment.

A micro fitted with suitable MIDI interface could perform wondrous tasks as part of a MIDI set up. Here are some examples:

- Sequencer.
- Patch data dump to take on disc.
- Patch data display.
- Music transcription.
- Intelligent arpeggiator.
- Educational software.

The following is a survey of commercially available interfaces and software for home micros. The list is not exhaustive, the criteria being to cover as many micros as possible. Manufacturers and retailers addresses can be found at the end of the article.

CONCLUSIONS

■ MIDI, though still very young, has definitely caught the imagination of both manufacturers and public. Its now almost impossible to sell any electronic musical instrument that doesn't feature MIDI in its specification.

■ Both the Soundchaser and PDSG systems are likely to incorporate MIDI shortly.

■ At present, the cheapest polyphonic synthesiser with MIDI is about £650; the cheapest MIDI drum machine is £950. So, assuming you use a MIDI home micro as the sequencer, a professional set up is going to cost about £1,750. However, the prices of synths and drum machines has been falling sharply over the past five years and this is a trend that is sure to continue.

■ It's clear that there are plenty of ways of getting extremely musical with your micro, even if your micro has not expressed a musical bent in the past. Why not take the plunge? It could prove to be a very rewarding experience.

USEFUL ADDRESSES

M.P.C. Percussion Computer:

M.P.C. Electronics,
The Gables,
Willingham,
Cambridgeshire.
Tel. (0954) 60264

Upstream MIDI Interface:

Upstream Computer Systems Ltd.
49, Bransgrove Road,
Edgeware,
Middlesex.
Tel. 01-952-9105

Soundchaser, Drumulator, Model 64 Sequencer, Sixtracks, DX series synths, CX5 Computer, Passport Designs Software:

Syco Systems Ltd.
20, Conduit Place,
London W2.
Tel. 01-724-2451

Micron MIDI:

X.R.I. Systems,
10, Sunnybank Road,
Sutton Coalfield,
West Midlands.
Tel. 021-382-6048

PDSG:

Cleff Products (Electronic) Ltd.
44a, Bramhall Lane South,
Bramhall,
Stockport,
Cheshire.
Tel. 061-439-3297

BBC "MIDITRACK" Software and Interface:

Electro-Music Research.
14, Mount Close,
Wickford,
Essex.
Tel. 03744 67221

Casio MT-200 Interface:

and MicroLink-2,
Micro Musical,
37, Wood Lane,
Shilton,
Coventry.
Tel. 0203 616750

CBM 64

Sequential Circuits, the pioneer of MIDI, has taken the CBM-64 under their wing and come up with a 4000 note real time sequencer called the Model 64.

The Model 64 allows overdubbing, auto time correction and transposition. Its six tracks can be chained together and both sequences and songs may be dumped to tape or disc. A drum machine sync input is provided, although

sequences may be recorded without a drum machine connected.

Passport Designs — designer of the Soundchaser software — will shortly be launching a MIDI card for the CBM-64. The card includes MIDI In, Out and drum sync connections. The MIDI/4 software provides 16 real time tracks, each of which can be assigned its own MIDI channel and instrument name.

Apple

The MIDI/4 software can also run on an Apple II or its using Passport's Apple Interface card. This card is also used for music transcription software called Polywriter. The software is a four note

polyphonic version of the Notewriter monophonic transcriber for the Soundchaser system. Polywriter allows printouts in eight different formats ranging from single, treble and bass clef parts, to large orchestral scores.

Spectrum

The ZX Spectrum is popular among the small entrepreneurs, like Upstream whose software consists of a six track, 3500 note real time sequencer. The interface, which is included in the overall price of £179, boasts a trigger output along with MIDI In, Out and Through connections. Optional extras include editing facilities and a dot and staff graphics display.

X.R.I. Systems is asking £108 for its MicronMidi interface and software for the Spectrum. Micron is an 8,000 note real time sequencer with MIDI In, Out and Through connections as well as a trigger output. The Micron can also handle step time note entry in eight tracks, each of which can hold 3,000 notes. Tracks may then be merged or "bounced" onto one track to make space available for further recording.

Yamaha CX5

If you are considering changing your micro, then Yamaha's MSX computer, the CX5 may well be worth the wait. It is expected in November.

The CX5 is actually going to be marketed as a musical instrument as well as a home computer in this country, due to the fact that it comes fitted with MIDI interface and an FM voice module as standard.

The Yamaha CX5 is not the same as

the Yamaha Y15503 MSX computer reviewed by the British computer press recently.

Having typed Cal Music, the CX5 becomes an eight note polytechnic 48 patch synth. There is also a rhythm box which unfortunately is rather weak.

The CX5 also allows 48 of your own FM synth patches which are used in the CX5's built-in real time sequencer. The CX5 is expected to retail for about £560, fair dos for its synth facilities alone.

BBC

The BBC Model B gets the MIDI treatment from Electro-Music Research (EMR). Its Miditrack software is step time only onto six tracks, however dynamics can be programmed. The interface which connects to the Beeb's 1MHz Bus, provides MIDI In, Out and drum machine synchronisation facilities. The interface and software is expected to go for about £120.

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NAME ADDRESS

POST CODE

I use a micro-computer

The easiest way to build the main circuit board, which consists of the four chips and the 1K resistor, is to use the Verowiring system. Using this system the chips can be placed in the specially made boards and simply wired up using the pen and soldering

CHIP TYPE
 IC1 74LS139
 IC2 74LS153
 IC3 74LS153
 IC4 74LS153

0v 5v

GND E_a VCC A_{0a} A_{1a} A_{2a}

IC1

0a 1a 2a

5v 0v

VCC GND

IC2

E₁ E₂ A₀

0

15

k

48 IN4002 DI

a

KEYBOARD FOR

* 10	DIMP 300	500	.LDOPA CMP FLAGS-1,X	990	STX &73
20	DIME 50	510	BNE NTHIS	1000	.J2 LDX #63
30	FLAGS=F	520	TAY	1010	AND #31
* 40	FOR:=0T07	530	LDA #1	1020	CPX &72
50	READ A	540	STA FLAGS-1,X	1030	BCS J4
60	P71=A	550	TYA	1040	STA &73
70	NEXT	560	.NTHIS DEX	1050	JMP CLSE
* 80	STBL=F	570	BNE LOOPA	1060	.J4 CPX &71
* 90	ST=F+8	580	LDX &70	1070	BCS J5
100	OSBYTE=FFFF4	590	STA FLAGS,X	1080	LDY &72
110	OSWORD=FFFF1	600	SIA S:BL	1090	S:Y &73
120	FOR1=0T02STEP2	610	LDA #1	1100	STA &72
130	P%ST	620	STA STBL+2	1110	JMP CLSE
140	[DPTI	630	.D: LDA #10	1120	.J5 LDY &77
150	.START LDX #0	640	STA STBL+6	1130	S:Y &73
160	STX &70	650	JSR SND	1140	LDY &71
170	LDX #17	660	.NKEY LDX &70	1150	STX &72
180	STX &71	670	INX	1160	S:Y &71
190	INX	* 680	CPX #48	1170	.CLSE LDX #0
200	STX &72	690	BNE STORE	1180	CPX D2+1
210	INX	700	LDX #0	1190	DEQ NKEY
220	STX &73	710	.STORE STX &70	1200	STA STBL
230	.LOOP LDX #0	720	JMP LOOP	1210	LDA #2
240	LDY #0	730	.NPRSD LDX &70	1220	STA STBL+2
250	LDA #129	740	LDA FLAGS,X	1230	.D2 LDA #1
260	JSR OSEYTE	750	TAY	1240	STA STBL+6
270	C:Y #&1B	760	LDA #0	1250	JSR SND
280	BNE NTEBC	770	STA FLAGS,X	1260	JMP NKEY
290	LDA #126	780	TYA	1270	.SND LDA &70
300	JSR OSEYTE	790	CMP #2	1280	STA STBL+4
310	RTS	800	BCC NKEY	1290	CLC
320	.NTEBC LDX &70	810	ORA #64	1300	ROL STBL+4
* 330	STX &FE60	820	CMP &71	1310	CLC
* 340	LDA &FE60	830	BNE J1	1320	ROL STBL+4
* 350	AND #&40	840	LDX &72	*1330	LDA #25
360	BNE NPFSO	850	STX &71	1340	CLC
370	LDX &70	860	LDX &73	1350	ADC STBL+4
380	LDA #0	870	STX &72	1360	STA DTOL+4
390	CMP FLAGS,X	880	LDX #0	1370	LDA #7
400	BNE NKEY	890	STX &73	1380	LXJ #STBL MOD 256
410	LDA &73	900	JMP J2	1390	LDY #STBL DIV 256
420	ORA #64	910	.J1 CMP &72	1400	JSR OSWORD
430	LDX &72	920	BNE J3	1410	RTS
440	STX &73	930	LDX &73	1420	J
450	LDX &71	940	STX &72	1430	NEXT
460	STX &72	950	LDX #0	1440	ONERORRGCTO1820
470	STA &71	960	STX &73		
480	AND #31	970	JMP J2		
490	LDX #48	980	.J3 LDX #0		

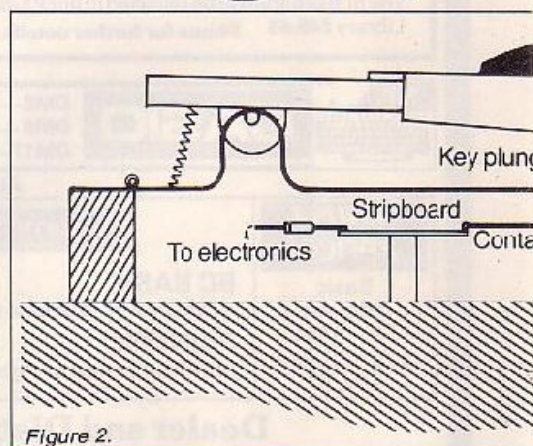
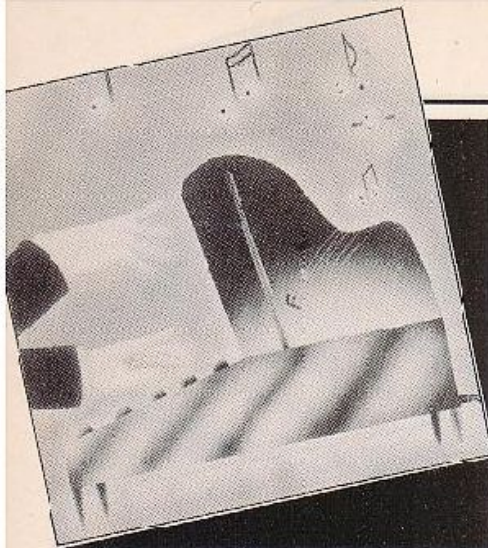


Figure 2.

[illegible]

(continued on opposite page)



(continued from previous page)
decaying/decayed.

The other important variable is stored at 70H. This is the number of the key being processed from 0 to 47.

The block diagram for the machine code is shown in figure 3 and the program for the music keyboard is in figure 4. For those who do not wish to build the keyboard, figure 5 shows the alternative lines. Those lines which occur in figure 5 as alternatives are marked with an asterisk in figure 4.

The machine code goes through the following functions cycling through the 48 keys — 41 in the computer keyboard version. First it tests the Escape key and returns to Basic if it is pressed — lines 230 to 360. Next the key is tested — lines 320 to 360. If it is found that the key is being pressed the program looks in the table to see if it was pressed when last scanned — lines 370 to 400.

If it was, then the program goes on to the next key. If it was not, a sound must be initiated. The lowest priority sound channel is read from 73H and the other two moved down. The one just removed is then marked as sounding and placed in the highest priority position. Lines 410 to 470 do this.

The flags table is then searched for the key corresponding to the previous sound on this channel, if there was one. This key is then marked as pressed but not sounding — lines 480 to 570. The new key allocation is then marked — lines 580 and 590 — and the sound started — lines 600 to 650. The next key is then scanned — lines 660 to 720.

If the key scanned is not being pressed the table is tested to see if it was sounding when it was last scanned — lines 730 to 800. If it was not sounding, the next key is scanned. If this key was sounding, then the sound channel used is found in the priority table and the rest moved up — lines 810 to 990. This is then marked as decaying and stored in the highest priority non-sounding position — lines 1000 to 1150.

Finally the decaying sound is produced — if its duration is not 0 — and the next key scanned — lines 1170 to 1260. It should be noted that in line 1180 the program actually inspects itself! This is because line 1850 sets the durations of the sounds by altering the constants in the program.

The Basic program is used to provide an easy way of defining the two envelopes. Lines 10 to 110 initialise the various arrays and constants. Lines 120 to 1430 assemble the machine code after which the key table is

initialised — line 450. Next the display is created and the envelope array initialised in lines 1460 to 1620.

The numbers are entered and the cursor moved by lines 1630 to 1810. When Escape is pressed the error is detected by line 1440 sending the execution to line 1820. This then sets up the envelopes and calls the machine code. The final section starting at line 1920 is the data for the program.

The program is designed to run in Mode 7 but will run in any. When Run, it gives a display of a column of names and two of numbers. Underneath these it says "Define envelopes". In this mode the cursor keys are used to choose the number to be altered. The number can then be typed in and entered either by moving the cursor or by pressing Return.

Note that if play mode is entered before doing this the number will be displayed but not entered. If the number is too large, the old one will be restored when the number is entered. The last parameter is not an envelope one but the duration of the sound.

In order to start playing, Escape must be pressed. The bottom of the screen now says "Play". If the keys are then pressed the correct sounds should be heard. Note that in order to hear the desired effect the first envelope should not decay but the second should. Other interesting effects can be created by not adhering to this pattern.

That irritating hiss which many BBC

Figure 5.

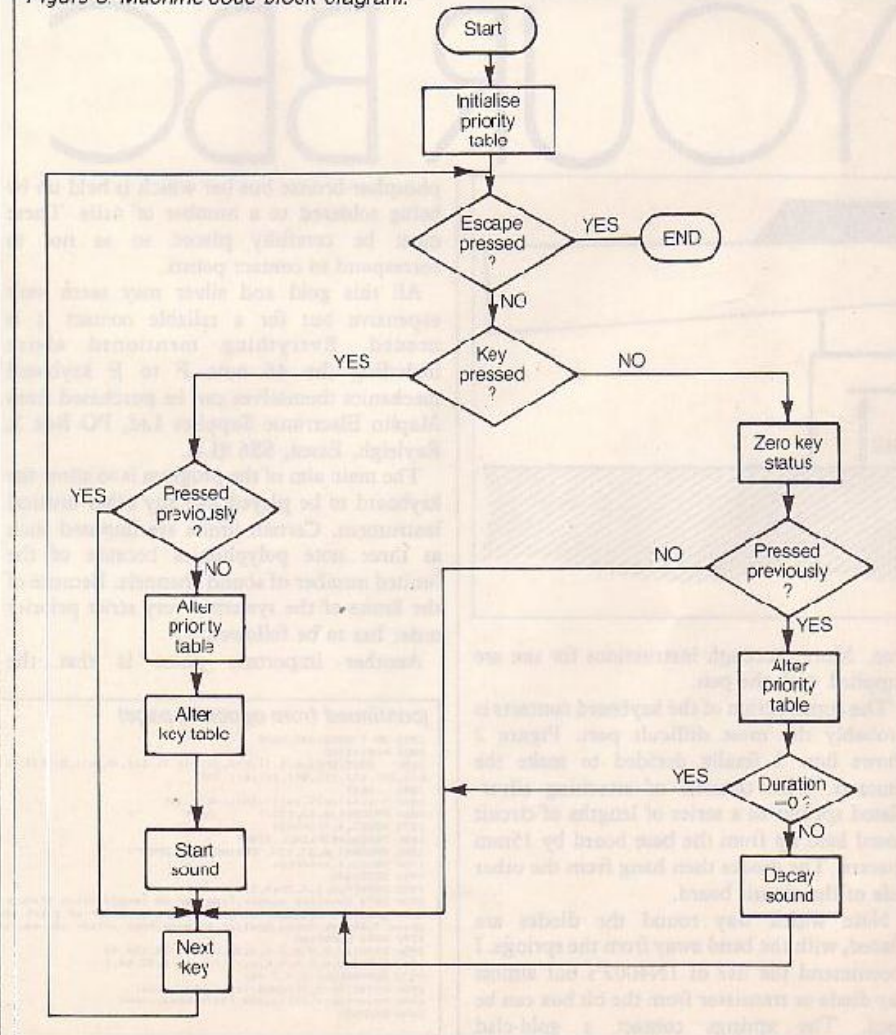
```
10 DIMP 350
40 FDFI=01048
80 STEL=P+41
90 ST=P+49
325 LDA P,X
330 TAX
335 LDY #FFF
340 LDA #129
345 JSR DSBYTE
350 CPY #FFF
680 CPX #41
1530 LDA #5
1912 DATA&E,&AE,&BD,&CD,&AD,&9C,&FC,&7B
1914 DATA&AB,&AA,&1A,&7A,&99,&A9,&5B,&AB
1916 DATA&57,&FF,&CF,&EF,&CE,&DE,&EE,&ED
1918 DATA&CC,&EC,&1C,&BC,&BB,&CA,&BA,&JA
1919 DATA&C9,&C9,&DB,&CB,&BE,&E7,&C7,&37,&D7
```

computers seem to have can be removed with ease. This is done by fitting a plug to the 1MHz bus under the computer and soldering a 1kΩ resistor between pins 16 and 1.

The second improvement which can be made is to use external amplification. This can be done by placing a 1/4 inch jack plug in the normally unused hole marked Reset on the back of the computer. This can then be connected via screened cable to PL16 on the circuit board. To find this, first remove the cover from the case and unbolt the keyboard.

There is no need to unplug this, just fold it away over the rest of the board. On the far left of the circuit board, looking from the front, very close to the side, and hidden in the middle of some components are two pads clearly marked PL16. The output from this is low level and can be used to supply a high quality amplifier. Please note that connection of devices, or modifications to your computer are done at your own risk.

Figure 3. Machine-code block diagram.



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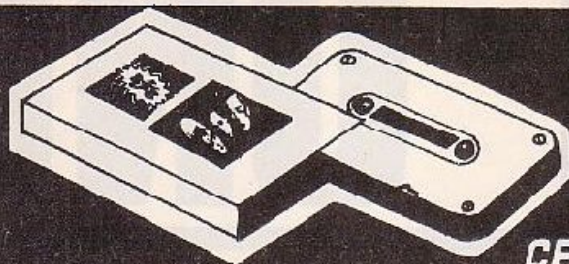
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WITH FRANKIE GOES TO HOLLYWOOD's new album due out in weeks Steve Lipson stares across a mixing desk into the void of a recording studio trying to improve on the great sounds he engineered for Relax and Two Tribes/War.

At the console he strikes a pose worthy of Captain Kirk at the controls of the USS Enterprise but Steve is under no illusions that he is a man with a mission. "I don't want to be Mother Theresa", he says. "I am the person who is employed to help defraud the public — and rightly so — because if the public honestly believe what they see they deserve to be defrauded."

"Frankie are nothing out of the ordinary. I've read articles which say they don't play on their records. This is a slight twist of the truth. In fact they play on their records then we make what they do better which is a perfectly logical thing to do. They're 20 years old — we're much older — we've had experience of making records and can make what they do sound a hundred times better. The artist becomes a performer. He's the guy who fronts the whole thing which is how it should be. If you have a tremendously good group to start with you limit the amount of input your production side can put in."

Steve's fraud factory is Sarm Studios in London. Outside it looks like the shabby derelict warehouses you expect to find at the wrong end of the Portobello Road. The only clue to its true purpose is a couple of fans on the steps in long black and white Relax T-shirts. They look like a pair of lost zebras as they wait for a glimpse of their heroes.

Inside, Steve Lipson is busy at the controls of his Sinclavier computer. Apart from the usual Qwerty keyboard and TV screen this has a 20 Megabyte hard disc storage unit — that's 500 times the capacity of a Commodore 64 — and a piano keyboard. Steve uses the Sinclavier mainly as a sampling machine. He can take any noise whether it's a bamboo cane hitting a shopping trolley or somebody hitting a snare drum and then produce a sequence of sounds based on that to create a new instrument.

Steve makes it sound very simple: "some geezer bangs a snare in the air. I get it to sound as wonderful as I can, stick it in the Sinclavier, organise it so that it's occupying as little space as possible for maximum effect and then proceed to sequence it. Then it is reverse compiled into script language." With his right hand Steve plays a bass line from Relax on the piano keyboard while his left hand on the Qwerty throws it on to screen as script language. On screen, phrases can be edited and repeated — just like word processing with sounds.

Another stab at the keyboard shows the file catalogue for two of the tracks from the new album, Only Star in Heaven and Black Night, White Light. Steve keeps most of the 20 Megabyte memory in use most of the time, making back up copies of any material he does not need immediately so he can free space. It is reassuring to know that even with such expensive equipment things can go wrong. The cartridge machine which should make the back-up copies on to tape is malfunctioning so Steve is having to use floppy discs "and 20 Megabytes is something like 200

Two Tribes — music and micros: Meirion Jones talks to the man who mixes them for Frankie.

HOW

Frankie's engineer Steve Lipson relaxes.

FRANKIE GETS TO

OHOLLYWOOD



discs so it's hopeless."

More and better equipment solves some problems but also creates new ones. "With Relax the problem was we were using an analogue tape recorder. Now we're using a digital — big difference." But on the new album "a lot of the bass sounds we're using now are two machines synchronised together which poses a great deal of problems."

While Steve deals with the technical side producer Trevor Horn is the man with the golden ears who seems to know what the public want to hear. "I am working with the best producer around. I will be working on a track for days and days and Trevor will walk in — he's very good at looking at the overview — and he'll say, 'No this track is rubbish, start again' ... Trevor signed Frankie goes to Hollywood because he thought they were ridiculous — good singer but absolutely ridiculous. He had two attempts to recording them, both dismal failures. I got recommended to him — it's not what you know it's who you know — I started engineering and did Relax."

The phone rings — oh no it's Trevor — but this time he is not asking for a track to be scrapped but just for a snare drum to be taken off one of the songs on the new album and

replaced with another snare drum and a tambourine. If it's a simple part Steve can do that in a matter of minutes. "If it's a complicated part it could take me four or five hours. It's easy now but the very first time I did it, it took me a whole day."

With a virtually unlimited budget for new equipment Steve can afford to dream of tomorrow's machines. "You will have an infinite track tape recorder, you will record something and then be able to move it wherever you want to." But this will require new forms of computer storage — "hard disc is so primitive".

Steve does not feel that the empires of the big recording studios are under threat from home computer-based systems using converted Commodore 64s and Midi compatible Yamaha CX-5s. "Nothing is going to happen with all that stuff. Midi's useful but going to run out shortly. There will be a Midi 2.

"8-bit sounds are unusable — the Fairlight's different because it has got a graunch noise of its own. It just lowers the quality of what we're going to be hearing. Very few people have got all the gear and then everyone else with their CX-5s and Commodore 64s will be struggling desperately hard with not really a hope in hell, apart from the odd genius."

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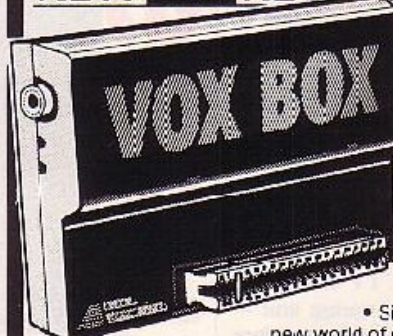
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MUSIC AND COMPUTERS have been on a collision course for some time now, and the noisy impact is imminent. You only have to switch on the radio to hear computer-generated rhythms and music. A whole new language has evolved that talks of sampling and the Midi interface.

Everyone knows that Frankie Goes To Hollywood uses a digitised version of Led Zeppelin's drums, and that the modern keyboard instrument has enough computing power to run your local power station.

Soon this technology will be available in people's homes. Already microchip pianos and organs are pushing out the steam-driven versions. While that other popular piece of household furniture, the micro, is being revamped as a musical beast. The next wave of computers will be more musical than the last, but for now we will have to make do with existing technology.

Micro musicians have two options. They can take the hardware route, or the software route. Hardware involves expense and even sometimes the horrors of a soldering iron, while there are a number of interesting, yet simple software solutions available.

Music Processor

Quicksilver — BBC B

ONCE LOADED, the screen displays a parameter map which allows access to various musical functions — for example, instrument tone, volume and octave selection for each of four channels — and an optional metronome facility. These are changed using the function keys — not a difficult technique to master easily. However, with a maximum of only nine numerical values for each function, there is not a great deal of resolution, and the

difference between one value and another can be extreme.

There are also drive functions — play, fast forward, and rewind — which are accessed via the cursor keys. The remainder of the screen is taken up with details of the four channels as you record and play music.

Recording is also a fairly simple affair, using the shift and keys. The counter ticks away, and off you go in real time, using the QWERTY keyboard. The Return key takes you out of the record mode, and a one-key function plays the tune back, warts and all.

Overdubbing is achieved by changing channel, key f0, which enables the original tune, as well as the overdub, to be heard. Channel 4, by the way, is reversed purely for noise for rhythm purposes. The whole procedure is quite straightforward, but as always there are drawbacks.

First, the real-time input is difficult on the QWERTY keyboard, and it is all too easy to make mistakes. Although there are editing facilities, we found it difficult to make them work. The sounds themselves are less than brilliant, but that has more to do with the limitations of the BBC B than with the

software — after all, there are not many variations to a square-wave beep.

The software is well-written, and the author is obviously musically aware. With the addition of a standard keyboard and better sound chips, it could be a potent system. As it is, both the music programmer and the programming musician are likely to be disappointed.

Synth

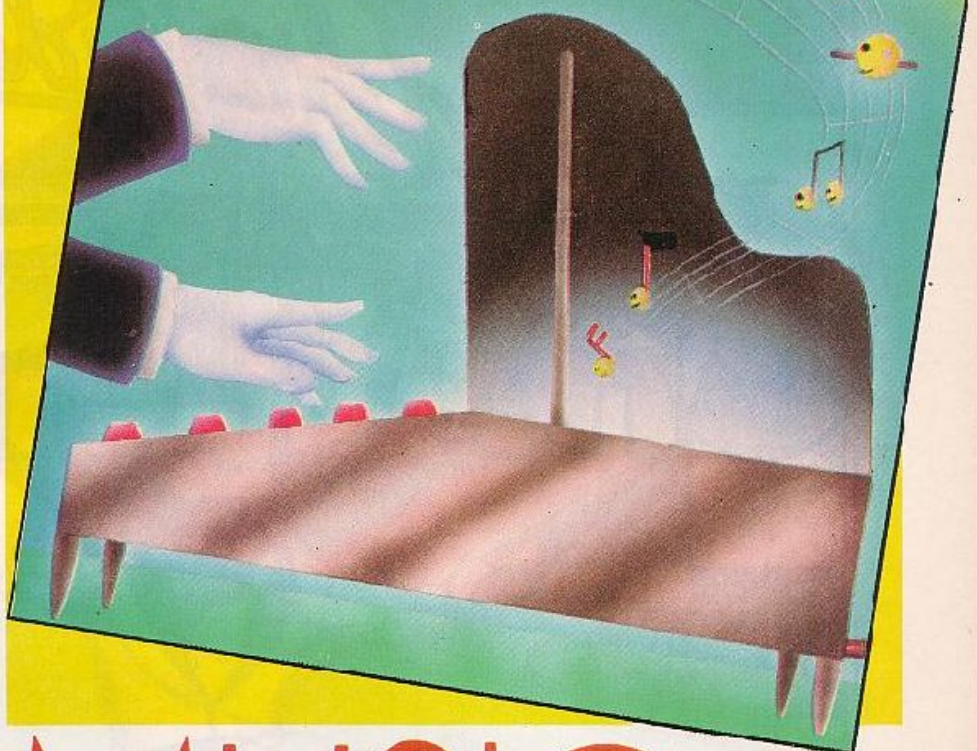
Worm Software — BBC B

SYNTH TURNS your BBC into an organ. Page 1 gives you Play, whereby the QWERTY becomes a musical keyboard with the top part a monophonic beep, and the bottom part playing chords of the major, minor or seventh variety.

One amazing shortcoming is that you cannot play both melody and chords at the same time, which would seem to negate the provision of such a facility — unless you have multi-track recording equipment, in which case you probably would not want to use the somewhat lack-lustre BBC B tones.

Page 2 allows you to modify the envelope of the sound, and thereby its tone, but again the

Stuart Kelling opens the doors on the musical software parade.



MUSIC SOFTWARE

sounds obtained may be more suitable for a Pac-Man game than a synthesiser melody. Page 3 is a Help page, containing information on how to use the program. Were it possible to program a tune into one channel and chords into another, this might be a useful package. This failing, taken with the limited tonal range, makes this piece of software disappointing.

Multisound Synthesiser

HOMIK — CBM-64

THIS PACKAGE is by far the best of the bunch. The flexibility and range of the Commodore's sound chips mean that the system's potential greatly exceeds that of many other computer-based instruments. The basis of operation lies with three screen displays — control panel, special effects panel, and the keyboard.

Switching from one to the other is a one-key operation, and an easy-to-follow explanation of basic sound synthesis is provided in the manual, covering the simple wave-shapes — figure 1 — and use of filters to control the harmonic content of the sound — figures 2 and 3.

The control panel features wave and filter controls, each with single-key representation, and envelope (ADSR) control is simply done incrementally. The sounds are actually produced in the keyboard mode, again using the QWERTY keyboard. Your tune is created
(continued on page 79)



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48K SPECTRUM · COMMODORE 64 · BBC 'B' · ELECTRON

(continued from page 77)

by single-key selection, and playing in real time. You can then add more music if you wish, and you can opt for the computer's own, "auto-spaced", tempo and note length.

You will not be able to alter the speed of playback while the tune is being played, but you can choose the right tempo before recording. Playing is monophonic, with the highest note taking priority if two keys are pressed simultaneously. One useful feature is the two playback modes. Mode II, for example, enables the player to vary the playback speed by using the < and > keys. In addition, the background playing mode means that overdubbing is possible. Nine tunes may be stored in the computer's memory, but only one will play back at a time.

Operation is made easier by use of a cursor for each note played, providing a visual aid for those unsure of their touch on the keyboard. Editing is a simple task, and the multisound also has a drum mode, consisting of eight built-in patterns selected from the control panel. Any drum pattern acts as a background tune, and the rhythm sound can be altered through the ADSR selectors. You can also write your own drum routine in the same way as a background tune.

The two main factors in this package's appeal are ease of use and the sounds available. Programmers and musicians may find this a useful writing tool, as well as a source of pleasure.

Features such as oscillator and envelope sweeping, ring modulation and wave-form synchronisation controlled by the special effects panel, add greatly to the machine's sound potential, while the software is sensibly written and well explained.

Musicmaster

Incognito Software — 48K Spectrum

AGAIN, A WELL-WRITTEN package limited by the Spectrum's sound capability. A keyboard overlay is provided to simplify playing, and two modes are available. The first is Stave, giving a two-octave range of notes and matching stave screen display; the second is Keyboard, giving a 17-note playing range.

A series of reminders display length of note, rests, deletion, and so on. Bar signs are inserted automatically, indicating this system's usefulness as an educational aid.

The package is limited — for example, only one tune can be retained at any one time — but operation is very simple, and tunes, once entered, can be amended easily. Familiarity with this instrument may help your keyboard literacy if you are just starting out, and may be a useful refresher for those who have forgotten their music theory.

From the point of view of a poverty-stricken musician, many of the available software packages for computer base synthesisers will be disappointing, due either to the poor sound range, or the limitations imposed by the software itself. The Commodore program is, in effect, a useful link between the standard play as you learn material, and the impending invasion of specialist packages such as Yamaha's new range.

This is not to deny that the BBC and Spectrum programs can fulfil a role — they

are certainly excellent educational instruments — but it is doubtful whether they will be suitable for someone intending to use the computer as a serious writing tool.

Musicians — like everybody else — will soon be facing a bewildering choice if they intend to make use of new technology. The only advice that can really be given is to be sure of what you want before you buy it. This may seem fatuous, but there is nothing more frustrating than buying a package which turns out to be a shelf-filler and nothing else.

If you want to use the computer as a complete system, you will have to be more selective. ■

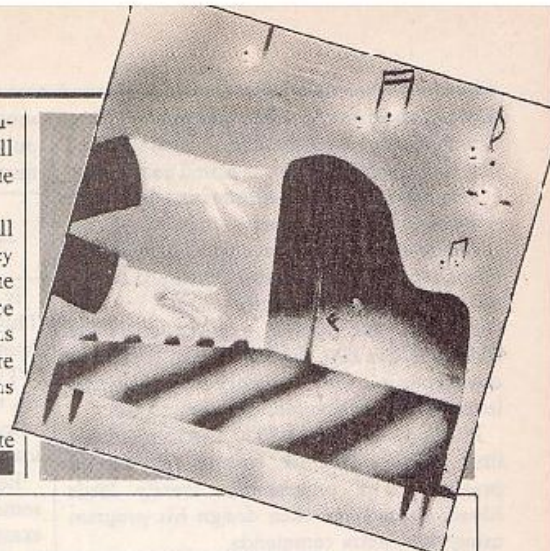


Figure 1. Saw tooth.

The sawtooth wave-form produces a tinnier sound, similar to a plucked string instrument.

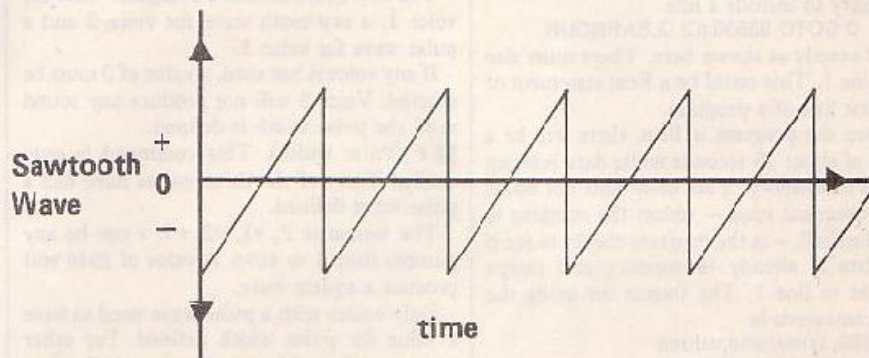


Figure 2. Low-pass filter.

The low-pass filter allows all notes below the cut-off point to pass unchanged. Notes above the cut-off point are muted at a rate of 6dB per octave.

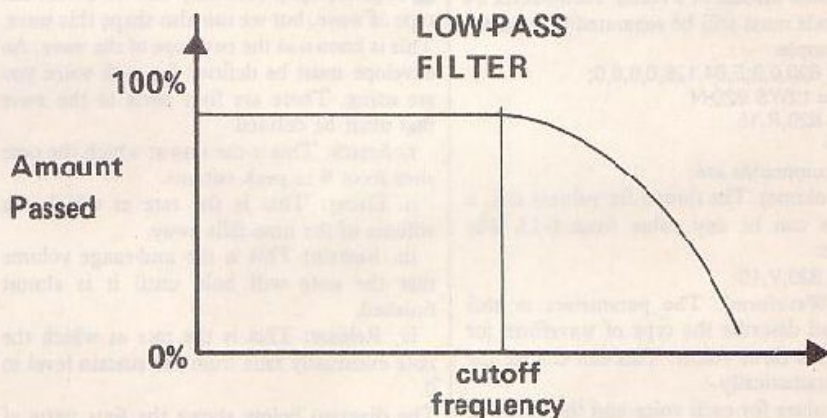
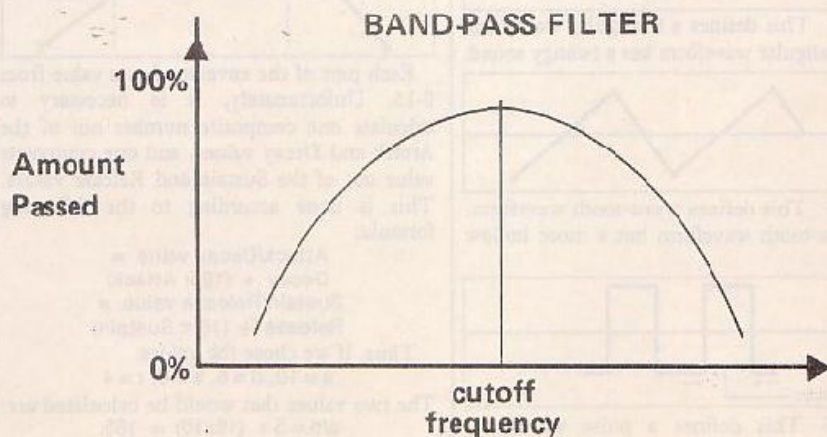


Figure 3. Band-pass filter.

The band-pass filter mutes notes both above and below the cut-off at a rate of 6dB per octave.



WHILE COMPILING music programs using the Commodore 64 synthesiser, I soon realised that it was sorely lacking in sound commands. It also necessitated the memorising of a large number of Poke addresses in order to be able to define the volume, wave-type, wave-shape, filters etc. For this reason I developed Musik 64 — a program which adds 13 new commands and which requires only one address — Sys 820. To use each of these new commands it is only necessary to type a single letter eg., V for volume, S for sound etc.

Musik 64 uses lines 63500 onwards, leaving lines 1-63499 free for writing any desired program. The programmer merely loads Musik 64 and can then design his program using these extra commands.

In order to get the program to run it is necessary to include a line

0 GOTO 63500:(C) G.BARBOUR
typed exactly as shown here. There must also be a line 1. This could be a Rem statement or the first line of a program.

When the program is Run, there will be a delay of about 20 seconds while data is being stored in memory. This delay will not occur on subsequent runs — unless the machine is switched off! — as the program checks to see if the data is already in memory and jumps straight to line 1. The format for using the new commands is:

SYS 820, command, values
eg., 10 SYS 820,V,15

Several different Musik 64 commands may be used in a single line using only the one Sys 820, as long as each command is separated by a semi-colon instead of a colon. Non Musik 64 commands must still be separated by a colon. For example:

10 SYS 820,0,3;E,64,128,C,0,0,0;
V,15:A=:SYS 820,N
20 SYS 820,R,15
30 END

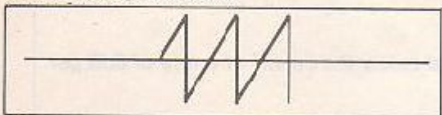
The commands are:

■ V (Volume). The format for volume is V, x where x can be any value from 0-15. For example:

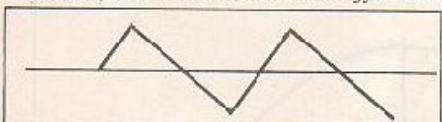
10 SYS 820,V,15

■ W (Waveform). The parameters in this command describe the type of waveform for each of the three voices. This can change the sound dramatically.

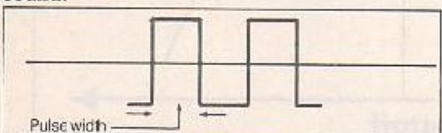
The values for each voice and the shape of wave they represent are:



i. 17 This defines a triangular waveform. The triangular waveform has a triangy sound.

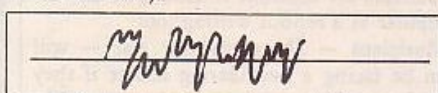


ii. 33 This defines a saw-tooth waveform. The saw-tooth waveform has a more hollow sound.



iii. 65 This defines a pulse waveform. This waveform can give a wide range of

sounds, due to the fact that the width of the pulse must be defined before it will play (see next command).



iv. 129 This defines the noise waveform. This is a random wave which can be used for sound effects.

The format for this command is W, v1, v2, v3, where the v1, v2 and v3 refer to the three voices. v must be chosen from the values listed above, viz. 17, 33, 65 or 129.

Each voice may have a different value or some or all the voices can be the same. For example:

45 SYS 820, W,17,33,65

The above line defines a triangular wave for voice 1, a saw-tooth wave for voice 2 and a pulse wave for voice 3.

If any voice is not used, a value of 0 must be entered. Voice 3 will not produce any sound until the pulse width is defined.

■ P (Pulse width). This command is only needed if any of the three voices have had a pulse wave defined.

The format is P, v1, v2, v3. v can be any number from 1 to 4096. A value of 2048 will produce a square wave.

Only voices with a pulse wave need to have a value for pulse width defined. For other voices, a value of 0 must be entered. For line 45 to work, a line such as the following is necessary:

47 SYS 820,P,0,0,2000

■ E (Envelope). Not only can we define the type of wave, but we can also shape this wave. This is known as the envelope of the wave. An envelope must be defined for each voice you are using. There are four parts to the wave that must be defined.

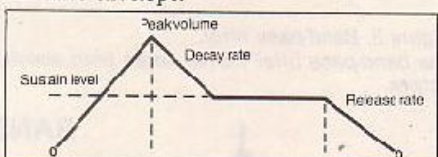
i. Attack: This is the rate at which the note rises from 0 to peak volume.

ii. Decay: This is the rate at which the volume of the note falls away.

iii. Sustain: This is the mid-range volume that the note will hold until it is almost finished.

iv. Release: This is the rate at which the note eventually falls from the sustain level to 0.

The diagram below shows the four parts of the wave envelope.



Each part of the envelope has a value from 0-15. Unfortunately, it is necessary to calculate one composite number out of the Attack and Decay values, and one composite value out of the Sustain and Release values. This is done according to the following formula:

$$\begin{aligned} \text{Attack/Decay value} &= \text{Decay} + (16 \times \text{Attack}) \\ \text{Sustain/Release value} &= \text{Release} + (16 \times \text{Sustain}) \end{aligned}$$

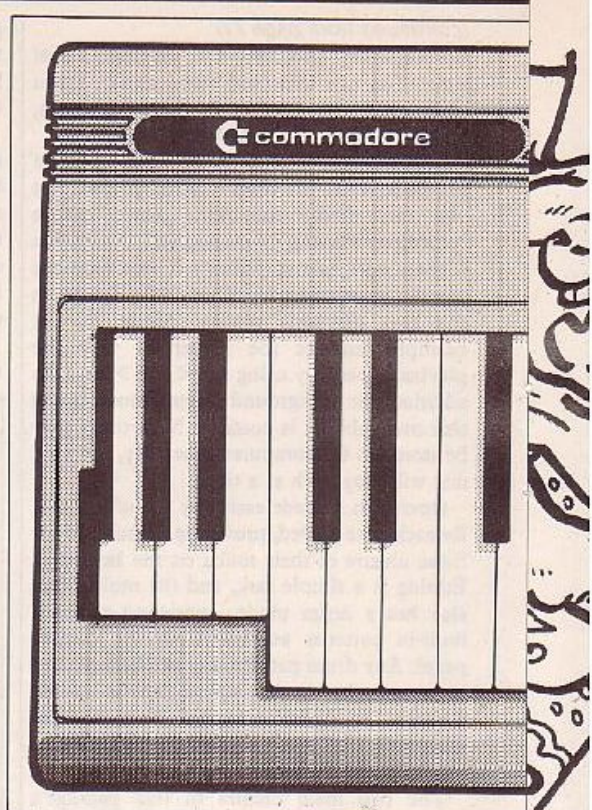
Thus, if we chose the values:

$$a = 10, d = 5, s = 9, r = 4$$

The two values that would be calculated are:

$$a/d = 5 + (16 \times 10) = 165$$

$$s/r = 4 + (16 \times 9) = 148$$



Graham Barbour's baker's dozen of sound commands puts some yeast in your 64

The format is:

E, ad, sr1, ad2, sr2, ad3, sr3.

eg. 40 SYS 820, E, 64, 128, 5, 10, 50, 200.

■ S (Sound). This command allows you to play a note or a chord for a specific duration, after which the sound is turned off. This ability to define a duration is sorely needed on the 64. This new command replaces the numerous For commands formerly required.

The format is:

S,n1,r2,n3,d

The value for n can be from 0-65536 and can be found in the note table in the Programmer's Reference Guide. The value must be taken from the table marked "Decimals".

If you only have the 64 Manual, these values must be calculated using the formula:

$$n = (\text{Hi freq.} \times 256) + \text{Lo freq.}$$

The values for Hi and Lo freq. are found on page 152 of the manual.

If you do not want a sound from a particular voice, a value of 0 must be defined for that voice — this represents a rest.

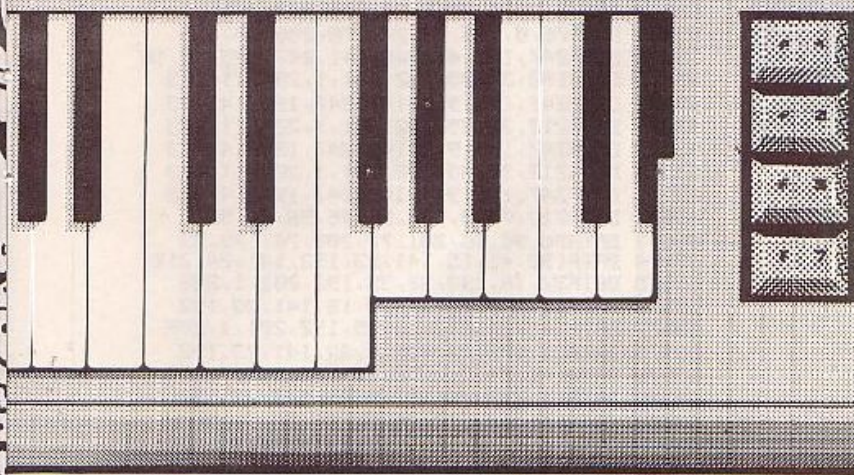
The duration can be any value from 0-65535; each unit represents 1/60th of a second. Thus 60 will represent a duration of 1 second.

If a value of 0 is used, the note will play continuously until switched off or until another S command is encountered. For example:

50 SYS 820, S,4000,5000, 6000, 120

■ 0 (Off). This command is used to zero or switch off all sound addresses (Waveforms,

64



MUSIK 64

Volumes etc.). This usually takes about 20 secs. in Basic, but this new command does it almost instantaneously.

The format is:

0,v

v can be from 1 to 3.

A value of 1 clears voice 1; 2 clears voices 1 and 2, while 3 clears all three voices. Any value clears all filters and the volume.

The following four commands are used to set the sound filters. The filters are used to change the harmonic structure of the wave. With the 64 we have three different types of filtering. These may be used separately, or two or more can be used simultaneously. There are a number of controls which must be set when using a filter.

■ **F** (Filter set). This command defines which voices are to be filtered and which not. The format is

F,v1,v2,v3

If v is given the value 1, then that voice will be filtered — if v is zero, that voice will not be filtered. For example:

70 SYS 820,F,1,0,1

In this case, voices one and three will be filtered while voice two remains unchanged.

The next three commands will only affect the voices you have selected to be filtered. There is not a different filter for each voice — the chosen filter will act on all the voices you have decided to filter.

■ **C** (Cut-off point). This tells the computer the exact stage in the wave cycle where the filtering process must begin — it is a reference

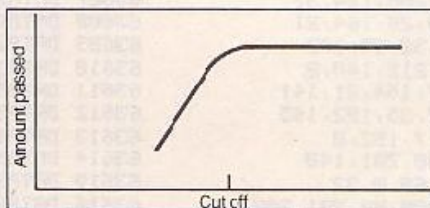
point for the filter. The format is:

C,v

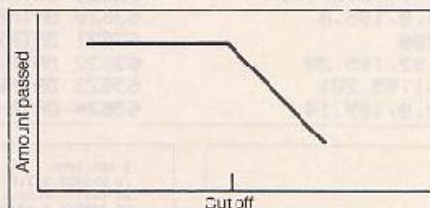
v can be any value from 0-255. For example:
70 SYS 820,C,100

■ **M** (Filter mode). This command defines the type of filter to be used. The 64 has three filter modes, which can be combined.

a. **Highpass**: This passes over all values above the cut-off point while attenuating the frequencies below.



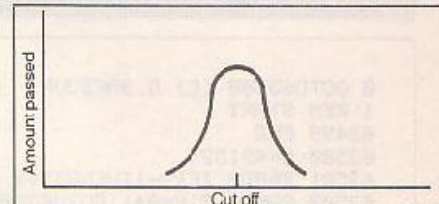
b. **Low pass**: This passes over all the low frequencies while attenuating the others.



c. **Band pass**: This attenuates all values except a narrow band around the cut-off point.

The format is: M,HP,LP,BP

A value of 1 sets that type of filter while 0 clears it. For example: 80 SYS 820,M,1,0,0



In this example a high pass filter has been selected.

■ **R** (Resonance). This is the last filter command which sets the resonance of the filter. The format is:

R,v

v can be from 0-15. For example:

100 SYS 820,R,14

110 GOTO 10

The last three commands are extremely useful. They allow a program, which plays a tune, to be built in memory using voice 1. When the program is executed, it plays in the background, allowing another program to run simultaneously. This is very effective for designing games, allowing the game to be played while music plays in the background. The music can even play while you are programming, and adjustments can be made to the music program — Volume, Waveform, Envelope etc. — while it is actually playing. Because only voice 1 is used, voices 2 and 3 are left free for additional sound effects.

■ **N** (New). This will rub out any tune in memory. It should be used before making up a tune. The format is:

N

For example:

110 SYS 820,N

■ **D** (Data). This will store the next note and duration in memory. Format is:

D,n,d

n can be any number from 0-65000. See Sound command; line 50.

d (duration) can be 0-255. (60 is equal to 1 sec). For example:

120 SYS 820,D,2000,120

These values could be read from a data statement — see program 2.

■ **X** (Execute). When your tune is finished, this command will cause it to play. Format:

X

For example: 130 SYS 820,X

When a program, which plays a tune, is run, the tune will repeat until the 0 (Off) command is encountered.

Although constants have been used for the values in the above examples, it is permissible to use variables for the values in any of the commands — as has been done in the demonstration programs. (continued on next page)

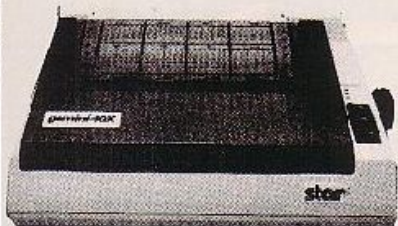
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DRAGON DISCO LIGHTS

THIS PROGRAM generates on-screen colour graphics in time with music that is played through the cassette port. In other words it simulates disco lights.

I had originally programmed this in Basic, but as usual, it proved to be too slow so I converted it to machine code. Although it sounds very complicated it is, in fact, very simple.

The first job is to turn the cassette motor and audio on; this is done in lines 0008 and 0009. Both lines call the respective ROM routines although it is just as easily done by the controlling program. Then the screen is cleared to black — lines 0010,0011. The ROM routine at 47737 clears the screen to the character in accumulator B — if you call 47735 then the screen is cleared to green.

The guts of the program come next; a byte is taken from the cassette recorder in line 0012 — this ROM routine is one of many that deal with the cassette port, see figure 1. Lines 0013-0027 then divide this byte by 31 to get it into the range of 0-8 because we only have nine colours. Lines 0028-0044 then send control to a routine which places the graphics on screen.

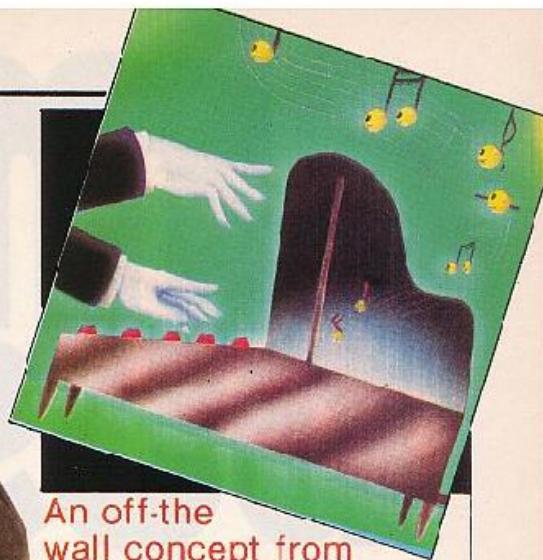
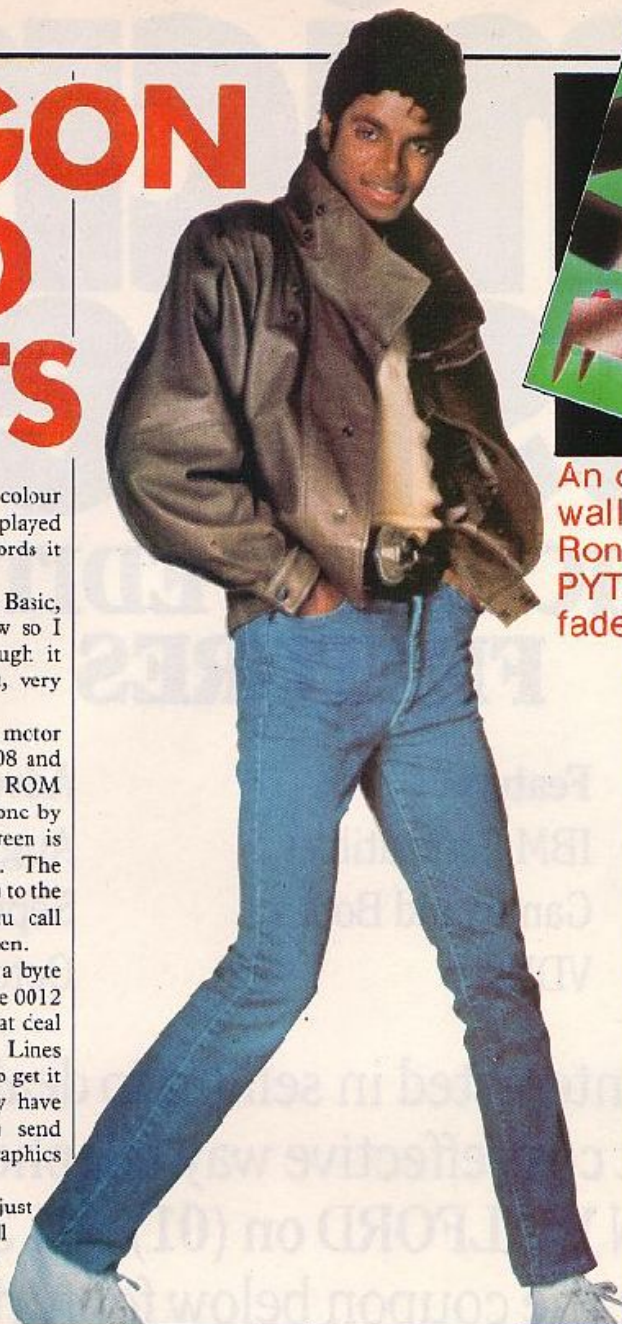
These are all very similar so we will just look at the first one. The first line of all the routines looks at the top right-hand corner of the graphics to see if it is On — colour — or Off — black. If it is On then it is turned Off and visa versa. Control is then passed back to the "byte-in" routine and the whole process is repeated.

To enter the program use the hex loader to enter the code from the hex dump. When you've finished save it by typing: CSAVEN "DISCO", &H6000, &H6114, &H6003

When the program is in memory place a music cassette into your cassette recorder and press Play. Type

EXEC &H6003

and hit Enter. If all is well then you should see some coloured graphics appearing on your screen and the music should be playing through the speaker, if not then reload the code and check through it.



An off-the-wall concept from Ron Gardler. Impress PYTs with your ability to fade away and radiate.

Program 2.

```
24576 : 4EC000BDB015BDBA = 791
24584 : ECC6B0BDBA79BDB0 = 1375
24592 : 24E76000B61FB760 = 759
24600 : 01E608B76002F660 = 746
24608 : 004F5849B1600125 = 551
24616 : 04E060015C7A6002 = 589
24624 : 24F0810127228102 = 612
24632 : 2733B10327448104 = 462
24640 : 2755B10527668106 = 534
24648 : 2777B10710270086 = 483
24656 : B1C8102700952086 = 333
24664 : B6C400B1BF2704C6 = 699
24672 : BF2002C6B0BE0400 = 649
24680 : 17C09520A1B60408 = 562
24688 : B15F2704C69F2002 = 722
24696 : C6E0BE040B170080 = 634
24704 : 20BCB60416B1AF27 = 723
24712 : 04C6AF2002C6B0BE = 879
24720 : 0416B0D6C16FF77B6 = 853
24728 : 04A0B1BF2704C6BF = 916
24736 : 2002C6B0BE04A0B0 = 807
24744 : 5716FF62B604B681 = 959
24752 : CF2704C6DF2002C6 = 887
24760 : B0EE04B680A216FF = 940
24768 : 4DB60540B1DF2704 = 723
24776 : C6EF2002C6B0BE03 = 928
24784 : 40BD2D16FF3B8605 = 770
24792 : 4BE1EF2704C6EF20 = 955
24800 : 02C6B0BE054B8D1B = 715
24808 : 16FF23B60556B1FF = 969
24816 : 2704C6FF2002C6B0 = 856
24824 : BE0556B0D0316FF0E = 668
24832 : 1F58C40510AF0004 = 554
24840 : A7E0313F26FA30B8 = 879
24848 : 165A26F039 = 447
```

Figure 1.

I/O routines in ROM.

&H8015..... turn the motor on.
 &H8018..... turn the motor off.
 &H801E..... prepare cassette for writing
 &H801E..... put out byte to cassette from A.
 &HA006..... outputs a block of data.
 &H8021..... prepares cassette for input.
 &H8024..... input a byte (into A).
 &H8027..... input a bit (into carry bit of CC).

&HA006..... get block in.

Locations used by the above routines.

&H90/91..... leader byte count.
 &H95/96..... cassette motor delay.
 &H7C..... block type: 0 = file header.
 1 = data
 255 = end of file.
 &H7E/7F..... base address of bytes to put out.
 &H81..... error code, cleared if read and verified correctly.

To achieve the best results adjust the cassette volume and the colour/brightness controls of your television and then turn the lights out.

If anyone does not wish to type in all the data then please send £2, an S.A.E. and a blank cassette to: R. Gardler, 23 Dorchester Road, Hazel Grove, Stockport SK7 5JR.

