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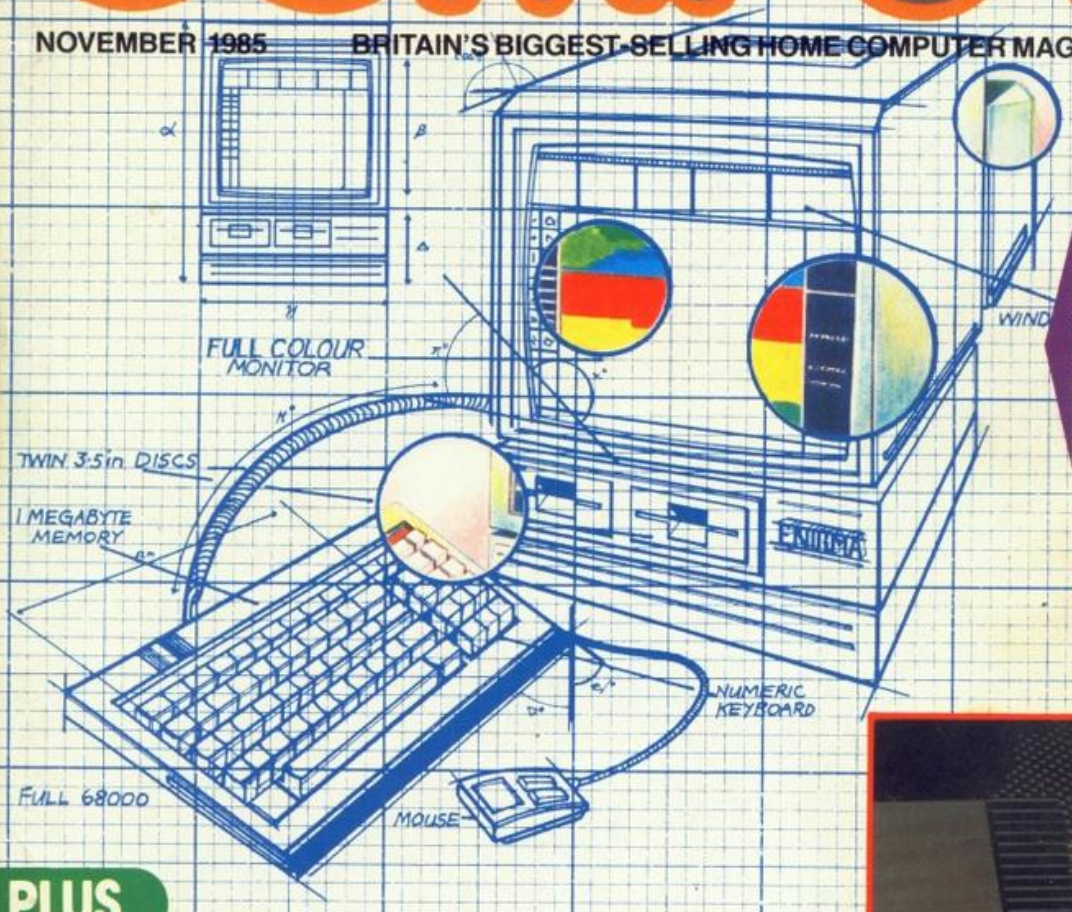

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27 LETTERS: Last word in the great Microdrive debate from Katherine Peel; is Sir Keith Joseph all he's cracked up to be; extra terrestrials may be upset.

31 HARDWARE HITLIST: Our boys in the backroom benchtest a Spectrum printer interface, DK'tronics' Amstrad lightpen and Arnor's Amstrad sideways Rom.

34 CHRISTMAS COMPUTER BARGAINS: Nothing stirring in your house — not even a computer mouse? Lee Paddon catalogues the available hardware for Santa.

37 SOFTWARE SHORTLIST: Hewson's Paradroid takes pride of place as the most innovative zapperoony yet; plus Donald Duck, Winter Games, Astroclone, and Adrian Mole.

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78 HOTSHOTS: Hints, tips, features and bugs. Hotshots is here to help you. We provide a map to help you rid the village of the plagues — yes, Nightshade.

79 THE GREAT GOONIES COMPETITION: Goonybirds permitting, you can win a compact disc player on one of 25 Goonies treasure chests. And Cyndi Lauper on disc.

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86 COMMODORE 64 DOUBLE-DENSITY BLOCKS: Keith Suddick shows how to make use of a simple Plot facility without going into bit-map mode.

88 SPECTRUM DRAWER: A complex draw program by Paul Rhodes with many advanced facilities usually only found on expensive commercial packages.

92 AMSTRAD GRAPHICS EXTENSION: This piece of Andrew Ware gives you 13 extra graphics commands, including an Inverse and CopyChar plus Stipple command.

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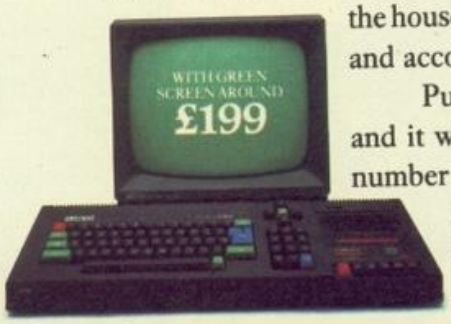

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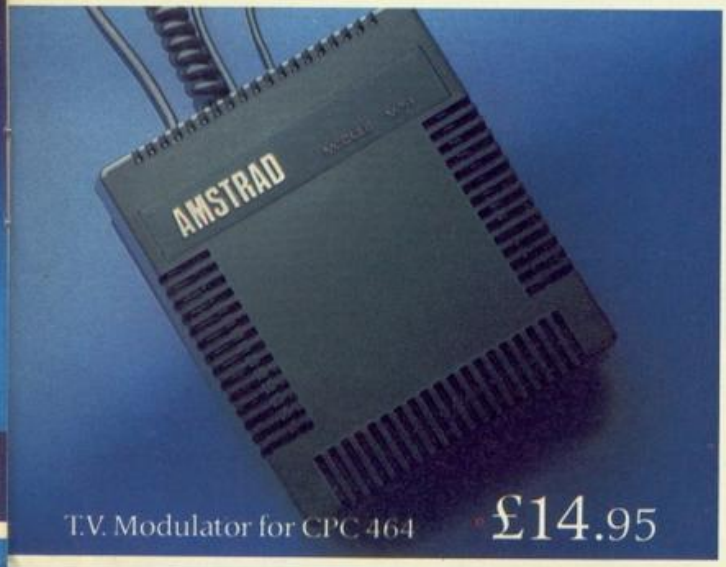

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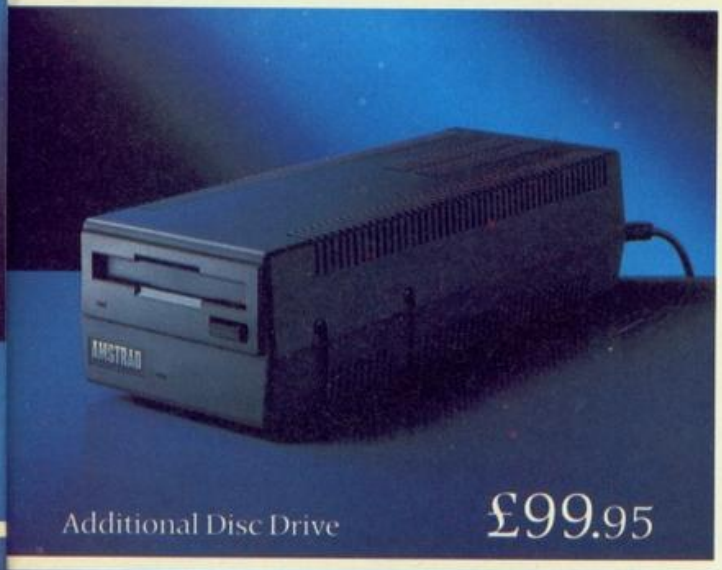

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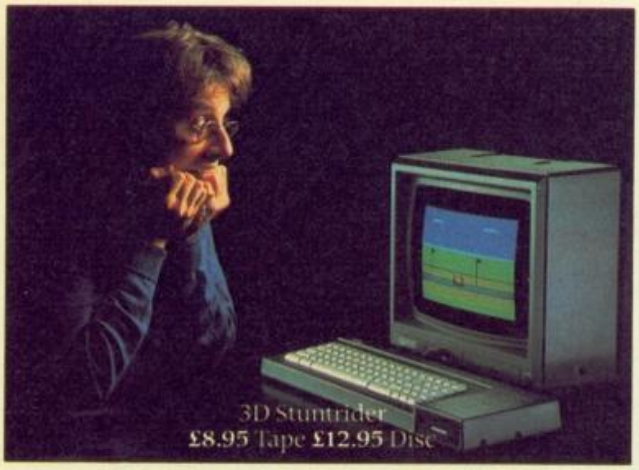
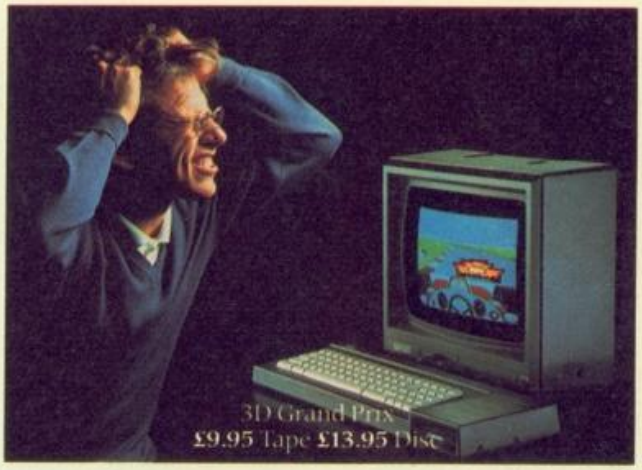
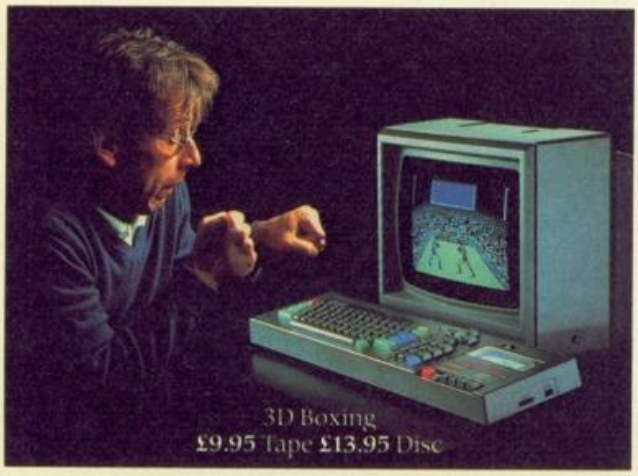




When it comes to computer games you can't beat an Amstrad.



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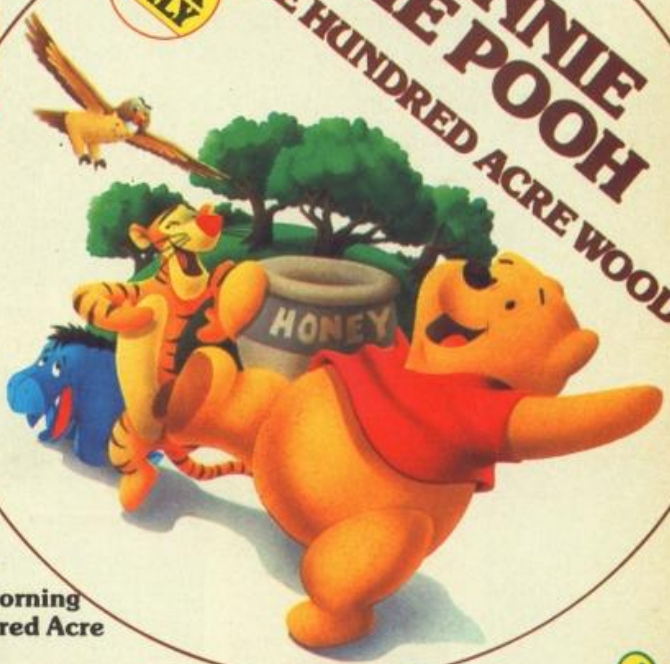

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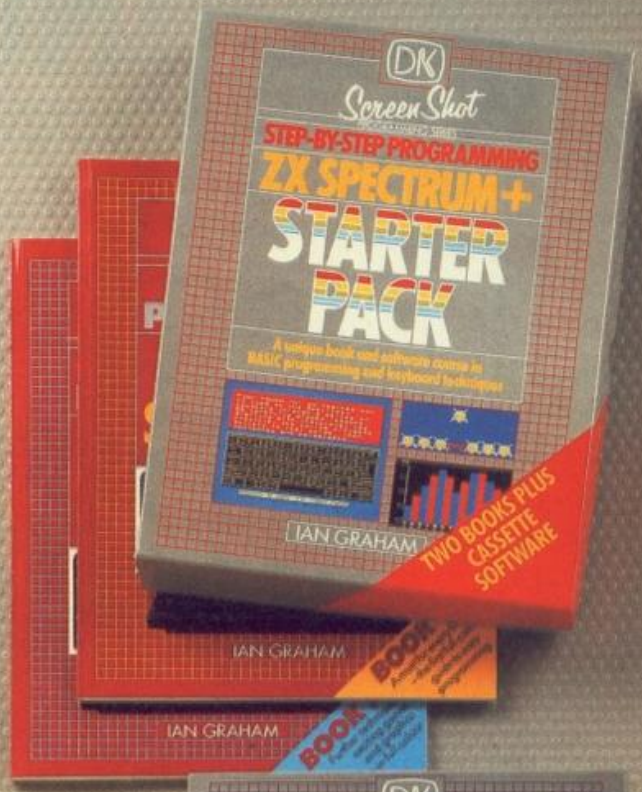

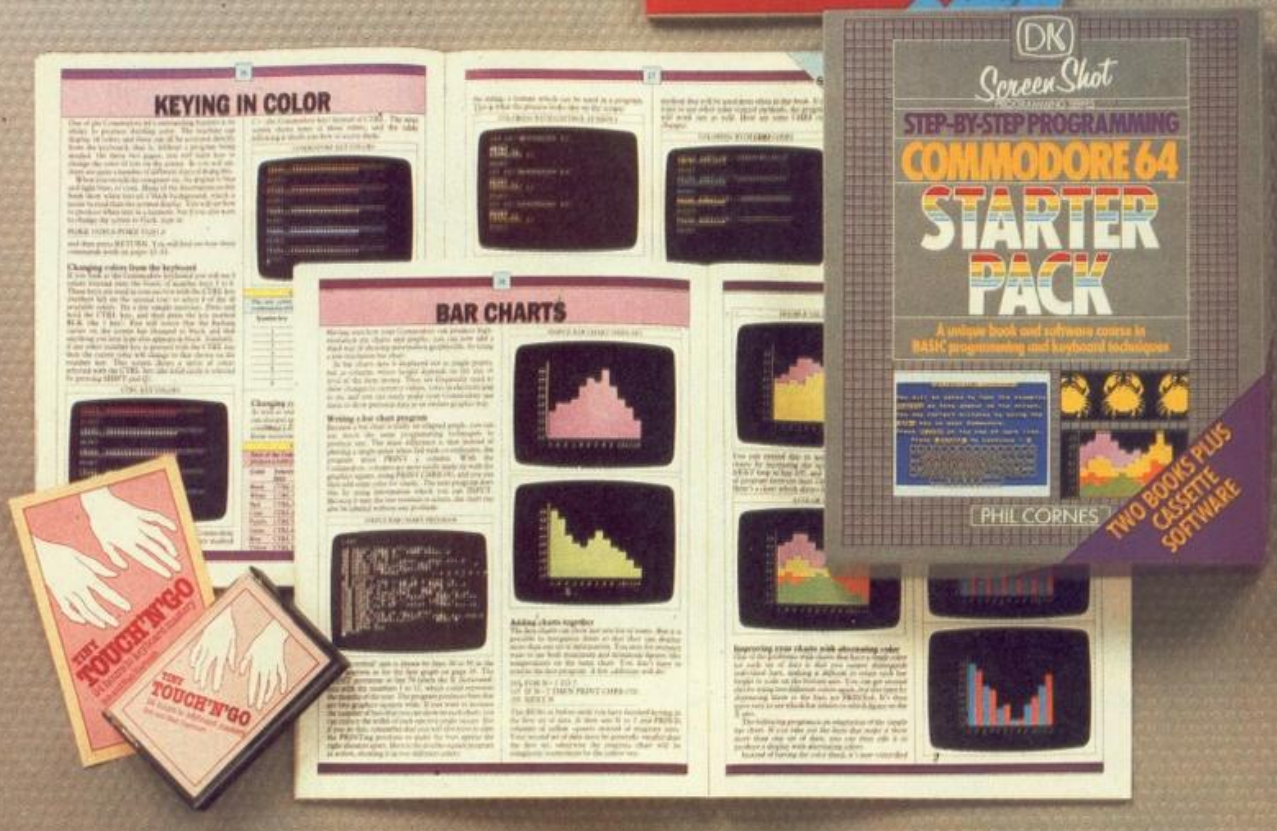

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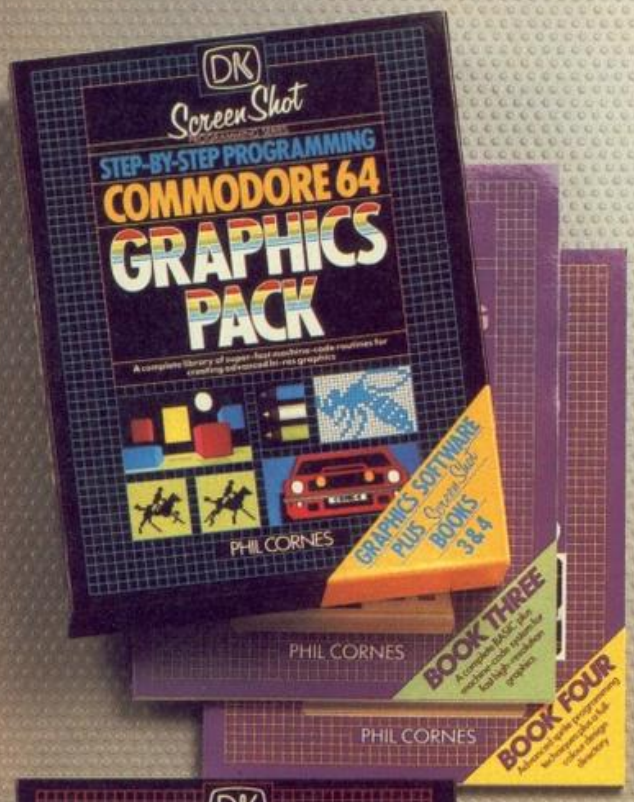

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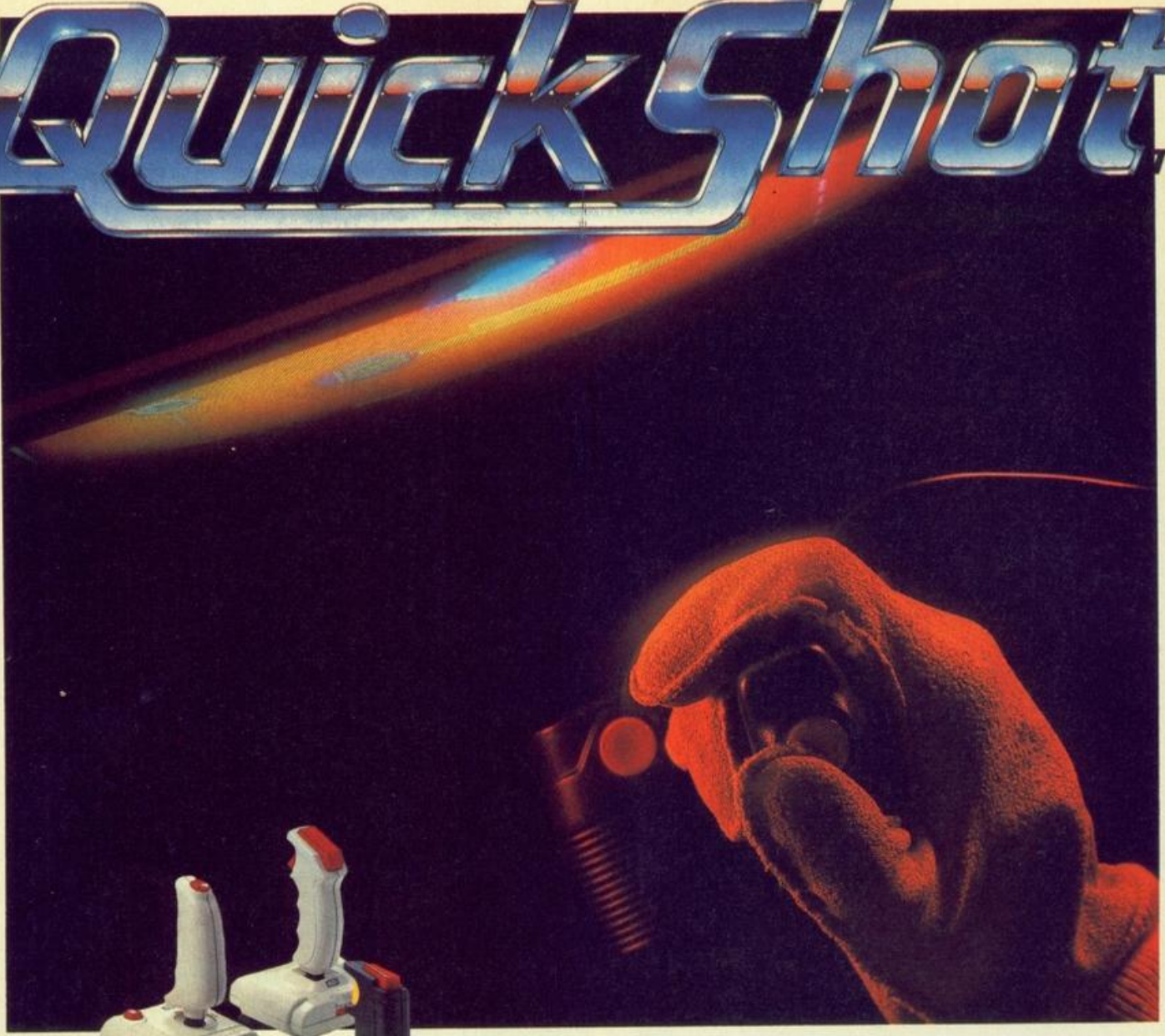

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THE LAMPS ARE GOING OUT...

THE PULL OF profit and prestige sucked Britain's biggest computer manufacturers Sinclair and Acorn into their great American disasters. If only they had looked closer to home. There, right on their dorrsteps waited the huge and largely untapped European markets.

At least Sinclair and Amstrad seem now to have cottoned on. Amstrad's impressive £20 million profit figures owe much to very healthy overseas sales — it's pushing its computers hard in West Germany under the Scheider marque, chosen to appeal to the Teutonic sensibility. Ironically the name Amstrad in this country scores with its overtones of Scandinavian efficiency.

Sinclair on the other hand has gone Spanish. Granting Investronica of Madrid the right to build a 128K machine may prove to be one of the most intelligent moves the company has made since the launch of the Spectrum itself back in 1982. Spain may not be in the same league as the U.K. in terms of computers per capita, but then that's the perfect reason for going there. Potentially it also opens up the vast Spanish-speaking South American market.

The Spaniards have already proved their skills in the car-building business: they took on contracts from major automotive manufacturers to build cars under licence. Now they are among the biggest car builders in Europe and are selling their own models into other countries.

Even British products written off as failures in the U.K. have been eagerly scooped up by other Europeans. Now alongside the Camembert factories you'll find Orics being churned out in Normandy, or Dragons being bred in Spain by Eurohard.

Two years ago Britain was a long way ahead in terms of volume and sheer variety of computers. If more energy had been spent then in spreading the risks and making a mark in Europe and less on the notoriously volatile U.K. scene, many of the financial disasters of 1985 could have been avoided.

The sun may never set over the British computer Empire, but that's because it never rose in the first place. If companies are to survive it must be on a broader footing. Europe may be the last chance they get.

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"Take that. Fion the Magic Cirle."

BATTLE OF WIZARDS

BRITAIN'S WIZARDS are locked in battle over who shall control the market for micro magic. One man, David Hambly from Knights Way (yes seriously) Ilford is taking on the whole power of the Magic Circle. The Magic Circle is releasing a book and tape which will allow you to perform 15 different tricks on your Spectrum, Commodore or Amstrad. "When you learn from this book and software the secrets of magic, remember that you must keep them to yourself." says John Salisse, Secretary of the Circle "They are not yours to give away". But despite John's claims that the Circle suite is unique David Hambly can show micro magin books and software that he has produced over the years. Contact Sardi's Software (01) 551-5908 for details.

Future plot

FLAT BED plotters are no longer the play things of the idle rich.

Future Music is selling Roland DXY100 A3 sized plotters at the remarkable price of £259. The plotter is connected to the computer via the centronics port, so, theoretically could be used with most home micros. However, the company only supplies software for the BBC. Supplied with the plotter is a ROM as well as some examples of 3D plots on cassette. The ROM routines include music and graph plotting, arcs and hatching. Resolution is to .1mm with a plotting speed of 70mm/s. You can find out further details from Future Music on (0245) 352490.

AMSTRAD BOOM

664 problems solved

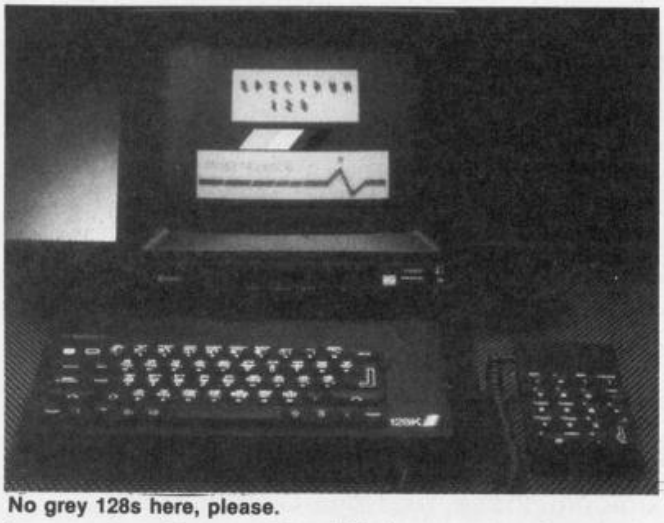
AMSTRAD CONTINUES to confound the prophets of doom in the micro industry by announcing record turnover and profits up to £20 million compared to Commodore's announcement that it is losing $1 million a day and Acorn and Sinclair's dismal results. What is more Amstrad's boom is based almost entirely on computer sales. When the British market started to flag Amstrad just sold them abroad instead.

The PCW 8256 all-in-one word processing package is selling briskly. Unfortunately companies like Dixons had neglected to stock up with the 3 inch discs it uses, leading to shortages in many areas.

Another problem for Amstrad 664 owners who found themselves ditched by the rapid introduction of the 6128 has been solved by DK'tronics. DK will sell an £50 64K extra memory unit for the 664 which will work with switching and system calls but not from Basic since the 664 Rom has not been overlaid. DK will also introduce a 256K expansion pack for £100 — the same price as a 16K expansion for the ZX-81 four years ago. A 256K silicon disc is also on the way.

PCW 8256 sells too fast for Dixons.

SECRET DIARY OF SIR CLIVE, AGED 45¼



No grey 128s here, please.

SINCLAIR SAYS Spectrum Plus and QL sales are booming — selling at twice the rate of Commodore and Acorn put together.

But Commodore is now fighting back hard with an Adrian Mole promotion for the 64, delivery at long last, of the 128 and announcement of the Amiga's official launch in January.

Behind the scenes neither company is having an easy time with Commodore announcing $124 million losses for March, April and May while Sinclair is moving out of its prestige headquarters in Willis Road, Cambridge, sacking 20 of its 120 employees and losing the likes of Robb Wilmot and Nigel Searle.

Rumours that the Spanish Investronica-built Spectrum 128 would be unofficially imported to Britain have been quashed. The only "grey imports" will be to software houses preparing products for the British launch next February. Commodore's Christmas promotion meanwhile will bundle a 64, cassette recorder, Music Maker, Designer's Pencil and the book and game of The Secret Diary of Adrian Mole.

The Commodore 128 is now on sale as a standalone but because the cost of the original 128 including 1571 double-sided drive looked prohibitive it will now be bundled with the 1570 single-sided 0.5 Mbyte drive for $450.

DIARY

WHICH COMPUTER is "the BMW of the home computer business" and who called it that?

HERE'S A CLUE for the BMW question. the designer of one of the chips inside it "Dave" also designed the three-wheeler which won the Euromouse 1985 micromouse merge race in Brussels last month.

SMELLYVISION will hit your screens on October 20.Brother, the computer printer makers, are launching a scratch and sniff TV promotions for their high speed cookers. The idea is that you will pick up copies of TV Times impregnated with the smell of roast beef, pies and bread. If you live in the Granada or TVS areas and see a Borther commercial starting the idear is that you will race to your paper rack and then wait for a "scratch now" caption to appear as the oven door is opened. That could be fun with computer games, we could have scratch 'n sniff pads in *Your Computer*. A prize for the best suggestion.

BRITISH TELECOM is enjoying what it is learning from the home computer market. The little birds, which we diarists use in preference to those nasty leaky phones, tell us that Firebird tasted so nice that BT is buying Beyond as well.

STEVE JOBS, who gets the credit as co-founder of Apple with Steve Wozniak for starting the home computer revolution, has left the company on acrimonious terms. Apple is suing Jobs for stealing information and employees now that he has left to set up a company making educational computers.

MEANWHILE that once-mighty school micro maker Acorn has turned out to be a participant in the "Euro-rival to MSX" project. Olivetti is of course involved but the third participant is not Philips as expected, but Thomson which dominates educational computing in France.

BMW Enterprise of course. Who said it? Enterprise's Mike Shirley. Dave Woodfield, who designed the chips and the mouse works for Intelligent Software.

Elsie Dee

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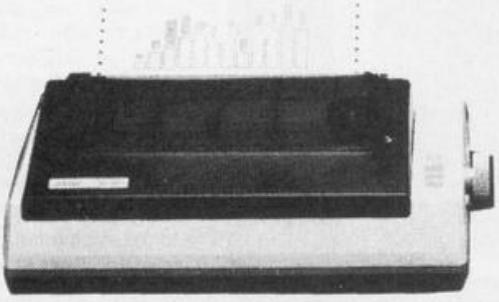

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UPDATE

Better late than never, but sometimes it's difficult to tell the difference. Digital Integration, who rocketed to obscurity after over-night success, look like finally releasing *Tomahawk*, a helicopter simulator after keeping the punters wating for over a year.

Despite this, they might be forgiven if it turns out to be as wonderful as they say it is. Air combat, vector graphics, ground targets, lots of instruments, it may well have the same impact as Fighter Pilot did when it came out in what silicon archaeologists like to call the early durasic period.

Novagen still insists

Mercenery is on the way, leaving the answer phone to cope with the calls of anxious punters. Novagen assures us the delay is simply due to wanting to make it even better!

Spectrum Elite nears completion. Unfortunately, Firebird have had to leave out most of the missions that other, less scrupulous magazines reported were in their "review copy" due to memory restraints. However, it still promises to be wonderful. Apparently Firebird's Gyron team has virtually re written the structure so that it won't slow down when a lot is happening. A new launch sequence and revamped display is promised.

Activision has forsaken the humdrum world of the shoot-em-up, for the philanthropic pursuits. Apparently, they discovered the presence of **Little Computer People**, and unlike you or I, would simply have given the thing a voilent shake and hoped the little debugger would fall out, Activision, gave it a house, coaxed him out of the innards and on to the screen. Of course, they are all different, Activision just give you the house, and the little chap takes on his own individual character. Not only that, **Hacker** is an attempt to spare NASA's blushes, and many parent's phone bills by diverting code breakers from the real thing to a game with the highly laudable task of saving the world.

ARIOLLAMA

Minter joins Zombies

MINTER IS back with a vengeance — the label may have changed but the psychotropic dreamer maintains his firm commitment to fast-scrolling all-action shoot-'em-ups that leave the player with much deeper comprehension of the traumas of shell-shock. Batalyx — not so much released as allowed to escape — from Ariolasoft is obviously Jeff's compilation album, sitting well on his shelves next to the Pink Floyd Relics cassette, no doubt.

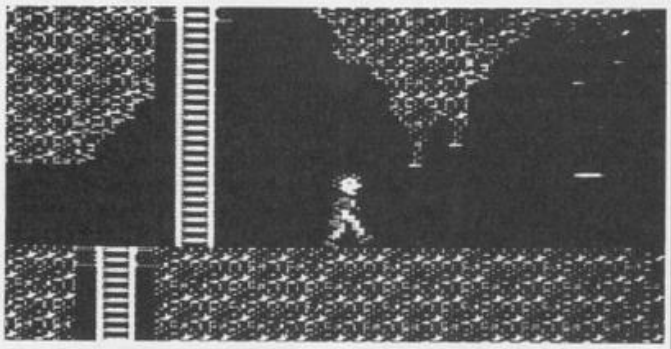
Six games for £12.95 on Commodore 64 disc, £9.95 on cassette: kick off with Hallucin-O-Bomblets, a freaky asteroid derivative; then AMC II, a dub version of Attack of the Mutant Camels; next, the very abstract Activation of Iridis Base. This gives you a driver's-eye-view of a mutant camel approaching a pyramid. When the base is activated a —

Recognisable Jeff Minter.

you guessed it — Dark Side Of The Moon album cover effect is generated. The Ancipital returns in Cippy on the Run, followed by a geometric puzzle called Syncro II. Finally a re-run of Psychedelia. Review next month.

Scarabeus sees Ariolasoft's phalanx of Hungarian programmers producing good graphics, great sound and an absorbing arcade adventure. Aim of the game: find the fabulous Emerald jewel of the Pharaohs by zooming aroud a 3D maze in Scrollerama. On each of the three levels you must assemble or find a key to get to the next level by capturing ghosts or entering places of information. Zombies and spiders conspire to prevent you getting into the Pharaoh's tomb. This ranks with Ariolasoft's Skyfox as an attempt to market good original material, rather than the older US games. Wizard, the third release, includes a screen construction set, so if you get tired of jumping the climbing through 40 dazzling screens as you reach for diamonds, gold and pearls, you can change the game. Both Wizard and Scarabeus are £12.95 on C-64 disc, and £9.95 cassette.

DOCTOR WHO AND THE MICRO ROMS



"The Daleks are off but can I recommend the TARDIS".

ROM chips have got cheaper — some EPROMs are reportedly available for a quarter of their January price — which has literally created ROM to move for claustrophobic programmers sweating away trying to produce epics in 32 or 48K of memory. At least two software houses are using sideways ROMs to expand the memory of a specific computer so it can run a specific games program. Means you have to dig a little deeper into the piggy-bank, but they claim it's worth your while. At £14.95, Mikro-Plus (alias Mikro-Gen) are confident that Shadow of the Unicorn is value for money. Not only do you get 64K of program on you Spectrum and a 120-page illustrated book, but you also get a built-in joystick port, and back-up to microdrive or tape facility, plus a diagnostic checking and tape alignment routine for trouble-free loading.

Shadow of the Unicorn is the tale of an unwitting farmer who opening an old tomb he has discovered releases evil forces. There are 10 fully-animated characters all with their own part to play in helping you to reseal the book. There are 2,800 locations and 11,500 views according to Mikro-Gen's Tony Bentley. "It's a very deep and complex adventure — it will definitely appeal to people who like Valhalla or Lords of Midnight."

Dr Who and the Mines of Terror is Micro-Power's foray into the land of the sideways ROM. For your £18.95, you get another 16K of memory (19.95 for disc version) and very large platform game. The aim of the game is to recapture the plans of the TARDIS time machine and destroy the Master's factory. Based on the popular sci-fi TV series, it lacks Daleks, but has plenty of problem-solving.

Mikro-Gen see a future for ROM: two more expanded games are under development. Battle of the Planets, licensed from BBC TV, and the ultimate Wally game, Wally in Paradise.

THOUGHTS & CROSSES

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POP TOPS

TOP 20

1	The Way of the Exploding Fist	Melbourne House	Sp/ 64/ Am
2	Frank Brunos Boxing	Elite	Sp/ 64/ Am
3	Nightshade	Ultimate	Sp
4	Hypersports	Imagine	Sp/ 64
5	Barry McGuigans Boxing	Activision	64
6	Hyway Encounter	Vortex	Sp
7	Summer Games II	US Gold	64
8	Frankie goes to Hollywood	Ocean	Sp/ 64
9	Sky Fox	Ariolasoft	64
10	Arnhem	CCS	Sp/ AM
11	Thats the Spirit	The Edge	Sp
12	Death Star	Superior	E1/ Bc
13	Impossible Mission	US Gold	64
14	Southern Belle	Hewson	Sp
15	Cylu	Firebird	Sp/ 64
16	Chopper	Sparklers	64
17	Nodes of Yesod	Odin	Sp/ 64
18	Booty	Firebird	Sp/ 64
19	Desert Burner	Sparklers	Sp
20	The Red Arrows	Database Software	Sp/ Am

Source: WH Smith

TOP 3 BY MACHINE

1	Crazy Cavey	M. Tronic	Vc
2	King Tut	M. Tronic	Vc
3	Rockman	M. Tronic	Vc
1	Now Games	Virgin	64
2	Sky Fox	Ariolasoft	64
3	Summer Games II	US Gold	64
1	Now Games	Virgin	Sp
2	Way of the Exploding Fist	Melbourne House	Sp
3	Frank Brunos Boxing	Elite	Sp
1	Match Day	Ocean	Bc
2	Terrimolinos	Melbourne House	Bc
3	Beachhead	US Gold	Bc
1	On the Ball	Thorn EMI	At
2	Bounty Bob Strikes Back	US Gold	At
3	Pole Position	US Gold	At
1	Formula One Simulator	M. Tronic	16
2	World Cup	Artic	16
3	BMX Racers	M. Tronic	16
1	Repton	Superior	El
2	Overdrive	Superior	El
3	Football Manager	Addictive	El
1	Frank Brunos Boxing	Elite	Am
2	Syrus II Chess	Amsoft	Am
3	3D Stunt Rider	Amsoft	Am
1	Killer	M. Tronic	Ms
2	G. Busters	Activision	Ms
3	Pitfall II	Activision	Ms

Source: Websters Software

Write to: Your Letters, Your Computer, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Our Prestel mailbox number is 019991800.

YOUR letters

Dear Sir Keith,

I would like to paint a small scenario. There you are early one morning eating your third Shredded Wheat. Your complimentary Daily Maxwell lies open on the kitchen table. The teachers pickets outside are still in their tent. Suddenly the peace is broken. A bulky figure plods up the garden path. It is none other than Chief Superintendent Robert Hay coming to feel your collar. Why?

This Conservative government, of which you are quite rightly a senior member, is responsible for many great achievements. The sinkings of the Belgrano and Arthur Scargill perhaps being the best known. Our concern however is two lesser known successes. The micros in schools scheme and the Copyright, Computer Software, Amendment Act 1985. It is the combination of these that will attract the attention of the afore-mentioned Chief Super.

The micros in schools scheme made two Cambridge based trainee businessmen unfairly rich. It also made our schoolchildren the most computer literate in the world. So far so good. The downside is that it has made our schools hotbeds of criminal activity. The problem is that the scheme has provided plenty of money for hardware and very little for software. Without lots of good software a computer is only useful as a paperweight.

It is not that teachers condone copying software. It is not even that they approve. The fact is that it is the teachers who are doing the copying. On the grand scale. Copying software is theft of intellectual property. Stealing. Just think of the effect on the moral judgment of our schoolchildren when they see that. Here are their elders and supposed betters, their peers in society, to look up to and emulate. Criminals.

These schoolchildren may be the most computer literate but do they know the right things? The fact is that the educational software market is a complete mess. The combination of lack of money and mass copying makes writing software for schools a waste of time. All the talent that could be writing educational software, raising our national educational standards, are writing games. They have to earn a living. Software piracy has led to the formation of the Federation Against Software Theft (FAST). The Federation has lobbied parliament and the result is the new Copyright Act. To enforce the act FAST has employed the gentleman from the scenario, Robert Hay. Anyone he catches copying software is liable to an unlimited fine or up to two years in jail. Surely as Secretary of State for Education there must be a degree of vicarious liability for the actions of your teachers?

Hence the scenario.

The solutions are straightforward. To provide hardware and not software is like providing text books with nothing but blank pages. For every pound spent on hardware at least two pounds must be spent on software. This might result in less hardware but it will definitely produce better educated children. Teachers must be sent directives not to copy software and those that do should be severely disciplined. If only to provide the correct moral example to their charges. The directive must extend to school computer clubs, where school equipment is used to copy the latest games under teacher's supervision.

This country needs a computer literate population to face the future successfully. This is the responsibility of you and your government. The above action is merely a step in exercising that responsibility.

Bruce Everiss

Bruce Everiss.

ALIENATING!

IT IS WITH growing concern that I note the ever-increasing popularity of the so-called "shoot-em-up" type of arcade game.

A craze which started with Space Invaders has now progressed to a cult dedicated to playing far more addictive and complex games. Why, you might ask, am I so concerned about this seemingly harmless pursuit? Well, let me elucidate...

During man's exploration of space, it is inevitable that, sooner or later, he will encounter extraterrestrial civilizations. It is imperative to man's survival that he realises the only way to approach these aliens would be peacefully, preferably followed by a scientific and/or cultural merger.

But when we are instilling into our populace the innate urge to destroy anything alien — through the aforementioned games, — we are simultaneously placing an ominous black cloud over man's very survival. An even more worrying facet of the shoot-em-up cult concerns terrestrial monitoring by alien beings.

We have absolutely no way of knowing whether the Earth is being monitored by a technically-superior civilization, but let's suppose for one moment that it is.

Now, assuming that they haven't gone through a similar "shoot-em-up" phase in their past, and that the very concept of a "game" is incomprehensible to them, then what do you think they will think when they see half the Earth's population squatting over VDUs and zapping pixelized aliens with an apparently insatiable gusto?

My guess is that they would be unlikely to permit the continued existence of the human species. Perhaps we could provide the answer to the problem by persuading computer firms to stop manufacturing these games.

However, I'm realistic enough

(continued on page 29)

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IN ★ TOUCH

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting your name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

The article must be submitted exclusively to *Your Computer*. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC — and soon the Commodore — which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in endless pages of hex digits.

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(continued from page 27)

to know that they won't, and hence the reason why I'm writing this letter. I'm pinning my hopes on two things: i). the aliens can read English, and ii). they subscribe to this magazine. If so, and they read this letter, then humanity will be able to breathe a sigh of relief, and once again continue on its weary path to eternity.

Harry Seldon,
Grimsby.

SCREEN DUMP

SCREEN DUMP — YC Software File, August 85 — will be welcome by ZX Spectrum/Interface 1 users as Basic screen dump routines take some 30 minutes to copy a screen. In fact, Brother HR-5 control codes do not fully match Epson ones so a half-height overprinted copy results from the unaltered code.

HR-5 owners need only change one byte at address 32829 from 04 to 08 hex to correct the routine for this popular printer.

A. J. Torlesse,
Helensburgh,
Dunbartonshire.

AMSTRAD ANGER

SO AMSTRAD have finally blown it! After introducing a strong influence of confidence and stability into the home computer market they have withdrawn the CPC-664 after just three months.

I am one of the unfortunate many who purchased the 664 and, after I read of the 6128 introduction, I thought that Amstrad would at least offer some means of upgrading the 664 to a 6128. Then I wondered what support would be available for the 664 in the future.

I wrote to Amsoft asking these questions and received a reply full of sales waffle which totally avoided answering these questions and seems to typify Amstrad's attitude to 664 owners. I would not be at all surprised if Amstrad had seriously miscalculated the date on which the 6128 development would be complete, which it almost certainly was when the 664 was released, and went through with the 664 launch in order to recover its development costs from the unsuspecting 664 purchasers.

I was amazed to hear Alan Sugar on *Database* stating that the 664 would be supported as it is compatible with the other Amstrad computers. What rubbish! I have already

YOUR Letters

encountered compatibility problems with 464 programs, and 6128 programs will aim to use the extra memory so they certainly will not run on the 664.

Amstrad owes it to 664 purchaser to offer an upgrade or trade in on the 6128 and I hope other 664 owners and magazines like *Your Computer* continue to pressure Amstrad until they do.

Prospective purchasers of the PCW-8256 beware. What will you do if this is dropped after such a short period and after the 664 experience, can you be sure that Amstrad won't?

J. F. Palmer,
Crawley,
Sussex.

'BRAVE GAMBLE'

ON READING Stephen Meadows' letter in Octobers *Your Computer*, I was amazed at its content.

Mr Meadows explains to us that the TMS 9900 has an eight bit data bus, it does in fact have a 16 bit data bus. Its major handicap is that it has a 15 bit address bus which only allows it to access 32K of Rom/Ram directly.

He also claims petty reasons for the machine's failure, such as the position of the power switch. There are quite serious reasons for the lack of popularity:

☐ the machine was initially over priced, due partly to the high chip/descrete component count and partly to the bad marketing strategy.

☐ early models needed a special American monitor.

☐ the software was overpriced and I personally have never seen any third party softeware for the machine.

☐ the TMS 9900 chip was marvelously suited to control systems but not suited for a micro.

☐ the expansion was
a) all supplied by Texas.
b) expensive.

☐ the Basic was, to put it politely, double-plusmega-slowwwww — not to mention the dreaded Call extention.

I am not a fan of the QL or Uncle Clive, I crack up if someone says 28 days. However the QL was a brave gamble which would have paid off if the designers had used 3.5 inch drives instead of the Microdrives.

Sinclair is a pioneer but a little eccentric, though not completely incompetent.

6800 v 9900 ??????

For me its a 68000 every time.

D. M. Platt,
Maltby,
Rotherham.

Line 64504 in Listing 3 of October's Spectrum game, Impulse, was left out. It should read:

501617DCOAD718B1 = 711

In the same issue line 55 in Listing 2 for Midnight Express should read:

Q=0:FOR T=1 TO 39 STEP 2:X$=MID$(Z$,T,2):GOSUB 90

*To increase the number of lines available in BBC Pikachanja it is not enough just to alter the value of NUMLN as suggested in the article. Instead, replace every occurance of C2 with C1+6*L, and delete the fourth statement in line 80. If you also replace BOO in line 750 with DOO you can have up to 80 lines.*

ATARI COMPUTERS

Atari 520ST computer with 3.5" disc drive, mouse, monitor and software £675 (£670) £730. Atari 130XE computer £158 (£163) £183. Atari 800XL computer + recorder £118 (£123) £143. Atari 800XL computer + disc drive £229 (£230) £260. Atari data recorder £34 (£37) £47. Atari disc drive £172 (£171) £191.

SINCLAIR COMPUTERS

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AMX Mouse

Graphics Package
Amstrad
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A conversion of the highly acclaimed BBC package for the Amstrad. For your money you get an art package, an Icon designer, and Basic extensions to allow you to use Mouse control in your own programs. Advanced Memory Systems are on 0925 602959/602690.

Delta

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BBC
£115
This board consists of a 65C2 processor and 64K Ram. Watford claim that the board doubles the speed at which any program will run, and is 50 per cent faster than the official Acorn version. They also claim complete software compatibility. Tel 0923 3774/40588.

Pacesetter

Interface/Controller
Spectrum
£14.95
Space Invaders still zap you? Just can't get through that room in Jet Set Willy, well this could be the product you're looking for. You stick the Pacesetter in the back, and as well as a Kempston interface you have a control which allows you to slow a game down virtually to a standstill if desired. Any game which doesn't mess around with the interrupt procedures will respond to the treatment. Nidd Valley Micro are on (0423) 864458.

HARDWARE hitlist

Camel Polyprint

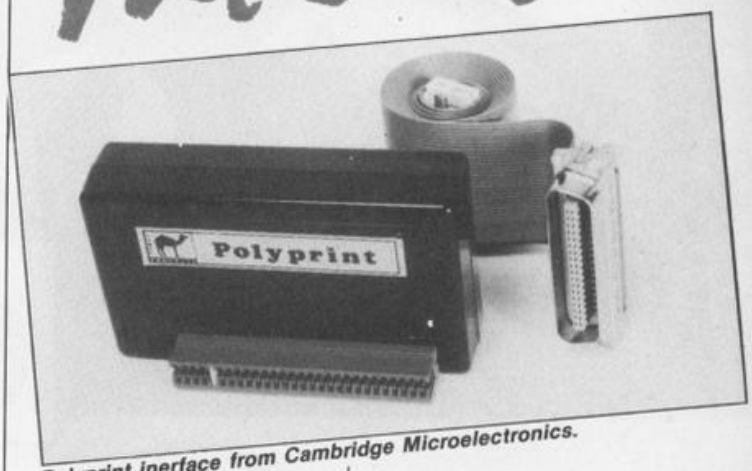
■ *Spectrum*
■ *Cambridge Microelectronics*
■ *£44.95*

NOT ANOTHER parallel interface! Yes, but this one's different. It will allow the usual LList, LPrint and small screen copy — bit image, somewhat oval circle — like the well-tried Kempston but without the option to copy using the printer's character set.

The customary and rather insubstantial add-on box with through port has eight 1K banks on Eprom, any 1K displacing the 15-16K area of the Spectrum Rom containing English, French, German, Danish, Swedish, Italian and Spanish, and a bank to change Tasword 2's character set to any of these.

It is specifically designed to be used with Epson's FX80, and Cambridge Microelectronics provide information to software switch the printer in conjunction with the character set changes. A list of addresses in Masterfile could thus be printed each in an appropriate character set. The unit is not cheap at £44.95 plus VAT.

However, for the specialist who wants a number of foreign languages and who doesn't relish poking Tasword 2 — I've done it and it takes a very long time — it's very handy. And the nicely mapped bits of Eprom can be used for other purposes — instructions are given for saving the character sets first. Not a hack interface, then, but rather one for the professional user or enthusiast. Cambridge Microelectronics is on 0223 314814.



Polyprint inerface from Cambridge Microelectronics.

Lightpen

■ *CPC-464 or 6128*
■ *DK'tronics*
■ *£24.95*

WITH THE right software, a lightpen is one of the most useful add-ons you can buy. Graphic design, control of games or business packages are all possible. So how does this offering from an established Spectrum hardware specialist measure up?

On loading the screen uses Mode 0 to display the five main menu's which you can step forwards and backwards through to select the various functions shown as small pictures or "icons". Screen's can be loaded or saved to cassette or disc although no catalogue function is provided.

The graphic software is not protected so that you can transfer it to disc or alter the speed screens are saved at. Drawing on screen is possible in one of 10 colours and four thicknesses as well as a nice air brush facility, although the lightpen flickers slightly fine movement of the cross on screen can be filled with any of the 10 colours but dark areas or backgrounds are best left till last as the pen has to be moved by the cursor keys across them.

Other facilities allow you to draw curves, boxes and circles and place text horizontally or vertically. Areas of the screen can be duplicated, reduced or enlarged in four set sizes. Fine detail can be achieved using the scratch pad which enlarges an area of the screen for editing of single pixels.

A comprehensive and well written manual gives full details of printing screen's using them in your own programs and writing programs to use the lightpen.

In conclusion a good hardware, software package that will appeal to most users especially the younger ones because of the use of icon's.

The lightpen is available from computer dealers or direct from DK'electronics on 0799 26350.

Rom card

■ *CPC-464 and 6128*
■ *Arnor Ltd*
■ *£10.39*

IT'S A BUMPER month for Amstrad add-ons as independent manufacturers realise there is a serious market out there. Perhaps Alan Sugar's truck driver's do a little word processing on the side. This Rom board takes four Roms and plugs into Arnor's Maxam assembler board; it's useless without it, but cheaper than the Micropower board.

To go with the Rom board, Arnor has launched two packages: Utopia, a utility package, and Protext, yet another word processor. Utopia might not transport you to paradise, but it does seek to patch up a few holes in the Amstrad operating system and the DOS.

Many of the commands will be familiar to Beeb owners, with Help, Spool, Printon, Romoff and many more, it therefore comes as no surprise it is from the author of Toolkit for the Beeb.

A particularly useful command is Romoff which allows any Roms you choose to be switched out. This saves you removing disc interfaces or other add-on's.

Utopia is £26.04 for a 16K Rom, and Protext £34.74. Protext is a comprehensive word processor, with the usual formatting and printer control functions.

In October's Hardware Hitlist page, Robcom was wrongly refered to as Robocom, a totally unrelated computer company. Robcom can be contacted on 01-209 0118.

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WHAT TO BUY FOR CHRISTMAS

Lee Padden tests possible Xmas presents.

THIS CHRISTMAS may well be a bonanza for manufacturers and consumers alike. Competition is likely to be extremely fierce with attractive deals on offer from most micro makers. Next month, we'll examine budget micro's making a bid for pride of place in the christmas stocking, this month we turn the spotlight on some more up-market machines in the price range of £180 and upwards which loosly come under the heading of home micro.

These range from the QL at its new highly competitive price of £199 all the way up to the ACT F1E and the recently announced Atari ST.

The table gives an outline specification of the 10 contenders. When talking about price, you must bear in mind what you get for your money. Many micros in this price range come complete with some form of storage, and perhaps a monitor or mouse. Next comes the amount of read only memory (Rom), random access memory (Ram), the type of processor and the speed at which it runs.

The amount of Rom gives some idea of the power of the machine's operating system and resident language, although it must be stressed that in the case of the Einstein and the PCW8256, the language is loaded in from disc after power-up.

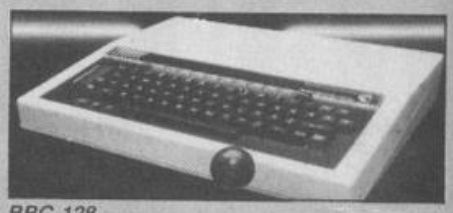
The figure for the Atari ST is provisional as the operating system is still being finalised at the moment, so it is only available on disc and not in Rom. Atari intend to produce a 260ST in the new year once the operating system has been sorted out, and this may well be around the £600 mark.

The processor and speed give some idea of the raw power of the system, although this is only a very approximate guide, ie despite the QL running a more advanced processor at twice the speed, its Basic is still slower than the BBC 128.

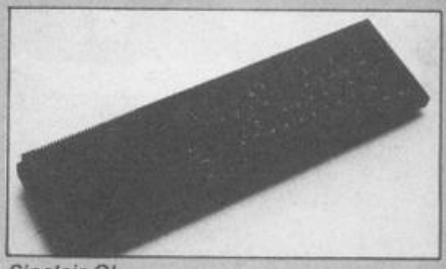
Graphics are still harder to be objective about. The figures given are the maximum in all cases. Usually, in order to get very high resolution graphics, colour or memory has to be sacrificed. It is also impossible to read 80 column text on a domestic TV.

The QL, F1E and 8256 have no sound save a very basic beep, usually to indicate a mistake of some variety. The rest either go with the ever popular General Instruments chip, which has a large, if not terribly subtle repetoire, or go

Machine	Price	Memory & processor	Display	Sound	Ports	Keyboard	Peripherals	Software
Amstrad PCW8256	£460 inc mono monitor printer & 3" disc drive	256K Ram — Z80A at 4Mhz	90 x 32 Text 720 x 256 Graph Mono	Beep		Full travel 4 function + WP keys	RS232	CP/M, WP, and GSX bundled
Amstrad CPC6128	£399 inc colour monitor printer & 3" disc drive	128K Ram 48K Rom Z80A at 4Mhz	80 x 25 Text 640 x 200 Graph 16 Col	Voices	Joystick, printer, disc sound.	Full travel 10 function/ number keys	RS232, speech light pen, TV modulator	Games, utilities and business progs. Quality much improved recently
Amstrad CPC464	£299 inc colour monitor & cassette	32K Rom 64K RAM Z80A at 4Mhz	80 x 25 Text 640 x 200 Graph 16 Col	3 voices	Joystick, printer, sound	Full travel 10 function/ number keys	RS232, speech light pen, TV modulator	ditto
Acorn BBC128	£499	128K Ram 48K Rom 6502 4Mhz	80 x 32 Text 640 x 256 Graph 16 Col	3 voices filtering & modulation	RS423, Print RGB, disc, joystick	Full travel, 10 func keys	Modem, speech 2nd processor mouse, net. Disc drive	Lots of utilities and business, few games.
Enterprise	£249 + Joystick	128K Ram 96K Rom 6502 at 4MHz	80 x 25 Text 672 x 512 Graph 256 Col	3 voices filtering stereo	Printer, RGB joystick, net cartridge	Membrane type, 8 func keys		Very little, mostly poor conversions.
Sinclair QL	$199 inc microdrives	128K Ram 48K Rom 68008 at 8Mhz	80 x 25 Text 512 x 192 Graph 16 Col	Beep	RGB, Net Cartridge 2 x RS232	Membrane type, 4 func. keys	Disc, modem printer, joystick	Bundled business software, some languages, few games.
Commodore C128	£269	128K Ram 64K Rom 8502 1 or 2 Mhz 16 Col	80 x 25 Text 640 x 200 Graph 16 Col	3 voices filter modulate	Video, cart seriel, user joysticks	Full Travel, 4 Func, number keys	Disc drive modem light pen, mouse	CP/M compatible and can run most C64 software
Atari 520 ST	£750 inc 3½ disc + mouse + mono monitor	512K Ram 192K Rom 68000 at 8Mhz	80 x 25 Text 640 x 400 Graph 512 Col	3 voices + midi in, out & thru	RS232, joystick disc, cartridge	Full travel 10 Func + number keys	Hard disc modem	Business and games software in preparation.
Tatung Einstein	£499 inc 3" disc + momo mon.	80K Ram 8K Rom Z80A at 4Mhz	40 x 24 Text 256 x 192 Graph 16 Col	3 voices	Net, disc, printer, a/d RS232	Full travel 7 func keys	80 column displayd	Not much good software.
Apricot F1E	£685 inc 3½" disc	256K Ram 32K Rom 8086 at 5 Mhz	80 x 24 text 640 x 256 graph 16 Col	Beep	Printer RS232, RGB	Full travel 10 func + number keys	Hard disc modem	Mainly business, runs MS/DOS, and BBC basic progs.



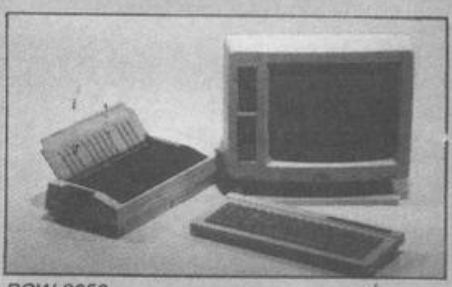
BBC 128



Sinclair QL

Amstrad CPC-464

Commodore C128



PCW-8256

for something a little more upmarket in the way of filtering and modulation.

Ports are a problem. Most peripherals such as disc drives, joysticks, printers and modems have a recognised standard port, which it seems micro makers do their best to avoid. Still, at leas this is some progress from the "leave part of the circuit board hanging out the back" approach common in cheaper machines.

The much maligned RS-232 interface is a case in point. Only the Atari has a "proper" 25 way connector. The BBC uses an RS-423 interface, which does the job, given the appropriate lead, but the QL uses a totally non-standard format, using phone-type plugs. Most joystick ports are of the "Atari" style nine pin format, the Enterprise needs an adapter. All except the Einstein, QL and Apricot have a cassette interface. Most machines also have an expansion port, but this is of little use to the average user.

You should certainly approach claims that these ports are standard with a fair degree of scepticism, and work out the real cost of attaching any gadgets you've got your eye on.

Keyboards are not usually a problem in this price range. With the possible exception of the Enterprise, the Einstein and the QL there should be few complaints. The BBC in particular has attracted warm praise from key bashers everywhere. The table mentions extra functions keys available over and above the Qwerty set, the obligatory shift, delete and escape keys. A numeric keypad can often speed up data entry.

One unique problem with the F1E is the keyboard is coupled to the main unit not by a cable, but by an infra red link, so you have to keep a nice tidy desk for this one.

Peripheral availability is rarely a problem with established micro's like the BBC, and most manufacturers give their machines hardware support.

If an RS-232 add-on is available, the machine should be able to use most modems, assuming suitable software is available.

One of the most important factors when choosing a micro is software. After all, unless you're going to get down to programming the thing yourself, how good the machine seems to be to you will largely depend on how good the available software is. Many a potentially good machine has ended up on the scrap heap for want of good software. It is always difficult to gauge how good software support is likely to be for a new machine.

PCW8256: A specialised word processor rather than a true home Micro, amazing value for money, no resident Basic, monochrome low res graphics. Bundled software includes Dr Logo, CP/M+, and GSX — a graphic system.

CPC6128: Possibly the best all round buy this Christmas for someone who wants to get into computers, has a bit of word processing or data handling to do and is not averse to playing the odd game. Hard to fault at the price. Easy to use, fast Basic, rather rudimentary disc system, and a flood of interesting peripherals arriving.

BBC 128: Looking a bit long in the tooth now, Beeb has changed little since its launch over three years ago. It has a massive cult following among hardware freaks. Software is rather patchy with the odd really stunning title among the froth. Perhaps the sudden expansion in memory will stimulate the software market a bit. The best machine for communications.

Above: Atari 520 ST. Below: Enterprise 128. Below right: Amstrad CPC 128.

Enterprise 128: First rumoured to be on the way in 1983, after a long gestation, it was virtually stillborn. May still recover given a stiff transfusion of good software. Technically superb, it probably represents the end of the line in the evolution of the eight bit home micro.

Act F1E: A cut down version of Apricot's highly successful F1 business machine, it will not only run Apricot's range of business software, but also most programs written in BBC Basic in a bid for the education market. Runs MS-DOS, the most widely used PC operating system.

Einstein: While by no means a bad machine, the Einstein has been unable to make much of an impression on the market and has little third party software support. A bit bulky, it runs CP/M but needs an add on 80 column graphics board to give it full compatibility. Disc software on the pricy side.

Atari 520 ST: Very much an unknown quantity at this stage, possibly a better bet for next christmas. Still, if you must have the best set of wheels on the street, this is definitely the micro getting the most column inches devoted to it at the moment. If it's all true, with a user friendly operating system, MIDI and superb graphics, it'll be a huge hit.

Commodore C128: As yet it isn't certain this will be around in time for christmas. Compatible with all CBM-64 software, with CP/M thrown in for good measure, it has superceded the C64 in the States, and presumably will do here as well, once Commodore have got rid of their stocks of CBM-64's. May well be a good compromise between a business and games machine.

Sinclair QL: Virtually given up for dead after an apparantly never ending series of teething troubles, the price cut and the new improved versions of the bundled software might just rescue this one from the realms of academic curiosity piece. Slow and cumbersome Basic, awful keyboard, and of course Microdrives. Monitor be specially adapted.

Amstrad CPC464: Older brother of the 6128, it suffers in comparison. But if £300 is your absolute limit, and you're happy with cassetes, you could do a lot worse. If you want a printer, make sure its the new 2000 rather than the awful DMP1. ■

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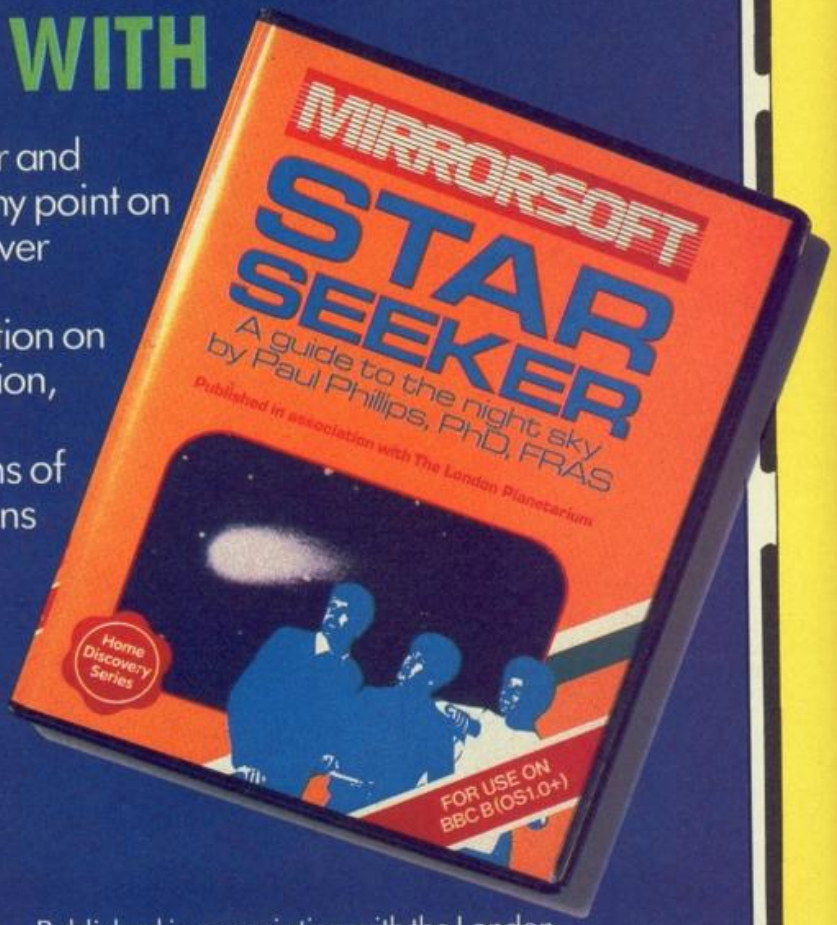

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SOFTWARE Shortlist

Paradroid

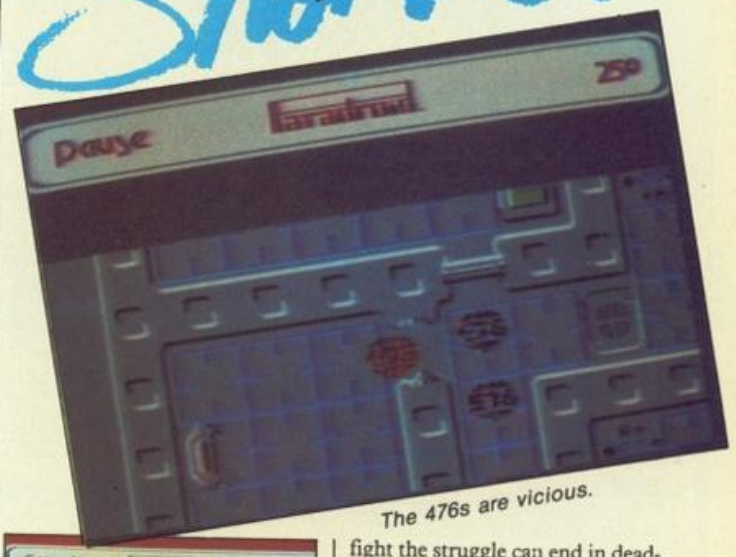
- CBM-64
- Hewson Consultants
- Shoot-'em-up
- £7.95

★ ★ ★ ★ ★

THIS IS PROBABLY the most original and striking game to appear from a dark horse software house since Llamasoft released Gridrunner. And it is far more than just a shoot-'em-up, though a certain amount of zapping is essential to survival in this highly addictive game.

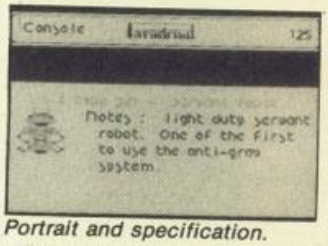
Your paradroid materialises on board a space freighter where mutiny if rife among the robots. Your job is to clear each deck of the dissident droids. You can either shoot them in the traditional way or take them over. You start out as a humble 001 influence device but you can work your way up through the social scale by taking over insignificant 123 disposal droids, 249 servants all the way up into the eight or nine hundreds. All the different types of droid are represented on the main screen as floating numbered globes, but when you taken one over you get a portrait of the machine you are and the one you are about to become together with specifications.

The takeover sequence is highly original and calls for a deal of quick thinking and pattern recognition. First you centre your joystick — your current host changes colour, then crash into your proposed victim. The description screen appears, followed by a screen depicting the logic circuits of the two machines divided by a central segmented column.



The 476s are vicious.

The deck plan.



Portrait and specification.

By moving the joystick up and down and firing charges along the circuits the aim is to turn the central column to the colour representing your side of the screen. If the victim puts up a fight the struggle can end in deadlock, rejection or burnout. If you die, a whole load of static comes up on the screen followed by the message "Transmission terminated". Another nice touch of sophistication in this program.

There are 24 classes of robot. Each has its own personality — the 476s are very aggressive and hang round in gangs quite often shooting each other if they get carried away — but they are nowhere near as mean as the 711s which pack disrupters capable of blowing up everything in the vicinity.

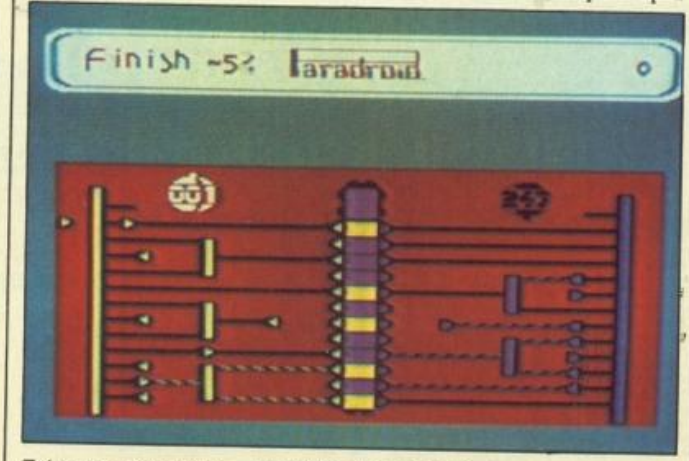
The toughest robot of all is the 999. The only way to take this out is to take it over. It is, however, very resistant to your influence so transfer to another robot before it rejects you — there is no lonelier feeling than turning back into a 001 on a deck full of 716s, except possibly catching a train from Shrewsbury which turns out to be full of West Ham supporters.

When the last droid on a deck is eliminated the deck lights go out and the strange background warbling noise — which sounds like someone calling "here, kitty-kitty" dies away and you score bonus points.

With over 400 screens of playing area and 20 decks at £7.95, there are eight spaceships, plenty for your money. Hewson has come up with the goods just when some of its fellow little league colleagues seem to be nightshades of their former selves.

Paul Bond.

(continued on page 39)



Takeover sequence — you'll need to think fast.

BEHIND THE SCREENS

Andrew Braybrook.

Andrew Braybrook, author of Paradroid, first started games programming the hard way — in Cobol on a mainframe, when working as an accounting packages analyst/programmer at Marconi in Chelmsford. Pioneering real-time computer games with Space Invaders built out of greater-than/less-than signs was good schooling for getting the best out of the Commodore 64. "On the mainframes there were no real graphic facilities, and the action only took place when you tapped a key. That Space Invaders game as the first one at Marconi that went on playing by itself."

Initially the Paradroid backdrop was planned to be a plain blueprint. but Hewson decided this would look too primitive. Having experimented with a pressed metal title screen, Andrew extended the concept to one deck, then to the whole ship.

How did the game's transfer sequence come about? "I couldn't think how to show the takeover so I thought of making a little game out of it. Steve (Turner) was playing about with one of those logic circuit designing programs on the Spectrum and I thought I can use this."

And the smooth-etc scrolling? "It doesn't scroll the screen as such. You would need to access all the screen area. We found that's OK if you just go up and down or left and right but if you go diagonally you get a sort of step effect. So we refresh the whole of the screen all of the time, 17 times a second."

ATARI ST 520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £851.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

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

FREE SOFTWARE AND FUTURE EXPANSION

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

Silica Shop Price: £851.30 + £97.70 VAT = £749.00 This price includes:

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

£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
186K ROM expandable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

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

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

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

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

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

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

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

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

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 3 button mouse)
MIDI interface for external music synthesisers

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

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

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

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

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

MACINTOSH v F16 v 520ST

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

FEATURES OF BASIC SYSTEM	APPLE MACINTOSH	APRICOT F1e	ATARI 520ST
Price includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x80
Keyboard size ins (LxDxH)	13x5¾x2	17½x6½x1	18½x9½x2½
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (16 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

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

Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	**£2,984**	**£1,382**	**£749**

PRESS COMMENT

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

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

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

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

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

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

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

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

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

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

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

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

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Do you already own a computer
If so, which one do you own?

Star chart

KEY

★ ★ ★ ★ ★ Best of its type
★ ★ ★ ★ Very good
★ ★ ★ Good
★ ★ Average
★ Below par

Interactive Basic Programming

ZX Spectrum
Eigen Software
Educational
£9.95

★ ★ ★

A very useful set of four cassettes which instead of letting books blow your mind, allow your computer to do it for you. Permitting you to type in and program normally while IBP is resident in the machine, it tries very hard to be a blow-by-blow introduction to hands-on home computing.

I think you would have to hang on to your manual — I'm sure most real novices need to have it pointed out to them that there actually is a Beep key, and if you try to type in Beep, all you get is Border BBB, because there are so many other keys to press first.

But common sense permitting, this looks like a very useful guide for beginners provided they can find a human to help them out when they're really stuck.

Seventh Cavalry

ZX Spectrum
Strategy game
Black Knight
£3.50

★ ★

For only £3.50 you don't expect to get wonderful moving graphics. This gives you basic map screen display with very slow-responding commands. Your troop units are represented by letters of the alphabet.

Watch out for the letter I as this stands for, guess what, Indians: it streaks across the screen and massacres all the Bluebellies. Good luck to 'em, I say.

(continued from page 37)

Stealth

■ *CBM-64*
■ *Ariolasoft*
■ *Strafe-'em-up*
■ *£9.95*

★ ★ ★ ★

BUCK ROGERS, EAT your heart out. Broderbund's Stealth, now available from Ariolasoft in the United Kingdom, takes the fast-scrolling-flying-straight-down-a-corridor-shooting-at-things format and turns it into quite an addictive scenario. The screen display depicts the rear view of your fighter as it hares at zero feet across the hostile landscape.

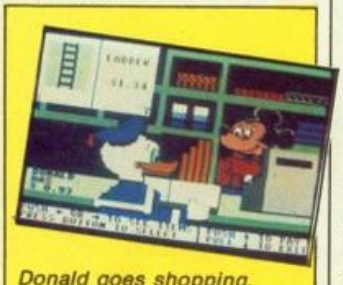
In the distance the dark tower casts gloom over the future of your once-proud people. You must blow it up so that they can go back to their former cultural pursuits of bean-eating and watching "V" instead of cowering in the bunker.

You can bank left and right but you cannot change altitude. Nevertheless, the sensation of speed and manoeuvre is exhilarating. You can despatch bunkers, tanks and scouts with gusto and a well-placed rocket. Past the third level you come under attack from heat-seeking missiles which you can dodge by veering to port. At the fourth level, fighters come at you and dormant volcanoes start to figure prominently as features of the landscape. On the elusive fifth level these spew forth lava and present a general traffic hazard.

The scouts are particularly interesting. They bounce down from the sky, accompanied by a ground shadow and then zoom up again, adding a bit more perspective to what might otherwise be rather flat visually.

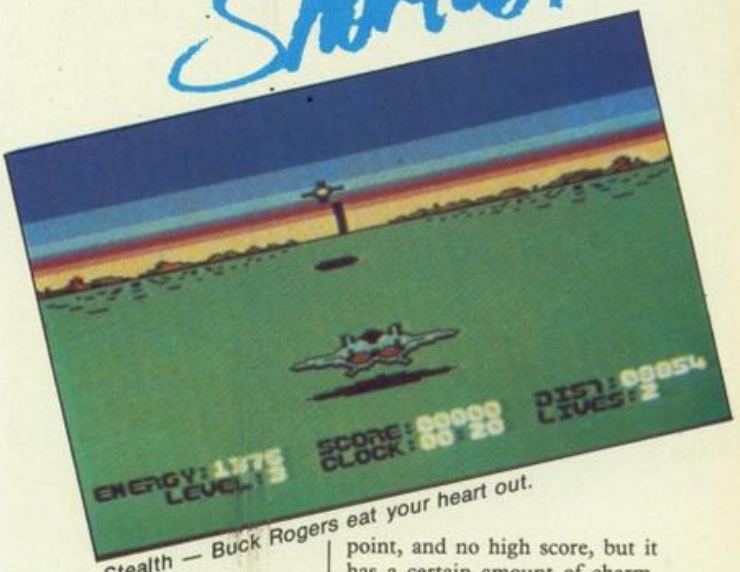
A couple of rather pale attempts at this kind of thing appeared on Dragons and Commodores 18 months back, followed by the release of the actual Buck Rogers game by which they were inspired. I am sure the concept could be stretched a little further but this is one of the most playable variations I have encountered.

Paul Bond.



Donald goes shopping.

SOFTWARE Shortlist



Stealth — Buck Rogers eat your heart out.

Donald Duck's Playground

■ *CBM-64*
■ *Transatlantic Simulations*
■ *Educational*
■ *£9.95*

★ ★ ★

THOSE BOYS at Centresoft again, cunningly launching a new label to cover up the fact they're taking over the entire software market. The spurious reason behind this is that the new label is aimed at a younger market.

This game sets out to teach youngsters the basic ideas of work, money, and buying things with money to build a playground — all good sound stuff which will doubtless come in handy in Reaganite America.

There are four different jobs to try your hand at, fruit packing, cargo handling, stacking shelves and signalman. You book Donald in for a shift from one to five minutes, and perform the various tasks. You get paid on a strict productivity basis — with no tea breaks.

After that, its off to Goofy's junk store, or Minnie's hardware store, to buy slides, ropes, ladders and so on for the Playground. After you've picked the item you want, you have to profer the correct change.

All this is done with pretty 3D graphics showing the various cartoon characters strolling around the screen. There is no real aim, in the sense of finishing point, and no high score, but it has a certain amount of charm, and will doubtless appeal to the 5-7 age group it is aimed at, and might actually teach something, like if you vacuum the living room, you might get a pocket money raise. Could this be the start of education programs which actually keep their audience switched on long enough to teach them something?

Lee Paddon.

