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Answers No.1**

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CONTENTS

UPGRADE

8 Century of Expansion

100 add-on possibilities for your Spectrum.

14 Talking Micros

What packages are around to help your Spectrum speak-up?

20 At Your Command

If you could talk to your Spectrum . . . We look at a selection of speech recognition packages.

25 Making Music

Turn your humble machine to a pseudo-synthesizer with a new range of hard/software add-ons.

27 Deciding Disk

In spite of Microdrives, disks reign triumphant — we look at one such, the Beta disk interface system.

GAMES

31 Hit List

Chart and reviews of the top 30 best selling Spectrum games.

40 One Step Beyond

Two games from the software house of Beyond set new standards in software strategy.

42 Mugsy

The first of a new brand of 'computer comics', reviewed.

44 Hungry Herman

A 'chomp-'em-up' games listing featuring a friendly little bug.

PROGRAMMING

48 Sound Affects

We show you how to add souped-up FXs to your space-based games programs.

51 Making Movies

Designing good graphics is pointless without knowing how to animate them — we provide some hints.

57 QL Graphics

The QL brings the 'turtle' to graphics design — we examine the concepts being the concept.



60 Checksum

Mistake-free listings with our error-proofing utility program.

63 Setting Standards

Does the QL's SuperBasic really set the standard?

65 Tools Company

Two utility programs, *Toolkit* and *HI-T*, that are worth their weight in gold.

72 Mastering Microdrives

Some tips on making the most of the infamous little beasts.

75 Crozzle

Solve our computer 'Fifteens' quiz and win £15.

ANSWERS

77 Three pages of your Sinclair queries answered.

EDUCATION

82 Newcomers

A blow-by-blow guide to getting intimate with your new Spectrum.

85 Logo

Learning computing can be fun using this education-orientated language, now available for the Spectrum.

86 Artificial Alternative

How strong a challenge does Prolog pose to Lisp's position in the AI world?



PROFESSIONAL

94 Down to Business

Get serious with your Spectrum — what business application packages are around, and what can you do with them.

99 Taxing Package

Will the *Which Tax?* program take the weight off your returns?

101 SciFile

A program generator that takes the sweat out of learning new languages.

107 Bookshelf

111 Legal File

What are the copyright liabilities of using games-designer packages?

112 Bulletin

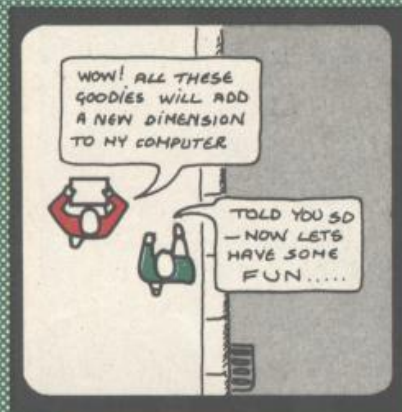
Spectrum Revisited — a revised version modified to run to five different RS232s.

117 Input

118 Back issues, binder offer

120 Advertisers' index

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PINNACLE

OPEN EDIT

Well, we're back again. This issue of *Sinclair Answers* is the first of the new style magazines derived from *Computer Answers*. We have devoted all our pages to the Spectrum and QL to give you complete coverage of these two machines.

In particular we have tried to get to grips with the ever expanding market in add-ons for the Spectrum. Guessing that there were probably around 100 hardware add-ons currently available, we set about finding them all, giving addresses, prices, and a pertinent comment. In fact, we found about 102, and you'll find them all on the following pages. This table should help you select the add-ons you need.

This issue launches what we think is a first for computer magazines: a checksum program for you to use to eliminate typing errors from published listings. *Herman*, an 'eat-em-up' game on page 47, is used as the pilot program for this invaluable utility.

So what interesting developments have been taking place on the Sinclair front?

Sinclair is going to try to boost Spectrum sales this Winter by offering six free software packages along with it, namely *Chequered Flag*, *Make a Chip*, *Survival*, *Horace Goes Skiing*, *Chess*, and *Scrabble*. This should certainly keep the Spectrum on top of the UK volume market, but does indicate Sinclair Research might be anticipating the Spectrum's eventual decline, perhaps in a year or so.

This brings us on to the great excitement, then the great boredom, of the QL. The best attended press launch this decade (we think) saw the launch of this machine, met with a fever of excitement from the press, which we should have known better to contain. The catalogue of delays and problems is too long, too well reported, and too boring to be repeated here. Sinclair's top brass have complained bitterly about the adverse press coverage of these problems, saying Acorn are even worse (which isn't in fact, saying very

much) but then again they really did bare their **se and ask the press to bite.

Despite all the problems surrounding the QL, you have to admire Sinclair Research. Who else could launch a non-IBM compatible, not quite business-not-quite-home, not much software, no add-ons computer, and confidently expect to sell a million?

But the QL is undoubtedly a machine with a future, and some software and add-ons are beginning to appear. Computer One from Cambridge should have finished a Pascal Interpreter by the end of August. The system compiles Pascal source code, which is near International Standards Organisation (ISO) Pascal, into an intermediate code, then when run, the intermediate code is interpreted. This apparently makes it much faster than the very disappointing speed of the QL's native SuperBasic.

One reason the Pascal is only 'near' ISO standard is that it incorporates certain QL specific 'features' — presumably to avoid the bugs, and take advantage of the windows and what-have-you, that the operating system offers. The same company are working on assembler and Forth packages.

Real disk drives should also be available soon. Quest will be marketing CP/M for the QL, along with disk drives, and these should (no promises) be available from around October of this year. In the next issue of *Sinclair Answers* (which hits the streets in December) we'll try and give you a lot more information on what's available.

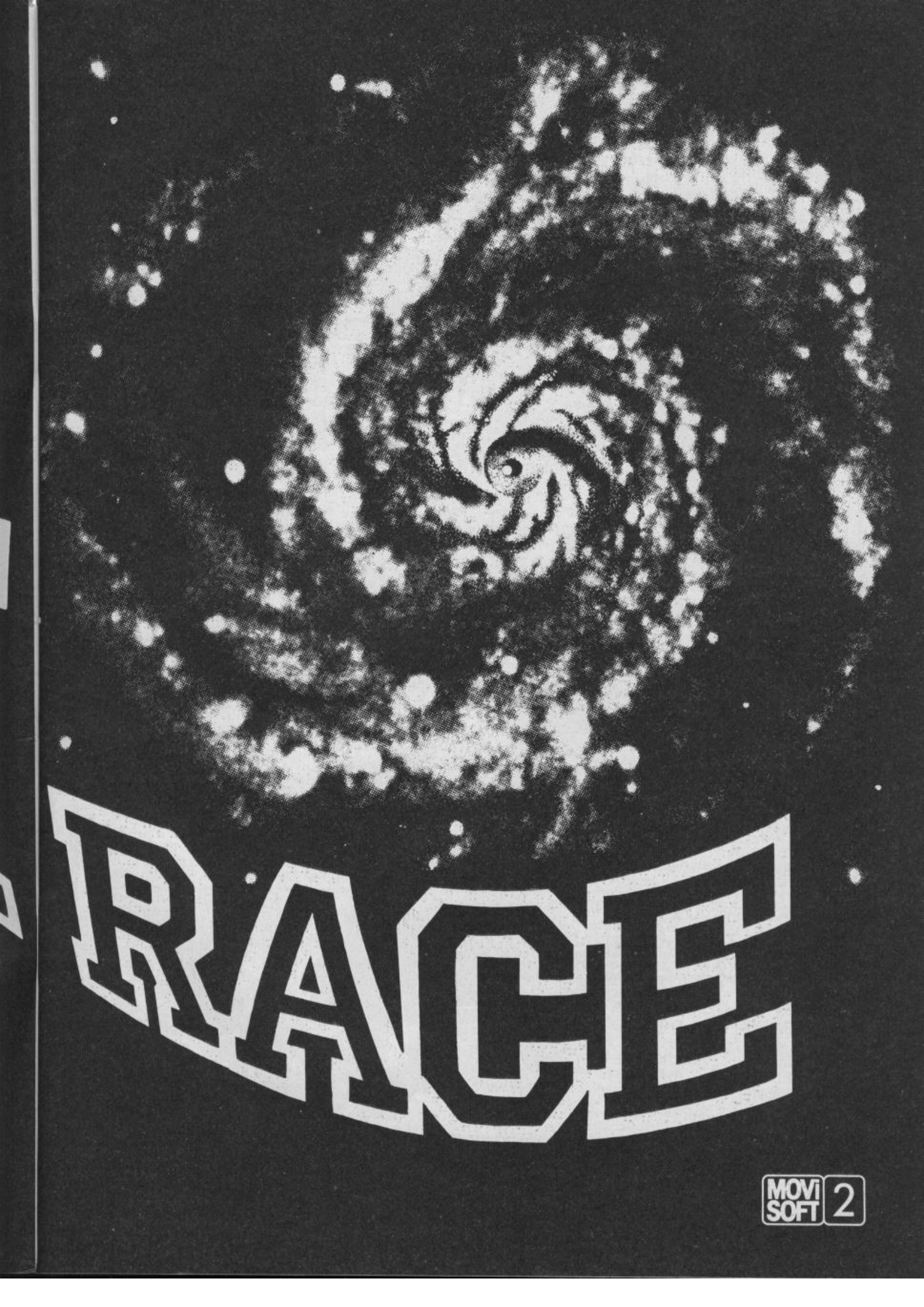
Finally, remember our free question cards. You can use them to send us a question, but also to comment on the magazine or to let us know of an interesting tip or problem you have come across when using your micro. First and foremost *Sinclair Answers* is a users' magazine, covering all aspects we can think of: programming, games, education, business, communications, and just for fun. If you think something is missing, why not let us know?
By Dr Peter Turcan, editor.

PS: The results of the QL competition, with reference to those of you who entered using Sinclair machines, will be summarised in the next issue, but all prize winners will be notified by post.

Entrants to this competition will remember that the runner's-up prizes are supplied by Stack Computers; unfortunately, we made something of a boo-boo in printing their address: The correct address should be: 290/298 Derby Road, Bootle, Liverpool L20 8LN.

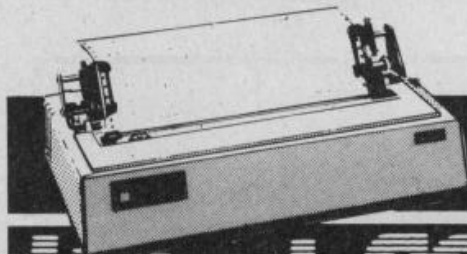
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CENTURY OF EXPANSION

EVERY ADD-ON YOU COULD EVER WANT TO PLUG ONTO THE BACK OF YOUR SPECTRUM — PLUS WHERE TO GET 'EM

Whatever anybody may think about the Sinclair Spectrum, it has had such an impact on the home computer market that an independent industry has exploded around it.

Hundreds of software houses and dozens of hardware manufacturers have jumped on the bandwagon and followed its success.

This is very fortunate for the user, since the market is so competitive that software prices are the cheapest for any computer, and there is an extensive choice of hardware add-ons.

We set out to capture details of 100 of 'em, and

present them in a short concise form. This should, we hope, be of interest to anyone considering expanding their Spectrum. Reviews of some of these products appear in various other articles in this issue, but we have also added a little pertinent comment, just to spice things up.

Unfortunately we cannot claim this list to be completely comprehensive (even as we go to press, details of new add-ons are coming into the office).

Anyway — good hunting!

By Steve Applebaum, staff-writer.

FIG. 1
100
ADD-ONS

Unit:

Cost:

Company:

Comments:

JOYSTICKS:

Cambridge Joystick	£7.90	Cambridge Computing	Analog/two fire buttons
Starfighter joystick	£13.95	Consumer Electronics	Compact and practical
TAC 2	£18.95	Consumer Electronics	Tacky, but accurate
Joy Sensor	£29.95	Consumer Electronics	A light touch necessary
Aerobic Joystick	£35.95	Consumer Electronics	For overweight arcaders only
Sure Shot	£15.95	CCS	Accurate, neat, and comfortable
Triga Command	£19.99	Datel Electronics	For would-be helicopter pilots
Quickshot Joystick 1	£9.99	dk'tronics	Suckers keep joystick stable
Quickshot Joystick 2	£12.95	dk'tronics	Good grip, trigger fire button
Trickstick	£34.50	East London Robotics	User touchpads for control
Arcade Professional	£38.50	Emax Computing	Arcade type design
Pro 1000	£10.99	Kempston Micro	One of the first and best
Pro 3000	£12.75	Kempston Micro	Has three fire buttons
Pro 5000	£13.50	Kempston Micro	One of the best



FIG. 1

AGF Hardware,
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Add-On Electronics,
Units 2,3 and 4,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.

British Micro,
A Hegatron Group Company,
Unit 22 Penfold Way,
Imperial Way,
Watford,
Herts WD24YY.
Tel: (0923) 48222.

Camel Products Cambridge
Microelectronics,
1 Milton Road,
Cambridge,
Tel: (0223) 314814.

Cambridge Computing,
1 Ditton Walk,
Cambridge CB5 8QZ.
Tel: (0223) 214451.

CCS,
Cases Computer Simulations,
14 Langton Way,
London SE3 7TL.

Cheetah Marketing,
Department Y51,
24 Ray Street,
London EC1.
Tel: (01) 833 4909.

Eprom Services,
3 Wedgewood Drive,
Leeds LS8 1EF.
Tel: (0532) 667183.

Euroelectronics,
Zlin House,
Oakfield Street,
Cheltenham,
Gloucester GL50 2UJ.
Tel: (0242) 582009.

Fox Electronics,
141 Abbey Road,
Basingstoke,
Hants.
Tel: (0256) 20671.

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Meenane,
Watergrasshill,
Co Cork, Eire.

JWV Software,
139 Allington Drive,
Strood, Kent.

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Downs Row,
Moorgate,
Rotherham

Kempston Micro Electronics,
Unit 30,
Singer Way,
Woburn Road Industrial Estate,
Kempston,
Bedford MK42 7AF.
Tel: (0234) 856633.

Maplin Electronic Supplies,
PO Box 3,
Rayleigh,
Essex SS6 8LR.
Tel: (0702) 552911.

Micro Power,
8/8a Regents Street,
Chapel Allerton,
Leeds LS7 4APE.
Tel: (0532) 683186.

Morex Peripherals,
39 Conway Road,
London N15 3BB.
Tel: (01) 800 1796.

Multitron Department EC,
5 Milton Close,
Headless Cross,
Redditch B97 5BQ.

Unit:	Cost:	Company:	Comments:
Pointmaster Pro	£14.95	Silica Shop	
Video Command	£11.95		
Wico Red Ball	£27.95	Silica Shop	
Wico Straight Stick	£21.95	Silica Shop	
Pro Ace	£12.95	Sumlock Microware	Good response, bad grip
Delta 14	£12.95	Voltmace	Has 14 user-definable keys
JOYSTICK INTERFACES:			
Joystick Interface	£27.95	AGF	Good design/easy to program
Joystick Interface 2	£16.95	AGF	As above but non-programmable
Protocol 4	£30.95	AGF	Programmed with 'custom cards'
Intelligent Interface	£34.90	Cambridge Computing	Microdrive compatible
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Joystick Interface	£11.50	Kempston	Has widest variety of software
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Programmable Interface	£24.95	Stonechip Electronics	Easiest to program
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SP48 (Issue 1 Spectrums)	£35.00	East London Robotics	No case
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48k Upgrade	£20.99	Fox Electronics	No case
KEYBOARDS:			
Low » Profile	£49.95	Advanced Memory Systems	Separate numeric pad
dk'tronics keyboard	£45.00	dk'tronics	Microdrive compatible
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Maplin keyboard (kit)	£44.95	Maplin	Soldering required
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Redditch,
Worcs B98 0ET.
Tel: (0527) 21429.

Consumer Electronics,
Failsworth,
Manchester M35 0HS.
Tel: (061) 682 2339.

Currah,
PO Box 1,
Gateshead NE8 1AJ.
Tel: (0632) 824683.

Datel Electronics,
Unit 8,
Fenton Industrial Estate,
Dewsbury Road,
Fenton,
Stoke-on-Trent.
Tel: (0782) 273815.

DCP Microdevelop,
2 Station Close,
Lingwood,
Norwich NR13 4AX.
Tel: (0603) 712482.

Dean Electronics,
Glendale Park,
Fernbank Road,
Ascot,
Berkshire.
Tel: (0344) 885661.

dk'tronics,
Unit 6,
Shire Hill Industrial Estate,
Saffron Walden,
Essex.
Tel: (0799) 26350.

East London Robotics,
Gate 11,
Royal Albert Dock,
London E16.
Tel: (01) 474 4430.

Emax Computing,
Pinfold Lane Industrial Estate,
Bridlington,
North Humberside.

Protek Computing,
1a Young Square,
Brucefield Industrial Park,
Livingston,
West Lothian.
Tel: (0506) 415353.

Orion Data,
3 Cavendish Street,
Brighton,
East Sussex.
Tel: (0702) 672294.

Rainbow Electronics,
Glebe House,
South Leigh,
Witney,
Oxfordshire OX8 6XJ.
Tel: (0993) 5432.

Ram Electronics (Fleet),
106 Fleet Road,
Fleet,
Hampshire GU13 8PA.

RD Labs,
20 Court Road Estate,
Cwmbran,
Gwent NP44 3A5.
Tel: (06333) 74333.

Redditch Electronics,
21 Ferny Hill Avenue,
Redditch,
Worcs B97 4RU.

Saga Systems,
Wooham Road,
Woking, Surrey.

Silica Shop,
1-4 The Mews,
Hathey Road,
Sidcup, Kent.

Tel: (01) 309 1111.

RS232/CENTRONICS INTERFACES:

Unit:	Cost:	Company:	Comments:
Parallel Interface	£49.95	dk'tronics	Features re-locatable software
Centronics interface	£26.95	Eprom Services	Dual parallel card
Serial Interface	£26.95	Eprom Services	Bi-directional RS232
ZX Lprint (parallel interface)	£34.50	Euro-electronics	ROM based; cannot handle UDGs
Parallel Interface	£49.95	Indescomp/(Spectrum Dealers)	Provides Centronics/
Micromania serial Interface	£33.95	JWV Software	Commands held in EPROM
Interface E	£55.00	Kempston Micro	Same as E minus EPROM
Interface S	£39.99	Kempston Micro	No printer software supplied
Serial interface (kit)	£17.95	Maplin	Includes cable and software
Serial/parallel Interface	£47.00	Morex Peripherals	Very low baud rate in RS232C
interface 1 (with Microdrive)	£29.95	Sinclair Research	
Interface 1 (minus Microdrive)	£49.95	Sinclair Research	
Serial/Parallel interface	£34.45	Watford Electronics	

EPROM PROGRAMMERS/ERASERS:

ROM-SP	£34.45	Camel Products	Loads and auto-runs two
Promer-SP	£34.45	Camel Products	All software on tape
Dhobi 1	£21.80	Camel Products	Eprom eraser
Dhobi 2	£26.40	Camel Products	As above with automatic timer
LIGHT PENS:			
The Light Pen	£30.00	Add-On Electronics	
Datapen	£29.00	Datapen Microtechnology	All software provided
Light-pen/Interface	£19.95	dk'tronics	Includes FILL, CIRCLE and ARC.
Light Pen	£42.15	RD Labs	For industrial or home use
Light-rifle	£29.95	Stack	Several compatible games available; difficult to use and inaccurate
Light Pen Speech Units	£17.25	Trojan	
Sweet Talker	£29.75	Cheetah Marketing	Uses allophones/fully cased
µ Speech	£29.95	Currah	Compatible with many games
Speech unit	£49.95	DCP Microdevelop	Rather over-priced
Orator	£34.95	Fuller	Uses allophones/has amplifier
ZMS	£24.99	Timedata	Requires an external speaker
Chatterbox	£56.35	William Stuart Sys.	Phoneme speech synthesis
Chatterbox (kit)	£44.85	William Stuart Sys.	As above

FIG. 1
ADD-ONS
CONTINUED

AMPLIFIERS:

Unit:	Cost:	Company:	Comments:
Amplisound	NA	AGF	
Telesound	£9.95	Compusound	Outputs sound through TV
Vox Box	£29.99	Datel Electronics	Unlimited vocabulary
Sound/Joystick	£19.95	Fuller Microsystems	
Sound Amplifier	£9.75	Fuller Microsystems	
Prog. Sound Generator	£29.95	Fuller Microsystems	
Sound Amplifier	£10.95	Indescomp	Variable level control
Sound Power base	£19.95	Kelwood Computer Cases	Sits under Spectrum
Sound Amplifier	£7.99	Pinnacle Electronics	Two sound levels
Sound Generator	£37.95	Ricoll Electronics	
Stonechip Echo	£19.95	Stonechip Electronics	

I/O PORTS

I/O Port	£21.28	Cambridge Micro-electronic	Simple TTL port
I/O Port	£16.00	Eprom Services	Requires a motherboard
I/O Port	£40.00	Glanmire Electronics	Includes real-time clock
Domestic Controller	£49.95	Indescomp	Controls switch operated units
I/O Port (24 lines)	£13.50	Multitron	
I/O Port	£33.95	RD Labs	For industrial or home use
I/O Port	£18.95	Redditch Electronics	Programmable mix of I/O
I/O Port	£19.95	Thurnell Electronics	Requires a motherboard

GRAPHIC EQUIPMENT:

Grapad Graphics Tablet	£143.70	British Micro	Drawing pad with all software
RD Digital Tracer	£55.50	RD Electronics	Uses a moveable arm

SPEECH RECOGNITION:

Micro Command	£49.95	Orion Data	Reviewed in this issue.
Big Ears	£56.35	William Stuart Systems	Reviewed in this issue.

MICRODRIVES:

Microdrive	£49.95	Sinclair Research	Low cost speed
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ROM PORTS/CARTRIDGES:

Interface 2 (Joystick/ROM port)	£19.95	Sinclair Research	Limited software for joysticks
ROM Cartridges	Various	Sinclair Research	Established programs

Sinclair Research,
Camberley,
Surrey,
Tel: (0276) 685311.

Spectrum,
Burrowfield,
Welwyn Garden City,
Herts.
Tel: (07073) 34761.

Stack Computers,
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Tel: (051) 9335511.

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Dead Brook Lane,
Aldershot, Hants.

Sumlock Electronic Services,
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198 Deansgate,
Manchester M3 3NE.
Tel: (061) 834 4233.

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Beckenham, Kent.
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Tel: (0925) 54117.

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(0462) 894410

Watford Electronics,
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Watford,
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Tel: (0923) 40588/37774.

William Stuart Systems,
Quarley Down House,
Chalderton,
Nr Salisbury,
Wiltshire SP4 0DZ.
Tel: (098) 064235.

TURNING IT UP!

VEXED VOLUME? WE LOOKED AT ADD-ONS DESIGNED TO PROVIDE AMPLIFICATION AND SPEECH FOR THE SPECTRUM

Spectrum owners won't need reminding that the internal loudspeaker leaves a lot to be desired. However, they needn't be stuck with muted zaps and music: independent companies have come out with a variety of products to improve the Spectrum's sound abilities, ranging from simple devices to channel the sound out through the TV's speaker, to at least six separate speech synthesizers.

Speech synthesizers are one of the most popular add-ons. Ardent programmers among you can even write short routines into games to enliven the action; for example, 'Enemy at eleven o'clock' could be added to an air attack game, or an adventure could ask you 'Which direction do you wish to go in?' Not everyone is a skilled programmer, but don't despair, as software houses are already producing games which are compatible with Currah's uSpeech, for instance.



A selection of Spectrum speech synthesizers (below); right: multi-function add-ons — Kelwood's powerbase boosts sound while Fuller's Orator incorporates speech.

We tested most of the speech synthesizers available and found that they all made use of the same speech chip, the General Instruments SP0256-A. This breaks down speech into units of sound known as phonemes. Phonemes are often combined to produce allophones, and it is the allophone set which is used to build up English words. For that matter the speech chip could be programmed to imitate French or German should you so wish.

Using allophones to synthesize speech has disadvantages, because the intonations and inflexions of English are hard to duplicate from what amounts to 250 odd allophones. Clearer speech can be achieved by digitizing actual words — this is what Acorn has done with its voice synthesizer, and Commodore has done with its Magic Voice. At least Acorn has used an Englishman (Kenneth Kendal), so for once the speech does not have an American accent. The drawback with this approach is a limited vocabulary since it takes a considerable number of bytes to store each separate word. No Spectrum voice synthesizer employs this technique, yet.

Although the same speech chip has been used, the hardware manufacturers have employed differing techniques for actually utilising the allophones. Currah has used a piggybacked ROM so that the required input most closely resembles actual written English. Thus should you wish the uSpeech to say 'hello', you would input 'he(11)(00)'.

On the other hand, the Timedata ZXS would need a string like this 'H1 EH LL LL OW'. Cheetah has taken a more extreme approach and the data string for hello would be '27,7,45,53,0,128'. In practice, all of these programming techniques involved a certain amount of trial and error. It would be difficult to say which one was easiest to program, as after a while we became familiar with the allophone set and much of the experience was transferable.



To our ears the Sweet Talker from Cheetah actually sounded clearer than all the other units. At first we thought this was because the demonstration tape supplied with the unit printed what was being said to the screen at the same time; however, when the screen was switched off it still sounded the best. Timedata supplied the most difficult to load demonstration tape, but once up and running it contained a useful editing program that allowed up to 20 words to be stored on tape. Both Timedata and Currah provided half-decent manuals to help program their

units. What is really needed, though, is English-to-allophone dictionaries. No-one had this.

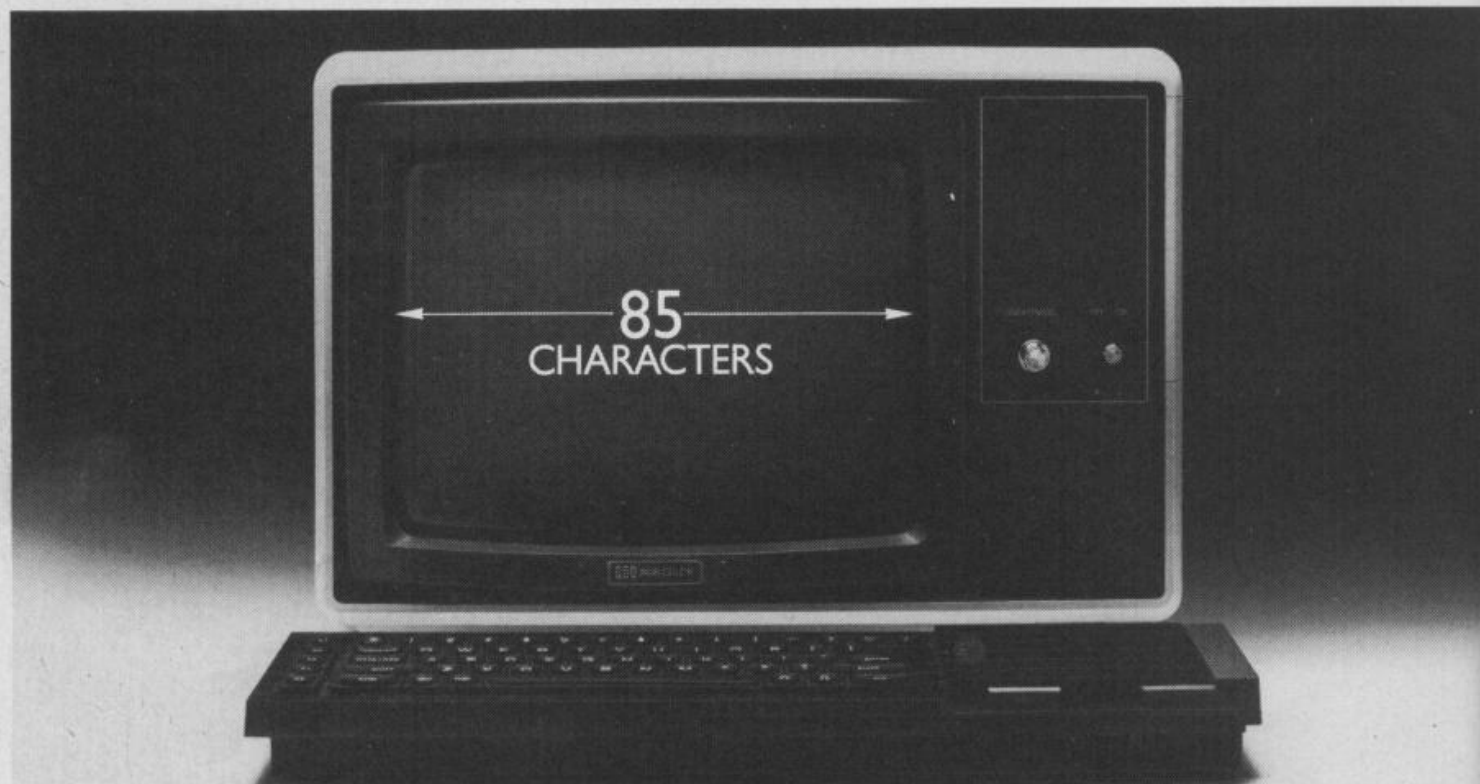
On the face of it, the ZXS from Timedata appears to be the cheapest of all the speech synthesizers. However, it does not have its own loudspeaker, and has to be connected to an external amplifier. One could, of course, buy such a unit (Timedata's own ZXM is suitable, for instance), but you can get round this by channelling the sound through a cassette recorder if required.

It is a distinct disadvantage to have the speech unit

FIG. 1 SOUNDS SUPPLIERS

Supplier:	Unit:	Price (inc. VAT):	
AGF Hardware , 26 Van Gogh Place, Bognor Regis, West Sussex PO22 9BY. Tel: (0243) 823337.	Amplisound	£14.95	Kelwood Computer Cases , Sound Power Base £19.90 Downs Row, Moorgate, Rotherham. Tel: (0709) 63242.
Cheetah Marketing , 24 Ray Street, London EC1. Tel: (01) 833 4909.	Sweet Talker	£29.75	Pinnacle Electronics , 1 Oasthouse Way, Orpington, Kent BR5 3QJ. Tel: (0689) 27000.
Compusound , 32-33 Langley Close, Redditch, Worcs. B98 0ET. Tel: (0527) 21429.	Telesound	£9.95	Rainbow Electronics , Glebe House, South Leigh, Witney, Oxfordshire OX8 6XJ. Tel: (0993) 5432.
Currah Computer , Hollymount, Wooler Road, Hartlepool, Cleveland TS26 0HA. Tel: (0429) 72996.	uSpeech	£29.95	Stonechip , Unit 9, The Brook Ind Est, Dead Brook Lane, Aldershot, Hants GU12 4XB. Tel: (0252) 333361.
Datel Electronics Unit 8, Fenton Ind Est, Dewsbury Road, Fenton, Stoke-on-Trent. Tel: (0782) 273815.	Vox Box Games Ace	£29.99 £15.99	Timedata , 16 Hemmells, Laindon, Essex SS15 6ED. Tel: (0268) 418121.
DCP Microdevelopments , 2 Station Close, Lingwood, Norwich NR13 4AX. Tel: (0603) 712482.	Speech unit	£49.95	William Stuart Systems , Quarterly Down House, Cholderton, Nr Salisbury, Wilts. SP4 0DZ. Tel: (0980) 64235.
dk'Tronics , Unit 6, Shire Hill Ind Est, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 26350.	Sound synthesizer Beeb amplifier	£29.95 £14.95	Zeal Marketing , Vanguard Trad Est, Storforth Lane, Chesterfield S40 2TZ. Tel: (0246) 208555.
Eprom Services 3 Wedgewood Drive, Leeds LS8 1EF. Tel: (0532) 667183.	Audio board	£20.95	MFM Data Service , 141a Camden Road, Tunbridge Wells, Kent TN1 2RA. Tel: (0892) 48832
Fuller Micro Systems , 13-15 Seal Street, Liverpool L2. Tel: (051) 709 9280.	Orator Sound amplifier	£34.95 £9.75	

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taking up the Spectrum's expansion slot preventing further peripherals from being added. The Timedata has an extra edge connector at the rear of the unit allowing a joystick to be used simultaneously with the speech synthesizer. The ZXS along with William Stuart's Chatterbox is one of the few speech units that is ZX81 compatible as well.

By contrast, the uSpeech from Currah has no further expansion slot to allow for joystick interfaces. In order to overcome this problem the company now sells the uSlot, which permits two peripherals (one of them the uSpeech) to be attached to the back of the



Making a big noise with the Spectrum: sending the sound through the tv with Telesound or amplifying it by a variety of other means.

Spectrum. Beware, because although in theory you could use any joystick interface, the single Kempston interface we tried would not fit. It was physically impossible to fit the uSpeech and still get at the Kempston's joystick port, so check this out before you fork out an extra £14.95 for the uSlot.

The uSpeech does not have an internal loudspeaker and instead sends the sound through your TV. This is quite handy because the user is then able to control the volume of any program run when the uSpeech is fitted. At the time of writing, Currah also claims that at least 20 games compatible with the uSpeech are available.

Fuller's Orator is an entirely different kettle of fish: it is a large black unit which fits directly behind the Spectrum and plugs into the expansion port. A major complaint against this device was that there seemed to be no other way to fit the TV lead other than taking the Fuller box apart and threading it through, as the box itself blocks the TV socket. Once this has been done, the Fuller unit is much like the Spectrum with EAR, MIC and edge connectors. The Orator has its own internal loudspeaker with a fiddly little volume switch.

Although the speech demonstration worked well, for some reason the rest of the demo program refused to run. If you intend to leave the Orator permanently attached to the rear of your Spectrum, this would be a viable choice.

William Stuart's speech synthesizer, the Chatterbox, is costly in comparison to the above. It is possible to save money by buying the unit in kit form, but in all fairness, the speech synthesizer is part of a large, voice recognition, system (see article on Speech Recognition, on page 20 of this issue). For this reason, it does come equipped with an internal loudspeaker, but we were unable to persuade the chip to work. However, we were using prototype version, and by the time you read this an upgraded version should be available which allows more flexible speech programming.

Both Datel and DCP have speech synthesizers, but sadly their products did not arrive in time for testing. By contrast, Eprom Services audio board had a

dramatic effect on the test Spectrum: after plugging it in, the Spectrum refused to work again, although it is impossible to say whether the board, motherboard (needed to fit the Eprom unit) or operator error had caused the problem. However, we'd looked unfavourably on the Eprom device in the first place, because the components are all exposed and no casing is supplied. You also need to make up a lead for an external amplifier connection.

After this little experience, we were very reluctant to take a Spectrum apart so that Compusound's 'Telesound' unit could be fitted internally. Instead we passed it on to a third party who reported that fitment was quite easy — push connectors instead of soldering — and that it worked well. If you are prepared to take the risk, kiss goodbye to your Spectrum's guarantee, and just want the sound to be channel through the TV instead of the internal speaker then we'd recommend this.

When the time came to test sound amplifiers for the Spectrum, our testbench soon became a tangle of wires. For this reason, the ZXM from Timedata scored extra points since it plugged straight into the expansion port with no fuss. In addition to adjustable volume, it had an Atari-type joystick interface built in — bit pricey though.

Best sound quality came from the Zeal sound booster. Its bad points were the guesswork involved in making the right connections should you lose the instructions, and the fact that loading became even more hit and miss than it usually is. Fortunately, it is mains powered and needs no batteries.

The next favourite was the Kelwood Powerbase, which combines a sound amplifier with Spectrum stand. Again a mass of wires, but the unit had one major advantage in that it supplied a power on/off switch in addition to its sound features. Sound quality was fair, and no extra difficulty was encountered when loading. There's even an extra switch to turn the MIC on and off to help with loading.

The Stonechip Echo was a strange device. It is free standing, so that it can be placed well away from the Spectrum and won't interfere with joystick, and so on. It is mains powered, and unlike the other units had both volume and tone controls. It did cut out the usual background loading noise which could be heard by pressing a special cue button if desired. However, the advantage over the standard Spectrum speaker seemed to be negated by the mass of leads.

Pinnacle's sound amplifier was the cheapest of the bunch and it showed. There are no tone or volume controls. It can be plugged into the MIC outlet using the standard cassette lead, but really it did very little. At least it has a tiny LED to show if the unit is on.

The dk'Tronics three channel sound synthesizer had only just been announced as we went to press. It is intended to provide a much better range of sounds to go with your games, such as bangs and whistles, as well as having certain musical potential. It employs the AY-3-8912 sound chip not a speech chip.

Spectrum owners who want to save themselves time can buy a tape of synthesized sounds (48K Spectrums only) from MFM Data Services. The range of effects is not devastatingly original, but the facility to play around with pitch or duration makes the pre-programmed effects more useable. At £7.95 it does seem rather a lot of money though.

For around £30 you can get a very reasonable introduction to sound or speech synthesis with your Spectrum. There is very little to choose between some of them — the Sweet Talker and uSpeech for example. In the end marketing will probably play the most important role and software compatibility will win out.

By Tony Dennis, deputy editor.

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Although speech recognition has not quite entered SF realms of having a friendly man-to-machine chat, Spectrum owners can now make limited verbal contact with their machines. Micro Command and Big Ears, two new packages for the 48K Spectrum, enable users to input single word spoken commands to aid games playing and software control.

However, it takes a lot of patience to train your micro to 'listen', and even more to train yourself to speak in the constant tone needed to elicit a successful response. Coupled with this is the small size of the systems' vocabulary. Micro Command can store up to 15 words, while Big Ears can manage only 10, putting them verbally somewhere between a gorilla and a chimpanzee on the evolutionary scale.

Micro Command, from Orion Data, is a small black box that interfaces to the edge connector at the rear of the Spectrum. There is no additional connector on Micro Command itself, so its use excludes other add ons. As well as the unit proper, Micro Command comes with a cheap microphone, software, and a couple of operating manuals.

The Micro Command's 'brain' centre is a Z80 and some RAM, so it takes none of the Spectrum's memory, but acts as a small micro in its own right.

Before trying something complicated such as making your Spectrum change channels on the TV by telling it which one you want, a small tutorial given in one of the manuals must be worked through. This gives information on how to use a special beginner's program supplied on an accompanying cassette.

The first step is to 'teach' the micro some specific words. It's rather like training a dog to understand simple commands, and an equal amount of patience is required before achieving practical results.

To get the micro to accept a command, the user must first give it a 'voice print' for comparison purposes. As each word has to be spoken at least four times before a voice print is formed, using the system in a crowded room can make you feel a bit stupid, to say the least. But this is not the only drawback to the system as both these speech recognition units really should be used in a quiet environment, as the micro can mistake other noises for a command.

Say, for instance, the micro has been taught the words 'left', 'right', 'up', and 'down'. Just tapping, clapping, or clicking your fingers near the microphone could be mistaken for one of the words — the system is that sensitive.

Another hassle is the fact that a word has to be spoken in exactly the same tone in which it was 'recorded', otherwise it is not recognised. Although this could be useful for security or password purposes, it can also be a pain in the larynx.

The main reason for the sound ambiguity and tonal restriction is because Micro Command has two ways to 'listen' to a word. In both cases a nearest fit method is adopted, whereby the incoming sound is compared with the different 'voice-prints' in memory, and a match made with the nearest fit.

The first of Micro Command's two modes involves analysing the *whole* word, while the second involves analysing the first few bits of data, since most information is often contained at the beginning of a word.

It is the second method of just testing a little data that causes the most problems. Even a clap, click of the tongue, or bang on the table could have a similar construction, making Micro Command confuse it as a word, so the system becomes rather unreliable.

This feature really showed up when we tried to play *Sheeptalk*, an uninspiring game provided on the cassette which comes with Micro Command. The idea is to guide a sheep dog around a field by voice alone with the aim of herding a number of woolly beasts into a pen.

As the game progresses the action does get luke warm, and even that amount of excitement can change the voice, making control very awkward indeed. Micro Command is certainly not suited to operating games. This is a shame, because up to 15 words can be stored, which would allow for a fairly extensive range of commands (imagine using it with a flight simulator).

Some of the best results gained with Micro Command were when the human voice input was replaced with that of the digital Kenneth Kendall output from the Acorn speech chip.

For obvious reasons, the results were perfect because of the same, continual, monotonous drone. However, the Beeb's high cost and the speech chip's small vocabulary makes this rather impractical, and near useless. And anyway, the point is for *us* to talk to the Spectrum — not two machines to have a cosy chin-wag.

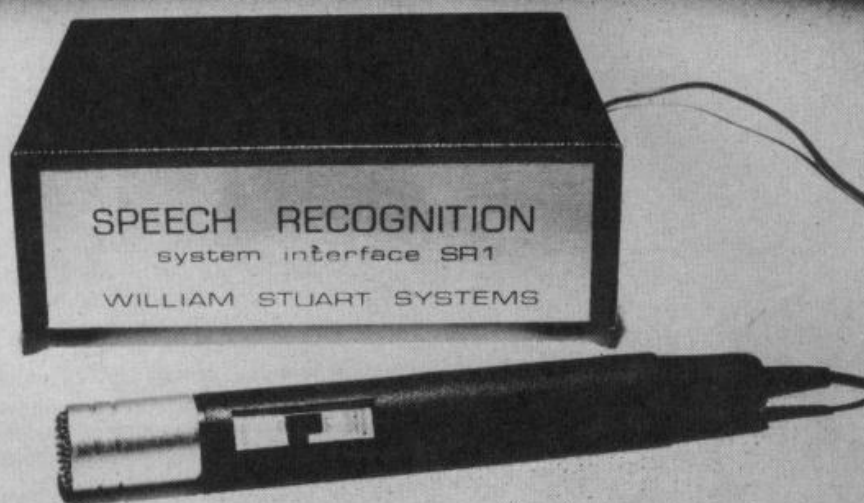
One of Micro Command's best features is a full listing of a program called *Teach*. Within this are three machine-code sub-routines which can be called from Basic, and allow new speech controlled programs to be written.

These are quite easy, (though not as easy as the manual seems to suggest), to incorporate into a program; and because Micro Command stores words as numbers, it means that they be easily accessed via user programs.

Big Ears is another, very similar, speech recognition system for the Spectrum. The software provided with it is very similar Micro Command's, but this time in LEARN mode, a 'voice print' is displayed on screen for each repetition of the word.

At the end of the reps, an average voice print is displayed in the form of a 6 x 5 array. Then TEST mode allows the user to see if the micro will accept the word.

Teaching the micro some specific words is rather like training a dog to understand simple commands, and an equal amount of practice is required.



Left: the Big Ears speech recognition system; below: Orion Data's Micro Command unit. Both products share similar flaws.



When we selected TEST mode, and tried to see if the Spectrum had learnt a given word, the comment 'you said such and such' appeared before we'd uttered a single syllable (triggered by a distant sneeze perhaps).

On the next attempt, the same comment appeared immediately after we'd said the word, but whether or not this was because of the voice, or just that it appeared spontaneously, we do not know.

The same incomprehension which resulted from a change in tone with Micro Command cropped up with Big Ears, which shows it is a general hazard with this type of device. However, one advantage of Big Ears is that it can be used in conjunction with Chatterbox, a speech synthesizer from the same company. But the user will have to write their own software to translate the digitized voice prints into allophones (a unit of sound of which the human voice is constructed).

At £49.95 for Micro Command and £56.35 for Big Ears, these two are far cheaper than some others of this type, though their use is very limited. Big Ears can output speech input through a speech synthesizer, but this means writing the software.

