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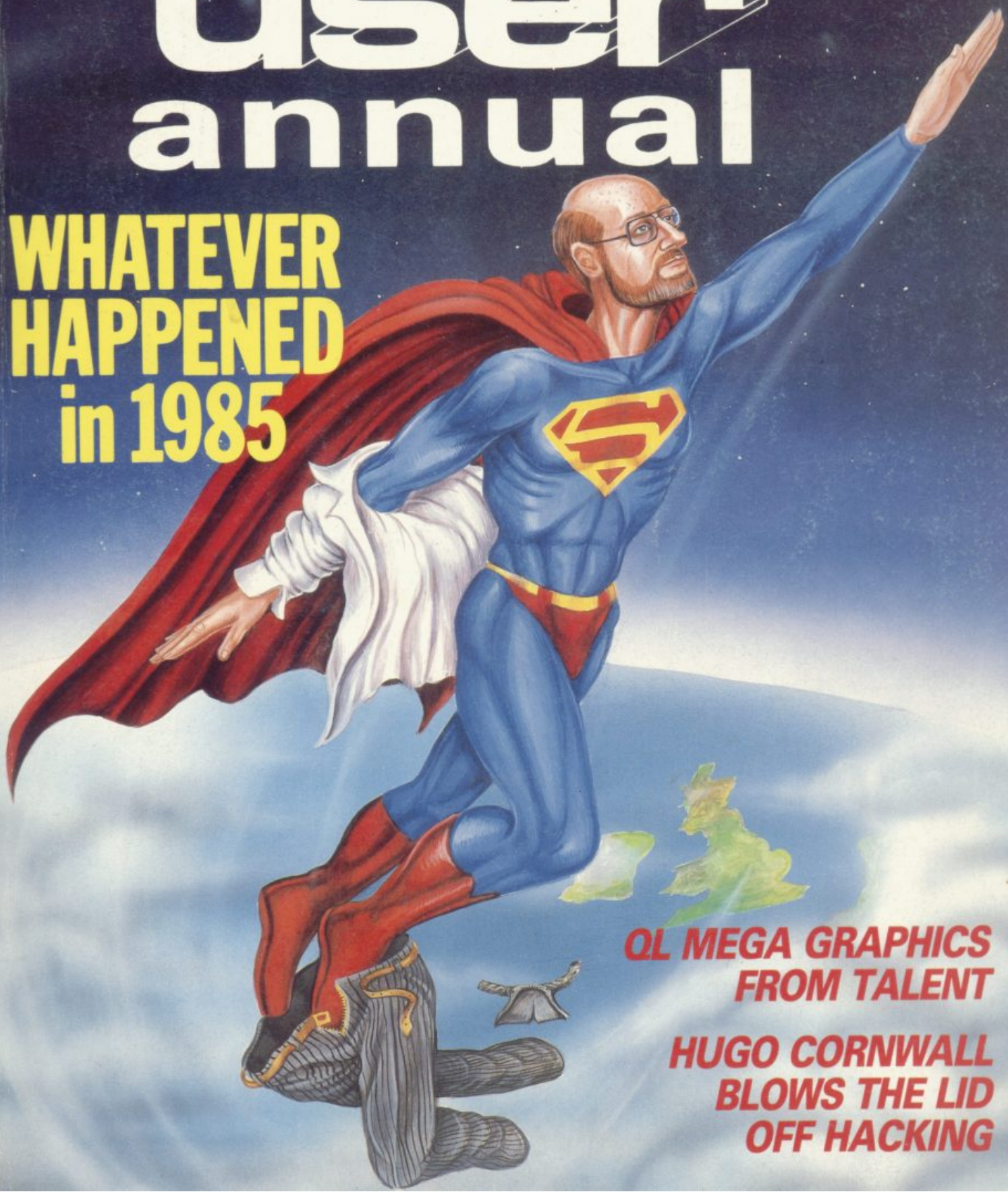
WHATEVER HAPPENED in 1985



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Consultant editor Bill Scolding

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Designer Craig Kennedy

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Publisher Neil Wood

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Advertising manager Louise Fanthorpe

Deputy advertisement manager Shahid Nizam

Advertisement sales executive Kathy McLennan

Production assistant Jim McClure

Advertisement secretary Linda Everest

MAGAZINE SERVICES

Subscriptions manager Carl Dunne

TELEPHONE

All departments 01-251 6222

***Sinclair User Annual* is published by EMAP Business & Computer Publications**

If you would like to contribute to *Sinclair User* please send programs or articles to:
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EMAP Business & Computer Publications,
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Typeset by Saffron Graphics Ltd, London EC1.
Printed by Peterboro' Web, Woodstone, Peterborough.
Distributed by EMAP Publications Ltd.

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ISSN No 0262-5458

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Survival of the fittest

John Gilbert looks back at a year of doom and gloom

SURVIVAL was the name of the game in 1985 and, despite the occasional shock, the players were successful.

In the big name league Acorn was the first to suffer from financial problems. Its share price fell, eventually being suspended, it owed creditors, including the BBC and AB Electronics, large amounts of money, and its machines were regarded as being too expensive.

Fortunately, Italian computer manufacturer Olivetti stepped in to save the business. After several months of negotiation the creditors extended the period of their loans to the company, and the BBC wrote off large sums which were due to them in royalties.

Sinclair Research, however, was a different proposition when it started to flounder in mid-1985. The company has a history of risk taking which does not inspire the sort of City money which is required to bail out a company with large debts. It needed a pioneer who was willing to take risks, and who would mix them with good business acumen, to take control.

Robert Maxwell was the ideal saviour. He had pulled the *Mirror* out of the doldrums, he evoked a strong nationalistic character — despite being Czechoslovakian — and had a liking for Sir Clive.

Unfortunately it was not to be and others, including creditors and the big London business institutions, were also unwilling to play ball. Sinclair did not have the respectability of Acorn with its BBC contract, and Timex, along with others, was not willing to extend credit over a long period of time.

To be fair big business was not very helpful to either Acorn or Sinclair and confidence in the computer industry from the stock market flagged dangerously during 1985.

The situation was ridiculous for three reasons. Firstly, computers rank among the top consumer products. They are now regarded on a par with washing machines, videos and hi-fi systems. Exports are also good and liable to double next year with the expansion of Spanish, French, Russian and US markets.

Large amounts of research into high technology areas are being carried out by such companies as Sinclair Research, yet support is hard to find from investors. Businesses may fall over each other to use the newest in communications technology but they are a little more reluctant to invest in the industry which is creating it.

That leaves the question of who is principally to blame. Sinclair and Acorn both carry the can of mismanagement but other institutions are also indirectly responsible.

The Government carries some of the blame. Although it projects the image that it carries the torch of high technology facts show otherwise. It has invested a paltry sum of money in new microchip technology in Scotland and has shut down the Micros in Schools scheme which was introduced in 1976.

CoCom, the organisation which polices high technology imports and exports between allied and non-allied countries, has not helped to cultivate the interests of the British computer industry either.

CoCom, the organisation in charge of the import and export of technology between aligned and non-aligned nations, has not been helpful in the growth of the computer industry either. Its restrictions on the export of magnetic materials is a case in point.

The organisation has restricted the movement of certain types of magnetic material between countries. The higher the magnetic density of a product the more difficult it is to export. If a software house wants to ship programs or microdrive cartridge to the United States it has to complete a mass of red tape for each shipment.

If that was not enough to contend with the manufacturer must fill in all the forms supplied by CoCom and send them to London to be vetted. That can take weeks and cost the distributor or software house dearly. The red tape has recently been wound tighter with restrictions being imposed on floppy discs.

The industry also suffers from being fragmented and, unlike those companies situated in the USA's Silicon Valley, it is not located in one area. If it was centralised then communication between software houses and machine manufacturers would be easier and perhaps more constructive.

Self interest groups such as The Guild of Software Houses, while laudable, are not doing the industry much good either. The companies which belong to them bicker about how much power they each should have and those who have not been invited to join write off such groups as useless.

GOSH should take a leaf out of the books of the retail trade. Bring down fees and more people will be willing to join. The more people who willing to join the more money the group will accumulate. Such a move would not only benefit software houses but users would see the benefits as companies learn to get on with each other and form common policies on prices and products.

Next year is important if the industry is to stave off attacks from the United States and Japan. Those companies have been friendly trade rivals as far as computers are concerned. While we have been quietly patting ourselves on the back, however the competition has been quietly creating such machines as the Amiga, ST and a new generation of 16-bit MSX machines.

During the next few months software will become even more important and the experience of companies who work within the Sinclair industry will pay dividends. Soon computers are going to be just little black boxes and it is then that such companies as Commodore will wish they had major personalities to head their operations.

Sir Clive Sinclair, and the industry which has been built up around his name, will continue to succeed because of his high profile. His company has one figurehead, something which few others have, and for that reason everyone can easily identify with his products.

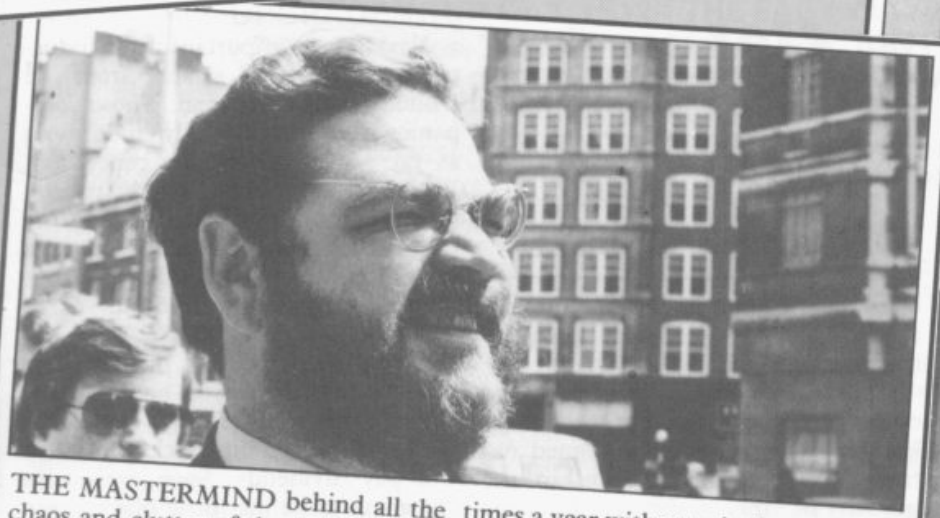
If you are an old Sinclair hand you will know the benefits to be reaped from his machines. If you are a beginner the Spectrum Plus and QL are the best machines to show you the way ahead. Either way you will find *Sinclair User*, and this Annual, will provide all the help and advice you need for computing in 1986.

John Gilbert

SIR CLIVE'S electric trike was launched in January and has probably inspired more jokes than any other vehicle in history. Hopes of flogging 100,000 in a year were swiftly dashed and production cut right back. This particular photo appears to be aimed at residents of Greenham Common or Sellafield.

ONE WAY of selling a game is to tie it i with some famous personality or T show. Elite's **Grand National** was a example from 1985, and here we se commentator Richard Pitman perched above the course at Aintree pretending to play the game.

Somebody really should have remembered to switch the telly on before the photo-session started.



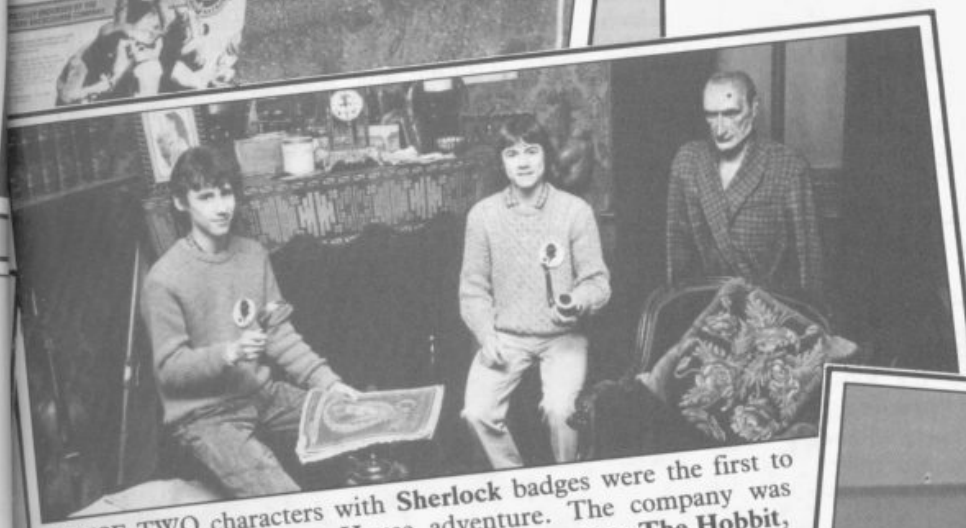
THE MASTERMIND behind all the chaos and clutter of the infamous ZX Microfair is Mike Johnston. Mike finances the whole thing out of his own pocket, and amazingly manages to keep the trestle tables groaning four times a year without winding up in the dock as a bankrupt. Here we see him attempting to find the show, which is always held in some remote part of London out of concern for public health and sanity.

SEYMOUR PAPERT is much beloved of edu tionalists because he invented Logo, the langu used mainly for drawing hexagons all over t screen. If you have a robot to do the drawing i not called a robot but a turtle. The pic sho Papert about to demonstrate the little-known fa that Logo also makes all mircros complete waterproof. Hence the word turtle . . .

WHEN Cap'n Bob Maxwell announced he was buying Sinclair, one major problem was how to get rid of the vast stocks of computers in the warehouse which were not selling. One idea was to stitch up a deal in Eastern Europe, but with the Russians going for MSX, that did not look easy. We reckon the old 'send 25 box tops and a postal order for ten quid' routine was probably just as good . . .

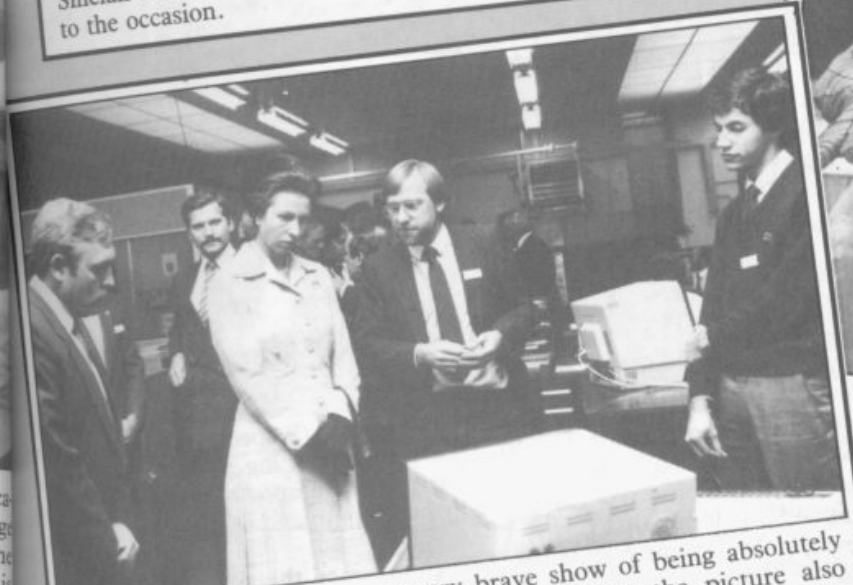
ONE NEW development in games software has been the appearance of creative teams who design and write programs which are then sold to the software house. Denton Designs is one such, formed from the residue of Imagine after it went bust. Here the lads are begging David Ward of Ocean to take **Gift from the Gods**, their first program.

Ward's reaction is said to have been "Where's the high score table?" but he took the game away and Denton has gone from strength to strength ever since.



THESE TWO characters with **Sherlock** badges were the first to complete the Melbourne House adventure. The company was looking for a similar success to their legendary game **The Hobbit**, but Sherlock never made it. **The Lord of The Rings** seems much more likely to re-establish the Australian software house at the forefront of the adventure market.

To judge from his joyful expression, the guy on the right is a Sinclair Research accountant dragged along to add respectability to the occasion.



PRINCESS ANNE puts on a very brave show of being absolutely fascinated by a new Microvitec monitor. What the picture also demonstrates is how computer people do not know what to do with their hands after five minutes away from a joystick.

JUST when it really did look as if Sinclair was on the point of collapse, in stepped entrepreneur Robert Maxwell waving a cheque for £12m. Maxwell is never less than charming in public, but he is said to be a tough customer to deal with in the boardroom. Here is how the deal was announced after the two tycoons spent nine hours closeted in Cap'n Bob Maxwell's Oxford lair . . .

JUST WHEN everybody thought Cap 'n Bob had sorted the whole Sinclair deal out, he announced he wasn't going through with it. The board of Hollis, the Maxwell-owned company surprised everybody by refusing to okay the deal. Everybody but Maxwell, we presume. "Perhaps he hasn't got any money left," quipped Clive, announcing a £10m deal with Dixons.

SIR CLIVE'S happiest moment of the year is probably th pictured above — the announcement of the waferchip. The b round slice of silicon can hold vast quantities of informatio The technology wasn't that new, the theory had been aroun for some years. Trouble was, nobody could find a way o producing the things cheaply and with reliability.

Now Sinclair reckons he's cracked it. Can the waferchip b his route back to glory and new conquests?

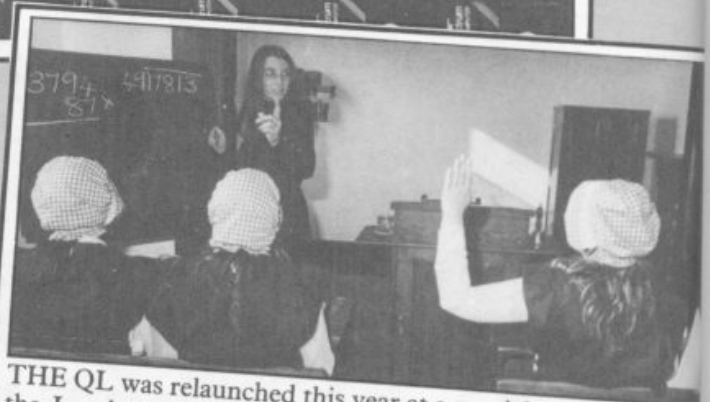
BY MARCH it was becoming clear that Sinclair had produced far too many computers before Christmas and was consequently stuck with thousands of machines it could not sell.

Here is a shot of the notorious Camberley Warehouse where Spectrums are being packed. Camberley is also where you phone for technical help, if you can get through to someone who understands what you are talking about.

Camberley is also that strange part of Britain where 28 days last three times as long as anywhere else . . .

SINCLAIR RESEARCH headquarters are up in Cambridge, along with a whole army of other hi-tech companies. It used to be a bottling factory, but the architects evidently had the bright idea of melting down the bottles and building a greenhouse instead.

People in glass houses, and all that . . .



THE QL was relaunched this year at a special mini-fair held a the London Hilton. One problem facing the QL has been lack of software. That is partly because of the high cost o microdrive cartridges when compared with cassettes and floppy disks.

Some companies have complained that Sinclair does not do enough to help them duplicate programs onto microdrive. That is quite unfair. The picture clearly demonstrates Sinclair's willingness to help dealers and programmers with any problems they might have . . .

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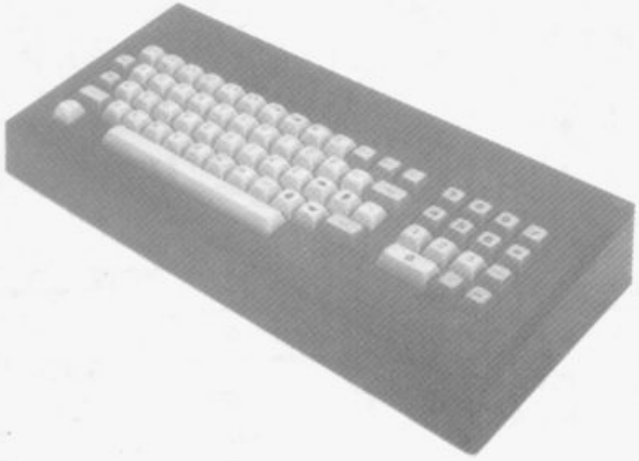

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A year in the life of . . .

January

FRESH FROM the annual Christmas punch-up at the Baron of Beef in Cambridge, Sir Clive invites the world's press to the London Hilton for a quick glass of Perrier and a glimpse of his new Pandora portable computer. The small black box is dwarfed by huge placards indicating the awesome potential of the machine.

So impressive are the placards – 5Mb RAM, built-in pocket TV, microdrives – that Gremlin completely fails to notice the gaping hole in Pandora's rear.

'Everything is in hand' says Slugger, applying raw liver to his left eye.

Two weeks later Acorn announces a new version of the BBC with a built-in telephone, at £799 . . .

February

AUTOMATA wins the Computer Trade Association's Game of the Year award for the third time. Christian Penfold expresses surprise on receiving the coveted trophy. It appears that not one copy was ordered by distributors nor did a single review appear in the computer press. Even more strangely, explains an embittered Christian, "there was no £$%!!× game because you have $$%@£×/s put us out of business months ago."

The new Acorn computer is universally condemned by the Press . . .

March

COMPLAINTS begin to filter through about the new Pandora.

Meanwhile, 34 Liverpool software houses go bust in the same week, but fortunately for their directors 33 new ones are formed immediately . . .

April

BRAZEN Backslappers of the Year Award goes to Elite for announcing that the average age at the Kindergarten is finally over 21.

Unfortunately the figure goes down to 15 again, after ageing sales manager Steve Wilcox is caught sheltering in an old tyre factory and is torn limb from limb by disgruntled distributors after the catastrophic sales of **Le Mans 24hr Spin-off** . . .

May

THE FIRST Pandoras are received by long-suffering customers who ordered in January. Although the microdrives are a bit dodgy, they work well enough if you switch the pocket TV off. The real breakthrough is the revolutionary battery which you strap to your thigh. Leads – £14.95 extra – run up through your underwear and plug in to the power socket. Fears over safety are met by Slugger's comment: "I've had wires up mine for years."

The new BBC school computer . . .

The whole business is universally condemned by *The Observer*, which rants on about financial markets and bores everybody witless . . .

June

THE NEW managing director of Sinclair Research is none other than Mr Micro-Arts himself, Geoff Davis. The high priest of pretension reckons the Pandora is a great example of 'bio-degradable text-synthesis' . . .

July

MIDSUMMER has now become the traditional freebie season as software houses launch all their games early to avoid being overwhelmed by some dire American import at Christmas.

Grand Sultan of Ocean, David Ward, steals a march on the competition by buying the entire McCormick stable of overrated athletes. This ensures a steady flow of tacky games such as **Boris Becker's Big Serve** and **Tony Knowles' Strip Snooker** . . .

August

THE WALLIES at Mikro-Gen announce a new line of games commencing with **We're all Berks**. Apparently you have to guess which one of 4096 flickering sprites you are actually moving with the joystick.

As far as Gremlin is concerned, it is even more silly than the new BBC Micro, with built-in CB radio . . .

September

ULTIMATE'S **Camra Obscura** is unseated from number one spot by **Arnold Schwarzeneggar's Biceps** from Ocean.

Elite, Alligata, Argus and DK'tronics immediately bring out body-building games. The graphics are awful, but pumping the joystick does wonders for the physique . . .

October

NOBODY tells the BBC about Acorn, so Chris Curry and his Italian masters win the contract yet again. With no computer available, the machine actually put into schools is the Olivetti Lettera 22 portable typewriter . . .

November

SLUGGER is furious about the Acorn business but since the Pandora is still undergoing "teething troubles" he can do nothing about it, except keep a date at the Baron of Beef and hope someone from Acorn turns up.

December

AMID horror stories of a totally unforeseeable slump in demand at Christmas, 87 software companies go bust as Mastertronic sweeps the charts with **Stupid Steve's Sticky Thumbs** given away with Bubble-gum. "It's the end of quality software" moans David Ward, as **Zola Budd's Tragic Trip** flops out at number 107.

The new BBC typewriter is universally praised by the press . . .

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SINCLAIR USER, JAN. 85 (ABOUT RELEASE 1.8): "HAS ESTABLISHED ITSELF AS THE STANDARD EXTENDED BASIC FOR THE SPECTRUM.....TURNS SINCLAIR BASIC FROM A GOOD VERSION OF THE LANGUAGE TO A FANTASTIC ONE...." NOW, WITH RELEASE 3.0, BETA BASIC BECOMES PROBABLY THE MOST POWERFUL BASIC AVAILABLE ON ANY 8-BIT MICRO!

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* TOOLKIT features: Renumber with block move or copy; block DELETE, search and/or change (e.g. ALTER apples TO a). 36 User-defined keys. List the variables, list a procedure, list DEF KEYs.
* EDITOR - lets you move the cursor around the screen 10 times faster! And you can move the cursor up and down within edited lines. AUTO, EDIT, JOIN and SPLIT commands.
* LISTINGS with optional automatic indentation of loops, IF, procedures etc. Works on existing programs e.g. you can choose to list:
  10 FOR n=1 TO 10: PRINT n: NEXT n
  as:
  10 FOR n=1 TO 10
  PRINT n
  NEXT n
* KEYWORDS can all be entered by typing them in full, or by the "single entry" method, or both in the same line; e.g. the line:
  10print"hello":if x=1 THEN goto 100 will be recognised and listed normally.
* Upgrades to Release 1.8 customers: If you bought direct from us, there is no need to return your cassette - just quote the (approximate) original purchase date with your order; otherwise return your cassette and name your supplier. The upgrade price of £6.95 (£7.50 overseas) includes a new manual.
* ARRAY and string handling features include fast INSTRING (100,000 chars/sec) and INARRAY search functions. You can JOIN arrays together, delete, transfer and insert sections, change dimensions without data loss. LENGTH function gives dimensions. Ultra-fast array SORT - e.g. a$(500,30) will sort in about 3 seconds!
* MICRODRIVE commands let you use simple forms, or exactly the same commands you normally use for tape - just enter DEFAULT =m1 or m2. Some possible Microdrive commands: SAVE "name#", ERASE "name#", LOAD 1, "name#", SAVE 10 TO 100; "part prog", SAVE a "slicer#" or just the variables. MOVE programs, CODE, arrays. MERGE auto-running programs. End-Of-File function.
* OTHER FEATURES, new or improved, are too many to describe: DO - LOOP structure with WHILE, UNTIL and EXIT IF; BREAK, CLEAR, CLOCK, CONTROL CODES, EDIT variables, ELSE, GET, KEYIN (programs can write themselves!) multi-LET, (L)LIST a "slicer#", ON (works with line nos, procs, etc.) ON ERROR, OVER 2, POKE strings, POP, READ LINE, TRACE, USING, DPOKE. Faster GOTOs, GOSUBs and FOR-NEXT loops.
* 26 FUNCTIONS: AND, OR, XOR, DEC, HEX$, BIN$; fast SINE, COSE, RNDM; CHAR$, NUMBER, DPEEK, EOF, FILLED, INARRAY, INSTRING, ITEM LENGTH, MEMORY$, MEM, MOD, SCRN$, SHIFT$, STRING$, TIME$, USING$.
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[ ] MORE INFORMATION ON _____. I HAVE/DO NOT HAVE RELEASE 1.8 ALREADY.
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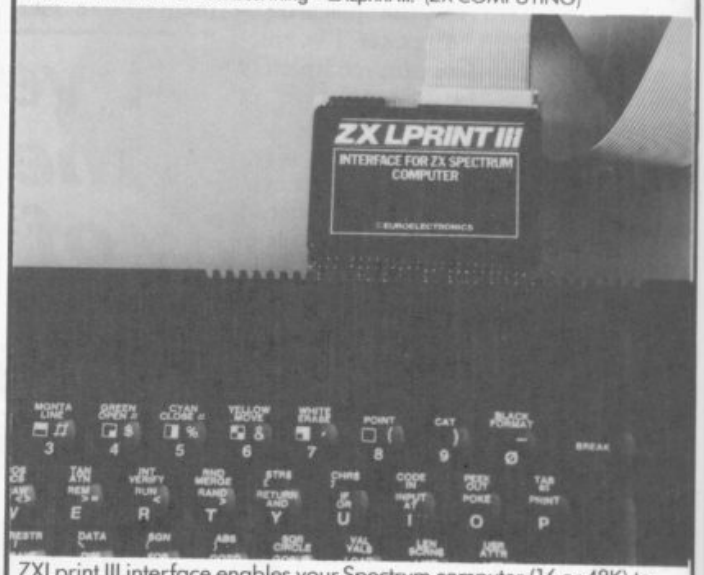

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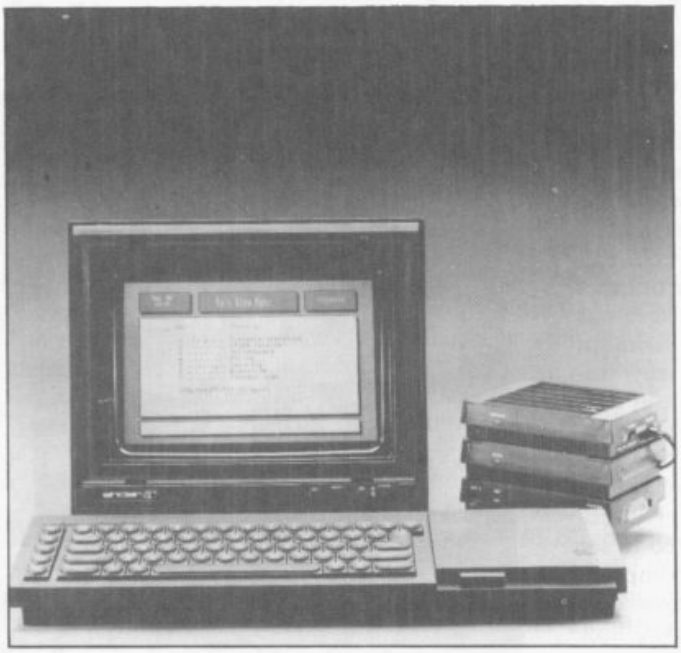


Communications

Expand the power of your Spectrum Plus or QL. Hugo Cornwall, author of the best selling *Hackers' Handbook* explains how he became a hacker and why he thinks his part time profession has such an appeal to teenagers.

John Williams continues the hacking theme with an introduction to communication networks such as Micronet 800 and Prestel. He provides all the information you will need to reach bulletin message boards.

On a different tack Gary Evans shows you how to interface your computer with a printer. He explains the differences between RS-232 and Centronics standards and how to set a baud rate.

Code Busters

Hugo Cornwall, author of the best-selling *Hacker's Handbook* explains the myths of hacking, and why so many are addicted to that most peculiar of pursuits

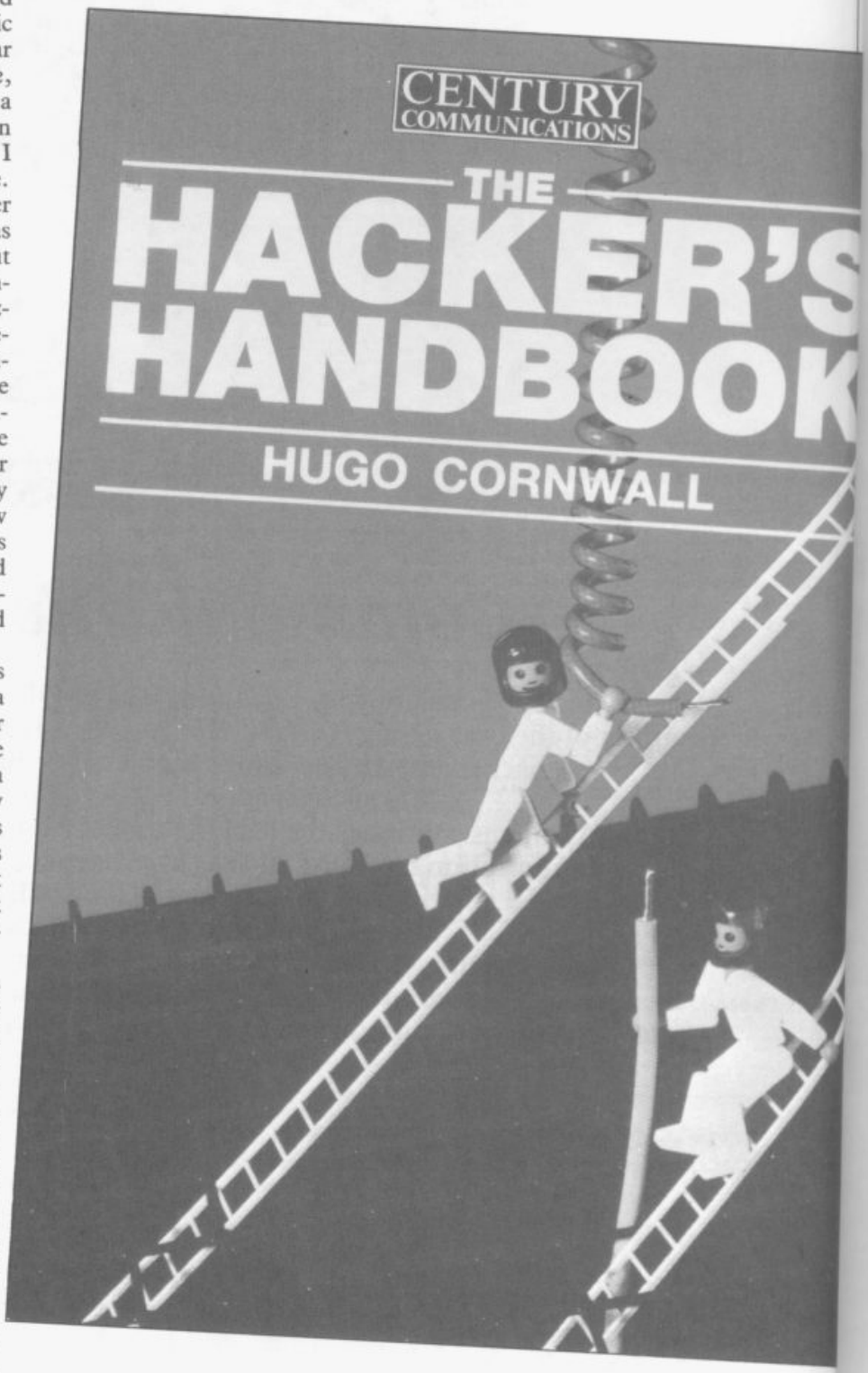
I HAVE become somewhat bemused by the extent of interest in the eclectic pastime of hacking. Earlier this year my book, *The Hacker's Handbook*, which was expected to stimulate a lively but modest interest, spent seven giddy weeks in the best-seller lists. I have been wondering why ever since.