Blast Compiler

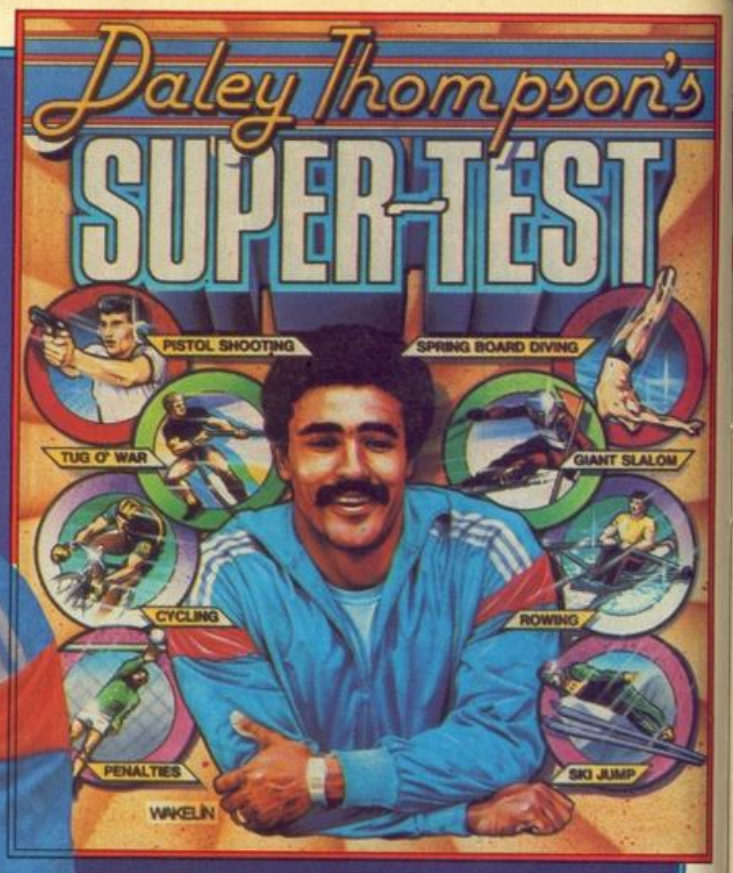
■ *Spectrum 48K*
■ *OCS*
■ *Utility*
■ *£26.95*

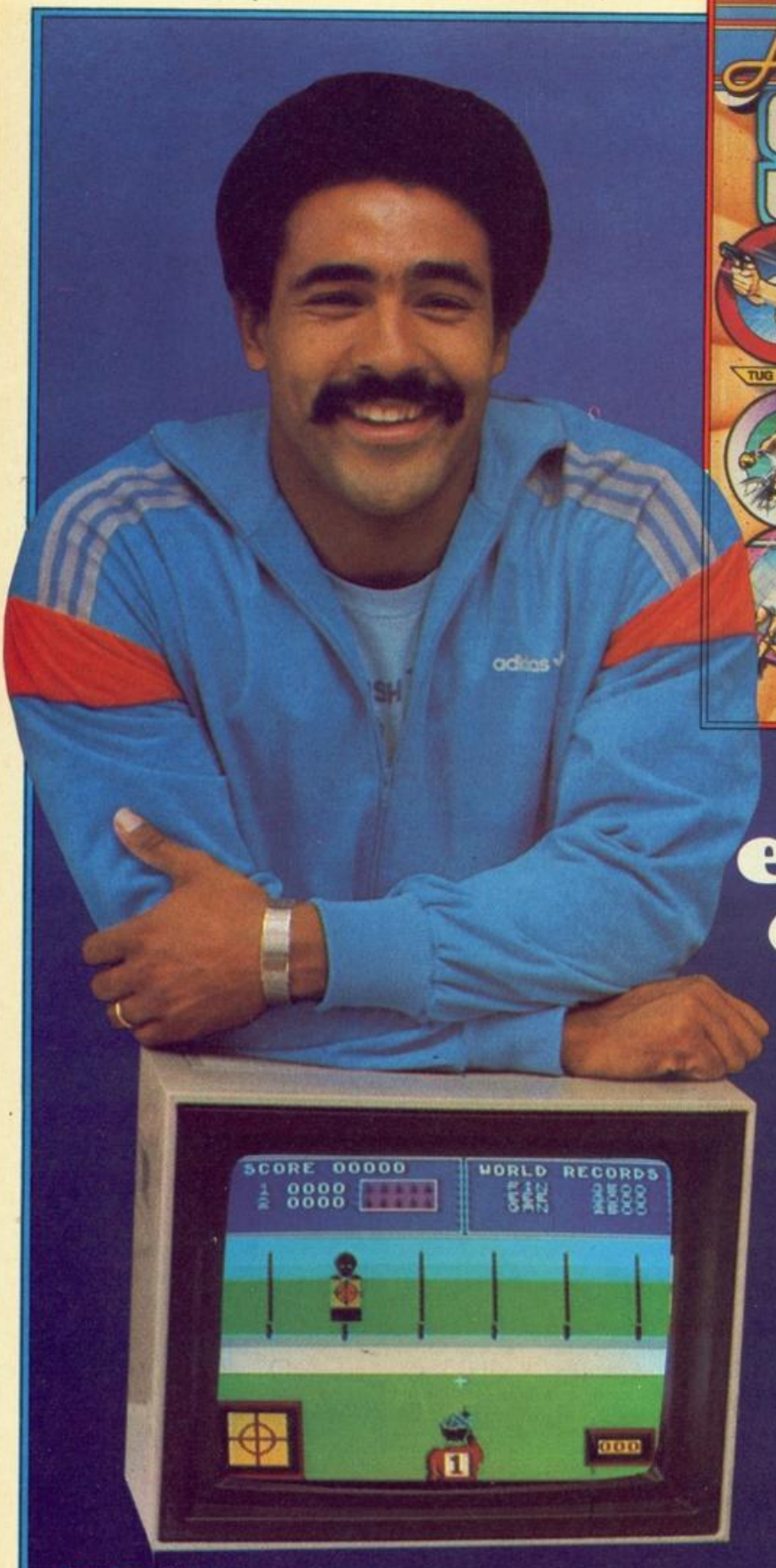
★ ★ ★ ★

THE IDEA of writing a game in Basic and then getting some dumb compiler to speed it up for you is enough to make some machine code purists take to the veil. But, for the rest of us, this utility could put an end to long nights hunting for an elusive bug which resets the machine when you shoot the fifth invader from the left on the third screen. There have been several Spectrum compilers before, but none have claimed to be as comprehensive as this.

On loading up, you are greeted with the cheery message that around 2K of the memory is free. So, any program to be compiled must be loaded section by section, compiled, and then saved; Microdrives are a must here. You can either compile into machine code, or p-code. P-code has the advantage

(continued on page 41)





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SPECTRUM 48k **6·95** COMMODORE 64 **7·95** AMSTRAD **8·95**

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Star chart

Elevator

ZX Spectrum
Platform game
Black Knight
£3.50

★ ★

The horrible Turling dromes have planted 15 time bombs in the kind of architecture you only find in platform games. Defuse the bombs in the correct order and in the specified time.

A faithful recreation of the early days of home computer gaming at a not appreciably reduced price. You have been warned.

Highway Encounter Amstrad CPC-464

Amstrad CPC-464
Vortex
Arcade adventure
£8.95

★ ★ ★ ★ ★

Brilliant Spectrum game re-implemented for the 464, enough to make you hang on to the old machine instead of rushing out and buying a complete wordprocessing system. You guide a crocodile of demented dalekoids up a Zaxxonesque 3D highway through zones of increasing hostility from totally indescribable things.

As lead droid you must defend the rest of them until you get your ultimate weapon into the final zone and drive these monsters from the planet's surface.

Lords of Midnight

Amstrad
Amsoft
Adventure
£9.95

★ ★ ★ ★ ★

Even a year after the launch of the Spectrum version, this game still looks state-of-the-art. You have to defeat the forces of evil by either going on a quest or recruiting a huge army and defeating them in battle.

(continued from page 39)

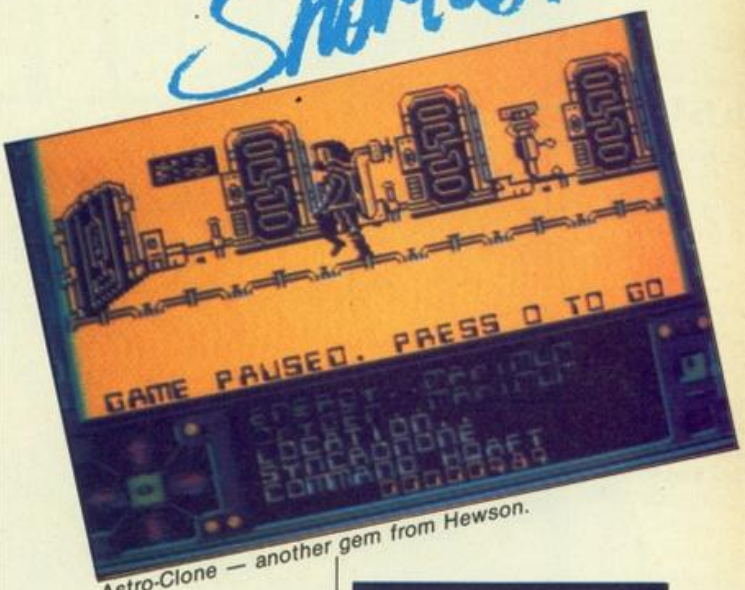
of being more compact than machine code, or even sometimes Basic, and, as an undocumented language, may be fairly secure against hacking.

However, it is slower; for this reason, sections of the program can be compiled into machine code. Obviously there are some things which are best done in machine code, and Blast allows users to call machine-code subroutines, and will compile user extensions to Basic. The package is supposed to contain extra Basic commands, but these have been left out due to space; but you do get a useful toolbox of editing commands.

It is difficult to gauge the performance of this program. OCS claim that speed improvements of up to 40 times are possible. This obviously depends on the length of the program, the amount of calculation, and the way the program is written. The manual is currently undergoing revision, but the version with the review copy was hard work. Despite this, it seems that Blast has lived up to expectations, and is by far the best Spectrum compiler on the market. OCS is on 0993 812700.

Lee Paddon

SOFTWARE Shortlist



Astro-Clone — another gem from Hewson.

Astro-Clone

- *Spectrum*
- *Hewson Consultants*
- *Arcade adventure*
- *£7.95*

★ ★ ★ ★

ANOTHER GEM from Hewson matches variety of gameplay with excellent animated graphics. Supposedly the third part of Steve Turner's Dragontorc trilogy, it is obviously something quite different, but is none the worse for that. The game is split into strategic, space combat and ground combat phases. The ground combat phase is where you are on the opening screen, with your Astro-Clone in his two-room spaceship.

On the lower part of the screen lies the control panel. To the left is an icon panel; this tells you what effect the joystick has at any point in the game. There is a message screen next to this, and to the right of this two square alert lights. The top one goes red to draw your attention to the message screen. The lower one goes yellow if those old Hewson bugbears the Seiddab are in the next room, red if they join you.

Your mission is to destroy the main launch computers in all the Seiddab bases to gain control of the stargate sectors shown on the strategic map. But before you access the strategic phase you must take off, enter the space phase — a Defender-style sequence and eithe. dock with a Seiddab starbase or slip through the pulsing diamond stargate to another sector. Either way you have to destroy all the Seiddab cruisers first.

If you fly through the stargate, you enter the strategic phase. If you dock with a starbase, you enter the ground combat phase again. In ground phase you have four modes, selection, movement, arm and laser. The arm mode is quite a nifty bit of programming which allows you to control and throw objects in a way unique to this game.

The game requires tortuous problem-solving capabilities — you need to be able to figure out that if you pass the Gravimag over the grating in room 8 a sonic key appears, for starters. And since the location of seven of the starbases change every time the game is played, the game is always slightly different. Publishing a solution for this game is going to be a bit more complicated than it is for something like Nodes of Yesod.

Hewson have excelled themselves once again — full credit to Steve Turner for producing a game that is destined to become one of the cult non-Ultimate adventure games at Christmas. If only because they've actually brought the game out, unlike some of their more flashy big brothers who are good on hype but slow on delivery.

Paul Bond.

Get your kicks with Karateka.

Karateka

- *CBM-64*
- *Ariolasoft*
- *Martial arts game*
- *£9.95*

★ ★ ★

WAY OF the Exploding Fist it isn't, but Karateka has plenty of Oriental charm. Of particular note is the film-like narrative technique: a kind of story is told in the preamble to each fight sequence — we see Princess Mariko thrown into the dungeons by the evil Akuma, and in later sequences we see Akuma sending his henchmen out to work you over as you try to rescue the unfortunate girl.

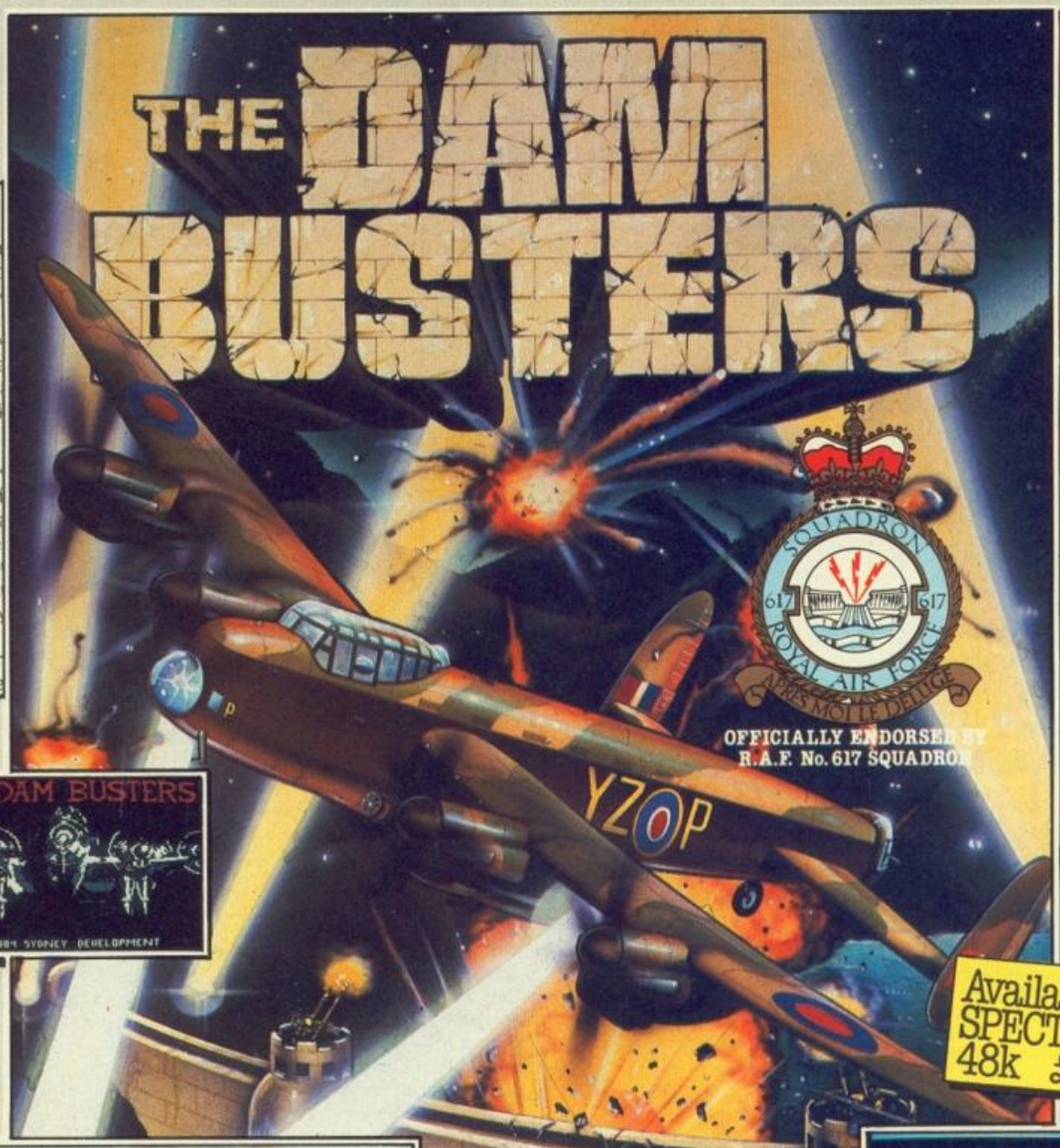
As rescuer and henchmen approach each other the hypothetical camera cuts between them until they appear on the same screen. You can shorten this process by running forward but it's not advisable as a good kick in the running mode floors you completely.

And here we encounter a major gripe concerning this program. Obviously not wishing to endure the blood, sweat and tears not to mention time consumed in

(continued on page 43)

Play THE GAME everyone's talking about:

ATARI



Available for SPECTRUM 48k £9.95

It's 21.15 hours on the evening of May 16th, 1943. A flight of specially prepared Lancaster bombers is leaving R.A.F. Scampton for Germany. After months of planning No. 617 Squadron are at last embarking on an operation destined to change the course of World War II.

Your objective is to destroy the Mohne, Eder and Sorpe dams, thus crippling Germany's industrial heartland.

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Game Package includes: Comprehensive flight instructions, maps and confidential documents including authentic material by Barnes Wallis and Wing Commander Guy Gibson.

Designed and Developed by Sydney Development Corporation. Licensed in conjunction with International Computer Group. Manufactured in the U.K. by U.S. Gold Limited, Unit 10, Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. Telephone: 021-359 8881. Telex: 337268.

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naintaining the corre
nd speed of your aim
It will take a while
what and the speed,
required for various
perservere you will
satisfying game.

Graphics: ****
Sound: ****
Playability: ****
CCI Rating: ****
Company: US Gold
Industrial Estate, H
Birmingham. Tel:

Star chart

Duckworth Highway Code

ZX Spectrum
Duckworth
Educational
£11.95

★ ★

Competent enough question and answer program, though questions along the lines of is it a good idea to drive with badly-maintained brakes? tend to rather lead the user to the correct answer.

The package contains two programs to test and improve your knowledge of the highway code, from the points of view of pedestrian and road user, together with special rules for cyclists. Prepared with the co-operation of Thames Valley Police

The Castles of Doctor Creep

CBM-64
Platform game
Ariolasoft
£9.95

★ ★

House hunting is no fun anywhere, let alone in Transylvania. You've made an appointment to visit 13 of evil landlord Dr Creep's castles with a view to purchase.

Not a wonderfully original setting for a standard platform game. But if you like roaming acres of haunted east wings then this game will certainly give you value for money.

The only catch is that it's unexciting to play — mapping out a whole castle so that you can escape requires a lot of to-ing and fro-ing and repetition.

Mummies and Frankenstein monsters hamper progress, together with plenty of very un-supernatural-looking ray guns and force fields.

Despite the large number of castles to choose from all the rooms are made up of the same components — trapdoors, ladders, doors and sliding poles.

Marginally more enjoyable than moving house in real life.

(continued from page 41)

producing the excellent tape version of Ariolasoft's Skyfox, the cassette version of the game is rather hastily implemented. Every time you lose, you must reload. A highly depressing experience — especially if you do something really dumb, like walk backwards off the cliff at the beginning of the opening sequence. I was only testing the joystick, guv. It takes two and one quarter minutes to reload the game — enough time to play a track off your latest Durutti Column album.

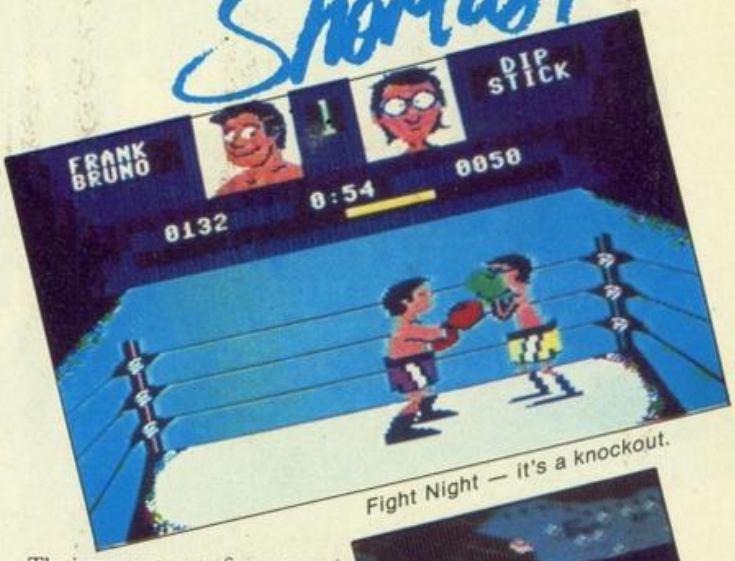
Anyway, if you manage not to fall off the cliff, a member of the local meat-squad turns up and starts chopping away at you. The animation of the figures is slower and more graceful than that in Melbourne House's Fist, but they are smaller, and there is less in the way of sound. The type of blow is restricted to kick and punch, controlled by how you squeeze the joystick button; the stick itself controls altitude of kick — high, middle, low.

You can withstand only a limited number of hits from your opponent. The row of red arrows across the base of the screen indicates how much stamina you have left. Every time he hits you, you lose an arrow. Conversely, the blue arrows on the left of the screen gauge his strength. Each guard wears different headgear and has a different fighting style.

Once you cross the porch the scenario shifts indoors. This also means loading a new section of the game. Here more of the same goes on except that the warlord's pet eagle has a go at you as well. So the moral of the story here is — watch the birdy.

Paul Bond.

SOFTWARE Shortlist



Fight Night — it's a knockout.

Racing Destruction Set.

Fight Night

- *CBM-64*
- *US Gold*
- *Boxing Game*
- *£9.95*

★ ★ ★ ★

THE WELTER of boxing games continues unabated. First the crisp job of Rocco, then the swinging upper cut of Frank Bruno, but US Gold reckons it can deliver the knock out blow with Fight Night, despite the rather punch drunk nature of the market.

Once the game loads, you are faced with a menu. You can "construct" a boxer, train him, do a bit of sparring, take on a series of progressively tougher challenges, or fight a tournament, several players taking one boxer each.

The important part of construction is to decide whether to make your jab or body blow hardest, and which part of your body can take the most punishment. You also get to choose the colour of your trunks and even skin (including blue, presumably to cater for any aliens who might care for a bout or two).

The actual fight simulation is probably the pick of the bunch. From the ring side seat view, the boxers move back and forth, move their guard up and down, punch and jab. This is no slugfest either, timing is all important. Landing a blow has a number of important effects, it scores you points, it decreases your opponent's endurance, and it puts him off his punch, so a flurry of punches can have a devastating affect, each new punch sending the opponent reeling. Obviously the punch has far less effect if blocked by the opponent's guard, and it is also affected by what the opponent was doing at the time, stepping out, moving in or punching.

There are three three minute rounds, and if no one can deliver a knock out in that time, a decision is given on points. The animation is very nice, with boxers reeling from the punches, and the computer controlled characters have a "special" punch which is great fun to watch (from a safe distance).

Well, Harry, perhaps not a knock out, but I'd say that I've got this one winning all the later rounds after getting away rather slowly and coming out on top in the end. A real contender for the title.

Lee Paddon.

Racing Destruction Set

- *CBM-64*
- *Ariolasoft*
- *Race Game*
- *£12.95*

★ ★ ★

REMEMBER SCALEXTRIC? You probably had more fun designing and building the track than actually racing. The cars kept coming off and ending up as a pile of twisted plastic against the skirting board, or worse, you'd get a short circuit and the transformer would blow up. Well, this game is rather similar, most of the effort goes into designing the track, with curves, cross overs, jumps, flyover and so on. You can also customise the car, anything from a fully fledged racing machine to a Morris Traveller.

But then you get to the actual racing bit. A split screen, one or two players, a plan view of the road! I'm afraid this will take a lot of selling to the Pole Position fraternity, used to an over-the-shoulder view. Despite this, it's quite fun, with the usual accelerate, brake and steer.

The jumps are a nice feature, you have to approach these at just

(continued on page 45)

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Star chart

Xcel

Spectrum 48K
Program Tecniques
Shoot-'em-up
£7.95

★ ★ ★

After one of the prettiest loading screens in Spectrum history, you would expect a pretty devastating game. A log zaps in from both sides of the screen, wow, this must be some game, you start orbiting a planet ready to whiz down onto the surface for a dazzing 3D shoot-'em-up, right? Sorry, wrong.

As long as you don't actually try to play this game, you might think it was something pretty special, but underneath it all is a sort of cross between Zalaga, Galaxians, and every other shoot-'em-up all the way back to Space Invaders. There is a spurious plot and a lot of spurious alien writing which you're meant to pick up clues from, but the guts of the game are to shoot anything that moves, or, on other screens, avoid the trees — simple really.

Ace

Commodore 64
Cascade
Fight emulator
£9.95

★ ★ ★

When Air Combat Emulator was released for the C-16, it filled a need for software, let alone flight simulators for that machine. It's up against tougher competition on the CBM-64, so a few more goodies have been injected into this fight and fly scenario. You can brush up your in-flight refuelling and choose different weather conditions. There are ground and naval targets as well as hostile fighters. It has a co-pilot option and synthesised speech which keeps the crew informed as to their status. One guy does all the flying and the other does weapons control. Tanks, helicopters, SAM sites, all the fun of a serious deterioration in East-West relations is here.

(continued from page 43)

the right speed to come down on the reverse slope of this or the next jump. If racing soon looses it's appeal, then you can always shoot the opposition off the road! This does tend to make the races rather short, but fun.

While this game has got plenty of chrome, with loads of different tracks and cars, it doesn't grab you the way Taledega did.

Lee Paddon.

Adrian Mole

- *Various*
- *Level 9*
- *Adventure*
- *£9.95*

★ ★ ★ ★

SEPTEMBER 30: Adrian Mole computer game arrived today. Looks really great. All the old characters there, Pandora, Rat Fink Lucas, Stick Insect, Barry Kent and the rest of the gang. The idea is to make Adrian popular.

October 1: Still playing Mole. Editor starts making noises about deadlines. I said that with over 20k of text loading in four parts, it really needs a long review to get to the bottom of it. He seemed pretty impressed. Managed to get through the game without getting beaten up and scored 55 per cent which makes me a spotty school boy. Its got a load/save option so it didn't matter when the cleaners threw me out at 9 o'clock.

October 2: The editor came to find out how the Mole review was going. I said I was seriously thinking about getting down to it. The game uses a tree structure you see. You make decisions and these affect your rating, and also what happens next in the game. So in one game you'll probably only see about a third of the text.

October 6: The editor just doesn't understand me. Here am I trying to write a masterpiece that will live for ever and all he can think about is his deadline. He just doesn't appreciate that I am a great writer and not just another hack. Even if you've read all the books and stuff, there are still plenty of new situations you can get in. I have now managed to score 78 per cent which makes me a gifted poet.

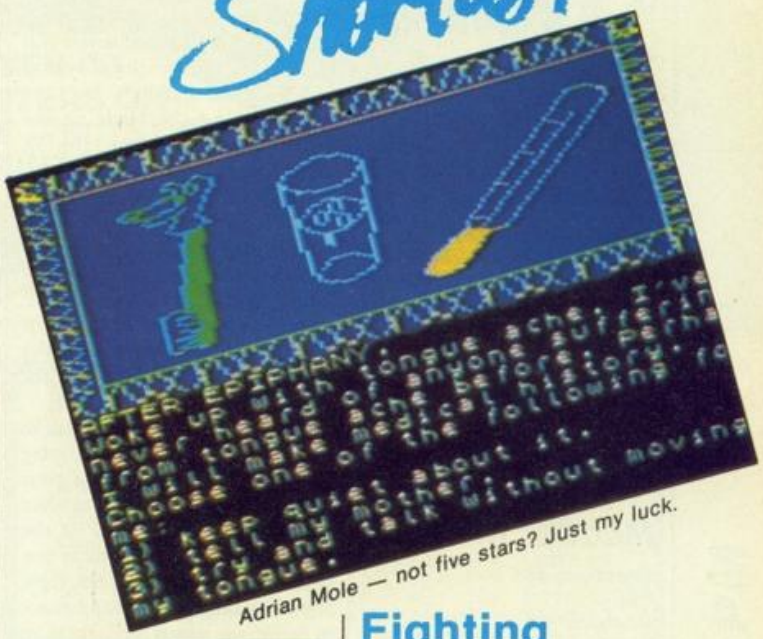
If you don't know the books, there's a Help system, which gives you some background.

October 9: Magazine going to the printers but, unfortunately, I feel the review still needs a little polishing.

October 10: Get the sack. How ungrateful can you get.

Lee Paddon (aged 13¾).

SOFTWARE Shortlist



Fighting Warrior — state-of-the-art graphics.

Daley Thompson's Super-Test

- *ZX Spectrum*
- *Sport simulation*
- *Ocean*
- *£9.95*

★ ★ ★

WHEN DALEY Thompson was momentarily dethroned as the world's top decathlete he is rumoured to have said "I lost my world record and took it like a man — I only cried for 10 hours."

Whether or not Ocean's follow-up to the enormously successful Daley Thompson's Decathlon will bring tears to your eyes, it will wreak havoc on your joystick and/or keyboard. Yes, it's another joystick waggler.

The program features eight events only — and suffers strong competition from other sports simulations like US Gold's Summer and Winter Games, not to mention Activision's old Decathlon and the Tour de

(continued on next page)

Fighting Warrior

- *Spectrum 48K*
- *Melbourne House*
- *Beat-em-up*
- *£7.95*

★ ★ ★

"THE BEST graphics ever seen on a Spectrum", a familiar line in publicity blurbs. But now there is no excuse. Stephen Cargill has upped the stakes once again with cartoon style animation of stunning smoothness and detail.

You have to rescue a princess again (groan). In order to do this you've got to fight your way through a veritable army of monsters, who, being honourable types, come at you one at a time. Just to add to the fun, arrows come hurtling at you as well. You have three sword strokes, walk forward, back, jump and duck. The controls are easy to get the hang of.

The screen scrolls right to left as you attempt to make your way to the cave where the Princess is incarcerated. In the background, a landscape of Pyramids, temples and sphinxs scrolls past.

The fight sequences are beautifully animated, easily surpassing those in "Fist" or "Frank Bruno". Unfortunately, the process of fighting your way through the local heavy mob is a shade boring. Still, perhaps we can hope for the same sort of technique to be used on more complex and absorbing games.

Lee Paddon.

Star chart

Sorcery +

Amstrad
Amsoft
Arcade adventure
£13.95

★ ★ ★ ★

One of the prettiest games for your Amstrad has been improved by the addition of some new screens and a whole new section.

After you've released all the sorcerers, in the old version, you put your feet up for a well earned rest; now, I'm afraid you go on to confront the necromancer himself.

Mcoder III

Spectrum 48K
PSS
Compiler
£12.95

★ ★ ★

A compiler of the old school. Good but not flashy. Copes with most Spectrum Basic, except Microdrive commands. It can cope with floating point arithmatic, produces fairly compact code, and speed increases in the order of 10 to 20 times depending on the sort of commands being used. If you don't need all the flashy extras of the Blast Compiler, or your pocket isn't that deep, this looks like a good second best.

High Rise Horror

BBC
Platform
Rabit Software
£3.99

★ ★

Nasty, brutish and noisy — would be a grossly unfair way of describing High Rise Horror. The game certainly has a crude addictive quality, but not much more.

Armed with only a balloon you must make your way from the bottom of the screen to the top, avoiding or destroying the assorted nasties which whizz mindlessly to and fro at high speed.

Then you can pass to the next stage where the landscape is the same but more crowded.

(continued from previous page)

France. But it has just as much potential appeal as its predecessor.

Spread over two days and two sides of a cassette, the events include pistol shooting, cycling, springboard diving, rowing, tug o' war, taking football penalties and two ski-ing events: the ski-jump and the giant slalom.

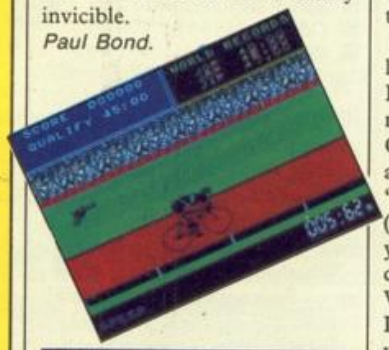
No time for the blade on the feather lark with the rowing section. Start pumping away to build up your speed shown at the bottom left of the screen. The display shows an overhead view of two kayaks zipping down the river. World records, i.e. hi-scores, are shown at the top right of the screen to encourage the spirit of competitive joystick destruction.

You stagger from you kayak to the football field — the display shows an overhead view of your footballer as he runs up to slam the leather into the back of the reticule. Your player runs as you either use the alternate left/right keys or pound away at the joystick to build up power for the shot. You control the ball's direction by timing the kick — the angle (or elevation) is controleld by the amount of time that the firebutton is depressed. You get five shots.

You won't find many footballer's ski-jumping, you may reflect as the pistol signals the gate to open. However, many of them are used to being on the slippery slope or for the high jump. Again continuous left/right movement builds up your momentum, but you must hit the joystick fire-button at the right moment as you come to the lip of the jump.

The tug o' war is impossible. You have a choice of 10 opponents, the weakest of which is totally invicible.

Paul Bond.



Daley Thompson's Super-Test — brings tears to your eyes.

SOFTWARE Shortlist

Winter Games

Winter Games

- *CBM-64*
- *Decathlon*
- *US Gold/Expyx*
- *£14.95*

★ ★ ★ ★

"BREAK OUT the silly hats" was the enthusiastic cry the moment Winter Games hit the office. Up to eight players can choose from 18 countries, and then under their borrowed flags and anthems battle through seven events. Although speed skating and biathlon use the time honoured decathlon — sorry heptathlon — skills of rythmic joystick waggling, the ski-jump and indoor skating are games in their own right.

The freestyle and figure skating look a little like Exploding Fist on Ice as different joystick movements allow you to carry out Camel and Sit Spins and Double and Triple Axel and Lutz jumps. "Figure" is used figuratively (*that's enough figures — Ed*) since you keep skating along the same direction for one or two minutes. With bush hat firmly on head Lynn "Call me Sheila" Dawson was moved to twang "She'll be out in the car park soon".

Toby put down his accordian, wiped the sweat off his brow with his beret and proceeded to win France's first ski-jump gold medal by a convincing display of balance and timing just beating Danneberg. of East Germany. Touch the jump button too soon and you just have to keep your balance in the air and land safely — did I say just! Hot Dogging again uses Fist-like controls to try Daffies, Swans and other stunts off a short ski-jump.

Winter Sports is great family fun — it should appeal to women more than most programs — and looks like being a winner this Christmas.

Meirion Jones.

Chop Suey

- *English Software*
- *Atari*
- *£11.95*

★ ★ ★

KUNG FU seems to be the recipe for success in computer games today, and Chop Suey is English Software's takeaway version for Atari owners. The introductory music is a bit of Bach (Brandenburg control) after which one or two players can get on with kicking each other's heads in.

The two figures appear on a three-dimensional stage, with a few rows of audience in the foreground. The animation is both detailed and colourful. You control your figure with a joystick, though as both figures are identical, it is hard to tell which you're controlling in the melee. The eight joystick positions provide an assortment of jabs, kicks and movements. Blows have to be on target to score. Two "pain-gauges" at the bottom provide a guide to your physical conditions (deteriorating).

The actual fighting seems to be pretty much the same as The Way of the Exploding Fist, so as King Fu games go, this is well done. However, it has few frills (scorpions to jump over; slow and fast modes) so it lacks variety.

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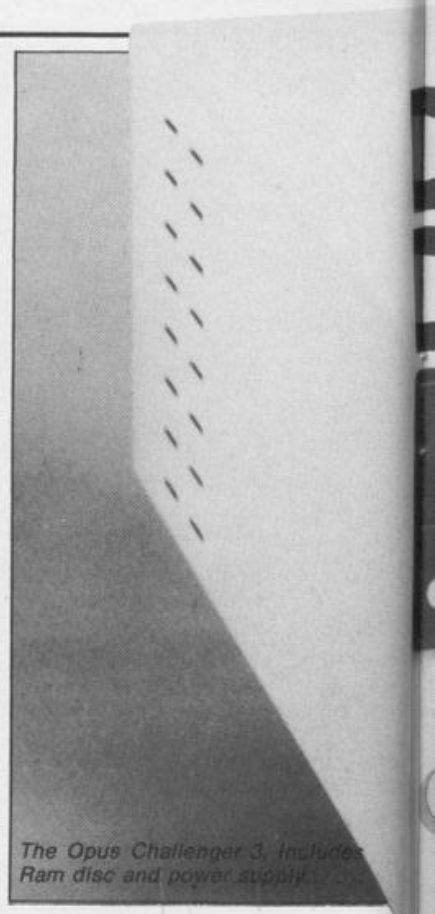
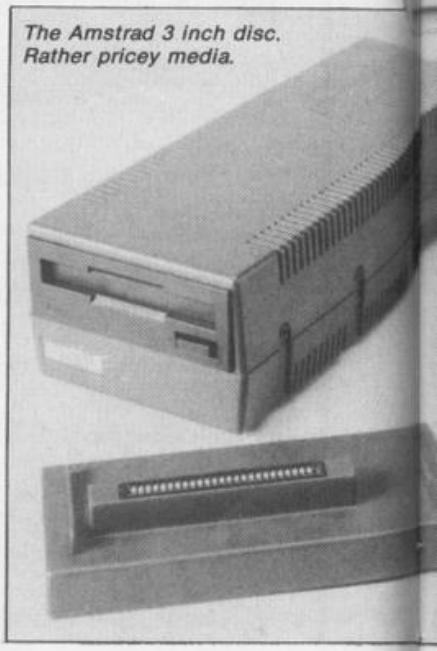


The Opus Challenger 3, includes Ram disc and power supply.

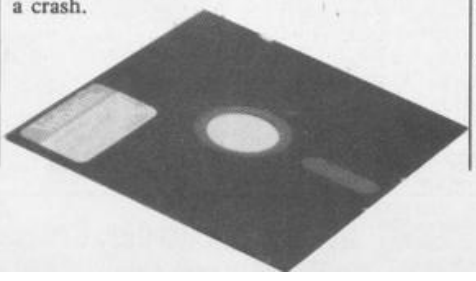


The Amstrad 3 inch disc. Rather pricey media.

A YEAR AGO a disc drive for your micro might have been looked upon as an expensive luxury, but now, with the price of drives dropping all the time, they come within the price range of many people looking to get more out of their machine. So what are the benefits and possible pitfalls of disc systems, and how do you cope with the conflicting claims and jargon?

A disc is much more than a fast cassette recorder, because, like an audio record, you can get to any track instantly. This means that you can virtually use your drive as an extension of the computer's memory. So databases and spreadsheets are no longer limited to 30K or so work space within the computer. To use a cassette like this would be tedious in the extreme.

Even if you don't use such heavyweight programs, a disc drive is reliable, and discs less cumbersome to store, although disc based software can be expensive. Also, when developing your own software, you can rapidly back up each new version, and so speedily recover from a crash.

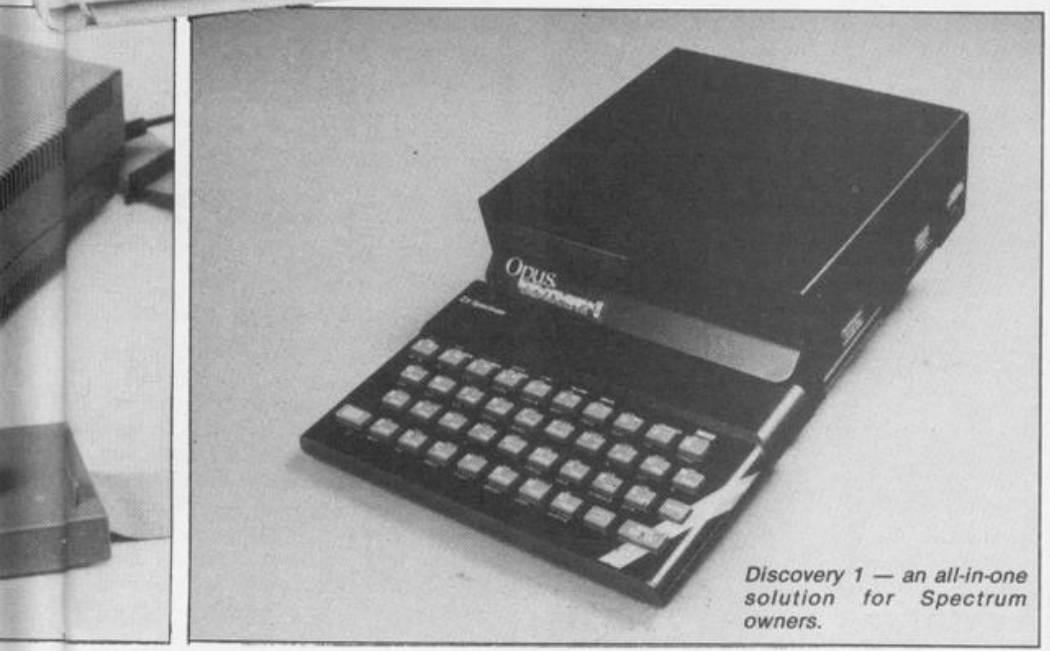


There are three components of any disc system. The drive, which is simply a mechanism which rotates the disc, moves a head across the disc, reads and writes data on the magnetic surface. Then there is the disc interface or controller, which makes the computer electronically compatible with the drive, and the operating system (DOS), the software which drives the interface.

Disc drives come in a number of types and sizes. Most drives not specifically designed for one micro use a Shuggart bus. So you should ensure that any interface you buy conforms to this standard — almost all do. The drive mechanism will either consist of one or two

DISC DRIVE-IN

Buying a disc drive or interface? Lee Paddon puts you on the right tracks



Discovery 1 — an all-in-one solution for Spectrum owners.

read/write heads, ie either capable of reading only one or both sides of the disc at once. Whereas once 40 tracks per side was standard, the quality of disc mechanisms means that 80 tracks is fast becoming the norm. Better still are switchable drives so they can read and write to 40 or 80 track discs. Drives come in a variety of sizes. First came 8inch monsters, then 5¼inch, now 3inch and 3½inch are bidding to become the new standard.

Each have their advantages. 8inch is now obsolete, 5¼inch are cheap, reliable and readily available. 3inch discs are electrically identical to 5¼inch and can be substituted at will. 3inch discs come in a rigid packaging, and so will last longer, but are about three times the price of 5¼inch discs.

3½inch is a relatively new innovation, but since its adoption by Atari for its ST, it may become the front runner. It offers half as much space again as its main rivals, and is just as rugged but a good deal cheaper than 3inch.

Dual drives are a nice luxury, it allows you to protect yourself from disaster by regularly backing up your working disc to prevent a careless error ruining hours of work.

A final consideration is whether you get a built in power supply. If you have to rely on your micro for juice, it will seriously limit the number of drives or other gadgets you can add on.

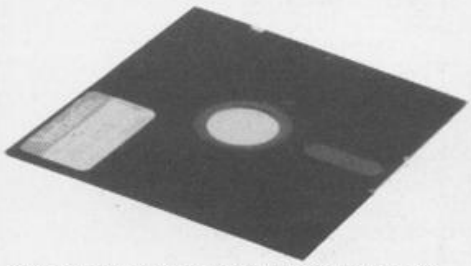
The electrical interface and the operating system are usually purchased as a package. Although each has a clearly defined function, most disc operating systems are designed around the interface hardware. This is where the jargon jungle is at its most impenetrable, and what you get is largely determined by how much you are prepared to pay. So make sure you get the facilities you really need.

Certain terms crop up time and time again. Each track on a disc usually has 10 sectors each holding 256 bytes. So, if storage is a prime consideration, 80 track double sided double density is going to give you 400K storage per drive.

Single versus double density is probably the most important factor. Double density operating systems are quite expensive, but they do give you twice as much room on the disc.

They do this by leaving out synch bits on the disc, and to cope with this, error checking must be more rigorous. One word of caution, you should find out what the formatted capacity of your system will be, unscrupulous dealers might try to tell you the unformatted capacity of the drive which is of no practical value at all.

Random access files are a must for serious



business applications. In a random access file, you can dig out the particular piece of information you need from a particular file and update it without loading and saving the whole file taking up precious time and memory. It is a sad fact that not many budget operating systems offer this facility.

It can, however, be fudged if a system supports serial access files where records can be read in order, and a new file created with the updated record — a poor second best.

Speed is not perhaps the most important consideration in a disc system, since most systems, with the glaring exception of the Commodore 1541 system are fast enough. However, hope is at hand, a new drive, the 1572 is promised. Speed is a function of both the speed of the drive and the efficiency of the DOS software. Whether this is important to you will depend on what you want a disc drive for. Try running two opposing systems side by side, ideally running the program you intend using most.

Operating system compatibility is another term often banded around. The Amstrad DD1 claims to be CP/M compatible, but will only run cut down versions of the standard packages. It claims to use IBM format files, but the IBM PC usually runs under a different operating system: MSDOS. Speaking of which, the new Enterprise disc system claims to run MSDOS and read IBM files, but this is rather pointless when the computer uses a Z-80 processor rather than the 8080 chip needed.

So treat all claims for "compatibility" with a good deal of caution. Another aspect of the

(continued on next page)

DISC DRIVE SUPPLIERS

Akhter, 28/29 Burnt Mill, Harlow, Essex CM20 2HU. Tel 0279 443521. Full range of 5¼ drives.
Advanced Memory Systems, Green Lane, Appleton, Warrington WA4 5NG Tel 0925 62907. 3 inch drives.
Chase Data, Unit 2, Crabtree Road, Thorpe Industrial Estate, Egham, Surrey TW20 8RN. Tel 0784 38487. Double Sided 5¼ inch drives.
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Keyaki, 44 Terrace Road, Walton-upon-Thames, Surrey. KT12 2SD 3½ inch drives.
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Watford Electronics, 250 High Street, Watford. Tel 0923 40588. Full range of 5¼ inch drives.

DISC INTERFACE SUPPLIERS

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Technology Research Ltd. (Beta), Unit 18, Central Trading Estate, Staines, Middx TW18 4XE. Tel Staines 63547.
Medic Data Systems, Hackwood Lane, Cliddesden, Basingstoke, Hants RG25 2NH. Tel 0256 460748.
Gordon Micro Ltd, 3 Callender Road, Heathfield Industrial Estate, Ayr KA8 9DJ. Tel 0292 280467.
Watford Electronics, 250 High Street, Watford, Herts WD1 2AN. Tel 0923 37774/40588.
Acorn — Any Acorn dealer.
Enterprise Computers Ltd, 31-37 Hoxton Street, London N1 6NJ. Tel 01-739 4282.
Dudley Langmead Enterprises, (Oric), 93 Bedford Road, Hitchin, Herts SG5 2UA. Tel 0462 31225. Available from end of October.

Cumana's 3½ inch drives, the up-and-coming standard.

(continued from previous page)

same problem is that if you buy a DOS from a third party, it must be compatible with the standard operating system of the micro manufacturer.

Thus any proper disc system for the QL for instance must be compatible with microdrive commands or you won't be able to use the new drive to run the bundled software. Next on your list of questions should be how much of your micro's precious Ram is taken up by the disc DOS and does the DOS support a ram disc.

Pinches over 2K of Ram

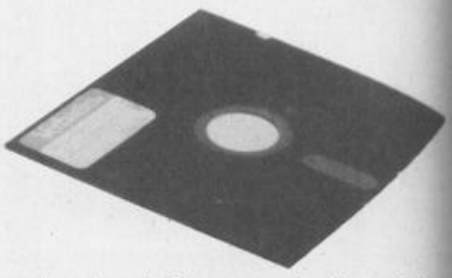
The Acorn DFS for the BBC micro pinches over 2K of Ram from the machine's already inadequate supply. Many Spectrum owners encounter problems with their interface 1's due to yanking them out every time they want to load up their favourite games, and a similar problem occurs to Amstrad owners.

A Ram disc is a data structure which sets aside an area of Ram which, in the eyes of the DOS, looks like a disc, with a directory and files, but with far quicker access times. A new idea is to incorporate Ram into the drive itself as in the new Challenger 3 from Opus, an idea which should become increasingly popular as memory prices continue to plummet.

Next we come to what is perhaps the guts of an DOS: the commands it offers, and their format. A bad example of syntax is the Sinclair system for interface 1. This is mainly due to the fact that you have to specify everything in an inflexible syntax, a good DOS will assume certain default values if the user fails to specify them. It should also be possible to specify files by "Wildcards". A file name normally has two parts, a name and an extension, wildcards allow a disc command to apply to all files with a certain name or extension, or those which start with a particular string.

Most disc systems can list the files on a disc, but ideally they should give more information than this. File size, type, and execution address are all helpful, although in some DOS, this information is provided by "help" or "info" commands. Obviously it must be possible to save blocks of memory, machine code, programs, arrays, and variables as well as Basic.

Another point to watch is some systems limit the number of files you can have per side of the disc. If you intend using a lot of short files, this is obviously going to mean a lot of fumbling around with discs. Rename might seem a rather trivial command, but is vital if random access is not supported. This means that after an updated version of an old file has been created, the old file is erased and the new file renamed

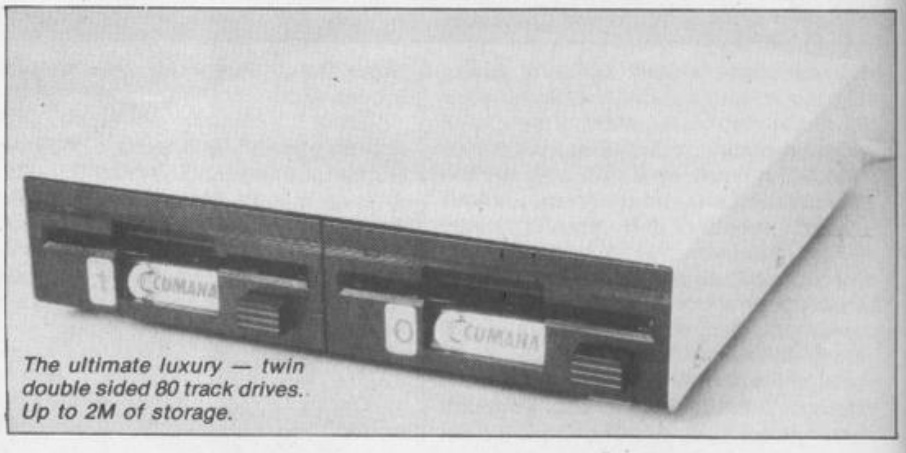


so that when the file next needs to be updated, the name will be the same. Compact tells the DOS to tidy up a disc.

After a time, gaps appear in a disc where programs have been deleted, this can decrease the amount of space available, compact crushes all the files up, freeing more space. Merge allows a large datafile to be created out of two smaller ones, with either one file in Ram, and the other on disc, or both programs on disc.

Make sure you shop around

It is obviously impossible to make any definitive recommendations about which system to go for, much depends on what you want and how much you are prepared to pay for it. The main thing is to shop around and make sure the system you go for in the end can actually deliver everything it promises. Apart from the actual purchase of a micro itself, the choice of a disc system is one of the most fraught decisions you can make, and mistakes can be costly.



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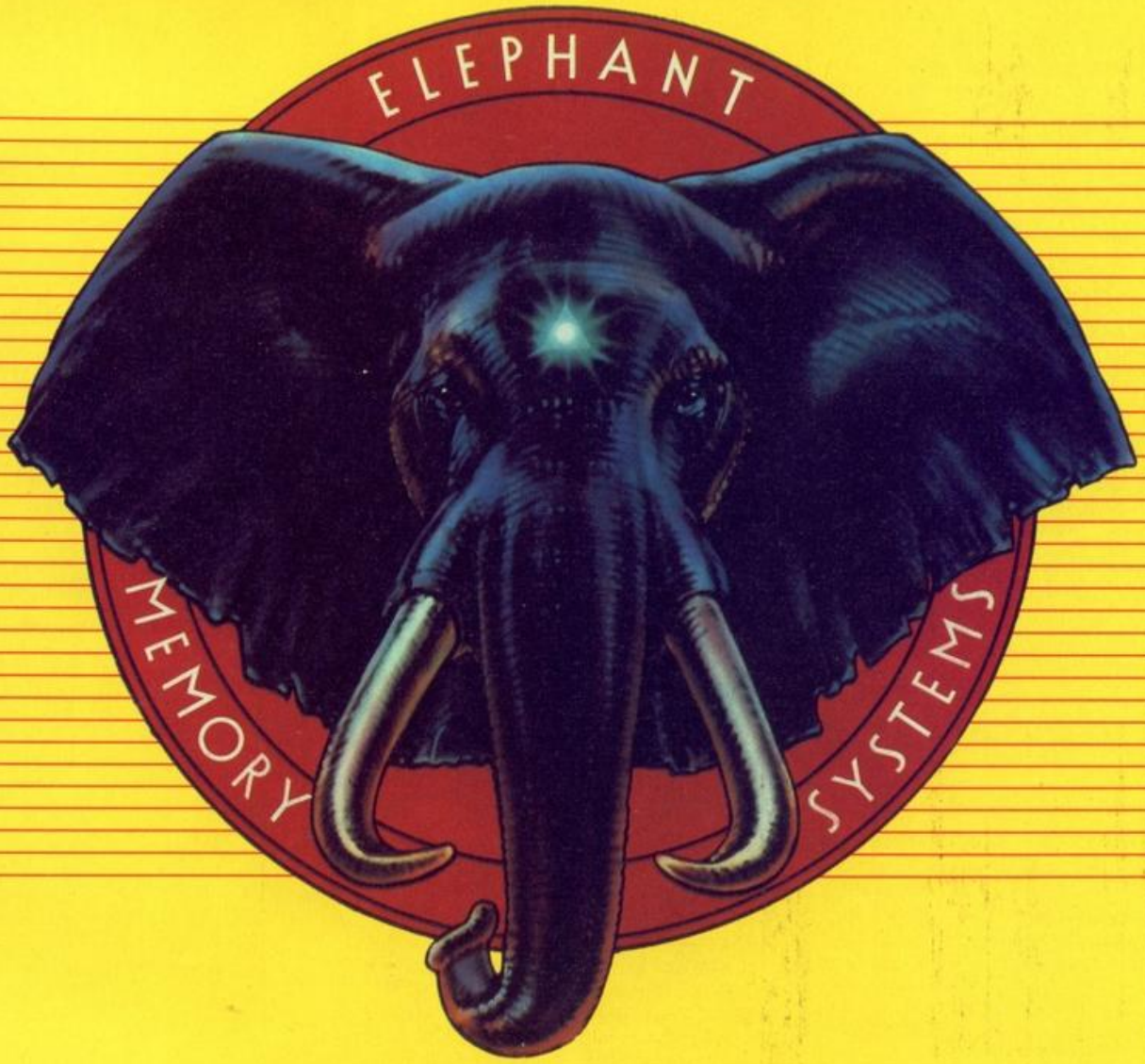

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SPECTRUM

WHAT DO YOU GET if you cross a mouse with a telephone?

Good taste, the Animal Liberation Front, and the Official Secrets Act prevent me from telling you what I have seen in the Government's genetic engineering laboratories. All I can say is that Sinclair has come close with the weird numeric keypad which is the Spectrum 128's most distinctive feature.

A white 128 badge and an external aluminium heatsink — that looks like it might be a constructivist memorial to all those who perished in the computer wars — are the only other signs that this is a Spectrum Plus Plus. The 128 goes on sale in Spain now, four months before it hits these shores, but if you are thinking of popping over to the Costa Investronica to bring back a new Sinclair and an autumn tan don't bother.

Devil worship

If you wait till the U.K. launch next spring the 128 will cost around £150 whereas a Spanish Sinclair will set you back £100 more, including tax but not including a dictionary to translate error messages such as "Entero fuera de rango". So why is Sir Clive making good old blighty play second fiddle (or maybe that should be Fidel, since Investronica plans to export to Latin America) to Spain?

In short this summer's financial problems have forced Sinclair to sell his soul to the Devil, or rather Dixons. They agreed to take the mountainous drifts of surplus QLs and Spectrum Pluses off his hands if he agreed not to launch any new products here, which might damage their sales, until well after Christmas. But Sir Clive still desperately needed to show he had new products on the way. Hence the Spanish 128 deal.

A close inspection of the 128 shows that the Plus keyboard has survived intact apart from a few cosmetic changes made to satisfy new Spanish government standardisation regulations — the word video in black out of white to show true video and reversed on the inverse video key for instance. the Mic and Ear sockets have been moved from the back of the Plus to the left hand side next to a new RS-232 port to take the interfacing out of connecting up a printer, or modem to your Sinclair.

The RS-232 claims to double up as a MIDI music connector. But then what's in a name? Everyone knows that Sinclair is a corruption of St Clare — the patron saint of televisions — but no-one takes seriously Sir Flat Screen Clive's claim to be a major producer of bent tellies.

The whole point of MIDI is supposed to be a single standard to make interfacing music machines and micros easy so you can control instruments from the computer, modify pices of music and interpret them on screen. So the 128's non standard MIDI connector will have to be carefully examined on a full production machine before it can be recommended to musicians.

At the back the expansion slot is still where it was and all peripherals are still compatible except perhaps those that initialise system variables. An RGB/composite video port has now taken the place of the Mic and Ear sockets. Because the 128 incorporates an AY-38910 sound chip like the Amstrad et al the internal loudspeaker that was happy enough beeping and purring its way through the death march which every other Spectrum game features, shows its shortcomings. Now like other micros a new modulator feeds the TV socket sound as well as vision. At last turning up the noise is a simple matter of sliding up the TV volume button.

Search as you may you still will not find a joystick port on the 128 — an unforgivable omission — although some software houses will doubtless use the 128's numeric keypad as a touch pad controller.

This numeric keypad is a strange looking creature, like a calculator attached to the front of the computer by a curly telephone cable. If it had a track ball in the base to allow you to spin a pointer around on screen you would call it a mouse — but it doesn't so we'll call it a hamster. You can use this 15 button rodent as a simple calculator which displays the answers on the screen or for entering numeric data into programs — it might make typing in *Your Computer* listings a little less tiresome-or in 128 mode as a full screen editor. At last you can edit programs at will including renumbering sending the cursor straight to the area that needs correction.

When you turn on the machine it defaults to 128 mode with a white or blue cursor instead of all the "Ks" and "Es" of the original. If you enter the command Spectrum it changes to 48K mode without losing the contents of memory but the only way to make it revert once again to 128 is by resetting — losing everything.

Basic programs can transfer from one mode to the other easily. If you Peek 80000 in 128 mode you will still get an out of range message because the additional 64K of memory is only accessible from machine code. The 32K Rom includes the old 16K Spectrum as well as the separate 128 operating system. The extra 64K Ram is paged in 16K blocks.

Memory maps are already in the hands of those software houses that have not had prototypes. Ocean is already demonstrating a 128 version of Match Day which takes advantage of the improved sound with cheering crowds, referee's whistle and so on. Supertest 128 is also near completion as well as the load-in-one version of the three part NeverEnding story

128 COMPARISONS

☐ Commodore 128. Better graphics, sound, software. £275.

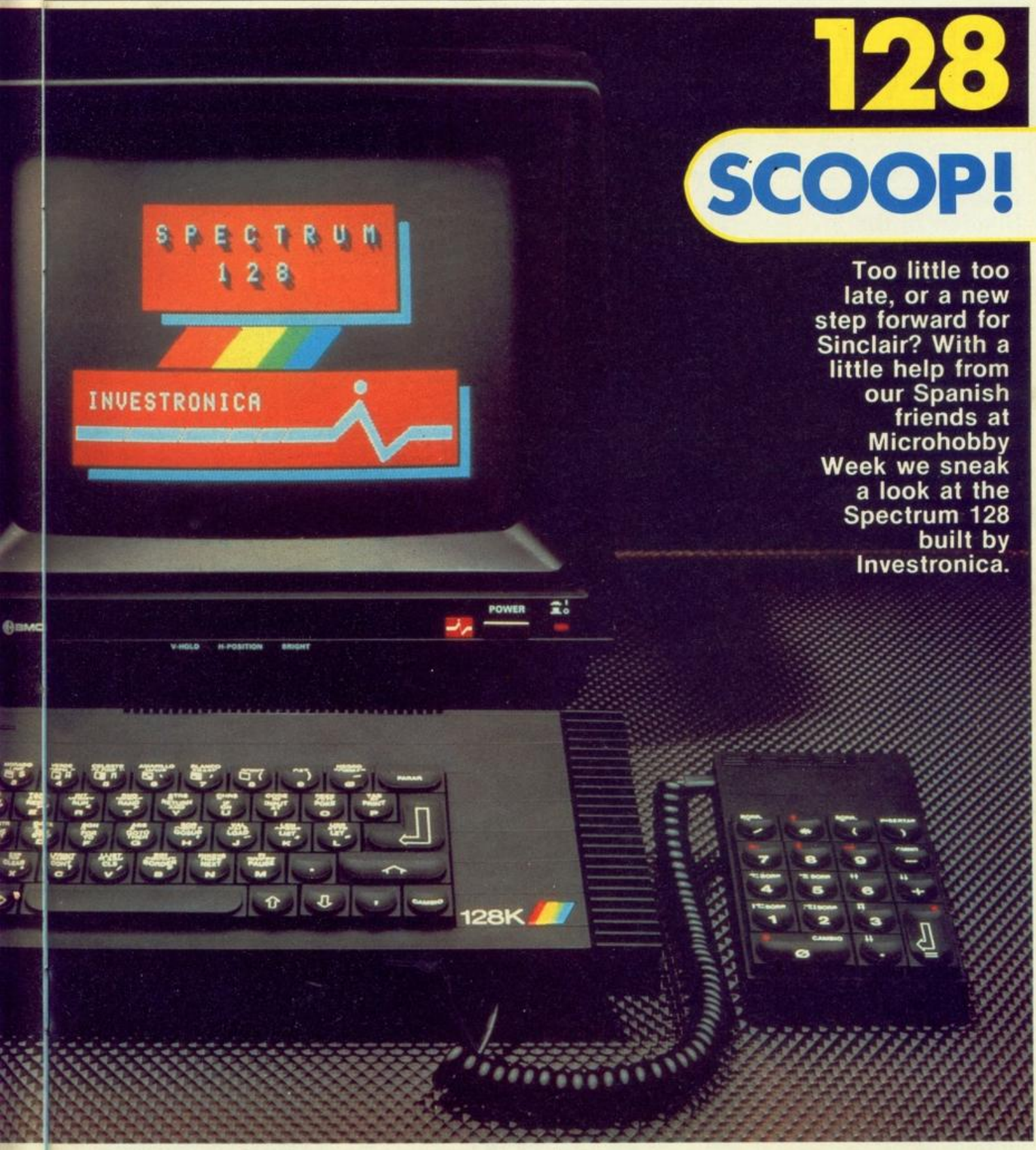
☐ Amstrad 6128. Includes CP/M, monitor and disc. Less games. £300.

☐ Enterprise 128. Includes word processor, joystick. Almost no software. £250.

☐ Atari 130XE. Brilliant games but not as many as for Spectrum. Still tops for sound and vision. £170.

128 SCOOP!

Too little too late, or a new step forward for Sinclair? With a little help from our Spanish friends at Microhobby Week we sneak a look at the Spectrum 128 built by Investronica.



epic. Ocean's David Collier says he has had no loading problems with the Sinclair 128 unlike the Commodore 128 which has a variant of the 6502 processor "which is not as robust" as that in the 64. Ocean has now rewritten its fast loader to avoid crashing the Commodore 128.

The Sinclair 128 has the same ULA as the Plus so resolution, colours and screen management are all the same — 256 × 192, 8 colours. A Play command gives access to the new sound facilities. Text can be stored as separate pages by storing in the form of variables — A$, B$ and so on.

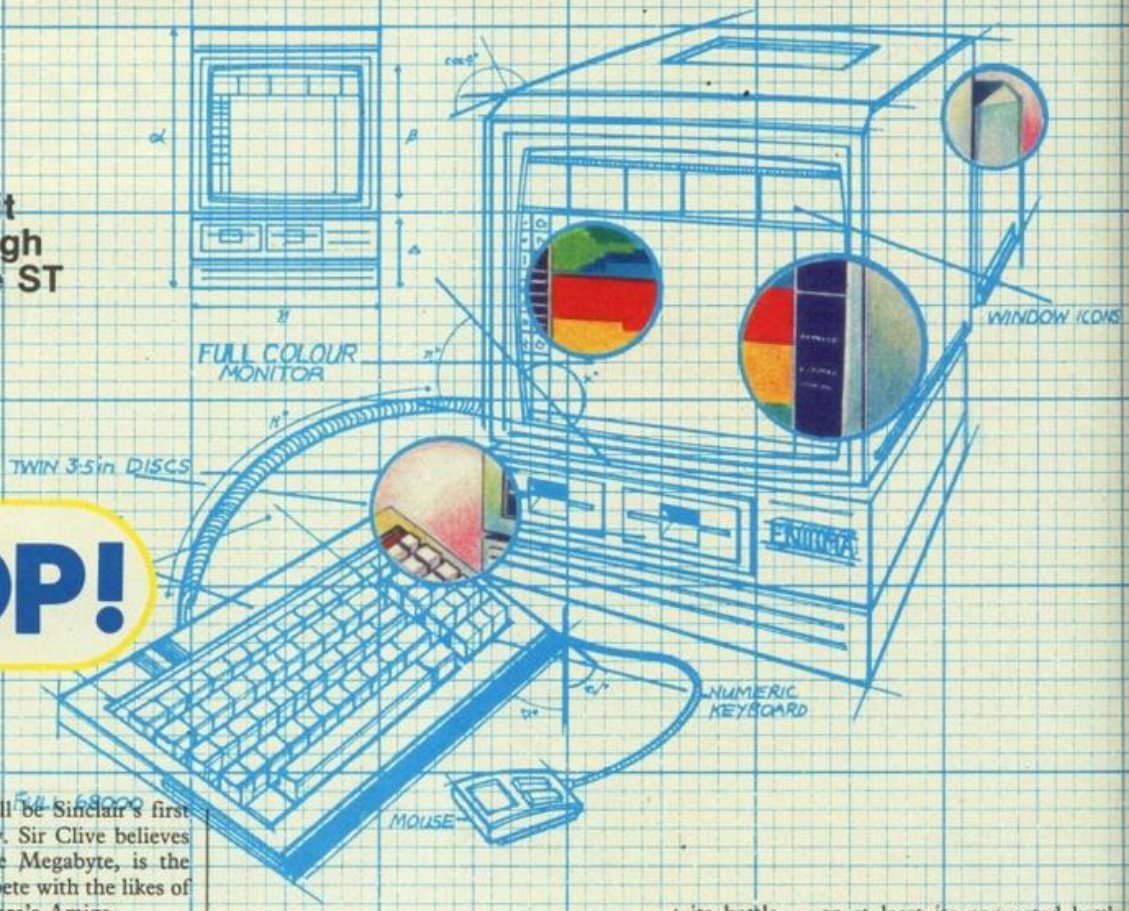
Spring offensive

Of course the machine we have seen is still a prototype, one which Domingo Gomez of Microhobby-Weekly magazine in Spain could only inspect at the headquarters of Investronica in Madrid but this is not a one-off special aimed only at Spain.

There may be some changes before it appears on the British market next spring but despite its faults the 128 looks like it will be a strong base model for Sinclair's new 1986 model range which will include the portable Pandora and the desk-top Enigma (see over page).

SINCLAIR ENIGMA

Next year's model from Sinclair is the Enigma. Can it be good enough to take on the ST and Amiga on their own ground?



SCOOP!

NEXT YEAR'S Enigma will be Sinclair's first Mega-machine — literally. Sir Clive believes that 1024K of Ram, one Megabyte, is the minimum needed to compete with the likes of Atari's ST and Commodore's Amiga.

He has also bowed to the inevitable and abandonned the Microdrives for a pair of built-in 3.5 inch disc drives. But the portable Spectrum-based Pandora also planned for early next year will still use Microdrives to keep down costs and weight. If Sinclair goes ahead with a portable QL that too may stay with the stringy floppies.

The Enigma is planned for launch in May '86 somewhere in the vague £500 — £1,000 price band. It will have a version of the Psion Quill, Abacus, Archive and Easel suite of programs but on Rom rather than the QL's Microdrive cartridges. The Enigma will also have a full Window, Icon, Mouse environment, probably Gem as used on the Apricot, since Digital Research has been having talks with Sinclair for some time and has publicly claimed that Gem could be ported straight across to the QL. The big question is whether Sinclair can compete with the Supermicros without going for a full 16-bit Motorola 68000 like the Amiga, Macintosh and ST rather than the cut-down 68008 in the QL.

The Enigma will be sold as a complete package; computer, software, two drives, mouse, colour monitor and printer. It might also develop with the addition of a phone and communications into a colour replacement for the Sinclair developed monochrome ICL One Per Desk — which because it was only black and white was known during its development as "Work Station Zebra".

Sinclair is also working on a "personal communicator" a £99 cigarette packet-sized portable phone that would allow you to make and take calls on the already established cellular radio network at any time or place. With the 128, Pandora and Enigma all lined up for launch in the first half of next year there would seem to be no place for the much-rumoured QL 2 as such. This now seems to have grown into the Enigma.

Sinclair's plans look ambitious at a time when the company is making 20 of its 120 staff redundant and such senior personnel as Nigel Searle and Robb Wilmot are being kicked off the Sinclair board. The company is also losing its bottle — or at least its converted bottle factory headquarters at Willis Road — where development work on new computers used to be concentrated and moving the entire operation to Milton Hall, country mansion of of Sinclair's Metalab.

Nigel Searle had been head of Sinclair's computer side before he was sent on a none too successful trip to America to boost Sinclair sales over there. Searle now loses his position on the board but stays on as Sinclair's top dog in the States. Robb Wilmot, Mr ICL, long-time associate of Sir Clive was brought in six months ago to develop the Sinclair/Catt wafer scale technology which promised to produce failsafe single-chip mega computers by the 1990's. Now Wilmot leaves the board and the company.

Can Sinclair's Enigma be ST, Amiga beater?

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ADVENTURE INTERN

HOME OF THE HEROES

Paul Bond goes in search of adventure.

FINDING THE headquarters of Adventure International UK is a bit like solving an adventure in itself. The clue is the company sticker in the window of an otherwise nondescript warehouse in Birmingham 19.

"We don't mind being hard to find", says Mike Woodroffe, managing director and general co-ordinator of programmers and projects. "We're happy to talk on the phone, but we couldn't do with hordes of crazed adventure fanatics hanging about outside".

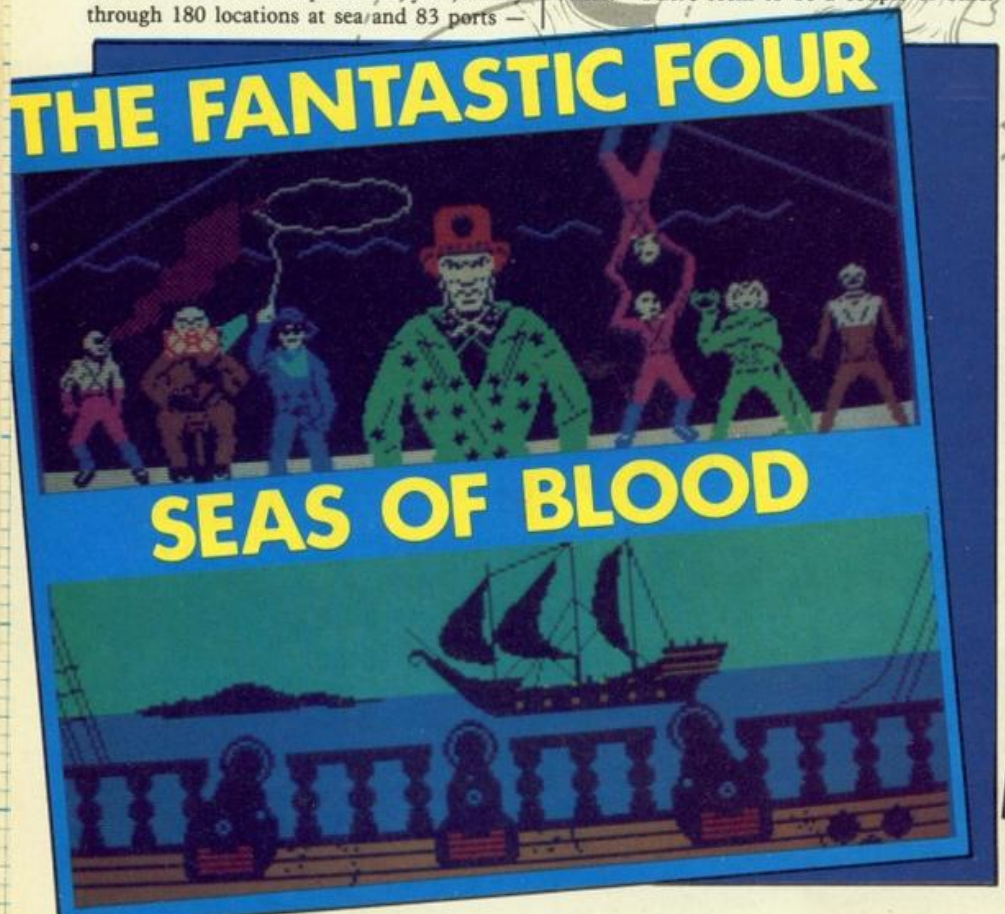
Life in the Handsworth area has been exciting enough without that: "Most of the rioting was only a mile away from the unit, but it affects the locals less than it affects people reading the national newspapers".

Seas of Blood, AI's next release, has nothing to do with urban unrest, but plunges us into a life on the ocean wave. Based on one of the Fighting Fantasy series of books by Steve Jackson and Ian Livingstone and published by Puffin, the game puts you in charge of a pirate ship. Together with your band of seasoned cutthroats you must scourge the Inland Sea, searching for gold and slaves and defeat your rival Abdul the Butcher in the race to become King of the Pirates. Setting off from Tak, the greatest den of thieves the world has ever known outside of a computer fair, you journey through 180 locations at sea and 83 ports — all with graphic illustration. There is a mini-adventure at every stop with 20 treasures to find all defended by gruesome monsters.

"We've taken the basic scenario of the book, changed some of the puzzles and objectives. The book and the game are different, but we've kept the scoring and stamina system. For instance, you don't just Fight Galley — you work out relative strengths to decide the outcome". Other FF games are planned — the next release looks like being Appointment with F.E.A.R. "The Fighting Fantasy books have sold over eight million copies — that's a lot of potential buyers".

A land-based outlaw is the subject of AI's Robin of Sherwood series of adventures, notable for their excellent graphics (see Quest Corner, this issue). Touchstones of Rhiannon's sequel, Seven Swords of Wayland, features the Hounds of Lucifer — sounds like Mike Woodroffe would like to unleash them on some nefarious characters in the industry; while the Robin Hood games are officially licensed and based on the books of Richard Carpenter, like the TV series. "There seem to be a couple of other Robin games about. We've sent copies of the ads to the licensing company. It's up to them — otherwise there's no point in our paying the licensing fee in the first place".

Adventure International also plans an assault on the arcade adventure market. Davy Jones' Locker is a joystick-based arcade adventure featuring Pegleg Bob, the lighthouse keeper. He must row to the lighthouse to rescue survivors of a shipwreck. In this sequence he is attacked by a whale, a swordfish and a shark which he has to beat off with his oars. Seagulls also fly about dropping unmentionable things on him. Next he runs across the rocks as the sea rises and waterspouts erupt around him. Now he must find the survivors and put them in a cave, while under attack from crabs. The final sequence is the wreck itself. He must row survivors to safety before being engulfed by a



Ian Livingstone and Steve Jackson.

NATIONAL

Nigel Bamford, Michael Woodroffe and Patricia Woodroffe.

tidal wave.

This is a long way from American Adventure International's founding father's original vision. Does Scott Adams, the man who originally crammed Crowther and Woods' Colossal Adventure into a TRS-80, let the UK operation have a free hand?

"We're totally different companies, both from the ownership and the financial point of view. We have the licence for Scott Adams' product in the UK and Europe — at the time we got it Tricia (Mrs Woodroffe) and I were importing American software for the Atari 400/800. We did more business with Scott than anyone else."

It struck Mike Woodroffe that the American packaging was unnecessarily large: "We were paying to fly blocks of polystyrene over the Atlantic. Scott suggested that we set up our own duplication operation here — so Adventure International UK was born. We went over to Florida, spent the week in Disneyland — it was great".

AI-UK also plan an arcade-style Gremlins game (not to mention a second Gremlins adventure proper). More Gremlins? Is this wise?

"Well, the first Gremlins by Brian Howarth, our ace programmer, outsold all our other stuff by double. It's been translated into Spanish and German with great success, and there's a French version on the way. A new Gremlin movie is due for release at the end of 1986."