As far as controlling a fast moving arcade game goes, neither Micro Command or Big Ears beat a good ol'fashioned joystick for speed and ease of use — apart from the fact that you look absolutely ridiculous talking to a heap of plastic.

The only practical use we could think of that does not include a mass of soldering to extra equipment, is using voice input for flicking through menus. However, judging by our experiences, the chances of getting the right one are minimal. This limp forward takes the user nowhere nearer the world of R2D2 and HAL, but at least gives some promise for the future and a certain degree of fun.

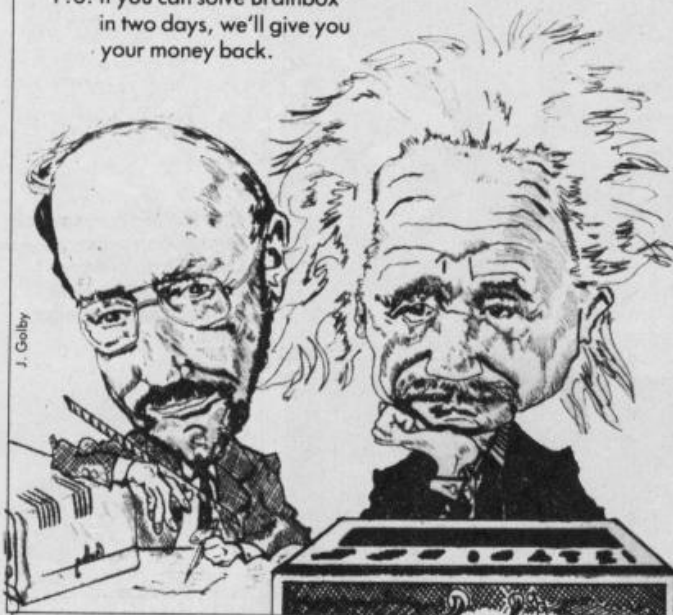
By Steve Applebaum, staff-writer.

Big Ears (priced £56.35) is available from: **William Stuart Systems**, Quarley Down House, Cholderton, Nr Salisbury, Wiltshire, SP4 0DZ. Tel: (098) 064235. Micro Command (priced £49.95) is available from: **Orion Data**, 3, Cavendish Street, Brighton, East Sussex, BN2 1RN. Tel: (0273) 672994.

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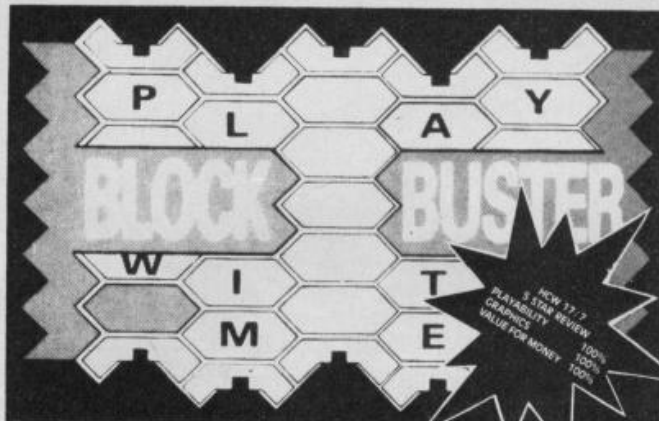
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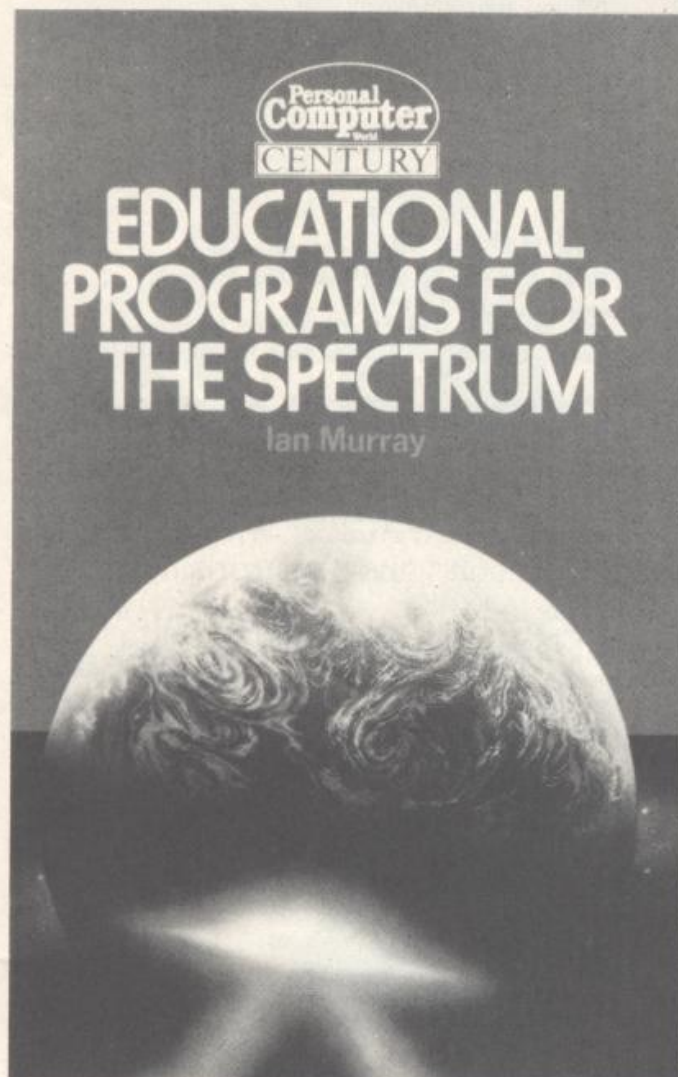


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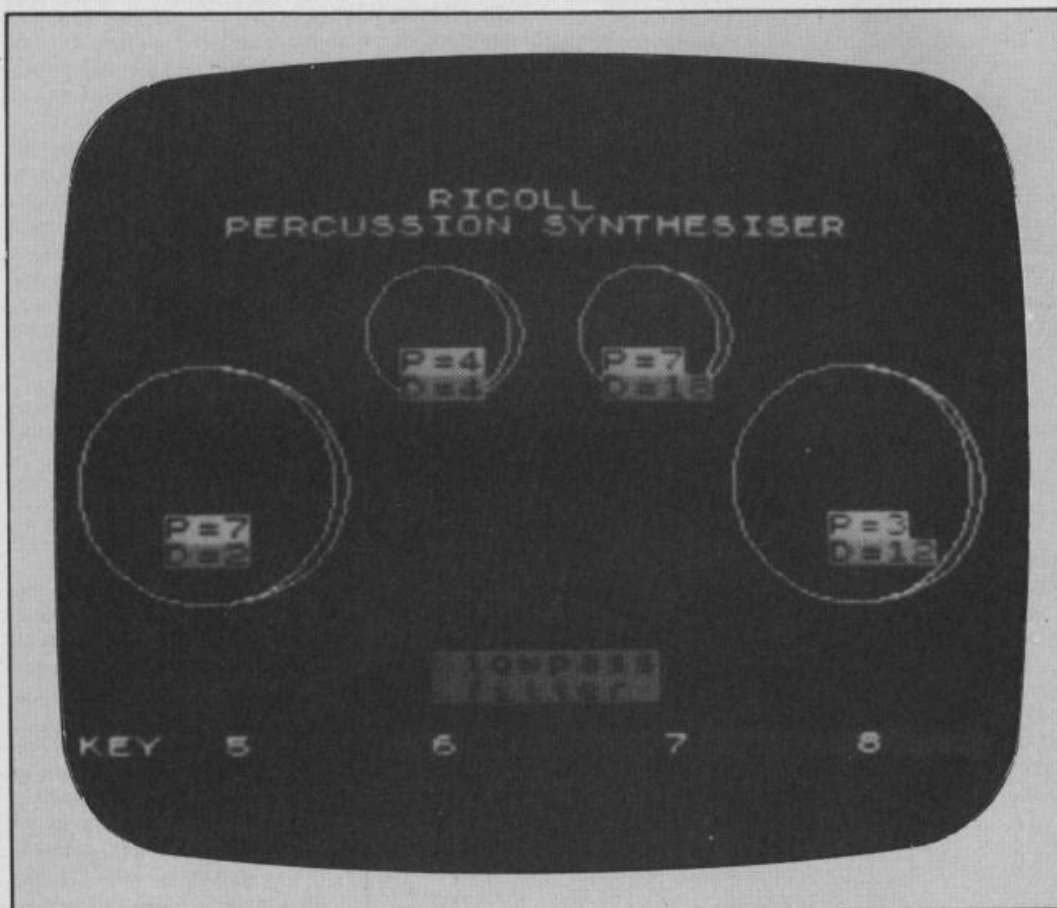
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GOING FOR A SONG

THE SPECTRUM'S MUSICAL ABILITIES ARE LIMITED—SYNTHESIZED SYMPHONIES ARE POSSIBLE WITH THE RIGHT ADD-ONS.



Innovative drum control at a good price from Ricoll Electronics' sound add-on.

Like its bigger brother the QL, the Spectrum is a single-command micro when it comes to music — another BEEPer, in fact. However, the Spectrum is far from being beyond salvation, and there are several hard/software products around to turn your machine to make more of its musical leanings.

In theory, the Spectrum BEEP has a range of 18 octaves, from 8.17Hz to 14,080Hz; but in fact Spectrum Basic limits the pitch range to 130 semi-tones. Spectrum Basic goes along with the usual convention of putting the parameters of duration after the BEEP command, but also has a PAUSE command, which allows some delay to be added between notes.

So, putting these snippets together gives us a typically tedious and unmusical rendition of a million-dollar tune:

```
10 FOR I=1 TO 5
20 READ P
30 BEEP 0.5,P
40 PAUSE 250
50 NEXT I
60 DATA 21,23,19,7,14,
70 STOP
```

Well, it could be worse. At least the Spectrum's designers have provided the option of directing the BEEP to an external amplifier via the cassette MIC socket, which offers a vast improvement over the wretched piezo transducer.

In fact, played through a decent sound system with some echo and chorusing (a quasi-random pitch variation that simulates the human variation in a section of string players), it's of remarkably good quality — albeit a square wave, which means that buzziness is inevitable.

What the Spectrum lacks in the sound and keyboard department can be improved upon with one of the many add-ons, though you may feel somewhat cheated once your cheap 48K machine has zoomed over the magical £200 mark.

Until recently, all the sound-oriented add-ons have been of bog-standard design — namely, the General Instruments AY-3-8910 chip with a greater or lesser degree of software support.

So here is a round-up of some of the less exotic musical additions that are around.

Basically there's a choice between the sort of hardware that just amplifies the basic sound output from the MIC socket, and that which drags the aforementioned GI sound chip into service. To be▶

Spectrum Sound Amplifier (priced £7.75) and Fuller Sound Box (priced £30.75) are available from:

Fuller Micro Systems,

71 Dale Street, Liverpool 2.

'Add-on' (priced £20.50) is available from:

Micropower,

8 Regent Street, Chapel Allerton, Leeds LS7 4PE.

Spectrum sound add-on, is available from:

Ricoll Electronics,

48 Southport Road, Ormskirk, Lancs L39 1QR.

Note Invaders (priced £9.95) is available from:

Chalksoft,

37 Willowslea Road, Northwick, Hants.

Composer (priced £5.95) is available from

Contrast

Software,

Farnham Road, West Liss,

Hants GU33 6JU.

White Noise & Graphics (priced £5.95) is available from:

Gilsoft,

30 Hawthorn Road, Barry, South Glamorgan CF6 8LE.

Upstream system (priced £139) is available from:

Upstream

Computer

Systems,

49 Bransgrove Road, Edgware, Middlesex.

The complete MICON package (hardware and software; priced £108) is available from:

XRI Systems,

10 Sunnybank Road, Wylde Green, Sutton Coldfield, West Midlands.

honest, we're not convinced it's worth adding on an amplifier and speaker of dubious quality if you've got anything like a decent hi-fi system, but if you haven't, the Spectrum Sound Amplifier (priced £7.75) from Fuller Micro Systems, should do nicely.

If you want a self-motivated sound box, there's two add-ons that work quite well. The first is the simply-named 'Add-on', which packs the usual four sound channels from a GI chip (three tones, one noise), three joystick ports, and amplification into one box at a reasonable price (£20.50, from Micro Power). The second is the Fuller Sound Box (£30.75), which uses the GI AY-3-8912 sound chip and provides a single joystick port to boot.

The point about these sound-chip boxes is that they basically do the same as the unadorned Spectrum which is to produce square waves, but they do it with a good deal more *panache* — that is, they have more voices and on-chip envelope generation.

The trouble is that square waves (with or without envelopes to shape their amplitudes) are hopelessly unmusical. No instruments, other than the kazoo — which could hardly be described as an instrument — have the faintest similarity to square wave of micro-generated origin. The unfortunate consequence of that is that computer music at this basic level has become almost synonymous with unmusicality.

One way to get round this is to go for the approach adopted by Ricoll Electronics with their sound add-on. Their approach is to take the basic output from the GI chip and then put it through a circuit called a voltage-controlled filter.

In effect, this is basically a very tight tone control where the degree of treble roll-off is determined by the voltage. If the voltage comes from the Spectrum via a digital-to-analog converter, then it's possible for the micro to shape the tone colour of the sound, filtering out the harmonics of the raw square wave.

This dynamic filtering ideal is the principle behind the majority of synthesizers on the market, and the £35 or so that Ricoll are selling their product for would seem a pretty cost-effective way of experiencing the world of sound synthesis techniques in conjunction with a Spectrum.

For instance, it doesn't take a vast leap of imagination to come up with some software that emulates the much-favoured Simmons synthesized drums, but where the drum pads are replaced by keys on the Spectrum (see the picture on page 25). Mind you, that doesn't exactly give you *carte blanche* to go banging your Spectrum with drum sticks!

In fact, most of the musical software for the Spectrum has been on the lacklustre side until very recently. One exception is *Note Invaders* (£9.25, from Chalksoft). This includes programs for note recognition in both a traditional and a frantic games format — naming notes before you're blasted from the sky, or something along those lines.

Another item of software using the basic capabilities of the machine is *Composer* (£5.95, from Contrast Software): this is a simple sort of 200-note sequencer, but it does have good editing facilities.

On the sound effects side, there's a utility program called *White Noise & Graphics* (£5.95, from Gilsoft), which adds various commands to Spectrum Basic, including those for explosion-type sound effects.

The other approach to sound relations with the Spectrum is to accept that it's never going to be more than a very basic means of producing sounds, and instead use it to control items of hardware that have been specifically designed for really high-quality music synthesis.

Fortunately, other people have come to the same conclusion, and the result is a universal interface that interconnects micros, keyboards, drum machines,

and the like. It's called the Musical Instrument Digital Interface, or MIDI for short.

In the July/August issue of *Computer Answers* we took an in-depth look at the principle of the MIDI system — but here's a brief run down of what it does.

In principle, this is like any RS232 serial interface; however, the MIDI standard works much faster than RS232, and also lays down some pretty strict rules about the programming side of the business.

The important thing about any communications standard is that it should remove the barriers that crop up between different machines. MIDI has still to meet this requirement in some areas, but, in general, the MIDI user can rest assured. A MIDI-equipped micro armed with some suitable software will communicate everything that's needed to produce musical results from a MIDI-equipped synthesizer.

Those musical results might be the product of a so-called 'step time' sequencer, where multiple parts of music are built up step-by-step using a simple code to determine the musical elements, or else they might derive from a keyboard performance that's played live and then overdubbed with different parts and different sounds.

The Spectrum is attracting a great deal of attention as a controller of MIDI synthesizers, and there's quite a range of software already. For starters, the Upstream system (£139, from Upstream Computer Systems) has achieved an enviable degree of media exposure on account of its parentage from the members of the rock group Mensana (the fact that the members of the group and Clive Sinclair are members of the Mensa hasn't escaped without attention either!)

The Upstream system consists of hardware that plugs on to the Spectrum's connector and provides all the necessary MIDI links, software that offers an 8,000-note polyphonic sequencer, 16 tracks, a display of musical 'dots', and has Microdrive compatibility.

Another home-grown product comes from XRI Systems in Birmingham. Their MICON Controller offers both live recording facilities (up to a total of 8,000 notes) and step-time sequencing (eight tracks, each with 3,000 events). Like its Upstream competitor, there's also extensive editing facilities for goof eradication plus a display of entered notes.

The complete MICON package (hardware and software) sells for £108 and is available from XRI Systems. Of course, none of this is worth its salt unless there's some sort of synthesizer on the other end ready to receive all the MIDI musical instructions. This raises the problem of cost. In fact, synthesizers capable of responding to MIDI have been plummeting in cost in a fairly encouraging way over the last year.

Those that are particularly cost-effective are the Yamaha DX-9 (around £900), and the Sequential Circuits Six-Traks (around £800).

Mind you, it doesn't take much imagination to see that this is only the tip of the iceberg, and the next year or so should see some pretty dramatic developments in the direction of cheap and musical synthesizers that are interfaceable with MIDI-based micros.

The most important thing for Spectrum users to bear in mind is that the MIDI standard has been designed to grow with the users' requirements. This should mean that a Spectrum-based MIDI synthesis system is protected from obsolescence.

Certainly, the fact that MIDI is a bandwagon that everyone's jumping on means that competition will be fierce, so perhaps we'll see musical software that really stretches the imagination.

By David Ellis, a computer musician.

Although the coming of the Microdrive heralded an end to some of the drawbacks in speed, a fairly large storage capacity and low cost do not make up for the comparatively faultless efficiency offered by disks.

The disk drive is still sovereign as far as speed and storage go, and some companies have braved Sinclair's onslaught to produce disk interfaces that put the Microdrive and Interface 1 in the shade.

A disk drive has the advantage of being able to reach any area of data as soon as it is required — the process known as random access filing. One of the best, and most freely available disk interfaces available at the moment, is the Beta Disk interface from Technology Research. The Beta Disk Interface is a neat little unit which plugs snugly onto the rear of a 48K Spectrum.

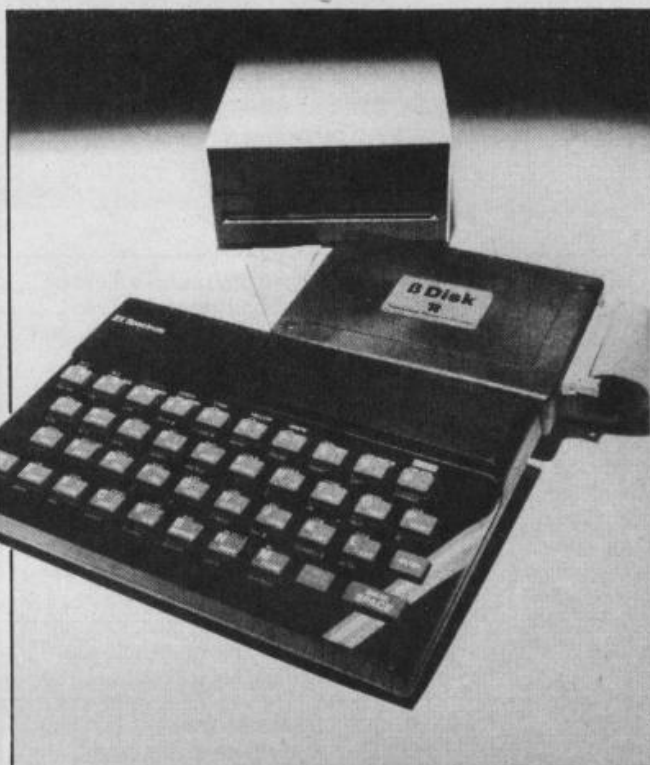
Unlike some other disk systems for the micro, the Beta interface has an edge connector on its rear allowing further expansion (printers, joysticks, and so on). A power socket is built into the interface's left side, whilst a Schugart (BBC) type connector making it compatible with a wide range of drives, is resident on the right. However, the drives must have their own power supply, as the Sinclair power unit is not capable of supporting a drive as well as a micro.

The system does, of course, take up some of the Spectrum's memory, a mere 1K in fact, plus an extra 4K for a buffer used to delete files. New versions of some software will have to be bought, or converted, as those written in machine code are dependent on specific areas of memory.

When the Spectrum is switched on the user is asked for a password. If the system is being used for the first time, a software disk supplied with the Beta interface must be put into the drive, and the password 'TRL' entered. Almost immediately an A> appears, replacing the familiar D> prompt, with a menu offering several different options.

A new disk has to be formatted before any data can be SAVED, so the first program selected is one to do just that. Technology Research appears very security conscious, as it has built a password system into the formatting procedure. Before formatting a disk, the program

BETA DISK



GOOD SPECTRUM DISK SYSTEMS ARE RARE—WE LOOKED AT ONE OF THE BEST ON THE MARKET, BETA.

asks for a password, or key, for the disk; forget this later, and the disk cannot be accessed, so it is worth keeping a written record of passwords if several disks are being used. Once

formatting is complete, VERIFY can be used to check the disk for any errors.

Disk formatting is just one of the features offered with Technology Research's Beta disk sys-

BETA DISK SYSTEM

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Features: DOS in Eprom, Utilises Spectrum keywords, Uses 40/80 track, single or double sided drives, Random access (though a little dodgy) provided; Supports up to three drives.

DESPITE LIMITED FILE HANDLING, BETA IS WELL WORTH CONSIDERING.

FIG. 1 Command:	Description:
ERASE "filename"	Erases a Basic program file.
ERASE "filename" CODE	Erases a machine code program.
ERASE "filename" DATA	Erases a data file.
LOAD "filename"	LOADS Basic program and returns to Basic.
LOAD "filename" CODE address	LOADS a machine code program at a specific address.
MERGE "program name"	MERGEs a program on disk with one in RAM.

UPGRADE

tem. A DOS is not merely an operating system, but also a kind of pseudo-language. Unlike Basic, the new 'OS' commands cannot be used to write a program with as such, but can be incorporated into a Basic program, making all the disk system's facilities freely available.

So what can you do? We've already mentioned that Basic programs can be stored on disk, but there are differences in the way that variables are SAVED. When data is stored, the user must specify whether it is a Basic program, variable array, or a character array — the various syntaxes are: SAVE "<filename>"; SAVE "<filename>"DATA a(); and SAVE "<filename>"DATA a\$() respectively (in the latter two cases the arrays called a() and a\$ are saved). Machine code programs can also be SAVED.

Three parameters, start location, end and an optional one for autorun are required, however. For example, to SAVE a program written in machine code, the program could be SAVE "<filename>"CODE 10,200, where 10 and 200 are the start and end addresses.

Most of the usual Sinclair commands can be used with the disk system (see Fig. 1), so all Spectrum owners should feel just as at home as when using cassettes. MERGE, for example, is available, linking programs stored on disk with those in RAM. MOVE, normally rarely used, is most effective in the disk system. When a file is deleted, a space is left on the disk, and unless the remaining files are compressed, 'holes' increase retrieval and storage times. MOVE does the compaction job, but it requires 4K of memory for its work-space. By using MOVE, the programmer can make most use of a disk, filling up every available hole with data.

Cassette users might feel uneasy using disks at first because of the worry of data corruption. Making a back-up is always a good idea when using disks, and the Beta system has several different ways of doing it. An actual BACKUP command transfers the contents of a whole disk, while COPY transfers specified programs and sets of data, and SCOPY a single file.

Micro owners who have always used disks will probably have some of their own work, as well as commercial programs, on tape. Technology Re- ▶

UPGRADE

search has thought of this and included hints on how to transfer programs from cassette to disk. This is useful, as at present there is no software commercially available for the Beta interface. TRL says that it is negotiating with several companies to convert programs for the system, but at the time of going to print there was nothing solid. We were told, however, that it is possible with a little jiggery-pokery of the Basic, to transfer programs already commercially available. It must be stressed, that although this is very useful and saves a lot of time when LOADING a program, it is totally illegal; also, it's a bit of a waste of a disk system, using it as little more than a glorified cassette.

The Beta Disk System gives the user speed and reliability, but rather primitive file handling — nowhere near the standard of meachines like the BBC. Users could find themselves having to write file handling programs for themselves.

Fig. 2 shows some comparative timings, for the Beta disk I/F, microdrives and cassettes.

With a disk system like the Beta, and a good keyboard, the Spectrum could become far

FIG. 1	
MOVE	Removes gaps by compressing files. Commands requires 4K of memory for workspace.
NEW	Used for changing the name of an existing file.
NEW "newfile", "oldfile"	For Basic program files.
NEW "newfile", "oldfile" CODE	For machine code files.
NEW "newfile", "oldfile" DATA	For data files.
PEEK "filename" 30023,1	Allows any part of a file to be read, and transferred into RAM. 30023 is the buffer start address, and 1 the record number.
POKE "filename" 30023,1	Writes a sector of data from RAM, to any location in a file on disk.
RUN "filename"	LOADS and RUNs a Basic program.
Run "filename" CODE	LOADS and RUNs a machine code program.
SAVE	SAVES a program onto disk (see text for various forms)
"B:" "C:" "D:"	Drive selection (up to three can be used).
USR	Can be used to change password on a disk.

FIG. 2	
Save (sec):	Load (sec):
Microdrive: 12.13	7.28
Disk: 6.73	3.82
Cassette: 59.00	60.63

(The program used for this timing test was Herman, this month's games listing (see page 44), taking about 10K of storage space.)

more than a games/educational micro. Greater things are hinted at in the database and word-processor areas, but without proper file handling, the Beta interface is really not the device to take the Spectrum out of the home, and into the serious business environment; nevertheless it has great advantages over the cassette/Microdrive competition.

By Steve Applebaum, staff-writer.

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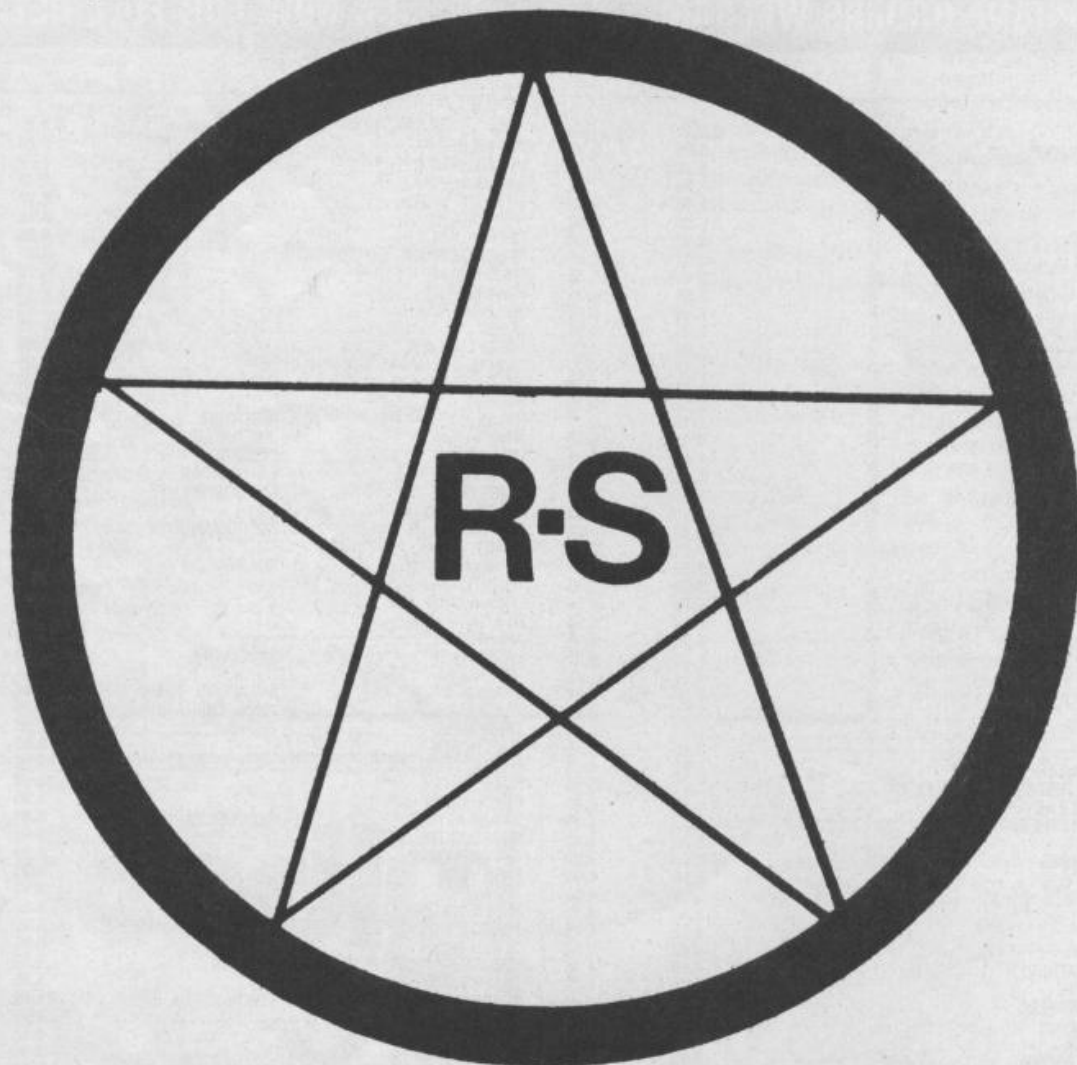
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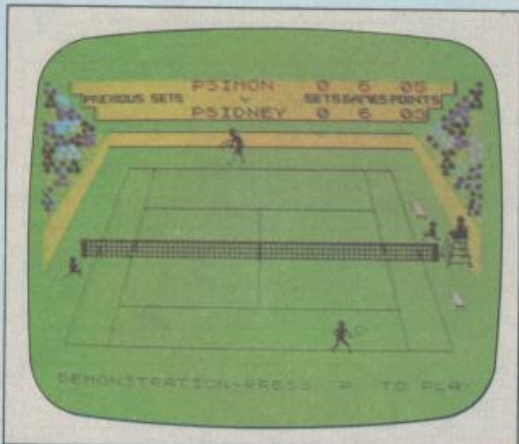
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TOP THIRTY GAMES

1	SABRE WOLF ULTIMATE	16	AUTOMANIA MICROGEN
2	TLL VORTEX	17	KOSMIC KANGA MICROMANIA
3	MUGSY MELBOURNE	18	CODE NAME MAT MICROMEGA
4	LORDS OF MIDNIGHT BEYOND	19	AD ASTRA GARGOYLE
5	MATCHPOINT PSION	20	CHEQUERED FLAG PSION
6	HULK ADVENTURE INT.	21	ATIC ATTACK ULTIMATE
7	PSYTRON BEYOND	22	MOON ALERT OCEAN
8	BEAKY & EGG SNATCHERS FANTASY	23	TITANIC R&R
9	JET SET WILLY SOFTWARE PROJECT	24	THE QUILL GILSOFT
10	WAR OF THE WORLDS CRL	25	BLUE THUNDER WILCOX
11	JACK & BEANSTALK THOR	26	WORLD CUP ARTIC
12	TRASHMAN NEW GENERATION	27	FOOTBALL MANAGER ADDICTIVE
13	NIGHT GUNNER DIGITAL	28	CAVELON OCEAN
14	STOP THE EXPRESS SINCLAIR	29	ERIC & FLOATERS SINCLAIR
15	FIGHTER PILOT DIGITAL	30	MANIC MINER SOFTWARE PROJECTS

This chart lists the 30 top selling games for the Spectrum over the last month, and was correct at time of going to press. A review of each game appears on the following pages. This chart was compiled for Sinclair Answers by RAM/C.

Our hero in 'Sabre Wulf' sythes through a nastie (right); while a Tornado is ready to take off in 'TLL' (far right); and Psimon and Psidney sweat it out for you in 'Match Point' (below)



1 SABRE WULF

It took an exceptionally good game to usurp *Jet Set Willy* from its long-held No 1 position; Ultimate's *Sabre Wulf*, if anything, is a bit too good. You have to guide explorer Sabre Man through the perilous jungle in his attempts to gather the pieces of a map which will show him (you) where the ultimate prize, the Golden Amulet, is located.

Throughout your quest you are beset by a host of jungle baddies in the form of wild animals, wilder natives, and poisonous plants. You have scurry on through the maze of foliage-festered paths fighting these nasties off with your trusty sabre, gathering prize points, going ever onward towards your goal.

All this sounds great fun, and it is — except for the fact that the said nasties materialize just about every inch of the way, making it practically impossible to get anywhere without first spending hours sharpening your reflexes and your knowledge of the jungle. Basically, the game is a little too difficult to extract maximum fun and thrills.

Apart from this flaw, *Sabre Wulf* has got the lot: varied action, plenty of fun features, excellent graphics and sound. It's certainly not the game that you'll be bored with after three or four goes — but it might infuriate you after 30 or 40.

However, *Sabre Wulf* is highly recommended, and Ultimate are to be praised on exploiting the Spectrum's capabilities so well.

3 TLL

Vortex's *Tornado Low Level* or *TLL*, is aptly named, for despite some brilliant graphics, it reaches only a low level of excitement.

You pilot the fighter/bomber of the title over a excellent 3D landscape, seen viewed sideways on, wand can control altitude and direction, but not speed. Your mission is to find and destroy enemy targets as shown on a map displayed prior to take-off.



The enemy targets are just that: little circled blobs which are bombed by making low passes over them. Making these passes is a laborious manoeuvre, and quite unrewarding — they simply explode with a red flash and disappear. After completing your sortie you have to return to the runway and land.

The graphics are exceptionally good for the Spectrum, but rather wasted — they do not make up for a lack of action. For flight fiends only.

5 MATCH POINT

Psion's *Match Point* is that rare thing: a sport simulation game that's actually captured some of the skills and thrills of the real thing — in this case, tennis.

You are presented with a monochromatic overview of a centrecourt (à la BBC Tv) with a sticklike player at each end, one of which you control, the other being you computer-directed opponent. Serves are delivered automatically, then you manoeuvre you player round the court, using the fire button to deliver backhands and volleys (the game really requires a joystick, though can be played via the keyboard).

Although it takes a few defeats to get the knack, the game is highly addictive and great fun, requiring genuine skill to win points. Ball movement is superbly accurate and realistic, and the game has nice touches like ballboys to retrieve nets, foul serves, and players changing ends between games (although you can't, sadly, question the umpire).

There are three levels of play, quarter finals, semi-finals and finals, and even has an Exhibition Match mode — a demo that's actually entertaining to watch! You can also punch in the name of your opponent of your choice on the scoreboard — perhaps your only chance to play against 'Connors' or 'MacEnroe'. Highly recommended.

THE HULK

The Hulk is a superb graphic adventure starring the Marvel Comics hero of the title. Written by adventure master Scott Adams, it takes our musclebound green monster into an adventure called 'Questprobe', in which he encounters some of his most famous adversaries.

Though similar in format to *Mugsy* (see page 50), it contains better, more varied situations and considerably superior graphics (although, of course, they are based on existing designs). Commands are entered in the usual adventure-game manner, as you try to help Bruce Banner/The Hulk get out of sticky situations and overcome their enemies. The impressive manual lists useful words, and provides a good deal of scene-setting information.

All in all, *The Hulk* has made a successful ►

Sabre Wulf (priced £9.95 is available from: **Ultimate (Ashby Computers & Graphics)**, The Green, Ashby de la Zouch, Leicestershire LE6 5JU.

TLL (priced £5.95) is available from: **Vortex**, 280 Brooklands Road, Manchester M23 9HD. Tel: (061) 973 95980.

Match Point (priced £7.95) is available from: **Sinclair Research**, Stanhope Road, Camberley, Surrey GU15 3PS.

The Hulk (Questprobe), priced £9.95, is available from: **Adventure International**, 119 John Bright Street, Birmingham B1 1BE. Tel: (021) 643 5102.

(A detailed review of 'Mugsy' appears on page 42; and a double review of 'Psytron' and 'The Lords of Midnight' is on page 41.)



Good graphics turn Bruce Banner into the Hulk (far left); as Beaky prepares to protect Condor eggs (left).

transformation to the micro screen, and is a surefire contender for the No 1 position in our next Spectrum Hit List chart.

8 BEAKY & EGGSNATCHERS

Fantasy Software's *Beaky and the Egg Snatchers* is one of the most original games in our charts. Although it's a shoot-'em-up spin-off, *Beaky* does not reach the depths so often plumbed by games of this type, saved mainly by a good scenario and amusing graphics.

The number of Andromedan Armed Condors is dwindling, so it is up to Beaky to save, and hatch, as many Condor eggs as possible. It's not easy: 'Strange Invader'-type creatures try to steal some of the eggs, while an odd giant frog attempts to stop them from hatching. Of course, looking after the eggs until they hatch is only part of the fun. Once hatched, the young chicks must be fed, until finally Beaky can return to start the cycle once again.

Beaky and the Egg Snatchers is a must for zap-em fanatics, or even for those who just want a good laugh. Whatever the reason, Beaky is certainly a good addition to anyone's software collection.

9 JET SET WILLY

After a long time at the top, FSW is bowing out gracefully. It takes place in a mansion after a raucous party: host Willy has to go round cleaning up after his guests, room by room, before being allowed to go to bed, fending off the usual variety of (you've guessed it) weird and whacky creatures and other pitfalls a *la* *Manic Miner*. All good fun.

10 WAR OF THE WORLDS

Despite all the hullabaloo, the computer game version of Jeff Wayne's *War of the Worlds*, based on HG Wells' novel of the same title, is rather a disappointment. The format of the game is in the manner of an action/adventure, but sets no new standards in either genre.

Basically, the plot follows that of the book/album in a convoluted way: you assume the role of the journalist who witnesses the landing of the alien cylinders on Horsham Common, then in the midst of the confusion following the Martian invasion, sets off across the panic-stricken Home Counties to find his beloved fiancé Carrie, trying to avoid Martian fighting machines and so forth. The scene is set by several screens of descriptive text, followed by a snazzy still graphic of the scene; sadly, the game then reduces to a stick figure representing the journalist wandering through the cardboard-cutout streets of various towns, trying to find his way to the coast and avoid the Martian fighting machines. If he encounters one he has to scramble away from it, lest he be

zapped by the terrible heat ray (intermittent lines of red phosphor), providing one of the few instances of action.

We found *War of the Worlds* a game that promises much, much more than it delivers; what it lacks in quality, it makes up for in hype, and themes from Jeff Wayne's album warble through various stages of the game to remind you of just what a lucrative story *WOTW* has proved to all who have come into contact with it. However, the game does have its entertaining moments, and for the dedicated (very dedicated) Spectrum games player, it is a worthy addition to the collection. Looks better on the shelf than it does on the screen.

11 JACK & BEANSTALK

Apart from some nice graphics, Thor's *Jack and the Beanstalk* really has nothing much to offer. The lack of instructions (Thor says this is due to the game being more of an adventure with specific items to pick-up, and special routes) makes the first level (actually getting up the Beanstalk's trunk) almost impossible; we only got through it by trial and a lot of error. Good background design makes the various screens pleasing to the eye, but the animated characters lose a lot by flashing and changing colour.

The game is compatible with the Currah speech module, so you can listen to 'you have fal-len d-own' each time Jack plummets from the beanstalk, or even walks to the edge of the screen. If you have not got the unit, a long wait and a lot of silence is met between each go.

Overall some good screen designs have been spoilt by a lack of documentation, and a very boring theme. Not recommended.

12 TRASHMAN

This program deserves an award for turning a dull job into an exciting game: *Trashman* gets intimate immediately as the player has to feed in a name before starting. Then it's a dash to complete the task of emptying five dustbins in the given time.

There are shades of *Frogger* as you dodge cars crossing the road to collect bins, but the graphics are well done as the whole scenario looks convincing. Nice touches abound as the player is chased by dogs and enticed into houses by housewives. Part of the fun is trying to empty the bins before the dustcart has disappeared up the road. It is possible to hare across lawns in an effort to do so but the result is a loss of bonus points and dogs at your heels.

The text is lively too, with suitably scathing remarks when you make it onto the Hall of Fame with a low score. It is also one of those games that gets better the more skilled the player becomes. Definitely a winner.

Beaky and the Eggsatchers (priced £5.50) is

available from:

Fantasy Software,
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Jet Set Willy (priced £5.95) is available from:

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War of the Worlds (priced £7.95) is available from:

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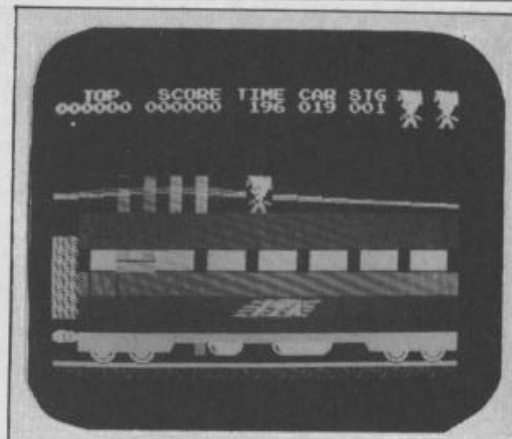
Thor (Computer Software),
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Tel: (051)-256 7666.

Trashman, available (priced £15.95) from:

New Generation Software,
The Brooklands, 15
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Lynchcombe Vale,
Bath, Avon BA2 4NA.

(Thanks to **Pilot Software** of 32
Rathbone Place,
London W1P 1AD (Tel: (01) 636 2666) for loaning us many of the games reviewed here.)

Far right: rooftop frolics from 'Stop The Express'; right: another successful sortie from 'Night Gunner'.



13 NIGHT GUNNER

Night Gunner is loosely based on flying an Avro Lancaster in the Second World War, and has no less than 30 different mission for the pilot to fly. The beauty of this game is ease of mastery. Unlike its sister game *Fighter Pilot*, *Night Gunner* has actually been well thought out, with options for skill levels, number of players, type of joysticks and a high score chart. It has demonstration frames as well as to give the player some idea of how to play. To avoid becoming tedious too quickly, it is hard to knock out all the enemy targets and planes set against you. Definitely a helmet and goggles job.

14 STOP THE EXPRESS

Hudson Soft are to be congratulated on an original setting for the *Stop the Express* game, even if the same old 'avoid and destroy' format fails to do it justice. The game is set atop a speeding express train, where you are the Special Security Agent whose job it is to apprehend the dastardly Redmen who are aboard the train making their escape across the border.

Your agent has to run along the top of the carriages to reach the front and stop the express, avoiding sneak attacks from the Redmen, but aided by a quirky creature called the Snakebird. If the Redmen get to you you fall off the train and are left rolling by the side of the track. Good graphics and reasonable fun.

15 FIGHTER PILOT

More of a mini training course than a game, it's best to think of *Fighter Pilot* as a challenge rather than fun — and a bloody complicated challenge at that!

For a start, there's multitude of keys to master — it's bad enough struggling with a joystick and fire button, but we managed to crash several times before discovering how to retract the undercarriage. In affect, it will keep any budding aviator enthralled for hours learning all the little nuisances. The program doesn't force the beginner into learning how to take off before progressing further; the player can pick one of five options and go straight into air-to-air combat if desired. Good instrumentation, though the scenery could be more inspiring.

16 AUTOMANIA

Automania is a superior *Manic Miner*-like, in that MikroGen has adopted the best features from the seminal precursor and added some originality of its own. You have to help 'Manic Mechanic' Wally Week (a neat bit of graphic characterization) gather the six parts of a car from around his garage

workshop, which is graught with the usual assortment of weird and whackies, collapsing walkways, and so on. There are ten cars to build, which works out at 20 screens, each scenario using two screens. Good graphics and varied fun, *Automania* is well worth giving a go.