I have been a hacker for a number of years. My original basic motive was to look at remote databases without have a salesperson to guide my fingers. A skilled demonstrator can dazzle you with flashy features and prevent you seeing how limited, or clumsy the service really is. Many people would have thought my level of interest rather technical. I wanted to see how quickly the remote computer responded to my requests, how easy the instructions were to follow, how complete the information and facilities offered. I have always been seduced by the vision of the universal electronic information service, and I wanted to be among the first to use it.

I began to collect 'phone numbers and passwords — when I didn't have a legitimate password, I invented or discovered one. I thought of those episodes as country walks across a landscape of computer networks. By and large, the owners of those services were anxious to acquire customers and, rather like farmers who don't mind careful ramblers, polite network adventurers like myself were tolerated.

In the early days of computer clubs — the sort that met after hours in the local polytechnic — I began to find people who had similarly acquired lists of interesting phone numbers. Only their preoccupations were not always the same as mine. There were those who sought facilities for playing with advanced languages of the type that could not be placed on micros, or those who wanted to locate the big games that were run on large machines.

As Prestel became more widely available, my attention was focused on discovering its hidden features, or



experiments in progress. My Prestel explorations were mostly carried out under my own legitimate ID; the fun and skill was to find information you were not supposed to see. A constant area of interest was the unindexed Res.D database — page 640 — which was run by the Martlesham Research and Development Laboratory.

If you persisted, you found hints about Prestel's future plans. At other times you could see experiments for what was then called Picture Prestel — dynamic frames before they had been announced, devices to render compatible French-standard videotex with that used in the UK, foreign character sets, and so on. On other pages, you could see what IPs were planning. In those early days, you could often download telesoftware free, because the IP had sent the frames but hadn't placed any charges on them. At one stage I was even able to see a demonstration of Prestel's status monitoring device — VAMPIRE.

It wasn't until late 1982 that anyone used the word hacker in its modern context. Up until then, hackers were American computer buffs who messed around on mainframes, or built their own home computers in garages. Quite suddenly, hacker had a new and specific meaning. At about the same time, it became evident that there were network explorers whose main interest was not the remote computers themselves, but the defeat of entry validation procedures.

Then came the bulletin boards, and with them the Hacker's SIGs — Special Interest Groups. For the first time I became aware of the number of

"Up to publication our ambition was to be the best-selling computer book of 1985"

people who seemed to have acquired the same curious interests. I, and some of the other contributors to the Hacker's SIGs, were being watched to see if we would qualify to be admitted to an elite group.

There was a super-secret SIG at that time, masquerading under the name of Penzance — Pirates of . . . — where it was said to be safe to exchange really sensitive material. In my book I included some disguised Penzance material under the name Erewhon, with the result that many people started to track down Erewhon or Nowhere. In fact, by the time the book was published, Penzance had already changed its name and form, and the only relic is my choice of pseudonym — Cornwall.

I still firmly believed that hacking was the recreation of a tiny minority. When Simon Dally — formerly of Century Communications and now the business mind behind MUD, Multi-User Dungeon — said he thought hacking needed a handbook, I got in touch to say, in effect, "You cannot be serious".

Right up to publication our ambitions were relatively modest — to be the best-selling computer book of 1985. We had no thought of competing with the best-sellers from the rest of the book world.

Undoubtedly, the single event which gave the book mass attention was an unwise remark by John Austen, then the recently appointed head of computer fraud at Scotland Yard. Asked by the eversharp Jane Bird of the *Sunday Times* what he thought of the idea of a hacker's handbook, he condemned it unread. He gave her a good story and me, unexpected publicity. The book trade was unprepared and by the end of the first day after publication, the first edition had vanished from the shelves, creating another element in the mystery. It was widely believed that the book was unavailable because it had been banned.

I had already decided that there were to be no public appearances by Hugo Cornwall, and only the most select of interviews — a strategy which made my publishers apprehensive. To secure wide attention for a book you need a body — an author who can be wheeled around the television hospitality suites and into pubs where the press hangs out. Deny the media a body and human interest vanishes. Hugo Cornwall was the exception. His very elusiveness added to his attraction. In fact, two uncomplimentary biographies were deliberately released to add to media confusion.

There are very definite reasons for my insistence on anonymity. In the first place, my job in the real, non-hacking world, has some considerable responsibility attached to it. I have never betrayed a confidence — I really do believe in a hacker's code of ethics — but it could alarm some of my colleagues to think I might. Secondly, I have noticed the willingness of public figures to condemn loudly that which they have not read or seen. While I don't mind being criticised for what I say and do, it seems a bit much to be victimised for what some MP or

"Hackerdom is not worth the martyrdom of arrest and conviction"

other opinion-moulder thinks I have said.

Shortly after publication, two men wre arrested on alleged hacking charges, thought to be in connection with the Great Prince Philip Prestel Hack. Many newspapers seemed to think I was one of them. Several claimed that *The Hacker's Handbook* had been referred to the Director of Public Prosecutions.

By contrast, serious hackers who had read the book were polite about the writing, but disappointed with the content. The book claims to be an introduction to those who know very little, not the last word for those who already know a lot. Besides, hackerdom is not worth the martyrdom of arrest and possible conviction.

Hugo Cornwall has become a full-blown media-myth. Those who have interviewed me felt, I think, a little short-changed. I do not resemble the hero of the film *Wargames* or any other stereotypes of hackers. I am quite a bit older, not particularly obsessive about computers and relatively well socially adjusted. But I don't think too many people are interested in the reality — they want the myth to be completely real.

A folk-myth is not something that is utterly untrue. It starts from a basis of truth and then takes on a life of its own, as those who repeat it find it so compellingly attractive that they invest, in each retelling, some of their own most important feelings.

Two good examples from British history are King Arthur and Robin Hood. King Arthur was probably a Celtic warlord. He became, for the Celts, a symbol of their lost independence and identity as other European tribes invaded Britain westwards. So he was dubbed the Once and Future King. Robin Hood was a nobleman, dispossessed of his lands, who

apparently showed more care for the common people than did most of his class at that time. So he became the man who robbed the rich to give to the poor.

The only way in which I can solve the conundrum of the success of my guide to hacking is by turning to the idea of the folk-myth. Don't get me wrong. Of course hackers exist, and the methods and events described in the book are all, as far as I can determine, true.

The real attraction of the book is that it represents an idea of hacker-dom, rather than reality. Lots of computer owners want to be hackers — though many of them, if I read my post-bag correctly, aren't prepared to put in the necessary work. Lots of non-owners are filled with a sort of admiration that they almost dare not express, because hacking is, after all, semi-legal, isn't it? And it's not only the general public who find the idea of the hacker attractive.

The hacker is a convenient scapegoat for the owner of a large, vulnerable computer. It is easier to think of criminals as outsiders, rather than your own staff, although all statistics collected on computer frauds state that unauthorised access by outsiders accounts for far less than the five per cent of the actual threat.

For those selling computer security systems, the hacker is a wonderful sales-aid. "Buy my hacker-cracker gismo", they cry. Most large computers and associated software already contain security devices quite sufficient to deter unauthorised outside access, provided system managers and legitimate users are prepared to adopt the necessary procedures. It is through slackness that hackers are successful — over 95 per cent of all hacks rely on simple password acquistion — reading passwords that have been left carelessly disclosed, or guessing the ludicrously simple choices that are still widely adopted.

The hacker is immensely attractive to the authorities. The detection of fraud is one of the most intellectually demanding tasks that is asked of a police force. In terms of the time and effort taken in order to prepare a particular case, it is extremely unrewarding. And when the court comes to consider, there is a real danger, as the persistent lobbying tells us, that an ordinary jury will lack the intelligence and knowledge to enable it to convict. The policing problems with computer fraud are even greater. The value of the hacker, in those circumstances, is that chasing after him gives everyone a sense of justice being done.

For the general public, whose view has been moulded by newspaper reports of sensational hacker successes, as well as movies like *Wargames* and its TV derivative *Whizkids*, the appeal must be powerful indeed, to gauge by viewing figures. *Wargames* was not great cinema; it is accurate in its representation of what hackers do in the same sense that *The A Team* and *Streethawk* are documentaries on US law enforcement.

I think the hacker-myth boils down to the belief that even the biggest computer, and all the control that it implies, is vulnerable. Ever since the 1960s, when the sociologist Jacques Ellul wrote about the forces of technology taking over from the decisions of mere man — progress forcing the pace of change without human kind having too much control over direction — we have been scared of the computer as an entity in itself. We have been scared also of the organisations that run the largest databases and most powerful machines, because they hold part of our privacy. It is the hacker who appears to demonstrate that it may be possible to fight back.

```
Msg#: 3766 #HACKER'S CLUB#
02/07/84 13:37:04 (Read 13 Times)
From: xxxxxx xxx
To: xxxxx xxxxxxxx
Subj: REPLY TO MSG# 3701 (PUBLIC DATA NET)
Primenet is a loal area network.  I know of one in Poole, And BTGold use one
between their systems too. It is only an internal network, I suggest using PSS
to communicate between diffferent primes.  Cheers.

<N>ext msg, <R>eply, or <S>top?

Msg#: 3799 #BBC#
02/07/84 22:09:05 (Read 4 Times)
From: xxxxx xxxxxx
To: xxxxx xxxxxx
Subj: REPLY TO MSG# 3751 (RGB VIDEO)
The normal video output BNC can be made to produce colour video by making a
link near to the bnc socket on the pcb. details are in the advanced user guide
under the chapter on what the various links do. If you require more I will try
to help, as I have done this mod and it works fine

Msg#:  935 #EREWHON#
09/20/83 01:23:00 (Read 90 Times)
From: xxxxx xxxx
To: ALL
Subj: US PHONE FREAKING
USA Phone Freaking is done with a 2 out of 5 Code.   The tones must be with 30
Hz, and have less than 1 % Distortion.

Master Tone Frequency = 2600 Hz.
>1 = 700 & 900 Hz
>2 = 700 & 1100 Hz
>3 = 900 & 1100 Hz
>4 = 700 & 1300 Hz
>5 = 900 & 1300 Hz
>6 = 1100 & 1300 Hz
>7 = 700 & 1500 Hz
>8 = 900 & 1500 Hz
>9 ? 1100 & 1500 Hz
>0 = 1300 & 1500 Hz
>Start Key Signal = 1100 & 1700 Hz
>End Key Signal = 1300 & 1700 Hz
> Military Priority Keys 11=700 & 1700 ; 12=900 & 1700 - I don't reccomend
using these. (
The method of use will be explained in a separate note. DO NOT DISCLOSE WHERE
YOU GOT THESE FREQUENCIES TO ANYONE!


Msg#:  936 #EREWHON#
09/20/83 01:34:43 (Read 89 Times)
From: xxxxx xxxx
To: ALL
Subj: UK PHONE FREAKING

The UK system also uses a 2 out of 5 tone pattern.

The Master Frequency is 2280 Hz
>1 = 1380 & 1500 Hz
>2 = 1380 & 1620 Hz
>3 = 1500 & 1620 Hz
>4 = 1380 & 1740 Hz
>5 = 1500 & 1740 Hz
>6 = 1620 & 1740 Hz
>7 = 1380 & 1860 Hz
>8 = 1500 & 1860 Hz
>9 = 1620 & 1860 Hz
>0 = 1740 & 1860 Hz
>Start Key = 1740 & 1980 ; End Keying = 1860 & 1980 Hz
>Unused I think 11 = 1380 & 1980 ; 12 = 1500 & 1980 Hz

This is from the CCITT White Book Vol. 6 and is known as SSMF No. 3 to some
B.T. Personnel.


The 2280 Hz tone is being filtered out at many exchanges so you may need quite
a high level for it to work.
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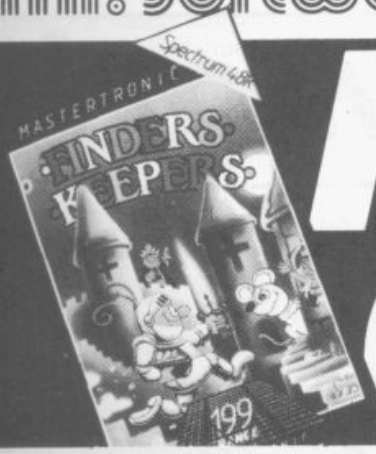
Mr. Software



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Tap the network

William John shows how to connect your computer to a database and receive information down the telephone line

THE MOST IMPORTANT fact about computer communications is that it is not expensive.

Dialling into Prestel — Britain's largest database — costs around 40 pence an hour. The necessary Spectrum hardware will set you back only £50, plus £24 a year for the subscription fee.

For that modest sum you get 350,000 screenfuls of information — everything from train timetables to up-to-the-minute world news — and an electronic mail service guaranteed to enhance your social life.

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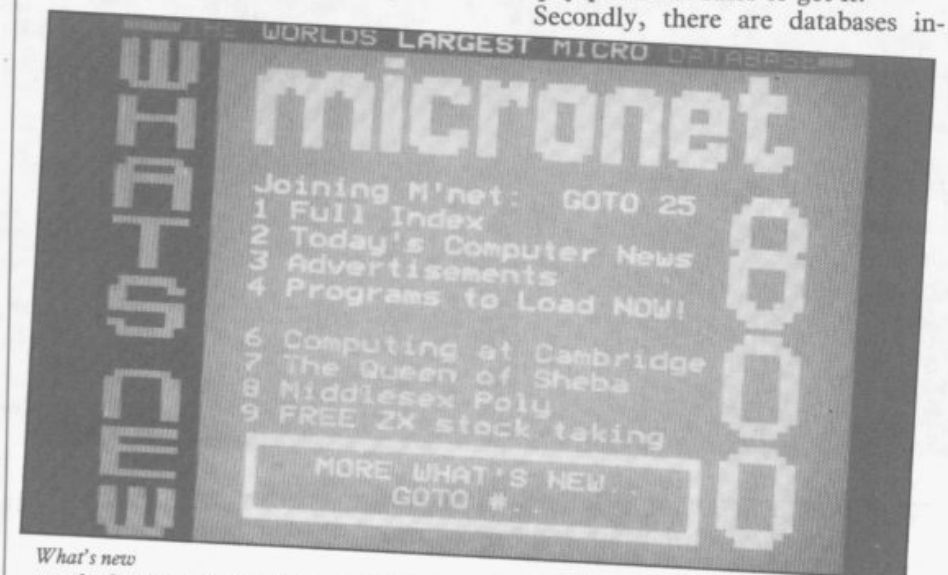
Behind the screens

Telecommunications — or comms — involves linking your micro down the 'phone line to another computer. Sometimes that remote machine is identical to your own, and the practice is referred to as user-to-user comms, but usually the distant computer is vastly larger with a huge data storage facility, often on hard disc.



What's new

Put simply, you are paying to use someone else's disc storage facilities, and for information which other users or commercial companies have left on those discs.

The remote computer also has a degree of processing power, ranging from the bare minimum of disc management — so that it doesn't give you screenfuls of garbage — to sophisticated messaging services and keyword search.

The information stored on those remote databases falls into two categories.

The first is aimed at those for whom knowledge is money. Stockbrokers desperate for a ten second lead on the competition, researchers weary of endless treks around libraries and newspaper vaults, and lawyers glad of an alternative to shelves full of vastly expensive reference books. They all need access to huge pools of rapidly-changing information and are willing to pay premium rates to get it.

Secondly, there are databases intended for the domestic market. Not surprisingly, most of those have a strong slant towards computer hobbyists who comprise the bulk of their users, concentrating on computer news and features, and software you can pull down the 'phone line into your machine.

The wisest of consumer-orientated databases are broadening their appeal with features for the human side of computer buffs; lonely hearts areas, advertisements for professional services, agony aunts, gay contacts, and a screen version of CB radio.

Equipment

As an interface between your micro and the 'phone line you need a black box called a modem. A similar modem sits between the 'phone line and the remote computer you are dialling up.

Modems are necessary because a computer moves data around, inside itself, on the equivalent of multi-lane highways — the electrical impulses travelling down parallel wires are like cars travelling side by side down a motorway.

If there are eight impulses travelling in line abreast, then your machine is an 8-bit computer; 16 impulses signify a 16-bit computer — and so on.

For most purposes, though, 'phone lines can only carry one electrical pulse at once — the signals travelling in single file down the telephone wire. So the modem has to convert the parallel impulses inside our computer into serial impulses suitable for the 'phone system — and vice versa.

The modem must also ensure that its output is at an appropriate voltage or frequency. The two computers it interfaces must be readied in their respective send and receive modes before data begins to flow.

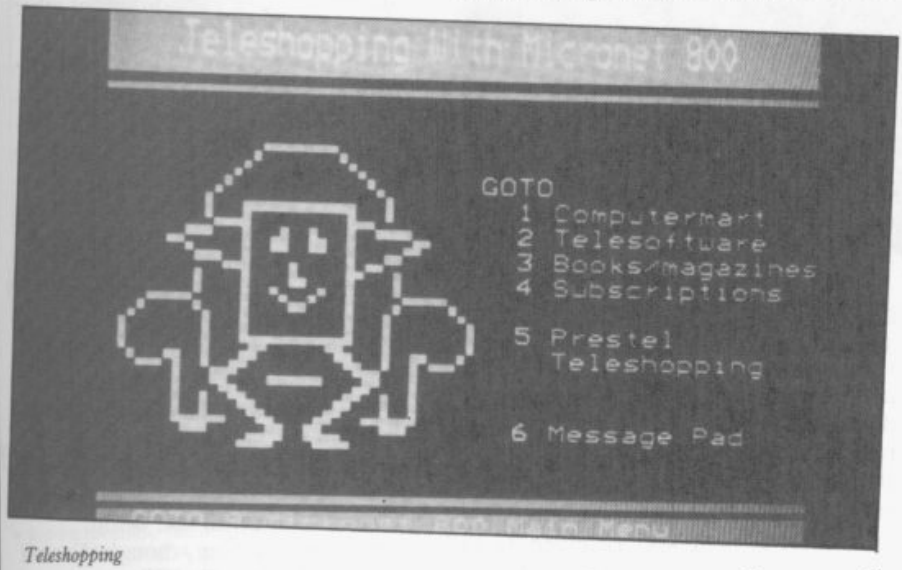
It must also conform with the teminal software in your micro which governs how incoming data will be handled — how it will be stored in memory, displayed on-screen, and so on.

The job of the modem is further complicated by the differing speeds at which remote computers send data to your micro. Data speed is measured in baud — a unit indicating the number of modulations per second occurring on the 'phone line.

The Prestel database sends out data to its 60,000 subscribers at 1200 baud, and receives data back from them at 75 baud. The vast difference in speed reflects the fact that Prestel was built to send out much more data than it receives.

Although the Prestel standard of

1200/75 is widely adhered to, and will gain you access to most of the large international databases, many smaller databases run on a 300/300 baud protocol. Your modem should be able to operate at lots of different baud rates, giving you access to as many on-line databases as possible.



Teleshopping

Spoilt for choice

Modems are generally built to plug into the RS232 port on their host computers. But neither the Spectrum's Interface 1, nor the QL's two serial ports provide that standard RS232 output. Therefore, the two machines have to rely on specially-customised modems — although interfaces providing standard outputs are about to be launched and should give access to a vastly wider range of modem hardware.

Spectrum owners needn't worry about any of those technicalities — they should buy the VTX5000 modem. Inexpensive, tried and tested, the VTX offers baud rates suitable for Prestel and user-to-user comms. It can also download a software patch from Micronet enabling it to access scrolling databases such as the giant US systems, and British Telecom's Telecom Gold.

The VTX's main limitation is that it cannot access those amateur bulletin board databases which operate only at 300/300 baud rates. It nevertheless remains the standard modem for Spectrum owners, and offers more than enough scope for the comms newcomer.

Due to the receivership of manufacturers OE Ltd and of distributors Prism, a large number of cheap VTXs fell into the hands of comms specialists, Modem House, which sells the device for £49.95 and throws in an £8.00 voucher towards your Micronet membership.

Those remarkably low prices are doubtless spoiling the pitch for other would-be Spectrum modem manufacturers. Waiting in the wings is well established modem maker, Miracle Technology — who promise a £45.95 modem interface for the Spectrum. That will allow the computer to link to more sophisticated modems such as Miracle's own £130 WS2000.

Modems for the QL have been advertised since late last year, but at the time of writing none are available for purchase or, therefore, for recommendation.

The computer's best-known comms system is the QCOM package originally developed by OE Ltd, and acquired by Tandata after the former's receivership.

QCOM has acquired semi-official status following its appearance in numerous Sinclair Research advertisements, and its QL-compatible black livery is complemented by a sophisticated range of features, including auto-dial, auto-answer and the automatic sensing of baud rates.

My chief reservation about QCOM is that the supplied modem unit is limited to 1200/75 and 1200/1200 operation, and that its sleek good looks would be compromised by the use of a more versatile device. At £219.65 it is also more expensive than its main rival, the £180 Bright Star modem from Modem House.

The latter device is a single box unit built around the 7910 modem on a chip, and should offer a range of facilities similar to QCOM's.

The QL modem from Medic has a similar one-chip modem at its heart, but the device will only appeal to owners buying other units in the company's range: the modem is priced at a competitive £150, but demands investment in the £99 Medic motherboard before connection can be made to the QL.

Inevitably, Miracle Technology has launched a modem interface for the QL, too. The £40 device should allow the computer to access any conventional modem.

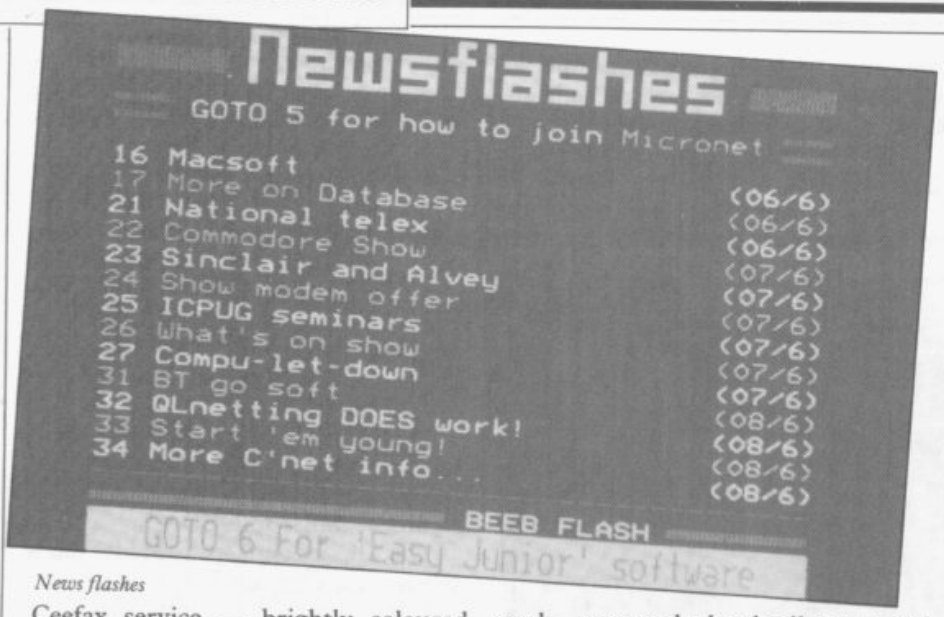
A conventional modem would not, of course, include the Spectrum's VTX5000, but the interface does offer the prospect of cheap QL comms to existing modem owners, or to users prepared to shop around for cheap modems on the second-hand market.

Choosing a database

The largest UK database is British Telecom's Prestel system. Stored on hard disc in a series of GEC minicomputers, Prestel is organised to the viewdata format of information distribution.

Viewdata looks just like the BBC's

Musicnet



News flashes

Ceefax service — brightly coloured pages of text and crude graphics — but it is sent down the 'phone line instead of being broadcast via the TV signal. And unlike Ceefax, Prestel's hard disc system ensures that an unlimited number of pages can be stored and almost instantly accessed.

Thanks to the BT connection, Prestel can offer local call charges to 92 per cent of 'phone users. Comms hobbyists can also avoid the computer time-charge, which ceases to be levied outside office hours — hence the figure of 40pence an hour.

Prestel was the world's first public-access database, and its pages still contain much dross from the years when nobody had much idea what users might want from such a system. However, one corner of the database will be of immediate interest to computer buffs.

Micronet is a 35,000 page computer magazine stored on an area of the system called Prestel Microcomputing. It is one of the few successful electronic publications in Britain, and the best place to experience comms in action.

Indeed, right after buying the VTX5000 modem, every budding Spectrum comms enthusiast should shell out the £66 annual subscription to join Micronet 800. Access to the rest of Prestel is included in that price.

Micronet is best regarded as a daily newspaper for Spectrum, BBC and Commodore 64 users — except that its news section, updated every day, has an even shorter print lead-time.

What makes Micronet so interesting is its 16,000 other subscribers, and the network of electronic pen-pals which they generate.

An electronic letter costs nothing to send — except the local call rate to dial into Prestel — and arrives at its destination anywhere in Britain, in two seconds flat. Unlike a conventional letter, it avoids the paraphenalia of paper, envelope, stamp and letter box because it is sent and received from your computer screen. And unlike a 'phone call, it does not require its recipients to be at home, and allows them to respond in their own time.

Its main disadvantage is that recipients have to log on before they can read their mail, which, I suppose, brings us back to where we started — the addictiveness of the medium.

Micronet members have access to the rest of Prestel, and many users have been drawn to the systems's other main facility — that of home banking.

Schemes run by the Bank of Scotland and the Nottingham Building Society provide bank statements, account transfers and bill paying via your Prestel terminal. Of the two, the Bank of Scotland is more attractive, requiring no minimum deposit — though neither service can avoid the fact that cash withdrawals and cheque deposits still require a trip to the High Street.

Beyond Prestel

Besides Prestel and that other BT giant, the message-orientated Telecom Gold service, there are dozens of other databases in the UK.

Those range from commercial organisations such as the One-to-One telex relaying service and the BLAISE on-line index of British Library stock, to tiny operations run by private enthusiasts using a personal computer and a domestic 'phone.

Of those one-man databases, the two most worthy of a long distance call are The Gnome at Home — 01-888 8894 — and London Underground — 01-863 0198.

But there is no reason for limiting your comms experience to Britain. Equipped with any of the modems recommended above, you can access databases all around the world.

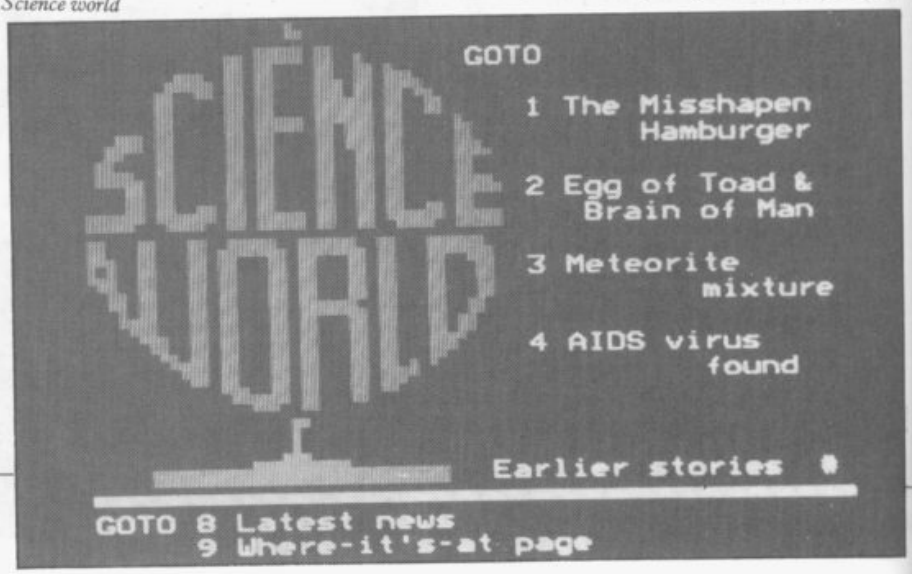
A word of warning, though. Even if you subscribe to BT's PSS service — a low cost system for sending data down a shared 'phone line — 'phone charges may still be prohibitive, and foreign databases generally charge much higher subscription fees than Prestel.

Bearing that in mind, most comms users will probably limit themselves to a brief dabble in one or other of the major US databases.

Their scrolling, monochrome text-only display may look monotonous after Prestel, but their stark appearance is indicative of a more hard nosed technical approach. US services are more advanced than Prestel in their provision of features, such as keyword search and user-editing.

The first US databases to try are CompuServe, 5000 Arlington Centre Boulevard, Columbus, Ohio 43220, USA, and The Source, 1616 Anderson Road, McLean, Virginia 22120, USA.

Science world



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INFINITE SOFTWARE CLUB NEWS

INFINITE SOFTWARE CLUB is a user group set up by us to help people of all ages to share KNOWLEDGE of the Spectrum and programming and an OPPORTUNITY to have your very own programs published and allow others to learn from your talent

We are now in our third year and have many services to offer you-the Spectrum owner.

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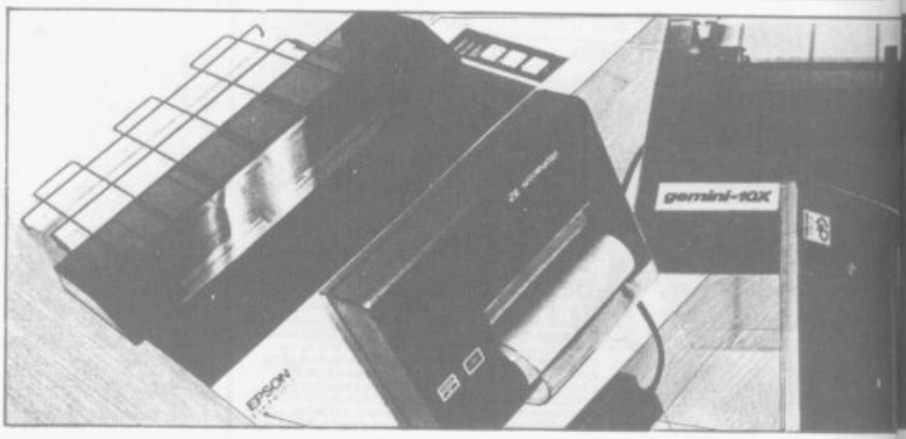
INFINITE SOFTWARE CLUB. NEWS

Connection

An interface is an important and necessary add-on for printing. Gary Evans describes its uses and the way in which it operates



SO YOU want to see your name in print? How do you go about achieving that ambition? Well, you could enter into negotiations with Cap'n Bob Maxwell to arrange for a look in at the *Mirror* but, quite frankly, your chances are about as great as Ronnie Reagan running a sub-four minute mile. Fortunately, if you own a Spectrum there is an alternative approach to the problem.

The first thing you are going to need is as printer. That is likely to set you back in excess of £100, more like £200 for a printer capable of producing decent hard copy. In order to get your printer dumping out your program listings with your name writ bold along the top you are going to need a printer interface, which will add another £30-£40 to the bill. We will return to the reason why the Spectrum requires an interface in a moment, but at this stage will address the obvious question — why spend 250 notes to add a printer to the Spectrum?

The initial reason for wanting a printer will vary from user to user, but once you have connected one to your computer you will wonder how you got on without it. Have you ever tried to copy a program from a magazine into the Spectrum? They never seem to work first time; it is usually a simple keying error. Trying to debug a long listing on the screen is a nightmare. Imagine being able to print out your errant piece of software and compare it with the published listing, away from the computer.

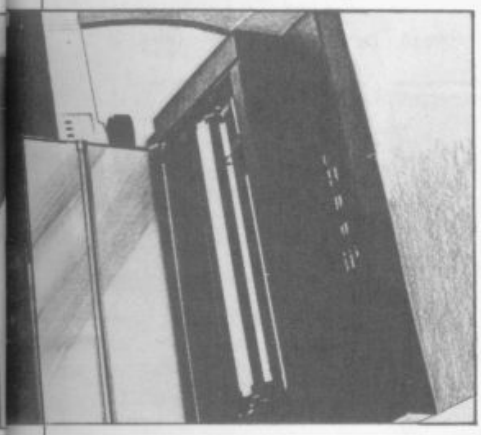
A printer can be of benefit if you are hooked on adventure games — it will allow you to keep a record of the correct moves and help to avoid repeating past mistakes. Buy a word processor such as **Tasword** and the printer will allow you to produce faultless items of prose.

Having convinced you that a printer is a must, just a few words about the selection of a suitable model. If you want to produce printouts which are legible, try to save up for either a thermal or dot matrix printer — electrostatic printers work, but only just. The choice of thermal and dot matrix printers is vast, and shopping around should reveal a printer that will be within your budget. One thing to make sure of is that any printer you buy for the Spectrum has a Centronics parallel computer interface. Some thermal typewriters have an RS232 interface that is not, in general, suitable for use with the standard Spectrum, although if you have Interface 1 fitted to the machine that will connect directly to an RS232 printer.

Having got yourself a printer, the next difficulty to face is how to hook it up to the Spectrum. With many computers that is no problem as the manufacturer will have built some form of printer interface into the computer. In the case of the Spec-

Pin No.	Signal	Direction	Explanation
1	RDP STROBE	Input	The strobe signal for data (RD1~RD8) read-in. Data is read in after the signal reaches a high level. Positive logic
2	RD1	Input	Shows eight bit parallel data from the first bit to eighth bit. RD1, RD8 match LSB, MSB respectively.
3	RD2	Input	
4	RD3	Input	
5	RD4	Input	
6	RD5	Input	
7	RD6	Input	
8	RD7	Input	
9	RD8	Input	
10	IRT	Input	The initial reset signal which returns the printer to READY. (Same conditions when turning on power).
11	$\overline{\text{RDA}}$ BUSY	Output	A signal to indicate whether printing is possible or not (Data can be entered or not). Negative logic and data can be entered with the signal at a low level.
12	$\overline{\text{STATUS}}$	Output	It responds with this signal, checking whether there is printing paper or not, and checking the condition of the printer mechanism in response to status demands from the host machine. It is negative logic and this signal is at a high level during correct conditions. This signal is at a low level when there is no printing paper or when trouble with the mechanism is caused.
13-25	GND	—	Logic GND level.

trum, the designers decided to keep the cost of the basic machine down by omitting such niceties as user interfaces. The grandly named Expansion Bus at the rear of the computer is just a way of getting at the inside of the computer without having to remove



the lid.

The job of the printer interface is to take the raw information, produced by the Spectrum, and to convert it into a form that can be used by the printer to form recognisable characters. As is so often the case, that task is handled by a mixture of hardware and software.

The connections to a typical Centronics interface are shown in Figure one. The functions of the various lines can be broken down into two distinct areas. Firstly there are the data lines — eight of those, labelled RD1 to RD8. Those lines expect information as to which character is to be printed and to be presented as an eight bit ASCII character — ASCII is the agreed format in which computer information is transmitted.

The 256 unique codes that can be represented by eight bits each have a character associated with them. As the entire alphabet — upper and lower case — plus all numerics and punctuation marks can be represented in far fewer than 256 codes, it is obvious that many ASCII codes are associated with special commands that are not often encountered.

The other lines on the Centronics connector are referred to as control lines. The STROBE line expects an input from the Spectrum to indicate that the data present on lines RD1 — RD8 is a vaild character and that it should be printed. The BUSY line is a signal generated by the printer to indicate that it is not ready to accept data. It could be that the print head has reached the end of a line and is moving to the start of the next, output from the computer must be halted during that operation, otherwise characters will be lost.

Turning now to the pin-out of the Spectrum's expansion port, shown in Figure two, while it is easy to spot data lines that look as if they could be connected to the printer, there is no sign of a STROBE or BUSY connector. The job of the interface is to whip up these lines from those provided by the Spectrum. It does that by decoding some of the control signals generated by the Z80 processor at the heart of the Spectrum. For example, when the Z80 wishes to output data, it signals the fact by taking its IORQ line to logic 0. The Z80 is capable of dealing with up to 256 different I/O lines and the interface must decide when the processor is outputting to the printer. Decoding the IORQ line and the address lines yields the STROBE signal to the printer. A similar process, but in reverse, provides the means of getting data from the printer's BUSY line into the Spectrum.

Most printer interfaces are designed around a special Integrated Circuit — IC — given the name of a PIO — Parallel Input and Output — together with a couple of other chips. The PIO, in addition to performing some of the decoding, provides another very useful function, it buffers the Spectrum from the printer. This means that the circuitry of the computer is protected from anything that may happen at the printer's input. A fault at the printer will only harm a cheap IC, not the Spectrum.

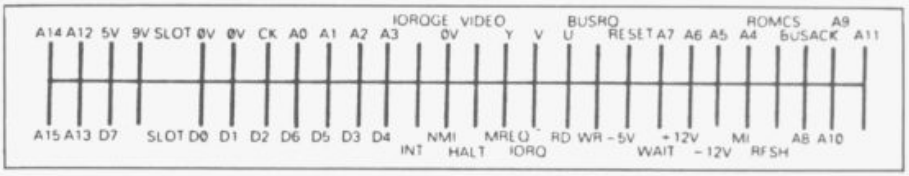
The job of the interface does not end with sorting out the electrical connections between the printer and the Spectrum. You will recall that a printer expects data to be presented to it according to the ASCII format. Unfortunately, the Spectrum does not store all data in that format. Line numbers within a program are stored in a binary representation; key words are stored as tokens rather than as an ASCII text string in order to save memory; block graphics characters must be changed before they are sent to the printer. It is obvious that some software is needed to take care of those conversions.

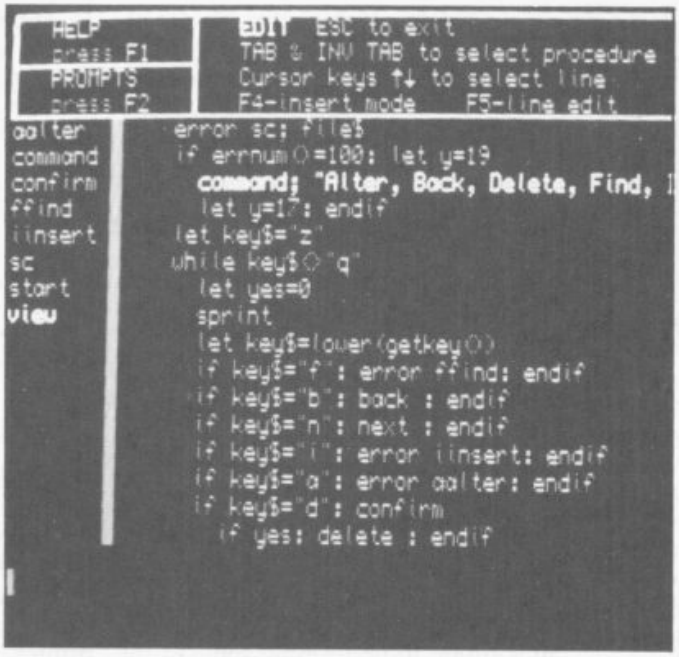
The way in which interfaces operate vary from design to design — the best will be transparent in operation. That is a posh way of saying that all the user has to do is press LLIST and the printer will start to dump out a program to the printer — there will be no need for any special commands. An interface accomplishes this by making use of the printer reflection provided in the Spectrum's operating system. In an unmodified Spectrum, the commands associated with a printer will generate output in a format suitable for the long gone ZX printer. That data would be of little use to any other type of printer. The reflection byte means that it is possible to intercept data before it is passed to the ZX printer driver, and to modify it in a way suitable for driving a normal ASCII printer.

The best interfaces will have their software stored in EPROM and there will be no need to load the program from tape every time you wish to use a printer.

Printer interfaces combine clever electronics with a small section of program to interpret signals generated by the Spectrum, so that they can be understood by off-the-shelf printers. Many companies produce excellent printer interfaces that also provide other facilities such as a joystick interface. Glance through the adverts in this annual or in *Sinclair User* to get an idea of what is available, bearing in mind the various points made above.

Finally, a word for QL owners. The QL has built into it both a printer interface in the form of its RS232 ports and, within **Quill,** a range of printer drivers. Many users of the QL wish to use the computer with a parallel printer and, in this case, they too will require a printer interface. The design of that unit is very different from one designed for the Spectrum. The job of a QL interface is to take the serial data output by the computer and to assemble it as a parallel byte of data. Once again those interfaces are designed around a special IC called a UART — Universal Asynchronous receiver/Transmitter. That chip takes care of most of the work involved and the complete conversion is taken care of by hardware — there is no need for any software.





Archive

THE POWERFUL QL database specially commissioned from Psion by Sinclair Research has not received its due acclaim.

Its facilities are equal to other databases which cost three or even four times the price of a QL but its problem has always been that it is not very user-friendly.

Sandra Essex corrects its faults, turning the program into a memory driven system which prompts enough for users at any level of ability.

Her ideas bring new life to a program which every QL owner possesses.

Database diary

Running a business is time consuming, often frustrating. Sandra Essex shows how Archive can make life easier

COMPARED with expensive business database software, **Archive** can often be more easily used to produce very sophisticated applications. It only requires a little imagination and patience to learn the built-in procedural language, to achieve some remarkable results. The listings which follow provide an interrelated set of procedures which make up a salesman's calling diary, including associated expenses. It could easily be changed to suit individual needs, but working through the notes will show how to structure groups of procedures to obtain more elaborate programs.

The manual already shows how **Archive** commands and functions such as First, Next and Last can be entered directly from the keyboard. Using the procedures editor — type "edit", Enter — allows you to write complex procedures — procs — which can trap errors, do complicated maths functions, sort and alter files with just a few key presses. Those procs can be saved to a microdrive and loaded automatically when needed. This example assumes that a printer and monitor are attached. A TV can be used, but some adjustments to the program will have to be made to fit 64 characters on the screen. REM statements point to any **Archive1** differences.

First we create a database file — dbf — within a proc. That is good practice and avoids end creating too soon by mistake. It also allows the fields to be edited before calling the proc and creating the dbf. **Proc a** in listing one shows the name of the procedure. When creating a file within a proc — **prof makef1** — the command **endcreate** must be added. The company$ field is arranged in ascending **order** before the file is closed. The use of **first,next** is then related to the field company$. If you want it arranged in descending order use **"order company$;d"**. **Order** only works on the first eight characters, so names such as British Telecom or British Aerospace would have to be abbreviated. You can **order** up to four fields, but the more fields ordered, the fewer files **Archive** will be able to support.

Design your screen and save it as **"repcall"**. Make sure you are in **mode0** and type sedit. The variables display from top to bottom and left to right should read: company$; contact$; area$; day$; mon$; year$; note1$; note2$; distance; due — due must be set at line: 14, col: 62; — day2$; mon2$; year2$. The vdate$ and vdate2$ do not need to be seen and so are not displayed. The dots show the screen area where the text is entered and will later be displayed. **Archive1** allows entry outside the specified area but **Archive2** needs one extra space — dot — than the text to be entered. Limiting dots to what can be printed, say, in a mail list file, will make sure that text fits an address label. Using **sedit** makes the screen easier to read and allows more variables to be shown. Remember that the default screen is very limiting because you can only use **insert,alter,sinput** on fields that are displayed.

Efficient use of memory is obviously important. Whilst all procs could be saved and then loaded together, it would have the effect of seriously reducing the available working memory. Therefore, the program can be broken into three parts by saving each separately. **Proc a** shows what each

Listing one