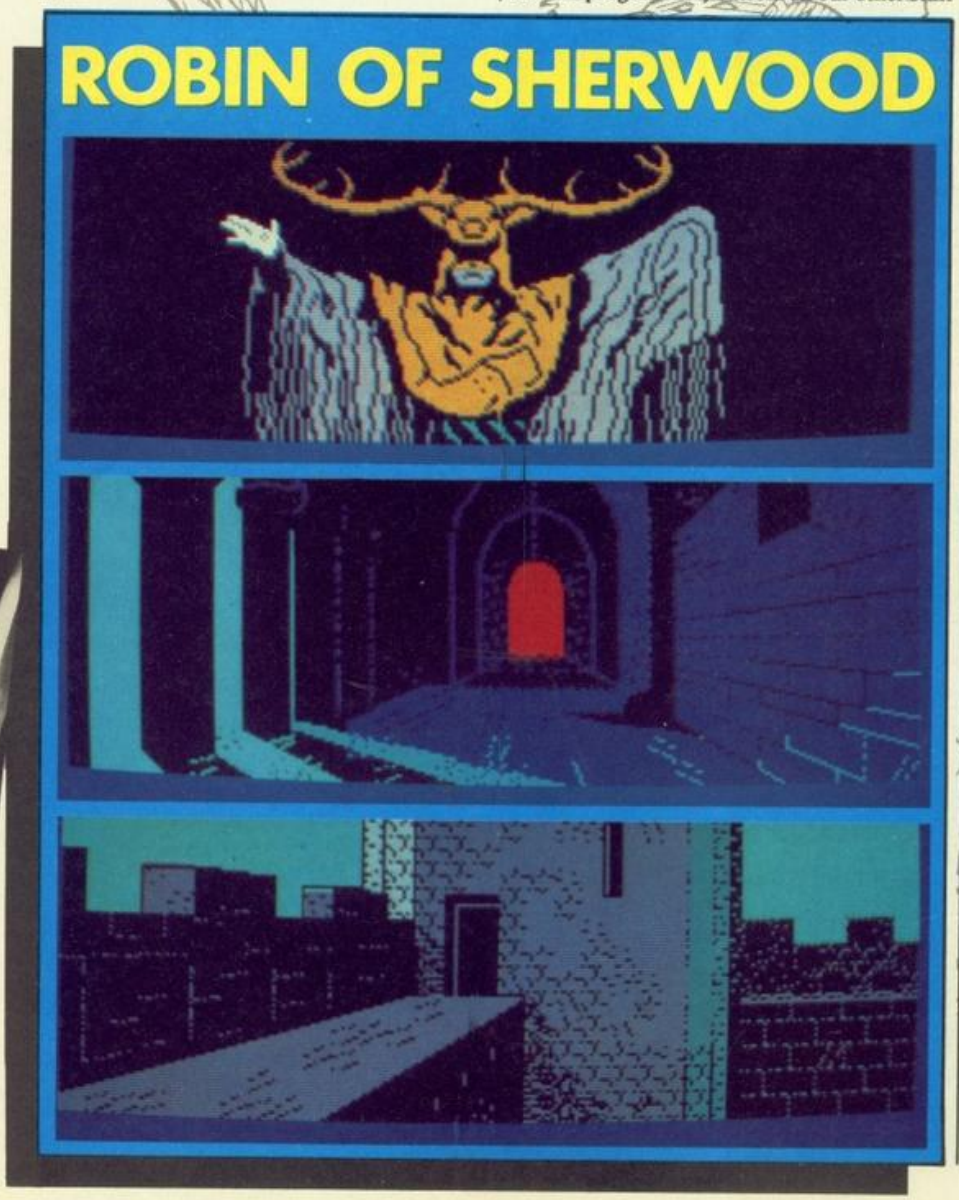
The company implements American products like the forthcoming Quest Probe III game, featuring the Fantastic Four in the following way. Scott Adams writes the main story and Marvel comics in New York draw up the artwork. This is then sent to Ken McNair in Florida who codes it all onto an Apple. "Then we take the plot and the disc and convert it to Spectrum, Commodore and so on".

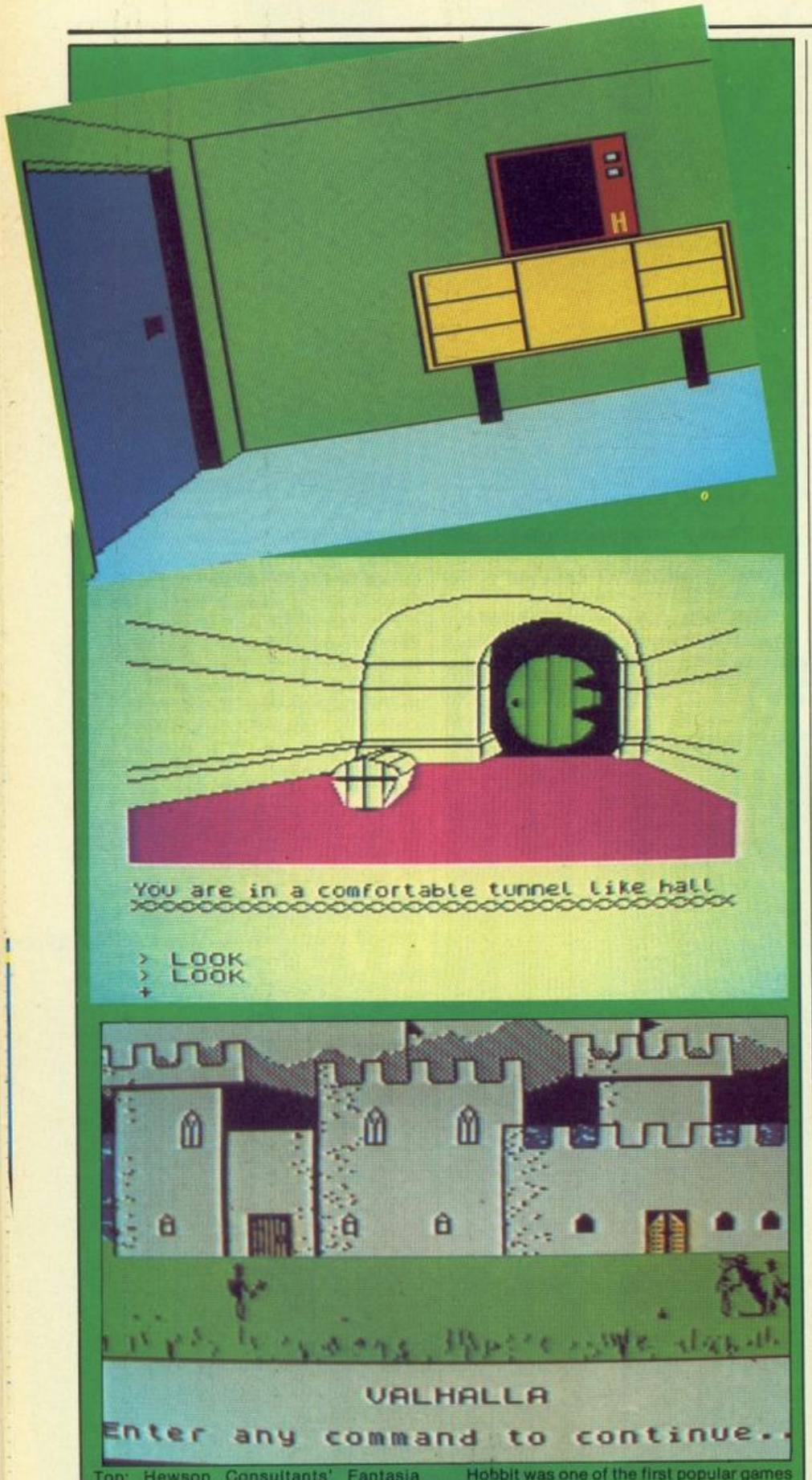
The Fantastic Four game stars the Thing and the Human Torch. It has a revolutionary new method of play for a Scott Adams game. You can switch indentities and there are far more Marvel characters featured than in recent games. "The US market is disc-based. Sometimes our cassette versions appear before they get the game over there". Anomalies are common in the adventure market. Adventurers buy strange things and the games can sit on the shelf for a long time. This puts off wholesalers.

"Would you believe, one chain store wouldn't take Robin of Sherwood — it has some of the best graphics I've seen in any computer game, not to mention publicity from the books and the TV series", says Woodroffe. The new series will star Sean Connery's son incidentally. "Only Centresoft carries our whole range."

To solve this, AI created the concept of the Scott Adams Adventure Centre — basically dealers don't need to pay for units until after they've sold them. "We haven't pursued the concept very energetically — there are about 15 Adventure Centres at the moment — we plan on 80 or 100, but we'll get down to that after Christmas". One thing is sure, AI have plenty of new releases planned — apart from Fighting Fantasy, Robin of Sherwood, Gremlins and Quest Probe, they have the rights to Buckaroo Banzai *(who is he ? — Ed).*

Take Indiana Jones, mix a little popstar, throw in some super-hero and space-ace and you've got a Twentieth Century Fox movie awaiting release. "They've actually got the film in stock over here, but it's not being released yet". Could be another first for Adventure International. You've played the game, now see the movie.





Top: Hewson Consultants' Fantasia Diamond is a typical 'post-Hobbit' program featuring a number of interactive characters, some of whom — the Toy Robot in particular — assume quite significant roles in the game. Middle: The Hobbit was one of the first popular games to feature true 'interactive characters'. Bottom: Valhalla was notable for its interactive characters, one important function of which was their ability to 'remember'.

INTER
ADVENTU

PROGRAMMING TEXT-ONLY adventures in Basic is really quite easy, and lots of people tend to have a bash at it at some time during their programming careers. The funny thing is, though, that although an adventure is meant to be a program that interacts with the player, there's one feature that's almost always missing from a Basic adventure game — and that's interactive characters.

An interactive character is someone like Thorin in the Hobbit — a computer-controlled personality who appears to have a mind of his own. You may even, if he or she has been well-programmed, be able to sit down at the keyboard and have a limited conversation together. This particular feature can add enormously to any adventure game, be it of the simple home-brewed Basic variety, or a fully-fledged commercial game. Unfortunately, it's often either badly implemented or left out altogether.

The reasons why so few games have good characters in them may seem obvious. If you're going to include other people in the game, you're also going to have to include a whole load more data for messages — either speeches for them to deliver, or descriptions to tell the player what they're up to. On top of that, you'll also need to test hundreds of conditions to determine when these messages should be output. Obviously all this is going to take up loads of Ram, which you probably can't spare, because adventures tend to take up loads of Ram anyway.

Well, the good news is that there are ways of programming "intelligent characters" into your Basic adventure games, and these methods don't necessarily take up much space. You'll still need to set aside data storage areas for messages, but you can fit an awful lot of messages into, say, 3K — and that still leaves you with lots of room for other things like location descriptions and so on.

In this, and the two issues of *Your Computer* that follow, we're going to let you in on the secret of how it's done, and leave you with a type-in listing that will have characters interacting away to their hearts' content, or until you press the Escape key.

First, for those who may be a little unclear about the subject, let's define exactly what an interactive character is — and what it isn't. An interactive character should have three main attributes: the ability to move from location to location without help from the player; the ability to get, carry, and drop objects; awareness of his/her surroundings. These three main attributes will enable the character to play a significant role in the game. We've already mentioned Thorin as an example of such a character — another example would be one of the characters in Valhalla.

RACTIVE
TURE CHARACTERS

MAKE IT LIVE

James Hartley meets interesting people.

Some games do, of course, include characters but include them in such a way as not to qualify for the term "interactive". Such characters are really just objects, which are described in human terms. They can still be quite effective, but the point is that such "pseudo-characters" are 100 percent predictable. Once you've met "the old man by the crossroads", you know that you'll meet him again at the same point in the game every time you play.

If, however, the old man was a real interactive character, you might meet him in the pub, on the street, at the hotel, or even catch him stealing up behind you and pinching your purse — whereupon you can chase him and try and get it back.

All these actions can, in an adventure program, be set in motion by a routine which from now on we shall call the character handler. This is a routine that can accept the data for any character in the game, process it, decide what action (if any) to take — such as moving the character — and then return to the main adventure program. There are two sorts of character handler — asynchronous and synchronous. All this means that in the first case the routine is called independently of the player's actions.

In other words, whatever may be going on in the main program, a call is suddenly made to the character handler to update all the characters. Both the Hobbit and Valhalla use this technique — if you sit back and do nothing, you'll see the characters continue to act out their own pre-programmed lives, with perhaps a message such as "You wait ..." or "Time passes ..." flashing up on the screen every few seconds. This system is rather difficult to implement in Basic, unless you have an MSX or Amstrad computer provided with Basic interrupt commands.

An asynchronous system can appear more lifelike, because the pace of the game doesn't depend on the player, but a synchronous system is easier to program. Using this system, the character handler is called regularly at a certain point in the program — usually when the player enters a command. This is the system we shall be using here.

Before we actually get down to the nitty-gritty of bringing our characters to life, there are just two more possible attributes for characters that need to be mentioned. The first is speech — they should ideally be capable of addressing the player without being prompted, and — even better — answer back if spoken to.

The second is "history" — which means that a character should have some idea not just of what is going on around him/her, but also of what has happened previously. The best example of this is Valhalla, where characters like Thor took note of our actions and this influenced their behaviour later in the game.

Allowing the player to address characters does not just involve the character handler routine — it also involves the parser, that bit of your program that accepts input from the player. For this reason, we shall not be including it in our program, but you will find that the techniques illustrated will make it simple to implement in your own games. We will, however, be giving our characters something to say. So much for the background. Now, how's it done?

The first problem we have to solve is how to test conditions, because we're going to have to do it a lot and we need an efficient method. If you look at any book on programming Basic adventures you'll see that there are lines upon lines of If statements, since this is the easiest way of testing a condition in Basic. Here are a couple of examples:

```
IF (the player is in the dungeon) AND
IF (the rats are hungry) THEN PRINT
(Aaaaaagh!!!)
IF (the player is in the dungeon) AND
IF (the rats are dead) AND IF (the
player is hungry) THEN PRINT
(Mmmmm! Revenge is sweet!)
IF (the player is not in the dungeon)
THEN PRINT (Freedom is slavery)
and so on ...
```

This is all very well, but you could soon find yourself writing a line full of Ifs for every message you want to print on the screen. However, the good news is that we can do without Ifs altogether! The first step is to look at the problem in a completely different way. Let's take the example above and represent the decision-making process as a "tree" — see diagram 1.

A structure like this is called a decision tree. It is composed of different nodes (the rectangles) connected. The nodes fall into two types —

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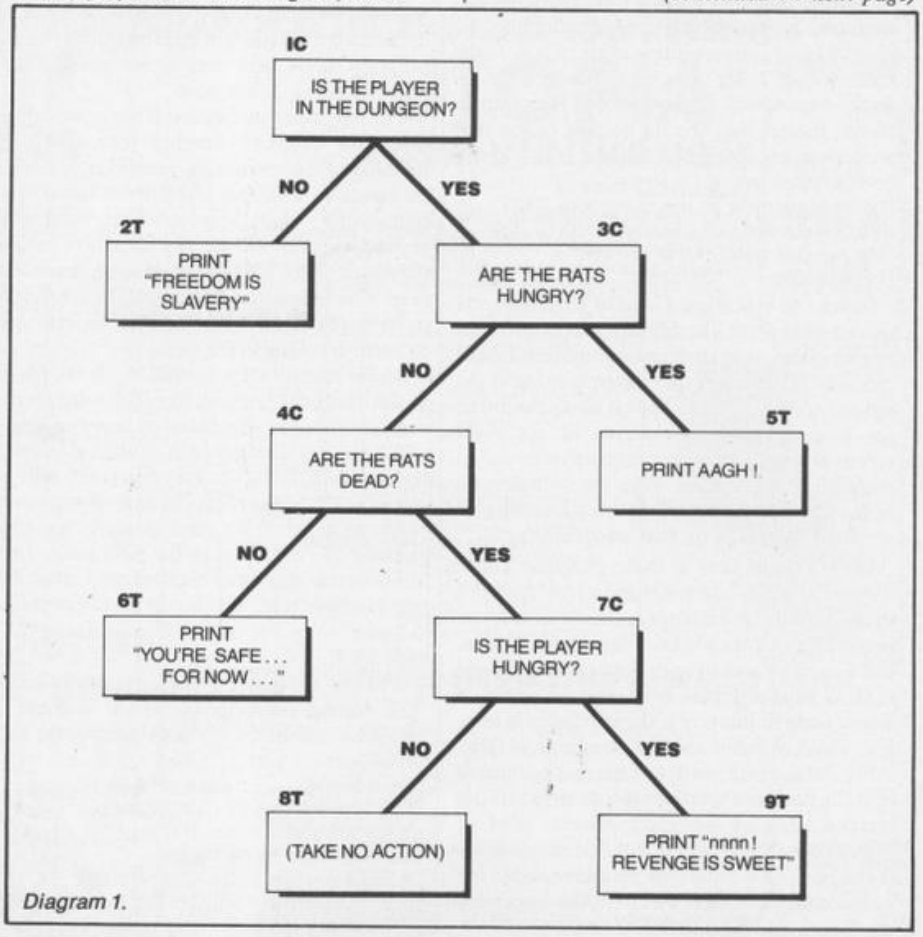
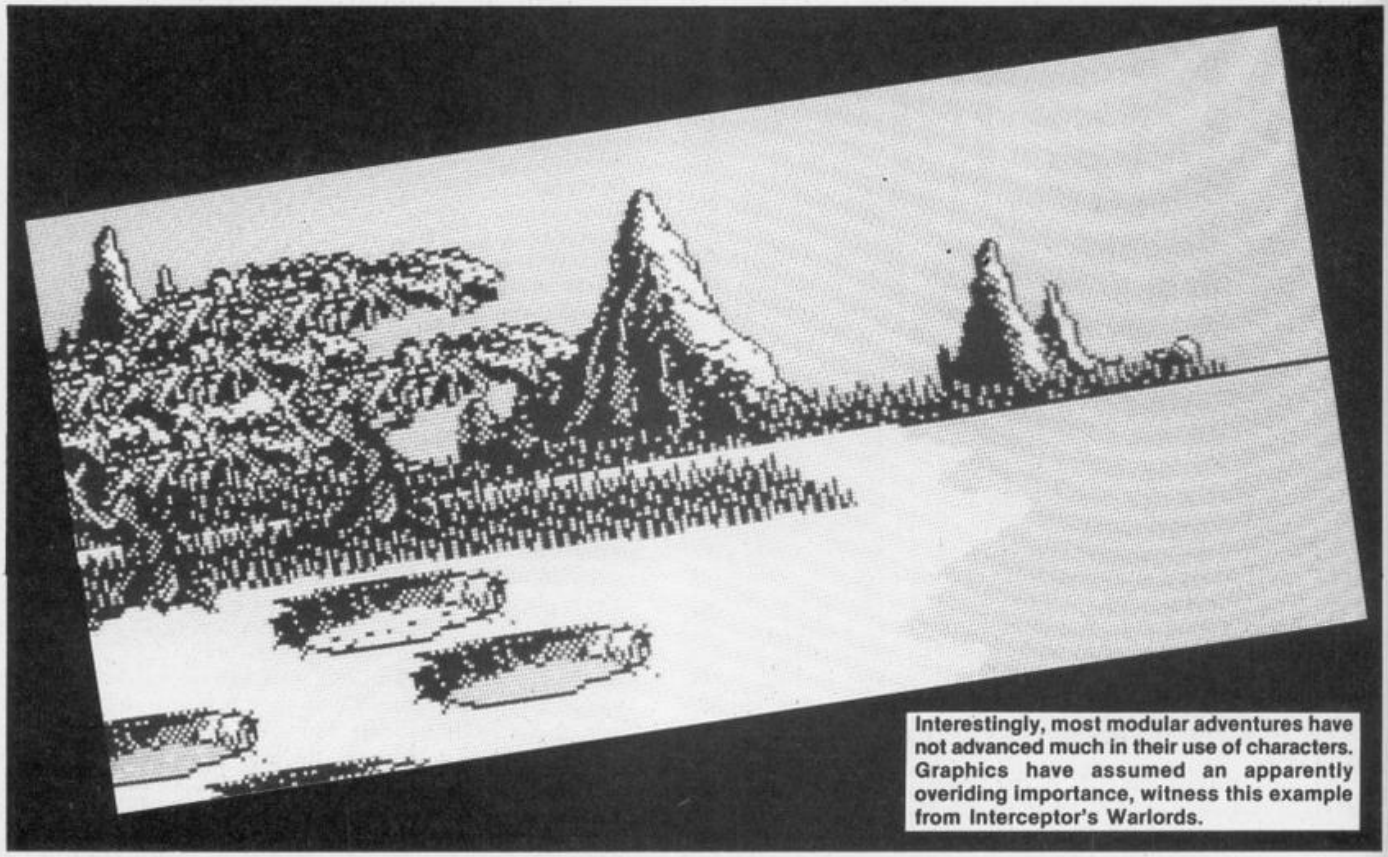


Diagram 1.



Interestingly, most modular adventures have not advanced much in their use of characters. Graphics have assumed an apparently overiding importance, witness this example from Interceptor's Warlords.

(continued from previous page)

choice nodes, which test a condition (such as Is the player in the dungeon?") and terminal nodes, which do not test a condition and have no further branches leading from them. In this diagram, each node has been numbered and given a letter corresponding to its type — C for choice, and T for terminal. The conditions tested correspond to those in our If examples above, though you should be able to see that we have made a simple addition, which could be expressed as:

```
If (the players is in the dungeon) AND
IF (the rats are not hungry) AND IF (the
rats are not dead) THEN PRINT
(You're safe . . . for now)
```

Instead of executing a load of If statements, we can enter a tree like this into a Basic program as a set of data, and then traverse it using a short routine. Traversing a tree means starting at the top and working our way down along the different branches until we arrive at the right terminal code, since when we arrive at one of these we know that we have reached the end of the decision process, and can take whatever action is indicated by that particular node.

Let's look at how a Basic program might traverse our rats-in-the-dungeon tree. In order to do this, all our Basic program needs to know is what type each node is — terminal or choice. If it's a choice node, the program will also need to know what condition is to be tested, and both which node to jump to if the condition is true, and which to jump to if the condition is false.

For the moment, we'll assume that our player is in the dungeon and the rats are alive but not hungry. Let's see what happens . . . Starting at node one, the program will first check to see if the node is a choice or terminal node. It's a choice node, so next we check the associated condition, and find that it is true.

The program looks up the data for node 1, result true, and finds that the new node to jump to is node 3. The process is repeated and the program jumps to the node associated with node 3, result false. Again the process is repeated for node 4, with the program ending up at node 6. This is a terminal node, so the program stops here and prints the message "You're safe . . . for now".

The tree we've just shown is very simple, but trees like this can develop into enormous baobabs of programming complexity, testing hundreds of different conditions, but still — remarkably — taking up very little Ram. The secret is in the way such a structure can be translated into a Basic program, and this is very easy. The first step is to store all the conditions to be tested in an array, so that we can refer to them by numbers.

So, for example, the condition "Is the player in the dungeon?", which like all conditions can evaluate either to zero (false) or non-zero (true), will have its value stored in conditionarray(1); the value of "Are the rats hungry?" will be stored in conditionarray(2), and so on.

All we need to do then is set up an array holding the information for each node. Let's suppose that this array is called the t array. For our example tree, we should Dimension it as follows:

```
DIM t(9,4)
```

The first subscript, 9, is the number of nodes. The second subscript, 4, is the number of different data items we need to store for each node — these are:

```
(1) node type — choice (indicated by a
0) or terminal (indicated by a 1)
(2) for a choice node, the number of
the condition to be tested
(3) for a choice node, the node to
branch to if the condition is false
(4) for a choice node, the node to
branch to if the condition is true
In the case of terminal nodes,
elements 2 and 3 are set to zero, and
element 4 holds a number used to
select the relevant message from a
data store.
```

As an example, then, the data for node one could be read into the t array from a Data statement as follows:

```
10 FOR n = 1 to 4: READ t(1,n): NEXT
20 DATA 0,1,2,3
```

We could extend this to read data for each of the nine nodes into our array.

Now comes the magic — we can traverse the tree simply by setting a variable 'nodenumber' to one and then using the following routine:

```
IF t(nodenumber,1) = 1 THEN (exit tree
because we've reached a terminal
node) ELSE
nodenumber = t(nodenumber,t
(nodenumber,2) + 3): GOTO (beginning
of line and do again)
```

The first part of the routine simply checks to see if we've reached a terminal node and, if so, jumps out of the traversal process. All you really need to pay attention to is the second part, and the way in which the new node number is assigned to the variable nodenumber.

This is done by getting the relevant record for the current node, and selecting from the array the appropriate node number to branch to next by adding the value of the condition number held in t(n,2) to the number 3, giving us either t(n,3) (if the condition was false) or t(n,4) (if it was true). The routine simply calls itself repeatedly until it finds a terminal node and exits.

In next month's issue, we'll show this technique in action, and begin the process of bringing our characters to life. ■

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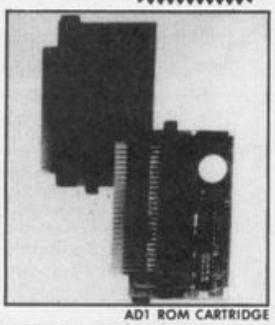

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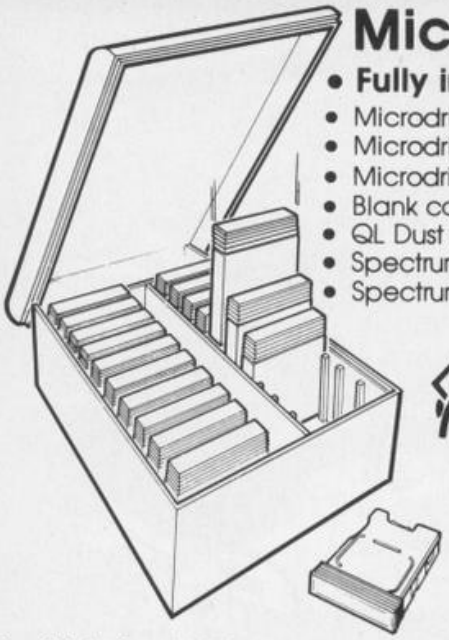

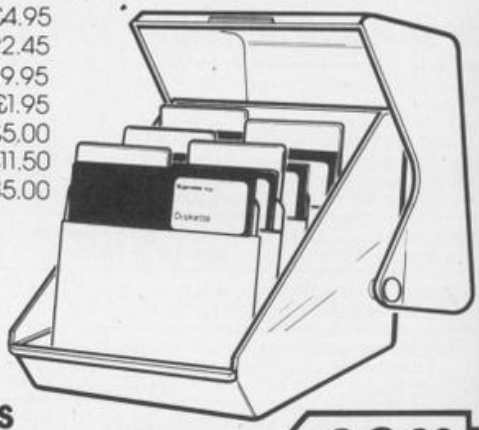

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NEWS oaeo rssu ttttt h h

The crystal ball

Windam Classics is the title of a new series of text and graphics adventures based on famous children's books. The series is being marketed on disc for Commodore 64 owners by W.H. Smith Distributers.

There are two types of game. Alice in Wonderland — reviewed this issue — and Below the Root — based on the Green-Sky trilogy — are mainly animated graphics with added text. The more traditional type of adventure can be found in Swiss Family Robinson where text plays a greater role.

Others planned for release include Treasure Island, Robin Hood and The Wizard of Oz. The Worm in Paradise, Level 9's sequel to Snowball and Return to Eden, should be with us any time now.

A helping hand

Dean Cooper of Dudley has found Scott Adams' Secret Mission — formerly Mission Impossible — a trifle tough.

Can't get the yellow key?
WODN IWHG UORH TRED ROCE FWOR HT

Bomb going off?
WODN IWNE KORB YBEG DABS RUET OBAS ESU

Still no joy?
SNOT TUBE TIHW NEHT WOLL EYNE HTDE RHSU PRIA HCNI

Where's the blue key?
POME HTEK AHS

Curiouser and curiouser.

QUEST Corner

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

Riding through the glen — Robin Hood.

Robin of Sherwood

- *Spectrum/CBM-64/Amstrad*
- *Adventure International*
- *£9.95*

IN THE DAYS of the Lion spawned of Devil's Brood, the Hooded Man shall come to the forest. There he will meet Herne the Hunter, Lord of the Trees, and be his son and do his bidding. The powers of Light and Darkness shall be strong within him. And the guilty shall tremble.

Or, to use prose of a slightly less purple hue, Robin Hood and his merry men are up and about again and all set to duff up the baddies in this new text and graphics adventure.

If the mention of the aforesaid Hooded Man and Herne the Hunter twanged your memory's bowstring, that's probably because this adventure is based on the popular TV series and has been officially licensed from Goldcrest.

Mike Woodroffe has joined forces with programmer Brian Howarth and graphics supremo Teoman Irmak to produce an adventure that is both mentally challenging and visually stirring. If you're a BBC or Electron owner, you'll have to be content with a text-only version at the lower price of £7.95.

Like many of Adventure International's recent releases — Gremlins, Hulk, Spiderman, Sorcerer of Claymorque Castle, etc — Robin of Sherwood boasts superb graphics, the best you'll see in any adventure. The only others I've seen that come near to A.I's standard are those by Terry Greer of Interceptor but you don't get many pics per adventure with theirs.

Subtitled Touchstones of Rhiannon, the adventure not only casts you as the bold Robin but also casts you straight into a dungeon at the start of the game. Although the opening parallels one of the TV scripts, you may find it a shade difficult to escape from this early predicament. Despair not — A.I. have thought fully given some coded clues on the packaging to get you out of the pit. Before you rush off to Sherwood Forest, you might care to explore the castle. The Lady Marion's in there somewhere and it might pay you to chat her up before you belt off.

Once in the Greenwood, you're sure to meet up with Herne The Hunter, he of the funny headgear. Hatrack-head will tell you that your quest is to find the six Touchstones of Rhiannon and return them home.

Sherwood Forest sure is a large place and you're likely to get lost quite quickly. Keep plugging away though and you'll be rewarded with a stunning animated picture of a waterfall. Elsewhere, you might be lucky enough to stumble across a bewitched John Little, Kirklees Abbey and a grange.

Robin of Sherwood is a visual treat coupled with a testing mission.

Alice in Wonderland

- *Commodore 64*
- *Windham Classics*
- *Disc £14.95*

CURIOUSER AND curiouser! Windham have combined traditional interactive text with command menus, graphics, sound and elements of arcade action.

The result is a charming adventure, offering something for the whole family. The game is based on the Alice books with some new ideas and characters added. You guide an animated Alice through some 250 screens, meeting over 60 different characters.

With the aid of a joystick, Alice can be made to walk, run, climb, crawl, stand, swim, and jump.

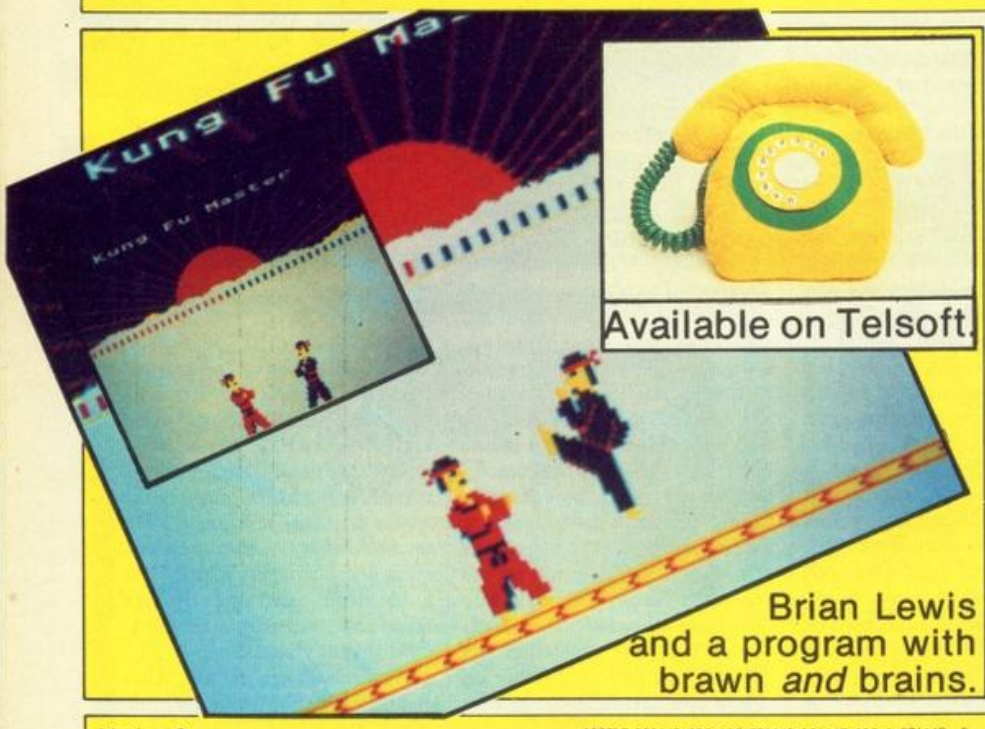
Part of the screen is reserved for entering commands and for receiving textual information. However, you don't have to type a thing — all input is done by means of option menus controlled by your joystick.

Most of the famous characters are there — all are animated — including the Cheshire Cat, the Mad Hatter, the March Hare, the Walrus — but no carpenter — and the White Rabbit.

Alice is a large, engaging and often humorous game. While it is undoubtedly aimed at younger children, many adults will enjoy this entertaining revisit to Wonderland.

Listing 1.

```
   10DATA17,59,7,58,50,50,16,0,204,238,14,228,240,226,
224,192,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,19,7,7,7,3,3
5,17,195,105,239,30,30,30,31,239,0,8,12,135,135,15,15,
8,0,0,0,192,192,128,0,0,1,1,17,1,1,3,3,3,15,15,255,47,
95,95,15,15,8,8,136,8,12,12
   20DATA12,14,0,0,0,0,0,0,0,0,7,7,7,7,7,7,48,48,47,77
,77,76,136,136,0,128,14,15,15,15,7,7,48,48,0,0,0,0,8,8
,0,128
   30DATA0,2,5,0,0,0,0,0,119,255,15,249,248,248,248,63
,0,136,8,129,193,139,135,15,0,96,224,224,72,72,8,8,1,3
,19,19,3,1,0,0,79,15,15,15,15,31,15,15,15,31,46,76,136
,8,8,8,136,0,0,0,0,0,0,0,0,0,0,0,0,1,1,3,15,255,47,95,
79,159,47,15,8,136,12,12,142
   40DATA15,15,15,0,0,0,0,0,0,0,0,3,3,7,7,7,119,96,112
,31,46,46,76,76,0,0,0,15,15,7,7,7,102,96,112,0,0,0,0,0
,0,0
   50DATA0,2,1,2,0,0,0,0,0,119,255,15,249,248,248,248,11
2,0,136,8,128,192,136,128,0,0,0,16,16,48,48,22,30,0,0,
1,1,3,3,3,3,60,30,207,47,91,105,105,15,9,15,15,15,15,1
59,46,12,30,14,46,76,136,0,0,0,3,3,1,0,1,1,3,3,79,143,
127,31,47,79,159,15,12,12,204
   60DATA12,142,142,15,15,0,0,0,0,0,0,0,0,3,7,7,7,7,7,
96,112,47,76,76,76,136,136,0,0,15,15,7,3,3,3,48,48,0,8
,8,8,8,8,0,128
   70DATA0,2,5,0,0,0,0,0,0,119,255,15,249,248,248,248,11
2,0,152,24,145,192,137,129,1,0,128,128,128,128,8,12,12
,0,0,1,1,3,3,3,3,60,30,207,47,91,105,105,15,9,15,15,15
,15,191,12,12,12,12,12,76,136,0,0,0,3,3,1,0,1,1,3,3,79
,143,127,31,47,79,79,15,12,12
   80DATA204,12,142,78,79,15,0,0,0,0,0,0,0,0,3,7,7,7,7
,7,96,112,47,76,76,76,136,136,0,0,15,15,7,3,3,3,48,48,
0,8,8,8,8,8,0,128
   90DATA0,17,59,7,58,50,50,16,0,204,238,14,228,240,22
6,224,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,3,7,31,15,15,1
5,7,192,105,15,15,207,60,60,109,0,0,8,12,14,15,143,111
,0,0,0,0,0,192,192,128,51,1,1,17,1,3,3,3,143,15,31,111
,175,31,14,12,31,76,140,142
   100DATA79,47,15,71,0,0,0,0,0,8,12,14,3,3,3,3,3,16,48
,0,12,12,12,8,8,128,128,0,35,17,0,0,0,0,0,0,30,30,248,
48,0,0,0,0
   110DATA0,0,17,3,21,17,17,0,0,238,255,15,242,240,241,
240,0,0,0,0,0,128,0,0,0,0,0,0,0,0,0,0,0,3,7,7,71,35,
17,104,45,143,79,47,30,30,158,0,0,8,12,30,150,150,206,
0,0,0,0,128,128,0,0,3,3,35,35,17,0,0,17,111,15,63,15,1
5,207,143,63,8,8,0,136,8,8,0
   120DATA0,0,0,0,0,0,0,0,0,35,33,48,48,1,1,0,0,46,76,1
40,132,12,12,192,224,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
   130DATA17,59,7,58,50,50,50,16,204,238,14,228,240,224
,226,44,0,0,0,0,0,192,192,12,0,0,0,0,0,0,0,1,3,3,3,7
,7,39,47,14,14,143,79,47,31,15,15,14,14,12,12,76,136,1
1,143,0,0,16,48,52,60,60,60,31,7,3,0,0,0,0,0,31,175,20
7,7,7,7,7,7,15,15,15,31,46,76
   140DATA8,8,12,76,136,0,0,0,0,0,0,0,0,0,0,0,0,0,0,7,7,7
,7,7,7,96,224,8,8,0,0,0,0,0,0,0,0,0,0,0,0,0
   150DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,51,119,7,114,
240,116,112,48,136,205,14,197,196,196,128,0,0,0,0,48,4
8,16,0,0,0,17,51,254,254,255,255,17,252,249,143,247,24
7,247,127,143,136,76,238,238,238,204,140,8,0,0,0,0,0,0
,0,0,17,17,1,17,51,51,51,119
   160DATA255,255,15,191,95,95,255,255,136,136,8,136,13
6,204,204,204,0,0,0,0,17,17,0,16,119,255,255,255,238,2
38,192,192,159,155,155,19,1,1,0,16,238,238,238,238,238
,238,192,192
   170DATA0,96,112,112,49,49,17,17,0,17,1,152,184,221,2
54,255,238,255,15,249,241,241,224,243,0,4,8,0,0,0,0,0,
1,0,0,0,0,0,0,0,255,127,55,19,1,17,17,17,253,255,255,2
55,255,127,255,255,136,204,76,76,204,136,0,0,0,0,0,0,0
,0,0,0,17,1,51,51,103,255
   180DATA255,255,255,15,191,95,223,111,191,255,0,0,0,0
```



KUNG FU MASTER is fairly unusual as magazine listings go, as it allows either Electron or BBC users to type in the program as it stands and the program itself detects which machine it is running on and makes any necessary changes to the program automatically. This is achieved by reading the value of the Inkey-256 command.

The game is standard Karate-style where each player can execute a certain number of moves, in this case 10, in order to attack his opponent or defend himself. The unusual thing about this game is the size and quality of the graphics; each player being 64 pixels or eight characters high. Such large characters would normally take a large chunk out of the already limited memory and would also result in a huge amount of data which would have to be typed in by the user.

To get around this problem I have used a simple but still effective compression technique; each character is stored in miniature form, in this case four characters high, and then this is expanded up to the full eight characters by the printing routine.

To implement the moves you must use the following combinations of control keys:

Listing 2.

```
   10IF INKEY-256<>0 AND INKEY-256<>-1 THEN spl=100 EL
SE spl=200
   20ENVELOPE1,1,10,1,-1,2,3,1,126,0,0,-126,126,126
   30ENVELOPE3,2,1,3,-1,1,5,2,126,0,0,-126,126,126
   40DATA&10,0,1,0,0,0,4,0,&10,0,3,0,2,0,5,0
   50?&=&4A00:FORT%=0TO15:READD:T%?&%=D:NEXT:pun=H%+12
8:cho=pun+128:blo=cho+128:kic=blo+128:for=kic+128:rou=
for+128:so=G%:so2=so+8
   60J%=so2+8:FORT=0TO2STEP2:P%=J%:[OPTT
   70LDA#&40:STA&70:LDA#&72:STA&71:LDA#H% MOD256:STA&7
2:LDA#H% DIV256:STA&73:LDA#0:STA&74:STA&80:STA&81:STA&
84:STA&85:STA&86:STA&52:STA&53:LDA#2:STA&77
   80.JSRdis
   90.start JSRdis:.H% JSRROT:JSRdelay
   100LDA&80:BNEc:LDA&84:BNEc:LDX#&9E:JSRkey:CPY#&FF:BN
Ea:JSRrigh:JMPc:.a LDX#&FF:JSRkey:CPY#&FF:BNEb:JSRlef:
JMPc:.b LDX#&BC:JSRkey:CPY#&FF:BNEc:JSRup:.c
   110LDA&52:BEQk8:JSRcru:.k8 LDA#0:STA&52:LDA&8E:BEQk9
:LDA&8F:BEQk9:JMPkk1:.k9 RTS:.kk1
   120.JMPstart
   130.SEF LDA&73:CMP#H% DIV256:BEQCE:JMPCF
   140.dis LDA&80:BEQmain:LDA&82:STA&72:LDA&83:STA&73:D
EC&80:BNEmain:LDA#2:STA&77:LDA#0:STA&50:LDA&81:CMP#6:B
EQCF:LDAA72:CMP#H% MOD256:BEQSEF:.CF JSRrub:LDA#H% MOD
256:STA&82:LDA#H% DIV256:STA&83:LDA#4:STA&80:STA&50:.C
E LDA#H% MOD256:STA&72
   150LDA#H% DIV256:STA&73:LDA&50:STA&74:LDA&81:BEQmain
:LDA#0:STA&81:CLC:LDA&70:ADC#&80:STA&70:LDA&71:ADC#2:S
TA&71
   160LDA#0:STA&81
   170.main JMPdis2
   180LDY#0:.A LDA(&72),Y:STA(&70),Y:INY:CPY#32:BNEA:CL
C:LDA&70:ADC#&20:STA&4D:LDA&71:ADC#1:STA&4E:.B LDA(&72
),Y:STA(&4D),Y:INY:CPY#64:BNEB:CLC:LDA&4D:ADC#&20:STA&
4D:LDA&4E:ADC#1:STA&4E:.C LDA(&72),Y:STA(&4D),Y:INY:CP
Y#96:BNEC
   190CLC:LDA&4D:ADC#&20:STA&4D:LDA&4E:ADC#1:STA&4E:.D
LDA(&72),Y:STA(&4D),Y:INY:CPY#128:BNED:RTS
   200.rub LDA#&29:STAK1:LDA#0:STAK1+1:JSRdis2:LDA#5:ST
AK1:LDA#&51:STAK1+1:RTS
   210.BLO LDA#1:STA&77:LDA#5:STA&80:STA&74:LDA#blo MOD
256:STA&82:LDA#blo DIV256:STA&83:RTS
   220.en LDA#2:STA&77:RTS
   230.righ LDA#0:STA&77:JSRrub:LDX#&FF:JSRkey:CPY#&FF:
BEQBLO:LDX#&CD:JSRkey:CPY#&FF:BEQPUN:LDX#&BD:JSRkey:CP
Y#&FF:BEQKIC:LDA&86:CMP#16:BEQen:INC&86:CLC:LDA&70:ADC
#8:STA&70:LDA&71:ADC#0:STA&71
   240LDA#2:STA&80:LDA#3:STA&77
   250STA&74:LDA#for MOD256:STA&82
   260LDA#for DIV256:STA&83:RTS:.PUN JSRSO:LDA#5:STA&80
:LDA#pun MOD256:STA&82:LDA#pun DIV256:STA&83:LDA#4:STA
&77:RTS:.KIC JSRSO:LDA#5:STA&80:LDA#kic MOD256:STA&82:
LDA#kic DIV256:STA&83:RTS
   270.ne RTS
   280.lef LDA#0:STA&77:LDX#&CD:JSRkey:CPY#&FF:BEQfly2:
LDX#&BD:JSRkey:CPY#&FF:BEQROU:LDA&86:BEQne:DEC&86:JSRr
ub:SEC:LDA&70:SBC#8:STA&70:LDA&71:SBC#0:STA&71:LDA#for
 MOD256:STA&82
   290LDA#for DIV256:STA&83:LDA#3:STA&77:STA&74:LDA#2:S
TA&80:RTS:.ROU JSRrub:LDA#5:STA&80:LDA#rou MOD256:STA&
82:LDA#rou DIV256:STA&83:JMPSO
   300.fly2 JSRrub:JSRSO:SEC:LDA&70:SBC#&80:STA&70:LDA&
71:SBC#2:STA&71:LDA#6:STA&80:LDA#1:LDA&84:BNEH2:LDA#1:
STA&81:LDA#4:STA&77:.H2 LDA#rou MOD256:STA&82:LDA#rou
 DIV256:STA&83:RTS
   310.CHO LDA#4:STA&77:LDA#5:STA&80:LDA#cho MOD256:STA
&82:LDA#cho DIV256:STA&83:RTS
   320.up JSRrub:LDX#&CD:JSRkey:CPY#&FF:BNEI:JMPfly:.I
LDX#&BD:JSRkey:CPY#&FF:BEQCHO:.jump SEC:LDA&70:SBC#&80
:STA&70:LDA&71:SBC#2:STA&71:LDA#4:STA&80:LDA#2:STA&77:
STA&74:LDX#6:STX&81:DEX:STX&77:RTS
   330SBC#&38:STA&70:LDA&71:SBC#1
   340STA&71:RTS:.fle DEC&86:SEC:LDA&70:SBC#&40:STA&70:
LDA&71:SBC#1:STA&71:RTS:.st SEC:LDA&70:SBC#&40:STA&70:
LDA&71:SBC#1:STA&71:RTS:.down LDA&85:CMP#1:BEQFLE:CMP#
0:BEQST:INC&86:CLC:LDA&70:ADC#&48:STA&70:LDA&71:ADC#1:
STA&71:RTS:.FLE DEC&86:CLC
   350LDA&70:ADC#&38:STA&70:LDA&71:ADC#1:STA&71:RTS:.ST
CLC:LDA&70:ADC#&40:STA&70:LDA&71:ADC#1:STA&71:RTS
   360.fly JSRSO:SEC:LDA&70:SBC#&80:STA&70:LDA&71:SBC#2
:STA&71:LDA#6:STA&80:LDA#1:LDA&84:BNEH:LDA#1:STA&81:.H
LDA#kic MOD256:STA&82:LDA#kic DIV256:STA&83:RTS
   370.SO LDX#so MOD256:LDY#so DIV256:LDA#7:JMPAFFF1
   380.key LDY#&FF:LDA#&81:JMP&FFF4:.delay LDX#100:.E L
DY#100:.F DEY:BNEF:DEX:BNEE:RTS
   390.dis2 LDX#0:LDA&70:STA&75:LDA&71:STA&76:JSRdis3:C
LC:LDA&70:ADC#8:STA&75:LDA&71:ADC#0:STA&76:JSRdis3:CLC
:LDA&70:ADC#16:STA&75:LDA&71:ADC#0:STA&76:JSRdis3:CLC:
LDA&70:ADC#24:STA&75:LDA&71:ADC#0:STA&76:JSRdis3
   400CLC:LDA&70:ADC#&80:STA&75:LDA&71:ADC#2:STA&76:JSR
dis3:CLC:LDA&70:ADC#&88:STA&75:LDA&71:ADC#2:STA&76:JSR
dis3:CLC:LDA&70:ADC#&90:STA&75:LDA&71:ADC#2:STA&76:JSR
dis3:CLC:LDA&70:ADC#&98:STA&75:LDA&71:ADC#2:STA&76:JSR
dis3
   410CLC:LDA&70:ADC#0:STA&75:LDA&71:ADC#5:STA&76:JSRdi
s3:CLC:LDA&70:ADC#8:STA&75:LDA&71:ADC#5:STA&76:JSRdis3
:CLC:LDA&70:ADC#16:STA&75:LDA&71:ADC#5:STA&76:JSRdis3:
CLC:LDA&70:ADC#24:STA&75:LDA&71:ADC#5:STA&76:JSRdis3
   420CLC:LDA&70:ADC#&80:STA&75:LDA&71:ADC#7:STA&76:JSR
dis3:CLC:LDA&70:ADC#&88:STA&75:LDA&71:ADC#7:STA&76:JSR
dis3:CLC:LDA&70:ADC#&90:STA&75:LDA&71:ADC#7:STA&76:JSR
dis3:CLC:LDA&70:ADC#&98:STA&75:LDA&71:ADC#7:STA&76:JSR
dis3
   430RTS:.f JT LDX#&9D:JSRkey:CPY#&FF:BNEk7:LDA#1:STA&5
2:.k7 RTS
   440.dis3 JSRRIP:CLC:LDA&75:ADC#&40:STA&75:LDA&76:ADC
#1:STA&76:.RIP LDY#&FF:.K INY:JSRrip:INY:JSRrip:INX:CP
Y#7:BNEK:RTS:.rip STY&50:LDA(&75),Y:STA&51:TXA:TAY:LDA
(&72),Y:.K1 ORA&51:LDY&50:STA(&75),Y:RTS
   450.cru JSRrub:SEC:LDA&70:SBC#8:STA&70:LDA&71:SBC#0:
STA&71:DEC&86:LDA#7:LDX#so2 MOD256:LDY#so2 DIV256:JMP&
FFF1
   460]:NEXT:delay?1=spl:E?1=spl
   470CHAIN""
```

```
.0,136.136,204.0.0.0,0.0.0.0.0.0.255.255.238.238.238.14.
96,224.127.55.55.19.19.0.0.0.204.204.238.238.238.238.9
6.224
  190DATA0.0.128.128.192.192.230.247.0.17.1.16.48.17.1
6.0.238.255.15.249.241.241.241.224.0.4.8.4.0.0.0.0.247
.119.55.19.1.0.0.0.153.255.255.255.255.111.55.51.243.2
47.207.191.125.249.249.255.0.0.136.136.204.204.204.204
.0.0.0.0.0.0.0.0.0.51.51.3.51
  200DATA103.103.255.255.223.239.31.127.191.223.111.25
5.204.204.136.0.136.136.204.204.0.17.17.17.17.17.0.16.
255.255.238.204.204.204.192.192.191.19.19.19.1.1.0.0.2
04.238.238.238.238.238.96.224
  210DATA0.16.16.16.16.17.51.51.0.145.129.152.48.153.1
52.136.238.255.15.249.241.241.241.224.0.4.10.0.0.0.0.0
.51.51.51.19.1.0.0.0.153.255.255.255.255.47.51.51.243.
247.207.191.125.249.249.255.0.0.136.136.204.204.204.20
4.0.0.0.0.0.0.0.0.0.51.51.3.51
  220DATA103.87.223.255.223.239.31.127.191.223.223.255
.204.204.136.0.136.136.204.204.0.17.17.17.17.17.0.16.2
55.255.238.204.204.204.192.192.191.19.19.19.1.1.0.0.20
4.238.238.238.238.238.96.224
  230DATA0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.51.119.7.11
4.240.116.112.0.136.205.14.197.196.196.128.0.0.0.0.0.48
.48.16.0.0.17.51.119.255.239.159.48.249.255.255.207.2
43.253.219.0.204.238.127.255.255.255.238.0.0.0.0.0.17.
51.119.127.19.35.103.223.191
  240DATA255.206.239.255.127.159.175.127.119.51.12.136
.136.8.136.204.204.204.247.247.225.192.0.0.0.0.140.8.0
.0.0.0.0.0.51.51.51.17.17.16.16.0.204.204.204.204.204.
128.192.0
  250DATA0.0.0.0.0.0.0.0.0.0.0.0.0.16.0.0.0.119.255.15
.244.240.248.240.0.0.136.12.138.136.136.0.0.0.0.0.16.1
6.0.0.0.0.17.51.247.246.246.71.113.251.239.223.191.247
.247.231.0.204.238.238.238.206.140.8.0.0.0.0.0.0.0.0.1
7.17.0.1.17.17.0.0.159.255.63
  260DATA255.255.207.239.63.204.204.140.140.8.0.0.8.0.
0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.55.19.35.50.51.51.48.112
.140.200.192.192.136.136.0.0
  270DATA0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.48.48.51.51.119.7.1
14.240.112.116.115.136.205.14.197.196.196.196.128.0.0.
128.192.226.243.243.243.119.119.51.51.19.1.221.239.119
.119.239.223.191.127.255.255.136.204.204.204.238.238.1
74.191.51.19.1.0.0.0.0.0.0.255
  280DATA255.255.127.55.19.17.17.127.175.207.238.238.2
38.238.238.127.238.204.0.0.0.0.0.0.0.0.0.0.0.0.0.0.17.17
.0.0.0.0.0.0.0.238.238.238.238.238.238.96.112.0.0.0.0.0.
0.0.0
  290DATA0.0.0.0.0.0.0.0.0.0.0.0.0.0.48.112.115.112.0.0.0.
0.192.224.230.224.0.0.0.0.0.0.0.0.0.0.0.0.0.0.3.7.7.112.
113.113.23.15.15.15.143.232.228.228.78.15.15.15.31.0.0
.0.0.0.12.14.14.23.71.71.35.3.23.47.31.15.143.79.60.25
2.30.15.15.15.31.47.135.243
  300DATA195.15.15.142.14.46.76.12.142.79.175.15.15.15
.143.71.35.16.16.143.79.47.31.15.15.143.199.31.47.79.1
43.79.60.60.60.15.15.15.31.46.76.128.128
  310H%=&4FFE:FORT%=0TO1919:READD:T%?H%=D:NEXT
  320MODE5:VDU19,0,7;0;19,3,0;0;18,0,2:FORT%=0TO1279ST
EP128:MOVE640,512:DRAWT%,0:MOVE640,512:DRAWT%,1023
  330NEXT:FORT%=0TO1024STEP64:MOVE640,512:DRAW0,T%:MOV
E640,512:DRAW1279,T%:NEXT
  340GCOL0,1:PROCCIRC(640,512,250):PRINTTAB(3,1);"Kung
 Fu Master"TAB(5,2);"Is Loading"
  350IF INKEY-256<>-1 AND INKEY-256<>0 THEN A$="Electr
on" ELSE A$="BBC'B'"
  360A$=A$+" Version":PRINTTAB((20-LENA$)/2,6);A$
  370VDU28,1,30,18,24,17,131,17,0,12
  380CHAIN""
  390DEFPROCCIRC(X,Y,R)
  400FORI=Y+R TO Y-R STEP-4:J=SQR(ABS(R*R-(I-Y)*(I-Y))
):MOVEX-J,I:DRAWX+J,I:NEXT:ENDPROC
```

KUNG FU MASTER

Forward/Backward/Jump — self explanatory.
Punch — Forward and up.
Face shove — Jump and down.
High kick — Backward and up.
Mid kick — Backward and down.
Lower Mid Kick — Jump and up.
Jab Kick — Forward and down.
Block — Forward and backward.

The actual keys for the players are:

Key Function	Player 1	Player 2
Forward	'Z'	','
Backward	shift	'.'
Jump	'F'	Return
Down	'X'	'?'
Up	'D'	';'

All four listings should be typed in and saved one after the other on the same cassette. If your cassette recorder has no motor control then allow quite a large gap between programs.

If you do not want to type in the game but do wish to play it simply send me a blank cassette and large s.a.e. and I will record the game for you free of charge. Brian Lewis, 47 Highlands Road, Bridgnorth, Shropshire WV16 5BZ. ■

Listing 3.

```
  10IF INKEY-256<>0 AND INKEY-256<>-1 THEN sp2=100 EL
SE sp2=200
  20ENVELOPE2,2,-1,3,2,1,3,1,126,0,0,-126,126,126
  30?&266=1:?&263=&11
  40VDU23,129,0,68,68,68,68,68,68,0
  50DATA&10,0,2,0,4,0,2,0,&10,0,3,0,5,0,5,0,&10,0,1,0
,0,0,4,0
  60?&78=A%0:?&79=a%73:?&7A=H%+896:?&7B=(H%+896) DIV25
6:?&89=36:?&88=0:?&7C=0:?&8D=2:?&8E=10:?&8F=10
  70pu2=H%+128:ch2=pu2+128:bl2=ch2+128:ki2=bl2+128:fo
2=ki2+128:ro2=fo2+128
  80sta=H%+896:pun=sta+128:cho=pun+128:blo=cho+128:ki
c=blo+128:for=kic+128:rou=for+128
  90A$="                Play Kung Fu Master if you da
re....a game of skill and determination....where intel
ligence and swiftness are essential to stay alive.....
    "
  100DIM M% 2000:FORT=0TO23:READD:T?M%=D:NEXT:so2=M%+8
:so3=so2+8:F%=so3+8:#F%=A%:G%=F%+165:FORT=0TO2STEP2:P%
=G%:[OPTT
  110LDX&60:INX:TXA:AND#3:STA&60:LDA#0:STA&53
  120LDA&88:BNEc:LDA&7C:BNEc:LDX#&99:JSRkey:CPY#&FF:BN
Ea:JSRFoR:JMPc: .a LDX#&98:JSRkey:CPY#&FF:BNEb:JSR8aC:J
MPc: .b LDX#&B6:JSRkey:CPY#&FF:BNEc:JSRJuM: .c
  130JSRjudge:LDA&53:BEQk9:JSRoru: .k9
  140JMPdis
  150.wef1 LDA&7C:BNEno:LDA&7A:CMP#sta MOD256:BNEno:LD
AA7B:CMP#sta DIV256:BNEno:LDX#0:RTS: .no LDX#&FF:RTS
  160.dis LDA&88:BEQdis2:DEC&88:LDA&8A:STA&7A:LDA&8B:S
TA&7B:LDA&88:BNEdis2:LDA#2:STA&8D:JSReef1:CPX#&FF:BNEk
3:JSRrub:LDA#4:STA&8B:LDA#sta MOD256:STA&8A:LDA#sta DI
V256:STA&8B: .k3 LDA#sta MOD256:STA&7A:LDA#sta DIV256:S
TA&7B
  170LDA&7C:BEQdis2:LDA#0:STA&7C:JSRrub:CLC:LDA&78:ADC
#&80:STA&78:LDA&79:ADC#2:STA&79
  180.dis2 LDX#0:LDA&78:STA&75:LDA&79:STA&76:JSRdis3:C
LC:LDA&78:ADC#8:STA&75:LDA&79:ADC#0:STA&76:JSRdis3:CLC
:LDA&78:ADC#16:STA&75:LDA&79:ADC#0:STA&76:JSRdis3:CLC:
LDA&78:ADC#24:STA&75:LDA&79:ADC#0:STA&76:JSRdis3
  190CLC:LDA&78:ADC#&80:STA&75:LDA&79:ADC#2:STA&76:JSR
dis3:CLC:LDA&78:ADC#&88:STA&75:LDA&79:ADC#2:STA&76:JSR
dis3:CLC:LDA&78:ADC#&90:STA&75:LDA&79:ADC#2:STA&76:JSR
dis3:CLC:LDA&78:ADC#&98:STA&75:LDA&79:ADC#2:STA&76:JSR
dis3
  200CLC:LDA&78:ADC#0:STA&75:LDA&79:ADC#5:STA&76:JSRdi
s3:CLC:LDA&78:ADC#8:STA&75:LDA&79:ADC#5:STA&76:JSRdis3
:CLC:LDA&78:ADC#16:STA&75:LDA&79:ADC#5:STA&76:JSRdis3:
CLC:LDA&78:ADC#24:STA&75:LDA&79:ADC#5:STA&76:JSRdis3
  210CLC:LDA&78:ADC#&80:STA&75:LDA&79:ADC#7:STA&76:JSR
dis3:CLC:LDA&78:ADC#&88:STA&75:LDA&79:ADC#7:STA&76:JSR
dis3:CLC:LDA&78:ADC#&90:STA&75:LDA&79:ADC#7:STA&76:JSR
dis3:CLC:LDA&78:ADC#&98:STA&75:LDA&79:ADC#7:STA&76:JSR
dis3
  220RTS
  230.dis3 JSRRIP:CLC:LDA&75:ADC#&40:STA&75:LDA&76:ADC
#1:STA&76: .RIP LDY#&FF: .K INY:JSRrip:INY:JSRrip:INX:CP
Y#7:BNEK:RTS: .rip STY&50:LDA(&75),Y:STA&51:TXA:TAY:LDA
(&7A),Y: .K1 ORA&51:LDY&50:STA(&75),Y:RTS
  240.BaC JSRrub:LDX#&97:JSRkey:CPY#&FF:BEQM1D:LDX#&B7
:JSRkey:CPY#&FF:BEQH1G:LDA&89:CMP#36:BEQne:CLC:LDA&78:
ADC#8:STA&78:LDA&79:ADC#0:STA&79:INC&89:LDA#for MOD256
:STA&8A:LDA#for DIV256:STA&8B:LDA#2:STA&8E: .ne RTS: .Mi
D JSRSO3:LDA#5:STA&88
  250LDA#rou MOD256:STA&8A:LDA#rou DIV256:STA&8B:LDA#0
:STA&8D:RTS: .MiD JSRSO3:LDA#6:STA&88:STA&7C:LDA#rou MO
D256:STA&8A:LDA#rou DIV256:STA&8B:SEC:LDA&78:SBC#&80:S
TA&78:LDA&79:SBC#2:STA&79:LDA#4:STA&8D:RTS
  260.FoR JSRrub:LDX#&B7:JSRkey:CPY#&FF:BEQPuN:LDX#&98
:JSRkey:CPY#&FF:BEQB1O:LDX#&97:JSRkey:CPY#&FF:BEQJaB:L
DA#89:CMP#19:BEQee:SEC:LDA&78:SBC#8:STA&78:LDA&79:SBC#
0:STA&79:DEC&89:LDA#for MOD256:STA&8A:LDA#for DIV256:S
TA&8B:LDA#2:STA&8E: .ee RTS
  270.PuN JSRSO3:LDX#5:STX&88:DEX:STX&8D:LDA#pun MOD25
6:STA&8A:LDA#pun DIV256:STA&8B:RTS: .B1O LDA#1:STA&8D:L
DA#5:STA&88:LDA#blo MOD256:STA&8A:LDA#blo DIV256:STA&8
B:RTS: .JaB JSRSO3:LDA#0:STA&8D:LDA#5:STA&88:LDA#kic MO
D256:STA&8A:LDA#kic DIV256
  280STA&8B:RTS
  290.JuM JSRrub:LDX#&97:JSRkey:CPY#&FF:BEQChO:LDA#4:S
TA&88:STA&7C:LDA#5:STA&8D:SEC:LDA&78:SBC#&80:STA&78:LD
A&79:SBC#2:STA&79:LDX#&B7:JSRkey:CPY#&FF:BEQJj:RTS: .Jj
 JSRSO3:LDA#0:STA&8D:LDA#6:STA&88:LDA#kic MOD256:STA&8
A:LDA#kic DIV256:STA&8B:RTS
  300.ChO JSRSO3:LDA#4:STA&8D:LDA#5:STA&88:LDA#cho MOD
256:STA&8A:LDA#cho DIV256:STA&8B:RTS
  310.rub LDA#&29:STAK1:LDA#0:STAK1+1:JSRdis:LDA#5:STA
K1:LDA#&51:STAK1+1:RTS
  320.key LDY#&FF:LDA#&81:JMP&FFF4
  330.den RTS: .judge LDA&86:CMP#16:BNEden:LDA&89:CMP#1
9:BNEden:LDA&77:BEQp11A:LDA&8D:BEQp12A:LDA&77:CMP#4:BE
Qp11H:LDA&8D:CMP#4:BEQp12H
  340RTS
  350.p11A LDA&8D:BEQden:LDA&8D:CMP#4:BNEden:JMPPL2: .p
12A LDA&77:BEQden:LDA&8D:CMP#4:BNEden:JMPPL1
  360.p11H LDA&8D:CMP#1:BEQden:LDA&8D:CMP#3:BNEden:JMP
PL2: .p12H LDA&77:CMP#1:BEQden:LDA&8D:CMP#4:BNEden:JMPP
L1
  370.PL1 LDA#31:STA&52:JSR&FFEE:SEC:LDA&8E:SBC#1:JSR&
FFEE:LDA#12:JSR&FFEE:LDA#32:JSR&FFEE:DEC&8E:JMPhit: .PL
2 LDA#31:STA&53:JSR&FFEE:SEC:LDA#20:SBC&8F:JSR&FFEE:LD
A#12:JSR&FFEE:LDA#32:JSR&FFEE:DEC&8F
  380.hit LDA#7:LDX#M% MOD256:LDY#M% DIV256:JMP&FFF1:.
SO3 LDA#7:LDX#so3 MOD256:LDY#so3 DIV256:JMP&FFF1
  390.cru INC&89:JSRrub:CLC:LDA&78:ADC#8:STA&78:LDA&79
:ADC#0:STA&79:LDX#so2 MOD256:LDY#so2 DIV256:JMP&FFF1
  400.QN LDA#&C0:STA&78:LDA#&6A:STA&79:LDA#pu2 MOD256:
STA&7A:LDA#pu2 DIV256:STA&7B:LDA#0:STA&88:JSRdis:LDA#&
E0:STA&78:LDA#&6B:STA&79:LDA#pun MOD256:STA&7A:LDA#pun
 DIV256:STA&7B:LDA#0:STA&8D:JSRdis
  410LDA#0:STA&78:LDA#F% MOD256:STA&7A:LDA#F% DIV256:S
TA&7B: .tars LDA#31:JSR&FFEE:LDA#2:JSR&FFEE:LDA#15:JSRA
FFEE:LDY#d: .tA LDA(&7A),Y:JSR&FFEE:INY:CPY#16:BNEtA:CL
C:LDA&7A:ADC#1:STA&7A:LDA&7B:ADC#0:STA&7B
  411LDA#&81:LDX#&90:LDY#&FF:JSR&FFF4:CPY#&FF:BNEQW:RT
S: .QW
  420LDX#200: .tty LDY#100: .yTT DEY:BNEyTT:DEX:BNEtty:L
NK%78:LDA&78:CMP#148:BNEuiQ:LDA#0:STA&78:LDA#F% MOD256
:STA&7A:LDA#F% DIV256:STA&78: .uiQ JMPtars
  430]:NEXT:M%?1=G%:M%?2=G% DIV256:tty?1=sp2
  440?HAIN"
```

Listing 4.

```
  10DATA60,60,88,60,60,80,60,76,88,88,76,76,80,80,60
  20VDU23,128,0,255,4,8,8,4,255,0
  30MODE5:VDU19,0,7;0;19,3,0;0;28,0,12,19,0,17,131,12
,26,17,128,23;8282;0;0;0;0;10,0,1
  40PROCscene
  50COLOUR128:COLOUR1:PRINTTAB(0,23);"Press Space To
Start":COLOUR3:CALL%
  60VDU28,0,23,19,14,12,26
  70?&78=&60:?&79=a%73:?&7A=H%+896:?&7B=(H%+896) DIV25
6:?&89=36:?&88=0:?&7C=0:?&8E=10:?&8F=10
  80pu2=H%+128:ch2=pu2+128:bl2=ch2+128:ki2=bl2+128:fo
2=ki2+128:ro2=fo2+128
  90stA=H%+896:pun=sta+128:cho=pun+128:blo=cho+128:ki
c=blo+128:for=kic+128:rou=for+128
  100COLOUR130:COLOUR1:PRINTTAB(0,29);STRING$(20,CHR$1
28):.COLOUR128:PRINTTAB(0,12):STRING$(10,CHR$129):COL
OUR3:PRINTTAB(10,12):STRING$(10,CHR$129);
  110CALL%:COLOUR128:COLOUR1:CLS
  120RESTORE10:FORT=0TO14:READD
  130SOUND&11,-15,D,4:FORG=0TO200:NEXT:*FX21,5
  140NEXT
  150*FX15,1
  170COLOUR2:COLOUR128:IF ?&8E=0 A$="Black" ELSE A$="R
ed"
  180A$=A$+" Wins":PRINTTAB((20-LENA$)/2,19);A$
  200GOTO40
  210DEFPROCmount(X%):Y%=639:FORT%=0TO1279STEP8:MOVET%
,607:DRAWT%,Y%:A%=RND(4):IF A%>=3 AND Y%>639 Y%=Y%-4 E
LSE IF Y%<X% Y%=Y%+4
  220NEXT
  230ENDPROC
  240DEFPROCCIRC(X,Y,R):LOCALI,J:FORI=Y+R TO 611 STEP-
4:J=SQR(ABS(R*R-(I-Y)*(I-Y))):MOVEX-J,I:DRAWX+J,I:NEXT
:ENDPROC
  250DEFPROCscene:VDU28,0,12,19,0,17,131,12,26,18,0,1:
FORT%=128TO1279STEP128:MOVE640,607:DRAWT%,1023:NEXT:FO
RT%=607TO1024STEP64:MOVE640,607:DRAW0,T%:MOVE640,607:D
RAW1279,T%:NEXT
  260GCOL0,1:PROCCIRC(640,607,200):GCOL0,2:PROCmount(6
80):GCOL2,0:PROCmount(670):GCOL0,2:MOVE0,684:DRAW1279,
684
  270VDU5:GCOL0,0:MOVE192,959:PRINT"Kung Fu Master":V
DU4:COLOUR0:ENDPROC
```

"My two sun spots"

1. Souls of Darkon
by Taskset
Sorry about the summer – a wee bit disappointing I'm afraid, but here's something to cheer you up. A super game sizzling with excitement!

2. Scooby Doo
by Elite
This game is full of ghosties and ghoulies and mysterious happenings. Good old Scooby is back and so is my dear friend Mrs McUrioch. (Her name is almost as difficult as mine!)

"Press the magic button and the picture changes"

GEOFF CAPES STRONG MAN

by Martech
Let's hear it for Geoff Capes. The World's strongest man. Did you know he is World Highland Games Champion too? Can you beat that? Well, with this game you can try. Six major challenges in all, and always a blue sky above so no chance of rain stopping play. Versions for most machines.
Cassette **£7.95 and £8.95**
Disk **£14.95**

ARNHEM

by CCS
1944 all over again, and what's this – a strong front advancing over Holland? Um, yes, of course it's the Allies attacking the Germans and they need your help. With bridges to capture and strategy to work out, it's as complicated as weather forecasting – but much more fun! (Sorry Michael).
Spectrum 48K **£8.95**
Amstrad **£9.95**

STRIKE FORCE HARRIER

by Mirrorsoft
What's faster than a hurricane and more devastating than a tornado? You've got it in one. Strike Force Harrier – the flight simulator that streaks through the skies like lightning. You are loaded with bombs to destroy the enemy – but watch out for the clouds of enemy fighters on the horizon.
BBC B and Electron **£9.95**

MARSPORT

by Gargoyle Games
This large dome on your screens is a force sphere protecting the Earth from attack by Sept Warriors. It's a wee bit scary as the sphere is weakening and the strengthening plans are in an occupied town. All in all a gloomy outlook. Can you change that?
Spectrum 48K and Amstrad **£9.95**

THORN EMI Computer Software
International Micro Software Division

"Look what my charts are showing"

HIGHWAY ENCOUNTER

by Vortex

Temperatures are rising fast. But it's not a heatwave, I'm afraid. The Aliens have landed. To save the globe from domination you have to activate the 5 Vortons and the deadly Lasertron. Dodging hailstorms of bullets you must boldly go forth to save the planet. (I think I'd rather stay at the Met office.)

Spectrum 48K and Amstrad **£7.95**

SCOOBY DOO

by Elite

The team of top sleuths is back. This lot could sniff out a sunbeam! Stunning graphics and super smooth action give this game a touch of class.

Spectrum 48K **£6.95**
Commodore 64 **£7.95**
Amstrad **£8.95**

ghs for Autumn'

COMPUTER hits

by Beau Jolly

A summary chart of all that's the best in computer games. But on this chart not a depression in sight! Every one is guaranteed to keep you smiling rain or shine. There are sports, simulations, arcade and adventures. Oh, and yes, I almost forgot, a version for most machines.

10 games **£9.95**
6 games **£6.95**

GANDALF

by Tymac

Two great games now on Spectrum. Gandalf – a man after my own heart – throws thunderbolts from his fingertips.

FLYER FOX

by Tymac

It's not raindrops falling on your head but fireballs from a Mig fighter.

Spectrum 48K Each game **£7.95**

"Super plays for rainy days"

Souls of DARKON

by Taskset

Not for the faint of heart this one. You must venture beyond the sun and through the gof – oops sorry fog (no, not to Lanzarote) to Megron, where the trick is to free the people from the curse of Darkon. Oh dear, quite a challange, but YOU can succeed.

Amstrad **£8.90**

Old Scores

by Global Software

Solving this is like finding a snowflake in July (or deciphering one of my maps). Private Investigators will love it, and if you have never been lost around London's South Bank, here's your chance. Solve the mystery, explore the theatres, and become famous!

Spectrum 48K **£6.95**
Amstrad and Commodore 64 **£7.95**

Graham Gooch's

TEST CRICKET

by Audiogenic

A super game for all seasons. Complete with googlies, silly mid-offs, authentic scoreboards and starplayers – relive the highlights of summer!

Commodore 64 (Cassette) **£9.95**
Commodore 64 (Disk) **£11.95**

Paintbox

by Audiogenic

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Spectrum, Commodore 64 and 16 **£9.95**

The Secret DIARY OF ADRIAN MOLE aged 13¾

by Mosaic

It's no fun being me. What with the sun turning to snow overnight and always having to look on the bright side. Now if I was a budding intellectual and poet like Adrian all my problems could be turned into great fun. And maybe they'd make me into a game too. (Well, I can dream.)

Versions for most machines.

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"Games to bring you Winter cheer"

BLADE RUNNER

by CRL

Gosh, here's a chance to be a bounty hunter *and* save the world. Scattered showers of Replidroids have run amok. These human look-alikes have to be pinpointed, tracked down and 'retired' if the outlook is to be at all sunny.

Commodore 64 **£8.95**

WORLD CUP

by Arctic Computing

This league table reads MUCH better than my round the world temperature chart. But then top teams are involved, and you get the chance to pick the players and score the goals. Och, what could be fairer than that, ref?

Spectrum and C16 **£6.95**
Commodore 64 and Amstrad **£7.95**

Screen Shot

GRAPHICS PACK

by Dorling Kindersley

Are you interested in really good value? I am too, and this books plus software pack has loads of routines for creating lovely graphics. There are over 200 sprite designs alone! Gosh, it's um well unbelievable – top class graphics, super fast speeds and hi-res reults.

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SPOT THIS MONTH'S MYSTERY MICROGAMER AND WIN A FANTASTIC PRIZE. TEN 2-PACK PROGRAM PRIZES MUST BE WON PLUS SINGLE GAME PRIZES FOR THE FIRST 100 RUNNERS UP.

If you think you know the answer, send this coupon to us, no later than 14 November 1985. The first ten correct entries will each receive SCOOBY DOO and SOULS OF DARKON. 100 runners up will each receive a super game for their machine type.

I say the Mystery Microgamer is:

_____

Send me your latest full list of software programs.

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Machine _____

Address _____

_____

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Send to: THORN EMI Computer Software Mystery Microgamer Competition
Thomson House, 296 Farnborough Road, Farnborough, Hants GU14 7NU

Prizewinners
David Cook, London
M Patel, Manchester
Lee Gardner, Norbury
Mike Davies, Llandeilo
Sarah Tansley, Uxbridge
Billy Marshall, Leeds
William Clark, Kingsthorpe
David Morris, Weston Super Mare
Mary Dolan, Preston
Amil K Seth, Wantage

Last month's mystery Microgamer was Tracy Ullman. 10 prizes are on the way.

All games featured are available from Laskys, WH Smith and other good software stores.

KEY CHOICES

Choosing electronic instruments can be as confusing to the newcomer from the world of computing as choosing a computer is for the musician.

MIDI-equipped instruments and accessories come in a variety of shapes and sizes, with price-tags from under £200 to £40,000 or more.

The first instrument you are likely to want is a synthesiser. Two years ago you would probablay have had to spend at least £1,000 for a MIDI-equipped synth. Now you have a choice of models retailing at under £500.

Of these, probably the most attractive from the computer user's point of view is Casio's £345 CZ-101 synthesiser.

The CZ-101 is the smallest of a family of fully programmable digital synthesisers, but the sounds it produces are as powerful as those of synthesisers many times its price. The one noticeable compromise is that its keyboard is smaller than standard, but for £150 more you can get the electronically identical CZ-1000 with a full-size keyboard.

One particular attraction of the CZ-101 for the computer user is that it is "multi-timbral". What this means is that in addition to its normal eight-note polyphonic operation (with each note producing a similar sound at a different pitch), it can also operate as four monophonic synthesisers, each with its own sound, responding to different MIDI channels.

Another synthesiser of interest to the computer user is Siel's £399 Expander 80. This is a synthesiser without a keyboard which can only be driven by MIDI signals.

Siel have also just introduced a range of keyboard instruments with preset voices, designed for connection to computers. The smallest of these, the £169 MK370 includes a non-standard interface to link it to the Commodore 64/128 computers. The more powerful £250 MK490 and £325 MK610 instruments also include RS-232 interfaces. Siel also markets a £26 RS-232-to-MIDI converter.

If your budget is big enough, you might look at the recently-introduced DX21 synthesiser from Yamaha. This is a £699 brother for the £1,299 DX-7 synthesiser.

Once you have a synthesiser, the next MIDI instrument on your shopping list will probably be a drum machine. Yamaha could help here as well with its £250 RX-21, a rhythmic companion for the DX-21. Although it has fewer drum sounds and facilities than most other drum machines it is also less than half the price.

Even if you play an instrument other than a keyboard, MIDI can still help you. For example, there are several devices for converting a guitarist's actions into MIDI signals although, at present, these cost well over £1,000.

More affordable is an ingenious Canadian development called the Pitchrider which analyses musical sounds such as those produced by the human voice or woodwind instruments and translates these into MIDI codes. This device, expected to retail for around £200, could open up the world of MIDI to musicians who have previously felt excluded because their instruments operate without an electrical supply.

IF – OR, IN the case of Spectrum owners, when – you tire of the music-making capabilities of your micro's internal sound system, don't despair. There are still two avenues you can explore with your micro to extend your musical horizons.

The first of these is to hook an external sound-making device onto your micro. The second is to use the computer's memory to store a digitised version of a real sound which can later be regurgitated in a more-or-less musical fashion. This is known as sampling.

The former option can be divided further into dedicated micro add-ons such as Acorn's Music 500, Siel's Sound Buggy and Commodore's Music Expander and the stand-alone music synthesisers and electronic percussion instruments, commonly known as drum machines, that are a vital ingredient in much of today's music.

The modern synthesiser or drum machine is essentially a computer dedicated to making musical sounds. All that is needed to allow your computer to converse with an electronic instrument is an interface and communication protocol. This exists in the form of the Musical Instrument Digital Interface — MIDI, for short.

MIDI emerged a few years ago when musical instrument manufacturers got together to draw up a standard way for their instruments to talk to one another. As we explained last year — *Your Computer*, September 1984 — MIDI is a serial link operating at 31.25kBaud — more than 60 per cent faster than the RS-232 — along which digitised information about the operations of electronic instruments is transmitted.

At its most basic level, this data defines which notes are being played, when they start and stop, and, sometimes, other factors such as the force with which they are struck and held down. These last two parameters — velocity and pressure sensitivity — can be used by some synthesisers to modify the sound produced thus giving the player more musical expression.