Program 1. The hex loader.

```
10 REM HEXLOADER
20 REM ENTER THE STRING OF HEX DIGITS FIRST
30 REM AND THEN THE CHECKSUM
50 FOR N = 24576 TO 24852 STEP 8
60 PRINT N; " : ";
65 TT=0
70 INPUT A$
75 Z=0
```

```
80 FOR G=1 TO LEN(A$) STEP 2
90 P=VAL("&H"+MID$(A$,G,2))
95 TT=P+TT:POKE (N+7),P
100 Z=Z+1
110 NEXT
120 PRINT " : ";
130 INPUT T$
150 IF VAL(T$)<>TT THEN PRINT "ERROR":GOTO 50
160 NEXT
```


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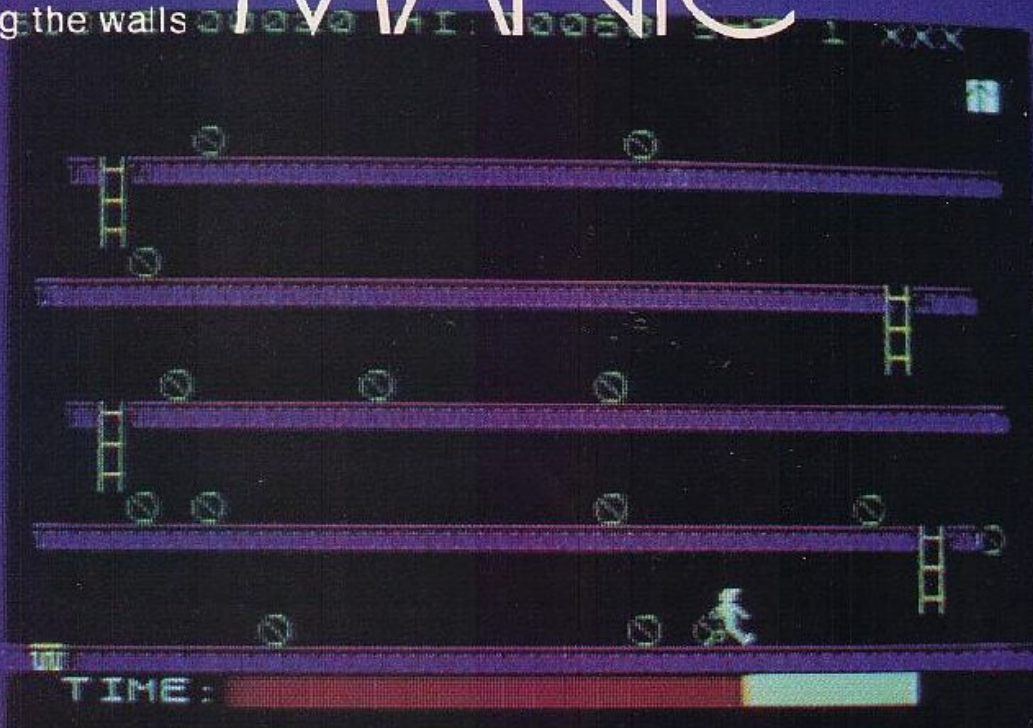
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 SELECTIVE BRANCHES OF BOOTS, CO-OP,
 MENZIES W. H. SMITH, WOOLWORTHS AND ALL
 GOOD DEALERS.
 AUTHORS WE PAY 20% ROYALTIES!

IF I WERE
 YOU, I'D ALSO BUY
 FELIX IN THE FACTORY,
 CYBERTRON
 MISSION AND
 GHOULS!



Hugh Dereli's
program will soon
have you
climbing the walls

MANIC



CLIMBER

Listing 2.

```

29700 7E 00 01 03 03 01 03 =73
29307 07 0B 13 03 03 03 06 =52
29314 0C 1B 0C 00 00 00 00 =630
29321 80 00 00 00 00 00 00 =1336
29328 00 60 34 1C 08 00 07 =383
29335 03 03 01 03 07 0B 13 =47
29342 03 03 03 04 2C 3D 10 =131
29349 00 80 00 00 00 20 00 =1056
29356 00 08 00 00 00 50 30 =1128
29363 18 30 00 1E 3C 3C 18 =246
29370 7E 7E 7E 7E 7E 3C 3C =684
29377 18 18 1C 00 7B 3C =280
29384 3C 18 3C 7E 7E 7E 7E =648
29391 3C 3C 18 18 18 3C 3C =308
29398 42 41 91 89 85 42 3F =748
29405 3C 42 41 91 89 35 42 =768
29412 3C 3C 00 00 55 55 55 =791
29419 77 00 42 42 42 7E 42 =509
29426 42 42 42 42 42 42 42 =916
29433 0F 0F 0F 0F 0F 0F 0F =1142
29440 00 7E 3C 00 00 3C 42 =312
29447 85 89 91 41 42 3C 10 =718
29454 92 54 38 10 06 3B 10 =588
29461 81 42 24 18 18 24 42 =381
29468 81 00 00 00 00 00 00 =129
29475 00 00 00 00 00 00 00 =0
29482 00 00 00 00 00 00 00 =0
29489 00 00 00 00 00 00 00 =0
29496 00 00 00 00 00 00 00 =441
29503 03 75 77 21 00 5B 01 =553
29510 00 02 3A F0 5B 57 72 =784
29517 23 08 78 81 20 1F 0F =425
29524 3A 3A 73 FE A2 20 06 =929
29531 3E 9D 32 CA 73 C9 3E =349
29538 A2 32 CA 73 C9 AF 32 =955
29545 90 6C 3E 18 07 AF 87 =724
29552 1E 02 21 4A 5B 5B 4E =537
29559 23 46 23 3E 20 16 07 =263
29566 0B EB 73 04 CD 04 73 =1097
29573 FE 44 2B 23 FE 04 28 =497
29580 3A FE 07 2B 32 05 56 =896
29587 FE 43 20 1D CB 42 20 =683
29594 05 CB C2 72 1B 14 FE =305
29601 7E 1F 1F 1F 1F 1F 1F =1585
29608 7F 1F 18 17 01 1F 01 =440
29615 3E 01 77 1B 0F C5 79 =539
29622 82 4F CD 04 73 FE 04 =997
29629 20 03 C1 1B 01 F1 E1 =719
29636 71 23 70 23 23 5E 9D =549
29643 16 04 CD EB 73 1D 20 =542
29650 A2 C9 E5 05 C5 6B 26 =1144
29657 00 29 29 29 29 29 06 =211
29664 00 09 01 00 5B 09 7E =233
29671 C1 D1 E1 C9 D5 E5 F5 =1515
29678 7A 32 BF 5C C5 3E 16 =688
29685 D7 C1 7B C5 D7 C1 7F =1254
29692 C5 D7 C1 F1 F5 C5 D7 =1503
29699 C1 F1 E1 D1 C9 3E FF =1386
29706 32 90 5C 3E 15 D7 3E =646
29713 01 D7 ED 4B FA 5B CD =1074
29720 C7 75 3A FC 5B 57 CB =1007
29727 5A 2B 4F 04 C4 CD D4 =634
29734 73 05 05 FE C6 F5 28 =670
29741 0B 3E 06 04 CD D4 73 =615
29748 05 FE 06 20 15 C5 01 =516
29755 FE FE ED 7B C1 CB F7 =1308
29762 FE FF 28 05 F1 04 C3 =974
29769 CB 74 F1 8 7D F1 FE =1204
29776 03 2B 78 FE 46 29 74 =643
29783 FE 04 2B 70 FE 43 20 =773
29790 6C 3A FD 5B FE 00 20 =796
29797 65 04 21 FE 5B 3A C1 =740
29804 E6 75 C3 9A 75 C5 04 =1014
29811 CB D4 73 C1 FE 04 26 =1025
29818 4C C5 04 0C D4 73 =821
29825 C1 FE 06 28 41 C5 04 =759
29832 04 CD D4 73 C1 FE 03 =986
29839 2B 3A FE 4A 7B 3A FE =770
29846 06 2B 32 FE 43 23 2E =503
29853 C5 04 04 0C D4 73 =749
29860 C1 FE 03 2B 22 FE 4E =848
29867 2B 1E FE 06 2B 1A FE =650
29874 43 2B 16 3A FD 53 FE =735
29881 00 20 0F 04 21 FE 5E =429
29888 3A CD E6 75 C3 9A 75 =1370
29895 F5 C3 39 74 3A FE 5E =1316
29902 5F AF 32 FE 5B 3C 05 =732
29909 BB DA 70 77 3A FD 5B =1038
29916 FE 00 20 3D C5 01 FE =799
29923 FB ED 7B C1 CB F7 FE =1505
29930 FF 2B 30 3E 03 CD 37 =658
29937 76 FE 20 2D 27 C5 05 =645
29944 CD D4 73 C1 FE 03 2E =1022
29951 1D 5F 3A FC 5B CB 5F =823
29958 7B 20 2B C5 05 05 05 =505
29965 D4 73 C1 FE 03 2B 09 =826
29972 05 3E 27 32 FD 5B CD =673
29979 15 76 3A FD 5B FE 00 =795
29986 2B 04 3D 32 7D 5B C5 =676
29993 01 FE 3F ED 73 C1 CB =1231
30000 F7 FE FE 20 2C 3A FC =1141
30007 5B CB 5F 3E 90 C5 20 =824
30014 03 CA 0B 0C 7F FC 5B =614
30021 3E F B9 20 04 0D 3E =391
30028 9B 32 FC 53 3E 03 CD =815
30035 37 76 E1 FE 00 2B 07 =699
30042 44 4D 3E 9B 32 FC 5B =752
30049 25 01 FE DF ED 7B C1 =1225
30056 CB F7 FE D7 20 2C 3A =1091
30063 FC 5B CB 5F C5 3E 9A =1064
30070 2B 03 D6 06 0D 32 FC =578
30077 5B 3E FF B9 20 04 0C =643
30084 3E 9A 32 FC 5B 3E 03 =674
30091 2D 37 76 E1 FE 00 2B =897
30098 07 44 4D 3E 9A 32 FC =670
30105 5B ED 43 FA 5B CD C7 =1140
30112 75 21 B0 5C 3A 00 3E =534
30119 04 CD 37 76 FE 00 2B =676
30126 02 CB C6 3E 47 CD 37 =796
30133 76 FE 00 2B 02 CB CE =823
30140 3E 05 CD 37 76 FE 00 =699
30147 CB CB D6 C9 C5 3A FC =1325
30154 5B 16 07 C3 EB 73 04 =679
30161 3C CD 0C 73 CB 5F C1 =1106
30168 0C 0C 3C C3 EB 73 3C =879
30175 04 CD EB 73 05 0D C9 =778
30182 C5 3A FE 5B 87 B7 57 =957
30189 87 87 82 AF 24 00 11 =844
30196 5A 00 19 3E 02 11 64 =256
30203 00 05 E5 F5 CD B5 03 =1076
30210 F1 E1 D1 01 06 00 09 =691
30217 EB 01 07 00 ED 42 EB =761
30224 3D 20 E9 C1 C9 C5 11 =934
30231 14 00 3E 04 21 CB 00 =319
30238 05 E5 F5 CD B5 03 F1 =1217
30245 E1 D1 01 06 00 ED 42 =744
30252 EB 01 CA 00 09 EB 3D =551
30259 20 E9 C1 C9 C5 57 CD =1148
30266 53 76 04 CD C3 76 3A =669
30273 FC 5B CB 5F 20 0B 0C =693
30280 CD 53 76 05 CD 53 76 =817
30287 3C 00 C1 C9 CD D4 73 =968
30294 BA C0 C1 C1 3E 01 C9 =1C2B
30301 3E 15 07 AF D7 AF 32 =913
30308 90 5C 21 64 5B 1E 01 =451
30315 E5 46 23 42 23 05 16 =682
30322 07 2E 20 CD EB 73 0C =648
30329 0C CD EB 73 0D CD EB =1C20
30336 7C 00 11 5B 1B 7A 2U =760
30343 4B 7A CB 3F CB 3F CB =932
30350 3F CE 3F E4 07 C6 03 =767
30357 0B 2C 04 CB FE 1B 35 =754
30364 01 45 77 F5 05 F1 2B =928
30371 2D E5 05 C5 3E 15 D7 =982
30378 3E 01 D7 3E FF 32 90 =789
30385 5C E1 4B FA 5B CD C7 =1149
30392 75 05 CD C7 75 ED 43 =947
30399 FA 5E AF 32 FD 5B 3E =972
30406 15 D7 AF D7 AF 32 90 =995
30413 5C C1 D1 E1 1B 3D 9A =926
30420 E4 0F C6 05 B8 20 04 =668
30427 C3 BE 1B 31 CD 49 77 =863
30434 F5 04 F1 2B 29 E5 05 =1015
30441 C5 3E 15 D7 3E 01 D7 =773
30448 3E FF 32 90 5C ED 4B =915
30455 FA 5E CD C7 75 04 CD =1071
30462 C7 75 ED 43 FA 5B 3E =1023
30469 15 D7 AF D7 AF 32 90 =995
30476 5C C1 D1 E1 05 16 03 =957
30483 3E 63 CD EB 73 0C 0C =772
30490 C3 EB 73 04 0D 3E 04 =798
30497 C3 EB 73 05 3E BF CD =970
30504 E3 73 3E 85 04 0D 16 =584
30511 01 C2 CD 73 0C 0C 3C =646
30518 BA C3 EB 73 0D 0D 05 =724
30525 D1 E1 70 23 71 23 23 =764
30532 13 C2 6B 76 C9 3A FB =958
30539 5B 3C 3C 9D 20 1B 7A =512
30546 FA 5B B9 30 0F 3C 99 =834
30553 20 11 3A FC 5B CB 5F =734
30560 20 06 AF FE 01 C9 3D =748
30567 3F 1F 89 3A FA AF FF =1033
30574 00 C5 CD C7 75 1B 2F =793
30581 E3 C7 F8 5B ED 4B FA =1253
30588 5B C3 C7 75 CD 9A 77 =1090
30595 C3 DE 77 CD BF 77 CD =1263
30602 E7 77 CD 9A 77 CD BF =1224
30609 77 CE 3A 7B EB D9 79 =1043
30616 1B E4 CD 0B 74 3A 80 =817
30623 5C CE 47 2B 0B 01 F4 =659
30630 01 E1 7B F8 5B C9 CB =1104
30637 57 CA C6 77 CB AF CB =1082
30644 34 7A 7B FE 00 C0 01 =748
30651 D0 07 1B EB 06 05 FB =733
30658 75 1D FD C9 21 7B 7B =864
30665 35 3E 15 D7 AF 77 ED =978
30672 43 FA 5B CD C7 05 01 =958
30679 EB 03 1B CC 3A DB 5B =831
30686 FE 0C 0C 32 6A 76 C3 =923
30693 5D 74 CD 54 73 3A E0 =897

```


Listing 1.

```

2 REM ENTER CODE
5 CLEAR 29300
10 LET a=10: LET b=11: LET c=1
20 LET d=13: LET e=14: LET f=15
15 INPUT "START ADDRESS>":add
17 LET check=0
19 PRINT add;TAB 6;
20 FOR i=1 TO 7
30 INPUT LINE i$; POKE add,VAL

```

```

1*(1)*16+VAL i$(2)
32 PRINT i$;" "
35 LET check=check+PEEK add: i
ET add=add+1
40 NEXT h
45 PRINT "=";CHECK
50 GO TO 17
55 REM CHECK CODE
60 INPUT "START ADDRESS>":add
65 PRINT add;" "
70 LET check=0

```

```

75 FOR f=1 TO 7
80 LET i=PEEK add
82 LET j=INT (i/16)
85 PRINT CHR$(j+48+(j>9)*7):C
HR$(i-j*16+48+(i-j*16>9)*7):" "
:
90 LET check=check+PEEK add: L
ET add=add+1
100 NEXT f
110 PRINT "=";check
120 GO TO 65

```

IN THIS FAST multi-sheet machine-code game for the 1648K Spectrum, you control Fred the builder who works on a construction site building a skyscraper. Fred must journey up the girders and ladders of the unfinished building to get to the top. Unfortunately, barrels are rolling down the girders towards our hero. Fred must jump over or avoid these. To get onto the next sheet he must collect all the hamburgers first.

Other hazards include lifts and poisoned weeds. You must also be careful that your time doesn't run out and don't fall too far either. If you manage to make it through all nine sheets, the game will begin again only this time the action will be faster. The keys are shown in the centre column of this page.

Q to T
Caps Shift to V
O
P
Jump/Up ladder
Down ladder
Left
Right



Now to typing in the game itself. First, type in your favourite hex loader. If you do not have one, use listing 1. This version includes a hex checker as well. Now enter and check the code in listing 2.

Now type:

NEW

Do not worry — the program is above RAMtcp and will not be destroyed. Now type in the main Basic listing — listing 3. You can now save the whole program by typing: SAVE "ManicClimb" LINE 0:SAVE "code" CODE 29300,4000

Now rewin and verify with:

VERIFY ""VERIFY"" CODE

Now, you can load it back in with LOAD ""

Listing 3.

```

5 DEF FN a$(x)=("0000"+STR$ x
)(LEN STR$ x TO 4)
5 POKE 23675,117: POKE 23676,
114
10 CLEAR 29300
20 LOAD ""CODE
30 LET hi=0
40 LET b$=CHR$ 13
42 POKE 30656,5: POKE 31079,0
50 LET a$=b$+"Missile controls
r/jump"+b$+"CAPS SHIFT-V,down la
dder"+b$+"D.....left"+b$+
"P.....right"
33 BORDER 7: INK 0: PAPER 7: C
LS
60 LET q=1
70 FOR f=1 TO LEN a$
80 PRINT a$(f): IF a$(f)=CHR$
13 THEN PAPER f+RND*6: INK f
90 IF INKEY<">" THEN GO TO 30
0
100 LET a$=a$+1.04: BEEP .05,q

```

```

110 NEXT f
120 PAUSE 60
121 FOR f=1 TO 15
122 FOR q=0 TO 7
123 BEEP f/500,q
124 PAUSE f
125 BORDER q
126 IF INKEY<">" THEN GO TO 50
0
127 NEXT q
129 NEXT f
130 PRINT #0:TAB 5: FLASH 1:"PR
ESS ANY KEY TO START"
140 FOR f=0 TO 13 STEP 3: BEEP
.005,f: NEXT f
150 IF INKEY="" THEN GO "D 110
300 LET sc=0: LET f=0: LET q=0
302 LET i=5
310 INK 7: PAPER 0: BORDER 0: C
LS
320 GO SUB 4000
340 POKE 23659,0: PRINT " 22.2
":TIME": INK 2: PAPER 7:"
345 BORDER 1
350 POKE 23536,s

```

```

360 PRINT :: RANDOMIZE USR 2950
0
380 FOR f=1 TO 3: BEEP .15,1: B
EEP .15,5: BEEP .4,1: BEEP .5,-4
0: NEXT f
390 PRINT :: GO TO USR 29503
310 BEEP .9,1: BEEP .9,-0: BEEP
.9,-1
320 LET i=i+1-1
325 LET a$="B A M E D V E R":
327 PRINT AT 10,7:
330 IF i<>0 THEN GO TO 310
340 FOR i=1 TO LEN a$
350 PRINT a$(i):
357 FOR q=1 TO 40: NEXT q
360 NEXT i
361 FOR q=0 TO 56 STEP 2:
365 POKE 23536,q: PRINT :: RAND
OMIZE USR 29506
367 NEXT q
370 FOR f=1 TO 600: NEXT f
380 IF sc>0 THEN LET hi=sc
390 GO TO 40
1000 FOR f=13 TO 0 STEP -3: BEEP
.005,f: NEXT f
1010 LET sc=sc+20: GO SUB 4000

```

```

1020 GO TO 390
2000 LET f=42: LET q=16
2005 POKE 30794,128
2100 POKE 30431,201
2021 POKE 23536,f: PRINT :: RAND
OMIZE USR 29506
2222 LET f=(f+42)*21+(f+21)*42
2225 PRINT :: LET i=USR 30774: P
OKE 23657,2
2227 POKE 30531,237
2228 IF i=500 THEN GO TO 2500
2330 LET sc=sc+53
2340 PRINT AT 0,4:FN a$(sc)
2350 BEEP .004,q: LET q=q+.4
2360 GO TO 2020
2500 LET s=s+1
2505 IF s>8 THEN POKE 30656,PEEK
30656-2: POKE 31079,PEEK 31079+
1: LET s=0
2510 GO TO 310
4000 INK 4: PRINT AT 0,0:"SCORE:
":FN a$(sc):" HI:"FN a$(hi):
4010 PRINT :: ST:="s+1":
4020 FOR f=1 TO 11: PRINT INK 5:
FLASH 1:"X": NEXT f
4030 INK 7: RETURN

```

```

30700 5B FE 09 28 12 2A E1 =670
30707 5B 22 73 32 71 73 =633
30714 2A 53 28 2D AD 73 CD =887
30721 67 73 3A 5B FE 00 =850
30728 28 12 2A E6 5B 22 73 =570
30735 73 32 71 73 2A E6 5B =753
30742 2D AD 73 CD 67 73 3A =805
30749 EA 5B FE 00 28 12 2A =677
30756 EB 5B 22 73 32 71 =753
30763 73 2A E6 5B 2D AD 73 =807
30770 67 73 3A 5B FE 00 =850
30777 AF 07 3E 11 D7 3E 07 =753
30784 07 3E 11 D7 AF 07 2A =940
30791 7B 7B 11 00 00 A7 ED =671
30798 02 22 73 7B DA AA 77 =857
30805 AF 32 63 5C 7C 06 16 =576
30812 C6 C7 47 16 3A 3E BA =561
30819 CB 70 29 02 3E 8F CD =780
30826 ED 03 02 3E 8F CD =780
30833 73 3E 02 3E 8F CD =780
30840 16 13 E6 02 AF 32 21 =532
30847 00 14 22 76 7B AF 32 =519
30854 06 5C 3A FC 5B 97 97 =895
30861 5F 07 57 87 82 83 5F =808
30868 DD 21 60 7C 16 00 DD =717
30875 19 3E 03 DE 6E 00 DD =642
30882 AA 01 57 37 7E FE 00 =804
30889 38 16 E6 3F 57 23 4E =571
30896 23 46 D5 16 03 3E 9E =563
30903 CD ED 73 D1 0C 15 20 =829
30910 F3 18 24 FE 40 3B 16 =699
30917 23 4E 23 46 E6 3F 57 =598
30924 D5 16 06 3E 9F CD ED =902
30931 73 D1 04 15 20 F3 1B =648
30938 0A 4F 23 46 23 56 23 =350
30945 7E CD EB 73 1D 20 BD =931
30952 DD 6E 02 DE 66 03 22 =693
30959 FA 5B 21 9C 00 22 FC =804
30966 5B AF 32 FE 5B 32 80 =887
30973 5C 21 E0 5B 1E 03 DD =694
30980 7E 04 77 DE 4E 05 23 =588
30987 71 DD 46 06 23 70 ED =794
30994 43 73 73 CD DD 4E 07 =800
31001 23 71 DD 46 0B 23 70 =594
31008 23 46 43 AD 73 FE 00 =881
31015 CA DB 09 43 F5 71 23 =1159
31022 70 23 36 01 23 DD 20 =330
31029 F6 F1 E1 AF 3C DD 56 =1254
31036 09 D5 E5 F5 32 71 73 =974
31043 3E 1B 32 80 73 CD 67 =748

```

```

31050 73 3E 20 32 80 73 F1 =804
31057 E1 D1 15 20 E7 DD BE =1129
31064 04 20 DE 01 06 00 DE =486
31071 09 1D 20 AD 03 7E 0A =581
31078 C6 00 32 4A 73 DD 23 =698
31085 DD 7E 0A DD 23 32 7B =780
31092 7B DD 6E 0A DD 66 05 =783
31099 11 64 5B DD 7E 0A 32 =611
31106 DB 5B FE 00 C3 E5 FE =1238
31113 47 80 80 4F 05 00 ED =649
31120 80 D1 5A E1 DD 21 64 =1054
31127 5B DD 46 00 DD 4E 01 =682
31134 16 03 3E 83 CD EB 73 =773
31141 0C 0C DE EB 73 0D 3E =654
31148 0F 0F 0F 0F 0F 0F =1058
31155 02 E6 0F 06 05 F5 3E =757
31162 A4 04 0C 16 03 CD EB =645
31169 73 0D 3E 85 16 04 CD =554
31176 ED 73 0D 0C 3E BA CD =779
31183 EB 73 0D 0F F1 B8 20 =833
31190 E1 C9 C1 B8 01 FE =1026
31197 FE ED 7B CB F7 FE =1567
31204 C0 01 FE F7 ED 7B CB =1261
31211 F7 FE FC 02 47 0A 0E =1102
31218 01 00 00 7E FE 00 CC =598
31225 0B 00 CD EB 73 0C 23 =610
31232 1B F3 2B 63 29 20 4B =551
31239 2E 43 2E 44 65 72 65 =543
31246 6C 69 DD 11 E3 00 15 =488
31253 DD 01 11 0D 02 0D DD =696
31260 01 09 DD 02 05 43 1C =353
31267 11 43 03 DD 43 1B 09 =203
31274 43 03 05 01 15 46 9E =325
31281 1E 15 43 9E 01 11 43 =361
31288 9E 1E 0D 43 9E 01 09 =436
31295 43 9E 1E 02 47 0A 0E =502
31302 12 05 01 14 05 43 9E =434
31309 16 00 00 15 03 01 11 =506
31316 DD 02 0D 0D 01 09 DD =688
31323 02 05 43 1C 11 43 03 =189
31330 DD 43 1B 09 43 03 05 =191
31337 01 15 46 9E 1E 15 43 =368
31344 9E 01 11 43 9E 1E 0D =444
31351 43 9E 01 09 43 9E 1E =490
31358 02 47 0A 0E 12 05 01 =431
31365 00 0A 05 01 1C 12 40 =409
31372 C3 10 0E C3 0E 0E C3 =643
31379 0B 06 14 C3 43 7E 1A =293
31386 E0 00 15 05 08 14 C9 =690
31393 16 13 C5 1A 10 D8 03 =499

```

```

31400 0F C5 04 0B DC 0A 0B =456
31407 F4 1B 0B C3 1C 0C C6 =467
31414 1A 07 CD 0B 06 C5 05 =457
31421 05 C3 02 04 42 1D 10 =317
31428 43 04 0B 43 1E 07 1F =217
31435 13 43 9E 19 0E 43 9E =505
31442 1F 07 43 9E 0E 04 43 =347
31449 9E 09 0F 43 9E 1B 10 =447
31456 05 01 05 08 0A 01 15 =366
31463 03 47 0A 00 01 05 0A =401
31470 01 15 46 9E 04 1A B8 =467
31477 1D 00 00 15 C6 16 10 =514
31484 C8 1B 0C C3 01 0C CC =648
31491 05 0C 0D 00 0E DD 01 =442
31498 04 C3 12 04 C6 16 04 =447
31505 43 1E 0C 47 0E 0D 43 =266
31512 02 0D 0F 0F 0C 01 03 =224
31519 0D 05 0A 00 05 05 0A =354
31526 00 01 00 1A 1F 01 47 =270
31533 00 00 15 46 9E 1F 15 =461
31540 46 9E 11 15 43 9E 10 =507
31547 0C 43 9E 00 0E 43 9E =470
31554 0F 04 43 7E 12 05 0A =271
31561 43 13 05 04 A2 14 05 =379
31568 04 A3 0A 05 04 A3 43 =416
31575 31 04 1C 12 0E A1 24 =253
31582 00 00 0E 0C 0E 11 C4 =664
31589 0E 12 DD 13 11 CC 13 =496
31596 0D CD 01 0B CD 09 =446
31603 2C 1A 09 C9 02 05 CC =645
31610 13 05 03 01 11 43 14 =194
31617 DD 43 00 09 43 1D 05 =190
31624 1F 15 46 9E 1F 12 05 =334
31631 01 00 11 43 9E 0D 11 =433
31638 46 9E 13 0B 46 9E 1F =519
31645 11 43 9E 13 0B 43 9E =499
31652 DD 0D 43 9E 15 0A 05 =291
31659 01 05 0A 04 A3 01 09 =353
31666 43 9E 1F 09 43 9E 0B =501
31673 05 43 9E 05 02 47 0A =468
31680 11 01 0A A3 0C 15 46 =276
31687 9E 1F 02 05 A1 02 06 =365
31694 05 01 0F 04 03 0E 05 =365
31701 31 04 A3 02 0E 05 A1 =350
31708 1D 0E 05 A1 21 E0 00 =466
31715 15 CE 00 11 C4 0E 12 =472
31722 DD 13 11 CC 13 DD CD =682
31729 21 DD 00 09 CC 14 =452
31736 09 C9 02 05 CC 13 05 =445
31743 43 01 11 1F 15 46 9E =365

```

```

31750 1F 12 05 A1 00 11 43 =299
31757 9E 0D 11 4A 9E 13 0B =448
31764 46 9E 1F 11 43 9E 13 =520
31771 0B 43 9E 0D 0D 43 9E =489
31778 19 0A 05 01 05 0A =220
31785 A3 01 09 43 9E 1F 09 =438
31792 43 9E 0B 05 43 9E 05 =471
31799 02 07 0A 01 01 01 A3 =418
31806 00 15 46 9E 1F 02 05 =287
31813 A1 02 06 9E 05 01 0F =351
31820 0A A3 10 01 04 A3 02 =353
31827 0E 05 A1 1D CE 05 A1 =389
31834 0B 0F 9C 0D 12 DF 11 =437
31841 7A 00 13 0C 2C 5B 14 =296
31848 01 1E 0A 05 5B 14 01 =153
31855 04 0A 4A 5B 14 01 14 =223
31862 1A 01 F2 7A 00 00 99 =538
31869 7A 00 13 03 2C 5B 08 =290
31876 01 14 03 00 5B 00 01 =142
31883 13 02 4A 5B 1F 01 18 =242
31890 0D 03 F2 7A 00 00 F5 =625
31897 7A 00 13 0C 2C 5B 08 =287
31904 01 14 02 00 5B 11 01 =132
31911 13 01 04 5B 15 01 18 =231
31918 0D 05 5B 7C 01 00 4B =313
31925 7A 00 13 0C 2C 5B 14 =296
31932 01 1C 0D 00 5B 14 01 =154
31939 0E 06 4A 5B 14 01 12 =224
31946 0D 02 F2 7A 00 00 5B =472
31953 7B 02 13 04 2C 5B 0A =293
31960 01 19 03 00 5B 12 01 =139
31967 0F 05 4A 5B 13 01 0F =220
31974 11 06 5A 7C 01 09 =391
31981 7A 00 13 05 2C 5B 08 =292
31988 01 14 06 00 5B 01 01 =132
31995 13 06 4A 5B 1F 01 18 =246
32002 0D 03 F2 7A 00 00 5B =473
32009 7B 02 13 09 2C 5B 08 =299
32016 01 0C 05 00 5B 12 01 =128
32023 09 07 4A 5B 13 01 0E =214
32030 0C 06 5A 7C 01 0E =457
32037 7B 02 13 0B 2C 5B 08 =298
32044 01 0C 05 00 5B 12 01 =128
32051 09 07 4A 5B 13 01 0A =210
32058 0D 06 5A 7C 01 0F =545
32065 7A 16 0E 07 2C 5B 0F =315
32072 01 09 04 00 5B 10 01 =122
32079 09 03 4A 5B 15 01 0B =212
32086 0A 05 5D 7C 01 00 00 =233
32093 00 00 00 00 00 00 00 =0

```



```

0 PAPER 0:INK7:CLD:PRINT"Please wait..
..."
1 FOR F=EA000 TO 42916
2 READ A:POKE F,A
3 NEXT F
5 DATA 162,0,214,100,208,26,181,108,20
1,32,208,12,169,121,149,108,3
2,47
6 DATA 160,149,100,24,144,8,169,32,149
,108,169,4,149,100,232,224,8,
208
7 DATA 221,96,0,0,0,0,0,0,0,0,173,4,
3,41,63,56,201,40,176,3,105,5
,96
8 DATA 233,35,96,0,0,0,0,0,0,0,0,0
0,133,132,32,231,160,169,133,131
,165,108,133,132,32,231,160,1
69
10 DATA 250,133,130,169,187,133,131,16
5,109,133,132,32,202,160,169,
114
11 DATA 133,130,169,188,133,131,165,11
0,133,132,32,231,160,169,234,
133,130
12 DATA 169,188,133,131,165,111,133,13
2,32,202,160,169,98,133,130,1
69,189
13 DATA 133,131,165,112,133,132,32,231
,160,169,2,8,133,130,169,189,
133
14 DATA 131,165,112,133,132,32,202,160
,169,82,133,130,169,190,133,1
31,165
15 DATA 114,133,132,32,231,160,169,202
,133,130,169,190,133,131,165,
115,133
16 DATA 132,76,202,160,0,0,0,0,0,0,0,0
0,0,0,160,1,177,130,136,145,1
30,200
17 DATA 200,192,36,208,245,165,132,136
,145,130,96,0,0,0,0,0,0,0,0,0
,0
18 DATA 160,34,177,130,200,145,130,136
,136,192,255,208,245,165,132,
200,145
19 DATA 130,96,0,0,0,0,0,0,0,0,0,0,160
,1,177,130,201,122,208,10,170
,169,32
20 DATA 145,130,138,136,145,130,200,20
0,192,36,208,235,136,56,165,1
30,233
21 DATA 120,133,128,165,131,233,0,133,
129,177,128,201,122,208,6,145
,130,169
22 DATA 32,145,128,96,0,0,160,34,177,1
30,201,122,208,10,170,169,32,
145,130
23 DATA 138,200,145,130,136,136,192,25
5,208,235,200,56,165,130,233,
120,133
~4 DATA 128,165,131,233,0,133,129,177,

```

```

128,201,122,208,6,145,130,169
,32,145
25 DATA 128,96,0,0,0,0,0,0,169,162,133
,130,169,190,133,131,32,56,16
1,169,42
26 DATA 133,130,169,190,133,131,32,4,1
61,169,178,133,130,169,189,13
3,131
27 DATA 32,56,161,169,58,133,130,169,1
89,133,131,32,4,161,169,194,1
33,130
28 DATA 169,188,133,131,32,56,161,169,
74,133,130,169,188,133,131,32
,4,161
29 DATA 169,210,133,130,169,187,133,13
1,32,56,161
31 DATA EE6,99,169,32,141,197,190,96,0
,0,0,0,0,0,0
32 DATA EAD,0,2,EC9,180,2D0,3,24C,0,16
2,EC9,172,ED0,3,EC4,114,162,E
C9,156
40 DATA ED0,3,EC4,228,162,EC9,188,EF0,
228,EC4,187,163
50 DATA 000,000,000,000,000,000,000,00
0,000,000
51 DATA 000,000,000,000,000,000,000,00
0,000,000
60 DATA E:8,EA~,124,E69,1,E85,126,EA5,
125,E69,0,E85,127,EA0,2,EB1,1
26,EC9,16
70 DATA ED0,13,E38,EA5,126,EC9,35,E85,
126,EA5,127,EE9,0,E85,127,EA9
,105
80 DATA E85,116,EA9,106,E85,117,EA5,12
0,EC9,0,ED0,14,EA2,11,E86,11
8,EEB
90 DATA ED0,117,EA2,1,E86,120,24C,128,
163,EC9,1,ED0,14,EA2,107,E86,
118,EEB
100 DATA E86,119,EA2,2,E86,120,EC4,128
,163,SHDD^A2,109,E86,118,EEB,
E86,119
~110 DATA EA2,0,E86,120,EC4,128,163
120 DATA 000,000,000,000,000,000,000,00
0,000,000
121 DATA 000,000,000,000,000,000,000,00
0,000,000
130 DATA E38,EA5,124,EE9,1,ED0,126,EA5
,125,EE9,0,E85,127,EA0,0,EB1,
126
140 DATA EC9,16,ED0,13,E18,EA5,126,E69
,35,E85,126,EA5,127,E69,0,E85
,127
150 DATA EA9,97,E8E,116,EA9,98,E85,117
,EA5,120,EC9,0,ED0,14,EA2,103
160 DATA E86,118,EEB,E86,119,EA2,1,E86
,120,EC4,128,163,EC9,1,ED0,14
170 DATA EA2,99,E86,118,EFR,FRA,119,FA
2,2,E86,120,EC4,128,163,EA2,1
01

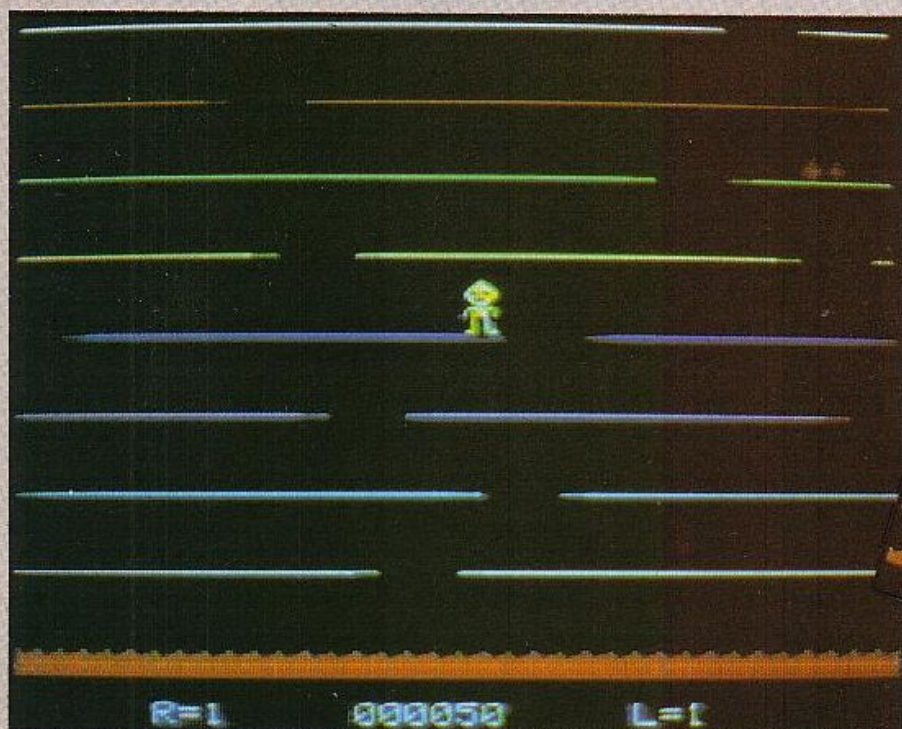
```

```

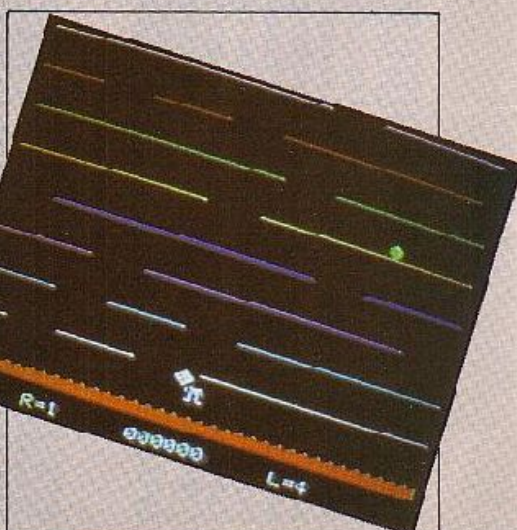
180 DATA E86,118,EEB,E86,119,EA2,0,E86
,120,EC4,128,163
190 DATA 000,000,000,000,000,000,000,0
00,000,000
191 DATA 000,000,000,000,000,000,000,0
00,000,000
200 DATA EA2,113,E86,116,EEB,E86,117,E
EB,E86,110,EEB,E86,119,220,4,
164
201 DATA EA2,80,ED0,131,166
210 DATA ED0,0,160,ED0,72,160,E38,EA5,
124,EE9,40,E85,126,EA5,125,EE
9~0
220 DATA E85,127,EA2,117,E86,116,EEB,E
B6,117,EEB,E86,118,EEB,E86,11
9
230 DATA EA0,0,EB1,126,EC9,32,EF0,3,EA
C,88,164,ECB,EB1,126,EC9,32,E
F0,3~
240 DATA EC4,88,164,ED0,149,163,E38,EA
5,124,EE9,40,E85,126,EA5,125,
EE9,0
250 DATA E85,127,EA0,0,EB1,126,EC9,155
,ED0,3,EC4,106,164,EC9,32,EF0
,3
260 DATA EC4,88,164,ECB,EB1,126,EC9,32
,EF0,3,EC4,88,164,ED0,149,163
,E38
270 DATA EA5,124,EE9,40,E85,126,EA5,12
5,EE9,0,E85,127,EA9,1,E85,123
280 DATA EA2,100,ED0
290 DATA 131,164,EC4,128,163,000,000,0
00,000,000
291 DATA 000,000,000,000,000,000,000,0
00,000,000
300 DATA EA0,40,EB1,126,EC9,122,ED0,3,
ED0,150,166,ECB,EB1,126,EC9,1
22,ED0,3
310 DATA ED0,150,166,ED0,223,163,ED0,3
7,164,EA5,126,E85,124,EA5,127
,E85,125
320 DATA ED0,4,164,E60
330 DATA 000,000,000,000,000,000,000,00
0,000,000,000
331 DATA 000,000,000,000,000,000,000,00
0,000,000,000
340 DATA EA2,117,E86,116,EEB,E86,117,E
EB,E86,118,EEB,E86,119,EC4,4,
164
350 DATA 000,000,000,000,000,000,000,0
00,000,000
351 DATA 000,000,000,000,000,000,000,0
00,000,000
360 DATA EA9,32,EA0,0,E91,124,ECB,E91,
124,EA0,40,E91,124,ECB,E91,12
4,E60
370 DATA 000,000,000,000,000,000,000,0
00,000,000
371 DATA 000,000,000,000,000,000,000,0
00,000,000
380 DATA EA5,116,EA0,0,E91,124,ECB,EA5

```

One small step for Ivan could be a major jump for an Oric. One step beyond with Matthias Gyllerup.



MAI




```

117,£91,124,£A0,40,£A5,118,£
91,124
390 DATA 7CB,£A5,119,£91,124,260
400 DATA 000,000,000,000,000,000,000,0
00,000,000
410 DATA £A9,1,£BD,225,2,£A9,0,£BD,227
,2,£A9,3,£BD,227,2,£A9,10,£BD
,231,2
420 DATA £20,182,251,£A9,0,£BD,225,2,£
BD,227,2,£BD,229,2,£BD,231,2
430 DATA £20,182,251,£60
440 DATA 000,000,000,000,000,000,000,0
00,000,000
450 DATA £20,149,163,£A9,0,£B5,116,£60
460 DATA 000,000,000,000,000,000,000,0
00,000,000
470 DATA £20,149,163,£A9,1,£B5,116,£60
480 DATA 000,000,000,000,000,000,000,0
00,000,000
490 DATA £A5,99,£C9,0,£D0,1,£60,£A5,98
,£C9,0,£F0,1,£60,£A5,121,£B5,
98,£C6,99
500 DATA £A9,122,£BD,210,187,£60
510 DATA 000,000,000,000,000,000,000,0
00,000,000
520 DATA £A0,40,£B1,124,£C9,122,£D0,3,
£20,150,166,£C8,£B1,124,£C9,1
22,£D0,3
525 DATA £20,150,166,£A0,80,£B1,124,£C
9,32
530 DATA £D0,31,£CB,£B1,124,£C9,32,£D0
,24,£20,237,164,£A0,00,£D1,12
4
540 DATA £C9,123,£D0,13,£A5,123,£C9,0,
£D0,3,£4C,88,164,£A9,0,£B5,12
3
550 DATA £A5,123,£C9,1,£D0,6,£20,42,16
5,£20,18,244,£A9,0,£B5,123,£6
0
570 DATA £20,167,163,£18,£A5,124,£69,4
0,£B5,126,£A5,125,£65,0,£B5,1
27
580 DATA £20,149,163,£18,£A5,124,£69,4
0,£B5,126,£A5,125,£65,0,£B5,1
27
590 DATA £20,149,163,£18,£A5,124,£69,4
0,£B5,126,£A5,125,£65,0,£B5,1
27
600 DATA £A5,0,£B5
610 DATA 123,£A2,100,£20,151,166,£4C,6
7,165,000
620 DATA £A0,5,£B5,159,191,£A6,£EB,£E0
,58,£F0,5,£EA,£99,159,151,£60
,£A9,48
630 DATA £99,159,191,£B5,£D0,234,£60
640 DATA £20,150,166,£4C,128,163,000,0
00,000,000
650 DATA £48,£A5,97,£C9,1,£D0,7,£A9,2,
£B5,97,£4C,154,165,£C9,2,£D0,
7,£A9,3
660 DATA £B5,97,£4C,187,165,£C9,3,£D0,

```

```

7,£A9,4,£E5,97,£4C,222,165,£D
9,4,£D0,7
670 DATA £A9,3,£B5,97,£4C,166,£C9,7,
£D0,7,£A9,6,£B5,97,£4C,222,16
5,£C9,6
680 DATA £D0,7,£A9,7,£B5,97,£4C,187,16
5,£A9,1,£E5,97,£4C,154,165
690 DATA 000,£A9,0,£B5,208,183,£BD,209
,183,£BD,210,183,£BD,213,183
700 DATA £BD,214,103,£BD,215,183,£A9,1
2,£BD,211,183,£BD,212,183,£68
710 DATA £4C,3,236,000,£A9,0,£BD,208,1
83,£BD,209,183,£BD,214,183,£B
D,215,183
720 DATA £A9,12,£BD,210,183,£BD,213,18
3,£A9,30,£BD,211,183,£BD,212,
183,£68
730 DATA £4C,3,236,000,£A9,0,£BD,208,1
83,£BD,215,183,£A9,12,£BD,209
,183
740 DATA £BD,214,183,£A9,30,£BD,210,18
3,£BD,213,183,£A9,63,£BD,211,
183
750 DATA £BD,212,183,£68
760 DATA £4C,3,236,000,£A9,12,£BD,208,
183,£BD,215,183,£A9,30,£BD,20
9,183
770 DATA £BD,214,183,£A9,63,£BD,210,18
3,£BD,211,183,£BD,212,183,£BD
,213,183
780 DATA £68,£4C,3,236
790 DATA £C6,0,£A5,0,£C9,255,£D0,5,£E6
,0
800 DATA £20,205,161,£A5,123,£C9,1,£D0
,10,£A2,50,£A0,255,£A9,£D0,25
3,£C4,£D0
801 DATA 248
802 DATA £20,0,160,£20,72,160,£A5,116,£
C9,0,£D0,1,£60,£C9,1,£D0,1
810 DATA £50,£20,112,161,£20,124,164,£
A5,97,£C9,0,£F0,2,£C6,98,£20,
160,164
820 DATA £A5,116,£C9,0,£D0,1,£60,£A2,8
0,£A0,255,£B8,£D0,253,£CA,£D0
,248
830 DATA £4C,37,166
840 DATA 000,000,000,000,000,000,000,0
00,000,000
850 DATA £A0,255,£B8,£D0,253,£CA,£D0,2
48,£60
860 DATA 000,000,000,000,000,000,000,0
00,000,000
870 DATA £A9,10,£B5,0,£20,187,163,£FA,
99,£A2,32,£B6,116,£B6,117,£A2
,124
880 DATA £B6,118,£E3,£B6,119,£4C,4,164
890 DATA £A0,0,£B9,189,166,£99,3,183,£
CB,£C0,232,£D0,245,£60
900 DATA 1,3,6,15,31,6,3,1,43,56,60,62
,38,12,24,48,3,5,9,3,2,6,4,23
,56,52,52

```

```

910 DATA 24,12,6,2,14,3,5,7,1,1,1,1,7,
56,52,52,48,48,48,48,15,3,
7,4,4,28
920 DATA 0,0,56,52,50,16,24,12,4,28,3,
7,5,31,25,12,6,3,32,48,24,60
,62,24,48
930 DATA 32,7,11,11,6,12,24,16,23,48,4
0,36,48,6,24,8,14,7,11,11,3,
3,3,3,3
940 DATA 48,40,36,32,32,32,32,36,7,11,
19,2,6,12,8,14,60,48,56,8,8,1
4,0,0,0,0
950 DATA 3,7,13,15,6,19,0,32,48,56,44,
60,24,50,9,7,3,9,3,15,9,56,3
6,56,48
960 DATA 36,44,60,36,7,1,3,7,13,15,5,3
,1,32,40,56,44,60,24,48,32,7,
11,11,2
970 DATA 2,2,2,14,56,52,52,16,16,16,16
,28,63,0,0,0,0,0,0,0,51,30,45
,63,45,33
971 DATA 63,30
980 DATA 33,55,63,63,63,63,63,63
990 DATA 0,0,0,1,33,63,63,0,0,12,30
,59,59,62,28
1900 R=1:L=5:SC=0:SCF="000000":POKE 12
1,252:POKE 98,0:POKE 99,
1910 CALL 42671
1920 POKE £26A,10
2000 CLS:POKE 0,0:POKE 48038,32:POKE 48
039,32
2001 A$="77711122233344455566677717777
777"
2002 C=1
2003 FOR F=108 TO 115:POKE F,121:NEXT F
2299 FOR F=48000 TO 49080:EP40:A=VAL(MID
$(A$,C,1)):POKE F,A:POKE F+1,16
2499 POKE F+39,16:C=C+1:NEXT F
2500 DOKE 124,48900
2510 DOKE 126,48900
2511 PLOT 15,25,SCF:PLOT 15,15,32
2519 FOR F=100 TO 107:POKE F,RND(1)*20
+5:NEXT F
2520 FOR F=108 TO 115:POKE F,121:NEXT
F
2521 PLOT 1,23,"((((((((((((((((((((
((((((((((((((((
2522 FOR F=47963 TO 47999:POKE F,155:N
EXT F
2523 FOR F=48002 TO 48037:POKE F,121:N
EXT F
2524 CALL 4:951:DOKE 124,48900:DOKE 12
6,48900
2525 FOR F=2 TO 20 STEP 3:PLOT 1,F,"vv
vvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvv
vvvvvv"
2526 NEXT F:PLOT 27,25," "
2527 PLOT 8,25,STR$(R):PLOT 7,25,"R="
2528 PLOT 27,25,STR$(L):PLOT 26,25,"L="
2529 IF AA=0 THEN DOKE 553,42317
2530 POKE 0,0:CALL 42533:DOKE 553,6041
9
2531 IF PEEK(116)=0 THEN L=L-1:IF L=-1
THEN GOTO 2700
2533 IF PEEK(116)=1 THEN R=R+1:FOR F=1
TO 104:CALL 42282:NEXT F:L=L
+1
2534 IF PEEK(116)=1 THEN POKE 99,R:DB=25
2700 POKE 98,0:POKE 121,DB:GOTO
2600
2600 SC$=""
2605 FOR F=49056 TO 49061:SC$=SC$+CHR$
(PEEK(F)):NEXT F
2610 AA=INT(RND(1)*6)
2615 ON AA GOTO 2617,2619,2621,2623,262
5
2616 GOTO 2600
2617 POKE 47056,51:POKE 47057,30:POKE
47058,45:POKE 47059,63:POKE 4
7060,45
2618 POKE 47061,33:POKE 47062,63:POKE
47063,30:GOTO 2000
2619 POKE 47056,0:POKE 47057,0:POKE 47
058,63:POKE 47059,45:POKE 470
60,63
2620 POKE 47061,12:POKE 47062,12:POKE
47063,51:GOTO 2000
2621 POKE 47056,63:POKE 47057,45:POKE
47058,63:POKE 47059,12:POKE 4
7060,12
2622 POKE 47061,12:POKE 47062,12:POKE
47063,51:GOTO 2000
2623 POKE 47056,12:POKE 47057,30:POKE
47058,63:POKE 47059,45:POKE 4
7060,45
2624 POKE 47061,63:POKE 47062,51:POKE
47063,30:GOTO 2000
2625 POKE 47056,12:POKE 47057,30:POKE
47058,63:POKE 47059,45:POKE 4
7060,63
2626 POKE 47061,51:POKE 47062,30:POKE
47063,51:GOTO 2000
2700 PLOT 14,10,"GAME OVER"
2710 PLOT 12,11,"PRESS ANY KEY"
2720 GET A$:WAIT 300:GET A$:GOTO 1900

```

D JUMP

IVAN IS A character with long legs and a big head and the object of this game is simply to make him jump up eight platforms to the top of the screen. The screen is divided by horizontal lines and gaps appear in these lines at intervals. When a gap appears directly above Ivan, he is able to leap into the air and ascend a level.

If you fall down through a gap or run into a monster you will become temporarily stunned. But if you knock your head into something or fall down on the ground you will lose one of your six lives.

There are six different hazards — a flame, some monsters and Leggy — which roam the platform. Each completed screen adds a bonus, increases number of lives and adds new hazards.

Ivan is controlled from the keyboard with

the Cursor keys.

Cursor Left to make him move left;

Cursor Down to make him move right;

Cursor Up to make him jump;

Cursor Right to pause — you can not pause when you are stunned.

For those interested in machine code the main subroutines and their addresses are given below, in case you wish to disassemble them.

41032 — Move holes.

41328 — Move hazards.

41421 — Read keyboard and move Ivan.

42021 — Sound.

42221 — Fall down.

42282 — Score.

42533 — Main routine

42648 — Draw stunned Ivan.

42317 — Interrupt routine that makes the flames burn.

BARREL BARRAGE

Miquel van Smoorenburg ushers in a scenario of simian mayhem, specially tailored for the Sinclair ZX-81.

THE AIM OF the game is to get the keys which are displayed on the top of the screen without losing a life. You lose a life if you get hit by a rolling barrel but you are able to jump over such obstacles and only three at most are present.

At the beginning of the game there is only one rolling barrel present. If you reach the top of the screen you can get a key. There are three keys at the start of the game. When there are two keys left there will be two rolling barrels and if only one key is left there are three rolling barrels. However, if you manage to get your hands on the last key you will get a bonus of 100 points. Then you start again, with three keys and one barrel, but with one difference — the speed increases. Scoring is as follows: you still start with five lives but this

and the starting speed are adjustable — it is even possible to start off with 38 lives. The game has on-screen scoring and a high-score.

Jump over a barrel: 10 points
Grab a key: 50 points
Get the last key: 100 points

The code is kept as short as possible; that is why I made the high-score in Basic. For entering the code, you need a Rem statement with at least 640 characters. This may look a lot but it isn't if you follow the instructions.

Type in:

2 REM 0000 etc.

You must enter 87 characters after the Rem. Now edit this line some times, and when you have seven of these lines — 2 Rem to 8 Rem — you can enter 1 Rem with nothing following it

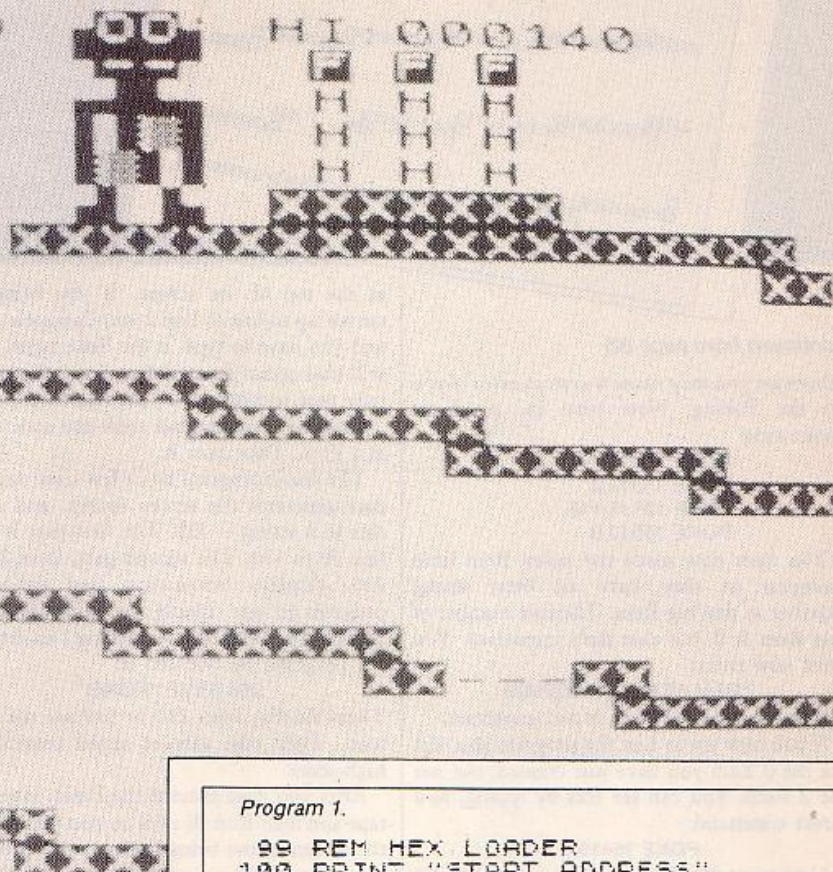
(continued on page 94)



Program 2. Machine code program.