```
proc a
  rem save "filemake"
  endproc
proc make
  create "callrep"
    company$:contact$:area$:day$:mon$:year$
    note1$:note2$:distance:due:day2$:mon2$:year2$
    vdate$:vdate2$
    endcreate
  order company$;a
  close
  endproc
```

Listing two

```
proc a
  rem     save "report"
  endproc
proc menu
  print at 22,56; ink 4;"FILES IN RECORD ";count()
  message;choice$
  print at 24,56; ink 4;"MEMORY LEFT ";memory()
  let opt$="": while opt$<>"e"
    let opt$=lower(getkey())
    if opt$="e"
      message;"CLOSING ALL FILES": close : mode 1,8: stop : endif
    print at 24,56;rept(" ",24)
    if opt$="i" or opt$="a" or opt$="d" or opt$="v":message;wait$
      run object "report1":rem archive(1) = run "report1"
      endif
    if opt$="p":message;wait$
      run object "report2":rem archive(1) = run "report2"
      endif
    endwhile
  endproc
proc message;mess$
  print at 23,0;rept(" ",80)
  print at 23,0; ink 2;mess$
  endproc
proc start
  mode 0: let wait$="***  PLEASE WAIT FOR SYSTEM TO LOAD  ***"
  let choice$="Insert (i): Alter (a): View (v): Delete (d):
Print out (p) End (e)  ?"
  print at 10,15; ink 2;wait$: open "callrep": sload "repcall"
  cls : screen :rem This line not required for Archive(1)
  menu
  endproc
```

group of procedures is to be called when saved. The program is started by entering **run "report"**. Once working the computer will drop from memory groups of procs which are not currently called.

To **run** a program, each group of procedures must include one called **start**, as that will be the first to be called. **Proc start**, in listing two, includes **mode0** to remove the default prompts from the work area. When **Archive** is first loaded the mode is 1,8. The strings **wait$** and **choice$** are used throughout the program to provide a standard and present a professional image which is easy to use.

Proc menu prints **choice$** and the text is displayed, asking what action is to be undertaken. The number of files in record and remaining memory are displayed using the functions **count()** and **memory()**. **Lower (getkey())** waits for a key to be pressed, then converts the letter to lower case. If 'e' is chosen the **message** is overwritten

Archive can be used to produce very sophisticated applications and changed to suit individual needs

with the new **message** while the file is being closed. If one of the other options is chosen the **message;wait$** is displayed and that whole group of procedures is cancelled from memory. **Archive** would then run the procs required.

Proc message;mess$ prints any text passed to it at the print-at position on screen. Any string can be displayed, for example, **message;"hello"** or **message; appropriate string variable**.

The group of procedures in listing three is saved separately as **report1**. When called it goes first to **proc start**, which includes an error trapping routine using the command **error**. The **while-endwhile** loop in **proc mistake** will trap any errors in subsequent procs and return you to the menu.

In **proc newrec** the use of **Archive**'s command **append** adds a record to the file with the information received in **proc sinp**. To ensure no details from an existing file are added, **proc clear** is called and the command **sprint** makes sure that the screen is ready for new

```
COMPANY:  GREENFIELDS
==========================
DATE VISITED :- 03/06/85        CONTACT Mr Tom Jarret
NOTES
First visit. Boss is Mr Adrian Green who was absent.
Jarret friendly old-timer and knows his business but Green
places orders.
DATE VISITED :- 03/07/85        CONTACT Mr Adrian Green
NOTES
Requires examples of rose root stocks before ordering.
Order potential considerable once Green won over.

DATE VISITED :- 03/08/85        CONTACT Mr Adrian Green
NOTES
Impressed with root stock quality. Willing to order 500 if
discount improved. Can we give 20% ?

DATE VISITED :- 16/09/85        CONTACT Mr Adrian Green
NOTES
Quoted 20% discount for rose root stocks but order must be 1000.
Agreed will order 2000 if 25% given. Phoned Boss who agreed. To
supply 11/85

DATE VISITED :- 01/11/85        CONTACT Mr Adrian Green
NOTES
Checked what delivery date best for 2000 rose root stocks as in
area. 23rd to 24th this month if we can arrange & preferably am.


AREA LONDON                FOLLOW UP VISITS FOR SEPTEMBER 1985

DATE          AREA          COMPANY              CONTACT

09/09/1985    LONDON    BAY TREE             Mr. I. White
16/09/1985    LONDON    GREENFIELDS          Mr Adrian Green



                         FOLLOW UP VISITS FOR SEPTEMBER 1985
DATE          AREA          COMPANY              CONTACT

05/09/1985    GLOS      FLOWER GARDEN        Miss I. Glass
09/09/1985    LONDON    BAY TREE             Mr. I. White
16/09/1985    LONDON    GREENFIELDS          Mr Adrian Green
20/09/1985    SURREY    GREENFINGERS         Miss A. Broom
21/09/1985    GLOS      STALKS               Miss B. Thin
30/09/1985    SUSSEX    TREES                Mr Bill Limb


              EXPENSES DUE FROM 01/01/1985 TO 31/12/1985

DATE VISITED    AREA          COMPANY          PETROL EXPENSES

01/02/1985      SURREY    GREENFINGERS         £    3.80
03/02/1985      GLOS      FLOWER GARDEN        £   10.60
09/02/1985      LONDON    BAY TREE             £    1.00
14/03/1985      LONDON    BAY TREE             £    0.80
16/03/1985      GLOS      FLOWER GARDEN        £   10.20
18/03/1985      GLOS      STALKS               £    9.60
27/04/1985      GLOS      FLOWER GARDEN        £   10.80
05/05/1985      LONDON    BAY TREE             £    0.80
06/05/1985      GLOS      STALKS               £    9.40
11/05/1985      SURREY    GREENFINGERS         £    3.80
03/06/1985      LONDON    GREENFIELDS          £    3.40
10/06/1985      GLOS      FLOWER GARDEN        £    9.40
28/06/1985      LONDON    BAY TREE             £    0.60
03/07/1985      LONDON    GREENFIELDS          £    3.40
07/07/1985      SURREY    GREENFINGERS         £    4.00
09/07/1985      GLOS      STALKS               £    9.40
03/08/1985      LONDON    GREENFIELDS          £    3.40
04/08/1985      SUSSEX    TREES                £    6.00
09/08/1985      SURREY    GREENFINGERS         £    4.20
09/09/1985      LONDON    BAY TREE             £    1.40
16/09/1985      LONDON    GREENFIELDS          £    3.40
30/09/1985      SUSSEX    TREES                £    6.20
01/11/1985      LONDON    GREENFIELDS          £    3.40
                                               =========
                                               £  119.00
                                               =========
```

input. Finally, before append takes place **proc check** is called. Note how **proc mistake** is used to return to the menu if necessary.

With **proc sinp**, the command **sinput** provides an alternative method of adding information. Data can be added to a displayed field in any order. That differs from **insert** in which data must be entered in the file's order of creation. In our case field, **company$** is made upper case. The dates entered are checked for errors by calling **proc getdate**. Petrol expenses are calculated when the distance is entered — let due = distance times 20 pence per mile/100 to give number of £ and p. Using the **let** command the dates are arranged in reverse order in **vdate$ and vdate2$** so that when they are required in **proc petrol** and **proc follup** the correct period can be calculated.

Proc getdate checks the entries which are passed to it, taking the name z$ and using the **Archive** functions **len & code**.

1st line: If only one number has been inserted a 0 is placed in front of it.

2nd line: Checks that both numbers inserted are not noughts.

3rd line: Checks that the first character is in the range 0-9.

4th line: Checks that the second character is in the range 0-9.

5th line: Checks that no more than two characters have been inserted.

If any mistakes are found by those lines, an error message is displayed — **proc mist** — and you are returned to the menu. If all is correct the value of z$ is given to q$, which can then be passed back to the calling variable. For example, 2 becomes 02 but 20 remains 20.

Proc action;act$ takes the form of any text passed to it. The text is shown on the screen and subsequent text is displayed next to it.

Proc bye deletes the record obtained through **proc getrec** after the required confirmation has been received.

Data can be added to a displayed field in any order and the dates entered are checked for errors

Listing three

```
proc a
  rem   save object "report1" :rem Archive(1) = save "report1"

  endproc
proc action;act$
  space: print at 23,0; ink 4;act$;
  endproc
proc bye
  let yn$="":getrec
  while yn$<>"y" or yn$<>"n"
    action;"DELETE THIS RECORD : ENTER  Y/N ? "
    input ink 4;yn$: let yn$=lower(yn$)
    if yn$="y": delete :clear: sprint : print at 22,72;"
      return : endif
    if yn$="n":mistake: endif : endwhile
  endproc
proc check
  message;"THESE DETAILS O.K. TO SAVE Y/N ?"
  let yn$="": while yn$<>"y" or yn$<>"n": let yn$=lower(getkey())
    if yn$="n":mistake: endif : if yn$="y": return : endif :
    endwhile endproc
proc clear
  let company$="": let contact$="": let area$=""
  let day$="": let mon$="": let year$="": let vdate$=""
  let note1$="": let note2$="": let distance=0: let due=0
  let day2$="": let mon2$="": let year2$="": let vdate2$=""
  endproc
proc getdate;z$
  if len(z$)=1: let z$="0"+z$: endif
  if code(z$)<49 and code(z$(2))<49:mist: endif
  if code(z$)<48 or code(z$)>57:mist: endif
  if code(z$(2))<48 or code(z$(2))>57:mist: endif
  if len(z$)>2:mist: endif : let q$=z$
  endproc
proc getrec
  action;"ENTER NAME OF COMPANY  :": input coname$
  let coname$=upper(coname$)
  locate coname$: sprint : let show$="": while show$<>"y":pos

    message;" THIS  RECORD Yes. Next. Back. Fwd jump. Rev jump.
    Quit. ?"
    let show$=lower(getkey())
    if show$="q": print at 22,15;rept(" ",20):mistake: endif
    if show$="y": print at 22,15;rept(" ",20): return : endif
    endwhile
  endproc
proc menu
  let opt$="": while opt$<>"e":message;choice$
    print at 22,56; ink 2;"FILES IN RECORD ";count()
    print at 24,68;rept(" ",11)
    print at 24,56; ink 4;"MEMORY LEFT ";memory()
    let opt$=lower(getkey()):option: endwhile
  endproc
proc message;mess$
  space: print at 23,0; ink 2;mess$
  endproc
proc mist
  print at 24,0; ink 2;"MISTAKE PRESS ANY KEY TO RETURN TO MENU"
  let me$=getkey(): print at 22,15;rept(" ",20)
  print at 24,0;rept(" ",80):mistake
  endproc
proc mistake
  let n=1: while n: error menu: let n=errnum()
    if n:mist: endif : endwhile
  endproc
proc newrec
  clear: sprint :message;"INPUT NEW DETAILS"
  sinp:check: append
  endproc
proc option
  if opt$="e":message;"CLOSING ALL FILES"
    close : mode 1,8: stop : endif
  if opt$="i":newrec: endif
  if opt$="a":swop: endif
  if opt$="d":bye: endif
  if opt$="v":view: endif
  if opt$="p": print at 24,56;rept(" ",24):message;wait$
    run object "report2":rem Archive(1) = run "report2"
    endif
  endproc
proc pos
  local z
  if show$="n": next : sprint : endif
  if show$="b": back : sprint : endif
  if show$="f":action;"JUMP FORWARD: HOW MANY RECORDS ? "
    input ink 4;z: position recnum()+z: sprint : endif
  if show$="r":action;"JUMP BACK: HOW MANY RECORDS ? "
    input ink 4;z: if recnum()-z<0: first : sprint : else
      position recnum()-z: sprint : endif : endif
  if recnum()=0
    print at 22,15; ink 4;"*** FIRST RECORD ***": else
    if count()-1=recnum()
```

```
      print at 22,15; ink 4;"*** LAST RECORD ***": else
      print at 22,15; ink 4;"FILE NUMBER "+recnum()+1;"        "
      endif : endif
  print at 24,68;rept(" ",11): print at 24,68; ink 4;memory()
  endproc
proc sinp
  sinput company$: let company$=upper(company$)
  sinput contact$,area$: let area$=upper(area$)
  sinput day$:getdate;day$: let day$=q$
  sinput mon$:getdate;mon$: let mon$=q$
  sinput year$: if len(year$)<2:mist: endif :getdate;year$
  let vdate$=year$+mon$+day$
  sinput note1$,note2$,distance: let due=distance*20/100
  print at 14,62;"        "
  print at 14,62; ink 4;due
  sinput day2$:getdate;day2$: let day2$=q$
  sinput mon2$:getdate;mon2$: let mon2$=q$
  sinput year2$: if len(year2$)<2:mist: endif :getdate;year2$
  let vdate2$=year2$+mon2$+day2$
  endproc
proc space
  print at 23,0;rept(" ",80)
  endproc
proc start
  error option: let n=errnum(): if n
    mist: endif :mistake
  endproc
proc swop
  getrec:message;"ALTER DETAILS OR PRESS ENTER":sinp:check: update
  endproc
proc view
  let show$="": first : sprint :pos
  while show$<>"q"
    message;"Next (n): Back (b): Fwd jump (f): Rev jump (r):
    Quit (q) ?"
    let show$=lower(getkey()):pos
    if show$="q": print at 22,15;rept(" ",20): endif
    endwhile
  endproc
```

Proc getrec uses the command **locate** to find the field most similar to that ordered and displays it. When previously using **proc sinp**, we converted the ordered field to upper case to ensure case matching.

Proc swop is used to alter existing records and we introduce the **Archive** command **update**.

Proc view displays the records for examination and calls the procedure **proc pos**. The latter displays the records using **next, back**. Also, by using the function **recnum**() and the command **position**, we are able to jump backwards or forwards.

The procedures in listing four: **action;act$ — getdate;z$ — menu — message — mist — pos — space — view** must also appear in **report2** and can be moved from **report1** to save typing.

Proc pout is called via **proc start and proc option**. It asks which printout is required and then calls the appropriate proc.

Proc petrol prints out total expenses due between the specified dates using the command **select** on the field **vdate$**. If any files are found, the field **vdate$** is ordered so that the printout is in chronological order. Each file found goes through the "first: while not eof()" loop, using **x** to add up total expenses due. The function **dec** — not available to **Archive** — is used to line up the numeric field on the right, for example, **dec — due, decimal places, width. Reset** restores all the files discarded when using **select**. As **reset** invalidated the order command, we **order** the **company$** field and **vdate$** field.

Proc follup selects all the follow-up calls to be made in the specified month. The files are selected through

Archive1 has a serious editing fault. If you enter edit with 18 or more procs, it will crash

vdate2$** if all the areas are to be printed but through **vdate2$ and area$ if only one area is to be covered. **Proc foll** then prints out the selected files. Function **month**() is used to change the month from number to words.

Proc mistake. If a mistake is detected the files will be reset and reordered because the command **select** may have been used. All files will be reinstated before displaying the menu.

Proc notes uses the command **search**, starting at the first record and continuing through the file until an exact match is found for the specified field. Smith Ltd would therefore not find Smith Limited. If a match is

continued on page 30

Listing four

```
proc a
  rem  save  object "report2" :rem Archive(1) = save "report2"
  endproc
proc foll
  message;"PLEASE WAIT FOR PRINTOUT"
  lprint tab 23;"FOLLOW UP VISITS FOR "+upper(month(val(mo$)))+
  lprint " 19"+ye$: lprint
   "CONTACT"
  lprint "DATE"; tab 16;"AREA"; tab 32;"COMPANY"; tab 62;
  lprint : first : while not eof()
    lprint day2$+"/"+mon2$+"/19"+year2$; tab 16;area$;
    lprint tab 25;company$; tab 55;contact$
    next : endwhile
  endproc
proc follup
  action;"FOLLOW UP CALLS FOR WHICH MONTH  "
  input ink 4;mo$;
  getdate;mo$: let mo$=q$: input ink 4;" YEAR 19";ye$
  if len(ye$)<2:mist: endif :getdate;ye$
  message;"FOLLOW UP CALLS FOR ALL AREAS Y/N"
  let fw$="": while fw$<>"y" or fw$<>"n"
    let fw$=lower(getkey())
    if fw$="n":action;"ENTER WHICH AREA TO PRINT OUT "
      input ink 4;are$: endif
    if fw$="y" or fw$="n":message;"PLEASE WAIT WHILE FILES ARE
      SORTED"
      if fw$="n": select area$=upper(are$) and mon2$=mo$ and
      year2$=ye$
    if count()>0: order vdate2$;a: lprint "AREA "+upper
      (are$);
          foll: else :action;"NO CALLS FOR "
          print ink 4;upper(month(val(mo$)));
          print ink 4;" 19";ye$;" AREA "+upper(are$);
          endif : endif
      if fw$="y"
        select mon2$=mo$ and year2$=ye$
        if count()>0: order vdate2$;a:foll: else
          action;"NO CALLS FOR "
          print ink 4;upper(month(val(mo$)));" 19";ye$;
          endif : endif
      if count()=0: print ink 4;" : PRESS ANY KEY FOR MENU"
        let no$=getkey(): endif
      reset : order company$;a,vdate$;a: return
      endif : endwhile
```

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Listing four continued