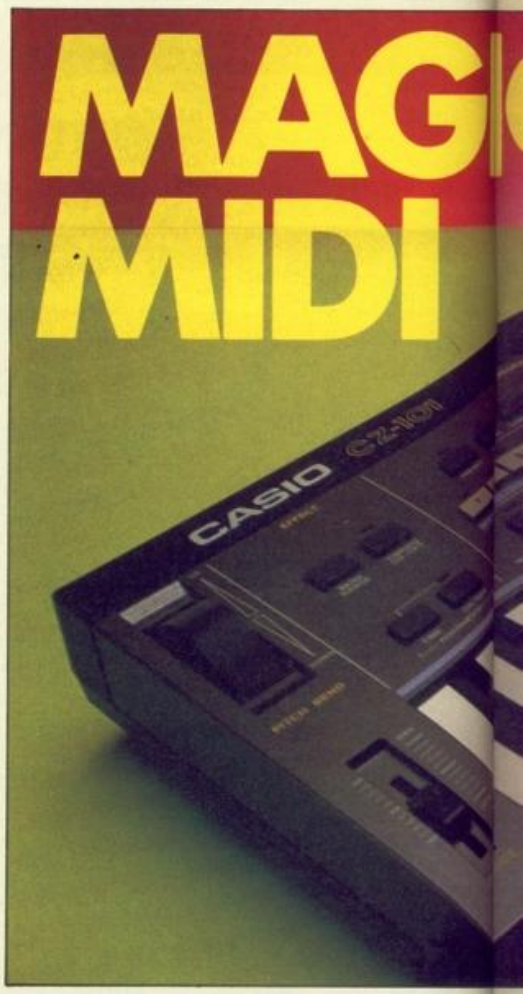
MIDI can also be used to transmit information about the parameter values used to define particular sounds or "voices".

MIDI information is transmitted on up to 16 software "channels" each controlling one or more instruments. This allows complex multi-part musical arrangements to be performed in real time.

Physically, MIDI manifests itself as two or more five-pin DIN sockets without which the modern electronic musical instrument would be incomplete. Separate MIDI In and Out sockets are used to transfer data to and from an instrument, and many instruments have a third, Thru, socket which passes the information fed into the In socket on to other instruments.

Most musicians probably either ignore the MIDI sockets or use them only to link one synthesiser with others. MIDI allows synths with differing or complementary voices to be linked together and played simultaneously from a single keyboard, thus providing a fuller, more interesting sound.

But MIDI also opens up exciting possibilities for linking electronic instruments with computers. Using a simple interface costing as little as £20 and suitable software, your computer can start to talk to synthesisers and drum machines. The resulting conversations



can be mind-blowing.

Already there are more than 20 MIDI packages on the UK market and the numbers are growing by the month. Software writers have so far concentrated on the Spectrum, BBC and particularly the Commodore 64 machines, but Amstrad and MSX owners will soon be able to experiment with MIDI when interfaces become available for their machines.

To date, most MIDI software packages have fallen into one of three categories; real-time recording; step-time recording; and voice editing and storage for specific synthesisers.

In all cases the hardware set-up is similar. A MIDI interface is plugged into the appropriate orifice of the micro and is, in turn, connected to a "master" electronic instrument by a pair of DIN leads, one for each direction of MIDI data flow.

In real-time recording, the micro is used to

MIDI Sophistication from Joreth.

GIC

Tony Sacks meddles with MIDI, the digital bridge between computers and synthesisers.

Casio's CZ-101, above, is a cheap way into MIDI. The MIDI beat: right: XRI's Micon, top left; Siel's interface top right; Micro Musical's Musician, centre; and the Passport interface from Rittor, bottom

simulate the operations of a tape-recorder — usually multi-track — except that instead of audio signals, MIDI information is recorded.

As the instrument is played, it transmits a stream of MIDI data which can be stored on one "track" of the simulated recorder. This track can then be "played back", re-transmitting the MIDI signals to drive the same — or other — synthesisers while the musician records accompaniments on other tracks. Software packages with up to 16 such tracks are available.

Each track can be assigned to a different MIDI channel and can thus play separate parts on up to 16 instruments or groups of instruments simultaneously. Although it is dangerous to take the tape recorder analogy too far, it is worth remembering that a 16-channel tape machine could cost tens of thousands of pounds and still not offer all the editing facilities of a good MIDI real-time recorder.

For example, some real-time recorders offer a facility unique to MIDI, known as "auto-correct" or "quantisation". What this does is that if, after recording a track, a musician feels that the timing of some of the notes played was not quite right, the MIDI software can be used to shift all the offending notes automatically so that the timing becomes spot-on.

The second type of package, the step-time recorder, again stores MIDI information, but not in real time. In this case, information about the pitch and timing of each note is specified separately, either from the Qwerty or musical keyboard. A major attraction of the step-time package is that it allows the user to compose and edit pieces that would normally be beyond their technical ability on the musical keyboard.

The third type of package is designed to make the programming of synthesisers sounds easier. On some synthesisers more than 100 parameters have to be specified when programming a sound.

To cut costs, synthesiser manufacturers often build just one multi-function variable control into an instrument. This is used in conjunction with a digital read-out to alter a single parameter at a time, a time-consuming and often confusing process.

However, if the parameter values are MIDI-encoded and sent to a computer running the appropriate software, almost all of the variables can be displayed simultaneously and graphically on the computer's screen, and adjusted using the computer's keyboard, making the programming process much easier. There are software packages designed to do this for several popular sythesisers.

A variation on this theme is to use the micro to build up a "library" of parameters defining various voices. A synthesiser's limited internal voice memory can usually only be expanded using expensive plug-in Ram packs. MIDI offers musicians the much cheaper option of storing their voice data on floppy discs or data cassettes via a micro.

In addition to the three main program types, other micro applications for MIDI are emerging. The Italian Siel company, for example, has developed a digital delay program which takes in MIDI information and spews it out again after a predetermined period to produce echoes and similar effects.

A graphic example of the possibilities opened up by MIDI comes from Electromusic Research (EMR), the most prolific British producer of MIDI software and hardware. EMR's £24.95 Vu-Music package for the BBC interprets MIDI data visually in the form of a kaleidoscopic display on the computer screen.

Pressure of space does not allow us to examine individual MIDI packages but there are some general points to bear in mind when looking at MIDI packages for micros.

First there is a confusing bit of MIDI terminology. The capacity of most MIDI recorders is specified in "events" rather than "notes". In MIDI, switching a note on is one event, switching it off is another. So a recorder with a 24,000 event capacity will only record a maximum of 12,000 notes.

But, if you are also recording extra information such as velocity and pressure sensitivity, the note storage capacity is cut back further. More valuable memory is eaten up if you store information which will tell the synthesiser to change voices at certain points in a composition.

The design of any MIDI recorder program is thus a compromise between the amount of memory available for event storage and the facilities offered by the program. The screen displays tend, therefore, to be rather rudimentary compared to games software. Every byte counts.

Another point to watch for in multi-track recorders is whether there is a fixed amount of memory allocated to each track or whether the memory is divided according to the number of tracks being used and the number of notes in each.

You may have noticed that MIDI hardware and software tends to be rather more expensive than other home micro packages. This is partly because there is not yet a mass-market for MIDI packages, and partly because many existing buyers are professional musicians who are prepared to pay extra for what are, to them, tools of their trade.

This price structure is beginning to break down with the entry of companies like Island Logic and Commodore into the market. On the hardware front, for example, there is Commodore's £19.95 MIDI interface. Admittedly, it is more basic than other interfaces but it will meet the needs of most MIDI novices at less than a quarter of the cost of rival products.

There is still, however, a problem with software prices, Commodore's £14.95 Sound Studio and Island's £34.95 TMS represent extremely good value but offer only a few of the facilities included in the up-market MIDI packages.

A more annoying barrier to the wider use of MIDI with micros is that most of the MIDI software now on the market will only operate with a MIDI interface from the same supplier. The suppliers are, in effect, using the interfaces as dongles to deter would-be software pirates.

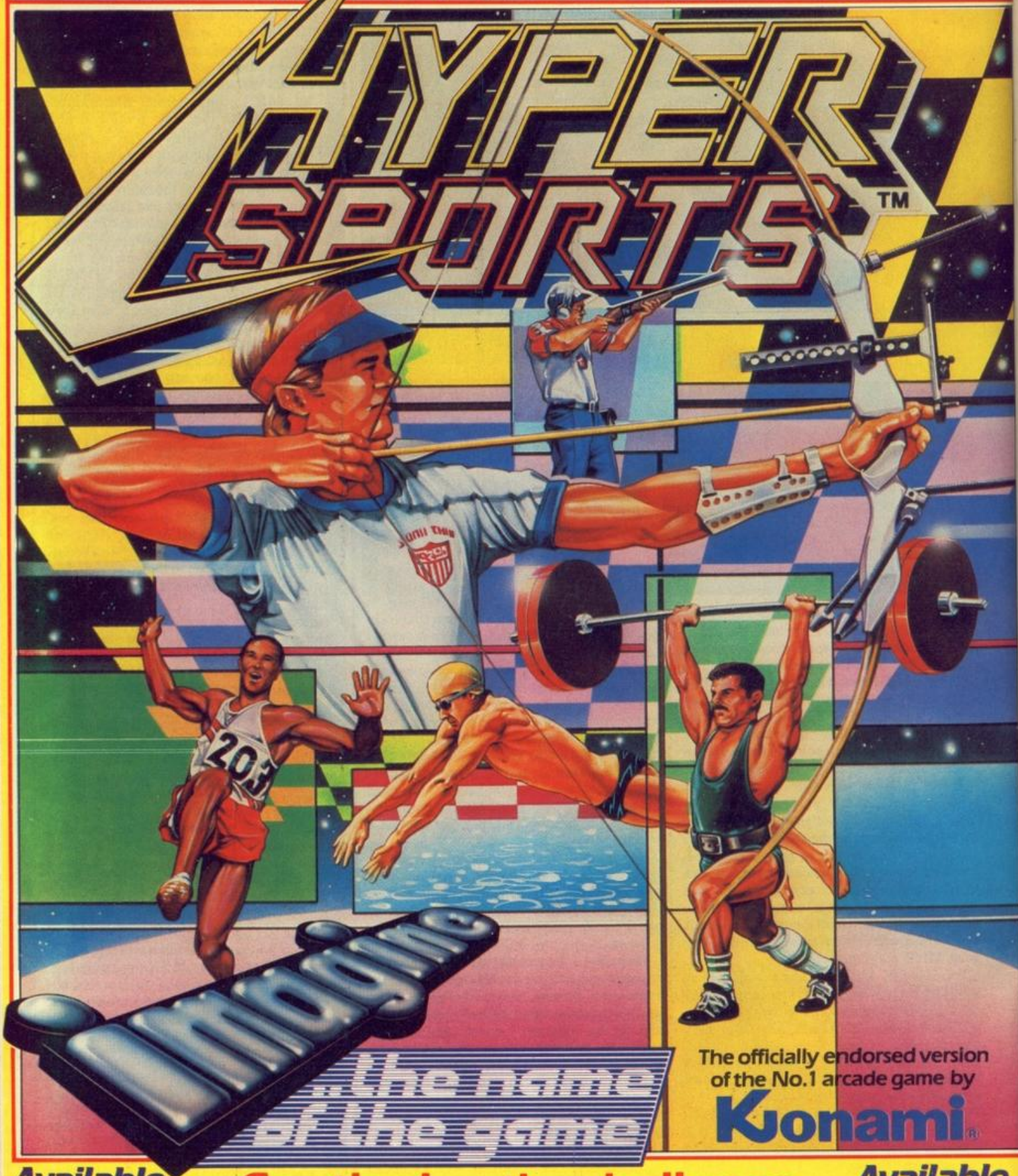
(continued on page 71)

AMSTRAD £8·95

ZX SPECTRUM £7·95

COMMODORE 64 £8·95

HYPER SPORTS™



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Imagine Software is available from: Boots, WHSMITH, John Menzies, WOOLWORTH, LASKYS, Rumbelows, Greens, Spectrum Shops and all good dealers.

(continued from page 69)

This leads to the absurd situation that if you like one supplier's real-time recorder but prefer another's step-time recorder you will have to buy two costly interfaces, performing almost identical functions, to run the two packages.

Some suppliers compound the problem by bundling the interface with an item of software which you may not need and selling separate programs which may interest you but which can only be used with the interface which is not available as a separate item.

A final word of advice if you are thinking of buying MIDI software. If at all possible, you should test the software with the synthesisers or drum machines you are planning to use. Trials with similar machines are not good enough because instrument manufacturers have a nasty habit of revising their MIDI firmware without telling anyone.

MIDI has its critics in the music industry. Some would have preferred a faster, parallel link to the serial format. Others feel that the DIN plug is not up to the job. But the present format was chosen because it offers a relatively simple and cheap way of linking instruments with each other and with micros.

Two recent developments in the micro world could help to spread the MIDI gospel. First, the trend towards 128K as the standard home micro Ram capacity could prove extremely important. It will boost event storage capacities and allow software writers to extend the facilities offered by their packages and to enhance screen displays.

But more significant is the arrival of the first general-purpose micro with a built-in MIDI interface, Atari's ST. Atari boss Jack Tramiel's decision to add $10 or $20 to the cost of the ST by including the MIDI interface shows how important he believes MIDI will become.

Next month we will look at the other method for expanding the micro's musical role — sampling. ■

ADDRESSES

Commodore Business Machines, Corby, Northamptonshire NN17 1BR (0536-205252).
EMR (Electromusic Research), 14 Mount Close, Wickford, Essex SS11 8HG (0702-335747).
Hybrid Technology, Unit 3, Robert Davies Court, Nuffield Road, Cambridge CB4 1TP (0223-316910).
Joreth Music, PO Box 20, Evesham, Worcestershire WR11 5EG (0386-831615).
LVL, Scientific House, Bridge Street, Sandicare, Nottingham NG10 5BA (0602-394000).
London Rock Shop, 26 Chalk Farm Road, London NW1 8AG (01-267 7851).
Micro Musical, 37 Wood Lane, Shilton, Coventry CV7 9LA (0203-616760).
Rittor Music Europe, 24 Broomgrove Gardens, Edgware, Middlesex (01-952 5302).
Rosetti, 138-140 Old Street, London EC1V 9BL (01-253 7294).
Sequential Circuits, PO Box 16, 3640 AA Mijdrecht, The Netherlands (02979-6211).
Siel (UK), Ahed Depot, Reigate Road, Hookwood, Horley, Surrey RH6 0AY (0293-776153/4)
XRI Systems, 10 Sunnybank Road, Wylde Green, Sutton Coldfield, West Midlands B73 5RE (021-382 6048).

MIDI MAGIC

Machine	Supplier	Package	Price	Interface	Comments
Spectrum	EMR	Performer	£39.95	£79.90	8-track polyphonic real-time recorder, 7,960 event capacity (with or without velocity), tracks can be merged.
	Micro Musical	MIDI Musician	£69.00	included	Monophonic step-time recorder, based on Romantic Robot's Music Typewriter (included), microdrive convertor.
	Siel	Live Sequencer	£21.30	£87.95	Simple 1-track polyphonic real-time recorder
	XRI Systems	Micon	£108.00	included	2 programs: 8-track monophonic step-time recorder, helpful stave display, up to 2,900 events/track; and simple 1-track polyphonic real-time recorder, auto-correct.
		Real-time Multitracker	£27.95	uses any interface	8-track real-time polyphonic recorder, 9,000 event capacity, over-dubbing.
BBC	EMR	Composer	£44.95	£79.90	6-track step-time recorder, 5,100 events, dynamic memory allocation, joystick option.
		Performer	£49.95		8-track polyphonic real-time recorder, capacity up to 7,960 events, track merging, auto correct.
		Editor	£34.95		Extra editing facilities for Performer, links it with Composer allowing data transfer.
		Vu-Music I	£24.95		Provides graphics display modulated by MIDI data, choice of type of music to be depicted.
	Hybrid Technology	Music 600	—	£129.00	MIDI hardware module for use with Music 500 system or independently, requires £35 Nucleus ROM.
	LVL	—	—	£ 39.95	Interface for use with LVL's keyboard and music ROM.
	London Rock Shop	UMI-2B	£495.00	included	ROM-based 16-track polyphonic real-time and step-time recorder, auto-correct, voice storage for DX7 synth.
	Siel	Multitrack Composer	£36.95	£99.00	6-track monophonic step-time recorder.
CBM-64 /128	Commodore	—	—	£19.95	Simple MIDI interface for use with Commodore packages including Music Studio, Music Expander and Sampler.
	EMR	Performer	£49.95	£79.90	8-track polyphonic real-time recorder, 18,000 event capacity, auto correct, track merge.
	Joreth	Music Composer System	£250.00	included	8-track step-time and real-time recorder, music composition language, auto-correct, score display.
	Rittor	Passport MIDI/4 +	£79.99	£109.99	4-track polyphonic real-time recorder, 12,000 event capacity, dynamic memory assignment, auto-correct.
		Passport MIDI/8 +	£119.99		8-track polyphonic real-time recorder, 12,000 event capacity, dynamic memory assignment, auto-correct, impressive demo pieces.
		Passport MIDI player	£64.99		stores music created on MIDI4 +, real-time graphic display during playback.
	Rosetti	Scorewriter	£340.00	£90.00	ROM-based 12-track real-time recorder, produces detailed score print-out of real-time playing.
		12-track recording studio	£99.95		12-track real-time recorder, 7,600 event capacity, auto-correct, track merge.
	Siel	Multitrack Composer	£36.95	£87.95	6-track monophonic step-time recorder.
		16-track sequencer	£67.25		16-track real-time polyphonic recorder, 9,000 event capacity.
		Digital Echo Delay	£54.35		provides delays of 5-200ms between MIDI In and Out signals, up to 14 "echoes" possible.
	Sequential	Sequential 964	£74.95	£99.00	6-track polyphonic real-time recorder, 8,000 events, auto-correct.
MSX	JVC			£TBA	Software similar to EMR's Performer 8-track real-time recorder (see above).
Amstrad	EMR	—	—	£79.90	Interface supplied with Introduction to MIDI program on cassette.

Richard Taylor improves the Spectrum's sound

THIS PROGRAM adds a further four commands designed to enhance its musical and sound capabilities to Spectrum Basic. They start where Beep left off, providing a Play instruction which allows tunes to be played by just specifying the notes rather than having to labouriously convert them into the numerical form required by Beep. Secondly, the program facilitates the use of tone envelopes whereby the pitch of a sound varies with time to produce the laser sounds and zaps that are all too popular in commercial games. Random "noise" can also be produced and, when used in conjunction with envelopes, can be made to create some convincing effects.

The program occupies about the top 2.5K of memory just below the UDG graphics area. When run the program lowers Ramtop and proceeds to poke the machine code into memory. After a couple of minutes the computer should respond with a message informing you that the data was OK. At that point the machine code can be saved to cassette or Microdrive etc. If, however, you are presented with a message informing you of a data error in a certain line then its necessary to go back to that line and check it against the original, correcting any mistakes as you go, and re-run the program. This process should be repeated until you get the data OK message.

The machine code can be saved to tape using:

SAVE "SOUND EXT"CODE 62683,1885

Remember to VERIFY!

To reload use:

CLEAR 62682: LOAD ""CODE

The new commands are used in a similar fashion to those which are standard except that the commands have to be typed out in full — in either upper or lower case — there's no lazy single key entry system. However, before any of the commands will be accepted by the Spectrum the machine code must be initialised with:

RANDOMIZE USR 62683

This instruction completely resets the program and introduces the new commands to the Spectrum so that when Basic comes across them they'll be accepted without any quibbles. Because of the somewhat obscure manner in which it operates, any errors reported by Interface 1 disconnect the sound commands so that they are no longer part of Basic's vocabulary. To reinitialise use:

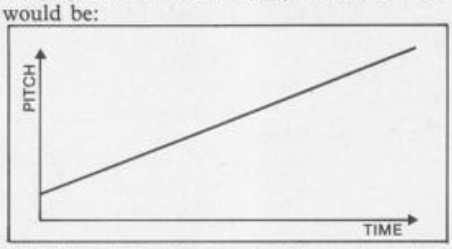
RANDOMIZE USR 62686

The most mundane of the new instructions is *Sound. In its simplest form it can be used as a substitute for Beep. In an analogous manner to Beep the command needs two arguments, the first being the length of the sound (in units of 1/100 of a second — so 300 means three seconds) and the next argument is the pitch of the sound. The pitch is described in a completely different way to that expected by Beep — the smaller the number the higher the pitch! The best way to produce a certain tone is by experimentation — there's no easy method of getting a pitch number for a specific frequency. If the pitch of a sound is made negative then noise is produced with a pitch of very approximately what it would have been if it wasn't negative e.g.

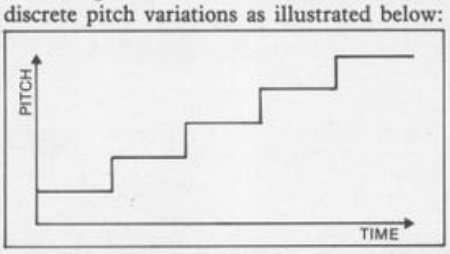
*SOUND 200, – 300

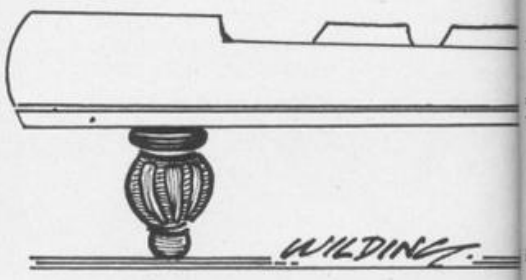
produces noise for two seconds. In fact the sound may not last exactly two seconds, when generating noise the duration you specify is only followed approximately — the sound may last much longer. If this is a problem then you'll have to compensate for it when defining sound lengths.

The *Env command is used to define the envelopes I mentioned. The definition of an envelope describes how the pitch of a sound varies from its initial value as time progresses. These tone changes give rise to the laser/zap effects which were previously unobtainable from Basic without enlisting the help of machine-code routines. A helpful aid in producing envelopes is to illustrate its effect graphically with the aid of a graph. For instance, the graphical form of a steadily increasing note would be:



Notice how the graph shows the pitch undergoing a continuous, smooth change from the intial to the final pitch value. In reality the computer cannot manage this but has to break the change down into a number of small, discrete pitch variations as illustrated below:





You decide how long each individual step wll last and by how much the pitch then "jumps" at the culmination of each of the steps.

Say you wanted to create an envelope similar to the one above, we have to specify three quantities, namely the total number of steps, the size of pitch variation after each of them and the length of each step. From these values the following can be calculated:

Total pitch change =
number of steps x size of step
Total length of env =
number of steps x length of step

Consider that the envelope is to last a total of one second and produce an increase in pitch of 100 units. Because of the weird way in which the pitch is measured an increase is represented by a decreasing pitch number — *Env uses the same method of pitch representation as *Sound. If we wanted to have a total of five steps in the effect then each would have a length of 1/5th second and a step of −20. To define the enyelope:

*ENV 0,5, – 20,20

is used. The first expression after the command is the number of the envelope, in this case 0. Up to 16 completely independent envelopes can be stored in the Spectrum's memory at one time, each one being specified by a number between 0 and 15. The second expression is the number of steps, the third the pitch variation per step and, finally, the 20 is the step length in 1/100th's of a second. Since each step lasts a comparatively lengthy 1/5th second its quite easy to hear the individual steps composing the envelope. To hear the envelope type:

*SOUND – 1,250,0

Notice how a third argument has been tagged onto the end of *Sound to specify the envelope to be used. The length of the sound is given as −1. This means that the envelope should be played only once. Similarly if it was −2 then the envelope would be repeated twice. Try

```
 10 REM  BASIC SOUND EXTENSION
 20 REM     By Richard Taylor
 30 REM         48K Version
 40 REM
 50 CLEAR 62682: LET a=62683
 60 FOR 1=0 TO 29
 70 LET t=0: READ v,a$
 80 FOR c=1 TO LEN a$ STEP 2
 90 LET x=CODE a$(c)-48-7*(a$(c
)>="A")
 100 LET y=CODE a$(c+1)-48-7*(a$
(c+1)>="A")
 110 POKE a,16*x+y
 120 LET t=t+PEEK a
 130 LET a=a+1: NEXT c
 140 IF v<>t THEN PRINT "ERROR i
n line ";8000+1*10: STOP
 150 NEXT 1
 160 PRINT "Data OK - Now save m
achine code to tape."
 170 STOP
```

```
8000 DATA 7192,"CDE8F42A3D5C11FD
F4732372C92138FCAF0610112100771
10FC13060877191 0FCC93A3A5CFE0BCA
6CF676FDCB01AEFDCB304EC4CD0E3A3A
5C3CF5210000FD75"
8010 DATA 6380,"37FD7526220B5C21
010022165CCDB016FDCB37AECD6E0DFD
CB02EEF147FE0A3802C607CDEF153E20
D778119113CD0A0CAF113615CD0A0CED
4B455CCD1B1A3E3A"
8020 DATA 5904,"D7FD4E0D0600CD1B
1ACD9710 3A3A5C3C281DFE092804FE15
2003FD340D0103001170 5C21445CFDCB
0A7E280109EDB8FD360AFFFDCB0 19E18
0AFD363102CD9517"
8030 DATA 6891,"CDB016AFCD0116CD
2C0FCD171BFDCB007E20143A3A5CFE0B
CA6CF62A595CCDA711FD3600FF18DC2A
595C225D5CCDFB1978B1280DFD360000
CD5D15FD3600FF18"
8040 DATA 9115,"C9DFFE0D28B3FDCB
3046C4AF0DCD6E0D3E19FD964F328C5C
FDCB01FEFD3600FFFD360A01CD8A1BC3
FDF4736F756EE4E2F9706C61F9BEF765
6EF693F665666665"
8050 DATA 6655,"63F41DF7001105F6
DF1AE67F4F7E23FE0D2806FE2038F6F6
20B9200E1A131730E8225D5CEB5E2356
EBE91A131730FB13131AA720D3ED7B3D
5CE12A5D5C225F5C"
8060 DATA 7619,"CDC516FD36000BFD
CB017EC205F5C3B6F521FDF4CD302520
0321A8F5E521761BE5FD3600FFFD3626
002A5D5C2B7EFE2038FAFE2A20BF188D
CD821CCD30252813"
8070 DATA 8063,"CD941EFE10D29F1E
CD11F71138FC19E5360023AFF5E5DFFE
2C2057CD791CDFFE2C2802CF0BCD811C
E1CD30252837E5CD941EE1E5232323A7
CA9F1E77CDA22DDA"
8080 DATA 6709,"9F1E08CB78C29F1E
082807792F4F782F4703E1E523712370
CD941EE1A7CA9F1E7723232323F13CFE
0838A9CD30250 8E177C9E1F118F56F26
005D542929292929"
8090 DATA 8384,"19C9CD821CCD3025
2810CD941EFE08D29F1ECD11F7191148
FE19E5DFFE2CC2BEF6CD811CCD3025E1
280FE53600CD941EE1A7CA9F1E7723E5
23AFF5E5DFFE2CC2"
8100 DATA 7829,"0DF7CD791CDFFE2C
C2BEF6CD811CE1CD30252846E5CDD52D
DA40F92004FE1038023EFFE1E577CDA2
2DDA9F1E08CB78C29F1E08280779 2F4F
782F4703E1E52323"
8110 DATA 7600,"71237 0CDD52DDA9F
1EF5CB7FC29F1EF12802ED44E1237723
2323F13CFE08389AC306F7CD8C1CCD30
25C8CDF12B78B12002CF090BED432EFC
ED5330FC21140022"
8120 DATA 7775,"32FC3E033236FCAF
3237FCCD4CF8211EF8CD8D2C3002F620
4F7EA728D4B9201E235E23562A2EFCE5
```

BASIC SOUND EXTENSION

```
*SOUND -5,250,0
```

The pitch value given in *Sound is the initial pitch which is decreased down to 150 by the envelope. If an envelope is being repeated then the pitch commences from its initial value at the start of every recital of the envelope. There is nothing to stop noise being enveloped in a similar fashion, try:

```
*SOUND -5,-250,0
```

Note that when using enveloped noise the pitch is varied as though the negative sign in front of it didn't exist (although noise is produced), otherwise decreasing −250 by 100 would produce −350 instead of −150 which is what we're after. Enveloped noise is the basis of many of the sound effects to be found in games, especially those of the "space-war" genre. In order to produce a much smoother envelope the step length has to be drastically reduced. Redefine envelope 0 with:

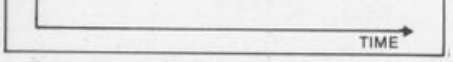
```
*ENV 0,100,-2,1
```

If you try

```
*SOUND -8,250,0
```

a greatly improved effect will be heard.

So far the envelopes that have been utilised are relatively simple in that they consist of only a single type of pitch change. In reality we may wish to use more complex envelopes such as:



The envelopes can be subdivided into five discernable different sections, A-E. We could define a seperate envelope for each of A-E and play them together using a string of *Sound commands. This method, as well as being unelegant and cumbersome, is further complicated because we need to calculate the value envelope A, say, leaves the pitch at when it terminates so that we know what to use as the starting pitch for envelope B. Thankfully the *Env command allows an envelope to be composed of up to eight individual sections. We could define the above envelope as follow:

```
*ENV 1,20,-4,2,20,-1,2,10,-1,4,20,4,2,
     20,2,2
```

Each of the five sections are 2/5th second in length, making the whole thing two seconds in duration. Try:

```
*SOUND -1,300,1
```

As you can hear such an envelope provides a much more complex sound.

The Beep instruction was designed for playing music rather than making exposion sounds etc. However, life still isn't easy if you're converting music since all the note values have to be converted into the relevant numbers required by the somewhat awkward Beep. The *Play command enables music to be converted without the need for any number crunching. It has a string argument which is used to contain the notes you wish to play and other associated information. Any letter from A to G found is the string played as that particular musical note — so:

```
*PLAY "abcdefg"
```

plays all the seven notes available. Of course it would be extremely limiting if you only had seven notes to play with so there is a facility to change octave.

Although the program supports eight octaves those at the extreme levels of pitch are of little use for musical purposes. In fact the upper few notes in the top octave will produce an error if you try to play them for the simple reason that the computer can't manage to produce such a high pitched sound. To change octave an O is simply put in the string followed by the new octave number — 1 to 8. all subsequent notes in that string are then played in the new octave. At the start of every new *Play the octave is reset to 3. To further increase the quantity of notes available sharps are also supported. A sharp note has a pitch slightly above — one semitone in fact; whatever that is — its ordinary value. To play a sharp note simply suffix the note with a hash character (#)

```
*PLAY "c#"
```

gives C sharp.

```
10 FOR a=1 TO 7
20 *PLAY "o"+STR$ a+"cc# dd# eff#
   gg# aa# b"
30 NEXT a
```

This short program demonstrates the full scope of the notes available in the lower seven octaves. The O "directive" — or any other directive that needs an argument, you'll meet some more in a moment — must be followed by a number, no variables or expressions are allowed. You can, however, circumvent this difficulty by using STR$ to construct the numerical part of the string — as in the above program — out of an expression, variable or whatever.

You can play noise instead of plain notes by

(continued on page 74)

```
EBCD18F83A2FFC3CE1C87CB5C8CD541F
D27B1B18CEE92323"
8130 DATA 8977,"2318D63A54F83B54
F86142F96242F96342F96442F96542F9
6642F96742F979BAF86EAAF86F9AF86C
D0F87089F8782CFA003A30FC7ECD6BF8
D03A30FC23230FC"
8140 DATA 9056,"ED4B2EFC78B1CACC
F70BED432EFC18E4FE21D0FE10D8FE18
3FD823ED4B2EFC78B1CACCF70BED432E
FC2230FC37C9CD00F947A7C82142052B
7CB520FB10F6C9CD"
8150 DATA 8578,"00F9A7CA6C04FE09
D26C043236FCC9CD00F9FE02D26C0421
37FCCB86B677C9CD00F9FE11307FFE10
20023EFF322DFC2137FCCBCEC92A30FC
E52A2EFCE5CD54F8"
8160 DATA 6969,"C1E1FE2D28072230
FCED432EFCF5CD00F9A728516F2600F1
FE2D20057DED446F252232FCC9CD54F8
CD1B2DDACCF721000CD1B2D38292938
2C5D542938272938"
8170 DATA 7190,"24193821D6305F16
00193819E52A2EFC7CB52806CD54F8E1
18D72B222EFCE17CA72002 7DC9CF0AD6
633002C60787F52A32FC2234FC2A2EFC
7CB5283CCD54F8FE"
8180 DATA 7529,"23200DF13CF52A2E
FC7CB52825CD54F8FE2E20242A34FCCB
7CC2CCF75D54CB2CCB1D192234FC2A2E
FC7CB5280 5CD54F8180621FFFF222EFC
F1676F26001 10DFC"
8190 DATA 6722,"195E2356EBCDB433
2A655C11FBFF193A36FCD6038677EF34
8043559F8001053435710338CD991EED
5B34FC2137FC3EFFCB4E28033A2DFCCB
4628090B792F4F78"
8200 DATA 7277,"2F4703 08C365FACD
7A1CDFFE2C2011CD811CCD3025C8CD94
1EFE10D29F1E1806CD3025C83EFFF5CD
A22DDA9F1E08CB78C29F1E0828 07792F
4F782F4703C5CDD5"
8210 DATA 7314,"2D5F1600DA6C0428
04ED445F15C1F118B3CD00F9FE08D240
F9CD11F7191148FE197EA7C84723C5E5
4623C5E54E235ECB039FCB0B5779234E
2346CD65FAE12323"
8220 DATA 7511,"2323C110E5E1C110
DDC9DD2137FCDDCB00BEDDCB00B66FCB
7A2808DDCB00FE7A2F577B2F5F13CB78
2808DDCB00F6792F4F782F47037DDDA6
00173002CF09CB7D"
8230 DATA 8090,"2039D5C57DCD11F7
1138FC197EA723E5DDE1E1D12825473A
37FC173E013001 7BF5C5D5E5210000 22
2BFCE1E5DDE5CDDAFADDE1E1D1C1F13D
20E6C969601874ED"
8240 DATA 7652,"5329FCC5DD4600DD
5E01DD5602DD4E03C5D5E559 1600CD4E
FBCD541FD27B1BE1D1D5CB7A2003191 8
0A7A2F577B2F5F13B7ED52DA40F91130
75ED5219D240F9D1"
8250 DATA 8423,"C1D53A37FC17381D
E52A2BFC7806000947 3004E1E1E1C9ED
5B29FCB7ED521930F2222BFCE1D110A8
C1D5110400DD19D11091C97CB5C87AB3
C8DDE5CDBEFB3A37"
8260 DATA 7807,"FCCB772006CDB503
DDE1C9F33A485CE6380F0F0FF6084FD5
DDE1CB3CCB1DCB3CCB1DCB3CCB1DE5ED
5FCB77CBB75F160020 0ACB2319300E21
FFFF1809CB23ED52"
8270 DATA 6992,"300321000023132B
7CB520FAE179EE104FD3FECB6720CFDD
7CDDB5DD2B20C7FBDDE1C9E5E5424B21
17110B78B1032817EBDD2E102100007C
298FCB11CB103003"
8280 DATA 5837,"19CE00DD2D20F14D
44DD2E18E1111E0019EB210000 37CB11
CB1017ED6AED523001 19DD2D20F0CB11
CB10792F5F782F57E1C96E0473047804
7D04820482048704"
8290 DATA 1106,"8C0491049604 9B04
A004A504A5040000000000000000000
0000000000"
```

(continued from page 73)

utilising the n directive, n0 turns noise off while n1 switches it on. To hear the effect try the above program with n1 preceding the 0 in the string.

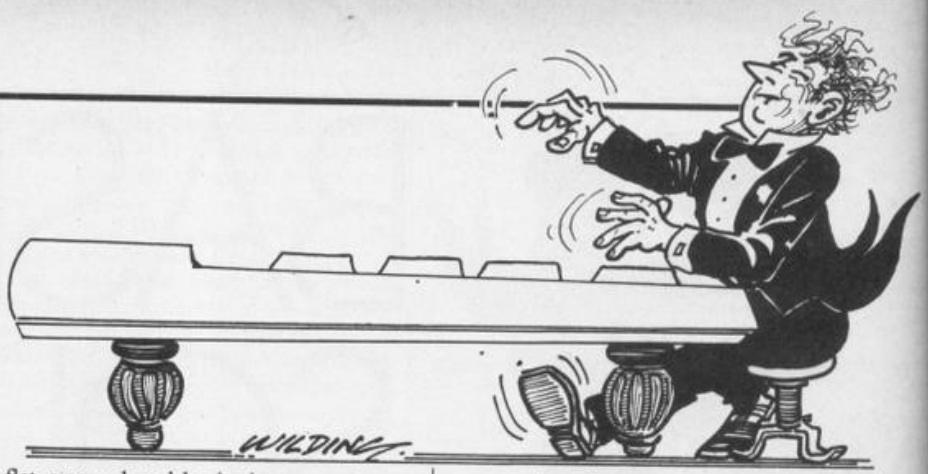
The pause (p) directive enables a silent gap, equivalent to a musical "rest" to be placed in a tune. The number following p is the length of the pause measured in 1/100ths of a second. The pause can be up to 2.55 seconds.

It is possible to modify the duration of each note using the L directive. The L is succeeded by a number between 1-255 representing the new length, in 1/100ths of a second, of each note. At the start of each new *Play command the note length is reset to 0.2 seconds. Dotted notes are also supported by the program. A dotted note is played for 1.5 times longer than an ordinary note. To make a dotted note simply put a full stop after the letter in much the same way as you would with a # .

```
*PLAY "L100c#."
```

plays c# for 1.5 seconds. If you require a dotted sharp note then the full stop should come after the # .

To add a little more interest to a tune it is possible to use an envelope. So far all the notes have kept the same tone value throughout their duration, like the sound produced by Beep. To turn envelopes on a Y directive is used. The number following the Y is the envelope you wish to use, or 16 to turn envelopes off. All subsequent notes are played using that envelope. By experimenting with a number of different envelope effects it is often possible to enhance the sound of a tune considerably from



its flat, unenveloped beginnings.

To summarise these are the directives available in a *Play string — actually, there is still one to come — I'll mention that one soon.

A-G	=	The notes.
#	=	If placed after a note will make it a sharp.
	=	If placed after a note will play it 1.5 times longer.
On	=	Lets you play subsequent notes in octave n.
Pn	=	Pauses for n 1/100ths of a second.
Nn	=	If n = 0 then noise is turned off. If n = 1 then its switched on.
Ln	=	Makes the duration of subsequent notes n 1/100ths of a second.
Yn	=	Makes following notes to be played in envelope n (or normal if n = 16).

If a certain sequence of sound commands are always used together then they can be made into a single unit called an effect. An effect is a construction of up to eight separate "sounds" strung together. Like envelopes, effects can be defined and stored in the Spectrum's memory for later, and repeated, use. You can have up to eight effects defined at any one time.

```
*EFFECT 0,1,100,200,16,100,150,16
```

This effect is equivalent to

```
*SOUND 100,200:*SOUND 100,150
```

The first value in an *Effect is the effect (0-7) and the next is the number of times the whole effect is to be repeated when used. Every block of three expressions from there onwards represents one of the maximum eight individual sounds that compose the effect. They are given in the same format as that expected by *Sound, i.e. length, pitch and then envelope number.

In an effect sequence it is mandatory to specify an envelope number, it cannot simply be left off. If no envelope is required then "16" should be specified. The only way to play an effect is by using the *Play command. An X directive, followed by an effect number, will sound the appropriate effect. ■

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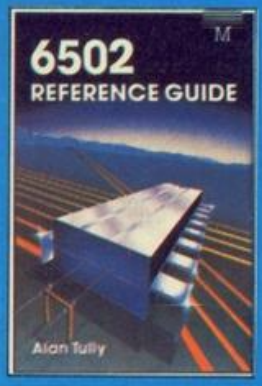

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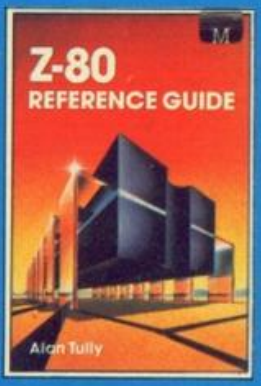

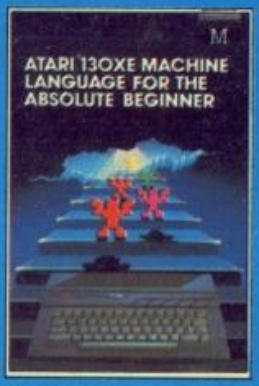

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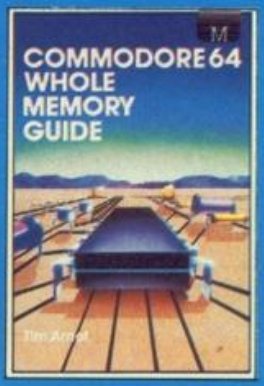

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Listing 1.

```
10 N=100:P=49152:GOSUB 50
20 N=57 P=12288:GOSUB 50:END
50 PRINT"PLEASE WAIT [ 1"
60 Z=48:X=1:C=9:V=T:B=16
70 READZ#:IFZ$="""THEN RETURN
80 PRINT"TAB(14)" "TAB(14)RIGHT$(STR$(N),LEN(STR$(N))-1)
90 Q=0:FORT=1TO4TSTEP2:X$=MID$(Z$,T,2):GOSUB130:POKEP,L:P=P+X:Q=Q+L:NEXTT
100 X$=MID$(Z$,49,2):GOSUB130:CK=L:X$=RIGHT$(Z$,2):GOSUB130:CK=CK+L*256
110 IFCK<>QTHENPRINT"DATA ERROR IN LINE"PEEK(63)+256*PEEK(64):END
120 N=N-X:GOTO70
130 G=ASC(X$)-Z:H=ASC(RIGHT$(X$,X))-Z:L=H+(H<C)*V+G*B+(G+(G>C)*W):RETURN
200 DATA 4C5FC5EAAD1690C98FF854C
E1204AD1284C938D04AA9398DF20A
210 DATA 1284CE1184AD1184C938003
BA9398D1184CE1084AD1084C98F87
220 DATA 38D02CA9398D1084CE8F84A
D0F84C92FD81DEC8F84A9028D6E88
230 DATA 6938A98F8D1690A9068D119
0A9388D1084BD1184BD1284EA0A00
240 DATA ADB1D9C9DF9005A9DF8D81
AADB0D8C9DC9813C9E1B80FAD268D
250 DATA 81D0C946B008A98F8D8990
D1690AD1ED02981C981D008A9B989
260 DATA 028D0398B01ED8EAADB0D0C
91F8005A91F8D88TAAD08D8C98C0A
270 DATA FB9805A9F880087AEAA2821
8BD807E7D887A9D887AC8E0180208
280 DATA D0F1EE0298AD0298C98A902
AAD8898C985F023A9888D0298FB0A
290 DATA 18AD887EED887A8D887AAD0
898C98AF08DA9208D8D4D4A3881D89
300 DATA 8D81D48D88D4A8888AFB91F
DC8C81DD8FT4C68C1EAEAEAA9D08E
310 DATA 0885F8A97A85FCA98885FDA
9D885FEA8888AFD91FBC8C82FDC8E
320 DATA D0F7A9888D8EDCA9818D197
AA9818D1A7A78A9838D1403A96D8A
330 DATA C88D1503A9F18D1AD858607
8A9318D1403A9EA8D1503A9F0F50A
340 DATA 8D1AD858A9888D15D8A9818
08E0CE040EAAD81D8C9C888187188
350 DATA C9649819AD888C920B805A
9F588D87A18A888D8C9F79885888
360 DATA A926B8D878AEAEAEAEAEAAD1
598C914988EA288B82C998F8FC0C
370 DATA 87CA18F74CAAC1A288B8AC
990F887CA18F7EE1598A81598188C
380 DATA C928D885A9888D1598EAADD
6TEC9FFD818A203A9CA9982C9E488
390 DATA EAA9C898BAC94CD8C1A203A
9CC9802C9A9CD988AC9A2181BEA8C
400 DATA BD888DC92D885A9B199887
EB888D8C9FAD88CB81D8C9DCTC8C
410 DATA B885A9FF9D887ECACAE888D
8DA189AD8CD8C9FF9814A9888D888C
420 DATA 1D888D187A8D188D4D8C9FF
E7A8D8ED818AD84D8C9FF9814938A
430 DATA A9848D1888D187A8D18D8A
9818D847A8D84D818AD86D8C9S888
440 DATA FF9813A9888D188D88D187A8
D188DA9818D86TA8D86D8AD8893383
450 DATA D8C9FF9813A9188D188D88D1
07A8D188DA9818D887A8D888D838A
460 DATA A88AD8C9FF9813A92888D18D
88D187A8D188DA9818D88A7A8D740A
470 DATA 8AD8A88CD8C9FF9813A9488
D188D88187A8D188DA9818D8CE88A
480 DATA 7A888CD818AD8ED8C981B81
7AD188D29TF8D187A8D188DA9T38A
490 DATA FE88E7A888ED82858C318A
D848C981817AD188D829F888218B
500 DATA 187A8D188DA9FE8D847A888
4D82858C318A888D8C981B81G788A
510 DATA AB18D829FT8D187A8D188DA
9FE888E7A8D86D82858C3A888388B
520 DATA D8C9818B16AD188D23EF881
07A8D188DA9FE888TA888D8A488
530 DATA 2858C3AB8A8C981B816AD1
8D829DF8D187A8D188DA9FE885F88
540 DATA 8ATA888AD82858C3A88CD8C
981B836AD188D29BF8D187A8T88A
550 DATA 188DA9FE9D8C7A88D8CD8285
8C34C75C3A9288D88D4A98A8D3T88
560 DATA 8CD4A98A88D8D4A93288D7D
488D8D4A928188D84684218BD28A
570 DATA 88D8C92CD888A9FF9D817EA
9889D887ECACAD8CBA218BD81E688
580 DATA D8C968D88FA9FF9D887EA98
89D817EA9619D817ACACAE884FA88
590 DATA D8E4AD83D8C9CDD885A9FF8
D837EAD83D8C941D885A9818D8E88C
600 DATA 837EAD82D8C9D2D885A9FF8
0027EEE8298A98298C981F852F888
610 DATA C982F868C983F87BC984D88
34C72C4C98598834C88C4C9868488
620 DATA D8834C9EC4C91ED885A9888
D8298AD1FD8298IC981D8834CB489
630 DATA B4C4A98898C985D8834C84C
4C98AD8834CB4C4A8818D8C9D7AA8C
640 DATA 9883CB4C4A9818D8598184
D1FD8C97FF8834CB4C418AD0FAE8A
650 DATA TA6928D8F7A8D8FD828C8C
4EAAD1FD8C9FBD86818AD85TAEF88
660 DATA 69288D85TA8D85D828C8C4E
AAD1FD8C9FTD851184D8T7A698188
670 DATA 288D77A8D87D828C8C4A81
FD8C9EFD83818AD897A68288DF38A
680 DATA 897A8D89D828C8C4AD1FD8C
9DFD82518AD87A6928D8D3AA8A
690 DATA 8D8D828C8C4AD1FD8C9BFD
88F18AD9D7A6928D8D7A8D8D928A
700 DATA D828C8C4A9FF8D1FD88D1F7
AEA4CD8C4A9288D88D4A98A888A8D
710 DATA 8C94A88A888DD4A9888D87D
48D88D4A92198D8468CEE8198988A
720 DATA AB818CD1298F8834C58C5A
9888D8138A8228T8D8898A8886883
730 DATA 8B238T9D228TE8E81CD8F5A
DE285883D87A288BE38598E28188
740 DATA 85E8E81CD8F5ADA18488FD8
5A288BDA2849A184C8E817D8858C
750 DATA F5AD88988D8T84AD5D86B8D
888A21CB8B1B638288CAE888888A
760 DATA D8F5AD5D858B8286A21CB84
1B598428SCAE88D8F5AD88983A88
770 DATA 8942854C31EAEAEAA98F8D1
8D4A98A8D85D4A9588D86D4A9628E
780 DATA 88D8D2988D898881138881
5988D1698A9838D1898A288BD1889
790 DATA D3C8C965F888D888D8E8E82
F88F14C98C5E84C8TC5A21FBB958C
800 DATA 12C998887ECA18F7A28T8D8
2C998F88TCAC8FFD8F5EA2887138D
810 DATA C1EAAD8998C981D8834C2DC
7C8828834C81CT88F88834C8788
820 DATA 28C8EA28E4FFC946F884C98
3D8834C43C1EAA9FF8D1F7A8D178D
830 DATA 1FD818A928D8D4D4A988888
8D48881D418A288A881DC4A88F89
840 DATA 5EB8878A8C48882C98B8AC
9A988D885838A881D8E9868B18A
850 DATA 817A8881D88928D8D4D4A93
28881D4A81EA9218B84D428B7888A
860 DATA C8A9328881D48888D488D8E
D18A928B8D4D4A881D8698688B8B
870 DATA 817A8B81B818A988B8B898E
A98C88B82C88B8AC9A8B7B84A588A
880 DATA 4A8828A828BC84D4A828BC8
1D48C88D4A8219BC84B4B8C88CD88A
890 DATA 82C9A8C18C8AC9CACACACA4
AB828A828BC84D4A828BC81D41A8C
900 DATA BC88D4A9218C84D4A8C28C8
2C9A8C38C8AC9E8E8E8E84A889A8D
910 DATA 54AC818DC858884D8B7B8A
9858D8898A9C58D82C98D8AC9D88A
920 DATA A838C81D48C88D4CE817AC
E817AA9218B84D4CE81D8CE81C88A
930 DATA D828B7C8C8C858D8E8A92
88B84D488B898A8B7B8A888A28288C
940 DATA B7C8888B8FAA9C88B82C98B8
```

TOWER OF ANTICS

WELCOME TO the Tower of the Antics. Here is a fast and smooth arcade-style game, written in machine-code, for the Commodore 64. It utilises multicoloured sprite graphics, and the smooth action is due to the raster interupt which displays the sprites 50 times a second, so no flicker.

You are Willy and you find yourself at the bottom of a tall, dark tower — the Tower of the Antics — named after the strange assortment of creatures which inhabit its depths. Regardless of how you got there, you decide to make your way to the top in search of an exit. However, your route is blocked by moving holes in the platforms which speed up after the sixth level, and the Antics themselves, who multiply, the higher you go. Don't get too disheartened, Willy is quite an agile little man, and can jump over the Antics and the holes with a bit of practice.

On your journey to the top, you will meet an assortment of weird and wonderful creatures. The green Wirrly Birrd is the most dangerous, as it flies all over the screen in order to catch you. All the others — Trumbles — furry creatures with big ears, snakes, mutant chinese teapots and strange, blue, dog-like creatures — Mugdags — move along the platforms, occasionally jumping through the moving holes to get you. Each Antic has its own peculiar way of moving — e.g. the teapot waves its lid up and down, and waggles its spout.

Reach for the top

To reach the top of each screen you must guide Willy out of the lift at the bottom of the screen, and into the lift at the top of the screen. If an Antic catches you, you will be thrown to the bottom of the screen and you will lose one life, of which you have three. If you fall through a hole, you will be dazed for a couple of seconds, allowing the Antics to get closer.

Meanwhile, your oxygen supply is running out and, when it runs out, Willy will die three deaths all at once. He will though, collect a bonus on completion of each screen which depends on the amount of oxygen Willy has left, and the number of screens so far completed. There are three transporters on each side of the screen which Willy can use to take him to the other side. When the Antics reach the bottom of the screen, they go up the elevator on the right of each screen to attack you again.

There is a Top 10 high score table to record the best scores. 120,000 is a good score. To see the table press f7 or wait until it comes up automatically.

Now to the process of typing the game in. There are two programs. The first includes all the sprite and machine-code data, as well as a check routine. Both programs should be typed in and saved. From now on, every time you want to load the first program, and following must be entered directly after switching on:

```
POKE 642,64:POKE 44,64:POKE 46,120:
POKE 48,120:POKE 16384,0
```

This raises the bottom of memory available to Basic to avoid it overwriting the sprite data.

Listing 2.

```
100 HI=0:000000":SC$=HI$:S=54272
:W=53248:DIMVE(15),PO(15)
110 FORT=1TO10:READ"ANTICS ACE
":NC(T):=(11-T)*1000:NEXT:HI$
="999999"
120 GOSUB860:PRINT"      PLEASE
 WAIT FOR INITIALISATION"
130 POKE56334,PEEK(56334)AND254
:POKE1,PEEK(1)AND251
140 FORT=0TO2500:POKET+8192,PEEK
(T+53248):NEXT
150 POKE1,PEEK(1)OR4:POKE56334,P
EEK(56334)OR1:POKE53272,(PEEK(53
272)AND240)+8
160 FORT=1TO8:READD:V(T)=D:NEXT
170 FORT=1TO10:READD:NO(T)=D:NEXT
180 FORT=0TO15:READD:VE(T)=D:NEX
T:FORT=0TO15:READD:PO(T)=D:NEXT
190 FORT=0TO159:READD:POKES828+T
,D:NEXT
200 GOSUB860:SC$="000000":LE=1:L
A=1:M=0:POKE36882,0
210 FORT=1TO40:IFPEEK(283)=60THE
N250:REM GOSUB1000
220 IFPEEK(283)=30RM=10THENGOTO7
60:REM HISCORESCREEN
230 NEXT:PRINT"
240 FORT=1TO40:IFPEEK(283)<>60TH
ENNEXT:GOTO200
250 GOSUB460:REM POKEV+21,LE(LE)
:REM GAMESCREEN
260 FORT=0TO15:POKES1474+T,VE(T)
:POKES1411+T,PO(T):NEXT
270 IFLA>5THEN300:REM SYS
280 FORT=15TOV(LA)STEP-1:POKES14
74+T,0:NEXT
290 FORT=14TOV(LA)STEP-2:POKET+S
1411,255:POKES1412+T,237:NEXT
300 POKEV+21,255:SYS49152:POKEV+
21,0:POKES+4,32:POKES+24,0
310 TS="":SC(1)=0:SC(2)=0
320 FORT=1TO4:TS=TS+STR$(PEEK(T+
1038)-48):NEXT
330 SC$(1)="":FORT=2TO8STEP2:SC$
(1)=SC$(1)+MID$(TS,T,1):NEXT
340 B0$=STR$(VAL(SC$(1))+LE):SC$
(1)=VAL(B0$)
350 SC(2)=VAL(SC$):SC$(2)=STR$(S
C(1)+SC(2)):SC$(1)=RIGHT$(SC$(2)
,LEN(SC$(2))-1)
360 SC$="000000"+SC$(1):SC$=RIGH
T$(SC$,6)
370 IFPEEK(36881)=100THEN1040:RE
M FINISHED LEVEL
380 IFVAL(SC$)<VAL(HI$)THENHI$=S
C$
390 FORT=1TO10:IFVAL(SC$)<VAL(HI$)TH
ENNEXT:GOTO190
400 IFT<10THENFORB=10TOT+1STEP-
1:HS(B)=HS(B-1):H(B)=H(B-1):NEXT
:POKE198,0
410 PRINT"
ELL DONE ! ! ! "
420 PRINT"
OUR NAME"
430 INPUT"U ";HS(T):H(T)=
VAL(SC$):HS(T)=LEFT$(HS(T),15)
440 GOTO190:REM START GAME
450 REM********** MAIN SCREEN **
*******
460 POKE53281,0:POKE53280,0
470 PRINT"
```

```
AC98E807E20B7C0A9208D04D4CB8C
950 DATA AD0604C92F0B034C43C1C93
A90034C43C1AD0904C92F0B03FD00
960 DATA 4C43C1C93A90034C43C14CB
9C5A9208004D4A9C6D002C9D08200
970 DATA 0AC9A9008D007EA04684C01D
40C0D04EE0147ACC81D0A9210DAD0A
980 DATA 84D4288B7C0A9208D04D488C
02600E2A9088D007EA9C78D027B0B
990 DATA C9BD0AC9A2192087C0A9018
D007F28B7C0A9C88D087FCAD0EF00
1000 DATA EDA9C88D087FCAD0EF00
0D09304C89C5A9208D04D4A9C6440C
1010 DATA 8D02C98D0AC9A9008D007E
18A9FFED01D08D01D48D009E0B00
1020 DATA 017ACE0100A9210D04D420
07C0A9208D04D4AD01D0C9DE9DE800
1030 DATA D0A9C78D02C98D0AC9A900
8D007E8D00BD4A914BD87D40D0BDC0A
1040 DATA D4A9218D0BD4A920AE1090
9D1304CE1B90A21920B7C0A9014780A
1050 DATA 6D007F28B7C0A9C88D007F
CA00EDAD1190C903F00BC906F0030C
1060 DATA 07AD10BBC90B00034C72C8
A9C80D02C98D0AC9A9008D0900600A
1070 DATA 4CB9C5A9C18D00AA90F8D
1630A9008D007EA211BD4FC99D1F0B
1080 DATA F904CA10F7A2FFEE27D0EE
21D0EE20D020B7C0CAD0F1A900E40E
1090 DATA 0D21D08D2000AE01D08E01
7A20B7C8CAD0F7A9648D11904C3A0C
1100 DATA 43C1EAA90F8D1690A90B8D
007EAD1190C986D000EA213BD221C80A
1110 DATA C99DF704CA10F74C9DC0A2
188D36C990F504CA10FTA2FFEE4F0E
1120 DATA 27D0EE12D0EE11D0EE18D0
EE0FD020B7C8CAD0EB4C43C18E530E
1130 DATA 8590BC8690A21EA0648BD0
FDCAD0F0AE8590AC8690E0EAEA1B0D
1140 DATA 4CB9C5230F3C3264A15A01
9C81C861FFA13261B0658165C30A
1150 DATA 6565026501650BFF020000
0000000000602040507070804C302
1160 DATA 0A0DC3D2C0CAD0CEC0D0C2
D3C9C8D1CFCBD1000001011FF00D70D
1170 DATA 0100FF000100FF0001000E
0F20200F181907050E20200C050903
1180 DATA 0614202121211400F0F200D
010E1920020F0E0513200212DFBE01
1190 DATA 08050E20212121190F1520
200D0104052020091420202121402
1200 DATA 21FF000000000000000000
0000000000000000000000002001
1210 DATA *
2000 DATA 00000000200000200000003A
00002A0000300000000000000000001
2010 DATA 001500001540005450008054
1001141015141400011400001400202
2020 DATA 0014000011700010700DF0
3000F0000100000002A00002A7A03
2030 DATA 00003A00002A0000300000
0000000000150000554000540A01
2040 DATA 500054100114140114040401
1400041400005500004500004300002
2050 DATA 0003C30003CF0001000000
00A000000A00000AC0000A0000D04
2060 DATA 2C0000200000200000540D
01540005150004150004144001A101
2070 DATA 1454001400001400001400
0D4400D04000C0F00000F00013101
2080 DATA 0000000A00000A00000AC
0000A000002C0000200000200001003
2090 DATA 0054000155000515000415
0014144010144000144000141021D2
2100 DATA 0055000051000C100000C3
C000F3C0010000C0010005D4549006
2110 DATA 5405554005554005147800
54A80100A0000000000000000E04
2120 DATA 0000000000000000000000
0000000000000000000000000000
2130 DATA 0000000000000001000000
00A00000A00000A00000A00000A102
2140 DATA A000002000002000005400
0155000155000555401454501040A3
2150 DATA 5410005400015500054540
0545403501703C00F00C00C001C104
2160 DATA 0000000000000000000000
0000000000000C00303C003C0400
2170 DATA 34005C0501405454001550
0000540000540001550005554E03
2180 DATA 1054105020144A00400A0
0000A0001000000000000003503
2190 DATA 0000000000000000000000
0000000000000000000000545400
2200 DATA 0001550001554005554005
5540055540145450542054440A02005
2210 DATA 443CA0F03CA0F0010000000
0000000000000000000000CD03
2220 DATA 0000000000000000020800
0A02A00002E000AAE00AAAA02A2E06
2230 DATA AAA0A9A9AAA9A9AA2AAAAA0
2AFFA80A0EA002AA0002800015400
2240 DATA 0000000000000000000000
0000000000000000000000000000
2250 DATA 0000000200000A02A000AA
E00AAAA02AAAAA6AA6AA6AA6A0F09
2260 DATA 2AAAA02AFFA80AAAA002AA
0000200010000000000000000F605
2270 DATA 0000000000000000000000
0000000001000009405055151301
2280 DATA 40555554545551105550000
4150090444089062040222044033B6
2290 DATA 1104101114504401000000
0000000000000000000000000000
2300 DATA 0000000000000000000000
00050010154154555495555055F702
2310 DATA 5550045550500444002244
0022200004400011100145500154A04
2320 DATA 0000000000000000000000
0000000000000000000000000000
2330 DATA 0000040050160154551555
57455515055504055100110600903
2340 DATA 8906208002104401104404
101105140100000000000000002102
2350 DATA 0000000000000000000000
0000000000000000050004154E500
2360 DATA 0415551505555605555505
551791105118800000001103304
2370 DATA 0004440005514001000000
0000000000000000000000000F00
2380 DATA 0000000000000000000000
1800006A80002A0000020024025401
2390 DATA 00A80000A0000000000000
020000020000022800000A0001A406
2400 DATA 0000000000000000000000
0000000000000000000000000000
2410 DATA 0000000000000000A0000202
0002020002020000020000003602
2420 DATA 0000A40200AB1A0020EA00
0020000001000000000000006A03
2430 DATA 0000000000000000000000
0000000000000000002300000AAD00
2440 DATA 0000020000AA0002A0023
AA8222FFE22AAAA20AAAA002AADE00
2450 DATA A000AA00003F000100000
0000000000000000000000000A02
2460 DATA 0000000000000000000000
0000002000000EC0000AA0020060A1
2470 DATA 2A8023AA8222FFE22AAAA2
0AAAA002AAA0000AA80003F00013C09
2480 DATA 0000000A0020200000000
020000020000220000220000A002
2490 DATA 2020000AAAA00AAA000299
8002AA0002AA0002BC0000AA003380
2500 DATA 0020000000000000000000
0000000001000000000000002900
2510 DATA 0000000000000000200000
AA0002AA000A66A02AAAA822AA5605
2520 DATA 80A2BC0000AA0A002080200
0002200000000A0020200200E06
2530 DATA 0000000000000000000000
0000000000000000000000000000
2540 DATA 0000000000000000000000
0000000000000000000000000000
2550 DATA 0000000000000000000000
0000000000000000000000000000
2560 DATA 0000000000FF00000000
0000000000000000000000FF00
2570 DATA *
```

David Swinnerton with a smooth and colourful program for the CBM-64 utilising sprites.

Listing 1 can now be loaded and run in the usual way. Listing 2 can now be loaded and run, and the game is ready. I suggest that listing 1 is saved just before listing 2 so that no swapping of tapes is needed. Every time you wish to play the game, the line of pokes must first be typed in. Then both programs can be loaded and run in quick succession.

To play the game, a joystick is needed in Port 1. The directions are:

pressing left — move Willy left
pressing right — move Willy right
pressing up — makes Willy jump over hole or an Antic
pressing Fire — makes Willy jump up to new level

Obviously, pressing up and left at the same time results in Willy doing a running jump to the left, a very handy manoeuvre.

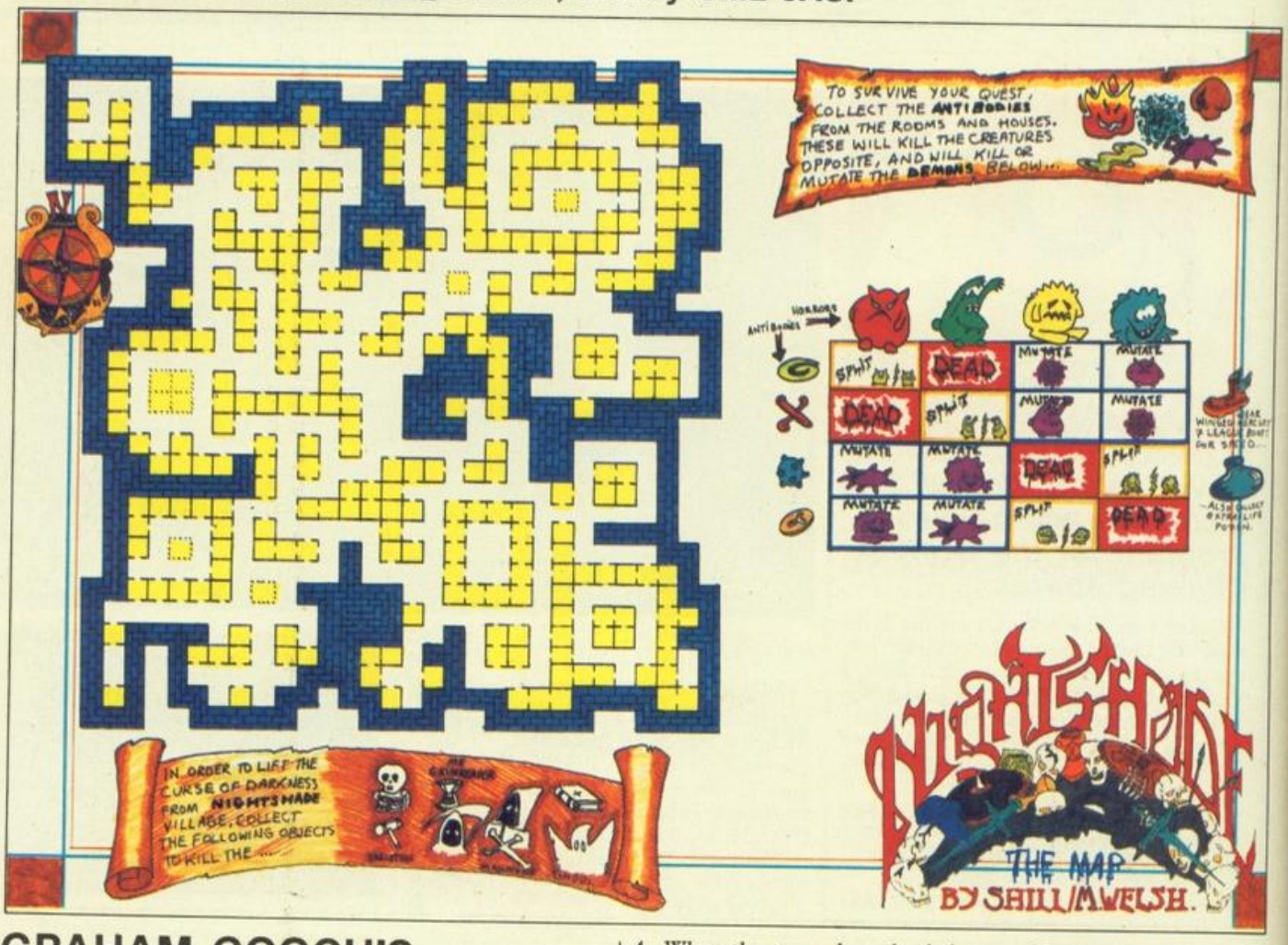
If you don't relish the thought of typing the game in yourself, then send £3.50 to David Swinnerton, 15 Bifrons Rd, Bekesbourne, Kent CT4 5DE. I will send you a fast loading version of Tower of the Antics on one side of the tape, and my other game, Auto 64 — see June issue — on the other side. ■

```
)+CHR$(0)):POKE182T+T,A:NEXT
T40 RETURN
T50 REM ****** HI-SCORE SCREEN *
******
T60 N=0:PRINT"[CLR]                TOWER
 OF THE ANTICS"
T70 PRINT"                 [RVS]
[OFF]";
T80 PRINT"                 [RVS]HI-SCORE
TABLE":PRINT"                 [OFF]
[RVS]"
T90 FORT=1TO10:PRINTTAB(7);"[7 SPACES]";HS
(T);TAB(22);"[7 SPACES]";N(T):NEXT
800 N=N+1:PRINT"[RVS][OFF][RVS][OFF][RVS]
[OFF][RVS]  [OFF]PRESS FIRE TO P
LAY  [RVS]"
810 FORT=1T040:IFPEEK(203)=60ORM
=10THEN190:REM RETURN
820 NEXT:PRINT"[RVS][OFF][RVS][OFF][RVS]
[OFF][RVS]
";
830 FORT=1T040:IFPEEK(203)<>60TH
ENNEXT:GOTO800
840 GOTO190
850 REM********** TITLE SCREEN **
*******
860 POKE53281,0:POKE53280,0
870 PRINT"[CLR]                T O
W E R"                    O F
880 PRINT"[3 DOWN]
 T H E"
890 PRINT"[3 DOWN]  [RVS] [OFF]  [RVS] [OFF]  [RVS] [OFF]  [RVS] [OFF]
[RVS] [OFF] [RVS] [OFF] [RVS] [OFF] [
```

It's the dead of night — no one can hear you scream. No one, that is, except David Williams, our adventure expert. Call him on 041-770 9599 after 9pm for help with your adventure problems — or nightmares . . .

HOT SHOTS

Heard any good pokes lately? Smashed any high-score barriers? Or perhaps you've just put the finishing touches to a game map that will put thousands out of their misery. Publish and be damned — and paid! Send in your secrets, high scores and maps to Hot Shots, *Your Computer*, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.



GRAHAM GOOCH'S CRICKET

The following tip will allow owners of Graham Gooch's Test Cricket on the 64 to save teams.

1. Load and run the Select program, and enter the teams as normal.
2. At the end when the program exists to Basic, enter the following . . .

POKE43,0:POKE44,192:POKE45,40:POKE46,194:
POKE56,200:CLR:SAVE"TEAMS" (,8 if using disc)

3. When the teams have been saved, switch the 64 off and then on again to reset the pointers, and load the teams by entering the following . . .

LOAD"TEAMS",1,1 (or ,8,1 if using disc)

4. When the teams have loaded, enter New and then load the main game program.

D A Henry Smithson.

WIZARDRY

Rewind tape to beginning and type: Load (return) — First small bit will load. Poke 1011,248:Poke 1012,252 (return). Run (return). 'Nova' section will now load and '64' will reset. Poke 2969,0 (return).

Sys 2816 (return). The four slow sections will now load.

POKE 3216,255:POKE 50766,255 (return)
POKE 3264,234:POKE 3265,234 (return)
POKE 27214,234:POKE 50151,234 (return)
POKE 50152,234:POKE 50153,234 (return).

The above pokes will give you more energy and will stop most nasties from deplenishing your energy.

Sys 2970 (return). Start Game.

Jason Hattrell.

competition THE GOONIES™

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- The names of the winners will be printed in the January issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in October 1985.
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- The decision of the editor is final.
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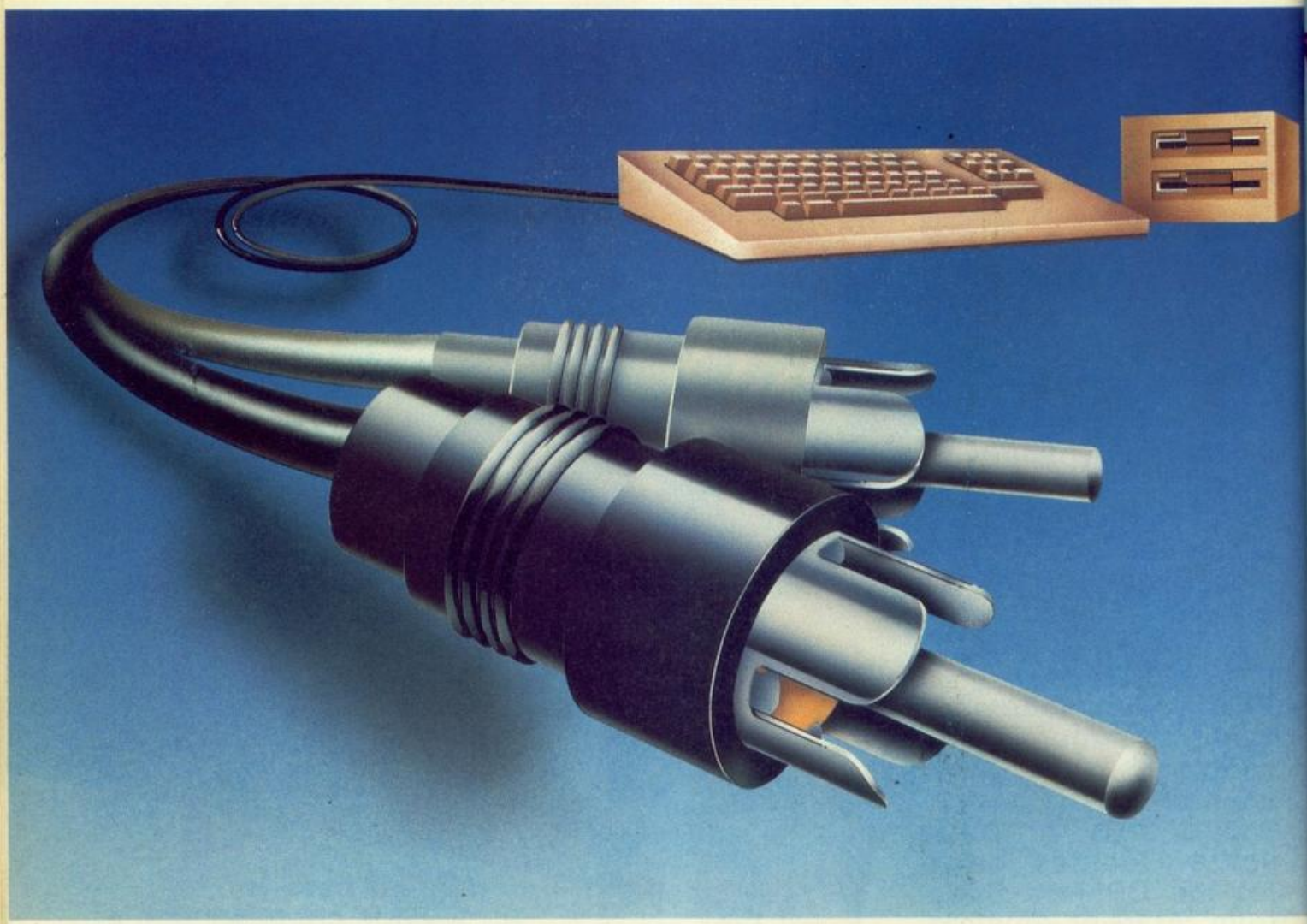
Don't forget to enclose this coupon, or a photocopy of it, when you send in your entry to Goonies Competition, *Your Computer*, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Name_____

Address_____

HOW DO YOU MAKE A COMPUTER SHARPER?



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PHILIPS. TAKE A LOOK AT OUR IMAGE.

PHILIPS

THE AIM of the game is, by pushing blocks around, to trap the three aliens who are trying to get you. Once an alien is trapped it dies, and can be ignored or squashed, and when all three are dead, you move to the next level — faster aliens and less blocks.

Your man is controlled with a joystick or the cursor keys and by pressing the fire button or space bar, you can move around faster. The arrow on the score level indicates the high-score.

First type in listing 1 — save it before running as the machine will probably reset. Next type in listing 2, run it, correct the errors and save it directly after listing 1 using:

SAVE"CODE",B,36980,924

Rewind the tape and load the game normally.

Renny Garderet springs an Amstrad ambush to alienate the aliens.