17 KOSMIC KANGA

Kosmic Kanga (from Micromania) is a kind of hybrid between *Jetpac* and *Mutant Camels*. You thrust the superheroic Kanga across a silly scrolling landscape as he searches for the spaceship that will get him back to his home planet, leaping about buildings and mountains, landing on various objects to gain points and firing boxing gloves at other bouncing hazards to avoid annihilation. Several screens of quirky sameness. Reasonably good fun and graphics, but does get rather tiresome.

18 CODENAME MAT

Codename Mat is an impressive 'Star Trek' pastiche with small space ships emerging from the depths of space to destroy your ship. It is possible to follow these by scanning the universe with both short, and long range, detectors. The most annoying feature of the arcade sequence is trying to get the fast moving enemy in the middle of a square representing your gunsights — very exciting, nonetheless.

Flying the Centurian — the player's craft — is just as difficult. In itself it requires the dexterity of an octopus, but no doubt arcaders with itchy trigger fingers will find it most amusing.

Condename Mat is a multi-faceted package containing an element of most computer game genres, and with a set of instructions that could put 'War And Peace' to shame; however, the feat of plowing through them is well worth it.

19 AD ASTRA

Ad Astra. (from newcomer Gargoyle Games), is the most exciting shoot-'em-up to hit the 48K Spectrum in a long time. Although reminiscent of *Star Raiders*, some excellent graphics put *Ad Astra* above a lot of others in the same genre.

In addition to shooting aliens, the player must guide a spacecraft through a maze of oncoming asteroids, hurtling towards the ship with impressive realism. The asteroids themselves don't pose too much of a problem, but the sheer size of the craft often makes them difficult to dodge (especially if it is stuck in the corner of the screen).

Once through the rocks, moving dots in the distance signify the aliens. These are the inevitable *Star Wars* look-alikes, but they are far superior to

Night Gunner (priced £6.95) is available

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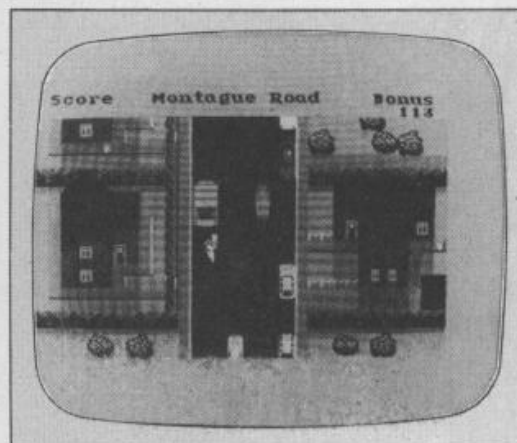
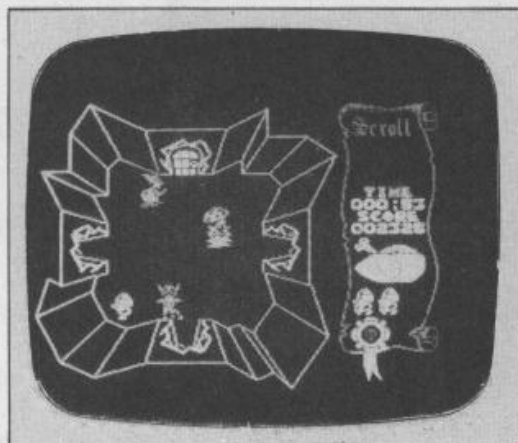
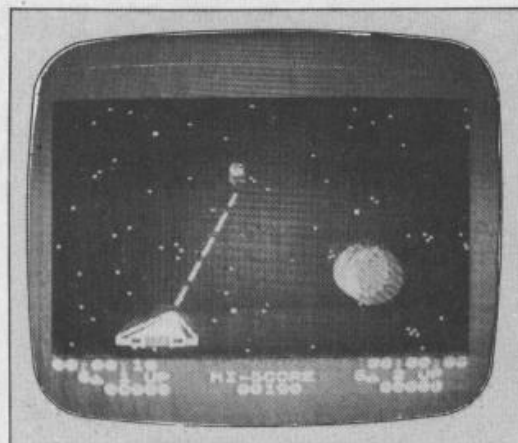
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Clockwise: astro zaps in 'Ad Astra' (see page 34); lonesome motor racing from 'chequered Flag'; far from trashy graphics in 'Trashman' (see page 33) haunted harassings from 'Atic Atac'.



those in, say, *Timegate*. As each level is passed, (there are 20, each with seven phases) the enemy gets more devious. We managed to get to the third featuring mine laying starships, but these proved too much for our tired trigger fingers.

Other features of the game include a high score indicator and real-time clock showing how long you have lasted — all of which go to make *Ad Astra* a must for arcade action seekers.

20 CHEQUERED FLAG

Psion's *Chequered Flag* is not (as its name might suggest) based around the Stars and Stripes — it's yet another racing car game. You choose your car and your track (ten famous circuits from around the world), number of laps and off you zoom, racing against the clock.

A cockpit view of the car occupies the lower portion of the screen, showing steering wheel, rev counters, speedometer, gear change, and so on, and you look out on an uninspired three-dimensional landscape.

The main snag with the game is that at least six keys are needed to operate the vehicle, so unless you've finger control of maestro proportions, the effort required is for disappointing result.

However, *Chequered Flag* does make the best of the (48K) Spectrum's graphics capabilities. Although not recommended for thrill-freaks, race game fans should lap it up.

21 ATIC ATAC

Trapped in a haunted castle, you have to find the key to the main door and escape. This is a colourful, fast varied and addictive game, with the choice of three types of warrior (serf, wizard or knight) each with their own weapons. You battle your way through a number of rooms, caverns and secret passageways (each quickly and colorfully drawn) in

your quest for escape.

We found that in the tradition of Ultimate's games, repeated use of your weapon is essential — needs hours of play to get the hang of it.

22 MOON ALERT

Strictly for moon buggy drivers, this one: what's required is a deft hand with the joystick and fire button as the player bounces along a scrolling lunar surface avoiding rocks, gullies and the inevitable alien spaceships. *Moon Alert* is fairly addictive as you're spurred into mastering seemingly impossible jumps. With a claimed 300 screens, actually finishing is an achievement. It's Currah μ Speech compatible, but the only interesting thing it said was 'blast missed' we think. Not an outstanding game.

23 TITANIC

Titanic (from R&R Software) is a reasonable graphic adventure in which your direct a diving expedition down to the wreck of the ill-fated liner in order to salvage the gold said to have gone down with her.

After first raising your finance and buying equipment and supplies, working on information supplied by a NASA satellite you locate the wreck and send a team of divers down to explore it. Their progress is relayed to you via video images (basic room views), as they swim through the maze of dark passages and cabins looking for the gold. The sunkend ship is fraught with sharks and conga eels, summoned up in slow-to-evolve static graphics that wouldn't frighten a paddler — but this is an adventure, after all.

Titanic is a well developed game, with variety and interest — recommended.

24 THE QUILL

Not a game, but a adventure-creation package that helps you write your own. It consists of three ►

Chequered Flag (priced £7.95) is available from:

Psion,

22 Dorset Square,
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Atic Atac (priced £9.95)
is available from:

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Moon Alert (priced
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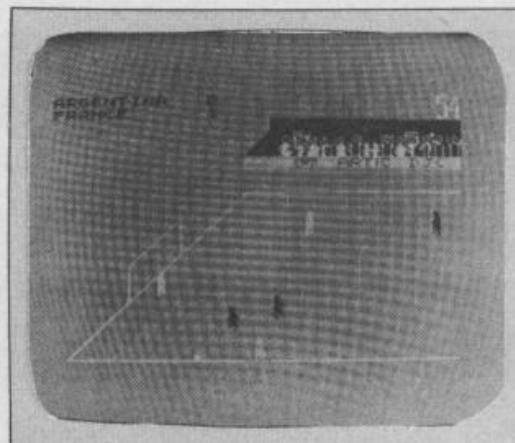
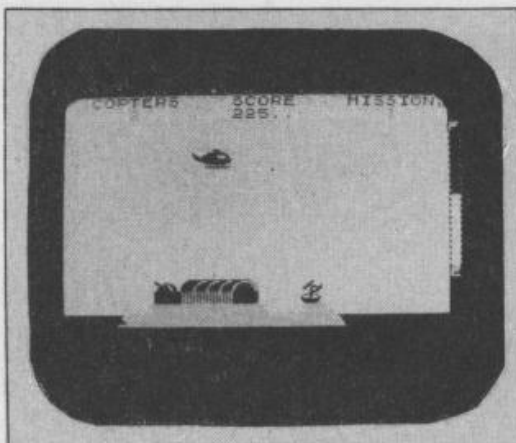
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Pitman

Far right: soccer simulation from Artic's 'World Cup'; right: choppy stuff from 'Blue Thunder'.



databases, each used to design a specific facet of the game, and aims to get the novice user into action with no previous programming knowledge. Ideal for anyone not simply content with mindless alien zapping or monotonous maze chases, who wants to get behind the screen.

25 BLUE THUNDER

Richard Wilcox Software's *Blue Thunder* causes little more than a distant rumble when it comes to excitement. The story is loosely based around a jetcopter, *Blue Thunder* of the title (and film), which is flown over enemy territory in order to destroy a nuclear reactor avoid anti-aircraft devices. If that sounds familiar, the rest of the game, will be even more so, as *Blue Thunder* is yet another 'Defender' pastiche.

Flying the jetcopter and destroying the reactor is made very difficult by the implementation of some very difficult controls. Getting the machine into the correct attitude for an attack, for instance, is done by pressing a fire button, either on a joystick or keyboard, with three different pressures. Neither is sensitive enough to distinguish between each press, so the result is some very haphazard reactions.

Blue Thunder is hovering around in our software charts, and its movement up is likely, in our view, to be as unreliable as in the game.

26 WORLD CUP

Artic's *World Cup* is a fair attempt at soccer simulation on the Spectrum. You choose your national side, then are presented with a scrolling football pitch onto which the five-a-side teams file out. The opposing team is controlled by the computer.

You control your team via the 'blue man' - the player of yours nearest the ball turns blue, and is the only player you can control - meanwhile your other players position themselves automatically about the field: if you pass the ball to one of them, he automatically turns blue, and becomes the player at your command. Kicks are made via the fire button or appropriate key.

For the Spectrum, the graphics and action are quite good, but of course rather rudimentary: for example, when two opposing players go for the ball they merge into one featureless blob until one manages to outrun the other; it is also practically impossible to gain possession of the ball from one of the opposing team. Despite these flaws, *World Cup* is fairly good fun, and worth taking a look at.

27 FOOTBALL MANAGER

Football manager (from Addictive) is a decision game, where the player takes the part of the FM and tries to take his/her team to the FA Cup final. Players are

bought and sold, and every so often there is the choice to play another team in the same division. Just before kick-off, a menu comes up on the screen with a comparison of each team's attributes, giving a good indication of how a game will go.

As far as a match goes, the player takes no part in it what so ever. All he does is sit back, whilst a 3D display shows stick men running about trying to score at one end of the pitch. Although the display is good, the action is slow and uninspired.

28 CAVELON

Ever since the introduction of *Pacman*, the maze scenario has been stripped bare, leaving a few remnants of rotting flesh for software houses to feed on. Ocean's *Cavelon*, however, leaves menacing balloons and gulping monsters behind, spicing things up with good olde English folklore.

Cavelon is loosely based around the Knights of the Round Table, with the object of the game being to rescue Queen Guinivere; monsters are replaced by strangely coloured archers and *Pacman*'s fruits by various weapons. Excalibur does the same as the original power pills, allowing the knight to move around unhindered for a short period of time.

Each of *Cavelon*'s six levels is entered by collecting various pieces of a door which lay scattered around each level. Getting to the door is made increasingly difficult by the number of archers prowling around the labyrinth's corridors.

Cavelon is a welcome variation to the old and very tired maze chase. Ocean has released another winner, and Arthur has returned to help *Pacman* in its hour of need.

29 ERIC & FLOATERS

Based, yet again, inside a maze, *Eric & The Floaters* has the novel twist of being able to blast the maze walls away to reveal hidden treasures. While demolishing and plundering, Eric is pursued by some less than friendly balloons. When these come in contact with him, they cause him to go through some strange contortions, giving a good impression of a deflating lilo.

Eric and The Floaters never comes near the promise of the cassette inlay, and the limited scenario is liable to bring on a boredom attack very quickly.

30 MANIC MINER

The granddaddy of so many, *Manic Miner* is still hanging on in the charts. Weird and whacky wotzits inhabiting 20 levels of play, as you take miner Willy through each one, collecting buried valuables and braving the hazards of subterranean adventure. The original, and many will say, the best.

Blue Thunder (priced £5.95) is available from:

Richard Wilcox Software,

Tel: (05433) 2787

World Cup (priced £6.95) is available from:

Artic Computing,

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Driffield YO25 8RL

Football Manager

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Addictive,

Albert House,

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Cavelon priced £5.90)

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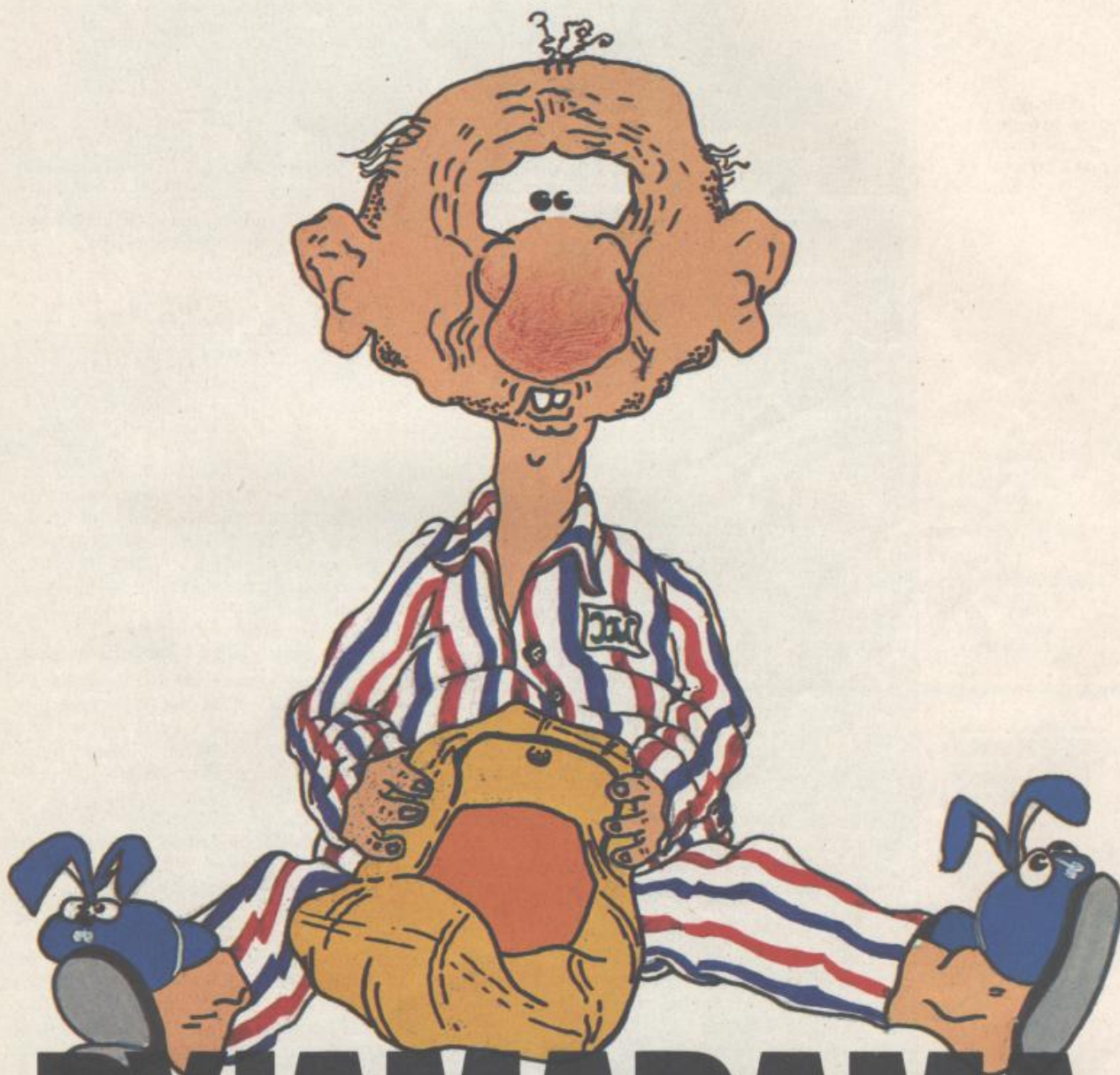
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TWO GAMES FROM BEYOND, 'PSYTRON' AND 'LORDS OF MIDNIGHT', SET NEW STANDARDS IN COMPUTER GAMING. WE FIND OUT WHY.

Offering a mixture of arcade action and brain-teasing strategy, *Psytron* and *The Lords of Midnight* are unlike anything else on the games market. Both games, from the innovative software house Beyond, are extremely challenging, and the graphics, particularly on *Psytron*, are some of the best to be seen on the Spectrum.

Psytron, written by Tayo Olowu and Paul Voysey, is a strange marriage between *Space Invaders* and home management. Not only does the player have to keep the sky clear of alien craft, but the *Psytron* ('less than human, far more than mere computer') must keep the Betula 5 space station in working order.

Although *Psytron* requires a lot of keyboard bashing, it is still more in the strategy, than 'shoot-'em-up' ilk. It is a large, multi-level, multi-screen game (although, thankfully, not as large as *Manic Miner*).

The game is made of 10 different screens in all, each showing a different view of Betula 5. In reality, because of overlap, there are only eight. Above the planet small space ships fly away from, and towards the player in fabulous 3D.

The sky and the area below the base are not held in the computer's memory, only the middle third is, so each screen requires 2K of memory.

A comprehensive manual is provided with the cassette, a good reading of which is essential if the player is going to get anywhere at all. We found it possible to get to the third level without consulting the manual, but from the fourth level onwards, things get very complicated indeed.

The scenario for the game comes from the authors' wish to 'lower the boundary between arcade and strategy games'; for Olowu and Voysey, cerebral games are interesting, but often their lack of fast action can lead to boredom very quickly.

This said, when we first encountered *Psytron*, we thought 'ho-hum, another boring shoot-the-aliens game' — all you do is shoot droids (robots that look like three-legged dogs) which drop from the alien craft into a tunnel below Betula 5.

However, this was only the first level, and as we found out, things hot up very quickly. In level two you don your space-suit, and rush headlong into

battle with the hordes of alien space craft. After the 'dumb' droids, the space craft are a real headache. Unlike the tri-ped dogs, the spacecraft dart about all over the sky, making them very difficult to hit. Even the most fanatical *Galaxian* player will have difficulty getting through this level without sustaining a lot of damage to the base.

Level three is virtually the same as level two, except you have to ward off both the droids and the spacecraft who attack at the same time.

It is at level four that the strategic aspect of the game comes to the fore. While still under attack, the player must designate repair crews to different parts of the game — and if your attention is on this task too long, the aliens get through.

An option called 'freezetime' gives damage reports for the entire base. Even this uses energy, so the player must balance between shooting the aliens, or repairing the base. Finally, level five gives the option of ordering supplies from a cargo ship.

Psytron is probably the most complex arcade/strategy game on the market, and we have seen no better for graphics. Every part of the base is shown in detail on the screen, and what each location does, and how damage to it will affect the base, is outlined in the manual.

As far as presentation goes, Beyond certainly know how to package a game. The cassette and manual are contained in a colourful box along with a scoresheet that gives the buyer a chance to enter a competition to win a Sinclair QL.

As for salesmanship, the B-side of the game has some sequences from the *The Lord of Midnight*, Beyond's other sure-fire winner — very canny.

Psytron is the first game from ex-control systems engineering students, and is an extremely commendable effort. It must have a lot of other software houses waiting for what their next move will be. Although it might not get as much recognition as, say, *Valhalla*, because of the smaller scale pre-sales advertising, *Psytron* is certainly in the same class as far as graphics and ingenuity go.

The Lords of Midnight, launched at the same time as *Psytron*, is a different kettle of fish altogether. Far removed from the world of arcade mazes and alien zapping, *TLOM* is more akin to a game of chess

played between a human and a computer.

The object of the game is to take over the land of Midnight, a strange world created by Mike Singleton, the game's author. You the human, have to get from a place called the Tower of the Moon, in the south-west of Midnight, up to the Citadel of Ushgarak in the north. On the way, you have to overcome various obstacles, and do battle as you encounter the enemy more and more frequently.

Singleton hopes *The Lords of Midnight* will appeal to both adventurer and wargamer alike, and as such, he has outlined two ways of winning the game in a well-produced manual. For the bloodthirsty war-monger, victory can be had by sending armies north to the enemies' command post. If a quest is more your scene, one of the characters, Morkin, can be guided to the Tower of Doom, where something called the Ice Crown must be destroyed.

Both strategies outlined above are for the human player. The computer's objectives are different. To win, the machine — in the guise of the evil Witchking Doomdark — must kill Morkin or stop the player's armies (the Free). The latter is accomplished by taking the Citadel of Xajorkith in the Land of Corely, to one south-east of Midnight.

In the true tradition of wargames, *The Lords of Midnight* takes place in a static, pre-defined location. The difference is, however, that the player can only see the land as it appears from where he/she is at any one time.

This is where *TLOM* really comes into its own: using a process termed 'landscaping', Mike Singleton has made it possible for the player to look in eight different directions at any of 4,000 possible locations. This gives a total of 32,000 different views, which sounds impossible, but it really does work!

By defining several different characters (generally in black and white), and drawing them in different

positions, Singleton has managed to give the impression of a vast landscape, across which the opposing armies do battle. As the player moves in any direction, the landscape unfolds in full perspective, showing mountains, lakes, and buildings in full panoramic splendour.

Whereas the panorama is not stored in memory, but is drawn at each location, the actual characters are. These are great, and can range from a relatively simple Morkin to the horseback Rothrin. Dragons, wolves, and strange Muppet-like creatures called Skulkrins also crop-up, all of which add additional hazards to the battle against Doomdark's hordes.

Morkin, as mentioned, is one of four characters under the control of the player at the start of play. The others are Luxor the Moonprince, Rothrin the Wise, and Corleth the Fey. It is the player's task to control these in the battle against the computer, and pick up other characters as he goes.

A lot of the characters' abilities, such as to LOOK, CHOOSE, and so on, are akin to an adventure, but whereas they would normally be typed in letter by letter, Singleton has put these choices on different keys, thus saving time, a keyboard overlay comes with the program which has all the commands on it.

We found the greatest hassle was when the SAVE key was pressed by accident. The routine cannot be exited, and that means the whole game up to that point is lost, which can be a great headache if many hours of play have gone into it.

Apart from this minor quibble, *The Lords of Midnight* should be another winner for Beyond. The price tag of £9.95 is well warranted, and the graphics and variation in play should keep even the player with the shortest of concentration spans happy for hours.

By Steve Applebaum, staff-writer.

Psytron (priced £7.95) and the *Lords of Midnight* (priced £9.95) are available from: Beyond, Competition House, Farnden Road, Market Harborough, Leics LE16 9NR.

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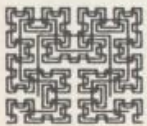
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MUGSY'S NO SCHMUCK



WE LOOK AT 'MUGSY' — THE GANGSTER GAME THAT POSES A NEW CONCEPT IN GRAPHICS PRESENTATION

After 'micro movies' and graphic adventures, we now have the computer 'comic': Philip 'The Hobbit' Mitchell's latest creation, called *Mugsy*, is a sort of cross between a gangster movie and an arcade/adventure game.

You play the *Mugsy* of the title, and as the Godfather to a gang of low-lives in the Chicago of the 1920s, it is your task to keep the mob in order and crime on the streets. Being in charge is never easy, and just how long you last is always in the balance. Enemies, including those in the gang, are ready to stab you in the back at any time, by putting out a contract if you are too successful.

In play, the screen switches from one scene to another with as fast a movement as could be hoped for with graphics as complex as *Mugsy's*. Most of the screens involve two characters talking to each other. One, Louey, feeds you with information in a cartoonish bubble. All the player's input is shown in a bubble on-screen, and usually only involves entering amounts of money for ammunition, bribes, the buying and selling of clients (a protection racket).

There is certainly no lack of humour in *Mugsy*, and the dictionary of the other characters is large for this type of game; for example: '...some of da boys in the mob is sayin' you're past it, and they're talkin about puttin' out a contract on you. If it goes any further, how many grand (if any) will you pay to keep the good guys faithful', comes the question when you're taking a dive.

If things go badly, a scene appears with you looking through a cafe window onto a deserted

street. Opposite, reading a newspaper below a street lamp, stands a hit man in a dark coat. A girl in a shimmy dress walks towards him, at which he closes his newspaper and walks off with her. A black limo then rolls up opposite the cafe, and a machine-gun fires a hail of bullets at the window, pockmarking it with holes. The scene is totally faultless. The figures move smoothly, and there is very little colour change — even the car moves as if it were designed using sprites. Another bar-room scene is equally as good.

Although the graphics in these two scenes are good, the player has nothing to do but watch the action. There is, however, an interactive arcade sequence involving a cafe shoot-out with 'The Man From Detroit'. We found that in this situation, one way to avoid being blown apart was to hide behind a woman sitting at one of the tables. If the woman should get shot, she falls from her chair and a man runs over to help.

Whereas the game is superb graphically, its scenarios leave quite a bit to be desired; for the first few plays the game is fun, but as there is little difference from game to game, its repeated jokes can wear a bit thin.

The percentage scoring system does nothing to help either: as far as we could tell, a high score is achieved by gaining lots of clients, and not lasting for as many years as possible.

Despite this, Mitchell and his team have once again produced an original and imaginative piece of software.

By Steve Applebaum, staff-writer.

Mugsy (priced £6.95) is available from:
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SINCLAIR ANSWERS

HUNGRY HERMAN

HERMAN CAN'T TELL A FLOWER FROM A WEED— BUT KNOWS HOW TO AVOID THE INSECTICIDE, IN OUR ARCADE GAME.

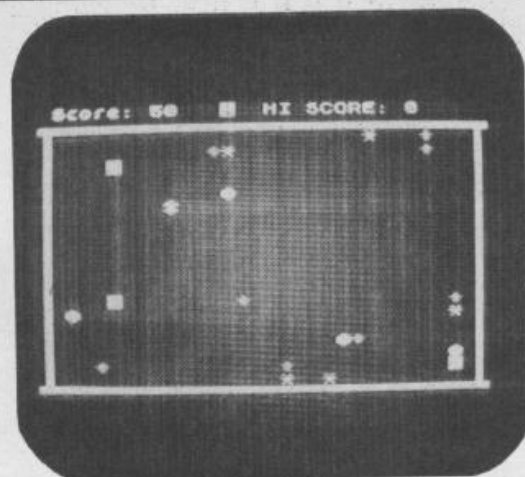
Herman is a bug — a hungry bug with an insatiable appetite for flora. In our arcade game listing you must guide Herman round the flower patch, chomping the blooms and avoiding the insecticides — no mean feat as it turns out.

Herman never stands still, but saunters round the flowerbeds working his way through the blooms, guided by the left and right arrow keys, which will turn him in that direction. Be warned — the keys turn him to his right or left, not your's. If Herman manages to eat all the flowers in one patch, then he moves on to neighbouring patch, which has more obstacles than the first.

Despite being written in Basic, the action is fast and quite addictive. In the listing given, note that each line is terminated with a number in angled brackets (for example <123>). Do not type this into the Spectrum because this number is the checksum. If you first type in the Checksum program listed in this issue on page 59, you can then check the numbers produced by your own typing against the listing of *Herman* (Fig. 1 below).

This should all but eliminate those infuriating typing errors that so often kill a program. This is our pilot project for the Checksum program, a first for computer magazines, and our future Spectrum listings will all include these special numbers after each line of Basic.

One more quick point about the listing: whenever a single letter appears in a print statement (for



example, 'A'), then it is probably a graphics character in the program. When you are typing it in, first press CAPS SHIFT and the GRAPHICS keys simultaneously, then the letter, then CAPS SHIFT and GRAPHICS again. The line numbers where these occur are: 1120, 1620, 3000, 3020, 4510, 4560, 4610, 5000, 5200, 6040, 6110, 6200, 6270, 7020 and 7200. The checksum should help you get these graphics symbols right.

Hopefully, Herman will turn out to be a bug you don't mind having in your Spectrum.

By Tony Cotterill, a freelance programmer.

Our screen shot shows Herman in his habitat, endlessly eating.

FIG. 1

[illegible]

```

1610 IF Y<2 OR Y>20 THEN GO TO 3000 <225>
1615 IF ATTR (Y,X)=4 THEN GO TO 3000 <191>
1617 INK 0: IF ATTR (Y,X)<0 THEN GO TO 4000 <170>
1620 PRINT AT Y,X: INK 6:"a" <079>
1630 BEEP .008,-10: PAUSE W <170>
1720 GO TO 60 <097>
3000 IF d=0 OR d=2 THEN PRINT AT Y,X: INK 2: BRIGHT 1: FLASH
W 1:"a": GO TO 3050 <055>
3020 PRINT AT Y,X: INK 2: BRIGHT 1: FLASH 1:"b" <234>
3050 INK 0: FLASH 0: BRIGHT 0: BEEP .5,3: BEEP .5,7: BEEP
.75,6: BEEP .25,4: BEEP .5,2: BEEP .5,-3: BEEP 1,-1 <070>
3052 IF sc=hi THEN LET hi=sc <039>
3300 PRINT I:" Press '0' to play again" <022>
3310 IF INKEY#="0" THEN GO TO 35 <163>
3320 IF CODE INKEY#<20 THEN GO TO 3330 <018>
3325 IF CODE INKEY#<48 OR CODE INKEY#>48 THEN GO TO 3500 <1
06>
3330 GO TO 3310 <015>
3500 CLS: PRINT AT 11,14: BRIGHT 1: FLASH 1: INK 6:"BYE!":
BRIGHT 0: FLASH 0: INK 7 <014>
3501 GO TO 3501 <208>
3977 REM <119>
3988 REM **F00D PARCELS** <028>
3999 INK 6 <115>
4000 IF ATTR (Y,U)#66 THEN LET sc=sc+1: BEEP .08,2: LET no
=not1: GO TO 4500 <085>
4050 IF ATTR (Y,U)#65 THEN LET sc=sc+2: BEEP .08,4: LET no=
not1: GO TO 4550 <091>
4100 IF ATTR (Y,U)#67 THEN LET sc=sc+3: BEEP .08,6: LET no=
not1: GO TO 4600 <240>
4150 IF ATTR (Y,U)#5 THEN LET sc=sc+4: BEEP .08,8: LET no=not
1: GO TO 4650 <105>
4200 IF d=0 OR d=2 THEN GO TO 1620 <021>
4210 GO TO 1120 <231>
4500 LET z=INT (RND*19)+2: LET a=INT (RND*29)+1: IF ATTR (z,
a)<0 THEN GO TO 4500 <237>
4510 PRINT AT z,a: INK 1: BRIGHT 1:"D": PRINT AT 0,1: INK 7:
"Score:" :sc: IF d=0 OR d=2 THEN GO TO 1620 <142>
4520 GO TO 1120 <060>
4550 LET z=INT (RND*19)+2: LET a=INT (RND*29)+1: IF ATTR (z,

```


FIG.1 HERMAN CONTINUED

```

a)<0 THEN GO TO 4550 <232>
4560 PRINT AT 2,2: INK 3: BRIGHT 1:"E": PRINT AT 0,1: INK 7:
"Score: ";sc: IF d=0 OR d=2 THEN GO TO 1620 <199>
4570 GO TO 1120 <078>
4600 LET z=INT (RND*19)+2: LET a=INT (RND*29)+1: IF ATTR (2,
a)<0 THEN GO TO 4600 <238>
4610 PRINT AT 2,2: INK 5:"P": PRINT AT 0,1: INK 7:"Score: ";
sc: IF d=0 OR d=2 THEN GO TO 1620 <247>
4620 GO TO 1120 <155>
4650 LET z=INT (RND*19)+2: LET a=INT (RND*29)+1: IF ATTR (2,
a)<0 THEN GO TO 4650 <235>
4660 PRINT AT 2,2: INK 4:"M": PRINT AT 0,1: INK 7:"Score: ";
sc: IF d=0 OR d=2 THEN GO TO 5000 <181>
4670 IF d=0 OR d=2 THEN GO TO 1620 <065>
4680 GO TO 1120 <223>
5000 IF d=0 OR d=2 THEN PRINT AT y,x: INK 6:"A": GO TO 5500
<228>
5200 PRINT AT y,x: INK 6:"B" <088>
5500 INK 0: PAUSE 3: BEEP .125,11: BEEP .125,2: BEEP .125,7:
BEEP .125,11: BEEP .125,10: BEEP .125,2: BEEP .25,9: BEEP
.25,7 <215>
5550 PAUSE 10: LET sh=sh+1 <187>
5570 GO TO 40 <030>
5597 REM <045>
5598 REM <046>
5599 REM **POWER UP** <089>
6000 IF ene=INT (sh/2) THEN RETURN <082>
6020 PAUSE 10: IF d=0 OR d=2 THEN GO TO 6200 <074>
6040 FOR a=5 TO 1 STEP -1: PRINT AT y,x: INK a: FLASH 1:"B":
BEEP .2,(10-a): NEXT a <031>
6050 LET sp=INT (RND*sh)+1+INT (RND*sh)+1 <120>
6060 FOR a=1 TO sp <254>
6070 PRINT AT y,x: INK 0: FLASH 0: " " <221>
6080 LET x=x+2-d <069>
6085 LET sc=sc-10 <043>
6090 IF x<1 OR x>30 THEN GO TO 3000 <123>
6100 IF ATTR (y,x)<0 AND ATTR (y,x)>4 THEN LET no=no+1 <2
06>
6110 PRINT AT y,x: INK 1: FLASH 1: BRIGHT 1:"B" <228>
6120 BEEP .008,20: NEXT a <043>
6125 LET ene=ene+1 <063>
6130 PAUSE 20: INK 0: FLASH 0: BRIGHT 0: RETURN <059>
6200 FOR a=5 TO 1 STEP -1: PRINT AT y,x: INK a: FLASH 1:"A":
BEEP .2,(10-a): NEXT a <177>
6210 LET sp=INT (RND*sh)+1+INT (RND*sh)+1 <151>
6220 FOR a=1 TO sp <017>
6230 PRINT AT y,x: INK 0: FLASH 0: " " <050>
6240 LET y=y+1+d <234>
6250 IF y<2 OR y>20 THEN GO TO 3000 <223>
6260 IF ATTR (y,x)<0 AND ATTR (y,x)>4 THEN LET no=no+1 <0
97>
6270 PRINT AT y,x: INK 1: FLASH 1: BRIGHT 1:"A" <074>
6280 BEEP .008,20: NEXT a <068>
6290 GO TO 6125 <147>
6997 REM <171>
6998 REM <168>
6999 REM **INSTRUCTIONS** <178>
7000 BRIGHT 0: INK 7: CLS: PRINT AT 3,11:"Meet Herman": PAU
SE 30: PRINT AT 6,10:"Here he comes" <109>
7005 PAUSE 30 <160>
7010 GO SUB 9800 <244>
7015 FOR a=1 TO 20: PAUSE 3: BEEP .008,-10: NEXT a <039>
7020 FOR a=0 TO 31: PRINT AT 10,a: INK 6:"B" <095>
7030 BEEP .008,-10 <047>
7035 PAUSE 2 <168>
7040 PRINT AT 10,a: INK 0: " " <090>
7050 NEXT a <013>
7070 FOR a=1 TO 20: PAUSE 3: BEEP .008,-10: NEXT a <222>
7080 PRINT AT 15,8: INK 7:"Herman is a bug who n
ever stands still!" <025>
7090 PRINT AT 21,9:"PRESS ANY KEY": PAUSE 0 <080>
7100 CLS: PRINT: INK 7: " In the following game you co
ntrol Herman's movement by pressing key 5 to move him left
and key 8 to move him right. But be careful because Herman
moves to his left or right whichever not be the same as
yours." <139>
7110 PRINT " In the playing area Herman must eat the dif
ferent coloured food packages and avoid the lethal green
squares which are covered with insecticide. You score fo
r the packages eaten." <169>
7120 PRINT " At screen three and higher Herman gains the
ability to 'power up' a number of times. This is done
by pressing key P." <138>

```

```

7130 PRINT " When powered Herman rushes forward and devours
anything in his path herelessly and fruitlessly (i.e. no poi
nts scored)." <006>
7140 PRINT AT 21,9:"PRESS ANY KEY": PAUSE 0 <006>
7150 CLS: PRINT " Powering up also costs energy (your poin
ts) to perform but is a useful way of clearing out green
squares." <158>
7160 PRINT " The times he can do this per. screen is a f
unction of how many screens he has cleared." <054>
7170 FOR a=14 TO 21: PRINT AT a,11: INK 6:"Screen":(a-11);A
T a,20: " ";(INT ((a-11)/2)): NEXT a <030>
7180 PRINT AT 21,9:"PRESS ANY KEY": PAUSE 0 <233>
7190 CLS: PRINT AT 1,12: INK 4:"SCORING": PRINT OVER 1:AT
1,12: INK 5:" " <098>
7200 PRINT AT 5,12: INK 2: BRIGHT 1:"C":AT 7,12: INK 1: BRIG
HT 1:"D":AT 9,12: INK 3: BRIGHT 1:"E":AT 11,12: INK 5:"F": F
OR a=5 TO 11 STEP 2: PRINT AT a,14: INK 7:"—": NEXT a <009
>
7210 PRINT AT 5,18: INK 6:"1":AT 7,18:"2":AT 9,18:"3":AT 11,
18:"4" <117>
7220 PRINT AT 15,8: INK 4:"M":AT 15,13:"M":AT 15,10: INK 7:"
or":AT 15,16:"—":AT 15,20: INK 2: FLASH 1:"DEATH" <166>
7221 PRINT AT 21,9:"PRESS ANY KEY": PAUSE 0: CLS <019>
7222 PRINT AT 2,13: INK 5:"SUMMARY":AT 2,13: OVER 1: INK 2:"
 " <117>
7223 PRINT AT 5,13: INK 4:"5 - LEFT":AT 7,13:"8 - RIGHT":AT
10,13: INK 6:"P - POWER UP":AT 13,6: INK 5:"ANY KEY - ACCELE
RATE" <255>
7230 PRINT AT 21,2: FLASH 0: INK 7:"When you're ready-press
a key" <080>
7240 PAUSE 0 <156>
7250 INK 0: FLASH 0: BRIGHT 0: OVER 0: RETURN <155>
9000 STOP <230>
9600 REM *** DRAW SCREEN *** <121>
9610 BORDER 0: PAPER 0: CLS: INK 4: PRINT AT 1,0:"
 " <236>
9620 FOR A=2 TO 20: PRINT AT A,0:"M":AT A,31:"M": NEXT A: IF
sh=1 THEN GO TO 9720 <240>
9630 IF sh=2 THEN FOR A=2 TO 8: PRINT AT A,15:"M": NEXT A:
FOR A=14 TO 20: PRINT AT A,15:"M": NEXT A: GO TO 9720 <249>
9640 FOR A=2 TO 9: PRINT AT A,10:"M":AT A,20:"M": NEXT A: FO
R A=13 TO 20: PRINT AT A,10:"M":AT A,20:"M": NEXT A <243>
9645 IF sh=3 THEN GO TO 9720 <135>
9650 PRINT AT 11,1:"M":AT 11,23:"M": IF sh=4 TH
EN GO TO 9720 <142>
9660 FOR A=11 TO 1 STEP -1: CIRCLE 123,83,A: NEXT A: IF sh=5
THEN GO TO 9720 <124>
9670 PRINT AT 4,3: INK 4:"M":AT 4,24:"M":AT 18,3:"M":
M":AT 18,24:"M" <142>
9675 FOR A=5 TO 8: PRINT AT A,3:"M":AT A,28:"M": NEXT A: FOR
A=14 TO 17: PRINT AT A,3:"M":AT A,28:"M": NEXT A: IF sh=6 T
HEN GO TO 9720 <099>
9680 PRINT AT 5,7: INK 4:"M":AT 8,4:"M":AT 5,24:"M":AT 8,27:
M":AT 14,4:"M":AT 17,7:"M":AT 17,24:"M":AT 14,27:"M":AT 4,1
4:"M":AT 18,14:"M": IF sh=7 THEN GO TO 9720 <227>
9690 FOR A=5 TO 7: PRINT AT A,13: INK 4:"M":AT A,17:"M": NEX
T A: FOR A=15 TO 17: PRINT AT A,13:"M":AT A,17:"M": NEX
T A: IF sh=8 THEN GO TO 9720 <185>
9700 PRINT AT 6,7: INK 4:"M":AT 8,5:"M":AT 10,10:"M":AT 11,8
:"M":AT 12,10:"M":AT 14,5:"M":AT 16,7:"M":AT 10,20:"M":AT 12
,20:"M":AT 11,22:"M":AT 6,24:"M":AT 8,26:"M":AT 14,26:"M":AT
16,24:"M" <186>
9720 FOR A=1 TO 20 <185>
9725 INK 2 <059>
9730 LET X=INT (RND*19)+2: LET Y=INT (RND*29)+1 <045>
9740 IF ATTR (X,Y)=4 OR ATTR (X,Y)=66 THEN GO TO 9730 <070>
9750 PRINT AT X,Y: INK 2: BRIGHT 1:"C": BRIGHT 0 <024>
9760 NEXT A <186>
9770 INK 0 <239>
9780 RETURN <227>
9800 REM *** UDG's *** <158>
9810 RESTORE 9880 <041>
9820 FOR a=USR "a" TO USR "f"+7 <011>
9840 READ user: POKE a,user <053>
9860 NEXT a <062>
9880 DATA 36,66,126,255,255,126,66,36 <054>
9882 DATA 24,126,189,60,60,189,126,24 <052>
9884 DATA 0,102,24,255,60,24,102,0 <194>
9886 DATA 0,24,60,255,60,60,24,0 <194>
9888 DATA 0,24,126,219,255,219,126,24,0 <249>
9890 DATA 24,126,255,231,231,255,126,24 <014>
9892 RETURN <115>

```


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THE SOUNDS OF BATTLE

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Zaps, zooms, launchings, landings, rapid fire and menacing music — all essential ingredients of an all action, fast-moving space arcade game. The trouble with including sound effects in your own programs is the time it can take to get them just right. Trial and error can take forever, so this article features a program to generate all action space sounds, and how to include them in your own work.

Two programs are listed — *Fig. 1* for 48K Spectrums, and *Fig. 2* for the 16K version. The sounds produced are slightly different for the two computers, and if you run them you will hear the following effects: a missile being fired, including the whine of it in flight and an explosion; a second missile being fired; the high pitched engine noise of a distant spacecraft; the rapid fire of missiles in space; more rapid fire; a spaceship landing; menacing music; a spaceship taking off, including engines warming up; the landing of a large spacecraft; a landing of a second spacecraft; the second spacecraft taking off.

Of course, when you add the sounds to your own programs they can be made in any order and at any time; this selection is just to give you an idea of what

to expect. For nearly all of these sounds there is a mix of a high-pitched background noise and a much lower pitched main noise. The Spectrum cannot produce sounds simultaneously, but the effect can easily be achieved by switching very rapidly from one sound to the other. This method adds realism, in particular the landings and launchings include the sounds of a powerful engine accelerating and decelerating.