```
  endproc
proc mistake
  let n=1: while n: error menu: let n=errnum()
    if n: reset : order company$;a,vdate$;a
      mist: endif : endwhile
  endproc
proc note
  action;"ENTER NAME OF COMPANY  :"
  input coname$: let coname$=upper(coname$)
  search company$=coname$: if found()
    message;"PLEASE WAIT FOR PRINT OUT"
    lprint "COMPANY:  ";company$
    lprint rept("=",10+len(company$)): lprint
    while found()
      lprint "DATE VISITED :- ";day$;"/";mon$;"/";year$;
      lprint tab 30;"CONTACT ";contact$
      lprint "NOTES": lprint note1$
      lprint note2$: lprint : continue : endwhile
    else :action;"NO COMPANY CALLED "
    print ink 4;coname$;" : PRESS ANY KEY FOR MENU"
    let no$=getkey$(): endif
  endproc
proc option
  if opt$="e":message;"CLOSING ALL FILES"
    close : mode 1,8: stop : endif
  if opt$="i" or opt$="a" or opt$="d"
    print at 24,56;rept(" ",24):message;wait$
    run object "report1":rem Archive(1) = run "report1"
    endif
  if opt$="p":pout: endif
  if opt$="v":view: endif
  endproc
proc petrol
  local x: let x=0
  action;"EXPENSES FROM DATE : ENTER DAY "
  input ink 4;da$;
  getdate;da$: let da$=q$: input ink 4;" ENTER MONTH ";mo$;
  getdate;mo$: let mo$=q$: input ink 4;" ENTER YEAR 19";ye$
  if len(ye$)<2:mist: endif :getdate;ye$: let expen$=ye$+mo$+da$
  action;"EXPENSES TO WHICH DATE: ENTER DAY "
  input ink 4;da2$;
  getdate;da2$: let da2$=q$: input ink 4;" ENTER MONTH ";mo2$;
  getdate;mo2$: let mo2$=q$: input ink 4;" ENTER YEAR 19";ye2$
  ye2$+mo2$+da2$
  if len(ye2$)<2:mist: endif :getdate;ye2$: let exp$=
  message;"PLEASE WAIT WHILE FILES ARE SORTED"
  select vdate$>=expen$ and vdate$<=exp$
  if count()>0: order vdate$;a
    message;"PLEASE WAIT FOR PRINT OUT"
    lprint tab 20;"EXPENSES DUE FROM ";da$;"/";mo$;"/19";ye$;"
    TO ";
    lprint da2$;"/";mo2$;"/19";ye2$: lprint
    lprint "DATE VISITED";tab 15;"AREA";tab 32;"COMPANY";
    lprint tab 64;"PETROL EXPENSES": lprint
    first : while not eof()
      lprint day$;"/";mon$;"/19";year$; tab 16;area$;
      lprint tab 25;company$;
      lprint tab 68;"£";dec(due,2,8)
      rem Archive(1) = lprint tab 68;"£    ";due
      let x=x+due: next : endwhile
    lprint tab 68;"=========="
    lprint tab 68;"£";dec(x,2,8)
    rem Archive(1) = lprint tab 68;"£    ";x
    lprint tab 68;"==========": else
    action;"NO PETROL EXPENSES DUE FOR THAT PERIOD"
    print ink 4;" : PRESS ANY KEY FOR MENU": let no$=getkey$():
    endif
  reset : order company$;a,vdate$;a
  endproc
proc pout
   message;"Petrol expenses (p): Follow up dates (f): Notes (n)
   ?"
  let pfc$="": while pfc$<>"p" or pfc$<>"f" or pfc$<>"n"
    let pfc$=lower(getkey$())
    if pfc$="p":petrol: return : endif
    if pfc$="f":follup: return : endif
    if pfc$="n":note: return : endif : endwhile
  endproc
proc start
  error option: let n=errnum(): if n
    reset : order company$;a,vdate$;a:mist: endif :mistake
  endproc
```

Archive2 has many extras that makes it a must for serious users, and has more memory than Archive1

found the **"while found() continue endwhile"** loop will print out details of all the matching records.

If you break into the program, entering: **mode0: screen: mistake** will return you to the menu.

To make editing easier, try not to make your proc lines any wider than the screen. Never use **llist** or **lprint** if a printer is not attached as **Archive** will then crash.

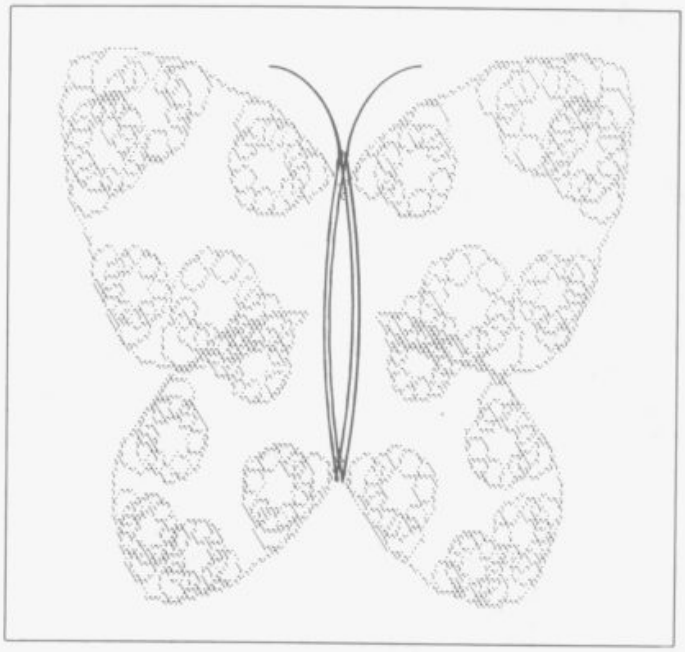
While must always be matched with endwhile; all with endall; if with endif. Each use of while, if or all moves a procedure two spaces to the right. The indentation stops when an endwhile, endif or endall command is added, and at the end of the procedure the endproc must be two spaces from the dividing line.

Archive1 has a serious editing fault in that, when no work area is displayed — mode 0 — and you enter edit with more than 18 procs, it will crash.

It is good policy to produce backup copies of all files on a separate cartridge. Do that by replacing the **Archive** cartridge and entering **backup** "filename_dbf" as "mdv1_filename_dbf". As **Archive2** will not overwrite the same name, you must **kill** the file in mdv1 first.

Archive2 has many extras that makes it a must for serious users. The screen editor is more versatile and two more lines are available for the screen display. The variables can be coloured using the **ink** and **paper** commands. **Archive1** procs can be run on **Archive2** but the designed screens are incompatible.

In **Archive2** the screen display determines the number of characters that can be inserted. Scrolling with **Archive1** is considerably slower than with **Archive2**. Procedures can be Saved, Run, Merged and Loaded with the option **protect**, preventing anyone from listing your procs. Files saved with the option **object** — as used in this program — are given the file extension _pro which makes loading faster. Many useful new functions have also been added.



Graphics Toolkit

TALENT has been setting the standard of QL software for more than a year. Its major successes include **GraphiQL, Cartridge Doctor, Akul** and **West.** In the summer of 1985 the company's talented programming team was set the task of producing a professional quality utility for the *Sinclair User Annual.*

The **Talent Graphics Toolkit** is the result of two months hard work. You can use it to experiment with the new science of Fractals, which deals with the replication of natural shapes to form landscapes, rock formations and even buildings. The techniques are similar to those used by Walt Disney Productions to create *Tron.* Enter a new world of computer generated graphics and a new area of programming.

FRACTALS were defined by Mandelbrot who conceived and developed 'a new geometry of nature'. Natural shapes, such as clouds, mountains, trees, coastlines, exhibit a totally different level of complexity to that of standard geometric shapes. Fractals describe many of the fragmented and irregular patterns found in nature and the degree of that irregularity is identical at all levels. For example, a coastline can be represented on a large-scale map as a series of bays or inlets. A more detailed map will reveal that the bays are themselves broken up into smaller bays and indentations.

A simple example of a fractal shape is the snowflake shown in figure one. The basic frame is an equilateral triangle (A). The next shape (B) has been formed by adding equilateral triangles, one third of the size of the original, on the central third of each side. The same process is repeated in (C) and can be repeated ad infinitum until the detail is too fine to see.

TALENT's fractal program allows you to choose one of twenty stored frame shapes or to define your own. The segment, or method by which each line is to be modified, can also be selected from a library of twenty stored shapes or can be user-defined. Finally, the computer draws the frame on screen at any level or generation of complexity you choose.

Program Design

The program has been carefully engineered. The interface should allow you to obtain pleasing results quickly and easily. You should not need to understand the basic mathematical concepts. All help is provided on-screen and no manual is necessary.

Main Menu — nearly always on screen. Options are highlighted in turn by using the cursor keys and selected with Space. When an option is chosen, a drop-down sub-menu is displayed.

Sub-Menu — brought down when an option is chosen. Options are selected in turn with the Space key. All sub-menus have an ESCape option which returns you to the main menu.

Segment Window — always on screen. This window displays the current segment selected out of a library of 20. The first 10 of those are defined. The remainder are stored as straight lines which can be picked up

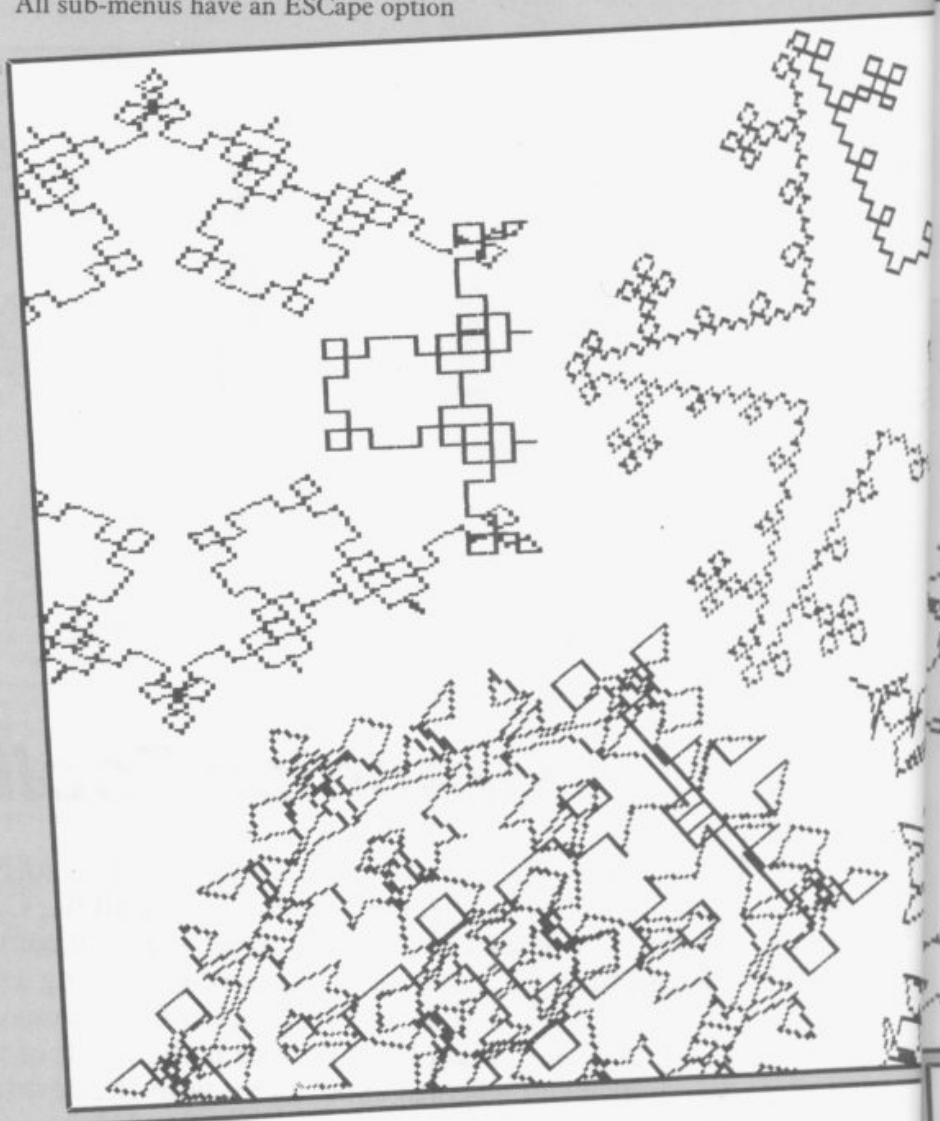
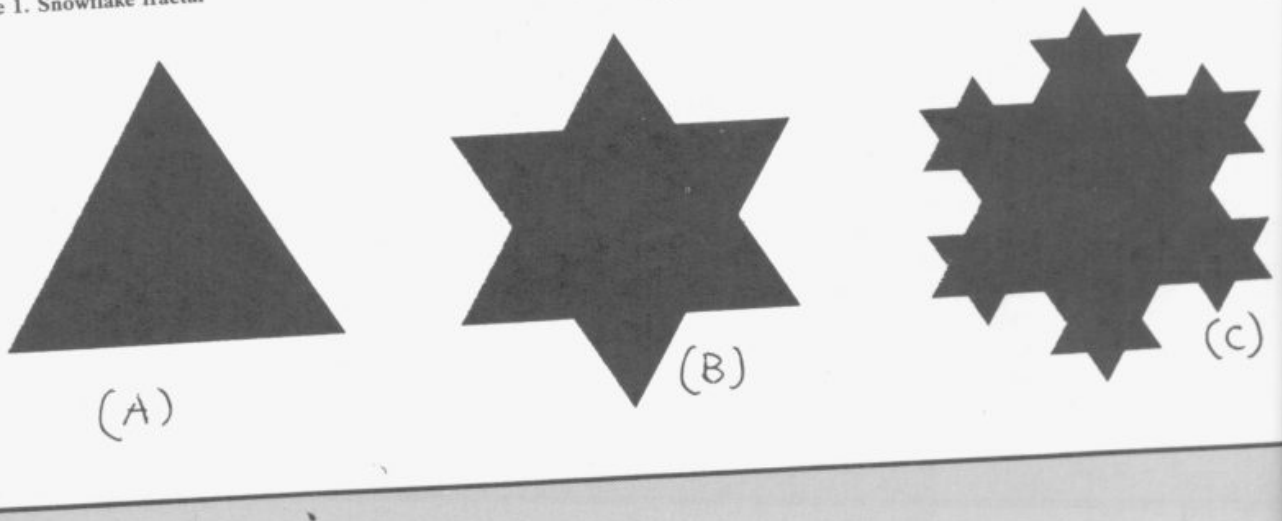


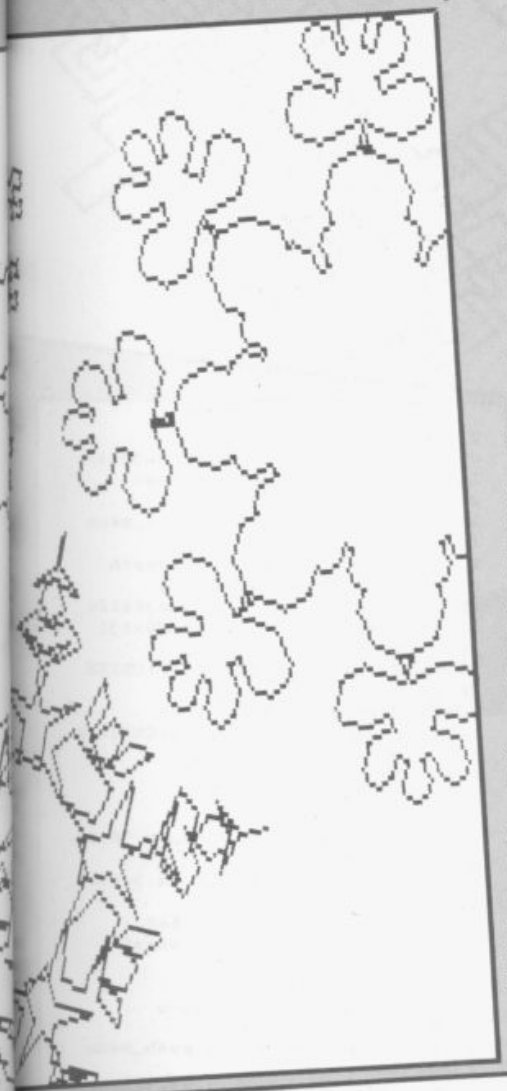
Figure 1. Snowflake fractal



and edited to become any shape you wish.

Frame Window — the same as segment window. Displays the current frame selected from the frame library. The first 10 are defined, the remainder can be edited in the same way as segments.

Input/Error/Message Window — this window is used when input is required — filenames. It will also display errors and other messages.



Summary of functions

After Segments/Frames

On-screen edit — used to change the segment or frame on-screen. After the segment/frame is drawn, you move the cursor to a point on the line. Then pick up the point and pull it to a new position using the cursor keys. The space bar is used to register the change. That is useful for specifying irregular shapes.

Numerical data — you are asked to input a series of numbers-distance, angle-to specify the segment or frame. That is useful for specifying regular shapes. Distance is scaled proportionately, for example, a standard length for the frame is 50 and for the segment, 10. The angles start at 0 degrees and work clockwise — 90 degrees, 180 degrees, 270 degrees and back to 0 degrees.

Change Segment/Frame

The current segment or frame is changed to another in store — 1-20.

Draw Fractal

When this item is specified on the main menu, the sub-menu will ask for various data which you must enter as numbers on the keyboard. The options are mode, paper, ink, x co-ordinate, y co-ordinate, depth and scale.

Permanent Store

Format device will format a specified device.

Directory device will give a directory of the specified device.

Save fractals will save the present store arrays.

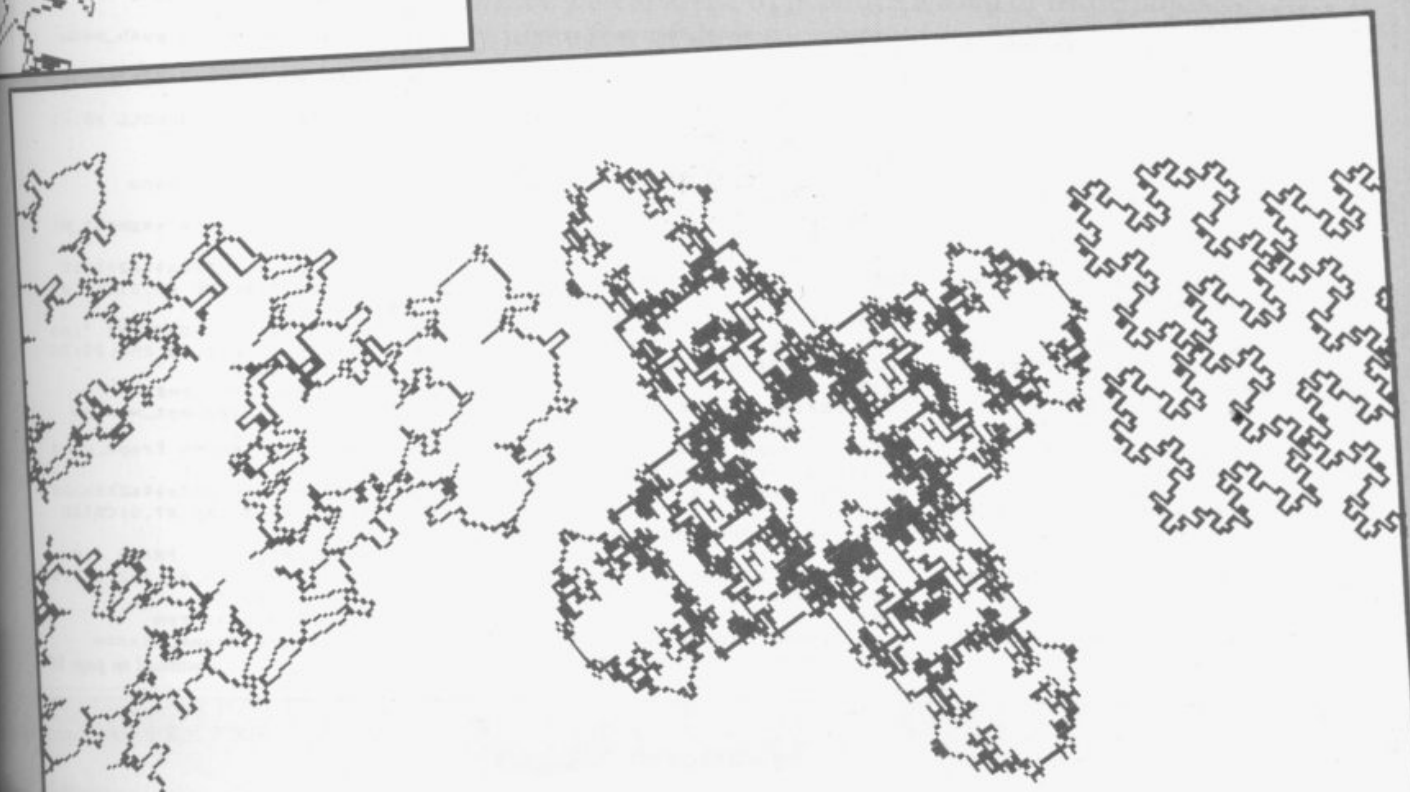
Load fractals will load the store arrays.

Additional information

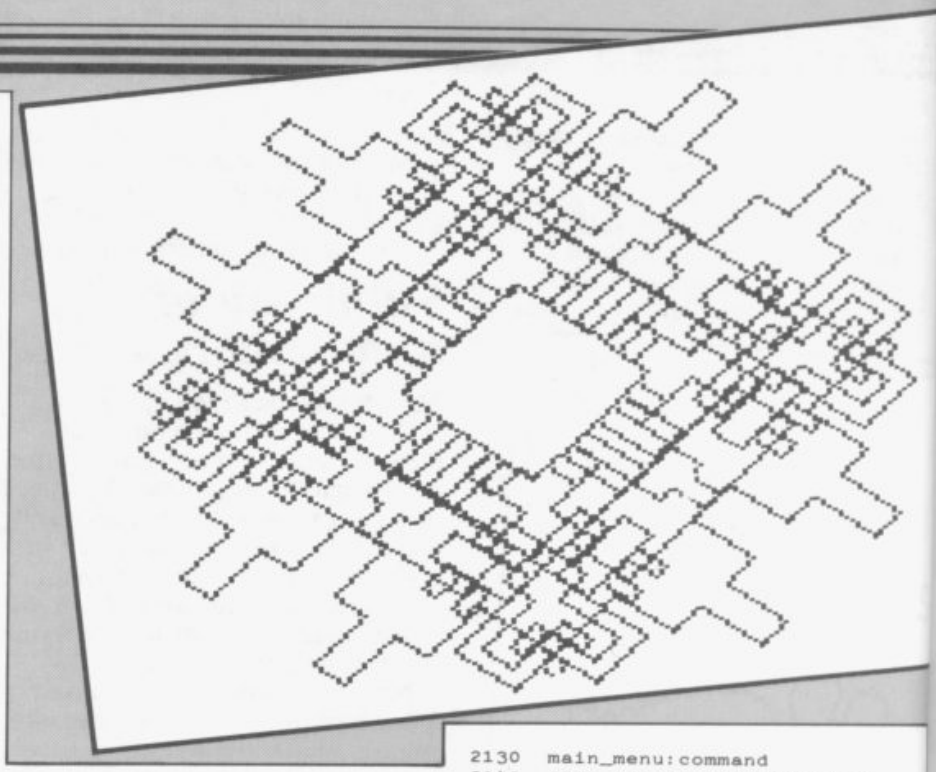
Occasionally values — paper, ink — must be entered in the input window. The default value — printed in brackets after the option — is printed first. If that is to be changed, it must first be erased using the Sinclair erase sequence of CTRL and back arrow. Then the new value must be typed in, followed by ENTER.

An error message will be generated if a segment is 'closed' — the start and end point are put in the same place. If the start and end point of a segment are too close together, the segment will not fit into the window. It will also run off the main fractal drawing screen. It should be changed using the on-screen edit to make it fit.

Talent Computer Systems will be happy to supply copies of this program on request. Send a formatted microdrive cartridge, name and address and £1.50 handling charge to Talent Computer Systems, Curran Building, 101 St James Road, Glasgow G4 0NS.