Listing 1.

```
10 '**********************
20 '#  T R A P   ' E M  #
30 '**********************
40 GOSUB 460:'(INITIALISE)
50 GOSUB 290:'(NEW GAME)
60 GOSUB 110:'(NEW SCREEN)
70 CALL MAIN
80 IF PEEK(X(2))=0 AND PEEK(X(3))=0 AND PEEK(X(4))=0 T
HEN FOR N=239 TO 63 STEP -2:SOUND 1,N,1:NEXT:FOR PAUSE
=1 TO 100:NEXT:LVL=LVL+1:GOTO 60
90 CALL SPRITE,PEEK(X(1)),PEEK(Y(1)),3:LVS=LVS-1:FOR N
=63 TO 239 STEP 2:SOUND 1,N,1:NEXT:FOR PAUSE=1 TO 500:
NEXT
100 IF LVS<>0 THEN 60 ELSE 50
110 '***************
120 '# NEW SCREEN #
130 '***************
140 IF LVL>20 THEN LVL=20
150 CLS#1:FOR N=1 TO 5:CALL SPRITE,19,1+(6-N)*2,2*ABS(
N<=LVS):NEXT
160 FOR N=1 TO 75-LVL*2
170 X=INT(RND*16+2):Y=INT(RND*11)*2+3:IF X=17 AND Y=11
 THEN 170
180 CALL SPRITE,X,Y,1:NEXT
190 RESTORE 200:FOR N=1 TO 4:READ A,B:POKE X(N),A:POKE
 Y(N),B:NEXT:POKE &9244,1:POKE &9171,3
200 DATA 17,11,2,3,2,23,17,23
210 POKE SP,41-LVL*2
220 FOR N=2 TO 4:CALL SPRITE,PEEK(X(N)),PEEK(Y(N)),4:N
EXT
230 X1=XPOS:Y1=YPOS
240 SOUND 1,478,75:FOR Y=202 TO 244 STEP 0.5:MOVE 558,
Y:DRAWR 4,0,0:NEXT
250 FOR X=19 TO 18 STEP -1::FOR PAUSE=1 TO 500:NEXT:SO
UND 1,127
260 CALL SPRITE,X,11,0:CALL SPRITE,X-1,11,2:NEXT
270 FOR Y=244 TO 202 STEP -0.5:MOVE 558,Y:DRAWR 4,0,7:
NEXT:PLOT -10,-10,1:MOVE X1,Y1
280 RETURN
290 '*************
300 '# NEW GAME #
310 '*************
320 WHILE INKEY$<>"":WEND
330 CLS#1:PEN#1,4:PRINT#1:PRINT#1,"    HIGH SCORES":PEN
#1,3:PRINT#1,"    ===========":PEN#1,12:PRINT#1:PRINT#1
,"    SCORE:";:PEN#1,2:PRINT#1,"  0"
340 PEN 2:FOR Y=YPOS TO 2 STEP -2:MOVE 580,Y:DRAWR 20,
0,0:SC=SC+10:LOCATE#1,11,5:PRINT#1,SC;CHR$(7);:NEXT
350 IF SC<HI(10) THEN 390 ELSE HI(10)=SC
360 PEN#1,6:LOCATE#1,4,7:PRINT#1,CHR$(20):INPUT#1,";",
HI$(10):IF LEN(HI$(10))>8 THEN 360 ELSE LOCATE#1,4,7:P
RINT#1,CHR$(20)
370 FOR N1=1 TO 9:FOR N2=N1+1 TO 10:IF HI(N2)>=HI(N1)
THEN H=HI(N2):H$=HI$(N2):HI(N2)=HI(N1):HI(N1)=H:HI$(N2
)=HI$(N1):HI$(N1)=H$
380 NEXT N2,N1
390 FOR N=15 TO 25:LOCATE 20,N:PRINT " ";:NEXT:PLOT -10
,-10,7:TAG:MOVE 608,(HI(1)/10)*2+8:PRINT CHR$(242);:TA
GOFF
400 PEN#1,6:FOR N=1 TO 10:LOCATE#1,1,N+6:PRINT#1,N;HI$
(N);TAB(12);HI(N);:NEXT
410 PEN#1,3:LOCATE#1,3,20:PRINT#1,"SPACE";:PEN#1,4:PRI
NT#1," or ";:PEN#1,3:PRINT#1,"FIRE":PEN#1,4:PRINT#1:PR
INT#1,"    TO START"
420 WHILE INKEY$<>"":WEND:A$="":WHILE A$<>" " AND A$<>
"X":A$=INKEY$:WEND
430 IF A$=" " THEN POKE LEFT,8:POKE RIGHT,1:POKE UP,0:
POKE DOWN,2:POKE FAST,47  ELSE POKE LEFT,74:POKE RIGHT
,75:POKE UP,72:POKE DOWN,73:POKE FAST,47
440 LVS=5:LVL=0:SC=0:PLOT -10,-10,1:MOVE 600,0
450 RETURN
460 '***************
470 '# INITIALISE #
480 '***************
490 SYMBOL AFTER 32:MEMORY 36979:LOAD"!CODE",36980
500 SYMBOL 33,10,32,73,2,0,36,124,63:SYMBOL 34,0,24,60
,60,60,60,24,60:SYMBOL 36,0,90,60,60,255,60,126,255:SY
MBOL 38,112,222,236,242,190,222,248,246
510 SYMBOL 254,219,146,146,210,82,82,219:SYMBOL 255,18
7,170,170,171,178,170,171
520 INK 0,0:BORDER 0:PAPER 0:MODE 0:INK 14,0,26:INK 15
,26,0
530 PEN 5:PRINT "-- - - - -- - - ----":PRINT CHR$(22);
CHR$(1):PEN 3:LOCATE 1,1:PRINT"  T R A P  ' E M":PRINT
 CHR$(22)CHR$(0);
540 PEN 7:PRINT CHR$(150);STRING$(16,CHR$(154));CHR$(1
58);CHR$(154);CHR$(156);
550 FOR N=3 TO 12:PRINT CHR$(149):LOCATE 18,N:PRINT CH
R$(149);" ";CHR$(149);:NEXT
560 PRINT CHR$(149):LOCATE 18,13:PRINT CHR$(151);CHR$(
154);CHR$(153);
570 FOR N=14 TO 24:PRINT CHR$(149):LOCATE 18,N:PRINT C
HR$(149):NEXT
580 PRINT CHR$(147);STRING$(16,CHR$(154));CHR$(153)
590 PEN 2:LOCATE 19,14:PRINT CHR$(254);CHR$(255)
600 MOVE 576,0:DRAWR 0,170,3:DRAWR 28,0:DRAWR 0,-170:D
RAWR -28,0:PLOT -10,-10,1
610 RESTORE 620:FOR N=1 TO 4:READ Y(N):X(N)=Y(N)+2:NEX
T:SP=&907D:MAIN=&9187:SPRITE=&9249:LEFT=&918C:RIGHT=&9
19C:UP=&91AC:DOWN=&91BC:FAST=&922F
620 DATA &923F,&9240,&9243,&9246
630 FOR N=1 TO 10:HI$(N)="Arnold":HI(N)=330-N*30:NEXT
640 WINDOW#1,2,17,3,24
650 RETURN
```

Listing 2.

```
10 '** HEX LOADER **
20 ADDR=36980:LIN=70:MEMORY ADDR-1
30 SUM=0:READ A$,CHECKSUM:IF A$="END" THEN 60
40 FOR N=1 TO LEN(A$)-1 STEP 2:X=VAL("&"+MID$(A$,N,2))
:POKE ADDR,X:SUM=SUM+X:ADDR=ADDR+1:NEXT
50 IF SUM<>CHECKSUM THEN PRINT"ERROR in":LIN:END ELSE
LIN=LIN+10:GOTO 30
60 PRINT"DATA CORRECT":END
70 DATA 3A44923D324492C03E003244 92DD4604DD4E023A4792D6
033003 2E063247922 13E92160005F19229F90DD2100000D7E02FE00
2003FEFFC9DD5604DD5E02CD0E9130 01C978BA280630031410011 5
,6637
80 DATA 79EB2003804 1C1C18021D1D626BCD0391381162DD6E02
CD0391380DD660460CD0391D0E5C53E00CD4C92C1E1DD7404DD75
027 8BC200379BDC83E04CD4C92FEFFC9E5CD75BBE1CD60BBFE23C9
,9041
90 DATA 626B25CD0391D02D2DCD0391D024CD0391D024CD0391D8
2C2CCD0391D82C2CCD0391D025CD0391D025CD0391D02D2DCD0391
D03E05CD4C92DD360200DD360400217591CDAABC217E91CDAABC11
,8657
100 DATA ECFF210200CDC3BB111400210000CDF9BB2171913 53E0
0FE00C901000000C03000F19000100000EE2E000F320000D213D923E0
0CD1EBB280921250 0CDDA91C818333E00CD1EBB280921240 0CDDA9
1,6312
110 DATA C818233E00CD1EBB280921 2D2DCDDA91C818133E00CD1
EBB280921 2C2CCDDA91C81803CD60BBCD7490C83E42CD1EBB28AEC
922E09122099 2DD6604DD6E021625240 0E5CD75BBE1CD60BBFE262
0,8423
120 DATA 04162318EEBAD0D5E53E00CD4C92DD6604DD6E0224 00D
D7404DD752CD758BCD60BBFE242003E1E1C93E02CD4C92C1F1FE2
320053E01CD5292 3E00CD1EBBC02100152B7CB520FBFEFFC9 00000
0,8816
130 DATA 00000000000000DD7E00DD4E02DD46043C0D052138921
14400193D20FCE56069CD1ADC545DE13E10F5D501040 0ED80D1EBC
D26BCEBF13D20EFC9 00000000000000000000000000000000000000
0,5800
140 DATA 00000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000001
43C00002C040F2800A0F0000F00280081E3C280D143C280C1E280
0,642
150 DATA 20 1E1428042 83C3C043C003C043C3C280528 3C3C053C3
C1414280 03C143C3C3C00003C28003C280000000000142800003
C3C00000D0E00000068946000 3C3C00001428000 0C1C2004 0C3C3804
0,3493
160 DATA C3C38000C1C20080C9C64498303064880303044044880
000CCCC0000000000030300000201000302010302000001030201
0300002010000020100000201000002010000020100000020100000
8,3544
170 DATA 0C00040C0008040404060C08080C080C0C0C000000000
0000000104 58A2000659A0000CFCF00CFCFCFCF00333300443338
89D9966EE443338811 76B92211B874221176B922113333220033 3
3,4578
180 DATA 00282010143C2814 3C0000000000020200020000010 0
020100000002000000000020450045 9ACF0000CFCF30443CF8A9
D9913454433338811 7666EE11B0B9883976742239 33B9363C333e3
C,4567
190 DATA END,0
```

Basic Program.

```
  1 REM MAIN ASTEROIDS BASIC
  2 DIM h(8): DIM h$(8,15): LET
usr=28501: LET redef=30853
 10 CLS : PRINT 'TAB 11;"ASTERO
IDS"''TAB 5; BY I.M. COLLIER 8/8
5"
 20 PRINT '''TAB 5;"Press P to
play game                or K to
redefine keys."
 30 POKE 23658,8: PAUSE 150: LE
T 1$=INKEY$
 40 IF 1$="K" THEN GO SUB 200:
GO TO 10
 50 IF 1$="P" THEN GO TO 300
 60 IF NOT h(1) THEN GO TO 30
 70 CLS : PRINT ''TAB 10;"HIGH
SCORES"'''
 80 FOR x=1 TO 8: IF h(x) THEN
PRINT TAB 5;"00000"(LEN STR$ h(x
) TO );h(x);" ";h$(x)
 90 NEXT x: PAUSE 250: LET 1$=I
NKEY$
 100 IF 1$="K" OR 1$="P" THEN GO
 TO 40
 110 GO TO 10
 200 CLS : PRINT ''"Press the ke
ys for:"'': RANDOMIZE USR redef:
 PAUSE 1: PAUSE 50: RETURN
 300 CLS : PAUSE 50: RANDOMIZE U
SR usr: PAUSE 1: PAUSE 50
 310 IF PEEK (usr-5) THEN GO TO
10
 320 LET sc=PEEK (usr-4)+256*PEE
K (usr-3): IF sc*10>h(1) THEN PO
KE usr-2,PEEK (usr-4): POKE usr-
1,PEEK (usr-3)
 330 IF sc*10<h(8) THEN GO TO 10
 340 FOR x=1 TO 8: IF sc*10<h(x)
 THEN NEXT x
 350 FOR y=7 TO x STEP -1: LET h
$(y+1)=h$(y): LET h(y+1)=h(y): N
EXT y
 360 CLS : PRINT ''TAB 7;"CONGRA
TULATIONS!"''TAB 7;"YOU HAVE TOD
AY'S "''TAB 7;STR$ X AND X>1;"ND
" AND X=2;"RD " AND X=3;"TH " A
ND X>3;"HIGHEST SCORE."
 370 PRINT 'TAB 4;"PLEASE ENTER
YOUR NAME."
 380 PRINT AT 10,7;"<_________
___>"
 390 LET N$=""
 400 PRINT AT 10,8;n$;"_" AND LE
N n$<15
 410 PAUSE 0: LET 1$=INKEY$
 420 IF 1$=CHR$ 12 AND n$<>"" TH
EN LET n$=n$( TO LEN n$-1): BEEP
 .005,34
 430 IF 1$=CHR$ 13 THEN GO TO 46
0
 431 LET 1$=(1$ AND CODE 1$<128)
+("~" AND 1$=" STOP ")+("¦" AND
1$="NOT ")+("\" AND 1$=" STEP ")
+("{" AND 1$=" TO ")+("}" AND 1$
=" THEN ")+("[" AND 1$=" AND ")+
("]" AND 1$=" OR ")
 440 IF 1$>CHR$ 31 AND 1$<CHR$ 1
27 AND LEN n$<15 THEN LET n$=n$+
1$: BEEP .005,34
 450 GO TO 400
 460 LET h(x)=sc*10: LET h$(x)=n
$
 470 GO TO 70
 500 BORDER 1: PAPER 0: INK 7: B
RIGHT 1: CLEAR 26920: LOAD "ASCO
DE"CODE : POKE 23675,42: POKE 23
676,108: POKE 23606,42: POKE 236
07,104: RUN
```

ASTEROID ATTACK is a program for the 16 or 48K Spectrum which is probably as close as the Spectrum allows to the arcade version. It has full rotation not limited by the scope of graphics characters; the ship is drawn onto the screen using sines and cosines. Thrusting provides the ship with frictionless motion up to a maximum speed of just less than that of a bullet.

The ship and bullets are moved to an accuracy of 1/128 of a pixel (stored — not on the screen). Obviously the sound cannot reach the high arcade standard, but I have created the best possible effects.

The machine code is created by the two high-speed data loaders. Type in the first Data Program and save a copy. Run the program and if lines 100 and 110 are correct, the machine code high-speed loader will be saved. If they are not correct, check and double check these lines until they are. If this machine code is correct, the Save and Verify statements can be removed from line 70.

After line 110 has been slow-poked, the other lines will be fast-poked into place (see the difference?). If this does not take place, reload the program and check lines 100 and 110. Don't worry about the mess on the screen as the high-speed loader runs; this is the only place to store the code as yet. When all the errors have been corrected, the code will be saved. Save another copy of the program as well. New the machine and type in program 2. You needn't bother about the lines starting with Rem.

Run the program. If the fast-load code is not in place, it will be loaded before part 2 of the machine code is fast-poked into place. Again, correct all the errors and save the code. Also save the program. New the computer and type:

```
CLEAR 26900:LOAD "ASCODE1"CODE
26922:LOAD "ASCODE2"CODE 29242
```

Play the tape on which you saved the two parts of code. The machine code is now set up. The graphics pointer can be set up by

```
POKE 23675,42:POKE 23676,108
```

and the new character pointer by

```
POKE 23606,42:POKE 23607,104
```

If you like you can test the code by

```
RANDOMIZE USR 28501
```

Type in the main Basic program. The finished program can now be saved by

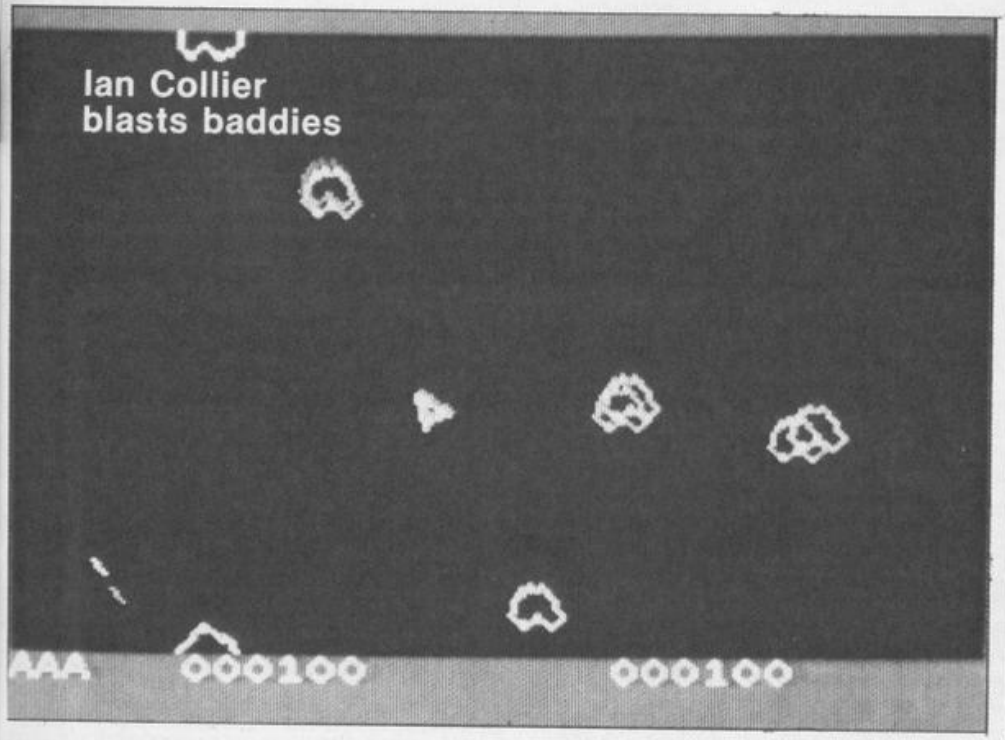
```
CLEAR:SAVE "ASTEROIDS" LINE 500:
SAVE "ASCODE"CODE 26922,4671
```

You will notice if you do the Pokes above that I have designed a new character set. The capitals and digits — also all brackets, string and hash — have been made slightly larger and closer to ordinary script. An advantage of this is that capital A looks like a ship and so is used to print the 'lives'. You can shorten the typing by removing this — omit the charcter pointer

Program 1.

```
  1 REM DATA PROGRAM 1
  2 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
 10 RESTORE : LET a=23296: FOR
x=100 TO 400 STEP 10
 20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0;"Length error in line ";x: S
TOP
 30 IF x>110 THEN PRINT AT 16,0
;"Line ";x;" ";CHR$ USR 23296,a,
a$,t: LET a=a+LEN a$/2: GO TO 80
 40 POKE a,FN h(a$): LET t=t-PE
EK a: LET a=a+1
 50 LET a$=a$(3 TO ): IF a$<>""
 THEN GO TO 40
 60 IF t THEN PRINT AT 16,0;"Er
ror in line ";x: STOP
 70 PRINT AT 16,0;"Line ";x;" O
K": IF x=110 THEN SAVE "hex"CODE
 23296,144: VERIFY "hex"CODE : L
ET a=16384
 80 NEXT x: PRINT AT 16,0;"All
OK - Saving part 1"
 90 SAVE "ASCODE1"CODE 16384,23
20: VERIFY "ASCODE1"CODE
 100 DATA "08740cd811ccda22ded43
905be7cd8c1ccdf12bed53925bcb38cb
19386578b7c21a374121000022945bc5
2a925b7ecbafd610fe0a3802d627fe10
3046070707074f237e2322925bcbafd6
10fe0a3802d627fe"
 110 DATA "060761030 2d812a905b77
2322905b5f16002a945b1922945bc110
becd811ccda22d2a945bb7ed427cb520
073e4fd7014b00c911895bafcd0a0ccf
08804552524f528d"
 120 DATA "0142200000000000000000
0018181818180018002424000000000
0014161c361c341400081e281c0a3c08
0062640810264600001028102a443a00
0008100000000000000810202020100 8
0010080404040810"
 130 DATA "0161800001408 3e0814 00
000008083e0808000000000000080810
000000003e0000000000000001818 00
0000020408102000001824424242241 8
0018280808080 83e003c42023c40407e
003c42021c02423c"
 140 DATA "0252300040c14247f0404
007e40407c02423c003c40407c42423c
007e0204081020200 03c42423c42423c
003c42423e02023c0000001000001000
0000100000101020000408102010080 4
0000003e003e0000"
 150 DATA "0429000201008040810200
003c42040800080000 3c4a565e403c00
00081414223e4141007c42427c42427c
003c42404040423c007844424242478
007e40407c40407e007e40407c404040
003c42404e42423c"
 160 DATA "0411900424242 7e424242
003e0808080808 3e0002020202023c
0044485070484442004040404040407e
0041635549414141004161514945434 1
001c22414141221c007c42427c404040
001c22414145221d"
 170 DATA "03457007c42427c484442
003c42403c02423c00fe1010101010 10
0041414141412 21c0041412222141408
0041414149556341004122140814224 1
0041221408080808007f020408102 07f
003c20202020203c"
 180 DATA "0237900004020100804 00
003c04040404043c0010385410101000
0000000000000ff001c227820207e00
0000380 43c443c0000202 03c22223c00
0000 1c2020201c00000404 3c44443c00
0000384478403c00"
 190 DATA "0258000 0c1018101010 00
0000 3c44443c0438004040 7844444400
0010003010103800000400040404241 8
0020283030282400001010101010 0c00
0000685454545400000078444444440 0
0000384444443800"
 200 DATA "0279800007844447840 40
00003c44443c040600001c2020202000
0000384038047800001038101010 0c00
0000444444443800000044442828100 0
0000445454542800000044281028440 0
0000444428102040"
 210 DATA "0244600007c0810207c00
000c1010201010 0c0008080808080800
0030080804080830003 24c0000000000
3c4299a1a199423c0000000003600c90
1010100820042004200420024001201c1
11220e1400080000"
 220 DATA "0691700000000036 00ff0
1ff01ff83ffc3ffc3ffc3ffe7fff3fff
3f3e0e1c0008000003800440082008 1c
1002200240028001800180018001820 1
8502488c3070000003800 7c00fe00ffc
1ffe3ffe7ffeffff"
 230 DATA "08434fffffffffffffff
```

ASTEROID ATTACK



Pokes above from the program, also omit lines 120 to 200 inclusive of Data program 1 and change:

```
LET a = 16384
```

in line 70 to:

```
LET a = 17104:LET x = 20
```

You can also shorten typing by omiting the fast-poke code, though the program will take ages to poke the data. To do this, omit lines 100, 110 in Data program 1, also omit 30, all but the first statement of line 70, and change 10 to:

RESTORE: LET a = 16384 (17104 to omit the character set): FOR x = 120 (210 to omit the character set) TO 400 STEP 10

Also omit 3 and 30 of Data program 2 and add all the lines which in the listing start with Rem, but do not type Rem — (except line 1). However the fast-poke code greatly reduces poking time and can be used in other programs where hex has to be poked into memory and a checksum is provided. The syntax is:

PRINT USR 23296, destination, hex — either a string name eg. a$ or a string of digits eg. "01ed2f"), checksum — (the sum of all the bytes in the string).

Having saved a copy of the finished program onto tape (with or without character set and/or fast-poke), you are now ready to clear the computer and load it.

You are given the option to play the game or redefine the keys — no joystick option, I'm afraid; Interrupt mode 2 on a 16K machine crashes with certain peripherals attached. If you do not redefine the keys they are X-left, C-right, L-fire, P-thrust, Z-Hyperspace, and Space-Abort. You will appear in the centre of the screen. The object is to avoid being killed by the rocks hurtling towards you by blasting them out of space. These large rocks, on being hit, will split up into two smaller asteroids, which in turn split up into two small ones.

These are destroyed when you hit them. If

(continued on next page)

```
fdfe78fc307000001c62818182814638
1c7effffeff7e380000000003c00420
05a005a004203ffc4002924992494002
3ffc0000000000000000000003c007e0
07e007e007e03ffc"
 240 DATA "054887ffeffffffff7ffe
3ffc0000000000000000000001c00220
02a002200ff810042552104040ff80000
0000000000000000000000001c003e0
03e003e00ff81ffc3ffe1ffc0ff80000
00000000000000"
 250 DATA "09039110101d9e5d9cb79
2805af914f1effcb782805af904716ff
79b8300669d5af5f1808b1282a6841d5
160060781f853803bc3807944fd9c1c5
18044fd5d9c12a7d5c78844779854fcd
8d6dd97910dfd1d9"
 260 DATA "09624e1d9c978feb0d4ae
6ded437d5ccdaa2247043efe0f10fd47
7ea0fdcb57562002a82f77c9fed83804
c6b047c9d6b047c91e01cb7928041eff
cbb9cb7128043e80914f692600d51126
6e19d14e2600af2e"
 270 DATA "1008508cb1117b8380190
3fcb142d20f36f1dc8af9467af956fc9
c579d6404fcdba6dc1cd0b6ee5c5cdba
6dc1cd0b6e44e14cc97cb5cb7f20077d
a717b8d824c9af95a717b8d825c9cdf2
6dc33a6d00060c12"
 280 DATA "13064181f252b31373d44
4a4f555b61676d72787d83888d92979c
a1a6abafb4b8bcc1c5c9ccd0d4d7dadd
e0e3e6e9ebedf0f2f4f5f7f8fafbfcfd
fdfefefeff3ae46eed4be56ecb45282e
c5c6e04f063ccdf2"
 290 DATA "099226de1e57c80477d81
4fcd8d6d3ae46ec6a04f063ccd206e3a
e46ec6604f063ccd206ec13ae46ec506
3cc6404fcdf26de17884477d814fc5cd
8d6d3ae46e061ac6b04fcd206ee13ae4
6e227d5c061ac6d0"
 300 DATA "080674fcd206e3ae46e06
80c6504fcd206e3ae46e062bc6804fc3
206e0080580976000000000cd6b0dcdf6
77cdb2773a4f6f3c324f6f32d87687c6
36672e1022d6763ad8764721697b7023
360123cd6076cb2f"
 310 DATA "07955cb2fcb2f774f23cd
6076cb2fcb2fcb2f5ffeb03802d65077
2379cb2fcb2f774f237bcb2fcb2fcb2f
77b1200134231 0c622d976c90a05018e
030000ed73d476af3241713e0332506f
3e02324f6f324e6f"
 320 DATA "08800210000221a742251
6f221874cded6e21805822e56e210000
22e96e22eb6eaf32e46e3240713e06ed
47ed5ec3857076184030b78b120fbfd
cb57d63a99706fcd676eaf47cd607878
ce0047cd6a7878de"
 330 DATA "079210047a720073e0332
9870180f3a9870a728093d3298707880
80180678878787878 0473ae46e8032e4
6e3efedbfecb4f2014212823110500cd
b503cd60766fcd60766722e56e214071
7ea72801353ebfdb"
 340 DATA "10366fecb4fccb5703a99
701f30353ae46e4f0604c5cdba6dc1e5
79c6404fcdba6ded4be96e54e15c2aeb
6ecd9a7078c60ffe1e300e79c60ffe1e
300722eb6eed43e96e2ae56eed4be96e
78844779854fed5b"
 350 DATA "10037e76e2aeb6ecd9a70
22e76e78feb0380afed83eb030023e50
8047ed43e56ecd7e7820083e3eed56ed
47fbc9fdcb5796cd74789f3c3299706f
cd676ec3986f03007c82e2a670043002
0505d680677d83e2"
 360 DATA "08378b3700c30020d0dd6
806fc97ea73e0277c02ae56e22667a3a
e46e32687a21417146f3347887878780
6f2600114471193610232242713a687a
4f0619c5cdba6dc1e579c6404fcdba6d
c1dd2a4271dd7004"
 370 DATA "07932dd7405dd7106dd75
07ed5b667a3a41711f380a78cb2f835f
7ccb2f8257dd7300dd7201dd360200dd
3603002132000604c5e5110a00cdb503
f3e1c1110a001910ef214071fbc90001
4571004c44e9ebf6"
 380 DATA "12198fffdfa63c9fe53c0
fdcb015663c9fe53c0fdcb015663c9fe
53c0fdcb015663c9fe53c0fdcb015663
c9fe53c0fdcb015663c9fe53c0fdcb01
5663c9fe53c0fdcb0156c0c33463f1f5
210000c0c33463f1"
 390 DATA "10054f5210000e5e5e530
1806001 1e37f1afdcb0146200cfdcb01
f6cdad753e07da777afe3bcab872cdc9
772d687ecd4d74211f7be51600d521e9
7f1808add8743e02dab871dde5e5d5c5
f52a7d5ce53a915c"
 400 DATA "09134f508f5d9c5d5d9ff
f321d676352009237e2b77218813180b
7e872396fe02300a218e1211020 0cdb5
03f3cd54793a4171a7ca057347dd2144
71c5fdcb57d6dd4e01dd4602c5cd8d6d
dd4e05dd4606cb29"
```

(continued from previous page)

one hits you — and all crashes are screen-checked, so no gyps — you explode and, providing you have a life left, you will appear back on the screen when a box 100 by 80 pixels is clear of asteroids. If you think this box is too large or too small, you can alter its size (see Pokes Table). In a desperate situation, hyperspace takes you away from the path of converging asteroids and plants you in a random position on the screen. However, this may move you into the path of another asteroid — so use with caution.

Levels vary in difficulty, partly because more asteroids appear. There are also alien ships which career across the screen firing at you. It can split asteroids — you get the points — but this can be a hazard as more small asteroids are created. If it crashes into an asteroid, it has a chance of being blown up — you don't get the points. There are two sizes of alien: slow large ones — these usually blow up on contact with anything — and faster small ones — these may not blow up on contact with an asteroid. The contents are in brackets.

The following pokes are available — normal

28510 Number of lives. (do not use more than 32. However if you use more than 6, the score will be printed on top of them.) (3)

28515 One less than the starting number of asteroids. If you poke this with an odd number, you will not be able to be killed. (2)

31099 Controls the generation of aliens. A higher number gives increased probability (11).

31116 Controls the type of aliens. A higher number means a greater proportion of large aliens. (15)

The following locations hold the parameters for the box which must be clear of asteroids before your ship is printed:

30773 Left x coordinate (78)
30777 Right x coordinate (178)
30784 Bottom y coordinate (48)
30788 Top y coordinate (128)

If you abort a game with a high score, your achievement will not be recognised. To change this, remove line 310 from the Basic program. If the program seems too daunting, I will supply a cassette of the completed game for £2.00 to: Ian Collier, 57 Wyndham Avenue, Bolton, BL3 4LG. ■

Program 2.

```
   1 REM DATA PROGRAM 2
   2 DEF FN a(a$)=CODE a$-48-7*(
a$>"9")-32*(a$>"Z"): DEF FN h(a$
)=FN a(a$(1))*16+FN a(a$(2))
   3 IF PEEK 23296<>205 THEN PRI
NT "Loading hex code": LOAD "hex
"CODE : CLS
  10 RESTORE : LET a=16384: FOR
x=100 TO 390 STEP 10
  20 READ a$: LET t=VAL a$( TO 5
): LET a$=a$(6 TO ): IF LEN a$/2
<>INT (LEN a$/2) THEN PRINT AT 1
6,0;"Length error in line ";x: S
TOP
  30 PRINT AT 16,0;"Line ";x;" "
;CHR$ USR 23296,a,a$,t: LET a=a+
LEN a$/2
  40 REM POKE a,FN h(a$): LET t=
t-PEEK a: LET a=a+1
  50 REM LET a$=a$(3 TO ): IF a$
<>"" THEN GO TO 40
  60 REM IF t THEN PRINT AT 16,0
;"Error in line ";x: STOP
  70 REM PRINT AT 16,0;"Line ";x
;" OK"
  80 NEXT x: PRINT AT 16,0;"All
OK - Saving part 2"
  90 SAVE "ASCODE2"CODE 16384,23
51: VERIFY "ASCODE2"CODE
 100 DATA "08052cb28cd3a6dc1dd7e
00a7203b3a41713d3241713c47878787
804f0600dde5d121090019edb0dde5d1
2a1a74a7ed52da0073280b1911f7ff19
221a74c30073210000221a74c30073dd
3500dd6606dd6e05"
 110 DATA "08119788447feb0380afe
d83eb030023e50804779854fdd6608dd
6e07dd5e03dd5604cd9a707ccb7c200a
fe19380ed61904671808fee73004c619
05677dcb7d200afe19380ed6190c6f18
08fee73004c6190d"
 120 DATA "101726fdd7101dd7002dd
7503dd7404fdcb5796cd8d6ddd4e05dd
4606cb29cb28cd3a6d110900dd19c105
c22372cd1c74d9d1c1d9f108f132915c
e1227d5cf1c1d1e1dde1fbc9321674d9
e50f0f3d28053cfe"
 130 DATA "06598c03802d6306f2600
ed5b7b5c19eb2120003a1674fe022003
21080019eb4d44d921000022c973cdaa
22321774e5d9e1d906103a1674fe0220
020608c5d9e50a03083a1674d6022802
0a03d94f08471600"
 140 DATA "101056ad91a13083a1674
d6022802la13d967085f3a1774a7280f
cb38cb19cb1acb3bcb1ccb1d3d20f1d9
7ed9a3a8c4c373d9cdcb737ed9a4a9c4
c373d9cdcb737ed9a5aac4c373d9c3d5
733e0132c973c900"
 150 DATA "08779002c7de61fc07dd6
206fc9e1247ce60720187dc6206f3812
7cd60867fe50200a7dfec038052640d6
c06fd9c105c265733aca73a7280ffe10
280bfe08200b3a1674fe0220043ac973
a7e1d9c90004feca"
 160 DATA "1040844713ad876a7cced
6e3ad876473a1874a7cc7779dd21697b
dd3500c5dd7e01dd4e02dd4603203fdd
360004fdcb57d6c5cdc275fdcb5796c1
dd7e01fe03d2cf79dd7e04814fdd7e05
8047feb0380afed8"
 170 DATA "083333eb030023e508047
dd7102dd7003dd7e01c5cdc275c13a41
71a7282b2145715f7e913cfe10301878
23962b3cfe10daf7745778fe0f30087a
d650fe10daf7747b11090019 3d20d83a
4e6f1f38352ae56e"
 180 DATA "098367d91c604fe163022
7894c604fe16380d5f78fe0f30147bd6
50fe16300ddd7e01fdcb5796cd1e73c2
9076dd7e01fe03d45479c1110600dd19
05c23274c92b7e23a7caa974dd7e01e5
c5fdcb5796f5d5cd"
 190 DATA "101131e73d12006f1c1e1
c3a974f1fdcb57d6c1c5cdc275cd8d77
21d77635060fcd7176c1e1dd7e012b36
00fe02382e21d87635dd7e01fe033804
af3218742ad976dde5d1a7ed52444d21
060019edb011faff"
 200 DATA "07846dd192ad9761922d9
7618871105001 97ecb2fcb2fdd86045f
3cdd7704237ecb2fcb2fdd8605 57cd60
76e60182dd7705dd7e013d28023e02dd
770121d876342ad9763604237723dd7e
0277dd7e03237723"
 210 DATA "07787cd6076e6012f8377
cd6076e6012f8223772322d976c3e474
321674d9e50f0f3d28053cfec03802d6
306f2600ed5b7b5c19d9cdaa22321774
06103a1674fe0220020608c5e5d97e23
083a1674d6022802"
 220 DATA "093557e23d94f085f1600
3a1774a7280947cb3bcb19cb1a10f8fd
cb57562012 7bae77cdcb7379ae77cdcb
737aae77c33b767b2fa677cdcb73792f
a677cdcb737a2fa677e1247ce6072018
7dc6206f38127cd6"
 230 DATA "096560867fe50200a7dfe
c038052640d6c06fc11090e1d9c9e5d5
ed5f6f260011697a197ed1e1ed4fc9e5
21697a7e230e085fe618f601d3fe1614
f5f11520fb7b0f0d20ed10e7e1c93eff
32d676324e6f2118"
 240 DATA "08874747ea72002360221
1974cbfeed7bd476215827d921506f35
cdf677fbcd0a773a506fa7280ecd1178
3e0a32d676324e6fc3796fed563e3eed
47c9116907360cb17be50605c53ae46e
864f234623e5cdf2"
 250 DATA "105616d2ae56e78844779
854fcd8d6de13ae46e864f230634e5cd
206ee1c110d6e1c9fdcb57962e00cd67
6e0650cd7176fdcb57d62e01cd676e06
05214277c5fdcb5796cddb760650cd71
76fdcb57d6cddb76"
 260 DATA "09837110f0019c110e5c9
3c32cc4432b4f650d48a50ace03c843a
2fc8462fb8fd4ad68c4aaadc3286382d
c4482dbcf144d88f44a8d829883626c0
4a26c0ee3adc924aa4d7268a3420bc4c
20c4ec30e09450a0"
 270 DATA "06575d6238cdd7e01110a
00a728151105003d280f110f003d2809
1119003d28031132002a516f1922516f
0606fdcb57962a516fcdce7706142a53
6fed5b516fa7ed52193001eb3e16d7af
d778d71e3001f0d8"
 280 DATA "09865cd2a190118fccd2a
19019cffcd2a1901f6ffcd2a197dcdef
157bd7c93e16d7afd7afd7fdcb57963a
506fa72806473e41d710fb3e20d7c93a
d876a7c8fb473eff32d6762118747ea7
2002360223cbfecd"
 290 DATA "103807e78c8dd21697bdd
7e02fe4e380ffeb2300bdd7e03fe3038
04fe8038ca110600dd1910e33e1032d6
76211974cbbe2b7efe04d03600c93efe
dbfecb5737c0a7c93efedbfecb5f37c0
a7c93edfdbfecb47"
 300 DATA "0866537c0a7c93e7fdbfe
cb47c921df780606c5e511eb78783dcd
0a0caf32085c763a085ca728f9d706fe
78dbfe0e051f30120d20facb0038f13e
08d73e20d73e08d718d8e15e235623e5
eb70110400193e05"
 310 DATA "0754591878787c6477721
6400116400cdb503e1c110acc961786b
7875780870e46f7f78800d41626f7274
2020202020ba0d487970657273706163
65ba0d4669726520202020202020ba0d54
68727573742020 20"
 320 DATA "0880820ba0d5269676874
2020202020ba4c656674202020202020
bac5cd1e73c1c8dd7e01fdcb57d6cdc2
75060acd7176fdcb5796e1af321874c3
37752a1a747cb5c83a4e6f1fd8235e23
562ae56e7c92c603"
 330 DATA "09150fe06d07b95c603fe
06d0c390763a4f6fc60b57cd6076bad0
4fcd6076bad081bad0fe0f3e04de0021
d876342ad976360123772360123cd60
76e67fc6147723360323cd6076e60187
3d4787807723 22d9"
 340 DATA "08931763ad87647210000
221a743eff321874af321974c92a1a74
7cb5202ec5c5cd607632687ac6404f06
1ccdf26de17cd60880677dc608816f22
667adde5cdc770f3dde12a42712b221a
74c13a1974cb7f20"
 350 DATA "077602f6717179f873c84
fe402001affe0520023e4a321974e61f
87878787c6966f2600cb14c5dde51104
00cdb503f3dde1c121657a35200a361e
3a1874ee013218743e06dd9601dd7700
79c6034f3a18741f"
 360 DATA "0966230 0578dd86054778
c363741ded57bb9394152ab1025a913d
bec1db0c0ad863776553c79b6c9a9d09
acef66ad101c205e3452e9276bcffd2b
388b6d14c4f173a5dfa93c24d050f3a0
4058218f6aaacbe8"
 370 DATA "09641ae4beab2bce45942
3a4d9222bbd18e5c0008c5e2e0579829
caa6dafe253e7643787ca8a244c3a747
511b18fa1ff0831907b7b5017ba1fb3b
b99e23ab32e6e5c68c138505ec122e36
26315faf280dd717"
 380 DATA "10634f5e34c72ffed7a86
99f7cccd960403c0d6ee8879117e64a4
7f3f378482c9872f55d3544e5dd948d5
8db660fc95f849bd0e8946f24590b4bf
62061681679f8a331a30dc0f3561ebb0
6f7097f95bc81e6e"
 390 DATA "04377 0b692dbae7dd809c
d27d6856f4c239742ca3e1751df6b841
4f4aced4de71b3"
```

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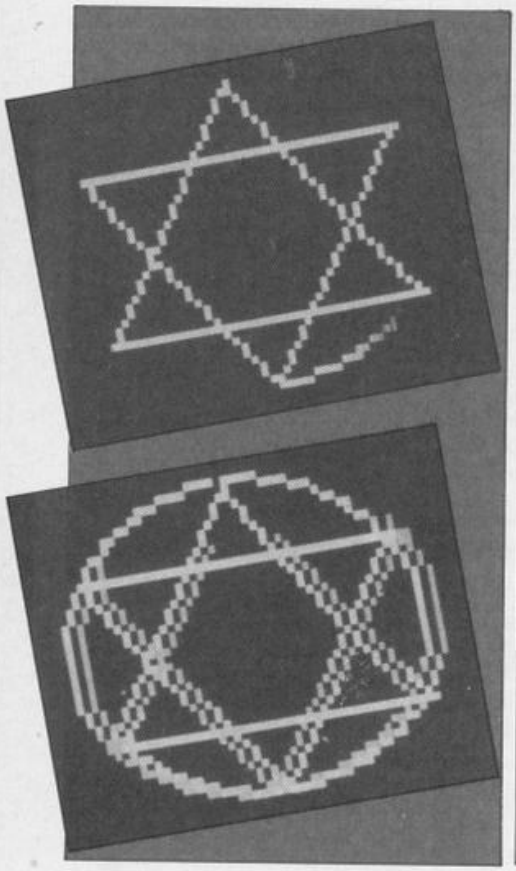
Interface

Listing 1.

```
100 P=52992:T=18680
110 FORX=PTOP+153:READB:T=T-B:PO
KEX,B:NEXT
120 IFTTHENPRINT"CHECKSUM ERROR:
"-T:STOP
130 R1=INT((P+128)/256):R0=P+128
-R1*256
140 POKEP+1,R0:POKEP+2,R1:POKEP+
6,R0:POKEP+7,R1
150 R1=INT((P+138)/256):R0=P+138
-R1*256
160 POKEP+72,R0:POKEP+73,R1:POKE
P+123,R0:POKEP+124,R1
200 DATA 32,128,207,132,  2, 32,
128,207
210 DATA192, 50,176,125,169, 79,
197,  2
220 DATA144,119,152,162,  0,134,
252, 74
230 DATA  8, 10, 10, 10,133,251,
 10, 38
240 DATA252, 10, 38,252, 24,101,
251,144
250 DATA  2,230,252, 70,  2,  8,
164,  2
260 DATA133,251,133,253,165,252,
 72, 24
270 DATA109,136,  2,133,252,104,
 24,105
280 DATA216,133,254,177,251,162,
  0,221
290 DATA138,207,240,  7,232,224,
 16,144
300 DATA246,162,  0,169,  1, 40,
144,  1
310 DATA 10, 40,144,  2, 10, 10,
134,  2
320 DATA174, 52,  3,240, 11,202,
240,  4
330 DATA 69,  2,144,  8,  5,  2,
144,  4
340 DATA 73,255, 37,  2,170,173,
134,  2
350 DATA145,253,189,138,207,145,
251, 96
360 DATA 32,253,174, 32,138,173,
 32,247
370 DATA183, 96, 32,126,124,226,
123, 97
380 DATA255,236,108,127,225,251,
 98,252
390 DATA254,160
```



ALTHOUGH THERE are many clever and complicated graphics utilities available for the 64 I have not come across one that allows the use of a simple "plot" facility without the bother of going into bit-map mode. Double density plotting is a method that can be used to do this and Blocks is a short and simple machine code routine that will allow double density plotting.

It utilises the fact that within the Commodore 64's built in character set are a range of block characters — quarter squares and a half squares, so that in conjunction with reverse video it is possible to display all the 16 variations of quarter squares within one character position. To put it another way, these characters can effectively double the resolution of the screen from 40 by 25 to 80 by 50.

Usual restrictions apply

Of course they are only blocks and the usual colour restrictions of the 64's display apply, but they can be very useful and because they do not need bit-map mode to be used, they can mixed freely with text on a normal screen from Basic.

The machine code routine is quite short — just over 150 bytes — and is intended to be located at 52992 (hex CF00) which is the top page of the much used 4K block of Ram from 49152 upwards. However, by changing just eight bytes you could relocate it anywhere in Ram, in the cassette buffer, for example. Listing 1 does this for you.

Listing 1 is a Basic loader program which will install the machine code routine in memory, in addition should you wish to relocate the routine then the Basic program will do this for you — simply change the value of P in the first line. The loader can very easily be made part of another program.

Once the routine is in memory it can be called form Basic by a Sys command in the following format:

SYS P,X,Y

Where P is the start address of the routine — 52992 as listed — X is the x co-ordinate (0-79) and Y is the y co-ordinate (0-49). X and Y may be any valid Basic expressions, any values out of the ranges shown will be ignored.

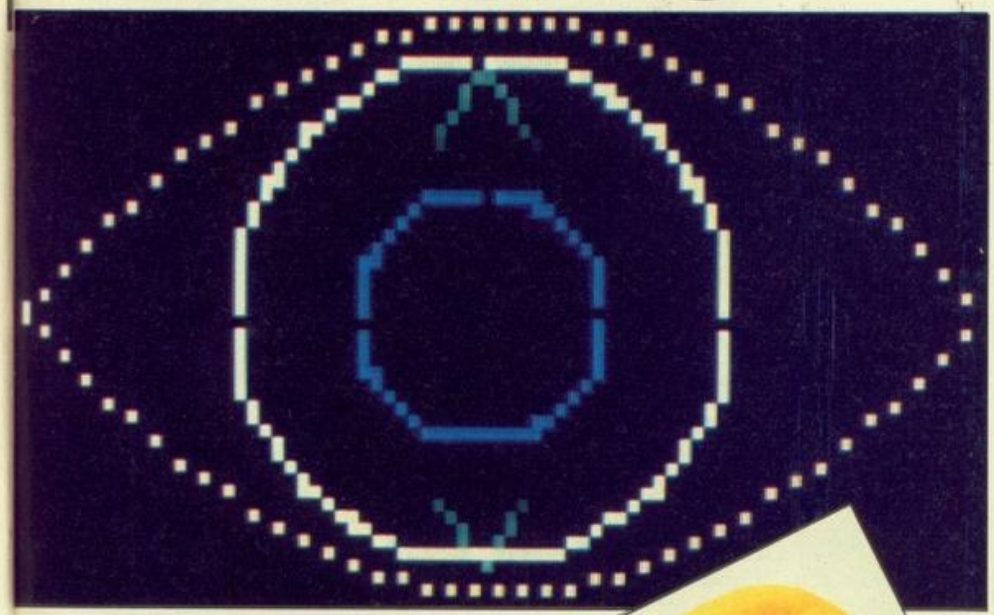
The only other information required by the routine is the type of plot that you want it do do. This is controlled by the contents of location 820 in the following way: a zero will cause un-plotting, a one — plotting and anything else will cause Exclusive-or plotting — to change whatever is there already. Any plotting will be done in the current cursor colour so changing the cursor colour will change plot colour.

Listing 2 is a demonstration program which will plot a few things using the Blocks routine and listing 3 is a version of biorhythms which uses Blocks to plot the charts. The biorhythms program accepts date in the format 1.1.85, any reasonable character may be used to separate the numbers and an asterisk will end the program.

Listing 3.

```
1 POKE53280,0:POKE53281,0:GOSUB2
000
10 PRINT"■■■■■"TAB(13)
20 PRINT"■┌──────────┐"SPC(26)
"■│ ◆◇↑↓←→ I II ♪\♥ ■│"SPC(26)"■└──
──────┘
30 PRINT"■■■■WHAT IS YOUR NAME ▶"
;:MX=18:GOSUB1000:N$=L$
35 IFN$=""THENN$="■NYBODY"
36 IFN$="■"THENPRINT"■":END
40 PRINT"■■■WHAT IS YOUR DATE OF
 BIRTH ▶";:MX=10
50 GOSUB1000:D$=L$:IFD$=""THEN11
0
55 IFL$="■"THEN10
60 D=INT(VAL(L$)):L$=MID$(L$,LEN
(STR$(D))+1)
70 M=INT(VAL(L$)):L$=MID$(L$,LEN
(STR$(M))+1)
80 Y=INT(VAL(L$)):IFY<100THENY=Y
+1900
100 IFM).ANDM<13THENIFD).ANDD<=(
L(M)-FNL(Y))THEN120
110 PRINTTAB(27)"■              ■■■■
■■■■■■■";:GOTO50
120 SX=ASC(MID$(E$,D))-65
130 PRINT"■■■■/AME:"N$:PRINT"■■OR
N ON "D"■■"S$(SX)" "M$(M)" IN"Y
140 Z=FNM(M-(D)Z(M)):Z$=Z$(Z):I
FD=Z(M)THENZ$=Z$+"/"+Z$(FNM(M+1)
)+" CUSP"
150 PRINT"■■■ODIAC SIGN: ■"Z$:GOT
0200
200 PRINT"■■■HAT DATE WOULD YOU
 LIKE TO HAVE YOUR -
210 PRINT"■BIORYTHMS CALCULATED
FOR  ▶";:MX=10
220 GOSUB1000:DD$=L$:IFL$=""THEN
310
225 IFL$="■"THEN10
230 DD=INT(VAL(L$)):L$=MID$(L$,L
EN(STR$(DD))+1)
240 MM=INT(VAL(L$)):L$=MID$(L$,L
EN(STR$(MM))+1)
250 YY=INT(VAL(L$)):IFYY<100THEN
YY=YY+1900
300 IFMM).ANDMM<13THENIFDD).ANDD
D<=(L(MM)-FNL(YY))THEN320
310 PRINTSPC(27)"■              ■■■■
■■■■■■■";:GOTO220
320 IFYY<YTHEN310
330 IFYY=YANDMM<MTHEN310
340 IFYY=YANDMM=MANDDD<DTHEN310
400 PRINT"■■■NE MOMENT PLEASE...
410 N=(YY-Y)*365-D+DD+((M)2)ANDF
NL(Y))+((MM<3)ANDFNL(YY))
420 FORX=YTOYY:N=N-FNL(X):NEXT
430 IFN>1THENFORX=1TON-1:N=N-L(X
):NEXT
440 IFMM>1THENFORX=1TOMM-1:N=N+L
(X):NEXT
450 IFN<36500THEN500
460 PRINT"■■■■ "DD$", THAT'S"N"
DAYS OLD ???
470 PRINT"■■ ■HO DO YOU THINK YO
U ARE - ■ETER ■AN ?
480 PRINTTAB(14)"■▶TRY AGAIN
490 GOTO200
500 SX=ASC(MID$(E$,DD))-65
510 PRINT"■■■■/AME:"N$:PRINT"■■N
 "DD"■■"S$(SX)" "M$(MM)" IN"YY
520 PRINT"■YOU WILL BE"N"DAYS OL
D."
530 PRINT"■■■OUR BIORYTHMS WILL
 BE SHOWN AS FOLLOWS-
540 PRINT"■■■  RED  ■ ::SHOWING Y
OUR PHYSICAL CYCLE,
550 PRINT"■■■ GREEN ■ ::FOR YOUR
EMOTIONAL CYCLE AND
560 PRINT"■■■ BLUE  ■ ::YOUR INTE
LLECTUAL CYCLE.
570 PRINT"■■HE CHARTS SHOW  2 WE
EKS BOTH BEFORE AND■AFTER THE DA
TE SHOWN.
580 PRINT"■■■  ■RESS ■ ─┐ ┌─┘ ■
WHEN YOU ARE READY...
590 GETK$:IFK$<>CHR$(13)THEN590
600 PRINT"■■"N$TAB(19)"+"TAB(22)
N"DAYS OLD
610 PRINT"BORN ON "D$TAB(23)"ON
"DD$
620 PRINT"■":FORX=1TO23:PRINTTAB
(19)"│":NEXT
630 PRINT" (1 DAY/DIVISON)■
640 PRINT"■■■■■■■■■■■■■";
650 PRINT"┌──────────────────────┐
└──────────────────────┘"
700 PRINT"■■■■■■■■■■■■■■■■■■■■■■
■■■ ";:POKE820,1
710 FORG=0TO2:PRINT" ■"MID$("■■■
",G+1,1)" "MID$("┌┐└┘",G+1,1)" ■"
;
720 W=W(G):FORX=0TO77:NN=N+X/2-1
9.5
730 SYSPLOT,X,25-20*SIN(NN/W*2*■
):NEXT:NEXT
740 PRINTTAB(24)"■■RESS ■ ─┐ ┌─┘
 ■"
750 PRINTTAB(27)"TO EXIT...■
780 POKE198,.
790 GETK$:IFK$<>CHR$(13)THEN790
850 PRINT"■■■■■■■■■■■■■■■■■■■■■■
■■■■■■■■■■■■■■■■■■■
```

DOUBLE DENSITY BLOCKS



Keith Suddick simplifies the extensive but complex graphics facilities of the CBM-64 using block characters with a short and simple machine-code routine.

Listing 2.

```
10 REM DOUBLE DENSITY EXAMPLES
15 REM FOR π READ PI
20 PRINT"■":POKE53280,0:POKE5328
1,0
30 P=52992:XX=80:YY=50:MX=79:MY=
49:X2=40:Y2=25
40 POKE820,1:REM PLOT
100 C$="■■■■":FORZ=0TO20STEP4
110 PRINTLEFT$(C$,1);:C$=MID$(C$
,2)
120 FORX=ZTOMX-Z:SYSP,X,Z:SYSP,M
X-X,MY-Z:NEXT
130 FORY=ZTOMY-Z:SYSP,Z,Y:SYSP,M
X-Z,MY-Y:NEXT
140 NEXT
150 FORX=0TO100:POKE199,XAND1
160 PRINT"■■■■■■■■■■■■■■■■"TAB(13)
"DOUBLE DENSITY"
170 NEXT
180 FORD=1TO500:NEXT
200 PRINT"■■";:A=23:D$="■"
210 FORX=1TO24:D$=D$+"■"+CHR$(20
)+CHR$(13):NEXT:D$=D$+"■"+CHR$(2
0)+"■"
220 FORX=0TO159
230 SYSP,X/2,Y2+A*SIN(X*π/X2)
240 SYSP,X/2,Y2-A*SIN(X*π/X2)
250 NEXT:PRINT"■";
260 FORX=0TO79:PRINTD$
270 SYSP,79,Y2+A*SIN(X*π/X2)
280 SYSP,79,Y2-A*SIN(X*π/X2)
290 NEXT
300 PRINT"■■";:FORA=20TO10STEP-10
310 FORX=0TO2*πSTEPπ/(A*3)
320 SYSP,X2+A*SIN(X),Y2+A*COS(X)
330 NEXT:PRINT"■";:NEXT
340 FORD=1TO700:NEXT
400 PRINT"■■";:A=1.5
410 FORY=0TO31
420 SYSP,40-Y/A,Y+5:SYSP,40+Y/A,
Y+5
430 SYSP,40-Y/A,45-Y:SYSP,40+Y/A
,45-Y
440 NEXT
450 FORX=19TO61
460 SYSP,X,36:SYSP,X,14
470 NEXT
500 A=24
510 FORX=0TO2*πSTEPπ/72
520 SYSP,X2+A*SIN(X),Y2+A*COS(X)
*.85
530 NEXT
600 FORX=1TO40:PRINTD$:FORD=1TO5
0:NEXT:NEXT
```

```
ETURN
1030 IFK$="■"ORK$="■"THEN1090
1040 IFK$=CHR$(20)ORK$="■"THEN10
70
1050 IFLEN(L$)=MXOR(ASC(K$)ANDI2
7)(32THEN1010
1055 IFK$=" "THENK$=" "
1060 L$=L$+K$:PRINTK$"■■";:GOT
01010
1070 IFL$=""THEN1010
1080 L$=LEFT$(L$,LEN(L$)-1):PRIN
TCHR$(20);:GOTO1010
1090 K$=CHR$(20):IFL$=""THEN1010

1100 FORDL=1TOLEN(L$):PRINTK$;:N
EXT:L$="":GOTO1010
2000 DIMM$(12),L(12),Z(12),Z$(12
),B(15)
2020 FORX=1TO12:READM$,L(X),Z$,Z
(X)
2030 M$(X)=CHR$(ASC(M$)+128)+MID
$(M$,2):Z$(X)=CHR$(ASC(Z$)+128)+
MID$(Z$,2)
2040 NEXT
2050 DEFFNM(X)=X+12*(X)12)
2060 S$(0)="ST":S$(1)="ND":S$(2)
="RD":S$(3)="TH"
2070 DEFFNL(X)=((X-1900)AND3)=.
2080 DEFFNM(X)=X+12*(X)12)
2090 W(0)=23:W(1)=28:W(2)=33:T=2
:FT=40:U=1:SS=1024:CS=55296:CC=6
46:PLOT=52992
2200 FORX=0TO7:READC(X):V(C(X))=
X:NEXT
2300 FORX=0TO153:READB:POKEPLOT+
X,B:NEXT
2400 E$="ABCDDDDDDDDDDDDDDDDDABC
DDDDDDDA"
3000 PRINT"■■■"TAB(13)
3010 PRINT"■┌──────────┐"SPC(2
6)"│ ◥◣┌─┐ ♥ ■│"SPC(26)"└──
──────┘
3020 PRINT"■■      WITHIN THE HUM
AN BODY, VARIOUS
3030 PRINT"      CHARACTERISTICS
 ARE KNOWN  TO
3040 PRINT"      VARY IN A  REGUL
AR MANNER OVER
3050 PRINT"      PERIODS OF TIME.

3060 PRINT"■      THESE  CHARACTE
RISTICS  CAN BE
3070 PRINT"      THOUGHT OF AS RE
PRESENTING THE
3080 PRINT"      LEVELS OF PHYSIC
AL,  EMOTIONAL
3090 PRINT"      AND INTELLECTUAL
 ACTIVITY  AND
3100 PRINT"      ALTHOUGH NEVER
EXACTLY RIGHT,
3110 PRINT"      THEY CAN BE CALC
ULATED FOR ANY
3120 PRINT"      PERSON AT ANY TI
ME.
3130 PRINT"■      THIS PROGRAM WI
LL CALCULATE  A
3140 PRINT"      SET OF THESE '┐┐
┌─┘ ♥' GIVEN
3150 PRINT"      YOUR DATE OF BIR
TH.
3230 PRINT"■■■      PRESS ■ ─┘ ,
─/ ■ TO BEGIN...
3900 GETK$:IFK$<>CHR$(13)THEN390
0
3999 RETURN
9000 DATAJANUARY,31,CAPRICORN,20
,FEBRUARY,28,AQUARIUS,19
9010 DATAMARCH,31,PISCES,20,APRI
L,30,ARIES,20
9020 DATAMAY,31,TAURUS,20,JUNE,3
0,GEMINI,21
9030 DATAJULY,31,CANCER,23,AUGUS
T,31,LEO,23
9040 DATASEPTEMBER,30,VIRGO,23,O
CTOBER,31,LIBRA,23
9050 DATANOVEMBER,30,SCORPIO,22,
DECEMBER,31,SAGITTARIUS,21
9100 DATA0,6,2,4,5,3,7,1
9200 DATA32,128,207,132,2,32,128
,207
9210 DATA192,50,176,125,169,79,1
97,2
9220 DATA144,119,152,162,0,134,2
52,74
9230 DATA8,10,10,10,133,251,10,3
8
9240 DATA252,10,38,252,24,101,25
1,144
9250 DATA2,238,252,70,2,0,164,2
9260 DATA133,251,133,253,165,252
,72,24
9270 DATA109,136,2,133,252,104,2
4,105
9280 DATA216,133,254,177,251,162
,0,221
9290 DATA138,207,240,7,232,224,1
6,144
9300 DATA246,162,0,169,1,40,144,
1
9310 DATA10,40,144,2,10,10,134,2

9320 DATA174,52,3,240,11,202,240
,4
9330 DATA69,2,144,8,5,2,144,4
9340 DATA73,255,37,2,170,173,134
,2
9350 DATA145,253,189,138,207,145
,251,96
9360 DATA32,253,174,32,138,173,3
2,247
9370 DATA183,96,32,126,124,226,1
23,97
9380 DATA255,236,108,127,225,251
,98,252,254,160
```

SPECTRUM

DRAWER

THIS IS A complex draw program for the ZX Spectrum with many advanced facilities usually found only on expensive commercial packages. These include a fill routine that can handle even the most complicated shapes, patterned fill, filled-in and empty circles, solid and dotted lines, variable cursor speed, screen magnify — magnifications — and two screen stores.

To enter the program, you should first type in the control program — listing 1 — and save it to tape or Microdrive with auto-run Line 500. You should make no changes to the program, except to the Load command in line 500 if you wish to use the program on Microdrive, as memory is tight and line numbers are important. If you do not have Microdrives, then you will be unable to enter the Microdrive Save/Load lines, so type in lines 200 and 201 again in place of lines 202 and 203.

Next:

```
CLEAR 24999
```

and type in the hexloader. If you are going to use your own hexloader, then you will have to enter the Pokes and Save command at the end of the program — line 80 — yourself after you have typed the hex in. Enter the hex from the listing, eight bytes at a time with no separating spaces, entering the checksums when prompted.

When you have finished the program will automatically save the code to tape. If you want to save it to Microdrive, you must New the hexloader first, as otherwise there will not be enough memory for the "m" channel. It is best to start off by saving everything to tape, then transfer to Microdrive later.

To test the program, first type:

```
PRINT USR 0
```

to clear the computer, then Load the control program. This will automatically Load the code and print up a menu on screen 1. If this does not happen, press 0 then r. If you get a menu now, then you must have forgotten to enter the Pokes at the end of the hexloader. If you do not, then you have made an error in typing in the code.

The menu has six options, numbered 0-5. Option 0 allows you to use the drawing program, option 5 will quit the program and return to Basic, and the others will bring up a submenu asking what you want to save or load.

When you press 0 you should be presented with a blank screen, except for a small information window in one corner. Assuming that there was nothing in memory before you loaded the program, the screen attributes will be set to 0, so you will be unable to see your cursor. Press Caps Shift V, then select option 3 from the Clear Screen menu.

How to use the program

I will now explain how to use the program. The first thing you will need to know is how to move the cursor. The keys Q, W, E, A, D, Z, X and C are the cursor control keys — these will be familiar to users of Melbourne Draw. When used in conjunction with Symbol Shift, these keys will scroll the screen, and with Caps Shift they can be used to move the magnification window — more of which later.

The cursor can be used in any one of the four plot modes, Set — plots point, Res — resets point-equivalent to Inverse 1, XOR — inverts pixels-equivalent to Over 1 and Skip — allows you to move the cursor without plotting. These modes are selected by the keys P, O, I and U respectively.

To change the colours on the screen you must change from the pixel cursor — indicated by SCRN in the information window — to the attributes cursor — ATTR. The L key will switch between the two cursors. The attribute cursor behaves exactly like the pixel cursor, except that it is character-sized. In Set mode, it will draw with the ink, paper, bright and flash values indicated at the bottom of the information window. These can be altered using the number keys. Keys 0-7 will change the ink — unshifted — or paper — with Caps Shift — colour, keys 8 and 9 will change the bright — unshifted — and flash — with Caps Shift — values.

Note also that, when using the attribute cursor, Symbol Shift with the movement keys will scroll the attributes. It is important to remember, with both pixel and attribute cursors, that the point underneath the cursor is not plotted until you move the cursor from it. If you wish to plot/change the attributes at the cursor position, press Enter — this will plot in the current mode, so obviously will have no effect in Skip mode. Finally, on this subject, if you wish to speed up or slow down the cursor, you can use Symbol Shift together with the number keys to select a speed. There are nine speeds (1-9) and also a special "no repeat" mode (0).

For the line and circle drawing routines, you have to specify two points — these will be the two ends of the line, or of a radius of the circle. To set one end of the line, or the centre of the circle, press Caps Shift and Enter. This defines the cursor position as the "last point". Next, move the cursor to the other end of the line, or a point on the circumference of the circle.

See "last point" flashing

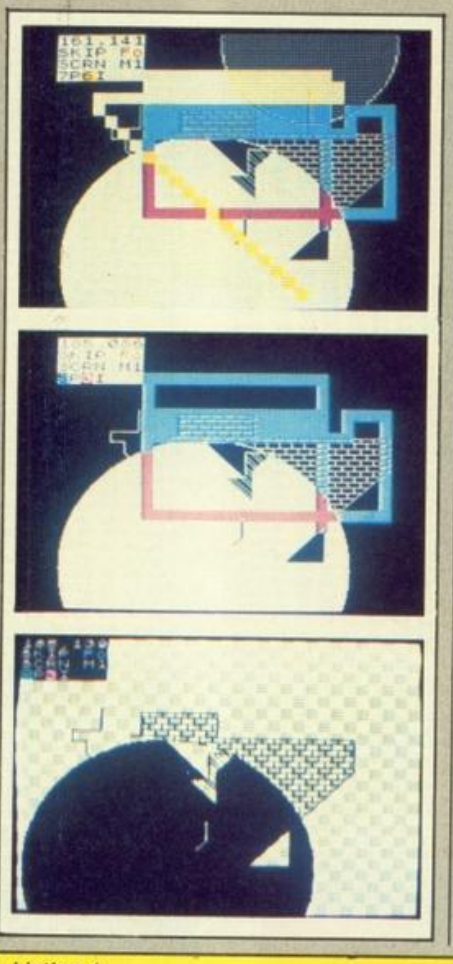
If you press Symbol Shift and Enter together, and hold them down, you will see the "last point" flashing. This can be useful when you wish to remind yourself of its position. To draw a line — select the appropriate mode first — it is pointless drawing a line in Skip mode! — press Caps Shift and J. To draw a circle, press Caps Shift and H. Symbol Shift and H will draw a filled circle, Symbol Shift and J gives a dotted line. To change the mask for the dotted line, press Caps Shift and K — the mask is initially set to 10101010.

It is important when drawing a picture in colour to be able to see the positions of the edges of character squares, so as to avoid "attribute clashes". To help you do so, the program can superimpose one of two grids over the screen. Press G for a black-on-white grid, or Caps Shift

Hex loader.

```
 1 DEF FN b(a$)=CODE a$-48-7*(a$>"9")
 2 DEF FN h(a$)=FN b(a$(1))*16+FN b(a$(2))
 3 DEF FN b$(a)=CHR$ (a+48+7*(a>9))
 4 DEF FN h$(a)=FN b$(INT (a/16))+FN b$(a-16*INT (a/16))
 5 POKE 23658,8
10 FOR a=25000 TO 30448 STEP 8
20 PRINT a;":";: LET c=0: LET a$=" "
30 FOR g=0 TO 7: IF a$(1)=" " THEN INPUT LINE a$: LET a$=a$+" "
60 LET z=FN h(a$): LET a$=a$(3 TO ): POKE a+g,z: PRINT " ";FN h$(z);:LET c=c+ z
70 NEXT g: INPUT "Checksum:";k: IF c<>k THEN PRINT "Error": BEEP .5,50: GO TO
20
80 PRINT : NEXT a: POKE 30456,128: POKE 30457,96: SAVE "DRAWCODE"CODE 25000,55
12
```

Paul Rhodes and an advanced draw program.



There are two memory-stores for pictures, so that you can save a picture at any stage in development, then recall it if you have messed something up. To save a screen, press Caps Shift and I. To recall it later, press Caps Shift and U. The long-term store will retain the picture until you store something else over it, but Fill, Line and Circle all copy the screen into the temporary store so that you can undo their operation if needs be.

This can be especially important with Fill as you might find that you have left a gap in the shape to be filled, and fill in more than you want to; or you may decide you have chosen the wrong pattern.

There is a text mode

For putting text and UDGs on the screen, there is a Text mode, selected by pressing T. Type in text as normal, except that capital letters are unshifted and lower case shifted, using Caps Shift with the keys 5-8 to move the cursor around the screen. Graphics mode is selected with Caps Shift 9, which will change the appearance of the cursor and display "GRPH" under "Text" in the information window.

The information window now needs some explanation. The two numbers at the top are, of course, the cursor coordinates. They follow the normal practice of defining (0,0) as the bottom left corner of the part of the screen normally available to Basic. The bottom two lines are assigned negative y-coordinates. The second line of the window will display the mode — Set, Res, XOR, Skip or Text — and "Fo" which signifies that "Follow mode" is in operation — this will be explained later.

(continued on next page)

G for a grid which retains the ink and paper colours already on the screen. As the grid is a pattern of Bright and normal squares, it will not show up on an RGB monitor.

Now on to the Fill routine. This will fill in any shape bounded by a solid line or the edge of the screen. Move the cursor within the shape and press Caps Shift F. To fill a shape in with one of the 20 fill patterns, proceed as for a normal fill but press Symbol Shift F. You will be prompted for a pattern number. Select the pattern using keys 0-9 for the first 10 patterns or Caps Shift plus 0-9 for the other 10.

If you want to make up your own pattern, any of the 20 can be redefined. The patterns consist of an 8 by 8 character square, like a UDG. Draw your pattern in a character square — use the grid — and, with the cursor still in the square containing the pattern, press Caps Shift P. Select the pattern as for Fill. Pressing Symbol Shift with the number will abort the fill or pattern define command if you have selected it by mistake.

Similar to the "define pattern" command is "define UDG" — selected with Caps Shift and O. In answer to the "UDG?" prompt you should press the key corresponding to the graphic you want to define, which must be in the range A-U. Any other letter key or Break will abort the command.

Listing 1.

```
 10 LET a=USR VAL "25383"
 20 LET o=INT (a/VAL "256"): LET b=a-VAL "256"*o
 30 IF NOT o THEN CLS : PRINT "RUN to restart": STOP
 40 INPUT n$: IF LEN n$>VAL "10" OR NOT LEN n$ THEN GO TO VAL "30"
 50 RESTORE VAL "100"+b: READ c,l: GO SUB VAL "199"+o
 60 RUN
100 DATA USR "a",VAL "168"
101 DATA VAL "30285",VAL "160"
102 DATA VAL "57344",VAL "6912"
200 SAVE n$CODE c,l: VERIFY n$CODE : RETURN
201 LOAD n$CODE c,l: RETURN
202 INPUT "Drive:";d: SAVE *"m";d;n$CODE c,l: VERIFY *"m";d;n$CODE : RETURN
203 INPUT "Drive:";d: LOAD *"m";d;n$CODE c,l: RETURN
500 CLEAR 24999: LOAD "DRAWCODE"CODE : RANDOMIZE USR VAL "25360": RUN
```