The procedure to add any of the above sound effects to your Basic programs is quite simple, just work through the following stages.

The first statement in your program should be `CLEAR 64099` (or `CLEAR 31885` for 16K owners): this sets RAMTOP to allow for the machine-code programs to fit above it. A few lines of Basic are required to `POKE 74` decimal numbers above RAMTOP (see lines 3 to 30 of *Spacesnds*).

Include the two Basic subroutines to generate sounds (see lines 30 to 39 of *Spacesnds*).

Now, whenever you want a sound effect, include two lines of Basic in the following way:

```
LET SS="AAABBBCCDDDD"
GOSUB 36
```

Replace AAA with the number of bursts required,

Fig 1

```
1 REM SPACESNDS 48K VERSION
2 CLEAR 64099: REM set RAMTOP
3 DATA 38,2,37,0,0,0
4 DATA 194,86,254,201,14,0
5 DATA 205,130,254,121,50,99
6 DATA 254,50,105,254,6,255
7 DATA 62,7,211,254,62,255
8 DATA 61,254,0,194,106,254
9 DATA 62,23,211,254,5,194
10 DATA 100,254,12,121,254,50
11 DATA 194,88,254,195,78,254
12 DATA 22,10,21,0,0,202
13 DATA 149,254,30,1,29,0
14 DATA 0,194,140,254,195,132
15 DATA 254,201
16 LET T=0
17 FOR I=65100 TO 65173
18 READ X: POKE I,X: LET T=T+X
19 NEXT I
20 IF T<9020 THEN PRINT "ERROR IN DATA"
21 IF T<9020 THEN STOP
22 LET BORDERCOLOUR=7: REM 0 TO 7
23 POKE 65125,BORDERCOLOUR
24 POKE 65137,BORDERCOLOUR+16
25 GO TO 100
26 REM
27 POKE 65101,VAL A$(1 TO 3)
28 POKE 65155,VAL A$(4 TO 6)
29 POKE 65111,VAL A$(7 TO 9)
30 POKE 65147,VAL A$(10 TO 12)
31 RETURN
32 GO SUB 31
33 LET M=USR 65100: RETURN
34 REM
35 LET A$="002020001100"
36 GO SUB 36
37 LET A$="002010001100"
38 GO SUB 36
39 LET A$="020001075060"
40 GO SUB 36
41 LET A$="040040001030"
42 GO SUB 36
43 LET A$="040100001020"
44 GO SUB 36
45 LET A$="002200001020"
46 GO SUB 31
47 FOR I=2 TO 50
48 POKE 65147,I
49 LET M=USR 65100
50 NEXT I: PAUSE 10
51 LET A$="050010001020"
52 GO SUB 31
53 FOR I=20 TO 18 STEP -1
54 POKE 65147,I
55 LET M=USR 65100
56 NEXT I: PAUSE 10
57 LET A$="006010001060"
58 GO SUB 31
59 FOR I=50 TO 20 STEP -1
60 POKE 65147,I
61 LET M=USR 65100
62 NEXT I: PAUSE 10
63 LET A$="002010001040"
64 GO SUB 31
65 FOR I=2 TO 60
66 POKE 65155,I
67 LET M=USR 65100
68 NEXT I: PAUSE 10
69 LET A$="002010001020"
70 GO SUB 31
71 FOR I=2 TO 255
72 POKE 65155,I
73 LET M=USR 65100
74 NEXT I: PAUSE 10
75 LET A$="002010001020"
76 GO SUB 31
77 FOR I=255 TO 2 STEP -1
78 POKE 65155,I
79 LET M=USR 65100
80 NEXT I
```


plus one. The number can be from 0 to 255, but must be typed in the form of three digits (for example, type 1 as 001 or 12 as 012). If you type in 015, for example, you will get 14 burst of the sound. The other three numbers, BBB, CCC and DDD, are typed in a similar format to AAA. BBB affects the frequency of the sound, a larger number slows it down. The last two numbers determine the start and finish of the sound. CCC must be less than DDD, and the larger the difference between the numbers, the longer the sound will last.

It is important to remember that A\$ must be exactly 12 digits long. We suggest that when you start using this program that sounds are kept short, just so you don't blow your eardrums listening to the high-pitched scream of an intergalactic megamissile exploding in your head, and taking ten minutes to do it. For missiles and the like, the above two lines should suffice (along with the statement LET M=USR 65100, which generates the sound), but for a more controlled and complicated sound, such as the noise

of a spacecraft landing, a short routine is needed —

```
LET A$="AAABBBCCDDDD"
GOSUB 31
FOR I = start TO finish
POKE 65147,I
LET M=USR 65100
NEXT I
```

[as above]
[to process A\$]
[enter numbers]
[or POKE 65155,1]
[generate sound]

For the 16K Spectrum change the numbers 65147,65155 and 65100 to 31933, 31941 and 31886 respectively. The examples in the *Spacesnds* listing should help clarify the procedure.

These programs are compatible with the *Movearea* utilities (listed in this issue on page 39) that enabled easy moving of your drawings. By co-ordinating movements and sounds, very realistic scenes can be animated. All that now remains to be done is for you to write an exciting, zappy new game — and send us a copy!

By Stephen Fowler, a computer programmer.

Fig 2

```
1 REM SPACESNDS 16K
2 CLEAR 31885: REM set RAMTOP
3 DATA 38,2,37,0,0,0
4 DATA 194,152,124,201,14,0
5 DATA 205,196,124,121,50,165
6 DATA 124,50,171,124,6,255
7 DATA 62,7,211,254,62,255
8 DATA 61,254,0,194,172,124
9 DATA 62,23,211,254,5,194
10 DATA 166,124,12,121,254,50
11 DATA 194,154,124,195,144,124
12 DATA 22,10,21,0,0,202
13 DATA 215,124,30,1,29,0
14 DATA 0,194,206,124,195,198
15 DATA 124,201
16 LET T=0
17 FOR I=31886 TO 31959
18 READ X: POKE I,X: LET T=T+X
20 NEXT I
22 IF T<>8316 THEN PRINT "ERROR IN DATA"
23 IF T<>8316 THEN STOP
24 LET BORDERCOLOUR=7: REM 0 TO 7
25 POKE 31911,BORDERCOLOUR
26 POKE 31923,BORDERCOLOUR+16
29 GO TO 100
30 REM -----
31 POKE 31887,VAL A$(1 TO 3)
32 POKE 31941,VAL A$(4 TO 6)
33 POKE 31897,VAL A$(7 TO 9)
34 POKE 31933,VAL A$(10 TO 12)
35 RETURN
36 GO SUB 31
38 LET M=USR 31886: RETURN
39 REM -----
100 LET A$="002001001100"
101 GO SUB 36
108 LET A$="002006010100"
109 GO SUB 36
112 LET A$="020001075080"
113 GO SUB 36
116 LET A$="040040001030"
117 GO SUB 36
120 LET A$="040100001020"
121 GO SUB 36
200 LET A$="002100001020"
201 GO SUB 31
202 FOR I=2 TO 50
203 POKE 31933,I
204 LET M=USR 31886
205 NEXT I: PAUSE 10
207 LET A$="100021003120"
208 GO SUB 31
209 FOR I=15 TO 13 STEP -1
210 POKE 31933,I
211 LET M=USR 31886
212 NEXT I: PAUSE 10
250 LET A$="005010001200"
253 GO SUB 31
254 FOR I=50 TO 25 STEP -1
256 POKE 31933,I
258 LET M=USR 31886
260 NEXT I: PAUSE 10
300 LET A$="002010001040"
301 GO SUB 31
302 FOR I=2 TO 60
304 POKE 31941,I
306 LET M=USR 31886
308 NEXT I: PAUSE 10
500 LET A$="002010001020"
501 GO SUB 31
502 FOR I=2 TO 61
504 POKE 31941,I
506 LET M=USR 31886
507 NEXT I: PAUSE 10
508 LET A$="002010001020"
509 GO SUB 31
512 FOR I=63 TO 2 STEP -1
513 POKE 31941,I
514 LET M=USR 31886
516 NEXT I
```


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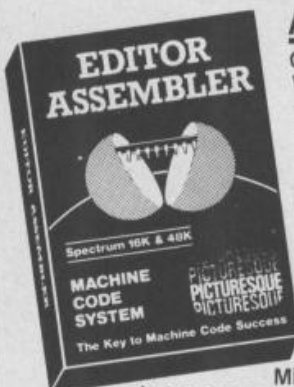
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Whether you see a missile glide through the air or an animal trot across the screen, smooth animation is one of the main features that makes a program look professional. Moving a figure one character position at a time is sometimes acceptable but tends to look jarred, (especially in comparison with a figure moving one pixel at a time).

On the Spectrum the screen is made up of 32 by 24 character squares, each square being 8 by 8 pixels in size, and this article explains how to move any drawing of this size or more smoothly round the screen. By typing in the program supplied in Fig.'s 1 and 2, you can achieve smooth movement of your

drawings from a Basic program, without having to write a single line of machine-code. As letters are simply small drawings, text can be moved using exactly the same procedure.

To create the drawings in the first place a commercial graphics development package could be used, or your own Basic program — or better still, the graphics design program listed in the May 1984 issue of *Computer Answers*. Having finished the artworks, the procedure to introduce animation into the program is as follows (note that numbers given are for the 48K Spectrum, the 16K values follow in brackets):

○ Type in the *Movearea* program — in Fig. 1 — ►

FIG. 1

```

1 CLEAR 50000
2 LET T=0
3 FOR I=64600 TO 65099
4 READ X: POKE I,X: LET T=T+X
5 NEXT I
6 IF T<>59504 THEN PRINT "DATA ERROR"
7 IF T<>59504 THEN STOP
9 SAVE "MOVEAREA"CODE 64600,500
10 PRINT "now MOVEAREA"
11 PRINT "is saved on tape."
12 STOP
13 DATA 243,205,95,252,251
14 DATA 201,0,205,44,254
15 DATA 24,3,24,242,255
16 DATA 1,8,8,197,42
18 DATA 75,255,126,230,252
20 DATA 32,2,193,201,126
22 DATA 50,165,254,205,171
24 DATA 252,58,165,254,230
26 DATA 3,202,188,252,61
28 DATA 202,15,253,61,202
30 DATA 97,253,61,202,210
32 DATA 253,58,165,254,230
34 DATA 248,32,10,42,75
36 DATA 255,35,237,99,75
38 DATA 255,24,202,58,165
40 DATA 254,214,4,50,165
42 DATA 254,24,206,58,164
44 DATA 254,71,197,71,197
46 DATA 71,16,254,193,16
48 DATA 249,193,16,244,201
50 DATA 6,8,197,5,237
52 DATA 91,77,255,122,128
54 DATA 87,213,58,81,255
56 DATA 71,197,123,214,1
58 DATA 95,213,221,225,58
60 DATA 83,255,198,1,71
62 DATA 221,203,0,38,48
64 DATA 4,221,203,255,198
66 DATA 221,35,16,242,193
68 DATA 16,2,24,14,209
70 DATA 123,198,32,95,48
72 DATA 4,122,198,8,87
74 DATA 213,24,209,209,193
76 DATA 16,191,193,16,9
78 DATA 58,77,255,61,50
80 DATA 77,255,6,8,197
82 DATA 195,144,252,6,8
84 DATA 197,5,42,77,255
86 DATA 124,128,103,229,58
88 DATA 81,255,71,197,58
90 DATA 83,255,198,1,71
92 DATA 22,0,90,22,0
94 DATA 203,62,48,2,22
100 DATA 128,126,131,119,35
102 DATA 16,241,193,16,2
104 DATA 24,14,225,125,198
106 DATA 32,111,48,4,124
108 DATA 198,8,103,229,24
110 DATA 213,225,193,16,196
112 DATA 193,4,62,16,144
114 DATA 32,9,58,77,255
116 DATA 60,50,77,255,6
118 DATA 8,197,195,144,252
120 DATA 237,91,77,255,58
122 DATA 81,255,60,71,123
124 DATA 214,32,95,48,4
126 DATA 122,214,8,87,24
128 DATA 10,123,198,32,95
130 DATA 48,4,122,198,8
132 DATA 87,213,197,122,246
134 DATA 7,103,123,214,32
136 DATA 111,48,4,124,214
138 DATA 8,103,6,8,197
140 DATA 213,229,58,83,255
142 DATA 71,26,119,28,44
144 DATA 16,250,225,209,107
146 DATA 98,20,193,16,235
148 DATA 193,209,16,203,58
150 DATA 83,255,71,54,0
152 DATA 44,16,251,193,121
154 DATA 61,79,32,20,237
156 DATA 91,77,255,123,214
158 DATA 32,95,48,4,122
160 DATA 214,8,87,237,83
162 DATA 77,255,14,8,197
164 DATA 195,144,252,237,91
166 DATA 77,255,58,83,255
168 DATA 71,197,24,2,197
170 DATA 19,213,38,0,58
172 DATA 81,255,71,4,197
174 DATA 24,11,197,123,198
176 DATA 32,95,48,4,122
178 DATA 198,8,87,122,230
180 DATA 248,87,6,8,24
182 DATA 1,20,108,26,103
184 DATA 125,18,16,248,193
186 DATA 16,226,209,193,16
188 DATA 209,193,121,60,79
190 DATA 214,16,32,20,237
192 DATA 91,77,255,123,198
194 DATA 32,95,48,4,122
196 DATA 198,8,87,237,83
198 DATA 77,255,14,8,197
200 DATA 195,144,252,58,80
202 DATA 255,203,39,203,39
204 DATA 203,39,203,39,203
206 DATA 39,38,255,46,79
208 DATA 134,50,77,255,58
210 DATA 80,255,230,24,198
212 DATA 64,50,78,255,201

```

The data statements in Fig. 1 are a machine code program. Type them in carefully!

and RUN it. When asked to start the tape recorder and press any key, do so and this will save a machine-code program called *Movearea* on the tape. ○ Now write your own Basic program. The first line should be CLEAR 50000 (CLEAR 29000). This command resets RAMTOP allowing memory space for the machine-code routines and also for some drawings. Memory addresses 50001 to 64511 (29001 to 31743) can be used to store pictures. The program *Store*, also listed in the May issue of *Computer Answers*, will help you do this. ○ After the CLEAR command, the next statement should be LOAD ""CODE, which loads in the *Movearea* program. The example program *Demo* in Fig. 2 should help clarify the procedure. ○ As a convention, your Basic program should start at line 200, so include the statement GOTO 200. ○ The subroutine in lines 4 to 11 of the *Demo* program feeds parameters to the *Movearea* program, to set the pictures size, co-ordinates, and speed of movement. Type in these lines exactly as they are in the *Demo* program, as the actual values are set later on in your Basic program. ○ The next thing to do is to work out the sequence of movements you wish the drawing to go through. This is added to the program in the form of a list of decimal numbers. Use the table in Fig. 3 to work out what these numbers should be. For example, if the

drawing should move 5 pixels up, the number to enter is $5 \times 4 + 2 = 22$. These numbers are POKed into successive locations in memory, starting at location 64512 (31744), and terminating in a zero. The movement sequence should not go beyond the address 64599 (31885). Note that none of the numbers poked should be greater than 255, as this is the maximum a byte can hold.

○ The movement sequence subroutine in your Basic program should be terminated by a RETURN.

○ Your program starts from line 200, and when a drawing is to be moved, the following lines of Basic should be included:

```
LET LENGTH = L
LET HEIGHT = H
LET DELAY = D
LET X = x
LET Y = y
GOSUB 25 : REM set up movement sequence
GOSUB 4 : REM move the drawing
```

Note that L and H are the length and height of the drawing in character sequences; x and y are the co-ordinates of the top left hand corner; x can be anything from 0 to 31, and y can be from 0 to 23 (0,0 is the top left hand corner of the screen); D is any number between 1 and 255, which determines the speed of movement. If D is set to 1 then the movement is fast, if it is 50 then it is quite slow, 255 gives very slow movement.

And that's just about it! Remember to save your program to tape before typing RUN just to be on the safe side. The computer will crash if you try to move a drawing down off the bottom of the screen, but if you move one off one side of the screen, it will reappear at the other side. The computer should not crash if a drawing is moved off the top of the screen, but the drawing will not reappear at the bottom. So, in general, be very careful about moving any picture off the screen.

When running your program for the second (or subsequent) time, type RUN 2 rather than RUN. This will avoid having to wait for the *Movearea* program to load, as it should still be there (unless your program inadvertently trampled all over it).

This is all you need to get going simple smooth movement, but there are a few limitations of the system that should be pointed out: first, it is only possible to move one drawing at once; and second a moving drawing will delete whatever is underneath it, so drawings cannot be moved over the top of one another. Very occasionally a drawing may split when changing direction. To correct this try altering the movement sequence slightly, or move a larger area of the screen.

The next stage is to add colour. To start off with it is probably best simply to stick with blank INK on white PAPER. Colours have to be set for one character position (fore and background colour), it is not possible to set the colour of one individual pixel. This makes full colour animation difficult, with some of the strange changes in colour that you see when playing some commercial games programs. The June '84 issue of *Computer Answers* explains the programs more fully.

In addition to *GR3* and *Store* from the May issue, *Movearea* is also compatible with the 48K version of the *Missile* machine-code program from the June issue and the *Spacesnds* program also listed in this issue on page 48. To make the 16K versions compatible, alter the 16K version of *Missile* by subtracting 240 from every number over 32198 in the program *Mslmkr*.

Try varying some of the values, such as HEIGHT and LENGTH to get a better idea of what *Movearea* can perform.

FIG. 2
DEMO

```
1 CLEAR 50000: LOAD ""CODE
2 GO TO 200
3 REM -----
4 POKE 65355,0: POKE 65356,252
5 POKE 65188,DELAY
6 POKE 65361,HEIGHT
7 POKE 65363,LENGTH
8 POKE 65360,Y
9 POKE 65359,X
10 LET M=USR 64612
11 RETURN
12 REM -----
13 REM movement sequences start here
14 REM -----
17 POKE 64512,20*4: REM LEFT
18 POKE 64513,20*4+3: REM DOWN
19 POKE 64514,20*4+1: REM RIGHT
20 POKE 64515,20*4+2: REM UP
21 POKE 64516,0
22 RETURN
23 REM -----
25 POKE 64512,5*32+3: REM DOWN
26 POKE 64513,3*32: REM LEFT
27 POKE 64514,6*32+1: REM RIGHT
28 POKE 64515,3*32: REM LEFT
29 POKE 64516,5*32+2: REM 3 UP
30 POKE 64517,0
31 RETURN
32 REM -----
33 REM space for more
34 REM movement sequences
199 REM -----
200 BORDER 5
201 PRINT AT 10,10: "*"
203 LET LENGTH=4: LET HEIGHT=4
204 LET Y=10: LET X=8
205 LET DELAY=20
206 GO SUB 17: GO SUB 4
208 REM -----
209 PAUSE 50: CLS : LIST 201
210 LET LENGTH=15: LET HEIGHT=5
211 LET Y=7: LET X=10
212 LET DELAY=1
214 GO SUB 25: GO SUB 4
215 PAUSE 30: GO TO 214
```


To achieve smooth animation, rather than just smooth movement the drawing can be altered using the GR3 program listed in our May issue. To move, for example, a walking figure across the screen with the y co-ordinate fixed and the x co-ordinate varying, the following loop should be implemented:

```

Initialize X and Y co-ordinates;
Loop: { Draw a figure with legs apart at position
        X,Y;
        Move a block of the screen (starting at X)
    
```

right by one character square;

LET X=X+1

Goto Loop

These utilities should take a lot of the drudgery out of programming your own games, so you can concentrate on the creative element. The important aspect of them is that you can take advantage of the speed of machine-code, without having to write a single line of it.

By Stephen Fowler, a computer programmer.

FIG. 3 MOVE NUMBER TABLE

If s = number of squares that are to be moved, then POKE the following values:

Direction	Number
Left	$S \times 32$
Right	$S \times 32 + 1$
Up	$S \times 32 + 2$
Down	$S \times 32 + 3$

If P = number of pixels that are to be moved, then POKE the following values:

Direction	Number
Left	$P \times 4$
Right	$P \times 4 + 1$
Up	$P \times 4 + 2$
Down	$P \times 4 + 3$

Example: if the drawing is to be moved three character squares up followed by two pixels left, then the two numbers that would need to be POKEd are 98 and 8.

The programs listed in Fig. 1 and 2 are for the 48K Spectrum. If you require 16K listings send us an SAE marked '16K Graphics' at our usual address, and we will forward 16K versions to you.

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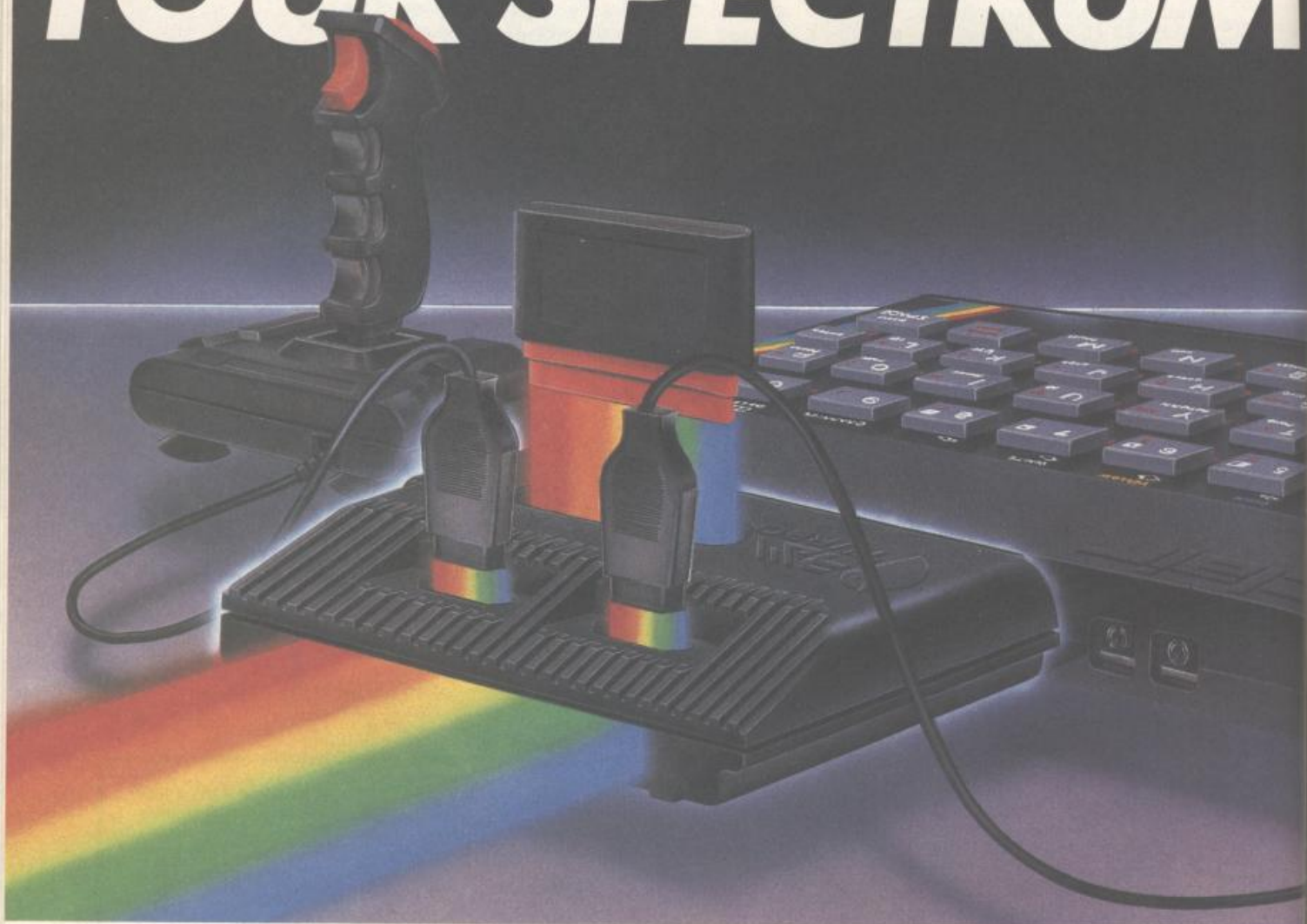
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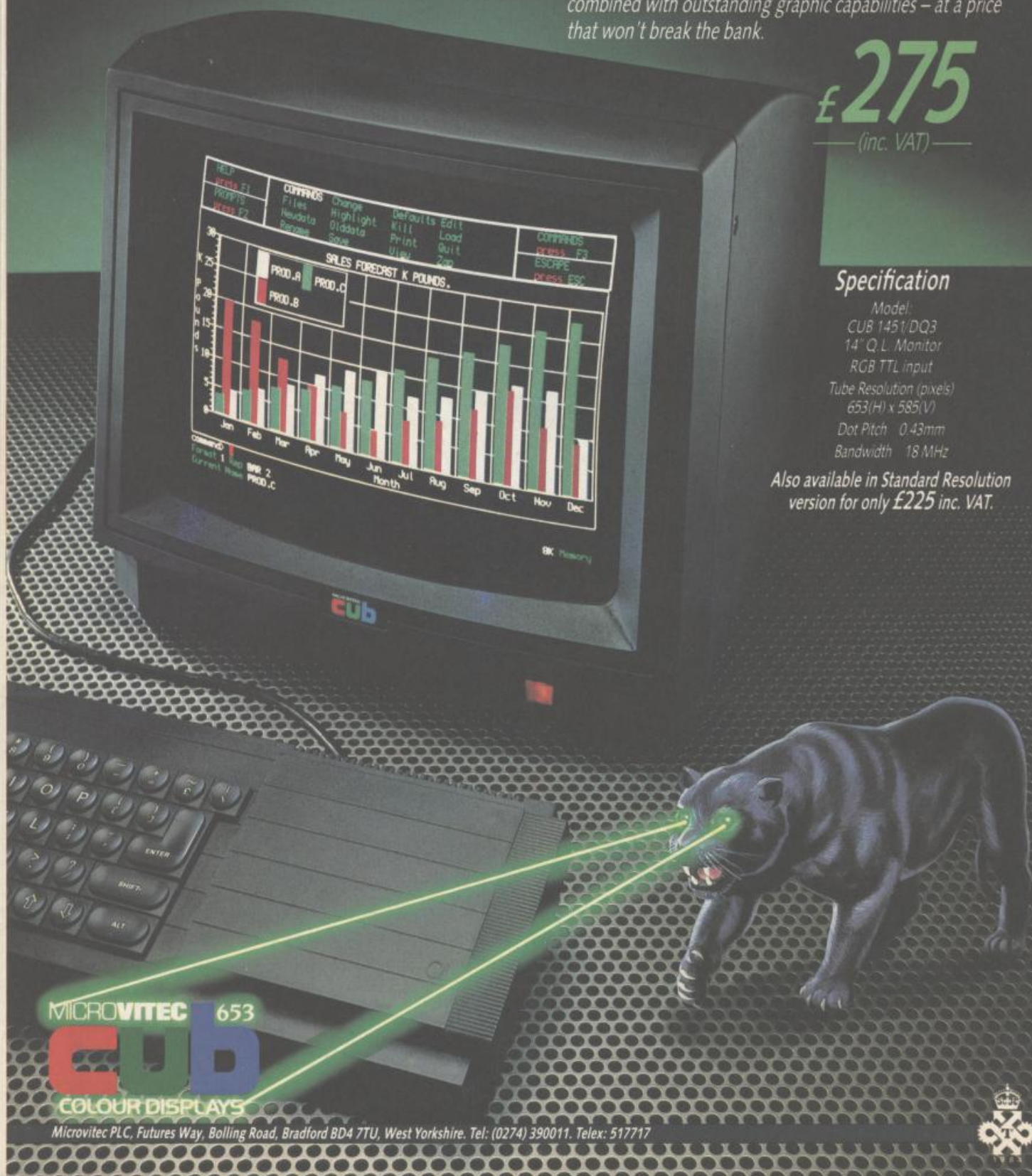
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TURNING TO TURTLE

**TURTLE GRAPHICS ARE ONE OF THE QL'S GREATEST ASSETS—
BUT WHAT ARE THEY, AND WHAT CAN THEY DO?**

The number of powerful and unusual features contained within the Sinclair QL is so long that it can give you a headache just reading the manual. Trying to think of all the clever things you could do if only you grasped this or that point a little more clearly is almost guaranteed to send you to bed early with a couple of Panadol.

Part of the problem is that it's frequently impossible to 'translate' standard techniques from other machines because there are no direct, (or even indirect) equivalents, so here we're going to introduce some of the more unusual features of the QL via some turtle graphics, which are at once easy to think about and remarkably powerful!

For those unfamiliar with the ideas of turtle graphics, we'll start with a brief description of the principles of drawing pictures with a turtle. The turtle is an (imaginary) animal, which can, on command, be moved around the screen. It has a pen slung beneath it which can be lifted (PENUP) so that it doesn't draw a line when it moves, or dropped (PENDOWN) when we want it to show where it's been. The turtle adopts the standard navigational notation and can be given a heading (told which direction to face) with the command TURNTO. TURNTO 0 will make it face right, TURNTO 90 will point it up, TURNTO 180 will head it left, and so on.

The command TURN will move it through a number of degrees from its current heading, thus TURNTO 90: TURN 20 would give it a final heading of 110. The command MOVE will move the turtle in a straight line on its current heading, finally POINT can be used to set the turtle down wherever you want on the screen. These are the only turtle commands in SuperBasic and some of them are slightly different from those on other turtle systems.

Now to drawing something on the screen. On the QL, you draw something in a window which may be anywhere on the screen and may occupy any portion of it. This is linked to an output command by means of a channel. Fortunately we don't have to worry about this to start with, because the QL sets up default conditions. So far as we are concerned, the default window is the whole screen organised as a conventional graph, with a y scale of 0-100 and an x scale of 0-166, linked to channel 1.

First we need to place the turtle at an arbitrary point in the window, say near the centre, facing in a particular direction, say right. We may want to repeat this operation frequently so we write it as a procedure:

```
1000 DEFine PROCedure centre
1010 POINT 83,50
1020 TURNTO 0
1030 END DEFine centre
```

This kind of construction will be familiar to Beeb freaks, but less so to those brought up on a more conventional Basic. Essentially, a procedure is a named subroutine. It doesn't need a RETURN, although one can be inserted if you want to leave the procedure before its end. Notice that DEF PROC and END DEF appear in upper case letters. When you key

in statements, SuperBasic recognises keywords, often before they are completed, and displays them with the unique characters only in upper case. Thus you could write: 1000 defproc centre or 1000 def proc centre or 1000 define procedure centre, and SuperBasic will generate exactly the same result 1000 DEFine PROCedure centre). This makes it easy to see if you have inadvertently used a keyword as a variable name, because it will be displayed in upper case. To call the procedure, you simply key in 'centre' either as a program line or as an immediate command.

Now we'll write a procedure called 'square' which will draw a square of side length 1:

```
1100 DEFine PROCedure square (1)
1110 LOCAL n
1120 FOR n=1 TO 4
1130 MOVE 1
1140 TURN 90
1150 END FOR n
1160 END DEFine square
```

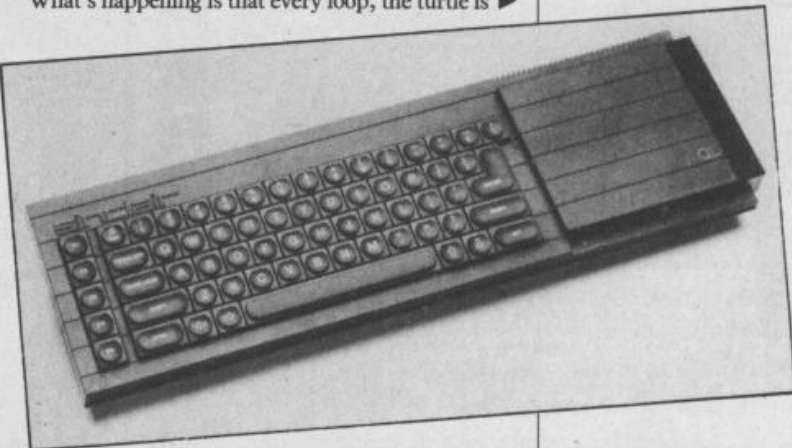
The procedure is self explanatory. It simply moves the turtle a distance 1 which will be passed to it as a parameter, then turns through a right angle, repeating the whole process four times. However, there are two new things to notice: first, since n is just a counter in this procedure, we don't want it to interfere with any other 'n' which might be referred to elsewhere in a program — so we declare it to be LOCAL to square and we can use n anywhere, and the two n's will not be confused; second, the clause terminator END FOR n is usual. It is like NEXT n is unusual. It is like NEXT n in other Basics (but NEXT n also exists in SuperBasic and has a subtly different meaning!).

To test square, you could write: CLS:PENDOWN:centre:square 40 and you'll get a square of side length 40 drawn. Now try this:

```
1200 DEFine PROCedure rot_square(s,1)
1210 FOR angle=0 TO 360 STEP s
1220 centre
1230 TURN angle
1240 square 1
1250 END FOR angle
1260 END DEFine rot_square
```

What's happening is that every loop, the turtle is ►

The turtle is an (imaginary) animal, which can, on command be moved around the screen. Most turtle SuperBasic commands are similar to other turtle systems.



PROGRAMMING

SuperBasic turtle routines can contain calls to themselves — what is known as a recursive procedure.

recentred, turned through an increasing angle and then made to draw a square. Since the process goes through a complete rotation (360°) you get a circular pattern. Try, for instance, CLS:rot_square 24,30 and CLS:rot_square 12,30. The latter gives a kind of paper doily effect. Here's another possibility:

```
1300 DEFine PROCedure squiral (n)
1310 MOVE n
1320 TURN 90
1330 LET n=n-1
1340 IF n<2 THEN RETURN
1350 squiral n
1360 END DEFine squiral
```

This routine contains a call to itself! This is a common technique in some languages, although not in common or garden Basic because, while it isn't actually illegal, it's difficult to keep track of the parameters. It's known as a recursive procedure. What happens in this is that it starts by drawing a line of length n, reducing n by 1, and turning through a right angle. Then it calls itself, which will draw a shorter line, reduce n, turn through a right angle, and so on, gradually building up a kind of square spiral (hence the name).

Now for the clever stuff. We said at the beginning that we're really outputting to a window rather than the screen, although so far the two things have seemed to be the same; however, we'll now separate them. We can define a window to be of a particular size and in a certain place on the screen, and associate it with a channel, like this for instance: OPEN#5,scr_50x100a80x90.

This sets up a screen window (scr_ is the standard name for the screen) to pixels wide and 100 pixels deep, with its top left hand corner at the point (80,90). Now try: PAPER#5,1;CLS#5.

This sets the paper colour on channel 5 to 1 (blue), and then clears the window associated with channel 5. (So CLW would be a better mnemonic than CLS). You'll see a block of blue appear.

Windows can overlay each other. (Try OPEN#6,scr_100 x 100a120 x 120:PAPER#6,4;CLS#6. Now we can use our existing functions (with a slight modification) to draw the shapes we've developed in windows, rather than on the whole screen. For instance, squiral becomes:

```
1300 DEFine PROCedure squiral (n,ch)
1310 MOVE#ch,n
1320 TURN#ch,90
1330 LET n=n-1
1340 IF n<2 THEN RETURN
1350 squiral n,ch
1360 END DEFine squiral
```

Now squiral 20,5 will draw a squiral in the blue window, but squiral 20,6 would produce one in the green window (assuming that is, that you have first put the pen down with PENDOWN#5 and PENDOWN#6 and positioned the turtle appropriately) — you don't even have to think about the scale of the drawing. Each window has a default height of 100 units (obviously, these units are not the same as pixels), and the horizontal scale is adjusted automatically so that, for instance, circles do not get flattened. You can alter the scale and the co-ordinate centre if you want to.

In principle (although not inside the SuperBasic) it's even possible to get these two processes to execute simultaneously.

Naturally, we haven't the space to extoll all the virtues of the QL, but hopefully this has given you a taste of its style.

By Robin Jones, a computer author and lecturer.

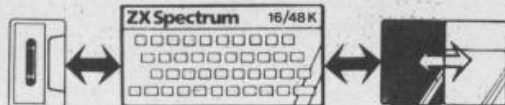
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the system is a major contribution to code safety.

Checksumming works in a number of ways, all based on mathematical manipulations on the value of the data being checked. This is possible because all data, be it a set of program commands or data that the program will work with, is stored in memory in the form of numbers. At machine level this is binary numbers, though for human convenience these are usually turned into decimal or hexadecimal numbers.

One method of checksumming is to add up all the values of the data together. For example, if we had the data 12, 18, 14, 15, 16, 5, 55, 45 we would count

NB: in Fig. 1 for '££' key in '##'.

FIG. 1
BASIC
LOADER

```

2 CLS : GO SUB 80
3 LET a=x
4 LET cs=0: GO SUB 4000: PRINT x$;" ";
10 FOR z=1 TO 8: GO SUB 60: IF a$="##" THEN GO
TO 1
12 LET cs=cs+PEEK a
15 LET a=a+1: NEXT z
20 LET x=cs: GO SUB 4000: PRINT CHR$(8);: PRINT
FLASH 1;x$: FLASH 0: PRINT
30 LET x=a: GO TO 4
60 INPUT "hex :"; LINE a$: IF LEN a$<>2 THEN GO
TO 60
61 IF a$="##" THEN RETURN
62 IF a$="££" THEN STOP
63 GO SUB 100
65 IF e=1 THEN GO TO 60
66 POKE a,x: PRINT a$;" ";
70 RETURN
80 INPUT "addr:"; LINE b$: IF LEN b$<>4 THEN GO
TO 80
83 GO SUB 90
84 IF e=1 THEN GO TO 80
85 LET x=t*256+x: LET a=x
89 RETURN
90 REM two byte hex input
93 LET a$=b$(1 TO 2)
94 GO SUB 100: LET t=x
95 LET a$=b$(3 TO 4)
100 REM one byte hex input
104 LET e=0
200 LET l=FN x(2): IF l>15 THEN LET e=1
300 LET h=FN x(1): IF h>15 THEN LET e=1
400 LET x=h*16+l
500 RETURN
2000 DEF FN x(n)=CODE a$(n)-48-(CODE a$(n)>57 AND
CODE a$(n)<71)*7-(CODE a$(n)>96 AND CODE a$(n)<103
)*39
4000 REM two byte input
5000 LET h=INT (x/256): LET l=x-h*256
6000 LET x=h: GO SUB 7000
6020 LET x=l: GO SUB 7900
6030 RETURN
7000 LET x$=""
7900 LET p=INT (x/16): GO SUB 8000: LET p=x-(INT (
x/16))*16
8000 REM hex
8010 IF p>9 THEN LET a$=CHR$(p+CODE "A"-10)
8020 IF p<=9 THEN LET a$=CHR$(p+CODE "0")
8030 LET x$=x$+a$
8040 RETURN
    
```

FIG. 2
16K

```

FA00: 21 0A 00 22 8B FB 21 0A <01FB>
FA08: 00 22 BA FB 2A 4B 5C 7E <02F6>
FA10: 32 1D FA 3E FF 77 CD 21 <03EB>
FA18: FA CD 80 FB C9 00 00 00 <040B>
FA20: 00 2A 53 5C 7E FE FF CB <041C>
FA28: E5 23 23 23 23 7E 23 FE <0310>
FA30: EA 2B 2B FE 0E 20 06 11 <0280>
FA38: 05 00 19 1B F0 FE EC 28 <0338>
    
```

```

FA40: 2A FE ED 2B 26 FE E5 2B <046E>
FA48: 22 FE F0 2B 1E FE E1 2B <045D>
FA50: 1A FE F7 2B 16 FE CA FE <0513>
FA58: 0D 20 D2 C1 1B C6 E1 23 <03A2>
FA60: 23 5E 23 56 19 23 1B BC <020A>
FA68: 1B F4 C9 CD 1C FB 20 FB <04D1>
FA70: 23 23 E5 5E 23 56 7B 32 <02AC>
FA78: 1E FA 4B 06 00 03 03 03 <016F>
    
```

```

FAB0: 03 A7 ED 42 22 1F FA CD <03E1>
FAB8: E3 FA E1 71 23 70 60 69 <04BB>
FA90: CD 3E FB 50 3A 1E FA 47 <03EF>
FA98: 7A 90 06 00 30 02 06 FF <0247>
FAA0: 4F E1 E5 23 23 5E 23 56 <0332>
FAA8: EB 09 EB 72 2B 73 2A 1F <0338>
FAB0: FA 00 CD CE FA 2A 1F FA <04D2>
FAB8: 00 CD 44 FB 1A FE 24 2B <0370>
    
```

```

FAC0: 05 77 13 23 1B F6 7E FE <033C>
FAC8: 0E CA 2D FA CF 0B 7B 3C <038A>
FAD0: 2B 04 CD 55 16 C9 06 00 <0233>
FAD8: 79 ED 44 4F E5 09 D1 CD <0485>
FAE0: E5 19 C9 ED 4B 8A FB 2A <04AE>
FAE8: 53 5C C5 7E 3C 2B 25 46 <02C1>
FAF0: 23 4E D5 EB A7 ED 42 2B <042F>
FAF8: 15 3B 13 EB 23 5E 23 56 <0245>
    
```

```

FB00: 23 19 D1 C1 E5 2A 8B FB <0460>
FB08: 09 4D 44 E1 1B DC D1 C1 <0401>
FB10: 3E 01 A7 C9 C1 00 00 00 <0270>
FB18: AF C9 CF 09 06 00 7E 23 <02F7>
FB20: FE 0E C8 FE 0D 2B 13 FE <041B>
FB28: 20 3B F3 FE 20 2B EF FE <047E>
FB30: 30 3B 07 FE 3A 30 03 04 <01DE>
FB38: 1B E4 3E 01 A7 C9 11 7B <0337>
    
```

```

FB40: FB CD 5E FB 11 7B FB 06 <04AE>
FB48: 04 1A FE 24 C8 FE 30 20 <0356>
FB50: 04 13 05 1B FA C9 EB 03 <02DC>
FB58: 64 00 0A 00 01 00 DD 21 <016D>
FB60: 56 FB DD 46 01 DD 4E 00 <03A0>
FB68: 3E 2F A7 3C ED 42 30 FB <03AA>
FB70: 09 12 13 DD 23 DD 23 0D <023B>
FB78: 20 EB C9 29 0B FE 27 24 <034E>
    
```

```

FB80: CD BC FB 3A 1D FA 77 C9 <04E5>
FB88: 00 00 00 00 2A 53 5C ED <01C6>
FB90: 5B BA FB ED 4B 8B FB 7E <0519>
FB98: 3C CB 72 23 73 23 EB 09 <0323>
FBA0: EB C5 4E 23 46 23 09 C1 <0354>
FBA8: 1B ED ED 56 C9 AF 32 70 <0462>
FBB0: FC 32 05 FD 3E FD ED 47 <049F>
FBB8: ED 5E FB C9 CD 3B 00 F3 <0507>
    
```


through and get the result 180. But this method has its shortcomings. What if we typed in 12, 18, 14, 15, 16, 15, 45, 45? We still get the checksum answer 180, yet we have a different set of data which could generate a dramatically different set of results. Also consider the order of the data. There's no easy way of producing a checking method for that!