```
240 :
1000 FOR a=3 TO 8:OPEN #a,scr:CL
OSE #a
1010 FOR a=0 TO 2:PAPER #a,0:BOR
DER #a,0
1020 MODE 4:INK 7:CSIZE 2,1:PRIN
T "Please wait.   Setting fracta
l data."
1030 init_main:main_screen:logo
1040 REPeat forever
1050  select_option 1,3,1,6,mpos
,1,-1:m_sel=selection
1060  pull_menu m_sel
1070  selection=0:scrn=2
1080  REPeat sub_menu
1090   sel1=selection-1
1100   IF scrn=2 THEN sel1=-1
1110   select_option 0,6,0,max,s
election,0,sel1
1120   IF selection=0 THEN EXIT
sub_menu
1130   IF m_sel=0
1140    SELect ON selection
1150     =1
1160      edit_s:scrn=2
1170     =2
1180      get_seg_data:scrn=2
1190    END SELect
1200   END IF
1210   IF m_sel=1
1220    SELect ON selection
1230     =1
1240      edit_f:scrn=2
1250     =2
1260      get_frm_data:scrn=2
1270    END SELect
1280   END IF
1290   IF m_sel=2
1300    SELect ON selection
1310     =1
1320      choose_seg:scrn=1
1330     =2
1340      g_val pres_seg,2
1350      IF input_$>20 THEN inp
ut_$=pres_seg
1360      pres_seg=input_$
1370      change_seg pres_seg:di
sp_seg pres_seg:scrn=1
1380    END SELect
1390   END IF
1400   IF m_sel=3
1410    SELect ON selection
1420     =1
1430      choose_frm:scrn=1
1440     =2
1450      g_val pres_frm,2
1460      IF input_$>20 THEN inp
ut_$=pres_frm
1470      pres_frm=input_$
1480      change_frm pres_frm:di
sp_frm pres_frm:scrn=1
1490    END SELect
1500   END IF
1510   IF m_sel=4
1520    SELect ON selection
1530     =1
1540      draw_fractal:scrn=2
1550     =2
1560      IF mode_=4 THEN mode_=
8:ELSE mode_=4
1570      UPDATE_FRACTAL_MENU se
lection,mode_:scrn=0
1580     =3
1590      g_val paper_,3
1600      IF input_$>255 THEN in
put_$=paper_
1610      paper_=input_$
1620      UPDATE_FRACTAL_MENU se
lection,paper_:scrn=1
1630     =4
1640      g_val ink_,3
1650      IF input_$>255 THEN in
put_$=ink_
1660      ink_=input_$
1670      UPDATE_FRACTAL_MENU se
lection,ink_:scrn=1
1680     =5
1690      g_val x_coord,3:x_coor
d=input_$
1700      UPDATE_FRACTAL_MENU se
lection,x_coord:scrn=1:disp_frm
pres_frm
1710     =6
1720      g_val y_coord,3:y_coor
d=input_$
1730      UPDATE_FRACTAL_MENU se
lection,y_coord:scrn=1:disp_frm
pres_frm
1740     =7
1750      g_val depth_,2:depth_=
input_$
1760      UPDATE_FRACTAL_MENU se
lection,depth_:scrn=1
1770     =8
1780      g_val scale_,3:scale_=
input_$
1790      UPDATE_FRACTAL_MENU se
lection,scale_:scrn=1:disp_frm p
res_frm
1800    END SELect
1810   END IF
1820   IF m_sel=5
1830    SELect ON selection
1840     =1
1850      directory:scrn=2
1860     =2
1870      format_device:scrn=1
1880     =3
1890      save_fractals:scrn=1
1900     =4
1910      load_fractals:scrn=1
1920    END SELect
1930   END IF
1940   IF scrn=1 THEN logo
1950   IF scrn=2 THEN main_scree
n:logo:pull_menu m_sel
1960  END REPeat sub_menu
1970  push_menu
1980 END REPeat forever
1990 :
2000 DEFine PROCedure logo
2010  prompt 1,0:prompt 10,1
2020 END DEFine logo
2030 :
2040 DEFine PROCedure g_val (def
ault,g_len)
2050  command:prompt 8,0:_input
8,0,10,g_len,default,1,1
2060 END DEFine g_val
2070 :
2080 DEFine PROCedure main_scree
n
2090  OPEN #3,scr_512x256a0x0
2100  PAPER #3,7,0,1:CLS #3:CLOS
E #3
2110  frame_window pres_frm
2120  segment_window pres_seg
2130  main_menu:command
2140  OPEN #1,scr_433x200a36x18
2150 END DEFine main_screen
2160 :
2170 DEFine PROCedure pull_menu
(no)
2180  LOCal a,option,a$,depth
2190  RESTORE no*10+10000
2200  OPEN #5,scr_200x92a36x120
2210  OPEN #6,scr_200x4a36x131
2220  PAPER #5,2:INK #5,0
2230  PAPER #6,0:INK #6,7:CSIZE
#6,1,0
2240  depth=4:READ title$
2250  AT #5,0,0:CLS #5,3:CSIZE #
5,2,0:PRINT #5;title$
2260  READ option
2270  FOR a=1 TO option
2280   depth=depth+10
2290   WINDOW #6,200,depth,36,12
9:BORDER #6,2,2
2300   AT #6,a-1,0:CLS #6,3:SCRO
LL #6,10
2310   READ a$:a$=a$&"   "
2320   AT #6;0,0:PRINT #6;a$
2330  END FOR a
2340  max=option
2350 END DEFine pull_menu
2360 :
2370 DEFine PROCedure push_menu
2380  LOCal a
2390  OPEN #6,scr_200x92a36x131:
PAPER #6,7,0,1
2400  FOR a=1 TO 10:SCROLL #6,-1
0
2410  CLOSE #6
2420 END DEFine push_menu
2430 :
2440 DEFine PROCedure segment_wi
ndow (no)
2450  OPEN #4,scr_220x94a248x18
2460  PAPER #4,4:INK #4,0:CLS #4
:CSIZE #4,2,0
2470  PRINT #4;'    SEGMENT ';no
2480  WINDOW #4,213,80,252,29:PA
PER #4,0:INK #4,7
2490  disp_seg pres_seg
2500 END DEFine segment_window
2510 :
2520 DEFine PROCedure frame_wind
ow (no)
2530  OPEN #7,scr_220x94a248x120
2540  PAPER #7,4:INK #7,0:CSIZE
#7,2,0:CLS #7
2550  PRINT #7;'      FRAME ';no
2560  WINDOW #7,213,80,252,131:P
APER #7,0:INK #7,7
2570  disp_frm pres_frm
2580 END DEFine frame_window
```



continued on page 97

Adventure

THE WORLD of Gordo Greatbelly comprises many strange lands in which can be found the solutions to all adventure games.
After a long search, large amounts of liquor and a little bribery, Gordo has been able to convince a local artist to produce a map of those lands, giving away just a few of their secrets in the process.
Back in the United Kingdom Richard Price provides a more down to earth look at the best adventures of 1985 and forecasts the trends of 1986.

RAMJAMIA
SKI HUT
HOTEL
THE BUTCHERS
LAKE
INDUSTRIAL ESTATE
PARK BENCH
TUBE STATION
COVENT GARDEN
THE CLUB
ELVEN KINGS BARRELS
THE GOBLINS DUNGEON
TEMPLE OF MERCURY
THE GRATING
GUARDIAN OF CEARDACALLUM
THE GATES OF MORDOR
THE ENGULFING TREES
VARIA
TOWN HALL
LONGSTRANDNESS
PLAINS OF URUNNIR
COLOSSUS AND TEMPLE OF SINCLAIR
BRACO'S TOWER
KORTHUN
MARU
TOMB OF MOGONS
MARU
NAHDRUUN
OASIS OF THE DREAM
SPICE ROAD

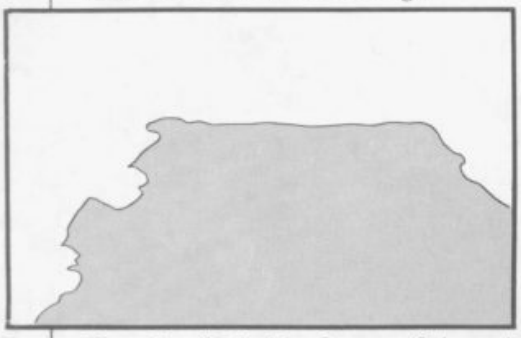
OPIUM DEN
BIG BEN
BASILS HOUSE
MELBOURNIA
RIVER BRIDGE
THE MORASS
QUICKSAND
LAVA FLOOD
THEEN MONSTE
KETLAND
HOUSE OF THE CARTOGRAPHER
THE MOUNTAIN
SLIME MONSTE
PLATEAU
WART WARRENS
THE GUARDIANS
THE MINT WALL
THE DOG
STICKEN SWAMP
ARTIC LAND
LIFT CONTROLS
CONTROL
JUNGLE CLEARING
LAKE OF DEATH
CENTRAL JUNGLE
ESHAKANI MOUNTAIN
TEMPLE OF ITHUKK
THE SINGING GRASS
AMDRUNN
URUNN RIVER
THE OUTPOST
MAZRA
CITY OF TENTS

Quest for adventure

Breaking his journey to refresh at an inn, Gordo Greatbelly puts quill to parchment to relate his travels and offer cryptic clues to those who follow

Maru

The Dancing Ogre: Greatbelly's home base. A rambling fortified inn at the centre of the high Eshak plateau. Earned five stars in Nogi Yanor's 'Guide to Good Adventuring'.



Temple of Ithukk: Centre of the cult of the Great Moon Goddess of the Northlands. Her priestesses are renowned for their savagery.

Colossus of Sinclaiv: The Red God of the North. Legend has it that he was devoured by Maksu-Elawon, the Smoking Mirror. Others say he jumped too high and is now a constellation.

Urunnar Swamps: Maru's northern frontier and home of the anthropophagous Snake Men.

Urtuun: Along with Kortuun, Amdruun and others, one of the great garrison posts of the empire.

The Empty Place: Waterless desert barrier protecting the irrigated plain of Maru.

Maru: Desert capital of the empire. Currently ruled by Janga Abn-Jangara, Consort of Mar, who is the Goddess of corn and water. Maru's wealth comes mainly from the silk and spice trades.

Braco's Tower: Commandery of the Brothers of The Axe — a guild of mercenaries and assassins.

Oasis of the Dream: The place where all Consorts of Mar stay during the month when they are to be united with the Goddess — ritually sacrificed.

City of Tents: The summer gathering place of the Eastern Barbarians. Their current Horse Lord is Malnach, Keeper of the Sacred Skull.

Ketland

The Cartographer: A map will be provided for a favour. Chopping and changing will warm his heart.

The Wall in Mint Condition: Waving your wand and uttering a spell of minty holiness will open new vistas.

The Dog: If fed and suitably restrained this beast will drive away thieving rats and save your treasures.

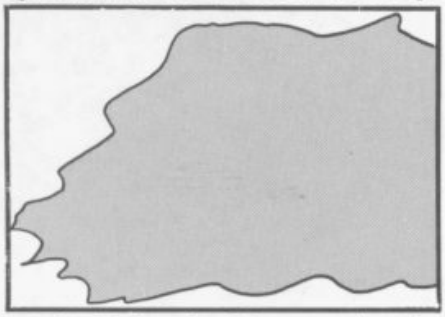
The Plateau and Crevasse: A draught of elixir will allow you to go south, but not with more than five items carried. Headgear here.

Dragon: Can be deterred by a libation of oil.

The Skull Gate: May be passed only when fully clothed as a wizard.

Elephant: Offer, but don't give, some cupboard love. The beast will follow you, becoming a suitable hitching post when fed in the right place.

Quicksand: Fire an arrow with rope



attached. That should get you into the swing of things! The gear resides in a high hole.

EN Monster: A useful beast if you follow its directions through a hall — but fatal if attacked.

The Oak Door: First fill its gap, then retire into a cubby hole. Waiting six times here will demolish the obstacle.

The Morgue: Home of the dead who are undead. Delphia will be discouraged from wandering by a clove.

The Slime Room: Waste no time here.

The Guardians: If a=26 then z=1.

Artic Lands

PLANET OF DEATH

The Old House: Its rotten floor will help you cross thin air.

Ravine: Beyond here lies a hut where protection may be found.

Cavern of the Green Man: This creature may be got, dropped and then destroyed. He has no attractive characteristics but his mirror does.

Laser: If held back by a force field, firing this twice followed by impromptu dancing should see you through.

The Lift Controls: 321 may help you enter your goal. Four may get you a rise — a welcome lift.

ESPIONAGE ISLAND

The Clearing: The dark bundle is your chute.

The Wreckage: Examining a dark corner will provide currency to buy a weapon — useful against guards.

The Stitched Swamp: Stitched is sewn. Initially this word is directional.

The Control Hut: A socket for explosives and a switch to detonate. Take care!

The Helicopter: A straight southern route will bring disaster. Be devious

and go round-about.

INCA CURSE

The Temple: Strip a branch of leaves to make a tool for breaking and entering.

The Fire Room: Blankets are useful for dousing flames.

The Right Possessions: A ring, a rope and two coloured stones.

EYE OF BAIN

The Bees: A net loss should prove a net gain.

The Beast in the Well: Read your ruby. Saying the name of the stone's element will quell the beast.

Melbournia

HAMPSTEAD

The Industrial Estate: Great status may be gained from the treasure hidden here. Map carefully by dropping some possessions.

The Park Bench: Rest is not the only thing of worth in that place. Access to greater things can be yours.

The Club: If you are tied up right and suitably attired you will be given an introduction you can bank on.

Covent Garden: Here be Pippa. She can be got easily enough if you have a home to go to.

Chubby's Mansion: Knightly honours may be yours if you meet Chubby. Request his daughter's hand and

then betray your boss by leaking documents.

SHERLOCK

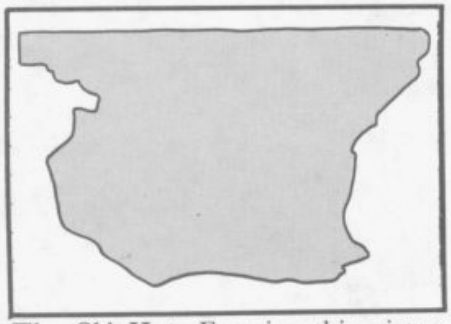
The Opium Den: In this place of sin the Major may be found. His innocence may only be proved by telling Lestrade of the soldier's visit to that terrible place. Be swift — two minutes are all you have.

Basil's House: Basil is in residence on Tuesday or Wednesday. Enter stealthily at the rear — but look first to see if Basil sleeps. Beware if not!

Big Ben: The game will finish at 1.02 am on Tuesday unless you can prove the Major's innocence. Lestrade will consider him guilty and will arrest.

Ramjamia — Land of Valkyrie 17.

The Hotel: Escape is impossible from here unless you have first entered the room along the ledge and read a useful book.



The Ski Hut: Examine this picture carefully. A journey in the snow is impossible without the aid of what is lying here.

The Butcher: To obtain the lamb, offer him some radioactive isotope — the rays are shielded by lead but he proves too inquisitive.

The Surveillance Camera: This eye can be blinded easily enough. An aerosol will provide the medium.

The Lake and Telescope: Look back, front and all around. A taxi's destination will then be revealed.

Varia

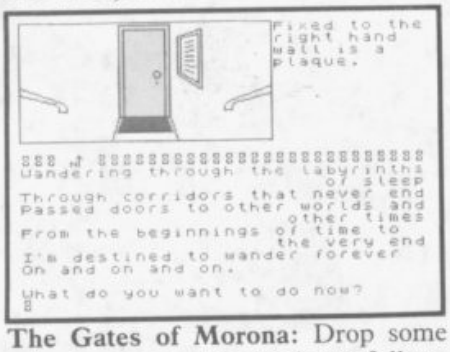
THE HOBBIT

The Goblin's Dungeon: Ask a friend to open a window. Get him to pick you up and take you through.

The Elven King's Barrels: Throw them in first and then get in. Otherwise you will always be caught.

BORED OF THE RINGS

The Engulfing Trees: If you need it why not call for help — mad Tim is into trees, man.



The Gates of Morona: Drop some spice to cause a stir. Look carefully at Featherwop to find this irritant.

THE LORDS OF TIME

The Temple of Mercury: Appropriate devotion to the god should call up winged helpers — handy in a scene of strife.

The Skeleton: Anything frightened by stones or pebbles cannot be as fearsome as you think.

URBAN UPSTART

The Dustbins: People throw away the strangest things — very much to your advantage.

The Police Station: Sustaining yourself with food or drink may result in a

welcome journey.

The Town Hall: Red tape and bureaucracy go well together. Make sure you are well supplied.

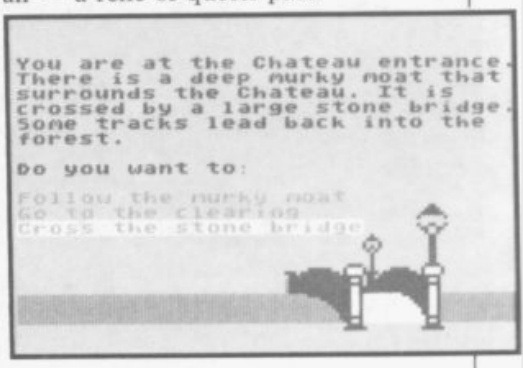
TIR NA NOG

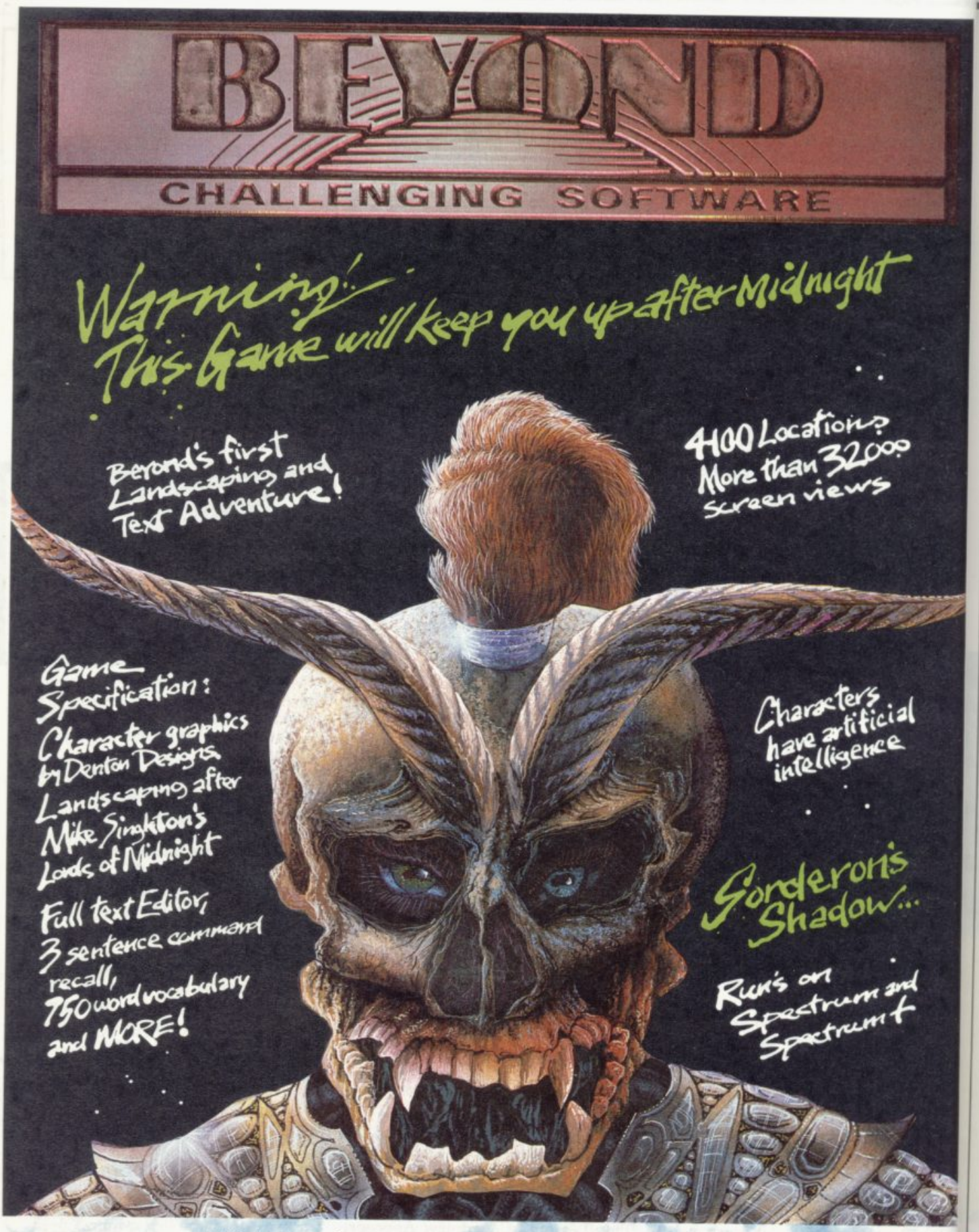
The Guardian Serpent: Unite the severed halves of a precious ornament. Thus you become invisible and remain unsinged.

The Stag: Be not misled. Antlers are the Crown of the Horned God Cernos. He has no need of gaudy metal.

The Giant Rat: In a **Dungeon Adventure.** Those creatures detest rancid chips — who does not?

The Grating: In the **Colossal Adventure** this may be unlocked with a key found in a building. In an **Adventure Quest** though, the grate is of no use at all — a relic of quests past.

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Best of '85

Pit your wits against the odds and pursue the road to adventure. Richard Price looks at the pick of the crop

THE HITCH HIKER'S Guide to the Galaxy, in its instructive and engaging way, offers words of great solace to those unfortunates who find themselves "stuck in a crack in the ground underneath a giant boulder you can't move, with no hope of rescue." Helpfully it suggests such travellers should "consider how lucky you are that life has been good to you so far."

If you're a computer adventurer, wherever you happen to be stuck, entombed, imprisoned, surrounded or just plain lost, much the same applies. You've never had it so good and all the signs show that it might get even better yet.

Many years ago, in the age of the mainframe dinosaurs, adventure was a new species, hiding behind the vast bulks of scientific or business programs and only coming out at night when the monsters were at rest. Then the great beasts died out and adventure evolved and mutated into many branches. That fast evolution has given players a huge variety of choice.

The choice is large, mainly because adventures tend not to be flash-in-the-pan. The good ones stick around and develop followings, unlike most arcade games which often disappear after only a few weeks' prominence on the shelves. Thanks to the **The Quill** and its graphic back-up, **The Illustrator**, the amateur games designer also has the chance to break into the market, and even be successful in a small way. You can't do that with arcade games anymore.

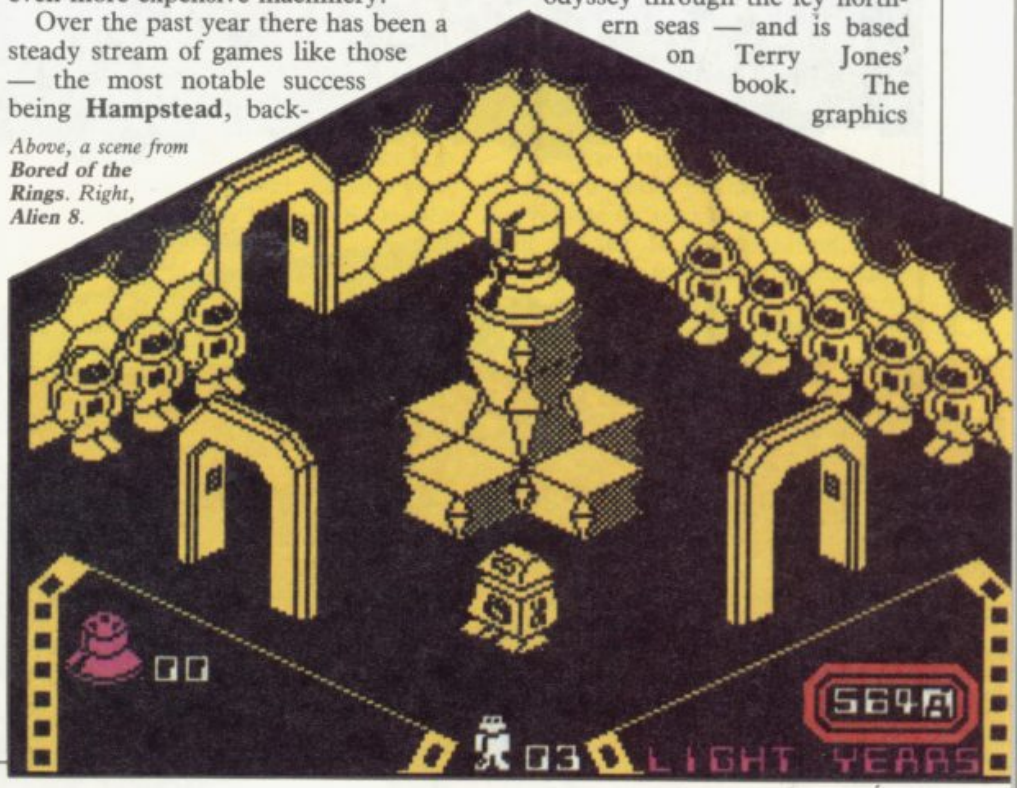
The Quill boom has allowed individuals and small companies to get their fantasies down on tape and into the shops. There is no need for a vast knowledge of code programming, or teams of expensive brains working on even more expensive machinery.

Over the past year there has been a steady stream of games like those — the most notable success being **Hampstead**, backed as it was by the big guns of Melbourne House. Delta 4 produced this year's classic spoof in the shape of **Bored of the Rings**, a genial and sick-humoured lampoon of Tolkien's vast fantasy — showing clearly that there is still room for young enthusiastic games programmers.

Although the big houses tend to charge quite high prices, even for Quilled games, they tend to be less expensive than tailor made programs. Those may not always be more than moderately difficult but they do represent real value for money, and their programmers will take risks with the quirky plots and picaresque humour. That is a great bonus as there is far too little knockabout fun in many of the huge and desperately serious professional productions. If you're a dedicated adventurer it's always worth keeping one eye on the small advertisements for games like those.

Connoisseurs will still go for the big vintages — large text games, more often than not, supported by location graphics. As usual, Level 9 seems to be the frontrunner and has brought out no less than four polished adventures since last year's annual. All those new games feature graphics but, thanks to the techniques of text compression used by Level 9, the text and problems have not been too badly affected. It is really quite staggering to think how much can be squeezed into your 48K Spectrum.

Erik the Viking takes you on an odyssey through the icy northern seas — and is based on Terry Jones' book. The graphics



Above, a scene from ***Bored of the Rings****. Right,* ***Alien 8****.*

are evocative and there is an air of mystery and uncharted waters in the presentation. If you want to follow up on their earlier adventures like **Snowball**, you could do worse than try **Return to Eden** where a complex, unexplored planet mutates bizarrely as you wander.

My own two favourites are **Red Moon** and **Emerald Isle**. The first contains a vast magical world, based loosely on the Runequest roleplaying system. Your aim is to recover the stolen moon crystal, and your antagonists are powerful mages seduced by the forces of evil. There are hit points, combat routines and it is possible to cast a variety of spells to counter superhuman and supernatural foes. There is a large amount of detail and a convincing atmosphere.

Emerald Isle strands you on a desert isle with a difference. Instead of the usual cluster of native huts and palm trees you'll find a complicated civilisation. You are expected to push your way up through the social structure to survive and escape.

These days it is unusual to see large scale text-only games — even from Level 9 — and the Quilled games don't have the same sophistication as custom-built compressed programs. That makes **Mordon's Quest** from Melbourne House something of a rarity. In this time-travelling game your aim is to wander through the ages retrieving the scattered parts of an immortality machine. The plot is admittedly rather old hat but the descriptions are excellent, fleshing out the storyline considerably. No space at all is wasted on graphics.

The traditional text game has its benefits but graphics have caught on in a big way. Animated games have become the biggest sensation of the year. Whatever your feelings about them, games like **Knight Lore** and **Dragontorc** have brought slick, classy moving pictures into the service of adventure.

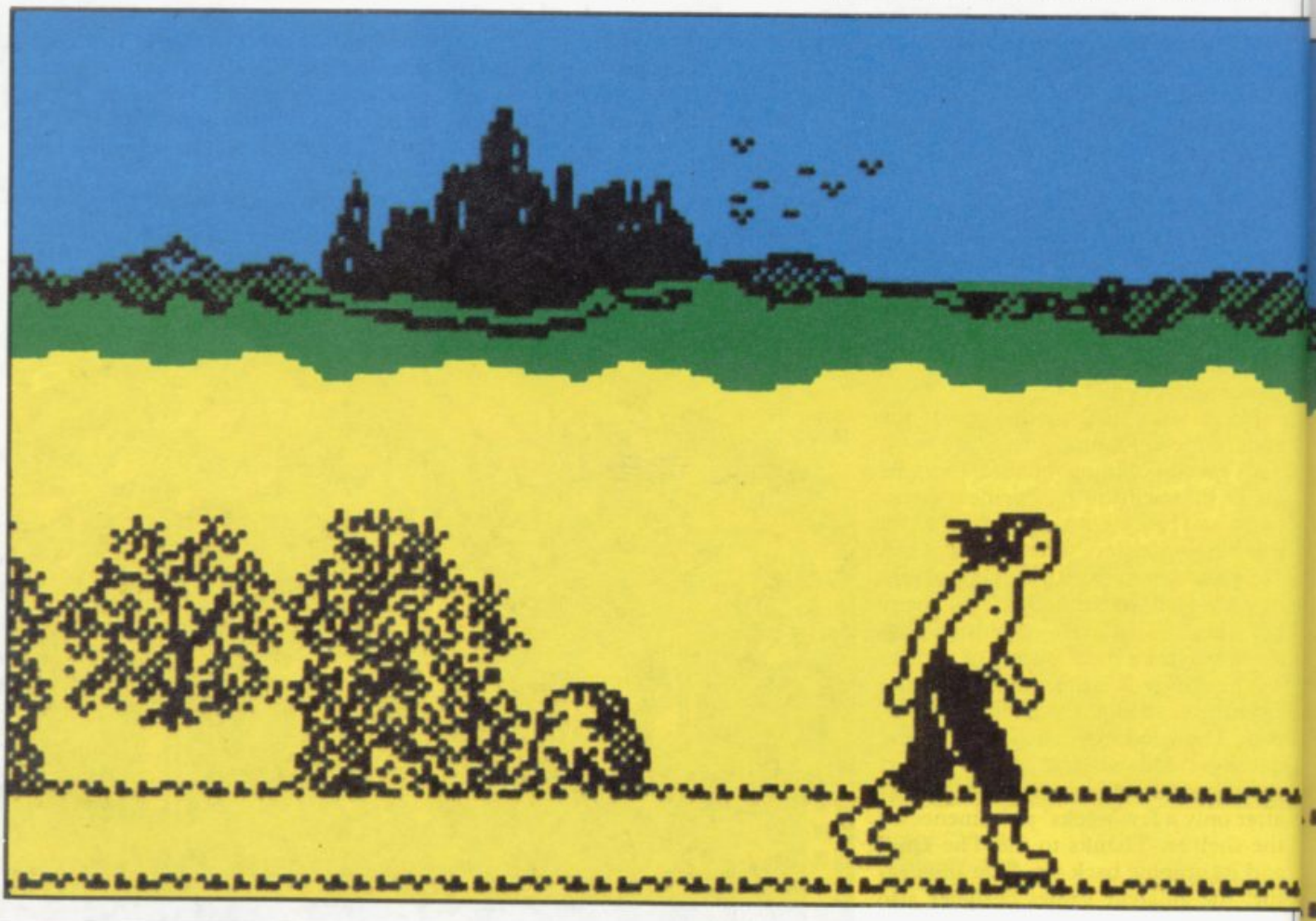
My own view is that animated graphic adventures can never quite replace text — mainly because text ensures that you must use your imagination. No matter how good the pictures, they probably won't have the same breadth as your own mind.

Despite that, the 3D effect and reacting environment of **Knight Lore** and its cousins gives you a strong sense of involvement. They use a lot of old adventure techniques such as experimentation with objects and other logical puzzles. The complexity of the graphics uses up an awful lot of precious RAM and it's hard to see how much further they can be taken.

Alien 8, the follow up to **Knight Lore**, disappointed many players because of its similarity — pushing bits of a room around and timing moves to avoid obstacles is all very well, but it does have serious limitations.

There are only two animated games which, at least in my book, transcend all those objections. **Tir Na Nog** and **Dun Darach**, both from Gargoyle, are complete adventures.

Both games have realistic settings with a convincingly human central character — the hero Cuchullain. Both quests include a number of sub-quests and diversions and there are other characters who go about their own business. Cuchullain must not only use objects but must solve codes, logical problems and, at times, theological questions. Connections can be obscure and there is no straight progression from one task to another. The games present you with an entire

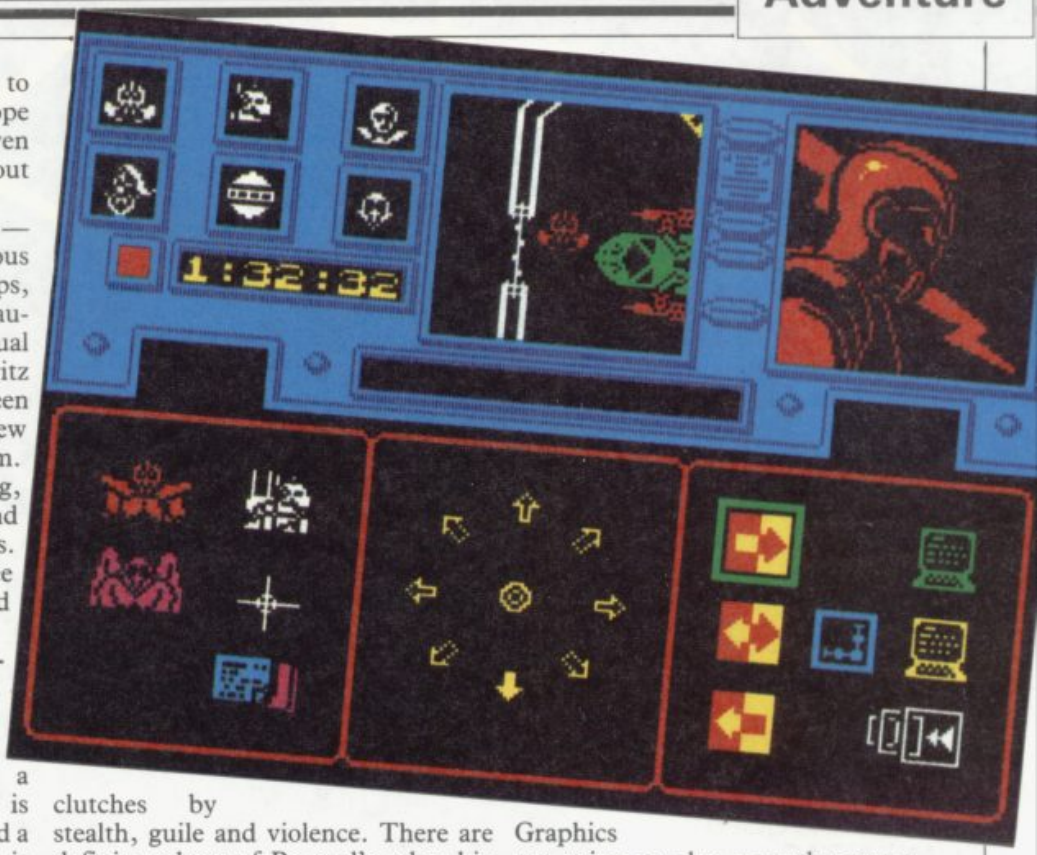


world — you must explore and get to know it well before you can even hope to reach a solution. You might even have to go to the library to find out more about Irish mythology!

Dun Darach — the most recent — places Cuchullain in a tortuous medieval city filled with shops, houses, temples and castles. The authors have set out to create a visual representation of places like Fritz Leiber's Lankhmar — and have been very successful. If you buy only a few games make sure this is one of them.

Since the Apple Mac came along, just about everyone has oohed and ahhed over its icon driven systems. Games designers were quick to see the potential for simply operated and visually attractive layouts.

Shadowfire and **The Fourth Protocol** are both controlled by icons. **Shadowfire** uses no text input at all and, although highly complex and sophisticated, it is essentially a strategy game. Its atmosphere is generated by high quality visuals and a set time limit. That high tech style is perfect for the setting where, in some suitably distant future, you must free a diplomat from an evil general's clutches by stealth, guile and violence. There are definite echoes of Beyond's other big hit, **Lords of Midnight**.



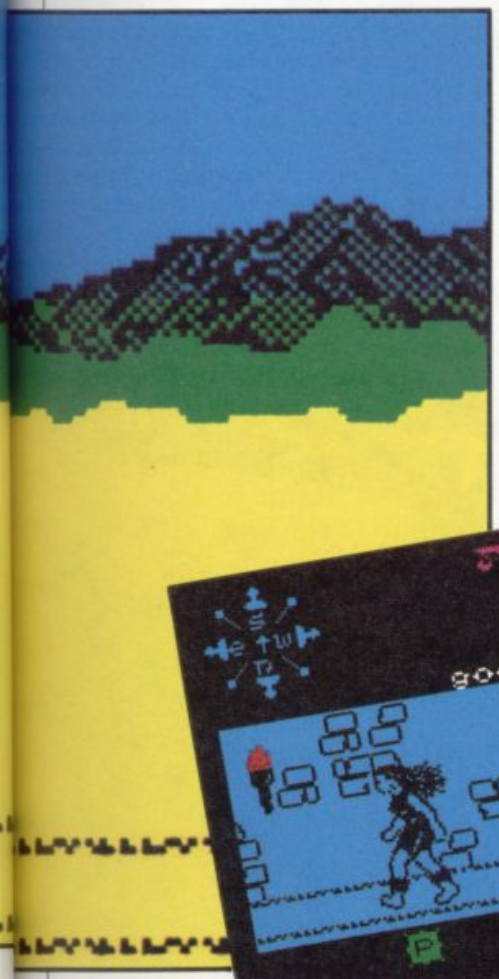
The Fourth Protocol is different. The game is split into three parts, two of which use an icon system. Many functions can be carried out by using only two or three keys and textual information, filing, telephone calls and manpower allocation can be handled with great ease. The simple manipulation of fairly complex material draws you ever deeper into the play — mainly because it's such fun to operate. It is all too easy to forget that you are there to catch traitors and locate bombs as you zip through the files or sort out codes.

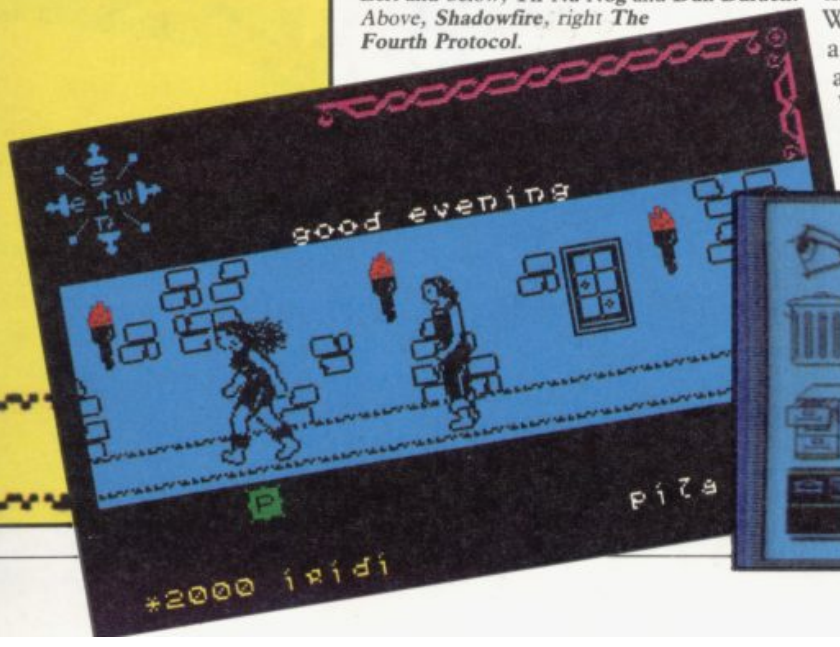
It is always difficult to predict how things will develop over the next year. Graphics are going to play a much greater part in games with an adventure format. If I were a betting man, I'd be prepared to put a few bob on icon systems achieving some prominence in the field. When I first started playing adventures on the Spectrum, I never imagined the transformation in presentation that would occur over a very short period.

Adventurers and arcade freaks are often seen as incompatible groups, scornful of the other's enthusiasms. Icon driven text systems, combined with high quality animation should go a long way to bringing the two sides together.

The new peripherals offering 64K RAM in a games package may be just the vehicle to achieve such a miracle. Wait and see. In the meantime, travel a bit and savour the exotic landscapes and faraway worlds of adventure. Whether you prefer text or graphics is unimportant — there's something out there to suit everyone.

Left and below, ***Tir Na Nog*** *and* ***Dun Darach.*** *Above,* ***Shadowfire****, right* ***The Fourth Protocol.***





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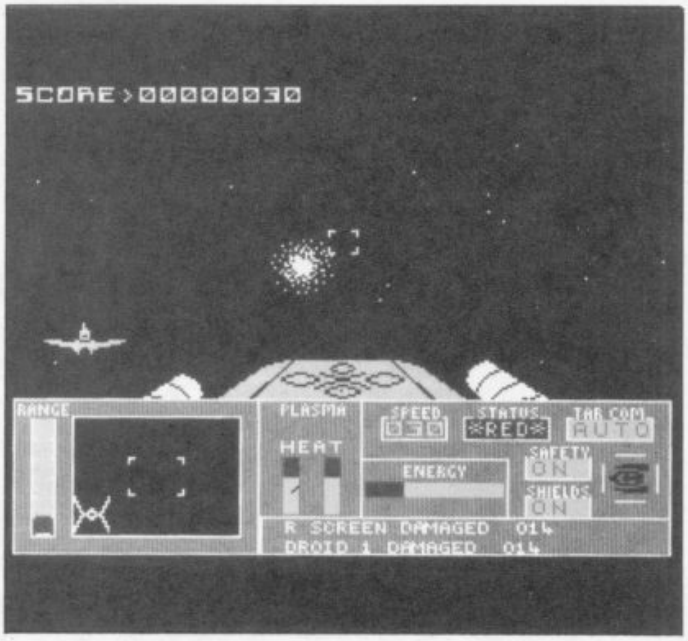


Software Scene

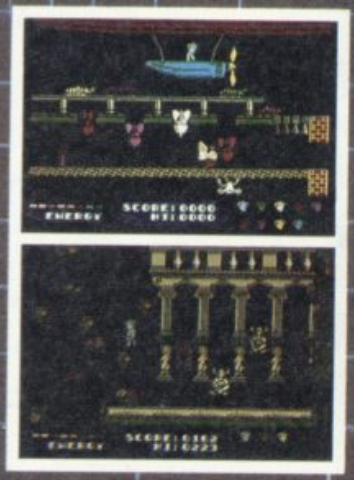
Our expert team of writers bring you the highlights of last year's software releases. Did **Jet Set Willy II** find favour with the public, which were the best icon driven games, how can a computer help you to forecast the weather, and is there a good machine code assembler available for the QL? All those questions are answered, along with many more.

Clare Edgeley finds that sport has dominated the arcade action, while Chris Bourne finds fly fishing on the Spectrum is tedious and John Gilbert finds that utility manufacturers prefer the QL.

A guide to the latest business software is provided by Mike Wright and Mike Johnston, and education is the subject from Theo Wood.

Last but not least we parade the turkeys of the year and give our awards for outstanding awfulness and cruelty to software.

WATCH OUT! IT'S



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Arcade

Clare Edgeley blasts her way through a wealth of challenging software

GET FIT QUICK just about sums up the last 12 months. 1985 has seen enough sports games to put you off doing anything more strenuous than lifting a pint glass, at least for the next year.

Since the 1984 Olympics, we have competed in every imaginable sport: played footie with Bobby Charlton, run rings round Daley Thompson and been KO'd by big Frank . . . There is hardly an action sport left which has not been turned into a money spinner, with a sportsman's name attached. What is wrong with Tessa Sanderson's Javelin anyway?

Daley Thompson's Decathlon was first to the tape back in November '84 and notched up a gold for Ocean when it jumped to number one in the charts for a few weeks. You have to compete in all ten events of the decathlon, taking part in the high jump, long jump and pole vault as well as track events. The 400m is the most gruelling and to keep up speed you must pump the joystick back and forth, which may result in a touch of cramp. The graphics are colourful and the game does give a taste of the real thing.

Melbourne House also attempted a compilation of events with **Sports Hero**, although it was nowhere near as successful as Daley Thompson. **Sports Hero** has you competing in four events – 100m sprint, long jump, 110m hurdles and the pole vault, over three difficulty levels. To gain speed you must pummel the run button and press the jump button before takeoff. Aching fingers seem to be the norm in that type of game and in many cases you will end up with a sick keyboard as well. There is no sound and the graphics are not fantastic, although the scrolling background is interesting. A few more events should have been possible.

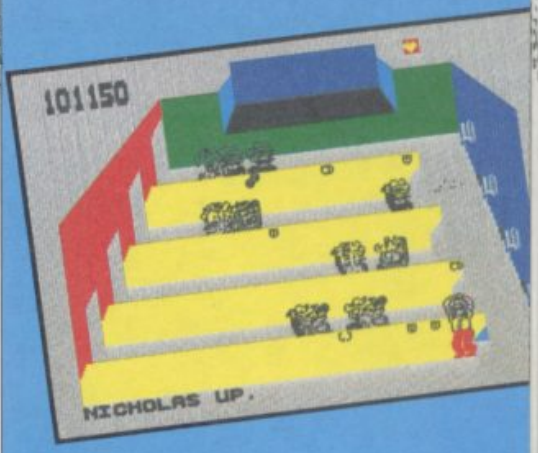
More recently, **Brian Jacks' Superstar Challenge** from Martech reached the top ten, although it came a poor second to Imagine's **Hypersports**. Both contain a weird hotch-potch of events – some interesting, others boring. Brian Jacks gives you a pretty raw deal. For £7.95 you can immerse yourself in such exciting events as squat thrusts and arm dips. Those may be thrilling to watch on TV but on computer they are about as much fun as a wet blanket.

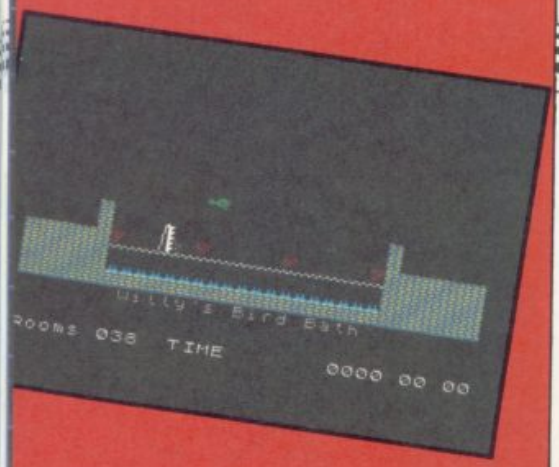
Hypersports is a different ball game altogether. Licensed from the arcade game of the same name, the computer version is very like the original, although some events lack imagination. When swimming – or floundering, if you forget to breathe – instead of tearing down to the end of the pool, the end moves towards you. Clay pigeon shooting is certainly one of the better events, in which you must shoot the skeets through automatically moving sights. The vault is tricky and rather than vaulting as far as possible from the horse, you are likely to end up on your head beside it. The graphics are generally thought to be more professional than **Daley Thompson's Decathlon**, though whether the game is better is a moot point.

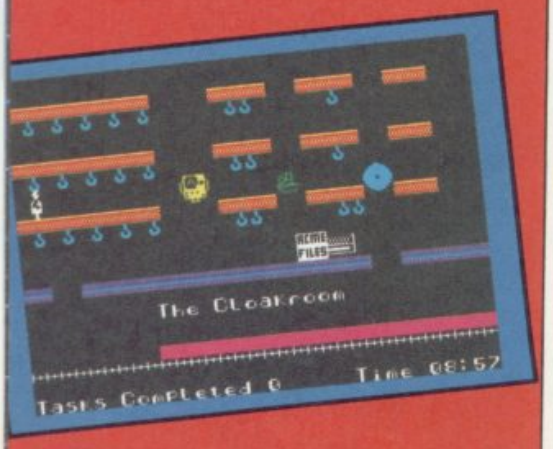
Jonah Barrington's Squash from New Generation is an interesting concept which seems to have fallen flat. Knock a miniscule black ball round the 3D court and try to beat Jonah at his own game. Jonah is one of Britain's leading squash players. Much was made of the fact that a taped recording of Jonah's voice calls out the scores. Unfortunately, all you get is an unintelligible gabble and it is easier to read them on the score board anyway.

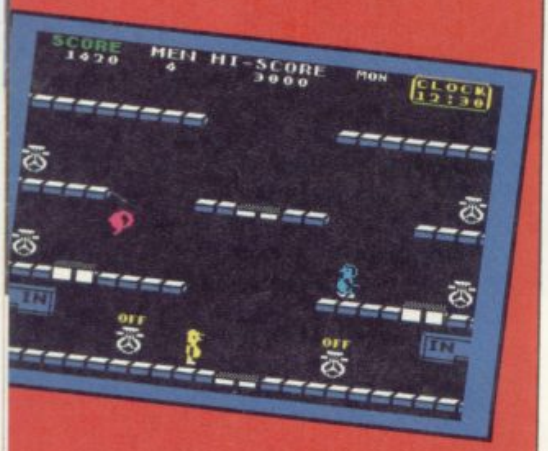
We awarded Imagine's **World Series Baseball** three stars in the June issue, which just goes to show that our forecasts are not always spot on. In June, July and August it remained at number three in the charts, only dropping to eleventh place in September.

The game opens with a traditional rendering of the American National Anthem. Then play starts, with one team pitching and the other batting. You can play with a friend or against the computer, adjusting the speed and direction of the ball when pitching and the strength and lift of your swing when batting. Loving attention has been paid to detail with a large









scoreboard displaying genuine adverts between innings.

Last, but not least, boxing – the sport for ugly mugs. Cauliflower ears and battered brains are only half the fun – just think what you can do to your opponent. A few months ago three games were released simultaneously on the back of **Punch Out!!**, a highly successful arcade game.