16514:	767803D0C41E5D5C5	= 1355	16834:	7E32774036172275	= 587
16522:	0DB802444D511420	= 672	16842:	42C93A7840FE0020	= 783
16530:	043E8018040D8D07	= 623	16850:	943E09327840E052	= 772
16538:	78C1D1E1C92A0C43	= 1072	16858:	13852A1040010500	= 292
16545:	019D000922794001	= 387	16866:	09ED580C40011903	= 442
16554:	5802092278402130	= 413	16874:	EDB0C09F40C02641	= 1149
16562:	40051E36002310F3	= 453	16882:	3E00322140CDBA40	= 664
16570:	3A21403C47213C43	= 443	16890:	CD3241FE34287AFE	= 1042
16578:	16005819545D0529	= 553	16898:	162375FEAB2808ED	= 893
16586:	013240ED421A7FE01	= 699	16906:	4B32400B78B120FB	= 780
16594:	28051630C110E6C9	= 773	16914:	18E33628E5CDBA42	= 1034
16602:	7E4F237E473E0002	= 501	16922:	E101F70F0B76B120	= 964
16610:	2B030AFE76202103	= 464	16930:	F835801936AD3E00	= 747
16618:	552A7840ED423005	= 615	16938:	3277402A78402275	= 613
16626:	E13E001218D0E1121	= 601	16946:	40CDBA4205005C0D	= 934
16634:	006069197EFE3D23	= 835	16954:	CD42C110F93A2140	= 384
16642:	06FE16230244403E	= 631	16962:	0C022140FE0320FD	= 669
16650:	3402E171237018C4	= 759	16970:	060ACDC04210FB2A	= 601
16658:	ED5FE60FF50A20B0	= 1091	16978:	0C400135000936FB	= 364
16666:	3E0112ED43794071	= 691	16986:	232336A8232336FB	= 590
16674:	237018B02A784022	= 610	16994:	3E003221402A3240	= 365
16682:	7540210600227742	= 431	17002:	015C06ED42360601	= 666
16690:	1121002A7540C087	= 613	17010:	5802092223240C3F7	= 689
16698:	40FE10C0A0C41FE24	= 1107	17018:	41F52A75403600C0	= 776
16706:	2009237EFE762010	= 635	17026:	BA42CDBA42E17EF5	= 1005
16714:	23181AFE21200923	= 458	17034:	060736177EC68077	= 661
16722:	7EFE7620102B1800	= 628	17042:	1100201B7A8320FB	= 660
16730:	FE2320093A7740FE	= 825	17050:	10F2F1772A0C4001	= 737
16738:	202002ED52E519E3	= 881	17058:	2900097E3D77FE1C	= 633
16746:	7EFE340C0C42E17E	= 1258	17066:	2005ED480C40C92A	= 668
16754:	E1112100FE8D2800	= 770	17074:	7840227540C3F741	= 909
16762:	FE20230D3A7840FE	= 643	17082:	2A0C400616237EFE	= 563
16770:	002006193E003278	= 295	17090:	76200310F8C9C680	= 944
16778:	403A7840FE012001	= 594	17098:	7718F22A0C400011	= 520
16786:	19FE0028043D3278	= 554	17106:	0A0019237EFE1CD8	= 694
16794:	407EFE002810FE20	= 799	17114:	FE260034FE252005	= 880
16802:	280CFE34C8FE16C3	= 1034	17122:	361C2B18EFC90000	= 589
16810:	FEAB0C82A7540E52A	= 1119	17130:	002A104001060009	= 133
16818:	75407EE1FE34C8E5	= 1267	17138:	EB2A0C40011903ED	= 619
16826:	2A75403A774077E1	= 808	17146:	50C9	= 377

SCORE: 000040
LIVES: 1



Program 1.

```

99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N;" - ";
170 INPUT A$
180 PRINT A$;" = ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=(CODE A$(K)-28)*16+00
DE A$(K+1)-28
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=1 THEN GO TO 310
290 PRINT "ERROR - PLEASE INPUT
AGAIN"
300 GO TO 150
310 NEXT N

```

Program 3. The Basic program.

```

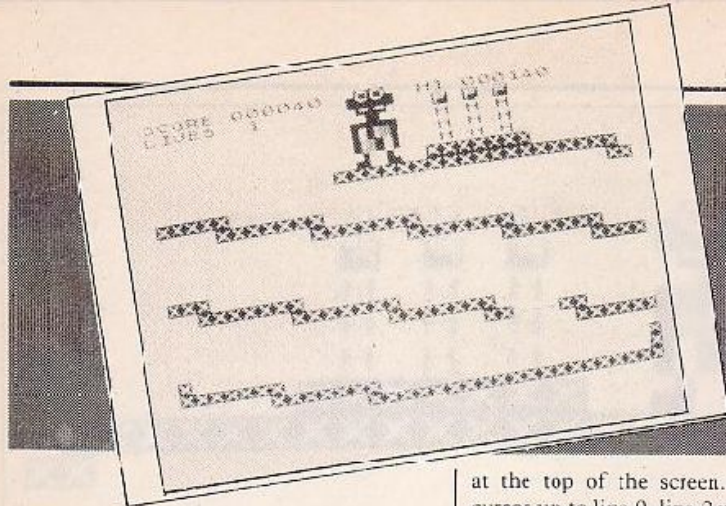
1 REM ---S---S---S---S---S---S---S---S---S---
2 REM MIQUEL VAN SMOORENBURG
3 REM 200 BALULUSTRAAT
4 REM TER-ARR P.CODE 2-613L
5 REM HOLLAND.
200 PRINT "-----++ CRAZY AP
210 PRINT " SEND YOUR MAN UP
TO GET THE " KEYS AND JUMP OVER
THE ROLLING"
220 PRINT " BARRELS. AFTER YOU
HAVE COLLECTED 3 KEYS, YOU STAR
T WITH 3 KEYS AGAIN. HOWEVER,
THE SPEED"
230 PRINT " HAS INCREASED...."
240 PRINT " CONTROL YOUR MAN
WITH:
250 PRINT " A. MOVE RIGHT", "
S. MOVE LEFT", " Q. JUMP", "TO
CLIMB THE LADDER, PRESS Q", "AND T
HEN HOLD DOWN 7."
260 PRINT " AT THE BEGINNING
OF EACH GAME, " YOU MUST SELECT
SPEED: 0-15. " 0 IS VERY FAST, F
ND 15 IS VERY " SLOW."
265 SAVE "KONG"
270 PRINT AT 21,0;" PLEASE
SELECT SPEED: 0-15"

```

```

280 POKE 16418,2
290 INPUT SPEED
295 IF SPEED>15 OR SPEED<0 THEN
GO TO 290
300 RAND 1000+100*SPEED
310 LET L=6+USR 16516
320 LET S$="
330 FOR X=1 TO 6
340 LET S$(X)=CHR$ PEEK (L+X)
350 NEXT X
360 IF VAL S$(VAL D$(23 TO 25)
THEN LET D$(23 TO 25)=S$
365 PRINT AT 13,6;"**** GAME "
OVER ****"
370 IF INKEY$="" THEN GO TO 370
380 IF INKEY$="Q" THEN GO TO 380
390 GO TO 270
400 REM ---S---S---S---S---S---S---S---S---S---

```

(continued from page 92)

otherwise you may cause a system error if you do the Poking. Now type in, as direct commands:

```
POKE 16511,141
POKE 16512,2
POKE 16515,118
POKE 16510,0
```

You have now made the sever. Rem lines disappear as they have all been strung together as one big Rem. The line number of this Rem is 0, but that isn't important. You must now enter:

```
2 REM START PROGRAM
```

What follows the Rem is not important.

If you now try to List the program you will see the 0 Rem: you have just created, but not the 2 Rem. You can see this by typing, as a direct command:

```
POKE 16419,2
```

Now press Newline and you will see line 2

at the top of the screen. If you bring the cursor up to line 0, line 2 will disappear again: and you have to type in the Poke again. This will also occur if you delete line 2. You must now type in program 1, the hex loader.

Run the program and enter the code a line at a time. Then save it.

The Basic program has a few uses: the first part generates the screen layout, and stores this in a string — D\$. The first part is from line 10 to 170. The second part, lines 200 to 265, displays instructions and saves the program on tape. Ignore the Rem before Save in line 265 — this was something I used to test the program. So line 265 is:

```
265 SAVE "KONG"
```

Then, finally, lines 270 to 390 are the main loop. They take care of speed control and high-score.

After you have entered the Basic, save it on tape and then Run. If all is correct you will see the screen layout being built and the program should stop with an error message: 9/170. If it

doesn't, check the Basic. If there are mistakes there is a fault in the machine-code starting from address 17130. This is a routine to store the screen layout in the Basic variable D\$, so by

PRINT D\$

you should see the screen layout: with many \$'s around the screen. If all this works delete lines 10 to 170. Be sure not to use Run or Clear, as this will destroy the variables. Now set your recorder to record-mode and type in as a direct command:

GOTO 2C0

If everything is alright you will see instructions being printed and the program saves itself. Now you will be asked to select speed. You must enter a number between 1 and 15, anything else will be ignored. Choose one and the game will start. If you have followed all my instructions then the game should work properly now.

The speed of the game is controlled by Rand (value). In my listing, it works as follows:

```
290 INPUT SPEED
300 RAND 1000 + 130 * SPEED.
```

So the Rand has a minimum of 1000 and a maximum of 2950.

Score, high-score and lives start off with a value given in the Basic listing in line 60. Score and high-score must be a number with a minimum zero; lives can be any characters between 0 and Z. Thus, it is possible to enter:

```
80 PRINT AT 0,0;"SCORE:095070";
```

```
HI:987320";"LIVES: G"
```

In this example lives will count down from G to 0. This is in alphabetical order. ■

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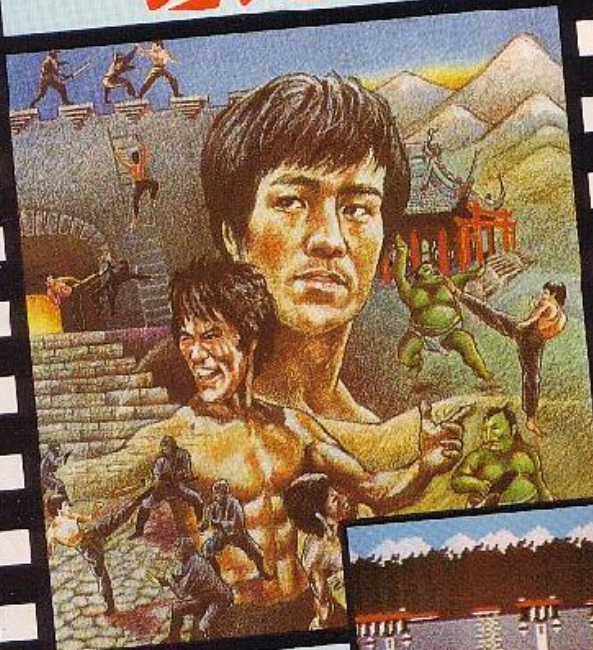
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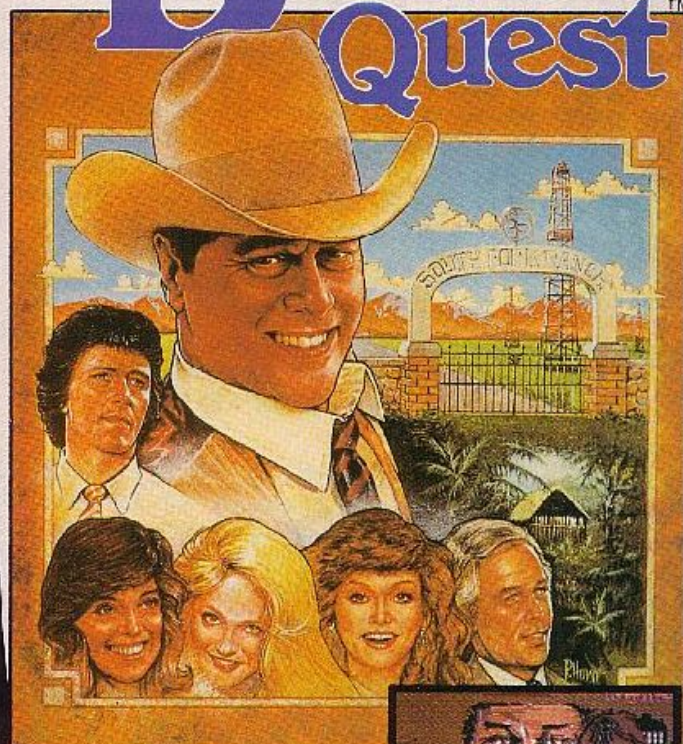
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Program 1.

```

1 DATA 162,233,160,31,134,0,132,1,162,233,160,151
2 DATA 134,2,132,3,160,0,177,0,201,3,208,3
3 DATA 32,44,25,201,2,208,3,32,67,25,201,4
4 DATA 208,3,32,90,25,76,107,25,160,0,169,32
5 DATA 145,0,160,21,177,0,201,1,240,76,169,3
6 DATA 145,0,169,5,145,2,96,160,0,169,32,145
7 DATA 0,160,23,177,0,201,1,240,53,169,2,145
8 DATA 0,169,3,145,2,96,160,0,169,32,145,0
9 DATA 160,22,169,4,145,0,169,7,145,2,96,56
10 DATA 165,0,198,2,233,1,144,5,133,0,76,16
11 DATA 25,198,3,198,1,133,0,165,1,201,29,208
12 DATA 139,96,169,38,145,0,169,240,141,13,144,141
13 DATA 163,2,96,0,0,0,0,0,0,0,0,0
14 DATA 0,0,0,0,173,163,2,240,43,234,169,0
15 DATA 141,163,2,169,48,162,4,221,148,30,208,5
16 DATA 202,224,255,208,241,162,3,254,6,30,169,58
17 DATA 221,6,30,208,10,169,48,157,6,30,202,224
18 DATA 255,208,236,234,162,23,189,227,31,201,4,240
19 DATA 4,202,208,246,96,174,61,3,169,4,157,43
20 DATA 30,96,0,32,0,25,32,160,25,32,80,26
21 DATA 32,128,26,96,0,0,0,0,0,0,0,0
50 DATA 169,76,141,119,2,169,79,141,120,2,169,65
51 DATA 141,121,2,169,68,141,122,2,169,13,141,123
52 DATA 2,169,82,141,124,2,169,213,141,125,2,169
53 DATA 13,141,126,2,169,9,133,198,96,0,0,0
100 FORA=6400TO6651:READN:POKEA,N:T=T+N:NEXT
110 IFT<>23157THENPRINT"DATA ERROR":END
120 T=0:FORA=673TO720:READN:POKEA,N:T=T+N:NEXT
130 IFT<>4690THENPRINT"DATA ERROR":END
140 POKE35879,8:PRINT"OK":SYS673

```

Program 2.

```

1 DATA162,22,160,30,134,0,132,1,160,22,177,0
2 DATA 201,1,208,3,32,44,26,32,29,26,165,1
3 DATA201,32,208,236,96,24,165,0,105,1,175,3
4 DATA133,0,96,230,1,133,0,96,160,22,169,32
5 DATA145,0,160,0,177,0,201,32,240,3,76,165
6 DATA26,169,1,145,0,96,169,38,145,0,169,240
7 DATA141,13,144,141,153,2,96,0,32,0,26,162
8 DATA22,169,7,157,227,151,157,227,31,202,208,245
9 DATA152,23,169,32,157,20,30,202,208,248,173,12
10 DATA144,240,3,206,12,144,173,13,144,240,3,206
11 DATA13,144,76,128,25,0,0,0,162,211,189,44
12 DATA30,201,33,176,16,202,208,246,162,255,189,255
13 DATA30,201,33,176,10,202,208,246,96,222,44,30
14 DATA76,137,26,222,255,30,76,149,26,201,2,240
15 DATA9,201,3,240,5,201,4,208,142,96,169,255
16 DATA141,163,2,76,66,26,0,0,0,0,0,0
17 DATA173,43,28,41,1,208,4,24,76,204,26,56
18 DATA110,43,28,110,44,28,110,51,28,110,52,28
19 DATA96,0,0,0
100 FORA=6656TO6873:READN:POKEA,N:T=T+N:NEXT
110 IFT<>21803THENPRINT"DATA ERROR":END
120 SYS673

```

Program 3

```

1 DATA169,0,141,19,145,169,127,141,34,145,169,5
2 DATA141,60,3,120,169,28,141,20,3,169,27,141
3 DATA21,3,88,96,206,60,3,240,3,76,192,27
4 DATA120,172,61,3,169,32,153,205,31,169,5,141
5 DATA60,3,169,16,44,17,145,208,3,32,130,27
6 DATA169,128,44,32,145,208,3,32,118,27,169,32
7 DATA44,17,145,208,3,32,152,27,172,61,3,185
8 DATA205,31,201,32,208,12,159,0,172,61,3,153
9 DATA205,31,88,76,176,27,169,255,141,161,2,169
10 DATA0,172,61,3,153,205,31,76,192,27,173,61
11 DATA3,200,192,23,240,14,140,61,3,96,173,61

```

(continued on opposite page)

Is it a seagull? Is it a plane? No, it's the first of the robots in David Hodgett's Vic-20 game.

ROBOT ATTACK IS A game for the unexpanded Vic-20 and a joystick. It uses a fair amount of machine code to give it extra speed, and features a rapid fire, and a laser base with variable speed which can be set by the user.

The game comes in five parts, the first three of which are for the machine code, the fourth is for the graphics and the fifth part is the game itself.

The first four parts are all data and each program has its own check sum as, if you make a mistake in the machine code, it could cause the computer to crash. If there is a mistake you will get a Data Error. If this happens then re-check the data. After the five parts have been entered and checked you may



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s become.

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Making the most of your micro.

EVENTUALLY, AFTER many months of disappointment, decent arcade games are appearing on the Dragon market, most often under the title Microdeal. However, I had never been able to get my hands on a Hunchback type game. After seeing my friend's version on a CBM-64, I just couldn't wait for Mr Kalish to relieve my pangs.

So I sat down and threw a version together. Realising the potential of the game I became more interested in it and began designing a brickwall and animated graphics. When I had finished it was difficult to stop playing.

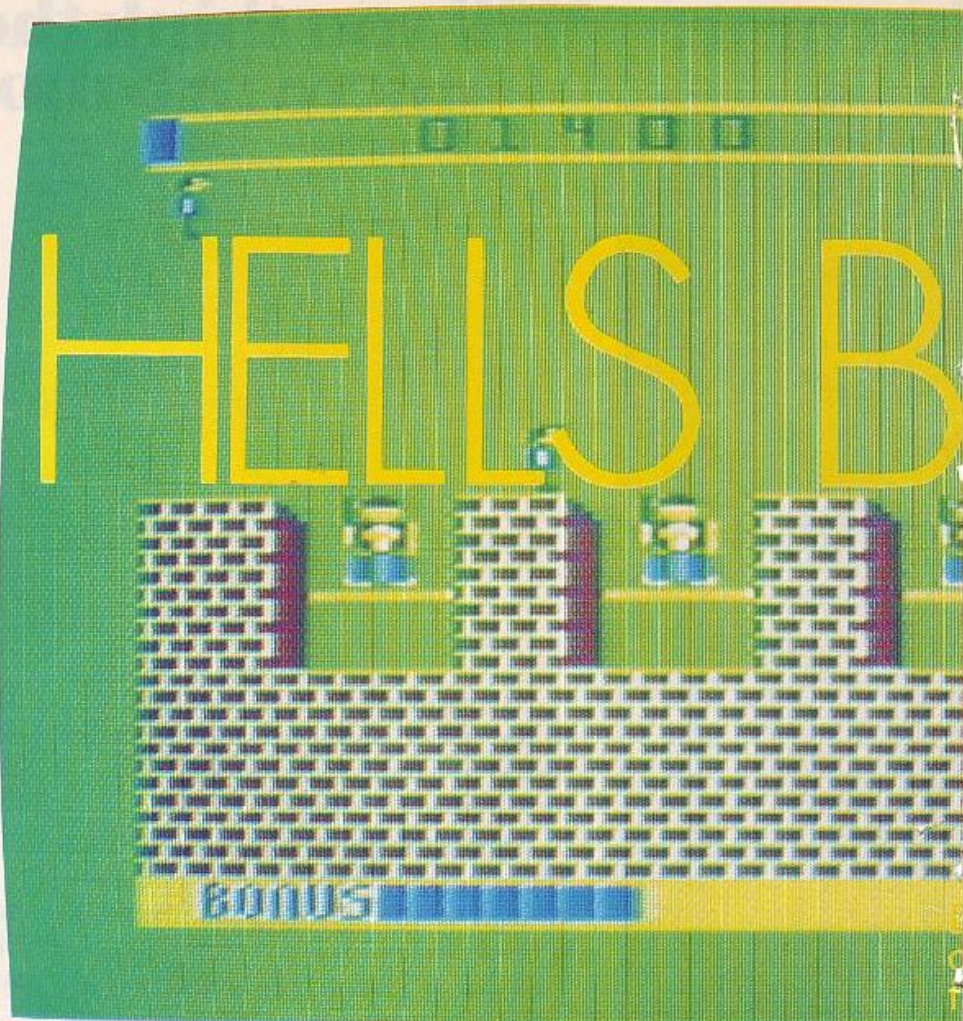
The idea of the game is to control your small blue knight along the side of the castle wall in search of the legendary 16th bell.

Your Queen has equipped you only with a blessing and the cape of unreal strength and agility. You must leap the dangerous fissures where knights hide waiting to spear you with their gruesome pikes while avoiding the flaming balls of oil and the deadly poison tipped arrows which will pierce your heart!

Back to reality, to type the game in first type in the hex loader: — listing 1 — and then run using the data from the listing provided. The data is checked after each line so there should be no mistakes. However, save the game before running just in case.

To save the game type:
CSAVEM CASTLE',&H5400,&H616A,21555
Once you have typed it in and saved it can be run using EXEC21555. However, once it has been loaded EXEC will do fine.

If there are any problems write to me at: 12 Yonge Close, Radcliffe-on-Trent, Nottingham NG12 2BE. Enclose a stamped addressed envelope and your problem. I will be happy to help out with any difficulties you meet.

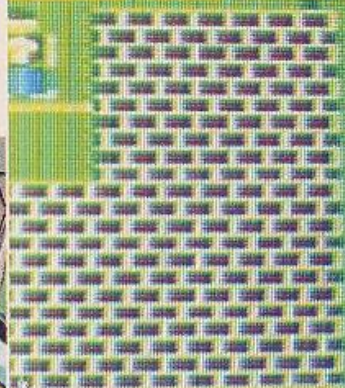


```
21504 : 00,00,00,00,01,00,FF,00,100
21512 : FF,14,C2,00,FF,0E,6F,0F,360
21520 : E2,0E,79,00,FF,00,FF,00,367
21528 : FF,00,FF,00,10,00,03,02,213
21536 : 00,00,01,00,00,01,00,20,22
21544 : 00,00,00,00,00,1D,80,06,D3
21552 : 68,09,73,8D,5D,59,BD,5F,373
21560 : 04,8D,5A,DD,8D,5A,13,7F,3A1
21568 : 01,12,7F,01,13,8D,5A,03,1C0
21576 : ED,5B,FD,8D,5A,7A,BD,5A,4D1
21584 : D3,86,54,13,10,26,04,05,231
21592 : ED,56,EC,8D,57,5D,BD,55,482
21600 : 4C,8D,55,21,10,8E,54,1C,2ED
21608 : 31,3F,7A,FD,7E,54,45,39,2E2
21616 : EE,54,28,30,86,5A,84,B7,3A1
21624 : 54,2D,1F,98,8B,54,2D,A7,31B
21632 : B4,8E,54,2C,A6,84,81,09,346
21640 : 22,0B,30,1F,8C,54,28,26,1A7
21648 : F3,39,6C,1F,80,0A,A7,84,36C
21656 : 20,F0,8E,54,28,36,10,A6,306
21664 : B4,C6,0B,3D,1F,7D,10,8E,314
21672 : 54,2F,8E,60,3F,30,86,C6,32C
21680 : 0B,A6,80,A7,A4,31,AB,20,372
21688 : 5A,26,F6,8E,54,2F,30,02,2E9
21696 : BF,54,2F,37,10,30,01,8C,246
21704 : 54,2D,26,D1,8E,06,68,BF,333
21712 : 54,2F,39,FC,54,31,81,01,2EF
21720 : 10,27,02,2F,11,00,27,06,156
21728 : C0,05,FD,54,31,39,C6,FA,440
21736 : 4A,FD,54,31,8E,1C,C7,C6,403
21744 : 55,86,14,E7,80,4A,26,FB,3C1
21752 : 30,0C,8C,1D,C7,23,F2,B6,377
21760 : 54,31,8E,1C,C7,C6,AB,36,39A
21768 : 10,31,86,10,BF,54,2D,E7,2FE
21776 : 80,8C,54,2D,26,F9,37,10,323
21784 : 30,8B,20,3C,1D,C7,26,E7,355
21792 : 39,86,54,22,81,02,27,1B,22A
21800 : BE,54,09,10,8E,5F,6F,C6,34U
21808 : 07,5A,10,27,07,EB,A6,A0,2D0
21816 : A1,84,10,26,01,CD,30,8B,2E1
21824 : 20,20,EE,8E,54,09,10,8E,2E7
21832 : 5F,E6,20,E3,B6,54,04,27,37D
21840 : 25,C6,0B,86,06,BE,54,0F,2A0
21848 : 8C,0F,E0,10,27,00,DF,1C,2AD
```

```
21856 : FE,69,84,69,1F,30,8B,20,34B
21864 : 4A,26,F4,5A,26,E5,8E,54,3DB
21872 : 0F,30,1F,BF,54,0F,86,54,29A
21880 : 02,27,23,C6,0B,86,06,8E,256
21888 : 54,11,8C,0E,60,10,27,00,196
21896 : C6,1C,FE,69,84,69,1F,30,395
21904 : 8B,20,4A,7A,F4,5A,7A,E5,371
21912 : BE,54,11,30,1F,BF,54,11,296
21920 : 86,54,03,27,25,C6,0B,86,2AD
21928 : 05,8E,54,0D,8C,0E,60,10,22E
21936 : 27,00,AD,1C,FE,69,84,69,344
21944 : 1F,30,8B,20,4A,26,F4,5A,2B5
21952 : 26,E5,8E,54,0D,30,1F,BF,338
21960 : 54,0D,B6,6A,0B,27,25,C6,202
21968 : 0B,86,05,8E,54,0B,8C,0F,24B
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22040 : 1A,30,01,BF,54,1A,86,54,292
22048 : 01,81,02,10,26,06,FA,8E,278
22056 : 01,12,8C,00,32,23,64,8C,1E4
22064 : 30,4B,10,23,00,82,8C,00,18C
22072 : B2,10,23,00,AB,39,86,0B,224
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22088 : FF,BF,54,0F,7E,55,76,86,3F0
22096 : 0B,8E,54,11,BD,61,16,8E,2ED
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22112 : 36,05,8E,54,0D,BD,61,16,2DE
22120 : BE,0E,7F,BF,54,0D,7E,55,30E
22128 : CA,86,05,8E,54,0B,BD,61,390
22136 : 16,8E,0F,FF,BF,54,0B,7E,34E
22144 : 35,F4,86,0B,8E,54,1A,BD,3C0
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22160 : 7E,56,1E,7F,54,23,8E,0F,285
22168 : 46,BD,56,A9,8E,0F,AE,BD,46A
22176 : 56,A9,8E,0F,B6,BD,56,A9,40E
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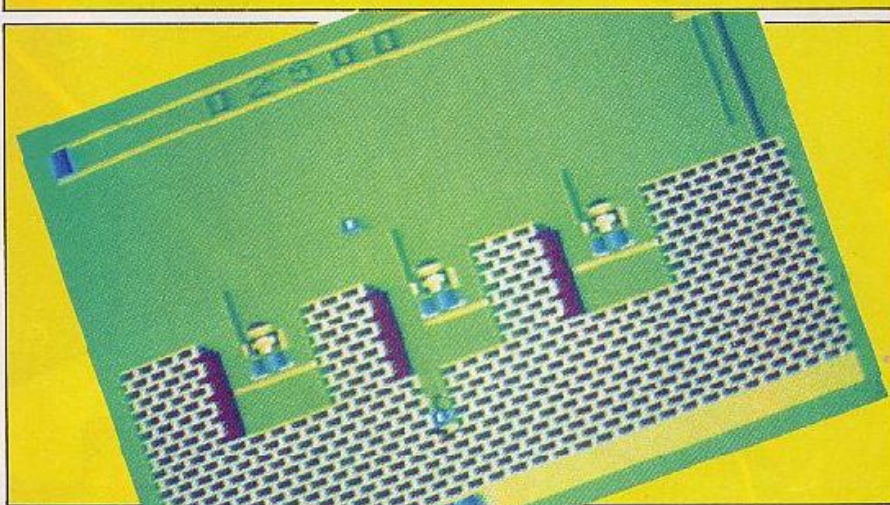
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22280 : 57,0B,39,8E,00,A0,BF,54,2DC
22288 : 26,BD,61,39,8E,00,45,3F,30F
22296 : 54,26,BD,61,39,C6,50,BD,3A4
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22336 : 3F,26,FE,84,54,1E,4A,87,38A
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22352 : A1,16,FC,E2,8E,0F,82,3F,473
22360 : 54,09,16,FD,DC,86,FF,3E,45E
22368 : 01,50,A7,8D,8C,01,60,26,28E
22376 : F9,BD,80,05,81,5A,27,4E,38C
22384 : 81,58,27,0D,81,0C,10,27,1D1
22392 : 06,D1,01,00,10,27,02,26,1DE
22400 : 39,86,54,25,81,01,10,27,221
22408 : 02,61,86,01,87,54,25,37,2D1
22416 : 54,22,86,0B,8E,54,09,C6,2E5
22424 : 10,66,84,66,01,30,8B,20,239
22432 : 5A,26,F6,4A,81,00,26,EC,353
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22456 : 9D,10,27,00,46,39,8E,54,265
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22488 : B7,54,22,8E,54,09,BD,5D,362
22496 : 2L,86,0B,8E,54,09,C6,10,2AC
22504 : 65,84,69,1F,30,8B,20,5A,2A7
22512 : 26,F6,4A,81,00,26,EC,8E,3B7
22520 : 54,09,30,1F,BF,54,09,BD,285
22528 : 3C,22,39,7C,54,00,86,54,292
22536 : 0C,81,0D,22,1F,8E,0F,82,1EE
22544 : BF,54,09,86,02,F6,54,31,31F
22552 : C1,09,22,0C,BD,54,70,FC,345
```


ELLS



remains the same, some changes with a program for boosting Dragon potential

```
10 INPUT "START ADDRESS";SA
20 PRINT SA;": ";
25 REM INPUT THE ENTIRE LINE AFTER THE ADDRESS
26 REM INCLUDING COMMAS AND CHECKSUM
27 REM PRESS BREAK TO STOP
30 LINEINPUT A$
40 IF LEN(A$)<25 THEN PRINT "TOO SHORT":GOTO 20
50 FOR I=1 TO 8
60 B$=LEFT$(A$,2):B=VAL("&H"+B$)
70 T=T+B
80 POKE SA,B:SA=SA+1
90 A$=RIGHT$(A$,LEN(A$)-3)
100 NEXT
110 IF T<>VAL("&H"+A$) THEN PRINT "ERROR:STOP"
120 T=0:GOTO 20
```



```
22560 : 0A,05,FD,54,31,8D,54,39,2DB
22568 : C5,09,20,F0,8E,00,7F,BF,3AB
22576 : 54,26,E6,0F,8D,61,39,4A,2B0
22584 : 26,FA,7F,54,00,8E,54,1C,321
22592 : 8C,00,00,27,CB,30,89,FE,332
22600 : D4,20,C2,8E,00,30,BF,54,3B7
22608 : 25,8D,61,39,86,01,B7,54,30F
22616 : 15,7F,54,21,39,86,01,B7,2B0
22624 : 54,25,86,54,22,B1,02,10,238
22632 : 27,00,43,81,03,10,27,01,1B5
22640 : 3F,E6,54,21,81,00,27,1B,22D
22648 : 81,01,27,34,81,02,27,13,19A
22656 : 81,07,27,61,81,08,27,28,1E3
22664 : 81,09,27,59,81,0A,27,70,22C
22672 : 7E,58,80,C6,07,8E,54,09,36E
22680 : 30,8B,F0,8F,54,09,8A,00,33A
22688 : A7,89,02,00,3D,5C,59,5A,2FE
22696 : 26,EB,7C,54,21,7E,54,5E,332
22704 : 1C,FE,8E,54,09,C6,0B,A6,3A9
22712 : 01,10,26,FE,4E,A6,89,02,2B4
22720 : 00,10,26,FE,4E,86,10,8E,2CE
22728 : 54,09,66,84,66,01,30,8B,266
22736 : 20,4A,26,F6,5A,26,EE,7C,370
22744 : 54,21,8E,54,09,30,01,BF,2B0
22752 : 54,09,7E,54,5E,C6,07,8E,31B
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22776 : 26,ED,7C,54,21,7E,54,5E,33A
22784 : 7F,54,15,86,01,B7,54,22,29C
22792 : 7F,54,21,7E,54,5E,86,54,32E
22800 : 21,81,00,27,1B,81,01,27,1B0
22808 : 34,81,02,27,13,81,07,27,1A0
22816 : 61,81,08,27,28,81,09,27,1FA
22824 : 59,81,0A,27,70,7E,59,4D,29F
22832 : C6,07,8E,54,09,30,8B,E0,3B0
22840 : EF,54,09,86,00,A7,89,02,2D4
22848 : 00,8D,5D,22,5A,26,EB,7C,323
22856 : 54,21,7E,54,5E,1C,FE,8E,37D
22864 : 54,09,C6,0B,A6,1F,10,26,226
22872 : FD,81,86,89,01,FE,10,26,412
22880 : FD,A9,86,10,8E,54,09,69,3C0
22888 : B4,69,1F,30,8B,20,4A,26,254
22896 : F6,5A,26,EE,7C,54,21,8E,413
22904 : 54,09,30,1F,BF,54,09,7E,246
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22960 : 86,54,21,81,00,10,27,FE,2E1
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23024 : 87,54,22,8D,5C,64,39,7C,33F
23032 : 54,25,86,02,87,54,22,8D,2EB
23040 : 5D,2D,39,8D,5C,6F,8D,5C,364
23048 : 31,8D,5C,93,8D,5C,C9,8D,42C
23056 : 5C,AF,39,8D,5C,59,86,01,33D
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23136 : 8E,0F,FF,87,54,04,10,BF,37A
23144 : 54,0F,A6,02,81,01,26,0B,18E
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23176 : 0D,87,54,03,A6,05,81,01,24B
23184 : 26,37,86,02,87,54,01,8E,27F
23192 : 11,86,10,8E,5F,82,EC,A1,303
23200 : ED,84,30,8B,20,1C,83,00,2DC
23208 : 00,26,F3,CC,55,55,ED,1F,39B
23216 : ED,01,ED,8B,1F,ED,8B,21,41B
23224 : DC,14,46,26,0C,8E,11,8E,245
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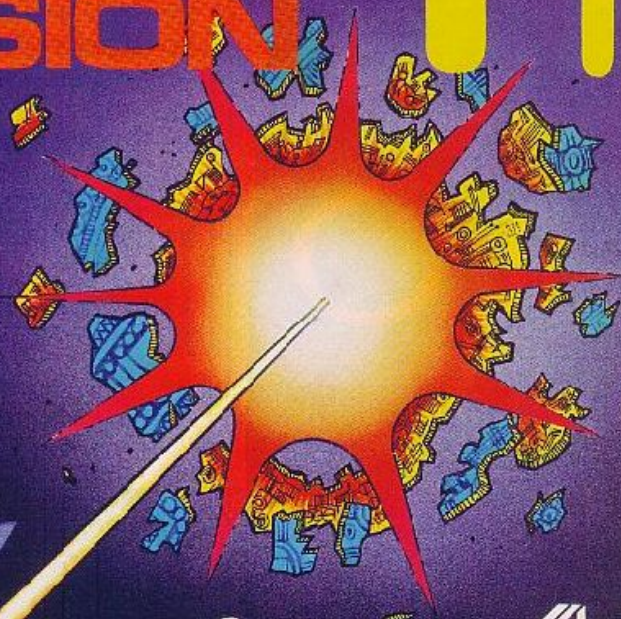
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23344 : F3,8E,1C,A0,86,55,A7,80,43F
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23392 : 87,54,1F,10,27,01,BA,8E,2DA
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23512 : 8E,11,E4,8D,5E,89,8B,03,3E7
23520 : 8E,12,04,8D,5B,89,8B,04,304
23528 : 8E,12,24,8D,5E,89,8B,02,322
23536 : 8E,12,44,8D,5E,89,4C,8E,3BF
23544 : 12,64,8D,5B,89,86,F0,8E,44B
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23600 : 26,F3,86,C0,3C,8B,E0,C6,4BD
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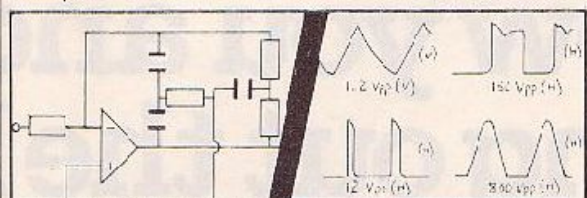
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 24224 : 20,5A,20,20,20,20,2E,2E,154
 24232 : 2E,2E,2F,4C,45,4A,5A,50,105
 24240 : 20,20,20,20,20,20,20,20,100
 24248 : 20,20,20,20,20,20,20,20,100
 24256 : 20,45,4E,5A,45,52,2E,2E,1F3
 24264 : 2F,2F,2F,47,4F,55,4E,43,201
 24272 : 45,20,20,20,20,20,20,20,125
 24280 : 20,20,20,20,20,20,20,20,100
 24288 : 80,7E,5D,7C,B6,CC,7E,5D,404
 24296 : 7E,5D,57,45,53,53,20,41,264
 24304 : 4E,59,20,4B,45,59,20,5A,224
 24312 : 4F,20,53,5A,41,52,5A,20,21D
 24320 : 47,41,4D,45,B6,53,37,FF,43B
 24328 : 22,B7,FF,C3,B7,FF,C5,B7,FF,43B
 24336 : FF,C7,86,00,8E,06,00,A7,3B7
 24344 : 80,BC,1E,00,26,F9,3E,0F,2E6
 24352 : B2,BF,5A,09,7F,5A,15,7F,305
 24360 : 5A,20,86,00,87,5A,20,7F,784
 24368 : 5A,21,7F,5A,01,7F,5A,3,22F
 24376 : 7F,5A,23,86,01,87,5A,24,2AC
 24384 : B7,5A,25,7F,5A,2B,7F,5A,2FE
 24392 : 25,7F,5A,2A,7F,5A,2B,7F,263
 24400 : 5A,2C,CC,06,68,FD,5A,2F,33A
 24408 : CC,0A,05,FD,5A,31,86,01,2E4
 24416 : B7,5A,22,8E,10,00,3F,5A,2DE
 24424 : IC,B6,03,B7,5A,1E,39,3F,244
 24432 : F4,F5,D4,20,40,98,9B,9B,5A5
 24440 : AE,30,30,30,30,3C,3C,00,1E0
 24448 : 0C,3F,F4,F5,D4,20,40,9B,454
 24456 : 9E,9A,AB,AB,30,30,CC,FF,470
 24464 : F3,00,00,02,0B,FC,0B,02,203
 24472 : 0C,3C,E7,DB,E7,DB,3C,00,3FC
 24480 : 3C,7E,FF,3C,24,3C,7E,56,329
 24488 : 6F,56,7E,66,66,66,66,E7,3BD

24496 : E7,C0,03,C0,0F,F0,0F,F0,3AB
 24504 : 05,50,45,50,41,40,7F,FD,2E7
 24512 : 7D,7D,75,5B,75,5D,7D,7D,398
 24520 : 7D,7D,00,71,03,C1,2B,2B,24C
 24528 : 2B,2B,2B,2B,2B,2B,2B,2B,14C
 24536 : 6B,27,5A,15,00,00,02,07,103
 24544 : 07,C2,02,02,02,00,FC,1F,12A
 24552 : 5F,17,0B,0A,2C,26,24,2A,124
 24560 : 0C,CC,0C,0C,3C,3C,00,00,AB
 24568 : FC,1F,5F,17,0B,0A,26,26,1EF
 24576 : 16,1A,2A,0C,0C,33,33,CF,1A7
 24584 : 00,00,3C,0B,07,0B,07,3C,3FC
 24592 : 00,C1,40,05,50,05,50,05,F0
 24600 : 50,C5,50,15,5A,15,5A,15,18C
 24608 : 5A,15,5A,15,5A,15,5A,15,1E4
 24616 : 55,00,00,55,55,FD,FD,FD,3FC
 24624 : FD,FD,FD,55,55,DF,DF,DF,63E
 24632 : BF,DF,DF,55,55,00,00,FF,446
 24640 : C3,C3,C3,C3,C3,C3,FF,F0,6B1
 24648 : 30,30,30,30,30,30,FC,3C,25B
 24656 : C3,C3,C3,C3,C3,C3,FF,3C,3BD
 24664 : C3,C3,C3,C3,C3,C3,FF,3C,3BD
 24672 : CC,CC,CC,CC,CC,CC,CC,CC,303
 24680 : CC,CC,CC,CC,CC,CC,CC,CC,303
 24688 : CC,CC,CC,CC,CC,CC,CC,CC,303
 24696 : 03,0C,3C,C0,C0,C0,C0,3C,37B
 24704 : C3,C3,C3,C3,C3,C3,C3,C3,3F3
 24712 : C3,C3,C3,C3,C3,C3,C3,C3,3F3
 24720 : 59,99,A5,99,99,99,99,99,447
 24728 : 65,99,99,99,99,99,99,99,460
 24736 : C0,65,99,99,99,99,99,99,3FB
 24744 : 99,00,99,99,99,99,99,99,42F
 24752 : 99,65,00,65,95,95,65,95,353
 24760 : 59,59,A5,00,80,20,3F,20,256
 24768 : E0,00,00,01,00,00,00,00,81
 24776 : C0,00,00,00,01,00,00,00,00,3
 24784 : C0,00,01,01,01,00,00,00,3
 24792 : C1,00,00,00,00,01,01,01,4
 24800 : C0,00,01,00,01,01,00,02,5
 24808 : C0,00,01,00,00,02,00,00,3
 24816 : C1,01,00,00,01,01,01,01,5
 24824 : C1,01,00,00,01,00,01,02,6
 24832 : 00,00,01,00,01,02,01,01,5
 24840 : C0,00,00,07,00,01,01,01,5
 24848 : 01,01,00,00,01,01,01,00,85
 24856 : 10,27,F5,EF,BC,06,00,10,2BD
 24864 : 23,F5,E8,5F,E7,84,30,8B,4B2
 24872 : 20,4A,2A,FF,39,4F,FF,0A,244
 24880 : 00,A7,80,BC,1E,00,26,F9,2F0
 24888 : 39,3A,32,B4,FF,23,BA,0B,309
 24896 : B7,FF,23,BE,00,01,84,FD,3EB
 24904 : B7,FF,20,8E,16,7F,B7,FF,20,417
 24912 : B0,11,30,01,BC,5A,26,25,22A
 24920 : ED,85,FF,23,84,F7,B7,FF,5F6
 24928 : 23,35,B2,1F,12,31,3F,26,1D1
 24936 : FC,39,FF,FF,FF,FF,FF,FF,77F

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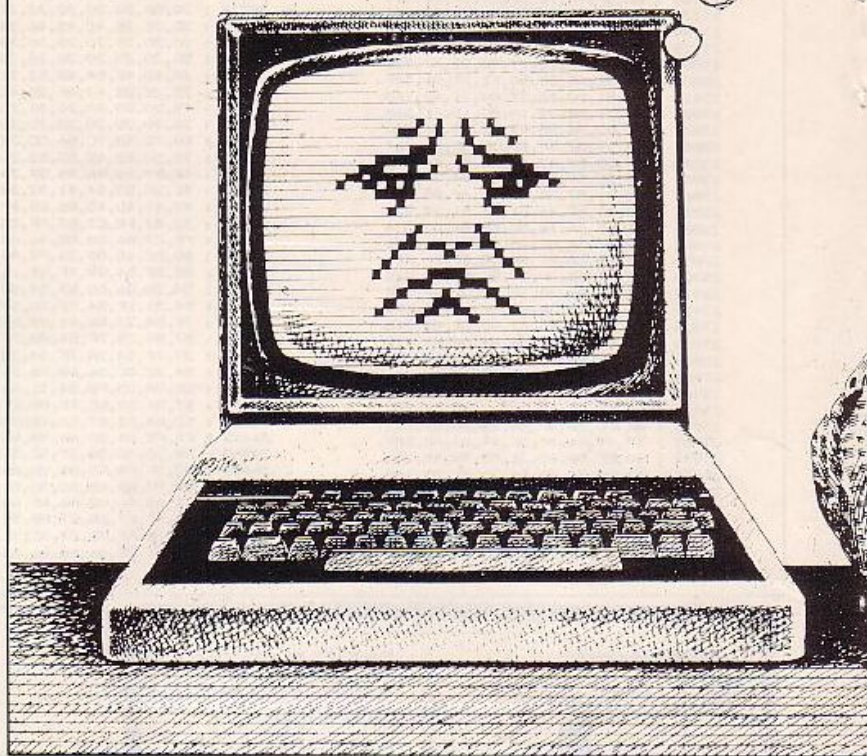
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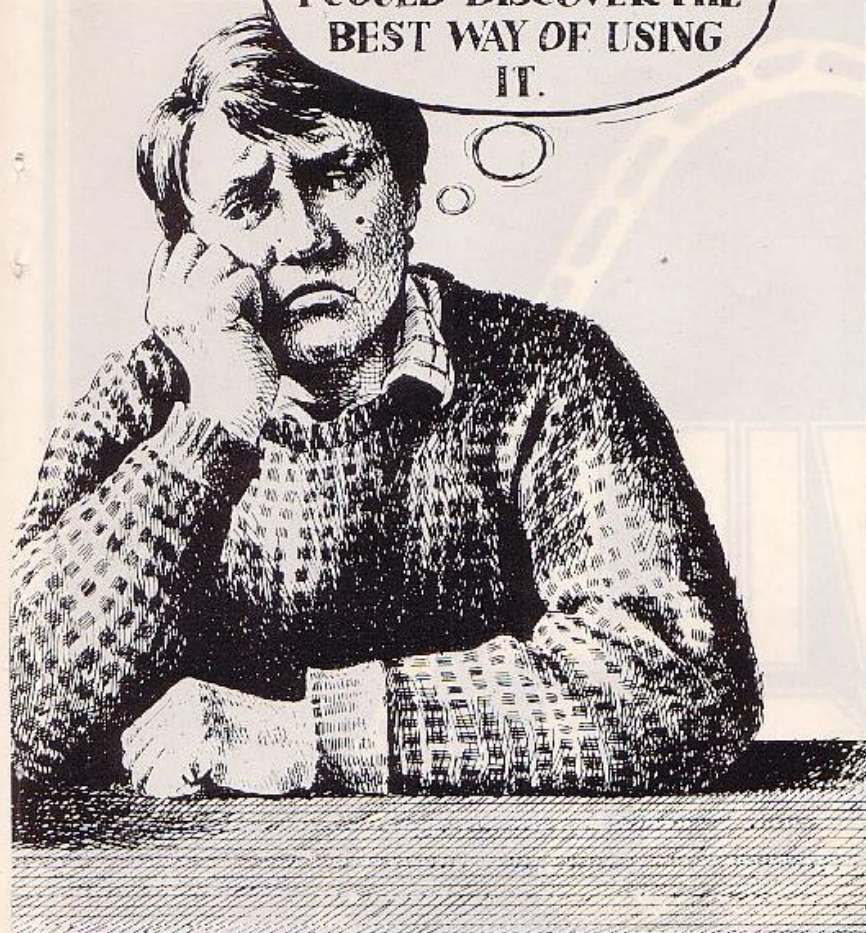
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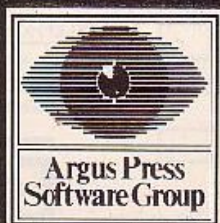
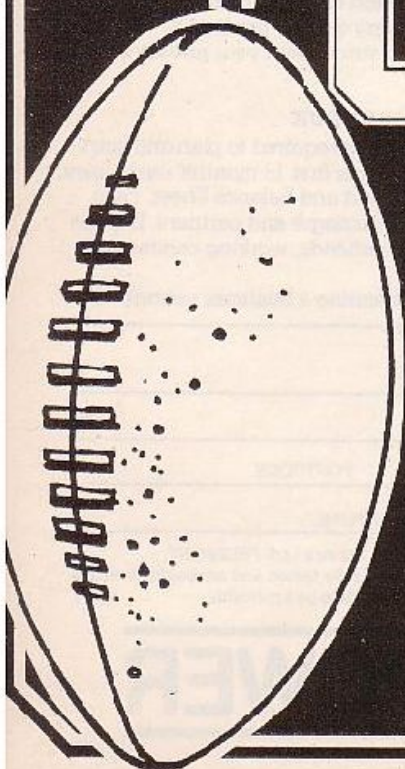
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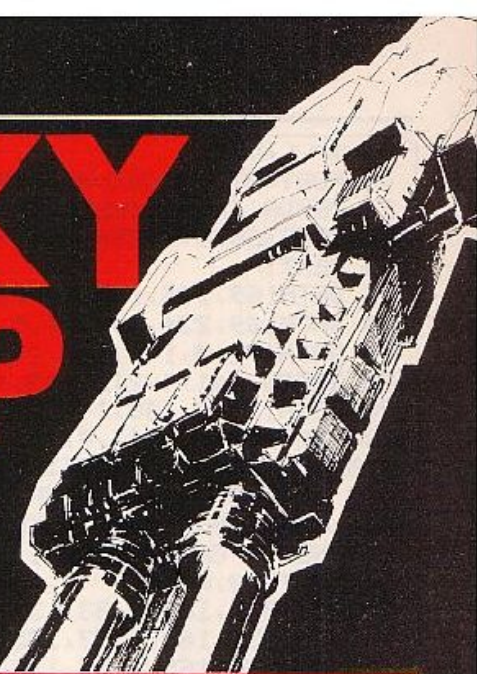
I HAVE TRIED to incorporate as many of the advanced features of Locomotive Basic as possible into this game for the Amstrad CPC-464; for example, high-res moving graphics and three channel-sound. Three well-known tunes have been included in the game — *Star Wars*, *Funeral March*, *Congratulations*.

The game is set on a hostile planet where the atmosphere is hydrochloric acid vapour. When clouds form, the vapour condenses to make concentrated acid. The sea at the bottom of the screen is also acid. At the start, a small sky craft hovers along to the middle of the screen. A small device is dropped from it and the idea of the game is to guide this device on to a randomly moving acid-proof platform which is floating on the acid sea.

Rod Markham puts the Amstrad through its paces.

SKY DROP

As both the sea and the clouds are acid, they must both be avoided. There is also a laser field which fires eight blasts then rests for two. To get past this, the craft must hover just above the laser beam until it stops firing. To do this the thrust key is used. Thrusting uses up fuel so be careful as there are only 30 units.



```

20 REM*****SKY DROP*****
30 REM*****BY R.MARKHAM*****
40 REM*****AND S.JOHNSON*****
50 GOSUB 1560
60 INK 3,20
70 INK 2,6
110 INK 1,0
120 HT=0
130 CL.H=150
140 LIVES=3
150 SCORE=0
160 ENV 6,15,-1,1
170 ENV 1,30,10,1
180 ENV 5,15,-1,10
190 FUEL=30
200 SYMBOL AFTER 205
210 SYMBOL 221,8,15,3,13,15,63,111,127
220 SYMBOL 222,0,0,224,128,255,201,2
230 SYMBOL 223,0,0,0,0,192,32,248
240 SYMBOL 212,111,63,4,31,0,0,0,0
250 SYMBOL 213,255,255,4,255,0,0,0,0
260 SYMBOL 214,255,128,0,0,0,0,0,0
270 SYMBOL 215,0,0,0,0,0,3,2,6
280 SYMBOL 216,0,0,0,0,0,X1101010,X110010
01,X1001001,2
290 SYMBOL 217,0,0,0,0,0,128,64,64
300 SYMBOL 218,X101,X111100,X100000,X
X100000,X1001000,X111111,3,0
310 SYMBOL 219,0,0,0,0,0,144,255,255,0
320 SYMBOL 220,X110000,X10001000,X11
00,X11010,X1100100,X11111000,X110000
00,0
330 BORDER 1:INK 0,0
340 CLS
350 MODE 0
360 X=5
370 RESTORE 1430
380 READ NOTE,DUR
390 SOUND 1,NOTE,DUR,15
400 PEN 1
410 PRINT"*****SKY DROP*****"
420 X=X+1:IF X>13 THEN 440
430 GOTO 380
440 READ NOTE,DUR:IF NOTE=9999 THEN GOTO
500
450 SOUND 1,NOTE,DUR,15
460 PEN 1
470 PRINT"*****SKY DROP*****"
480 X=X+1
490 GOTO 440
500 PEN 7:PRINT "*****SKY DROP*****"
510 PEN 4:PRINT "*****SKY DROP*****"
520 PEN 5:PRINT "*****SKY DROP*****"
530 FOR K=1 TO 2000:NEXT K
540 CLS:MODE 1
550 WINDOW 4,56,2,5
560 BORDER 18:INK 0,11
570 ENV 1,10,-1,2
580 ENV 2,15,1,3
590 ENV 3,1,0,2,15,-1,20
600 S=6
610 CLS
620 DROP=200
630 BASE=270
640 DRIFT=290
650 PLOT 38,392,1:DRAW 544,0:DRAW 0,-
7:DRAW -344,0:DRAW 0,73
660 TAG
670 PLOT 0,0,1
680 FOR X=1 TO DRIFT-4 STEP 2
690 MOVE X,DROP+32
700 PRINT CHR$(221);CHR$(222);CHR$(223);
213);CHR$(214);
720 PITCH=INT(RND(1)*60)+12
730 SOUND 2,PITCH,2,15,0,0,1
740 NEXT X
750 MOVE 1,173:PRINT CHR$(246);

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760 MOVE 624,175:PRINT CHR$(247)
770 TAGOFF
780 CLOUD=250
790 CLOUD2=BASE
800 REM*****START LOOP*****
810 TAG
820 PLOT 0,0,1
830 MOVE X,DROP+32:PRINT CHR$(221);CHR$(
222);CHR$(223);
840 MOVE X,DROP+16:PRINT CHR$(212);CHR$(
213);CHR$(214);
850 TAGOFF
860 FUEL=30
870 IF A=0 THEN RT=-1 ELSE ST=1
880 A=INT(RND(1)*20)+10
890 FOR P=1 TO A STEP 1
900 PEN 3:LOCATE 1,2:PRINT"FUEL=";FUEL
910 LOCATE 1,3:PRINT"DRIFT=";DRIFT
920 LOCATE 1,1:PRINT"LIVES=";LIVES
930 LOCATE 1,4:PRINT"DROP=";DROP
940 LOCATE 12,4:PRINT"SCORE=";SCORE
950 SCORE=SCORE+1
960 BUTT=INKEY$
970 IF BUTT=L THEN DRIFT=DRIFT-5
980 IF BUTT=R THEN DRIFT=DRIFT+5
990 IF BUTT=T THEN FUEL=1 THEN DROP=DRO
P+5:FUEL=FUEL-1:IF FUEL<1 THEN FUEL=0
1000 DROP=DROP-5:IF DROP<8 THEN 1210
1010 BASE=BASE+P*(6/5):IF BASE<0 THEN B
ASE=1
1020 IF BASE>=575 THEN BASE=575
1030 CL.H=CL.H+1
1040 TAG
1050 PLOT 0,0,1
1060 MOVE BASE,12:PRINT " ";CHR$(209);CH
R$(189);CHR$(211);" ";
1070 CALL 8019
1080 CLOUD=CLOUD+(INT(RND*6))-3
1090 CLOUD2=BASE
1100 MOVE CLOUD,220:PRINT " ";CHR$(215)
;CHR$(216);CHR$(217);" ";MOVE CLOUD,204
:PRINT " ";CHR$(218);CHR$(219);CHR$(220)
;" ";
1120 MOVE DRIFT-1,DROP:PRINT CHR$(46);
1130 IF DRIFT=CLOUD+16 AND DRIFT=CLOU
D+8 AND DROP<220 AND DROP>204 THEN 12
30
1140 IF DRIFT=CLOUD2+16 AND DRIFT=CLOU
D2+48 AND DROP<CL.H AND DROP>CL.H-16
THEN 1230
1150 TAGOFF
1160 IF LASER<=7 THEN INK 2,6:PLOT 16,1
68:INK 2,6:DRAW 620,168,2:SOUND 1,10,30,
5,0,1:IF 168<DROP AND 168>DROP-16 THE
N SOUND 7,0,150,15,5,0,15:GOTO 1230
1170 LASER=LASER+1:IF LASER=11 THEN LASE
R=0
1180 INK 2,11
1190 NEXT P
1200 GOTO 370
1210 REM*****TEST LAND*****
1220 IF DRIFT=BASE-16 AND DRIFT<=BASE+
50 THEN GOTO 1320
1230 TAGOFF:LOCATE 12,1:PEN 15:PRINT "YO
U FAILED!TRY AGAIN";
1240 FOR V=1 TO 150:V=INT(RND*15)+1:SOUN
D 1,0,3,15,0,0,0:NEXT V
1250 LIVES=LIVES-1
1260 CL.H=150-SC
1270 RESTORE 1410
1280 READ NOTE,DUR:IF NOTE=9999 AND LIVE
S<1 THEN 1430
1290 IF NOTE=9999 THEN 540
1300 SOUND 1,NOTE,DUR,0,2
1310 GOTO 1280

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1320 RESTORE 1420
1330 LOCATE 12,1:PEN 15:PRINT "YOU SUCCE
EDED!"
1340 LOCATE 12,3:PEN 15:PRINT "TRY A HAR
DER LEVEL"
1350 SCORE=SCORE+(FUEL*10)+100
1360 SC=SC+10:CL.H=150-SC
1370 READ NOTE:IF NOTE=9999 THEN 540
1380 SOUND 4,NOTE,20,15,1
1390 GOTO 1370
1400 DATA 478,50,315,50,358,13,379,13,42
6,13,239,60,319,60,358,13,379,13,426,13,
239,60,319,60,358,15,379,15,358,15,426,7
0,9999,9999
1410 DATA 1911,130,1911,80,1911,40,1911,
120,1607,80,1703,40,1703,00,1911,40,19,1
400,3125,40,1911,120,9999,9999
1420 DATA 60,53,47,45,60,0,45,47,45,40,5
7,0,53,47,45,36,40,40,45,45,47,53,47,60,
9999
1430 REM *****END*****
1440 MODE 0:CLS
1450 SPEED INK 30,30
1460 BORDER 7,12
1470 INK 0,7
1480 IF SCORE>HI THEN HI=SCORE
1490 LOCATE 5,1:PEN 14:PRINT"SCORE=";SCOR
E
1500 LOCATE 5,5:PEN 15:PRINT"H=";SCORE;"
";
1510 LOCATE 7,10:PEN 0
1520 PRINT"DO YOU WANT ANOTHER GO?"
1530 LOCATE 7,15:INPUT"Y/N";I$
1540 IF I$="Y" THEN GOTO 130
1550 END
1560 MODE 1:INK 0,0:INK 2,10:INK 1,10:BO
RDER 1
1570 PRINT"*****SKY DROP (INSTRUCTIONS
*****"
1580 PRINT
1590 PRINT "You must guide a small dev
ice, which is dropped from a hovering sp
ace craft, onto a moving platform. This p
latform is floating on an ACID sea, so
if the device misses, it will be diss
olved."
1600 PRINT "To make the task more deman
ding, there are several hazards which mus
t be avoided.
ACID clouds, which drift ab
ove the sea, are also able to diss
olve the device."
1610 PRINT "Also, there is an automatic
laser field, which gives regular bur
sts of fire. You must wait above this unti
l it stops to re-energize, using THRUST. W
hen it stops, you must quickly drop t
hrough it."
1620 PRINT "Before it starts up again,
you will have THREE chance
s to land the device before the game en
ds.
Remember that you can only
use THIRTY fuel units. When there
are none left, you will drop."
1630 PRINT "PRESS 'SPACE' TO CONTINUE"
1640 IF INKEY$=" " THEN GOTO 1660
1650 GOTO 1640
1660 CLS
1670 PRINT"*****CONTROLS*****"
1680 PRINT
1690 PRINT
1700 PRINT
1710 INPUT
1720 INPUT "KEY FOR LEFT====";L$
1730 INPUT "KEY FOR RIGHT====";R$
1740 INPUT "KEY FOR THRUST====";T$

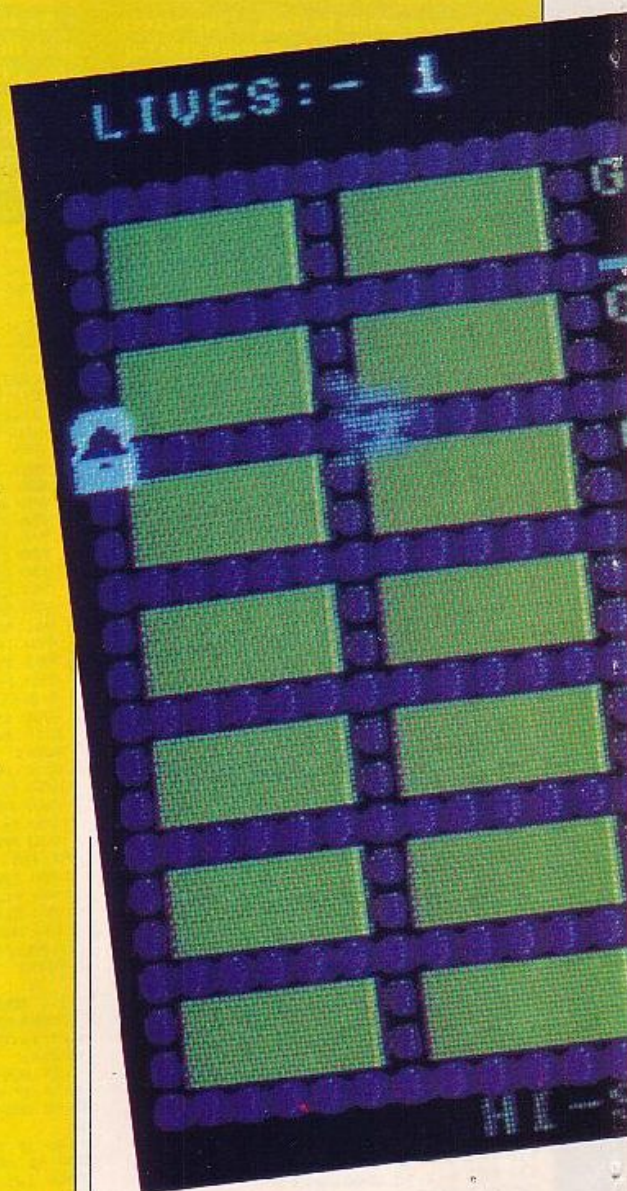
```


Program 1. Music.