To limit this cancelling effect on the checksum it is wise to produce a checksum for smaller chunks of data, say groups of 100 bytes. However, this only reduces the problem, it doesn't make it disappear. So when using checksums, beware that through some rare fluke you may have typed in different data with exactly the same checksum. And don't always rely on the code being typed in correctly because the checksum is right; save your code before executing.

There are other ways of doing a checksum, though adding the data is the most popular way. You could multiply the values, divide them — perform any mathematical function you like.

We have used the exclusive OR method. The logic of the exclusive OR (EOR for short) may be hard to grasp if you haven't encountered fairly advanced maths or logic. It works like this.

Take p and q to be sentences, or mathematical propositions. p EOR will only be true if one of them is true and the other false. For example, p could be replaced with 'the sun is shining', and q with 'it is dark'. These can't both be true or false at the same time.

In binary terms, 1 EOR 0 and 0 EOR 1 produces the result 1, and both 1 EOR 1 and 0 EOR 0 yields 0.

Our checksum program starts off with the first byte in the data being EORed with 0 (so, if the first byte is 10101010, the result is the same). Then the next byte is checked, but this time not against zero but against the new value, in our case 10101010.

Say the second byte is 10110110, then the result is worked out as follows:

```
10101010
EOR: 10110110
```

00011100

00011100 is then EORed with the third byte, and so on until the chunk of data is checked. The result is a byte that should match the checksum value we will

FIG 3
48K

```
FBC0: F5 C5 D5 E5 D9 08 F5 C5 <060F>
FBC8: D5 E5 DD E5 3A 70 FC A7 <05C9>
FBD0: 20 45 3A 46 5C FE FF 20 <035E>
FBD8: 4B 3A B2 5C FE 20 20 44 <02E5>
FBE0: 3A B3 5C FE 17 20 3D 3A <02C5>
FBE8: 0B 5C FE 0D 20 36 2A 49 <0238>
FBF0: 5C 7D B4 2B 03 CD 8F FC <0410>
FBF8: 3E 04 32 70 FC 32 73 FC <03B1>
```

```
FC00: DD 21 32 FC DD E5 E1 22 <04F1>
FC08: 6E FC 32 70 FC 2A 49 5C <03D7>
FC10: 11 0A 00 19 22 71 FC 3A <01FD>
FC18: 70 FC 3D 32 70 FC 2A 71 <03E2>
FC20: FC CD 3A FC DD E1 E1 D1 <066F>
FC28: C1 F1 D9 0B E1 D1 C1 F1 <05F7>
FC30: FB C9 EB 03 64 00 0A 00 <031D>
FC38: 01 00 DD 2A 6E FC DD 4E <039D>
```

```
FC40: 00 DD 46 01 3E 2F A7 3C <0274>
FC48: ED 42 30 FB 09 CD 5B FC <04B7>
FC50: DD 23 DD 23 DD E5 E1 22 <04C5>
FC58: 6E FC C9 22 71 FC 0B 3A <0404>
FC60: 73 FC A7 CB 0B 32 0B 5C <037C>
FC68: 21 3B 5C CB EE C9 00 00 <033A>
FC70: 00 00 00 00 00 AF AE 23 <01B0>
FC78: AE 23 4E AE 23 4E AE 23 <0307>
```

```
FC80: 0B 0B AE 23 0B 0B 7B B1 <021D>
FC88: 20 F7 0B 26 00 6F C9 2A <02A7>
FC90: 49 5C CD 6E 19 2B 0A ED <031B>
FC98: 56 FD CB 01 AE E1 C3 24 <0495>
FCA0: FC CD 75 FC CD C2 FC FD <06C2>
FCAB: 7E 0E 0F 0F 0F E6 07 4F <01F5>
FCB0: 21 03 5B FD 7E 0E E6 FB <03E3>
FCB8: B1 4F 3E 20 71 2C BD 20 <02DB>
```

```
FCC0: FB C9 AF 32 73 FC 22 71 <04A7>
FCC8: FC 11 34 FC ED 53 6E FC <04E7>
FCD0: 11 00 40 2A 71 FC CD 3A <02EF>
FCD8: FC C5 0B CD E3 FC C1 0D <0543>
FCE0: 20 F1 C9 F5 3A 05 FD A7 <04B2>
FCE8: 2B 03 F1 D7 C9 F1 ED 4B <04E5>
FCF0: 36 5C 6F 26 00 29 29 29 <01A2>
FCF8: 09 D5 06 0B 7E 23 12 14 <01B3>
```

```
FD00: 10 FA D1 13 C9 00 2A 4B <032C>
FD08: 5C 3A 1D FA 77 00 00 AF <02D3>
FD10: 32 05 FD FB C9 3E 02 CD <0405>
FD18: 01 16 1B 05 3E 03 CD 01 <0143>
FD20: 16 2A 4B 5C 7E 32 1D FA <02AE>
FD28: 3E 01 32 05 FD 36 FF 2A <02D2>
FD30: 53 5C 7E FE FF CA 06 FD <04F7>
FD38: E5 CD 55 1B EB 3E 20 D7 <043F>
```

```
FD40: 3E 3C D7 E1 D5 CD 75 FC <0545>
FD48: CD C2 FC 3E 3E D7 3E 0D <0429>
FD50: D7 E1 1B DE BC FB CD 3A <056C>
FD58: FC C5 0B CD E3 FC C1 0D <0543>
FD60: 20 F1 C9 F5 3A 05 FD A7 <04B2>
FD68: 2B 03 F1 D7 C9 F1 ED 4B <04E5>
FD70: 36 5C 6F 26 00 29 29 29 <01A2>
FD78: 09 D5 06 0B 7E 23 12 14 <01B3>
FDFF: BC FB <01B7>
```

```
7C9C: 21 0A 00 22 24 7E 21 0A <011A>
7CA4: 00 22 26 7E 2A 4B 5C 7E <0215>
7CAC: 32 B9 7C 3E FF 77 CD BD <04A5>
7CB4: 7C CD 1C 7E C9 00 00 00 <02AC>
7CBC: 00 2A 53 5C 7E FE FF CB <041C>
7CC4: E5 23 23 23 23 7E 23 FE <0310>
7CCC: EA 2B 2B FE 0E 20 06 11 <02B0>
7CD4: 05 00 19 1B F0 FE EC 2B <0338>
```

```
7CDC: 2A FE ED 2B 26 FE E5 2B <046E>
7CE4: 22 FE F0 2B 1E FE E1 2B <045D>
7CEC: 1A FE F7 2B 16 FE CA FE <0513>
7CF4: 0D 20 D2 C1 1B C6 E1 23 <03A2>
7CFC: 23 5E 23 56 19 23 1B BC <020A>
7D04: 1B F4 C9 CD BB 7D 20 FB <04EF>
7D0C: 23 23 E5 5E 23 56 7B 32 <02AC>
7D14: BA 7C 4B 06 00 03 03 03 <01BD>
```

```
7D1C: 03 A7 ED 42 22 BB 7C CD <03FF>
7D24: 7F 7D E1 71 23 70 60 69 <03AA>
7D2C: CD DA 7D 50 3A BA 7C 47 <042B>
7D34: 7A 90 06 00 30 02 06 FF <0247>
7D3C: 4F E1 E5 23 23 5E 23 56 <0332>
7D44: EB 09 EB 72 2B 73 2A BB <03D4>
7D4C: 7C 00 CD 6A 7D 2A BB 7C <0391>
7D54: 00 CD E0 7D 1A FE 24 2B <03BE>
```

```
7D5C: 05 77 13 23 1B F6 7E FE <033C>
7D64: 0E CA C9 7C CF 0B 7B 3C <03AB>
7D6C: 2B 04 CD 55 16 C9 06 00 <0233>
7D74: 79 ED 44 4F E5 09 D1 CD <04B5>
7D7C: E5 19 C9 ED 4B 26 7E 2A <03CD>
7D84: 53 5C C5 7E 3C 2B 25 46 <02C1>
7D8C: 23 4E D5 EB A7 ED 42 2B <042F>
7D94: 15 3B 13 EB 23 5E 23 56 <0245>
```

```
7D9C: 23 19 D1 C1 E5 2A 24 7E <037F>
7DA4: 09 4D 44 E1 1B DC D1 C1 <0401>
7DAC: 3E 01 A7 C9 C1 00 00 00 <0270>
7DB4: AF C9 CF 09 06 00 7E 23 <02F7>
7DBC: FE 0E CB FE 0D 2B 13 FE <041B>
7DC4: 20 3B F3 FE 20 2B EF FE <047E>
7DCC: 30 3B 07 FE 3A 30 03 04 <01DE>
7DD4: 1B E4 3E 01 A7 C9 11 17 <02D3>
```

```
7DDC: 7E CD FA 7D 11 17 7E 06 <036E>
7DE4: 04 1A FE 24 CB FE 30 20 <0356>
7DEC: 04 13 05 1B F4 C9 EB 03 <02DC>
7DF4: 64 00 0A 00 01 00 DD 21 <016D>
7DFC: F2 7D DD 46 01 DD 4E 00 <03BE>
7E04: 3E 2F A7 3C ED 42 30 FB <03AA>
7E0C: 09 12 13 DD 23 DD 23 0D <023B>
7E14: 20 EB C9 00 00 00 00 24 <01F5>
```

```
7E1C: CD 2B 7E 3A B9 7C 77 C9 <0422>
7E24: 00 00 00 00 2A 53 5C ED <01C6>
7E2C: 5B 26 7E ED 4B 24 7E 7E <0357>
7E34: 3C CB 72 23 73 23 EB 09 <0323>
7E3C: EB C5 4E 23 46 23 09 C1 <0354>
7E44: 1B ED 00 00 00 00 ED 56 <024B>
7E4C: C9 AF 32 10 7F 32 A5 7F <03BF>
7E54: 3E 2B ED 47 ED 5E FB C9 <04A9>
```


have printed in the magazine. Our checksum program is written in machine code, and includes the auto line number and renumber facility — essential utilities for the serious programmer.

The auto line number inserts an incrementing line number automatically at the beginning of each line ready for you to type in the program statements. The renumber allows you make all the line numbers in the program (including those embedded in GOTO and GOSUB) increment by a set amount (for example, by tens). Both utilities can be used with any program.

There are two listings, one for the 16K and the other for the 48K Spectrum. A word of warning. This program works on interrupts and may crash if another peripheral (such as a Kempston joystick) is on the back of the Spectrum.

Type in the Basic loader (Fig. 1) for both the 16K and 48K Spectrums remembering to save a copy to tape. After typing in the Basic loader type CLEAR 31888 for the 16K, or CLEAR 63988 on the 48K. Run the program and input the hex data Fig. 2 for the 16K and, Fig. 3 for the 48K.

The listing is printed out into blocks for easier reading. The first number on each line is the address where the data should be inputted. The hex number in the angle brackets is the checksum for that given line.

The Basic loader will give a checksum on every line of input, indicated by a flashing two byte hex number, so you will be able to check against the hex listings. If you have made a mistake type in '\$\$' when asked for data, and the monitor will ask you for the start address you wish to edit.

Enter the data in hex, copying the appropriate hex listings given for your machine (depending on whether it's 16K or 48K). Please check each block of data with the checksum given. Once you have finished exit from the Basic program by typing '##' when prompted for hex input.

Before running the program SAVE the machine-code first. to SAVE on 16K machines type: SAVE "TOOL" CODE 31900, 931. On the 48K model type: SAVE "TOOL48" CODE 64000, 1028.

Now you're ready to run. Type: CLEAR 31900 (CLEAR 63990 for 48K). Then type: LOAD "" CODE 31900 (48K machines: LOAD "" CODE 64000). Your program is now ready and waiting.

To start the renumbering routine on the 16K model, type: RANDOMIZE USR 31900, or for 48K: RANDOMIZE USR 64000 (48K).

This defaults to renumber with starting line 10 and increasing in steps of 10. But if you wish to change this, select the appropriate POKE from the list below, replacing the variables (like LOW STEPNUMBER) with the appropriate decimal number. The 'LOW' and 'HIGH' are there because the step size and start number (both currently set at 10) are stored in two bytes, LOW and HIGH.

In the unlikely event that you want a number in either case over 255 (which in binary is the highest value of a byte — 11111111), then you will have to use the HIGH byte, otherwise ignore it. Note that the program will not renumber properly if the numbers are greater than 10,000, so alter the steps accordingly.

16K models:

POKE 31901, low step-number
POKE 31902, high step-number

POKE 31907, low start-number

POKE 31908, high start-number

48K models:

POKE 64001, low step-number
POKE 64002, high step-number

POKE 64007, low start-number

POKE 64008, high start-number

The start the auto line number on the 16K models, type: RANDOMIZE USR 32333, or for 48K: RANDOMIZE USR 64429.

Then type the startline. After each ENTER the program will automatically produce the next line number.

After each line entered you will see on the right hand side of the screen a number in angle brackets. This is the all important checksum. You check this

FIG. 3
48K
CONTINUED

```
7E5C: CD 38 00 F3 F5 C5 D5 E5 <056C>
7E64: D9 08 F5 C5 D5 E5 DD E5 <0617>
7E6C: 3A 10 7F A7 20 45 3A 46 <0255>
7E74: 5C FE FF 20 4B 3A 82 5C <03DC>
7E7C: FE 20 20 44 3A 83 5C FE <0399>
7E84: 17 20 3D 3A 08 5C FE 0D <021D>
7E8C: 20 36 2A 49 5C 7D B4 28 <027E>
7E94: 03 CD 2F 7F 3E 04 32 10 <0202>
```

```
7E9C: 7F 32 13 7F DD 21 D2 7E <0391>
7EA4: DD E5 E1 22 0E 7F 32 10 <0394>
7EAC: 7F 2A 49 5C 11 0A 00 19 <01B2>
7EB4: 22 11 7F 3A 10 7F 3D 32 <01EA>
7EBC: 10 7F 2A 11 7F CD DA 7E <036E>
7EC4: DD E1 E1 D1 C1 F1 D9 08 <0603>
7ECC: E1 D1 C1 F1 FB C9 E8 03 <0613>
7ED4: 64 00 0A 00 01 00 DD 2A <0176>
```

```
7EDC: 0E 7F DD 4E 00 DD 46 01 <02DC>
7EE4: 3E 2F A7 3C ED 42 30 FB <03AA>
7EEC: 09 CD FB 7E DD 23 DD 23 <044F>
7EF4: DD E5 E1 22 0E 7F C9 22 <043D>
7EFC: 11 7F 08 3A 13 7F A7 C8 <02D3>
7F04: 08 32 08 5C 21 38 5C CB <0221>
7F0C: EE C9 00 00 00 00 00 00 <01B7>
7F14: 00 AF AE 23 AE 23 4E AE <034D>
```

```
7F1C: 23 46 AE 23 08 08 AE 23 <021B>
7F24: 08 08 78 B1 20 F7 08 26 <0281>
7F2C: 00 6F C9 2A 49 5C CD 6E <0342>
7F34: 19 28 0A ED 56 FD CB 01 <0357>
7F3C: AE E1 C3 C4 7E CD 15 7F <04F5>
7F44: CD 62 7F FD 7E 0E 0F 0F <0355>
7F4C: 0F E6 07 4F 21 03 58 FD <02C4>
7F54: 7E 0E E6 FB B1 4F 3E 20 <03C8>
```

```
7F5C: 71 2C BD 20 FB C9 AF 32 <041F>
7F64: 13 7F 22 11 7F 11 D4 7E <02A7>
7F6C: ED 53 0E 7F 11 00 40 2A <0248>
7F74: 11 7F CD DA 7E C5 0B CD <044F>
7F7C: 83 7F C1 0D 20 F1 C9 F5 <049F>
7F84: 3A A5 7F A7 28 03 F1 D7 <03F8>
7F8C: C9 F1 ED 4B 36 5C 6F 26 <0419>
7F94: 00 29 29 29 09 D5 08 08 <0167>
```

```
7F9C: 7E 23 12 14 10 FA D1 13 <02B5>
7FA4: C9 00 2A 4B 5C 3A B9 7C <0309>
7FAE: 77 00 00 AE 32 A5 7F FB <0377>
7FB4: C9 00 00 00 00 00 00 00 <00C9>
7FBC: 00 00 00 00 00 00 00 00 <0000>
7FC4: 00 00 00 00 00 00 00 00 <0000>
7FCC: 00 00 00 00 00 00 00 00 <0000>
7FD4: 00 00 00 00 00 00 00 00 <0000>
```

```
7FDC: 00 00 00 00 00 00 00 00 <0000>
7FE4: 00 00 00 00 00 00 00 00 <0000>
7FEC: 00 00 00 00 00 00 00 00 <0000>
7FF4: 00 00 00 00 00 00 00 00 <0000>
7FFC: 00 00 00 00 3E 02 CD 01 <010E>
8004: 16 18 05 3E 03 CD 01 16 <0158>
800C: 2A 4B 5C 7E 32 B9 7C 3E <02F4>
8014: 01 32 A5 7F 36 FF 2A 53 <0309>
```

```
801C: 5C 7E FE FF CA A6 7F E5 <05AB>
8024: CD 53 18 EB 3E 20 D7 3E <0398>
802C: 3C D7 E1 D5 CD 15 7F CD <04F7>
8034: 62 7F 3E 3E D7 3E 0D D7 <0356>
803C: E1 18 DE 00 00 00 00 00 <01D7>
8044: 00 00 00 00 00 00 00 00 <0000>
804C: 00 00 00 00 00 00 00 00 <0000>
8054: 00 00 00 00 00 00 00 00 <0000>
```

Our checksum program is written in machine code, and includes the auto line number and renumber facility — essential utilities for the serious programmer.

against the number printed in the same fashion in the listing in the magazine.

If the numbers match, you can be fairly certain that you haven't made any typing errors. If the numbers don't match, check carefully through the line, trying to spot those obscure but often damaging little errors.

But remember, even the smallest change will alter the value of the checksum, even if it won't alter the running of the program (for example, if you re-worded or shortened a REM statement).

In order to stop entering the program, just press ENTER straight after the line number. If you wish to turn the auto line function off at any time, type: RAND

OMIZE USR 32330 for 16K models, or for 48K: RANDOMIZE USR 64426.

Note that when entering the program the first line will not be listed to the screen. To produce a full listing to the screen with checksums, type: RANDOMIZE USR 32768 for 16K models, or for 48K: RANDOMIZE USR 64789.

To produce a checksum listing to the printer type: RANDOMIZE USR 32775 on 16K models, or for 48K: RANDOMIZE USR 64796. A summary of the POKEs and USR calls are given in Fig. 4.

By John Wilson, a computer programmer.

FIG. 4

Function:

Starting up:
Loading

(Note that you can use the program name between the inverted commas in the LOAD statement.)

Renumber:

Enable
Change step

Change start

Auto line and checksum:

Enable
Disable
Change step

Listing program plus checksum:

To screen
To printer

16K addresses:

CLEAR 31888
LOAD "" CODE 31900

RANDOMIZE USR 31900
POKE 31901, low step
POKE 31902, high step
POKE 31907, low start
POKE 31908, high start

RANDOMIZE USR 32333
RANDOMIZE USR 32330
POKE 32433, low step
POKE 32434, high step

RANDOMIZE USR 32768
RANDOMIZE USR 32775

48K addresses:

CLEAR 63988
LOAD "" CODE 64000

RANDOMIZE USR 64000
POKE 64001, low step
POKE 64002, high step
POKE 64007, low start
POKE 64008, high start

RANDOMIZE USR 64429
RANDOMIZE USR 64426
POKE 64529, low step
POKE 64530, high step

RANDOMIZE USR 64789
RANDOMIZE USR 64796



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The QL finally arrived; no real specification for SuperBasic was published. The information that was given was almost entirely fictitious and bore no resemblance to the finished product. At the launch, managing director Nigel Searle promised impressive things, like 'Multi-Tasking from Basic' and 'pull down windows'. These things, although entirely possible, are extremely difficult to do. The QL can multi-task, but not Basic programs, and as for Pull down windows — these were obviously soon thrown out the window. As soon as Sinclair decided to drop the GST operating system in favour of Tony Tebby's in-house, but more concise, one.

SuperBasic's main advantage spreads from the fact that it was designed with expansion in mind, and from the innovative ideas on procedures and functions. On most other versions of Basic where procedures have been implemented, it is necessary to spell out. PROCthing to inform the computer that you wish it to call up a named subroutine from somewhere. In SuperBasic it is simply used as if it were an existing command. A Basic exists that truly allows definitions of new commands. It is almost Forth-like in ideology.

The same is true for functions, as these are almost identical. The former are used for defining new commands, while the latter allows new constants and equations to be added to Basic's vocabulary. These are added to SuperBasic through the use of the DEF PROC and DEF FN statements. On the screen, SuperBasic tidily displays DEFINE PROCEDURE and DEFINE FUNCTION, respectively — a nice touch.

SuperBasic contains some interesting and novel features — for example, array slicing and long variable names. The array slicing features can be very useful for database programs. If any array has been dimensioned, then the entire array can be accessed globally via its variable name. Typing DIM A(100) followed by PRINT A1, for example, would result in a screenful of 100 zeroes. This is because the entire array has been printed in a single command. Also, since SuperBasic tries to zero out each element of an array when you dimension it, this can sometimes mean waits of as much as a minute or two on the part of the user.

There is one peculiarity in global array usage: on typing DIM A(100) and then PRINT A * 2 you will be greeted with the rather cryptic message: Not implemented. We understand from the programmers that this was never an advertised feature, but merely one that they hoped to implement on a rainy day. Let's hope it rains soon on Sinclair City because that feature could be most useful.

Other niceties that caught our eye are high

mathematical accuracy, and 'type-coercion'. Type-coercion is a concept that has been adopted from other languages and slyly inserted into SuperBasic. It takes a little while to get used to but once you catch on, it has endless possibilities.

In simple terms, coercion allows variable types to be freely mixed. That means the older Basic's commands: 'STR\$', 'VAL' (converting numbers to strings, and back again) are no longer necessary, as all types of variables can be used in all ways. It suddenly makes sense to say PRINT A \$ * 2 (so long as A \$ contains numbers). Just imagine how confusing the statement: PRINT A \$ + B \$ is going to be! Does it mean 'add' A\$ and B\$ together? Or does it mean 'concatenate' them? The simple answer is yes to both. If the strings could be evaluated numerically then they will be summed; alternatively, if they were alphabetic then they will be concatenated.

To alleviate the problem of 'What if I wanted to concatenate two numeric strings, there is a new operator for us called Amersand (&). This implicitly informs SuperBasic to concatenate, regardless of the contents of the string-variable.

SuperBasic feels most at home with large programs and long variables, and will usually beat the BBC in terms of speed when those conditions apply. BBC Basic is optimized for speed, and is most at home with short variable names and short programs. The big test will come with a big program — say something of 20K in length (The QL would be even faster than the Beeb with large programs, but the Beeb can't handle anything much larger than 25K!)

The BBC can perform an empty loop from 1 to 10000 in under seven seconds; the QL does the same loop in 18 seconds. The BBC does not perform quite so well when there is something inside the loop, and this must be taken into account. There is also an interesting omission from SuperBasic — there are no useful integer variables! Integers are only available when dimensioning numeric arrays, but these serve to reduce space rather than increase speed. In fact, integers are even slower on the QL than their floating-point counterparts. This is due (oddly enough) to the silly way that SuperBasic converts integers to floating-point before processing them — and then re-converts them back again.

There is one final feature on SuperBasic that we have yet to find on any other Basic: it is extremely extensible. There are commands (albeit in machine code) for adding statements to Basic's vocabulary. These are more than procedures; they are proper extensions to Basic, with proper interfacing techniques. Documents are available from Sinclair that explain the hows and whys.

All in all, SuperBasic looks promising and could quite easily become a standard Basic. It will take quite some pushing to shift the BBC's rock-solid place in the educational sector, but Sinclair firmly believes their machine will get into the educational market from the top-down.

By Jeremy San, a freelance technical writer.

GETTING TO GRIPS WITH 'TOOLKITS'

Good utility programs are worth their weight in gold — they're time, effort, money and (at their best) sanity savers. Few computers are in need of sanity savers more than the Sinclair Spectrum, so we investigated two new packages from Timedata, called *HI-T* and *Toolkit*.

First *HI-T*, a 'screen enhancer'. This is a small 1.5K machine code program that allows a programmer to use a new pre-defined character set. All 133 characters of the Spectrum have been redesigned to fit into a 4 by 6 matrix of pixels. The normal characters are defined in an 8 by 8 matrix — this means that the new characters are half the width of the normal ones, so twice as many can be printed along a line. The *HI-T* letters appear very small in comparison, and letters such as W and M would be difficult to distinguish if printed on their own, without the help of a word.

The small characters can be printed quite easily, and can be combined with normal characters on the screen. To access them all that is required is an additional '#4' in PRINT and INPUT statements; for example: 10 PRINT #4; "Small characters" 20 INPUT #4; "Type your name:";n\$

In line 20, both the prompt and the typed name will appear in the *HI-T* lettering.

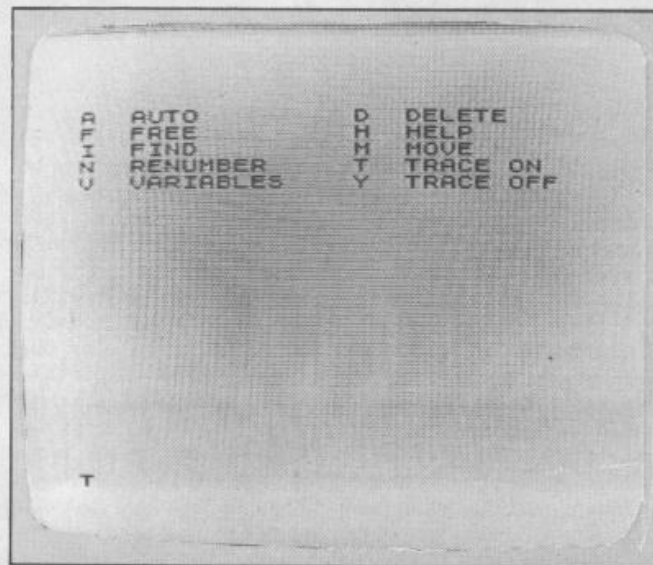
The 'AT' statement can be used to place text, scrolling is automatic and tab positions can also be defined.

A text window can be set up, that will separately scroll from the main screen. This is done by printing (though you don't see anything) a string that contains a selection of character codes; for example, CHR\$ 1 + CHR\$ tw will set the top of the window to 'tw'. There are similar commands for setting the bottom, right and left sides of the window.

Another interesting feature is that *HI-T* supports superscripts and subscripts. Again a pair of character codes is used to move following characters up or down by 1 to 5 pixel positions.

Finally, it is possible to define your own graphics characters, using the 4 by 6 matrix. Up to 21 of these can be set up, and a small routine is given in the manual showing how these can be POKED into the right locations in memory.

HI-T offers a new, small,



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character set with fairly complete set of routines to manipulate it. These routines are easy to use, and do not take up a lot of space. However, on the negative side, some of the letters can be difficult to make out and makes reading from a TV screen a bit more of a strain.

HI-T would have to be incorporated into an applications program as it is being written. Although the utility has been professionally done, we do not really see many niches in the market crying out for the features it offers. It costs £5.95 (inc. VAT and P/P).

The second package we looked at is called *TT-S* (Timedata's *Toolkit* for the Spectrum). It consists of five main programs: an extension to Basic, a hi-res screen drawing utility, a program to create udg characters, a RAM test, and a program to give information about the files held on cassette tape.

The Basic extensions include Auto, Renumber and Delete — three commands that programmers have found to be of great use, and sadly missing from Spectrum Basic. In addition to these there is a find command to locate all the occurrences of a particular string, printing out the line numbers where it is found. A help function prints

out the extra commands available.

Another very valuable command is one to move a block of lines from one place to another. The syntax for this command is quite straight forward, for example: Move 100,200 To 50,5 will move the lines numbered 100 to 200 and place them at line 50, with line increments of 5.

A trace function will print out a line of diagnostics at the bottom of the screen as it is being run, including such information as the current line number, current statement number (as more than one can be on a line), and information on any variable specified in the trace statement. This extra command, unlike the others, is most useful when included in a program. There is also a parameter which sets a delay between the execution of each statement, which gives you time to read the diagnostic line. An excellent feature of this is that the delay can be set to single step mode, only moving on to the next command when a key is pressed.

The last two commands, Variables and Free, give information on the free memory left and the variables currently being used by a Basic program.

The extra commands added by loading this program are accessed by typing 'symbol-shift' and 'O' on the Spectrum keyboard (see picture, left). A 'T' then appears on the screen, and a single letter will invoke the command (such as A for Auto and N for Renumber). If you've forgotten the single letter, pressing H (for Help) will list them. All in all we were impressed by the commands made possible by this program.

TT-S also includes a hi-res screen drawing utility. Shapes are drawn by moving a cursor round the screen, plotting or not as it is moved. The cursor is made up from two dotted lines stretching the full width and height of the screen. The arrow keys move the lines 1 pixel at a time, and various other commands allow the ink and paper attributes to be changed. It is also possible to print text on the screen in any specified position, and also to fill any object with a specified colour. Screens can then be saved onto tape. Other commands allow a single point to be plotted, a line to be drawn or deleted and user defined characters to be loaded and used.

One thing that struck us about this utility was its ease of use. In the April issue of *Answers* we reviewed two graphics utilities, *Paint Box* and *Melbourne Draw*, and found neither of them particularly easy to use or well explained in their manuals. Although they had extra graphics development utilities, for just designing and saving a colour screen this one proved to be quite adequate and much less fiddly to use. Unless you were looking for a feature not present in Timedata's screen program, we would recommend it in preference to either of the other two packages mentioned.

The *Toolkit* package costs £7.95 (inc. VAT and P/P), and is highly recommended for Spectrum Basic programmers. By Dr Peter Turcan, editor.

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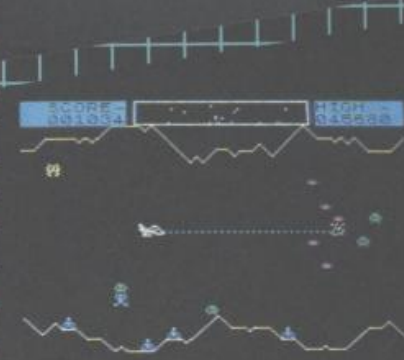
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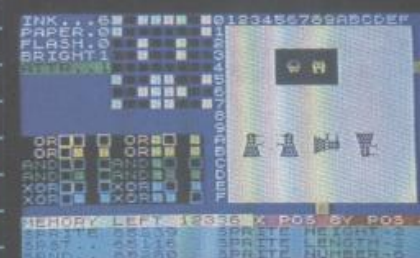
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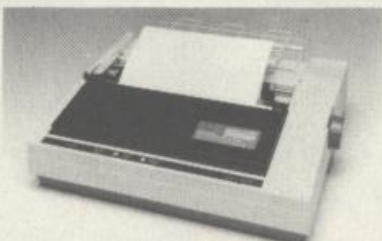
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MASTERING MICRODRIVES

THE MICRODRIVE SYSTEM OFFERS FAST, EFFICIENT DATA STORAGE RETRIEVAL — WE SHOW YOU HOW TO GET MORE OUT OF IT.

Although not the most outstanding backing store one could hope for, the Microdrive does represent a leap forward in cheap mass storage. Providing you already have an Interface 1, you can purchase extra Microdrives for under £50 — and that's not at all bad.

So what do you get for your money, and what can you do with them? To answer these questions it's necessary to compare the newcomer with the traditional method of storing programs — the cassette. The reason why cassette tape is not the best method of storing programs is because they were not designed for the purpose in the first place. It is sometimes argued that high-quality audio tape should be fine for storing programs, but this is not totally true. The fact is that program tapes must have a more consistent layer of magnetic recording material, rather than just noise reduction features.

The second problem with cassettes is that they are slow in operation. The tape travels at three and a half inches per second, and to store programs on cassette so that they load faster means that the program has to be packed densely on the tape, as mentioned before, this can cause problems.

The Microdrive system consists of three parts: the Spectrum, the Interface 1 and the Microdrive itself. The Microdrive cartridge holds about five meters of glossy video tape that is 1.5 mm wide. The whole tape is in one continuous loop, and the mechanism within the Microdrive cartridge is very similar to that of the now defunct eight-track cartridges.

Before the Microdrive is used, there are some 'don't's' that should be observed. First, the glossy tape can be easily smudged and damaged, so don't touch the surface under any circumstances; also, keep the cartridge away from any magnetic source: the TV or monitor, and to an extent the Spectrum as well.

Cassette users will have no doubt come across the problem of tape that comes loose within the casing. This can — and quite often does — happen with the Microdrive cartridges, and the best way to protect against this is to ensure they don't get knocked about.

If you find that the tape is loose and you get a read error trying to load a program, do a couple of CATs, and this should tighten the tape up a little. On the other hand, it is possible to have problems with new cartridges. A microdrive cartridge can hold an average of up to 90K of program and data — 'can', because you sometimes get different amounts when formatting a cartridge. One of the reasons for this is because the tape in the new cartridge is stiff; formatting the same cartridge a couple of times can help to increase the maximum number of K per cartridge, and the program in Fig. 1 should demonstrate this.

You will notice that the screen flickers violently when a format/save/load is in operation; to avoid this, POKE the system variable IOBORD (23750) with a

number corresponding to the current PAPER colour.

The main reason for buying a Microdrive is to load and save programs and data faster than is possible with tape; you will, however, probably find some problems in transferring programs from cassette to Microdrive. If the programs you wish to transfer are your own, then they will most likely be in Basic, and this shouldn't cause too many problems. The only thing to remember is that programs that have more than one part will need their LOAD statements amended to incorporate the Microdrive syntax. Also note that ambiguous filenames " " are not allowed, and you will have to replace these with real names.

The Spectrum manual warns people from incorporating machine code within REM statements. This is good advice, because when an Interface 1 is attached to the Spectrum, it 'moves' the program area up in memory. The matter is further complicated as channels and streams are used; these move everything up further.

These facts are worth bearing in mind when developing software with the Microdrive attached to the Spectrum. Using the program in Fig. 2 as a subroutine will print a memory map of the Spectrum, from the start of the Microdrive maps to the end of the program area, it will also give information on the amount of memory left, as well as what the last device and stream was.

One of the major deficiencies with Microdrive file handling is that there is no random access; worse, you cannot append to an existing file, it has to be MOVED to another. Simply producing a new file from two existing ones by adding them together is not always the best solution — this is especially so with data files that have to be in order.

An example would be a couple of files that contained names and addresses: the problem is to 'blend' these files together to make one large file that is in order. This is called merging, and it can be done with just one Microdrive.

To demonstrate this, create two files, DATA1 and DATA2. In each file put some numbers that are in increasing order — both files can have different numbers and amounts in them; make sure, however, that the last number in each file is 99999. Next run the program in Fig. 3.

The algorithm for merging the two DATA files can be expanded to include more files. Also, it is possible to use strings and numeric variables in a record.

Finally, after using a particular cartridge for some time, it is noticeable that the access time grows. This is because programs and data saved are scattered over the file, instead of being saved in one block. The only way to remedy this situation is to transfer all programs and data to another cartridge: save programs first, then data and then arrays, which should speed up access time considerably.

By David Janda, a freelance computer journalist.

Fig 1
EXTRA K

```

100 REM Maximum 'K' FORMAT
110 CLS
120 INPUT "NAME OF CARTRIDGE ";n$
130 IF LEN n$>10 THEN PRINT "TOO LARGE" : GO TO 120
140 PRINT "INSERT NEW CARTRIDGE INTO M/D 1 AND PRESS THE 'F' KEY"
150 IF INKEY$<>"F" AND INKEY$<>"f" THEN GO TO 150
160 CLS
170 FOR c=1 TO 3
180 PRINT AT 0,0
190 PRINT "FORMATING ";n$;" ";c;" OF 3"
200 PRINT
210 FORMAT "m";1;n$
220 CAT 1
230 NEXT c
240 PRINT : PRINT "FORMAT COMPLETE"

```

Fig 2
MAP PRINT

```

9000 REM MAP
9010 CLS
9020 PRINT AT 1,7;"AREA";AT 1,18;"ST AD";AT 1,25;"SZ"
9030 PRINT AT 3,1;"MICRODRIVE VARS";AT 3,18;23734;AT 3,25;58
9040 PRINT AT 5,1;"MICRODRIVE MAPS";AT 5,18;23792;AT 5,25; (PEEK
23631+256*PEEK 23632)-23792
9050 PRINT AT 7,1;"CHANNEL INFO";AT 7,18;PEEK 23631+256*PEEK 23632;AT
7,25 (PEEK 23635+256*PEEK 23636)-(PEEK 23631+256*PEEK 23632)
9060 PRINT AT 9,1;"PROGRAM AREA";AT 9,18;PEEK 23635+256*PEEK 23636;AT
9,25; (PEEK 23627+256*PEEK 23628)-(PEEK 23635+256*PEEK 23636)
9070 LET s=(PEEK 23730+256*PEEK 23731)-(PEEK 23653+256*PEEK 23654) :
LET s$=STR$ (s/1024) : IF LEN s$>4 THEN PRINT AT 11,8;
"SPARE = ";s$( TO 5);"K" : GO TO 9090
9080 PRINT AT 11,8;"SPARE = ";s$;"K"
9090 PRINT AT 13,7;"LAST STREAM No.";PEEK 23768
9100 PRINT AT 15,8;"DEVICE TYPE ";CHR$ (PEEK 23769);""

```

Fig 3
FILE BLEND

```

10 REM MERGE-SORT
15 OPEN £5;"m";1;"DATA1"
16 OPEN £6;"m";1;"DATA2"
18 OPEN £7;"m";1;"DATA3"
20 GO SUB 100 : GO SUB 110
40 IF o<t THEN PRINT £7;o : GO SUB 100
50 IF t<o THEN PRINT £7;t : GO SUB 110
55 IF t=99999 AND o=99999 THEN PRINT £5;t : CLOSE £5 : CLOSE £6 :
CLOSE £7 : STOP
60 IF t=o THEN PRINT £7;t : GO SUB 100 : GO SUB 110
70 GO TO 40
100 INPUT £5;o : RETURN
110 INPUT £6;t : RETURN

```




THE
OFFICIAL

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JUMP CHALLENGE



If you've ever wondered how it feels to be Eddie Kidd... defying danger and gravity, soaring on a motor-bike over a long line of cars... here's your chance to find out!

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

SOLVE OUR 'CROZZLE' QUIZ AND WIN £15!

This month's Crozzle is in some ways similar to the hand-held 'Fifteens' puzzles which consist of a grid of letters that you have to shunt around until you get them into the right positions.

The Crozzle grid consists of a 7x7 matrix of letters (see Fig. 1), but there is no blank. The rules for movement are:—

○ On every move each letter shifts one place to the right, except for letters at the end of a line which move down to start the line below, and the letter in the bottom left-hand corner which moves up to the top right-hand corner.

As well as shifting according to the conditions above, on every move each letter goes one higher in the alphabet (so As become Bs, Ms become Ns, and so on, except for Zs, which start again as As).

To clarify these rules, and to provide a check that your program logic is working, Fig. 2 shows the grid obtained after the first move. As you will see the J in the top right hand corner of Fig. 1 (the starting grid) has moved one place to the right, and become a K in Fig. 2, and so on; also, the A at the end of the first line has moved down to start the second line, and become a B, and so on (NB: the Z at the end of the sixth line

starts the seventh line as an A — all Zs become As); and lastly, the 'Y' in the bottom left-hand corner moves up to the top right and becomes a Z.

Fig. 3 shows the grid obtained after the next move (from Fig. 2.)

Since there are 49 positions in the grid and 26 letters in the alphabet, a large number of grids will be generated from the starting grid by following the rules — one of these grids contains six seven-letter words (three are across and three are down) whose positions are indicated in the grid for you to use to submit your entry to the competition (below left).

In fact, the grid which holds the words is the only grid which has the letters 'CO' in the first and second position of the second line — as indicated in the entry form. So there is no need to risk eye-strain and a headache by looking at all the possible grids to find the one containing the words — you can identify this grid in your program.

To enter the competition, simply fill in the words where they occur and send this to:

Sinclair Answers editorial,
Crozzle,
62 Oxford Street,
London W1A 2HG.

Crozzle set by Henry Howarth.

The winner of the June Crozzle was M J Leonard of London — well done, £15 is on its way!

The winner of the July/August Crozzle was R J Paget, BFPO — congrats — another £15 will be with you soon!

FIG. 1

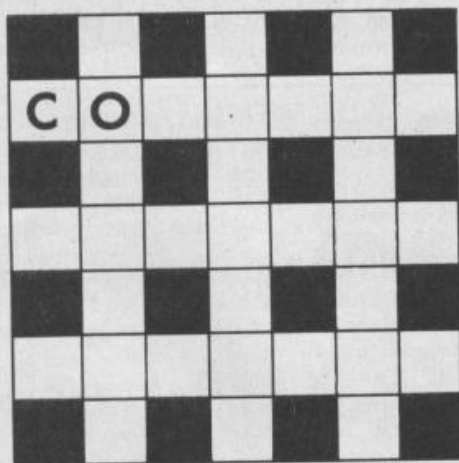
JIWRYYA
WXUKNUK
XXHTWWJ
HYJWFJR
TXAJWXX
TSNFTJZ
YJUWNSY

FIG. 2

ZKJXSZZ
BXYVLOV
LYYIUXX
KIZKXGK
SUYBKXY
OUTOGUK
AZKVXOT

FIG. 3

UALKYTA
ACYZWMP
WMZZJVV
YLJALYH
LTVZCLY
ZPVUPHV
LBALWYP

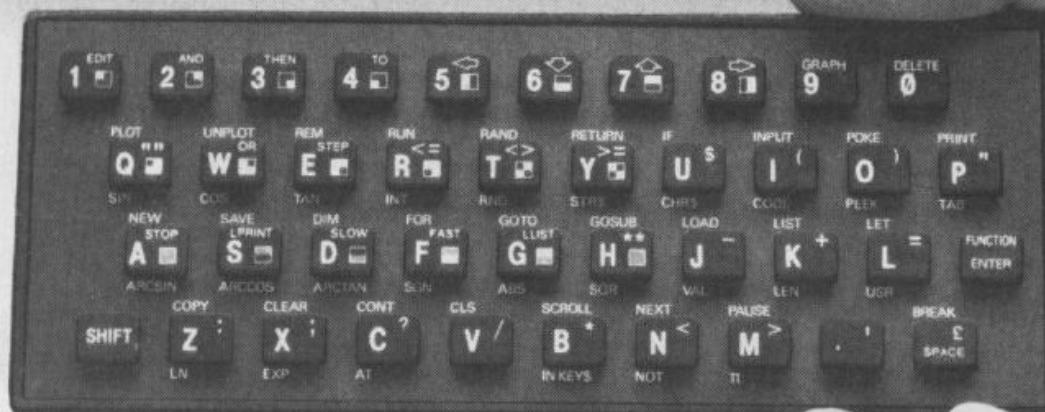


Send to: Sinclair Answers editorial, Computer 'Crozzle', 62 Oxford Street, London W1A 2HG. The winner will be the first correct entry drawn from a hat. The Editor's decision is final. Closing date 31 September 1984. Winners will be notified by post

NAME: _____

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Name

BLOCK CAPITALS

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UPGRADE LIABILITY

I intend to get my Spectrum upgraded from 16K to 48K at a local store — are there likely to be any problems with my guarantee in the future because of this?

Philip Saw, Surrey.