Elite's **Frank Bruno's Boxing** knocks **Rocco** and **Knockout** for six, and is easily the most playable and realistic, offering more possible moves and a greater number of competitors than either of the other games. It is also the only boxing game featuring a sporting personality – Bruno helped in an advisory capacity during production which explains the close attention to detail.

Gremlin Graphic's **Rocco** squares up well in the ring, though you will find it is not as easy to dodge your opponent as it is in Frank Bruno, and there are only three competitors. The scoring system is simple and the graphics are the clearest of the three games. It is worth playing and annihilates Alligata's **Knockout** in the ring.

Knockout is appalling and lacks any addictive qualities. It is the only game which uses colour – the others being mono – although that could have been sacrificed for extra playability. Other than left and right punches to the body and head, there is no facility for ducking and dodging, but at least you can amble away if the going gets too rough. You tend to spend a great deal of time seeing stars after being KO'd. At least it lives up to its name.

The legendary success of **Manic Miner** and **Jet Set Willy** lives on. Platform and ladders games are still the rage and dozens of versions have landed in the *Sinclair User* offices over the last 12 months. Two years ago **Manic Miner** was a sure recipe for success, and because it was ahead of its time a lot of money was made. Programming techniques are now more sophisticated and with games like **Alien 8** and **Spy vs Spy** around, who needs a **Manic Miner** spin-off?

However, they are here to stay and some at least are worth the money you pay for them. One of the more successful games is **Strangeloop**, released late in '84, which has gone a long way to repairing the damage done to Virgin by **Sheepwalk** – one of its earliest and most awful games.

A half-crazy computer is the source of all your troubles in **Strangeloop** and, playing the part of a metagalactic repairman, you must shut it down. There are over 240 rooms filled with lethal swarf which attacks and damages your space suit. A jetbike waits somewhere and will make your task easier but you have to locate and refuel it first. Objects picked up will help with various tasks and friendly robots will patch your torn suit. The graphics are colourful and simple and there is even a facility for saving your position on tape, to be resumed later when you have recharged your batteries.

Jet Set Willy II is the biggest rip-off of them all as Software Projects has done little other than add about 70 extra screens to the original. Essentially it is the same as **Jet Set Willy** which was launched back in 1984. The plot is similar; clear up the house before going to bed and avoid the hundreds of lethal thingummies found in each room. Despite being little more than a re-release, **Jet Set Willy II** is currently doing very well in the charts.

Despite the lack of original thought, if you are still hooked on the challenge of platform and ladders, try The Edge's **Brian Bloodaxe**. A loopy game if ever there was one. Brian, a viking soldier has been trapped in a block of ice for centuries, and as it thaws, he leaps out shivering, but ready to conquer the British. Flapping loo seats, deadly ducks and mad Scotsmen are a few of the dangers that lurk on each level. Objects to collect and chasms to be leapt add to his daunting task. **Brian Bloodaxe** is at least as good as **Jet Set Willy**, with much visual humour and bright, clear graphics.

Hewson Consultants, which has made a name for itself in recent months with arcade adventures such as **Dragontorc** and simulations like **Heathrow ATC**, must have had a brain storm late last year with **Technician Ted**, which is totally unlike the semi-serious games released since. Guide Ted around a silicon chip factory while looking for a plate of the real things. Pick up knives, forks and other necessary implements and avoid several nasty traps. Easy to play and reasonably addictive, **Technician Ted** is not one of Hewson's best games but has done quite well in the platform and ladders stakes.

Artic's **Mutant Monty** is more sophisticated than **Technician Ted** and includes some extremely tricky screens requiring split second timing –

if you are slightly out, a lemon or some other incongruous object will squash you flat, and then where will the beautiful maiden be? It is a constant source of amusement that so much work goes into preparing intricate story lines bearing absolutely no resemblance to the game you are playing.

On the whole rip-offs are uniformly mediocre in standard and not the sort of game you would buy for lasting playability. Real fanatics will find Activision's **Toy Bizarre** and Micromega's **Jasper** a doddle, and probably have more fun playing blindfold with their hands tied behind their backs. Both games are average and employ run-of-the-mill graphics. In **Toy Bizarre**, the player leaps round the levels of a toy factory popping balloons while being chased by a gang of irate toys.

Meanwhile, in **Jasper** much the same thing is going on, only this time you are a furry rat collecting money bags and treasure chests while avoiding furry cats, rabbits and other hairy animals. Platform games are usually fast moving and it is generally easier to keep up with the pace using a joystick. Unless you have very strong fingers, **Jasper** is doomed as your only option is to use the Spectrum's sticky keyboard.

Arcade adventures have come into their own in recent months, some remaining for weeks at a time in the top ten. With the advent of games like **Gyron**, fewer people are willing to put up with games like **Jet Pac** – classics two years ago but now gathering dust in cupboards across the country.

Superior graphics is the name of the game and the Spectrum is being stretched to its limits in a constant effort to improve software. Some games combine excellent graphics with originality, though equally large numbers have been launched on the back of the successful few. Ultimate's **Knight Lore**, **Underwurlde** and **Alien 8** are three successful examples and **Nightshade** is expected to do as well.

Underwurlde is rather like a vertical **Atic Atac** featuring the Sabre-man who must escape a series of chambers while avoiding hosts of nasties. The pace is fast, the screens colourful – a devious game.

Knight Lore and **Alien 8** could, at first glance, be mistaken for the same game. Featuring superb 3D grahpics, **Knight Lore**'s hero must search a maze of rooms and find the ingredients of a spell to lift a curse placed upon him. Each room presents a challenge and one wrong move spells instant death. The scenario in **Alien 8** is different from its predecessor and the quality of graphics is even higher.

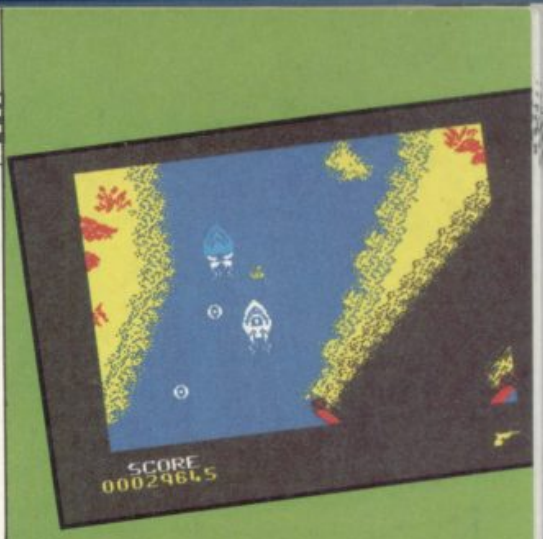
Wizard's Lair from Bubble Bus is an **Atic Atac** lookalike with shades of **Sabre Wulf** and is an excellent game, even if you have seen the same sort of thing before. Bubble Bus has made some attempt to change the scenario which covers three levels, accessed via a magic wardrobe lift.

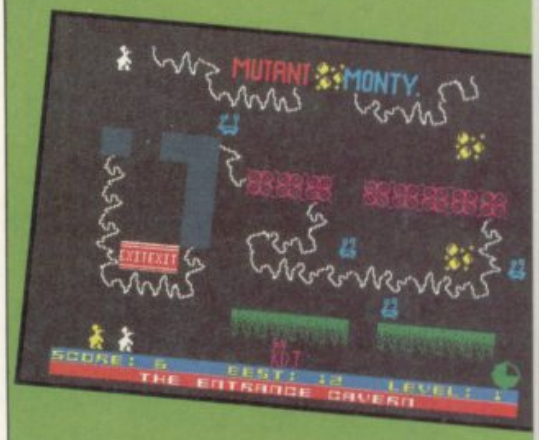
The programmers of Firebird's **Cylu** were influenced by **Alien 8**. **Cylu** is in the Silver range and at £2.50 represents very good value – it is almost as frustrating as the original but the graphics are a little patchy. Ultimate should be proud that so many companies want to copy their games, though it's a crying shame that those same software houses cannot put their combined programming expertise to good use, and produce something original of their own.

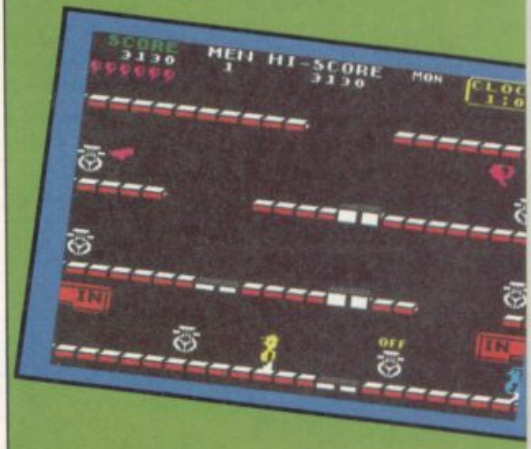
Games featuring film scenarios and famous names are often the subject of massive advertising campaigns, and Domark's **A View to a Kill** was no exception. Played in three parts you must guide the intrepid 007 through the streets of Paris, San Francisco and into Silicon Valley to stop the evil Max Zorin from tipping chip valley into the drink. The game received mixed reviews but, at the time of writing, it had just made it into the top ten – probably due to the James Bond name. It is an exciting game but lacks much visual detail.

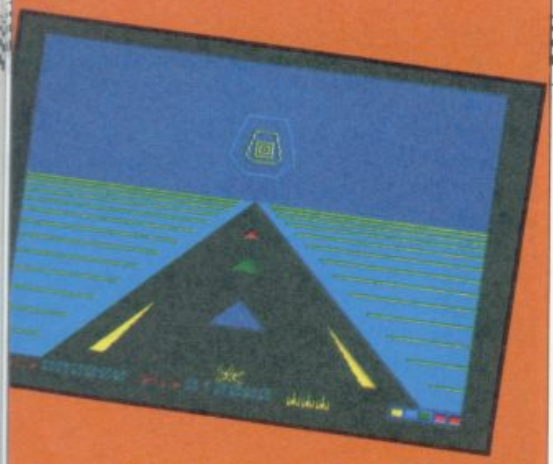
The Rocky Horror Show from CRL is already sliding down the charts and does not live up to its namesakes, the film and play. Rescue Janet or Brad from the Medusa machine by finding 15 component parts of the de-Medusa machine. It sounds riveting. Your task seems enormous as you can carry only one part of the machine at a time and if you expect to meet normal sane characters in the castle, forget it. More could have been made of the graphics and the action is slow in places, but it is worth playing if only to meet Magenta who will strip you of your clothes. Wow!

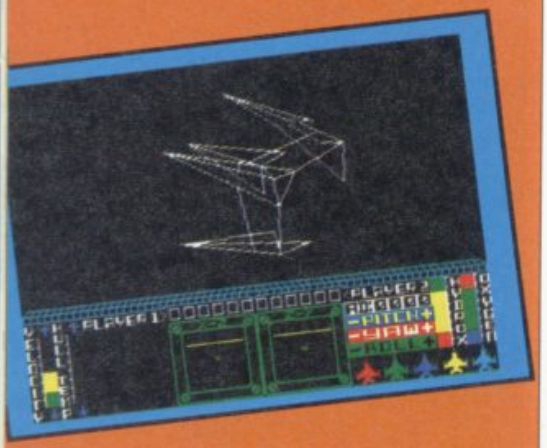
Beyond's **Spy vs Spy** is unique and features simultaneous play between two players on a split screen. Take part in the zany humour of *MAD* magazine's two famous characters, the black spy and the white spy, each











trying to stop the other finding secret documents in a foreign embassy. Set whacky traps as you ransack each room before escaping to the airport. It is fun, highly addictive and very amusing. Buying the licence to films, books and names is an expensive business, and at last one company has made the most of it with an excellent game.

It is interesting to note that when one unusual game is launched others of a similar nature swiftly follow. Perhaps all programmers follow the same thought waves. Last summer we had an unusual trio of games, reviewed in May, June and August issues. Two are based on the human body – not the most obvious subject for a game.

Quicksilva's **Fantastic Voyage** is a thrilling game based on the sixties film of the same name, in which Raquel Welch is injected into the body of a brain damaged scientist. Unfortunately, your mini-sub breaks up and you have only one hour to locate all the missing parts. Searching is a novel experience as you rush from atrium to stomach to lung and heart in a never ending circle. Finding your way to the brain is difficult as it is not signposted and the turning is easy to miss. Dine on red blood cells to keep up your energy and clear any infections which frequently break out – normally in the most inaccessible parts of the scientist's anatomy. A great way to learn about your bits, and where they are situated.

Icon's **Frankenstien 2000** bears little resemblance to **Fantastic Voyage**, though it is played in a monster's body. Whoever heard of monsters smoking fags? This one obviously did and that is probably why it's dead. On reaching the lungs, battle with cigarette packets, avoid hopping frogs in the trachea, and fire at any oxygen molecules it is your misfortune to encounter. The graphics are uninspired and the game is simple.

Genesis' **Bodyworks** was reviewed in June and it is difficult to know what to make of it. It is hardly an arcade game – more of an illustrated, educational tour of the workings of a human body, describing the nervous, circulatory and respiratory systems.

Space Invaders was one of the first great games on the Spectrum and software houses have never tired of the theme. Space games crop up in all categories; simulations, adventures and arcade adventures. Activision has even brought out **Ballblazer**, a sports game played in space. Way out!

Moon Cresta from Incentive is a traditional game in which you shoot everything in sight, and then dock with another space ship before taking off to do exactly the same on the next level. With complex games like **Starion** around one would think that games of this calibre would flop. But no, there must be some people around whose brains are in their trigger fingers. Surprisingly, **Moon Cresta** is creeping up the charts. Long live the aliens.

Melbourne House's **Starion** takes space travel seriously and combines a number of features, including the traditional shoot 'em up, word puzzles and anagrams. Kill off enemy space ships and collect the letters they drop, then unscramble those to form a word. Fly down to earth and answer a puzzle to change the course of Earth's history. There are 243 events to rewrite – and that amounts to a lot of flying time. **Starion** is well up in the top ten.

System 3 has come up with the goods against all opposition with the dreadful **Death Star Interceptor**, which has proved surprisingly popular. If you are really into boring games, this is right up your alley. Played in three sections, first take off into outer space, next avoid assorted aliens and then, as in *Star Wars*, plant a bomb in the exhaust port of an enemy death star. It is all thrilling stuff.

Quicksilva's **Glass** is amazing to look at. Psychedelic colours make you want to blink in this repetitive but addictive game. There are hundreds of screens to blast through, and whole sections are spent dodging columns as you hurtle through a 3D spacescape. The rest of the time is spent shooting radar antennae off unsuspecting space ships. The graphics make up for any limitations in the game and demonstrates that a traditional shoot 'em up need not be boring.

This final section consists of a number of games which cannot be categorised. A strange mixture falls into this area – many are shoot 'em ups in some form or another, others require an element of cunning and strategy.

Gyron from Firebird, a *Sinclair User* classic, is a unique game in which you must travel through a complex maze, dodging massive rolling balls and keeping a watchful eye on the

guardian towers to be found at each junction. Those shoot at you, but approaching from another angle may change the direction of their fire. As there are two mazes to get through, it should take months. **Gyron** is likely to deter arcade nuts, but for those with staying power, it is an attractive proposition. It did make a brief appearance in the top ten at the time of writing, but has since fallen away.

US Gold's **Spy Hunter**, based on the arcade game of the same name, is a faithful replica of the original. It all takes place on the road as you drive your souped-up sports car through a variety of traps laid down by the baddies. Equip your motor with a variety of weapons, obtainable from a weapons van which you drive into *Italian Job* style. Rockets, smoke screens and oil slicks are all strongly reminiscent of 007.

Elite's **Airwolf** is a game that we found so hard as to be almost impossible, and which everyone else seemed to find a cinch – and told us so in no uncertain terms! Try if you can, to fly your chopper down a long, narrow tunnel to rescue five scientists stuck at the end. Blast your way through walls, which rematerialise as fast as you can destroy them – a well nigh impossible task for those whose trigger fingers and joysticks have suffered from the likes of **Daley Thomson's Decathlon**. **Airwolf** has done better than we predicted. You can't win them all.

Ghostbusters, the mega box office hit last Christmas was a prime candidate for a computer game and Activision was first to the ghost. Featuring all the best parts of the film, it was an instant success and Activision did well to launch it simultaneously with the movie. Drive around the city coaxing ghouls into your ghost trap but listen out for a Marshmallow Alert. That giant sticky marshmallow man is quite capable of flattening whole streets unless halted. Greenbacks play an important part in the game as you have to buy your equipment to get started, and earn enough prize money for the number of ghosts caught, in order to take part in a final showdown with Zuul.

Finally **Tapper** from US Gold – another *Sinclair User* classic. **Tapper** is a simple but refreshing game centered round an all-American soda bar. You play a harassed barman, who must serve his customers with drinks. Easy at first as you slide them down the bar but wait until they have gulped down the fizzy stuff. Running backwards and forwards between four bars, make sure the customers have got a drink, and catch the empties as they come skidding back. There are three difficulty levels, each one faster and more hectic than the last. **Tapper** is moving up the charts and we are sure that it will go far towards refreshing the parts other games cannot reach.

The fierce competition over the last 12 months has chased many companies into liquidation. There have, however, been successes, particularly with a number of small software houses bringing new blood into the market. That can only be seen as a healthy sign.

The lack of QL games software is the only disappointment. Where is it? Other than a few basic programs such as **Reversi**, which cut its eye teeth on the ZX-81 years ago, there has been a dearth of games for this flagging micro. If games of the quality of **Knight Lore** can be produced for the Spectrum, why not for the QL?

Toy Bizarre
Activision **£7.99**
★★★

Jasper
Micromega **£6.95**
★★★

Underwurlde
Ultimate **£9.95**
★★★★

Knight Lore
Ultimate **£9.95**
★★★★★

Alien 8
Ultimate **£9.95**
★★★★★

Wizard's Lair
Bubble Bus **£6.99**
★★★★

Cylu
Firebird **£2.50**
★★★★

A View to a Kill
Domark **£10.99**
★★★★

The Rocky Horror Show
CRL **£8.95**
★★★

Spy vs Spy
Beyond **£9.95**
★★★★★

Body Works
Genesis **£14.95**
★★

Fantastic Voyage
Quicksilva **£6.95**
★★★★

Frankenstein 2000
Icon **£6.95**
★★

Moon Cresta
Incentive **£6.95**
★★★

Starion
Melbourne House **£7.95**
★★★★

Death Star Interceptor
System 3 **£7.95**
★

Glass
Quicksilva **£7.99**
★★★★

Gyron
Firebird **£9.95**
★★★★★

Spy Hunter
US Gold **£7.95**
★★★★

Airwolf
Elite **£6.95**
★★★

Ghostbusters
Activision **£9.99**
★★★★

Tapper
US Gold **£7.95**
★★★★★

Daley Thompson's Decathlon
Ocean **£6.90**
★★★★

Sports Hero
Melbourne House **£6.75**
★★★

Brian Jacks' Superstar Challenge
Martech **£7.95**
★★

Hypersports
Imagine **£7.95**
★★★★

Jonah Barrington's Squash
New Generation **£7.95**
★★★

World Series Baseball
Imagine **£6.95**
★★★

Frank Bruno's Boxing
Elite **£6.95**
★★★★

Rocco
Gremlin Graphics **£7.95**
★★★

Knockout
Alligata **£6.95**
★★

Strangeloop
Virgin **£5.95**
★★★★★

Jet Set Willy II
Software Projects **£6.95**
★★★

Brian Bloodaxe
The Edge **£7.95**
★★★★

Technician Ted
Hewson Consultants **£5.95**
★★★★

Mutant Monty
Artic **£6.95**
★★★★

Spectrum 48K
SCORE: 01850 05 HISCORE: 04550
Das Boat
Spectrum 48K
MO
ON
THE
SCORE: 01550 05 HISCORE: 04550
Tree Stump
From the beginning of October
Spectrum 48K £7.95
CBM 64 £9.95
Also available: –
Amstrad £8.95
SCORE: 01500 04 HI-SCORE: 00500
Das Boat
CBM64
MONTY MOLE
Gremlin Graphics
Gremlin Graphics, Alpha House, 10 Carver Street,
Sheffield S1 4FS. Tel: (0742) 753423.

ITY
FUN

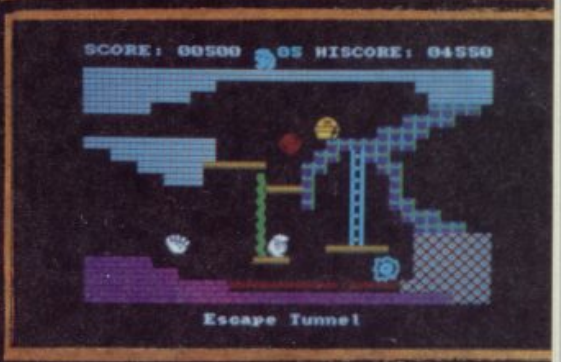
CBM64

Spectrum 48K

CBM64

Spectrum 48K

SEALINK



Super fit and desperate for freedom, Monty makes his daring escape from Scudmore Prison. Hounded by the bastions of law and order, our frightened hero finds refuge with the criminal underworld who offer him his chance to breathe fresh air and bask in the sunlight once again.

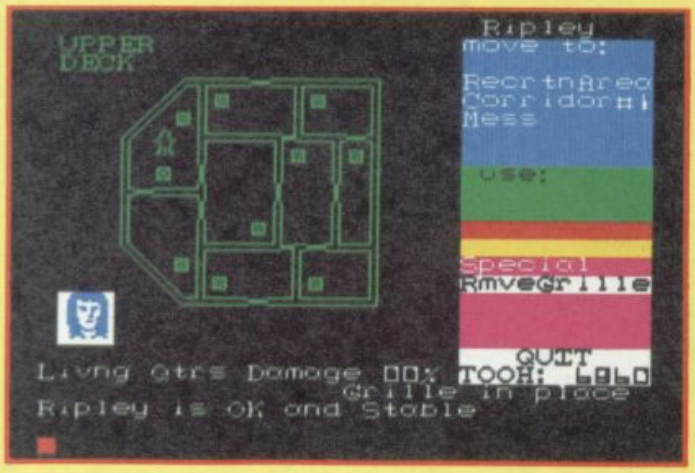
Moving from safe house to hideout to underground lair, Monty must select the correct five elements of his freedom kit from the many he's offered and not miss out on the hidden gold coins that will make him a mole of leisure.

At last he's free but can he make the cross-channel ferry on time?

CBM6

CBM64

Strategy



Chris Bourne takes a nostalgic trip through the battle-strewn fields of last year's strategy games

BEFORE PROGRAMMERS discovered sprites, 3D graphics and continuous fire buttons, strategy games were regarded as a sort of ideal computer entertainment. That was partly based on the idea that computers were essentially souped-up calculators and partly because mainframe computers were very good at games like chess.

If you were into computers when the Spectrum was launched, you'll remember titles like **Football Manager**, and **Flight Simulation** being held up as examples of the finest programs around. These days it's more likely to be **Alien 8, Shadowfire** or **Dun Darach**, and their reputation depends in great part on graphics programming.

One of the reasons for that is financial. In their wisdom, retailers and distributors tend to see strategy games as having a narrow appeal. They are the classic sleepers which sell steadily but slowly. The trade wants the money now and lots of it. That means quick-selling arcade games, preferably with some spin-off celebrity theme attached, which hits number one in the charts in a couple of weeks and stiffs out a month later.

Many of the fine strategy/simulation games, produced in 1985, saw little exposure in the shops — certainly not in the big high street chains. That does not mean they were no good. In fact, there has been something of an upsurge in the quality of strategy games recently, and most spectacularly in the field of wargames.

Wargames have as long a tradition as any sort of computer entertainment. If you've ever read the hefty instruction books for classic wargames of the past — Avalon Hill's *Afrika Korps* you'll understand why. Those rules tended to read like a computer program with complicated look-up tables for cross-referencing dice throws, gridded maps and strict sequences of actions within a given turn of play. They also took hours to play.

The computer is supposed to take all the argument of table-top gaming out of wargames. It quickly does all the adding up, it doesn't cheat, and it can handle secret moves easily.

Unfortunately, most wargames never turn out like that. Graphics tend to be based on unrealistic grids, the rules appear over-simple, and the computer generally takes a vast amount of time to think about the moves.

One such game, which in other respects might have deserved success, was **ATRAM**. The name stands for Advanced Tactical Reconnaissance and Attack Mission, which turns out to be a NATO exercise in which the RAF and USAF battle it out using Harrier jump jets. The idea neatly sidesteps the obvious problems involved in trying to flog a game based on bombing the daylights out of Port Stanley.

The game is a computer-moderated boardgame with a glossy magnetic board and stylized pieces that you slide about as if you were a real NATO general. Unfortunately, the computer part is less fun. The only excuse for the program is to handle the boring bits like keeping track of how much fuel each jet has consumed.

The author is clearly fixated on jargon, which makes the rules almost unreadable, and all moves are keyed-in in a jumble of letters and numbers. It is so easy to make a mistake that you'll never be entirely sure whether you're playing the game properly. Headbangers and retired Harrier pilots only.

A much better two-player wargame is **Confrontation** from Lothlorien. **Confrontation** is a wargame system which allows you to design your own maps and, within reason, choose the composition of your armies. That allows you to play at a tactical or strategic level. The flavour is essentially modern, with armour and mechanised infantry supported by footsloggers, artillery and air units.

To go with the system, Lothlorien has also released a set of four scenarios ranging from a fictional WWII invasion of Kent to guerilla warfare in Afghanistan and Angola. We found the Egypt-Israel scenario most interesting in that the open terrain left units extremely vulnerable without air support. The organisation of such support requires capturing and defending a chain of airstrips in order to reach Tel Aviv or Suez depending on which way you're going.

Nevertheless, **Confrontation** is still slow. The same cannot be said of **Overlords**, another two-player game

Alien

Formula One

from Lothlorien. Loosely based on an old boardgame favourite, *Campaign*, it is played across a large area of fairly basic terrain. The concept is abstract, involving footsoldiers, generals, and the Overlord. The objective is to capture strongpoints — ownership of which generates one piece per turn. The fighting is equally abstract, based on the number and strength of the pieces in contact with the enemy.

Both players play simultaneously, and the game is so fast that you'll almost certainly need joysticks — preferably one each. The pieces whizz about the screen and that leads to a magnificent confusion as both players simultaneously attempt to outflank their opponent.

By and large, it is the epic battles of WWII which command the keenest attention from programmers. **Battle for Midway** is a strange hybrid from PSS, and incorporates arcade sequences. The Battle of Midway was a crucial turning point in the war against Japan, when the US sent a force to smash the invasion fleet.

The PSS game falls into two parts. First, locate the course of the three arms of the Japanese forces. Having done that you must send out strike forces from your aircraft carriers to bomb them.

When battle is joined you get the chance to zap the Japs using a joystick, which rather spoils the point of a supposedly realistic wargame. The author claims it simulates the fog of war, or some such nonsense.

We found the game easy to beat — it's good to see the computer taking an active part in a solo game for once, but the graphics are primitive and not very clear. A year ago we might have had more praise, but there are better games around.

Much better, in fact, and the star of the bunch is undoubtedly **Arnhem** from CCS. CCS, like Lothlorien, specialises in strategy games. For years CCS games were worthy rather than exciting, and almost always writtin in super-slow Basic. With **Arnhem** the company has finally struck gold.

The game follows the thrust of the Allied armies across the Rhine against fierce German opposition. The main idea was simple enough. The British were supposed to hurtle down country roads to Arnhem while American paratroopers were dropped on the bridges ahead to hold them for the main advance.

Of course it wasn't as simple as that, and neither is the game. There are a number of levels at which you can play, until you get to the full battle. A time limit is set, and if you don't capture the bridges quickly enough you lose. The German task is therefore to hold up the advance.

The graphics are pleasant, and information about each unit's strength can be obtained by positioning the cursor. One of the best features is the movement system. You can choose to move in open or close order — open order means you are far less vulnerable to attack but cannot take proper advantage of the roads. The game can be played by up to three players — with three, one player gets the Germans and the other two play British and American forces.

The feel of the game is tremendously realistic, with the onus placed on keeping the British moving down the roads. **Arnhem** is absolutely recommended and will hopefully encourage other software houses to pull their socks up and match the standard.

Less attractive, but equally fast, is Lothlorien's **The Bulge** — the German counter-attack on Antwerp and Hitler's last great offensive in Western Europe. It was always doomed to failure, what with narrow country lanes and terrain choked in snow. The computer plays so quickly and viciously that you'll be hard put to survive.

Although **The Bulge** scores over **Arnhem** for speed, the graphics are less clear and the strategy less easy to fathom. Lothlorien has opted for simultaneous movement, and one is frequently reduced to hurling forces willy-nilly into the fray without much regard for tactics.

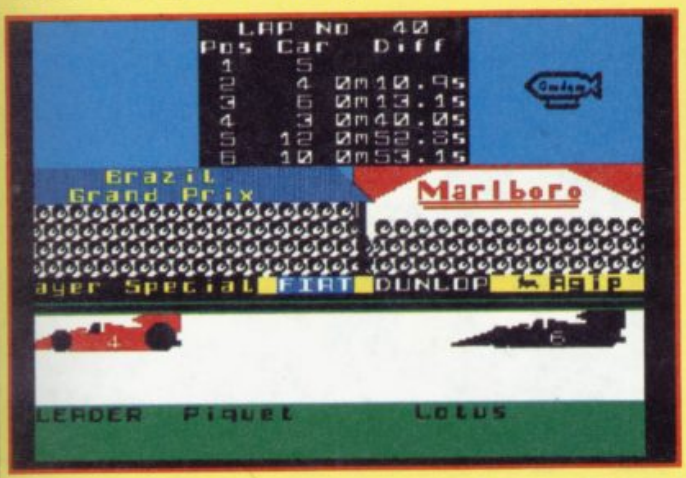
A pleasing feature of both **Arnhem** and **The Bulge** is that you can issue general orders to units which they will continue to obey until you change them. That is a sensible and much more realistic alternative and saves having to move fifty pieces every turn, slowing the whole flow of play.

Moving away from wargames, another category of great antiquity in computer circles is what is known as the land-management game. An early example of the genre was *Hamurabi* which puts you in charge of an ancient kingdom. You are head of a population, and there is corn in the treasury.

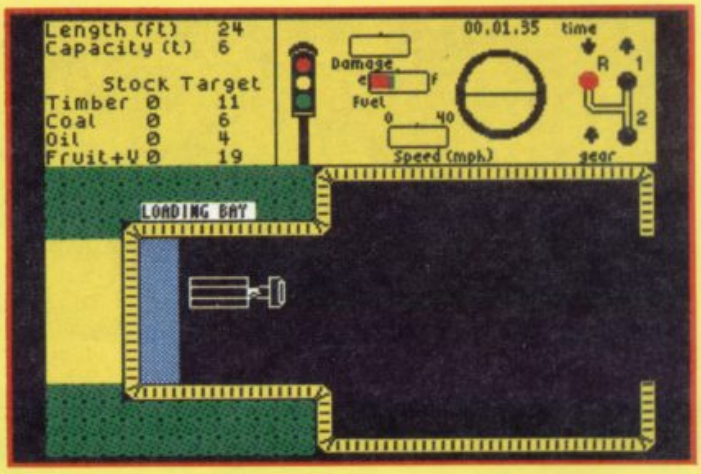
The idea is to manage the economy — based entirely on corn — so that everybody gets enough to eat. There is enough corn to sow for next year with some in reserve in case of natural disaster.

Of course, the way the game is set up at the beginning, there is never enough, so you get to make decisions about how many people to starve to death for the greater good of the rest, and so on.

Such games are very easy to construct on computers, and if you want to write your own strategy game we suggest you try something along those lines. The secret is to construct a set of formulae governing the relationship



Formula One



Juggernaut