```

10 FORT=0T02:FORX=0T0255
20 READR:IFA=-1THEN40
30 POKE36864+T*256+X,R:NEXTX
40 NEXTT
50 DATA169,146,141,21,3,169,0,141,20,3,96,-1
60 DATA169,234,141,21,3,169,49,141,20,3,96,-1
70 DATA172,0,147,192,17,240,57,206,1,147,173,1,147,201,0,208,44,238,0,147,169
80 DATA0,141,4,212,169,10,141,5,212,169,0,141,6,212,169,17,141,4,212,185,0,147
90 DATA185,0,148,141,1,212,185,0,149,141,0,212,185,0,150,141,1,147,76,49,234
100 DATA169,0,141,0,147,141,4,212,24,144,242,-1
110 POKE37632,0:POKE37633,0
120 FORT=0T0202:READHF,LF,D
130 POKE37888+T,HF:POKE38144+T,LF:POKE38400+T,D
140 NEXT:POKE37380,T+1
142 DATA28,49,8
143 DATA31,165,8,33,135,8,42,62,8,28,49,8
144 DATA31,165,8,33,135,8,42,62,8,28,49,8
145 DATA31,165,8,33,135,8,42,62,8,28,49,8
146 DATA31,165,8,33,135,8,42,62,8,28,49,8
147 DATA31,165,8,33,135,8,42,62,8,28,49,8
148 DATA31,165,8,33,135,8,42,62,8,28,49,8
149 DATA31,165,8,33,135,8,42,62,8,28,49,14
150 DATA21,31,14,21,31,14,22,96,14,22,96,14
160 DATA21,31,14,21,31,14,22,96,14,22,96,14
170 DATA21,31,14,21,31,14,22,96,14,22,96,14
180 DATA21,31,14,21,31,14,28,49,14,28,49,14
190 DATA26,156,30,37,162,14,37,162,30,37,162,14
200 DATA33,135,60,21,31,14,21,31,14,22,96,14
210 DATA22,96,14,21,31,14,21,31,14,22,96,14
220 DATA22,96,14,21,31,14,21,31,14,22,96,14
230 DATA22,96,14,21,31,14,21,31,14,28,49,14
240 DATA28,49,14,26,156,30,44,193,14,44,193,30
250 DATA44,193,14,42,62,60,21,31,14,37,162,14
260 DATA37,162,30,33,135,7,33,135,45,33,135,15
270 DATA31,165,14,31,165,30,33,135,7,31,165,7
280 DATA28,49,50,37,162,14,37,162,30,33,135,14
290 DATA33,135,30,33,135,14,31,165,14,31,165,30
300 DATA33,135,7,31,165,7,28,49,45,28,49,14
310 DATA28,49,14,31,165,14,31,165,14,28,49,14
320 DATA28,49,14,31,165,14,31,165,14,28,49,14
330 DATA28,49,14,31,165,14,31,165,14,28,49,14
340 DATA28,49,14,33,135,14,33,135,14,31,165,30
350 DATA21,31,14,22,96,14,18,209,14,21,31,14
360 DATA15,195,14,18,209,14,15,210,14,21,31,14
370 DATA22,96,14,18,209,14,21,31,14,16,195,14
380 DATA18,209,14,15,210,14,16,195,45,28,49,14
390 DATA31,165,14,33,135,14,28,49,14,31,165,14
400 DATA33,135,30,33,135,14,28,49,14,31,165,14
410 DATA33,135,30,31,165,14,28,49,14,33,135,14
420 DATA33,135,30,28,49,3,28,49,70
430 DATA28,49,14,31,165,14,33,135,14,28,49,14
440 DATA31,165,14,33,135,45,33,135,14,28,49,14
450 DATA31,165,14,33,135,45,31,165,14,28,49,14
460 DATA33,135,12,33,135,28,28,49,60,28,49,14
470 DATA44,193,45,50,60,7,44,193,7,37,162,14
480 DATA42,62,60,44,193,14,42,62,14,44,193,14
490 DATA42,62,14,28,49,14,37,162,45,33,135,28
500 DATA31,165,28,28,49,14,31,165,14,33,135,14
510 DATA28,49,14,31,165,14,33,135,45,31,165,14
520 DATA28,49,14,33,135,10,33,135,28,28,49,60
530 DATA42,62,12,42,62,12,42,62,12,42,62,12
540 DATA21,31,7,28,49,7,33,135,7,42,62,7
550 DATA39,223,12,39,223,12,39,223,12,39,223,12
560 DATA39,223,12,39,223,12,22,96,7,28,49,7
570 DATA33,135,7,42,62,35,31,165,14,28,49,14
580 DATA33,135,10,33,135,35,28,49,45
1000 POKE54296,15:SYS36864

```



BULLION FOR THE CBM-64 is split into two parts: part one is loaded first and run. This part, called Music, uses the system interrupt to play the background music for the game. It is initiated by the command

SYS36864

and is stopped by the command

SYS36864+256

For this particular game I have stored the music data in locations 9000 (hex) onwards. There is, however, no reason why anybody with machine-code knowledge could not use this program to make music for their own games, and re-locate the data to wherever they wish.

In the listing for music, lines 10 to 40 are the loader, line 50 is the machine-code data to

251	This holds the direction of your man; 1=left, 2=right; 3=up; 4=down.
252-253	These hold the X and Y position used in the Kernal Print Routine to print the man's footsteps.
255	This holds monster

	number one's direction.
164	This holds monster number two's direction.
711-716	These locations are used to store the vertical positions of the grid for use in the check block routines.

679-686	These store the Y positions of the grid for use in comparisons for sprite movement.
700-706	These hold the X positions.
820	This location is used to call the "Pirates" again.

```

687 REM ***** NO LEFT *****
690 ITR173 0,208,201,30,208,7,173,16,208,41,1,240,16,56,206,0,208
691 ITR206 0,208,208,16,73,16
692 ITR209 73,1,141,16,194,24,76,0,194
693 REM ***** MOVE RIGHT *****
694 REM ***** ITR206,173,208,7,173,16,208,41,1,208,16,24,208,0,208
695 ITR230 0,208,208,3
696 ITR173 16,208,73,1,141,16,208,24,76,0,194,-1
697 REM ***** FIND X CO-ORDINATE *****
710 ITR170 0,208,168,0,56,233,8,144,3,209,008,248,106,192,2,48,1,24,144,5
720 ITR152 34,165,32,168,132,252
723 REM ***** FIND Y CO-ORDINATE *****
730 ITR150 1,208,168,0,56,233,8,144,3,232,288,248,282,202,282,202,174,232
733 REM ***** PRINT CURSOR POSITION *****
740 ITR164 164,252,166,252,2,216,205,165,206,119,207
743 REM ** POINT CURSOR UNDER CURSOR **
750 ITR169,156,32,210,255,169,113,32,218,255,76,0,155,-1
753 REM ***** LORD ONE'S *****
760 ITR168,1,165,1,153,288,2,206,192,4,208,13,24,144,243
763 REM ***** CHECK BLOCKS 4-5 10R *****
762 ITR160,2,162,1,185,158,6,201,81,208,16,152,221,199,2,240,3,200,208,240
763 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
764 REM ***** CHECK BOTTOM LINE *****
765 ITR160,2,162,1,185,208,4,201,81,208,16,152,221,199,2,240,3,200,208,240
766 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
767 REM ***** CHECK UPRIGHTS *****
768 ITR160,2,162,1,185,208,3,201,81,208,11,192,32,240,19,189,199,2,168,232
769 ITR209,238,169,6,157,225,2,202,57,229,2,232,208,233
770 ITR160,2,162,1,185,158,6,201,81,208,11,192,32,240,19,189,199,2,168,232
771 ITR208,238,169,6,157,205,2,202,57,205,2,232,208,233
772 REM ***** CHECK BLOCKS 6-10 *****
773 ITR150,2,152,1,185,208,4,201,81,208,16,152,221,199,2,240,3,200,208,240
774 ITR224 0,240,11,232,208,233,169,0,157,211,2,24,144,232
775 REM ***** CHECK BOTTOM LINE *****
776 ITR150,2,152,1,185,158,4,201,81,208,16,152,221,199,2,240,3,200,208,240
777 ITR224 0,240,11,232,208,233,169,0,157,211,2,24,144,232
778 REM ***** CHECK UPRIGHTS *****
779 ITR160,2,162,1,185,240,4,201,81,208,11,192,32,240,19,189,199,2,168,232
780 ITR209,238,169,6,144,1,2,2,202,57,211,2,232,208,233
781 ITR160,2,162,1,185,24,5,201,81,208,11,192,32,240,19,189,199,2,168,232
782 ITR208,238,169,6,157,211,2,202,57,211,2,232,208,233
783 REM ***** CHECK BLOCKS 11-15 *****
784 ITR160,2,162,1,185,64,5,201,81,208,16,152,221,199,2,240,3,200,208,240
785 ITR224 0,240,11,232,208,233,169,0,157,217,2,24,144,232
786 REM ***** CHECK BOTTOM LINE *****
787 ITR160,2,162,1,185,184,5,201,81,208,16,152,221,199,2,240,3,200,208,240
788 ITR224 0,240,11,232,208,233,169,0,157,217,2,24,144,232
789 REM ***** CHECK UPRIGHTS *****
790 ITR160,2,162,1,185,194,3,200,81,208,11,192,32,240,19,189,199,2,168,232
791 ITR209,238,169,6,157,217,2,202,57,217,2,232,208,233
792 ITR160,2,162,1,185,144,5,201,81,208,11,192,32,240,19,189,199,2,168,232
793 ITR208,238,169,6,157,211,2,202,57,211,2,232,208,233
794 REM ***** CHECK BLOCKS 16-20 *****
795 ITR160,2,162,1,185,168,6,201,81,208,16,152,221,199,2,240,3,200,208,240
796 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
797 REM ***** CHECK BOTTOM LINE *****
798 ITR160,2,162,1,185,48,6,201,81,208,16,152,221,199,2,240,3,200,208,240
799 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
800 REM ***** CHECK UPRIGHTS *****
801 ITR160,2,162,1,185,128,6,201,81,208,11,192,32,240,19,189,199,2,168,232
802 ITR209,238,169,6,157,225,2,202,57,225,2,232,208,233
803 ITR160,2,162,1,185,6,6,201,81,208,11,192,32,240,19,189,199,2,168,232
804 ITR208,238,169,6,157,221,2,202,57,221,2,232,208,233
805 REM ***** CHECK BLOCKS 21-25 *****
806 ITR160,2,162,1,185,48,6,201,81,208,16,152,221,199,2,240,3,200,208,240
807 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
808 REM ***** CHECK BOTTOM LINE *****
809 ITR160,2,162,1,185,168,6,201,81,208,16,152,221,199,2,240,3,200,208,240
810 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
811 REM ***** CHECK UPRIGHTS *****
812 ITR160,2,162,1,185,308,6,201,81,208,11,192,32,240,19,189,199,2,168,232
813 ITR209,238,169,6,157,225,2,202,57,229,2,232,208,233
814 ITR160,2,162,1,185,128,4,201,81,208,11,192,32,240,19,189,199,2,168,232
815 ITR208,238,169,6,157,225,2,202,57,225,2,232,208,233
816 REM ***** CHECK BLOCKS 26-30 *****
817 ITR160,2,162,1,185,168,6,201,81,208,16,152,221,199,2,240,3,200,208,240
818 ITR224 0,240,11,232,208,233,169,0,157,225,2,24,144,232
819 REM ***** CHECK BOTTOM LINE *****
820 ITR160,2,162,1,185,352,7,201,81,208,16,152,221,199,2,240,3,200,208,240
821 ITR224 0,240,11,232,208,233,169,0,157,241,2,24,144,232
822 REM ***** CHECK UPRIGHTS *****
823 ITR160,2,162,1,185,208,6,201,81,208,11,192,32,240,19,189,199,2,168,232
824 ITR209,238,169,6,157,233,2,202,57,235,2,232,208,233
825 ITR160,2,162,1,185,248,6,201,81,208,11,192,32,240,19,189,199,2,168,232
826 ITR208,238,169,6,157,233,2,202,57,235,2,232,208,233
827 REM ***** CHECK BLOCKS 31-35 *****
828 ITR160,2,162,1,185,168,7,201,81,208,16,152,221,199,2,240,3,200,208,240
829 ITR224 0,240,11,232,208,233
```

[illegible]



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WHITE LIGHTNING

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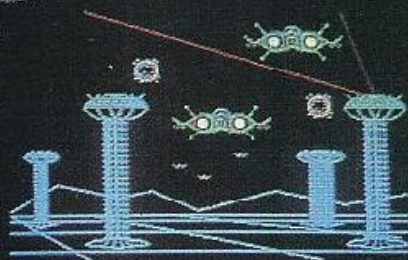
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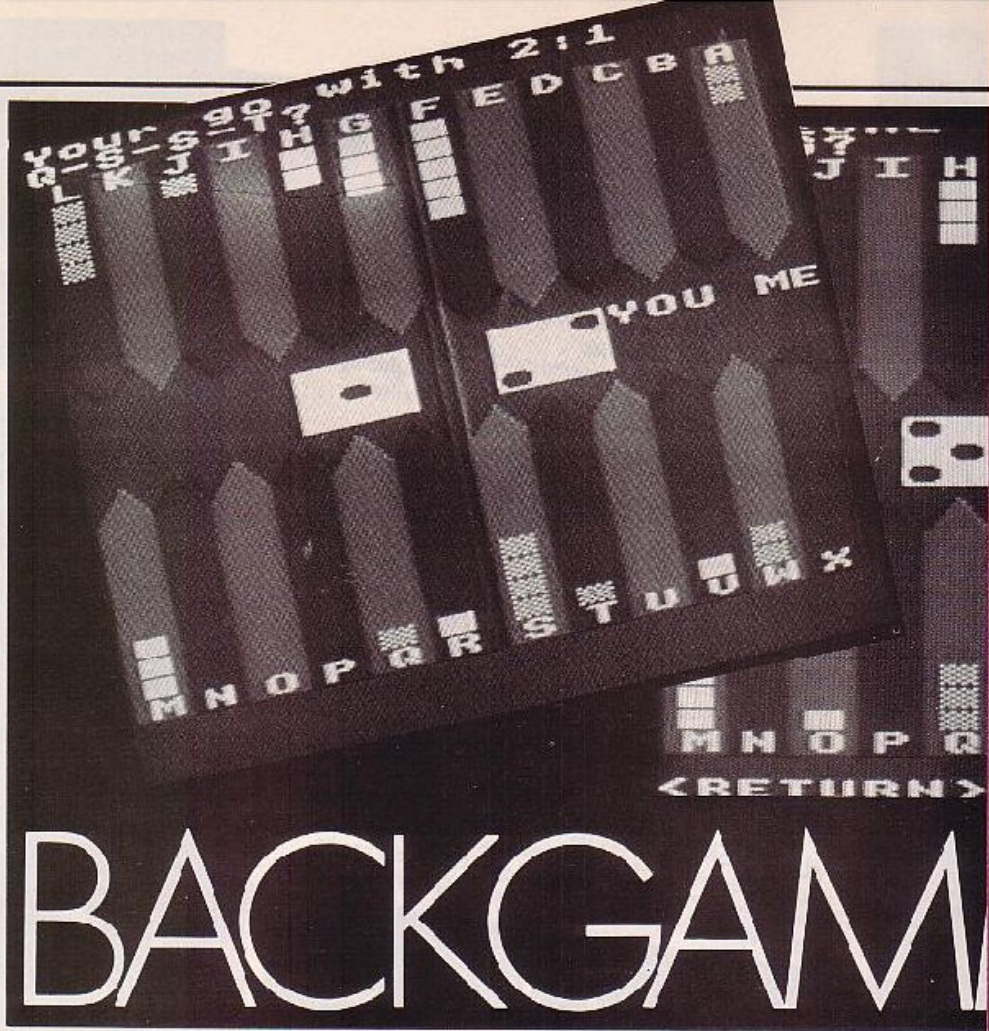


YC9


```

10MODE4:PROCIN
20DIFAX(30),CX(30),EX(30),DX(2),BX(4,
2),E(2),AF(5):PROCC:PROCCG:ME=0:YOU=0:
TV255
30MODE5:PROCCRS:PRINT"BACKGAMMON.":IN
PUT"Game level 1-6":LV:IFLV/6 LV=6
40PROCDI:VDU28,0,31,15,1,12,26:PROCCD:
FORLZ=1TO24:PROCP:NEXT:PROCB:IX=RD(20):
gm=1
50PRULDI:IFDX(1)=0X(2) FULUSD:GOTO5C
6Cdb=1:IFDX(1)DX(2) IX=DX(1):DX(1)=D
X(2):DX(2)=IX:db=-1:GOTO180
70PROCC:PRINT"My co with":DX(1):":
DX(2):PROCBac:PROCC:PRINT"MY MOVES-":FOR
IX=1TOM:IFBX(IX,1)=0ANDBX(IX,2)=0 PRINT
0:0:":GOTO110
80IFEX(IX,1)=25 PRINTCHR$(228):"CHR$(6
4+BX(IX,2))":":GOTO110
90IFEX(IX,2)=0 PRINTCHR$(64+BX(IX,1))
":"CHR$227":":GOTO110
100PRINTCHR$(64+BX(IX,1)):"CHR$(64+BX
(IX,2))":":
110NEXT:PROCCP:PROCR:IFAX(27)=15 X=1:G
OTO250
120gm=1:IFdb>0 PROCC:GOTO170
130IFd=64THEN170ELSEPROCDB:IFA$(<)"D"
THEN170
140PROCCG:PROCC:IF gm=1THEN160
150PROCDR:GOTO330
160db=1:PROCAD:PROCDSD
170PROCDI
180PROCC:PRINT"Your go with":DX(1):":
DX(2):PROCLG:IFgm<1 VDU7:PRINTTAB(0,0
)"ILLEGAL-TRY AGAIN":PROCR:GOTO180
190PROCC:PRINT"YOUR MOVES-":FORIX=1TOM
:IFBX(IX,1)=0ANDBX(IX,2)=0 PRINT"0:0:":
GOTO130
200IFBX(IX,1)=0 PRINTCHR$(228):"CHR$(64
+BX(IX,2))":":GOTO230
210IFBX(IX,2)=25 PRINTCHR$(64+BX(IX,1))
":"CHR$227":":GOTO230
220PRINTCHR$(64+BX(IX,1)):"CHR$(64+BX
(IX,2))":":
230NEXT:PROCCP:IFAX(28)=-15 PROCC:X=0:
GOTO290
240PROCR:PROCC:gm=1:IFdb<0THEN280
250IFd=64THEN280ELSEPROCDB:IFgm=0THEN2
80
260PROCCDI:IFA$(R) X=1:PROCDR:GOTO330
270db=-1:PROCAD:PROCDSD
280PROCDI:GOTO70
290gm=1:JX=19-18X:IFAX(27+X)<0THEN33
0
300gm=2:IFAX(IX)>0 gm=3:GOTO330
310FORIX=JX TOJX+5:IFAX(IX)<0 gm=3
320NEXT
330CLS:Y=gm+5:IFX=1 PRINT"I":ME=ME+Y:
GOTO350
340PRINT"YOU":YOU=YOU+Y
350PRINT"ve won":Y="un":IFY>1 PR
INT"s."
360IFgm=2 PRINT"(GAMMON)"
370IFgm=3 PRINT"(BACKGAMMON)"
380PRINT"MY moves":ME:PRINT"Your sco
re":YOU:"Do you want another?"game(Y/
N)?":PROCCyn:CLS:GOTO30
390DEFPROC
400gm=3:PROCR:IFLX<0THEN420
410IFAX(29)+AX(A)<(3LX+220)/40 gm=1:G
OTO430
420PROCR:IFPX<QX+2 gm=1
430ENDPROC
440DEFPROCRT
450PX=0:QX=0:FORIX=1TO24:FAZ(IX)>0 PX
=PX+AX(IX)*INT((IX-1)/4+1)
460IFAX(IX)<0 QX=QX-AX(IX)*INT((24-IX)
/4+1)
470NEXT:PX=PX+AX(F)*7:QX=QX-AX(26)*7
480ENDPROC
490UL:PHULCBUB
500C=1:KX=0:E(1)=KX:E(2)=KX:C=C:IFCX(
26)<0 JX=2
510FORIX=1TO24:IFCX(IX)<0 JX=2
520IFCX(IX)<0 C=1:GOTO570
530IFJX=2 KX=1
540IFCX(IX)=1 C=1:GOTO570
550E=h+S-1X:IF(E(1)-(E+h) E=1
560E(JX)=E(JX)+E(C)=C+.5
570NEXT:B=E(2)+AX(A)-CX(A)+.01*(CX(27)
-AX(27)):IFKX<0 B=B+px+E(1)+kw
580IFB<G THEN640
590E(1)=X:E(2)=Y:FORIX=1TOp1:IFCX(IX)<
0 THEN630
600FDRS=1TO2:LX=IX-5*(5-1):FORJX=1TO6:
KX=X-JX:IFKX<0 KX=-S:JX=6-S:GOTO620
610IFCX(KX)<0 B=B-E(S)*(F-IX)
620NEXT:NEXT:IFKX<0 IFCX(26)<0 B=B-E(-
KX)*(F-IX)
630NEXT
640ENDPROC
650DEFPROCGLX=-AX(A):IFLX>AX(29) LX=
AX(29)
660ENDPROC
670DEFPROCDB:gm=0:PROCRG:IFLX>99THEN77
0
680JX=1:IFAX(28)<0 JX=100
690IFLX<0THEN720
700N=-AX(29)-AX(A):IF(N<(3LX+100)/40)
-(N>35J2) THEN770
710GOTO730
720PRUCR:IN=GX-PX:IF(N/2)-(N/16+JX)THE
N770
730FORIX=1TO7:JX=F-IX:FAZ(JX)>0 JX=IX
:IX=7
740NEX:IFJX>7 gm=1:GOTO770

```



```

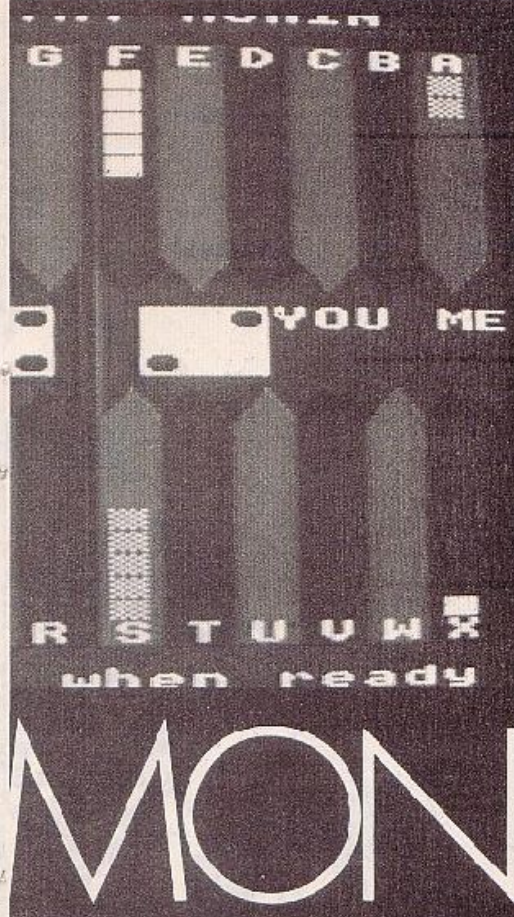
750KX=0:FORIX=JX TO12:JX=F-IX:IFAX(JX)
<-1 KX=KX+1
760NEX:IFKX<4 gm=1
770ENDPROC
780DEFPROCBB:MI=1:N=0:R=1:U=0:G=-999:
FORIX=1TO3:EX(IX)=L:NEXT:ol=18:h=5:px=.2
5:kw=U:IX=DX(1)+DX(2):IFDX(1)=DI(2) IX=I
X+2
790IX=IX-AX(25)-AX(A):IF IX<3+AX(29)+
380)/40THEN810
800kw=-999:pl=13:h=1:px=1
810PROCBac:IFN:MI THEN850
820U=U+1:IF(U/15)*(N=N) THEN850
830PROCBac:IF(B=-G)*(N=MI) THEN810
840G=B:MI=N:FORIX=1TOM:EX(IX)=BX(IX,1)
:EX(IX,2)=BX(IX,2):NEXT:GOTO810
850FORIX=1TOM:BX(IX,1)=EX(IX):BX(IX,2)
=-EX(IX,2):NEXT
860FORIX=1TOA:EX(IX)=AX(IX):NEXT:CF=1:
FORIX=1TOM:A1=BX(IX,1):A2=BX(IX,2):PROCH
:NEXT:FORIX=1TOA:AX(IX)=CX(IX):NEXT
870ENDPROC
880DEFPROCBCB:IFN:0THEN1100
890R=1
900N=1:QX=24:FORIX=1TOA:EX(IX)=AX(IX):
NEXT
910SI=0:IT=DX(R):IFN<0: IT=DX(3-R)
920IFCX(F)=0THEN950
930KX=F-1:IFCX(KX)<-1THEN1100
940BX(N,1)=F:BX(N,2)=KX:GOTO1080
950PX=0:FORJX=SI TO1STP-1:DX(JX)=IFCX(
JX):=0THEN980
960KX=JX-1:IFKX<0 PX=-JX:1:GOTO980
970IFCX(KX)>=1 PX=2:JX=1
980NEXT
990IFPX=0THEN1100
1000IFPX=1THEN1020
1010BX(N,1)=QX:BX(N,2)=KX:GOTO1080
1020IFKX<0 KX=7
1030IFKX<0 KX=QX+1
1040PX=0:FORIX=KX TO24:IFCX(IX)>0 PX=1:
IX=24
1050NEXT
1060IFPX=1THEN1100
1070BX(N,1)=QX:BX(N,2)=0
1080A1=BX(N,1):A2=BX(N,2):KF=1:PROCH:IF
N=N THEN1230
1090N=N+1:GOTO910
1100IFN>M1 THEN1220
1110IFN=1THEN1190
1120N=N-1
1130IFBX(N,1)=F THEN1190
1140IFBX(N,2)=0THEN1110
1150SI=BX(N,1)-1:IFSI<0THEN1110
1160FORIX=1TOA:EX(IX)=AX(IX):NEXT:IT=BX
(R):IFN<0: IT=DX(3-R)
1170KX=N-1:IFKX=0THEN950
1180KF=1:FORIX=1TOKX:A1=BX(IX,1):A2=BX(
IX,2):PROCH:NEXT:GOTO950

```

```

1190IF(M=4)-(R=2)THEN1210
1200R=2:GOTO900
1210N=1
1220FORIX=N TOM:BX(IX,1)=0:BX(IX,2)=0:N
EXT:N=N+1
1230ENDPROC
1240DEFPROCMI:IFA1=A2 THEN1320
1250LX=(G9-KP)/2:GX(LX)-CX(LX)+A2-A1:1"
A1=0 CX(26)=CX(26)+1:GOTO1290
1260IFA1=F CX(F)=CX(F)-1:GOTO1280
1270CX(A1)=CX(A1)-KP
1280IFA2=0 CX(27)=CX(27)+1:GOTO1320
1290IFA2=F CX(28)=CX(28)-1:GOTO1320
1300IFCX(A2)<-KP CX(A2)=CX(A2)+KP:GOTO
1320
1310CX(A2)=KP:LX=55-LX:GX(LX)=CX(LX)-KP
:LX=4+LX:GX(LX)=CX(LX)-A2:IFLX=25 CX(LX)
=GX(LX)+F
1320ENDPROC
1330DEFPROCGL:FCRIZ=1TOM:BX(IX,1)=0:BX(
IX,2)=0:NEXT
1340B$=""
1350F=FX,1
1360PROCGT:FX=0
1370IFASC(A$)=13 VDJ26:GOTO1450
1380IFASC(A$)=127 PRINTL$ "L$":A$=""
":GOTO1460
1390IZ=ASC(A$)-64:IFIZ=75 IZ=25:A$=CHR$
227
1400IFIZ=74 IX=CX(A$)=CHR$228
1410IF(IX-1)*(IX/24) 75=STR$(IX):GOTO143
0
1420Z$=""
1430B$=B$+Z$
1440PRINTA$:GOTO1350
1450PRINT:GOTO1510
1460B=LEN(B$):IFRIGHT$(B$,1)="-" E=LEN(B$)
-1:GOTO1480
1470IF(IX)? B=LEN(B$)-2ELBEB=LEN(B$)-1
1480IFB<0 PRINTTAB(0,1)A$:GOTO1340
1490IFB<1THEN1350
1500B$=LEFT$(B$,B):GOTO1440
1510B=LEN(B$):KX=0:ZX=0:FORIX=1TOM:-UKJ
X=1TO2
1520KX=KX-1:IFKX>B IX=M:JX=2:GOTO1570
1530A$=MID$(E$,KX,1):IFA$(<)"-":THEN1560
1540IFLX=1THEN1570
1550LX=1:GOTO1570
1560BX(IX,JX)=BX(IX,JX)+10+VALA$:LX=0:G
OTO1520
1570NEXT:NEXT:gm=0:FORIX=1TOA:EX(IX)=AX
(IX):NEXT:E(1)=DX(1):E(2)=BX(2):FORIX=1T
OM:MI=BX(IX,1):M2=BX(IX,2):IFM1<M2 THEN
1720
1580IFIX<1THEN1630
1590KX=DX(1):PROCC:IFgm=0THEN1970
1600IFLX=1CX(2)THEN1680
1610KX=DX(2):PROCC:IFgm=1THEN1680
1620GOTO1970

```

BACKGAMMON ENABLES the user to play against the computer and instructions are included within the program. Briefly, the program plays the traditional rules of backgammon, including the use of a doubling cube. The points are labelled alphabetically from A to X. The dice are shown graphically as is whether the player or the computer has the doubling cube.

Moves are made by entering two pairs of information comprising the point from which a piece is to be moved and the destination point for each dice.

For example, a six and three are thrown. To move a piece six places from the C point and a piece three pieces from the F point type C:1 F:1. To move the piece the full nine places of the throw type C:1 I:1. To return from the bar use the down arrow key as the point references. To bear off use the up arrow key as the destination.

The player must use both throws of the dice if at all possible. If this is not possible simply press Return after entering the move possible — if any can be made.

The program checks for legal moves and will not allow the player to cheat. The computer plays a strong game and on the lower levels will enable the novice to become familiar with backgammon. On the higher levels it presents a challenge for even the experienced player.

The program itself is written in compressed form.

```
1630K=DZ(3-JZ):PROCC: IFgm=0 THEN1970
1640IFDZ(3-JZ) > DZ(JZ) THEN1670
1650K=DZ(JZ):FORLZ=1TOA:EX(LZ)-CX(LZ):
CX(LZ)=AX(LZ):NEXT:PROCC:FORLZ=1TOA:CX(
LZ)=EX(LZ):NEXT: IFgm=1 THEN1980
1660GOTO1970
1670IFIX=1 THEN1980
1680gm=0:JZ=IX+1:R=0:FORKX=JZ TOH: IFBZ(
KX,1) < BZ(KX,2) R=1:KX=H
1690NEXT
1700IFR=1 THEN1970
1710GOTO1980
1720IF(M1<0)-(M2<24) THEN1970
1730IF(M2<1)-(M2<F) THEN1970
1740IFM1<0 THEN1800
1750IFCZ(26) > 0 THEN1970
1760JZ=0:FORKX=1TO2: IFM2=DZ(KX) JZ=KX
1770NEXT: IFJZ=0 THEN1970
1780KX=CZ(M2): IFKX=1 THEN1970
1790GOTO1950
1800IF(CZ(26)<0)-(CZ(M1) > 0) THEN1970
1810IFM2=F THEN1860
1820JZ=CZ(M2): IFJZ=1 THEN1970
1830KX=M2-R: IFR=0: JZ=1: GOTO1950
1840IFR=0: JZ=2: GOTO1950
1850GOTO1970
1860R=-M1: S=0:FORKX=1TO2: JZ=3-KX: IFKX=
CX(JZ) S=1:KX=2
1870NEXT
1880IF S=0 THEN1970
1890FORKX=1TO18: IFCZ(KX) < 0 S=0:KX=18
1900NEXT
1910IF S=0 THEN1970
1920IFR=0: JZ=1: THEN1950
1930KX=M1-1:FORLZ=1TOX: IFC1(LZ) < 0 S=0
LZ=X
1940NEXT: IF S=0 THEN1970
1950A1=M1: A2=M2: KP=1: PROCC: IFM=2 DZ(JZ)
=0
1960GOTO1990
1970gm=2
1980IX=H
1990NEXT
2000IFgm=2 DZ(1)=E(1): DZ(2)=E(2): GOTO20
2010gm=1:FORLZ=1TOA:AX(LZ)=CX(LZ): NEXT
2020ENDPROC
2030DEFFPROCC: gm=0: IFCZ(26) =0 THEN2060
2040IFCZ(KX) < 2 THEN2180
2050JZ=U2160
2060S=0:FORLZ=1TO24: IFCZ(LZ) > 0 THEN2090
2070KP=LZ-KX: IFKP>24 S=LZ: LZ=24: GOTO209
0
2080IFCZ(KX) < 1 S=-1: LZ=24
2090NEXT
2100IF S=0 THEN2160
2110IF S=-1 THEN2180
2120IFKP=F KP=18
2130IFKP=F KP=5=1
```

```
2140S=0:FORLZ=1TOKP: IFEX(LZ) < 0 S=1: LZ=X
F
2150NEXT: IF S=0 THEN2160
2160gm=1
2170ENDPROC
2180DEFFPROCC:
2190IF(LZ=0) (LZ=F) THEN2320
2200VLU=30: JZ=AX(LZ): FX=ABS(JZ)
2210IFLZ>12 DZ=295: AX=(LZ-12)*100-60:
MOVEAX,DZ: GOTO2230
2220DZ=793: AX=(LZ-LX)*100-60: MOVEAX,D
Z
2230IF(LZ>18)-(LZ<7): AX=AX+20: MOVEAX,DZ
2240FORKX=1TO1STEP-1: IFPKX PROCC: PRI
NITS: GULLO,0: DZ=DZ+32: MOVEAX,DZ: GOTO2300
2250IF(JZ=KX) * (KX<5) PROCC: PRINTS: MC
VEAX,DZ: GULLO,3: PRINTM: DZ=DZ+32: MOVEAX,D
Z: GOTO2300
2260IF(JZ=KX) * (KX<5) PROCC: PRINTS: M
OVEAX,DZ: GULLO,3: PRINTM: DZ=DZ+32: MOVEAX,D
Z: GOTO2300
2270IFJZ=KX PROCC: PRINTS: MOVEAX,DZ: GULLO,3:
PRINTM: DZ=DZ+32: MOVEAX,DZ: GOTO2300
2280IFJZ=KX PROCC: PRINTS: MOVEAX,DZ: GULLO,3:
PRINTM: DZ=DZ+32: MOVEAX,DZ: GOTO2300
2290FORCC: PRINTS: MOVEAX,DZ: GULLO,3: PR
INT: GHTS(STR$(PZ),1: DZ=DZ+32: MOVEAX,DZ
2300IFLZ>12 DZ=DZ-64: MOVEAX,DZ
2310NEXT: VDU4,23,1,0,0,0,0
2320ENDPROC
2330DEFFPROCCMP: FORLZ=1TOX: LZ=BX(LZ,1: PR
OCC: PROCC: LZ=AX(LZ,2): PROCC: PROCC: NEXT
LZ: ENDPROC
2340DEFFPROCCB: PRINTTAB(0,17): PZ=7-INT(A
Z(F)/2): JZ=PX+AX(F): R=7-INT(-AX(26)/2):
X-R=AX(26): PRINTUS " "STR$(6,L4):
FORLZ=1TO15: IF(LZ>PZ) * (LZ<JZ) PRINTUS#
DZ:
2350IF(LZ>R) * (LZ=KX) PRINTUS#DZ:
2360NEXT: PRINTD#
2370ENDPROC
2380DEFFPROCCAD: PROCC: PRINTTAB(0,0) "DOUB
LE ACCEPTED": ENDPROC
2390DEFFPROCCSD: D=D+1: A=RIGHT$(STR$(D),
DI): PRINTTAB(15,15) " ": IFD=0 PRINTTAB(
15,15)A#
2400PRINTTAB(15,15) " ": IFD=0 PRINTTAB
(15,15)A#
2410PROCC: PROCC
2420ENDPROC
2430DEFFPROCCBDC
2440PROCC: VDU7: PRINT "HIT <D> TO DOUBLE"
ELSE HIT <RETURN>": A=GET$: PROCC: IFA#
="D" ENDPROC
2450IFASC(A#)=13 PROCC: ENDPROC
2460GOTO2440
2470DEFFPROCCD
```

```
2490PROCC: VDU7: PRINT "DOUBLE? <A> - <R>
refuse": A=GET$: IFA#<"A" AND A#<"R" TH
EN2480
2490PROCC: VDU26
2500ENDPROC
2510DEFFPROCC: CLS: PRINT "Double refused.
": gm=1: ENDPROC
2520DEFFPROCC: LOCAL PZ,QZ,T,Z
2530PZ=0: QZ=0: RND(6): T=TIME
2540IF TIME-200 THEN2560
2550PZ=PZ+1: IFPZ>6 PZ=1
2560QZ=QZ+1: IFQZ>6 QZ=1
2570FORZ=1TO150: NEXT
2580PRINTC$(PZ)STR$(2,R#)+STR$(
2,U#)A#(QZ): IF TIME-T<350 THEN2540
2590DZ(1)=QZ: DZ(2)=PZ: IFDZ(1)=CX(2) M=4
: GOTO2620
2600M=2: IFDZ(2)<DZ(1) THEN2620
2610IFgm=0 IX=DZ(1): DX(1)=DZ(2): DX(2)=1
Z
2620ENDPROC
2630DEFFPROCC: LV=LV+(LV+2): A=30: d=1: db=0
: X=7/18: Y=1/5: FORLZ=1TOA: AX(LZ)=0: NEXT: A
Z(29)=167: AX(A)=167: F=75: AX(1)=75: AX(17)
=-5: AX(17)=3: AX(17)=5: AX(24)=2: AX(13)
=5: AX(8)=3: AX(6)=5: ENDPROC
2640DEFFPROCC: VDU19,1,4,0,15,2,4,0:
2650col=1: GULLO,129: MOVE20,860: FORLZ=X-20
TO50STEP100: MOVELZ+100,960: PLOTB7,LZ,65
0: PLOTB7,LZ+100,650: PLOTB7,LZ+50,600: MOV
ELZ+100,960: IFcol=1 col=0: GULLO,130ELSEcol=
1: GULLO,129
2660NEXT: MOVE640,950: FORLZ=640TO1140STE
P100: MOVELZ+100,960: PLOTB7,LZ,650: PLOTB7
,LZ+100,650: PLOTB7,LZ+50,600: MOVELZ+100,
960: IFcol=1 col=0: GULLO,130ELSEcol=1: GULLO,
129
2670NEXT: col=0: GULLO,130: MOVE20,100: FOR
LZ=20TO50STEP100: MOVELZ+100,100: PLOTB7,
LZ,410: PLOTB7,LZ+100,410: PLOTB7,LZ+50,46
0: MOVELZ+100,100: IFcol=1 col=0: GULLO,130
ELSEcol=1: GULLO,129
2680NEXT: MOVE640,130: FORLZ=640TO1140STE
P100: MOVELZ+100,100: PLOTB7,LZ,410: PLOTB7
,LZ+100,410: PLOTB7,LZ+50,460: MOVELZ+100,
100: IFcol=1 col=0: GULLO,130ELSEcol=1: GULLO,
129
2690NEXT: VDU19,1,1,0,17,2,5,0: GULLO,12
9: MOVE20,100: PLOTB7,620,960: GULLO,130: MO
VE640,100: PLOTB7,640,960: VDU5: GULLO,3: MO
VE40,955: T2=12: FORLZ=40TO540STEP100: MOVE
LZ,955: PRINTCHR$(T2+64): T2=T2-1: NEXT: MO
VE640,955
2700FORLZ=660TO1160STEP100: MOVELZ,955: P
RINTCHR$(T2+64): T2=T2-1: NEXT: MOVE40,130
: T2=13: FORLZ=40TO540STEP100: MOVELZ,130: P
RINTCHR$(T2+64): T2=T2-1: NEXT
2710MOVE660,130: FORLZ=660TO1160STEP100:
MOVELZ,130: PRINTCHR$(T2+64): T2=T2-1: NEX
T: VDU4,23,1,0,0,0,0
2720PRINTTAB(14,14) "YOU ME"
2730DEFFPROCC: L$=CHR$(3): R$=CHR$(5): U$=CHR$(
11): D$=CHR$(10): C$=CHR$(30): STRINGS$(14,D$)+S
TRINGS$(5,R$): S$=CHR$(225): F$=D$+STRINGS$(3,L
$): T$=CHR$(230): Y$=CHR$(231)
2740R$=STRINGS$(3,CHR$(225)): R1$=CHR$(225)+
STRINGS$(2,CHR$(225)): R2$=CHR$(225)+CHR$(226)+
CHR$(225): R3$=STRINGS$(2,CHR$(225))+CHR$(226)+
CHR$(226)+CHR$(225)+CHR$(226)
2750A$=(1:R0$=F$+R2$+F$+R0$: A$=(2:R3$=F$
+R0$+F$+R1$: A$=(3:R3$=F$+R2$+F$+R1$: A$=(
4:R4$=F$+R0$+F$+R4$: A$=(5:R4$=F$+R2$+F$
+R4$: A$=(6:R4$=F$+R4$+F$+R4$
2760ENDPROC
2770DEFFPROCC: VDU25,235,255,255,255,255
,255,255,255,255,23,225,255,195,129,129,
129,129,195,255,23,230,0,254,254,254,254
,254,254,254,23,231,0,170,84,170,84,170,
84,170,23,227,16,56,124,254,56,56,56,56,
23,228,56,56,56,56,254,124,56,16
2780ENDPROC
2790DEFFPROCC:
2800A$=GET$: IFA#<"Y" AND A#<"N" THEN2810
2810IFA#="Y" ENDPROC ELSECLS: END
2820DEFFPROCC: VDU28,0,1,19,0,12,26: ENDPR
OC
2830DEFFPROCC: VDU28,0,31,19,24,12: ENDPR
OC
2840DEFFPROCC: PRINT " "?L$: A$=GET$: ENDPR
OC
2850DEFFPROCC: PROCC: VDU7: PRINT "<RETURN>
when ready": A$=GET$: PROCC: VDU26: ENDPROC
2860DEFFPROCC: VDU23,1,0,0,0,0,19,2,5,0
:19,3,7,0:19,0,4,0: ENDPROC
2870ENDPROC
2880DEFFPROCC: IFLZMOD2=0 GULLO,1ELSEGULLO,2
2890ENDPROC
2900DEFFPROCC: VDU19,0,4,0: PRINT "BACKG
AMMON. This version of the game plays
the standard rules of Backgammon in
cluding the use of a doubling cube whic
h you can read about in any good book on
the game."
2910PRINT "MOVEMENT. Points are la
bed alphabetically. To move from point
A to 3 and from 3 to A, type A-B-G-U. T
o return from the bar, press the down c
ursor key, and the up key to bear off.
If you are unable to"
2920PRINT "use all your throw, press ret
urn after you have used that part which
you can. The Computer plays a fair
game, so if you are a novice start on t
he lower levels of play." "PRESS SPAC
E TO START": A$=GET$: ENDPROC
```


MAKER



ALL BEGINNERS at computers learn to program using Basic; this is fine since it is easy to learn and easy to use. However, its real disadvantage is that it is usually slow in comparison to machine code. This means that if any fast moving graphics are required in the program then they will have to scrap the idea, or use my program which equips the ZX-81 16K with sprite Basic.

The sprite Basic can handle up to 256 sprites which can be at three levels:

- Underneath the characters
- Same level as the characters
- Over the characters.

Also when the sprite hits the edge of the screen it can either stop, bounce or wrap-round. If this sounds like what you want then roll up your sleeves and begin the hard work. First, type in

1 REM (118 characters)

followed by lines 2 to 9 which have a Rem statement containing 128 characters. Now enter:

```
POKE 16509,0
POKE 16510,0
POKE 16511,168
POKE 16512,4
POKE 16514,118
POKE 16515,118
```

You have now produced a Rem statement with 1190 characters, and when listed should appear as 0 Rem. If not then begin again. Type in the hex loader — listing 3 — and enter all the machine code in listing 1.

Now delete the loader and add the lines in listing 2. The complete sprite Basic has been entered. It should now be saved under an appropriate name.

In order to test the program I must explain what the sprite commands are, how to use them and their syntax. The first and longest is **Sprite**: it takes the form:

LET Z=USR SPRITE

PRINT number; on or off; velocity; flag\$; xcoord; ycoord; xmove; char\$

Number: this is the sprite number. Range: 0 to 255.

On or Off: this is either 1 for on or 0 for off.

Velocity: this is not really the true velocity but it is the number of times the Move command is called before the sprite moves.

N.B. if velocity is zero the sprite will move with a velocity of 256. Range of velocity is 0 to 255

Flag\$: this is a string which is seven characters long and consists of 0s or 1s eg., "0010110" "0010111"

This tells the computer what level the sprite is at and what it does at the edge of the screen.

If the seventh character is 1 then the sprite wraps around.

If the sixth character is 1 then the sprite bounces.

If the sixth and seventh character is a 0 then it stops at the edge of the screen; if they are both 1s then it will wrap-round.

Now let us consider the fourth and fifth characters.

If the fifth is 1 it goes under the characters. If the fourth is 1 it goes over the characters, but if they are both 0s then it travels at the same level as the characters on screen.

The third character is not used by the sprite Basic.

The second character is only used if the sprite is at the same level as the characters on the screen. If this is 1 when a sprite collides with some character on screen then it continues but if it is 0 the sprite will stop.

Finally if the first character is 1 it will remain stationary or if 0 it allows the sprite to move normally.

Xcoord: this is the initial x co-ordinate.

Ycoord: this is the initial y co-ordinate also 24 lines of screen are used.

Xmove: this is the distance the sprite will move horizontally.

Y move: same as xmove except vertically.

Char\$: this is a string four characters long which contains the characters that go to make up the sprite as follows:

```
1 2
3 4
```

(continued on next page)

```
280 LET F#(1)="0000101"
290 LET F#(2)="0000110"
300 LET Z=USR SPRITE
310 PRINT C;1;1;F#(INT (RND*2)+
1);15;12;RND*3;RND*3;A$(INT (RND
#4)+1)
320 LET C=C+1
330 IF C=245 THEN GOTO 380
340 POKE NUM,C+1
350 PRINT AT 0,0;C
360 LET Z=USR MOVE
370 IF INKEY#="" THEN GOTO 350
380 GOTO 300
390 CLS
```

```
400 PRINT AT 10,0;"NOW FOR SOME
REAL SPEED"
410 FOR F=1 TO 100
420 NEXT F
430 POKE NUM,3
440 LET Z=USR INIT
450 STOP
1000 FOR F=0 TO 3
1010 LET Z=USR SPRITE
1020 PRINT F;1;F+1;F#;RND*32;RND
#24;RND*3;RND*3;A$(F+1)
1030 NEXT F
1040 RETURN
```




(continued from previous page)

The number represents where that character is in the string, this also means that all sprites are 2'x 2.

Note this command can be abbreviated to

LET Z = USR SPRITE

PRINT number, on or off

in order to switch sprites on or off only. This is the only possible abbreviation.

The second command is Move and takes the form:

LET Z = USR MOVE

This calls the sprite moving routine which moves sprite 0 to whatever number specified by NUM command (see next command)

Num takes the form:

POKE NUM, number of sprites + 1

Therefore to have no sprites POKE NUM, 1

Flag takes the form:

LET Z = USR FLAG

PRINT number of sprite

This puts either 0, 1, 2 or 3 into Z, depending on the condition of the sprite.

If Z=0 then the sprite has hit nothing and is

allowed to move

Z=1 sprite has stopped ie. if it is at the same level as characters then it has hit a character over and under sprites won't affect this flag simply because they will either go over or under the characters and can't hit them.

Z=2 sprite has collided; if it is at a same level sprite and it collides with a character on the screen then Z=2, or if the sprite has stopped at the edge then Z=2 but the 'stopped' flag is not set.

Z=3 sprite has stopped and collided; see Z=1 and Z=2

Coord takes the form:

LET Z = USR COORD

PRINT number of sprite

This returns with Z equal to ycoordinate + 256 * xcoordinate and

PEEK 16507 = ycoordinate

PEEK 16508 = xcoordinate

of the sprite defined in the Print statement.

Motion takes the form:

LET Z = USR MOTION

PRINT number of sprite

This is the same as Coord except that the x and y movements are found.

Init takes the form:

LET Z = USR INIT

This allows the Move routine to be interrupt driven. So you could run a program and when it has finished sprites can still be moving around. However the drawback is that only two sprites can be used, any more causes the screen to jump.

This command is turned off by the following commands:

FAST, SLOW, LPRINT, LLIST, COPY, LOAD, SAVE, DATA (new command) or when entering a program line.

Data takes the form:

RAND USR DATA

PRINT number of sprites

The data for the sprites is stored in a Rem statement after the machine code and 16 bytes is required for each sprite and two 'Newline' characters at the start to blank out the data. So to do this you use this command which produces enough bytes for the number of sprites in the Print statement.

REPORT CODES

T: no line after command which requires PRINT statement

W: flagS not correct length

U: charS not correct length

C: data missing in PRINT statement

One other thing is that if an 'over' sprite passes over another sprite it may leave part or all of that sprite behind but usually when it runs over anything it will not do this, but some very good 3-D effects can now be easily created.

Any commands which require a Print statement after them will change this Print to a Rem so if you edit the line with a Rem then this Rem must be converted back to a Print.

You can now test the program by entering some commands for yourself or type in the demonstration program. This program begins with four sprites bouncing around, now hit a key and they will wrap-round. Hit a key again and a sprite begins moving randomly, now every time a key is hit another sprite is added, the number of sprites on the screen is shown at the top left-hand corner of the screen. If the 0 key is pressed then the program ends but leaves two sprites moving around.

If a crash does occur reload the saved program and type in listing 4 and run it checking the output with listing 1.

If you have keyboarditis and don't feel up to keying in this program then I will send you a cassette with SP.BASIC and the demonstration program for £3. Malachy Devlin 50 Ruskey Road, Cookstown, Co. Tyrone, BT80 0AH.

Listing 3.