By opening the Spectrum's case you make the guarantee invalid, but the company doing the upgrade has to guarantee any work done by them for at least three months. As the kits used

As the kits used are similar to Sinclair's factory fitted ICS, there should be no problems after three months.

NOT ANY OLD PORT

I need to know which ports on the Spectrum correspond to interrupt modes 0, 1 and 2; also, could you say which is the cheapest digital joystick with a fire button?

John Caten, Essex.

Details on the interrupt modes will be found in any decent Z80 instruction book. We would recommend Nat Wandsworth's *Z80 Instruction Set*, published by Scelbi.

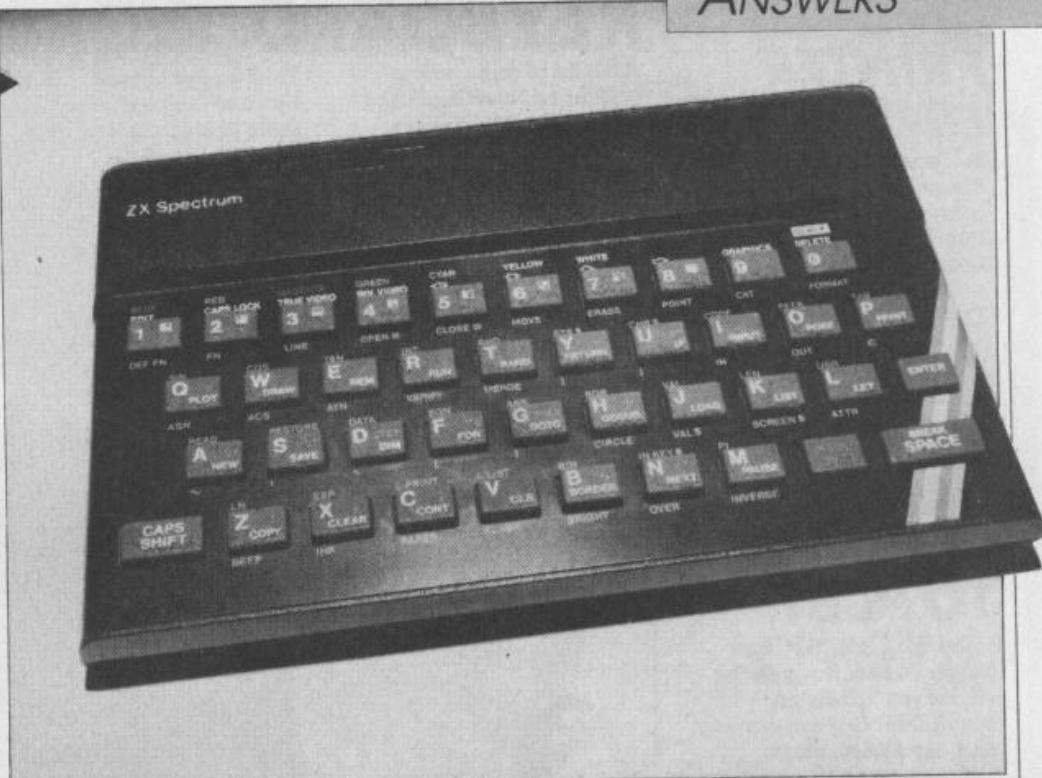
For information on joystick prices, see our '100 hardware Upgrades' article on page 8 of this issue.

COUNTING THE BYTES

The facility to check the number of bytes of memory still available is not available on my 16K Spectrum. I have read somewhere that it is possible to find the free memory by a simple routine — I think it was by POKEing or PEEKing certain memory locations — can you advise me?

G M Jones, Bristol.

PRINT (PEEK 23614*256 + PEEK 23613) - (PEEK 23654*256 + PEEK 23653) should tell you how many bytes are left (approximately). It uses two of the system variables STKEND (the end of all the memory used by the program) and ERR SP which is the bottom of the GOSUB stack (at the top of memory). The difference between them is the space left to be used. See page 165 of the manual for details.



SAVING DATA FILES

Can the 48K Spectrum use data files? If so, how are they created and read from? Also can a screen created by a graphics package be saved on cassette?

Frazer Davies, Sutton.

The ZX Spectrum can SAVE and LOAD arrays as DATA files (see page 143 in the manual) which can be MERGED into a running program. Also the variables may be saved on their own by clearing out the Basic program lines before SAVEing. These may then be MERGED back into the program in the same way.

Pictures may be SAVED by the use of the SCREEN\$ command detailed on the same page.

BEST RS232 LINK-UP

Which is the best way to connect an RS232 Interface 1 to a Tandy printer / plotter?

D Thomas, Port Talbot.

The RS232 on Interface 1 should be used connected to the serial input on the printer. The pin connections are listed for RS232 connectors in the Interface 1 manual. Set the number of stop bits to one (this is the amount of delay between each character).

DIY CONNECTIONS

Are there any DIY kits available to enable me to use the Brother EP22 printer with my Spectrum?

W Williams, Bradford.

When I visited Compec '83 I was impressed with the Brother EP22 printer. If so could it be connected with either the QL or the Spectrum using the ZX interface?

TITLE READING ROUTINE

Can you suggest a routine which will allow the ZX Spectrum to read the titles or programs stored on tape, and report them as a screen or printer list to be used as a catalogue?

If so, could this include a listing of the Block titles?

P Wells, Manchester.

You can use VERIFY "ZZZZ" to get all the names of programs listed on the tape. The 'ZZZZ' can be any name not on the tape. For the block titles a machine code routine is required, as the IX register is required to hold the address of a buffer in which to store the header details.

There are several commercial programs which include such a utility. See the review of the Timedata Toolkit in this issue.

Also, does the EP22 need special paper?

H Magri Overent, Wilts.

The EP22 printer has an RS232 25 way 'D' connector under a flap on the right hand side. This can be used to connect it to any computer by setting it to 300 baud, 1 stop bit (and using interface 1 on the Spectrum).

The EP22 uses thermal paper or plain paper (with a special cartridge ribbon). Connect the input pin 3 to the output from the computer and pin 20 to DTR on the computer.

MORE COLOURS

Is there any hard / software available to increase the number of fore / background colours on the ZX Spectrum? Is there any hard / software available for the Spectrum which can increase the number of UDGs available?

Keith A Gibb, Scotland

No, there isn't — the number of colours is fixed by the ULA, and cannot be changed. The whole character set can be moved into RAM thus giving as many UDGs as you like by altering the system variable CHARS (23606 and 23607). This should be moved above RAMTOP allowing eight bytes for each of the 256 characters.

PRINTER LINK-UP

Is it possible to connect my Spectrum to an Atari 1027 printer? If so, what interface will I need, and how much will it cost?

Steven Dewley, London.

The Atari 1027 is an RS232 device, and so requires an RS232 interface for the ZX Spectrum. Interface 1 from Sinclair would do, or there are others available from about £50.

CAN I CONNECT TO PCB?

I find the EAR, MIC and power connections on the rear of my Spectrum unreliable. Is there any way to make a permanent connection on the machine to help?

Peter Hewett, London.

Soldering the wires direct to the printed circuit board would seem to be the only solution to your problem.

ENTER THE ROM

Could you supply me with the entry points in the ROM for the following functions: BEEP, SCREEN, ATTR, PLOT, DRAW and CIRCLE.

Edward Marcus, Stowmarket.

We suggest you purchase a copy of Ian Logan's excellent book *Understanding Your Spectrum*, published by Melbourne House (priced £7.95), as certain entry variables have to be set for each routine.

NO SIGN OF ZODIAC

Can you please tell me of any 48K Spectrum software to give astronomical information?

RP Shore, Southampton.

We know of no program that can supply this information, but it could be compiled from tables obtained from the Royal Astronomical Society. Their address is given below.

RAS,
Burlington House,
London W1.
Tel: (01) 734 4502.

KEYBOARD WOBBLE

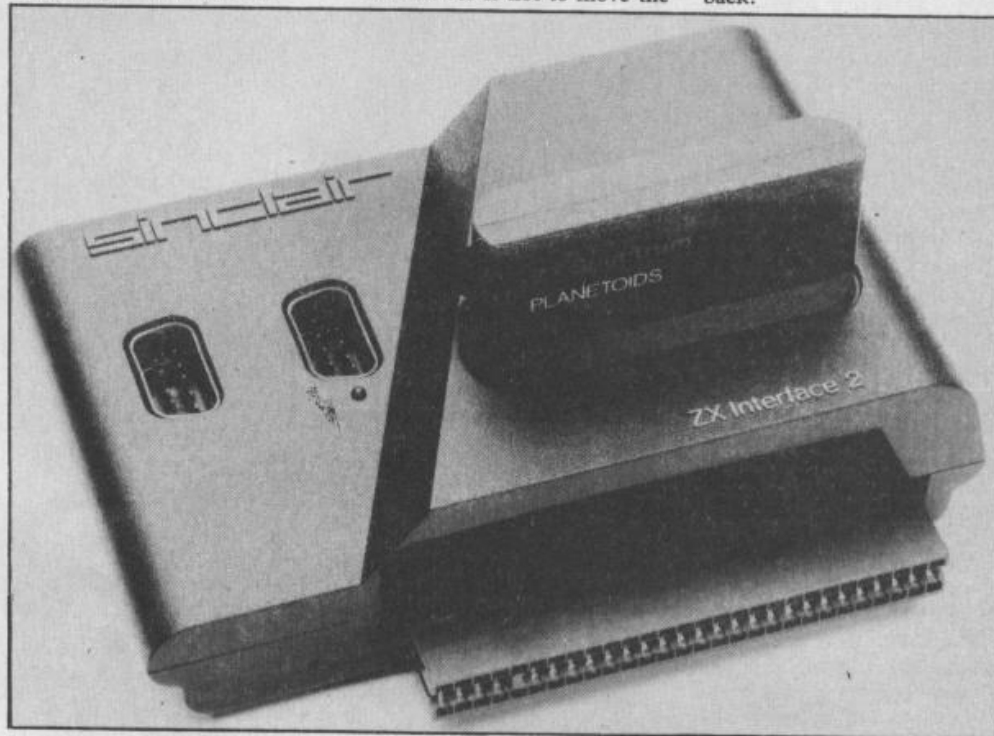
A friend of mine recently bought an Interface 2 and a games cartridge for his Spectrum, but it keeps crashing when ever the

keyboard is moved — is there anything that can be done to stop the wobble?

L Kirkwood, Poole.

The answer is not to move the

keyboard! The Interface 2 is designed to work with a joystick. If you feel that it still wobbles despite this, take it back.



HOW TO SIZE YOUR MEMORY

How can I tell if a Spectrum is 48K? What should I do if the Spectrum has broken though still under guarantee, but I have lost the receipt?

Chi Wah Yau, Birmingham.

PRINT PEEK 23733 will be 255 on a 48K Spectrum and 127 on a 16K version. Send back the Spectrum to Sinclair — they have a register of purchasers. State when and where you bought it.

DATA READING

Is it possible to read data from the MIC socket with the 48K Spectrum, and plot a graph on screen according to the amount of power fed in from tape recorder or microphone? If so, how?

M Hewitt, Cleveland

It is possible to read data from the EAR socket, but not advisable in Basic, as it is too slow. The EAR socket can be read by looking at Bit 6 of the keyboard port. The MIC socket is an output, and therefore cannot be

AUTO-RUN IDEAS

How do I make my programs run automatically? And how do I make them draw a picture while loading?

Andrew Walker, Kent.

To make programs run automatically, use the LINE command at the end of the SAVE command. When the program is LOADED it GOTOs the line number indicated instead of to the listing (see example below).

No picture can be drawn while LOADING, as the computer only does one command at a

time. Modern games designers, however, load a nice picture first, which gives the user something to look at while the rest of the program is loading using the SCREEN\$ command.

Example of autorun in Sinclair Basic:

○ Type in program; for example: 10 PRINT "SINCLAIR ANSWERS".

○ Save program to tape with: SAVE "prog" LINE 10.

○ When loaded, program will auto-run 'SINCLAIR ANSWERS'.

MEMORY MAPPING

What difference is there in memory mapping ROM (and so on) between the Spectrum Issue 2 and the Issue 3?

Richard Barnes, Kent.

There is no difference in memory mapping between any of the Spectrums, the difference is in the ULA chip, which acts as the cassette interface. Some programs will not work with Model 3s — return the copy of the tape and ask for a more up to date version which should work.

BLOCK DELETE

Can you delete more than one line at a time without ruining the whole of the program?

Mark Mavell, Herts.

One of the many omissions in the Spectrum Basic development system is the facility to delete a range of lines — so here is a short routine to get you started.

To produce the machine code routine, type in the loader program as listed and then run it. The loader program can be used on both 16K and 48K machines because it loads the routine relative to RAMTOP, the last byte of basic program space. If the loader runs OK, then a message will be produced which tells you the calling address of the routine.

In a standard machine this will be 65314 on the 48K, and 32546 on the 16K. If you have any other machine code routines loaded, then this may be different — write it down!

If an error message is produced, then there is an error in the data statements, and these must be checked before rerunning. After running the loader you can save the routine by typing SAVE "blockdel" CODE [calladdr], 55, where calladdr is the value printed by the loader program.

It might also be useful to save a small program such as:

```
10 CLEAR [calladdr]-1
20 LOAD "blockdel" CODE
...on the tape using the
command SAVE "lodbd" LINE 10
before the machine code routine
to autoloading it.
```

To execute the routine you type PRINTUSR [calladdr], first, last, where 'first' is the first line to be deleted, and 'last' is the last. For example, PRINTUSR [calladdr], 20, 100 will delete all lines from 20 to 100 inclusive.

If the first line does not exist, then the first one greater than 'first' will be the first deleted, and if the last line doesn't exist then the first line below 'last' will be the last deleted.

After typing this line one of four events will occur: the message 'Nonsense in Basic is printed', the routine was called without any line numbers, the other three return values are: '0', meaning that the first line number was invalid, either too large or non numeric; and '2', which means that the last number was invalid.

FIG.1
BLOCK DEL
ROUTINE

```
10 REM *****
11 REM
12 REM Block Delete
13 REM Loader program
14 REM 16K & 48K version
15 REM
16 REM *****
40 REM calc current value of ramtop
50 LET rt=(PEEK 23731)*256+PEEK 23730
59 REM make space routine
60 CLEAR rt-54
65 REM calc start of routine
70 LET ps=(PEEK 23731)*256+PEEK 23730+1
80 LET cs=0
90 FOR n=ps TO ps+54
100 READ b
110 POKE n,b
120 LET cs=cs+b
130 NEXT n
140 READ tot
150 IF tot<>cs THEN GO TO 320
160 PRINT "the routine has been"
170 PRINT "loaded ok. The calling address is ";ps
200 DATA 205,121,28,205,162
210 DATA 45,56,3,176,32
220 DATA 8,205,162,45,1
230 DATA 2,0,24,35,96
240 DATA 105,35,205,110,25
250 DATA 229,205,162,45,56
260 DATA 3,176,32,6,193
270 DATA 1,1,0,24,14
280 DATA 96,105,205,110,25
290 DATA 84,93,225,205,229
300 DATA 25,1,0,0,201
305 STOP
310 DATA 4842: REM This is the checksum for the d
ata statements
320 CLEAR ps+53
330 PRINT "ERROR in the data statements. Check th
e rerun"
```

The routine works by making calls to four routines within the Basic ROM. The first call gets the two values from the command line and puts them onto the calculator stack. The next call is to a routine which fetches a value from the stack, which is passed to a routine to find the address of this Basic line. Having done this for both line numbers, the routine to recover space is called with the two addresses as parameters.

By Richard Dickens, a computer programmer.

STICKY FIX-UP

How can I stop my Spectrum's keyboard surround coming apart from the main body of the machine?

Also, have you any idea where I can obtain the solution to *The Hobbit* (which has been driving me around the bend)?

Chris Cooper, Ayrshire.

Some kind of adhesive would probably be your best fix: try polystyrene cement (used for

model aeroplanes) or a brand of superglue.

As regards *The Hobbit*, the *Guide to Playing The Hobbit* should help you with this, now classic, adventure. It's priced £3.95, and is published by Melbourne House.

Melbourne House
(Publishers),
Church Yard,
Tring, Herts.

fantasy

SOFTWARE

"Ziggy turned, his fingers clutching the trigger of his capsule gun, something had startled him or had it?"

He looked back, he had grown very tired from his many exploits in THE PYRAMID negotiating 120 different chambers and coming face to face with some pretty nasty aliens.

No sooner than he had accomplished this mission, he was summoned by Time Lord Hamilton (known as Super Ham to his friends) to go to DOOMSDAY CASTLE and to save the Universe from the infinitely evil Scarthax, this being no small task took several megayears. By this time Ziggy was completely exhausted, his capsule battered, dented and wobbling as he limps in the direction of home, a real super hero of our time. Unable to leave the Universe undefended he radioed his great friend and colleague Beaky on the planet of Crackit to stand guard until his return.

Beaky would normally assume this role without a second thought, however he had his own problems to face for the dreaded Eggs snatchers had returned to threaten the very existence of his breed. Beaky's survival instincts do not allow him to leave Crackit until he has reared enough chicks to fight off the Eggs snatchers. In order to crack it, he must pass through 12 different stages each getting progressively harder.

So we have it, Ziggy returning home for a complete refit under the illusion that Beaky is defending the Universe, surely it can't take Beaky that long to secure his own species and when will Ziggy be back.....?"

SPECTRUM 48K:-

The Pyramid £5.50

Beaky & The Eggs snatchers £5.50

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ABSOLUTE BEGINNERS

FIRST IMPRESSIONS ARE IMPORTANT IN ANY RELATIONSHIP—
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SHOULD YOU GO ABOUT ACQUAINTING YOURSELF?

You've just rushed home clutching your brand new Spectrum, and are all fired up and rarin' to go, just one step away from *zap, blast, pow*, and 'highest score is'... You're about to become one of the computer people...

But, of course, there's a lot you need to learn before you can just work the thing, never mind write the ace successor to *Death Race* or *Manic Miner*; so the purpose of this article is to acquaint the Spectrum novice with the rudiments of getting up-and-running — from making those first connections to entering that initial command. So, to begin at the beginning...

Getting it out of the box: you might think this is absurdly obvious, but having all the bits and pieces that come with the basic machine is vital to getting underway. When you open the carton and lift off that polystyrene lid, you should find:

○ The Spectrum itself.

○ A black box with a thick wire coming out one side, and a long thin wire coming out the other. The latter wire will have either a white or a red strip running along it, and a metal plug at the end, and is the power supply unit.

○ A single black wire about two metres long, with a big fat plug at one end and another nearly-as-fat at the other: this is the TV lead.

○ A short, double wire, with two jack plugs — one black and one grey — at both ends: this is the tape recorder lead.

These four items are 100 per cent vital; the other stuff in the box — the two manuals, and the free cassette of programs — these are only about 90 per cent vital. If you have not got all of these items, stuff what you have got back in the box, go right back to the shop, and complain.

Now, having got all the bits, the next thing you need is a TV set. Any UHF, 625-line, 50cps set is fine. There is another check you need to make before you start plugging: make sure the make or brand of TV will work with the model of Spectrum that you have. Now by 'model' we're not talking 'is it a 16K or a 48K?' — what we mean is that there are three versions (or internal designs) of the Spectrum, called Model 1, Model 2, and Model 3. Models 1 and 2 do not work too well with certain makes of television — specifically, Grundig, Toshiba, or Hitachi.

On the other hand, you'll have no trouble at all with any set made by Sony — their KV 1400 UB for example, works a treat with the Spectrum, (and their KV 1430 UB has an extra aerial socket at the front for a computer, and which saves all that tedious plugging and unplugging).

If, however, you have a Model 3 Spectrum, there's no problem at all: when Sinclair modified the circuit a second time, they made it so Model 3 will work with any television.

So how do you tell which model you've got? Well, there are those people who will tell you it's all to do

with the keyboard, that if it's got those naffish, light-grey keys then it's Model 1, and if it's got nice, dark-grey keys, it's Model 2; and they'd be wrong.

The only way to tell, apart from opening the casing and checking the circuit design, is to peer into the expansion slot at the back: if you look closely at the bit of printed-circuit board protruding you can see 27 metal strips that run out towards the edge. If the gaps between these strips are as wide as the strips themselves, then you've got a Model 1; if the gaps are narrower, much narrower than the strips themselves, then you've got a Model 2; and if you look inside and can clearly see a piece of flat, shiny aluminium, which is the 'heat sink', you've got a Model 3 (it also helps that Model 3 says 'Model 3' on the bottom of the casing).

By now you are probably itching to get going, so go ahead and plug it all together as per the manual diagram (but don't be surprised if you don't get the nice neat set up depicted in the diagram).

The first time you meet, the Spectrum keyboard can be pretty daunting. Almost every key does at least five things, and there's 38 like that. How do you remember 190 commands and symbols at one time? The simple answer is: don't try. Familiarise yourself only with as many as you need to as you start to program.

The reason for this multi-function plethora is that when Sinclair designed the Spectrum, and it's predecessor the ZX81, the idea of 'keyboards' — whole word commands on one key — was to save time, especially for those who can't type. But it doesn't work out like that.

For example if you want INK, you have to press CAPS SHIFT and SYMBOL SHIFT together, then you have to hold down SYMBOL SHIFT, and then press "X"; on other computers you just type I, N, K.

But the Spectrum is cheap, it's popular, so you might as well get used to it; so here are some hints on overcoming the common key vexes.

○ When you see that flashing K, that's your clue that the Spectrum wants a Keyword. Keywords are in white.

○ When you want any of the symbols in red on the keys, such as +, &, £ and ?, or one of those ever-popular keywords, AND, OR, AT, STOP, NOT, STEP, TO, THEN, press SYMBOL SHIFT at the same time. Hint: it's also in red.

○ When you want any of the words in grEen, remember there's Extra work involved, so press CAPS SHIFT and SYMBOL SHIFT together, and the flashing K will change to a flashing E.

○ When you want any of the rEd keywords — the ones below the keys — it's even more Extra work. You have to press CAPS SHIFT and SYMBOL SHIFT together to get the flashing E, and then hold down SYMBOL SHIFT again. Hint: it's still in red.

○ To get the top row of 'only when I'm editing' commands — such as EDIT, start doing GRAPHICS, and DELETE — notice that these are in white, and



'I had no idea computing was so difficult!'

hold down CAPS SHIFT which is also in white.

You'll find it helps to practise these 'find the key' routines on their own, out of the heat of battle as it were. Then when you've got them 'wired in', you'll find you don't have to devote all your attention on the keyboard, and you can concentrate on the program.

Spectrum keys don't go 'plink' like grown-up computer keys do. Nor do they give that satisfying slight-resistance-then-give-in feel. To ensure you get adequate feedback when you've actually pressed a key, try this: press POKE 23609, 100 followed, of course, by ENTER. The keys on the keyboard should now give a fairly satisfactory 'beep' when you press any key.

How it works is this: the Spectrum actually makes a little clicking noise everytime you press a key anyway, and what you've done, in effect, is tell it, 'Hey, you know how you remember to go click? You go and look in address 23609, and find the number there, 0, which tells you to click for 1/255th of a second? Well, make that 100, and go beep for 100/255ths of a second. Ta.'

You can do other things to turbo charge your keyboard. For example, if you go POKE 23561, 20 (ENTER), keys start repeating faster. What you've done is cut the time the Spectrum waits to see if you really want it again from 35/50ths of a second to 20/50ths of a second.

And that's only for 'first repeat'. If you want to shorten the time *between* repeats, try POKE 23562, 2 (ENTER) and see what you get (you get a hair-trigger Spectrum that goes off like a machine gun). The only snag is that these three modifications get wiped from memory when you switch off and have to be done again every time you switch on.

There are tricks you can do during programming that make life easier too. For example, if you have:

```
10 CLS
20 PRINT "Give me a number", a
30 PRINT a
40 INPUT "give me another number", b
50 PRINT b
```

```
60 PAUSE 40
70 PRINT "The answer is"; a + b
```

With the little prompt sign '>' at line 20, and say you wanted to move down to line 70 to change it from 'The answer is' to 'Added together = ', then only a dummy would press CAPS SHIFT plus 6 (move down) five times. The faster way to do it is LIST 70, ENTER: and you get right there.

Likewise, if you have to edit a line or change it, the 'book' way is CAPS SHIFT plus EDIT, then when you've got the line in the working area, DELETE, DELETE, DELETE until the bit you want is rubbed out, then enter the correct stuff. But if you press the line number — say, 70, in the example above — and nothing else except ENTER, you wipe the whole line out. Then you can start afresh, which you may find is quicker.

Tricks like this are actually in the manual, but like so much of the information in that mighty tome, it's presented in such dry, factual style that you can easily miss them.

The trouble with the Spectrum manual — with all computer manuals — is that they're usually written by some back-room whizz-kid who knows the machine inside out, but who's forgotten what it's like to be a humble, raw beginner.

There are tricks to discover that aren't in the manual. One that's quite fun is how to make bits of program listing stand out in colour. For instance, if you had: 10 PRINT "Hello", and you wanted the word 'Hello' to stand out in red ink, then press 10 PRINT as usual, but then CAPS SHIFT and SYMBOL SHIFT together, followed by CAPS SHIFT and 2. 'Hello' will now be in red ink. to get back to black ink, press CAPS SHIFT and SYMBOL SHIFT, and then CAPS SHIFT and 0.

Now, according to the manual, you shouldn't really be doing that, since you're interrupting the strict logic of the Spectrum; but it's the kind of thing you can discover once you start to play around with it — which is what we think it's all about.

By Eric Robbie, a freelance writer.

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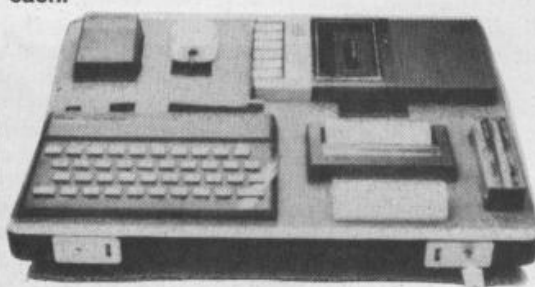
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LOGO SQUARES UP

LOGO IS EASY TO USE AND RESPONSIVE, SO IDEAL FOR THE YOUNG PROGRAMMER.

Using computers in education is fun, but having to learn a language like Basic can be frustrating for both teacher and pupil alike. Logo, the language specially developed with the young user in mind, is a much better alternative, and its success has spawned several versions for home micros, especially the Spectrum. We looked at one from LCSI/SOLI, a cassette-based package that comes with two manuals, and offers a wide range of facilities, from drawing simple lines to mathematics.

Logo's great virtue is that it uses plain English commands, rather than the convoluted syntax of Basic. For example, to draw a line in Basic you need to use DRAW, and then x and y parameters, whereas in Logo you use either LEFT or RIGHT to determine the slope of the line, then FORWARDN where N is the line length.

Logo's best feature, however, and the one that sparked most enthusiasm when it was introduced, is the ease at which complex graphics can be constructed with very little programming via the 'turtle'. Most people should have heard of the turtle by now — it's a small cursor that can be moved around on screen (some turtles are ground-based robots, and two commands, STARTROBOT and STOPROBOT, allow these to be used).

The turtle can be moved using plain English commands making it perfect for the educational environment. Drawing a square, for instance, is as simple as REPEAT 4 (FORWARD 50 RIGHT 90). By repeating the procedure several times, and moving the square through a small angle, some neat designs can be made. Virtually any shape can be defined in this way.

Most users will want to use their procedures more than once, so Sinclair Logo utilises several storage techniques. While the machine is switched on, all procedures can be stored and called directly. This is only a temporary measure, as all is lost when the power is disconnected, so putting everything onto cassette is a far better method if the procedures are going to be required again.

If some screen has been designed and it is required for further editing at a later date, SAVESCR "filename" can be used to put it onto tape. Microdrive owners will be pleased to know that there is no need to disconnect the Interface 1 before using Logo, as it has been made to operate with the little beasts.

One of Logo's great time savers, as in most languages, is the use of local and global variables. A local variable is input into a procedure before execution and only lasts until it stops running, while the latter works throughout a procedure and remains in memory even after the final statement.

In Logo, a local variable is defined in the title of a procedure with the colon. Say, for example, we define a square, but do not want it to have sides of any specific length. The variable :SIDE could be put into the procedure definition, telling Logo that each time a square is to be drawn, a number will be put in the container :SIDE. The complete procedure definition is then TO SQUARE :SIDE, and the statement to draw a square (SQUARE 20), where the number is the



side length, and can be anything the user chooses. Being able to define a shape in this way opens up whole new areas for the programmer, because it allows different shapes to be drawn easily and quickly, without the worry of correct DATA statements or arrays.

Global variables do not rely on an input before a procedure is executed, but on a variable definition which stands for any procedure. Logo regards a number as a word, so by saying MAKE "NUMBER 35, the computer will PRINT 35 whenever asked for NUMBER. MAKE, therefore, defines a variable which can either be a word or a number, and used in any procedure.

As mentioned, drawing is very simple under Logo. Colour can be added and changed with very little hassle, though the Spectrum's screen handling does not make it very good for more than one colour on any shape, as the attributes of a character change when a new colour is introduced.

Colour, procedures, different variables — Logo has it all. There's even a new sound command that tries to extend the Spectrum's range: although adding some clout to the machine's sound ability, this facility is still overshadowed by the fact that its basis is a simple 'beep'.

Finally, Logo's editing facilities will be invaluable to all; Sinclair Logo has a very comprehensive editor, allowing the programmer to alter any screen picture or procedure. It is possible to turn the cursor (or pen as it is called in Logo), into an eraser and move it along a line, getting rid of characters as it goes. The editing facilities of this Logo implementation are all anyone could ask for, and far better than those supplied in Sinclair Basic.

Fundamentally, Logo goes where Basic fears to tread, supplying facilities for drawing simple graphics to complex mathematics. With the current cutbacks in educational spending, authorities could do just as well getting a Spectrum and Sinclair Logo, as paying out for an expensive Beeb.

By Steve Applebaum, staff-writer.

Sinclair Logo (developed by Logo Systems Inc (1983) and Les Systemes D'Ordinateur Logo Internationale (1983)), is priced £39.95, and available from:
Sinclair Research,
25 Willis Rd,
Cambridge, CB1 2AQ.

PROGRESS IN PROLOG

WITH THE SPECTRUM PROLOG PACKAGE YOU CAN GET INTO EXPERT SYSTEMS THE EASY WAY.

The language Lisp is now available on a wide range of microcomputers, and it is becoming increasingly popular amongst the Artificial Intelligence and Expert System fraternity. However, many people, used to a more conventional language such as Basic, find Lisp difficult to use. But if you are interested in AI — but not on facing the rigours of Lisp — an alternative is now available: Prolog.



Prolog is a major rival to Lisp, and is currently being used as the basis for some of the work towards fifth generation computing. Generally, Prolog tends to be easier to use than Lisp, and it is far better suited to the generation of Expert Systems.

Micro-Prolog (from Logic Programming Associates) is available for the 48K Spectrum costing £24.95, for which you get a cassette containing the Micro-Prolog interpreter along with a number of utility programs, and a 300-page Primer which introduces the language to new-comers (the Micro-Prolog Reference Manual is also sold separately, and costs an extra £9.95.)

The Micro-Prolog language is loaded in the normal way, taking little over a minute, though you also have to wait for the title page and copyright message. If all goes well — we certainly didn't have any loading problems — you're informed that over 23K is still free and receive the standard '&' Micro-Prolog prompt. At this point, the introductory booklet suggests that you load the SIMPLE front-end

utility, which is the next program on the cassette. This is not absolutely essential in order to use Micro-Prolog, but it does make the language easier to understand, and it is used extensively throughout the Primer.

To load the SIMPLE utility, you merely type: LOAD SIMPLE. All the utility programs are written in Micro-Prolog, which is saved and loaded from tape in a number of small blocks. As each block loads, the message 'BLOCK OK' appears to tell you that it has loaded correctly, otherwise a 'READ ERROR' will be displayed. If this happens, it is a simple matter to rewind the tape a little, possibly altering the volume and tone controls, and just reload the erroneous block. This tape system does aid error recovery and, since the name of each block is displayed, finding programs on the tape is very easy. However it is slow — SIMPLE takes over two minutes to load its 26 blocks.

Having loaded SIMPLE, the introductory booklet guides you through the implementation of a small database of facts about the relative positions of four geometric shapes. The booklet then explains how to ask elementary questions and construct simple rules; after this, you move to the Primer which explains the basic features of the language in a logical step-by-step approach. Fig. 1 shows an annotated conversation with the interpreter.

The Primer does not appear to have been specially written for the Spectrum and contains 'system notes' explaining implementation-dependent features; however, these are fairly infrequent and do not detract from the clear writing style. Though it is realised that the Primer is not designed to be used for reference, one major omission is an index — it is very easy to find yourself frantically flicking through the book, trying to find that elusive page which you saw only a moment ago!

The Reference Manual is an essential purchase for anybody wanting to use the language seriously, or make full use of the utilities given on the cassette (which include tracing and error-trapping debugging aids and an alternative front-end, 'Micro' for more advanced users).

When using Micro-Prolog, all commands must be typed out in full, because there is no single key entry facility — a godsend to anyone who can type, but may not please all Spectrum users.

The main drawback with Micro-Prolog is that all programs are interpreted rather than compiled, making the execution time of large programs very slow. This is, however, only to be expected on the Spectrum, and should not prove to be a major problem to the average user.

Micro-Prolog is a wholly application-orientated package. If you're interested in Artificial Intelligence, would like to build your own Expert System, or simply want to learn a 'true high-level language', then Micro-Prolog is highly recommended. And don't be put-off by the price — the Reference Manual is well worth the price, and a must for the serious user.

By Marcus Jeffery, a computer consultant.

Micro-Prolog (priced £24.95) and Reference Manual (priced £9.95) are from Logic Programming Associates, and available from:

Sinclair Research,
25 Willis Road,
Cambridge CB1 2AQ.


```
&. add (Spectrum cheaper_than Commodore_64)
&. add (Commodore_64 cheaper_than BBC)
&. add (BBC cheaper_than IBM_PC)
```

(We have now given Prolog a few facts based upon 'cheaper_than'. We can list these facts out.)

```
&. list cheaper_than
Spectrum cheaper_than Commodore_64
Commodore_64 cheaper_than BBC
BBC cheaper_than IBM_PC
```

(We can now ask some questions.)

```
&. is (Spectrum cheaper_than Commodore_64)
YES
&. is (Spectrum cheaper_than IBM_PC)
NO
```

(Oh dear! We haven't told it this, and it's too stupid to realise. We could add all possible extra facts, but lets be clever and teach Prolog a rule.)

```
&. add (x less_than y if x cheaper_than y)
```

(This tells it that any object x which is cheaper_than y, is also less_than y.)

```
&. add (x less_than y if x cheaper_than z and z less_than y).
```

(This tells it that an object x is less_than an object y if an object z exists such that x is cheaper_than z and z is less_than y. This is a recursive definition.)

(Rules can be listed out.)

```
&. list less_than
x less_than y if
  x cheaper_than y
x less_than y if
  x cheaper_than z and
  z less_than y
```

(We can now correctly ask the above question using less_than)

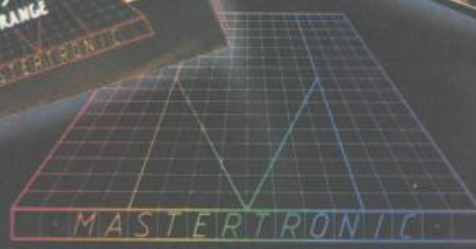
```
&. is (Spectrum less_than IBM_PC)
YES
```

(We could also find all the objects which are less_than another.)

```
&. which(x:x less than IBM_PC)
BBC
Spectrum
Commodore_64
No (more) answers
&.
( .....and so-on)
```

Prolog is based on facts and rules, as this Fig. 1 shows.

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Mike and Peter Gerrard are regular contributors to *Which Micro?* and *Personal Computer News*. Peter Gerrard is the author of many titles in the Duckworth Home Computing list, including the Exploring Adventures series, and contributes to *Popular Computing Weekly*, *Commodore Horizons* and *Micro Adventurer*.



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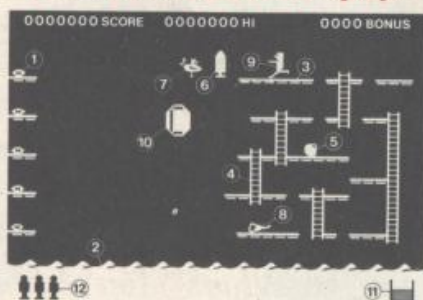
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You have a Rocket Pac to help you (a Vulture on higher levels) but you must rush around the platforms and ladders collecting cans of fuel (legs of lamb with the Vulture) and cursing that weird Bubble. Once you have enough fuel then it's Chocks Away!

Oh... but don't run out of fuel on the way - otherwise it's SPLASH!

The aim is to collect all the diamonds from the far left hand side of the screen, whilst avoiding the rampant Bubloid. These emerge from the sea and are hell-bent on returning to their watery habitat with you in tow. Sooner or later you are going to end up in the drink - The idea is to make it later!

By belting round the system of platforms and ladders, cleverly avoiding the Bubloid, you collect the fuel cans which appear in random positions, until you consider that your fuel gauge indicates sufficient in the tank. Now you can go and collect your rocket. With the rocket-pack strapped to your back you can fly across the expanse of sea to collect the diamonds... but don't run out of fuel or your rocket-pack will simply disappear and you will wind up in the drink!

There are six stages with six different platform layouts. On stages 1-3 the Bubloid, which floats in front of the platforms with uncanny ease, gets an ever increasing ability to home in on your position, making the task of staying alive more demanding with each stage. On stages 4-6 you once again start with the easiest Bubloid (which is a blessed relief!) but the fuel cans are replaced by legs of lamb which you must collect to feed your vulture, and once it has enough energy (or you think it has!) you must flap across the water on its back to collect the diamonds.

Extra men are awarded for every 10,000 points - but ONLY once you have collected all the diamonds and so completed each particular stage.

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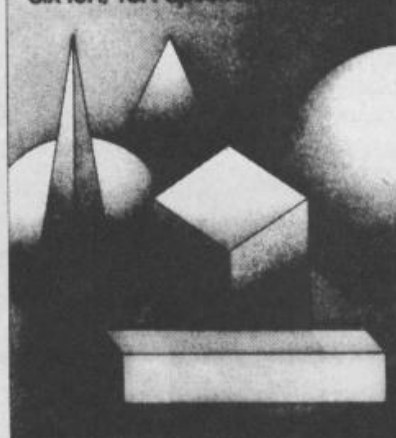
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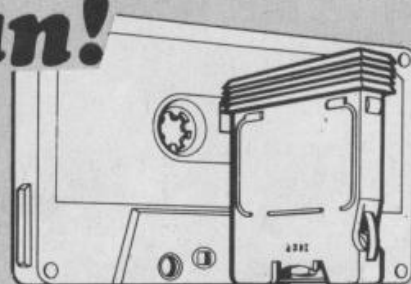
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SINCLAIR ANSWERS

WORLD OF BUSINESS

WE LOOK AT THE RANGE OF SPECTRUM SOFTWARE
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For a supposedly games-orientated machine, there is a surprisingly large number of business packages for the ZX Spectrum. It is possible to get anything from a database to a word-processing package for it. So what should you look for, and what can it do?

The major drawback is, of course, lack of memory space. A few packages will run on the 16K Spectrum, but the vast majority are only available for 48K machines. There is also no point going ahead with computerizing a business using the Spectrum and then expecting to be able to transfer your files to an IBM PC next year. However, as a low cost business micro, the Spectrum is hard to beat.

If you do intend to use the Spectrum for business, the most obvious drawback is printed output. The first business programs for it were compatible with the Sinclair ZX printer (and therefore with the Timex and Alphacom printers too). The snag here was 32 characters per line, plus the fact that thermal paper hardly looks very professional. Fortunately, there are now printer interfaces, such as Sinclair's Interface 1 for RS232 equipped printers and Kempston's Eprom Centronics interface, which allow standard 80 column printers to be used.

Oxford Computer Publishing (like a number of other software houses) went through an intermediate stage of software development where they offered Plus 80 versions of their programs. These gave 80 columns of printed text, but were compatible purely with Kempston's first Centronics 'S' interface. Oxford is now producing 'universal range' versions which are compatible with the Interface 1, Morex, Euroelectronics, Tasman, Hilderbay and Kempston Centronics.

Campbell Systems employ Myrmidon's Micro-print program which actually squeezes 42 or 51 columns onto a ZX printer; however, Campbell has also made its Masterfile compatible with MF-Print which can handle up to 100 columns as long as your printer can too!

Our advice therefore is to check with the manufacturer which is the latest version of whatever software

you've decided upon; alternatively, ask the dealer which printers it can support. On the latter score a quick look at the documentation will probably answer the question if the dealer is unwilling or unable to do so.

Until relatively recently Spectrum business software was limited by reliance on cassette tapes for data storage, but the advent of the Microdrive has changed that. Software houses have been rushing to update their programs to provide Microdrive compatibility. We found that those who have already achieved this trumpeted it loudly in the form of some flash on the packaging. Sinclair Research has taken the fairly unusual step of packing two business programs into a special Microdrive system expansion pack — *Tasword 2* from Tasman, and *Masterfile* from Campbell Systems. Naturally one assumes these packages will now work with Interface 1. The advantage of using Microdrive cartridges is the improvement in speed of accessing data, and (to a certain degree) of accessing the actual program itself.

The capacity for keeping records still is not vast. Kemp estimate that between 700 and 1,000 records could be held on one Microdrive cartridge using its Stock control package. On cassette, a typical C60 can supposedly hold six months worth (approximately 26,000 entries) of Flowchart's simple business accounts; however, presumably it would take at least an hour to upload said data.

At the time of writing no software house had introduced business software that was compatible with disk operating systems like Technology Research's. This is the next logical step; however, the price of such software added to the cost of a disk drive will begin to negate the Spectrum's price advantage in the business field.