between various factors — for example, how much food do people need? How many people are needed to sow an acre of land? How much corn?

There are very few business-type activities that cannot be simulated in that sort of way. Two famous games of this type are **Football Manager** from Addictive Games and **Mugsy** from Melbourne House, in which you play a gangster trying to run rackets with the aid of a none too loyal gang.

Sadly, Kevin Toms — Mr Football Manager himself — has not managed to follow that enormous success.

Addictive has brought out a number of games along similar lines in 1985, but none of them match the old classic.

Software Superstar casts you as a producer of games. You have to allocate time and money each month to releasing games, programming, advertising and the like. Nice touches include the decision to hype games or be honest about them, but the overall impression is dull, and we found it easy to get a hit program and reach the targets set.

Grand Prix Manager from the same outfit was equally tedious, with poor graphics to boot. Luckily CRL brought out the infinitely more entertaining **Formula One** — a *Sinclair User* classic — which we found totally compulsive.

Formula One is a full simulation of a grand prix season. Start off by hiring drivers and building cars — you have a million quid or so but it goes very fast. When the race starts choose your tyres and then watch the cars whizz past in convincing graphics. Messages inform you of the state of the track and incidents involving other cars, while a leader board keeps you in touch with the race positions.

Best of all, you can call pit stops for tyre changes, and the correct choice of timing may win or lose a race. The pit stop sequence is arcade based, and you have to manoeuvre a mechanic around the four wheels to complete it. Purists may have their doubts, but the speed of movement is linked to the amount of money you invested in the crew, and does not therefore make a mockery of the strategic element.

Formula One is a good game against the computer, but becomes really exciting when played with friends.

Almost as enthralling, although less well presented and rather more anarchic in play is **The Biz**, a simulation of the record industry from Virgin Games. You begin by choosing your social class — from stinking rich to unemployed — and then form a band. Hire a manager, go on the pub or college circuit and send endless demo tapes to bored record companies. If you have the money, you can cut your own discs, but beware — without the clout of the big boys behind you it may all go to nothing. The ultimate goal is, of course, to get a number one, but the road is full of pitfalls.

The game is full of subtle humour — you may reckon a dry ice machine is just right for your tacky rock band, but watch your credibility plummet. You may even get a chance to sample drugs during the game. Try it and see where it gets you.

On then to simulation proper, by which is meant those worthy and sometimes addictive attempts to portray accurately a real-life experience. The original impetus comes from the flight simulators used by airlines to train pilots, and for some time software houses only seemed to be interested in mimicking those.

They all look more or less the same, with an array of instruments on the lower half of the screen and a view of the horizon with occasional crude landmarks. Some are better than others for speed and ease of use, and the best are still Psion's antique classic, **Flight Simulation** and Digital Integration's **Fighter Pilot**, which is rather more difficult but does allow for aerial dogfights.

DACC specialises in those features, and recently brought out **747 Flight Simulator**. We've taken a bit of stick at *Sinclair User* for giving it the thumbs down, but I still maintain it's an unexciting production, mainly because the Jumbo jet isn't a patch on a light aircraft for aerobatics.

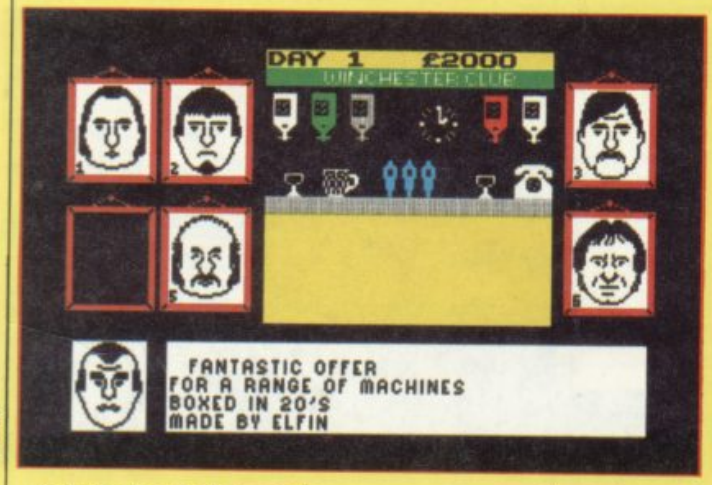
Real enthusiasts will probably enjoy it, it is certainly a worthy and apparently highly accurate program. If you're looking for entertainment, though, try elsewhere.

You might try looking at **Southern Belle** from Hewson Consultants. The program simulates the old Pullman service from London to Brighton, and you have to handle the great steam engine all the way.

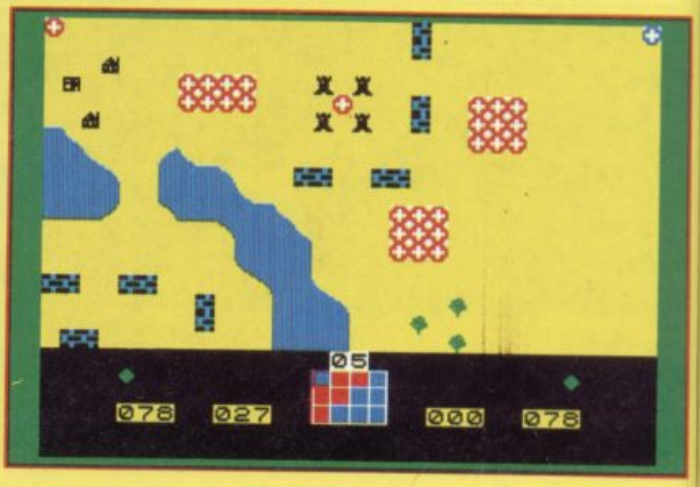
Initial levels involve handling only one or two controls while the computer does the rest, but you work up to a full schedule with stops, signals, hazards on the track, brakes and handling gradients, to name a few.

It is a surprisingly fulfilling program, and the wireframe graphics of recognisable landmarks along the track are well executed. You are marked at the end according to your accuracy on the schedule and how economically you conserved fuel.

Another unusual simulation is **Juggernaut** from CRL, in which you have to drive a container truck around town picking up cargoes. The screen shows an overhead view of the lorry and road, with traffic lights, status, steer-



Minder



747 Flight Simulator

ing and gears. The movement is slow and there are no other vehicles around — presumably you're driving in the middle of the night, council bye-laws notwithstanding. The irrepressible John Gilbert reckons the lorry looks like a Gillette GII razor. He's quite right, and although **Juggernaut** isn't a bad idea, the end result is rather dull.

Finally, a look at a few odds and ends which don't really fit any categories. One such **Minder**, a much-hyped trading game based on the famous television series.

You play Arthur Daley, the dodgy entrepreneur, and the idea is to buy and sell an incredible range of weird goods such as gold acupuncture needles while steering clear of the law in the form of mean Inspector Chisholm.

You do that by seeking out dealers and wide boys, either at their warehouses or in the Winchester Club. Terry, as ever, gets to do the fetching and carrying, and can also be hired to mind you — an important function when dealers discover goods are stolen.

In essence the game is simply trading, with a large text interpreter enabling you to bargain with characters in authentic Daley cockney — it understands words like bent, or pony. Once you get into it there's rather more strategy involved. You have to organise Terry's time so goods get collected and delivered on schedule, while you need sufficient cash to pay for the next lot.

Minder is a pleasant romp and deserved to do better in the charts than it did, but would have benefitted from a greater variety of incidents. Memory taken up with slang during the bargaining is fun at first but since it is really only window dressing it leaves you with the feeling that the game lacks depth.

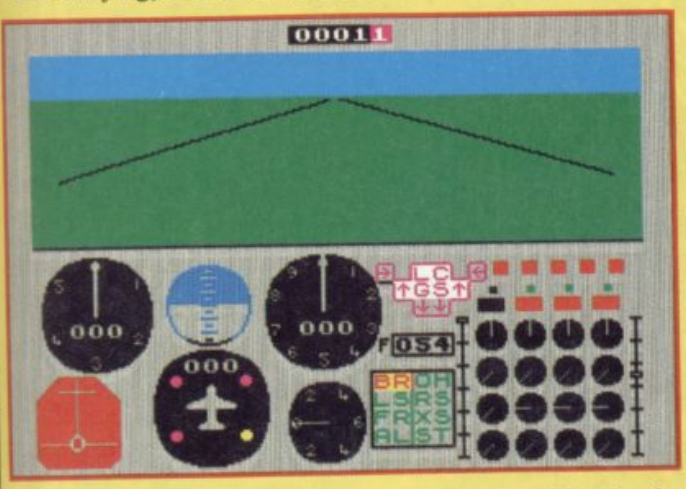
Alien on the other hand, from Argus, has plenty of depth but is difficult to get into. It follows the tense cult movie in which a devastating alien invades a spaceship and proceeds to exterminate the crew.

The game uses menus to pick characters, objects and locations in the spaceship Nostromo, while plans of the decks indicate your position. The idea is to destroy the alien either in a straight fight — fat chance — or by escaping from the ship and blowing it up by remote control.

You only see the alien when you are in control of a character in the same room. The rest of the time you can hear it as doors and ventilation grilles slide open, or your scanner picks up the presence of a living creature nearby. That makes for tremendous tension in the play, and the one drawback is the simplicity of the graphics which works against the otherwise strong illusion of involvement. Fans of the film will enjoy it. Others may find it tough going.

We have made no mention of some of the plethora of spin-off titles in the sports arena which might come under the umbrella of simulations. Those are generally disappointing, especially in comparison with the arcade based sports games. Two, which play quite well, are **Steve Davis' Snooker** and **American Football** from Argus — which has the added virtue of not involving a famous personality. **Nick Faldo's Open** is a lovingly programmed simulation of the course at Sandwhich which suffers from one horrible flaw. The closer your ball is to the flag on the green, the more difficult it is to judge the angle at which you should strike it. In fact, the reverse should happen.

It is heartening to see arcade games taking on more elements of strategy in their play. Arcade-adventures such as **Knight Lore** or **Gyron** — if you can categorise those masterpieces at all — have as much to do with logical thought and planning as they do with swift reactions. That argues a growing maturity, both among games publishers and also in public taste, as computer owners look for more than a quick joystick fix from their hobby.



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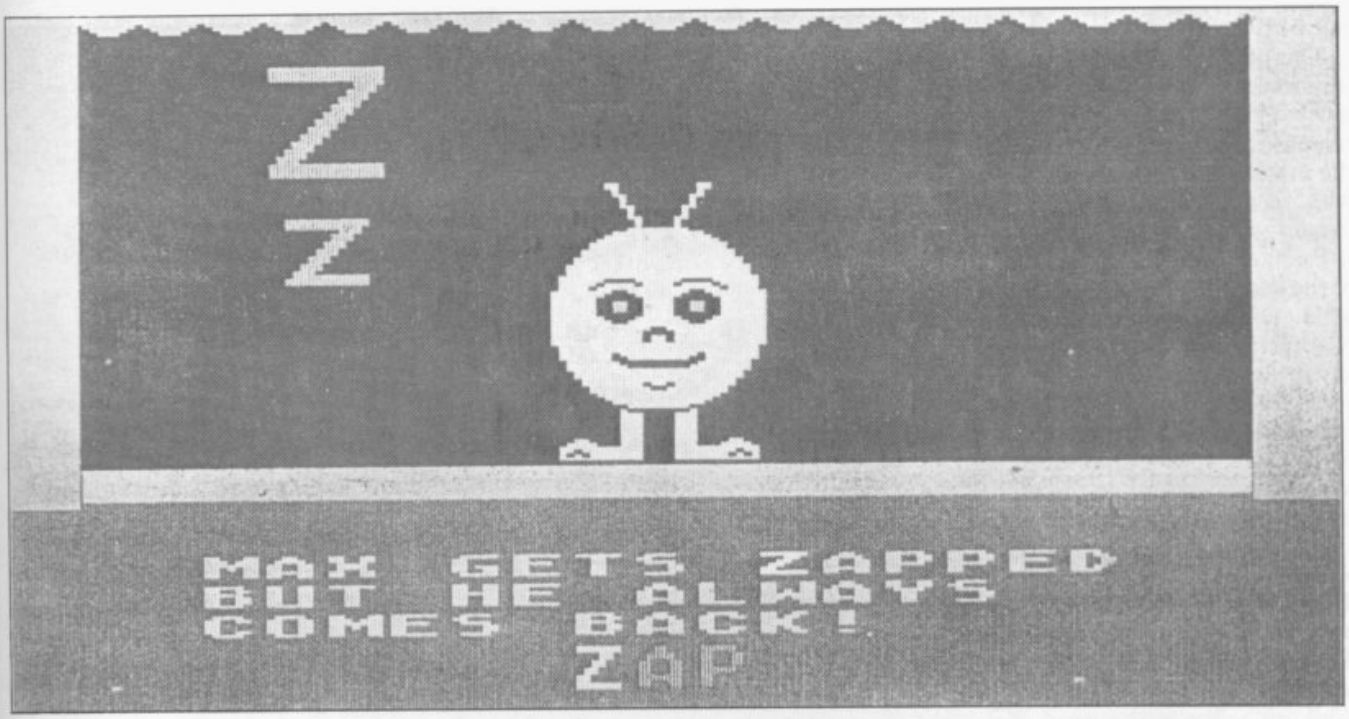


A first class romp

Theo Wood finds that educational software is a boon to teachers

ONE FEATURE which stands out when you look back on 1985 is the increasing sophistication of software in the learning field.

While previous years saw a mass of new software the quality was not necessarily good. There was a feeling that publishers were keen to jump on the bandwagon and produce software quickly for a perceived, rather than an actual, market.

Some of those programs were distinctly dull, but 1985 saw an increase in the games element and the fun/educational borderline became blurred.

Preschool learning

For the pre-school and infant age group **Romper Room** from Beyond is another attempt at using the Spectrum for initial alphabet teaching. **Romper Room** is much more lively than previous programs of this type. It features a character called Max who illustrates each letter with an action. The screen picture above is one example.

On the first game, Watch the Letters, both capital and small letters are shown together with a small sentence to be read by the parent. Max then acts the word, such as dancing for D. That is much more fun than a static graphic of an object.

The three other games in the package, Press a Letter, Find a Letter, and Letter Quiz work from that basis. Letter Quiz is the hardest of the games, where the player has to observe Max's action, determine the initial letter, and then press the letter on the keyboard.

Education publisher Macmillan has produced games which follow on from the kind of skills learnt in **Romper Room.**

Tops and Tails and **Castles and Clowns** are designed with the help of Betty Root, who is the 1985 President of the United Kingdom Reading Association. Those games are involved with the recognition of initial sounds and **Tops and Tails** introduces sound blends. Both feature games and, interestingly, two people can play. That is really useful when you have two children squabbling over who should play with the computer.

Mr T Meets His Match by Good Housekeeping, deals with memory skills. The players have to pick out pairs of animals as they turn over cards on the screen. The one-player option allows Mr T to be a forgetful or clever computer opponent. At a higher level the animals on the cards change to geometric shapes.

The other game, **Switcheroo**, provides food for thought as the task is to change one animal into another in four moves. That can be done by changing the size, colour, or animal. **Mr T Meets His Match** is an interesting package which deals with non-verbal skills using entertaining graphics.

Paddington's Garden Game is a gentle arcade frolic in which Paddington has to go around the garden to find a pot of marmalade, catching butterflies as he goes. The butterflies are released at the end of the game.

Joystick control ensures easy use. The game is innocent enough for the younger age group for which it is designed. Paddington fans should enjoy it, while practising hand/eye coordination.

Simple arithmetic

While today's educational thinking encourages calculators for yesterday's burdensome tasks of long division and multiplication, elementary numeracy cannot be ignored. Several programs work on that problem and are so designed as to deal with varying skill levels from five to 11.

Mirrorsoft's **Ancient Quests** package has a game called The Count which provides practice of simple counting to more complicated sums such as division and multiplication. Moving around the castle you must solve the problems posed before reaching the library where the Count

can be overcome.

The other game, King Tut's Treasure includes arcade action. You must move Professor Diggins around the screens, avoid the hazards and dig for the matching shapes, match a fraction with a decimal or fraction with a name.

Psion and ASK collaborated on two of the year's best programs which deal with numbers. **Estimator Racer** is another arcade classic in which you have to race around a track as fast as possible. The faster you go the more frequently you have to answer questions. The speed and level can be selected and depend on the type of car and player's control.

Estimator Racer is different from other similar programs in that it is not the correct answer which is needed but the one nearest to the answer. That skill is useful when using a calculator, and encourages quick thinking without the need for complete accuracy.

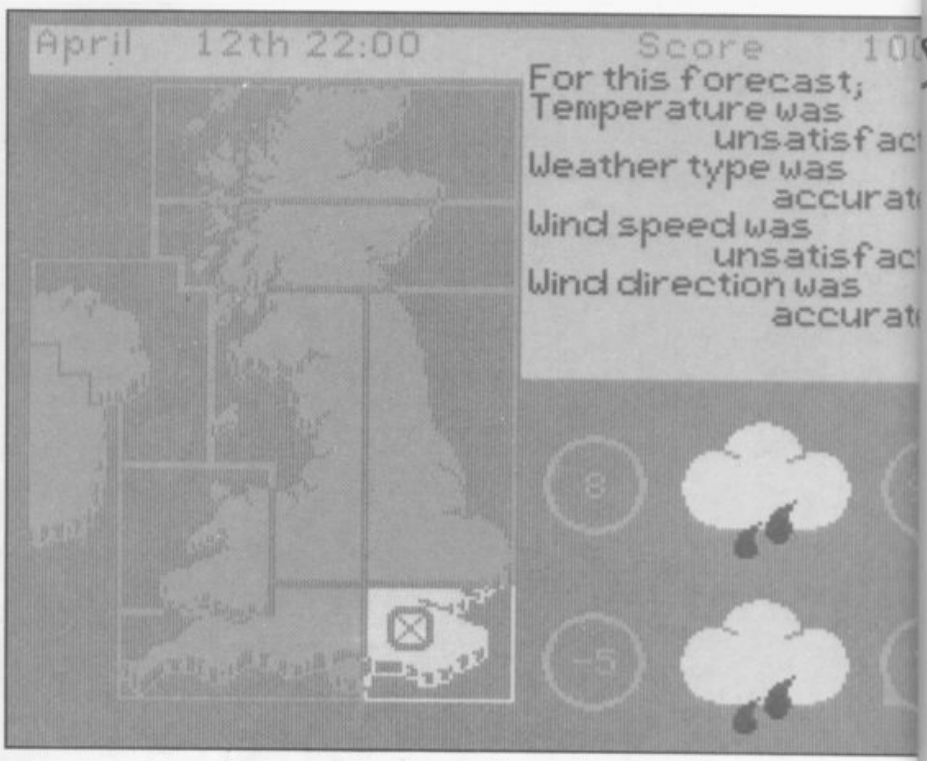
Number Painter is another program with the same pedigree. This time the aim is to reach the target number by painting out other numbers — such as +2, +3 — until the target is reached. Based on a platform and ladders game, and operating at a number of different skill levels, **Number Painter** is great fun and has enough action to appeal to players who are hooked on games.

Adventures

Adventure games have proved popular and the format is selling well in adventure books with multiple choice options. Taking an active role in the development of the plot, young readers are encouraged to improve their reading skills.

Mirrorsoft's **Phineas Frogg** must be considered a classic of its type for eight to 10 year olds. A story book is provided to fill in the plot background before you start the game, and a multiple choice of action is shown on each screen. There are also several arcade games which have to be played to solve the mystery, which is to save the scientist Mole from the Secret Lair of the Terrible Hamsters — SLOTH for short.

Jack in Magicland could be played by the same age group, or as with Phineas, with younger non-readers as an alternative to reading a story. Based on the old tale it too has options. As a text-only adventure it lacks some of the interest of Phineas, but that is compensated by using a more descriptive text.



Simulations

Simulations are one way of introducing a subject and practising skills. **Weathermaster** by Sinclair/Macmillan is one of my favourites. Using it you can play at being a weather forecaster.

Onscreen you see a picture of the British Isles and the frontal systems moving over the chart. The aim of the game is to provide a correct forecast. That must be done for each region until the whole country has been covered. If you can do that you can become a weathermaster — no mean feat.

Oilstrike is another in the Science Horizons series from Sinclair/Macmillan. It is a simulation similar to **Weathermaster** but this time you have to survey and drill for oil. The secret is to find suitable oilbearing strata before drilling, otherwise costs mount turning the operation into what could prove to be a fruitless exercise.

The success of sports simulations in the software charts proves their popularity. Two sports simulations which require more skill than usual are **Yacht Race** and **Run For Gold**, both from Hill MacGibbon.

Yacht Race is an introduction to the art of sailing and comes with a printed chart of the different courses. There are six levels of difficulty which allow the novice to learn by coping with steering the dinghy before moving on to trimming the sails and setting the balance.

Run For Gold similarly requires a learning curve to fully master the pace and steering of your two chosen runners. Setting the pace too high for your runners will quickly tire them out. The object of the game is to increase your fitness level in local meets, before moving on to reach Olympic standard.

The Spectrum is not noted for its musical capability but one program stands out which uses what little there is to the full. **Music Typewriter**, from Romantic Robot, enables you to print out a score on to a wide selection of printers and interfaces.

The product is a real aid to budding composers who are working with a musical instrument. You can ENTER the notes with the help of the keyboard overlay which is provided, and edit the tune bar by bar.

A substantial section dealing with setting key changes, rhythm or tempo, as well as right or left-hand play options, means that the package can cover a wide variety of musical styles. You cannot use chords, but that is a failing of the hardware.

More Logo logic

Sinclair's own version of **Logo** was a critical success in 1984 and provided Spectrum owners with the chance to experiment with a full implementation

continued on page 62

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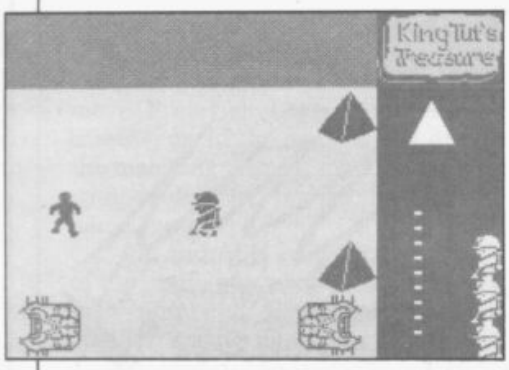

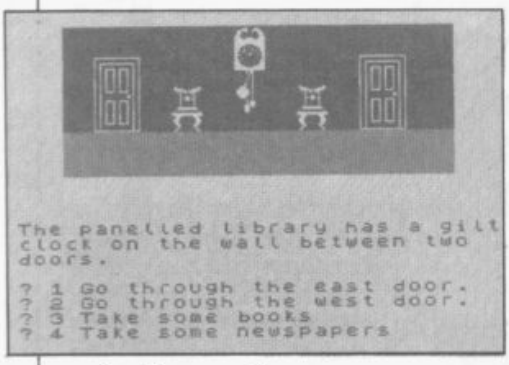

Ancient Quests, opposite
Phineas Frogg, below

continued from page 60

of the language. Two Logo lookalikes were released in 1985 which offer Logo facilities of Logo at a reduced price.

Spectrum Logo Graphics from Sigma deals purely with turtle graphics. Using a keyboard overlay the main commands can be ENTERed with single key stroke. Spacing between commands is added automatically. That may be of some help to younger children but the entry of commands will not deter most children. The big drawback with the program is, however, that routines cannot be SAVEd.

The second Logo program was **Picture Logic**, from Addison Wesley. The program is a reworking of Heather Govier and Malcolm Neave's earlier program **Logo Challenge.**

Picture Logic adopts the structured approach to turtle-type graphics. The book accompanying the software takes you through the first stages and beyond by a series of exercises, called challenges, with many hints and tips to help beginners. In neither of the two programs is there any list processing facility which can be found in the full Sinclair version. If, however, you want turtle graphics and want a structural approach **Picture Logic** is the best buy.

One package which is easy to use and provides access to the Spectrum's graphics capability is New Generation's **Light Magic.** The program allows you to draw onscreen, change brush size and generally play around with colour and pattern without any programming skills. A program such as that can give some insight into how a graphic system works as well as being instantly useable.

Bookware

For 11 to 16 year olds the Century Communications book *Maths Tutor for the Spectrum* is to be recommended. It is not a revision package but a self-contained maths course in book form with a tape for a few pounds extra.

A maths course could well be very difficult to follow but author Robert Carter has brought a masterly use of language into play which ensures that the whole subject does not become too dry. The explanations in the book are oustandingly clear and simple, and use of the programs in the book reinforces understanding of the mathematical concepts required up to O Level.

Revision programs are the mainstay of the program lists for secondary school age. The best of those on the science side are the Pan/Hill MacGibbon packages, called Pan Course Tutors. They cover all the usual science subjects and come with a text book.

There are diagnostic tests at the beginning of the programs which help students to identify weak spots in their study course.

The student is then directed to a suitable module. The modules make extensive use of screen windows, with one for the explanation, one for a question and a third for hints.

Penguin has released more titles in its study range, which mostly cover English Literature. Those operate on database techniques which allow you to browse through and follow characters in a novel or play. As the study of English Literature is largely interpretive, and the space for text is extremely limited, it would seem that those and other, similar, packages offer little real advantage over revision notebooks.

Worldly wise

A program for older students which does not concern revision is **Worldwise**, a study of nuclear weapons. It operates as a database as well as providing a basis for playing negotiation simulations. It is meant as a factual program and not, in itself, an opinion former.

The Richardson Institute for Conflict and Peace Research, at Lancaster University, operates an update system for members of the user group WUG — Worldwise Users Group, membership £2.00. Extra copies and microdrive versions can be obtained through the group at a special price.

Programs such as **Worldwise** can be used to provide the basis for intelligent discussion in an area which is renowned for bias and emotion, frequently unsupported by hard facts.

All in all, 1985 has been a good year for educational software. As it becomes less easy to rely on simple rule and drill exercises, producers of software are showing imagination and wit in their programs. In doing so the packages are becoming more attractive to use and more fun to play.

Early Learning

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Tops and Tails Macmillan **£5.95** ★★★★
Castles and Clowns Macmillan **£5.95** ★★★★
Mr T meets his Match Good Housekeeping **£9.95** ★★★
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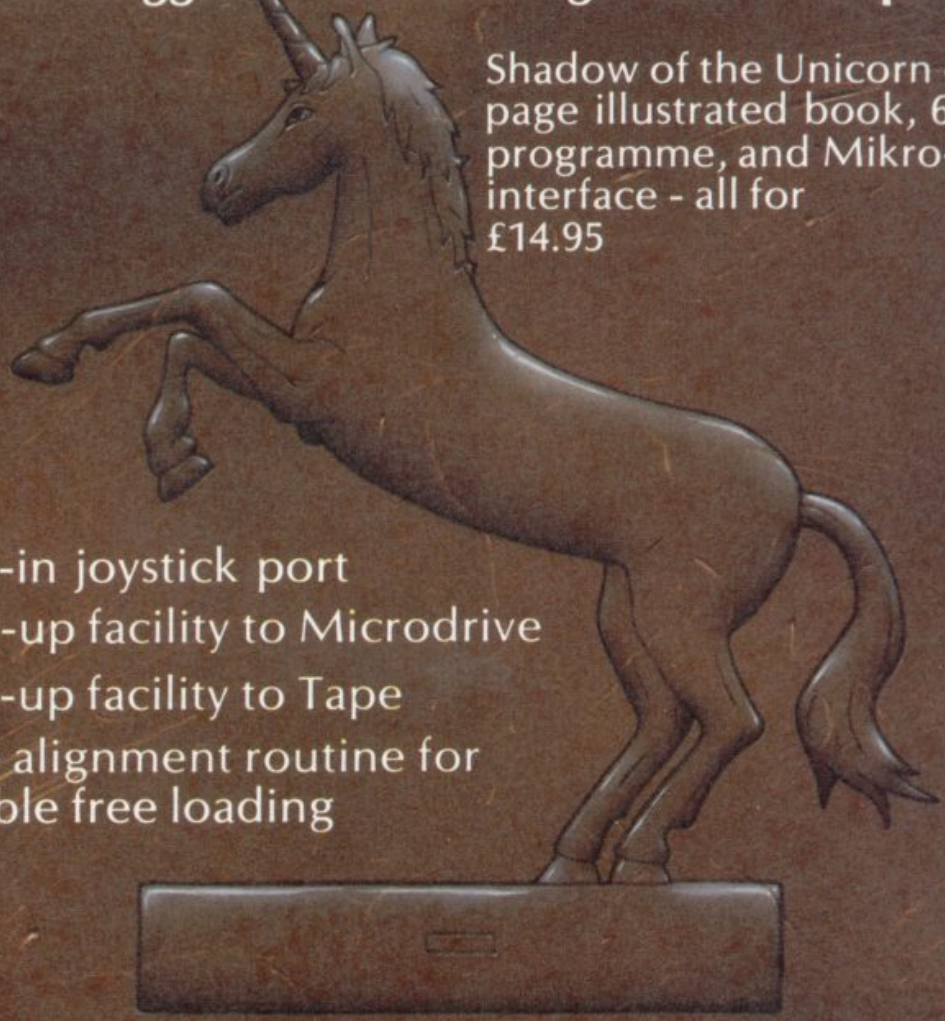

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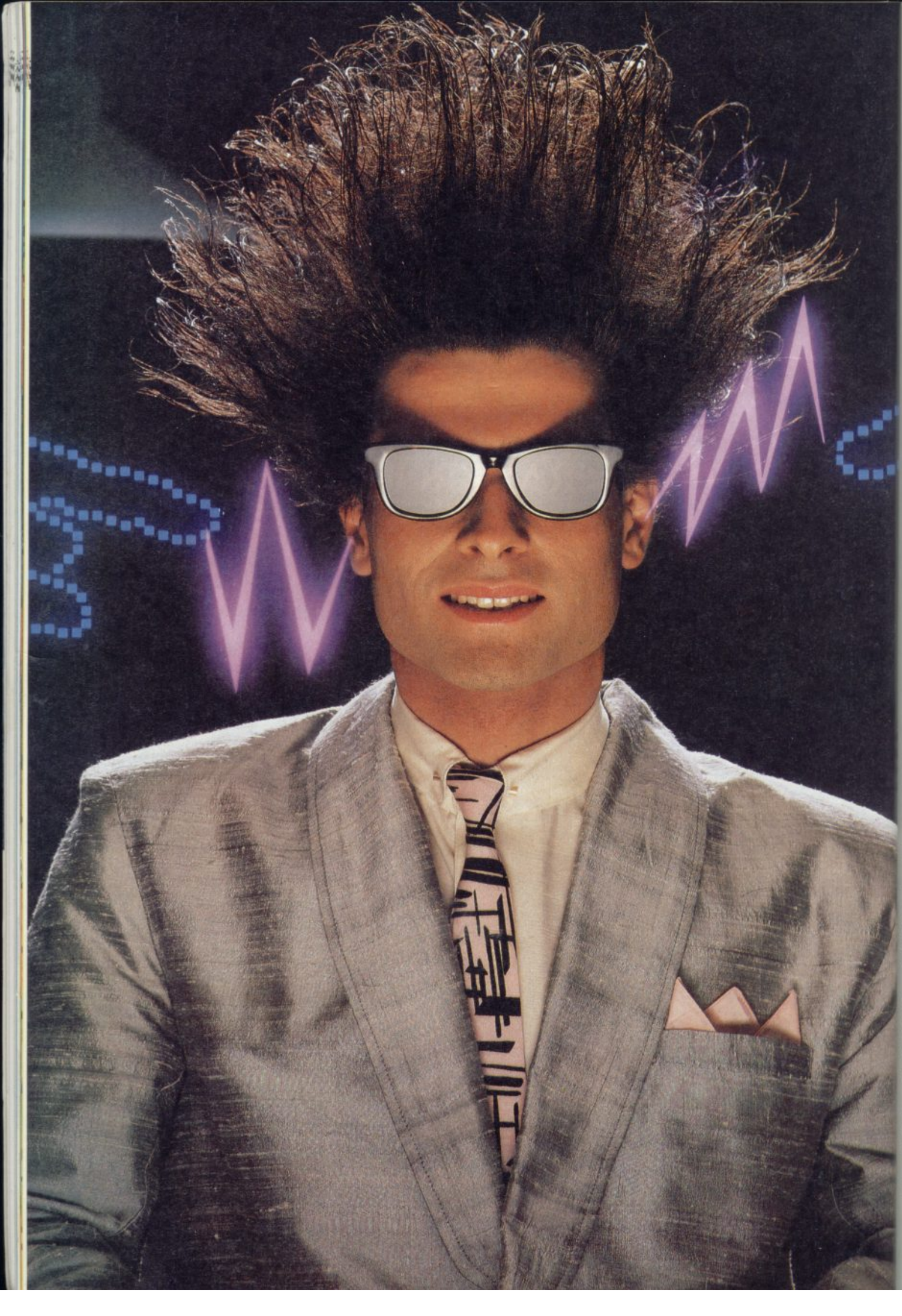

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Southend-on-Sea. Estuary Personal Computers, 318 Chartwell North, Victoria Circus Shopping Centre. Tel: 0702 614131.

GLOUCESTER

Cheltenham. Screen Scene, 144 St. Georges Road. Tel: 0242 528979.
Gloucester. Boots, 38-46 Eastgate Street. Tel: 0452 423501.

HAMPSHIRE

Basingstoke. Boots, 15 Old Basing Mall. Tel: 0256 51611.
Bournemouth. Boots, 18-20 Commercial Road. Tel: 0202 21713.
Fareham. Electronequip, 36-38 West Street. Tel: 0329 230670.
Fareham. Boots, 21 Westbury Mall. Tel: 0329 232011
Portsmouth. Micro Choice, 159 Havant Road, Drayton. Tel: 0705 327591.
Portsmouth. RDS Electrical (Portsmouth) Ltd, 157-161 Kingston Road. Tel: 0705 812478.
Portsmouth. Boots, 194/204 Commercial Road, Tel: 0705 825248.
Southampton. Boots, 23-29 Above Bar Street. Tel: 0703 333983.
Waterlooville. GB Microland, 7 Queens Parade, London Rd. Tel: 0705 259911.

HERTFORDSHIRE

Potters Bar. The Computer Shop, 197 High Street. Tel: 0707 44417.
Stevenage. DJ Computers, 11 Town Square. Tel: 0438 65501.
Watford. SRS Microsystems, 94 The Parade, High Street. Tel: 0923 26602.
Welwyn Garden City. DJ Computers. 40 Fretherne Road. Tel: 96 28444

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Beverley. Computing World, 10 Swabys Yard, Dyer Lane. Tel: 0482 881831.
Grimsby. R.C. Johnson Ltd, 22 Friargate, River Head Centre, Tel: 0472 42031.
Hull. Boots, 48-58 Prospect Centre. Tel: 0482 22334.
Hull. Computer Centre, 26 Analby Road. Tel: 0482 26297.

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Douglas. T.H. Colebourn, 57-61 Victoria Street. Tel: 0624 73482.

KENT

Ashford. DGH, 10 North Street. Tel: 0233 32597.
Beckenham. Supa Computers, 425 Croydon Road. Tel: 01-650 3569.
Bromley. Boots, 148-154 High Street. Tel: 01-460 6688.
Chatham. Boots, 30-34 Wilmott Square, Pentagon Centre. Tel: 0634 405471.
Gravesend. Gravesend Home Computers, 39 The Terrace. Tel: 0474 28871.
Folkstone. Boots, 24-26 Sandgate Road. Tel: 0303 54007
Maidstone. Boots, 56-62 King Street. Tel: 0622 53912.
Maidstone. Kent Micros, 52 Union Street. Tel: 0622 52784.
Rainham. Microway Computers, 39 High Street. Tel: 0634 376702.
Sevenoaks. Ernest Fielder Computers, Dorset Street. Tel: 0732 456800.
Shortlands. The Village House of Computers, 87 Beckenham Lane. Tel: 01-460 7122.
Sittingbourne. Computer Plus, 65 High Street. Tel: 0795 25677.
Tunbridge Wells. Boots, 7-11 Calverley Road. Tel: 0892 26486.
Tunbridge Wells. Modata Computer Centre, 28-30 St. Johns Road. Tel: 0892 41555.

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Blackpool. Boots, 28-38 Bank Hey St & Victoria St. Tel: 0253 22276.
Blackpool. Blackpool Computer Store, 179 Church Street. Tel: 0253 20239.
Bolton. Computer World UK. 208 Chorley Old Road. Tel: 0204 494304
Burnley. IMO Computer Centre, 39-43 Standish Street. Tel: 0282 54299.
Lancaster. Northern Lights, 89 Scotforth Road. Tel: 0524 62634.
Preston. 4Mat Computing, 67 Friargate. tel: 0772 561952.
Rochdale. Boots, 50 Market Way. Tel: 0706 53225.

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Leicester. Boots, 30-36 Gallowtree Gate. Tel: 0533 21641.
Leicester. DA Computers 104 London Road. Tel: 0533 549407.
Market Harborough. Harborough Home Computers. 7 Church Street. Tel: 0858 63056.

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W1. Computers of Wigmore Street, 104 Wigmore Street. Tel: 01486 0373.
W1. Galaxy. 230 Tottenham Court Road. Tel: 01-636 6500.
W1. Sonic Foto Micro Center, 256 Tottenham Court Road, Tel: 01-580 5826.
W1. Tomorrows World Today, 27 Oxford Street. Tel: 01-439 7799.
WC1. Transam Micro Systems, 59-61 Theobalds Road. Tel: 01-405 5240.
W8. Boots, 127a Kensington High Street. Tel: 01-937 6882.
SE7. Vic Oddens Micros, 6 London Bridge Walk. Tel: 01-403 1988.
SE15. Castlehurst Ltd, 152 Rye Lane, Peckham. Tel: 01-639 2205.
EC2. Devron Computer Centre, 155 Moorgate. Tel: 01-638 3339.
N14. Logic Sales, 19 The Bourne, The Broadway, Southgate, Tel: 01-882 4942.
N22. Boots, 38-40 High Road, Wood Green. Tel: 01-881 0101.
NW4. Davinci Computer Store, 112 Brent Street, Hendon. Tel: 01-202 2272.
NW4. Boots, Brent Cross Shopping Centre. Tel: 01-202 5256/7.
NW11. Computers Inc, 86 Golders Green. Tel: 01- 209 0401.

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Altrincham. Boots, 13-17 George Sreet. Tel: 061-928 4471
Hyde. C Tech Computers, 184 Market Street. Tel: 061-366 8223
Manchester. Boots, 32 Market Street. Tel: 061-832 6533.
Manchester. Mighty Micro, Sherwood Centre, 268 Wilmslow Road, Fallowfield. Tel: 061-224 8117.
Manchester. NSC Computer Shops, 29 Hanging Ditch. Tel: 061-832 2269.
Marple. Marple Computer Centre, 106 Church Lane. Tel: 061-449 9933.
Oldham. Home & Business Computers, 54 Yorkshire Street. Tel: 061-633 1608.
Oldham. Boots, 1 Town Square Shopping Centre. Tel: 061-624 2525
Stockport. National Micro Centres, 36 St Peters Gate. Tel: 061-429 8080

MERSEYSIDE

Liverpool. Hargreaves, 31-37 Warbreck Moor, Walton. Tel: 051-525 1782.
St Helens. Microman Computers, Rainford Industrial Estate, Mill Lane, Rainford. Tel: 0744 885242.
Southport. Boots, 31-39 Chapel Street. Tel: 0704 33907.
St. Helens. Boots, 8 Church Street, 24 La Grange Arcade. Tel: 0744 25488.

MIDDLESEX

Harrow. Camera Arts, 42 St. Anns Road, Tel: 01-427 5469.
Hounslow. Boots, 193-199 High Street. Tel: 01-570 0156.
Southall. Twillstar Computers Ltd, 7 Regina Road. Tel: 01-574 5271.
Teddington. Andrews, Broad Street. Tel: 01-977 4716.
Twickenham. Productive Computers Ltd, 72 Heath Road. Tel: 01-891 4991.
Uxbridge. JKL Computers, 7 Windsor Street. Tel: 0895 51815.

NORFOLK

Norwich. Adams, 125-129 King Street. Tel: 0603 22129.
Thetford. Thetford CB & Micros, 21 Guildhall Street. Tel: 0842 61645.

NOTTINGHAMSHIRE

Mansfield. Boots, 39 Four Seasons Shopping Centre, Tel: 0623 23089.
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Worksop. Computer Graphix, 32 Bridge Street. Tel: 0909 472248.

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Kettering. Boots, 35 Gold Street. Tel: 0536 514675.
Northampton. Boots, 9 The Parade. Tel: 0604 22573

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Morpeth. Telerents (Northern) Ltd, 31 New Gate Street. Tel: 0607 513537.

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Abingdon. Ivor Fields Computers, 21 Stert Street, Tel: 0235 21207.
Banbury. Computer Plus, 2 Church lane. Tel: 0295 55890.
Oxford. Science Studio, 7 Little, Clarenden Street. Tel: 0865 54022.
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Aberdeen. Boots, 133-141 Union Street. Tel: 0224 585349.
Dundee. Boots, 49-53 High Street, Tel: 0382 21756.
Edinburgh. Boots, 101-103 Princes Street. Tel: 031-225 8331.
Edinburgh. Microworld Computer Group. 12 Leven Street. Tel: 031 228 1111
Edinburgh. Edinburgh Computers, 51-57 Lothian Road. Tel: 031 229 4418.
Edinburgh. Silicon Centre, 7 Antigua Street. Tel: 031 557 4546.
Glasgow. Boots, 200 Sauchiehall Street. Tel: 041 332 1925.