```

99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N; " = ";
170 INPUT A$
180 PRINT A$; " = ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=CODE A$(K)+256*CODE A$(K+1)
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=T THEN GO TO 310
290 PRINT "ERROR - PLEASE INPUT AGAIN"
300 GO TO 150
310 NEXT N

```


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DOES TRANSCENDENTAL meditation produce the effects that are claimed for it? The HULK, a program for Bayesian analysis on the BBC microcomputer, can't give you a definitive answer to that question, but it can, as the name implies, Help Uncover Latent Knowledge.

The HULK is a set of three programs, one editor, and three demonstration files supplied on tape. The programs in the suite can be used for many different applications. If you can measure a number of things about a series

of objects then the HULK can be used to classify the objects and make predictions about a related group of objects.

Transcendental meditation is described as a state of silent awareness devoid of any thought process. Large claims have been made for the techniques of transcendental meditation in terms of a reduction of stress, improvement in psychological and physical agility tests, and changes in the subject's electro-cardiogram.

Papers have been published in very respectable journals such as *Scientific American* (vol.

226, 1972, pp 84-90) and the *Lancet* (no.7651, 1970, p833) describing various aspects of the physiological changes that are said to occur during transcendental meditation.

The data shown in table 1 relates to the blood pressure of a number of subjects before, during, and after transcendental meditation. It has been taken from a PhD thesis by Dr. R. K. Wallace from the University of California at Los Angeles. Data files for analysis by programs in the HULK suite are typed into the BBC micro like any Basic program but must be structured to a format described in the HULK User Guide.

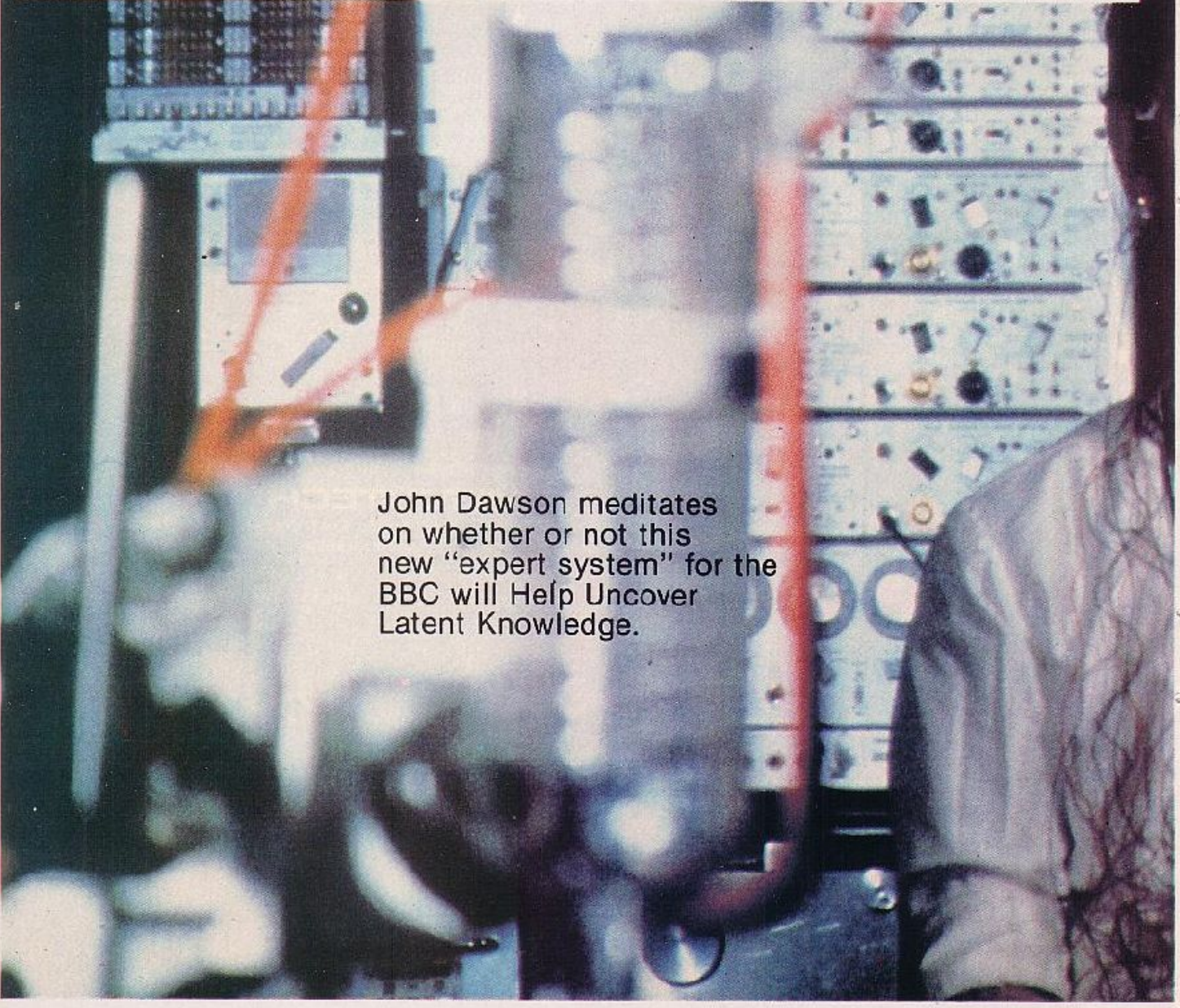
Unlike the data for the subject's heart rate the blood pressure data showed no significant decrease during the meditation phase. Indeed, it is difficult to draw any conclusions from the information in table 1. For the purposes of experimenting with the programs, however, I typed in four sets of data, one of which showed highly significant results — heart rate.

Three of the sets had seven variables, that is the elapsed time during the experiment and the number of samples, the subjects, varied in each set. One set of data stopped before the final 70 minute reading, consequently there

Table 1.

Minutes Subject	Mean Blood Pressure						
	Pre.		Meditation			Post.	
	10	20	30	40	50	60	70
13	70.0	67.5	62.5	62.5	65.0	67.5	65.0
2	78.0	78.0	73.0	75.5	78.0	79.5	30.0
21	76.0	74.0	71.5	76.0	76.0	77.0	79.0
6	90.0	90.0	87.5	90.0	91.0	91.0	97.6
14	70.0	72.5	72.5	72.5	67.5	67.5	70.0
Mean	76.8	76.4	73.4	75.3	75.5	76.5	76.3
S.E.	3.7	3.8	4.0	4.4	4.6	4.4	4.0
N	5	5	5	5	5	5	5

$p = <0.000$



John Dawson meditates on whether or not this new "expert system" for the BBC will Help Uncover Latent Knowledge.

HULK

are only six variables in this set.

PRESCAN is a HULK program that asks you for a hypothesis — an idea about the data in the sample that you think might be true — and then carries out a rough analysis on the basis of your hypothesis. From this program you can get some idea as to the variables that can be usefully incorporated into rules to refine or improve your hypothesis.

The success/failure tables show how the hypothesis is linked to each variable. In this run the hypothesis was successful when nine samples were analysed and the each variable is then analysed by successful or failed samples.

A potentially valuable variable for the rule building process using LOOK is identified with two stars — as it happened there were none in this run.

LOOK is the first of the two major programs in the HULK. LOOK helps you to build a rule set to improve the discrimination that you have decided on in the hypothesis. In table 2, for example, a small set of rules — TMR — has been created to support the

hypothesis that the average value of the variable being measured — blood pressure, heart rate and so on — is lower during the period of transcendental meditation than it is afterwards:

$$(tm30 + tm40)/2 < pc60$$

Using LOOK I found that both rule 1 ($tm30 < pc20$ — a drop in the measured parameter, heart rate, for example, would be expected after the subject had started to meditate) and rule 2 ($tm50 < pc60$ — a rise in heart rate would be expected after meditation had stopped) helped to improve the success rate of the original hypothesis on the heart rate data.

Table 3 shows how LEAP, the second major component of the HULK suite, can apply a hypothesis and a set of rules to a data file. I repeated the LEAP program run for the other three sets of data and the results are printed without the rules. The second part of table 3 shows the application of a second set of rules to the same blood pressure data.

Several points emerge from the tables. First, you need to be fairly statistically literate to make the best use of the results generated by

(continued on next page)





(continued from previous page)

LEAP. Unlike Tim de Dombal's program for helping to identify the cause of abdominal pain which produces a bar chart of the probability of various conditions, the HULK has no graphics capability.

However, the program can be modified for your own purposes; this is one of the most attractive features of the HULK programs.

Second, you need to understand the problem when you start to formulate your hypothesis, and you must be able to express yourself in logical and mathematical terms using the BBC microcomputer's arithmetic, comparator and logical operators.

"Proper" expert systems are said to have a number of features in common. Among them are:

- An expert system should be able to acquire greater competency as rules are added to the system. Conversely, the absence of a rule should leave a gap in the system's capability.

- An expert system should have an English-language dialogue and some provision for help.

- An expert system should be able to explain: why a fact is necessary in a line of reasoning and how an answer was generated.

- Expert systems should be capable of learning from experience.

- Expert systems should be able to provide answers in conditions of uncertainty and should be capable of probabilistic reasoning.

(adapted from *Byte* magazine May 1984 p. 152)

Clearly the HULK scores more on some of these items than on others. The user's dialogue with the program is entirely logical and statistical with the exception of the starred ratings for "correctness" or usefulness of a variable.

Improving the system's performance is not automatic and depends heavily on the user to complete the loop from data put into the system, to the output, to modification of the next rule set and selection of data to type in.

Nevertheless, the HULK is well suited to providing answers where there is uncertainty in the data you are working with. The system can acquire greater competency as you work to refine the rules that you run over the data and I have no doubt that it can give you a greater insight into the relationships within a set of data. As the scrupulously honest User Guide says 'All you need is a data set, (and) some curiosity . . . Think of it as a research assistant.'

Brainstorm Computer Solutions say that the

HULK is intended as an introduction to knowledge-based systems, and I think it is fair comment for them to claim that "the HULK lets you dip your toes into the warm blue lagoon of expert systems and find out what all the fuss is about."

The company proposes to carry on the development of the programs and wants feedback from users by way of a user group. Until the group is established you may need some additional reading material if you are not familiar with Bayes theorem.

The LOOK and LEAP programs are rather over 500 lines long and the point is well made in the User Guide that you will find the HULK frustrating to use from cassette tape. The sample coal mining data files supplied with the program have 64 samples of 30 variables and you must reload the data each time you wish to use LEAP or LOOK.

I am not sure whether that is a necessary part of the process, because, for example, the data is modified in the course of the analysis, or whether the program can be altered to allow you to run a different rule set over the same data without having to reload it.

All the programs are written in straightforward Basic and can be copied from tape to disc without any trouble. Any company that gives you a telephone number to ring and a program that you can build on for your own purposes must be good. The HULK will keep you absorbed for hours and may make you look at the world in a new, probabilistic, light.

And does transcendental meditation produce the effects claimed for it? Ah well . . .

Table 2. PRESCAN printout.

HYPOTHESIS: (tm30 + tm40)/2 < pc60		
Variable 1	pc10	
	SUCCESS 9	FAILURE 2
average:	70.89	77.00
std. dev.:	7.08	7.07
difference-score = 1.11		
Variable 2	pc20	
	SUCCESS 9	FAILURE 2
average:	70.22	76.50
std. dev.:	6.83	7.73
difference-score = 1.05		
Variable 3	tm30	
	SUCCESS 9	FAILURE 2
average:	66.78	76.00
std. dev.:	7.69	8.49
difference-score = 1.41		
Variable 4	tm40	
	SUCCESS 9	FAILURE 2
average:	65.00	73.00
std. dev.:	5.05	8.49
difference-score = 1.28		
Variable 5	tm50	
	SUCCESS 9	FAILURE 2
average:	66.67	71.00
std. dev.:	6.98	12.73
difference-score = 0.47		
Variable 6	pc60	
	SUCCESS 9	FAILURE 2
average:	69.89	72.50
std. dev.:	6.39	6.36
difference-score = 0.52		
Variable 7	pc70	
	SUCCESS 9	FAILURE 2
average:	68.89	77.50
std. dev.:	6.25	14.85
difference-score = 0.80		
Data from: HIR		

Table 3. LEAP printout using first rule set

HYPOTHESIS IS:		
(tm30 + tm40)/2 < pc60		
Rule 1: tm30 < pc20		
Likelihood ratios:		
	1.43	0.70
	0.77	1.30
Rule 2: tm50 < pc60		
Likelihood ratios:		
	3.33	0.30
	0.59	1.70
SAMPLE		Prob. Success
1 *S01		0.99 1
2 *S21		0.99 1
3 *S06		0.99 1
4 *S13		0.99 1
5 *S10		0.99 0
6 *S20		0.99 1
7 *S23		0.97 1
8 *S02		0.97 1
9 *S22		0.97 1
10 *S24		0.75 1
11 *S05		0.47 0
Data from: HR		
Rules used: TMR		
Success rate = 90.9090909%		
SAMPLE		Prob. Success
1 *S21		0.99 1
2 *S02		0.99 1
3 *S13		0.99 1
4 *S06		0.75 1
5 *S14		0.47 0
Data from: BP		
Rules used: TMR		
Success rate = 100%		
SAMPLE		Prob. Success
1 *S23		0.99 0
2 *S13		0.99 1
3 *S14		0.99 1

4 *S07	0.99	1
5 *S09	0.99	1
6 *S20	0.97	1
7 *S22	0.97	1
8 *S01	0.75	0
9 *S06	0.75	0
10 *S02	0.75	1

Data from: FO2

Rules used: TMR

Success rate = 70%

SAMPLE		Prob. Success
1 *S03		0.97 1
2 *S05		0.97 1
3 *S01		0.97 1
4 *S02		0.97 0
5 *S06		0.75 1
6 *S04		0.47 0

Data from: RQ

Rules used: TMR

Success rate = 83.3333333%

LEAP printout using second rule set

HYPOTHESIS IS:

(pc10 + pc20)/2 > pc60

Rule 1: tm30 < pc20

Likelihood ratios:

	3.57	0.28
	0.71	1.40

Rule 2: (tm30 + tm40 + tm50)/3 < pc60

Likelihood ratios:

	0.10	9.80
	3.10	0.32

SAMPLE		Prob. Success
1 *S14		0.77 1
2 *S06		0.03 0
3 *S21		0.03 0
4 *S02		0.03 0
5 *S13		0.03 1

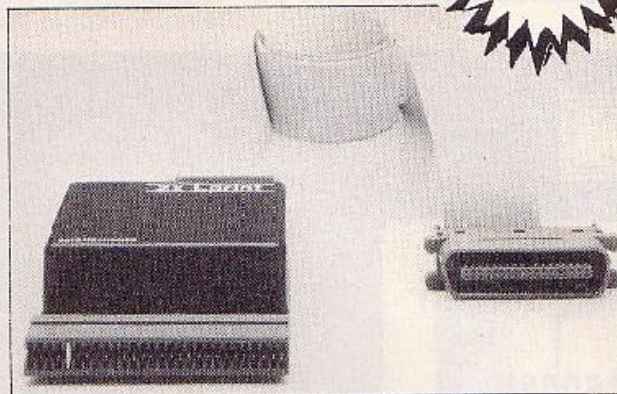
Data from: BP

Rules used: TMR3

Success rate = 80%

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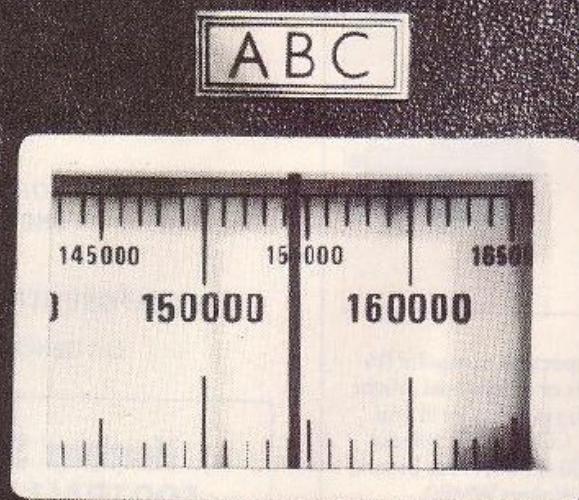
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TEXT

TEXT COMPRESSION METHODS have been in use on computer systems for a number of years and a variety of techniques are available. A recent article in *Your Computer* (L.F. Boulton, Vol.4, No 3) demonstrated such a technique for the ZX-81 where the unused character codes were used to represent the more commonly found character pairs. This type of tokenisation has been used widely with the unused ASCII codes 128 to 255 being taken to represent groups of letters, words or even frequently occurring phrases. However, a limitation of this method is due to the fact that only 128, or at most 255, token values are possible, i.e. the text may be only partially tokenised. I will describe a simple text compression technique which overcomes this limitation and enables any piece of text to be totally tokenised.

The principle of tokenising text appears very attractive since it is easy to see that commonly occurring words or phrases can be replaced by tokens of far fewer bytes than the original text. Single byte tokens, having values in the range 0 to 255, impose severe limitations as we have already noted. Two byte tokens, with values in the range 0 to 65535, are obviously excessive. However, when we consider the number of different words likely to be found in an adventure text database, or even in every day usage, we find that this number is only a few thousand. Therefore, if we use two bytes per token and limit the number of items in the dictionary to 2048, which is more than adequate for the majority of applications, then the token number may be stored in 11 bits only with the 5 remaining bits being used to convey additional information about the text. In developing this technique I decided to use these bits to describe details of the text punctuation and layout.

Before proceeding, we should note that one of the most commonly occurring characters in any passage of text is a space. Furthermore, we can see that, with the exception of words which terminate exactly at the end of full width lines (including any commas or



COMPRESSION

Alan Tobias goes in for a little letter crunching on the Spectrum.

periods), all words may be regarded as having a trailing space. Thus, if our decoding/expansion routine is able to apply this simple rule then there is no need to code spaces explicitly.

An obvious application of some of the unused token bits is to indicate the presence of commas or periods following any word. By using a separate bit for each of these it is

possible to accommodate words which are followed by both.

When we construct the dictionary of different words which appear in the text, it is obviously desirable that any word occurring both at the start and in the middle of a sentence is stored in the dictionary once only. Therefore, it would be advantageous to use one of the token bits to indicate that a word should be output with a capital letter at its start. This requires that all words stored in the dictionary should have their first letters converted to lower case. Again it is possible for our decoding routine to apply some simple rules, namely that a word should be automatically output with a capital letter at the start of any text message or following a period. It will therefore be necessary to code the capital letter flag bit only when these are required in the middle of a sentence.

Another punctuation item which could usefully be coded in a token bit is the presence of a newline character following a word plus its trailing blank, period or comma. However, we can again minimise the text coding by having the decoding routine provide a newline character automatically if the next word to be output will not fit within the current line. Thus, it will be necessary only to code those newline characters which are specifically required at particular points in the text.

In setting up the two byte tokens I have taken care to minimise the number of bits which will be set for any word. This means

(continued on page 127)

Table 1. Special input characters

Character	ASCII Code	Interpretation
@	64	Treat as a space within phrases
.	94	Insert newline character after word
-	95	End of input for current message

Listing 1. The hex loader.

```

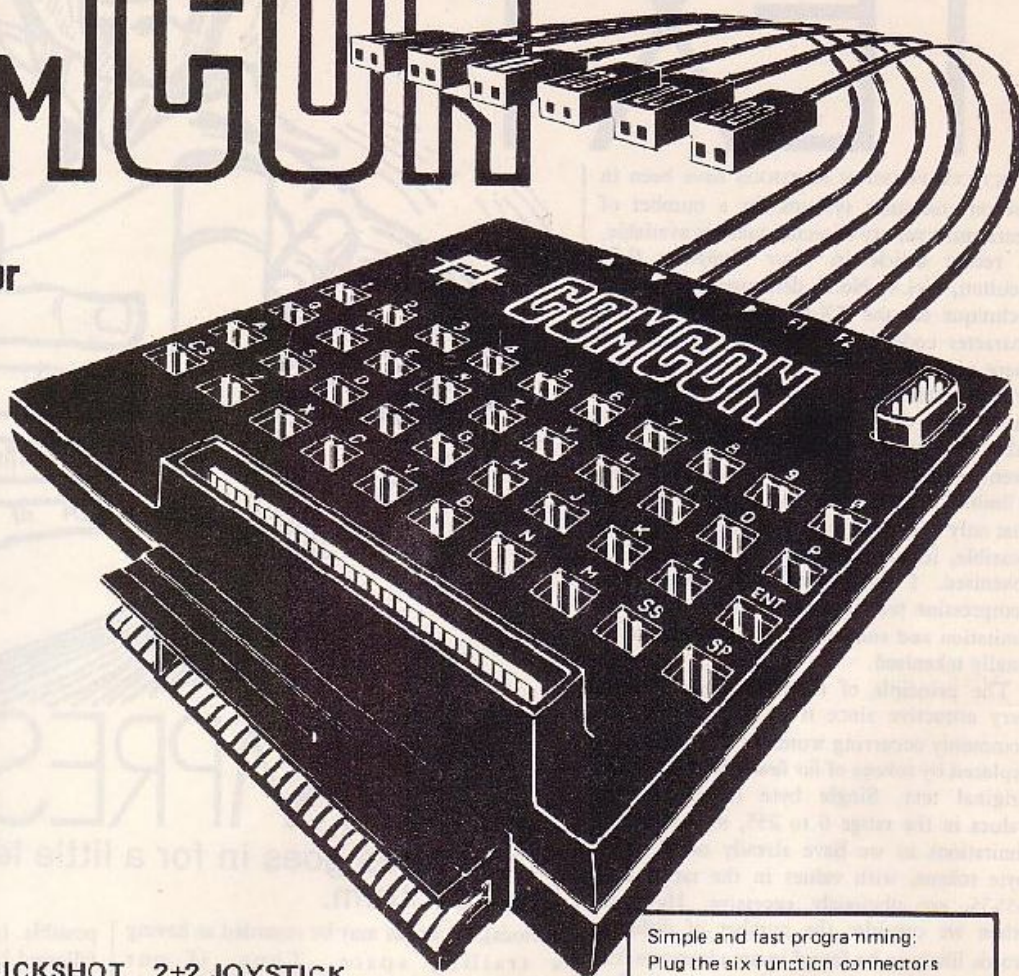
10 REM hex loader
20 DEF FN h$(a)=CHR$(INT (a/16)+48+7*(a>159))+CHR$(a-16*INT (a/16)+48+7*(a-16*INT (a/16))>9)
30 DEF FN h(h$)=CODE h$-48-7*(CODE h$>57)
40 INPUT "Start Address:";s
50 INPUT "Finish Address:";f
60 FOR n=s TO f STEP 3
70 PRINT n;" ";
80 LET tot=0
90 INPUT a$
100 IF a$="END" THEN STOP
110 PRINT a$
120 FOR b=0 TO 7
130 LET z=FN h(a$)*16+FN h(a$(2))
140 LET tot=tot+z
150 POKE (n+b),z
160 LET a$=a$(4 TO )
170 NEXT b
180 PRINT " = ";
190 INPUT t
200 IF t<>tot THEN PRINT "Data input error": GO TO 70
210 PRINT t
220 NEXT n
230 STOP
    
```


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(continued from page 125)

that for the large majority of words in a passage of text the token will contain the word's dictionary number only. For dictionary numbers less than 256 a single byte token would thus suffice in many cases. However, we need some means of telling the decoding routine whether it should expect a one- or two-byte token. This can be achieved by using the one remaining unused bit of the token which, through necessity, will be located in the first byte of the token together with the low order bits of the dictionary item number. This arrangement will permit single byte tokens for dictionary numbers less than 128 when the words require no punctuation flag bits.

The one remaining item we need to define

is the means of terminating each string of tokens which represent a message. For this we require some unique byte value. If in the tokens we add 1 to the dictionary numbers, so that there is a maximum of 2047 dictionary entries numbered from 1 to 2047, we find that a zero value byte will provide a suitable message terminator. Thus, if we want to print out any text message then it is necessary only to locate the appropriate occurrence of a zero byte and begin printing at the token which follows it.

For the present it is assumed that the total number of different text messages within the data base will not exceed 256. The required message number for output may then be specified by a single byte. Applications having more than 256 different text messages may be

accommodated by permitting a suitable number of message lists all based upon a single text dictionary.

In storing the text dictionary we need some means of marking the end of each entry. A suitable method of doing this appears in the Spectrum ROM and has been used here. It is done by setting bit 7 of the final character in each entry thus giving it an ASCII code of greater than 127. Any required dictionary entry is then found by locating the appropriate occurrence of a dictionary byte in which bit 7 has been set.

Earlier, we saw that it was not necessary to code trailing spaces explicitly. Therefore, if we want to define phrases which are to be tokenised then it is necessary to consider other

(continued on next page)

Listing 2.

```

31000: FE 00 C4 3E 79 3E 08 32 = 753
31008: D1 79 7E FE 00 C8 16 C0 = 945
31016: 57 23 CB 43 28 02 56 23 = 563
31024: CB 1A CB 1B 1B E5 C5 CD = 1117
31032: 4A 79 C1 E1 18 E4 C5 47 = 1133
31040: 7C 23 FE 00 20 FA 10 F8 = 961
31048: C1 C9 C5 E1 C9 86 79 CD = 1529
31056: 97 79 3A BE 79 E2 57 AF = 1:13
31064: CE 5A 28 02 3E E0 84 CB = 958
31072: BF FE 40 20 02 3E 20 CD = 842
31080: D6 79 AF CB 7E 23 28 EE = 1:52
31088: CB 62 28 C7 3E 2E CD B6 = 875
31096: 79 3E C8 32 06 79 3E 2C = 690
31104: CB 6A C4 D6 79 3A 88 5C = 1126
31112: FE C1 3E 20 C4 D6 79 3E = 942
31120: 0D CB 72 C4 D6 79 C9 E5 = 1291
31128: D5 C5 3A 86 5C 3D 3D CB = 1021
31136: 7E 23 28 FA CB 62 28 01 = 793
31144: 3D CB 6A 28 01 3D FE 20 = 758
31152: 38 28 3E 0D 18 23 7A E6 = 532
31160: C7 FE 00 C4 C7 79 7B FE = 1154

31168: 00 C8 43 3E 01 18 02 06 = 362
31176: 00 CB 7E 23 28 FB 10 F9 = 920
31184: 3D FE 00 20 F2 C9 E5 D5 = 1232
31192: C5 D7 C1 D1 E1 C9 01 CD = 1446
31200: 68 0D 3E 02 CD 01 16 3A = 470
31208: 70 5C ED 4B 2F 7B 2A 31 = 841
31216: 7B C3 18 79 DD 21 01 5B = 809
31224: DD 7E 00 FE 5F CA 77 7A = 1139
31232: 1E 00 16 00 4A 21 3E 7B = 344
31240: DD 7E 00 DD 23 FE 5E 28 = 991
31248: 4C FE 20 28 3A FE 2E 20 = 786
31256: 04 CB E1 18 2C FE 2C 20 = 830
31264: 04 CB E9 18 24 77 7A FE = 995
31272: 00 20 15 7E FE 5B 30 10 = 586
31280: FE 41 38 0C C6 20 77 3A = 794
31288: DE 79 FE 00 20 02 CB D9 = 1051
31296: 23 14 1C 3A 00 5B BB 3C = 467
31304: BF 1C 7A 00 5B BB 3A 14 = 631
31312: DD 7E 00 FE 20 20 06 1C = 699
31320: DD 23 DD 7E 00 FE 5E 2C = 903
31328: 03 1C CB F1 7A 32 3E 7B = 831
31336: CD 81 7A 3A 00 5B BE 3C = 840
31344: 91 2A 35 7B AF 77 C5 2A = 900

31352: 35 7B AF 77 23 22 35 7B = 715
31360: C9 D3 E5 D5 E5 11 00 00 = 1110
31368: 21 37 7B 7E FE 00 20 06 = 629
31376: 23 7E FE 00 28 47 DD 2A = 769
31384: 2F 7B DD 2B 21 3E 7B 3A = 710
31392: 3D 7B 47 DD 23 DD 7E 00 = 858
31400: CB BF BE 23 20 18 7B FE = 1049
31408: 01 23 0A 0A CB 00 7E 28 = 651
31416: 00 1B 06 DD CB 00 7E 20 = 625
31424: 05 10 E0 D5 18 3A DD CB = 964
31432: 00 7E DD 23 28 F8 DD 2B = 934
31440: 13 21 37 7B 7E 1B 20 C4 = 771
31448: 23 7E BA 20 FF 2A 37 7B = 790
31456: E5 23 22 37 7B 2A 33 7B = 692
31464: DD 21 3E 7B 3A DD 7B 47 = 752
31472: DD 7E C0 DD 23 77 23 10 = 773
31480: F7 2B CB FE 23 22 33 7B = 990
31488: AF CB 41 28 01 3C 32 BE = 848
31496: 79 D1 3A 35 7B 13 7A E6 = 919
31504: C7 E1 57 AF CB 13 CB 12 = 889
31512: 7A FE 00 28 02 CB C3 73 = 931
31520: 23 CB 43 28 02 77 23 22 = 535
31528: 35 7B E1 D1 DD E1 C9 00 = 1257

```

Listing 3.

```

10 REM *TEXT COMPRESSION SYSTEM*
20 REM A. Tobias: June 1984
30 REM ** Main Driving Routine
40 BORDER 1: PAPER 1: INK 7
50 CLS: PRINT "TEXT COMPRESS
SSION SYSTEM": PRINT "
": PRINT "PRI
NT"
60 PRINT TAB 9: INK 0: PAPER 5
:" A.Tobias ": PRINT
70 PRINT TAB 13: PAPER 7: INK
0:"MENU": PRINT "PRINT
80 PRINT " 1. Reset Message
Pointers 2. Input Text vi
a Keyboard 3. List Stored T
ext 4. List Current
Dictionary 5. Compression S
tatistics 6. Save Dictiona
ry/Text 7. Load Dictiona
ry/Text"
90 INPUT "Required Option ?":o
pt
100 IF opt<1 OR opt>7 THEN GO TO
0 90
110 PRINT AT (opt+8),3: FLASH 1
:opt
120 PAUSE 100
130 GO SUB (opt*1000)
140 GO TO 40
150 CLEAR 30999
160 LOAD "CODE
170 GO TO 10
180 LET x=nd: GO SUB 940
190 POKE 31543,1: POKE 31544,f
200 LET x=nm: GO SUB 940
210 POKE 31545,1: POKE 31546,h
220 LET x=ct: GO SUB 940
230 POKE 31547,1: POKE 31548,h
240 RETURN
250 LET nd=PEEK 31543+PEEK 3154
4*256
260 LET nm=PEEK 31545+PEEK 3154
6*256

820 LET ch=PEEK 31547+PEEK 3154
8*256
830 RETURN
900 PAUSE 30
910 PRINT E1:AT 1,0:"Press any
key to continue."
920 IF CODE INKEY#0 THEN GO TO
920
930 RETURN
940 LET h=INT (x/256)
950 LET l=x-h*256
960 RETURN
1000 REM ** Reset Pointers **
1010 BORDER 1: PAPER 1: INK 7
1020 CLS
1030 PRINT "Reset Dictionary Sto
rage ?": PRINT
1040 INPUT rs
1050 IF rs#="n" OR rs#="N" THEN GO
TO 1160
1060 IF rs#<>"y" AND rs#<>"Y" THEN
GO TO 1040
1070 PRINT "Dictionary Base Addr
ess ? (0 for no change)"
1080 INPUT x: IF x=0 THEN GO TO
1100
1090 GO SUB 940: POKE 31535,1: P
OKE 31536,h
1100 POKE 31543,0: POKE 31544,0
1110 POKE 31539,PEEK 31535
1120 POKE 31540,PEEK 31536
1130 POKE 31547,0: POKE 31548,0
1140 PRINT "Dictionary has been
reset.": PRINT
1150 GO TO 1200
1160 PRINT "Reset Text Storage ?
": PRINT
1170 INPUT rs
1180 IF rs#="n" OR rs#="N" THEN GO
TO 1270
1190 IF rs#<>"y" AND rs#<>"Y" THEN
GO TO 1170
1200 POKE 31545,0: POKE 31546,0
1210 PRINT "Text Base Address ?
(0 for no change)"

1220 INPUT x: IF x#0 THEN GO TO
1240
1230 GO SUB 940: POKE 31537,1: P
OKE 31538,h
1240 POKE 31541,PEEK 31537
1250 POKE 31542,PEEK 31538
1260 POKE 31547,0: POKE 31548,0
1270 PRINT "Text Storage has bee
n reset."
1280 GO SUB 900
1290 RETURN
2000 REM ** Input Text **
2010 BORDER 5: PAPER 5: INK 0
2020 GO SUB 800
2030 IF nd<2000 THEN GO TO 2070
2040 CLS: PRINT FLASH 1:"WARNIN
G"
2050 PRINT "No. of Dictionary It
ems > 2000"
2060 GO SUB 900
2070 CLS: PRINT "Message No.":n
m
2080 POKE 31198,1
2090 INPUT a#
2100 LET a=LEN a#
2110 IF a=0 THEN GO TO 2090
2120 IF a<255 THEN GO TO 2150
2130 PRINT AT 20,0:"Error - stri
ng > 255 Characters Please retyp
e input"
2140 GO TO 2090
2150 POKE 23296,(a-1)
2160 FOR i=1 TO a
2170 POKE (23296+i),CODE a$(i)
2180 NEXT i
2190 RANDOMIZE USR 31220
2200 IF a$(1)="" THEN GO TO 227
0
2210 PRINT AT 1,0:
2220 LET c=PEEK 31198
2230 POKE 23728,nm: RANDOMIZE US
R 31207
2240 POKE 31198,c
2250 LET ch=ch+a

```

(listing continued on next page)

(continued from previous page)

ways of representing spaces within these phrases. A simple solution is to represent them by some other character, preferably one which is unlikely to be found elsewhere in the text. The system described here has been designed to interpret the character '@' (ASCII 64) as a 'phrase space'. When found in a phrase this character is stored explicitly in the dictionary entry whereas during output it is replaced by a true space.

Using the hex loader shown in listing 1, you can load the Z-80 machine-code routines which will both compress and expand text according to the system described above. Listing 2 gives a hexadecimal dump of the Z-80 machine-code routines. The decoding routine occupies 199 bytes beginning at location 31600 and the compression routine occupies 315 bytes starting at location 31220. The code beginning at location 31199 merely sets up the registers for the expansion routine as used by this overall program.

The first location of the printer buffer (23296) holds the total number of characters in an input line or lines of text while the remainder of the buffer — 23297 to 23551 — is used to store the input text.

Listing 3 gives the Basic program which will drive the text compression routines described above. It is menu driven and is simple to use. Option 1 enables you to reset the base addresses for both the dictionary and the tokenised messages. It is essential that you select this option prior to initial text input.

During operation of the program the dictionary of words and phrases is built up as

Figure 1. Text Example and corresponding tokens.

Message: You are in a dark, damp cellar with a narrow passageway leading south.

Word/Phrase	Token Value(s)
You are in	2
a	4
dark,	7, 64
damp	8
cellar	10
with	12
a	4
narrow	14
passageway	16
leading	18
south.	21, 32, 0

No. of token bytes in compressed message = 14

the text input is scanned. This method of operation is sensible since, for large text databases, it is unlikely that both the original and compressed text may be stored simultaneously. In order to take full advantage of the use of single byte tokens it is advisable to enter some dummy text messages initially which contain the words you believe to occur most frequently in your text. When you have done this, reset the message storage but retain the dictionary.

Because the program given here has been devised to compress text as it is input from the keyboard, it enables you to lay out the text as required. During input you may type in up to eight lines of text at once — maximum of 255 characters — and each section of input does not have to finish at the end of a sentence. It is only necessary to ensure that you leave a space

between each word.

When you have completed the input for a message type the character "—" (ASCII 95) as the first character of a new single item of input. As was noted above, newline characters are automatically provided if the next word to be printed will not fit into the current line. Additional newline characters can be inserted into the text by including a " " character (ASCII 94) at the appropriate place.

With the exception of the characters shown in table 1, for which special interpretation applies, all ASCII characters with codes in the range 32 to 127 will be treated as normal text characters.

Note that if you want to save some compressed text for subsequent extension then it is essential that this is done by the program so that all pointers are preserved. These pointers are required only for the compression system's book-keeping and are not needed by any program which will use the compressed text. Similarly, the compression routine, stored in locations 31220 to 31534, may be omitted from the target program. You will, however, require the heart of the expansion routine — stored in locations 31000 to 31198, or suitably relocated as required. On entry to the start of this routine, register 'a' should contain the required message number and register pairs 'hl' and 'bc' should point to the start addresses of the text tokens and dictionary respectively. Since these are saved as 'code' and are position independent they may be loaded into any region of memory for your target program.

(listing continued from previous page)

```

2260 GO TO 2090
2270 LET nm=nm+1
2280 INPUT "Any more text?" ; r#
2290 IF r#="y" OR r#="Y" THEN GO
TO 2070
2300 LET nd=PEEK 31543+PEEK 3154
4*256: GO SUB 700
2310 IF nd<2000 THEN GO TO 2330
2320 CLS: PRINT FLASH 1: "WARNIN
G": PRINT "Dictionary Almost Full
!"
2330 GO SUB 900
2340 RETURN
3000 REM ** Print Stored Message
**
3010 BORDER 4: PAPER 4: INK 0
3020 GO SUB 800
3030 IF nm=0 THEN RETURN
3040 FOR i=0 TO nm-1
3050 POKE 23728,i
3060 RANDOMIZE USR 31199
3070 PRINT AT 21,0: "Message No."
: i
3080 GO SUB 900
3090 NEXT i
3100 RETURN
4000 REM ** Print Dictionary **
4010 BORDER 5: PAPER 5: INK 1
4020 GO SUB 800: IF nd=0 THEN RE
TURN
4030 LET wds=PEEK 31535:PEEK 315
36*256: CLS
4040 FOR i=1 TO nd STEP 20
4050 CLS: PRINT PAPER 1: INK 7:
"DICTIONARY ITEM":TAB 20:"ENTRY
NO.": PRINT
4060 FOR i=i TO i+19
4070 LET c=PEEK wds: LET wds=wds
+1
4080 LET d=c: IF c>128 THEN LET
c=c-128
4090 PRINT CHR# c:
4100 IF d<128 THEN GO TO 4070
4110 PRINT TAB 20:j

```

```

4120 IF j=nd THEN GO TO 4140
4130 NEXT j
4140 GO SUB 900
4150 NEXT i
4160 RETURN
5000 REM ** Compression Elastisti
cs **
5010 BORDER 6: PAPER 6: INK 1: C
LS
5020 GO SUB 300
5030 PRINT "COMPRESSION STATISTI
CS": PRINT "-----"
5040 PRINT "Uncompressed Text":T
AB 20:ch:TAB 27:"bytes": PRINT :
PRINT
5050 LET d1=PEEK 31539-PEEK 3154
0*256-(PEEK 31535+PEEK 31536*256
)
5060 PRINT "Dictionary Items":TA
B 20:nd: PRINT
5070 PRINT "Dictionary Size":TAB
20:d1:TAB 27:"bytes": PRINT
5080 LET n1=PEEK 31541+PEEK 3154
2*256-(PEEK 31537+PEEK 31538*256
)
5090 PRINT "Compressed Text":TAB
20:n1:TAB 27:"bytes": PRINT : P
RINT
5100 PRINT "Dictionary + Text":T
AB 20:(d1+n1):TAB 27:"bytes": PR
INT: PRINT
5110 LET x=INT (10000*(1-(d1+n1
)/ch))/100
5120 PRINT "Compression Factor":
TAB VAL "20": FLASH VAL "1":x:"
%"
5130 GO SUB 900
5140 RETURN
6000 REM ** Save to Tape **
6010 BORDER 0: PAPER 0: INK 7
6020 GO SUB 700
6030 CLS: PRINT "Load tape and
prepare to record."

```

```

6040 PRINT : PRINT "Saving Point
ers."
6050 SAVE "Pointers"CODE 31535,1
5
6060 LET x=PEEK 31535+PEEK 31536
*256
6070 LET l=PEEK 31539+PEEK 31540
*256-x
6080 PRINT "Done.": PRINT : PRIN
T "Saving Dictionary."
6090 SAVE "Dictionary"CODE x,1
6100 LET x=PEEK 31537+PEEK 31538
*256
6110 LET l=PEEK 31541+PEEK 31542
*256-x
6120 PRINT "Done.": PRINT : PRIN
T "Saving Compressed Text."
6130 SAVE "Text"CODE x,1
6140 PRINT "Done."
6150 GO SUB 940
6160 GO SUB 900
6170 RETURN
7000 REM ** Read from Tape **
7010 BORDER 0: PAPER 0: INK 7
7020 CLS: PRINT "Load tape in r
ecorder and start."
7030 PRINT : PRINT "Loading Poin
ters"
7040 LOAD ""CODE 31535
7050 PRINT : PRINT "Loading Dict
ionary"
7060 LET x=PEEK 31535+PEEK 31536
*256
7070 LOAD ""CODE x
7080 PRINT : PRINT "Loading Comp
ressed Text"
7090 LET x=PEEK 31537+PEEK 31538
*256
7100 LOAD ""CODE x
7110 GO SUB 740
7120 GO SUB 900
7130 RETURN
9500 SAVE "Comptext" LINE 150
9510 SAVE "Code"CODE 31000,550

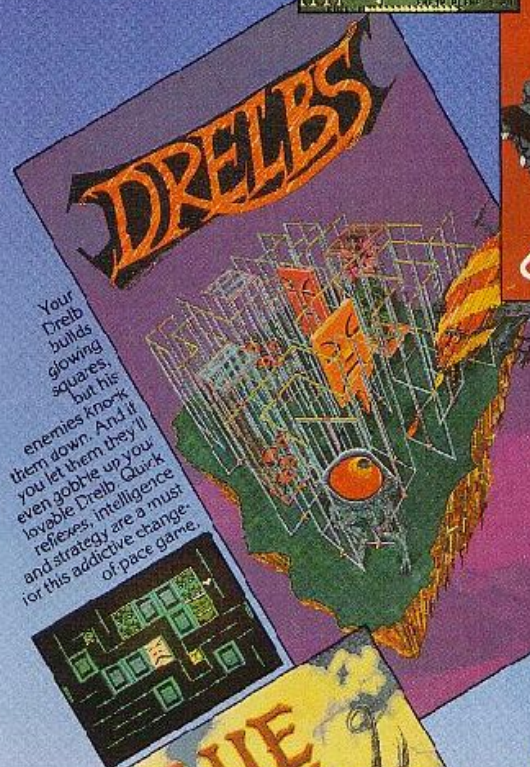
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MICRODRIVE

Kathleen Peel with an appraisal of Microdrives after eight months' use.

IT IS EIGHT MONTHS since a Microdrive first appeared on my desk so it is about time I presented a brief long-term appraisal of the reliability of not only the drives, but also the Microdrive operating system.

During the eight month period, nearly all the reviews I have written have used a Microdrive-based word processor. Also much software development has taken place for the Spectrum and the now extinct Timex 2068.

This has resulted in almost continuous use for cartridges employed in software development over a period of weeks and a periodic exercise for the cartridges used for the reviews.

Combined with this almost continuous use of the Spectrum Microdrives can be coupled preliminary thoughts on the QL drives and the QL's operating system, which have received a great deal of my attention lately.

Although the Spectrum Microdrives have worked without losing any files — and not all disc drives can have that said about them — that does not mean they are without minor niggling faults.

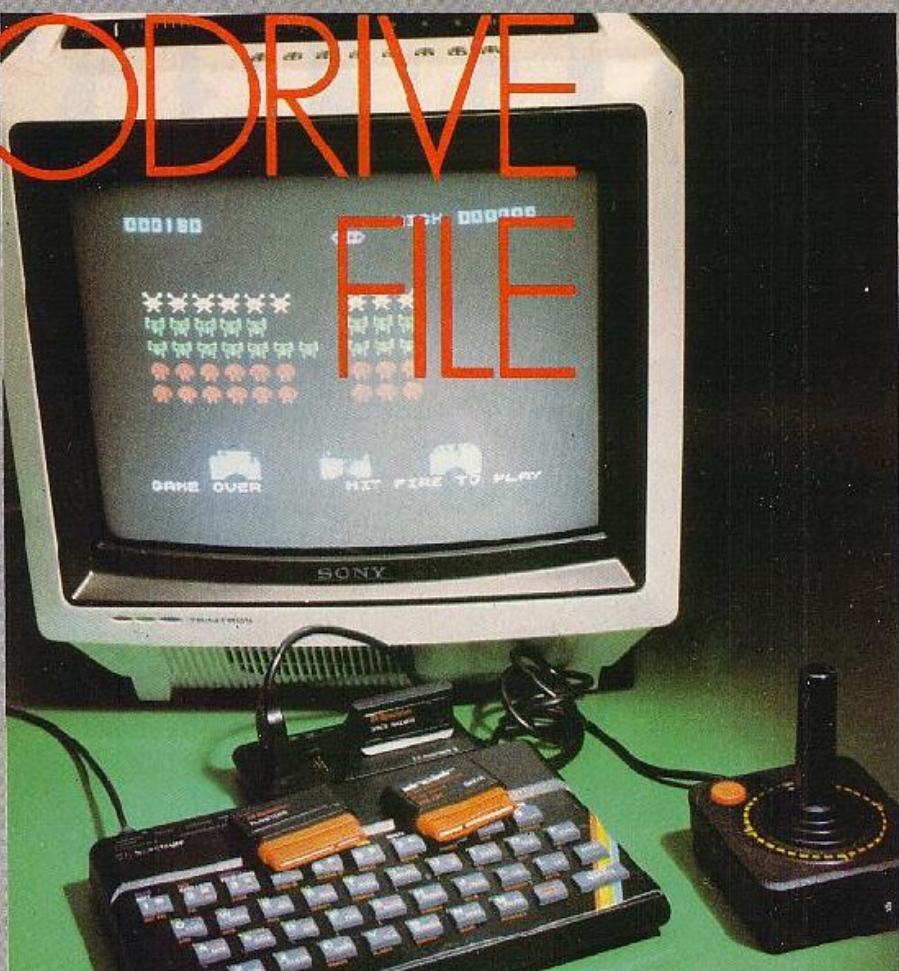
The restraints placed on program transfer restrict the ability to produce a simple Basic back up program to transfer all the programs and data on the cartridge to cassette tape and back again. The cost of cartridges makes it very expensive to create a library as they only have a fraction of the storage capacity of a cassette and there is also no convenient way of storing cartridges.

One of the early problems was in finding somewhere safe to store the very small cartridges, they are very much smaller than the new 3-inch Japanese micro-floppies.

The plastic wallet now supplied free with cartridges bought in packs of four is a great help in overcoming the problem of misplacing a cartridge, or more likely its cover. It would have been perfect if the wallet could have been made to fit the cassette racks.

Another problem that arises as a result of the small size of the cartridges is indexing contents. Cassettes cases are provided with an inlay card for this very purpose, a quick glance along a cassette rack will normally find a tape — with the cartridges this is not possible.

A solution for two-drive setups is for drive 1 to contain the working files and drive 2 the



utilities and system index. This works well provided none of the utilities are very large.

Although the Microdrives perform adequately for speed, on cartridges with a lot of free space I tend to double-save each program as it does make the drives load even quicker.

There was a stage when I started writing utilities to handle the rather long syntax command entries but, after a while, these became restrictive as they used up space which could be better used elsewhere.

The QL drives have been extremely erratic and so far have frequently refused to load programs that have just been saved. As this problem does not afflict all programs on the cartridge, it can be assumed that the problem lies with the QL's operating system — QLOSS.

My impression is that the QL seems to lose track of where it has just loaded or saved a file, possibly due to changes to the stack pointer brought about by breaks. As none of the

programs contain machine-code or memory Pokes, they are purely Basic, this is very disappointing.

There appears to be no vertical restraint for the cartridges at the front edge. This can lead to the cartridge rocking between the top and bottom surfaces of the Microdrive causing a rhythmic banging of the cartridge case, a problem that also appears in the Spectrum drives.

If you already have Spectrum Microdrives, they can be used with the QL in a read only mode. Format and save are not possible — I'm not sure why saving is not possible at the moment. Just remember to use QL formatted and written cartridges. The Psion cartridges make reference to a specific Microdrive and may not work.

The Interface 1 is extremely good — the only minor problem is the lack of a Tab function, but that can be overcome if necessary.

The RS-232 capability has allowed connection to virtually everything that I have tried and the Spectrum to Spectrum networking is also very good and extremely fast.

Strange, then, that the QL should not be fully able to link with the Spectrum over the network. The Spectrum passes tokenised keywords which the QL cannot read. This may well be compounded by adding two incompatible sets of timings.

Overall, the performance of the Spectrum Microdrives is highly satisfactory and complaints revolve around minor details of logistics.

The drives have virtually the same
(continued on page 133)



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(continued from page 131)

performance as the disc drives I have used recently except for the lack of random access to Spectrum files.

I have a feeling that the high cost of cartridges is being used to restrict demand for the cartridges while production builds up.

The performance of the QL Microdrives is far less satisfactory. There appears to be a major design problem in the software which allows a user to create non-loading files from Basic programs which do not contain machine-code or system Pokes.

The simple little program, right, provides the new ROM entry position of the Microdrive commands. The reader can get a better understanding of the Microdrive operation by producing a disassembled listing from the start of each of these commands. The code tends to jump around but sections can be used quite easily within your own programs.

Recently, I reported that the QL Microdrives in the FB ROM machines (check by typing: Print ver\$) were prone to lose programs and data by becoming unreadable. You will be pleased to hear that the latest version of the QL seems to have cured the problem which means it must have been a software problem in the old ROM.

Using the "new" QL for a period of weeks has provided the data integrity that a user would require and given a much higher level of confidence in the drives. All that remains are the two problems of excessive cartridge costs — £5 is still daylight robbery — and disappointingly long and frequent QL Microdrives accessing times especially when using the Psion software packages.

```
1 CLEAR 30000
2 SAVE *"m";1;"urom"CODE 435:61
3 LOAD *"m";1;"Lrom"CODE 30000
4 PRINT " Syntax check entry points":
PRINT
5 FOR a=30003 TO 30053 STEP 5
6 PRINT CHR$ (206+PEEK a),: GO SUB 10
: PRINT b
7 NEXT a
8 PRINT : PRINT " Extend Vector Address":
PRINT : LET a=a-2: GO SUB 10: PRINT
,(PEEK b+256*PEEK (b+1))
9 ERASE "m";1;"urom": STOP
10 LET b=PEEK (a+2)+256*PEEK (a+3): RE
TURN
9000 CLEAR #: FORMAT "t";600: OPEN #3;"t
": STOP
9990 ERASE "m";1;"ufile1": SAVE *"m";1;"
ufile1": CAT 1: STOP
```

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INTERFACE
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— — — We're the experts! — — —

Bernard Harmel puts the Dragon on file.

THIS PROGRAM, which is entirely in machine-code, allows you to store, search look at and save data in the form of a card-index in the memory of the computer.

The program has been realised on a Dragon 32 with the EDTASM + cartridge. It occupies 1,971 bytes and leaves approximately 29,200 bytes free for data storage. For first time loading, switch the machine off, then on, and load the decimal machine-code in listing 1 using the Basic program supplied — listing 2. A checksum is included at the end of each line to prevent errors.

After that save the code on tape as a machine-code file:

CSAVEM "\$FILESS", 30920, 32400, 0

Turn the machine off, then on, and type:

POKE 25,6 Enter
NEW Enter } to reserve them
CLEAR 20, 1690 Enter

Then you must set RAMtop.
That is to say you must tell the

computer from where it must store the data — min. 1,701; max. 30,900 — that is done by Poking the value 210 in the desired address. Poke 170, 210 receive the maximum place for data storage and Poke 30900 the minimum. Finally, type:

EXEC 31921

The menu must appear on the screen. Let us suppose that we want to classify books — each book is identified by a file specifying the author, title, year, price.

We must first define a model file collecting these different pieces of information. Command 1 allows you to do that. Press 1, the screen turns green and a cursor appears in the left-hand corner of the screen. You have 10 lines to create your model file; if you try to write on the 11th you get an end of file error. Press ↑ and continue. Use the four arrow keys to move the cursor and the other keys to write. To clear a character put the cursor on

the left and press ←. When data first appears after an item it must be followed by:

(CHRS\$(58))

For our example, the model file could be like this — use command 1 to create it.

BOOKS

AUTHOR:

TITLE:

YEAR:

PRICE:
(WITHOUT VAT)

32 Columns

When the model file is finished just press Enter and the message File Recorder will appear on the screen. Press any key to return to the menu.

(continued on next page)

DRAGON FILES

Listing 2 Decimal loader.

```

10 CLS
20 FOR F=30920 TO 32391 STEP 5
30 S=0:PRINT@32." "
40 PRINT@0.F;" --> "
50 FORG=0 TO 4
60 INPUT
70 PRINT@G*4+10.P
80 POKEF+G.P
90 S=S+P
100 NEXT G
110 INPUT"CHECKSUM ":"P
120 IF P<>S THEN PRINT "TRY
    AGAIN PLEASE":GOTO 30
130 PRINT@64." "
140 NEXT F

```



(continued from previous page)

The command allows you to complete the model file with information. Press 2 and the model file will appear. Use the arrow key to move the cursor near the items and type the information corresponding to the item between

(CHR\$(34))

If an item has no information it must be followed by "". If you forget a " you will get a Syntax Error — use the arrow keys to correct.

When every item is followed by the information press Enter and you get OK? If you press:

Break: return to menu and file is recorded.

N : the file is cleared and you can write it again any other key: You record the file and make offers the model file and the cursor ready to write the next file.

Example:

BOOKS

AUTHOR: "H. G.

Wells"

TITLE: "War of the

Worlds"

YEAR: "1964"

PRICE: "3.5"

(WITHOUT VAT)

Command 3 allows you to search a string among all the files stored in memory. Press 3 — Searching will appear at the bottom of the screen with the cursor. Type your string followed by

(CHR\$(35))

and press Enter. If you make an error use ← to correct it. Example — Searching: WAR#. If the string searched is in memory the corresponding file is displayed on the screen and, at the bottom of the screen, the message 'Space' Dump to Printer. If you press: Space: you will get a copy of the screen on the printer.

Break: return to the menu:

Any other key will make the computer continue the research.

If the string is present several times in the file, it is displayed several times also. If the string isn't in memory the program displays Finished. Press a key to get the menu. Command 4 allows you to save the card index and also to leave the program. Press 4 several times and you are in Basic. You can type:

(continued on page 138)



Listing 1. Decimal dump.

30920	-->	70	73	76	69	32	=	320	31170	-->	68	85	84	73	79	=	369	31420	-->	13	16	37	3	70	=	141
30925	-->	42	69	67	79	82	=	370	31175	-->	78	32	49	33	85	=	298	31425	-->	129	9	39	41	129	=	347
30930	-->	68	69	68	70	73	=	348	31180	-->	78	69	32	70	73	=	322	31430	-->	8	39	33	129	94	=	302
30935	-->	70	73	83	72	69	=	375	31185	-->	67	72	69	32	32	=	272	31435	-->	39	43	129	10	39	=	260
30940	-->	68	39	83	80	65	=	335	31190	-->	66	82	69	65	75	=	357	31440	-->	34	246	127	245	193	=	845
30945	-->	67	69	39	58	63	=	301	31195	-->	32	32	32	62	69	=	247	31445	-->	0	38	11	140	5	=	194
30950	-->	85	77	80	32	84	=	358	31200	-->	84	79	85	62	32	=	362	31450	-->	65	35	5	189	124	=	410
30955	-->	79	32	80	82	73	=	346	31205	-->	65	85	32	77	69	=	328	31455	-->	114	126	122	170	185	=	721
30960	-->	78	84	69	82	79	=	392	31210	-->	76	85	113	32	32	=	340	31460	-->	122	146	126	122	170	=	686
30965	-->	75	32	63	48	32	=	250	31215	-->	32	68	69	70	73	=	312	31465	-->	198	255	126	122	250	=	951
30970	-->	32	68	85	77	80	=	342	31220	-->	78	73	84	73	79	=	387	31470	-->	198	1	126	122	250	=	697
30975	-->	32	32	32	32	49	=	177	31225	-->	78	32	68	32	85	=	295	31475	-->	198	32	126	122	250	=	726
30980	-->	32	32	67	76	69	=	276	31230	-->	78	32	71	69	66	=	316	31480	-->	198	224	48	153	182	=	785
30985	-->	65	82	83	69	65	=	364	31235	-->	65	82	73	84	32	=	336	31485	-->	127	245	129	0	38	=	535
30990	-->	82	67	72	73	78	=	372	31240	-->	32	32	32	32	114	=	242	31490	-->	11	40	5	63	35	=	254
30995	-->	71	58	69	78	69	=	344	31245	-->	32	32	32	83	84	=	263	31495	-->	5	89	129	114	126	=	560
31000	-->	32	79	70	32	70	=	283	31250	-->	79	67	75	65	71	=	357	31500	-->	122	70	140	4	0	=	436
31005	-->	73	76	69	83	89	=	390	31255	-->	69	32	68	32	73	=	274	31505	-->	37	11	191	127	248	=	614
31010	-->	78	84	65	88	32	=	347	31260	-->	78	70	79	88	77	=	306	31510	-->	193	258	38	4	198	=	688
31015	-->	59	82	82	79	82	=	394	31265	-->	65	84	73	79	78	=	379	31515	-->	96	331	132	126	122	=	707
31020	-->	79	85	84	32	79	=	359	31270	-->	83	32	32	32	32	=	211	31520	-->	175	142	4	0	127	=	443
31025	-->	70	32	77	69	77	=	325	31275	-->	32	115	32	32	32	=	243	31525	-->	127	254	16	190	127	=	714
31030	-->	79	82	89	78	79	=	407	31280	-->	82	69	67	72	69	=	390	31530	-->	250	16	191	127	252	=	836
31035	-->	32	83	84	65	82	=	346	31285	-->	82	67	72	69	32	=	322	31535	-->	165	128	140	5	63	=	502
31040	-->	84	73	78	71	32	=	338	31290	-->	68	32	73	78	70	=	321	31540	-->	34	67	129	98	38	=	386
31045	-->	30	79	73	78	84	=	394	31295	-->	79	82	77	65	84	=	387	31545	-->	245	246	127	254	193	=	1065
31050	-->	32	40	50	49	48	=	219	31300	-->	73	79	78	83	32	=	345	31550	-->	0	38	7	198	134	=	377
31055	-->	41	32	70	79	85	=	307	31305	-->	32	32	32	115	32	=	244	31555	-->	231	160	124	127	254	=	896
31060	-->	78	68	106	106	106	=	464	31310	-->	32	32	83	65	86	=	298	31560	-->	165	128	140	5	63	=	502
31065	-->	106	106	106	106	106	=	530	31315	-->	69	32	70	73	76	=	320	31565	-->	37	27	185	125	123	=	501
31070	-->	106	106	106	106	106	=	530	31320	-->	69	117	32	32	32	=	282	31570	-->	16	190	127	252	16	=	601
31075	-->	106	106	106	106	106	=	530	31325	-->	78	69	87	32	32	=	298	31575	-->	191	127	250	139	126	=	883
31080	-->	106	106	106	106	106	=	530	31330	-->	32	32	32	32	32	=	160	31580	-->	85	142	4	0	191	=	422
31085	-->	106	106	106	106	106	=	530	31335	-->	32	32	32	32	32	=	160	31585	-->	127	248	185	122	170	=	856
31090	-->	106	106	106	106	106	=	530	31340	-->	32	32	32	32	32	=	160	31590	-->	126	123	32	57	129	=	468
31095	-->	148	82	45	71	73	=	326	31345	-->	32	32	32	32	32	=	160	31595	-->	98	39	20	157	160	=	484
31100	-->	78	32	70	73	76	=	329	31350	-->	32	32	32	118	32	=	246	31600	-->	16	140	124	190	37	=	493
31105	-->	59	32	32	32	32	=	197	31355	-->	32	32	73	78	85	=	298	31605	-->	210	189	122	132	189	=	845
31110	-->	32	66	49	82	73	=	327	31360	-->	80	69	67	81	73	=	375	31610	-->	126	85	126	124	198	=	659
31115	-->	55	82	68	32	72	=	719	31365	-->	79	78	32	60	85	=	342	31615	-->	126	123	72	134	128	=	583
31120	-->	55	82	77	69	76	=	369	31370	-->	32	70	73	67	72	=	314	31620	-->	167	160	16	191	127	=	661
31125	-->	106	106	106	106	106	=	530	31375	-->	73	69	82	129	63	=	416	31625	-->	250	124	123	47	134	=	680
31130	-->	106	106	106	106	106	=	530	31380	-->	34	5	139	64	126	=	368	31630	-->	210	167	164	189	123	=	853
31135	-->	106	106	106	106	106	=	530	31385	-->	127	159	128	85	34	=	539	31635	-->	228	142	4	0	16	=	390
31140	-->	106	106	106	106	106	=	530	31390	-->	6	167	128	191	127	=	619	31640	-->	190	127	257	144	128	=	842
31145	-->	106	106	106	106	106	=	530	31395	-->	248	57	128	96	124	=	655	31645	-->	140	5	63	35	43	=	286
31150	-->	106	106	106	106	106	=	530	31400	-->	122	159	120	127	248	=	846	31650	-->	246	127	255	193	0	=	821
31155	-->	106	106	106	69	78	=	465	31405	-->	230	132	134	124	167	=	787									
31160	-->	84	67	82	32	32	=	299	31410	-->	172	189	126	85	331	=	763									
31165	-->	32	86	65	76	73	=	332	31415	-->	132	189	126	106	129	=	682									

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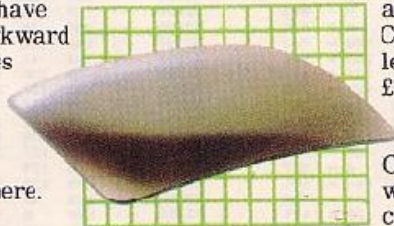
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(continued from page 136)

1. CSAVEM "MODEL", 32420, 32740, 0 save the model file.
 2. CSAVEM "\$FILES\$", 30920, 32400, 0 save the program.
 3. CSAVEM "FILE", 1700, RAMTOP, 0 save the card-index.
- where RAMtop = 256 * PEEK(32762) + PEEK(32763).

Command 5 allows you to reset the memory. This command is error trapped. Press 5 — OK? appears at the bottom of the screen. If you press 0 (not zero) this command is executed. All the memory is cleared and RAMtop is set at 1700. Any other

returns you to the menu.

Command 6 allows you to look at your card-index sequentially and to clear certain files. Press 6 and the first file is displayed with the message 0 Dump 1 Clear. If you press 0 you will see 'Space': Dump to Printer. If you press — Space: you will get a copy of the screen on the printer. Any other key displays the following file.

If you press 1 the present file is cleared from the screen and from memory and the next file appears on the screen. If you press Break you return to the menu.

If you press any other key the next file will be displayed. The message Finished appears when the exploration of the card index is terminated. Press any key for the menu.

Messages.

File recorded	see command 1
Finished	" " 3, 6
'Space: Dump to Printer	" " 3, 6
OK?	" " 2
0 dump and clear	" " 3
End of File	" " 1
Syntax Error	" " 2
Out of Memory	" " The memory is full.

The message No Starting Point (210) Found can appear after an

EXEC31921

The program explores the memory searching RAMtop (210); if it doesn't find it it displays that message. When you load a card-index again you must not set RAMtop — it is automatic.