Unlike games, useful documentation is an absolute must with business programs. Some companies, such as Richard Shepherd, manage to squeeze simple instructions onto a folded cassette inlay. This isn't a bad thing *per se*, but the software houses that provide comprehensive manuals seem to have covered all the bases. Such information as printer compatibility,

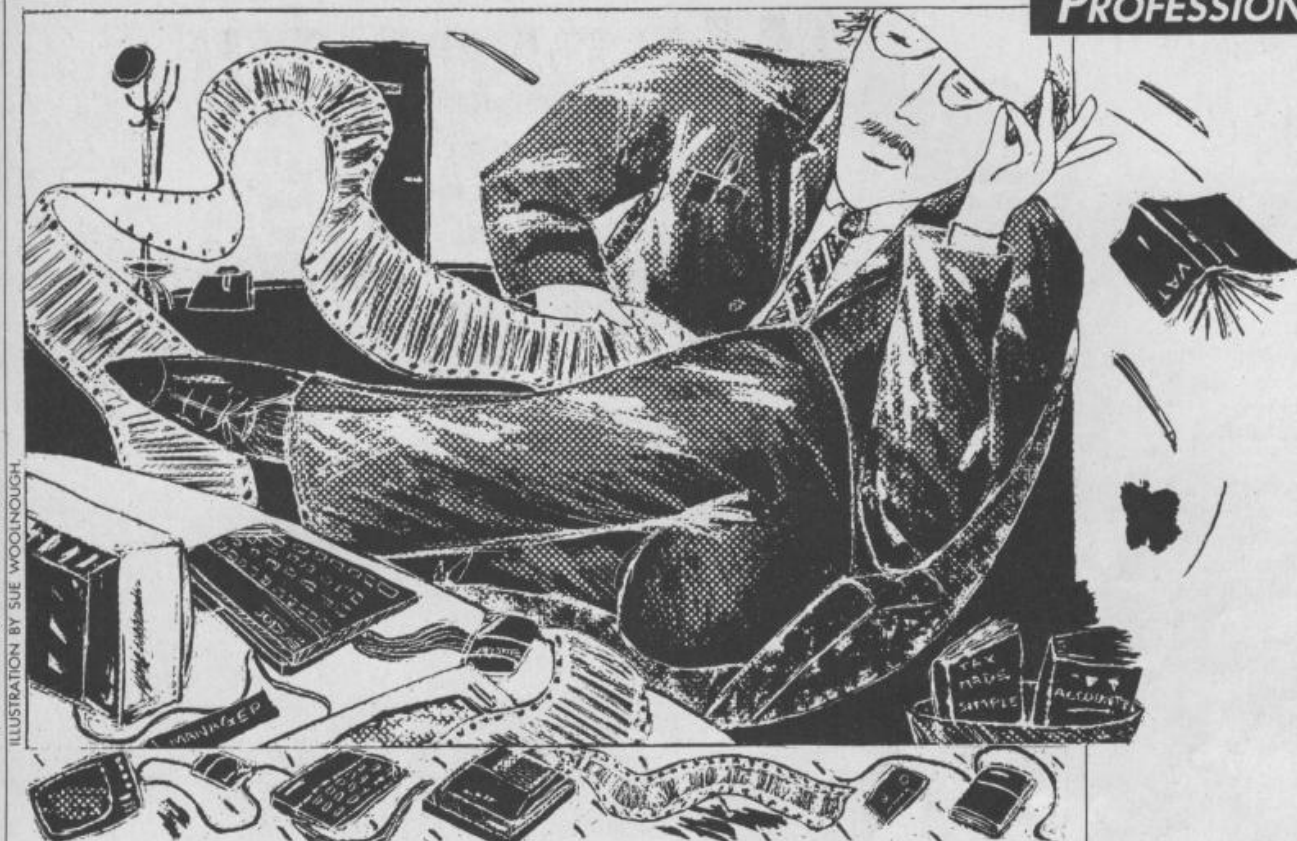


ILLUSTRATION BY SUE WOOLNOUGH

how to save and load efficiently, and so on, is vital.

Backup is always important for business users, so companies such as Flowchart and Kemp, who make some attempt to register their users, are worth looking at. Not everything is going to be free, but if you only have to spend £3 to get the latest update that is much better than £19 for another program.

Business records by definition are valuable even if only in terms of time spent constructing them; thus, easy instructions as to how to save your data and how to make backup copies are a must. It is also important to be able to take a backup of the master program itself, so software which has been protected against piracy and will prevent this is something of a misery.

It is also exceedingly useful when the software provides the means for installing a password so that not just anybody can run the program and discover potentially damaging information on your business.

Datagenie (from Audiogenic) takes advantage of another standard business ploy — pop-up menus. These allow the user to step easily through the program without having to learn the ins-and-outs of programming at the same time.

Apart from good documentation, business software needs to be far more user friendly than the average adventure game, as no-one wants to spend hours guessing what the next stage is in the middle of a business package. Some software houses supply a demonstration program of how their packages work. If at all possible get a dealer, friend or colleague to show you this. However, don't place too heavily a reliance on the demo program, because it is very easy to make a program look slick when running only a few demo files, but when it comes to doing the real thing the program can become really slow.

One important proviso before considering the use of any word-processing package on the Spectrum is that no touch typist will be able to get enough speed to make it comparable with more expensive systems. However, most Sinclair owners won't be typists and will already be familiar with the Spectrum's rubber keys. In this field *Tasword 2* appears to be the market leader but there are also packages from Quicksilva

and Oxford Computer Publishing.

The greatest competition among software houses comes in the realms of small business or home accounts. We identified at least 10 packages in this field. For once, price becomes very important as you can afford to be choosy.

There's no point in forking out nearly £20 for Kemp's *Stock Control* program with its full Micro-drive compatibility *et al*, if you only want to keep brief records of your bus bills which will fit easily on a C12 cassette. For this reason, Hilderbay at least do two versions of its pay slip program: payroll and checkpay. The latter doesn't print cheques or keep records on other employees.

There are some really specialized programs which have been written for the Spectrum. Hilderbay do a number such as their statutory sick pay program, and David Martin Associates do a multiple regression analysis package. We found that if you don't know already what multiple regression is, the program won't be of interest anyway. More information on the types of programs available is contained in the table provided overleaf.

There are a number of publications in this field. Websters have done a business software directory for home computers which covers the Spectrum and has details of eight packages, including *Tasword 2* and *Vu File*. Phoenix has produced *Business Programming on your Spectrum*, by Peter Jackson and Peter Goode, a book which contains seven programs for the business user to key in.

However, they are aimed mainly at salespeople with titles like "Forecaster" and "Contacts". *The Complete Sinclair Database* by Adams, Beardsmore and Gilbert has brief descriptions of the more popular business packages if you need any guidance.

One noticeable trait of the software houses involved in this field was that they all seem very dedicated to the Spectrum and more than willing to listen to criticism or suggestions from end users. One thing that business programming on the Spectrum will never be, and that's mundane!

By Tony Dennis, deputy editor.

Overleaf: a comprehensive guide to business software packages for the ZX Spectrum and their suppliers.

FIG. 1

Supplier:	Package:	MDC*	Price:	Supplier:	Package:	MDC*	Price:
Audiogenic, 34-36 Crown Street, Reading, Berks. Tel: (0734) 664646.	Datagenie (database)		£9.95	Oxford Computer Publishing, 4a High street, Chalfont St Peter, Bucks. SL9 9QB. Tel: (0753) 888866.	Financial manager Stock manager VAT manager Word manager Address manager		£19.95 £19.95 £19.95 £19.95 £19.95
Campbell Systems; 57 Trap's Hill, Loughton, Essex IG10 1TD.	Masterfile 16 MF-print Dlan (commercial display prog)	Y Y Y	£15.00 £6.95 £7.95	Quicksilver, Palmerston Park House, 13 Palmerston Road, Southampton SO1 1LL Tel: (0703) 20169.	Word processor		£5.95
Flowchart, 62 High Street, Irthlingborough, Northampton NN9 5TN. Tel: (0933) 650073.	Simple business accounts	Y	£11.95	Salmon, Monkend hall, Croft-on-Tees, Darlington DL2 2TN. Tel: (0325) 721368.	Investments		£7.90
Gemini Marketing, 18a Littleham Road, Exmouth, Devon EX8 2QG Tel: (0395) 265165.	Cash book accounting Easiledger Database Graphplot Final accounts Home accounts Mailist Stock control		£29.95 £19.95 £19.95 £19.95 £29.95 £19.95 £19.95 £19.95	Richard Shepherd Software, 23-25 Elmshott Lane Cippenham, Slough, Berks. Tel: (06286) 63531.	Cash controller	Y	£9.95
Hestacrest, PO Box 19, Leighton Buzzard, Beds LU7 0DG. Tel: (052523) 7785.	Accounts (sole trader or limited company) Sales/purchase ledger	Y Y	£25.00 £25.00	Sinclair Research, Stanhope Road, Camberley, Surrey GU15 3PS. Tel: (0276) 685311.	Vu-Calc (calculator) Vu-File Which? Tax		£8.95 £8.95 £12.95 Y £12.95
Hilderbay, 8-10 Parkway, London NW1 7AA. Tel: (01) 485 1059	VAT calc Critical path analysis Stock control Statutory sick pay Checkpay Payroll Project planning		£9.95 £15.00 £25.00 £40.25 £7.95 £25.00 £138.00	Tasman Software, Springfield House, Hyde Terrace, Leeds LS2 & LN. Tel: (0532) 438301.	Tasword 2 (word-processor)	Y	£13.90
Hilton Computer Services, 14 Avalon Road, Orpington, Kent BR7 9AX Tel: (0689) 35101.	Personal banking system (inc. bank reconciliation module) Sales day book	Y	£15.00 PNA	Transform, 41 Keats House, Porchester mead, Beckenham, Kent. Tel: (01) 658 6350.	Business bank account Invoicing Wages records/payroll Purchase day book Stock control Sales day book		£10.75 £15.00 £15.00 £10.75 £10.75 £10.75
Kemp, 43 Muswell Hill, London N10 3PN. Tel: (01) 444 5499.	Purchase ledger Sales ledger Stock control	Y Y Y	£19.95 £19.95 £19.95	Other useful addresses:			
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Micromega, 230-236 Lavender Hill, London SW11 1LE. Tel: (01) 223 7904.	Comp-u-share Personal banking system		£9.95 £9.95	Phoenix Publishing Associates, 14 Vernon road, Bushey, Herts WD2 2JL. Tel: (0923) 32109.	Business Programming on your Spectrum		£6.95
Microsphere, 72 Rosebery Road, London N10 2LA. Tel: (01) 883 9411.	Omnicalc 2	Y	£14.95	Websters Software, Curzon House, Midleton Estate, Guilford, Surrey GU2 5XW. Tel: (0483) 62222.	Business Software Directory for Home Computers		PNA

*MDC = Microdrive compatible; PNA = price not available.

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THE DIY TAX CALCULATOR

DOES WHICH? MAGAZINE'S TAX CALCULATOR PACKAGE COST YOU MORE THAN IT SAVES?



For anyone who has ever earned anything outside of the PAYE scheme, income tax is a terrific headache. For the self-employed, or those with fringe benefits, the tax complications can be beyond their understanding — hence the accountant.

But now that well-known protector of public interests, *Which?* magazine, has produced a tax calculator package for the 48K Spectrum. We checked it out on some real data (our own

tax bills — ough!) to see whether it could help recover its £12.95 price tag.

The package comes on cassette, and a fairly comprehensive tax guide is included. There is no need for a program like this to be written in machine code for speed, but the Basic listing is so long that it is loaded in three sections.

The program consists of a long series of questions, where you basically enter either 'Y' or 'N' or an amount of money. The

screens are quite well presented, with only a few questions (sometimes only one) at a time. This means the screen is not cluttered with text — which is a mistake that many programmers make.

The sort of questions asked are exactly those that exist on a tax return form: your income, marital status, tax paid to date, fringe benefits, and so on.

The second part of the program covers income such as freelance work, and unearned income such as interest from

PROFESSIONAL

accounts, investments, pensions, and so on.

The third part covers outgoings, such as relief on the interest for a mortgage. It also covers additional allowances, such as housekeeper's allowance. At the end of this section the all-important information is presented — how much you owe the taxman and what tax brackets your income falls into.

There are a few, slightly disappointing instances of lack of processing in the package. For example, you are asked to enter what the housekeepers allowance is (if you are entitled to one), rather than simply answering 'Y', you have to look up the information in the booklet. This seems rather strange, as many of these allowances are fixed figures and not complicated to program.

Another example is when calculating the value of a company car. There is a fairly simple table of the car's value, engine sized, and age that gives the taxable addition to your salary. Again, it would have been less of a strain simply to enter the car's details, and rely on the program to do the additions.

It's also worth remembering that the package may be useless after this year because of changes in tax laws.

We think that there is little this package does that you couldn't do yourself. For most of us, even with freelance income, a mortgage, and the odd fringe benefit, it is almost as quick to do the maths by hand (using the *Which?* tax saving guide, perhaps) rather than step through the package answering 'N' to most of the questions on investment income and the like.

People with more complicated income may benefit from the help with the maths, but again, if their income is that complicated, they would probably want to try 'what if' questions.

For example, saying 'what if I bought a 2000cc Lotus at £20,000 rather than take the £20,000 as income?' In short, a spreadsheet package set up with tax data would probably be much closer to what they want.

By Dr Peter Turcan, editor.

Which? Tax calculator (priced £12.95) from **Sinclair Research**, Stanhope Road, Camberley.

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This is what they said about Tasword Two:

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PERSONAL COMPUTER WORLD September 1983

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"Tasword is showing a degree of sophistication that business computers took many years to develop." WHAT MICRO? October 1983

TASWORD TWO The Word Processor*

48k ZX Spectrum £13.90

Your Spectrum becomes a **professional** word processor with TASWORD TWO. TASWORD TWO gives you an amazing **64 characters per line** on your screen. This is ideal for standard A4 paper and TASWORD TWO prints your text just as it appears on your screen.

Tasword Two drives the following interfaces:

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Euroelectronics Interface

Hilderbay Interface
Sinclair ZX Interface 1

ADS Interface
Kempston Interface

Morex Interface
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The same program drives these interfaces. A short easy to follow set of instructions takes you through setting up your Tasword Two to drive the interface you have or choose to buy. Tasword Two also drives the ZX printer.

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THE PROGRAM GENERATOR

FINDING A SUITABLE BUSINESS PROGRAM MAY NO LONGER
BE A PROBLEM—IF YOU CAN CREATE YOUR OWN.

Ever wanted to write a program for your Spectrum without having to learn a language? Or to be able to have your own program without having to go and buy one each time you needed a new application? *SciFile* from Visions claims to be the program generating system you have all been waiting for.

Although such claims are common in the software market, this is not just yet another one of those programs which allows games programs to be written like a string of sausages; *SciFile* is intended for the far more serious task of creating your own business-type programs.

As many Spectrum users may want to progress beyond games without learning one of those special languages, it's a product with potentially wide appeal.

The *SciFile* package contains two cassettes, a manual, and a set of planning sheets with some sample details already completed. Cassette tape one is the Program Generator; tape two, the Report Program Generator. The first stage is normally to load tape one, and when this is complete the display PG1 menu should appear. At this point the tape is stopped and not rewound, as there will be a need to load again starting from this point on the tape.

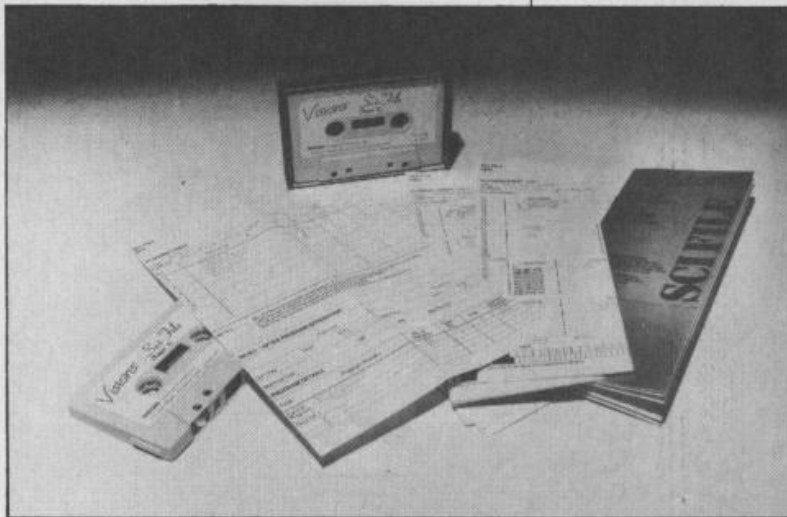
The PG1 menu should give two options, New program and Amendment. But when we loaded our own tape one we found that it was the Report Generator—the cassettes had been labelled incorrectly; we loaded tape two, and the correct menu appeared.

Once the main menu is reached and the New program option has been taken, the first stage is to define a Data File. *SciFile's* screen display allows these parameters for the data. A Field name can be up to 12 characters in length, and Field types are divided into four categories: N for numeric; £ for sterling; D for date in the sequence DDMMYY, and A for alphabetic. A maximum of 30 letters or numbers is allowed, which includes the number of decimal places and decimal point, up to eight decimal places are accepted.

There's a maximum of 19 different data items that can be specified; if less than 19 are to be entered, then using symbol shift and A together to give, STOP tells *SciFile* that data entry is complete.

At each stage the program asks whether the information entered is correct and offers provision for changing it. Once the basic outline has been created, the key fields are defined. Two key fields are allowed and the Sort and Search keys are then defined. Now this agreed file format is saved, but before taking this step a name must be given which can have any nine character format.

Final stage is to give the program a title, and this can be up to 16 characters in length. Now the system has all the information needed to create the Basic program. The play button on the tape recorder is pressed after the 'Load systems tape and press enter' message has been followed.



The Basic program will have seven menu options: Input items; Amendment; Print items; Find and print; Save file; Load file; and Save program.

Once the program has been created and stored, the second step is to create the report side. This is done using tape two (or in the case of the sample which was supplied, tape one). There are five main functions of this second tape: to title the reports being used; to allow a range of multiple calculations on the numeric fields and £ fields of the records; to select the records on which these calculations are to be carried out; to total selected numeric or fields; and finally, to design the layout of the report by precisely positioning the calculated or previously formatted fields. After this stage has been reached, this information is stored on tape and the program is ready for use.

As you are essentially creating your own personal database system, it could be argued that one of the commonly available programs would do instead (for example *Vu File*). However, although one of these database programs may well do the same job in practice, there could be two problems: the operation of the program could be too complicated for the first time user, and it would still not produce a separate program as a result of the work.

Equally, the manual for the *SciFile* although in two parts: a simplified version for the truly non-technical, and a for the more advanced section. In each case the user could choose the Quickstart section of the manual to avoid complications.

Except for the labelling hiccup we found no significant flaws, although when two of the keys were pressed as correct options, instead of being accepted and the information appearing on screen, a buzzing noise was heard. On persevering, by the second or third time all was well. The keys were Y=yes and A=alphabetic, and it was only an intermittent fault.

For the person who wants to write semi-serious database programs without learning a language, *SciFile* does fill a gap.

By Neville Ash, a freelance writer.

The *SciFile* package comes with plenty of helpful documentation.

SciFile (priced £17.95 inc. VAT) is available from:
Visions
(Software Factory),
1 Felgate Mews,
Studland Street,
London W6.

QL Utilities

FOUR programs on one Microdrive for the Sinclair QL.

"Nothing very dramatic... could be quite useful" (PCW).

1 "boot"

displays DIRectory in columns, and allows LOA-Ding of programs with single key-press. Without this, the directory will overflow the screen if you have more than about 18 files on cartridge; also "load mdvl_ program" has 17 keypresses!

2 "qmark"

will allow you to FORMAT a cartridge repeatedly (as recommended by SINCLAIR). You only have to enter a name and number once.

3 "qback"

makes back-up copies of cartridges. One key-press will copy *all* files onto an *empty* cartridge, or you may single-step and choose whether or not to copy each file. If receiving cartridge is *not* empty, you will be asked whether or not to over-write any namesake of a file about to be copied. You can copy from many cartridges onto one until it is *full*.

4 "qprune"

will delete any file with a single key-press, so *be careful* with this one!

Instructions

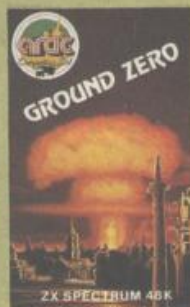
on paper and in a QUILL file (for when you lose the paper!). *All four programs* will work with the extra microdrives if you get them, and have been successful with cartridges holding over 60 files each.

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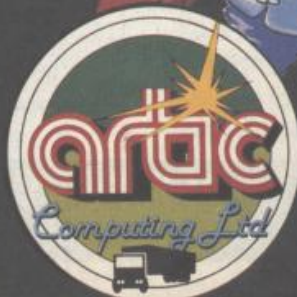
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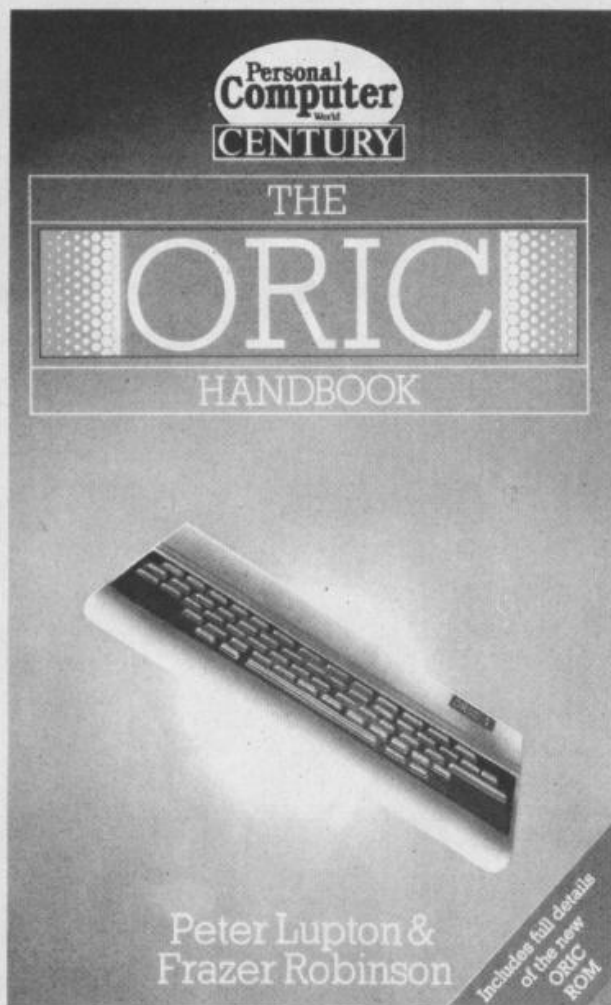
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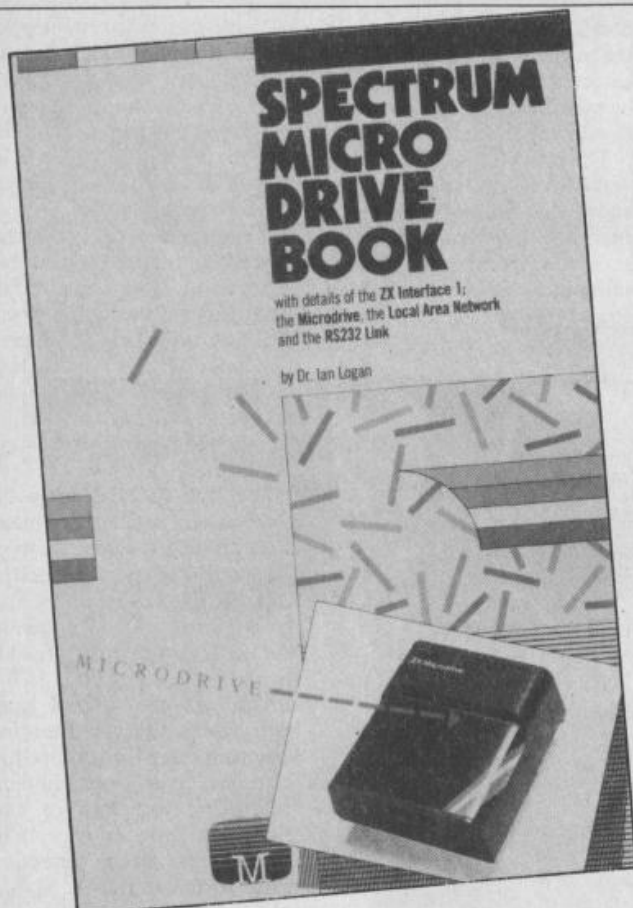
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Spectrum Microdrive, by Dr Ian Logan; **Making the Most of Your ZX Microdrive**; **An Expert Guide to the Spectrum**, by Mike James.

If any Spectrum add-on is worth its salt, it isn't long before there are one or two books about it on the shelves. The three books reviewed here are either totally or partially concerned with the Spectrum and the use of its Microdrives.

The first is *Spectrum Microdrive* by Ian Logan. This is written in an extreme note form, but, as you would expect from this author, is packed with detail. This detail must be pieced together by the reader, or rather user, since the book should not be read cover-to-cover, but dipped into for reference.

As any keen Spectrum user knows, the Microdrive system consists of the ZX Interface 1 as well as the Microdrive unit itself. The Interface 1 also adds the hardware and software necessary to support a standard RS232 serial interface and a local area network link.

The book's first two chapters are concerned with the extended system and extended Basic that result from fitting the Interface-1. By 'extended system', the author means the extra connections made possible by the Interface, and the second or 'shadow' ROM. The shadow ROM

is built into the Interface and provides the software to support the use of these connections.

The software in the shadow ROM extends the Basic syntax checker to allow for 'new' commands, and provides the input and output routines for the Microdrive, RS232, and local area network links.

The chapter three covers the use of the Microdrive itself, and all those technical details that it is felt will not compromise the 'security' of the Microdrive. As said already, the book does not discuss applications, rather it concentrates on low-level details of usage. Chapter four then discusses the local area network in a similar fashion.

The chapter on the RS232 link includes a discussion of how another computer (in this case an Acorn BBC Micro) could be linked to a Spectrum system. Finally, for machine-code buffs we have chapter six, where the author covers 'hook codes' and the addition of new statements to the Spectrum Basic. 'Hook codes' enable a machine-code programmer to use routines from the shadow ROM, and the routines available are discussed.

The same mechanism that enables that extension can be used by the machine-code programmer to build his own Basic extensions, and several possibilities are suggested. All in all,

Spectrum Microdrive is a precise and informative book, and a handy reference source for a Microdrive Owner.

Make the Most of Your ZX Microdrive by Ian Sinclair, takes a completely different approach. In the preface the author, who has written a large number of books for the beginner, stresses that the book is not aimed at the expert so you will not find here the details of Microdrive operation or machine-code programming that appear in the first book.

As said, the emphasis of the second book is on the facilities afforded by Interface 1. In particular, it considers the use of the Microdrive for data storage and the connection of printers through the RS232 link.

Networking is not covered at all, a reflection of the limited use the author sees for that outside of clubs and schools.

The book opens with an overview of the Microdrives and the Interface and the question: why use microdrives? The author, having answered this question to his satisfaction, then proceeds to discuss the care of cartridges and standard back-up procedures in the next two chapters.

These chapters cover such a miscellany of points, with a liberal helping of horse sense and experience, that it would be easy to miss the significance of the section on streams and channels. Fortunately, the whole book is written in such a way that it can be read cover-to-cover, and such points noted for later ination.

Chapter four covers Basic filing techniques. This is often too simplistic and, given that the readers are assumed not to be complete beginners, some points seem unnecessary. For example, on page 37 the reader is reminded that the command word TO requires a single key depression and not two depressions, 'T' followed by 'O'. Later on in this chapter the author makes some simple ideas on file updating appear needlessly complicated.

The author concentrates his attention on the use of the interface for RS232 links in the fifth chapter, and in particular on the connection of printers through the link, which he considers to be its most likely use.

Finally, in chapter five we are given a ready-to-use database program; 'ready-to-use' means here machine code that in ►

DATA FILE

BOOKSHELF



THREE
TESTAMENTS
TO THE
MICRODRIVES
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EDUCATIONAL
GAMES FOR
THE SPECTRUM.

the words of the author, has not been 'cleaned up'. In fact, plenty has been left for the reader to do to tune the program to his own requirements.

Unfortunately, to read the descriptions of the code, with its line number references, and the code itself requires a great deal of flipping between the pages. An alternative presentation of the code could have greatly helped readability.

The last book we're going to look at is only partially concerned with those facilities. *An Expert Guide to The Spectrum* by Mike James is aimed at the experienced user, but this time is looking at the whole range of facilities available on the Spectrum and how together they make the Spectrum such a successful microcomputer.

In fact only 50 pages are spent on the Interface 1. However, James makes up in presentation and clarity for any comparable lack of detail.

After an introductory chapter, three chapters cover both the structure of the Spectrum and the internal structure of ZX Basic. Neither is done at the detailed working level that a machine-code programmer might require, but the approach is at a sufficient level to enable a Basic programmer to use Basic more effectively.

The fifth chapter discusses streams and channels, and the general method for dealing with different I/O devices. Ian Sinclair's book tends to hide this away; Mike James seems to have struck a better balance, recognising the significance of the concepts involved.

The next three chapters cover the use of the video display, the tape system, the sound generator, and the ZX printer — all quite adequate.

Next, there are three chapters devoted to Interface-1, the microdrive, RS232 links, and networking. The final chapter is a collection of applications, examples to illustrate the way in which the facilities discussed throughout the book may be used.

Mike James' book is the one that we found gave explanations at the most suitable level, and whose material was most accessible. In particular, the contents steer you very quickly to the right section of the book.

So which book is for whom? If you are a machine-code hacker eager for details Ian Logan's book is for you. If your particular concern is file handling then Ian Sinclair's book is useful, and is also easy to read.

But if you are looking for a good all-round approach in a very readable form, then Mike James' book is your best bet. **By Martin Field, a lecturer in Computer Science at the University of East Anglia.**

dressed specifically to the younger members of the family (this sometimes produces the dubious advice that any problems should be referred to parents!).

The programs are all specific to the Spectrum, and a working knowledge of that machine is assumed throughout. The program descriptions are very brief and mostly limited to details of how to play the game. Occasional vague hints on how to alter the program are given, but the

are quite interesting, with some use of the Spectrum's colour, graphics and sound capabilities, however, the shortness of the programs means that the overall presentation isn't as smooth as that of the commercially available ones.

We gave this book to a teacher without much previous experience of computing. After being introduced to the Spectrum, he was able to type in a number of the programs without serious error (he did have some difficulty in reading parts of the dot-matrix listings, though).

The lack of descenders on lower-case characters produced some problems, as did the precise number of spaces needed in some PRINT statements. Sadly, these failings are not unique to this book but are widespread in the industry.

Although the listings have been taken directly from the Spectrum this hasn't stopped at least one error from slipping through: line 190 in the 'Hangman' program appears to be missing. Some detective work revealed that it should read 190 FL = 0; the program will not function correctly otherwise.

The teacher was on the whole satisfied that many of the programs do have some educational value, and was quite impressed with the relatively small number of lines required.

On the whole a worthwhile collection.

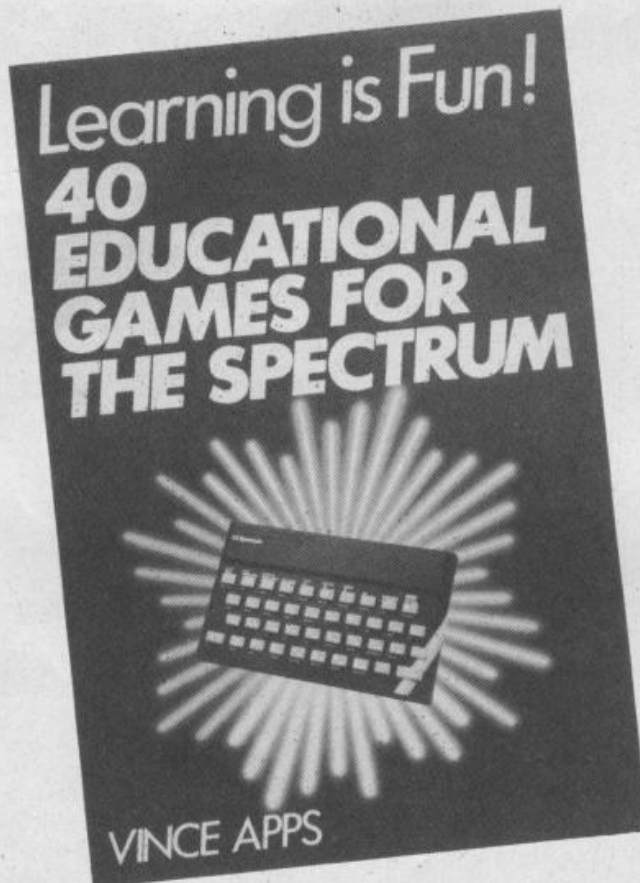
By Ron Yorston, a research assistant in computational physics.

Spectrum Microdrive, by Dr Ian Logan is published by Melbourne House priced £5.95 (106 pages).

Make the Most of Your ZX Microdrive, by Ian Sinclair is published by Granada at £4.95 (99 pages).

An Expert Guide to the Spectrum, by Mike James is published by Granada priced £6.95 (190 pages).

40 Educational Games for the Spectrum, by Vince Apps, is published by Granada priced £5.95 (170 pages).



40 Educational Games for the Spectrum, by Vince Apps.

For better or for worse, microcomputers have now found their way into schools throughout the nation.

There is still doubt and controversy in educational circles about how best to use them in the classroom, particularly about their place in primary schools. There is still a shortage of suitably trained teachers, and the machines themselves are still in quite short supply. However, great strides are now being made in the quality and availability of educational software.

This book is aimed at the family which already owns a Spectrum and would like to use it to help increase both general knowledge and familiarity with computers. The text introducing each of the programs is ad-

programs themselves are not connected.

One major task of what instructions are provided is to explain which of the many inconsistent sets of conventions for entering data is used. Some of the programs require upper case characters, and some lower case, and some don't mind.

In some you have to press ENTER to register your answer, in others you don't. Obviously it's not possible to specify universal standards, but it would have been nice to have had a bit more consistency about such matters within the book.

A wide variety of games are provided, covering many different subjects. Number skills are well represented, as are programs dealing with letters and words. History, geography and more general reasoning are also included. Most of these games

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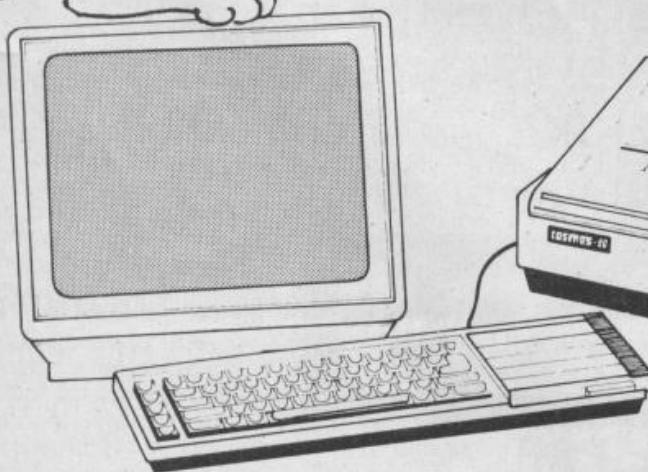


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ALL YOUR OWN?

Games designer packages for the Spectrum, such as *HURG* and *The Quill*, pose some interesting legal problems: they provide the micro user with the programming tools to create their own arcade/adventure-type games.

You can, therefore, buy the package and run the program as a pure entertainment exercise, forever developing new and more challenging games as the novelty of the earlier creations begin to wear thin.

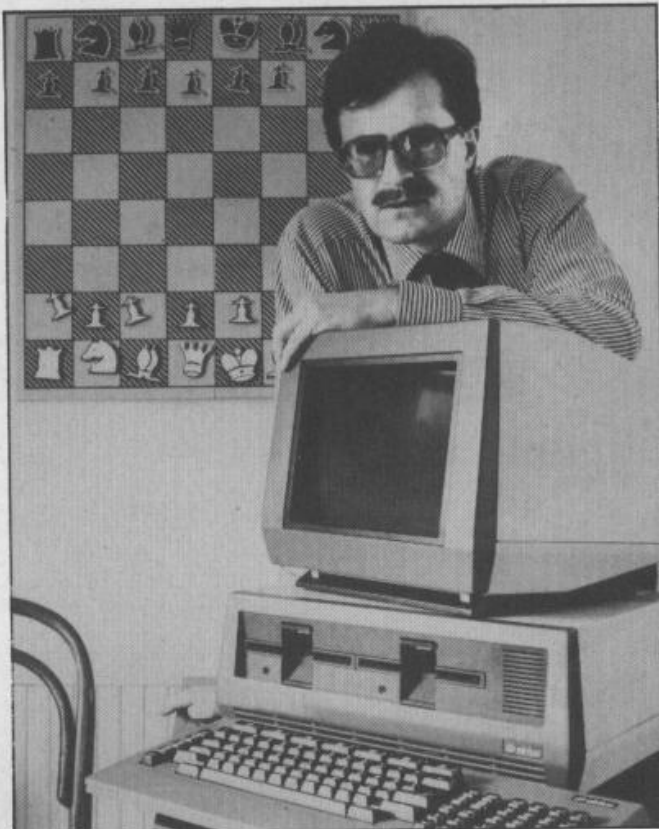
But what happens when you go even further along the line and actually start selling these programs to other users, setting up in effect your own home-grown software business?

Because such games are ultimately derived from someone else's software, are you going to be free to commercially exploit the fruits of your labours for all it is worth? Or are you going to run into all sorts of licensing and royalty problems — or even be accused of software piracy?

To be fair to both Melbourne House and Gilsoft, (the two companies who manufacture *HURG* and *The Quill*, respectively) they certainly do not appear to want to place any restrictions on the activities of their users, indeed they both seem to be positively encouraging users to sell their games — in fact, until very recently, Melbourne House, as part of a competition, were offering cash prizes for the best games written each month and giving entrants the opportunity of having their games published; whilst over in Wales, Gilsoft were offering to market games on behalf of their creators and, by way of red-tape, merely stating that they would be grateful if anyone intending to sell a game written with *The Quill* would acknowledge the fact somewhere in the program.

But although Melbourne House and Gilsoft are to be congratulated upon their sympathetic approach, not all software houses are quite so magnanimous. So, is this freedom to sell dependent purely upon the largesse of the individual design program producers, or are there any more concrete legal principles involved?

First off, be under no misconception about the actual games design program and routines (as opposed to what you subsequently produce with them) —



these are subject to copyright and woe-betide should you infringe it; for example, this is what is stated in connection with the *HURG* package: 'The entire program and its subroutines are copyright property and no part may be copied, reproduced, hired, lent, distributed, stored or modified in any form, in full or in part, without express written permission'.

As to the end product of your activities. It was stated in the Whitford Committee's Report on Copyright and Design Law several years ago that a computer system, along with its software, is primarily a 'tool' — a labour-saving device. And in this capacity its role is subordinate to that of the human manipulator.

There is also a nexus (or connection) between you and the finished game: you know and can predict what the end product will be. As opposed to the sort of situation that can arise with the type of program sometimes used in experimental synthesized music, where the outcome is randomly generated by the computer and thus is to a very large extent unpredictable.

Lastly, what you have to add to one of these design programs before you can actually create a finished product — such as

defining the characters, verifying the scoring possibilities, and so on — would certainly seem to satisfy the criteria usually necessary before copyright can be claimed. In the words of a judge in one recent case: 'To secure copyright it is necessary that the labour, skill and capital expected should be sufficient to impart to the product some quality or character which the raw material did not possess, differentiating the product from the raw material'.

As far as the law is concerned, the copyright on a game produced with the aid of a game design program should belong to you, the creator of the finished product, rather than the producers of the design program software. They merely produced the 'tool' — the means to the end, but not the end itself.

As to what you should do to safeguard your legal position, probably your best bet when you are considering acquiring one of these packages is to carefully study the small print relating to what you can and cannot do with it. If what you read seems ambiguous or unduly restrictive, steer clear of it; otherwise, even though you may have the law on your side, you could be letting yourself in for a lot of undue aggravation.

DATA FILE

LEGAL FILE



ARE THERE
COPYRIGHT RISKS
IN USING GAMES—
DESIGNER
PACKAGES
TO CREATE YOUR
OWN PROGRAMS?

Charles Christian (above) is a qualified barrister and a computer writer, who will using his knowledge of Britain's impenetrable legal system to answer your complaints and queries in a comprehensive way. If you want access to the Legal File use the question card bound in with this issue, and mark the card 'Legal File'.