Listing 2.

```
25000: 20 00 4D 4E 42 0D 4C 4B =417
25008: 4A 48 50 4F 49 55 59 30 =600
25016: 39 38 37 36 31 32 33 34 =424
25024: 35 51 57 45 52 54 41 53 =604
25032: 44 46 47 01 5A 58 43 56 =541
25040: FF 00 6D 6E 62 0D 6C 6B =800
25048: 6A 68 70 6F 69 75 79 00 =776
25056: 09 08 07 06 00 00 00 00 =30
25064: 05 71 77 65 72 74 61 73 =780
25072: 64 66 67 00 7A 78 63 76 =764
25080: 20 00 2E 2C 2A 0D 3D 2B =281
25088: 2D 5E 22 3B 7F 5D 5B 5F =638
25096: 29 28 27 26 21 40 23 24 =326
25104: 25 20 20 20 3C 3E 7E 7C =505
25112: 5C 7B 7D 00 3A 60 3F 2F =604
25120: 00 00 00 00 DE 66 99 75 =594
25128: 51 67 BB 65 D3 66 00 00 =734
25136: 00 00 00 00 BA 66 C2 66 =584
25144: BE 66 C6 66 00 00 7E 66 =820
25152: 7E 66 7E 66 7E 66 7E 66 =912
25160: 7E 66 7E 66 7E 66 7E 66 =912
25168: 7E 66 BD 65 92 65 97 65 =969
25176: 00 00 B0 71 9C 65 63 8D =706
25184: A1 65 00 00 BC 67 00 00 =553
25192: A6 65 AB 65 B0 65 00 00 =816
25200: 00 00 00 00 E2 66 B2 75 =623
25208: 51 67 69 65 D3 66 E6 75 =1050
25216: BC 73 E8 72 57 70 75 70 =1029
25224: FB 6F FE 6F 00 00 7A 66 =948
25232: 7A 66 7A 66 7A 66 7A 66 =896
25240: 7A 66 7A 66 7A 66 7A 66 =896
25248: 7A 66 5C 64 61 64 66 64 =815
25256: 00 00 00 00 6B 64 39 6D =373
25264: 70 64 FE 6E C0 67 00 00 =871
25272: 75 64 7A 64 7F 64 69 6A =877
25280: 00 00 00 00 E6 66 B2 75 =627
25288: 51 67 70 65 D3 66 00 00 =710
25296: B7 73 E4 72 BA 66 C2 66 =1176
25304: BE 66 C6 66 00 00 AB 66 =865
25312: AB 66 AB 66 AB 66 AB 66 =1092
25320: AB 66 AB 66 AB 66 AB 66 =1092
25328: AB 66 9D 6D A2 6D A7 6D =1086
25336: 00 00 00 00 AC 6D DA 66 =601
25344: B1 6D 15 6F C0 67 00 00 =713
25352: B6 6D BB 6D C0 6D A5 6A =1159
25360: 11 00 E0 ED 53 2E 77 CD =931
25368: 0B 70 AF 32 3B 76 32 F6 =821
25376: 76 3E 18 32 2D 77 C9 ED =856
25384: 73 FE 76 31 00 E0 CD 5A =1055
25392: 63 ED 7B FE 76 C9 3A F7 =1337
25400: 76 D3 FE CD 0D 6B CD 2E =1159
25408: 67 CD 3D 67 CD 26 64 CD =1020
25416: 04 74 3A 25 77 E6 0B 20 =604
25424: 09 3A 2D 77 A7 CC 2E 67 =751
25432: 1B E7 CD A6 67 DD 21 BE =1173
25440: 63 CD 56 6B A7 2B CF FE =1162
25448: 05 01 FF 00 CB F5 CD 0D =924
25456: 6B DD 21 94 63 CD 56 6B =1003
25464: C1 4F C5 CD 0D 6B DD 21 =1048
25472: BC 63 CD B6 6B CD 62 6B =1137
25480: C1 C9 4F C9 07 03 4E 41 =827
25488: 4D 45 3F 27 11 07 53 41 =420
25496: 56 45 2F 4C 4F 41 44 27 =529
25504: 55 44 47 20 41 52 45 41 =537
25512: 27 46 49 4C 4C 20 50 41 =511
25520: 54 54 45 52 4E 53 27 53 =602
25528: 43 52 45 45 4E 27 1B 0A =438
25536: 4F 50 54 49 4F 4E 53 27 =595
25544: 45 44 49 54 20 50 49 43 =546
25552: 54 55 52 45 27 53 41 56 =593
25560: 45 20 54 4F 20 54 41 50 =525
25568: 45 27 4C 4F 41 44 20 46 =498
25576: 52 4F 4D 20 54 41 50 45 =568
25584: 27 53 41 56 45 20 54 4F =537
25592: 20 4D 49 43 52 4F 44 52 =560
25600: 49 56 45 27 4C 4F 41 44 =555
25608: 20 46 52 4F 4D 20 4D 49 =522
25616: 43 52 4F 44 52 49 56 45 =606
25624: 27 45 58 49 54 20 50 52 =547
25632: 4F 47 52 41 4D 27 21 20 =478
25640: 62 3A 2B 77 A7 2B 09 21 =564
25648: 70 62 3D 2B 03 21 C0 62 =637
25656: DD 21 20 77 0E 0B DD 7E =774
25664: 00 06 05 1F 3B 0A 23 23 =178
25672: 10 F9 DD 23 0D 20 EF C9 =1006
25680: 5E 23 56 7A B3 CB 21 2E =795
25688: 67 E5 EB E9 11 FF FF 18 =1351
25696: 21 11 00 FF 18 1C 11 01 =375
25704: FF 18 17 11 FF 00 18 12 =616
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25720: 18 0B 11 00 01 18 03 11 =94
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25736: 2E 77 79 E6 1F B3 FE 20 =964
25744: D0 7B 81 4F 7A A7 28 11 =885
25752: FE 01 28 12 79 D6 20 4F =759
25760: 30 07 7B D6 0B 47 FE E0 =946
25768: D8 ED 43 2E 77 C9 0B 79 =1015
25776: C6 20 4F 30 F4 7B C6 0B =927
25784: 47 E6 18 FE 18 20 EA C9 =1070
25792: 7B 07 07 07 AA E6 07 AA =721
25800: 07 07 07 AA E6 FB AA C9 =1040
25808: 57 07 07 AB E6 E0 AB 5F =992
25816: 7A 37 1F 37 1F 37 1F AA =550
25824: E6 FB AA E6 FB 57 C9 7C =1538
25832: 0F 0F 0F E6 03 C6 58 67 =667
25840: C9 22 2A 77 24 7C E6 07 =793
25848: C0 7D C6 20 6F 3B 05 7C =843
25856: D6 08 67 C9 7C 2F E6 18 =951
25864: C0 2A 2A 77 C9 22 2A 77 =791
25872: 25 7C 2F E6 07 C0 7D D6 =976
25880: 20 6F 3B E8 7C C6 08 67 =864
25888: C9 7D 07 07 07 AC E6 07 =756
25896: AC 07 07 07 AC E6 FB AC =1015
25904: 57 C9 0C CB 0B D0 7D 3C =904
25912: E6 1F 2B 02 2C C9 0D CB =764
25920: 00 37 C9 0D CB 00 D0 7D =805
25928: 3D 2F E6 1F 2B 02 2D C9 =657
25936: 0C CB 0B 37 C9 7D E6 E0 =1058
25944: 6F 7D C6 20 6F D0 7C C6 =1107
25952: 08 67 2F E6 1B C0 26 40 =706
25960: C9 2A FB 76 22 FA 76 C9 =1212
25968: CD F4 66 ED 4B FA 76 CD =1436
25976: 97 69 CD 93 69 CD 16 67 =1043
25984: 20 F1 CD 0A 67 C3 0D 6B =906
25992: 11 00 00 18 26 11 FF FF =606
26000: 1B 21 11 00 FF 1B 1C 11 =398
26008: 01 FF 1B 17 11 FF 00 1B =599
26016: 12 11 01 00 1B 0D 11 FF =345
26024: 01 1B 0B 11 00 01 1B 03 =78
26032: 11 01 01 C1 ED 4B FB 76 =890
26040: 3A 3B 76 E6 40 2B 0E 7B =706
26048: E6 1F 07 07 07 5F 7A E6 =729
26056: 1F 07 07 07 57 7B B2 FE =643
26064: C0 D0 47 7B 07 CB 12 0F =837
26072: B1 CB 12 0B CB 1A 17 AA =780
26080: E6 01 C0 0B 4F 2A FB 76 =918
26088: ED 43 FB 76 4D 44 CD E6 =1250
26096: 69 C3 00 69 79 07 07 07 =547
26104: AB E6 C7 AB 07 07 6F 3A =948
26112: 3B 76 E6 40 20 16 7B A7 =812
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(listing 2 from previous page)

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26120: 1F 37 1F A7 1F AB E6 FB =961
26128: AB 67 79 E6 07 3C ED 4B =1001
26136: 3B 76 47 C9 7B 07 07 EE =821
26144: 5B E6 03 EE 5B 67 ED 4B =1062
26152: 3B 76 06 00 C9 3A 3B 76 =619
26160: F5 E6 BF 32 3B 76 CD 3E =1160
26168: 66 F1 32 3B 76 C9 79 07 =899
26176: 07 07 AB E6 C7 AB 07 07 =793
26184: 6F 3A 3B 76 E6 40 20 1B =699
26192: 7B F6 07 0F 0F 0F AB E6 =816
26200: FB AB 67 79 E6 07 3C 47 =1008
26208: 3E FE 0F 10 FD ED 4B 3B =971
26216: 76 47 C9 7B 07 07 EE FB =1010
26224: E6 03 EE FB 67 ED 4B 3B =1193
26232: 76 C9 0E 01 1B 02 0E 00 =374
26240: C5 CD 7F 67 C1 47 FE 08 =1158
26248: 3B 0C D6 09 2F 0D 06 7F =484
26256: 2B 0E CB 08 1B 0A 06 FB =553
26264: 0D 20 05 07 07 07 06 C7 =276
26272: 4F 3A 3C 76 A9 A0 A9 32 =863
26280: 3C 76 C9 CD 7F 67 6F 26 =963
26288: 00 11 ED 76 19 7E 32 2D =618
26296: 77 C9 06 00 1B 0A 06 01 =367
26304: 1B 06 06 02 1B 02 06 03 =73
26312: 3A 3B 76 AB E6 FC AB 32 =1103
26320: 3B 76 C9 CD A6 67 06 40 =922
26328: 1B 0E 06 80 1B 0A 06 04 =216
26336: 1B 06 06 10 1B 02 06 08 =92
26344: 3A 3B 76 AB 32 3B 76 03 =825
26352: 94 6B 00 00 2A 3B 76 3A =532
26360: F6 76 67 22 F2 66 F6 08 =1099
26368: 32 F6 76 7D F6 80 32 3B =1022
26376: 76 C9 2A F2 66 7D 32 3B =939
26384: 76 7C 32 F6 76 C9 3E EE =1173
26392: DB FE F6 E1 47 3E 7F DB =1423
26400: FE F6 E2 A0 47 3E 81 DB =1367
26408: FE F6 E0 A0 3C C9 CD 3A =1408
26416: 6B CD 04 74 CD 93 69 CD =1094
26424: 16 67 CB 18 F1 CD 3A 6B =960
26432: CD 04 74 CD 93 69 CD 16 =1009
26440: 67 2B F2 CD F6 6B C3 DF =1345
26448: 6B DD 21 6A 67 CD B6 6B =1061
26456: CD 62 6B CD 74 67 FE 08 =1093
26464: 30 F9 32 F7 76 D3 FE C3 =1372
26472: 0D 6B 09 03 42 4F 52 44 =427
26480: 45 52 3F 27 CD CF 6B CD =977
26488: 7F 67 FE FF 2B F6 C9 ED =1463
26496: 4B 23 77 7B F6 20 06 00 =633
26504: 0F 04 30 FC 7B FE 06 D8 =915
26512: 06 0B 79 F6 20 0F 05 30 =484
26520: FC 7B FE 06 30 03 3E FF =1000
26528: C9 FE 0A D8 AF C9 3A F6 =1361
26536: 76 0F D0 3F 17 32 F6 76 =841
26544: 21 00 FB 11 00 FB 01 00 =550
26552: 03 ED B0 C9 06 01 1B 02 =650
26560: 06 02 3A 3B 76 E6 40 C0 =729
26568: 3A F6 76 21 0D 6B E5 E6 =1034
26576: 01 20 03 C5 21 00 FB 11 =739
26584: 00 FB 01 00 03 ED B0 3A =726
26592: F6 76 F6 01 32 F6 76 C1 =1218
26600: 05 20 26 21 01 FB 11 02 =376
26608: FB 36 3B 2B 36 7B 01 1E =606
26616: 00 ED B0 23 ED A0 2E 00 =891
26624: 01 1F 00 ED B0 21 00 FB =726
26632: 11 40 FB 01 C0 02 ED B0 =937
26640: C9 21 00 FB 11 00 40 01 =564
26648: 1B 10 7E E6 BF B2 77 23 =919
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26672: C9 CD B6 6B DD 7E 00 D6 =1253
26680: 04 47 48 E5 CD 62 6B E1 =1008
26688: CD 59 65 CD 59 65 E5 79 =1140
26696: 90 C6 30 CD 72 6B 2C CD =1062
26704: 62 6B E1 10 EE C9 CD 31 =1136
26712: 6B C5 CD 74 67 C1 B9 DB =1319
26720: 1B F7 3E 47 0B DD 23 DD =889
26728: 7E 00 FE 27 CB CD 72 6B =1042
26736: 1B F3 C5 E5 6F 26 00 29 =883
26744: 29 29 11 00 3C 19 EB E1 =644
26752: E5 CD BF 6B 25 CD E7 64 =1254
26760: 0B 77 0B E1 2C C1 C9 06 =804
26768: 08 1A 77 24 13 10 FA C9 =675
26776: 0A 0B 43 4C 45 41 52 27 =416
26784: 4E 4F 4E 45 27 53 43 52 =575
26792: 45 45 4E 27 41 54 54 52 =570
26800: 27 42 4F 54 4B 27 3D 46 =670
26808: 00 DD 4E 01 04 04 21 00 =341
26816: 40 3E 70 0B 3E 23 CD 72 =662
26824: 6B 10 F9 CD 55 65 3E 23 =857
26832: CD 72 6B 3E 47 0B DD 46 =855
26840: 00 3E 20 CD 72 6B 10 F9 =782
26848: 3E 70 0B 3E 23 CD 72 6B =702
26856: CD 55 65 0D 20 E0 DD 46 =951
26864: 00 04 04 3E 23 CD 72 6B =528
26872: 10 F9 21 42 40 DD 23 C9 =885
26880: 3A 3B 76 E6 20 C4 97 69 =949
26888: 3A 3B 76 E6 04 CA C6 69 =974
26896: CD 23 69 DB CD 57 69 DB =1174
26904: 3A 3B 76 E6 0B CA 05 6A =786
26912: C3 2D 6A 2A 2E 77 CD 21 =791
26920: 65 7D 07 07 07 E6 F8 5F =820
26928: 79 93 3B 50 07 4F 0F 0F =520
26936: 0F 0F E6 1F 2A 3B 76 B0 =696
26944: 30 42 7B 92 3B 3E BC 30 =734
26952: 3B 07 47 3A 3B 76 E6 0B =610
26960: CB CB 00 CB 01 A7 C9 3A =1033
26968: F6 76 E6 0B C0 C5 2A 02 =1035
26976: 74 CD 21 65 7B 92 3B 19 =802
26984: FE 20 30 15 7D E6 1F 07 =748
26992: 07 07 6F 79 95 3B E0 FE =929
27000: 3B 30 06 CD 99 75 C1 37 =833
27008: C9 C1 A7 C9 3A 3B 76 E6 =1227
27016: B0 37 C0 CD 63 6D CD 16 =1015
27024: 75 37 C9 ED 4B FB 76 ED =1288
27032: 5B 3B 76 3A F6 76 E6 04 =924
27040: C2 DF 70 7B EE 20 E6 FC =1404
27048: F6 01 32 3B 76 D5 3E 3F =812
27056: 32 3C 76 C5 CD 0B 69 C1 =936
27064: D1 3A 3B 76 AB E6 FC AB =1268
27072: 5F ED 53 3B 76 C9 CD 57 =1085
27080: 69 DB CD F4 65 79 E6 40 =1286
27088: 20 22 3E FE 0F 10 FD 47 =737
27096: 7E CB 41 20 01 A0 CB 49 =863
27104: 20 02 AB 2F 77 C9 C5 CD =971
27112: 3E 66 CD EF 69 C1 C9 79 =1228
27120: E6 40 2B E4 3A 3C 76 47 =869
27128: 7E CB 41 20 01 AF CB 49 =878
27136: 20 01 AB 77 C9 CD F4 65 =1071
27144: 79 E6 40 20 0F 3E 7E 0F =665
27152: 10 FD 47 CD DB 69 47 CD =1142
27160: F1 64 70 C9 7D E6 DE 6F =1342
27168: CD F4 69 23 77 11 20 00 =757
27176: 19 77 2B 77 C9 CD F4 65 =1059
27184: 79 E6 40 20 13 3E 1E 0F =573
27192: 10 FD 47 CD DB 69 06 03 =875
27200: 4F CD F1 64 71 10 FA C9 =1205
27208: 7D E6 9C 6F CD F4 69 01 =1177
27216: 03 00 5D 54 13 3E 04 E5 =494
27224: ED B0 D1 21 20 00 19 EB =947
27232: D5 01 04 00 3D 20 F1 D1 =761
27240: C9 DD 21 98 6B CD 56 6B =1106
27248: 21 0D 6B E5 A7 CB 3D 28 =850
27256: 06 3D 28 11 CD 8D 6A 21 =609
27264: 00 E0 11 01 E0 01 FF 17 =745
27272: 36 00 ED B0 C9 21 00 FB =949
27280: 11 01 FB 3A 3C 76 77 01 =622
27288: FF 02 ED B0 3A F6 76 E6 =1322
27296: FE 32 F6 76 C9 DD 21 EE =1361
27304: 6A CD 56 6B 21 0D 6B E5 =883
27312: A7 CB 3D 28 06 3D 28 13 =594
27320: CD CB 6A 21 00 E0 01 00 =772
27328: 18 7E 2F 77 23 0B 78 B1 =659
27336: 20 F7 C9 CD A6 67 21 00 =987
27344: FB 01 00 03 7E 5F 0F 0F =503
27352: 0F AB E6 07 AB 57 7B 07 =811
27360: 07 07 AA E6 38 AA 77 23 =794
27368: 0B 78 B1 20 E7 C9 0A 0B =790
27376: 49 4E 56 45 52 54 27 4E =589
27384: 4F 4E 45 27 53 43 52 45 =566
27392: 45 4E 27 41 54 54 52 27 =540
27400: 42 4F 54 4B 27 3A 3B 76 =575
27408: E6 DF 32 3B 76 47 E6 04 =985
27416: 28 14 7B 21 00 40 ED 5B =605
27424: 2E 77 ED 4B 3B 76 E6 0B =889
27432: CA C0 6C C3 36 6C 21 00 =892
27440: E0 11 00 40 01 00 1B ED =570
27448: B0 C9 3A 3B 76 E6 14 FE =1116
27456: 10 C0 2A 2E 77 CD E7 64 =951
27464: E5 3A 37 76 77 3A 3B 76 =814
27472: E6 0B 01 0F 00 2B 03 01 =298
27480: 07 00 5D 54 13 ED B0 E1 =841
27488: 3A 3B 76 E6 0B 01 10 0B =501
27496: 2B 03 01 0B 05 C5 E5 11 =500
27504: 20 00 EB 19 EB 06 00 ED =770
27512: B0 E1 11 20 00 19 C1 10 =684
27520: EC 3A 37 76 4F C6 03 A9 =916
27528: E6 07 A9 D6 0B E6 3F 32 =971
27536: 37 76 AF C9 3A 3B 76 E6 =1014
27544: 0B 01 10 60 2B 03 01 0B =173
27552: 30 ED 43 3B 76 ED 5B 2E =900
27560: 77 7B E6 1F 3D B1 FE 20 =979
27568: 3B 07 7B E6 E0 C6 20 91 =1015
27576: 5F CD C0 64 B0 3D FE C0 =1227
27584: 3B 06 3E C0 90 CD D0 64 =973
27592: ED 53 2E 77 C3 0D 6B CD =1005
27600: 0F 6C CD F6 6B CD 1C 6C =1022
27608: CB CD F6 6B 3A 20 77 57 =1054
27616: E6 FD 32 20 77 AA 5F 3A =1007
27624: 27 77 57 E6 FE 32 27 77 =937
27632: AA B3 32 2B 77 C9 CD 93 =1111
27640: 69 3A 2D 77 A7 CB 6F 3A =863
27648: F6 76 E6 04 28 03 2A 2C =727
27656: 77 10 FE 2D 20 FB C9 21 =951
27664: 20 77 11 21 77 01 07 00 =328
27672: 36 1F ED B0 21 20 77 01 =683
27680: FE 7F 1E 00 ED 7B 2F A6 =981
27688: 77 B3 5F 23 CB 0B 3B F4 =939
27696: 7B 32 2B 77 A7 C9 E5 D5 =1142
27704: C5 C5 D5 E5 41 C5 D5 1A =1337
27712: 4F 06 04 CB 11 9F 5F CB =766
27720: 11 9F AB E6 0F AB 77 23 =917
27728: 10 F1 D1 13 C1 10 E6 E1 =1149
27736: 06 03 C5 E5 5D 54 14 06 =638
27744: 00 CB 21 CB 21 ED B0 E1 =1110
27752: 24 C1 10 EE CD F1 64 EB =1264
27760: E1 CD F1 64 EB C1 10 C1 =1408
27768: C1 E1 CD E7 64 C6 A0 57 =1399
27776: 5D E1 CD E7 64 CB 3B CB =1316
27784: 3B CB 3B CB 21 CB 21 C5 =984
27792: D5 E5 41 1A 77 23 77 23 =841
27800: 77 23 77 23 13 10 F4 06 =593
27808: 03 E1 C5 11 20 00 EB 19 =734
27816: E5 EB 06 00 ED B0 CB 3B =1142
27824: E1 C1 10 EE 11 20 00 19 =746
27832: EB C1 09 EB C1 10 B0 C9 =1290
27840: E5 D5 C5 C5 E5 D5 E5 41 =1572
27848: D5 C5 1A 4F 06 04 AF CB =903
27856: 01 17 17 10 FA 5F 0F B3 =602
27864: 77 23 06 04 AF CB 01 17 =566
27872: 17 10 FA 5F 0F B3 77 23 =732
27880: C1 D1 1C 10 DB E1 5D 54 =1067
27888: 14 CB 21 ED B0 E1 CD F1 =1340
27896: 64 EB E1 24 CD F1 64 C1 =1335
27904: 10 C1 C1 E1 CD E7 64 C6 =1361
27912: A0 57 5D E1 CD E7 64 7B =1221
27920: 0F 0F 0F E6 1F 47 C5 E5 =803
27928: D5 41 C5 01 20 00 1A 77 =653
27936: 09 77 2C 77 ED 42 77 2C =757
27944: 1C C1 10 EE E1 0E 20 09 =755
27952: EB E1 0E 40 09 C1 10 DE =978
27960: C9 2A 2E 77 CD 21 65 7D =872
27968: 07 07 07 E6 F8 5F 3A 3B =711
27976: 76 21 20 1B E6 08 20 01 =478
27984: 29 19 ED 4B FB 76 22 FB =1026
27992: 76 3A 3B 76 E6 20 CB C3 =1010
28000: 97 69 C9 ED 4B FB 76 3A =1193
28008: 3B 76 E6 08 28 14 79 D6 =810
28016: 1F 30 01 AF E6 F8 4F 7B =932
28024: D6 17 30 01 AF E6 F8 47 =1010
28032: 1B 12 79 D6 3F 30 01 AF =664
28040: E6 F8 4F 7B D6 2F 30 01 =987
28048: AF E6 F8 47 CD 2D 66 22 =1110
28056: 2E 77 C3 94 6B 11 FF FF =1142
28064: 1B 21 11 00 FF 1B 1C 11 =398
28072: 01 FF 1B 17 1B FF 00 1B =599
28080: 12 11 01 00 1B 0D 11 FF =345
28088: 01 1B 0B 11 00 01 1B 03 =78
28096: 11 01 01 21 0D 6B E3 D5 =612
28104: 3A 3B 76 E6 40 28 72 7A =805
28112: A7 28 3B F2 F3 6D 21 00 =893
28120: FB 11 00 77 01 20 00 ED =654
28128: B0 11 00 FB 01 E0 02 ED =905
28136: B0 21 00 77 01 20 00 ED =598
28144: B0 1B 1B 21 FF FA 11 1F =813
28152: 77 01 20 00 ED B8 11 FF =845
28160: FA 01 E0 02 ED B8 21 1F =962
28168: 77 01 20 00 ED B8 D1 7B =905
28176: A7 CB F2 2B 6E 21 01 FB =1044
28184: 11 00 FB 06 1B C5 1A 01 =519
28192: 1F 00 ED B0 12 23 13 C1 =709
28200: 10 F3 C9 21 FE FA 11 FF =1269
28208: FA 06 1B C5 1A 01 1F 00 =535
28216: ED B8 12 1B 2B C1 10 F3 =961
28224: C9 7A A7 28 53 F2 71 6E =1078
28232: 21 00 E0 11 00 77 01 20 =426
28240: 00 ED B0 21 00 E1 11 00 =688
28248: E0 E5 01 20 00 ED B0 D1 =1108
28256: 6B 62 CD F1 64 20 F2 21 =1058
28264: 00 77 01 20 00 ED B0 1B =589
28272: 27 21 FF F7 11 1F 77 01 =742
28280: 20 00 ED B8 11 FF F7 21 =1005
28288: FF F6 E5 01 20 00 ED B8 =1184
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(continued from previous page)

The third line displays the cursor mode — SCRN or ATTR for the normal cursor, GRPH or nothing for the text cursor — and the magnification — so far, always 1. Along the bottom are the paper and ink colours and bright and flash settings — a bright B appears for Bright 1, a flashing F for Flash 1. The window can be turned off and on with Caps Shift N, and it can be moved by pressing N. This is normally unnecessary as it moves automatically if you move the cursor over it. So as to be noticeable at all times when switched on, the window selects black or white paper to contrast with the paper colour underneath it.

One of the most important and useful features of the program is the magnifier. This allows you to magnify part of the screen by a factor of either two or four in each direction — i.e., magnifying the area by four or 16. The area to be magnified is called the "magnification window" and can be seen by pressing Caps Shift and M — press them again to turn it off. It can be moved around the screen by pressing Caps Shift along with the cursor movement keys. Symbol Shift M will select the magnification and hence the size of the window — with a greater magnification, the area to be magnified is smaller.

To magnify the area in the window, press M. There is a special feature of the magnifier which causes the window to automatically centre itself on the cursor if it is not within the magnification window. This means that when drawing in magnified mode, the window will automatically follow the cursor when it goes off the edge of the screen and is therefore called "Follow mode".

You can turn it off — and back on again — by pressing Symbol Shift and S. To centre the window press S, and to move the cursor to the centre of the window, press Caps Shift and S. You can still change the magnification and move the window around when in magnified mode, but remember that in follow mode you cannot move the window away from the cursor.

To clear the screen, press Caps Shift and V, then select either screen which will leave the attributes alone, attributes which will clear the colour details only or both — a normal CLS.

Symbol Shift and V will select the Invert command, which has the same options available. This can be useful for many things. For example, for inverted text you should invert the screen, then put the text on the screen normally, then invert the screen again.

You can also clear parts of the screen by inverting the screen, drawing round them and filling them in, and then inverting the screen again. Note that the option to invert both screen and attributes will have no visible effect, unless you turn the grid on. One other command which can be used in conjunction with Clear is Border — press B — which can be used to set the border colour. This does not affect the picture itself, it is purely for the convenience of the user.

The only other key which you will need to use is R. Regardless of any shifts, this will return you to the main Save/Load menu.

I think you will find that it is worth the time and effort to type it in. Alternatively, as usual, I can supply it on tape for £3 — with instructions for transference to Microdrive. Orders to P. Rhodes at 104 Ventor Gardens, Luton LU3 3SW. ■

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28296: E1 5D 54 CD 0D 65 20 F2 =995
28304: 21 1F 77 01 20 00 ED B8 =637
28312: D1 7B A7 CB F2 B9 6E 21 =1269
28320: 1F E0 06 C0 C5 E5 06 20 =917
28328: CB 16 2B 10 FB E1 CB 1E =993
28336: CB 06 CD F1 64 C1 10 EC =1200
28344: C9 21 00 E0 06 C0 C5 E5 =1082
28352: 06 20 CB 1E 23 10 FB E1 =798
28360: CB 16 CB 0E CD F1 64 C1 =1181
28368: 10 EC C9 7B B6 77 7C E6 =1244
28376: E0 67 7B A3 B6 77 7C E6 =1265
28384: 5F 67 C9 7B A6 C9 3A FF =1199
28392: BF FE FF C0 79 0F 0F 0F =1058
28400: AC E6 E0 AC 08 7D D9 6F =1259
28408: 08 67 E3 E5 D9 C9 21 00 =1018
28416: 3C 18 18 11 03 50 41 54 =357
28424: 54 45 52 4E 20 4E 55 4D =585
28432: 42 45 52 3F 27 CD 32 70 =686
28440: DA 0D 6B 22 FC 76 D9 E5 =1188
28448: CD F4 66 21 FF FF 22 FE =1382
28456: BF E5 AF 32 3B 76 CD 0B =1038
28464: 70 ED 4B FB 76 CD F4 65 =1340
28472: 48 0D 3E 01 0F 10 FD 47 =503
28480: 7C E6 07 ED 5B FC 76 83 =1190
28488: 5F 7A CE 00 57 1A 5F 16 =653
28496: 00 CD 43 65 3B 0B CD E3 =869
28504: 6E 2B F6 CD 32 65 CD D3 =1168
28512: 6E CD F1 64 2B 10 CD E3 =1144
28520: 6E 2B 04 CB 8A 18 07 CB =729
28528: 4A CC E6 6E CB CA 2A 2A =1107
28536: 77 CD 0D 65 2B 10 CD E3 =926
28544: 6E 2B 04 CB B2 18 07 CB =721
28552: 42 CC E6 6E CB C2 2A 2A =1091
28560: 77 CD 32 65 3B 05 CD E3 =968
28568: 6E 2B C3 E1 7C E6 E0 07 =1155
28576: 07 07 4F 3C 47 7C E6 1F =609
28584: F6 40 67 FE 5B 3B 0B CD =1155
28592: 0A 67 E1 D9 C3 0D 6B 13 =889
28600: 06 53 54 4F 52 45 2F 52 =532
28608: 45 54 52 49 45 56 45 27 =571
28616: 54 45 40 50 4F 52 41 52 =618
28624: 59 20 53 54 4F 52 45 27 =557
28632: 4C 4F 4E 47 20 54 45 52 =571
28640: 4D 20 53 54 4F 52 45 27 =545
28648: DD 21 B7 6F CD 56 6B 2E =989
28656: 00 0F 0F 0F C6 80 67 C9 =675
28664: CD EB 6F EB 1B 10 CD EB =1260
28672: 6F 3A F6 76 E6 FE 32 F6 =1313
28680: 76 1B 1C 11 00 80 21 00 =348
28688: E0 01 00 1B ED B0 3A F6 =966
28696: 76 E6 01 01 00 03 2B 0D =406
28704: 26 FB 1B 09 21 00 40 11 =436
28712: 00 E0 01 00 1B ED B0 C3 =860
28720: 0D 6B DD 21 03 6F CD B6 =875
28728: 6B CD 62 6B CD 74 67 B7 =1070
28736: B7 B7 6F 26 00 3A 2B 77 =636
28744: FE 02 3F D8 A7 11 4D 76 =914
28752: 2B 03 11 9D 76 19 C9 CD =766
28760: 32 70 DA 0D 6B E5 ED 4B =1041
28768: FB 76 CD 2D 66 7C E6 F8 =1320
28776: 67 D1 06 08 7E 12 13 24 =525
28784: 10 FA C3 0D 6B DD 21 A0 =995
28792: 70 CD B6 6B CD 62 6B CD =1215
28800: 2E 67 CD 3D 67 CD A7 70 =1002
28808: E6 DF D6 41 3B F4 FE 15 =1307
28816: D2 0D 6B 26 00 87 B7 B7 =773
28824: 6F ED 5B 7B 5C 19 1B BD =892
28832: 06 03 55 44 47 3F 27 11 =352

28840: A8 61 3A 2B 77 A7 2B 09 =698
28848: 11 D0 61 3D 2B 03 11 F8 =691
28856: 61 21 20 77 06 05 0E 0B =314
28864: CB 1E 3B 0B 13 10 F9 23 =619
28872: 0D 06 05 20 F3 AF C9 1A =701
28880: C9 3A F6 76 E6 FB 32 F6 =1400
28888: 76 3A 3B 76 E6 20 CB 3A =873
28896: 3B 76 EE 20 32 3B 76 E6 =904
28904: 20 DD 21 00 A0 2B 0F 3A =559
28912: F6 76 E6 02 DD 21 3D 76 =1029
28920: 2B 04 DD 21 45 76 3A 3B =602
28928: 76 ED 4B FB 76 E6 04 20 =1062
28936: 09 CD F4 65 DD E5 D1 C3 =1413
28944: 8F 6B CD 23 69 D8 2B 36 =902
28952: CD F4 65 06 08 C5 DD 5E =1076
28960: 00 06 04 C5 CB 03 9F 4F =651
28968: CB 03 9F A9 E6 0F A9 06 =954
28976: 04 77 24 10 FC 7C D6 04 =769
28984: 67 C1 2C 10 E6 C1 DD 23 =1035
28992: 7D D6 04 6F 7C C6 04 67 =883
29000: CD F6 64 10 D0 C9 CD F4 =1425
29008: 65 06 08 C5 DD 4E 00 DD =832
29016: 23 06 04 4F CB 11 17 17 =486
29024: 10 FA 47 0F B0 77 06 04 =657
29032: AF CB 11 17 17 10 FA 47 =778
29040: 0F B0 4E 2C 77 24 77 2D =632
29048: 71 CD F1 64 C1 10 D4 C9 =1281
29056: 3A 3B 76 07 07 D8 07 DC =692
29064: 93 69 3A F6 76 F6 04 32 =974
29072: F6 76 ED 4B FB 76 7B E6 =1392
29080: FB 47 79 E6 F8 4F ED 43 =1301
29088: FB 76 CD 20 72 CD 2E 67 =1071
29096: 3E 10 32 2C 77 CD CF 68 =810
29104: CD A7 70 FE FF CA D1 70 =1516
29112: A7 2B ED CD D1 71 3A 2C =1073
29120: 77 D6 1B 3B 0B FE 20 30 =755
29128: E1 3E 20 1B DD 3E 50 18 =730
29136: D9 F5 CD D9 70 F1 FE 20 =1523
29144: 3B 56 6F 26 00 3A F6 76 =713
29152: E6 02 ED 5B 36 5C 2B 12 =764
29160: 7D FE 20 2B 0D FE 41 D8 =999
29168: FE 56 D0 D6 41 6F ED 5B =1266
29176: 7B 5C 29 29 29 19 E5 ED =829
29184: 4B FB 76 CD 2D 66 D1 D5 =1215
29192: CD 8F 68 DD E1 ED 4B FB =1458
29200: 76 79 C6 0B 4F 78 47 C5 =912
29208: CD FE 70 C1 ED 43 FB 76 =1434
29216: CD 2D 66 11 00 A0 01 0B =538
29224: 00 7E 12 24 13 10 FA C9 =666
29232: DD 21 00 A0 FE 09 20 0B =720
29240: 3A F6 76 EE 02 32 F6 76 =1076
29248: C3 2E 67 FE 05 DB ED 4B =1131
29256: FB 76 20 05 79 D6 0B 18 =770
29264: C3 FE 0B 2B BC FE 07 78 =1066
29272: 20 0B D6 0B 30 BB D6 40 =772
29280: 18 B4 C6 0B FE C0 3B AE =1086
29288: D6 C0 18 AA C5 3A 0B 77 =982
29296: 90 ED 43 07 77 32 07 77 =750
29304: CD B4 72 C1 79 4B 47 91 =1053
29312: CB 32 07 77 11 00 00 C5 =590
29320: CD 95 72 C1 7B A7 CB 11 =1165
29328: 00 FF ED 44 47 3A 29 77 =849
29336: A7 20 2A C5 D5 CD A9 72 =1139
29344: D1 C1 79 A7 CB ED 44 4F =1274
29352: 1D 2A FA 76 7C B0 47 9F =921
29360: AA C0 7B FE C0 D0 7D B1 =1390
29368: 4F 9F AB C0 C5 CD 08 69 =1116
29376: C1 CD E6 69 C9 3A 07 77 =1118

29384: A7 C8 79 A7 2B DB C5 D5 =1324
29392: CD A9 72 D1 C1 C5 D5 1D =1329
29400: 79 ED 44 4F CD A9 72 D1 =1202
29408: C1 0D 1B E1 3E FF 18 01 =797
29416: AF 32 29 77 CD 0B 70 CD =918
29424: F4 66 ED 4B FB 76 2A FA =1316
29432: 76 78 94 30 02 ED 44 F5 =986
29440: 79 95 30 02 ED 44 CD 60 =926
29448: 73 F1 E5 CD 60 73 D1 19 =1235
29456: CD 74 73 7C A7 20 46 7A =951
29464: B3 28 01 2C DD 21 00 77 =637
29472: 7D DD 77 00 A7 20 0B 01 =673
29480: 00 00 CD A9 72 18 2E 11 =575
29488: B5 00 CD 63 73 7C DD 77 =1064
29496: 01 DD 7E 01 CD 60 73 E5 =994
29504: DD 7E 00 CD 60 73 C1 A7 =1123
29512: ED 42 CD 74 73 45 DD 4E =1107
29520: 01 CD 6C 72 DD 7E 01 DD =997
29528: 35 01 A7 20 DC C3 0A 67 =781
29536: 5F 16 00 21 00 00 06 08 =164
29544: CB 3F 30 01 19 CB 23 CB =781
29552: 12 10 F5 C9 11 01 00 A7 =665
29560: ED 52 3B 04 13 13 1B F7 =688
29568: 19 CB 3A CB 1B EB C9 3A =1010
29576: 3A 76 1B 02 3E FF 6F D9 =847
29584: E5 CD 0B 70 CD F4 66 2A =1150
29592: FA 76 ED 4B FB 76 11 01 =1064
29600: 01 78 94 28 05 30 04 ED =603
29608: 44 15 15 47 79 95 28 05 =496
29616: 30 04 ED 44 1D 1D 4F B0 =670
29624: 28 42 79 B8 D5 38 06 16 =708
29632: 00 68 41 18 03 1E 00 69 =331
29640: 60 D9 ED 4B FA 76 D9 7B =1330
29648: CB 3F 85 38 03 BC 38 07 =709
29656: 94 4F D9 D1 D5 18 04 4F =973
29664: D5 D9 D1 7A B0 47 79 83 =1212
29672: 4F CB 0D 30 0A E5 C5 CD =984
29680: 08 69 C1 CD E6 69 E1 D9 =1288
29688: 79 10 D7 D1 CD 0A 67 E1 =1104
29696: D9 C9 00 40 2A 02 74 3A =700
29704: 3B 76 E6 04 28 03 2A 97 =647
29712: 65 CD E7 64 7C F6 E0 67 =1334
29720: 7E E6 20 3E 07 20 02 3E =553
29728: 38 21 53 75 11 00 9B 01 =462
29736: 1C 00 ED B0 EB 11 1B 9B =877
29744: 77 01 1B 00 ED B0 6F 0F =686
29752: 0F 0F AB E6 07 AD 6F 67 =827
29760: 22 35 9B 22 28 9B EE 06 =715
29768: 32 30 9B 21 00 9B ED 4B =753
29776: FB 76 C5 79 0E 03 CD 7F =1033
29784: 75 23 C1 3E AF 90 0E 03 =743
29792: 30 06 ED 44 36 2D 23 0D =506
29800: CD 7F 75 3A F6 76 E6 04 =1105
29808: 20 05 3A 3B 76 E6 03 07 =512
29816: 07 EB 6F 26 00 01 3F 75 =572
29824: 09 01 04 00 ED B0 11 0E =458
29832: 9B 3A F6 76 E6 06 FE 04 =1071
29840: 30 08 3A 3B 76 E6 40 07 =592
29848: 07 07 07 6F 26 00 01 6F =282
29856: 75 09 01 04 00 ED B0 3A =602
29864: 3B 76 07 3B 0B 2A 2B 9B =488
29872: 7C EE 05 6F 67 22 2B 9B =810
29880: 3A 3C 76 47 E6 07 C6 30 =790
29888: 32 17 9B E6 07 FE 04 17 =746
29896: 0F 07 17 0F 07 17 32 33 =191
29904: 9B 7B E6 3B FE 20 30 02 =897
29912: F6 07 32 31 9B 0F 0F 0F =552

29920: E6 07 C6 30 32 15 9B CB =912
29928: 00 30 0B 3A 36 9B EE B7 =696
29936: 32 36 9B CB 00 30 0B 3A =576
29944: 35 9B EE 47 32 35 9B 3A =833
29952: 3B 76 2E 32 E6 0C FE 0B =777
29960: 3B 02 2E 34 E6 04 20 02 =424
29968: 2E 31 7D 32 14 9B 3A F6 =749
29976: 76 E6 10 C0 2A 02 74 DD =937
29984: 21 00 9B 01 04 07 E5 C5 =626
29992: DD 7E 1C 0B DD 7E 00 CD =935
30000: 72 6B DD 23 10 F2 C1 E1 =1150
30008: CD 59 65 0D 20 EB C9 53 =956
30016: 45 54 20 5B 4F 52 20 52 =548
30024: 45 53 20 53 4B 49 50 54 =579
30032: 45 5B 54 20 20 20 2C 20 =413
30040: 20 20 20 20 20 20 46 20 =294
30048: 6F 20 20 20 20 20 4D 20 =380
30056: 20 50 20 49 42 46 20 53 =468
30064: 43 52 4E 41 54 54 52 20 =574
30072: 20 20 20 47 52 50 4B E5 =630
30080: 06 00 21 95 75 09 5E E1 =633
30088: 06 2F 93 04 30 FC 83 70 =747
30096: 23 0D 20 EB C9 00 01 0A =527
30104: 64 2A 02 74 7C FE 40 20 =734
30112: 05 21 B0 50 1B 03 21 00 =306
30120: 40 22 02 74 CD 0D 6B C3 =736
30128: 16 75 3A F6 76 EE 10 32 =865
30136: F6 76 1B F0 0D 07 44 52 =798
30144: 41 57 20 4B 41 53 4B 27 =523
30152: 52 45 53 45 54 20 42 49 =558
30160: 54 27 53 45 54 20 42 49 =550
30168: 54 27 27 20 2A 2A 2A 2A =362
30176: 2A 2A 2A 2A 27 27 DD 21 =500
30184: BC 75 CD 31 6B 21 C2 40 =954
30192: E5 CD 65 6B 3E 87 32 C3 =1081
30200: 5B E1 2C 06 0B C5 E5 CD =1002
30208: 2E 67 CD 74 67 FE 02 30 =877
30216: F6 6F 07 07 F6 43 0B 3E =754
30224: 30 B5 E1 CD 72 6B E5 CD =1263
30232: E7 64 36 B7 E1 C1 10 DD =1175
30240: 06 0B 21 C3 5B 7E 23 E6 =721
30248: 04 0F 0F 0F CB 11 10 F5 =530
30256: 79 32 3A 76 C3 0D 6B 03 =665
30264: 0B 2B AA 00 07 FF B1 B1 =738
30272: 99 99 B1 B1 FF B1 7E 66 =1176
30280: 5A 5A 66 7E B1 55 AA 55 =877
30288: AA 55 AA 55 AA AA 00 AA =1020
30296: 00 AA 00 AA 00 FF 00 FF =850
30304: 00 FF 00 FF 00 BB 11 22 =697
30312: 44 BB 10 20 40 21 90 4B =565
30320: 24 12 09 B4 42 AA AA 44 =669
30328: 44 AA AA 11 11 EE 22 33 =765
30336: 99 EE 22 33 99 B0 B0 B0 =1013
30344: FF 0B 0B 0B FF BB 44 22 =772
30352: 22 22 44 BB BB 22 50 BB =658
30360: 05 22 50 BB 05 0B 04 7C =396
30368: A4 25 3E 20 10 43 A5 5A =633
30376: 34 2C 5A A5 C2 55 55 55 =800
30384: 55 55 55 55 CC CC 33 =884
30392: 33 CC CC 33 33 3B 70 E0 =953
30400: C1 B3 07 0E 1C 22 FA BA =795
30408: AA AA AA A8 AF E5 07 3B =1145
30416: AB BA B3 E0 A7 BB 55 22 =1134
30424: 11 44 22 55 BB 0B 1C 3E =438
30432: 7F FF 7F 3E 1C A0 BE B2 =1079
30440: FA 0A EB 2B AF 00 01 0B =719
30448: 10 18 20 30 40 50 00 00 =264
```


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YC1185

GRAPHICS

AMSTRAD

Andrew Ware with a suite of 13 new graphics commands for the CPC-464.

THIS PROGRAM gives you 13 extra graphics commands. The Inverse and Copychar commands are text-orientated and the others are graphics orientated. The Stipple command affects both graphics and text. After the Ston command has been used all text is stippled as well as all points plotted, all lines drawn and all shapes filled. When using stippled text no text will be printed when the graphics pen and paper are equal since the graphics Tag mode is used to print the text.

Any stippled text may be fully edited provided that the background colour does not appear within the stipple parameters. The Stoff command will return the text and graphics to their original pen and paper colours. If the Paint command is used while the stipple effect is on unpredictable patterns will occur due to the order in which points are plotted. To fill a shape with stipple I would advise the use of the Box, Ellipse and Circle commands with the Fill command on.

Any colour parameters used refer to the pen and paper colours currently selected and will respond to mode changes in the same manner as does Amstrad Basic. For example, if the stipple colours are selected by:

```
STIPPLE,1,2,3,4,5,6,7,8
```

then in mode 0 all eight colours will be used, however in mode 1 these colours will appear Mod 4 and the stipple will be equivalent to:

```
STIPPLE,1,2,3,4,0,1,2,3,0
```

If the incorrect number of parameters for a command have been entered the routine will return to Basic and display an error message.

Type in the data from program 3 followed by program 1. Once program 1 has been run the code can be saved by:

```
SAVE"CALL 38155",B,37985,2220
```

To load this data type:

```
MEMORY 37985:LOAD"CALL 38155"
```

and to use the new commands type:

```
CALL 38155
```

Remember that if you wish to use the Symbol command it must be used before the Memory command.

¦BOX,x co-ordinate,y co-ordinate,width, height [,ink]. This command responds to FILL. With ¦FILL,0 an outline of the box is drawn and with ¦FILL,1 the box is filled.

¦CIRCLE,x co-ordinate,y co-ordinate,radius [,ink]. Circle responds to FILL. With ¦FILL,0 the circumference only is drawn and with ¦FILL,1 the circle is filled.

¦COPYCHAR,column,row,@variable%. Returns the CHR$ value of the character at the given row and column position into the integer variable following the "@" character.

¦ELLIPSE,x co-ordinate,y co-ordinate,width, height [,ink]. Ellipse responds to FILL in the

Program 1.

```
10 DEG:FOR F=0 TO 255:POKE (156*256)+F,SIN(F/255*180)*
255:NEXT
```

Program 3.

```
10 REM Hex loader
20 REM use this program to enter
30 REM the hex dump code
40 REM Type in each line of 20
50 REM hex digits as a single string
60 REM and then the checksum. E.g.
70 REM for the first line enter the
80 REM digits from F to 1
90 MEMORY 37985
100 FOR n = 37986 TO 39906 STEP 10
110 LET t=0:PRINT n;":";
120 INPUT a$
130 FOR c = 0 TO 9
140 z = VAL("&"+MID$(a$,c*2+1,2)):POKE (c+n),z
150 t = t + z
160 NEXT
170 PRINT " = ";:INPUT ch
180 IF ch<> t THEN PRINT "input error
  - try again": GOTO 110
190 NEXT
```

Hex dump.

```
37986 : F5D5C54D060085C16002I = 893
37996 : 0000CB3930119CB23CB = 775
38006 : 12052QF4C1D1F1C9F5D5 = 1601
38016 : C5571E000600AFED5223 = 857
38026 : F28F94192B2910F4C1D1 = 1304
38036 : F1C9BF94C32E95C3AC95 = 1687
38046 : C30896C3D599C35196C3 = 1538
38056 : F397C30298C39F98C3B4 = 1624
38066 : 98C3E599C3F699C3279A = 1711
38076 : C3139A43495243CC545 = 999
38086 : 4C4C495053C5475045CE = 1011
38096 : 475041504SD246494CCC = 998
38106 : 4D4153CB424FD8494E56 = 1026
38116 : 455253C55041494ED453 = 1022
38126 : 544F46C653544FCE5354 = 1050
38136 : 4950504CC5434F505943 = 888
38146 : 4841D200000795969401 = 802
38156 : 9694210795CDD1BC21FD = 1375
38166 : 9A2264BB3EC33263BBCD = 1273
38176 : F6993E01CD0EBCCDB89B = 1413
38186 : CDE599C9FE05D22C9BFE = 1710
38196 : 042007CD7C95DD23DD23 = 1033
38206 : DD4E00DD4601ED431396 = 1064
38216 : DD6E02DD6603DD5E04DD = 1199
38226 : 5605CD83953E02327395 = 954
38236 : ED437495ED4376953E3F = 1265
38246 : 32A795ED537895227A95 = 1260
38256 : C36E960232003200200 = 591
38266 : 2300DD7E00CDDEBBC9C5 = 1394
38276 : E5D5CDCCBBED53A89522 = 1709
38286 : AA95D1E1D5E5ED4BAA95 = 1826
38296 : 09EBED4BA8959BEBCDC9 = 1523
38306 : BBE1D1C193F000000000 = 1078
38316 : FE06D22C9BFE052007CD = 1172
38326 : 7C95DD23DD23DD6E00DD = 1337
38336 : 6601227695DD6E02DD66 = 1060
38346 : 0322749522139GDD6E04 = 840
38356 : DD6605DD5E06DD5607CD = 1168
38366 : 8395ED537895227A953E = 1236
38376 : 7F32A795AF3273952A74 = 1140
38386 : 95ED5B7695ED52D26E96 = 1533
38396 : 3C19327395EB227495ED = 1170
38406 : 5376951863FE01C22C9B = 1121
38416 : C37C9532002100000ED5B = 879
38426 : 1396E5D5CDEABBD1E13E = 1733
38436 : FFAA573EFFAB5FCDEABB = 1721
38446 : C9CD3296E5D5CDEABBD1 = 1883
38456 : E1E53EFFAA573EFFAB5F = 1611
38466 : D5CDEABBD1E13EFFAC67 = 1865
38476 : 3EFFAD6FC9FE01C22C9B = 1450
38486 : DD7E0032GD96FE012804 = 955
38496 : 3EEA18023EF6322C9632 = 924
38506 : 4496C900CD1596ED5B76 = 1241
38516 : 95ED4B74952A7695ED42 = 1338
38526 : 3002C5D17AFE0020107B = 1003
38536 : FE3F300B218000CD7E94 = 1016
38546 : 7DFE0020023E01FE0F30 = 801
38556 : 023E0F32C096F52A7495 = 1023
38566 : 232322C196210000022C3 = 709
38576 : 96F132C596673AA79584 = 1397
38586 : 32C696C3C7960220022 = 1012
38596 : 0040413AC59626006FED = 920
38606 : 5B7495E5CD049B227895 = 1252
38616 : EBE1D5ED5B7695CD0A9B = 1638
38626 : 227A95E53A7395FE0128 = 1151
38636 : 1F2A7A95ED5BC3961313 = 1055
38646 : AFED523811192B2BD5ED = 1128
38656 : 5B7895227A95CD2F96D1 = 1276
38666 : 18EA3A6D96FE012007 1A = 927
38676 : 7395FE002829ED5B7895 = 1196
38686 : ZAC1962B2B3E80BC381B = 932
38696 : AFED523816191 3E5D52A = 1100
38706 : 7A953A7395FE002801EB = 1123
38716 : CD2F96D1E118E5E1D122 = 1557
38726 : 7A95ED5378953A6D96FE = 1431
38736 : 0120403A7395FE012817 = 737
38746 : 2A7A95ED5BC39613ED52 = 1324
38756 : 3802819ED5B7895CD2F96 = 1091
38766 : 22C1963A7395FE00284A = 1069
38776 : ED5B78952AC19613ED52 = 1320
38786 : 3E3ED5B7A952A7895CD = 1233
38796 : 2F9622C196182F3A7395 = 967
38806 : FE0128112A7A95ED5B78 = 1073
38816 : 95CD2F9622C396ED53C1 = 1443
38826 : 963A7395FE0028102A78 = 944
38836 : 95ED5B7A95CD2F9622C1 = 1377
38846 : 9622C3963AC596673AC0 = 1287
38856 : 968467JAC696BCDAE897 = 1580
38866 : 7C32C596C3C796E567CD = 1602
38876 : 62945C1600E16FCD6294 = 1147
38886 : 19C9ED5BA8952AAA95CD = 1437
38896 : C9BBC9FE01C22C9BDD7E = 1584
38906 : 00322B9BCD59BCC9FE06 = 1191
38916 : D22C9BFE0520 0ADD7E00 = 1057
38926 : CDDEBBDD23DD23DD4E00 = 1425
38936 : CB81DD46 01DD5E02DD56 = 1248
38946 : 03DD6E04CB85DD660522 = 1036
38956 : 7A95DD6E06DD66072278 = 1092
38966 : 95C5D5ED5B78952A7A95 = 1469
38976 : CD8395D1C13A6D96FE00 = 1458
38986 : 2827210000CD5F982323 = 634
38996 : 7DB920F77CB820F3C3E8 = 1599
39006 : 97C5D5E5110000CDC0BB = 1391
39016 : E1D1D5E5CDF6BBE1D1C1 = 2141
39026 : C9210000D5C5110000CD = 866
39036 : C0BBE1110000E5CDF6BB = 1488
39046 : E1D1D5CDF6BBD1210000 = 1527
39056 : CDF6BB210000110000CD = 893
39066 : F6BBC3E897FE01C22C9B = 1659
39076 : DD7E00E60121B398BEC8 = 1332
39086 : 77CD9CBBC900FE04D22C = 1380
39096 : 9BFE032007CD7C95DD23 = 1185
39106 : DD23DD6E00DD6601DD5E = 1226
39116 : 02DD5603ED537895227A = 1057
39126 : 95AF32D39932D4993253 = 1286
39136 : 9932549932559932 6B99 = 1038
39146 : 326C99326D99CD11BCFE = 1287
39156 : 022820F53E2332539 93E = 764
39166 : 2B326B99F1FE0128103E = 967
39176 : 2332549932559993E2B32 = 765
39186 : 6D99326C99CDE7BB325F = 1341
39196 : 9932779932BC9932A199 = 1182
39206 : 2A7A95ED5B7895CDB899 = 1452
39216 : 3AD4993C3C32D4996F26 = 1107
39226 : 9D5E23562B244E2346ED = 671
39236 : 537895ED437A952A7895 = 1238
39246 : ED5B7A9523000000EBD5 = 1082
39256 : E5CDF0BBE1D1FE00CCB8 = 1937
39266 : 992A7895ED5B7A952B00 = 1106
39276 : 0000EBD5E5CDF0BBE1D1 = 1743
39286 : FE00CCB899ED5B78952A = 1434
39296 : 7A952323E5D5CDF0BBD1 = 1624
39306 : E1FE00CCB899ED5B7895 = 1617
39316 : 2A7A952B2BE5D5CDF0BB = 1473
39326 : D1E1FE00CCB8993AD499 = 1652
39336 : 21D3993C3CBEC8CD09BB = 1308
39346 : DADC99C33099D5E5CDEA = 1868
39356 : BBC1D13AD3993C3C32D3 = 1392
39366 : 99269D6F7323722B2471 = 915
39376 : 2370C90000DD7E00CDE4 = 1128
39386 : BBC9FE03C23099CD4BBB = 1507
39396 : C92168 0C22E9BDAF322A = 1073
39406 : 9B214A1322D4BDC9215C = 1042
39416 : 9A22E9BD21F59A220FBC = 1279
39426 : 3EC3320EBC3E01322A9B = 819
39436 : 214A9B22D4BDC9DD6602 = 1223
39446 : DD6E04CD75BBCD60BBDD = 1553
39456 : 6E00DD6601770 9600BDD = 989
39466 : 7E00E60FC5060421589A = 853
39476 : 0FCBBE3002CBFECB0E23 = 1167
39486 : 10F4C1DD23DD2310E221 = 1240
39496 : 589A0604CB062310FBCD = 968
39506 : 11BCCDC99AC955FF0000 = 1306
39516 : E5F5D5C53A039BFE0028 = 1394
39526 : 0678FE00CA919AAF0604 = 1066
39536 : ED5B589A2A5A9ACB0130 = 1108
39546 : 0BCB03CB02CB04CB05C3 = 1032
39556 : B39A0710EE0FED53589A = 1171
39566 : 225A9AC147D1F1E1C368 = 1516
39576 : 0CCB4420 02CBC7CB4228 = 1036
39586 : 02CBD7CB4528 02CBE7CB = 1371
39596 : 4328D7CBF710D3CB4228 = 1316
39606 : 02CBC7CB4328C9CBE718 = 1373
39616 : C5CB4328C1CBC718BDFE = 1569
39626 : 0020 10FE01281021C19A = 755
39636 : 22849A216F9A3608C921 = 914
39646 : 999A22849A216F9A3602 = 981
39656 : C921B39A22849A216F9A = 1185
39666 : 3604C9E5CDC99AE1CFCA = 1602
39676 : 8A32039BCFA79300D511 = 1097
39686 : 8000019D1F5C5E5D5EB21 = 1514
39696 : 009C1600197EE1CDD997 = 1127
39706 : D1CB4228 083EFFAD6F3E = 1189
39716 : FFAC67C1F1C900000611 = 1188
39726 : 21399B7ECD5ABB2310F9 = 1153
39736 : C90A5041152414D455445 = 802
39746 : 52204552524F520AF53E = 825
39756 : 013203 9BE5CDCCBBED53 = 1354
39766 : B09B22B29B1100002100 = 748
39776 : 00CDC9BBCDC6BBED53B4 = 1683
39786 : 9B22B69BE15C16006229 = 1004
39796 : 292929EB292929CD11BC = 891
39806 : FE02280629FE01280129 = 680
39816 : EBE5C1218F01ED42CDC0 = 1534
39826 : BBF1CDFCBB2AB69BED5B = 1779
39836 : B49BCDC0BB2AB29BED5B = 1622
39846 : B09BCDC9BBAF32039BC9 = 1508
39856 : 0000000000000000000635 = 59
39866 : 21C59B7E23CD5ABB10F9 = 1293
39876 : C90A2052535820455854 = 769
39886 : 454E4445442047524150 = 682
39896 : 484935320524F555449 = 730
39906 : 4E45530A0A0D20412E50 = 486
```

S EXTENSIONS

same manner as circle.

¦FILL,integer.¦ FILL,0 turns fill off. ¦FILL,1 turns fill on. FILL responds to the stipple command.

¦GPAPER,graphics paper colour. The background graphics paper is set to the colour specified.

¦GPEN,graphics pen colour. The foreground graphics pen is set to the colour specified.

¦INVERSE,integer. ¦INVERSE,0 turns the inverse mode off and text is printed in the current pen colour on the current paper colour. ¦INVERSE,1 turns the inverse mode on and text is printed in current paper colour on the current pen colour.

Paint responds to stipple

¦MASK,integer. Sets ink mask: ¦MASK,0 Force mode. Pixel plotted over background. ¦MASK,1 XOR mode. Pixel XORed with background pixel. ¦MASK,2 AND mode. Pixel ANDed with background pixel. ¦MASK,3 OR mode. Pixel ORed with background pixel.

¦PAINT,x co-ordinate,y co-ordinate[,ink]. Paints an enclosed area of the graphics window around the point x,y. This command can be terminated by pressing Ctrl and C keys together. Paint responds to stripple, however the results are unpredictable.

¦STIPPLE,pen 1,pen 2,pen 3,pen 4,pen 5,pen 6,pen 7,pen 8. Sets the order of pixel colour While stipple is activated the current graphics pen colour is ignored. Text will be printed in current stipple colours.

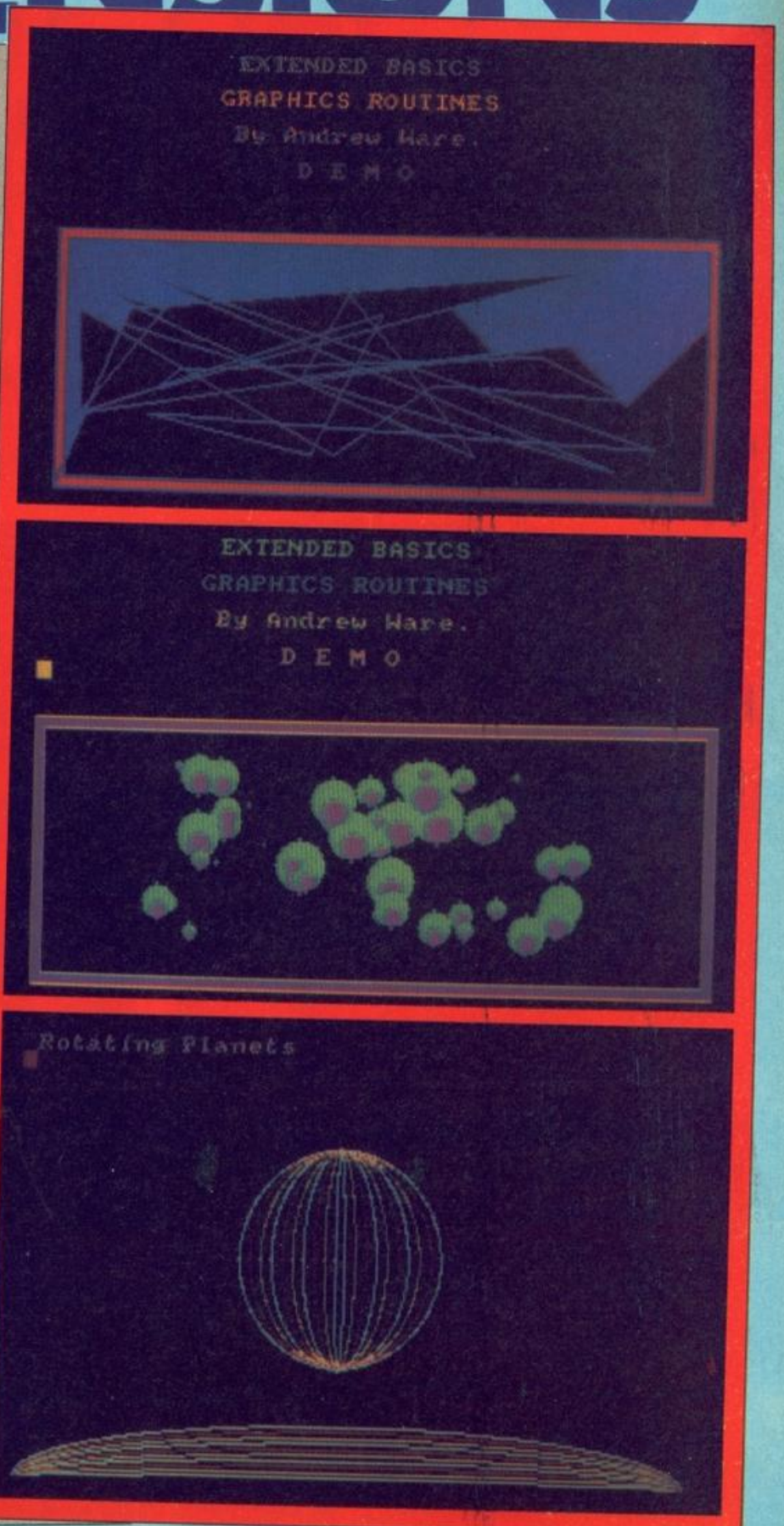
¦STOFF. Turns stipple off.

¦STON. Turns stipple on.

Terms in brackets are optional and all co-ordinates are relative to the current graphics origin. ■

Program 2.

```
10 !MASK,0:INK 0,0:BORDER 0:INK 1,24:INK 2,6:INK 3,5:I
NK 4,15:INK 5,18:MODE 1:!STIPPLE,1,2,1,2,1,2,1,2:!STON
20 LOCATE 12,1:PRINT"EXTENDED BASICS":!STIPPLE,2,3,2,3
:,3,2,3:LOCATE 11,3:PRINT"GRAPHICS ROUTINES":!STIPPLE
:,2,3,1,1,2,3,1:LOCATE 12,5:PRINT"By Andrew Ware."
30 !STIPPLE,1,3,1,3,1,3,1,3:LOCATE 16,7:PRINT"D E M O"
:!STOFF
40 !FILL,0:!BOX,0,0,639,239,1:!BOX,10,10,619,219:!PAIN
T,5,5,3
50 !FILL,1:FOR f=0 TO 50:x=RND*400+120:y=RND*150+50:r=
RND*25:!CIRCLE,x,y,r,2:!CIRCLE,x,y,r/2,r/2,3:NEXT
60 FOR f=0 TO 20:INK 2,RND*26:INK 3,RND*26:FOR g=0 TO
500:NEXT:NEXT
70 INK 2,24:INK 3,6:INK 1,5:!FILL,1:FOR g=1 TO 3:!MASK
,f:FOR f=0 TO 4:!BOX,12,12,615,216,0
80 !MASK,0:!BOX,12,12,615,216,0
90 FOR f=0 TO 25:DRAW RND*600+20,y=RND*200+10,1:NEXT
100 FOR f=0 TO 20:x=RND*600+20:y=RND*200+10:IF TEST(x,
y)=0 THEN c=(f MOD 3)+1:!PAINT,x,y,c
110 NEXT
120 !MASK,0:MODE 1:!STON:!STIPPLE,1,2,1,2,1,2,1,2:PRIN
T" Rotating Planets ":!STIPPLE,1,1,1,1,1,1,1,2:FOR f=0
TO 100:PLOT RND*640,RND*400,1:NEXT:!STOFF
130 !FILL,1:::CIRCLE,320,200,100,0:!ELLIPSE,320,0,320,
50:!FILL,0:FOR f=5 TO 100 STEP 10:!ELLIPSE,320,200,f,1
80,(f/10) MOD 3+1:NEXT
140 FOR f=5 TO 50 STEP 5:!ELLIPSE,320,0,320,f,(f/5)MOD
3+1:NEXT
150 FOR f=0 TO 50
160 INK 1,6:INK 2,26:INK 3,26:GOSUB 190
170 INK 1,24:INK 2,6:INK 3,6:GOSUB 190
180 INK 1,26:INK 2,24:INK 3,6:GOSUB 190
185 NEXT:GOTO 200
190 FOR g=0 TO 100:NEXT:RETURN
200 CLS:!STON:PRINT"EXAMPLE OF STIPPLE"
210 FOR f=0 TO 3:FOR g=0 TO 3:FOR h=0 TO 3:FOR i=0 TO
3:!STIPPLE,f,g,h,i,f,g,h,i:PRINT "STIPPLE";
220 NEXT:NEXT:NEXT:NEXT
230 MODE 0:!STIPPLE,1,2,3,4,1,2,3,4:PRINT"In mode 0 up
to 8  stipple colours can be defined."
240 !STIPPLE,1,3,5,7,9,11,13,15:PRINT"In mode 1 all fo
ur  colours may be used to make up the eightparameters
of the  stipple command."
250 !STIPPLE,1,2,1,2,1,2,1,2:PRINT"In mode 2 both
colours can be used to make up the eightcolours of th
e  stipple command."
260 FOR f=0 TO 10000:NEXT:INK 0,26:INK 1,5:BORDER 26:I
NK 2,6:INK 3,18:MODE 0:!STIPPLE,1,2,3,4,5,6,7,8:a$="IS
TIPPLE,1,2,3,4,5,6,7,8":PRINT a$:PRINT"In mode 0":FOR
f=0 TO 2000:NEXT
270 MODE 1:PRINT a$:PRINT"In mode 1":FOR f=0 TO 2000:N
EXT:MODE 2:PRINT a$:PRINT"In mode 2":FOR f= 0 TO 2000:
NEXT:RUN
```



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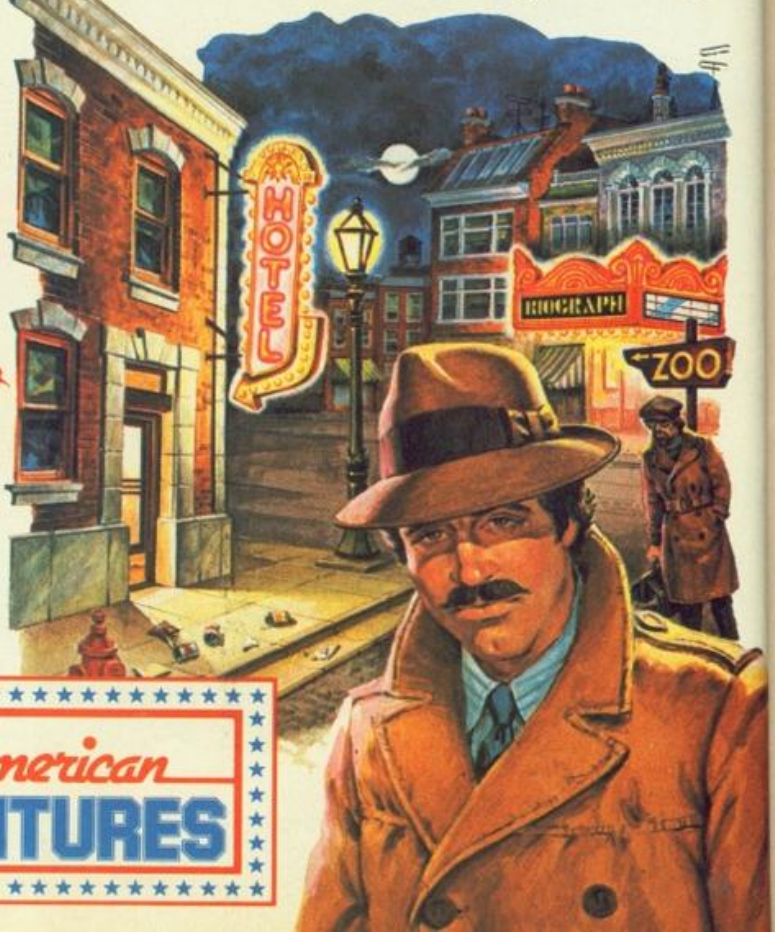

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CHANGER

WHEN LECTURING I often include informal definitions of computing terms to make them more memorable to students. My informal definition of a utility is a program which makes life easier for an operator or a programmer. The utility presented here falls into the latter category. This machine-code program does nothing that cannot be done from Basic; but it does it much faster and with much less bother to the programmer.

The utility is designed to manipulate the colour attributes of a BBC's mode 7 screen. A simple call is included to invert the colours — excluding black and white; a more involved series of calls will select an area of the screen to be affected, and allow a more precise exchange of attributes. All of this could be done from Basic; but would involve the program keeping track of the position and nature of teletext control codes. The memory involved for this may be greater than the memory occupied by this utility; and it would certainly execute more slowly.

Teletext — mode 7 — screens have colour and other attributes set and controlled by character codes in the range 129 to 159 Ascii. A control code on a line will control the manner in which succeeding characters on that line are presented by the hardware. Such codes only affect the current line up to either the end of the line or an overriding code on the same line.

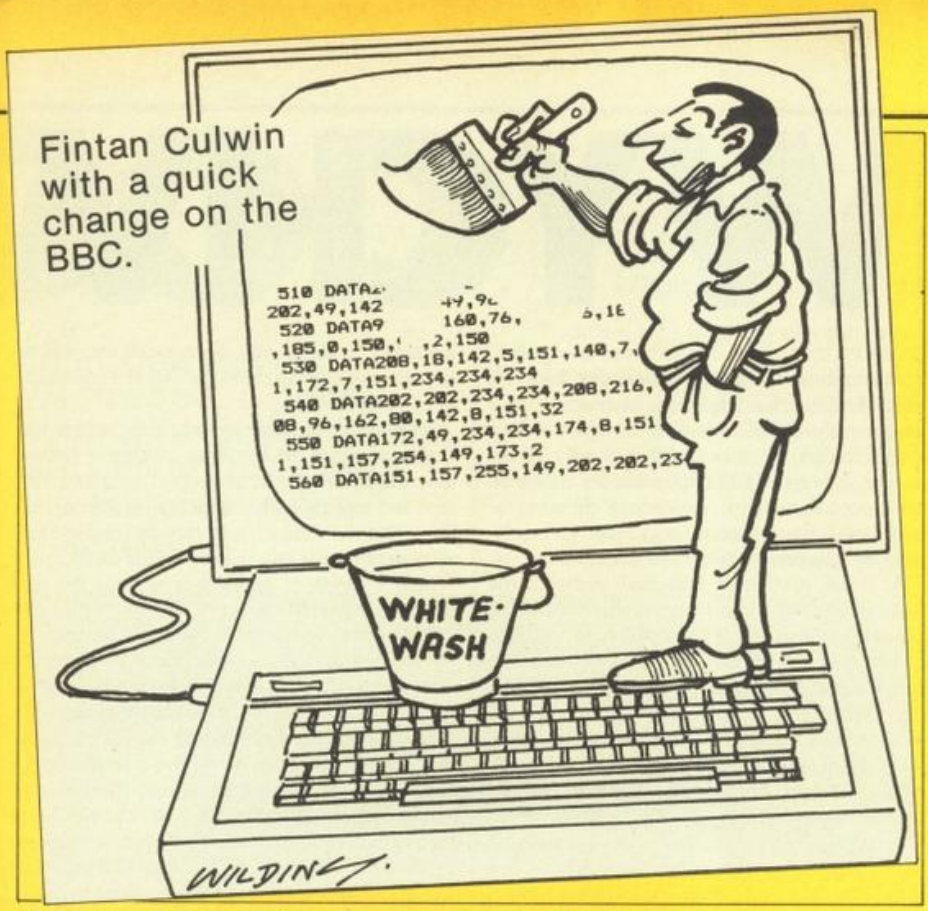
An example may make this clearer; suppose the message "HELLO!" is required to be presented in red text. The red text control code is given in the user guide as Ascii 129 (page 486). This can be incorporated into a string by the command

```
string$ = CHR$(129) + "HELLO!"
```

When this string is printed onto a mode 7 screen the control code will occupy one character position and the text will follow it in red. The colour will be changed by a following colour code or by the end of that line. If it is wanted to change the colour from red to blue; it is only necessary to change the control code from red text — 129 — to blue text — 132. It is not necessary to rewrite the text itself.

The utility presented here, if called without any parameters will cause a predefined change in text and graphic colour attributes. These predefined changes are red to green and vice versa, yellow to blue and cyan to magenta and vice versa. White codes are not affected.

```
100 MODE 7
110 REM MODE 7 CHANGER
120 REM FINTAN CULWIN
130 REM VERSION 1.0
140 origin% = &D02
150 FOR opt = 1 TO 3 STEP 2
155 P% = &D00
160 PROC prepare
170 PROC checkit
180 PROC doit
190 NEXT opt
200 PROC_test
210 PROC_save
220 END
1000 DEF PROC_prepare
1010 zerop = &70
1020 table = &72
1030 table?0 = &B5
1040 table?1 = &C3  : REM address of *40 table
1100 [ OPT opt
1110 .yhi : NOP
1120.ylo : NOP
1130 .xleft : NOP
1140 .xright : NOP
1150.flag : NOP
1160.address : NOP : NOP
1170.temp : NOP : NOP
1180 .from : NOP
1190 .to   : NOP
1900]
1999 ENDPROC
2000 DEF PROC checkit
2010 [ OPT opt : .invert
2020 LDA &355
2030 CMP #7
2040 BNE wally
2050 LDA #0
2060STA flag
2070LDA &600
2080BEQ default
2082 CMP #2
2084 BEQ two
2090CMP #4
2100BEQ four
2110CMP #6
2120BEQ six
2130.wally  : BRK
2140]
2150?P% = &17
2160$(P%+1) = " wally !"
2170P%?$0=0
2180P% = P% + 11  : REM ERROR MESASAGE
2200[ OPT opt
2210.default      \ default parameters
2220 JSR setdefaults
2230 JMP main
2300.four         \ get four parameters
2310JSR getfour
2320 JMP main
2400 .six         \ get six parameters
2410 JSR getfour
2420 LDA &600
2430STA zerop
2440LDA &608
2450STA zerop+1
2460LDA (zerop),Y
2470 STA from
2480 LDA &610
2490 STA zerop
2500LDA &611
2510STA zerop+1
2520LDA (zerop),Y
2530STA to
2540INY
2550STY flag      \ set flag for change
2560 JMP main
2590.two          \ get two parameters
2600JSR setdefaults
2610LDY #0
2620LDA &601
2630STA zerop
2640LDA &602
2650STA zerop+1
2660LDA (zerop),Y
2670STA from
2680LDA &604
2690STA zerop
2700LDA &605
2710STA zerop+1
2720LDA (zerop),Y
2730STA to
2735 INY
2738 STY flag     \ set flag for change
2740JMP main
2800 .setdefaults \ set default parameters
2810LDA #0
2820STA ylo
2830STA xleft
2840LDA #39
2850STA xright
2860LDA #24
2870STA yhi
2880RTS
2910 .getfour          \ STORE FIRST FOUR PARAMATERS
2920LDY #0
2930LDA &601
2940STA zerop
2950LDA &602
2960STA zerop+1
2970LDA (zerop),Y
2980STA xleft
2990LDA &604
3000STA zerop
3010LDA &605
3020STA zerop+1
3025 LDA (zerop),Y
3030STA xright
3040LDA &607
3050STA zerop
3060LDA &606
3070STA zerop+1
3075 LDA (zerop),Y
3080STA ylo
3090LDA &608
3100STA zerop
3110LDA &600
3120STA zerop+1
3125 LDA (zerop),Y
3130STA yhi
3140RTS
3150]
3160ENDPROC
4000 DEF PROC_doit
4010 [ OPT opt
4020 .main
4022 INC xright
4024  INC yhi          \ correct max values
4030.lineloop
4040LDA ylo
4050 ASL A            \ offset for table (2*Y)
4060TAY
4061 STY temp
4070LDA (table),Y
4080STA zerop+1
4090INY
4100LDA (table),Y
4110 STA zerop        \ offset from HIMEM
4112 CLC
4113 LDA #&7C
4115 ADC zerop+1
4116  STA zerop+1 \ add HIMEM to offset
4120JSR oneline
4130INC ylo
4140LDA ylo
4150CMP yhi
4160 BCC lineloop  \ do each line
4170 RTS           \ from routine
4200.oneline
4210 LDY xleft \ offset into Y index
4220  .nextchar LDA (zerop),Y \ get screen char into
4230 JSR onechar
4235  STA (zerop),Y  \ return to screen
4240 INY
4250 TYA
4260 CMP xright
4270  BCC nextchar    \ do each character
4290  RTS             \ from oneline
4500 .onechar
4510 LDX flag
4520  BNE switch      \ branch for change
4530 CMP #&81
4540  BCC nogud       \ byte too low
4550 CMP #&97
4560  BCS nogud       \ byte too high
4570  PHA             \ preserve byte
4580  AND #&0F        \ strip high nibble
4590  CMP #&7
4600  BCS notgud      \ low nibble > 7
4610 AND #1
4620  BNE up          \ increase byte
4630 PLA : TAX
4635 DEX
4640  TXA
4650  RTS             \ decrease byte
4660 .up              \ from onchar down
4670 PLA : TAX
4675 INX
4680  TXA
4690  RTS             \ increase byte
4700 .notgud PLA      \ from onechar up
4710  .nogud RTS      \ from onechar no good
4800 .switch
4810 CMP from
4820  BNE nogud       \ not to be switched
4830  LDA to          \ change it !
4840  RTS             \ from onechar switch
4850 ]
4999 ENDPROC
6000 DEF PROC_test
6010 CLS
6020 screen$ = CHR$(133)+CHR$(157)+CHR$(147)+CHR$(234
)+CHR$(131)+STRING$(32," ")+CHR$(147)+CHR$(181)+CHR$(3
2)
6030 FOR ytab= 0 TO 21
6040 PRINT screen$;
6050 NEXT
6060 PRINTTAB(3,0)CHR$(232)+STRING$(34,CHR$(252))+CHR
$(180)
6070 PRINTTAB(3,21)CHR$(170)+STRING$(34,CHR$(175))+CH
R$(165)
6080 FOR char = 0 TO 6
6090 PRINTTAB(15,3+char);CHR$(156);CHR$(129+char);"TE
STING "+CHR$(133)+CHR$(157);
6099 PRINTTAB(0,15);
6100 NEXTchar
6110 star$=CHR$(157)+CHR$(132)+"********"+CHR$(129)+"
================"+CHR$(133)+CHR$(157)
6120 stripe$=CHR$(157)+CHR$(132)+"================
========"+CHR$(133)+CHR$(157)
6130 FOR star = 11 TO 14 :PRINTTAB(7,star)star$ : NEX
T star
6140 FOR stripe = 15 TO 19 :PRINTTAB(7,stripe)stripe$
:NEXTstripe
6150 FOR demo = 1 TO 6
6160 PROC_message("INVERT WHOLE SCREEN")
6170 CALL invert
6180 NEXT demo
6190 left% = 0 : right% = 39 : top% = 0
6200 FOR demo% = 1 TO 21
6210 PROC_message("INVERT PART SCREEN")
6220 CALL invert.left%,right%,top%,demo%
6230 NEXT demo%
6240 PROC_message("CHANGE CYAN TO MAGENTA")
6250 cyan% = 134 : magenta% = 133
6260 CALL invert.cyan%,magenta%
6270 PROC_message("CHANGE STARS TO STRIPES")
6280 star% = 42 : stripe% = 61 : string% = 36
6300 PROC_message("FIRST STARS TO STRING")
6310 CALL invert.star%,string%
6320 PROC_message("NOW STRIPE TO STAR")
6330 CALL invert.stripe%,star%
6340 PROC_message("AND STRING TO STRIPE")
6350 CALL invert.string%,stripe%
6360 left% = 7 : right% = 36: top% =11
6370 PROC_message("ONE LINE AT A TIME...")
6380 FOR bottom% = 11 TO 19
6385 top% = bottom%
6390 CALL invert.left%,right%,top%,bottom%,star%,stri
ng%
6400 CALL invert.left%,right%,top%,bottom%,stripe%,st
ar%
6410 CALL invert.left%,right%,top%,bottom%,string%,st
ripe%
6420 TIME=0 : REPEAT UNTIL TIME > 50
6430 NEXT bottom%
6440 PROC_message("THAT'S ALL FOLKS")
6450 ENDPROC
6900 DEF PROC_message(string$)
6905 *FX 15,0
6908 VDU28,0,24,39,22,12,26
6910 xtab= (40 - LEN(string$))/2
6920 FOR ytab = 22 TO 23
6930 PRINTTAB(xtab,ytab)CHR$(141);string$
6940 NEXT ytab
6950 PRINTTAB(14) "PRESS";CHR$(136);"SPACE";CHR$(137)
;"BAR";
6960 REM TIME = 0 : REPEAT UNTIL TIME > 100
6970 REPEAT
6980 UNTIL INKEY(-99)
6990 ENDPROC
6999 ENDPROC
7000 DEF PROC_save'
7005 VDU7
7010 VDU28,4,19,36,2,12,26
7100 PRINTTAB(8,8);
7110 PRINTTAB(11,24)STRING$(15," ");
7120 yellow% = 131 : blue% = 132 : green% = 130
7130 CALL invert.yellow%,green%
7140 CALL invert.blue%,green%
7150 PRINTTAB(10,5)CHR$(129)"CODE ASSEMBLED -
7160 PRINTTAB(5,7)CHR$(129)"START  ADDRESS ~"~origin%
7170 PRINTTAB(5,9)CHR$(129)"END    ADDRESS ~"~P%
7180 PRINTTAB(5,11)CHR$(129)"ACTION ADDRESS ~"~main
7200 ENDPROC
```

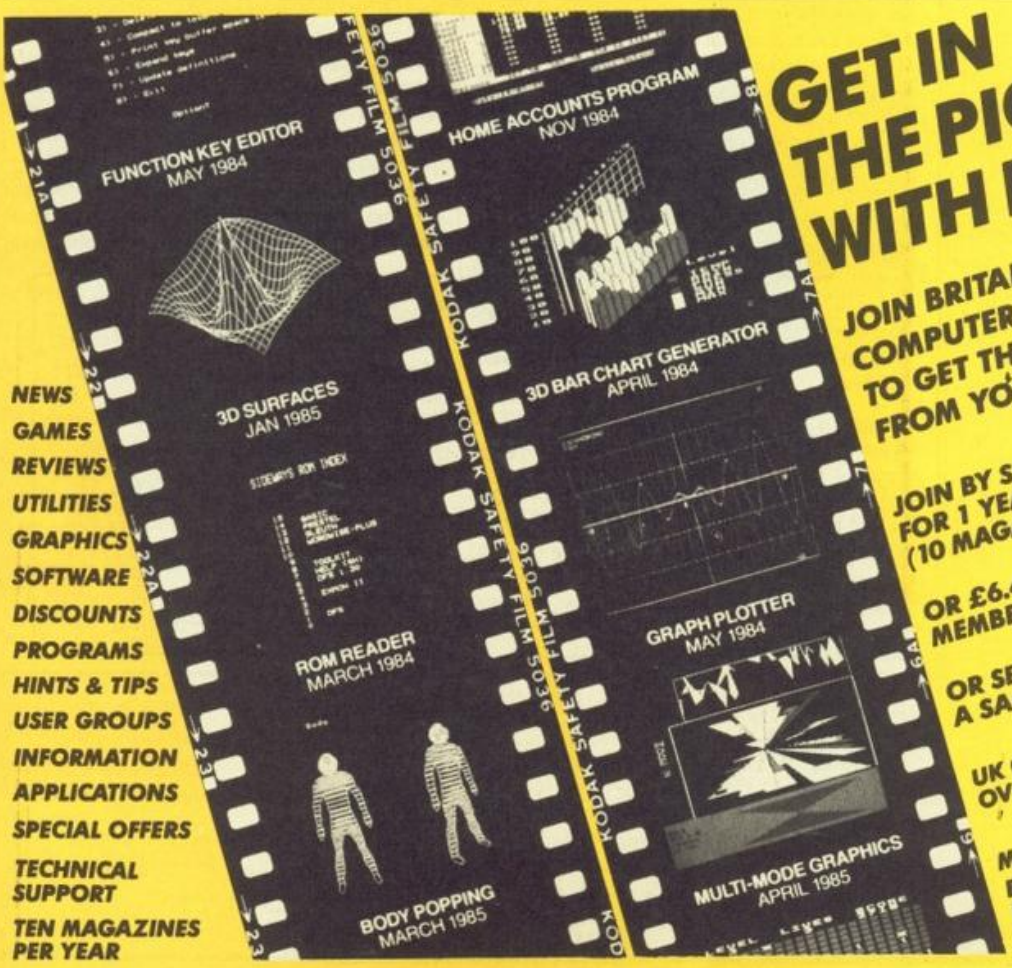


The default of the whole screen can be modified by adding four integer parameters to the call. These parameters define an area of the screen in the order leftX, rightX, topY and bottomY. Only the codes in this area will be changed; but the effects of the codes may extend to the right of the area.

More selective control of the changes can be made by specifying two or six integer parameters. Two parameters indicate a code to be found and a code to replace it. These codes are not limited to teletext control codes; any Ascii characters can be exchanged. Two integer parameters will effect the whole screen; six will select an area of the screen. The first four define the area as before; the last two specify the codes to be found and replaced respectively.

Only a limited error checking is provided. A check is made that the machine is in mode 7; and a check is made that the correct nns only. The left/right and up/down should be in the correct order and within the confines of the screen. If these conditions are not adhered to unexpected and possibly disastrous results will be obtained.

For the non technical all that is necessary is to copy out the listing. It is configured for tape based systems to occupy memory from &D00 onwards; it extends beyond the normal start of user memory &E00; so it will have to be protected or assembled for a different area. When run the code is first assembled and then tested with all four possible types of command. Once tested the start, end and execution addresses are displayed allowing a working copy to be saved. ■



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WYCHW

SOME PEOPLE make a fetish out of "good" programming. Computer academics run riot with the idea that any Goto instruction in a program should be erased as though it were a manifestation of the Devil himself. Other people have more laid back attitudes which do not necessarily help to produce tight, error proof, well documented programs that can be used by someone other than the author.

As usual, a sensible mid-point between the poles of opposing arguments seems to produce a good outcome; there are solid advantages in structuring a program so that the logic of the steps that the computer needs to follow is set out clearly and simply; while an occasional Goto, with a local destination and not crossing any exits from the segment of the program in which it is used, produces no confusion and can save space and effort.

I tend to write programs out of my head and the tidying up gets done later on when I have some idea that I can achieve what I want to do. That's the opposite of what you might be taught about "proper" computing but it's human and the end result may not be so bad. What you do need is a sense of the good structure at which you are aiming finally.