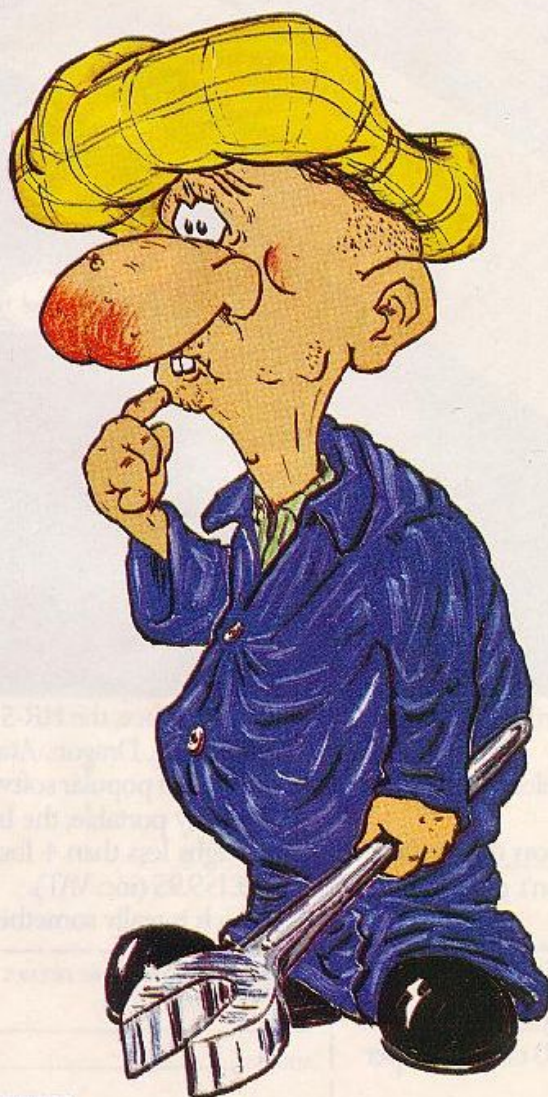


(decimal dump continued from page 136)

31655	-->	16	38	2	92	16	=	161	31905	-->	126	121	48	31	191	=	517	32155	-->	90	193	0	38	246	=	567
31660	-->	142	170	244	198	4	=	703	31910	-->	137	250	160	127	245	=	740	32160	-->	57	16	142	121	11	=	347
31665	-->	189	125	147	89	126	=	775	31915	-->	191	127	252	126	124	=	820	32165	-->	198	10	142	5	96	=	451
31670	-->	85	129	78	38	9	=	339	31920	-->	72	189	126	121	140	=	648	32170	-->	109	128	150	151	127	=	782
31675	-->	190	127	252	91	127	=	887	31925	-->	120	190	16	36	7	=	352	32175	-->	236	189	122	170	142	=	859
31680	-->	250	126	125	75	129	=	705	31930	-->	710	48	31	191	127	=	607	32180	-->	6	165	16	150	127	=	504
31685	-->	3	16	39	0	252	=	310	31935	-->	250	127	127	245	127	=	875	32185	-->	236	230	160	193	99	=	918
31690	-->	126	125	75	29	122	=	577	31940	-->	127	255	134	128	142	=	785	32190	-->	39	38	16	140	5	=	323
31695	-->	38	202	166	60	129	=	695	31945	-->	4	0	151	127	243	=	570	32195	-->	235	36	181	247	27	=	946
31700	-->	128	39	196	29	210	=	702	31950	-->	167	128	140	6	0	=	441	32200	-->	240	166	128	129	210	=	873
31705	-->	39	208	129	34	39	=	549	31955	-->	38	249	142	4	0	=	433	32205	-->	39	44	177	127	240	=	627
31710	-->	242	167	128	126	123	=	786	31960	-->	16	142	121	86	193	=	563	32210	-->	39	230	126	125	182	=	707
31715	-->	209	16	142	4	0	=	371	31965	-->	96	189	125	8	142	=	560	32215	-->	191	127	242	166	130	=	856
31720	-->	142	126	164	66	128	=	726	31970	-->	4	128	16	142	121	=	411	32220	-->	129	134	38	250	48	=	599
31725	-->	167	160	16	140	5	=	488	31975	-->	182	198	54	189	125	=	748	32225	-->	1	191	127	252	124	=	695
31730	-->	63	35	246	57	189	=	590	31980	-->	8	48	136	42	16	=	250	32230	-->	127	255	189	123	145	=	839
31735	-->	126	93	189	122	170	=	700	31985	-->	142	121	236	198	109	=	806	32235	-->	127	127	209	189	126	=	824
31740	-->	142	4	0	16	142	=	304	31990	-->	189	125	6	48	136	=	506	32240	-->	8	129	3	39	18	=	197
31745	-->	176	164	166	128	167	=	751	31995	-->	9	16	142	122	09	=	388	32245	-->	190	127	242	126	125	=	810
31750	-->	160	140	5	64	37	=	406	32000	-->	198	57	189	125	0	=	577	32250	-->	182	16	142	120	213	=	473
31755	-->	247	16	142	120	200	=	725	32005	-->	126	125	26	166	160	=	605	32255	-->	190	0	189	123	147	=	667
31760	-->	198	13	189	125	147	=	672	32010	-->	129	32	38	2	131	=	335	32260	-->	189	126	85	57	16	=	473
31765	-->	189	126	85	126	124	=	650	32015	-->	192	128	61	167	128	=	679	32265	-->	142	120	221	198	23	=	704
31770	-->	177	189	126	93	16	=	601	32020	-->	90	193	0	38	239	=	560	32270	-->	189	125	147	189	126	=	776
31775	-->	142	120	244	198	4	=	708	32025	-->	57	189	126	85	129	=	586	32275	-->	85	129	32	39	4	=	207
31780	-->	189	125	147	189	126	=	776	32030	-->	49	16	39	254	211	=	569	32280	-->	189	126	106	57	142	=	620
31785	-->	85	129	79	16	38	=	347	32035	-->	129	50	30	4	189	=	412	32285	-->	4	0	127	127	244	=	502
31790	-->	0	150	142	6	164	=	462	32040	-->	125	75	126	124	198	=	648	32290	-->	246	127	244	193	31	=	141
31795	-->	134	210	167	128	140	=	779	32045	-->	129	51	38	4	189	=	413	32295	-->	34	36	174	177	244	=	565
31800	-->	120	180	37	249	126	=	712	32050	-->	125	94	126	124	198	=	667	32300	-->	166	128	140	5	63	=	502
31805	-->	124	177	142	6	165	=	614	32055	-->	129	52	39	48	129	=	397	32305	-->	34	12	129	95	37	=	308
31810	-->	191	127	252	189	126	=	885	32060	-->	53	16	39	254	218	=	580	32310	-->	2	128	64	189	128	=	511
31815	-->	53	190	127	252	191	=	852	32065	-->	129	54	30	213	189	=	623	32315	-->	15	126	126	34	134	=	435
31820	-->	127	246	189	126	106	=	794	32070	-->	124	63	126	124	198	=	635	32320	-->	13	169	126	15	189	=	534
31825	-->	166	132	127	210	16	=	653	32075	-->	189	126	93	189	123	=	720	32325	-->	129	15	89	123	15	=	475
31830	-->	39	1	162	191	127	=	526	32080	-->	228	142	4	0	191	=	565	32330	-->	126	126	24	134	13	=	423
31835	-->	252	124	127	255	189	=	947	32085	-->	127	248	189	222	170	=	856	32335	-->	189	128	15	126	126	=	584
31840	-->	123	45	127	127	255	=	777	32090	-->	189	123	33	57	189	=	591	32340	-->	31	189	20	0	129	=	480
31845	-->	16	191	127	252	16	=	602	32095	-->	126	93	124	27	245	=	715	32345	-->	0	39	249	57	142	=	487
31850	-->	142	70	248	198	19	=	727	32100	-->	189	128	161	127	127	=	729	32350	-->	4	0	98	96	231	=	529
31855	-->	189	125	147	189	126	=	776	32105	-->	245	57	189	226	121	=	738	32355	-->	129	140	6	0	37	=	311
31860	-->	85	129	3	16	39	=	272	32110	-->	191	127	250	57	16	=	641	32360	-->	249	57	16	142	8	=	469
31865	-->	1	140	129	48	30	=	356	32115	-->	142	121	21	198	1	=	493	32365	-->	64	198	96	231	160	=	749
31870	-->	6	189	176	8	126	=	452	32120	-->	176	175	147	16	142	=	489	32370	-->	16	140	5	96	37	=	294
31875	-->	124	72	129	49	39	=	413	32125	-->	121	32	193	12	126	=	489	32375	-->	248	57	142	8	164	=	617
31880	-->	3	126	124	72	190	=	515	32130	-->	125	147	16	42	121	=	551	32380	-->	166	128	140	120	180	=	734
31885	-->	127	246	16	190	127	=	706	32135	-->	44	198	13	126	125	=	506	32385	-->	36	4	129	210	38	=	417
31890	-->	252	191	127	252	166	=	988	32140	-->	147	16	142	121	57	=	485	32390	-->	245	57	255	255	255	=	1067
31895	-->	160	167	128	16	140	=	611	32145	-->	158	29	142	5	64	=	438									
31900	-->	120	180	37	246	189	=	772	32150	-->	166	160	189	122	146	=	783									

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Nine new commands for Spectrum Basic, courtesy of Robert Newman

I HAVE WRITTEN a machine-code routine which adds nine new commands to Spectrum Basic which will run with or without Interface 1.

The machine-code routine must be loaded and initialised before either writing a program, or loading a program which uses the new commands. If you do this it is not necessary to save the machine code again when you save your program.

A short Basic program, listing 1 (16K) or listing 2 (48K), is used to load the machine code above RAMtop, and perform the initialisation. This program should be typed in, and then saved on a cassette or Microdrive cartridge to auto-run from Line 3. If you use a Microdrive, the program can be given the filename "run", ie:

SAVE "m";1;"run" LINE 3 or

SAVE "BASIC+" LINE 3

New the computer, then type in and Run listing 3, the machine code loader program. Copy the machine code bytes from either listing 4 or 5 depending upon memory size. Great care must be taken while copying from the machine code dump, since a single mistake could cause the computer to crash.

You should now have a working copy of the Basic 1 interpreter. To test it, rewind the tape and clear the computer by typing Randomise USR 0. Then load the initialisation program and machine code, and type *ZAP which should produce a laser type sound effect.

Graphic characters

*USE (Nchars), (Memory): (Nchars) is the number of different graphic characters that you want to use, and can take values from 1 to 255. (Memory) is the memory size in bytes needed for storing those characters. To calculate the number of bytes required to store each character, divide its width by 8, and add 1 for any remainder, then multiply by its height.

This command causes part of the memory to be reserved for the storage of your graphics characters. The total number of bytes required is (Memory) + (Nchars)*4 bytes. For example, the command *USE 8,256 reserves 288 bytes. If you try to reserve more memory for your graphics than the spare memory available, this will halt your program with a runtime error.

The graphics memory area is situated just before the start of the machine code. If



EXPANDED BASIC

necessary, RAMtop will be lowered — and the machine stack and Gosub stack moved — to make room for the graphics memory. The routine will only lower RAMtop, and never moves it to a higher address. This is to allow your own machine-code routines to be used with extended Basic provided that they are located between the graphics memory and RAMtop.

The *Use command clears the graphics memory and character-size definitions — see *Def — and can be used more than once in a program for this purpose. If there is no *Use command in a program, the command *USE 8,256 is assumed by the routine.

*DEF (Char), (Width), (Ht): After *Use, the *Def command is used to set the size of a graphics character. (Char) is the character number, which can take values from 1 to (Nchars). (Width) and (Ht) are the sizes of this character in pixels — from 1 to 256 pixels wide, and from 1 to 176 pixels high. You must set the size of a character before using it in one of the remaining commands, which are:—

*GET (char), (xpos), (ypos)

*PUT (char), (xpos), (ypos)

*CLR (char), (xpos), (ypos)

Lines 2,3 and 4 of the initialisation program can be deleted once the machine code has

(continued on page 143)

Listing 1. 16K initialisation.

```
1 POKE PEEK 23613+256*PEEK 23614,206: POKE 1+PEEK
  23613+256*PEEK 23614,PEEK 23733-6
2 GO TO 4
3 CLEAR 31131: LOAD "16KMC" CODE: GO TO 1
4 CLS: PRINT "16K BASIC+ (C) Robert Newman 1984"
```

Listing 2. 48K initialisation.

```
1 POKE PEEK 23613+256*PEEK 23614,206: POKE
  1+PEEK 23613+256*PEEK 23614,PEEK 23733-6
2 GO TO 4
3 CLEAR 63999: LOAD "48KMC" CODE: GO TO 1
4 CLS: PRINT "48K BASIC+ (C)
  Robert Newman 1984"
```

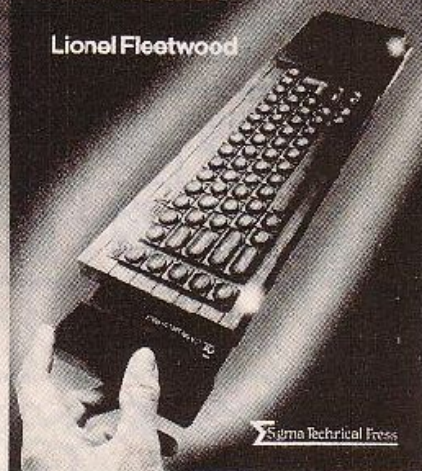
Listing 3. Machine code loader.

```
1 REM listing 3
10 CLEAR 31131+32768*PEEK 23733-255
20 LET K48=(PEEK 23733-255)
30 LET mc=31132+32768*K48
40 FOR j=mc TO mc+22: POKE j,0: NEXT j
50 LET sum=0
60 FOR j=mc+23 TO mc+1464
```

```
70 PRINT j;TAB 7;
80 INPUT n: POKE j,n
90 PRINT n: LET sum=sum+n
100 NEXT j
110 LET checksum=161457+16*28 AND K48
120 IF sum<>checksum THEN PRINT "Checksum error": STOP
130 LET a1=(16KMC AND NOT K48)+(48KMC AND K48)
140 SAVE a# CODE mc,1465
150 REM or SAVE "m";a# CODE mc,1465
```


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Lionel Fleetwood



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40-way £2.15

50-way £2.30

60-way £2.45

9-way 85

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9-way 85

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16-way £1.25

20-way £1.40

26-way £1.70

34-way £2.00

40-way £2.15

50-way £2.30

60-way £2.45

9-way 85

14-way £1.00

16-way £1.25

20-way £1.40

26-way £1.70

34-way £2.00

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(continued from page 141)

loaded, but you must not delete line 1, otherwise none of the new commands will be recognised when you Run your program.

During runtime, if the command cannot be executed, the error message produced is code Q — "Parameter error."

*BRK 0 and *BRK 1: These commands allow the break key to be disabled (*BRK 0), or re-enabled (*BRK 1).

*ZAP: This command gives a laser-type zap sound.

*NSE (Length): This command gives white noise for a time depending upon (Length) which can take values from 1 to 255.

Depending upon the length, this can sound like an explosion, gunshot etc. A machine-gun type sound can be made using a loop — eg., FOR j = 1 TO 10: *NSE 50: PAUSE 10: NEXT j *SCR (Paper), (Ink). This command changes the Paper and Ink colours of the screen without erasing its contents. Paper and Ink can take values from 0 to 9 as with the normal colour commands.

The remaining commands are concerned with printing of user-defined graphics. These can be copied from the screen into graphics memory with *Get and then printed anywhere on the screen with *Put. The routine can handle graphics of any size from 1

by 1 pixels to 256 by 176 pixels, and caters for up to 255 different graphics characters.

First, you need to decide how much memory you want to set aside for the storage of graphics characters. This is done with the *Use command.

In all three commands, (Char) is the character number — the size of which must have previously been defined with *Def. (Xpos) and (Ypos) are the pixel co-ordinates of a point on the screen at the top left hand corner of the area from where the graphic character information is to be copied from, printed to, or erased.

(continued on next page)

Listing 4. 16K machine code dump.

```

311551: 98 114 107 115 99 114 110 115 121 122 97 112 117 115
311552: 101 99 108 114 112 117 116 103 131 102 58
311553: 50 92 254 11 40 19 254 12 40 5 224 22 194 167
311554: 122 253 118 125 202 147 122 195 12 174 45 33 92
311555: 126 254 43 194 147 122 254 17 179 12 47 3 16
311556: 6 9 223 203 239 221 190 0 40 7 22 25 16 247
311557: 195 147 122 120 50 176 121 6 2 221 35 221 203 239
311558: 221 190 0 32 121 16 244 231 58 176 12 244 7 40
311559: 55 254 0 40 26 254 7 40 35 254 6 40 50 254
311560: 40 14 203 251 36 253 203 1 118 40 88 254 44
311561: 82 221 205 251 36 253 203 1 118 40 71 254 44
311562: 33 68 231 205 251 36 253 203 1 118 40 53 24 18
311563: 223 254 48 51 254 50 48 47 253 203 1 126 194
311564: 20 233 254 13 40 8 23 54 0 11 254 58
311565: 26 253 203 1 126 194 39 123 53 54 0 255 253
311566: 54 38 0 33 206 121 229 33 183 18 229 145 118 27
311567: 253 203 1 126 32 13 33 206 121 229 42 93 32 34
311568: 95 92 195 183 18 118 253 203 1 174 253 203 48 78
311569: 176 200 14 58 98 92 60 243 33 0 213 116 30
311570: 116 38 34 11 92 35 34 32 92 205 176 22 253
311571: 203 55 174 205 110 13 253 203 2 258 24 71 254 10
311572: 2 198 7 203 239 21 62 32 215 120 17 145 19
311573: 10 12 175 17 54 31 205 13 12 237 7 49 92
311574: 205 27 26 62 58 15 253 78 13 6 205 27 26
311575: 151 16 58 98 92 253 54 0 253 33 236 121 229
311576: 195 104 19 231 254 13 40 4 254 88 33 176 121
311577: 214 49 50 176 92 195 12 123 253 54 0 25 58 176
311578: 214 254 4 40 42 254 4 40 112 48 164 254 5 40
311579: 254 1 40 56 205 50 127 254 176 210 156 122 50
311580: 167 121 205 50 127 50 166 121 205 62 127 61 253 190
311581: 119 210 166 122 50 165 121 24 70 205 50 127 254 10
311582: 101 166 122 50 165 121 205 50 127 254 10 210 166 122
311583: 166 121 205 50 165 121 205 50 127 254 10 210 166 122
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311742: 166 121 205 50 165 121 205 50 127 254 10 
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Listing 6. Demonstration program.

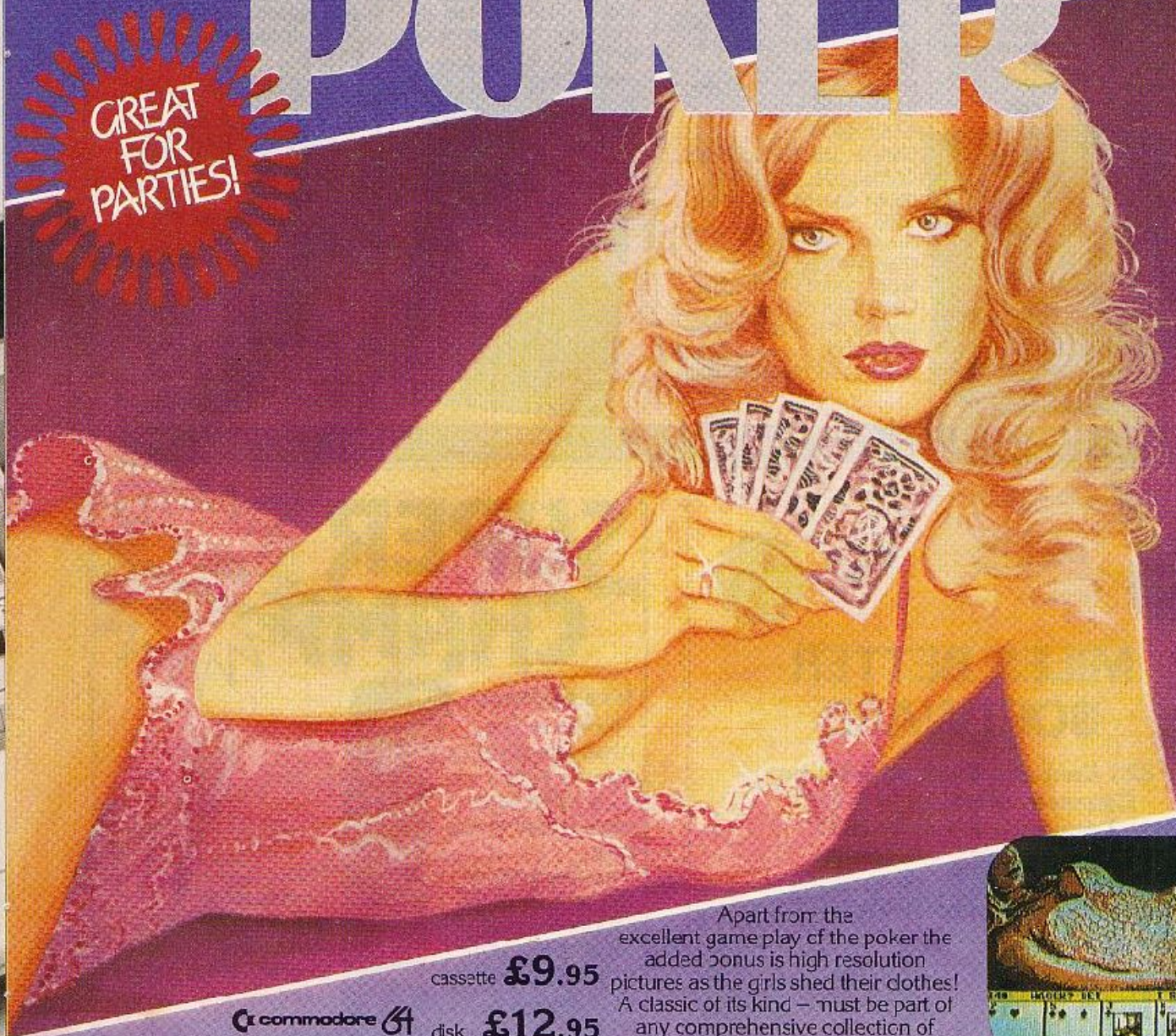
```

1 POKE PEEK(25613)+256*PEEK(25614),200: POKE PEEK(25613)+256*PEEK(25614),
PEEK(25613)+256*PEEK(25614)
20 CLS: PRINT "EXTENDED BASIC Robert Newman."
30 REM ***** demo *****
40 BORDER 1:SCR 4,0
50 PRINT "This program shows how the new commands of the extended BASIC
C can be used."
60 PRINT "There are two new sound commands"
70 GO SUB 8000
80 PRINT " *zap gives this sound,"
90 FOR i=1 TO 5:zap:PAUSE 20: NEXT i
100 PAUSE 50
110 PRINT "You can also make white noise for explosions or gunshots et
c. with the command :-"
120 PRINT "TAB 10: *zap n""
130 PRINT "where n is a number from 1 to 255 to set the length of the sound"
140 FOR i=1 TO 10:zap 50: NEXT i
150 GO SUB 9000
160 PRINT "There is a command for disabling/enabling the BREAK key."
170 PRINT " *brk 0 disables BREAK."
180 PRINT " *brk 1 re-enables it."
190 PRINT " *brk 0"
200 PRINT "Try pressing BREAK while the counter is running up to 1000"
210 FOR i=1 TO 1000
220 PRINT AT 12,15: i
230 NEXT i
240 PRINT "BREAK is now re-enabled."
250 PRINT "There are several new graphics commands."
260 PRINT "TAB 7: *scr (paper), (ink)"
270 PRINT " *scr 1 change the paper and ink colours of the whole screen"
280 PRINT " *scr 2 without changing the contents."
290 PRINT " *scr 3 *scr 4 *scr 5 *scr 6 *scr 7 *scr 8 *scr 9"
300 PRINT " *scr 10 *scr 11 *scr 12 *scr 13 *scr 14 *scr 15 *scr 16 *scr 17"
310 PRINT " *scr 18 *scr 19 *scr 20 *scr 21 *scr 22 *scr 23 *scr 24 *scr 25"
320 PRINT " *scr 26 *scr 27 *scr 28 *scr 29 *scr 30 *scr 31 *scr 32 *scr 33"
330 PRINT " *scr 34 *scr 35 *scr 36 *scr 37 *scr 38 *scr 39 *scr 40 *scr 41"
340 PRINT " *scr 42 *scr 43 *scr 44 *scr 45 *scr 46 *scr 47 *scr 48 *scr 49"
350 PRINT " *scr 50 *scr 51 *scr 52 *scr 53 *scr 54 *scr 55 *scr 56 *scr 57"
360 PRINT " *scr 58 *scr 59 *scr 60 *scr 61 *scr 62 *scr 63 *scr 64 *scr 65"
370 PRINT " *scr 66 *scr 67 *scr 68 *scr 69 *scr 70 *scr 71 *scr 72 *scr 73"
380 PRINT " *scr 74 *scr 75 *scr 76 *scr 77 *scr 78 *scr 79 *scr 80 *scr 81"
390 PRINT " *scr 82 *scr 83 *scr 84 *scr 85 *scr 86 *scr 87 *scr 88 *scr 89"
400 PRINT " *scr 90 *scr 91 *scr 92 *scr 93 *scr 94 *scr 95 *scr 96 *scr 97"
410 PRINT " *scr 98 *scr 99 *scr 100 *scr 101 *scr 102 *scr 103 *scr 104 *scr 105"
420 PRINT " *scr 106 *scr 107 *scr 108 *scr 109 *scr 110 *scr 111 *scr 112 *scr 113"
430 PRINT " *scr 114 *scr 115 *scr 116 *scr 117 *scr 118 *scr 119 *scr 120 *scr 121"
440 PRINT " *scr 122 *scr 123 *scr 124 *scr 125 *scr 126 *scr 127 *scr 128 *scr 129"
450 PRINT " *scr 130 *scr 131 *scr 132 *scr 133 *scr 134 *scr 135 *scr 136 *scr 137"
460 PRINT " *scr 138 *scr 139 *scr 140 *scr 141 *scr 142 *scr 143 *scr 144 *scr 145"
470 PRINT " *scr 146 *scr 147 *scr 148 *scr 149 *scr 150 *scr 151 *scr 152 *scr 153"
480 PRINT " *scr 154 *scr 155 *scr 156 *scr 157 *scr 158 *scr 159 *scr 160 *scr 161"
490 PRINT " *scr 162 *scr 163 *scr 164 *scr 165 *scr 166 *scr 167 *scr 168 *scr 169"
500 PRINT " *scr 170 *scr 171 *scr 172 *scr 173 *scr 174 *scr 175 *scr 176 *scr 177"
510 PRINT " *scr 178 *scr 179 *scr 180 *scr 181 *scr 182 *scr 183 *scr 184 *scr 185"
520 PRINT " *scr 186 *scr 187 *scr 188 *scr 189 *scr 190 *scr 191 *scr 192 *scr 193"
530 PRINT " *scr 194 *scr 195 *scr 196 *scr 197 *scr 198 *scr 199 *scr 200 *scr 201"
540 PRINT " *scr 202 *scr 203 *scr 204 *scr 205 *scr 206 *scr 207 *scr 208 *scr 209"
550 PRINT " *scr 210 *scr 211 *scr 212 *scr 213 *scr 214 *scr 215 *scr 216 *scr 217"
560 PRINT " *scr 218 *scr 219 *scr 220 *scr 221 *scr 222 *scr 223 *scr 224 *scr 225"
570 PRINT " *scr 226 *scr 227 *scr 228 *scr 229 *scr 230 *scr 231 *scr 232 *scr 233"
580 PRINT " *scr 234 *scr 235 *scr 236 *scr 237 *scr 238 *scr 239 *scr 240 *scr 241"
590 PRINT " *scr 242 *scr 243 *scr 244 *scr 245 *scr 246 *scr 247 *scr 248 *scr 249"
600 PRINT " *scr 250 *scr 251 *scr 252 *scr 253 *scr 254 *scr 255 *scr 256 *scr 257"
610 PRINT " *scr 258 *scr 259 *scr 260 *scr 261 *scr 262 *scr 263 *scr 264 *scr 265"
620 PRINT " *scr 266 *scr 267 *scr 268 *scr 269 *scr 270 *scr 271 *scr 272 *scr 273"
630 PRINT " *scr 274 *scr 275 *scr 276 *scr 277 *scr 278 *scr 279 *scr 280 *scr 281"
640 PRINT " *scr 282 *scr 283 *scr 284 *scr 285 *scr 286 *scr 287 *scr 288 *scr 289"
650 PRINT " *scr 290 *scr 291 *scr 292 *scr 293 *scr 294 *scr 295 *scr 296 *scr 297"
660 PRINT " *scr 298 *scr 299 *scr 300 *scr 301 *scr 302 *scr 303 *scr 304 *scr 305"
670 PRINT " *scr 306 *scr 307 *scr 308 *scr 309 *scr 310 *scr 311 *scr 312 *scr 313"
680 PRINT " *scr 314 *scr 315 *scr 316 *scr 317 *scr 318 *scr 319 *scr 320 *scr 321"
690 PRINT " *scr 322 *scr 323 *scr 324 *scr 325 *scr 326 *scr 327 *scr 328 *scr 329"
700 PRINT " *scr 330 *scr 331 *scr 332 *scr 333 *scr 334 *scr 335 *scr 336 *scr 337"
710 PRINT " *scr 338 *scr 339 *scr 340 *scr 341 *scr 342 *scr 343 *scr 344 *scr 345"
720 PRINT " *scr 346 *scr 347 *scr 348 *scr 349 *scr 350 *scr 351 *scr 352 *scr 353"
730 PRINT " *scr 354 *scr 355 *scr 356 *scr 357 *scr 358 *scr 359 *scr 360 *scr 361"
740 PRINT " *scr 362 *scr 363 *scr 364 *scr 365 *scr 366 *scr 367 *scr 368 *scr 369"
750 PRINT " *scr 370 *scr 371 *scr 372 *scr 373 *scr 374 *scr 375 *scr 376 *scr 377"
760 PRINT " *scr 378 *scr 379 *scr 380 *scr 381 *scr 382 *scr 383 *scr 384 *scr 385"
770 PRINT " *scr 386 *scr 387 *scr 388 *scr 389 *scr 390 *scr 391 *scr 392 *scr 393"
780 PRINT " *scr 394 *scr 395 *scr 396 *scr 397 *scr 398 *scr 399 *scr 400 *scr 401"
790 PRINT " *scr 402 *scr 403 *scr 404 *scr 405 *scr 406 *scr 407 *scr 408 *scr 409"
800 PRINT " *scr 410 *scr 411 *scr 412 *scr 413 *scr 414 *scr 415 *scr 416 *scr 417"
810 PRINT " *scr 418 *scr 419 *scr 420 *scr 421 *scr 422 *scr 423 *scr 424 *scr 425"
820 PRINT " *scr 426 *scr 427 *scr 428 *scr 429 *scr 430 *scr 431 *scr 432 *scr 433"
830 PRINT " *scr 434 *scr 435 *scr 436 *scr 437 *scr 438 *scr 439 *scr 440 *scr 441"
840 PRINT " *scr 442 *scr 443 *scr 444 *scr 445 *scr 446 *scr 447 *scr 448 *scr 449"
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870 PRINT " *scr 466 *scr 467 *scr 468 *scr 469 *scr 470 *scr 471 *scr 472 *scr 473"
880 PRINT " *scr 474 *scr 475 *scr 476 *scr 477 *scr 478 *scr 479 *scr 480 *scr 481"
890 PRINT " *scr 482 *scr 483 *scr 484 *scr 485 *scr 486 *scr 487 *scr 488 *scr 489"
900 PRINT " *scr 490 *scr 491 *scr 492 *scr 493 *scr 494 *scr 495 *scr 496 *scr 497"
910 PRINT " *scr 498 *scr 499 *scr 500 *scr 501 *scr 502 *scr 503 *scr 504 *scr 505"
920 PRINT " *scr 506 *scr 507 *scr 508 *scr 509 *scr 510 *scr 511 *scr 512 *scr 513"
930 PRINT " *scr 514 *scr 515 *scr 516 *scr 517 *scr 518 *scr 519 *scr 520 *scr 521"
940 PRINT " *scr 522 *scr 523 *scr 524 *scr 525 *scr 526 *scr 527 *scr 528 *scr 529"
950 PRINT " *scr 530 *scr 531 *scr 532 *scr 533 *scr 534 *scr 535 *scr 536 *scr 537"
960 PRINT " *scr 538 *scr 539 *scr 540 *scr 541 *scr 542 *scr 543 *scr 544 *scr 545"
970 PRINT " *scr 546 *scr 547 *scr 548 *scr 549 *scr 550 *scr 551 *scr 552 *scr 553"
980 PRINT " *scr 554 *scr 555 *scr 556 *scr 557 *scr 558 *scr 559 *scr 560 *scr 561"
990 PRINT " *scr 562 *scr 563 *scr 564 *scr 565 *scr 566 *scr 567 *scr 568 *scr 569"
1000 PRINT " *scr 570 *scr 571 *scr 572 *scr 573 *scr 574 *scr 575 *scr 576 *scr 577"
1010 PRINT " *scr 578 *scr 579 *scr 580 *scr 581 *scr 582 *scr 583 *scr 584 *scr 585"
1020 PRINT " *scr 586 *scr 587 *scr 588 *scr 589 *scr 590 *scr 591 *scr 592 *scr 593"
1030 PRINT " *scr 594 *scr 595 *scr 596 *scr 597 *scr 598 *scr 599 *scr 600 *scr 601"
1040 PRINT " *scr 602 *scr 603 *scr 604 *scr 605 *scr 606 *scr 607 *scr 608 *scr 609"
1050 PRINT " *scr 610 *scr 611 *scr 612 *scr 613 *scr 614 *scr 615 *scr 616 *scr 617"
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1080 PRINT " *scr 634 *scr 635 *scr 636 *scr 637 *scr 638 *scr 639 *scr 640 *scr 641"
1090 PRINT " *scr 642 *scr 643 *scr 644 *scr 645 *scr 646 *scr 647 *scr 648 *scr 649"
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1340 PRINT " *scr 842 *scr 843 *scr 844 *scr 845 *scr 846 *scr 847 *scr 848 *scr 849"
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1410 PRINT " *scr 898 *scr 899 *scr 900 *scr 901 *scr 902 *scr 903 *scr 904 *scr 905"
1420 PRINT " *scr 906 *scr 907 *scr 908 *scr 909 *scr 910 *scr 911 *scr 912 *scr 913"
1430 PRINT " *scr 914 *scr 915 *scr 916 *scr 917 *scr 918 *scr 919 *scr 920 *scr 921"
1440 PRINT " *scr 922 *scr 923 *scr 924 *scr 925 *scr 926 *scr 927 *scr 928 *scr 929"
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1510 PRINT " *scr 978 *scr 979 *scr 980 *scr 981 *scr 982 *scr 983 *scr 984 *scr 985"
1520 PRINT " *scr 986 *scr 987 *scr 988 *scr 989 *scr 990 *scr 991 *scr 992 *scr 993"
1530 PRINT " *scr 994 *scr 995 *scr 996 *scr 997 *scr 998 *scr 999 *scr 1000 *scr 1001"
1540 PRINT " *scr 1002 *scr 1003 *scr 1004 *scr 1005 *scr 1006 *scr 1007 *scr 1008 *scr 1009"
1550 PRINT " *scr 1010 *scr 1011 *scr 1012 *scr 1013 *scr 1014 *scr 1015 *scr 1016 *scr 1017"
1560 PRINT " *scr 1018 *scr 1019 *scr 1020 *scr 1021 *scr 1022 *scr 1023 *scr 1024 *scr 1025"
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1590 PRINT " *scr 1042 *scr 1043 *scr 1044 *scr 1045 *scr 1046 *scr 1047 *scr 1048 *scr 1049"
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1620 PRINT " *scr 1066 *scr 1067 *scr 1068 *scr 1069 *scr 1070 *scr 1071 *scr 1072 *scr 1073"
1630 PRINT " *scr 1074 *scr 1075 *scr 1076 *scr 1077 *scr 1078 *scr 1079 *scr 1080 *scr 1081"
1640 PRINT " *scr 1082 *scr 1083 *scr 1084 *scr 1085 *scr 1086 *scr 1087 *scr 1088 *scr 1089"
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1660 PRINT " *scr 1098 *scr 1099 *scr 1100 *scr 1101 *scr 1102 *scr 1103 *scr 1104 *scr 1105"
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1680 PRINT " *scr 1114 *scr 1115 *scr 1116 *scr 1117 *scr 1118 *scr 1119 *scr 1120 *scr 1121"
1690 PRINT " *scr 1122 *scr 1123 *scr 1124 *scr 1125 *scr 1126 *scr 1127 *scr 1128 *scr 1129"
1700 PRINT " *scr 1130 *scr 1131 *scr 1132 *scr 1133 *scr 1134 *scr 1135 *scr 1136 *scr 1137"
1710 PRINT " *scr 1138 *scr 1139 *scr 1140 *scr 1141 *scr 1142 *scr 1143 *scr 1144 *scr 1145"
1720 PRINT " *scr 1146 *scr 1147 *scr 1148 *scr 1149 *scr 1150 *scr 1151 *scr 1152 *scr 1153"
1730 PRINT " *scr 1154 *scr 1155 *scr 1156 *scr 1157 *scr 1158 *scr 1159 *scr 1160 *scr 1161"
1740 PRINT " *scr 1162 *scr 1163 *scr 1164 *scr 1165 *scr 1166 *scr 1167 *scr 1168 *scr 1169"
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1850 PRINT " *scr 1250 *scr 1251 *scr 1252 *scr 1253 *scr 1254 *scr 1255 *scr 1256 *scr 1257"
1860 PRINT " *scr 1258 *scr 1259 *scr 1260 *scr 1261 *scr 1262 *scr 1263 *scr 1264 *scr 1265"
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1910 PRINT " *scr 1298 *scr 1299 *scr 1300 *scr 1301 *scr 1302 *scr 1303 *scr 1304 *scr 1305"
1920 PRINT " *scr 1306 *scr 1307 *scr 1308 *scr 1309 *scr 1310 *scr 1311 *scr 1312 *scr 1313"
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1980 PRINT " *scr 1354 *scr 1355 *scr 1356 *scr 1357 *scr 1358 *scr 1359 *scr 1360 *scr 1361"
1990 PRINT " *scr 1362 *scr 1363 *scr 1364 *scr 1365 *scr 1366 *scr 1367 *scr 1368 *scr 1369"
2000 PRINT " *scr 1370 *scr 1371 *scr 1372 *scr 1373 *scr 1374 *scr 1375 *scr 1376 *scr 1377"
2010 PRINT " *scr 1378 *scr 1379 *scr 1380 *scr 1381 *scr 1382 *scr 1383 *scr 1384 *scr 1385"
2020 PRINT " *scr 1386 *scr 1387 *scr 1388 *scr 1389 *scr 1390 *scr 1391 *scr 1392 *scr 1393"
2030 PRINT " *scr 1394 *scr 1395 *scr 1396 *scr 1397 *scr 1398 *scr 1399 *scr 1400 *scr 1401"
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2180 PRINT " *scr 1514 *scr 1515 *scr 1516 *scr 1517 *scr 1518 *scr 1519 *scr 1520 *scr 1521"
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2310 PRINT " *scr 1618 *scr 1619 *scr 1620 *scr 1621 *scr 1622 *scr 1623 *scr 1624 *scr 1625"
2320 PRINT " *scr 
```


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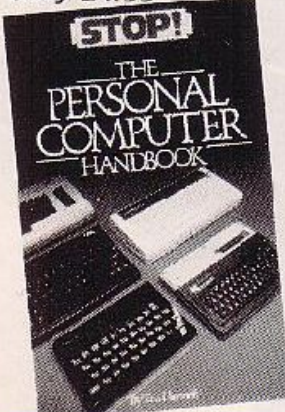
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RESPONSE FRAME

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QL TIMING

■ I have finally, after months and months and months of waiting, got my QL. I am writing a game in which the time it takes a player to enter a move is crucial — there is a limited number of seconds to enter the answer. I thought the inbuilt clock would be ideal for this. However, I can't get it to work as it claims it does in the manual, and to extract parts of the Date\$ — although the manual suggests this is the same as extracting 'slices' of any string — seems impossible. How can I do it?

Ian Cavalier,
Huntingdon.

I HAVE ALSO HAD some problems working out how to use the clock. I suggest you define two procedures: The first one, which you could call something like Setclock, would just reset the clock to zero after each move, with the line

```
SDATE 1984.9.3.0.0
```

or you could just include this within the program, if you didn't want to set up a separate procedure.

The second one, to print just the part of the time you want on the screen, could be called Printclock. It would need to include

```
CLOCKS = DATE$:PRINT CLOCKS
```

(13 TO 20)

to get minutes and seconds, or

```
CLOCKS(19 TO 20)
```

just to get the seconds. The last two characters of Clock\$ can also be checked for their numeric value if you want the program to do something after a specific time has elapsed.

THREE AND ONE

■ On reading that some Issue Three ZX Spectrum owners are experiencing difficulty loading commercial software, I am writing to inquire where you've heard of Issue One owners having problems loading some of the latest software releases. Quicksilver's Ant Attack just will not load on my Spectrum, and yet it will run on my friend's Issue Three machine. Could it be that software writers have now mastered the Issue Three problems at the expense of Issue One owners, or could it be that my trusted Issue One is feeling its age?

Brian Richardson,
Sittingbourne,
Kent.

THERE SHOULD BE no problems with Ant Attack as I have seen it running

quite happily on an Issue One machine. However, I have been told that there is some current software which "hiccups" a little on Issue One's. I suggest you go back to the store where you bought Ant Attack, tell them it won't load, and get another copy. If that doesn't work, perhaps your machine is feeling its age and either an overhaul is called for, or you'll have to settle for some other program.

BBC SUBSTITUTE

■ I used to own a 48K Spectrum, and was very happy with it. I especially like the Screen\$ and ATTR commands. Now I have a BBC Model B. To my surprise — and disappointment — I have found that this computer does not use those commands, so I feel very restricted in what I can do. Is there any way I can substitute these commands on my BBC Micro?

Norman Butt,
Dean Park,
Rushmore.

YOU CAN USE the Point command to return the colour of a single pixel. This does not work in Mode 7. Alternatively, and far more satisfactorily, you could investigate the operating system call which provides the functions you want. It is explained on page 452 of the user guide, where there is a program of 110 lines or so to demonstrate how it is done.

ACE IN THE HAND?

■ I am interested in learning Forth and have noticed that the Jupiter Ace is now available from some sources for as low as £29.95. However, I am reluctant to buy a machine from a company which is out of business and for which there is no expandability and little software. Can one get a colour board and, if so, is it possible to generate a true hi-res display?

C.J. Slade,
Rechester,
Kent.

IT SEEMS IT WOULD be hard to go wrong with a £29.95 machine, although the Ace is becoming increasingly difficult to get hold of. An add-on memory is the only peripheral which I have seen widely advertised. It might well be a better buy to get a Spectrum, and then buy one of the available Forth programs such as that produced by Artic, than start going down a dead-end street.

WHAT ADD-ONS?

■ I have a BBC Model B, and am very pleased with it. However, now that I've been using it for a year — and have saved up some more money — I would like to expand the hardware. I would appreciate it if you could give me some ideas of the priorities I should assign to various bits of add-on hardware, so I would know which ones to buy first.

Martin Kersh,
Southsea.

THIS QUESTION IS, I'm afraid, almost impossible to answer as you do not indicate the prime use of your BBC Micro, nor do you tell me what hardware you already have. However, keeping in mind that your letter suggests you have a "basic" Model B, and that your activities with the computer presumably include playing commercial software and writing your own programs, I would suggest the following should be considered first.

A disc drive is a tremendous asset to have, and you'll soon wonder why you put up with cassettes for so long. A wide range of drives is available, from around £160 for 5 1/4 inch 40 track, single-sided drives, dual drives of a similar standard are around £340, and a double-sided 5 inch Microdrive — which is totally compatible with 5 1/4 inch drives — is available from around £230.

A joystick will add a lot to your game playing, and these start from around £10. If writing your own programs is a higher priority than running commercial games, you might consider adding the Second Processor. Full details on this are available from Acorn Computers Ltd., Fulbourn Road, Cherry Hinton, Cambridge, CB1 4JN.

EASY REMS

■ In an earlier issue of *Your Computer*, there was a game called Frogger, which required one long Rem statement of 6208 characters. Please could you tell me an easy and reliable way to do this, as I have not yet fully mastered machine code on my ZX-81?

R.G. Simmonds,
Studley,
Warwickshire.

THERE ARE MANY ways of solving the problem. A particularly elegant way — developed by the former chairman of the Dutch ZX Users Group, Han van Abbe de Wassenaar, and passed on to me by Jan Verhoeven — suggests Peking the machine code into a Print statement. The procedure is as follows. Type in a Print statement with the structure

```
PRINT 0-0+0+0+0+... etc.
```

Every combination of a zero and a plus sign takes up one byte for the character zero, one byte for the delimiter (126), five bytes for the floating point representation, and

one byte for the plus sign. Altogether this yields eight bytes of memory space, with only two bytes of screen space. You next enter the line,

```
POKE 16513,234
```

to change the Print token to Rem, and then use your hex loader to fill the Rem.

Another method, devised by Jan Verhoeven himself, uses a single large Rem statement, which takes up about 200 spaces. This line is repeatedly edited, and during every edit the line number is changed. You first type in the large Rem statement, and use Edit to alter the line number several times. Next you enter the statement

```
LET L = PEEK 16511 + 256 * PEEK 16512
```

to get L as the length of one line. Add 4 to L, and add the new L to the old L. Poke a Newline (118) in locations 16514 and 16515 to prevent the display from uncontrolled scrolling during listings. Repeat these steps until enough space is reserved. But, take care, as a mistake is easily made.

COPYRIGHT

■ We are setting up a software business, and are wondering what to do about copyright. Also, what tape do you suggest we use for sound and speech?

Simon Martin and Craig Seager,
Lyvested,
Kent.

THE PROBLEM of copyright is a difficult one. At the moment, despite the best efforts of the Guild of Software Houses, it seems impossible to stop people copying your tapes if they want to, although a few ingenious systems — such as providing a hard-to-photocopy colour code card which tells you which numbers to enter at the beginning of a load — have been tried.

As to sound and speech, I'm afraid you'll have to develop your own routines, if you are to include them with your programs.

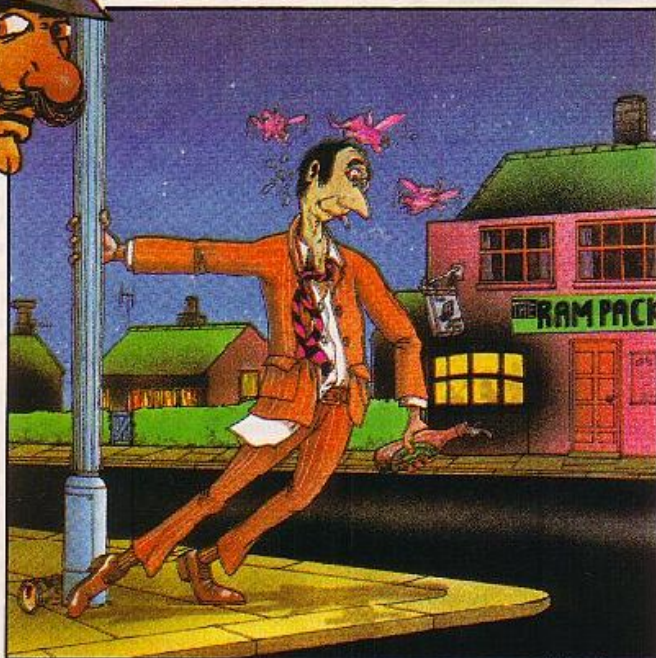
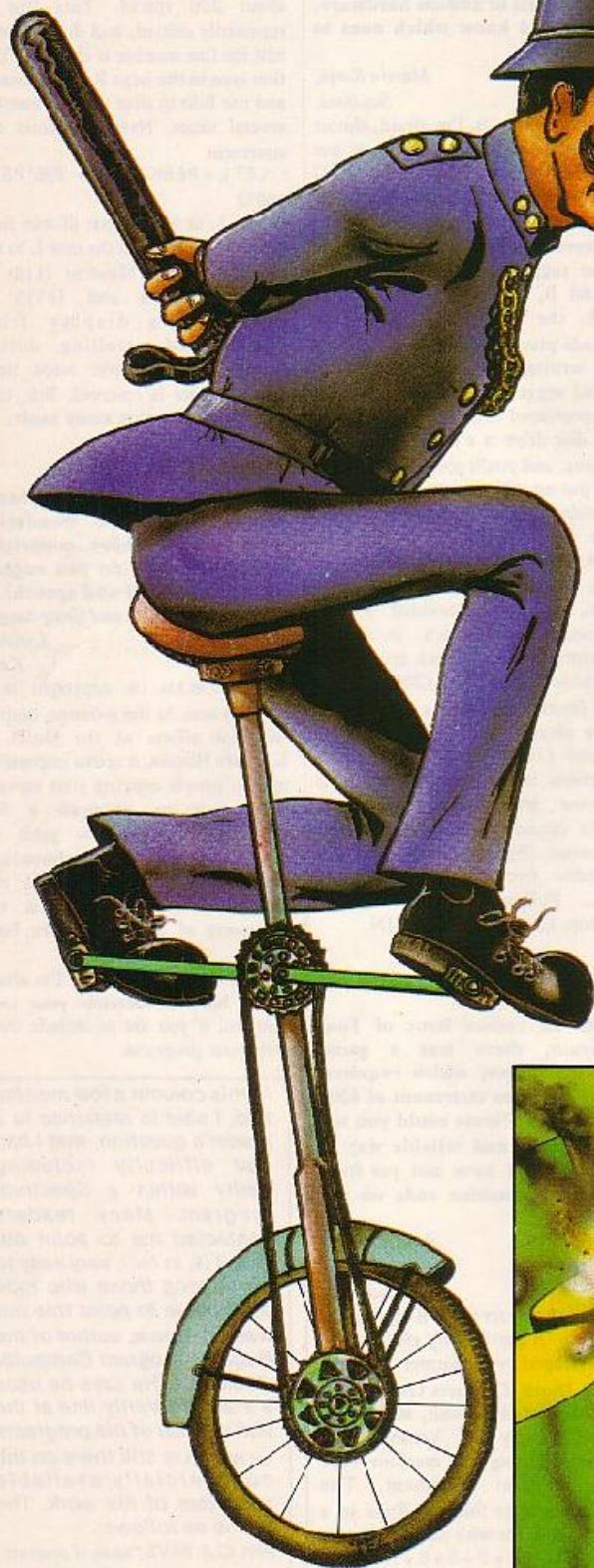
In this column a few months ago, I said in response to a reader's question, that I had had difficulty including Verify within a Spectrum program. Many readers contacted me to point out that it is, in fact, very easy to do. Among those who took the trouble to point this out was Ian Hoare, author of the Bugbyte program Computer Cookbook. He says he uses a standard Verify line at the end of each of his programs — which is still there on the commercially-available cassettes of his work. The line is as follows:

```
9999 CLS: SAVE "name of program"  
LINE0 : SAVE "name" CODE  
55120,415: VERIFY "name of  
program": PRINT "PROGRAM  
OK": VERIFY "name" CODE:  
PRINT "CODE OK"
```


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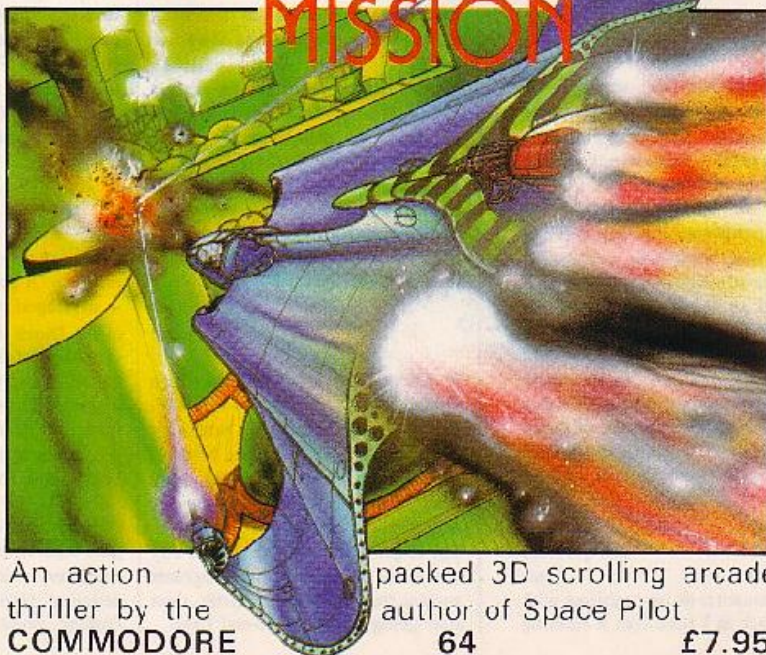
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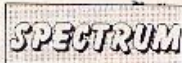
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Rhythmix

Timothy Closs,
Shepperton,
Middlesex.



RHYTHMIX ENABLES you to record digitally up to six separate sounds which may then be replayed manually on the computer keyboard. Alternatively, they can be programmed into a fixed sequence to give rhythmic accompaniment while you play another musical instrument. As a visual extra, the screen border can be made to flash in time with the rhythm.

When you run the program, a menu will be displayed:

1. RECORD
2. PLAY
3. PROGRAM
4. RUN
5. BORDER FLASH

RECORD sets up your cassette player as in figure 1 and type in a number from 1 to 6. Generate your first sound near the microphone — it will be stored by the computer, to be recalled under Play or Run below. Now type in your second number, generate your second sound, and so on up to a maximum of six. It is worth experimenting with a wide variety of sounds — including the human voice — as the results can be quite surprising, but the duration of each should not exceed about 0.5 seconds.

PLAY: By tapping the keys 1 to 6 you can

now reproduce sounds from your rhythm tank to accompany other musicians. Amplification is achieved through the set-up in figure 2. Pressing E at any stage will Escape to the menu.

PROGRAM: First enter the number of beats you want in your rhythm sequence — anything from 1 to about 60 might be suitable. Then tap out the sounds using keys 1 to 6 as above. The sounds will be heard as you program them in. Typing R records a rest i.e., a period of silence equal in length to each of the sounds. An audible beep confirms that the rest has been entered.

RUN: The computer will ask you for the required speed. Returning 1 gives the fastest rate of replay, while higher numbers give successively slower and lower frequency rhythms. Your programmed rhythm will now be repeated over and over until the menu is called by pressing E.

BORDER FLASH: Using the normal border colour numbers — for example 2 is red — enter first the colour for sound on and then the colour for sound off.

```

6 POKE 23658,8: GO SUB 6000:
GO TO 500
100 REM *****RHYTHMIX*****
110 REM *****BY TIM CLOSS*****
120 REM *****
500 CLS : POKE 32050,1: PRINT "
*****RHYTHMIX*****MAIN MENU*****
": PRINT : PRINT "(1)-RECORD": P
RINT : PRINT "(2)-PLAY": PRINT : P
RINT : PRINT "(3)-PROGRAM": PRINT : P
RINT : PRINT "(4)-RUN": PRINT : PRINT "(5
)-BORDER FLASH"
501 IF INKEY$="4" THEN GO TO 40
00
502 IF INKEY$="5" THEN GO TO 50
00
505 IF INKEY$="1" THEN GO TO 51
3
506 IF INKEY$="2" THEN GO TO 20
00
507 IF INKEY$="3" THEN GO TO 30
00
512 GO TO 501
513 INPUT "SOUND NO. ? ":S: LET
S=S-1
514 POKE 32002,128+(S*20)
515 PRINT AT 15,10;"ENTER SOUND
NOW"

```

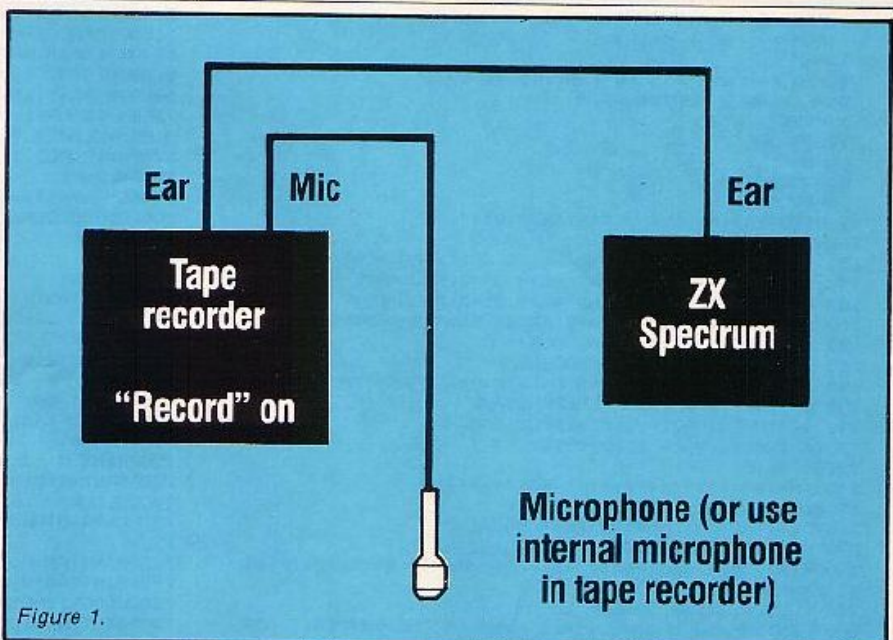


Figure 1.

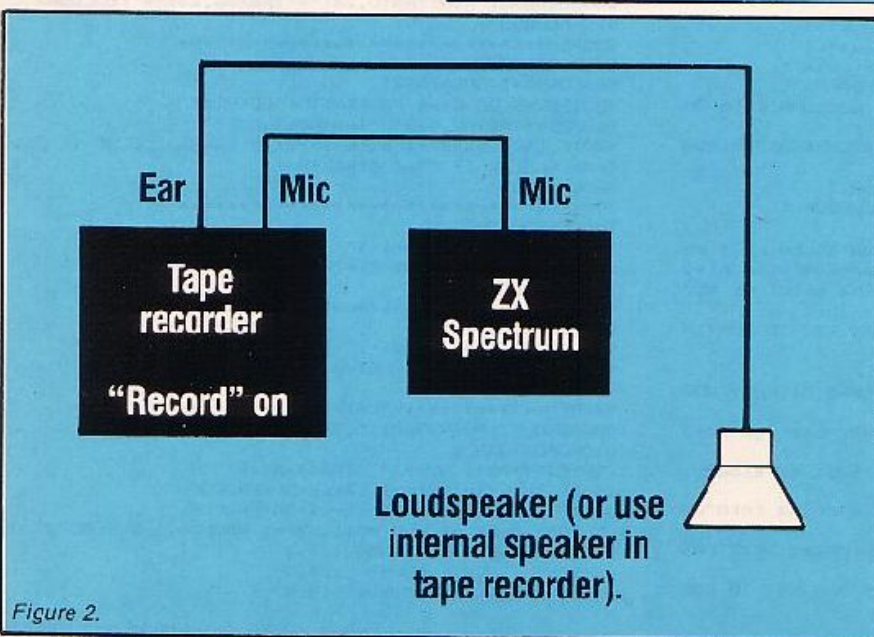


Figure 2.