Specterm machine code listing for Cobra/Micro Mania interface.

```

67E8 C3 9F 69 15 00 00 00 00
67F0 00 00 00 00 00 00 00 00
67F8 00 00 E5 D5 C5 CD BE 02
6800 20 42 CD 1E 03 3D 5F
6808 0E 00 16 08 CD 33 03 21
6810 EE 67 BE 28 2F 32 EE 67
6818 A7 FE 0C 20 04 3E 08 18
6820 06 FE 07 20 02 3E 1F F5
6828 3E 07 32 48 5C 11 29 00
6830 21 C8 00 CD B5 03 AF D3
6838 FE 3E 0F 32 48 5C F1 F3
6840 C1 D1 E1 C9 37 32 EE 67
6848 18 F6 F5 AF DB FE E6 1F
6850 FE 1F 20 F7 AF DB FE E6
6858 1F FE 1F 2B F7 F1 18 9A
6860 78 71 23 BC 20 FB C9 3E
6868 18 D3 FE 21 00 40 01 00
6870 58 CD 60 68 21 00 58 01
6878 0F 58 CD 60 68 21 00 58
6880 01 07 40 71 23 10 FC C9
6888 ED 5B EC 67 CB 3A CB 3A
6890 CB 3A CB F2 CB E2 62 6B
6898 36 0F FE 20 3B 61 FE 7F
68A0 38 02 3E 3F ED 5B EC 67
68A8 FE 20 20 0B 7B FE FB 3E
68B0 20 38 04 3E 0D 18 48 CD
68B8 8A 69 ED 53 EC 67 7B FE
68C0 00 28 0E CB 3A CB 3A CB
68C8 3A CB F2 CB E2 EB 36 38
68D0 C9 2A EC 67 CB 3C CB 3C
68D8 CB 3C CB E4 CB F4 36 0F
68E0 21 E0 50 22 EC 67 3A 9E
68E8 69 CB 47 2B 06 06 0B CD
68F0 B2 0E F3 06 15 CD 00 0E
68F8 F3 21 E0 5A 36 38 C9 FE
6900 0D 28 CE FE 07 20 15 3E
6908 07 32 48 5C 21 6A 06 11
6910 82 00 CD B5 03 F3 3E 0F
6918 32 48 5C C9 FE 0A 20 1E
6920 21 18 58 7E FE 57 20 12
6928 36 07 2A EC 67 CB 3C CB
6930 3C CB 3C CB E4 CB F4 36
6938 38 C9 36 57 18 EC FE 0B
6940 20 23 ED 5B EC 67 7B FE
6948 E0 2B 01 1D ED 53 EC 67
6950 CB 3A CB 3A CB 3A CB E2
6958 CB F2 3E 38 12 ED 5B EC
6960 67 3E 20 18 25 21 19 5B
6968 18 B9 E1 5E 23 56 23 7A
6970 E6 07 0F 0F 0F 83 5F 7A
6978 E6 F8 F6 40 57 E5 E1 7E
6980 23 E5 FE FF CB CD 8A 69
6988 18 F4 6F CB FD 26 07 29
6990 29 29 D5 06 08 7E 12 14
6998 2C 10 FA D1 1C C9 00 F3
69A0 FD CB 30 DE 3E 0F 32 8D
69A8 5C 32 8F 5C 32 48 5C 3E
69B0 02 32 9E 69 CD EC 6E 21
69B8 00 70 22 F0 67 22 F2 67
69C0 AF 32 F4 67 CD 67 68 CD
69C8 6A 69 01 00 5A 58 20 54
69D0 45 52 4D 49 4E 41 4C 20
69D8 42 59 20 41 4E 44 52 45
69E0 57 20 47 4C 41 49 53 54
69E8 45 52 FF CD 6A 69 02 02
69F0 52 49 4E 47 20 4E 55 4D
69F8 42 45 52 2C 54 48 45 4E
6A00 20 50 52 45 53 53 20 41
6A08 20 4B 45 59 FF CD 6A 69
6A10 0A 05 47 4F 44 20 4E
6A18 55 4D 42 45 52 53 FF CD
6A20 6A 69 04 07 31 2E 43 42
6A28 42 53 20 30 34 38 36 32
6A30 20 32 35 37 31 34 20 20
6A38 20 FF CD 6A 69 04 09 32
6A40 2E 54 42 42 53 20 4C 4F
6A48 4E 20 30 31 20 33 34 38
6A50 20 39 34 30 30 FF CD 6A
6A58 69 04 0B 33 2E 43 41 42
6A60 42 20 30 31 36 33 31 20
6A68 33 30 37 36 FF CD 6A 69
6A70 04 0D 34 2E 4C 49 56 20
6A78 4D 41 49 4C 20 30 35 31
6A80 20 34 32 38 20 38 39 32
6A88 34 FF CD 6A 69 01 11 20
6A90 56 45 52 53 49 4F 4E 20
6A98 54 57 4F 20 42 59 20 53
6AA0 54 45 50 48 45 4E 20 41
6AA8 44 41 4D 53 20 FF CD 6A
6AB0 69 05 17 50 52 45 53 53
6AB8 20 41 20 4B 45 59 20 54
6AC0 4F 20 43 4F 4E 45 43
6AC8 54 FF AF DB FE E6 1F FE
6AD0 1F 28 F7 AF DB FE E6 1F
6AD8 FE 1F 20 F7 AF DB FE E6
6AE0 1F FE 1F 20 F7 CD 67 68
6AE8 CD 6A 69 00 00 4D 4F 44
6AF0 45 3A 20 54 45 52 4D 49
6AF8 4E 41 4C 20 20 20 20 20
6B00 20 20 20 3C 3C 4C 43 58
6B08 52 54 3E 3E 20 FF 21 E0
6B10 50 22 EC 67 CB 3C CB 3C
6B18 CB 3C CB F4 CB E4 36 38
6B20 CD DC 6E C4 A0 6E CD FA
6B28 67 38 F5 FE 1F 28 11 CD
6B30 80 6E 47 3A 9E 69 CB 4F
6B38 20 E6 78 CD 88 68 18 E0
6B40 CD 45 6B 18 DB 3E 13 CD
6B48 80 6E CD 6A 69 00 01 46
6B50 55 4E 43 54 49 4F 4E 20
6B58 3A 20 52 45 54 2C 53 50
6B60 41 2C 45 2C 4E 2C 52 2C
6B68 54 2C 4C 2C 53 2C 43 FF
6B70 3E 7F DB FE 1F 38 37 CD
6B78 6A 69 00 01 20 20 20 20
6B80 20 20 20 52 45 54 55 52
6B88 4E 20 54 4F 20 42 41 53
6B90 49 43 20 3F 20 20 20 20
6B98 20 20 20 20 20 20 FF CD
6BA0 4A 68 FE 59 C2 70 6B E1
6BA8 CD 67 68 FB CF FF CD FA
6BB0 67 FE 0D 20 35 CD 6A 69
6BB8 00 01 20 20 20 20 20 20
6BC0 20 20 20 20 20 20 20 20
6BC8 20 20 20 20 20 20 20 20
6BD0 20 20 20 20 20 20 20 20
6BD8 20 20 FF AF DB FE E6 1F
6BE0 FE 1F 20 F7 F3 3E 11 C3
6BE8 80 6E FE 43 20 2F CD 6A
6BF0 69 00 01 45 4E 54 45 52
6BF8 20 4C 45 54 54 45 52 20
6C00 41 2D 5A 20 46 4F 52 20
6C08 43 4F 4E 54 52 4F 4C 20
6C10 20 FF CD 4A 68 D6 40 CD
6C18 95 6E C3 B5 6B FE 45 20
6C20 0B 3A 9E 69 CB 8F 32 9E
6C28 69 C3 B5 6B FE 4E C2 3C
6C30 6C 3A 9E 69 CB CF 32 9E
6C38 69 C3 B5 6B FE 4C 20 40
6C40 21 00 70 22 F0 67 DD 2A
6C48 F0 67 11 11 00 AF 37 CD
6C50 56 05 30 F2 21 00 70 E5
6C58 DD E1 DD 5E 0B DD 56 0C
6C60 01 20 00 09 E5 DD E1 37
6C68 3E FF CD 02 08 DD E5 E1
6C70 06 00 36 1A 23 10 FB 2E
6C78 00 22 F2 67 F3 C3 B5 6B
6C80 FE 53 20 3C 2A F2 67 ED
6C88 5B F0 67 A7 ED 52 CA B5
6C90 6B DD 2A F0 67 DD E5 11
6C98 11 00 AF CD C2 04 DD E1
6CA0 FB 06 32 76 10 FD F3 DD
6CAB 5E 0B DD 56 0C 2A F0 67
6CB0 01 20 00 09 E5 DD E1 3E
6CB8 FF CD C2 04 F3 C3 B5 6B
6CC0 FE 54 20 32 3E 11 CD 95
6CC8 6E 2A F2 67 ED 5B F0 67
6CD0 A7 ED 52 CA B5 6B 21 1C
6CD8 58 CD 23 69 06 41 21 00
6CE0 00 CD DC 6E 20 12 2B 7C
6CE8 B5 20 F6 10 F1 21 1C 58
6CF0 CD 23 69 C3 B5 6B 18 74
6CF8 CD DB 6E FE 15 20 E2 3E
6D00 01 32 F5 67 2A F0 67 22
6D08 F6 67 3E 01 CD 95 6E 3A
6D10 F5 67 CD 95 6E 2F CD 95
6D18 6E 01 00 80 2A F6 67 7E
6D20 CD 95 6E 81 4F 23 10 F7
6D28 79 CD 95 6E CD D3 06 FE
6D30 06 28 0B FE 18 CA B5 6B
6D38 FE 15 28 CE 18 EE 22 F6
6D40 67 3A F5 67 3C 32 F5 67
6D48 ED 5B F2 67 A7 ED 52 C2
6D50 0A 6D 3E 04 CD 95 6E CD
6D58 DC 6E 28 F6 CD DB 6E FE
6D60 06 20 EF 21 1C 58 CD 23
6D68 69 C3 B5 6B FE 52 C2 70
6D70 6B 3E 11 CD 95 6E 21 1B
6D78 58 CD 23 69 21 00 70 22
6D80 F0 67 22 F6 67 3E 01 32
6D88 F5 67 3E 15 CD 95 6E 06
6D90 03 21 00 00 CD DC 6E 20
6D98 17 2B 7D B4 20 F6 10 F1
6DA0 3E 15 CD 95 6E 3E 7F DB
6DAB FE 0F DA 8F 6D C3 17 6E
6DB0 CD DB 6E FE 01 C2 8F 6D
6DB8 CD 55 6E 21 F5 67 BE C2
6DC0 73 6E CD 55 6E 2F BE C2
6DC8 1E 6E 2A F6 67 22 FB 67
6DD0 01 00 80 CD 55 6E 77 81
6DD8 4F 23 10 F7 CD 55 6E B9
6DE0 20 3C 22 F6 67 3A F5 67
6DE8 3C 32 F5 67 3E 06 CD 95
6DF0 6E 21 1B 58 CD 23 69 3E
6DF8 7F DB FE 0F 30 0B CD 55
6E00 6E FE 01 2B 83 FE 04 20
6E08 EE 3E 06 CD 95 6E 21 1B
6E10 58 CD 23 69 C3 B5 6B 3E
6E18 18 32 35 6E 18 05 3E 15
6E20 32 35 6E 06 01 21 00 00
6E28 CD DC 6E 20 23 2B 7D B4
6E30 20 F6 10 F1 3E 00 CD 95
6E38 6E FE 18 CA 09 6E 3E 7F
6E40 DB FE 0F D2 09 6E CD 55
6E48 6E FE 01 20 F1 C3 B8 6D
6E50 CD DB 6E 18 CE E5 C5 06
6E58 01 21 00 00 CD DC 6E 20
6E60 0C 2B 7C B5 20 F6 10 F1
6E68 E1 D1 C1 18 B1 CD DB 6E
6E70 C1 E1 C9 3D BE 20 A0 2A
6E78 F8 67 22 F6 67 C3 C2 6D
6E80 F5 CD E2 6E 28 FB F1 CD
6E88 E8 6E FE 0D C0 3E 0A CD
6E90 80 6E 3E 0D C9 F5 CD E2
6E98 6E 28 FB F1 CD E8 6E C9
6EA0 CD DB 6E FE 13 28 03 C3
6EA8 88 6B 21 1A 58 CD 23 69
6EB0 3E 7F DB FE CB 47 20 09
6EB8 3E FE DB FE CB 47 CA 9F
6EC0 69 CD DB 6E 28 EA CD DB
6EC8 6E FE 11 20 E3 21 1A 58
6ED0 C3 23 69 CD DC 6E 28 FB
6ED8 DB FF 00 C9 DB 7F CB 47
6EE0 00 C9 DB 7F 00 CB 4F C9
6EE8 D3 FF 00 C9 3E 03 D3 7F
6EFO 3A EB 67 D3 7F CD DB 6E
6EF8 C9 00 00 00 00 00 00 00

```


GETTING ON-LINE WITH SPECTERM

When *Computer Answers* originally published Andrew Glaister's ZX Spectrum communications program, *Specterm*, back in the March 1984 issue of *Computers Answers*, it had been written solely for use with the Cobra/Micro Mania interface. Subsequently, we received many requests for versions to run with other makes of RS232 interface.

One of them was from Stephen Adams who had the ZX81 version of the Cobra interface. Armed with the assembler listing, Steve was able to rewrite the whole program so that the five interface sensitive subroutines called by the main program all appeared at the end.

The result is the main listing, *Fig 1* which is compatible with the Cobra/Micro Mania RS232 for the Spectrum. If any other interface is being used the program needs to be changed from byte 6ED8 onwards. Alternative listings have been provided for RS232 devices from Maplin, USP, Eprom Services (dual) and the Cobra ZX81 interface.

When searching for alternative RS232 devices we came across several interfaces which were software controlled. These are not suitable for communications use since the interface needs to be able to cope with incoming data while the CPU is carrying out some other task, such as printing the last message. Included in this category is the Interface 1 from Sinclair.

Once you have carefully keyed in *Specterm*, save the program using SAVE "Specterm" CODE 26600, 2000. To check that it is correct we have provided two routines. *Fig. 6* will display the machine code listing, *Fig. 7* is a checksum routine. If the program contains any errors the checksum will be incorrect. It will also be wrong if the checksum routine is used after *Specterm* has been run. It's important to note that the values for n and Q depend on which interface is used. Look up the values in the table provided.

In order to run *Specterm* use PRINT USR 26600. The title page should then appear.

Specterm will default to a

communications protocol setting of 1 start bit, 8 data bits, no parity and 1 stop bit. If alternative settings are required the protocols may be changed by using POKE 26603, whatever. POKE 26603, 10 for instance would change it to 7 data bits, even parity, 1 stop bit. See *Fig. 8* for further details. The baud rate is set to 300/300 full duplex.

The original version of *Specterm*

allowed only routines for SAVEing and LOADing from cassette. However, Steve Adams has moved the program up in the Spectrum's memory to allow programs and data to be stored on Microdrive. To do this first enter Basic from the main menu. To save data, use SAVE "m"; 1; "name" CODE 28672, n + 1 000 [where n is the length of file in Kbytes.] For loading use LOAD "m"; 1; "name" CODE 28672.



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Other peripherals can be used without special provisions except with the Eprom Services dual interface which needs the same company's Microdrive decoder, if the Microdrive is used.

With *Specterm* it is possible to access our bulletin board, CABB, and other 300 baud boards with little more than an RS232 interface and a modem.

Once run, *Specterm* will display example telephone numbers of other boards. When you have dialled the requisite telephone number, wait for a whistling sound - this means a computer is at the other end. Connect your modem, press a key and you're away!

Once you press a key from the title page, you will be in 'termi-

nal' mode, in which you should be able to type and receive data from the computer at the other end of the telephone line. There are a number of 'flags' at the top right hand of the screen; these are "LCXRT".

Flashing 'L' means that you are being sent line feeds which the Spectrum does not really need. If you get the chance, ask for no line feeds. If 'C' flashes it means that you are receiving a control character (code 0-31), which the Spectrum again doesn't know what to do with. Flashing 'X' means that the other computer has sent a XON which means, 'Don't send anything else till I'm ready', and the Spectrum will do just that.

R and T stand for receive and transmit respectively, and should only flash when receiving or transmitting a file. If you find that what you are typing in does not appear on the screen you need to switch 'echo' on; you can do this by entering EDIT (shift + 1) then pressing E. If you find that whatever you press is repeated twice, then you need echo off; this means pressing EDIT then N.

Press EDIT brings up a special functions menu from which you may specify a return to terminal mode (ENTER), or a return to BASIC (SPACE), or from which you may either load a file from cassette (L), or save a file to cassette (pressing S to save a file you have just loaded for tape copying or a file you have just downloaded).

There is one last option, C, which allows you to send a control code (ASCII 0-32) to the

BULLETIN



A REVAMPED
VERSION OF
OUR SPECTERM
PROGRAM, HINTS
FOR GETTING
ONTO CABB
SUCCESSFULLY
AND LOTS MORE.

other computer. Press C followed by the letter that corresponds to the control code: A = 1, B = 2, and so on.

Uploading and downloading files can take a long time; so during receive the R flag will flash to tell you that everything is OK. You may press space at any time to abort. When uploading or downloading files to or from a bulletin board, such as CABB for example, give your Spectrum file an easily recognisable name (name.XS) so that other users will know for which computer the files are intended.

Once a file has been received you should save it to tape by typing 'EDIT', then S. To send a file type 'EDIT' then L to load it from tape, then 'EDIT' and T to transmit, assuming that the other end is ready to receive. Should you ever dial up a number, only to find that, no matter what you do, you can only get garbage on the screen, then it may be that the communication protocols are wrong.

Nearly all the bulletin boards work on 300 baud. If you have any problems, leave a message for the system operator (Sysop). Alternatively use 'CHAT' to talk to one of the system operators.

Once you have pressed 'EDIT', caps shift and 1, the program will prompt you to enter a special function, accepted commands being listed across the screen outlined in Fig. 9.

By Tony Dennis, deputy editor, and Stephen Adams, a computer engineer.

FIG.2

Maplin

```
6EDB 3A FF 3C C9 3A FD 3C CB
6EE0 47 C9 3A FD 3C CB 4F C9
6EEB 32 FE 3C C9 3E 03 32 FD
6EFO 3C 32 FD 3C 3A EB 67 32
6EFB FD 3C CD DB 6E C9 00 00
```

FIG.3

USP

```
6EDB C3 0E 6F 00 C3 16 6F 00
6EE0 00 00 C3 20 6F 00 00 00
6EEB C3 2A 6F 00 C5 01 DF FE
6EFO 3E 18 ED 79 3E 14 ED 79
6EFB 3E 44 ED 79 3E 05 ED 79
6F00 3E 68 ED 79 3E 03 ED 79
6F0B 3E C1 ED 79 C1 C9 C5 01
6F10 DF FC ED 78 C1 C9 C5 01
6F1B DF FE ED 78 CB 47 C1 C9
6F20 C5 01 DF FE ED 78 CB 57
6F2B C1 C9 C5 01 DF FC ED 79
6F30 C1 C9 00 00 00 00 00 00
```

FIG.4

Eprom

```
6EDB C3 23 6F 00 C3 2B 6F 00
6EE0 00 00 C3 35 6F 00 00 00
6EEB C3 3F 6F 00 C5 01 7F A7
6EFO 3E 36 ED 79 01 7F 97 3E
6EFB A1 ED 79 3E 01 ED 79 01
6F00 7F A7 3E B6 ED 79 01 7F
6F0B B7 3E A1 ED 79 3E 01 ED
6F10 79 01 7F E7 3E 40 ED 79
6F1B 3A EB 67 ED 79 3E 15 ED
6F20 79 C1 C9 C5 01 7F F7 ED
6F2B 78 C1 C9 C5 01 7F E7 ED
6F30 78 CB 4F C1 C9 C5 01 7F
6F3B E7 ED 78 CB 57 C1 C9 C5
6F40 01 7F F7 ED 79 C1 C9 00
```

FIG.5

ZX81

```
6EDB DB 7F 00 C9 DB 3F CB 47
6EE0 00 C9 DB 3F 00 CB 4F C9
6EEB D3 7F 00 C9 3E 03 D3 3F
6EFO 3A EB 67 D3 3F CD DB 6E
6EFB C9 00 00 00 00 00 00 00
```

FIG.6

Display routine

```
100 FOR A=26600 TO 28672 STEP 8
110 LET Z=INT (A/256): GO SUB 1000
120 LET Z=A-(INT (A/256)*256): GO SUB 1000: PRINT " ";
130 FOR B=A TO A+7
140 LET Z=PEEK B: GO SUB 1000
150 PRINT " ";
160 NEXT B: PRINT : NEXT A
170 STOP
1000 LET X=INT (Z/16): GO SUB 2000
1010 LET X=Z-(INT (Z/16)*16): GO SUB 2000: RETURN
2000 LET A$="": IF X>9 THEN LET A$=CHR$ (X+CODE "A"-10)
2005 IF A$="" THEN LET A$=CHR$ (X+CODE "0")
2010 PRINT A$;: RETURN
```

FIG.7

Checksum routine

```
10 LET Z=0: FOR A=26600 TO N
20 LET Z=Z+PEEK A: NEXT A
30 PRINT "CHECKSUM=";Z
40 PRINT "CHECKSUM SHOULD TOTAL Q"
```

Values for n and Q for above routine:

Cobra/Micro Mania	n = 28408	Q = 195318
Maplin	n = 28413	Q = 195698
Eprom Services	n = 28486	Q = 206134
USP	n = 28465	Q = 202602
Cobra ZX81	n = 28408	Q = 194806

FIG.8

Protocol settings

Specterm has been set so that it defaults to the following protocol setting:

1 start bit, 8 data bits, no parity and 1 stop bit.
For communications use the only other common setting is:
1 start bit, 7 data bits, even parity and 1 stop bit.

To alter the setting to the above:

Cobra/Micro Mania/ZX81/Maplin:

POKE 26603, 10

Eprom Services (dual):

POKE 26603, 78

USP: Does not use the variable 26603. The whole initialisation routine has to be rewritten to make any alterations.

FIG.9

Edit commands

RETURN Will return you to terminal mode with no loss of data as the program sends an XON (13h) to begin with and a XOFF (11h) to end.

SPACE Will ask you RETURN TO BASIC? Any key other than Y will return you to the edit mode.

N Will make the Spectrum switch off its echo. The keys you press are no longer repeated on the screen. This is the default setting and should work on most boards.

E Has the opposite effect of the above command, that is to force the Spectrum to echo any character entered from the keyboard.

L Will load any program from the tape into memory, ready to be copied to another cassette or transmitted to another computer (see T). This will erase any program already in memory; so if you have a program that you have just received in memory, save it to tape before loading the next program.

S This will save the program in the memory you have just loaded or received to tape. As this, load and save routines will work on any files other than headerless ones; as a spin off, you now have a very good tape copying device.

R Once R is pressed the Spectrum will go into a loop, and wait for the other end to be ready to send. Once it is, the files will be transferred across. It takes roughly 40 seconds to transfer 1K, this isn't too bad when you remember that the program is doing some very complicated error checking.

T Transmits the file.

GETTING ONTO THE BOARDS: STEP-BY-STEP GUIDE

Entering the world of micro communications can appear daunting. In order to make things easier for Sinclair users we have prepared a layman's guide to accessing bulletin boards. *Sinclair Answers* has its own board — CABB — but the information given here will stand you in good stead with all the systems used in the UK.

To access any bulletin board, first connect your micro to the modem via the RS232 interface (list of recommended RS232 add-ons is provided in *Table 1*). Now load the communications software (i.e. *Specterm*).

Check that the default values in the communications software are correct for the board you intend to call. Baud rates are given in our guide (see *Table 3* below) and virtually all boards are full duplex (that is, informa-

cases Prestel software and bulletin boards' are incompatible.

ACCESSING CABB

Ensure the modem has been set to the correct baud rate and mode (that is, originate) then dial (01) 631 3076. When CABB's modem answers the call, you will hear a whistling sound. It is often necessary to flick a switch on your modem to initiate communications. Users with acoustic couplers must put the mouthpiece into the correct end of the coupler.

The most common cause of problems is the micro-to-modem cable. Check with the modem supplier if you suspect that the connections are incorrect. Some modems require one of the pins on the RS232 to be 'high' before they start commu-

nicating, and this may require cross connecting two pins in order to fool the modem into working.

If all is well, the greetings text should appear on your screen.

When prompted, enter your first name and then carriage return <CR>.

Enter your last name (for speed, you can enter Fred;

Bloggs; Anytown) <CR>.

After the system has checked the userlog (it takes a little while), it will ask for town/country if you are a new user.

The board will then display 'TBBS welcomes FRED BLOGGS, calling from ANYTOWN. Is this correct?'

Check this very carefully. If anything is misspelt or corrup-

tion has occurred (normally in the form of little squiggles) answer N for no.

The reason for being so careful is that any personal message sent back to you will mirror the misspellings

or other errors. If next time you log on with the correct data it will appear that you have no mail.

Take a note of your own details, as it is fairly common for users to log on under a nickname, Dave for example, then wonder why the system does not recognise them as David.

Once satisfied that the details are correct, enter Y for yes. The system will then ask for a screen width. Spectrums are usually 32 characters but 40 and 80 are other common settings. The user is then presented with a list of popular micros.

There are established settings for the QL <L> and Spectrum <K> but these are set up for communications software such as *Specterm* so if you have anything different hit <CR>. Then CABB will ask: ▶



TAB.1

Recommended RS232 interfaces for communications use:

Supplier:	Name:	Price inc. VAT	Comments:
JWV Software , 139 Allington Drive, Strood, Kent.	Micro Mania RS232 interface	33.50	Enclosed. Needs extra resistor for Maplin modem. Comes with JWV's own programs.
Maplin Electronic Supplies PO Box 3, Rayleigh, Essex SS6 8LR. Tel: (0702) 552911.	Serial interface	£17.95	Kit form. Some skill at electronics needed. Uncased.
U-Microsystems , Winstanley Ind Est, Long Lane, Warrington WA2 8PR. Tel: (0925) 54117.	RS232 interface	£34.50	Requires motherboard (£25.30) to use it. Covers (£3.45)
Eprom Services , 3 Wedgewood Drive, Leeds LS8 1EF Tel: (0532) 667183	Dual Serial interface	£25.95	Uncased. Complicated instructions for modem connections.
Microcomputer Resources , 1 Branch Road, Park Street Village, St Albans, Herts. Tel: (0727) 72917.	Universal modem adaptor for ZX81	£34.95	Contains software on ROM.

Please note: Sinclair Interface 1 is NOT recommended.

tion flows both ways simultaneously).

The protocols needed for bulletin boards will be: 1 start bit, 8 data bits, 1 stop bit, no parity; or 1 start bit, 7 data bits, 1 stop bit, even parity. Some bulletin boards can be accessed using Prestel/Micronet software, and these are marked in our guide. However, in the majority of

TAB.2

Recommended modems:

Model name:	Supplier	Baud rate:	Price (inc. VAT)	BT approval
MM 102	Answercall , Kangley Bridge Road, London SE26 5AH. Tel: (01) 659 1133.	300	£75	Pending
Busbee	Bee Systems , 29-31 Back Cheapside, Bolton BL1 1LT. Tel: (0204) 395440.	1200/75	Under £100	Yes
Buzzbox	DaCom Systems , 26 Heathfield, Stacey Bushes, Milton Keynes MK12 6HR. Tel: (0908) 311885.	300	£86	Yes

Can your terminal print lower case?
Does your terminal need line feeds?
How many nulls do you require?

The first two questions need little explanation, but should you ask for no line feeds and find that everything gets printed on the same line it will spell trouble. The solution is to input two 'S's and then press X followed by F. This should get you to <F>ormat from the system settings menu.

The opportunity to reconfigure your system settings will be then presented and you can ask for line feeds. Should you still be confused you'll have to call back using a slightly different name!

Alternatively, call up as LOS-T:PASSWORD and ask the Sysop to change your userlog entry not — forgetting to give your real name.

The question asking how many nulls are required is really for users who have unbuffered printers attached to their micros or unusually slow terminals. In

TAB 2

DSL 21 23 Portman	DaCom Systems (as above). Interlekt Electronics, Reacis House, Portman Road, Reading, Berks RG3 1LU. Tel: (0734) 589551.	300 + 1200/75 300 + 1200/75	£286 £224	Yes Yes
MS 21/23	Master Systems (Data Products), 100 Park Street, Camberley, Surrey GU15 3NY. Tel: (0276) 685385	300 + 1200/75	£199	Yes
WS2000	Miracle Technology (UK), 1 Great Colman Street, Ipswich, Suffolk IP4 2AA. Tel: (0473) 50304.	300 + 1200/75	£115	Pending
VTX500	OEL Gillwilly Ind Est, Penrith, Cumbria CA11 9DN Tel: (0768) 66748.	1200/75	£99.95	Yes
Nightingale	Pace 92 New Cross Street, Bradford BD5 8BS. Tel: (0274) 729306.	30 + 1200/75	£137	Pending
Minimo	Steebeck Systems, 3 The Paddock, Hambridge Road, Newbury, Berks RG14 5TO. Tel: (0635) 33009.	300	£110.40	Yes

most cases, zero (0) nulls are required.

If you selected <K> for the Spectrum, CABB then prints: Upper/lower case
Line feeds needed
00 nulls required after each

<CR>

Do you wish to modify this?

Unless you have unusual software, the answer is naturally N for no.

The system now asks for an eight character password. Don't

forget to take a note of it immediately as you won't be allowed on to the system under that name without the correct password.

Each user has three attempts to get the password right before being thrown off.

At this point the caller should be well and truly logged on to the system.

CABB which is using popular bulletin board software called The Bread Board System (TBBS) will then give your caller number, and the number of the last message. It will also display which boards you have access to.

The next thing to appear will be a newsfile, followed by a new user guide. If possible capture these to a printer. The newsfile is updated weekly.

The new user guide can be read again if you go to <I>nfo and select option 5.

After these two files, the user is presented with the main CABB menu.

The majority of the main CABB menu is self explanatory. Should you <P>ause a file, then use a <CR> to restart it.

Callers initially have 15 minutes on the system so speed is of essence.

It is not strictly necessary to sign off the board using <G>oodbye (but we would recommend using <G>). It is feasible just to ring off as there is no connection charge (other than your 'phone bill)!

Good hacking!

By Tony Dennis, deputy-editor.

TAB 3

Board Name:	Tel. No:	System operator	Hours:	Baud rate:
(TBBS systems:)				
TBBS London	(01) 348 9400	John Nolan	24 hrs	300
Mailbox-80 Liverpool	(051) 428 8924	Peter Tootill	24 hrs	300
Blandford Board	(0258) 54494	Leo Knaggs	24 hrs	300
TBBS Southampton	(0703) 437200	Chris Cain	24 hrs	300
TBBS Nottingham	(0602) 289793	Paul Beaumont	24 hrs	300 + 1200/75
CNOL	(0524) 60399	Mike Buckingham	12.00-10.00	300
Microweb	(061) 456 4157	Mike Bibby	24 hrs	300
CABB	(01) 631 3076	Tony Dennis	24 hrs	300 + 1200/75
BASUG	(0742) 667983	Quentin Reidford	24 hrs	300
North Birm BBS	(0827) 288810	Paul Smith	24 hrs	300
(CBBS (R) systems:)				
CBBS (R) South West	(0626) 890014	Boyd Hitchcock	24 hrs	300 + 1200/75
CBBS (R) Surrey	(04862) 25174	Mike Parker	24 hrs	300
CBBS (R) MG-Net	(01) 399 2136	Peter Goldman	17.00-22.00 Sun	300
(Forum-80 systems:)				
Forum-80 Hull	(0482) 859169	Fred Brown	13.00-22.00 request	300
Forum-80 Wembley	(01) 902 2546	Victor Saleh		300
(Other systems:)				
Mailbox-83 West Mid	(0384) 635336	Jim Roden	17.30-08.30	300
Southern BBS	(0243) 511077	Jonathan Sanders	24 hrs	300
OBBS Manchester	(061) 427 3711	Robert O'Donnell	22.30-00.00	300
Remote CP/M Stoke	(0782) 265078	Ian Hickman	24 hr	300
(Commercial systems:)				
Estelle	(0279) 443511	STC Electronics	9.00-18.00	300
Maptel	(0702) 552941	Maplin	24 hrs	300
Distel	(01) 679 1888	Display Elect	24 hrs	300
(Prestel compatible systems:)				
C-View	(0702) 546373	Rochford D.C.	24 hrs	1200/75
Hackney	(01) 985 3322	Hackney B.C.	24 hrs	1200/75
Optel	(0908) 71188	Open University	24 hrs	1200/75
Aberdeen	(0224) 641585	Aberdeen ITeC	24 hrs	1200/75
Estelle	(0279) 441188	STC Electronics	9.00-18.00	1200/75

ZX81 GOES FORTH

The 'Input' page in July/August issue of *Computer Answers* contained an item by Frank O'Hara on the method of finding prime numbers known as the Sieve of Eratosthenes, and a program for the Beeb to print those less than 1000. Following on from this I decided to try this on my ZX81, which has the Forth chip produced by Skywave, and I enclose the program I wrote.

Dr O'Hara's program took about four seconds to run whereas mine takes about 10 seconds. Intrigued by this result, I decided to do the same using ZX81 Basic. The program to print primes using ZX81 Basic is attached and you will notice that I have had to use an input statement to enter the first 10 primes starting with 3.

After entry of this initial input, the program takes two-and-a-half minutes to run. Forth is indeed faster than Basic, by this reckoning about 15 times faster. By the same token, I wonder how much faster Forth runs on the Beeb? Perhaps someone will have a go and let us know.

G Blackwood, W Halifax.

MISPLACED PRAISE?

I was disappointed to find on the 'Bookshelf' page of the July/August issue of *Computer Answers* issue a recommendation for 'Mastering Machine Code' (Vols 1/2) by James Walsh and Paul Homes (published by Interface). I don't know what Vol 1 is like, but I have spent countless hours correcting the enormous number of errors in Vol 2.

I wrote to Interface in November of last year informing them of the problems, and in February I received a cheque in payment for the book with a request to send it to them with all the errors marked up and they would take it up with the author.

I replied, saying that I thought that I should get some recompense for the hours I had put in or at least some recognition for some, but since February there has been no answer.

Seeing as the book is meant to

FIG.1
ZX81
SIEVE

```
: PRIMES ;
0 VARIABLE Z
: ARRAY<BUILDS 2*ALLOT
DOES > SWAP 2*+;
500 ARRAY A%
2 0 A% !
10 ARRAY P%
: A%FILL 500 1 DO I 1 +
2* 1 - I A% ! LOOP;
: P%FILL 31 29 23 19 17 13 11 7 5 3
10 0 DO I P% ! LOOP;
: ZERO! 500 SWAP DO 0
I A% ! Z @ + LOOP;
: SIEVE 10 0 DO I P% @
DUP DUP Z ! * 2/
ZERO! LOOP;
: RESULTS 500 0 DO
I A% @ DUP
IF . THEN LOOP;
: S A%FILL P%FILL SIEVE
RESULTS;
```

S <CR> RUNS THE PROGRAM
TIME IN RUNNING 10 SECONDS
(4 TO START OF PRINT).

ZX81 "PRIMES"

```
10 DIM P(10)
20 FOR I=1 TO 10
30 INPUT P(I)
40 NEXT I
50 DIM A(500)
60 LET A(1)=2
70 FOR I = 2 TO 500
80 LET A(I) = 2*I-1
90 NEXT I
100 FOR I = 1 TO 10
110 FOR J = (P(I)*P(I)+1)/2
TO 500 STEP P(I)
120 LET A (J) =0
130 NEXT J
140 NEXT I
150 FOR I = 1 TO 500
160 IF A(I) = 0 THEN GOTO 180
170 PRINT A(I); " ";
180 NEXT I
```

RUNNING TIME = 2 MINUTES 30 SECONDS
AFTER INPUT OF THE
10 PRIMES STARTING WITH 3.

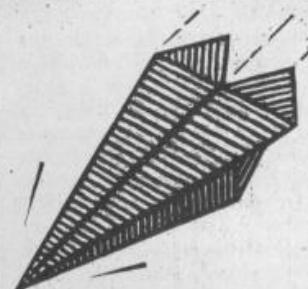
be a teaching book, I think it is appalling. Unbelievably, even the basic loader program in the book is wrong, and will not work on the hex conversions. Thus none of the other

programs will work (even after correction) if the loader program is used for entering them.

R Ellis, High Wycombe.

DATA FILE

INPUT



FINDING PRIME

NUMBERS ON THE

ZX81, AND A

MACHINE CODE

BOOK

CRITICIZED.

Computer Answers, the forerunner of Sinclair Answers, was published as a general magazine for two years before expanding into machine-specific titles. Many of the articles, answers and reviews were relevant to Sinclair machines. Here's a run down of what you might have missed . . .

ISSUE 1

(Nov/Dec 1982):

If you want a copy of an article from this issue, please send 50p per article (see contents page for address) marking the envelope 'Copy service'. We will send you photo copies of the appropriate pages. Jupiter Ace, DEC Rainbow, Commodore 64 (reviews); ZX81 upgrade; 8/16 bit choice; Z80 cards; ASCII code; Program swapping; I/O concepts; Printer plug-in; Assembler course (introduction); Program generators; Basic queries; Graphics; Communications; Database management systems; The UCSD p-system; Multiuser systems; CP/M utilities; Bad-quality software.

ISSUE 2

(Jan/Feb 1983):

CP/M Plus (CP/M facelift); Memory (RAMs and ROMs explained); Baud explained; Configurations (WordStar on Epson); Program editors; Assembler course (part 1); List sorting program; Program concurrency; CP/M revealed; **Computer Answers File No 1: Home Computing** (domestic applications); Word-processing advice; Communications modems; Maintenance; Sales talk; Legal File (maintenance agreement small print).

ISSUE 3

(March/April 1983):

VisiOn and Lisa (reviews); Torch upgrading (the Tube); Changing print characters; Z80 workhouse; Assembler course (part 2); APL program language; CP/M utilities and corrupted disks.

Sinclair Clinic; Systems expertise; Beware of selling hype ('relational databases'); Business graphics (principals); Stargazing and bi-rhythmic software; Copyright clauses; Budget micros; Micro manufacturers answer back; Renting software; Legal File (piracy problems).

ISSUE 4

(May 1983):

Sage IV (review); Microflopies; Data preservation; Apple IIe (review); Government's choice of micros; Monitors; Slide-show controlling; Digital input; Random numbers; Assembler (part 3); Professional games programmers.

Dragon and Texas Clinic; Making music on micros; Spreadsheets (Planner-Calc); Business graphics (practice); Toolkits; Ergonomics; Legal File (small claims procedure).

ISSUE 5

(June 1983):

Pinball Construction Set (review); VisiWord (review); Power (what constitutes a micro's muscles); IBM Clones; Buses; Data structures; WordStar Workshop (part 1); Number base conversion; Random numbers; Gw Basic; **BBC Clinic**; Business Operating System; Horse-race Forecast Package (review); MasterCalc (review); Classroom computing; Games simulation; Software security; Setting up (selling your own software); Legal File (defaulting mail order advertisers).

ISSUE 6

(July 1983):

New Osborne Executive (review); Lotus 1-2-3 integrated software package (review); Plotters; Memory expansion; User-friendly software; 'Turtle' conversion job; Communications (file transference); **Commodore Clinic**; Lisp language; WordStar Workshop (part 2); CP/M supervisors; Computer aided design; Spreadsheets (MultiPlan); Micros in the music studio; Insurance; Computer holidays.

ISSUE 7

(August 1983):

System speed; Choosing a printer; Typewriter conversion; Preserving on Proms and Eproms; 'Turtle' conversion (Part 2); Assembler course (final part); Programmers Ten Commandments; WordStar Workshop (part 3); **Atari Clinic**; Exploiting Operating Systems; Cassette-based word processing, spreadsheets, and databases (reviews); Computer Aided Learning (CAL); Pilot (CAL language); Data management; Selling your programs to companies; Legal File; the intricacies of copyright.

ISSUE 8

(Sept. 1983):

AMS 3 inch microdisks (review); **Computer Answers File No 1: Interfaces**; Making 3D images; WordStar Workshop (part 4); dBase II Workshop; Numbers; Recursion; Game of Life; Programming logic statements; Data compaction; **Apple Clinic**; Microsystem's insides; BCPL (language); Spreadsheet formulation; micros in schools; Abstract computer Art; High street retailers; Legal file: the cost of going to court.

ISSUE 9

(Oct. 1983):

Colne's Armadroid robot (review); Advanced VisiCalc; Coping with cassettes; Tandy 100 versus Epson HX20; Translating Basic into Assembler; Data Programming; WordStar Workshop (part 5); dBase II Workshop (part 2); Bill Budge interview; True Random Number Generation;

Logo (language); **CP/M Clinic**; Probing the processor; micro-designing computer; database reviews; Spreadsheet formulation; computerised graphics on Rock albums; Disk prices; Legal File: customer/dealer disputes.

ISSUE 10

(Nov. 1983):

ACT Apricot (review); Hard disks (overview); The Sord M5/CGL M5 (review); Spectrum expansion (add-ons); Vic port project (Rs232 card); Break into Barcodes; Getting RAM; Wordstar Workshop (part 6); **Tandy, Dragon, Genie Clinic**.

Memory Mapping; Peripheral chips; MSX Compatibility; War games (reviews); An Epson in Turkey (roadtest *exotique*); Keyboard trainers; Computer training courses; Brixton ITec (Econet); Buying second hand systems; Legal File (problems of setting up a software library).

ISSUE 11

(Dec. 1983):

New generation of cheap modems; printer buffers; Watford Electronics disk filing system; Disk benchmarking test; Mice-like inputting devices; Communications software; Using arrays; Seymour ('Logo') Papert (interview); Programmers Workshop ('Wolf Fence Algorithm' / 'Instrumentation'); Worms; **Sinclair Clinic**; Device drivers; Bulletin boards; dBase version 2.4 (d'Base III); Spreadsheet DIF facility; Choosing a user group; Correspondence course in computing; GOSH — the Guild of Software Houses; Legal File: options on going to court.

(Also incorporating the **Computer Answers Upgrade Supplement** (gratis), which contains full information on the upgrading possibilities of the 13 most popular micro-computers.)

ISSUE 12

(Jan. 1984):

Elan Enterprise; Atari 600XL; Spectravideo; Cheap daisywheel printers; Best games of '83; Personal CP/M; Converting one Basic into another; **BBC/Electron Clinic** Cassette editors and assemblers; Games programming with sprite graphics; Bank Street Writer word processor; Reflexive VisiCalc; Start your own user group; Furniture to keep your micro tidy.

(Incorporating 'Program Power' booklet (gratis) containing listings for all the popular micros).

ISSUE 13

(Feb. 1984):

Inside Oric ROM, IBM PC jr; Joysticks; scope (games writer); Instructional games videos; special effects from dot-matrix printers; Interface I problems; Beyond Basic; Getting Sound Effects; Game of Go (Part 1); Game of Nim (Part 1); Programmers Workshop: speeding up;

Commodore 64/Vic 20 Clinic; Microcache package; Business databases; Everyman database package; Disk corruption; Cassette duplication; Second-hand peripherals; Setting-up a bulleting board; Legal File; secondhand micro sales.

ISSUE 14

(March 1984):

Memotech MTX; Dragon 64; Vic 20 add-on boards; adventure game writing packages; fancy fonts for the BBC; RS232 interface revealed; Bluff (game); Go (Part 2); BBC disk file expansion; Nim (Part 2); Fog Index (game); Wordwhizz (game); Assembler Workshop; Basic Workshop; **Spectrum / ZX81 Clinic**; Operating systems; Business: accounts packages; accessible megadatabases; weekend training course.

Introducing **Computer Answers** Bulletin Board-CABB — our very own, free electronic magazine; Legal File — what are the pros and cons of buying a micro with a credit card.

ISSUE 15

(April, 1984):

Sinclair QL; Apple Macintosh; Disk drives; programming by video; Tactical computer war games; Spectrum graphics packages; VDU conversion; Documentation; Data compaction; Atari Graphics modes; Oric synthesizer; Four-sight game; Philip 'The Hobbit' Mitchell interview; screen display storage;

BBC/Electron Clinic; Operating systems (Part 2); Using your micro to make money; **Brainstorm** 'ideas processor'; **Starburst** and **Starindex** data management packages; Micro repair sources; Legal File; up-market micro deals.

ISSUE 16

(May, 1984):

New generation of Japanese MSX micros (Part 1); Transam Wren (review); New range of high-quality dotmatrix printers; Upgrading to disk drives; Hurg games designer; Motorola 68000 chip; Commodore interactive **Battleships**; Spectrum animation techniques; Guide to the Dragon's 6809 processor; **Crocus** — crossword solving program; BBC program security;

Commodore 64/Vic 20 Clinic; Operating systems (Part 3); Micro system cleaning products; Legal File: software houses' case.

ISSUE 17

(June, 1984):

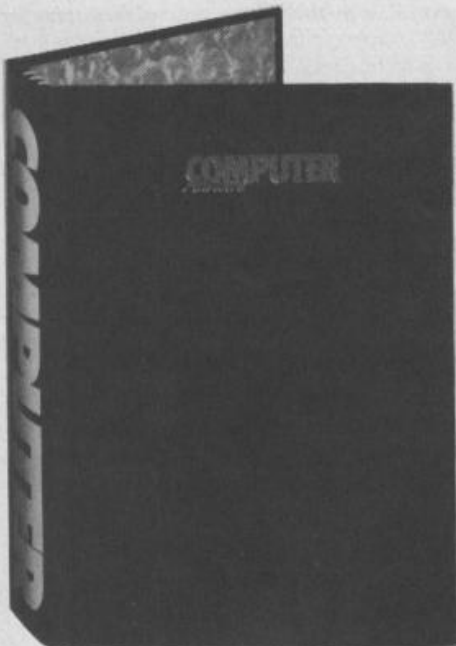
Japanese MSX micros (Part 2); BBC add-on boards; Cheap modems; Cheap CP/M; Program testing techniques; Creating your own adventure routines; Spectrum animation techniques (Part 2); Spectrum sound effects techniques; **Towers of Hanoi** (game for the 48K Spectrum); **Reversi** (game for the Spectrum); Converting Vic programs to run on the 64; Assembler Workshop;

SuperClinic: masses of Q&As on the Spectrum, BBC, Commodore, Oric and Dragon machines, including articles on Dragon Pascal and Oric hires graphics; Backup and archiving (*Clip* package); Wiring up your own connecting leads; Operating System tables (appendix); Legal File: advantages of 'under-age' software authors.

ISSUE 18

(July/Aug 1984):

Robot arms and servo-controllers; PC Junior Creview; Amstrad (review); **Homeward** word-processing package; radio software; MIDI System; Incorporating dialogue into your adventure games; C language; techniques for getting the PRINT AT function on the Vic 20 and Commodore 64; Syllogism program; Basic Workshop: programming idioms; **Sinclair Clinic**; database packages; **Everyman** revisited; Software piracy; stationery supplies; Legal File: what to look out for when signing contracts.



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		Orwin Software	93	V	
H		P		Vu Ucan	109
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Highsoft	41	Picturesque	50	W	
		Pinnacle Electronics	2	W.D. Software	102
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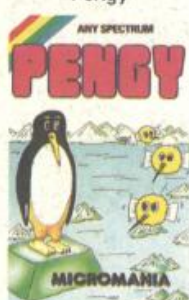
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