Figure 1 is a listing of Wychwood; a plotter control language for the BBC micro. I wrote the program originally because I wanted to control the sophisticated features of an Epson HI-80 plotter and that's quite difficult to do using Basic, spreadsheet programs or a word processor. The version listed here is adapted for the Oric-1/Tandy four colour plotter.

All computer langauges allow you to construct a series of steps, or program instructions, that the computer will follow when the program is run. If you are writing a language in Basic you need some way of inputting and storing the steps that the computer is to carry out.

It would be possible to enter each step at the keyboard, store the sequence on tape or floppy disc and then run the program by starting the tape and reading each instruction as it occurred. One obvious difficulty of this method is that all programming languages provide facilities to repeat a series of operations until a desired result is achieved.

With the program steps stored on tape you'll have to rewind the tape each time the program went round the loop. That seems a bit slow and perhaps boring — but it could be done.

Another method of holding the instructions that your langauge must follow is to place the program steps into a Basic array. Finding the start of the program is easy, to find the next instruction you need only increment a counter by one, and loops are easy to establish and run as you can alter the value of the counter to point to the instruction after the label that marks the start of the loop.

For example, Wychwood uses the array A$ to hold the series of instructions that form a Wychwood program.

The idea of using an array to store the instructions that are to be carried out by Wychwood is fine so far as it goes. But first of all the program you have written to control a plotter will be lost when the power to the computer is turned off, and second, the BBC computer is comparatively short of space for very large arrays.

In fact, the second objection is a good thing because it leads to a neat solution which removes all practical limitations on the size of plotter control program you can wirte and gives

Figure 1.

```
10 REM  WYCHWOOD  Plotter control program for the ORIC-1
20
30 GOTO 70
40 GOTO 5810: REM Indirection to program error routine
50 GOTO 3920: REM Indirection to PROCPLOT error routine
60
70 Drive$ = "1": F$ = "Default"
80 #TV0,1
90 MODE 3
100 CLOSEEO
110 ARRAYSIZE = 150
120 DIM A$(ARRAYSIZE)
130 CLS
140 PRINT SPC(15); "WYCHWOOD - Plotter Control Program"
150 PRINT: PRINT SPC(15); "(c) John Dawson 1985"
160 PRINT: PRINT SPC(15); "Version 1.10"
170 PRINT: PRINT SPC(15); "for the ORIC-1 plotter"
180 FOR delay% = 0 TO 700: NEXT delay%
190 CLS
200
210 REPEAT
220   ON ERROR GOTO 40
230   #DRIVE 0
240   PROCINSTRUCTS("COMMAND")
250   Z$ = GET$
260   IF Z$ = "W" THEN D% = 0: PROCWRITE
270   IF Z$ = "E" THEN PROCEDIT_PLOT
280   IF Z$ = "S" THEN PROCSAVE
290   IF Z$ = "R" THEN PROCLOAD
300   IF Z$ = "D" THEN PROCHANGE_DRIVE
310   IF Z$ = "P" THEN PROCSTART_UP: PROCPLOT: VDU3
320   IF Z$ = "L" THEN PROCLIST_PLOT
330   IF Z$ = "C" THEN PROCCATALOGUE
340   IF Z$ = "T" THEN PROCSPOOL_TEXT
350   UNTIL Z$ = "X"
360 VDU26
370 VDU12
380 END
390
400 DEF PROCCATALOGUE
410 PROCRH_WINDOW
420 CLS
430 PRINT "CATALOGUE of the current data disc:"
440 PRINT STRING$(40,"_")
450 PRINT: PRINT
460 IF Drive$ = "0" THEN #,0
470 IF Drive$ = "1" THEN #,1
480 IF Drive$ = "2" THEN #,2
490 IF Drive$ = "3" THEN #,3
500 PRINT
510 ENDPROC
520
530 DEF PROCHANGE_DRIVE
540 PROCRH_WINDOW
550 CLS
560 PRINT "DATA - alter the drive number for data storage"
570 PRINT STRING$(40,"_")
580 PRINT TAB(10,5); "Current drive number is "; Drive$
590 PRINT TAB(10,7); "ENTER new drive number or"
600 PRINT "press <Return> to leave unchanged ";
610 Z$ = GET$
620 IF Z$ = CHR$(13) THEN 660
630 IF Z$ = "0" THEN Drive$ = Z$:GOTO 660
640 IF VAL(Z$) < 1 OR VAL(Z$) > 3 THEN VDU7: GOTO 590
650 Drive$ = Z$
660 CLS
670 ENDPROC
680
690 DEF PROCERASE_LINE(Y)
700 VDU 31,0,Y
710 PRINT SPC(79)
720 ENDPROC
730
740 DEF PROCRETURN
750 PRINT "Press <Return> to continue ";
760 x$ = GET$: IF x$ <> CHR$(13) THEN 760
770 ENDPROC
780
790 DEF PROCSTART_UP
800 PROCRH_WINDOW
810 CLS
820 PRINT "PLOT current array"
830 PRINT STRING$(40,"_")
840 PROCRH_W2
850 #FX5,1
860 #FX6,10
870 VDU 2
880 VDU 1,13,1,10,1,13
890 PRINT "I"
900 ENDPROC
910
920 DEF PROCLH_WINDOW
930 VDU 28,0,24,30,0
940 ENDPROC
950
960 DEF PROCRH_W2
970 VDU 28,31,24,79,3
980 ENDPROC
990
1000 DEF PROCRH_WINDOW
1010 VDU 28,31,24,79,0
1020 ENDPROC
1030
1040 DEF PROCWRITE
1050 PROCINSTRUCTS("ELEMENT")
1060 PROCRH_WINDOW
1070 CLS
1080 C%=0%
1090 REPEAT
1100   PRINT STR$(C%); ":";
1110   INPUT LINE " " Z$
1120   IF Z$ = "Q" THEN 1150
1130   A$(C%) = Z$
1140   C% = C%+1
1150   UNTIL C% >= ARRAYSIZE OR Z$ = "Q"
1160 C% = C%-1
1170 ENDPROC
1180
1190 DEF PROCINSTRUCTS(X$)
1200 PROCLH_WINDOW
1210 CLS
1220 X = OPENUP X$
1230 REPEAT
1240   INPUT#X,Y$
1250   PRINT Y$;
1260   IF NOT EOF(X THEN PRINT
1270   UNTIL EOF(X
1280 CLOSE#X
1290 ENDPROC
1300
1310 DEF PROCPLOT
1320 ON ERROR GOTO 50
1330 CLS: Err$ = F$
1340 FOR D% = 0 TO C%
1350   Err% = D%: Err$ = Err$
1360   IF LEFT$(A$(D%),1) = ":" THEN NEXT D%
1370 IF LEFT$(A$(D%),1) = "." THEN PROCMACRO ELSE
PRINT A$(D%)
1380 NEXT D%
1390 VDU26
1400 CLS
1410 ENDPROC
1420
1430 DEF PROCSAVE
1440 CLOSEEO
1450 PROCRH_WINDOW
1460 CLS
1470 PRINT "SAVE plot array to disc"
1480 PRINT STRING$(40,"_")
1490 PRINT TAB(10,3) "CHECK data disc is in drive "; Drive$
1500 PRINT TAB(10,5) "ENTER file name";
1510 INPUT " " N$
1520 IF LEN(N$) > 7 THEN VDU7: GOTO 1500
1530 F$ = "1"+Drive$+".X,"+N$
1540 Y = OPENOUT(F$)
1550 PRINT#Y,N$,C%
1560 FOR D%=0 TO C%
1570   PRINT#Y,A$(D%)
1580   NEXT D%
1590 CLOSE#Y
1600 CLS
1610 ENDPROC
1620
1630 DEF PROCLOAD
1640 CLOSEEO
1650 PROCRH_WINDOW
1660 CLS
1670 PRINT "READ plot array from disc"
1680 PRINT STRING$(40,"_")
1690 PRINT TAB(10,3) "CHECK data disc is in drive ";Drive$
1700 PRINT TAB(10,6) "ENTER file name";
1710 INPUT " " N$
1720 IF N$ = "" THEN PROCCATALOGUE: PROCRETURN: GOTO 1660
1730 IF LEN(N$) > 7 THEN VDU7: GOTO 1700
1740 F$ = "1"+Drive$+".X,"+N$
1750 FOR F% = 0 TO C%+1: A$(F%) = "": NEXT F%
1760 Y = OPENUP(F$)
1770 INPUT#Y,N$,C%
1780 PROCRH_WINDOW
1790 CLS
1800 PRINT "Loading ";F$
1810 C%=0
1820 REPEAT
1830   INPUT#Y,A$(C%)
1840   PRINT A$(C%)
1850   C%=C%+1
1860   UNTIL EOF(Y
1870 CLOSE#Y
1880 C% = C%-1
1890 CLS
1900 ENDPROC
1910
1920 DEF PROCMACRO
1930 K = INSTR(".AXIS-1.GREEN,RED,BLUE,BLACK,TITLE,SIZE80,
SIZE40",A$(D%))
1940 IF K = 0 THEN 2050
1950 IF K = 1 THEN RESTORE 4050: PROCX
1960 IF K = 8 THEN PRINT "C2"
1970 IF K = 14 THEN PRINT "C3"
1980 IF K = 18 THEN PRINT "C2"
1990 IF K = 23 THEN PRINT "C0"
2000 IF K = 29 THEN RESTORE 4060: PROCX
2010 IF K = 35 THEN PRINT "S0"
2020 IF K = 42 THEN PRINT "S1"
2030 ENDPROC
```

Figure 2.

```
WRITE      a new plot sequence
EDIT    the current plot array
STORE   the plot array to disc
READ    a plot array from disc

PLOT         the current array
LIST    the current plot array

CATALOGUE     the current disc
DRIVE     alter the data drive

TEXT spool array to text file

EXIT <X> to BASIC
Which C D E L P R S T W X
```

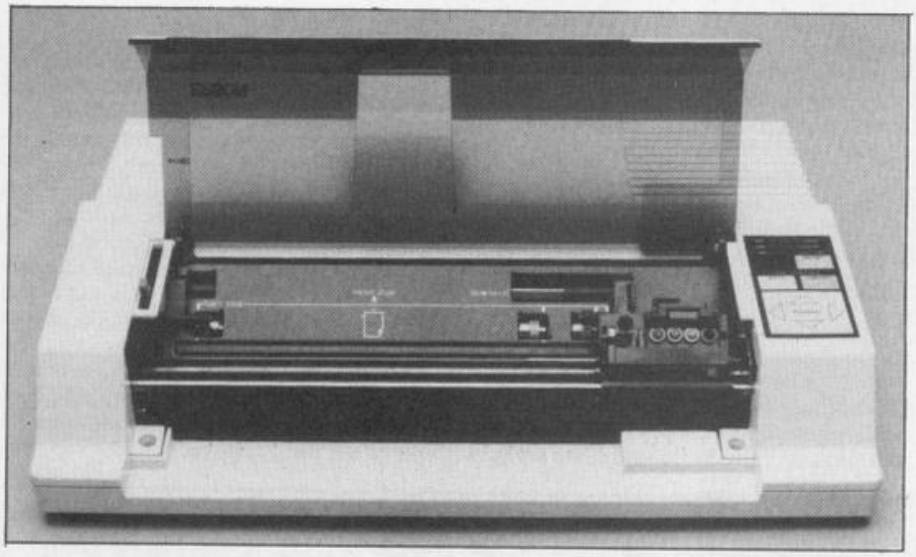
```
WYCHWOOD - Plot array editor
----------------------------

APPEND instructions to array

DELETE instruction

INSERT instructions into the
       array.  Enter <Q> to
       exit the insert mode

MODIFY an instruction

EXIT <X> the editor to
       return to the MCL
```

WOOD

John Dawson with Wychwood, a plotter control language for the BBC micro to control the features of the Oric-1/Tandy.

array
- D Change the current data disc — default '1'
- P Send the contents of A$ to the plotter
- L List the A$ program array to a parallel printer
- C Display a catalogue of the current data disc
- T Produce a text file from the current A$ array
- X Exit the Wychwood program to Basic

For my own education, I decided that I wanted to show different prompt messages and instructions on screen at various places in the program. It is inefficient to try to store these as part of the Basic program because the relatively large amounts of textual information seriously detracted from the data you can hold

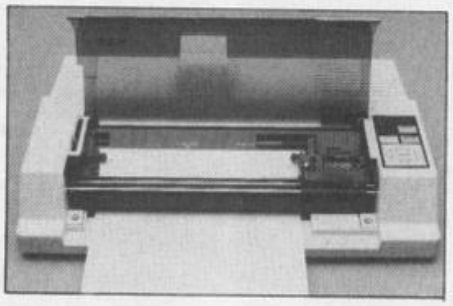


your programs a tidy, easy to understand structure. The solution does depend, however, on the use of a floppy disc drive.

In theory, you could use the program with one or two cassette decks but you lose the ability to find one out of a collection of files in a few milliseconds and that will make the program very frustrating to use.

Before you can "run" a Wychwood program, you need to be able to enter the instructions into the program array, save the program on a floppy disc and read it back into the computer. Nobody writes correct programs in one go and Wychwood has an editing facility that allows you to Modify, Delete, Insert and Append instructions to those already in the array. The functions available from the Main Command Level (lines 210-350) are:

- W Write a new program
- E Edit the contents of the A$ program array
- S Store the A$ array on disc
- R Read a program from disc into the A$



in the machine at any one time.

This is a key difference between a program written for the BBC using cassette tape as its mass storage facility and the same machine fitted with disc drives. A cassette tape based program must hold the whole program in Ram at once unless you intend to Chain one section of the program after another. With floppy discs you can ready one file or another from disc just as often as you want.

(continued on next page)

```
2040
2050 K = INSTR(".INCX.INCY.SETX.SETY.LOOP", LEFT$(A$(D%),5))
2060 IF K = 0 THEN 2170
2065 V% = LEN(A$(D%))-5
2070 XY$ = RIGHT$(A$(D%),V%)
2080 XYZ = VAL(XY$)
2090 IF K = 1 THEN X1 = X1+XYZ
2100 IF K = 8 THEN Y1 = Y1+XYZ
2120 IF K = 11 THEN X1 = XYZ
2130 IF K = 16 THEN Y1 = XYZ
2140 IF K = 21 THEN Loop% = XYZ
2150 ENDPROC
2160
2170 K = INSTR(".REPEAT.UNTIL", A$(D%))
2180 IF K = 0 THEN PROC_ELEMENT
2190 IF K = 1 THEN Repeat% = D%
2200 IF K = 8 THEN PROC_UNTIL
2210 ENDPROC
2220
2230 DEF PROCEDIT_PLOT
2240 PROCINSTRUCTS("EDITOR")
2250 P%% = 15
```

```
2260 PSTART% = 0
2270
2280 REPEAT
2290   PROCDISPLAY_PAGE
2300   PROCEDIT_COMMAND
2310   IF Z% = 138 THEN PSTART% = PSTART%+10: D% = D%+10
2320   IF Z% = 139 THEN PSTART% = PSTART%-10: D% = D%-10
2330   IF PSTART% >= ARRAYSIZE THEN PSTART% = ARRAYSIZE-15: D% = PSTART%
2340   IF PSTART% < 0 THEN PSTART% = 0: D% = PSTART%
2350   IF Z$ = "A" THEN D% = CX%+1: PROCWRITE: PROCINSTRUCTS("EDITOR")
2360   IF Z$ = "D" THEN PROCDELETE
2370   IF Z$ = "I" THEN PROCINSERT
2380   IF Z$ = "M" THEN PROCMODIFY
2390   UNTIL Z$ = "X" OR Z$ = "x"
2400 Z$ = ""
2410 PROCRH_WINDOW
2420 CLS
2430 ENDPROC
2440
2450
2460 DEF PROCDISPLAY_PAGE
2470 PROCRH_WINDOW
```

```
2480 CLS
2490 FOR H% = PSTART% TO PSTART%+P%%
2500   PRINT STR$(H%);": ";A$(H%)
2510   NEXT H%
2520 ENDPROC
2530
2540 DEF PROCEDIT_COMMAND
2550 #FX4,1
2560 VDU28,31,24,79,19
2570 CLS
2580 PRINT STRING$(40,"-");
2590 PRINT "Select (A D I M X): ";
2600 IF D% < PSTART% THEN D% = PSTART%
2610 IF D% >= PSTART%+P%% THEN D% = PSTART%+P%%
2620 PRINT TAB(0,3); BPC(40)
2630 PRINT TAB(0,3); STR$(D%); ": ";A$(D%)
2640 PRINT TAB(3,4);
2650 Z% = GET
2660 IF Z% = 136 THEN D% = D%-1: GOTO 2600
2670 IF Z% = 137 THEN D% = D%+1: GOTO 2600
2680 Z$ = CHR$(Z%)
2690 #FX4,0
2700 ENDPROC
2710
2720 DEF PROCDELETE
2730 FOR E% = D% TO ARRAYSIZE-1
2740   A$(E%) = A$(E%+1)
2750   NEXT E%
2760 A$(ARRAYSIZE) = ""
2770 C% = C%-1
2780 ENDPROC
2790
2800 DEF PROCINSERT
2810 FOR E% = ARRAYSIZE TO D% STEP -1
2820   IF E% < 1 THEN 2840
2830   A$(E%) = A$(E%-1)
2840   NEXT E%
2850 C% = C%+1

2860 A$(D%) = ""
2870 CLS
2880 PRINT STRING$(40,"-");
2890 PRINT "ENTER new instruction"
2900 IF D% < 1 THEN 2920
2910 PRINT TAB(0,2); STR$(D%-1); ": "; A$(D%-1)
2920 PRINT TAB(0,4); STR$(D%+1); ": "; A$(D%+1)
2930 PRINT TAB(0,3); STR$(D%);:INPUT LINE ": " A$(D%)
2940 IF A$(D%) = "D" OR A$(D%) = "q" THEN PROCDELETE:
ENDPROC
2950 D% = D%+1
2960 GOTO 2810
2970
2980 DEF PROCMODIFY
2990 CLS
3000 PRINT STRING$(40,"-")
3010 PRINT "COPY or MODIFY the current instruction"
3020 PRINT TAB(0,3); STR$(D%); ": "; A$(D%)
3030 PRINT TAB(0,4); STR$(D%); ": ";
3040 INPUT LINE "" E$
3050 IF E$ = "" THEN ENDPROC ELSE A$(D%) = E$
3060 ENDPROC
3070
3080 DEF PROCLIST_PLOT
3090 PROCRH_WINDOW
3100 CLS
3110 IF A$(0) = "" THEN 3390
3120 PRINT TAB(0,6) "Enter page header (40 chars max)
     ";
3130 INPUT LINE "" TI$
3140 IF LEN(TI$) > 40 THEN VDU7: GOTO 3100
3150 #FX5,1
3160 #FX6,0
3170 VDU 2
3180 PL% = 50: PP% = 1
3190 FOR E% = 0 TO C% STEP PL%
3200   PRINT SPC(10); TI$;
3210   PRINT TAB(60); "Page "; PP%
3220   PRINT: PRINT
3230   FOR J% = 0 TO PL%-1
3240     PRINT SPC(10); STR$(E%+J%);
3250     PRINT TAB(16); A$(E%+J%)
3260     IF A$(E%+J%) = "" THEN 3370
3270     NEXT J%
3280   VDU 1,12
3290   VDU 3
3300   CLS
3310   PP% = PP%+1
3320   PRINT TAB(0,6) "Press <RETURN> to continue"
3330   Y$ = GET$: IF Y$ <> CHR$(13) THEN 3330
3340   CLS
3350   VDU 2
3360   NEXT E%
3370 VDU 3
3380 GOTO 3420
3390 CLS
3400 VDU7: PRINT "PLOT ARRAY EMPTY ";
3410 FOR DELAY% = 0 TO 1000: NEXT DELAY%
3420 PROCRH_WINDOW
3430 ENDPROC

3440
3450 DEF PROCSPOOL_TEXT
3460 *DELETE T.DEFAULT
3470 PROCRH_WINDOW
3480 *SPOOL T.DEFAULT
3490 PROCPLOT
3500 *SPOOL
3510 ENDPROC
3520
3530 DEF PROC_ELEMENT
3540 CLOSE#0
3550 F$ = ":"+Drive$+".T"+A$(D%)
3560 E = OPENUP(F$): Err% = F%: Err% = 0
3570 REPEAT
3580   Char% = BGET#(E)
3590   Char$ = CHR$(Char%)
3600   PRINT Char$;
3610   Err% = Err%+1
3620   UNTIL EOF#(E)
3630 CLOSE# E
3640 ENDPROC
3650
3660 DEF PROCX
3670 READ J%
3680 FOR H% = 1 TO J%
3690   READ COMM$
3700   PRINT COMM$
3710   NEXT H%
3720 ENDPROC
3730
3740 DEF PROC_UNTIL
3750 Loop% = Loop%-1
3770 IF Loop% > 0 THEN D% = Repeat% ELSE ENDPROC
3780 ENDPROC
3790
3800 VDU 3
3810 VDU 26
3820 VDU 12
3830 PRINT TAB(10,1) "PROGRAM FAULT "; VDU 7
3840 PRINT TAB(10,4) "Fault in line number "; ERL
3850 PRINT TAB(10,6) "Fault number       "; ERR
3860 PRINT: PRINT: PRINT
3870 PROCRETURN
3880 CLOSE#0
3890 CLS
3900 GOTO 210
3910
3920 VDU 3
3930 VDU 26
3940 VDU 12
3950 PRINT "A fault has occurred while
interpreting a file"
3960 PRINT: PRINT "The Filename is: "+Err$
3970 PRINT: PRINT "The fault occurred in line number:
 "+E$
3980 PRINT: PRINT: PRINT
3990 PROCRETURN
4000 CLOSE#0
4010 CLS
4020 GOTO 210
4030
4040 REM Coseands for Oric-1 plotter
4050 DATA 5,1,"M10,0","X1,15,20","M10,0","X0,-20,20"
4060 DATA 4,C1,S3,"M800,0",01
```

(continued from previous page)

Procinstructs (lines 1190-1290) sets up a text window on the left hand side of the VDU, clears the screen and then reads a sequential text file, printing it to the screen until the End of File marker is reached.

Having loaded the instruction file, the remainder of the procedure to write a new Wychwood program is pretty straightforward. The program line number is printed by line 1100 and line 1110 accept into Z$ any alphanumeric characters that you type on to the keyboard. This is important because many plotter commands contain commas which will terminate the normal Basic Input instruction — pages 277 and 278 in the BBC User Guide.

Wychwood has the facility to turn the contents of the A$ Basic array into a text file. The Wychwood Main Command Level loop will go (if you press T — line 340) to Procspool__Text. Procspool__Text deletes the old file 'T.DEFAULT' on the program disc and then prints the program instructions currently held in memory to a new text file "T.Default" in lines 3480 and 3490.

The plotter is not turned on because Procstart__Up is not called before Procplot. The next stage has to be done manually when you copy the default file from the program disc to the data disc, if you are using two disc drives, and then rename the file to the name of whatever element it will form in the final program.

Because Procspool__Text calls Procplot, which will read existing element text files in the course of printing out a plotter program, it is possible to repeat this process more than

once, increasing the size of the text file each time.

My BBC micro is fitted with version 2 of the Basic interpreter and that means that the Openup instruction should be replaced by Openin for those people working with Basic 1.

Wychwood has changed since last month and the interpreter procedure — Procplot — has grown as I have added new commands to the Wychwood repertoire. In order to make the program easier to adapt to different plotters I have written a new procedure — Proccx — which reads the low level commands that are to be sent to the plotter when a high level program instruction is encountered.

AXIS-1

for example, restores the data pointer to line 4050 and then reads five commands from the data in the line. This method concentrates the data that will need changing when the program is adapted to a different plotter, in one place.

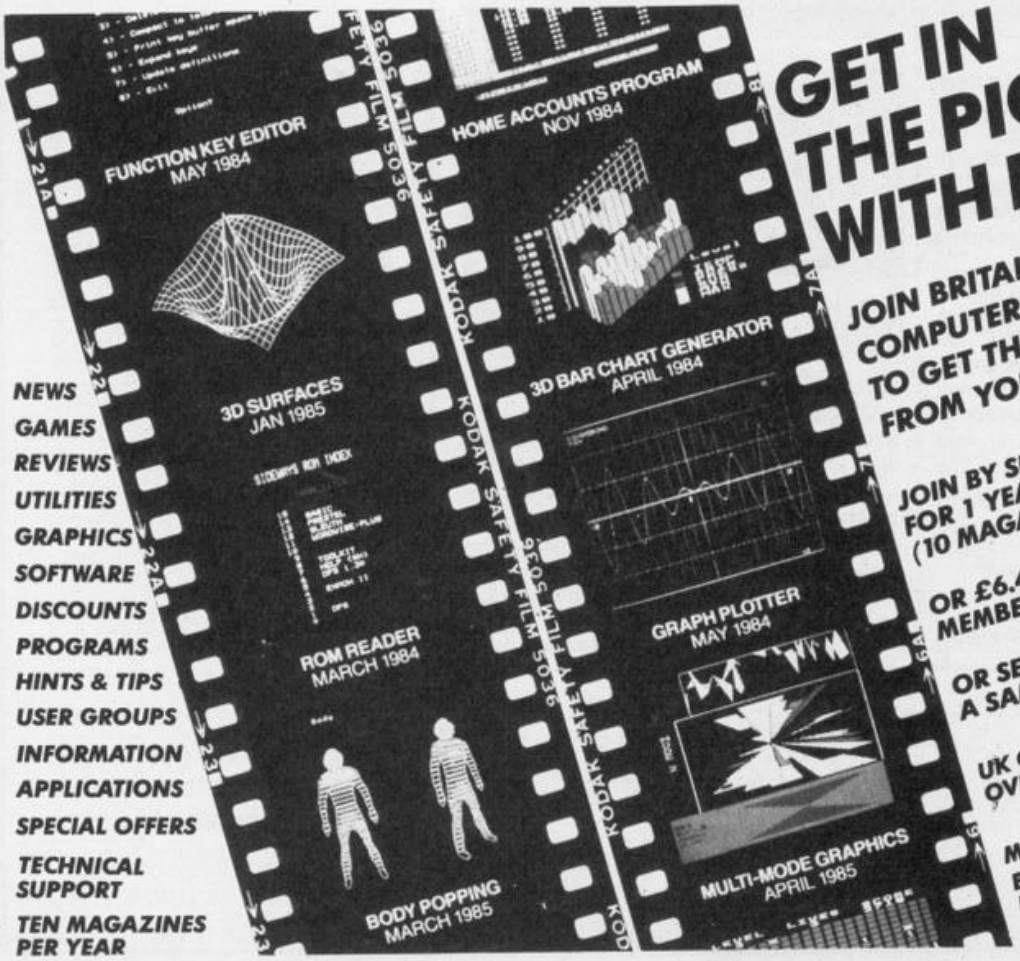
The program is incomplete and must be structured to some extent to suit the particular needs of an individual. Nevertheless, the procedures for writing and editing the contents of a single dimension array, and storing and retrieving the array on floppy discs are complete and working well. Additionally, the program can display large quantities of information to guide the user when Wychwood is operating.

An interpreter of this sort can be used for many purposes, not just for controlling a plotter, and, because it is written in Basic, it is very easy to extend or modify the actions that will be carried out when a particular instruction is executed. The speed of execution should be entirely adquate for many domestic tasks as well as some applications in school laboratories.

Extracting parameters from the text strings in a single element array is not impossible but tends to be a clumsy business using Basic. If the machine you wish to control, an astronomical telescope or an automatic heating and watering system in a greenhouse, for example, requires a fixed number of parameters associated with each instruction, you may find life far easier if you use a multi-dimension array to store the program.

You could use a single dimension string array to store the instuction name and a two or three dimension integer or real array to hold the parameters. The program pointer will identify the current elements in each array, linking the instruction name to its associated parameters or values.

If, to save typing and additional work to create the Command, Element and Editor files, you would like a copy of Wychwood as it is listed in this article with the additional files, write to me at *Your Computer* enclosing your return address in block capitals, a note of whether you want the program on a 40 or 80 track disc and a cheque for £5.75 to cover the cost of the disc, post, packing and copying.



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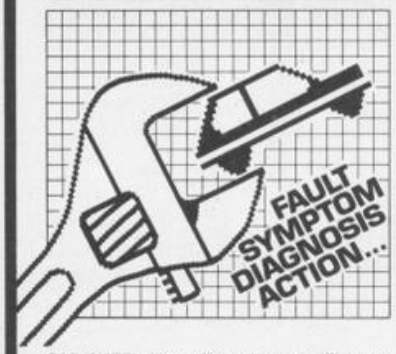

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COMMODORE 64, BBC AND SPECTRUM

THE PROGRAMS given here will enable Spectrum, BBC, and CBM-64 owners to download via *Your Computer's* Telsoft service. Each month for each machine we transmit at least one — and usually two — of the main programs appearing in the current issue. Also available is the full user to user communications program, Dialsoft.

So far OE LTD's Telemod 2 and the VTX 5000 modems have been tested with the BBC and Spectrum but the service also works with

```
5 REM   HEX LOADER FOR CBM 64   FIG.1
6 REM
10 FOR I=680 TO 727:READA:POKEI,A:T=T+A
20 NEXT:IF T=6716 THEN GOTO 100
30 PRINT"ERROR IN DATA ";T-6716:END
40 DATA 169,1,133,186,169,1,133,184
50 DATA 133,185,169,8,133,183,169,208
60 DATA 133,187,169,2,133,188,169,56
70 DATA 133,251,169,199,133,252,169,251
80 DATA 162,231,160,206,32,216,255,96
90 DATA 68,79,87,78,76,79,65,68
100 SA=51000:LA=52855
110 INPUT"START ADDRESS";A
120 IF (A<SA) OR (A>LA) THEN GOTO 140
130 IF A/8=INT(A/8) THEN GOTO 150
140 PRINT:PRINT"ADDRESS ERROR":GOTO 110
150 T=(A-32768)AND255:PRINTA;:INPUTD$
160 IF D$="END" THEN GOTO 900
170 IF LEN(D$)=20 THEN GOTO 190
180 PRINT"WRONG LENGTH":GOTO 150
190 FOR B=0 TO 7:B$=MID$(D$,2*B+1,2)
200 GOSUB 300:IF E=1 THEN GOTO 280
210 POKE A+B,D:T=T+D:NEXT
220 B$=MID$(H$,18,3):GOSUB 300
230 IF E=1 THEN GOTO 280
240 IF T=D THEN GOTO 260
250 PRINT"CHECKSUM ERROR":GOTO 150
260 A = A+B:IF A<LA THEN GOTO 150
270 GOTO 800
280 PRINT TAB(8+2*B+D)C$"??"
290 B=8:NEXT:GOTO 150
300 E=0:D=0:FOR N=1 TO LEN(B$)
310 C$=MID$(B$,N,1):GOSUB 400
320 IF E=1 THEN D=N:N=4:NEXT:RETURN
330 D=D*16+X:NEXT:RETURN
400 X=ASC(C$)-48:IF X<0 THEN E=1:RETURN
410 IF X<10 THEN RETURN
420 X=X-7:IF X<10 THEN E=1:RETURN
430 IF X>15 THEN E=1
440 RETURN
500 H$="0123456789ABCDEF"
510 FOR A=SA TO LA STEP 8
520 PRINT A;"? ";:T=(A-32768)AND255
530 FOR B=0 TO 7:X=PEEK(A+B):GOSUB 600
540 T=T+X:NEXT:PRINT"=";
560 Y=INT(T/256):PRINT MID$(H$,Y+1,1);
570 X=255 AND T:GOSUB 600:PRINT
580 NEXT:GOTO 900
600 PRINT MID$(H$,INT(X/16)+1,1);
610 PRINT MID$(H$,1+(XAND15),1);:RETURN
800 SYS 680:C$=CHR$(34)
810 PRINT:PRINT" TO RELOAD CODE :"
815 PRINT:PRINT"  LOAD"C$"DOWNLOAD",
820 PRINTC$",1,1  (RETURN)"
825 PRINT:PRINT"  THEN TYPE   NEW";
830 PRINT"  (RETURN)"
835 PRINT:PRINT"TO RUN THE PROGRAM":
840 PRINT"  SYS 51000  (RETURN)"
900 PRINT:PRINT:PRINT"1  ENTER DATA"
910 PRINT:PRINT"2  PRINT DATA"
920 PRINT:PRINT"3  SAVE DATA"
930 INPUT Z:ON Z GOTO 100,500,800
```

```
51000 ? A9068D21D08D20D0=3E2
51008 ? A90F8D8602A90E20=2E4
51016 ? D2FFA9008D15D0A9=4DD
51024 ? FF8D8A02BA8E92CE=510
51032 ? 20CAC920C7CB20F8=4D5
51040 ? CAAD80CEC931F023=532
51048 ? C935F014C936D006=43F
51056 ? 208EC74C5BC7A914=410
51064 ? 20D2FF202FCBD0DB=52E
51072 ? 203FC8A92020D2FF=461
51080 ? 4C93C94C4AC82063=411
51088 ? CC2022CDA95B85FD=4F1
51096 ? A9CE85FE2028CDA0=547
51104 ? 002095CC202FCBC9=404
51112 ? 44F00BC954D0ED20=4E1
51120 ? D2FFA901D007A944=4EF
51128 ? 20D2FFA90885BA20=4B9
51136 ? 25CDA90820ABCCA9=4A3
51144 ? BD85FDA9CD85FEA9=6A0
51152 ? 00209SCC2025CD20=383
51160 ? 95CC9848A9048C83=4CC
51168 ? CE20D8C968A92025=4C4
51176 ? CD2095CC9848A906=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6EA
51200 ? 68A82060CBA90185=38A
51208 ? B985B998A293A0CE=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C82025CD=479
51232 ? A9FB20D8FF20F1CB=597
51240 ? 6020D9CCC90DD00B=3FE
51248 ? A900085C7A92020D2=3E0
51256 ? FFA90D20D2FF60A9=4E7
51264 ? 0D2029C8A90D20D2=306
51272 ? FF602063CCA000A9=43F
51280 ? FF9993CEC8D0FA20=5FB
51288 ? D2CB90FB20D2CBB0=5ED
51296 ? FB8D72CEA0008C7C=4D0
51304 ? CE8C7DCE202ECCAD=4D4
51312 ? 72CE29F0C980D0E4=5C6
51320 ? 20D2CBB0DA9973CE=599
51328 ? C8202ECCC009D0F0=4EB
51336 ? A000AD76CE2980D0=492
51344 ? 0FA52B85FB18A52C=3D8
51352 ? 6D75CE85FC4CAAC8=587
51360 ? AD78CE85FBAD79CE=607
51368 ? 85FC20D2CBB0A820=55E
51376 ? D9CC20D2FFC820D9=607
51384 ? CC202ECCC010D0EA=528
51392 ? A92020D2FFAD75CE=56A
51400 ? 202ECD20D2CBB087=4D7
51408 ? CD7CCEF00BA9582D=503
51416 ? D2FF2030C84C57C8=52C
51424 ? 20D2CBB0F8CD7DCE=65D
51432 ? D0EBAD75CEA8B993=687
51440 ? CED00E2030C8A991=4EE
51448 ? 20D2FF4C7EC94C57=51F
51456 ? C8A0008C7CCE8C7D=447
51464 ? CE20D2CBB0F091FB=5BF
51472 ? 202ECCCC8CC77CED=4D3
51480 ? F020D2CBB0E0CD7C=59E
51488 ? CEF003A95820D2FF=4D8
51496 ? 4C57C820D2CBB0CE=4CE
51504 ? CD7DCEF0034C23C9=473
51512 ? 20ACCB2030C8AD75=489
51520 ? CEA8A9009993CEAD=506
51528 ? 84CEC902D02520BC=436
51536 ? CBA9C820F3CBA955=568
51544 ? 2016CDA95020F3CB=432
51552 ? 20C7CBAC73CEC888=54F
51560 ? B993CED02398D0F7=5D4
51568 ? 4C5BC7A9552016CD=3DF
51576 ? 20F1CB4C63C9AC77=4EF
51584 ? CE20D2CB88D0FA20=57D
51592 ? D2CB20D2CB4C47C9=53E
51600 ? 4C5CC8A52B85FBA5=4F5
51608 ? 2C85FCA000B1FB99=52A
51616 ? 2200C8B1FB8523F0=4CE
51624 ? 0BA52285FBA52385=447
51632 ? FC4C9BC918A5FB69=57D
51640 ? 02852D852F8531A5=37B
51648 ? FC690085E2E53085=412
51656 ? 32602063CCA9028D=3E1
51664 ? 84CEA90B8D02DE60=4A3
51672 ? 8E81CE8C82CEA200=533
51680 ? A9098DCDCE202FCB=4D4
51688 ? C914F016C90DF051=4E2
51696 ? C924D01920D2FF8D=544
51704 ? C3CEE84CE5C9E000=64B
51712 ? D0E3E000F0DF20D2=554
51720 ? FFCA4CE5C9C93090=554
51728 ? D4C93A901548ADC3=444
51736 ? CEC924F004684CE5=460
51744 ? C968C94190BFC947=4BA
51752 ? B0BB20D2FF38E930=4D5
51760 ? C90A9002E907E005=36A
51768 ? F0AB9DC3CEE84CE5=61A
51776 ? C9E000F0A0E001D0=52A
51784 ? 07ADC3CEC924F095=4FF
51792 ? A92020D2FFA9FF9D=54F
51800 ? C3CEA2008ECFCE8E=544
51808 ? D0CE8ED1CE8ED2CE=659
51816 ? ADC3CEC924D006A9=512
51824 ? 0F8DCDCEE8D3CE=5DD
51832 ? C9FFF01D20CBCA80=5B2
51840 ? 3418BDC3CE6DCFCE=524
51848 ? 8DCFCEA9006DD0CE=566
51856 ? 8DD0CEB020E84C75=534
51864 ? CAADCFCEAC83CE99=642
51872 ? A3CEC8ADD0CE99A3=660
51880 ? CEC8188C83CEAC82=561
51888 ? CEAE81CE602025CD=4ED
51896 ? A200BD41CEC921F0=500
51904 ? 0720D2FFE84CBACA=570
51912 ? 4CDEC9ADCDCE8DCE=65E
51920 ? CEADCFCE8DD1CEAD=6C1
51928 ? DACE8DD2CE18ADD1=639
51936 ? CE6DCFCE8DCFCEAD=68F
51944 ? D2CE6DD0CE8DD0CE=6BE
51952 ? B005CECECED0E660=625
51960 ? 2063CCA90F8D8602=414
51968 ? A95185FDA9CD85FE=575
51976 ? A000209DCC2025CD=343
51984 ? 209DCC209DCC209D=3DF
51992 ? CC2022CD20A9CC20=3A6
52000 ? 95CC2022CD2095CC=411
52008 ? 202FCB20D2FF608E=421
52016 ? 81CE8C82CE2069CC=4B0
52024 ? 20ECCC20CACCC900=48F
52032 ? D00D20FDCCC931F0=4F0
52040 ? 062001CC4C35CB8D=314
52048 ? 80CEAE81CEAC82CE=597
52056 ? 60AE92CE9A4C5BC7=4CE
52064 ? 2022CDA92285FDA9=465
52072 ? CE85FEA9002095CC=4DA
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52096 ? 202FCBC914D010C0=417
52104 ? 00F0F520D2FF88A9=58F
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52152 ? 20D2FF60A9138D00=452
52160 ? DEA9128D00DE60A9=4CD
52168 ? 538D00DEA9528D00=40E
52176 ? DE60A996188D87CE=547
52184 ? 8C82CEAC82CE2004=4D4
52192 ? CC20ECCCCE87CED0=677
52200 ? 02386020FDCCB0EE=509
52208 ? 60A9FA8C82CEA820=597
52216 ? 04CC88D0FAAC82CE=616
52224 ? 602004CC8AA2A8CA=3EE
52232 ? D0FDAA2069CC6020=454
52240 ? 25CDA90220ABCC20=364
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52272 ? CE8D7DCEA200AD7D=4AA
52280 ? CE2A9010AD7DCE49=411
52288 ? 088D7DCEAD7CCE49=460
52296 ? 100D7CCE2E7CCE2E=3D5
52304 ? 7DCECAD0E160A000=516
52312 ? A9009900D4C8C018=40E
52320 ? D0F660A99320D2FF=5B3
52328 ? 6048A5A2290FD01F=37E
52336 ? A5D448A5A2290F0=4A1
52344 ? 05A9A44C80CCA920=42B
52352 ? 20D2FFA90085D4A9=51C
52360 ? 9D20D2FF6885D468=53F
52368 ? 6020D2FFC8B1FDC9=620
52376 ? 21D0F6C8602025CD=4B9
52384 ? A90C20ABCC2095CC=46D
52392 ? 60A9058E81CEAAA9=4E6
52400 ? 2020D2FFCAD0FAAE=603
52408 ? 81CE60C914F008C9=505
52416 ? 7FF0160A91460A9=456
52424 ? 7F6020E4FFC9C190=5C4
52432 ? 07C9DB00338E960=4AF
52440 ? 60C941900EC95B90=494
52448 ? 08C961900EC97BB0=49C
52456 ? 02492060488A4808=2D5
52464 ? 20E1FFD0034C59CB=533
52472 ? 2868AA6860AD00DE=485
52480 ? 49016A9003A90060=250
52488 ? AD01DE6048AD00DE=3C7
52496 ? 49026A6A6860200C=223
52504 ? CDB0FB8D01DE20EC=508
52512 ? CC60025CD2028CD=373
52520 ? A90D20D2FF604829=3A0
52528 ? F06A6A6A6A0930C9=3CA
52536 ? 3A30031869072 0D2=21F
52544 ? FF68290F0930C93A=31B
52552 ? 3003186907 20D2FF=2F4
52560 ? 60444F574E4C4F41=2C4
52568 ? 44204D454E552131=243
52576 ? 2020205245434549=228
52584 ? 564521352020 2045=1FE
52592 ? 5849542054 4F2042=28A
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52624 ? 4520122053544F50=26D
52632 ? 209220544F20524 5=2C4
52640 ? 5455524E20544F20=2CC
52648 ? 4D454E5520292145=28C
52656 ? 4E544552204E554D=2F9
52664 ? 4245522021494620=281
52672 ? 4144454245535320=2E6
52680 ? 495320494E204845=2C8
52688 ? 582C119D9D9D9D9D=476
52696 ? 9D9D9D9D9D9D9D=5C0
52704 ? 9D9D9D9D50524546=481
52712 ? 4958205749544820=305
52720 ? 2421535441525420=2E3
52728 ? 4144445245535320=31E
52736 ? 464F522041524541=220
52744 ? 202146494E414C20=1D3
52752 ? 4144445245535320=236
52760 ? 464F522041524541=238
52768 ? 202150524F475241=22C
52776 ? 4D2054495544C4520=237
52784 ? 284D41582031362 0=1E5
52792 ? 4348415227532920=219
52800 ? 21124E4F54205641=21B
52808 ? 4C4944922C205452=2A5
52816 ? 592041474149 4E20=249
52824 ? 3A202144495343 20=216
52832 ? 4F5220544150 4520=26B
52840 ? 2820442F54202920=1E0
52848 ? 3F2100000000000=0D0
```

TELSOFT

A reminder of how to use the Telsoft service.

a number of other makes. For the CBM-64 it will initially only be available with the OEL Comms pack together with the Telemond 2 or similar modem; later we hope to adapt the service to work with Commodore's modem.

To enter the download program first type in the hexloader for your machine — figure 1 — and then enter the machine code — figure 2. Once the program has been saved you can run it by entering CALL &6000 on the BBC, SYS 51000 on the CBM 64, RANDOMIZE USR 60000 on the Spectrum.

To find out what is available and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bit/s services.

When a program you want to download is on line, make sure your modem is set up and dial the number appropriate to its speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received you will see "OK" printed if there are no errors, otherwise the program will wait for the blocks to come round again. When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run the program.

Note that CBM-64 owners will need to use Option 6 if machine code is to be saved.

Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)";A$
40 A=EVAL("&"+A$)
50 IF A>&6FB7 THEN 200
60 IF A<&2A00 OR A>&6FE7 THEN 20
70 PRINT "A" ";
80 INPUT ";" B$,C$
90 IF LEN(B$) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6FB7
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>71 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 :A9CBA0FEA220120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F00BC934F0E9C9,4CB
6A18 :35F0864C0C6A4C47,200
6A20 :6AA9BC20E3FFA9E8,4B2
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A220F4FFA9CBA0,4CB
6A40 :FEA20020F4FF60A9,4BC
6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA000,3E9
6A58 :A9FF8099056F0FA,507
6A60 :A9154A20120F4FF20,394
6A68 :0C6C90FB200C6C00,34B
6A70 :FBA0008477847884,416
6A78 :79847A847B857820,3BB
6A80 :056DA57829F0C900,4B9
6A88 :D0E220C6C6D0D099,46B
6A90 :7100CB20D56ADC009,364
6A98 :D0F8A000A5742900,422
6AA0 :D000A51C857610A5,354
6AA8 :1DA573857720C6C,289
6AB0 :00B520E3FFC820D5,524
6AB8 :6DC810D0F0A57320,435
6AC0 :B26D200C6C00A0C5,3CC
6AC8 :7AF00BA95820E3FF,47B
6AD0 :20E7FF4C676A200C,34F
6AD8 :6CB00CC578F00BA9,48C
6AE0 :5820E3FF20E7FF4C,4AC
6AE8 :676AA573A009856F,43E
6AF0 :D00E20E7FFA900B20,3B0
6AF8 :E3FF4C0B6B4C676A,469
6B00 :A000847A847B200C,2C9
```

Figure 1. Spectrum.

```
  5 REM SPECTRUM 48k          fig 1
 10 REM Hex Code Loader
 15 CLEAR 59000
 20 POKE 23658,8: CLS : PRINT
 30 INPUT "Start Address ";a
 50 IF a>61135 THEN GO TO 200
 60 IF a<60000 THEN GO TO 20
 70 PRINT a;
 80 INPUT " ;";b$
 85 IF b$="END" THEN GO TO 200
 90 IF LEN b$<>20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN PRINT ";";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN LET e=1
320 RETURN
```

Figure 2. Spectrum.

```
60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66EDCD,631
60016 :50EDCD47EE30FBCD,5AF
60024 :BBEDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D0
60040 :15ED3EFACD84EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,58C
60064 :003EFF121310FCCD,45B
60072 :15EE11CDEE06173E,3D2
60080 :20121310FCCD1FED,3DA
60088 :30FBCD50EDCD1FED,5BB
60096 :30FB3265EF3E0032,3E9
60104 :6CEF326AEF3270EF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :091165EFCD1FEDDA,581
60136 :AAEA1312CDEBEC0D,552
60144 :28F23A69EFE60820,51A
60152 :0D2145C3A6BEFBE,36C
60160 :004709226BEFBE00,1DA
60168 :11CDEECD1FED389A,47F
60176 :1213CCDEBEC79FE,45C
60184 :1820F83A6BEFCDB1,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6EFEBE2B133E5811,326
60208 :EBEE12133E0012CD,348
60216 :D7ECCDA6ECC3AAEA,6B1
60224 :CD1FEDDAAAEA217B,518
60232 :EFBE20E121E5EE3A,524
60240 :6BEFB56F3E000EC7,40F
60248 :3E000E2000CDD7EC,482
60256 :3E2132005CC3FFEB,482
60264 :3E0026FEF3270EF,3C7
60272 :ED5B6BEFBE00CD1F,48C
60280 :EDDAAAEA3273EFCD,634
60288 :EBEC3A6BEFFE0020,586
60296 :053A69EFE6803A73,432
60304 :EF1213CC3A6AEFB9,3FC
60312 :20DCCD1FEDDAAAEA,5DB
60320 :216FEFBEC22D6BCD,584
60328 :1FEDDAAAEA217BEF,5A2
60336 :BEC22DEB3E6F32E2,589
60344 :EE3E6B32E3EE3E00,498
60352 :32E4EE3A005CFE21,581
60360 :2003CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A68,5C5
60376 :EFB56F3E000C6736,422
60384 :0021E5EEED4B66EF,561
60392 :0C7EFE00C20DEA23,4FC
60400 :0D20F63EFACDB4ED,5B9
60408 :3E01D3FEC366EACD,5EB
60416 :1FED30FBC3BDEAF3,594
60424 :B6B3AFD3FF10FB3E,3DB
60432 :40D3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,385
60448 :320D5C32485C3E01,250
60456 :D3FE21915CCB9EFB,56B
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD0FEC,442
60488 :CD04ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,58F
60504 :CDA0ECCDD4ECCDA6,661
60512 :EC233E0DCD0FECCD,4CF
60520 :04EC23CDA3EC3E03,498
60528 :CD0FECCDD4ECC9CD,68B
60536 :A3EC3E07CD0FECCD,561
60544 :B4EC23C97EFE00C8,520
60552 :CD0BED23C384ECFE,651
60560 :00C8F53E20CD0BED,520
60568 :F13DC30FECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CD0BED3EFF320C5C,574
60592 :C9F513E6F0CB1FCB,68C
60600 :1FCB1FCB1FF630FE,4CF
60608 :3AFAC6ECC6071213,498
60616 :F1E60FF630FE3AFA,686
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E2077231BFC3E,339
60648 :0077C9E5217BEFAE,53B
60656 :77C50E007EA7CB17,449
60664 :300D7EEE0077A6F,3C9
60672 :EFEE10326FEF3721,3D5
60680 :6FEFCB1623CB16BD,358
60688 :20E2C1E1C9110581,394
60696 :216A00CD0503C93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C8
60720 :AF2177EF35200237,2FC
60728 :C9CD77ED30E8C9CD,5F0
60736 :47EED0FEC8C837C9,5E6
60744 :F5D0FF3A01EFFE00,5C7
60752 :2004E3E1803E37,187
60760 :D3FFDB7FF1C9F53A,675
60768 :01EFFE002004E36,376
60776 :D3FFCD50EDF1C93E,644
60784 :FE0A0237C80BFFE6,626
60792 :00D0FFE60037C8DB,59.
60800 :3020040DB7FA7C93A,3E0
60808 :B1EFFE002004E357,397
60816 :10023E36D3FFDB7F,452
60824 :C9CD47ED3A73EFD0,5DE
60832 :F1C366EAF53ED23D,5EE
60840 :20FDF1C9CDACED3D,62A
60848 :20FAC9C5D5E5F5FE,78D
60856 :7F2B13CDF9EDFE0C,537
60864 :20DCFE0D200D53E20,28A
60872 :D73E0DD71813E20,34F
60880 :D73E00D73A005CFE,4E8
60888 :2120033E00D73E5F,2E6
60896 :D73E00D7F1E1D1C1,640
60904 :C9FE0728ICFECB20,4F3
60912 :19FE0C2814FE0828,388
60920 :10FE0D200CFE20FA,367
60928 :0FEEFE00FA11EE3E,4BA
60936 :00C93E07C9CD6D00,32C
60944 :3E02CD0163E1832,1C4
60952 :095CC93E121601CD,382
60960 :1122C93E121600CD,257
60968 :1122C9C5D5E53E02,3EB
60976 :CD0116CD47EE30FB,451
60984 :CD5CEEE1D1C1C93A,5CD
60992 :3B5CCB6F200C3A00,28F
61000 :5CF5213B5CCBAEF1,4C3
61008 :A7C937C9F5111000,3DE
61016 :CD18EDF1C9444F57,4D6
61024 :4E4C4F4144494E47,284
61032 :20205245434554956,276
61040 :20AD454E55003120,216
61048 :4500352020204570,217
61056 :697420746F204261,32B
61064 :7369630020205573,2DF
61072 :652053796D626F6C,393
61080 :2053686966742020,38B
61088 :2847007746F205265,2C9
61096 :7475726E20746F20,39C
61104 :4D454E5520290845,27B
61112 :4E5445522E554D,389
61120 :4245522000000000,1C1
```

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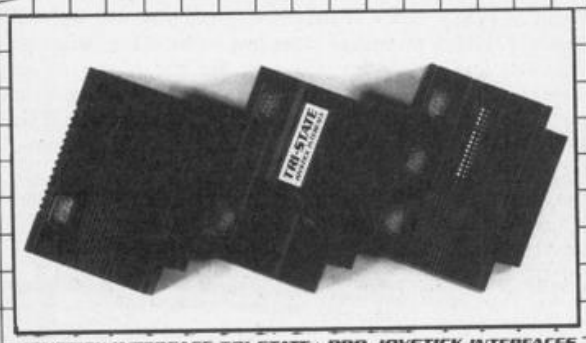

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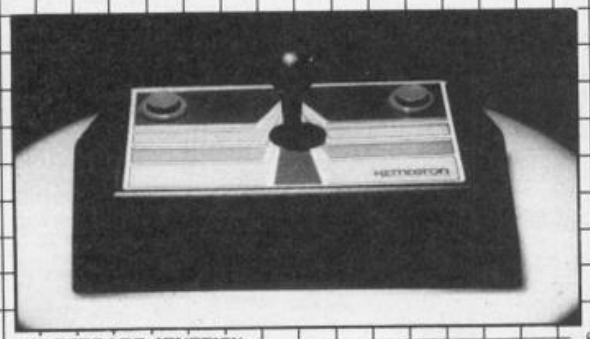

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Interface

I could do that...

In support of his one man campaign against the structuralists John Ransley asked you to desing a haywire program for September's competition. It had to combine a loop with a liberal sprinkling of Gotos and Gosubs; and, most importantly, there were to be no elaborate modules. M. Wright, 2 Rye Lane, Halifax, HX2 0QB, wins the £15 prize for his Spectrum Ducksheet program. While the program may not be as messy as John Ransley would like, the author has successfully managed to avoid any suggestion of a logical structure. This month's competition continues our policy of reviving the arcade classics. A Basic version of Space Invaders is in the pipeline. We would like you to follow it up with Breakout in Basic. Remember that the program should be as compact as possible — no more than 20 lines long, . and don't worry about sacrificing non-essential features.

```
  10 GO TO 140
  20 REM    ++ duck ++
  30 LET d$=a$(20)+a$( TO 19): P
RINT AT 0,0; PAPER 7;d$: RETURN
  40 REM    ++ fire ++
  50 FOR n=10 TO 3 STEP -1
  60 PRINT AT n,15;" ": IF n/2=I
NT (n/2) THEN GO SUB duck
  70 PRINT AT n,15;" ": NEXT n
PRINT AT n,15; PAPER 7;" "
  80 IF d$(10)=" " THEN PRINT AT
 2,15; PAPER 7; INK 2; FLASH 1;
A" AT 4,11; PAPER 6; INK 0; FLAS
H 0;"well done"
  90 INPUT "Press ENTER to conti
nue";a$: RUN
 100 REM    ++ game ++
 110 GO SUB duck
 120 IF INKEY$<>"" THEN GO TO fi
re
 130 PAUSE 3: GO TO game
 140 REM    ++ initialise ++
 150 LET duck=20: LET fire=40: L
ET game=100
 160 FOR n=0 TO 23: READ a: POKE
USR "a"+n,a: NEXT n
 170 DATA 0,0,6,7,196,126,60,0,8
,8,8,8,8,8,56,40,56,8,24,24,
40,40
 180 BORDER 4: PAPER 4: CLS: PR
INT AT 11,15;"B" AT 12,15;"C"
REM  Graphic B and C
 190 LET d$="          A       A
      A"
    REM d$ needs 20 characters
with Graphic A's scattered at
random.
 200 GO TO game
```

BEGINNERS *first bytes*

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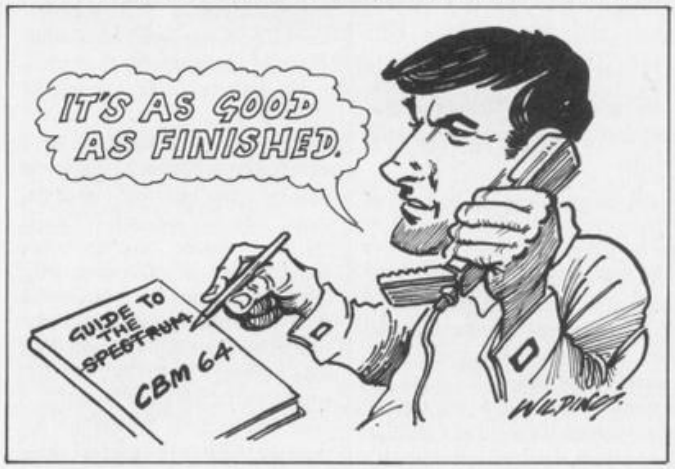
A bluffers' guide to micros



REMEMBER THE computer-book boom, with each new machine followed by enough "instant books" to start a paperchase to Alpha Centauri? *The MicroGrot Explained ... Revealed ... Unzipped ... Hit With A Sledgehammer.*

Bluff reigned supreme. Some of these books managed to be less useful than the supplied manuals, which generally takes some doing. A programmer's idea of a manual opens with several chapters describing special and incomprehensibly powerful features: only experienced users know to turn to Appendix F, section VI, subsection 3.14, to find the footnote on how to switch the machine on and load programs.

And those were people who *knew* about the wretched gadgets. In computer publishing's days of glory, *The MicroGrot Explained* could be written by anyone, and usually was. The following bluffer's tales are true, but names are omitted to protect the innocent (me) from the guilty ...

"Why not write a *Basic For The Very Stupid* book for your computer?" asked a friend who'd written two. "Money for old rope."

"I've only had it a month," I said evasively.

He gave me a look. "I haven't even *got* one, and I've sold two books on it. Haven't written them yet, but it should be a doddle. It's all in the other books."

Far off, you could hear the crash of mighty pines being felled.

Another pal gloated over lucrative video commissions, with masterworks to be delivered within the week. With gritted teeth I quote: "It's great fun though — and rather silly — we've only had the Spectrum for a fortnight and we have to appear both wonderfully knowledgeable and highly skilled. This is difficult to put over when you have to spend five minutes searching for the word "or" or "to" or whatever ..."

Something snapped inside me when the author of *A Moron's Guide To The Spectrum* dropped in to research his *Moron's Guide To The Commodore 64.* Conscientiously he spent whole minutes researching my 64; meanwhile I flipped through his hideously matrix-printed draft introduction. "Ha ha," I quipped, "it says *Spectrum* here — anyone would think this was your Spectrum introduction again, and you missed that one when you changed the name to CBM-64."

"Er yes well um," he said sheepishly. "That's right."

After this it seemed quite possible to believe people had published authoritative, hands-on explanations of the QL before ever seeing the machine. Like lifelong nuns writing sex manuals.

It's harder now to flog easy-to-read, easy-to-forget works titled *Rearranged Bits From All The Other Books On The Spectrum.* I've given the thumbs-down to a couple myself: because I'm a world authority on not writing computer books, publishers occasionally ask me in to sneer at submitted manuscripts. My favourite was a book of CBM-64 graphics programs — *none* of which worked on my 64. There are three variants of the machine, distinguished by what happens when you reach page 64:

POKE 1524,81

The resulting blot was once white, is now cursor coloured.

The dwindling boom is familiar news to SF fans. Decades ago, a dreadful outfit called Badger Books found any SF would sell, and published 159 hackworks by a single author (R.L. Fanthorpe) who wrote one each weekend. It would be libellous to identify the Fanthorpes of computer publishing — but just as Badger poisoned the 1960s SF market, the exploiters have made home-micro books a bit of a joke.

And next, for the dim...

ONE OF THE main uses of a micro, or any other type of computer, is the manipulation of large volumes of data, as a single mass, or split up by any given criteria. In Basic, there are several simple commands which are at the heart of any data handler — arguably the most useful are Dimension, For, and Next.

Dim allows a user to set up an *array* of similar variables, so that, instead of using, say, A to Z for the first 26 variables entered, e.g.:

```
 10 INPUT A
 20 INPUT B ...
260 INPUT Z
```

it is possible to have each variable as a different point on the "number line" of the *one-dimensional array,* A:

```
 10 DIM A (26)
 20 INPUT A (1) ...
270 INPUT A (26)
```

(continued on next page)

(continued from previous page)

Line 10 sets up the array of variables, and from there onwards, they may be treated as independent variables. The advantage of this system only really comes to light when the array is used in conjunction with a *loop*. A simple loop can be set up using Goto, with a counter and decision to get out of it at the right time. This principle is used in the program below, which does just the same as the previous one, but in 22 less lines:

```
10 LET COUNT = 0
20 DIM A (26)
30 LET COUNT = F COUNT + 1
40 INPUT A (COUNT)
50 IF COUNT < 26 THEN
   GOTO 30
60 . . .
```

Using a For . . . Next loop, the program can be simplified still further:

```
10 DIM A (26)
20 FOR C = 1 TO 26
30 INPUT A (C)
40 NEXT C
```

The two programs function identically, but with the second version, the programmer does not have to bother keeping count himself; nor does he have to remember which line the original For command is on: the computer works out where to go to itself.

The same principle can be used for strings of letters, but, on the Spectrum, the length of the string must be defined, as though, on another computer, a two-dimensional array was being created:

```
10 DIM A$ (20,10)
```

will, on the Spectrum, create an array of 20 words, each 10 letters long. This is, in effect, the same as creating a two-dimensional array of characters, and, due to the string splicing commands, can be treated exactly as that. In most Basics, A$(20) is all that is required for a string array, and the variables can be of any length. Although the Spectrum's approach is more logical, and requires less memory, the latter system is more suited to data comparison and retrieval.

Once an array is set up, the component variables may be manipulated in the same way as any variable, but they may also be treated as a group, e.g.:

```
10 FOR X = 1 TO 26
20 LET A(X) = A(X) + 1
30 NEXT X
```

will add one onto each number in the array A. Using Step, every second value, for example:

```
10 FOR X = 1 TO 26 STEP 2
20 LET A(X) = A(X) + 1
30 NEXT X
```

. . . or only the second 13:

```
10 FOR X = 14 TO 26
20 LET A(X) = A(X) + 1
30 NEXT X
```

So far, arrays of only one "dimension" have been looked at; but any number of dimensions is possible: Dim A (10,10) creates a 2-D array of 10 numbers by 10 numbers (100 in all), and Dim A (10,10,10) will create a 3-D array. In practice, most programs seldom use more than two dimensions, so, to turn back to the 10 by 10 array:

Each of the primary "columns" has another 10 sub-rows: there are numbers ranging from A(1,1) through A(1,2)...A(1,10)... A(2,1)...A(10,10). This capability is important when *sets* of data must be processed: e.g. when programming a "Monopoly" card. The dimensions needed for "Rent — six values for each card, of which there are 22 — would be R(22,6).

Every card is referred to by a number (1 to 22), and each house state by a number from one to six, where one is "site only", two is "with one house", etc. up to six, which is "Hotel". The rent, then, for three houses, on property 18 is in R(18,4). The names of the properties could be stored in a string array, e.g. P$(22), so P$(1) would be "Old Kent Road".

In practice, it would be extremely tedious to enter all these values each time a game was to commence, or to write a program where the data are given on a one-to-one basis with their variable's name, and to alleviate this chore, there exists the Data command set to do this automatically.

After the command Data in a program, there exists a storage place for numbers or strings, e.g.

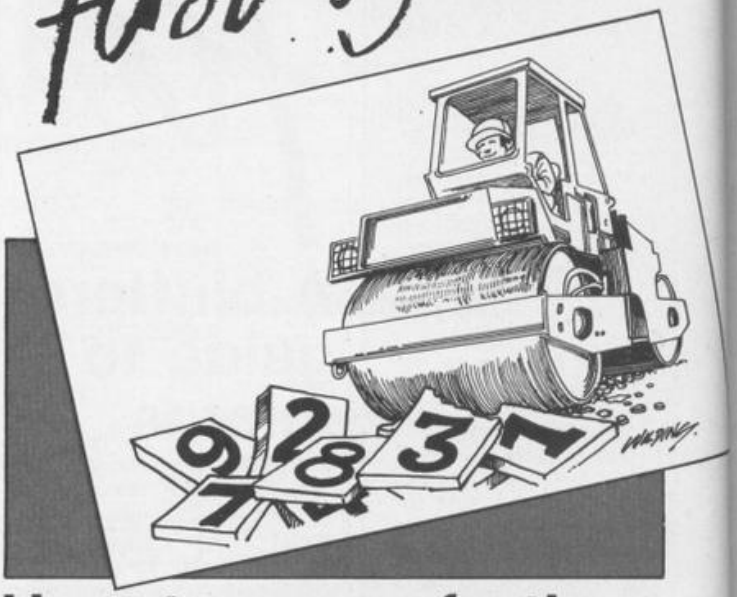
```
10 DATA "Old Kent Road",2,10,
   30,90,160,250,"Whitechapel
   Road",4,20,60,180,320,450
   (etc)
```

The program below reads this data line in the same basic way as the previous programs inputted data, but as there are two dimensions, it uses a "nest" of two loops, X and Y.

```
10 DATA (as above)
20 DIM R(22,6): DIM P$ (22)
   (P$ (22,20) on the Spectrum)
30 RESTORE
40 FOR X = 1 TO 22
50 READ P$(X)
60 FOR Y = 1 TO 6
70 READ R(X,Y)
80 NEXT Y: NEXT X
```

Restore resets the Data market so that data is read from the beginning of the line onwards. Read reads the data into the specified variable, and moves the market on one "data element", so that the next item is read next time. Note that, as there is only one string element to be read for each property, the Read P$(X) command is outside the inner nested loop.

BEGINNERS first bytes



How to come forth

FORTH IS very different from Basic and, indeed, most other high-level languages. It was originally developed by Charles Moore to control radio telescopes at the Kit Peak National Observatory, Arizona, in the early 1970s.

Described as a "high-level" language, Forth is effectively an extensible "macro language". It comes with a standard dictionary of words — i.e. macro definitions — which can be used and expanded to create the user's program. Each new word can be made up of those already in the dictionary or with assembly language mnemonics.

A macro definition is a collection of similar, or lower, level commands which make up a higher level function. This creates a language on a higher level than machine code but with very nearly the same execution speed.

Since each word can be used in successive words the user ends up with a program which is executed by typing one single word. The outcome of all this is that the user creates virtually a new language based around the original dictionary, so you can tailor the language to meet your requirements.

What really makes Forth a high-level language is that fully structured programming methods are employed as a fundamental feature. This is done through the use of control structures such as If . . . Else . . . Endif and Begin . . . While . . . Repeat. They give it many advantages over Basic such as the ability to support recursive structures.

Another major difference between Forth and Basic is the way in which the former evaluates arithmetic expressions.

Forth employs the use of a stack on which data are held and operated on. All access is to the top of the stack. Therefore, the last number on is the first off.

Operations upon the data use a convention called Reverse Polish Notation (RPN). As an example: 1 2 + 3 x is the RPN equivalent of (1+2)x3. As can be seen the operators are input after the data upon which they operate.

The 1 and 2 go on to the stack where they are added together. The result is placed at the top and the 3 is placed on the stack and then multiplied by the previous result. The final result is again left at the top of the stack.

Unlike nearly all implementations of Basic, standard Forths use integer arithmetic for their operations. In most cases they can handle up to 32-bit precisions if required. Floating-point routines can be incorporated but these would result in a reduction in execution speed.

Debugging a Forth program can be a real headache. This is mainly because of the way in which a Forth program is built up.

TOP TIPS

SMOOTH MESSAGE

This program allows you to add the final touch to that game you have just finished writing, or it could be used to customise any other programs you have.

The message is Poked into memory at location 32122 onwards, along with the required length and colour. When the routine is executed, the message is scrolled slowly and smoothly — not a trace of flicker — across the whole 32 colomns of the screen using the extreme bottom of the screen.

```
 10 DATA 0,0,0,0,0,0,0,0
 20 DATA 118,33,255,80,17,32,1,
14
 30 DATA 6,8,32,126,25,119,43,1
6
 40 DATA 250,25,15,32,244,201,1
,48
 50 DATA 117,22,8,33,255,80,30,
0
 60 DATA 10,7,203,19,8,126,179,
118
 70 DATA 3,197,1,0,1,9,193,21

 80 DATA 32,236,201,38,0,111,41
,41
 90 DATA 41,17,0,61,25,1,8,0

 100 DATA 17,48,117,237,176,201,
33,224
 110 DATA 90,58,168,117,119,35,1
25,183
 120 DATA 32,247,33,169,117,126,
79,35
 130 DATA 126,229,197,205,187,11
7,6,8
 140 DATA 197,205,96,117,205,78,
117,193
 150 DATA 16,246,193,225,13,32,2
32,201
 200 CLEAR 29999: RESTORE 0: FOR
 x=30000 TO 30119: READ A: POKE
 x,A: NEXT x
 300 INPUT "Enter Length Of Mess
age ";L: POKE 30121,L
 400 CLS
 500 INPUT "Now Enter The Messag
e ";M$: FOR x=1 TO L-1: POKE 301
21+x,CODE M$(X)-32: NEXT x
 600 INPUT "Enter Colour Value "
;C: POKE 30120,C: RANDOMIZE USR
30078
```

DOUBLE HEIGHT

This program for the Amstrad is designed to let you use double height characters in all modes. Simply type out the demonstration program and Run it and it will save the code for you. When you wish to re-use it you must load the code and type CALL&AAE0 (Enter) to set up the RSX. You can then use it like this:

```
10 a$="Hellow World"
20 locate 4,4:pen 2
30 a$""+a$
40 |double,§a$
```

Paul Mason

```
10 MEMORY &AADF
20 FOR i=0 TO 5:c=0:READ a$,check
40 FOR j=0 TO 15
50 v=VAL("&"+a$):POKE &AAE0+(i*16+j
),v:c=c+v
60 NEXT
70 PRINT USING"&AAE0+(i*16)";i*16;
80 IF c<>check THEN PRINT "checksum error in line"
:END
90 NEXT
100 PRINT "SAVING DOUBLE.B &aae0,145"
110 SAVE "double",B,&AAE0,145
120 CALL &AAE0
130 MODE 0:PEN 1:PAPER 3:LOCATE 7,2:a$="This is" +
e+a$+"!":|DOUBLE,&a$
140 a$="Double Height"+a$+a$:PAPER 1:PEN 3:LOCA
TE 4,6:|DOUBLE,&a$
150 END
1000 DATA 01E0AA21E9AAC3D1DCE9AAE0AAF2AAC3,AF025
1010 DATA F5AA444F5364243CD5A600D6E8E0D0668146,AF053
1020 DATA 2356237562E7E5E7AE2B9160F2A6DC1A9A83,AF16A
1030 DATA 545019160FB1180391923E13CD3AB2EF09,AF59F
1040 DATA C51A8D80D4CDA9D57ED5A8DC51A8D223,AF705
1050 DATA 18F218CD1A8D18EF1CD5A8D80D4CDA90,AF72A
1060 DATA D07ECD1A8DCD7A8D2316F33EFBC51A80,AF911
1070 DATA 3E8AC51A8D13E8CD1A8D3EF1CD1A8D7E,AFA71
1080 DATA 80CD3A8DC181233EF0CD93E80F313D46,AFD49
```

RESPONSE Frame

Do you have a problem related to your micro? Our panel will do their best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you'd like to pass on to others. Why not write to us with your top tips?

FASTER SAVE

■ **Having seen many games over the past year with Hyperloads and a few games that have no Border, I have tried to write my own, also allowing me to disable Break completely by stopping the keyboard scan. The problem that I have come up against is that having found the Rom routine, how do I successfully transfer the routine to Ram so as it can be fiddled with? I think I know how to stop the border but I can't make it save faster.**

Andrew Shoren,
West Drayton,
Middlesex.

FIRST OF all the thing that you must understand is that there are relative and absolute jumps in the routine (relative means jump backwards or forwards by X bytes. Absolute jump means jump to a given address). Get yourself a good assembler/disassembler and a copy of *The Complete Rom Disassembly* by Dr Ian Logan. As you will see, the routine to save is at 1218D/04CZH and is approximately 148 bytes long. As you will know, every time the routine is executed (by leaving an "edge" on the tape) the Border changes colour by way of the Out instruction. All that you do is NOP them out or if using an assembler leave them out altogether. Define the Border colour from Basic and jump into the routine and you're away.

To hypersave is a more difficult job. The highest speed I have ever attempted to use was in approx 1/7th of the normal time. Unfortunately the computer then wouldn't listen to it when I tried to load it back.

What happens is that the program waits for a set period of time before it either sends or listens for another pulse. If you decrease this length of time you will save far quicker. The delay is stored in the B register at 051FH (normal value 62D) and must be decreased (to about 45150).

To sum it up you can either copy the routine into Ram via a For-Next loop and search out all the absolute jumps (code 195) and replace the addresses with + however many bytes further up in the memory you put it. Otherwise use an assembler and copy the mnemonics from Dr Logan's book.

Craig Rawston.

PSEUDO BLEEP

■ **Could you briefly explain how I could simulate the Beep function in machine language, also how do some programs manage to make the music play far louder than normal?**

Michelle Pendleton,
Shepperton,
Surrey

FIRST, TO simulate the Sinclair Beep you need to use the following routine:

```
LD HL,Pitch
LD DE,Duration/Frequency
CALL 03B5H (Beep routine in Rom)
Ret
```

To work out the duration just multiply the time you want the noise to last by the frequency in HZ. Now if you want to make the sound louder, what you have to do is write a twin or three channel sound routine.

Try the following little ditty that I've concocted:

```
LD A, (5C48H)
RRA
RRA
RRA
LD B,Duration
LOOP LD C,254
DEC H
JR NZ, LOOP
XOR 16
OUT (C),A
LD H, FREQ 1
DEC L
JR NZ, LOOP
XOR 16
OUT (C),A
LD L,FREQ Z
DJNZ LOOP
RET
```

Place this routine at around 60000 in the memory and use the following:

```
 10 REM TWIN-SOUND DEMO
 20 REM c 1985 THE SHIRE
 30 CLEAR 59999: LOAD "" CODE
 40 FOR N = 0 TO 5
 50 READ DUR:READ FREQA:
    READ FREQB
 60 POKE 60007, DUR
 65 POKE 60018, FREQA
 70 POKE 60027, FREQB
 80 RANDOMIZE USR 60000
 90 NEXT N
100 DATA 200,205,206
110 DATA 70,230,231
120 DATA 255,254,255
130 DATA 255,205,206
140 DATA 255,170,171
150 DATA 255,125,126
```

You will notice that if FREQB is only one higher or lower than FREQA then the noise (sorry! note) caused will seem louder than the average Beep. If you were to write a three-channel routine, which is infinitely harder because registers only come in pairs, you would find the volume even higher.

Craig Rawston.

STORING M/C

■ **I am planning to write a game in Basic with machine-code routines. What I would like to know is, where can I store the machine-code routines?**

ALTHOUGH BBC Basic is very fast, one way of giving that extra "gloss" to games is to use machine-code routines for the most time critical points. Because of the small memory capacity, it is very important to choose the area of memory for the code carefully.

There are several ways to reserve memory for code but the most obvious way is to use the Dim statement. For example:

```
DIM code 100
```

would reserve 100 bytes, the start address being assigned to variable 'code'. Another technique is to store the code between video ram and the basic program. To do this, the size of the object code must first be estimated, say &100 bytes. Then the value of Himem must be lowered by that amount, ie:

```
HIMEM = HIMEM – &100
```

Now the machine code can be assembled from Mimem (the new value) onwards.

For small machine-code routines, it might be convenient to place them in parts of memory below Basic. The choice depends on your Basic program but here are a few guidelines.

900-9FF A safe area so long as you are not using the commands Opening and Openout on tape.

A00-AFF This part of memory is normally used as cassette workspace and may be used on disc based machines.

B00-BFF Function key definitions. Use this area of memory if function keys are not being used.

C00-CFF User defined character definitions. This part of memory may be used if user defined characters are not being used.

D00-DFF User defined character definitions. This part of memory may be used if user defined characters are not being used.

D00-DFF Used by NMI routines. Usually safe for tape based machines.

Patch On

M K Mostowyj,
Peterborough.

Amstrad

ANYONE WHO owns a DMP1 Printer should already know that the character matrix used is only 5 by 7. Whilst the printout is reasonably good, it could be improved by using a larger character matrix. This program does just that. It works by inserting a patch in the appropriate jump block to redirect the printer routine to a new one in memory.

The new routine provides the DMP1 with a matrix of 8 by 7 with a maximum width of 60 characters in normal mode and 30 characters when printing double width. Although the width is reduced the clarity is increased considerably, and this ability to redefine the complete printer character set is included. Also the # and £ symbols can be mied without the need to alter the Dip switches on the printer.

When the routine is in memory and has been called two RSX commands are logged on. These are:

:PATCHON to turn on the routine
:PATCHOFF to turn it off

All RSX commands must be preceeded with the : symbol. Shifted @?;

First of all type in listing one, and save it before running in case of any errors you may make. When this is run, if all is well, you will be given the opportunity to save the resultant code to tape.

SOFTWARE File

Programs for Software File should be fairly compact and sent on a cassette. Please include clear instructions and say what computer it's for. We pay between £6 and £36 for programs published. They must be double-checked and submitted

Once this is done you can reload it any time with:
MEMORY 41659:LOAD"PATCH":CALL 41660

This can either be a direct command or a line within your basic program.

Now enter listing two and save it on a separate tape. When this program is run you will be asked for the name of the character set you wish to load. The original is saved as patch. Once you have loaded the set various options are open to you.

Menu 1.

N — New Character. If pressed the prompt enter character is issued. Enter any Character from the keyboard and press enter. Menu 2 is Then displayed.

S — Save driver and code. Saves Character set and driver complete with any Alterations you may have made. A Library of different set can be compiled.

Menu 2.

ARROWS — Moves cursor around grid.
COPY — Sets/resets bit Occupied by curso.
ENTER — Large enter key stores character as defined in grid.
C — Clear grid.
I — Inverse character.
Q — Quits character Without Storing it and returns to menu 1.