```

520 IF IN 61438=255 THEN GO TO
520
530 LET A=USR 32000
535 PRINT AT 15,10;"SOUND RECEI
VED "
540 PAUSE 0
550 GO TO 500
2000 LET E$=INKEY$
2005 IF E$="E" THEN GO TO 500
2010 IF E$="1" THEN POKE 32032,1
28: LET A=USR 32030: GO TO 2000
2011 IF E$="2" THEN POKE 32032,1
48: LET A=USR 32030: GO TO 2000
2012 IF E$="3" THEN POKE 32032,1
68: LET A=USR 32030: GO TO 2000
2013 IF E$="4" THEN POKE 32032,1
88: LET A=USR 32030: GO TO 2000
2014 IF E$="5" THEN POKE 32032,2
08: LET A=USR 32030: GO TO 2000
2015 IF E$="6" THEN POKE 32032,2
28: LET A=USR 32030
2030 GO TO 2000
3000 INPUT "BEATS ? ":B
3010 DIM G(B)
3020 FOR H=1 TO B
3021 IF INKEY$="R" THEN BEEP .2,
10: LET G(H)=10: GO TO 3025

```

(continued on next page)

SOFTWARE FILE

(continued from previous page)

```
3022 IF CODE INKEY#<49 OR CODE I
NKEY#>57 THEN GO TO 3021
3023 LET G(H)=(CODE INKEY#)-49
3024 POKE 32032,128+(20*G(H)): L
ET A=USR 32030
3025 NEXT H
3030 GO TO 500
4000 INPUT "SPEED ? ";S: POKE 32
050,S
4005 FOR H=1 TO 8
4006 IF G(H)=10 THEN FOR D=1 TO
```

```
26+(PEEK 32050): NEXT D: GO TO 4
015
4010 POKE 32032,128+(20*G(H)): L
ET A=USR 32030
4015 IF INKEY#="E" THEN GO TO 50
0
4020 NEXT H
4030 GO TO 4005
5000 INPUT "OFF COLOUR ? ";O: IN
PUT "ON COLOUR ";N
5010 IF O<0 OR O>7 OR N<0 OR N>7
THEN GO TO 5000
5020 POKE 32044,O
```

```
5030 POKE 32061,16+N
5040 GO TO 500
6000 FOR G=32000 TO 32065
6010 READ D: POKE G,D: NEXT G
6020 RESTORE : RETURN
6030 DATA 33,0,128,6,20,197,6,0,
62,254,219,254,119,197,6,1,14,-2
,193,35,16,-14,193,16,-20,201,0,
0,0,0,33,0,128,6,20,197,6,0,62,1
91,190,40,17,62,7,71,254,35,197
,6,1,16,-2,193,16,-18,193,16,-24
,201,62,16,211,254,24,-19
```

Back beat

David Quinney,
Solihull,
West Midlands.

886

THIS PROGRAM, WITH a bit of skill, will produce a reasonable backing beat. A lot of the program could be cut down in length, but in its present state it is much easier to read and thus debug after entering.

The program is written in Mode 1 due to the size of the screen and has 16 steps each

which will produce four different beats simultaneously. The 16 steps can be decreased by altering the two stars at the edge of the screen. The main instructions are included in the program.

Program breakdown.

Lines 110-230 Main loop for entering beat
240-490 Instructions
500-580 Set up variables
590-810 Draw screen
820-980 Move cursor, update screen
990-1130 Play beat pattern

1140-1200 Speed
1210-1230 Move step pointer
1240-1410 Save beat pattern
1420-1580 Load beat pattern
1590-1660 Draws pattern after saving or loading
1670-1730 Clear beat pattern
1740-1750 Error routine

Variables.

A%,B% - co-ordinate of cursor
O% - step pointer
L% - speed
M%(3,15) - array for beat pattern
All £ should be read as #

```
10REM (C) D.A.QUINNEY 1984
20REM 'BEAT MACHINE'
30REM
40REM for all in listing type £
50*KEY100.D:MGOTO160:RM
60MDE?
70PROCINST
80MDE?
90PROCSETJP
100PROCSCREEN
110PRINTTAB(A%,B%)>"TAB(A%+2,B%)<"
120*FX21,0
130 IF INKEY(-42)=-1 AND B%<23 C%=1:PROCMOVE
140 IF INKEY(-58)=-1 AND B%>8 C%=2:PROCMOVE
150 IF INKEY(-26)=-1 AND A%>9 C%=3:PROCMOVE
160 IF INKEY(-122)=-1 AND A%<33 C%=4:PROCMOVE
170 IF INKEY(-67)=-1 PROCBEAT
180 IF INKEY(-104)=-1 PROCCEBEAT
190 IF INKEY(-73)=-1 AND O%<(B%-8) PROCSTAR
200 IF INKEY(-82)=-1 CLS:PROCCAVE
210 IF INKEY(-87)=-1 CLS:PROCLD
220IF INKEY(-56)=-1 GOTO990
230GOTO110
240REM*****
250DEFPROCINST
260PRINTTAB(13)CHR$129"BEAT MACHINE"
270PRINTTAB(13)CHR$129" "
280PRINT""Do you want instructions?":G$=GET$:IF G$
="N" ENDPROC
290VU28,0,23,39,2:CLS
300PRINT"These controls are used in"CHR$129"EDIT MOD
E :-"
310PRINT"CHR$129" 'X' "CHR$135" -Make beat."
320PRINTCHR$129" ' ' "CHR$135" -To clear."
330 PRINTCHR$129" 'S' "CHR$135" -SAVE DATA."
340PRINTCHR$129" 'L' "CHR$135" -LOAD DATA."
350PRINT"CHR$129" 'P' "CHR$135" -Put machine into"CH
R$131"PLAY MODE."
360PRINT"CHR$131" 'M' "CHR$135" -Move"CHR$131"pointe
r"CHR$135"to CURSOR position"
370PRINTCHR$129"><"CHR$135" -CURSOR."
380PRINTCHR$129"CURSOR Keys to move CURSOR."
390PRINT"CHR$131"POINTER."
400PRINT" On either side of the screen there is a po
inter.Where ever the pointer is the machine will play
to this position and then return to the start of you
r beat pattern."
410PRINTTAB(6)CHR$136CHR$133"PRESS ANY KEY TO CONTIN
UE."
420G$=GET$:CLS
430PRINT"These controls are used in"CHR$131"PLAY MOD
E :-"
440PRINT"CHR$131" '>' "CHR$135;" -Make beat go fast
er."
450PRINTCHR$131" '<' "CHR$135" -Make beat go slower."
460PRINT"CHR$129"ESCAPE"CHR$135"-Put machine into"CH
R$129"EDIT MODE."
470PRINT"CHR$129"BREAK will clear unwanted beat pat
tern."
480PRINTTAB(6,20)CHR$136CHR$133"PRESS ANY KEY TO CON
TINUE.":G$=GET$
490ENDPROC
```

```
500REM*****
510DEFPROCSETUP
520JN ERROR GOTO:750
530VU23;8202;0;0;0;
540DIM M%(3,15)
550J%=15:L%=1000:A%=9:B%=8
560CNVELOP1,2,0,0,0,0,0,0,124,60,60,0,124,60
570CNVELOP2,1,0,0,0,0,0,0,126,-10,0,-1,126,100
580ENDPROC
590REM*****
600DEFPROCSCREEN
610J%=&5
620CLS
630COLOUR1
640PRINTTAB(13)"BEAT MACHINE"
650PRINTTAB(13)"-----"
660COLOUR3
670PRINT"Type 'X' for beat, '.' to clear,"
680PRINT"'P' to play, 'ESCAPE' to stop beat,"
690PRINT"and '*' to return to start of beat."
700PRINT"Finally 'S' to SAVE and 'L' to LOAD"
710COLOUR1
720PRINT"" Indic. BASS SNARE BLEEP TRIANGLE"
730FORR%=1TO16:PRINTR%:NEXT
740COLOUR3
750FORR%=8TO23:FORR%=10TO34STEP8:PRINTTAB(EX,R%)".":
NEXT,
760PRINTTAB(0,30)"CURSOR KEYS TO MOVE EDITOR"
770PRINTTAB(0,26)"<="SLOWER,">="FASTER."
780COLOUR1:PRINT"SPEED (0=Fastest)= 14"
790PRINTTAB(15,24)"EDIT MODE"
800COLOUR2:PRINTTAB(0,23)"*TAB(36,23)*":COLOUR3
810ENDPROC
820REM*****
830DEFPROCMOVE
840FORR%=1TO80:NEXT
850IFC%=3 OR C%=4 FORR%=1TO1000:NEXT
860PRINTTAB(A%,B%) "TAB(A%+2,B%) "
870IF C%=1 B%=B%-1 ELSE IF C%=2 B%=B%+1 ELSE IF C%=3
A%=A%-6 ELSE IF C%=4 A%=A%+8
880ENDPROC
890REM*****
900DEFPROCBEAT
910PRINTTAB(A%+1,B%) "X"
920M%((A%-1)/8-1,B%-8)=1
930ENDPROC
940REM*****
950DEFPROCCEBEAT
960PRINTTAB(A%+1,B%) "."
970M%((A%-1)/8-1,B%-8)=0
980ENDPROC
990REM*****PLAY*****
1000COLOUR2:PRINTTAB(15,24)"PLAY MODE"
1010FORR%=0TODX
1020PRINTTAB(1,R%-7) "TAB(1,R%+8):>"
1030IF INKEY(-104)=-1 L%=L%-50:PROCCUP
1040IF INKEY(-103)=-1 L%=L%+50:PROCCUP
1050IFM%(0,R%)=1 AND M%(1,R%)=1 SOUND0,1,5,2:GOTO:080
1060IFM%(0,R%)=1 SOUND0,1,6,2
1070IFM%(0,R%)=1 SOUND0,1,4,2
1080IFM%(2,R%)=1 SOUND1,-15,7,1
```

(continued on page 155)



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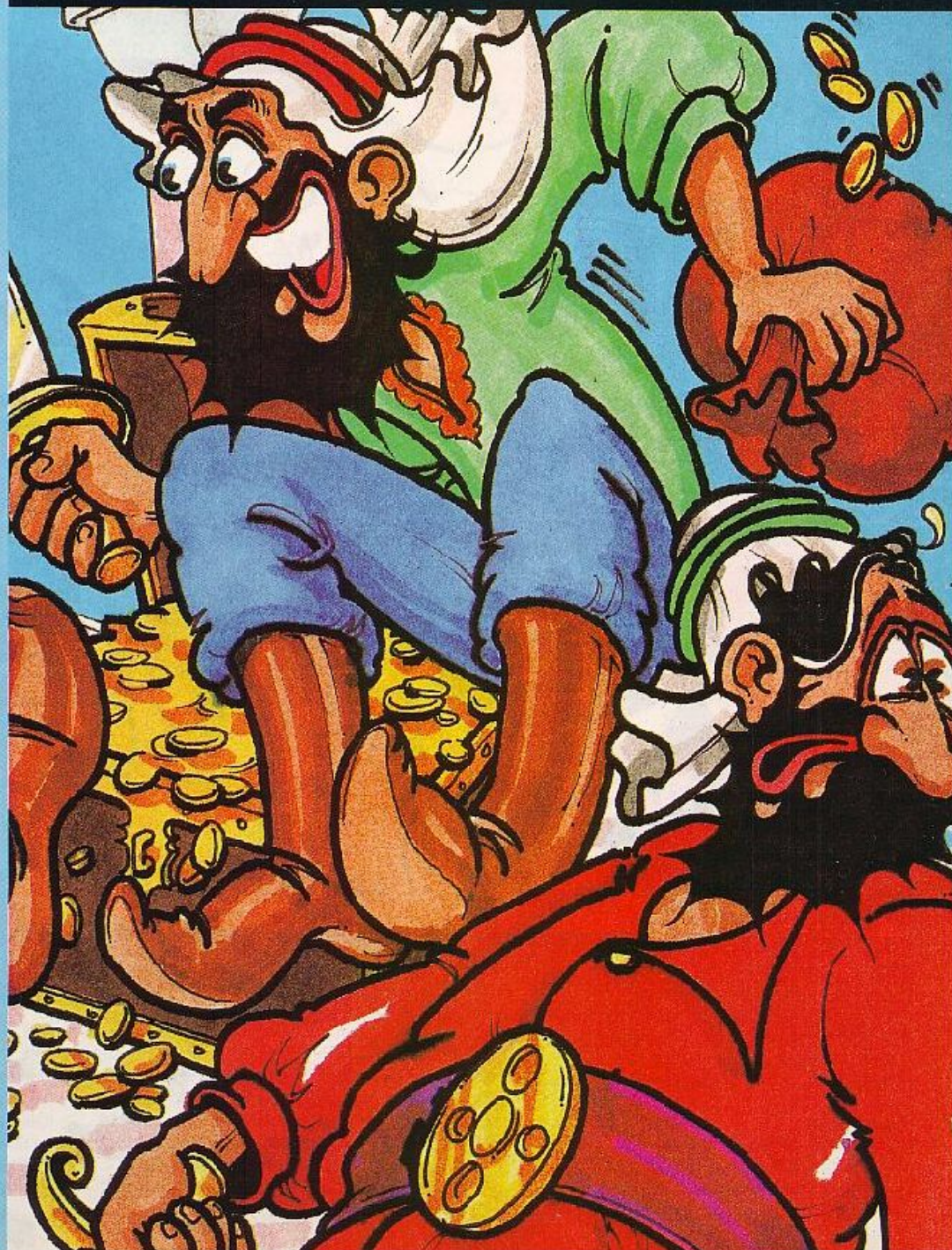
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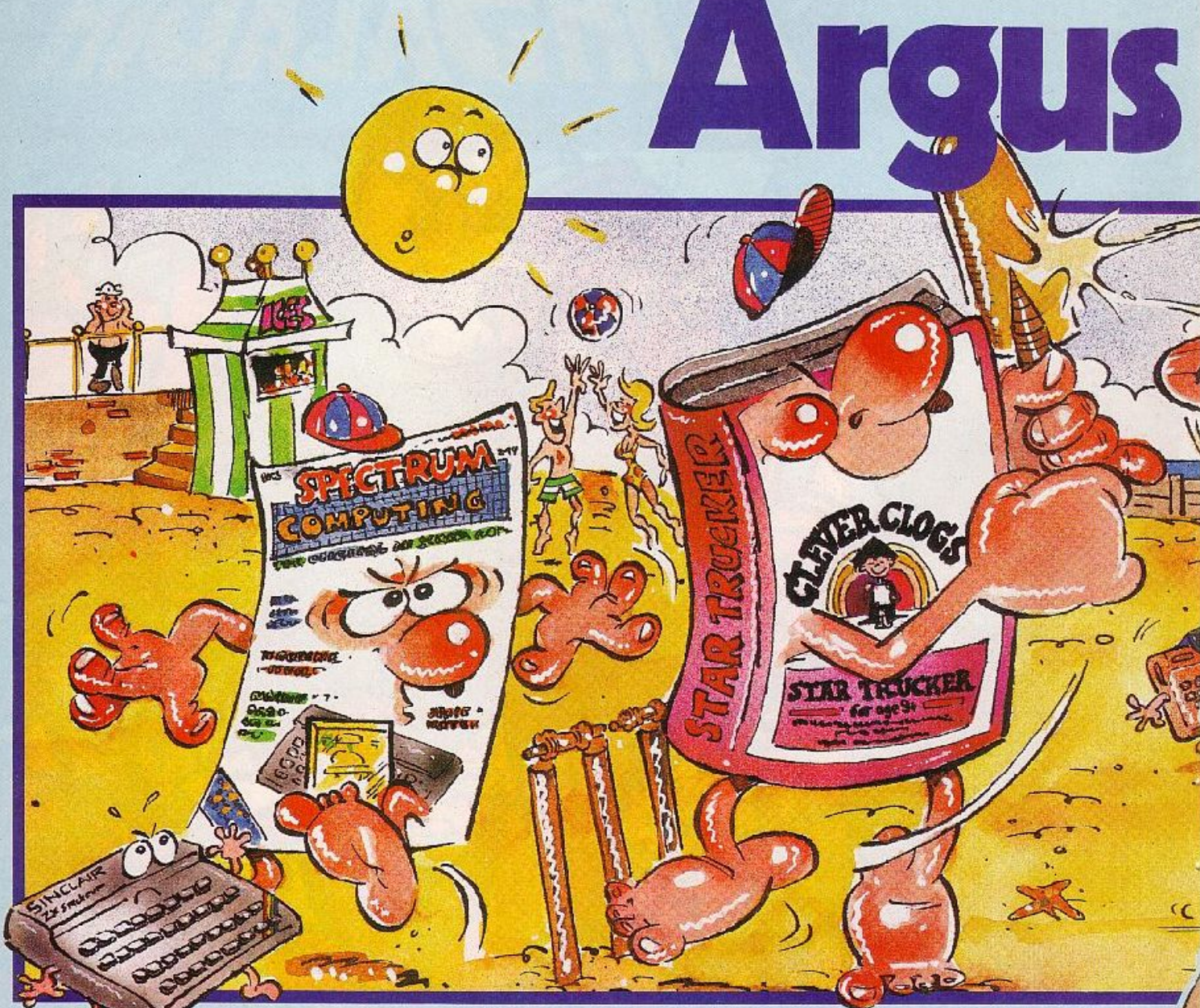
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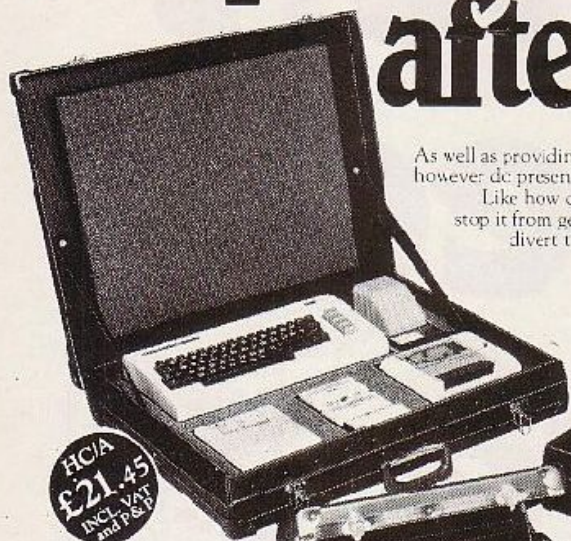


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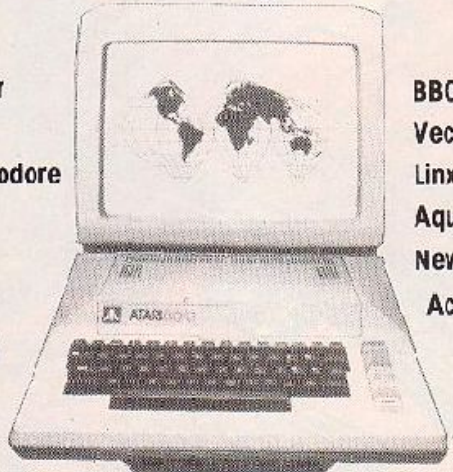
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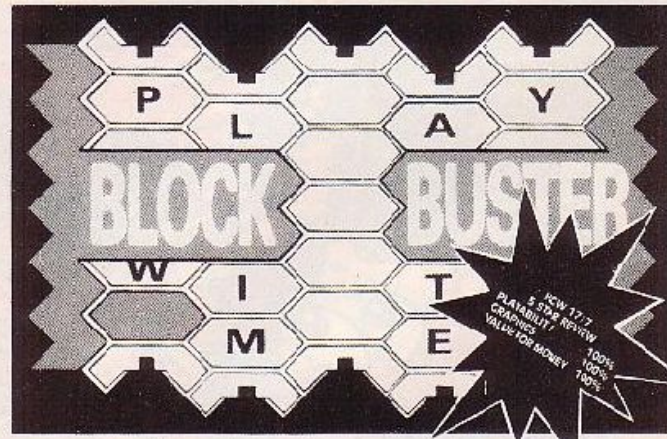
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COMPUSOUND

DEPT HCW, 32-33 LANGLEY CLOSE, REDDITCH, WORCS B98 0ET
TELEPHONE (0527) 21429 (21439 24 Hr. HOTLINE)

(continued from page 150)

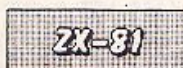
```

1090IFM%(3,R%)=1 SOUND3,2,245,1
1100FORE%-1TOLX:NEXT
1110NEXT
1120PRINTTAB(1,R%+7):" "
1130GOTO1010
1140REM*****
1150DEFPROCUP
1160COLOUR1
1170IFLX<300 LX=300
1180PRINTTAB(18,27)"  TAB(18,27)(LX/50)-6
1190COLOUR3
1200ENDPROC
1210REM*****
1220DEFPROCSTAR
1230PRINTTAB(0,0%+0)"  TAB(36,0%+0)"  ":COLOUR2:PRINT
AB(0,B%)+"  TAB(36,B%)"  ":COLOUR3:0%+B%-8:ENDPROC
1240REM*****
1250DEFPROCSAVE
1260*FX200,1
1270COLOUR2
1280PRINTTAB(15)"SAVE MODE"
1290PRINTTAB(14)"-----"
1300PRINTTAB(5,10)"PLEASE PRESS ";
1310ZZ=OPENOUT"BEAT"
1320PRINT"PLEASE WAIT"
1330FORE%-0T03
1340FORR%=0T015
1350PRINTLZX,M%(LX,R%)
1360NEXT
1370CLOSELZX
1380VDU7
1390PROCRAW
1400*FX200,0
1410ENDPROC
1420REM*****
1430DEFPROCLOAD
1440*FX200,1
1450COLOUR2
1460PRINTTAB(15)"LOAD MODE"
1470PRINTTAB(14)"-----"
1480PRINTTAB(1,10)"Play tape and please wait for DATA
to load"
1490ZZ=OPENIN"BEAT"
1500FORE%-0T03
1510FORR%=0T015
1520INPUTLZX,M%(LX,R%)
1530NEXT
1540CLOSELZX
1550VDU7
1560PROCRAW
1570*FX200,0
1580ENDPROC
1590REM*****
1600DEFPROCRAW
1610PROCSCREEN
1620FORE%-0T03
1630FORR%=0T015
1640IFM%(LX,R%)=1 THEN PRINTTAB(LZX+B+10,R%+8)"X"
1650NEXT
1660ENDPROC
1670REM*****
1680MODE1
1690COLOUR1
1700PRINTTAB(15,15)"CLEARED"
1710PRINTTAB(14)"-----"
1720FORR%=1T05000:NEXT
1730GOTO90
1740REM*****
1750IFERR=17PRINTTAB(1,R%+8)"  ":COLOUR1:PRINTTAB(1
5,24)"EDIT MODE":COLOUR3:GOTO110ELSEMODE7:REPORT:PRI
NT"ATLINE";ERL

```

Boggled

D Harris,
Great Barr,
Birmingham.



BOGGLED IS BASED ON a popular table game and although exciting to play, a few problems become apparent after playing the game a few times.

One of the players has to shake the box containing the dice, remove the lid without looking at the dice in position and lastly start the timer. I then decided to program the game on my ZX-81 which would solve all these problems and also enable more than four people to take part with these added benefits:

- No shaking of dice — no noise.
- All players have equal advantage in seeing the playing grid one way up. Normally, four players would sit around a table and the board will appear different in each position. This results in some players finding some words and maybe higher scoring words, easier.
- The screen goes blank to end the game when the timer is finished. This stops the

players writing on after time if the timer has been missed finishing. Here is a breakdown of the program and what it does:

Lines 30 to 190	Minimum three-letter word game on a four by four grid.
Lines 380 to 336	Letters as displayed on the grid.
Lines 700 to 732	Timer.
Lines 734 to 744	Attracts players' attention that the game is about to start.
Lines 750 to 860	Timer countdown.
Lines 870 to 890	Blank out screen to end game.
Lines 892 to 910	Re-display grid with scoring details.
Lines 920 to 1140	Introduction.
Lines 1150 to 3120	Instructions and rules.
Lines 3125 to 3150	Choice of grid size.
Lines 4000 to 4180	Minimum four letter word game on a five by five grid.

This program chooses a random letter from one "die" and then randomly places that letter on the grid. This is achieved by putting all the letters into one string and using the string slicing to remove one die at a time. The machine-code routine at the beginning of the

program is used to find an empty position on the grid in which to print the letter.

I would like to give credit to Alan Potter of Glasgow for this routine. It is much quicker than the

LET P = PEEK(PEEK 16398 + 256*PEEK 16399)
Basic line and reduces the time waiting for the grid to be set up.

Direct commands

When typing in the program line 1 is typed as:

1 REM E: RND ? TAN

or the line can contain seven characters and then entering as direct commands:

POKE 16514,42
POKE 16515,14
POKE 16516,64
POKE 16517,78
POKE 16518,6
POKE 16519,0
POKE 16520,201
POKE 16510,0

Line 1 now becomes 0 and the rest of the program can now be entered.

```

00REM E:RND? TAN
01REM "BOGGLED" BY D.H.HARRI
02MAR 1983
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```

495 RETURN
496 LET X$=""
497 LET Y$=""
498 LET Z$=""
499 LET X$="M"
500 LET Y$="H"
501 LET Z$="O"
502 LET X$="P"
503 LET Y$="P"
504 LET Z$="P"
505 LET X$="Q"
506 LET Y$="R"
507 LET Z$="S"
508 LET X$="T"
509 LET Y$="U"
510 LET Z$="V"
511 LET X$="W"
512 LET Y$="X"
513 LET Z$="Y"
514 LET X$="Z"
515 LET Y$="Z"
516 LET Z$="Z"
517 RETURN
518 FOR F=0 TO 18
519 PRINT AT F,26;" "
520 NEXT F
521 NEXT F
522 PRINT AT 10,24;" "
523 PRINT AT 20,24;" "
524 FOR F=1 TO 40
525 FAST
526 SLOW
527 PRINT AT 30,1;"LETTERS 3."
528 PRINT AT 31,1;"OR MORE"
529 PRINT AT 32,1;"PLINIS 1."
530 PRINT AT 33,1;"ANY"
531 PRINT AT 34,1;"AT 3,26;"KEY"
532 PRINT AT 35,1;"AT 10,26;"CLEAR"
533 PRINT AT 36,1;"AT 10,26;"SCREEN"
534 PRINT AT 37,1;"IF INKEY$="" THEN GOTO 510"
535 CLS
536 PRINT AT 38,1;"THANK YOU FOR"
537 PRINT AT 39,1;"PLAYING"
538 GOSUB 390
539 PRINT AT 12,3;Z$;AT 11,3;Y$
540 AT 10,3;X$
541 GOSUB 520
542 PRINT AT 12,7;Z$;AT 11,7;Y$
543 AT 10,7;X$
544 GOSUB 440
545 PRINT AT 12,11;Z$;AT 11,11;Y$
546 AT 10,11;X$
547 PRINT AT 12,15;Z$;AT 11,15;Y$
548 AT 10,15;X$
549 GOSUB 520
550 PRINT AT 12,19;Z$;AT 11,19;Y$
551 AT 10,19;X$
552 GOSUB 420
553 PRINT AT 12,23;Z$;AT 11,23;Y$
554 AT 10,23;X$
555 GOSUB 410
556 PRINT AT 12,27;Z$;AT 11,27;Y$
557 AT 10,27;X$
558 PRINT AT 15,0;"WOULD"
559 LIKE A GAME?"
560 PRINT AT 17,8;"PRESS YES"
561 OR NO"
562 FOR F=1 TO 10
563 NEXT F
564 PRINT AT 17,8;"PRESS YES"
565 OR NO"
566 FOR F=1 TO 10
567 NEXT F
568 IF INKEY$="Y" THEN GOTO 115
569
570 IF INKEY$="N" THEN NEW
571 IF INKEY$="Y" OR INKEY$="X"
572 THEN GOTO 1050
573 CLS
574 PRINT AT 5,0;"DO YOU WANT I"
575 NSTRUCTIONS?"
576 IF INKEY$="Y" THEN GOTO 300
577
578 IF INKEY$="N" THEN GOTO 100

```

```

770 NEXT F
780 FOR F=1 TO 20
790 PRINT AT F,26;" "
800 NEXT F
810 FOR F=1 TO 30
820 NEXT F
830 FOR F=1 TO 20
840 PRINT AT F,26;" "
850 NEXT F
860 NEXT F
870 FAST
880 SLOW
890 PRINT AT 30,1;"LETTERS 3."
900 PRINT AT 31,1;"OR MORE"
910 PRINT AT 32,1;"PLINIS 1."
920 PRINT AT 33,1;"ANY"
930 PRINT AT 34,1;"AT 3,26;"KEY"
940 PRINT AT 35,1;"AT 10,26;"CLEAR"
950 PRINT AT 36,1;"AT 10,26;"SCREEN"
960 IF INKEY$="" THEN GOTO 910
970 CLS
980 PRINT AT 38,1;"THANK YOU FOR"
990 PRINT AT 39,1;"PLAYING"
1000 GOSUB 390
1010 PRINT AT 12,3;Z$;AT 11,3;Y$
1020 AT 10,3;X$
1030 GOSUB 520
1040 PRINT AT 12,7;Z$;AT 11,7;Y$
1050 AT 10,7;X$
1060 GOSUB 440
1070 PRINT AT 12,11;Z$;AT 11,11;Y$
1080 AT 10,11;X$
1090 PRINT AT 12,15;Z$;AT 11,15;Y$
1100 AT 10,15;X$
1110 GOSUB 520
1120 PRINT AT 12,19;Z$;AT 11,19;Y$
1130 AT 10,19;X$
1140 GOSUB 420
1150 PRINT AT 12,23;Z$;AT 11,23;Y$
1160 AT 10,23;X$
1170 GOSUB 410
1180 PRINT AT 12,27;Z$;AT 11,27;Y$
1190 AT 10,27;X$
1200 PRINT AT 15,0;"WOULD"
1210 LIKE A GAME?"
1220 PRINT AT 17,8;"PRESS YES"
1230 OR NO"
1240 FOR F=1 TO 10
1250 NEXT F
1260 PRINT AT 17,8;"PRESS YES"
1270 OR NO"
1280 FOR F=1 TO 10
1290 NEXT F
1300 IF INKEY$="Y" THEN GOTO 115
1310
1320 IF INKEY$="N" THEN NEW
1330 IF INKEY$="Y" OR INKEY$="X"
1340 THEN GOTO 1050
1350 CLS
1360 PRINT AT 5,0;"DO YOU WANT I"
1370 NSTRUCTIONS?"
1380 IF INKEY$="Y" THEN GOTO 300
1390
1400 IF INKEY$="N" THEN GOTO 100

```

```

0
1190 IF INKEY$="Y" OR INKEY$="X"
1200 THEN GOTO 1150
1210 CLS
1220 GOTO 3105
1230 CLS
1240 PRINT "THE OBJECT OF BOGGLE"
1250 IS TO LISTAS MANY WORDS OF THE"
1260 REE ON 4x4 GRID. FOUR ON 5x5 OR"
1270 2D. OR MORE LETTERS (AS SHOWN ON"
1280 BOARD) WITHIN THE TIME LIMIT"
1290
1300 PRINT "RULES:"
1310 PRINT "1. USE ADJUNCTIVE (LET"
1320 TERS ONLY) IN ANY DIRECTION"
1330 "IN CORRECT SEQUENCE."
1340 PRINT "2. INDIVIDUAL LETTER"
1350 S CANNOT BE USED MORE THAN ON"
1360 CE IN ANY ONE WORD."
1370 PRINT "3. PROPER NAMES, ABBS"
1380 EV, AND WORDS WITH APOSTRO"
1390 PHES OR HYPHENS ARE NOT A"
1400 CCEPTABLE."
1410 PRINT "SCORING:"
1420 PRINT "DUPLICATED WORDS ARE"
1430 CROSSED OFF ALL LISTS. REMAINING"
1440 WORDS ARE SCORED AS IN POINTS"
1450 TABLE AT END OF GAME. PRESS A KEY"
1460 TO CONTINUE"
1470
1480 PRINT AT 10,0;"PLEASE INPUT"
1490 WHETHER A 4x4 OR 5x5 BOARD IS REQ"
1500 URED. ENTER A 4 OR 5 FOLLOWED BY"
1510 A NEWLINE."
1520 INPUT G
1530 CLS
1540 IF G=4 THEN GOTO 32
1550 IF G=5 THEN GOTO 4200
1560 IF G<4 OR G>5 THEN GOTO 3"
1570
1580 LET A$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1590 LET B$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1600 LET C$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1610 LET D$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1620 LET E$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1630 LET F$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1640 LET G$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1650 LET H$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1660 LET I$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1670 LET J$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1680 LET K$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1690 LET L$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1700 LET M$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1710 LET N$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1720 LET O$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1730 LET P$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1740 LET Q$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1750 LET R$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1760 LET S$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1770 LET T$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1780 LET U$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1790 LET V$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1800 LET W$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1810 LET X$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1820 LET Y$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1830 LET Z$="A B C D E F G H I J K L M N O P Q R S T U V W X Y Z"
1840
1850 FAST
1860 LET W$=""
1870 FOR F=1 TO 25
1880 LET B$=A$(1 TO 6)
1890 LET R=INT (RND*6)+1
1900 LET C$=B$(R)
1910 LET A$=A$(7 TO 1)
1920 GOSUB (1000 C$)+10
1930 LET R=INT (RND*6)
1940 LET X=R+1
1950 LET Y=INT (RND*6)+1
1960 LET Y=R+4
1970 PRINT AT Y,X;C$
1980 LET P=555 15514
1990 IF P<10 THEN GOTO 4090
2000 PRINT AT Y,X+3;L$;AT Y-1,X;
2010 Z$;AT Y-2,X;Y$;AT Y-3,X;X$
2020 NEXT F
2030 GOTO 700
2040 SAVE "BOGGLE.B"
2050 RUN

```

BMX rider

Al Herbert,
London SW4.

DRAGON

FOR THOSE OF you who enjoy BMX riding, here is a hi-res game which you should like. It consists of a BMX which, with your aid, must traverse a tough course. Control is via the right-hand joystick. Moving the joystick to the left or moving it down will pull the BMX into a wheelie. Pressing the fire button will make the bike jump into the air.

There are four main obstacles which have to be avoided.

Brick — hitting one of these will cost you 500 points. They may be wheeled or jumped over.

Fence — ramming one of these will also cost you 500 points. They may only be jumped over.

Hole — falling down a hole will knock you off the bike and the game will end.

Ledge — if you see a ledge at any time during the game, you must jump up on to it. If you do not land on the ledge, then you will fall off the bike and the game will end.

At the bottom of the screen are a number of drink bottles. These determine the speed at which your score will increase. During the game, however, this will slowly decrease. To help stop this, you will find bottles of drink in places along the course. Providing you are not in the middle of a jump or a wheelie, the drink will be collected and added on at the bottom. You will also score 2,000 points for this

To set up the game, type in Program 1. This is the main program which is written in Basic. When you have typed this in, do not try to Run the program yet. First of all, Save it by typing:

CSAVE "B.M.X."

Now type New to clear this program. You may now type in program 2. This program produces a machine-code scroll. Now you should Run this and then type:

CSAVEM "M/C",26001,26028,26001

So now, on your tape, you should have the program BMX followed by M/C. To Load the finished program type Load.

Now you should Run the Loaded program and leave the tape running for the machine-code scroll to load. The game will now begin.

Program 1.

```

1 REM *****
2 REM === B M X ===
3 REM === RIDER ===
4 REM *****
5 REM
6 CLOADM
7 CLS:CLAR 300,2000:PCL:CLS
8 PMODE4,1:COLOR0,5:PCL5
9 DRAW"BM5,16L2FGD2FR3D3R2HU3L3U2NR4U2N
10 RU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
11 2L3RF2HU2HUHED3L
12 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
13 PCL5
14 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
15 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
16 2L3RF2HU2HUHED3L
17 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
18 PCL5
19 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
20 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
21 2L3RF2HU2HUHED3L
22 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
23 PCL5
24 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
25 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
26 2L3RF2HU2HUHED3L
27 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
28 PCL5
29 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
30 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
31 2L3RF2HU2HUHED3L
32 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
33 PCL5
34 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
35 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
36 2L3RF2HU2HUHED3L
37 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
38 PCL5
39 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
40 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
41 2L3RF2HU2HUHED3L
42 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
43 PCL5
44 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
45 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
46 2L3RF2HU2HUHED3L
47 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
48 PCL5
49 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
50 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
51 2L3RF2HU2HUHED3L
52 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
53 PCL5
54 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
55 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
56 2L3RF2HU2HUHED3L
57 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
58 PCL5
59 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
60 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
61 2L3RF2HU2HUHED3L
62 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
63 PCL5
64 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
65 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
66 2L3RF2HU2HUHED3L
67 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
68 PCL5
69 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
70 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
71 2L3RF2HU2HUHED3L
72 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
73 PCL5
74 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
75 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
76 2L3RF2HU2HUHED3L
77 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
78 PCL5
79 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
80 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
81 2L3RF2HU2HUHED3L
82 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
83 PCL5
84 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
85 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
86 2L3RF2HU2HUHED3L
87 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
88 PCL5
89 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
90 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
91 2L3RF2HU2HUHED3L
92 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
93 PCL5
94 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
95 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
96 2L3RF2HU2HUHED3L
97 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
98 PCL5
99 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
100 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
101 2L3RF2HU2HUHED3L
102 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
103 PCL5
104 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
105 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
106 2L3RF2HU2HUHED3L
107 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
108 PCL5
109 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
110 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
111 2L3RF2HU2HUHED3L
112 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
113 PCL5
114 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
115 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
116 2L3RF2HU2HUHED3L
117 DIMBMX(17,16):GET(0,0)=(17,16);BMX,G:
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179 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
180 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
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248 PCL5
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305 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
306 2L3RF2HU2HUHED3L
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308 PCL5
309 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2NR2ERBL
310 4UNRU2NRUGD6FGD3FG2L2U2R2R4RUGD3D2R2U2
311 2L3RF2HU2HUHED3L
312 DIMBMX(17,16
```



```

73 IF INKEY$ <> " " THEN 71
72 PLAY "D1G02F03E040C5C"
75 RUN 10
74 DATA 2,"U31C",2,"U0C",2,"U31G",2,"U0C",
  2,"U31C",2,"U0C",1,"U31G",1,"U31A#
75 DATA 2,U31C,2,U0C,2,U31G,2,U03,2,U31C,
  2,U0C,1,U31G,1,U31A#,2,U31C,2,U0C,2,U31G,
  2,U03,2,U31C,2,U0C,2,U31C,2,U310#
76 DATA 2,U31F,2,U0C,3,U31C,3,U0C,2,U31F,
  2,U0C,1,U31G,1,U31A#
77 REM
78 REM =====
79 REM = A. J. HERBERT =
80 REM ===== AND =====
81 REM = J. P. DOWLER =
82 REM =====

```

```

10 CLEAR 200,25000
20 FOR N=20001 TO 25000
30 READ A#
40 POKE N,VAL("&H"+A#)
50 NEXT N
60 END

100 DATA 8E,0C,00,A5,01,A7,A0,AC,18,06
110 DATA 25,F2,8E,0C,00,B6,1F,A7,A4,30
120 DATA 88,20,8A,18,1F,25,F6,39

```

To run, load the presentation program and run it — this program will automatically load and run the machine code.

[illegible]

YOUR COMPUTER, SEPTEMBER 1984 157

The Best in Books and Software for the BBC Micro from WILEY

ADVENTURE INTO BBC BASIC

by Miles Ellis and David Ellis

A book with a difference! This is far more than a conventional teach yourself programming book. By using a sophisticated and exciting adventure game Miles Ellis, with the aid of his twelve-year-old son, has designed a program which will be enjoyable from the outset as well as teaching the beginner the basic principles of good programming style, the use of sound effects, colour, graphics, program editing, and the storage and reloading of tapes.

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Incorporated in Aviator is a three-dimensional world ready for you to explore (map provided). Your score is based on successful landings and tests of skill such as flying between skyscrapers or under bridges.



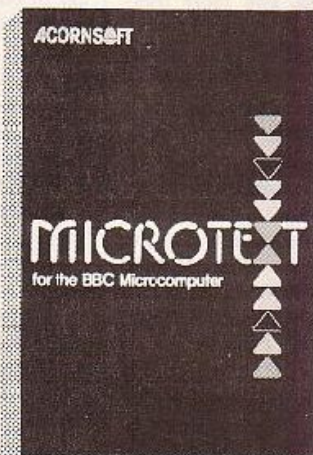
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Developed by the National Physical Laboratory

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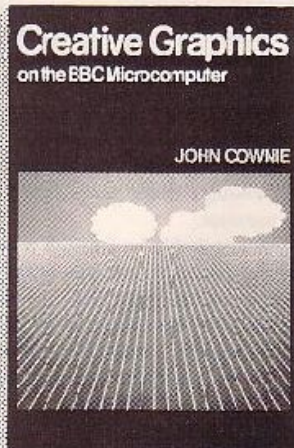
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CREATIVE GRAPHICS on the BBC Microcomputer

by John Cowrie

This book describes how to exploit the excellent graphics facilities provided by the BBC Microcomputer. Starting with first principles the book proceeds to explore more advanced routines, explaining in detail the individual procedures that go to make up whole programs.

There are listings for 36 programs which will run on either the A or B Model to produce a dazzling range of pictures and patterns in full colour, including animated pictures, recursively-defined curves, and rotating three-dimensional shapes.



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12th
ZX MICROFAIR
at Ally Pally on
8th September 1984

(continued from page 159)

```
Y,0:WAIT20:UNTILY=26:WAIT200
1502 CLS:PRINT"YOU JUMPED INTO OUTER S
PADE":LI=LI+1
1505 WAIT200:IFLI<3 THENGOTO7000+SS+10
1510 PRINT:PRINT"YOU SCORED "SC" POINT
S":PLOT10,26,"PRESS ANY KEY T
O PLAY AGAIN
1520 GET A$:RUN
1998 :
1999 REM *** DEFINE CHARS ***
2000 FORC=1TO13:READA:FORD=0TO7:READB:
POKE46080+B+A*D,B:NEXTD,C:RET
URN
2010 DATA 97,7,31,63,63,31,47,26,7
2020 DATA 98,56,62,63,63,62,59,46,56
2030 DATA 99,12,18,33,45,45,30,12,0
2040 DATA 100,5,7,5,7,15,27,2,4
2050 DATA 101,48,56,40,62,58,48,16,32
2060 DATA 102,7,9,11,7,1,29,47,0
2070 DATA 103,56,36,52,56,32,46,61,0
2080 DATA 104,3,5,15,58,47,59,38,51
2090 DATA 105,48,24,52,63,21,63,41,51
2100 DATA 106,10,17,36,33,40,21,10,5
2110 DATA 107,42,1,40,1,42,20,40,16
2120 DATA 108,7,9,17,23,19,31,15,0
2130 DATA 109,56,36,54,58,50,62,60,0
2958 :
2959 REM <<< REDEFINE VARS >>>
3000 A=15:L=15:F=15:H=15:D=15:B=7:M=7:
G=7:I=7:K=7:X=15:Y=15:::R=0
3010 TEST(1)=0:TEST(2)=0:TEST(3)=0:TES
T(4)=0:RETURN
3998 :
3999 REM *** DEFINE SCREEN ***
4000 FING:CLS:LORESO:Z=48377:FORC=0TO6
:FORD=0TOC:DOKEZ+4*D,25185:PO
KEZ+4*D-1,S
4010 NEXTD:Z=Z+78:NEXTC:PRINT:PRINT"
PYRAMANIAC":POKE48
082,1C
4020 PRINT" PYRAMANIAC":PO
KE48083,4:POKE40122,10:POKE40
123,2
4030 PRINT"CHANGE":PRINT" TO":PRINT"
ab":POKE48243,E:PRINT:PRINTS
C$
```

```
4040 FORC=1TO3-LI:PLOT 35,10+C,"cc":PL
OT34,10+C,4:NEXTC:RETURN
4993 :
4994 REM ((( DEFINE FUNCTIONS )))
5000 DEF FNA(P)=P+2*SGN(RND(1)-.5)
5010 DEF FNC(P)=P+2*((X<P)-(X>P))
5020 DEF FNB(P)=P-2*((Y>P)-(Y<P))
5030 DEF FNX(P)=P+2*((A$="Q")+(A$="N")
-(A$="H")-(A$="V"))
5040 DEF FNY(P)=P+2*((A$="Q")+(A$="W")
-(A$="H")-(A$="V"))
5050 RETURN
5998 :
5999 REM ... INSTRUCTIONS ...
6000 CLS:INKO:FJR C=1TO29:READB:PRINT
CHR$(27);B:NEXTC
6010 DATA"Q YOU ARE IN A PYRAMID CON
STRUCTED OF"
6020 DATA"Q DISKS"
6030 DATA"R ab ab ab ab ab ab ab ab ab
ab ab ab"
6040 DATA"V YOU MUST CHANGE ALL THE DI
SKS TO THE"
6050 DATA"V SPECIFIED COLOUR BY JUMPIN
G ON THEM"
6060 DATA"U WATCH OUT FOR THE ALIENS,S
ENT BY THE"
6070 DATA"U THE MAD DRUMMER"
6080 DATA"R fg AND HI BOUNCE DOWNWARD
S"
6090 DATA"R jk WILL FOLLOW YOU SO BE C
ARE FULL!"
6100 DATA"R de CHANGES THE DISKS LULU
R AND"
6110 DATA"R KILLS YOU"
6120 DATA"U IF YOU KILL THE MANIAC DRU
MMER IN"
6130 DATA"U YOU WILL GAIN A GREAT DEAL
OF POINTS"
6140 DATA"Q WATCH OUT OR HIS CAGLESS
DRUMMING"
6150 DATA"Q WILL SEND YOU MAD AS WELL
!! !!!!"
6160 PLOT 10,26,"PRESS ANY KEY TO PLAY
":GET A$
6170 DATA"V","T YOU CAN ONLY JUMP DIAG
ONALLY"
6180 DATA"U USING KEY Q FOR UP/LEFT"
```

```
6190 DATA"U W UP/RIGHT"
6200 DATA"U N DOWN/LEFT"
"
6210 DATA"U M DOWN/RIGH
T"
6220 DATA"U","R BY ANDREW GORDON"
6998 :
6999 REM === CONTROLLING SEQ ===
7000 S=1:E=2:SC$="SCREEN 1":W=20:GOSUB
10
7010 S=3:C=4:GC$="SCREEN 2":W=15:LM=TR
UE:GOSUB10
7020 S=5:E=6:SC$="SCREEN 3":W=10:LM=0:
FG=TRUE:GOSUB10
7030 S=2:E=3:SC$="SCREEN 4":W=10:LM=TR
UE:GOSUB10
7040 S=1:E=3:SC$="SCREEN 5":W=15:FG=0:
LM=0:HI=0:GOSUB10
7050 S=6:E=7:SC$="SCREEN 6":W=5:FG=TRU
E:GOSUB10
7060 S=4:E=5:SC$="SCREEN 7":W=10:FG=0:
HI=TRUE:GOSUB10
7070 S=2:E=4:SC$="SCREEN 8":W=10:LM=TR
UE:GOSUB10
7080 S=3:E=5:SC$="SCREEN 9":W=10:LM=0:
HI=TRUE:GOSUB10
7090 S=4:E=6:SC$="SCREEN 10":W=5:LM=TRU
E:GOSUB10
7100 S=5:E=7:SC$="SCREEN 11":W=5:FG=TRU
E:GOSUB10
7120 S=1:E=4:SC$="SCREEN 12":W=10:FG=0:
HI=0:LM=0:GOSUB10
7130 S=2:E=3:SC$="SCREEN 13":W=5:FG=TRU
E:HI=TRUE:GOSUB10
7140 S=3:E=6:SC$="SCREEN 14":W=5:FG=FAL
SE:LM=TRUE:GOSUB10
7150 S=4:E=7:SC$="SCREEN 15":W=0:FG=TRU
E:GOSUB10
7160 S=1:E=6:SC$="SCREEN 16":W=5:LM=0:G
OSUB10
7170 S=2:E=7:SC$="SCREEN 17":W=0:FG=TRU
E:GOSUB10
7180 S=1:E=7:SC$="SCREEN 18":W=0:GOSUB1
0:GOTO7000
7999 :
8000 REM ***** PYRAMANIAC *****
8010 REM By ANDREW GORDON.
```

Darts

Mike Hyams,
Edgware,
Middlesex.



AT LAST YOU CAN be Eric Bristow or John Lowe on your 48K Spectrum. This version of the standard pub game has several built-in options. One or two players, 501 or 301 start, and starting with a double or straight off. When presented with the selection page you should press keys one to six to change the type of game to the one you require, and then start the game by pressing S.

Each dart throw takes place in two moves. First by stopping the radar-probe on the dartboard, and then by stopping the multiplier under the blackboard. Pressing almost any key will stop these markers, hopefully where you want them to stop. The keys with a different use are 0 and Q. 0 will drop the dart

being thrown — useful for unsure players near the end of a game — and Q quits the game, returning to the title screen — useful when you have just failed your 16th attempt at double one and can't face another go.

As usual, all games must end on a double and if there are two players the winner will have a leg added to his/her score. Each set is five legs so the first to win three legs wins the set.

The alternative game, the Arcade Challenge, is so called because of its resemblance to arcade-style games rather than the traditional pub game. The computer presents you with a score which you must better with three darts. If you do not equal or beat this score then you lose one of your three lives.

The score to beat starts at 50 and rises in steps of 10 up to 150. If you survive this far then the score to beat drops back to 70, but things speed up. Only a true champion will

turn through this cycle three times.

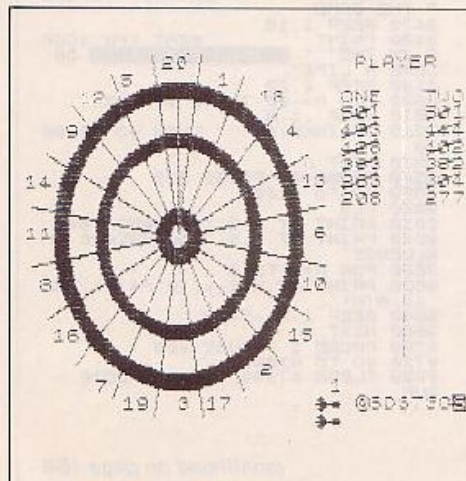
A score of 180 is rewarded with lots of buzzing and flashing, and a bonus of 500 points. A top five high score table is presented at the end of each arcade game.

First type in listing 1, and save to tape using

SAVE "DARTS" LINE 9999

Then new the computer. Next type in listing 2. This program produces the dartboard screen and takes nearly 20 minutes to run so now is a good time to go and make a cup of coffee. When the program is finished an alarm will sound to alert you. You will be asked to prepare the cassette for saving. This should be saved directly after the Darts program.

Listing 2 takes a long time to finish but as it is only needed to produce the screen display which has now been saved, it can be discarded. The machine code used to retrieve the screen is almost instant, a slight improvement on 20 minutes.



```
10 GO TO 9000
20 FOR S=0 TO 255: QLT 254,S
OUT 254,S: NEXT S
30 RETURN
90 INK 0: PAPER 6
91 PRINT AT 20,24,"@SDSTBOS"
92 LET I=1
93 OVER 1
100 LET I=INT(RND*20)+1
110 PLOT 20,30
115 OUT 254,21
120 DRAW E(I),F(I)
130 IF INKEY$(0) THEN GO TO 20
140 PLOT 20,30
145 OUT 254,5
150 DRAW E(I),F(I)
160 LET I=I-1: IF I=21 THEN LET
I=1
170 GO TO 110
200 OVER 0
201 IF INKEY$="0" THEN LET U=0:
GO TO 300
202 IF INKEY$="Q" THEN GO TO 91
203 BEEP .25,-10
204 LET U=INT(RND*7)+1
205 FOR U=1 TO 30: NEXT U
210 PRINT AT 20,24:TS(U)
220 FOR U=1 TO WAIT: NEXT U
```

```
230 IF INKEY$(0) THEN GO TO 30
240 LET U=U+1: IF U=9 THEN LET
U=1
250 GO TO 210
300 BEEP .25,-5
310 PLOT 20,30
320 DRAW OVER 1:E(I),F(I)
330 INK 7: PAPER 0
340 LET I=1
350 IF U=0 THEN LET I=0
360 IF U=3 THEN LET I=1+2
370 IF U=5 THEN LET I=1+3
380 IF U=7 THEN LET I=2+3
390 IF U=1 THEN LET I=3+3
400 IF U=3 THEN LET U=0: GO TO
400
410 LET U=1
420 RETURN
999 REM *****
***** CHOOSE A GAME *****
1200 CLS
1210 PRINT AT 1,10:"DARTS"
1220 PRINT AT 4,8:B$(1):"1 - ONE
PLAYER"
1230 PRINT AT 6,8:B$(2):"2 - TWO
PLAYERS"
```

(continued on next page)

SOFTWARE FILE

(continued from previous page)

```

1040 PRINT AT 8,8,B$(3);"/3 - 501
1050 PRINT AT 10,8,B$(4);"/4 - 50
1060 PRINT AT 12,8,B$(5);"/5 - 00
1070 PRINT AT 14,8,B$(6);"/6 - 5T
1080 PRINT AT 16,8,B$(7);"/7 - 5T
1090 PRINT AT 18,4,"A - THE ARCADE CHALLENGE"
1100 PRINT H 20,10; FLASH 1;"PRESS A KEY"
1110 FOR Z=1 TO 2000
1120 LET Z$=INKEY$
1130 IF Z$<>" " THEN GO TO 1100
1140 NEXT Z
1150 GO TO 9100
1160 IF Z$<>"1" THEN GO TO 1140
1170 LET B$(1)=0; LET B$(2)=0;
1180 GO TO 1010
1190 IF Z$<>"2" THEN GO TO 1150
1200 LET B$(2)=0; LET B$(1)=0;
1210 GO TO 1010
1220 IF Z$<>"3" THEN GO TO 1160
1230 LET B$(3)=0; LET B$(4)=0;
1240 GO TO 1010
1250 IF Z$<>"4" THEN GO TO 1170
1260 LET B$(4)=0; LET B$(3)=0;
1270 GO TO 1010
1280 IF Z$<>"5" THEN GO TO 1180
1290 LET B$(5)=0; LET B$(6)=0;
1300 GO TO 1010
1310 IF Z$<>"6" THEN GO TO 1190
1320 LET B$(6)=0; LET B$(5)=0;
1330 GO TO 1010
1340 IF Z$<>"7" THEN GO TO 1200
1350 LET B$(7)=0; LET B$(6)=0;
1360 GO TO 1010
1370 IF Z$<>"A" AND Z$<>"S" THEN
GO TO 1010
2000 REM *****
      PLAY A GAME
*****
2001 LET PLAYER=1
2002 BRIGHT 0
2003 LET S1=0; LET S2=0
2004 LET L1=0; LET L2=0
2005 LET U=0
2010 IF B$(2)=0 THEN LET PLAYER=2; LET U=1
2015 IF Z$="A" THEN GO TO 5000
2020 LET START=50
2030 IF B$(4)=0 THEN LET START=301
2040 LET BEGIN=1
2050 IF B$(5)=0 THEN LET BEGIN=0
2060 LET X(1)=START
2070 LET X(2)=START
2080 LET WAIT=1
2100 RANDOMIZE USR 48000
2105 PRINT #1;"  © 1984 M. HYAMS"
2106 INK 0; PAPER 6
2110 PRINT AT 0,24;"PLAYER:"
2120 PRINT AT 2,23;"ONE";AT 3,23
      INK 7; PAPER 2; START
2121 IF U=1 THEN PRINT AT 4,23
      INK 7; PAPER 2; START;AT 3,23
2130 IF PLAYER=2 THEN PRINT AT 2,23;"TWO";AT 3,23; INK 7; PAPER 0; START
2140 LET SC=4
2150 GO SUB 8000
2210 FOR N=1 TO PLAYER
2215 IF U=1 THEN LET U=0; NEXT N
2220 PRINT AT 19,21; INK 6; PAPER 0;"/";AT 20,21;"/";AT 21,21;"/"
2230 PRINT AT 2,23+6*(N-1); OVER 1; FLASH 1; BRIGHT 1;
2240 INK 6; PAPER 0
2245 LET TOT=0
2250 FOR M=1 TO 3
2270 GO SUB 90
2275 LET ZZ=1
2280 IF BEGIN=0 THEN GO TO 2300
2281 IF ZZ=50 THEN GO TO 2300
2285 IF X(N)-TOT<START AND U=0 THEN LET ZZ=0
2300 PRINT AT 18+M,21;" " AND Z X(10);ZZ
2310 LET TOT=TOT+ZZ
2311 IF X(N)-TOT=0 AND (U=1 OR I=50) THEN GO TO 4000
2312 IF X(N)-TOT<2 THEN PRINT AT 21,24; FLASH 1;" BUST " GO TO 2330
2320 NEXT N
2330 IF X(N)-TOT>1 THEN LET X(N)=X(N)-TOT; IF TOT=180 THEN GO SUB 8,20
2340 PRINT AT 30,23+6*(N-1);X(N)
2370 PLOT 185+48*(N-1);(22-50)+8
2375 ORA 20,7
2380 IF SC=17 THEN FOR R=3 TO 17
      PRINT AT R,23+6*(N-1); INK 7; PAPER 0;"/"; NEXT R; PRINT AT 3,23+6*(N-1);X(N)
2385 FOR Q=1 TO 100; NEXT Q
2390 PRINT AT 2,23+6*(N-1); OVER 1; FLASH 0; BRIGHT 0;
2400 NEXT N
2410 LET SC=SC+1
2420 IF SC=10 THEN LET SC=4
2430 LET WAIT=WAIT+.5
2500 GO TO 2210
4000 REM *****
      WIN ROUTINE
*****
4010 GO SUB 20
4015 RESTORE 4000
4020 FOR M=1 TO 5
4030 READ 3,8

```

```

4040 BEEP 3,8
4050 NEXT M
4060 IF N=1 THEN LET L1=L1+1; IF L1<3 THEN LET L1=0; LET S1=S1+1; LET L2=0
4065 IF N=2 THEN LET L2=L2+1; IF L2<3 THEN LET L2=0; LET S2=S2+1; LET L1=0
4070 DATA .5,0,.25,-.5,0,.25,-.5,1,5
4080 IF U=1 THEN LET U=1
4090 IF U=2 THEN LET U=1
4095 IF PLAYER=1 THEN GO TO 9100
4095 PRINT AT 20,23;" " AT 19,21; PAPER 5;"/"
4100 PRINT AT 20,23;"SETS " S1;T AB 29,52
4110 PRINT AT 21,23;"LEGS " L1;T AB 29,52
4120 PRINT #1;AT 0,1;"PRESS "D" TO FINISH THE MATCH OR ANY OTHER KEY FOR NEXT LEG"
4130 IF INKEY$="D" THEN GO TO 9100
4140 IF INKEY$=" " THEN GO TO 4500
4150 GO TO 4130
4500 PAPER 5; CLS; GO TO 2000
4999 STOP
5000 REM *****
      ARCADE GAME
*****
5005 DIM U(2)
5006 LET U(1)=3; IF PLAYER=2 THEN LET U(2)=3
5010 RANDOMIZE USR 48000
5015 PRINT #1;"  © 1984 M. HYAMS"
5015 PRINT AT 0,23;"THE " AT 1,23;"ARCADE " AT 2,23;"CHALLENGE"
5020 PRINT AT 0,20;"HI-SCORE " AT 5,24;HI
5025 INK 7; PAPER 0
5030 PRINT AT 9,23;"PLAYER 1"
5040 IF PLAYER=2 THEN PRINT AT 1,3,23;"PLAYER 2"
5050 INK 7; PAPER 0
5060 PRINT AT 10,23;" "
5070 IF PLAYER=2 THEN PRINT AT 1,4,23;" "
5100 LET WAIT=3
5105 GO SUB 8000
5110 LET TOP=50
5200 PRINT AT 19,29;" "
5205 PRINT AT 18,23;"SCORE TO " AT 19,23;"BEAT- " FLASH 1;TOP
5300 FOR N=1 TO PLAYER
5305 IF U(N)=0 THEN GO TO 5600
5310 PRINT AT 9+4*(N-1),23; OVER 1; FLASH 1
5320 PRINT AT 19,23;" " AT 20,20;" "
5330 LET TOT=0
5400 FOR M=1 TO 3
5450 GO SUB 90
5460 LET ZZ=1
5470 PRINT AT 10+M,20;" " AND Z X(10);ZZ
5480 LET TOT=TOT+ZZ
5500 NEXT M
5510 IF TOT=TOP THEN GO TO 5600
5560 BEEP 7,10; BEEP 7,15
5570 PRINT AT 10+4*(N-1),20+U(N)+3;" "
5580 LET U(N)=U(N)+1
5590 IF U(N)=0 THEN PRINT AT 10+4*(N-1),23;"GAME OVER" BEEP 7,15
5595 GO TO 5610
5600 LET X(N)=X(N)+U(1)
5601 IF TOT=180 THEN PRINT AT 20,24; FLASH 1;"BCNUS* " AT 21,24; FLASH 1;500 PTS; GO SUB 24
      LET X(N)=X(N)+500
5605 PRINT AT 11+4*(N-1),24,X(N)
5610 PRINT AT 9+4*(N-1),23; OVER 1; FLASH 0;
5620 IF U(1)=0 AND U(2)=0 THEN GO 5800
5625 FOR R=1 TO 100; NEXT R
5630 NEXT N
5640 LET TOP=TOP+10
5650 IF TOP=150 THEN LET TOP=70; LET WAIT=WAIT+.4
5660 GO TO 5200
5800 PAUSE 1; PAUSE 100
5801 FOR M=1 TO 2
5805 FOR N=1 TO 5
5810 IF X(M)>A(N) THEN GO TO 5850
5820 NEXT N
5830 NEXT M
5835 LET HI=A(1)
5840 GO TO 5800
5850 FOR Z=0 TO N+1 STEP -1
5860 LET A$(Z)=A$(Z-1)
5865 LET A$(Z)=A(Z-1)
5870 NEXT Z
5880 PRINT AT 7,3;"CONGRATULATIONS";AT 8,7; FLASH 1;"PLAYER " M
5890 PRINT AT 10,3;"ENTER YOUR NAME";AT 11,2;"FOR HI-SCORE TABLE"
5919 INPUT FLASH 1;"NAME " A$
5920 LET A$(Z)=A$
5930 LET A$(Z)=X(M)
5950 GO TO 5830
6000 BEEP .3,0; BEEP .3,12; BEEP .3,3
6010 BEEP .3,10; BEEP .3,9
6020 BEEP .3,7; BEEP .3,0
6050 RETURN
6099 STOP

```

```

9000 REM *****
      INITIALISE
*****
9001 RESTORE 9000; FOR N=0 TO 23
      READ 3; POKE USR "B"+N,3; NEXT N
9010 DATA 0,2,4,30,30,127,30,30,2,4,8,2,0,50,2,30,30,30,66,153,165,153,53,30,30
9011 DATA 0,35,30,61,32,52,52,15,51,20,65,0,51,20,52,32,38,52,20,51
9012 DIM E(20); DIM F(20)
9013 FOR N=1 TO 20
9014 IF N=11 THEN RESTORE 9011
9015 READ C(N); READ F(N)
9016 IF N>5 AND N<16 THEN LET F(N)=F(N)
9017 IF N>10 THEN LET E(N)=E(N)
9018 NEXT N
9020 LET HI=0
9021 DIM T$(8,12)
9022 LET T$(2)=0;DST503"
9023 LET T$(3)=0;DST503"
9024 LET T$(4)=0;DST503"
9025 LET T$(5)=0;DST503"
9026 LET T$(6)=0;DST503"
9027 LET T$(7)=0;DST503"
9028 LET T$(8)=0;DST503"
9030 DIM A$(5,9)
9031 FOR N=1 TO 5
9032 LET A$(N)="?????"
9033 NEXT N
9040 POKE 23658,8
9041 DATA 20,1,18,4,13,6,10,15,2,17,3,19,7,16,8,11,14,9,12,5
9042 DIM I(20)
9043 FOR N=1 TO 20; READ I(N); NEXT N
9050 DIM A(5)
9051 DIM B$(10,2)
9054 LET D$=CHR$(20+CHR$ 0)
9055 LET C$=CHR$(20+CHR$ 1)
9056 LET B$(3)=C$
9057 LET B$(3)=C$
9058 LET B$(5)=C$
9059 LET B$(2)=B$
9070 LET B$(4)=B$
9071 LET B$(6)=B$
9100 OVER INK 0; BRIGHT 1; B0
9101 DIM X(2)
9105 PRINT AT 2,12;"DARTS"
9110 FOR N=0 TO 21; BEEP 2
9120 PRINT AT N,0;"@";AT N,31;"@
9130 NEXT N
9170 FOR N=-20 TO 20
9180 BEEP .01,N
9190 NEXT N
9210 BEEP 1,20
9230 PRINT AT 4,8;"RAY MTKE HYAMS"
9240 PRINT AT 6,8;" " © 1984 "
9250 PRINT AT 10,5;"PRESS ON " BEEP 2,5
9260 PRINT AT 12,4;"OR " M; FOR INSTRUCTIONS"
9300 PAUSE 1; PAUSE 500
9320 IF INKEY$="I" THEN GO TO 9400
9330 IF INKEY$=" " THEN GO TO 1000
9340 GO TO 9600
9400 CLS
9430 PRINT AT 0,6;"DARTS - INSTRUCTIONS"
9435 BEEP 2,0
9450 PRINT AT 2,0;"PRESS ANY KEY TO STOP THE DART PROBE ON THE BOARD"
9455 BEEP 2,5
9465 PRINT "PRESS ANY KEY TO STOP THE DART PROBE"
9470 PRINT "TAB 10;"5 - SINGLE"
9475 PRINT "TAB 10;"0 - DOUBLE" PRINT "TAB 10;"T - TRIPLE" PRINT "AD 10;"0 - 25" PRINT TAB 10;"@ - BULL"
9487 BEEP 2,10
9490 PRINT "PRESS "0" TO QUA OR A DART"
9495 PRINT "PRESS "0" TO QUIT THE GAME"
9470 BEEP 2,15
9480 PRINT "BEAT THE SCORE IN THE "
9490 BEEP 2,20
9500 FOR N=-50 TO 50 STEP 3
9510 BEEP .1,N
9525 IF INKEY$=" " THEN GO TO 9600
9530 NEXT N
9540 PAUSE 4; PAUSE 500
9550 GO TO 9100
9600 CLS
9610 PRINT AT 2,9;" " DARTS "
9615 PRINT AT 4,5;"THE ARCADE CHALLENGE"
9620 FOR N=1 TO 5
9630 PRINT AT N+2+4,10;A$(N);TAB 18,A(N)
9640 BEEP 1,N+5+10
9650 NEXT N
9700 PAUSE 1; PAUSE 200
9710 GO TO 9100
9999 CLEAR 47999; LOAD "CODE" RUN

```

(continued on page 164)

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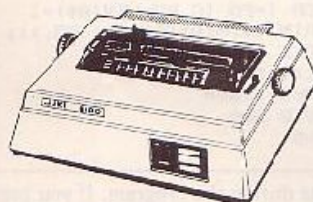
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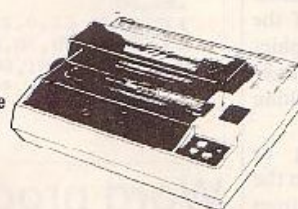
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(continued from page 162)

Program 2.

```

10000 CIRCLE 80,90,13
10001 LET N1=77
10002 LET N2=133
10003 GO SUB 9999
10004 INVERSE 1
10005 LET INV=0
10006 CIRCLE 80,90,5
10007 LET N1=9000
10008 GO SUB 9999
10009 INVERSE 0
10010 FOR N=PI/20 TO 2*PI STEP P
10011 PLOT 80+8*SIN N,90+8*COS N
10012 DRAW 80+8*SIN N,80+8*COS N
10013 NEXT N
10014 PAPER 5:INK 2
10015 PRINT AT 0,10,"20"
10016 PRINT AT 1,7,"8" AT 1,11,"1"
10017 AT 2,17,"8" AT 2,11,"1"
10018 PRINT AT 4,3,"7" AT 4,19,"4"
10019 AT 7,17,"8" AT 7,11,"13"
10020 PRINT AT 10,0,"13" AT 10,21
10021 AT 13,1,"9" AT 13,23,"10"
10022 PRINT AT 16,7,"18" AT 16,19
10023 AT 19,3,"8" AT 19,17,"10"
10024 PRINT AT 20,7,"19" AT 20,13
10025 AT 20,11,"3"
10026 INK 7:PAPER 0
10027 FOR N=0 TO 15

```

```

3010 PRINT AT N,23;" "
3020 NEXT N
4000 FOR N=0 TO 69:1
4010 POKE N+48012,PEEK (N+15384)
4020 NEXT N
4100 RESTORE 4110
4110 DATA 1,0,27,30,140,187,17,0
4120 FOR N=178,201
4130 OR N+48000 TO 48011
4140 READ S:POKE N,S
4150 NEXT N
4999 PRINT #1,FLASH 1:"Prepare
cassette, then press key."
5000 BEEP ,5,0:IF INKEY$="" THEN
EN GO TO 5100
5010 BEEP ,5,10:GO TO 5000
5100 SAVE "screen"CONF 48000,502
4
5030 STOP
5040 FOR N=N1 TO N2
5050 FOR M=90 TO 175
5060 IF POINT (P,M)=INV THEN GO
TO 5030
5070 PLOT PAPER P&N,M
5080 NEXT M
5090 FOR M=90 TO 0 STEP -1
5100 IF POINT (M,M)=INV THEN GO
TO 5030
5070 PLOT PAPER P&N,M
5080 NEXT M
5090 NEXT N
5100 RETURN

```

Flash routine

Brian Allan,
Saintfield,
County Down.

DRAGON

MANY HOME MICROS have the ability to show flashing characters: the Dragon 32 is not one of them. My first program is a hex loader and a flash routine. The second gives you an idea of how this flash routine could be used. First I will explain how it works. It uses the ability to divert the timer interrupt to any machine-code routine.

The routine comes into action every 1/50th of a second. When active, the routine compares the bytes in the first graphics page to 0. For example, if location 1535 is not 0, then position 0 on the text screen flashes. This means you cannot use page 1 if the routine is active, but if page 1 of the graphics is cleared the computer will not crash because it only contains the data to see which position on the text screen to flash.

The flashing is done by adding or subtracting the value 64 from the bytes in the text screen memory. The routine is held from locations 32600 to 32677. Once the hex loader is finished you can save it as a machine-code program. Always enter Clear 200,32599 before loading it. If you do not and use text files, the data for Print #1 or Input #1 will overwrite the routine causing it to crash.

To use the routine, Exec 32600 switches it on while Exec 32607 switches it off. Poking location 32621 gives the speed of the flash. For example Poke 32621,50 causes a flash every second while Poke 32621,25 flashes every half second. The routine will not slow the Basic down if the flash rate is reasonable — Poke 32621, (10-255).

Lastly, for those who like to experiment with machine code, I will show them how to divert an interrupt. First, using machine code, store the address of the routine in locations 269 and 270. Then at the end of your routine, instead of an RTS, use JMP 40253.

You cannot use a lengthy routine as the computer will be impatient waiting for it to end and may crash. The reason why the address has to be stored with machine code is because Basic is too slow and will not complete the store in time for the next interrupt.

```

10 REM *****
20 REM * FLASH ROUTINE *
30 REM * HEX LOADER. *
40 REM * BY BRIAN ALLAN. *
50 REM *****
60 CLEAR 200,32599
70 CLS
80 PRINT "LOADING IN HEXADECIMAL
CODES...":PRINT STRING$(32,"*")
90 FOR I=32600 TO 32677
100 READ A$:POKE I,VAL("&H"+A$)
110 NEXT I
120 PRINT:PRINT"LOADED."
130 PRINT:PRINT"EXEC 32600 -FL
ASH ROUTINE ON."
140 PRINT"EXEC 32607 -FLASH RO
UTINE OFF."
150 PRINT"SPEED LOCATION - 32621
."
160 DATA 6E,7F,66,BF,1,D,39,8E,9
D,3D,BF,1,D,39,7C,8,1,B6,3,1,B1,
64,26,17,7F,8,1,BE,4,0,10,BE,6,0
,E6,40
170 DATA C1,0,26,A,30,1,8C,5,FF,
23,F3,7E,9D,3D,A6,B4,B1,3F,23,F,
81,7F,23,4,B1,EF,23,7,80,40,A7,8
4,7E,7F,80,BB,40,A7,34,7E,7F,80
180 NEW
190 END

```

```

30 REM * DEMONSTRATION *
50 REM
60 REM !! FLASH ROUTINE MUST !!
70 REM !! LOADED & EXECUTED !!
80 REM !! BEFORE THIS !!
90 REM !! DEMO. IS EXECUTED. !!
100 REM
110 PMODE 0,1:PCLS 0:EXEC 32607
120 CLS
130 PRINT"FLASH DEMONSTRATION.":
PRINTSTRING$(20,"*")
140 INPUT "ENTER A SENTENCE ":A$
150 INPUT "ENTER POSITION ON SCK
EEN ":P0
160 INPUT "ENTER FLASH RATE ":FR
170 IF FR<0 OR FR>255 THEN PRINT
"FLASH RATE OUT OF RANGE..":GOT
O 150
180 IF (P0+LEN(A$))>511 THEN PRI
NT"SENTENCE TOO LONG FOR POSITIO
N ON SCREEN...":GOTO 140
190 POKE 32621,FR
200 CLS 4
210 FOR I=P0 TO P0+LEN(A$)-1
220 PRINT@I,MID$(A$,I+1-P0,1);
230 POKE 1536+I,255
240 NEXT I
250 EXEC 32600
260 GOTO 260
270 END

```

Word processor

Richard Dodd,
Caterham,
Surrey.

BBC

THIS PROGRAM HAS been designed to provide BBC users with a word processor that will perform the basic text-processing functions on a Model B with a printer but no discs. This means that the text has to be stored in RAM during processing which limits the amount of text that is able to be stored. With this in mind the program has been made as short as possible while still providing many of the features you would expect from a word processor.

This word processor has been designed to be used with an 80-column printer but can be easily changed to run on a 40-column printer.

When you run the program you will be presented with a list of 11 commands and the two letter code for each. These commands are:

Load text; Save text; Print text; Enter text; Justify text; Help; Centre on; Centre off; Count words; Exit program.

Any of these commands can be entered at

any time during the program. If you press the Tab key the prompt "Next Command..." will appear at the bottom of the screen. You can then enter the two-letter code for the command you want.

Load/Save: When this option is chosen you will be asked for the name of the file you wish to load or save. After loading text there will be a short wait while the number of words in the document are counted.

Edit text: If during entering text you make a mistake this command enables you to go back and edit any page you wish. When you choose this option you will first be asked if you wish to (I)nsert, (D)elete, or (R)eplace words. Next you will be asked which page you wish to edit. You can then edit the page using a cursor "+" that is moved using the four arrow keys.

Centre on/off: This command enables you to centre a complete line of text by touching the Return key. This command is useful for centering titles etc.

Help: If you forget the two letter code for one of the 11 commands entering this command or pressing the Escape key will display a list of all the commands.

Count words: After you have finished entering a document this command will

SOFTWARE FILE

recount the number of words.

Justify: This command will line up both the left and right margins of the lines in your document by adding extra spaces.

The program, if loaded with Page set to B00, is able to store over 70 lines of text each of 80 characters. When you reach this limit the program will stop and tell you that the

memory is now full up. You must then save the text or print it and then restart the program. At this point you can also edit the text but you cannot insert any extra words.

```

10 REM *****
20 REM * WORD PROCESSOR BY RICHARD DDD *
30 REM *****
40 MODE 3:PROCinit
50 PROCchoice
60 PROCchoice
70
80 DEF PROCinit
90 PRINT TAB(29,5);"Word Processor Program";TAB(39,
71);"B":TAB(34,7);"Richard DDD";TAB(37,11);"For The";
TAB(31,13);"BB: model B 1.2 Row"
100 DIM Texts(90);FOR FX=1 TO 90:NEXT
110 ON ERROR IF ERR=216 AND ERR=218 PROCerror ELSE
GOTO 50
120 CX=0:GX=1:GX=0:GX=0:GX=0:GX=0:GX=0:GX=0:GX=0:GX=0
130 DEF PROCB
140 DEF PROCB
150 DEF PROCB
160 DEF PROCB
170 DEF PROCB
180 PRINT TAB(20,"PR...print Text CF...centre o
ff"
190 PRINT TAB(20,"EN...enter Text X...exit prog
ram,"
200 PRINT TAB(20,"ED...edit Text NO...Count do
wn"
210 PRINT TAB(20,"JU...Justify Text"
220 PRINT TAB(20,"CH...Change Mode"
230 PRINT TAB(20,"CT...Continue to Continue:CS=GETS:O
L:ENDPROC
240 DEF PROCcenter
250 PRINT TAB(0,1);1;2;3;4;5;6;7;8;9;10;11;12;13;14;15;16;17;18;19;20;21;22;23;24;25;26;27;28;29;30;31;32;33;34;35;36;37;38;39;40;41;42;43;44;45;46;47;48;49;50;51;52;53;54;55;56;57;58;59;60;61;62;63;64;65;66;67;68;69;70;71;72;73;74;75;76;77;78;79;80;81;82;83;84;85;86;87;88;89;90;91;92;93;94;95;96;97;98;99;100;101;102;103;104;105;106;107;108;109;110;111;112;113;114;115;116;117;118;119;120;121;122;123;124;125;126;127;128;129;130;131;132;133;134;135;136;137;138;139;140;141;142;143;144;145;146;147;148;149;150;151;152;153;154;155;156;157;158;159;160;161;162;163;164;165;166;167;168;169;170;171;172;173;174;175;176;177;178;179;180;181;182;183;184;185;186;187;188;189;190;191;192;193;194;195;196;197;198;199;200;201;202;203;204;205;206;207;208;209;210;211;212;213;214;215;216;217;218;219;220;221;222;223;224;225;226;227;228;229;230;231;232;233;234;235;236;237;238;239;240;241;242;243;244;245;246;247;248;249;250;251;252;253;254;255;256;257;258;259;260;261;262;263;264;265;266;267;268;269;270;271;272;273;274;275;276;277;278;279;280;281;282;283;284;285;286;287;288;289;290;291;292;293;294;295;296;297;298;299;300;301;302;303;304;305;306;307;308;309;310;311;312;313;314;315;316;317;318;319;320;321;322;323;324;325;326;327;328;329;330;331;332;333;334;335;336;337;338;339;340;341;342;343;344;345;346;347;348;349;350;351;352;353;354;355;356;357;358;359;360;361;362;363;364;365;366;367;368;369;370;371;372;373;374;375;376;377;378;379;380;381;382;383;384;385;386;387;388;389;390;391;392;393;394;395;396;397;398;399;400;401;402;403;404;405;406;407;408;409;410;411;412;413;414;415;416;417;418;419;420;421;422;423;424;425;426;427;428;429;430;431;432;433;434;435;436;437;438;439;440;441;442;443;444;445;446;447;448;449;450;451;452;453;454;455;456;457;458;459;460;461;462;463;464;465;466;467;468;469;470;471;472;473;474;475;476;477;478;479;480;481;482;483;484;485;486;487;488;489;490;491;492;493;494;495;496;497;498;499;500;501;502;503;504;505;506;507;508;509;510;511;512;513;514;515;516;517;518;519;520;521;522;523;524;525;526;527;528;529;530;531;532;533;534;535;536;537;538;539;540;541;542;543;544;545;546;547;548;549;550;551;552;553;554;555;556;557;558;559;560;561;562;563;564;565;566;567;568;569;570;571;572;573;574;575;576;577;578;579;580;581;582;583;584;585;586;587;588;589;590;591;592;593;594;595;596;597;598;599;600;601;602;603;604;605;606;607;608;609;610;611;612;613;614;615;616;617;618;619;620;621;622;623;624;625;626;627;628;629;630;631;632;633;634;635;636;637;638;639;640;641;642;643;644;645;646;647;648;649;650;651;652;653;654;655;656;657;658;659;660;661;662;663;664;665;666;667;668;669;670;671;672;673;674;675;676;677;678;679;680;681;682;683;684;685;686;687;688;689;690;691;692;693;694;695;696;697;698;699;700;701;702;703;704;705;706;707;708;709;710;711;712;713;714;715;716;717;718;719;720;721;722;723;724;725;726;727;728;729;730;731;732;733;734;735;736;737;738;739;740;741;742;743;744;745;746;747;748;749;750;751;752;753;754;755;756;757;758;759;760;761;762;763;764;765;766;767;768;769;770;771;772;773;774;775;776;777;778;779;780;781;782;783;784;785;786;787;788;789;790;791;792;793;794;795;796;797;798;799;800;801;802;803;804;805;806;807;808;809;810;811;812;813;814;815;816;817;818;819;820;821;822;823;824;825;826;827;828;829;830;831;832;833;834;835;836;837;838;839;840;841;842;843;844;845;846;847;848;849;850;851;852;853;854;855;856;857;858;859;860;861;862;863;864;865;866;867;868;869;870;871;872;873;874;875;876;877;878;879;880;881;882;883;884;885;886;887;888;889;890;891;892;893;894;895;896;897;898;899;900;901;902;903;904;905;906;907;908;909;910;911;912;913;914;915;916;917;918;919;920;921;922;923;924;925;926;927;928;929;930;931;932;933;934;935;936;937;938;939;940;941;942;943;944;945;946;947;948;949;950;951;952;953;954;955;956;957;958;959;960;961;962;963;964;965;966;967;968;969;970;971;972;973;974;975;976;977;978;979;980;981;982;983;984;985;986;987;988;989;990;991;992;993;994;995;996;997;998;999;1000;1001;1002;1003;1004;1005;1006;1007;1008;1009;1010;1011;1012;1013;1014;1015;1016;1017;1018;1019;1020;1021;1022;1023;1024;1025;1026;1027;1028;1029;1030;1031;1032;1033;1034;1035;1036;1037;1038;1039;1040;1041;1042;1043;1044;1045;1046;1047;1048;1049;1050;1051;1052;1053;1054;1055;1056;1057;1058;1059;1060;1061;1062;1063;1064;1065;1066;1067;1068;1069;1070;1071;1072;1073;1074;1075;1076;1077;1078;1079;1080;1081;1082;1083;1084;1085;1086;1087;1088;1089;1090;1091;1092;1093;1094;1095;1096;1097;1098;1099;1100;1101;1102;1103;1104;1105;1106;1107;1108;1109;1110;1111;1112;1113;1114;1115;1116;1117;1118;1119;1120;1121;1122;1123;1124;1125;1126;1127;1128;1129;1130;1131;1132;1133;1134;1135;1136;1137;1138;1139;1140;1141;1142;1143;1144;1145;1146;1147;1148;1149;1150;1151;1152;1153;1154;1155;1156;1157;1158;1159;1160;1161;1162;1163;1164;1165;1166;1167;1168;1169;1170;1171;1172;1173;1174;1175;1176;1177;1178;1179;1180;1181;1182;1183;1184;1185;1186;1187;1188;1189;1190;1191;1192;1193;1194;1195;1196;1197;1198;1199;1200;1201;1202;1203;1204;1205;1206;1207;1208;1209;1210;1211;1212;1213;1214;1215;1216;1217;1218;1219;122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JUNE'S COMPETITION offered two prizes, as the first prize an Amstrad CPC-464 which comes with a colour monitor, and as the second the same machine with a monochrome monitor. All you had to do to enter was place eight features of computer games in order of preference. For a tie-breaker we also asked you to think of an original title for a computer game.

To pick what was to be the winning order we assembled a panel of hardened games players. Between them they brought years of arcade experience to bear on the problem. In effect their task was to define the ingredients of a best-selling game.

As it turned out it proved almost impossible to reach an agreement. For example, everyone on the panel agreed that high-resolution graphics deserved a place near or at the top of the list, but what about realism? Surely realism in a game and high-res graphics amount to the same thing? On the other hand several of the most successful games have a cartoon style which is far from realistic — and so the argument continued.

One judge wanted to give easy loading priority on the grounds that without it a game is unplayable. But most games load without any trouble; this would seem to be more a precondition for playing games rather than a favourite feature.

Our final decision was a compromise. You probably will not agree with it exactly but it broadly reflects the preference of our panel and, indeed, of most of the entries: 1. High-resolution graphics. 2. Sound effects. 3. Different screens. 4. Quick reactions. 5.

AMSTRAD

competition

RESULTS

Realism. 6. Problem solving. 7. Easy loading. 8. User definable controls.

Two contestants came up with the same list as our judges. We awarded the first prize to Michael Burdass, 6 Town Hill, Broughton, Near Brigg, South Humberside. His title, Fea Pod Pete, was thought to be more appealing than AKA — Death, which was suggested by the second prizewinner, Carl Chippendale, 93 Common Road, Huthwaite, Sutton-in-Ash, Nottingham.

A look at the rest of the entries — almost 2,000 of them — turned up some highly entertaining titles. Anagram makers went to town on the name Amstrad and sent in, by the dozen, Mad Star or Mad Rats. More original were C Robinson's surreal Underparts in Space, D Walker's topical Picket Panic — a sequel to Manic Miner — and R Avery's

mystifying Catbird Ten Twenty.

From A Karhumaki in Finland came The Rise of the Patriotic People of Finland against the Military Power of Imperialism and for the Sprouting Independence of their Nation; while from Spain E Diaz suggested Crazy Bullfight. C Oakes almost matched the Finnish entry in length with Revenge of the 90 Foot High, Pan Dimensional, Laser Spitting, Kamikaze, Combat Hamsters.

There were many others deserving of a mention. Here's a small selection from them: Jet Lag Willy, Tebbit Attack, Stompicator, Boku Boku the Exterminator, Lost in Tesco's, Armadillo Nights, Cambridge Clive and the Temple of Delays, Tutencarman, Attack on Amstradam, Bunfight: at Theo Kay's Corra, Half a Worn-out Toothbrush Bristle, Invasion of the Killer Odour Eaters.

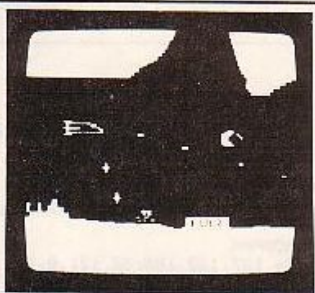
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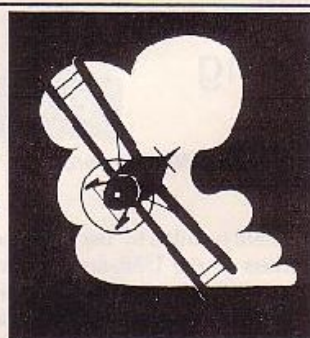
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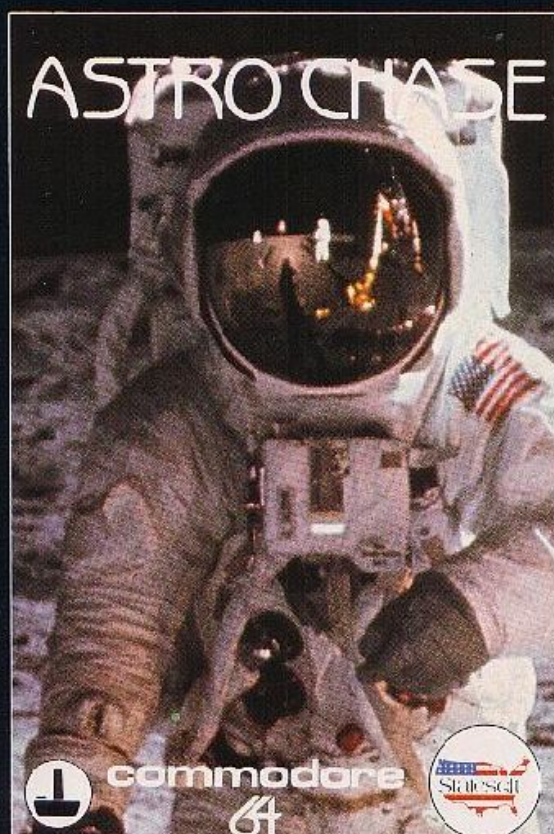
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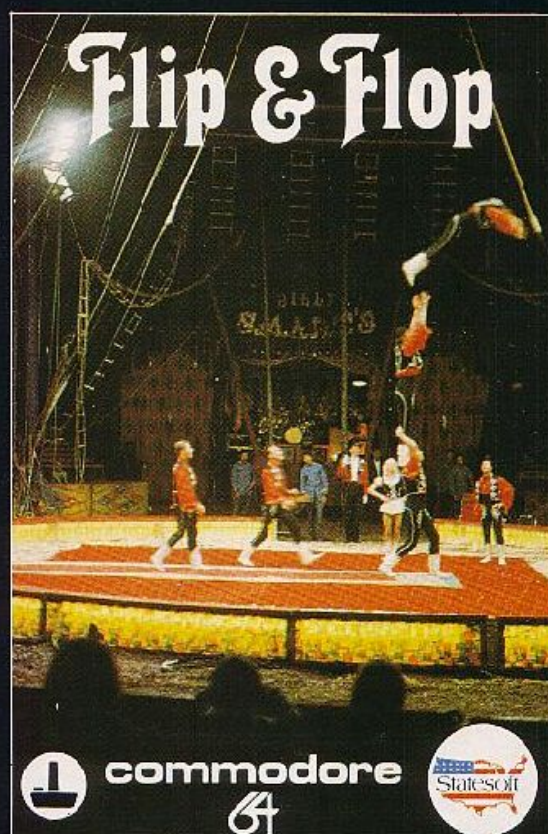


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Science Fiction/Fantasy Game of the Year, 1984
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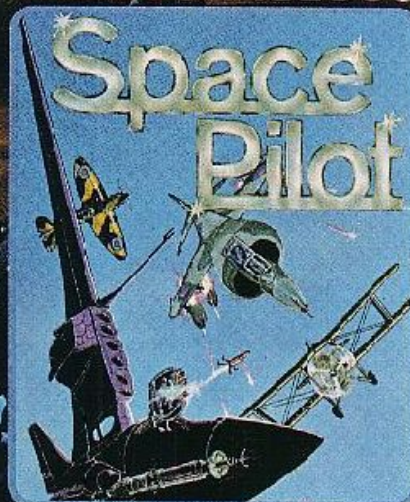
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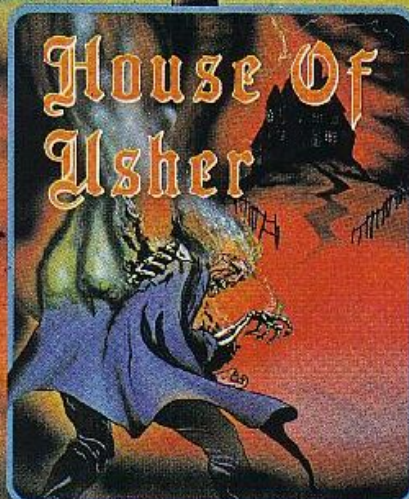
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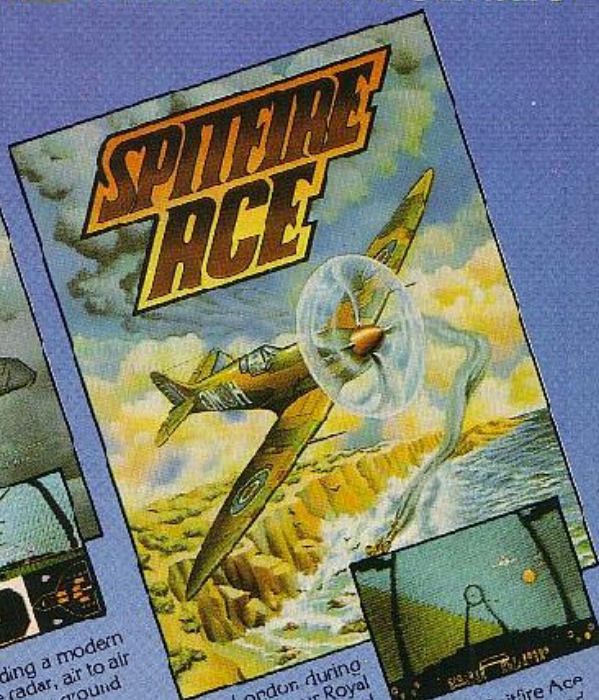
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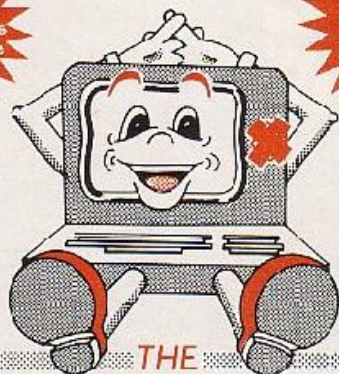
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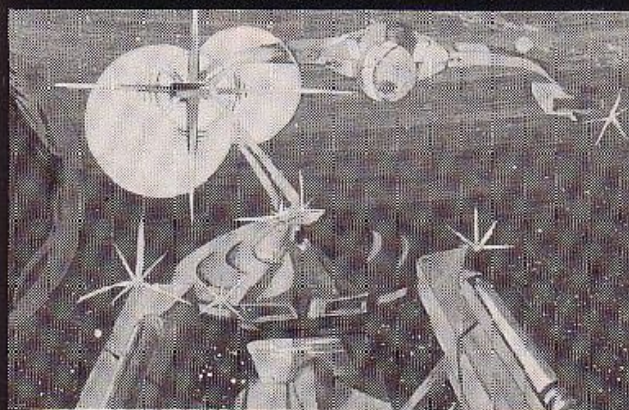
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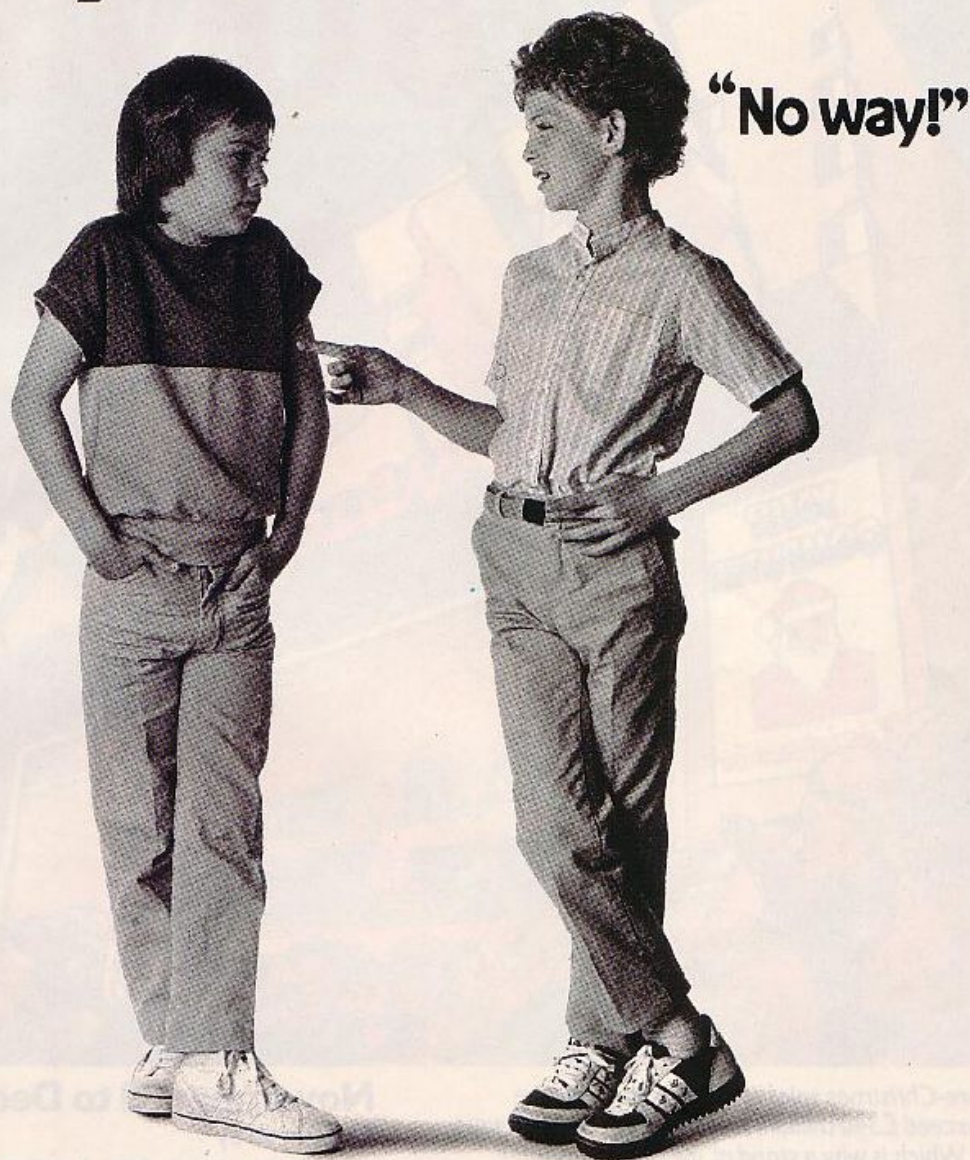
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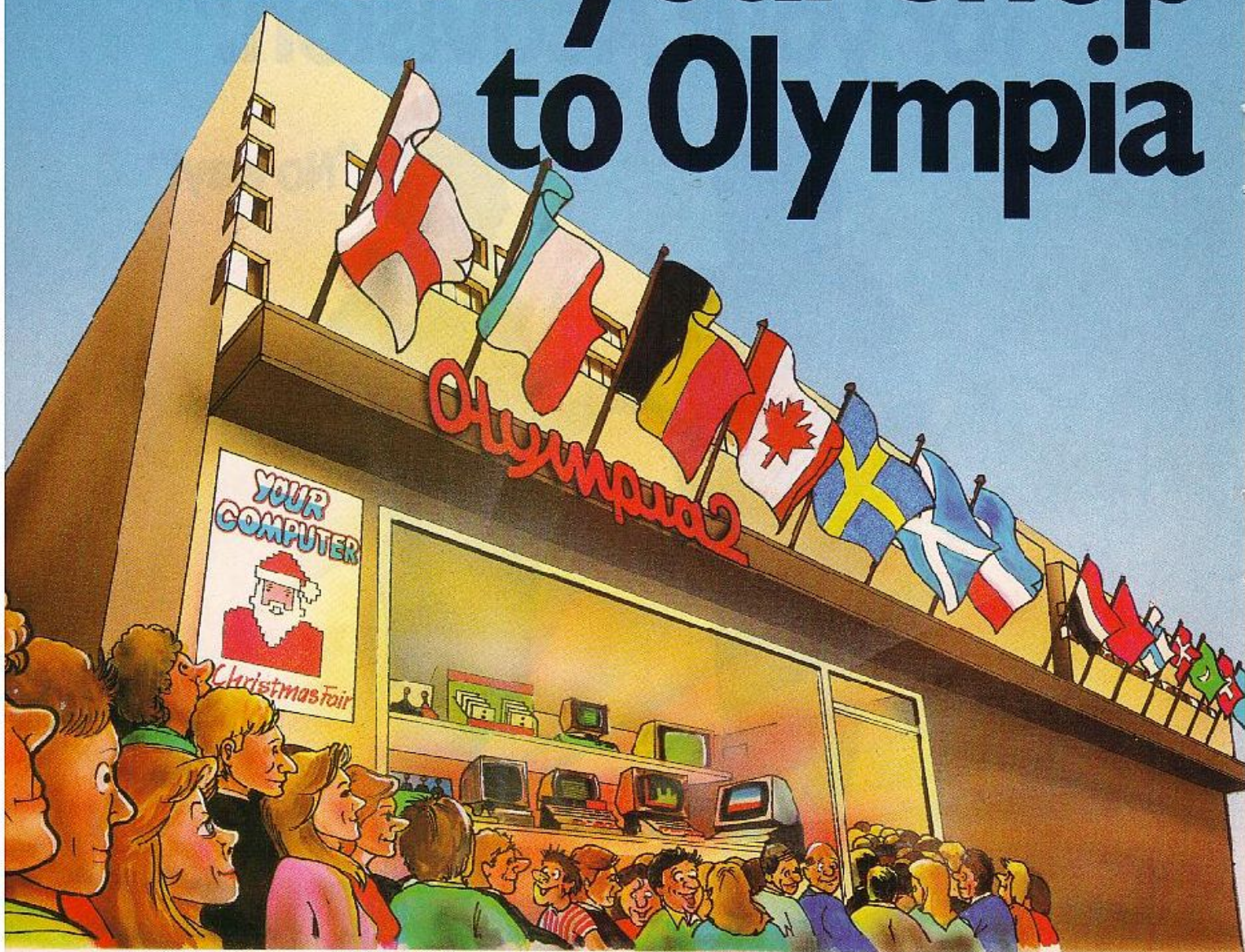
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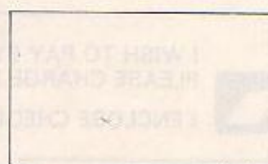
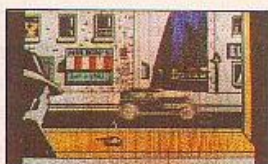
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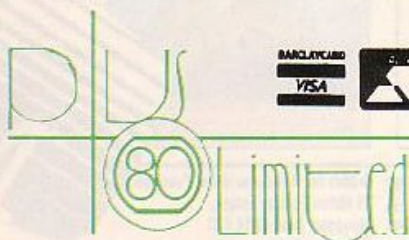
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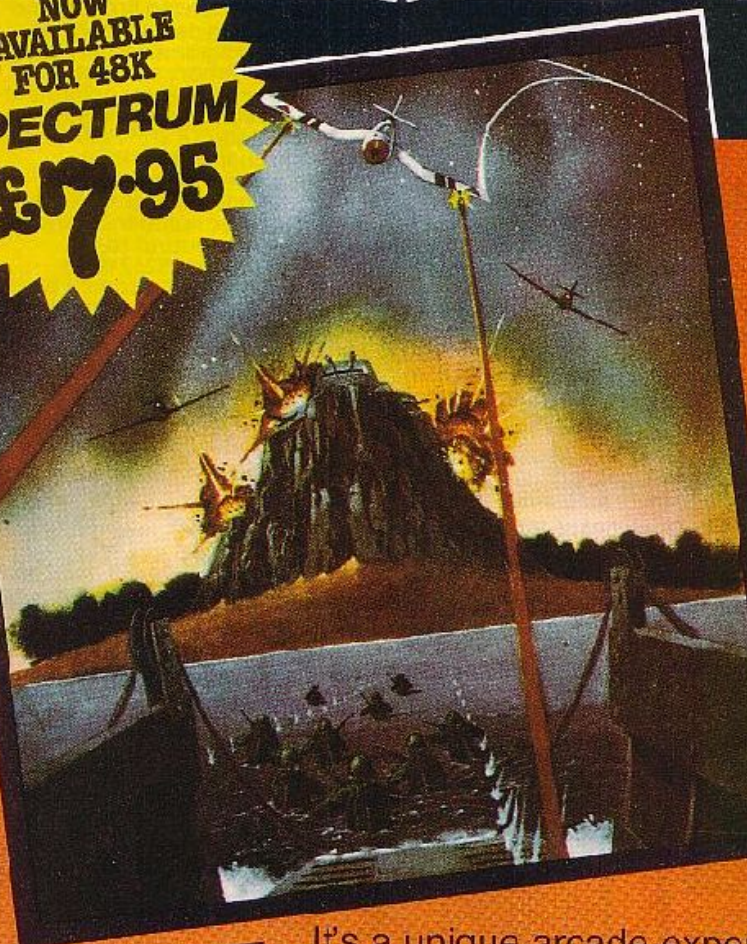
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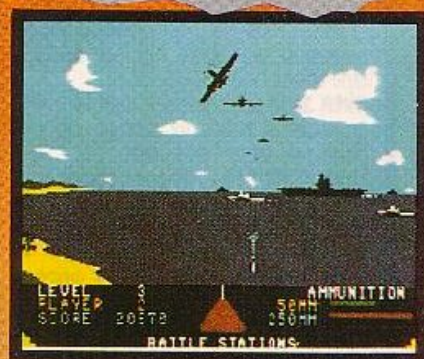
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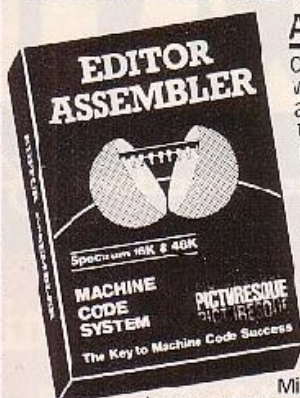
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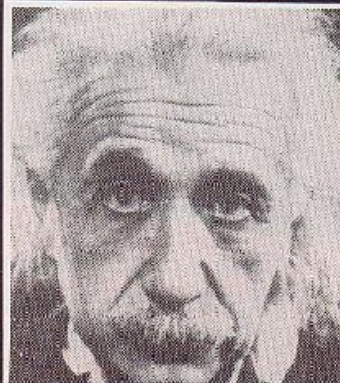
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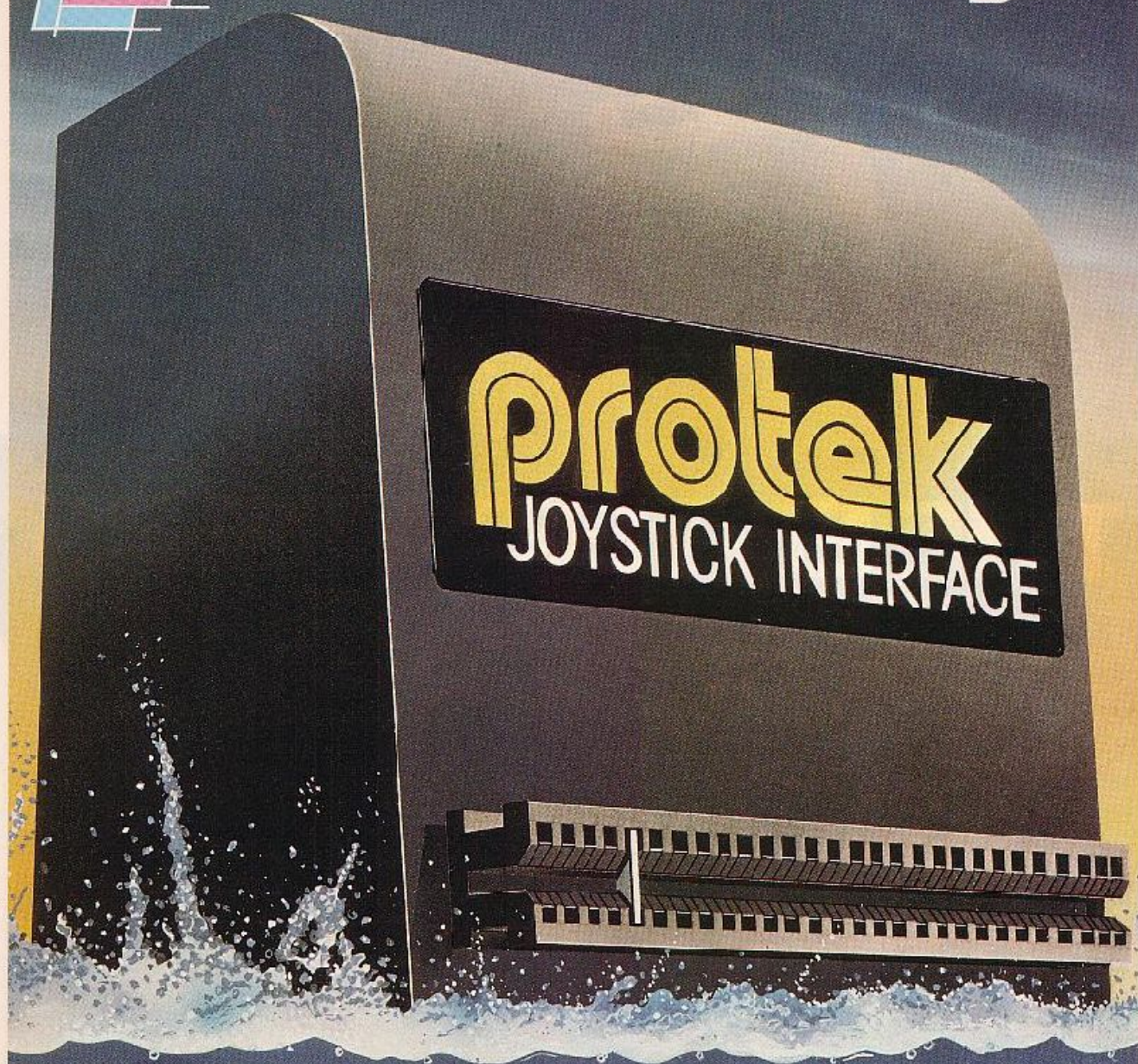
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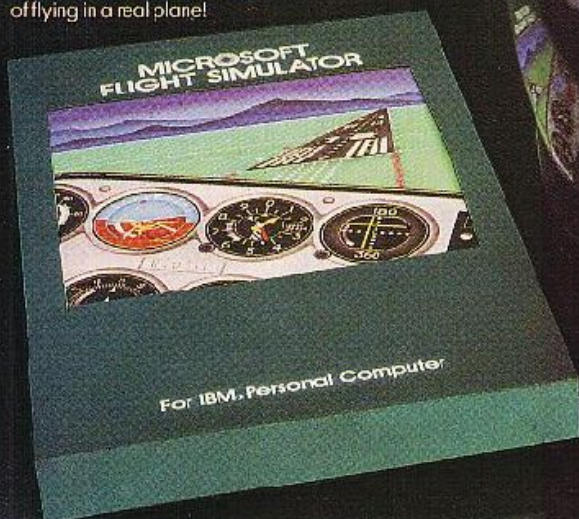
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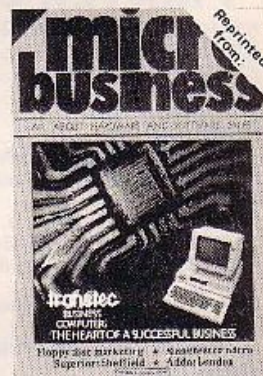
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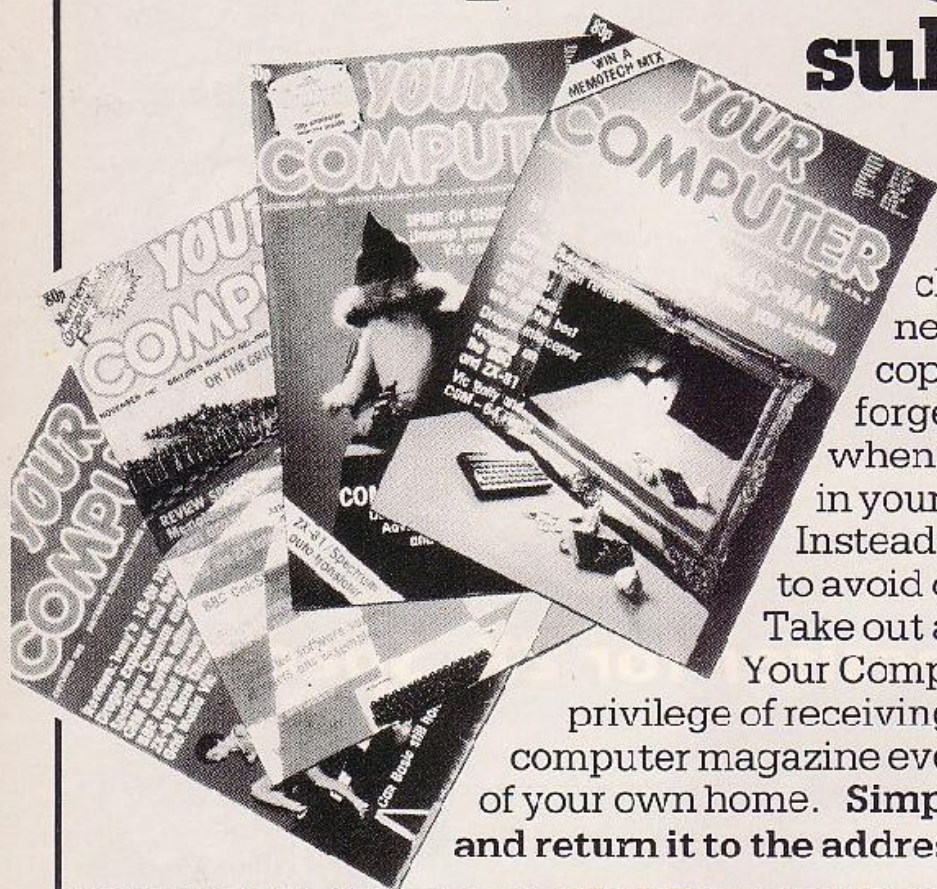
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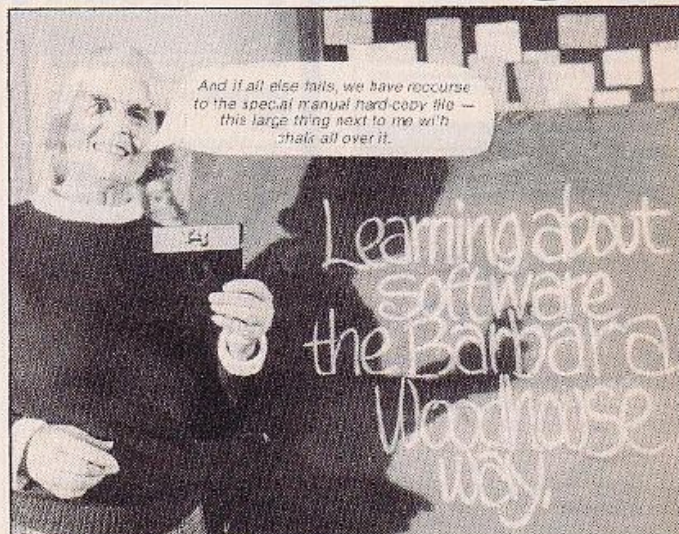
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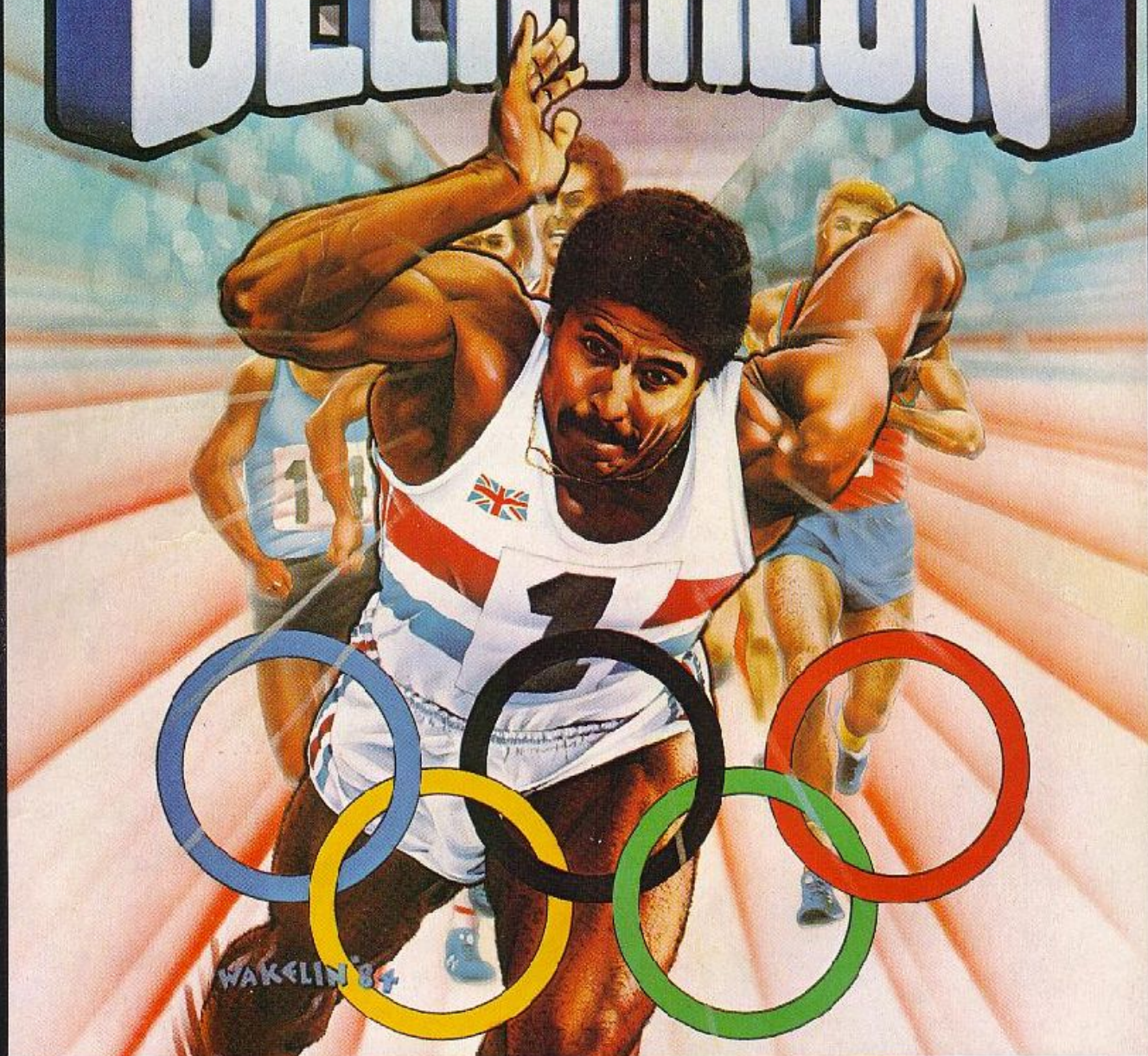
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