```
>10 MODE 1
20 MEMORY 41659
30 sum=0:RESTORE 130
40 PRINT"PLEASE WAIT!!"
50 FOR n=41660 TO 41660+950
60 READ a$:POKE n,VAL("&"+a$)
70 sum=sum+VAL("&"+a$)
80 NEXT
90 IF sum<>60007 THEN CLS:PRINT"ERROR IN DATA!!!!":END
100 CLS:PRINT"Insert tape to save bytes"
110 SAVE "PATCH",b,41660,951
120 END
130 DATA 01,C9,A2,21,C5,A2,C3,D1,BC,00,00,00,00,D1,A2,
C3,E1,A2,C3,F3,A2,50
140 DATA 41,54,43,48,4F,CE,50,41,54,43,48,4F,46,C6,00,
2A,F2,BD,22,69,A3,21
150 DATA FF,A2,22,F2,BD,3E,3C,32,24,AC,C9,2A,69,A3,22,
F2,BD,3E,50,32,24,AC
160 DATA C9,E5,D5,FE,0E,20,17,3A,24,AC,CB,3F,32,24,AC,
3E,02,32,57,A3,17,17
170 DATA 17,32,4F,A3,AF,C3,66,A3,FE,0F,20,0C,3A,24,AC,
CB,27,32,24,AC,3E,01
180 DATA 18,E3,FE,20,38,36,FE,A3,20,02,3E,80,21,6B,A2,
47,11,08,00,19,10,FD
190 DATA 3E,1B,CD,68,A3,3E,4B,CD,68,A3,AF,CD,68,A3,3E,
08,CD,68,A3,06,08,C5
200 DATA 06,01,C5,7E,CD,68,A3,C1,10,F8,23,C1,10,F1,3E,
0F,D1,E1,C3,00,00,00
210 DATA 00,00,00,00,00,00,00,00,00,00,5F,5F,00,00,00,
00,07,07,00,07,07,00
220 DATA 00,14,7F,7F,14,7F,7F,14,00,00,24,2A,7F,7F,2A,
12,00,46,66,30,18,0C
230 DATA 66,62,00,30,7A,4F,5D,37,7A,48,00,00,00,04,07,
03,00,00,00,00,00,1C
240 DATA 3E,63,41,00,00,00,00,41,63,3E,1C,00,00,08,2A,
3E,1C,1C,3E,2A,08,00
250 DATA 08,08,3E,3E,08,08,00,00,00,40,70,30,00,00,00,
00,08,08,08,08,08,08
260 DATA 00,00,00,00,60,60,00,00,00,60,30,18,0C,06,03,
01,00,3E,7F,51,49,45
270 DATA 7F,3E,00,00,40,42,7F,7F,40,40,00,00,72,7B,49,
49,6F,66,00,00,22,63
280 DATA 49,49,7F,36,00,18,1C,16,53,7F,7F,50,00,00,2F,
6F,49,49,79,33,00,00
290 DATA 3E,7F,49,49,7B,32,00,00,03,03,71,79,0F,07,00,
00,36,7F,49,49,7F,36
300 DATA 00,00,26,6F,49,49,7F,3E,00,00,00,00,6C,6C,00,
00,00,00,00,40,6C,2C
310 DATA 00,00,00,00,08,1C,36,63,41,00,00,00,24,24,24,
24,24,24,00,00,41,63
320 DATA 36,1C,08,00,00,00,06,07,51,59,0F,06,00,3E,7F,
41,5D,5D,5F,1E,00,00
330 DATA 7C,7E,13,13,7E,7C,00,41,7F,7F,49,49,7F,36,00,
1C,3E,63,41,41,63,22
340 DATA 00,41,7F,7F,41,63,3E,1C,00,41,7F,7F,49,5D,41,
63,00,41,7F,7F,49,1D
350 DATA 01,03,00,1C,3E,63,41,51,73,72,00,00,7F,7F,08,
08,7F,7F,00,00,41,41
360 DATA 7F,7F,41,41,00,30,70,40,41,7F,3F,01,00,41,7F,
7F,08,1C,77,63,00,41
370 DATA 7F,7F,41,40,60,70,00,7F,7F,0E,1C,0E,7F,7F,00,
7F,7F,06,0C,18,7F,7F
380 DATA 00,1C,3E,63,41,63,3E,1C,00,41,7F,7F,49,09,0F,
06,00,3C,7E,43,51,33
390 DATA 6E,5C,00,41,7F,7F,09,19,7F,66,00,00,26,6F,49,
49,7B,32,00,00,03,41
400 DATA 7F,7F,41,03,00,00,3F,7F,40,40,7F,3F,00,00,1F,
3F,60,60,3F,1F,00,7F
410 DATA 7F,30,18,30,7F,7F,00,61,73,1E,0C,1E,73,61,00,
00,07,4F,78,78,4F,07
420 DATA 00,47,63,71,59,4D,67,73,00,00,00,7F,7F,41,41,
00,00,01,03,06,0C,18
430 DATA 30,60,00,00,00,41,41,7F,7F,00,00,00,04,06,7F,
7F,06,04,00,40,40,40
440 DATA 40,40,40,40,40,00,00,01,03,06,04,00,00,20,74,
54,54,3C,78,40,00,41
450 DATA 7F,3F,44,44,7C,38,00,00,38,7C,44,44,6C,28,00,
38,7C,44,45,3F,7F,40
460 DATA 00,00,38,7C,54,54,5C,18,00,00,48,7E,7F,49,03,
02,00,00,4C,5E,52,52
470 DATA 7E,3E,00,41,7F,7F,08,04,7C,78,00,00,00,44,7D,
7D,40,00,00,00,20,60
480 DATA 40,44,7D,3D,00,41,7F,7F,10,38,6C,44,00,00,00,
41,7F,7F,40,00,00,78
490 DATA 7C,0C,38,0C,7C,78,00,04,7C,78,04,04,7C,78,00,
00,38,7C,44,44,7C,38
500 DATA 00,42,7E,7C,52,12,1E,0C,00,0C,1E,12,52,7C,7E,
42,00,44,7C,78,4C,04
510 DATA 0C,08,00,00,48,5C,54,54,74,20,00,00,04,3F,7F,
44,64,20,00,00,3C,7C
520 DATA 40,40,7C,7C,00,00,1C,3C,60,60,3C,1C,00,3C,7C,
60,38,60,7C,3C,00,44
530 DATA 6C,38,10,38,6C,44,00,00,4E,5E,50,50,7E,7E,00,
00,4C,64,74,5C,4C,64
540 DATA 00,00,08,08,3E,77,41,41,00,00,00,00,77,77,00,
00,00,00,41,41,77,3E
550 DATA 08,08,00,02,03,01,03,02,03,01,00,55,55,2A,2A,
55,55,2A,2A,48,7E,7F
560 DATA 49,49,63,62,00
```

Rotate 'N' Roll

Dave Millen
Welwyn Garden City,
Hertfordshire.

Spectrum

ROTATE 'N' ROLL is an intriguing program for any Spectrum written in Basic, which enables the operator to produce three-dimensional wire frame images of prisms or polyhedrons. The number of sides is optional as is the size of the drawing. The shapes can be shown as a series of single frame movements or can be superimposed to create patterns. Apart from the fascination of the patterns produced, the program can be a valuable aid to secondary school teachers of technical graphics to help pupils to visualise objects in movement.

The rotate facility turns clockwise around a vertical axis and the roll turns the object clockwise around a horizontal axis. The size increase give the impression of movement towards the viewer. A combination of superimposed images using all three facilities simulates a solid moving in space, showing the loci of the sides for specified movements.

The program can be paused at any stage of drawing by holding down M. To continue or abort the drawing, follow the instructions on the screen.

Watching the Demo mode will give the operator an idea of what can be achieved. In Run mode the operator is required to program in his/her instructions. Here is a brief explanation of each input in turn. Each input must be terminated with Enter. Mistakes can be rectified by pressing Caps Shift and Delete.

Polyhedrom — a 3D shape with a flat base, number of sides optional, and lines from each corner joining in a point. Example: pyramid.

Prism — a 3D shape with a flat base and top, number of sides optional. Lines from each corner join the base and top. Example: Cube.

Enter number of sides — This is self-explanatory.

Enter Size-(0-140) — Each unit represents one pixel on the vertical axis at 0 rotation and roll. 140 units is the maximum size, otherwise the program will stop drawing with the message "figures too big" when the roll approaches 45.

Enter initial rotation — To establish the starting position of the object in degrees. 0 degrees rotation gives a side view with a flat face towards the viewer. 45 deg. rotation of a cube would give a corner towards the viewer.

Enter initial roll — Again establishing the starting position of the object in degrees. 0 degrees rotation gives a side view of the object with the face towards the viewer determined by the rotation. The top of the object rolls towards the viewer. 90 deg. roll will give a top view of the object.

Repeat (Y/N) — If the viewer wishes just a drawing of the object already entered then N should be entered. If a sequence of drawings is required then enter Y.

How many! — Number of drawings required in the sequence.

Enter size inc/dec — To increase or decrease the size of the object during a sequence. To avoid exceeding the maximum size the initial size should be subtracted from 140 and the result divided by the number of repeats previously entered.

When decreasing in size, enter a minus number in response to the prompt. If the size reaches 0 before and end of the sequence it will continue but start increasing in size.

Enter rotation increase — The number of degrees by which the object must rotate each time, in a sequence. 360 deg. gives a complete rotation and would give no change. A minus number causes the object to rotate anticlockwise.

Enter roll increase — The number of degrees by which the object must roll towards the viewer each time, in a sequence. 360 deg. gives a complete roll. A minus number causes the object to roll away from the viewer.

Superimpose? (Y/N) — If drawings are required as separate images one after another then enter N. To overlay each successive drawing onto the previous drawings, in the sequence, enter Y.

Enter paper colour — Use keys 0 to 7 to enter your desired paper colour.

Enter ink colour — Use keys 0 to 7 to enter your desired ink colour.

The program will now proceed to follow the instructions entered. Details of each drawing are printed on the left of the screen display. Rotate 'n' roll is very easy to use and provides endless fascination for young and old alike.

For those who do not like typing in listings, I can supply copies on cassette for £3, including postage and packing. Send a cheque or postal order to Dave Millen, 28, Well Garth, Welwyn Garden City, Herts, AL 3AX.

```
   5 GO SUB 8000
  10 GO SUB 5000
  20 GO SUB 6000
  30 IF a3=1 THEN GO TO 4000
2000 FOR u=1 TO d+1
2002 LET j=172
2004 LET j1=j
2006 LET m=b
2010 LET k=88+a/1.4+COS ((c+PI/18
0)
2015 LET k1=k
2020 FOR i=1 TO 2
2025 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): IF y>175 OR y<0 THEN GO
TO 7000
2026 PLOT x,y: LET xx=x: LET yy=
y
2030 FOR m=b TO b+365 STEP o
2090 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): IF y>175 OR y<0 THEN GO
TO 7000
2092 DRAW x-xx,y-yy: LET xx=x: L
ET yy=y
2140 NEXT m
2150 LET k=88+a/1.4+COS ((c+180)
+PI/180)
2160 NEXT i
2170 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): PLOT x,y: LET xx=x: LET
yy=y
2180 FOR m=b TO b+365 STEP o
2190 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): PLOT x,y
2200 LET xx=j1+a+SIN (m+PI/180):
 LET yy=k1+a+COS (m+PI/180)+SIN
(c+PI/180): DRAW xx-x,yy-y
2230 NEXT m
2240 IF d$="1" THEN GO TO 2310
2300 IF t$="n" OR t$="N" AND r$=
"n" OR r$="N" THEN GO SUB 9000:
GO TO 10
2310 IF t$="n" OR t$="N" THEN GO
 TO 2370
2320 IF INKEY$="M" OR INKEY$="m"
 THEN GO SUB 9000
2325 IF u=d+1 THEN GO TO 2360
2330 IF r$="n" OR r$="N" THEN CL
S
2335 LET a=a+a1/2: IF a>70 THEN
GO TO 7000
2340 LET b=b+b1: IF b>360 THEN L
ET b=b-360
2350 LET c=c+c1: IF c>360 THEN L
ET c=c-360
2355 GO SUB 6000
2360 NEXT u
2370 IF d$="1" THEN RETURN
2380 GO SUB 9000
2385 CLS
2390 GO TO 10
4000 FOR u=1 TO d+1
4002 LET j=172
4004 LET j1=j
4006 LET m=b
4010 LET k=88+a/1.4+COS ((c+180)
+PI/180)
4015 LET k1=k
4020 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): IF y>175 OR y<0 THEN GO
TO 7000
4025 PLOT x,y: LET xx=x: LET yy=
y
4030 FOR m=b TO b+365 STEP o
4090 LET x=j+a+SIN (m+PI/180): L
ET y=k+a+COS (m+PI/180)+SIN (c+P
I/180): IF y>175 OR y<0 THEN GO
TO 7000
4092 DRAW x-xx,y-yy: LET xx=x: L
ET yy=y
4140 NEXT m
4150 LET j=172
4160 LET k=88+a/1.4+COS (c+PI/18
0)
4170 FOR m=b TO b+365 STEP o
4190 LET x=j1+a+SIN (m+PI/180):
LET y=k1+a+COS (m+PI/180)+SIN (c
+PI/180): PLOT x,y: DRAW j-x,k-y
4200 NEXT m
4210 GO TO 2300
4999 STOP
5000 INK 0: PAPER 6: BORDER 6: C
LS : INPUT "Polyhedron(1) or Pri
sm(2)? ";a3: IF a3>2 OR a3<1 THE
N GO TO 5000
5002 LET u=0: LET d=1: LET a1=0:
 LET b1=0: LET c1=0: LET r$="n":
 LET t$="n"
5004 DIM c$(8,7): LET c$(1)="Bla
ck": LET c$(2)="Blue": LET c$(3)
="Red": LET c$(4)="Magenta": LET
 c$(5)="Green": LET c$(6)="Cyan"
: LET c$(7)="Yellow": LET c$(8)=
"White"
5005 IF a3=1 THEN PRINT "Polyhed
ron."
5007 IF a3=2 THEN PRINT "Prism."
5010 INPUT "Enter No. of sides.
";h: PRINT "Sides.....";h
: LET bb=(INT (h/2)=h/2)
5020 LET o=360/h
5030 INPUT "Enter size (0-140).
";a: PRINT "Size.....";a
 LET a=a/2: IF a<-70 OR a>70 THE
N GO TO 5030
5070 INPUT "Enter initial rotati
on.(0-360) ";b: LET b=b+bb*(360
/(h*2)): PRINT "Rotation.....
";b-bb*(360/(h*2))
5110 INPUT "Enter initial roll.(
0-360) ";c: PRINT "Roll.....
...";c
5190 INPUT "Repeat?(y/n) "; LINE
 t$: IF t$="n" OR t$="N" THEN GO
 TO 5360
5200 IF t$<>"y" AND t$<>"Y" THEN
 GO TO 5190
5240 INPUT "How many? ";d: PRINT
 "Repeats.....";d: LET u=0
5280 INPUT "Enter size inc/dec.
";a1: PRINT "Size inc/dec....";a
1
5320 INPUT "Enter rotation incre
ase. ";b1: PRINT "Rotation inc..
..";b1
5330 INPUT "Enter roll increase.
";c1: PRINT "Roll increase...";
c1
5340 INPUT "Superimpose?(y/n) ";
 LINE r$: IF r$="y" OR r$="Y" TH
EN PRINT "Superimpose": GO TO 53
60
5350 IF r$<>"n" AND r$<>"N" THEN
 GO TO 5340
5360 INPUT "Enter paper colour (
0-7). ";p: IF p<0 OR p>7 THEN GO
 TO 5360: BRIGHT (p=0)
5370 PRINT "Paper.....";c$
(p+1)
5375 INPUT "Enter ink colour (0-
7). ";q: IF q<0 OR q>7 THEN GO T
O 5375
5376 PRINT "Ink.....";c$
(q+1)
5378 FOR l=1 TO 100: NEXT l
5380 BORDER p: PAPER p: INK q: C
LS
5390 RETURN
6000 IF a3=2 THEN PRINT AT 0,0;
INK 9;"Prism."
6010 IF a3=1 THEN PRINT AT 0,0;
INK 9;"Polyhedron."
6020 PRINT AT 2,0; INK 9;"Sides=
";h;AT 4,0;"Size =";a*2;" ";AT
6,0;"Rot. =";b-bb*(360/(h*2))-(3
60 AND b+bb*(360/(h*2))>360);"
";AT 8,0;"Roll =";c;"  ";AT 10,0
;"Moves=";u
6025 PRINT #1;AT 1,0;"
"M";Pause                "
6030 RETURN
7000 PRINT #1;AT 0,8; FLASH 1;"F
IGURE TOO BIG"
7010 GO SUB 9000
7020 GO TO 10
8010 BORDER 1: PAPER 1: INK 2: C
LS
```

(continued on next page)

(continued from previous page)

```
8020 PRINT AT 1,1;"▛▀▀▀
```

```
17606 : CB5720031101003E = 405
17614 : FDDBFECB47200311 = 1052
17622 : FFFFCB4F20031164 = 944
17630 : 00CB5720031010 = 343
17638 : 3EDBDBFEFE7F2803 = 1178
17646 : 119CFF3EDFDBFECB = 1357
17654 : 67200311010C05F = 438
17662 : 200311FFFF3E7EDB = 969
17670 : FEFE7F2803116400 = 795
17678 : 197EB7280AFE0528 = 686
17686 : 05AFED52C3294636 = 860
17694 : 8DCDA640ED534040 = 1072
17702 : 227B402A0C401130 = 404
17710 : 02197E3DFE182005 = 532
17718 : 36252B18F5770E00 = 536
17726 : 3A2140470B78B120 = 566
17734 : F8C3BB432A0C4011 = 835
17742 : 77011922A4C402A4A = 435
17750 : 402BE5AF324E40E1 = 928
17758 : 237EFE632004 2A4A = 566
17766 : 407EE54F2A4C4011 = 697
17774 : DEFF19224C407EFE = 1056
17782 : 072002C1C93A4E40 = 635
17790 : 3C3C324E40472371 = 531
17798 : 10FC1121004719 71 = 527
17806 : 10FC472B7110FC11 = 780
17814 : DFFF47197110FC10 = 979
17822 : BE0609C5211B04722 = 596
17830 : 4A400603C5CD4A45 = 622
17838 : 0100050B78B120FB = 597
17846 : 2A4A402323232322 = 354
17854 : 4A40C110E7C110DB = 1006
17862 : 2A1040115D0019CD = 462
17870 : D3402A0C40112E02 = 458
17878 : 197EFE0E28103DFE = 790
17886 : 1B200536252B18F1 = 463
17894 : 77CD4C4118E40604 = 727
17902 : 23361C10FB3A3C40 = 566
17910 : 3CFE0A20013D323C = 528
17918 : 403A21403DFE0220 = 568
17926 : 013C3221400100 00 = 209
17934 : 0B78B120FB2A0C40 = 709
17942 : 11AC01197E3CFE26 = 693
17950 : 2005361C2B18F577 = 550
17958 : C36443E52A104011 = 730
17966 : 7B0019CDD340E1CD = 1058
17974 : 64412A0C40116A01 = 407
17982 : 197E3C7701006405 = 442
17990 : 78B120FB7EFE21C2 = 1187
17998 : 64430603C52A1040 = 495
18006 : 11990019CDD340C1 = 866
18014 : 10F2C9E5CD1C42E1 = 1212
18022 : CD1C42C9ED737B40 = 1039
18030 : ED5B7B40210080AF = 851
18038 : ED52444D21E85822 = 851
18046 : 0440AFED42227B40 = 767
18054 : EBED B02A7B40F9C9 = 1327
18062 : ED737B40ED457B40 = 1038
18070 : C9046502 0EDFFF0E = 814
18078 : FFFF0721000E0100 = 565
18086 : 0570010E010007DF = 364
18094 : FF0EFFFF0E21000E = 840
18102 : 010007DFFF028900 = 625
18110 : 0E01000F21000597 = 219
18118 : 000EFFFF0E21000E = 585
18126 : 010007DFFF0EFFFF = 1010
18134 : 0597000EFFFF0721 = 720
18142 : 000E01000721000F = 70
18150 : FFFF04B900721 00 = 691
18158 : 0E010007DFFF0F21 = 548
18166 : 0006B9000E010007 = 165
18174 : 21000EFFFF0E0100 = 572
18182 : 0721000FFFFF0589 = 707
18190 : 000E01000721000E = 69
18198 : FFFF0721000F0100 = 565
18206 : 0190000F21000459 = 334
18214 : 000E01000E21000E = 76
18222 : FFFF0EDFFF000000 = 1002
18230 : 003D00500E630500 = 304
18238 : 0063000000630000 = 462
18246 : 0063000000630000 = 454
```

Listing 4. Screen data loader.

```
  10 LET A$="[illegible]"
     BY, D.GREEN, SCORE:, 00000
60, DEFEATS:0,,GRID5:001, THEM:
0,,TIME:0000,[illegible]
  20 FOR N=1 TO LEN A$
  30 POKE 16251+N,CODE A$(N)
  40 NEXT N
```

Listing 5. Basic program.

```
  10 REM >> SHORT CIRCUIT <<
        (C)D.GREEN 1985
  20 CLEAR
  30 LET X$=".....READY TO FIG
HT ?.....COMBAT IN PROGR
ESS.....OPPONENT DESTROYE
D.....ALL DESTROYED - KILL BO
NUS.....*** DEFEATED ***....
.....GAME OVER.....
..."
  40 GOSUB 620
  50 PRINT ,,"
  60 PRINT ,,"
  70 PRINT ,;TAB 11;"BY D.GREEN"
  80 PRINT ,;TAB 12;"(C) 1985"
  90 PRINT ,;TAB 9;"HIGH TECH SO
FT"
 100 FOR N=1 TO 150
 110 IF INKEY$<>"" THEN GOTO 350
 120 NEXT N
 130 CLS
 140 PRINT TAB 7;"SHORT CIRCUIT
";TAB 7;"[illegible]";,,,"** U
ELCOME TO THE GAME GRID **"
 150 PRINT ,,"FORCE THE ENEMY LI
GHT TRACERS  TO CRASH INTO THE
JETWALLS."
 160 PRINT ,;"USE KEYS:"
 170 PRINT ,;"  7   U   I
U   I         5 6   A D   J K   J
 K   A D         6     Z     M
S     M"
 180 PRINT ,,"(ALL OPTIONS ARE S
IMULTANEOUS)"
 190 PRINT ,,TAB 3;"""HORITURI T
E SALUTANT"",,,"
 200 PRINT ,,TAB 2;">PRESS ANY K
EY TO START;,,"
 210 FOR N=1 TO 200
 220 IF INKEY$<>"" THEN GOTO 350
 230 NEXT N
 240 CLS
 250 PRINT TAB 5;"* HIGH SCORES
*";TAB 5;"[illegible]"
 260 FOR N=1 TO 10
 270 PRINT "*** ";S$(N);" ....";
N$(N);" ***",,
 280 NEXT N
 290 PRINT TAB 2;">PRESS ANY KEY
 TO START<"
 300 FOR N=1 TO 200
 310 IF INKEY$<>"" THEN GOTO 350
 320 NEXT N
 330 CLS
 340 GOTO 50
 350 POKE 17532,54
 360 IF USR 18062>30000 THEN LET
 X=USR 18026
 370 LET X=USR 17067
 380 FOR N=1 TO 100
 390 NEXT N
 400 LET HL=PEEK 16396+256*PEEK
16397+289
 410 LET A$=""
 420 FOR N=0 TO 6
 430 LET A$=A$+CHR$ PEEK (HL+N)
 440 NEXT N
 450 FOR N=1 TO 10
 460 IF A$>S$(N) THEN GOTO 500
 470 NEXT N
 480 GOTO 240
 500 CLS
 510 POKE 16418,2
 520 PRINT AT 5,4;">>CONGRATULAT
IONS<<,,,"YOU ARE REQUESTED TO
ENTER YOUR NAME FOR THE GAME GRI
D                ** HALL OF FAME *
*"
 530 FOR B=10 TO N+1 STEP -1
 540 LET S$(B)=S$(B-1)
 550 LET N$(B)=N$(B-1)
 560 NEXT B
 570 INPUT N$(N)
 580 POKE 16418,0
 590 LET N$(N)=" "+N$(N)( TO 11)
 600 LET S$(N)=A$
 610 GOTO 240
 620 POKE 16418,0
 630 DIM S$(10,7)
 640 DIM N$(10,12)
 650 FOR N=2 TO 10
 660 LET S$(N)="0000000"
 670 LET N$(N)="      ZX-81"
 680 NEXT N
 690 LET S$(1)="0017150"
 700 LET N$(1)="     A.X.E"
 710 RETURN
 720 SAVE "S[illegible]"
 730 RUN
 750 REM
           THE END
```

Autodialler

John Derrick,
Cheddar,
Somerset.

CBM-64

I HAVE been using your Telsoft service. I wrote this to take advantage of the auto-dial facility..

The program D3 is entirely machine code and is designed to work with D1 and D2 of the Dialsoft program. To use it load the three programs and type

SYS 49188

and press Return. The program prompts for the number to dial. Type the number, with a minus sign separator if necessary, pressing Delete if you make a mistake. Pressing Return or typing 5 digits, causes the number to be dialed. D3 now passes control to D1 and the program proceeds as normal. The program on tape is a Basic loader for the machine code, so the saver with the dialsoft program used to save D1 and D2 can be used to save D3 to tape or disc.

The D3 program isn't relocatable unless it is re-written, i.e. change the JSR's and some LDA's, but it doesn't matter if the program is over-written once you are on-line, as it won't be reused.

```
0 PRINT"[illegible] D3 - COMMUNICATIONS PROGRAM"
1 PRINT"[illegible] WRITTEN FOR '[illegible]YOUR COMPUTER[illegible]'"
2 PRINT"[illegible] BY [illegible]DAVID DERRICK[illegible] 1-7-85."
10 TT=0:FORX=49152TO49482:READA:POKEX,A:TT=TT+A:NEXT
20 IFTT<>41165THENPRINT"[illegible]DATA ERROR":END
30 PRINT"[illegible]TYPE 'SYS 49188' + RETURN TO ACTIVATE"
1000 DATA206,85,77,66,69,82,32,42,196,73
1010 DATA65,76,76,73,78,71,215,65,73,84
1020 DATA73,78,71,32,70,79,82,32,67,65
1030 DATA82,82,73,69,82,162,169,6,141,0
1040 DATA222,169,0,141,1,222,32,243,192,169
1050 DATA6,141,0,222,169,1,141,1,222,32
1060 DATA243,192,169,23,141,24,208,32,68,229
1070 DATA162,2,160,4,24,32,240,255,162,0
1080 DATA189,0,192,32,210,255,232,224,8,208
1090 DATA245,169,0,133,2,169,95,32,210,255
1100 DATA169,157,32,210,255,32,2,193,201,0
1110 DATA240,239,170,201,13,208,3,76,156,192
1120 DATA233,48,48,237,138,233,58,16,232,138
1130 DATA32,210,255,201,48,208,2,162,58,138
1140 DATA164,2,153,64,3,230,2,165,2,201
1150 DATA15,240,3,76,95,192,160,3,162,4
1160 DATA24,32,240,255,160,8,185,0,192,32
1170 DATA210,255,200,192,16,208,245,169,32,32
1180 DATA210,255,160,0,185,64,3,170,224,58
1190 DATA208,2,162,48,138,32,210,255,201,45
1200 DATA208,6,32,243,192,76,232,192,169,8
1210 DATA141,0,222,185,64,3,141,1,222,169
1220 DATA8,141,0,222,185,64,3,205,1,222
1230 DATA240,248,200,196,2,208,203,32,243,192
1240 DATA76,232,7,32,53,193,96,234,234,234
1250 DATA234,234,234,234,234,234,234,234,32,228
1260 DATA255,133,78,201,20,240,11,234,165,78
1270 DATA201,45,240,20,234,165,78,96,165,2
1280 DATA201,0,240,7,169,20,32,210,255,198
1290 DATA2,169,0,96,32,210,255,169,45,164
1300 DATA2,153,64,3,230,2,169,0,96,152
1310 DATA72,138,72,160,0,162,0,202,224,0
1320 DATA208,251,136,192,0,208,244,104,170,104,96
READY.
```

Screen Handler

Steven Meyfroide,
Middleton,
Manchester.

Enterprise

AS YOU will probably have discovered, the screen handling on the Enterprise is very flexible. Like the Atari, previously unequalled for graphics, it has a total of 256 colours, and also like the Atari, different screen modes can be displayed at the same time. For example, say you want a 16 colour hi-res screen for graphics and a small text screen above it for score etc, then just open the appropriate channels and display them wherever you want them:

```
100 set video mode 1 !Hi-res graphics
110 set video colur 2 !16 colours; horizontal res
160
120 set video x 40 !40 chars across
130 set video y 20 !20 chars down
140 open£1: "video:" !Open the hires page
150 set video mode 0 !40 column text
160 set video colour 0 !Two colours
170 set video y 4 !4 chars down
180 open£3:"video:" !Open the text page
```

At this stage the pages are not on the screen, so display them

```
190 display£1:at 5 from 1 to 20 !16 colour hires
from 5-25
200 display£2:at 1 from 1 to 4 !Text from 1-4
```

Note that the settings for 'videox' etc are not

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erased by an open, ie they don't have to be defined for every channel if the channels have the same settings for any of them. Hence, in the program above, "video × " is defined once and this setting is used for both pages.

At the top of Ram is a block of memory that the video chip uses to display a screen. this is like a program, telling the chip what mode the next line is to be in etc, but more importantly, it holds a palette for every single line it has to display. If we could change this, we could change the palette for a given line within the same channel ie, Colour 1 could be red on the first line of channel 1, in which case anything drawn in colour one appears as red; and also, colour 1 could be blue on the next line.

The only problem is how to access this block of memory, but luckily, it is quite easy with the Speek and Spoke commands in IS Basic. Firstly, you need to know where the Line Parameter Block is so:

A=SPEEK(255,49140)+SPEEK(255,49141)*256).

An address will be put into A that is the beginning of the block of memory we want. A will usually be equal to 47872 in Basic. The format of this table is:

Disp Contents
00 Two's complement of scanlines in this modeline.
01 The video display mode for this line
02 See Technical manual
03 See Technical manual.
04 Lo byte of address of screen memory for this modeline.
05 Hi byte of address of screen memory for this modeline.
06 Lo of graphic memory in attribute mode or address of character definitions in text modes.
07 Hi of above.
08-15 Palette definition. (Colours 0-7)

The address of the screen memory (04-05) can be used to Poke the display in Basic or machine code — the format of the screen memory for the various modes is detailed in the Technical Manual. Moreover, the data we want is there at 08-15. All that is needed is a small program to change the palette definition to what we want - here is a simple one. Put the colours wanted for colours 0-7 in the Data statement and run it.

```
5 LET num =5
10 FOR A=47872 TO 47872 + num*16-6 STEP 16
20 FOR B=08 TO 15
30 READ C
40 SPOKE 255,A+B,C
50 NEXT B
60 NEXT A
70 END
100 DATA 15,25,35,45,55,65,75,85,
110 DATA 95,105,115,125,135,145,155,165
120 DATA 175,185,195,20 5 ,215,225,235,245
130 DATA 49,59,69,79,89,99,109,119
140 DATA 58,46,112,195,237,247,168,249
```

...etc for number of lines wanting to be changed...Just set 'num' to however many lines you want changing. Notice that the first line is the Status Line, and to miss this out change line 10 to:

10 FOR A=47872+16 TO 47872+16+...etc..

With the knowledge of what is in the Line Parameter Block, I'm sure you can think of many interesting things to do — scrolling is easy, for example: just change the address of the screen memory on every line to equal the address of the line above or below it. Sideways scrolling can also be done but with a bit more difficulty.

One interesting project would be to install a new device driver so that a channel could be opened that simulated say a Spectrum screen (attribute mode is the obvious choice!) or BBC screen(s). The driver would have to be able to interpret control codes sent to it and act on them as the BBC or Spectrum would do.

This wouldn't be too difficult with a knowledge of machine code since the way to install device drivers is outlined in the Technical manual. If a BBC screen was simulated like this (but beware of the different modes, especially teletext — ignore colour control codes), then coversion from BBC Basic to IS Basic would be simple — procedures and functions are defined in similar ways (though the IS versions are more powerful with parameter passing by reference — including other functions and arrays).

You have probably noticed that you can't use FOR...NEXT loops in immediate mode! This can be very useful while editing to test the contents of memory, so to do this, type EDIT 200 to create a work space for program 200 (!) and type your For loop in as a separate program, eg:

```
EDIT 200
10 FOR A=1 TO 10
20 PRINT PEEK (A);
30 NEXT A
```

This can be run and then Newed. Type EDIT 0 or whatever to get to your real problem.

Turboload

R Grzasko,
London SE15.

Vic 20

THIS UTILITY program will load, save and verify programs six times faster than normal.

First of all type in program one save it then run it. This will move the start of basic above the part of Ram where the Turboload program is located.

Save in case of error

Next type in program two and save it in case of an error. Then run the program.

If all is well after a short time a message will appear on the screen — "You are now ready to Turboload programs". Type:

SYS5120

to activate the Turboload program. The Turboload program will not load programs that have not been saved by the Turboload program, also normal programs will not load with the Turboloader activated.

Press Run Stop and Restore

To overcome this problem press run stop and restore together. You can now load normal programs. Then you can type:

SYS5120

and save your program at turbo speeds.

When programs using the Turboloader are loading the border will turn blue. A more colourful display may be obtained by changing line 2000 to:

2000 DATA90,29,FC,EA,EA,49,04,8D,1123

If you experience load, verify and save problems try using a good quality computer tape.

```
100 PRINT"□■■■■THE FAST LOAD PROGRAM WILL TAKE A SHORT TIMETO LOAD SO PLEASE WAIT
"
140 S=5120:N=0:AD=0
150 T=0
160 READA$:IFA$="END"THEN480
170 H=ASC(A$)-48:L=ASC(MID$(A$,2))-48
180 V=16*(H+7*(H>9))+L+7*(L>9)
185 T=T+V:AD=AD+V
190 IFRIGHT$(A$,1)="*"THENV=V+INT(S/256)
200 POKES+N,V:N=N+1
210 IFNAND7THEN160
220 READTT:IFTT=TTHEN150
480 READTC:IFTC=ADTHEN500
500 READTN:IFTN=NTHEN520
520 SYS5120
530 PRINT"□YOU ARE NOW READY TO  SAVE OR LOAD PROGRAMS USING THE FAST LOAD"
540 PRINT"WHEN YOU WISH TO LOAD THE NEXT PROGRAM YOU  MUST ■1■ PRESS RUN/STOP"
550 PRINT"RESTORE THEN ■2■ LOAD"
1000 DATAA9,B3,8D,30,03,A9,01*,8D,851
1010 DATA31,03,A9,22,8D,32,03,A9,618
1020 DATA00*,8D,33,03,A2,00,BD,9A,700
1030 DATA01*,F0,06,EA,EA,EA,E8,D0,1389
1040 DATAF5,60,A5,BA,C9,01,F0,03,1137
1050 DATA4C,85,F6,A9,00,85,90,A2,1063
1060 DATA1E,20,AB,F8,F0,07,20,B7,943
1070 DATAF8,B0,E6,A2,B4,86,A5,20,1327
1080 DATA28,F7,A0,00,A5,B9,91,B2,1120
1090 DATAA5,C1,C8,91,B2,48,A5,C2,1312
1100 DATAC8,91,B2,48,A5,AE,C8,91,1279
1110 DATAB2,48,A5,AF,C8,91,B2,48,1185
1120 DATA20,54,F8,A5,B7,A0,05,91,1022
1130 DATAB2,A2,00,A9,20,E4,B7,B0,1128
1140 DATA0C,88,88,88,88,88,B1,BB,1056
1150 DATAC8,C8,C8,C8,C8,C8,91,B2,1523
1160 DATAE8,C0,BF,90,E6,A5,A5,A2,1481
1170 DATAF0,20,A4,00*,68,85,AF,68,952
1180 DATA85,AE,68,85,C2,68,85,C1,1168
1190 DATAB0,07,A9,14,A2,0F,20,A4,745
1200 DATA00*,A9,00,60,85,A5,86,AA,867
1210 DATA20,60,01*,A5,C1,85,C3,A5,980
1220 DATAC2,85,C4,A9,64,8D,16,91,1100
1230 DATAA9,00,8D,15,91,A9,FF,8D,1041
1240 DATA26,91,8D,25,91,A9,FF,8D,1071
1250 DATA25,91,A9,0F,20,28,01*,B0,615
1260 DATA49,AD,2D,91,29,40,F0,F2,1023
1270 DATAAD,24,91,C6,A5,D0,E6,A2,1317
1280 DATA0F,8A,20,28,01*,CA,10,F9,693
1290 DATAA5,AA,20,28,01*,A9,00,85,710
1300 DATABD,A5,C3,C5,AE,D0,06,A5,1299
1310 DATAC4,C5,AF,F0,18,A0,00,B1,1169
1320 DATAC3,48,20,28,01*,68,B0,12,638
1330 DATA65,BD,85,BD,E6,C3,D0,E1,1470
1340 DATAE6,C4,18,90,DC,A5,BD,20,1200
```

```
1350 DATA28,01*,A5,B4,8D,0F,90,A9,855
1360 DATA00,8D,A0,02,58,4C,CF,FC,926
1370 DATAA0,08,0A,48,A9,40,2C,1D,556
1380 DATA91,F0,FB,90,08,A9,0C,85,1102
1390 DATABE,C6,BE,D0,FC,A9,00,8D,1348
1400 DATA15,91,AD,20,91,49,08,8D,738
1410 DATA20,91,29,08,D0,07,20,59,562
1420 DATA01*,90,D9,68,60,68,88,D0,1010
1430 DATAD1,AD,21,91,49,01,4A,60,804
1440 DATA78,AD,0F,90,85,B4,AD,1C,966
1450 DATA91,29,FC,8D,1C,91,A9,F7,1168
1460 DATA8D,20,91,A9,C0,85,C0,A9,1173
1470 DATA40,8D,1E,91,A9,42,8D,2E,802
1480 DATA91,A9,00,8D,1B,91,8D,2B,811
1490 DATA91,8D,15,91,8D,25,91,A2,937
1500 DATAFF,A0,FF,88,D0,FD,CA,D0,1677
1510 DATAF8,60,93,11,56,49,43,20,766
1520 DATA54,55,52,42,4F,20,28,43,535
1530 DATA29,20,4A,2E,54,57,49,44,505
1540 DATA44,59,00,85,93,A5,BA,C9,989
1550 DATA01,F0,03,4C,4B,F5,A9,00,809
1560 DATA85,90,20,94,F8,A9,00,B0,1050
1570 DATAD0,20,47,F6,A5,93,85,0A,1012
1580 DATAA9,00,85,93,A5,C3,48,A5,1046
1590 DATAC4,48,20,54,F8,A9,F0,20,1073
1600 DATA81,02*,68,85,C4,68,85,C3,996
1610 DATAB0,36,24,9D,10,15,A0,63,719
1620 DATA20,E6,F1,A0,05,B1,B2,AA,1193
1630 DATAF0,09,C8,B1,B2,20,D2,FF,1301
1640 DATACA,D0,F7,A9,00,85,9E,A9,1286
1650 DATA06,85,9F,A4,9E,C4,B7,B0,1175
1660 DATA0E,B1,BB,A4,9F,D1,B2,D0,1296
1670 DATABB,E6,9E,E6,9F,D0,EC,18,1432
1680 DATAA5,0A,85,93,A5,90,F0,03,1007
1690 DATAA9,18,38,90,01,60,20,6A,628
1700 DATAF6,A0,00,B1,B2,D0,04,A5,1138
1710 DATAB9,F0,0A,C8,B1,B2,85,C3,1318
1720 DATAC8,B1,B2,85,C4,A0,03,B1,1224
1730 DATAB2,38,A0,01,F1,B2,AA,A0,1144
1740 DATA04,B1,B2,A0,02,F1,B2,A8,1108
1750 DATA18,8A,65,C3,85,AE,98,65,1018
1760 DATAC4,85,AF,A5,C3,85,C1,A5,1355
1770 DATAC4,85,C2,A9,0F,20,81,02*,870
1780 DATAA5,90,F0,08,A9,1D,A6,93,1068
1790 DATAF0,02,A9,1C,A6,AE,A4,AF,1118
1800 DATA60,85,AA,20,60,01*,A9,0C,709
1810 DATA8D,16,91,A9,01,8D,15,91,785
1820 DATAA9,FF,8D,26,91,8D,25,91,1071
1830 DATAA9,FF,85,A9,20,59,01*,B0,1024
1840 DATA10,20,43,03*,26,A9,A5,A9,659
1850 DATAC9,0F,D0,F0,20,33,03*,90,894
1860 DATA03,4C,FB,02*,C9,0F,F0,F4,1032
1870 DATAA2,0E,E4,A9,D0,DA,20,33,1082
1880 DATA03*,CA,10,F6,C5,AA,D0,D0,1250
1890 DATAA9,00,85,BD,A5,C1,85,C3,1177
1900 DATAA5,C2,85,C4,A5,C3,C5,AE,1419
1910 DATAD0,24,A5,C4,C5,AF,D0,1E,1215
1920 DATA20,33,03*,C5,BD,18,F0,13,755
1930 DATAA9,20,05,90,85,90,A5,AA,962
1940 DATAC9,F0,D0,06,A9,10,05,90,989
1950 DATA85,90,38,4C,1A,01*,20,33,519
1960 DATA03*,B0,F8,A0,00,A6,93,D0,1108
1970 DATA04,91,C3,F0,0C,D1,C3,F0,1240
1980 DATA08,AA,A9,10,05,90,85,90,789
1990 DATA8A,18,65,BD,85,BD,AD,0F,962
2000 DATA90,29,FC,09,02,49,04,8D,666
2010 DATA0F,90,E6,C3,D0,A6,E6,C4,1384
2020 DATA4C,D4,02*,A0,08,20,43,03*,560
2030 DATA26,A9,88,D0,F8,20,59,01*,921
2040 DATAA5,A9,60,A9,42,2C,2D,91,899
2050 DATAF0,FB,AD,1D,91,0A,0A,A9,1027
2060 DATA01,8D,15,91,A9,FF,8D,25,910
2070 DATA91,AD,21,91,60,END,109406,861
```

Headerless files

Ian Harris,
Old Windsor,
Berkshire.

Spectrum

WHEN YOU USE the ordinary Spectrum Save and Load commands, the computer normally deals with the tape file in two parts. The first is the header which contains information about the start address and the length and name of the file. The secod is the actual block of code to be saved/loaded.

This short machine code program enables the user to bypass the header, and save or load the block of code on its own. This is achieved by typing in one of the two new commands, the format of which is as follows.

To save a headerless file, type:

*SAVE start, length

To load a headerless file, type:

*LOAD start, length

where "start" is the address at which the file is to begin, e.g.: 16384 — the start of the screen — and "length" is the number of bytes that are to be saved/loaded, e.g.: 6912 — the length of a Screen.

Note that the program will not load the actual header of a file; only the code block after it. You can also load a specified amount of a file, e.g.: the first third of a screen picture. To do this, take any screen picture file, and type:

*LOAD 16384, 2048

16384 is the start of the screen; 2048 is the number of bytes in the first third of the screen. The program will stop loading part way through the tape file, i.e., when 2048 bytes have been loaded.

If you don't know the length of a headerless file, just set the length equal to 65535; this will load in everything, no matter what length.

To get the routine up and running, type in listing 1. Save this on a blank tape using:

SAVE "HEADERLESS"LINE 1

Now type New and enter listing 2. Run it, and when there are no errors save the machine code after the loader with:

SAVE "H" CODE 65162,206

The checksum in the listing should detect most errors. Now reset your machine, and Load the whole thin ing. To initialise the routine, type:

RANDOMIZE USR 65356

*Save and *Load should now be accepted. If they are not, or the routine crashes, then there is an error in the machine code.

If for any reason the Spectrum fails to accept the commands but you know that they work correctly; this is probably due to a Clear command or Run command being executed; then just reinitialise the routine using the USR statement as above.

If you wish to use the commands in a program, make sure that:

RANDOMIZE USR 65356

is the first line of your routine.

Loader program.

```
  1 CLEAR 65161: LOAD "H"CODE 6
5162,206: PRINT "Type RANDOMIZE
USR 65356 to""initialise."
```

Hex loader.

```
 10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
 19 REM hfdhd
 20 INPUT "Start ";s
 30 INPUT "Finish ";f
 39 REM fd
 40 FOR n=s TO f STEP 8
 50 LET tot=0: PRINT n;": ";
 60 INPUT h$: PRINT h$;
 70 LET x=0
 80 FOR b=1 TO LEN h$ STEP 2
 90 LET z=FN h(h$): LET tot=tot
+z
100 POKE n+x,z
110 LET h$=h$(3 TO ): LET x=x+1
120 NEXT b
130 PRINT " = ";: INPUT t: PRIN
T t
140 IF tot<>t THEN PRINT "input
error - try again": GO TO 50
150 NEXT n
160 REM enter STOP to stop
```

Hex dump.

```
65162: 3A3A5CFE0B2823FD = 801
65170: CB017E20082AB25C = 682
65178: 23E5C3B71ACD0313 = 887
65186: FD3600FF2AB25ECD = 990
65194: A7112AB25C23E5C3 = 958
65202: B4122AB25C2B7EFE = 848
65210: 2A20D4DFFE532815 = 907
65218: FE4C20C8E7FE4F20 = 1161
65226: C8E7FE41200C1E7FE = 1158
65234: 44200BC180FE7FE41 = 877
65242: 20B5E7FE562080E7 = 1283
65250: FE4520AB32815CE7 = 1028
65258: FE2028FBFD3600FF = 1139
65266: FD36260000CD7A1CFD = 953
65274: CB007E2892FE0D28 = 822
65282: 04FE3A203AFD3600 = 793
```

(continued on next page)

(continued from previous page)

```
65290:  FFFDCB017E200C2A  = 924
65298:  B25C23E521B712E5  = 997
65306:  C37B1BCD991E5059  = 897
65314:  D5CD991EED43B05C  = 1173
65322:  DD2AB05CD13A815C  = 1019
65330:  FE44280B3EFF37CD  = 947
65338:  C2041803EFF37CD   = 805
65346:  5E052AB25C23E5C3  = 862
65354:  7618ED5BB25C132A  = 804
65362:  3D5C732372C9003C  = 678
65370:  42 = 66
```

Telecolour

J C Bullock,
Telford,
Shropshire.

BBC

TELECOLOUR MAKES it easier to produce the CHR$ colour commands, by printing the correct CHR$ expression when one of the function keys is pressed with Shift/CTRL for example:
When Telecolour is off, SHIFT + f1 produces a red colour control character.
When Telecolour is on, SHIFT + f1 produces 'CHR$129;'

The program occupies less than 255 bytes in machine code. Type it in, Run it, an type:

*SAVE TELECOL 900 9FF

If you press CTRL and Break or redefine f0 or the Break key, you will have to type in *FX18 followed by the 2 function key definitions given in lines 50 and 60 of the listing. Now, Break will switch Telecolour on, f0 will switch it off.

```
   10 REM*******************************
   20 REM*Telecolour (c)1985 J.Bullock*
   30 REM*******************************
   40
   50 *K.10 ?&71=?&210:?&72=?&211:?&210=0:?&211=9|M|K|
K|M|HTelecolour switched on.          |J|U|K|M
   60 *K.0 ?&210=&C5:?&211=&DE|M|K|K|M|HTelecolour swi
tched off                |J|U|K|M
   70 FOR A%=0 TO 2 STEP 2:P%=&900
   80 [OPT A%:STA &70
   90 PHA:PHP:TXA:PHA:TYA:PHA
  100 LDA &70
  110 CMP#144:BCC ALPHA
  120 CMP#154:BCS NOCODE
  130 PHA:JSR chr:PLA
  140 CLC:SBC#143
  150 ASL A:TAX:STX &70
  160 LDY graphic,X
  170 LDA#138:LDX#0:JSR &FFF4
  180 INC &70:LDX &70
  190 LDY graphic,X
  200 LDA#138:LDX#0:JSR &FFF4
  210 LDY#59:JSR &FFF4
  220 LDA#1:STA &70:JMP OUT
  230 .ALPHA
  240 CMP#128:BCC NOCODE
  250 CMP#138:BCS NOCODE
  260 PHA:JSR chr:PLA
  270 CLC:SBC#127:ASL A:TAX:STX &70
  280 LDY alpha,X
  290 LDA#138:LDX#0:JSR &FFF4
  300 INC &70:LDX &70
  310 LDY alpha,X
  320 LDA#138:LDX#0:JSR &FFF4
  330 LDY#59:JSR &FFF4
  340 LDA#1:STA &70:JMP OUT
  350 .NOCODE
  360 LDA#0:STA &70
  370 .OUT
  380 PLA:TAY:PLA:TAX:PLP
  390 LDA &70:CMP#1:BEQ VEC
  400 PLA:JMP (&71)
  410 .VEC PLA:LDA#0:JMP (&71)
  420 .chr
  430 LDA#138:LDX#0
  440 LDY#127:JSR &FFF4
  450 LDY#67:JSR &FFF4
  460 LDY#72:JSR &FFF4
  470 LDY#82:JSR &FFF4
  480 LDY#36:JSR &FFF4
  490 LDY#49:JSR &FFF4:RTS
  500 .graphic
  510 ]
  520 $P%="56454647484950515354"
  530 P%=P%+LEN $P%:[OPT A%
  540 .alpha
  550 ]
  560 $P%="57293031323334353637"
  570 P%=P%+LEN $P%:[OPT A%:]:NEXT
```

RESULTS

50 STICKS COMPETITION

HAVING RECEIVED hundreds of entries to the August competition we had a most interesting and often amusing read that took us well into the night.

Certainly, if a joystick could be implanted into one's brain, the majority of *Your Computer* readers would at last be happy. The most surprising thing was how few females entered the competition — come on now girls, you were only noted by your absence. We find it hard to believe that only a mere handful of females read *Your Computer*!

The eventual 50 winners of The Stick cover a noticeably wide age range and the elaborate imaginative illustrations of the younger entrants — about eight and nine year olds — foretell dynamic things for the future. Some harrassed fathers needed a joystick to control their wilder offspring, some entrants seem to be budding brain surgeons with implants threateningly popular, some were constructive well thought out joystick ideas and some were concerned with aiding the disabled.

The Stick, being extremely responsive and for single handed use, working on an eight point mercury switch, will — we know — fulfill all your joystick needs — until of course one of those eight year olds with aspirations to brain survery come of age. And then....?

Among the more off-beat suggestions were D. Bourn's thought-controlled food dispenser and A. Burns' speech activated joystick which moves objects faster when it detects stress in your voice. Best of all, perhaps, was H. McMillan's Jeeves Mk 1 Computer Control System — the accompanying cartoon shows Jeeves running for the keyboard while Bertie Wooster is shouting from the comfort of his armchair: "Dammit Jeeves, Fire!".

WINNERS

B. Mawson, Slough
K. Scott, Jedburgh
R. Scaife, Newcastle
D. Bourne, Wolverhampton
J. Powell, Telford
C. Noad, Yateley
R. P. Shaw, Nailsea
P. Jordan, Pontefract
H. Reeve, Wetherby
B. Woods, Liverpool 12
A. R. Newby, Harrogate
F. Mathieson, Pairley
C. Bloxham, Stratford upon Avon
A. Craig, Heaton Mersey
A. Oxley, Cleveland
S. James, Liversedge
J. Astbury, Clent
A. Adamson, Romsey
H. McMillan, Tollcross
S. Keyworth, Gedling
A. Philmore, Leeds
R. Devlin, Belfast
T. Roche, Poole
M. Cameron, Cowplain
M. Blackburn, Carterton
A. Burns, Penryn
A. Standen, Leonards-on-sea
de Geweidge, Amsterdam
A. Riley, East Moseley
P. Boyde, Northwich
L. Wood, Peterborough
J. Williams, Stoke on Trent
C. Sawyer, Exeter
S. Russell, Glasgow
C. Dorr, Cork
A. Sawney, London W12
M. van Slagesen, Amsterdam
A. Hughes, Wembourne
C. Gallast, BFPO 42
J. Avern, Guildford
D. Perryman, Faversham
M. Sheppard, Brackley
B. Coates, Sth Queensferry
O. Adekunle, Chirnside
K. Lee, RAF Bishops Court
J. Laus, Nottingham
W. Owen, Manchester 23
J. Lambshead, Rainham
A. Hooper, Hauxton
D. Woods, Liverpool 13

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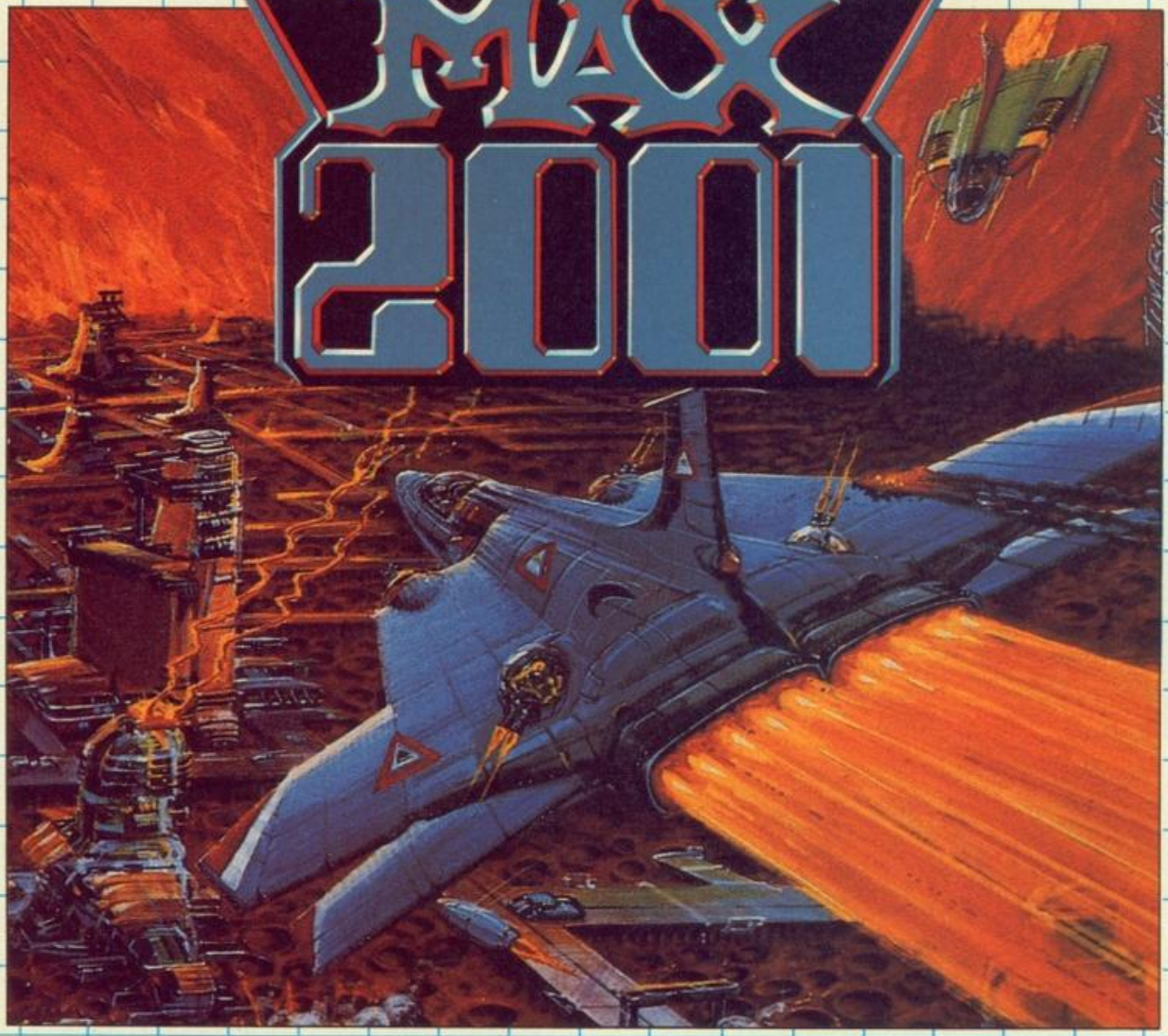

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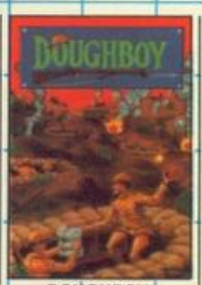
Having effected an easy victory, the FURXX now intend to invade all earth colonies and finally capture the earth herself.
Your mission is to penetrate enemy defences, destroy their hoverfields, and finally destroy the symbol upon which the FURXX EMPIRE IS BUILT. And this must be accomplished IMMEDIATELY, for the fate of the world rests in your hand!

BLUE MAX

ZAXXON



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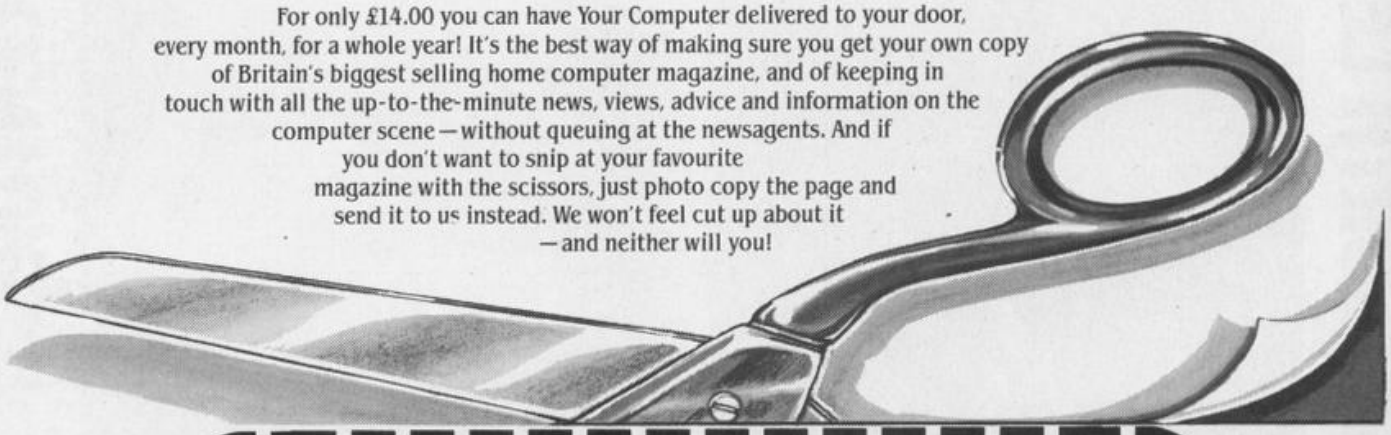

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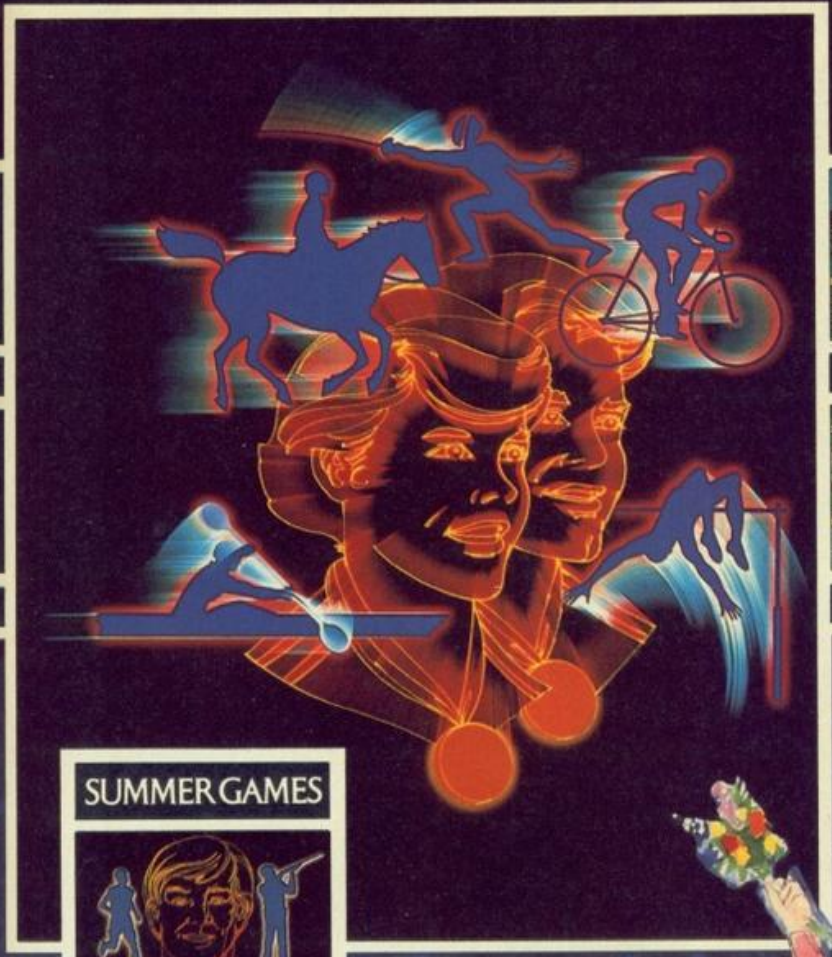

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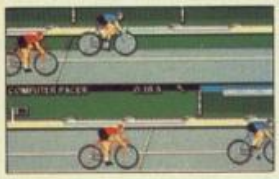

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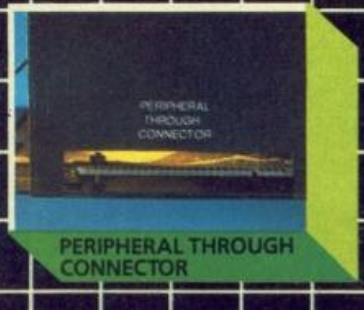

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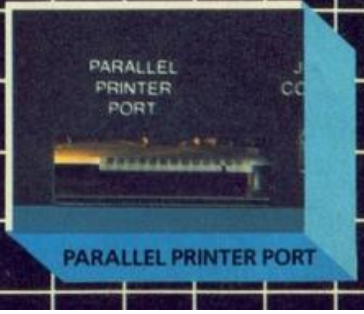

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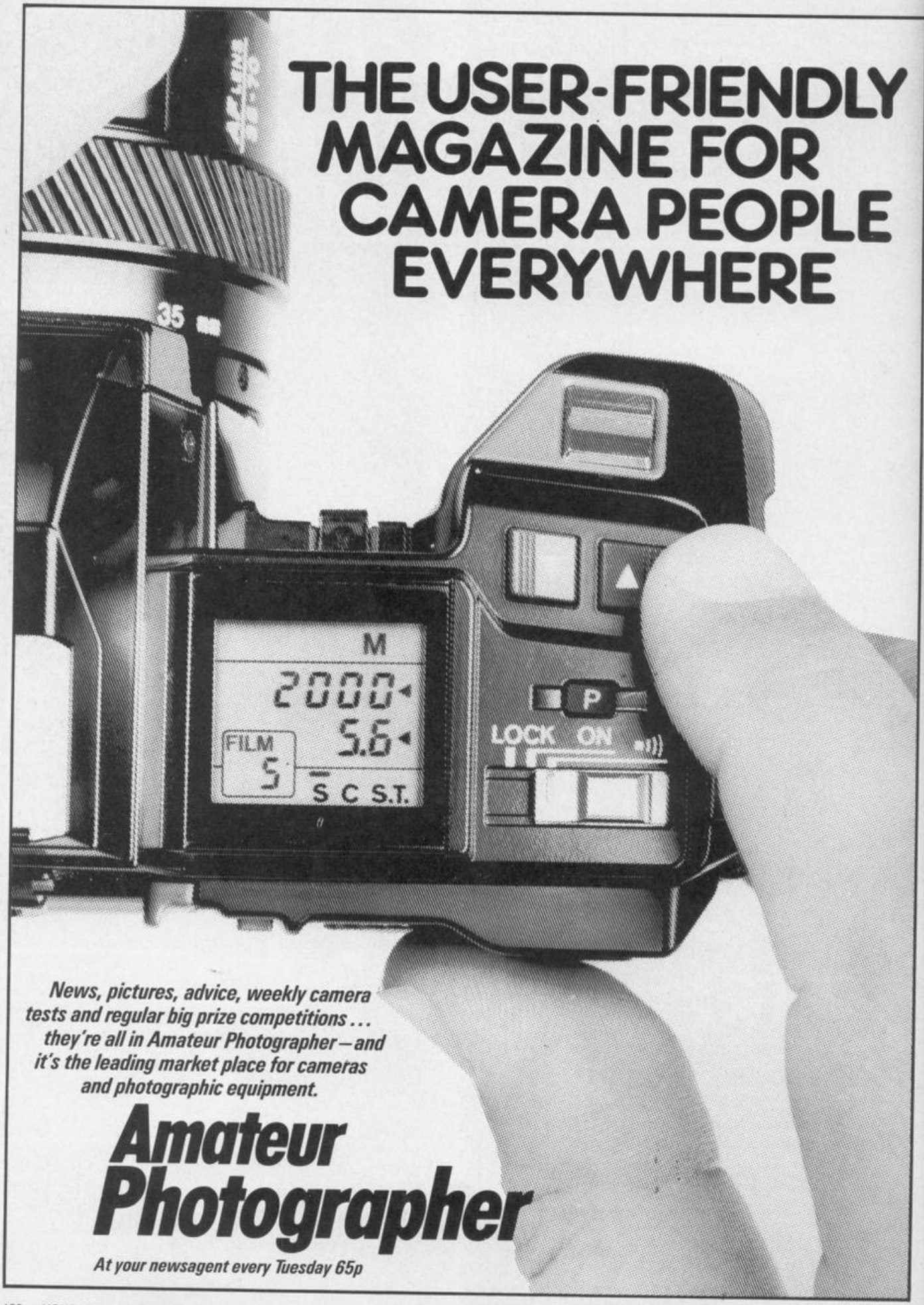

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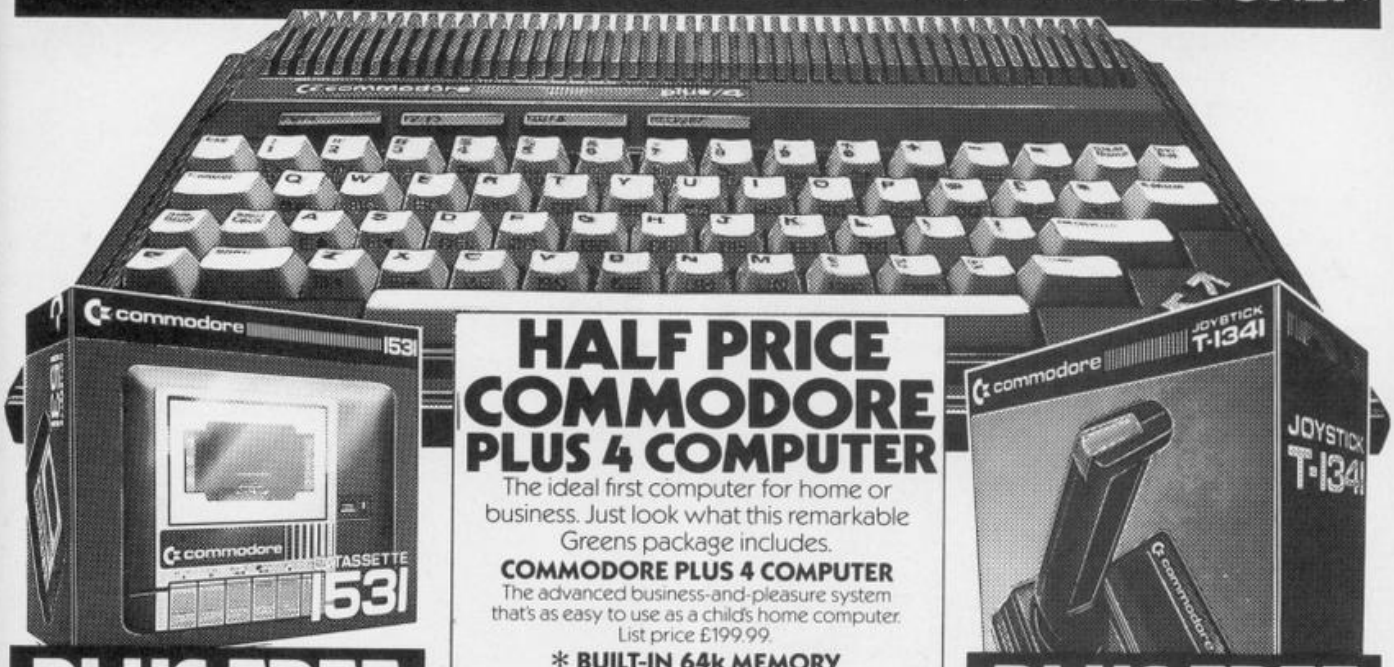

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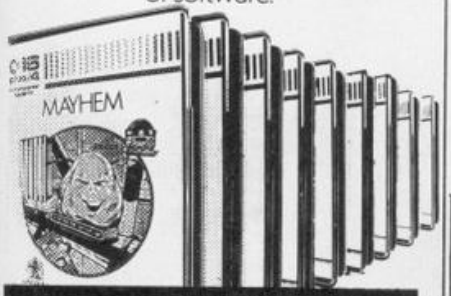

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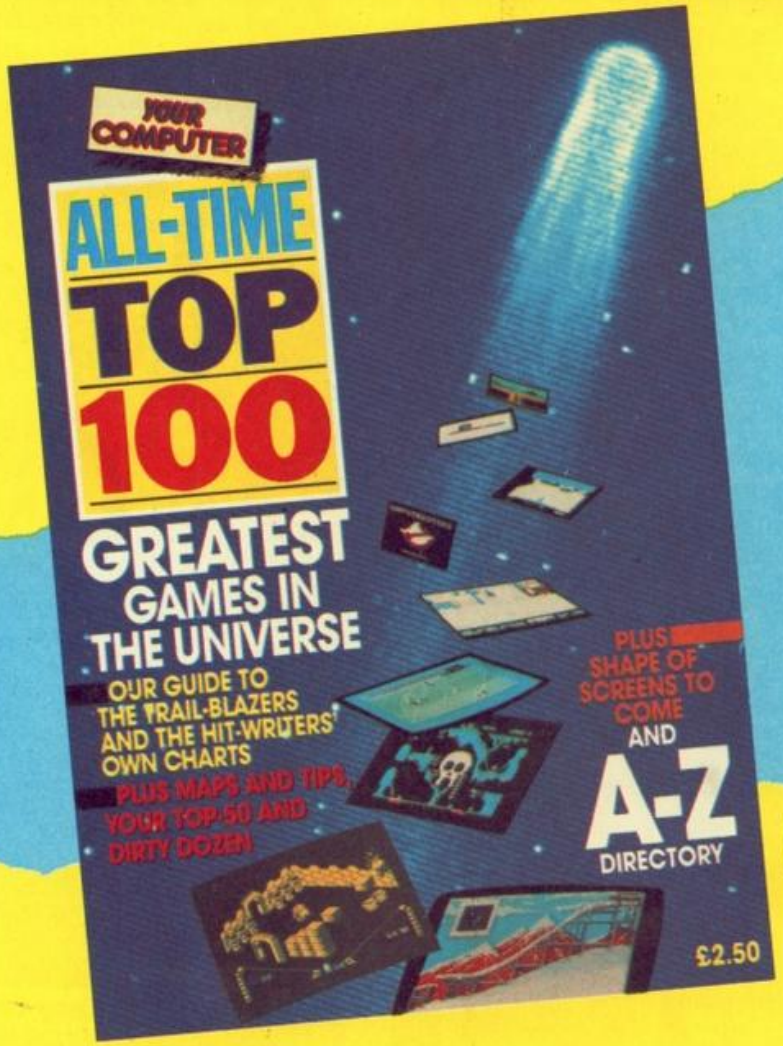

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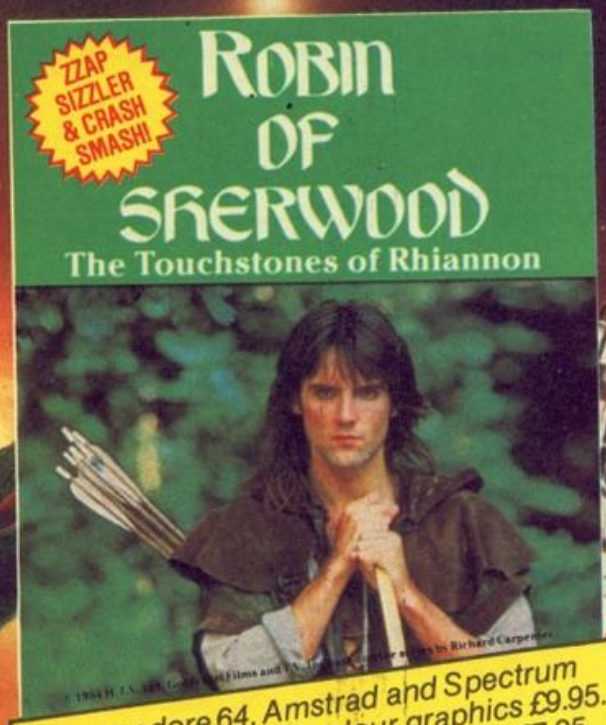

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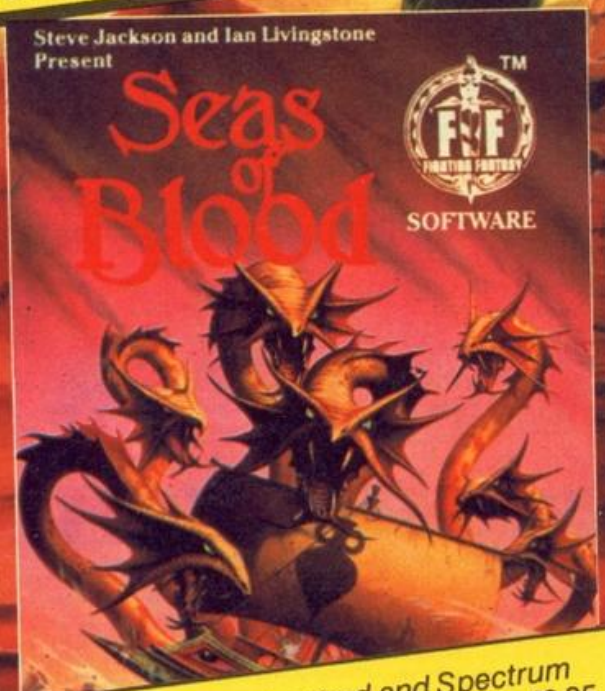

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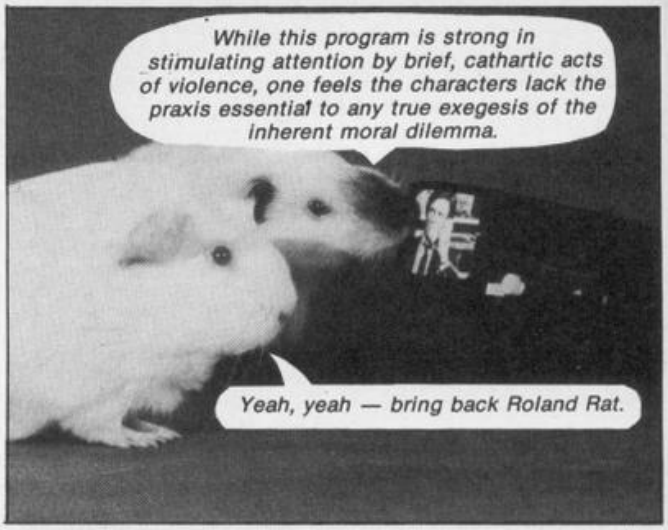

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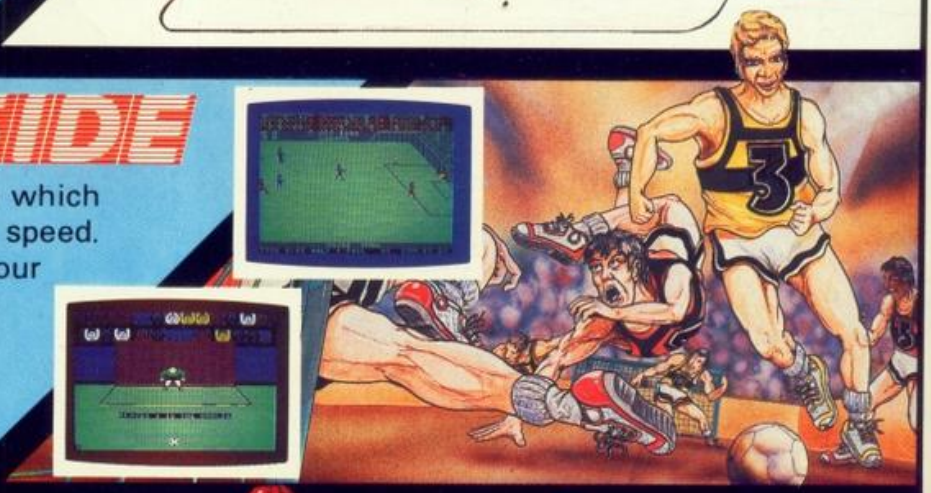

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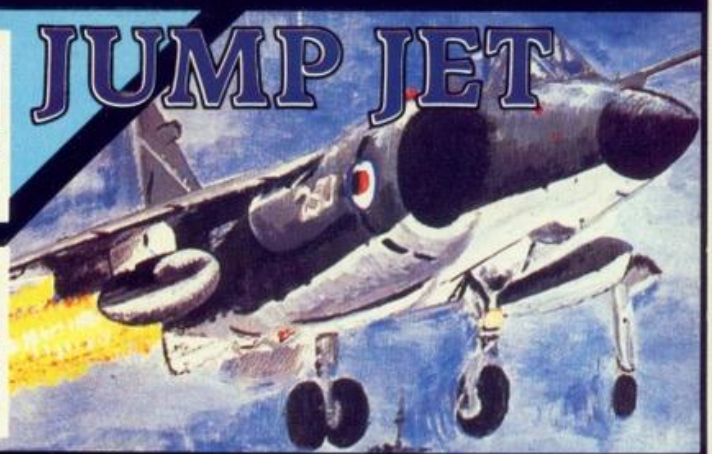

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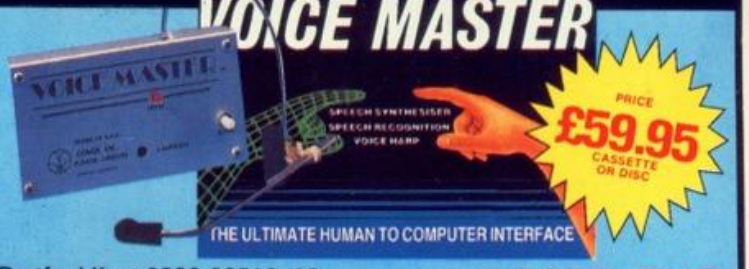

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