Glasgow. Microworld Computer Group, 11 Bath Street. Tel: 041 332 1116.
Glasgow. Boots, Union Street and Argyle Street. Tel: 041 248 7387.
Glasgow. Tom Dixon Cameras, 15-17 Queen Street. Tel: 041-204 0826.
Glasgow. Commscot Ltd, 30 Gordon Street. Tel: 041 226 4878.
East Kilbride. Boots, 33-37 The Plaza. Tel: 035 52 20629.
Falkirk. Boots, 79-91 High Street. Tel: 0324 20535.
Hamilton. Tom Dixon Cameras, 8 Cadzou Street. Tel: 0698 283193.
Peterhead. North East Computers. 1 Ellis Street. Tel: 0779 79900.

SHROPSHIRE

Shrewsbury. Computerama, 13 Castlegate. Tel: 0743 60528.
Telford. Computer Village, 2/3 Hazeldine House, Central Square. Tel: 0952 506771.
Telford. Telford Electronics, 38 Mall 4. Tel: 0952 504911.

SOMERSET

Taunton. Boots, 64-65 High Street. Tel: 0823 76061.

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Newcastle-under-Lyme. Computer Cabin, 24 The Parade, Silverdale. Tel: 0782 636911.
Stoke on Trent. Town Computer Store, 30 Town Road, Hanley. Tel: 0782 287540.
Stoke on Trent. Boots, 3-5 Market Square, Hanley. Tel: 0782 23271.

SUFFOLK

Bury St. Edmunds. Boots, 11-13 Cornhill. Tel: 0284 701516.
Bury St. Edmunds. The Suffolk Computer Centre, 1-3 Garland Street. Tel: 0284 705503.
Ipswich. Computer Magic, 24 Crown Street. Tel: 0473 50965.

SURREY

South Croydon. Concise Computer Consultants. 1 Carlton Road. Tel: 01-681 6842.
Croydon. The Vision Store, 53-59 High Street. Tel: 01-686 6362.
Croydon. Boots, The Mall, 12-18 Whitgift Centre. Tel: 01-688 6021.
Epsom. The Micro Workshop, 12 Station Approach. Tel: 0372 721533.
Guildford. Guildford Computer Centre, 5 The Quadrant, Bridge Street. Tel: 0483 578848.
Wallington. Surrey Micro Systems, 53 Woodcote Road. Tel: 01-647 5636.
Woking. Harpers, 71-73 Commercial Way. Tel: 0486 225657.

SUSSEX

Brighton. Boots, 129 North Street. Tel: 0273 27088.
Brighton. Gamer, 71 East Street. Tel: 0273 728681.
Bognor Regis. Bits & Bytes, High Street. Tel: 0243 867143.
Eastbourne. Boots, 15 Eastbourne Arndale Centre. Tel: 0323 27742.
Horsham. Boots, 1 Swan Walk, Tel: 0403 53053.
Horsham. Orchard Computer Centre, 34 East Street. Tel: 0403 64884.
Worthing. Boots, 48-52 Montague Street. Tel: 0903 207106.

TYNE & WEAR

Newcastle-upon-Tyne. Boots, Eldon Square. Tel: 0632 329844.
Newcastle-upon-Tyne. RE Computing, Parkview House, Front Street, 4 Lane Ends. Tel: 091 2701740.
Sunderland. Business Micro Communications Ltd, Refuge Assurance Buildings, Saint Thomas Street, West Sunniside. Tel: 0783 654916.

WALES

Aberdare. Inkey Computer Services, 70 Mill Street, The Square, Trecynon. Tel: 0685 881828.
Aberystwyth. Aberdata at Galloways, 23 Pier Street. Tel: 0970 615522.
Cardiff. Boots, 36 Queens Street & 105 Frederick Street. Tel: 0222 31291.
Cardiff. The Computer Shop, 41 The Hayes. Tel: 0222 26666.
Cardiff. Cardiff Microcomputers, 46 Charles Street. Tel: 0222 373072.
Newport. Gwent Computers, 92 Chepstow Road. Tel: 0633 841760.
Newport. Boots, 155-156 Commercial Street. Tel: 0633 51212.
Swansea. Boots, 17 St. Marys Arcade, The Quadrant Shopping Centre. Tel: 0792 43461.
Swansea. The Micro Store, 35-36 Singleton Street. Tel: 0792 46980.

WARWICKSHIRE

Coventry. Boots, 38-42 Corporation Street. Tel: 0203 26561.
Leamington Spa. Boots, 31 Parade. Tel: 0926 24945.
Leamington Spa. Leamington Hobby Centre 121 Regent Street. Tel: 0926 29211.
Nuneaton. Micro City, 1a Queens Road. Tel: 0203 382049.
Rugby. O.E.M., 9-11 Regent Street. Tel: 0788 70522.

WEST MIDLANDS

Birmingham. Boots, City Centre House, 16-17 New Street. Tel: 021-643 7582.
Dudley. Central Computers, 35 Churchill Precinct. Tel: 0384 238169.
Stourbridge. Walters Computer Systems. 12 Hagley Road. Tel: 0384 370811.
Walsall. New Horizon, 1 Goodall Street. Tel: 0922 24821.

WILTSHIRE

Trowbridge. West Wiltshire Micros, Whiteheart Yard. Tel: 02214 67259.

YORKSHIRE

Bradford. Boots, 11 Darley Street. Tel: 0274 390891.
Doncaster. Boots, 13-15 French Gate, Tel: 0302 62238.
Barnsley. Boots, 34-40 Cheapside. Tel: 0226 82616.
Huddersfield. Micro World Computers, 1006-1010 Manchester Road, Linthwaite. Tel: 0484 846117.
Huddersfield. Boots, 22 King Street. Tel: 0484 21756.
Leeds. Boots, 19 Albion Arcade, Bond Street Centre. Tel: 0532 33551.
Leeds. Micro Power, Northwood House, North Street. Tel: 0532 458800.
Sheffield. PIP Micro Communications, 9 Taptown Crescent, Broomhill. Tel: 0742 661096.
Sheffield. Boots, 4-6 High Street. Tel: 0742 78333.
Wakefield. Boots, 26-28 Upper Kirkgate. Tel: 0924 376181.
York. York Computer Centre, 7 Stonegate Arcade. Tel: 0904 641862.

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Disc software

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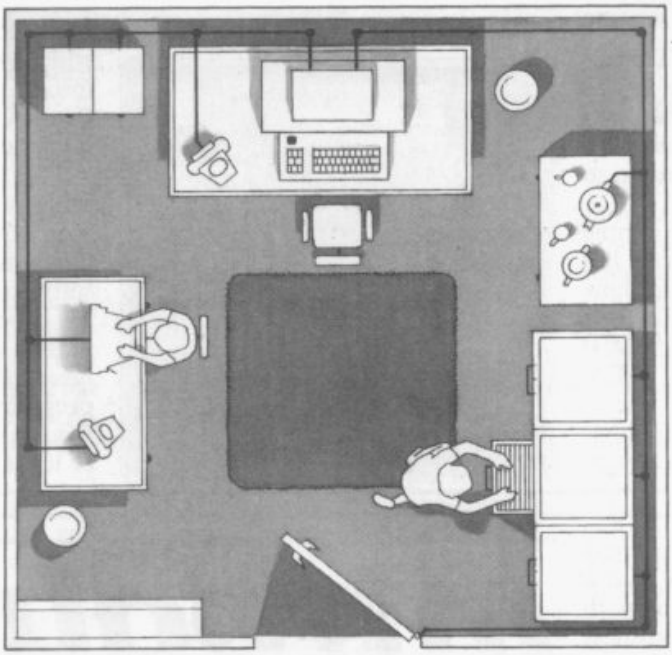

THE ARGUMENT over the usefulness of Sinclair computers in business continues. Supporters are mostly independent businessmen with small to medium size companies who are also computer enthusiasts. They have found that, within limitations, Spectrums, QLs and even ZX-81s can be used successfully for specific, clearly defined tasks. Although the detractors are a less homogenous group, their arguments have consistently centred on the lack of disc drives.

A bewildering array of disc interfaces and drives now exists for the Spectrum and QL. That is only the start, suitable software to run on the discs must also be found. While commercial tape or microdrive to disc conversion programs are available, and indeed most manufacturers now include one in their system, software written especially to make the most of a disc's features is rare. In part this is caused by many different systems occupying what is still a relatively small sector of the market. Software houses will not spend a great deal of time and money on writing programs that which will generate little or no profit.

The Spectrum situation seems to be getting better, with two manufacturers, Opus and Kempston, setting the pace for available business programs. Although neither has yet had any software specially written OCP, in conjunction with the designers of the Kempston interface (Abbeydale Designers), has converted most of its business programs to make best use of the interface. The Opus system has **Mini Office** from Database Software, and Transform is converting its software to run on the system.

For the Spectrum more software is going to be available in disc format during the coming year. However, such software is still likely to consist of conversions to run on the systems rather than be designed to make the most of them.

QL software seems to have been written, in the main, with disc drives in mind. While Medic has produced its own business software with its discs Quest has released CP/M 68K for its disc system. The problem is that while CP/M has become an industry standard operating system for Z80 processors with a glut of software written for it, CP/M 68K for 68000 processors has not yet made the same impression and software is still scarce and expensive. Again, partly because of the proliferation of disc systems for the QL (five at the last count), most of the software released for the QL in the coming year will be for use on microdrives and not for specific systems.

Having concentrated on disc systems for both the Spectrum and QL it would be easy to imagine that there is no place for other storage media such as microdrives and wafadrives. When the wafadrive was launched for the Spectrum it came with its own specially written word processor, **Special Writer**. There was also the promise of a database and a spreadsheet to follow. To the best of my knowledge those products are still waiting to be released and publicity about other software for the wafadrive seems virtually non-existent.

The main advantage of the wafadrive over microdrive was its reliability. Refinements of the design and manufacturing process seem to have improved the microdrive's reliability considerably. However, the wafadrive still seems more reliable — an important factor for business users wishing to keep large amounts of data.

There is no sign that further specially written software is likely to appear for any of the independent markets, but all software is likely to be written to run from tape or microdrive. If speicalised software does appear it is highly likely that it will be that much more expensive than anything already available. Business software for the Spectrum probably costs about a tenth to a fifth of that for recognised business machines, while for the QL it is about a quarter of the cost. Although the quality of some software already matches that produced for more expensive computers, the overall quality can be expected to improve as programmers find new ways of extracting more performance from the machines. Despite those improvements the cost of the software can be expected to remain at a fraction of the cost of the business software for more expensive machines.

The majority of business programs for Sinclair computers are still written in Basic. Because of the low quality of Basic games compared to those written in machine code some writers have highlighted that as a weakness of such programs. That is not necessarily true. Machine code usually results in a program which is faster at processing data than one in Basic, but the majority of time in business programs is spent in entering data, not in processing it. Partly because of the games market there are many more machine

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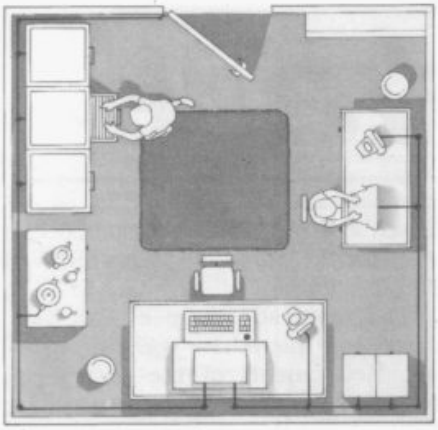

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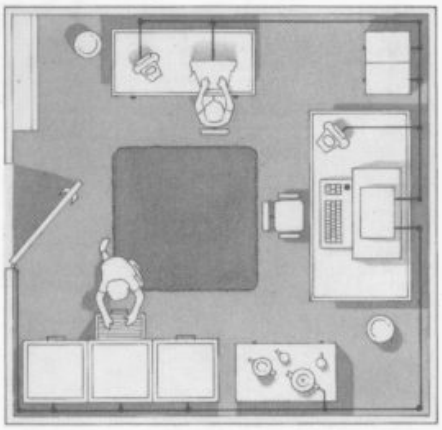
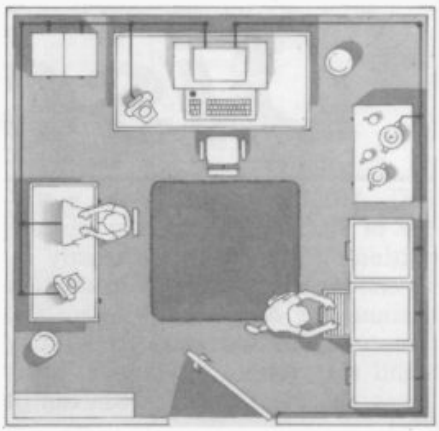
code programmers around. That is likely to result in an increase in the number of business programs written in machine code, although the more specialised programs will continue to be written in Basic.

Since the arrival of the Apple Macintosh a great deal of interest has been focused on WIMPS and how they make business software easier to use. In the jargon jungle WIMP stands for Windows, Icons, Mice Programs or programs that use a number of little screens or windows within the display screen. Each window can be scrolled independently of the others. They use pictures — icons — instead of words for a menu and use a mouse to enter data.

A mouse is a device which uses an on screen pointer to pick out and select icons. The pointer is moved by running the mouse across the desk and the icon is selected by pressing a button on the mouse. So far such software has been generally available only for the more expensive 16-bit computers. However, it is only a matter of time before WIMPS become available for the QL.

Windowing on the Spectrum may be difficult but the **Fourth Protocol**, which was recently released by Hutchinson, uses icons and I understand that OCP has a graphics package in preparation that uses a mouse.





The coming year is unlikely to see much development of disc based programs, those that become available are likely to be conversions of existing software. However, developments can be expected as more programs are written in machine code and programmers, possibly using techniques learnt programming games, stretch the machines capabilities, allowing the use of icons and mice.

Introducing computers

Mike Johnston shows how you can easily computerise your business

ANY ADVICE on buying business software needs to be prefaced with a word of warning. Before parting with your hard-earned cash for a business program you need to be as clear as possible in your own mind, firstly, what task it is that you want to computerise and secondly, just what you expect the computer to do for you. The third stage is to look at the software available and your specific requirements.

A surprising number of companies, big and small, have run into difficulties because they have neglected just that point. Given that computers are firmly based on logic, it is ironic that human reaction to them is so often illogical. A strange kind of mania sometimes afflicts normally rational people when computers are intoroduced into business. Those who don't know too much about computing either take an over optimistic view and see them as a magic wand to be waved over a problem, or they fear them as a branch of the black arts, to be avoided as far as possible.

On the other hand, there is the enthusiasts approach, which is little better, and involves using the computer wherever and whenever possible.

That is fine for a hobby, but can be quite lethal in a business, and in the long run can cost much more than the purchase price of the software. It needs to be said that computers are not always the answer. Manual systems are quicker and more flexible for some jobs and inappropriate software will waste both your time and your money.

As a first step it is worth putting down on paper how a job works and exactly what you would like the computer to do. Armed with that, you will find it easier to evaluate and compare programs that are available.

In thinking about the way you do the job now, you need to ask a number of questions. Is your system likely to change in the near future? Will it expand or contract? How central is the job to the rest of your business? Is it time critical? Smaller business systems like the Spectrum and QL are most often used as an aid to business — for example, a word processor for standard replies, a spread sheet for financial estimates or for costings, or a database to hold mailing lists. That type of use can speed up your operation or provide facilities you could not otherwise manage.

However, if you intend to computerise your stocklist or accounts, you need to be more careful about the quality of the software you buy and to think about what you will do for back-up — a second QL for emergencies? — and for training.

Large companies pay systems analysts and designers to examine and describe the existing job and consider how it could be dealt with by a computer. As a small business user, you must effectively be your own consultant or systems analyst.

Suitability

The first and most important consideration when looking at software must be how far it goes towards meeting your requirements. It is unlikely to be a perfect fit, and you must decide if you are prepared to sacrifice some of the features of your present manual system to gain the advantages the program offers.

Alternatively, how easily can the system be modified to bring it closer to what you want or to meet your future needs? Is it fast enough, is it expandable, is it flexible?

Price

Sinclair computer owners are in the fortunate position of having a good deal of reasonably priced software available. If your experience of computers is limited, you could be in for a nasty shock if you decide to upgrade to a large business system. The price of a single program may exceed the entire amount you have spent on all your Spectrum programs.

QL programs are, of course, more expensive, partly because of the smaller user base, but they are still cheap compared with ordinary business programs. And QL owners start with the advantage of having the four most common business programs supplied free.

Reliability

If your latest shoot 'em up game fails to load one evening, or crashes just as your are about to exceed the all-time high score, you may be justifiably annoyed. However, if the same thing happens to your mailing list just as you are about to make a back-up copy, or to your accounts program as it works out your VAT returns, annoyance can barely describe the experience. You may lose days or weeks of work, and potential customers.

As a business user, the reliability of the software you choose must be of paramount importance. A program may be forgiven for being slow, poorly documented and hard to use, but it can not be forgiven for being unreliable if you intend to trust your valuable data to it. There are some programs which give a balance with 0.001 pence in the answer. Others that crash on simple input errors are mercifully fewer than they were but are still around. It is not too difficult to pick out those watch the system lock up — preferably before you buy it. Some suppliers offer a help line or back-up service, and that is worth having.

Documentation

If the suppliers have bothered to provide a well written explanation of how there program works there is a reasonable chance they have taken the trouble to make the program approachable.

Dismal software documentation has a long history and there is still a lot of it about. It is often written by programmers with limited concessions to the novice, sometimes badly printed, full of elementary spelling mistakes, and even factual errors and omissions. You should not let that put you off though, particularly with regard to the smaller applications programs which may still be good, despite the poor presentation.

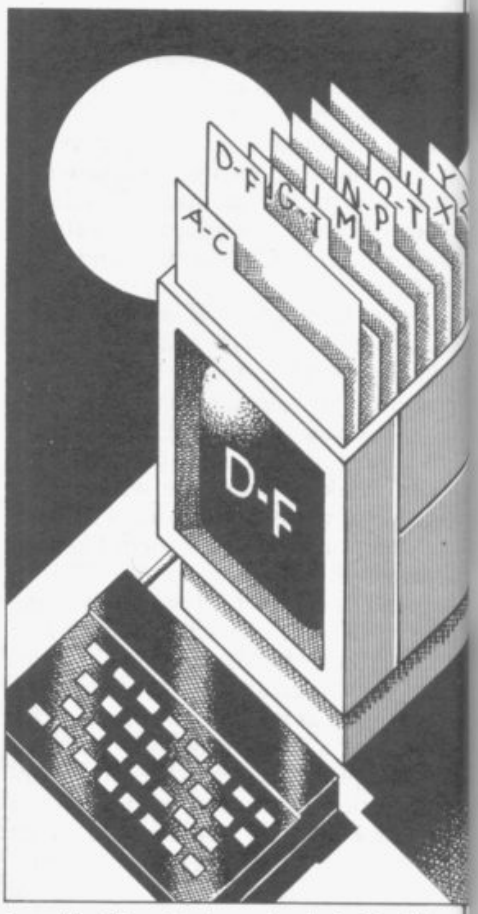
By all means have a go at computerizing some of yor business applications — it can be tremendously enjoyable and educational — but unless you are clear about what you are doing, it will not necessarily help your business.

User friendliness

Just how easy it is to use a program can only be found in practice. It certainly helps if a program starts with a list of options, offers an easily accessible help facility when you get stuck and provides meaningful error messages when you make a mistake it is worth checking to see if the program you have in mind offers those facilities. However, there is sometimes a trade off between ease of use and flexibility. Some programs are user friendly because they are highly structured and will only allow you to take certain options.

Tailored to your needs

Mike Wright takes stock of the best business software around



APPLICATIONS software comes in many different forms. **Word processing** is probably the most commonly used of these and this is reflected in the number of programs available. However, on the Spectrum one, **Tasword II**, from Tasman Software stands out above all the others and has done so since it was launched. One unusual characteristic of Tasword is the large number of extension programs available for it, some from independent software houses. These include extensions to allow different print styles and one to merge data from the **Masterfile** database.

Spectext from McGraw-Hill includes a mailmerge program and a limited database in the package. **Spectral Writer** from Softek was originally released on Wafadrive but is currently being revamped for general release as **The Writer**. I am told that it will be able to read and write **Wordstar** files, allowing you to send files to the office computer via an RS232 link. **Word Manager** from OCP is another that we can expect to see being released shortly.

The only word processor available for the QL is **Quill**. That was written by Psion and is bundled with the machine. However, supporting programs are now available. Those include a number of spelling checkers, the best of which seems to be **Qspell** from Eidersoft. **M-Spell** is bundled as part of Medic Data Systems disc system and is not generally available. Also included in their system is **M-Merge** which provides a mailmerge facility. The only commercially available mailmerge program I have come across is **Quilmerg** from Pitch Associates although I understand that Transform are working on one currently and that it will be ready shortly.

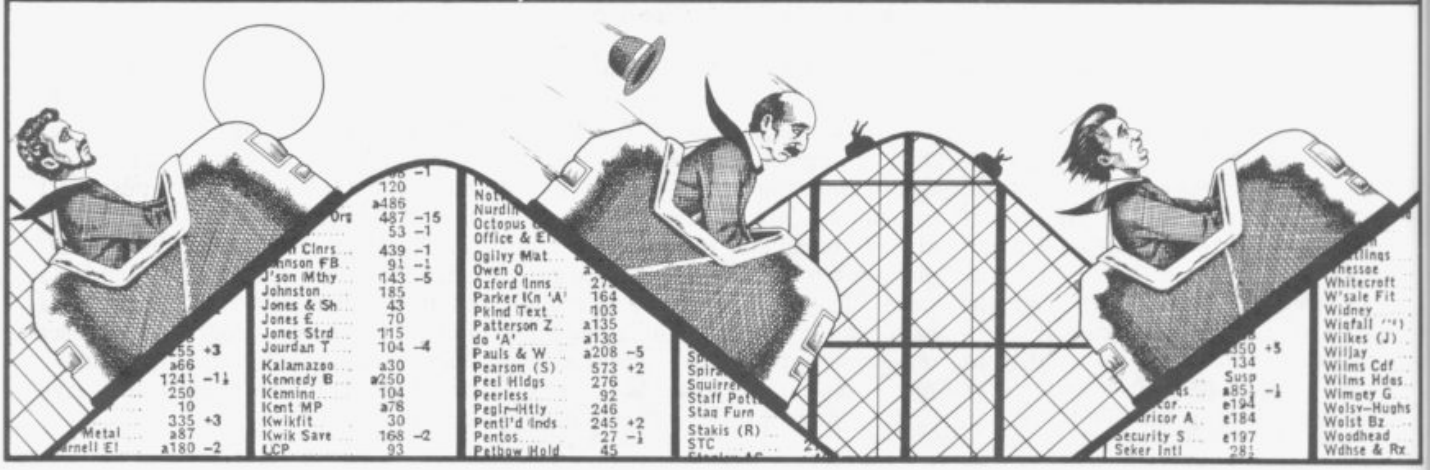
Features you should look out for when buying a word processor include insertion of new text at any point, word wrap, automatic justification, on screen editing, block copy, word search and replace and margin setting.

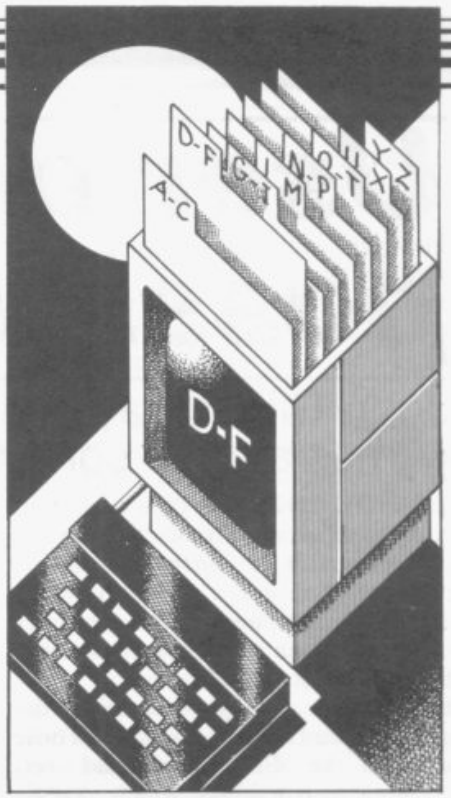
Databases vary in complexity from simple card indexes to full databases that are more akin to a programming language than a program. It is generally true that the more flexible a database, the harder it is to use. Before selecting any database you should consider carefully what uses it is likely to be put to now and in the future. You should also consider the amount of programming skill, in relation to your own, required to retrieve information from it.

The classic Spectrum database is **Masterfile** from Campbell Systems. Less flexible databases include **Vu-file** from Psion, **Superfile** and **V-notch** from Transform and **Datagenie** from Audiogenic.

Sinclair Research also publishes two dedicated databases in **Collectors Pack** and **Club Record Controler,** while OCP's catalogue includes **Address manager.**

The QL comes complete with its own very good database **Archive**, again written by Psion. However, it is not easy to use effectively and many companies are now releasing specialised routines that save the ordinary user having to write a program. **Archiver** from Eidersoft is one such program which provides routines for





invoicing, stock control, mailing list and appointments system. A mailing list routine is also available from Transform.

Spreadsheets simulate large sheets of paper divided into sections and are usually used for tables and other numeric work. Features to look for when selecting a spreadsheet program include insertion and deletion of rows of columns, ability to use formulae to link entries, use of row or column names in formulae and block copy. The best spreadsheet currently available for the Spectrum is **Omnicalc2** from Microsphere which includes a histogram plot, a separate work area and a cell copy. A recent addition is the **Omnicalc2 Extension Kit** which allows Omnicalc2 to be used from disc or wafadrive. It includes a formulae printout facility and a screen dump routine. Also available are **Vu-Calc** from Psion and **Profile2** from McGraw-Hill.

Business Graphics tends to be applied only to programs that draw graphs but, using the fullest sense of the meaning, I also believe that it includes programs which run an advertising display or are used to give visual displays for a presentation. In **Projector 1** McGraw-Hill has a program which could be used for all three. Data can be entered and drawn as line graphs, histograms, and bar charts. A series of 'slides' of text or graphs can be built up, stored and then redisplayed either automatically or manually. If you specifically want a program to run an advertising display then **Dlan** from Campbell Systems is worth a look. It will display text in up to eleven styles and scroll it in any direction.

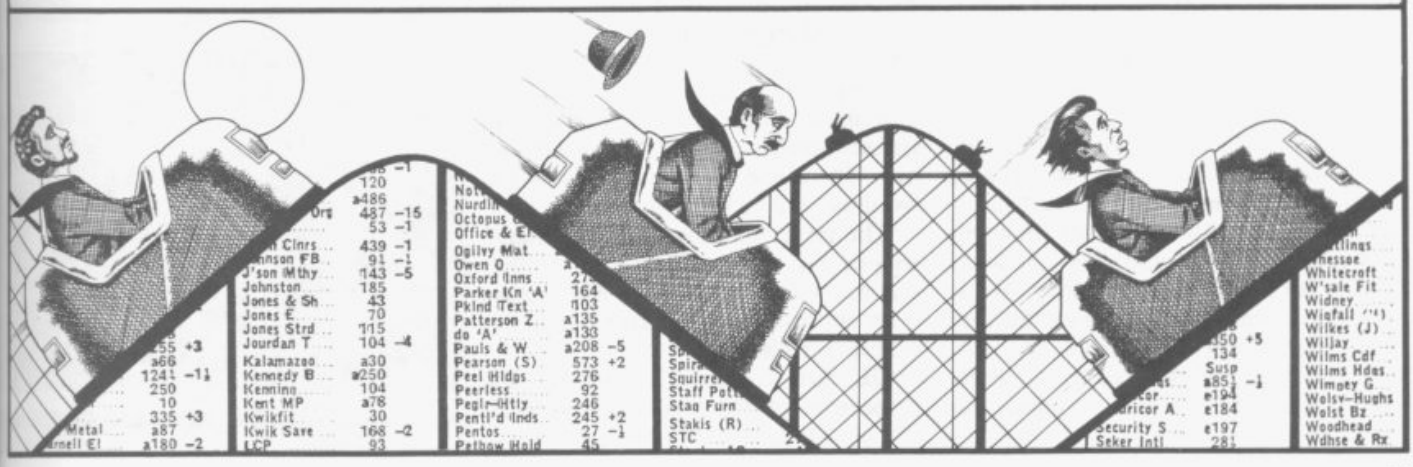
The QL program **Easel** is for drawing graphs and no QL equivalent of **Dlan** exists. However, I understand from Talent that they are working on a program which stores and displays a series of screens very quickly. It is called **Backdrop** and will be an extension of **Graph-QL**.

Stock Control programs for the Spectrum have been produced by Kemp, OCP and Transform. Each one has slightly different features that make it impossible to select the best program. However, if you have a Kempston disc interface I strongly recommend OCP's program. Being able to display any one of up to 6000 items in under four seconds is almost worth the cost alone.

Selecting the best Finance/Accounting package is almost impossible since every user requires some slightly different feature or approach. The packages available range from those dealing with home accounts through individual ledgers to complete book-keeping systems. In my view the best program for home finance if **Finance Manager** from OCP. Either it or its companion **VAT Manager** can also be used highly successfully in business. If you are looking for a program which will prepare invoices and keep a record of customers' accounts then you should consider Transform's **Sales/Purchasing Ledger/Invoicing**. Manx tapes produce what is probably the most comprehensive accounting package, **Classic Book-keeping**. Financial software for the QL has so far been of a very high standard with **Cash Trader** and **Integrated Accounts** being released by Sinclair Research. Home users aiming to keep the bank account in check can turn to **QL Bank Account** from Cenprime Software, **Home Accounts Manager** from Dialog Software and **Bank Account System** from K Gouldstone.

The Investment Monitor from Michael Slatford Software and **Va£ttrack2** from Morley Davies Associates are portfolio management programs. Builders and DIY enthusiasts have not been forgotten by J Redmond. His **Building Price** and **Plumbing Price** are two programs which will help evaluate the cost of materials for putting up a building or extension and installing a central heating system. For statisticians Unisoft produces the very comprehensive **Unistat**, while Lobos Software has released **Survey II** for analysing questionnaires. Talking of analysis, **Lifeline** from William Stuart Systems is a self analysis and careers counselling program.

Many bad decisions are made in business because the skills required to analyse the problem are lacking. Triptych have gone some way to correcting this with a series of programs consisting of a tutorial and an applications program. Two of these, **Entrepreneur** (accounting and profitability) and **Decision Maker** (on decision theory) are published for the Spectrum and QL by Collins Soft and Sinclair Research respectively.



User-defined possibilities

John Gilbert says: Why not stop playing games and do something useful instead?

THE DEFINITION of a utility in computer parlance has widened in the past year. In the early days of the industry it meant a program which aided the machine code programmer to accomplish a task. Now it can have five meanings.

The first category takes in the graphics and sound toolkits. Those expand the Basic command set, adding instructions which create shapes, fill them in, and save pictures to tape or microdrive. The sound generators sometimes included within those packages can make music or even create a voice for your computer.

Machine code utilities include assemblers, disassemblers and monitors, all of which are designed to help you write your own machine code routines. If you are not up to that sort of exercise you may like to acquire a new operating system or high level language such as Pascal, Forth or C.

General utilities which will teach you the highway code, help you with car maintenance or show you how to diet efficiently are also available.

Graphics packages have the most visible effect on a Spectrum or QL, and they have proved popular this year even with people who would not normally program a computer. **Light Magic**, from New Generation, started the interest in all things graphical during 1985. It carried on where **Melbourne Draw**, from Melbourne House, and **Paintbox**, from Print 'n' Plotter, left off.

The program is totally menu driven and can be operated either under keyboard or joystick control. There are five modes of display. The first is pen mode in which, you can draw on the screen using an electronic nib.

Circle and Fill mode will allow you to produce circles and arcs which can then be filled in with colour. Brush mode is similar to Pen mode but you can use 10 types of brush.

The block mode operates in parts, or blocks, of the screen. It allows you to rotate and mirror blocks on pictures, saving time if you need to draw an object which is symetrical.

Finally, the Text mode enables you to write on the screen. User-defined graphics can also be produced as a UDG generator is included in the package.

If **Light Magic** does not impress you then **The Artist**, from Softechnics surely will. It is one of the most powerful packages on the market.

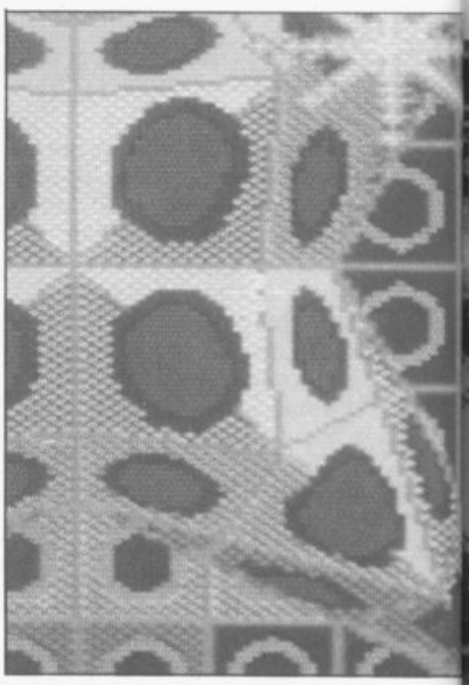
The Artist can be used to take one section of a picture and reproduce it on another part of the screen, where it can be enlarged or reduced. The package will also allow you to produce UDGs and a animator utility is included within the program. Not satisfied with that the author has also included a simple routine which will take a screen display and reduce the number of RAM bytes required to store it.

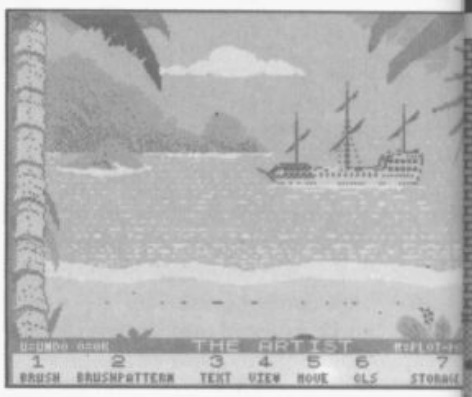
Art Studio, from OCP outperforms **The Artist** in almost every way. It has superior speed to the Softechnics package and the pull down menus are easy to use. It can be used with disc, tape or microdrive and contains a printer driver which handles most Spectrum compatible printers. It should be of use to professional artists and designers as well as to the home user.

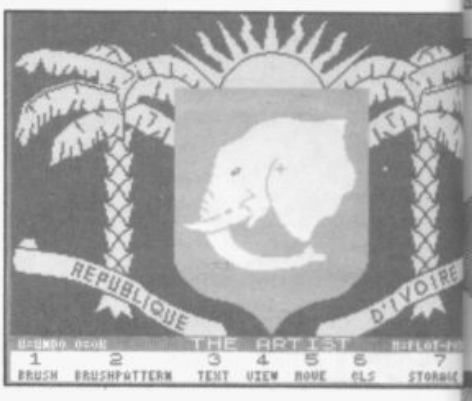
A similar package came onto the market for the QL. **GraphiQL** marked the entry of quality software house Talent onto the QL scene. Not only can the package produce every conceivable type of line, circle, arc and angle, but it can also be used to define textures, using form and colour. Those can then be used with Fill routines.

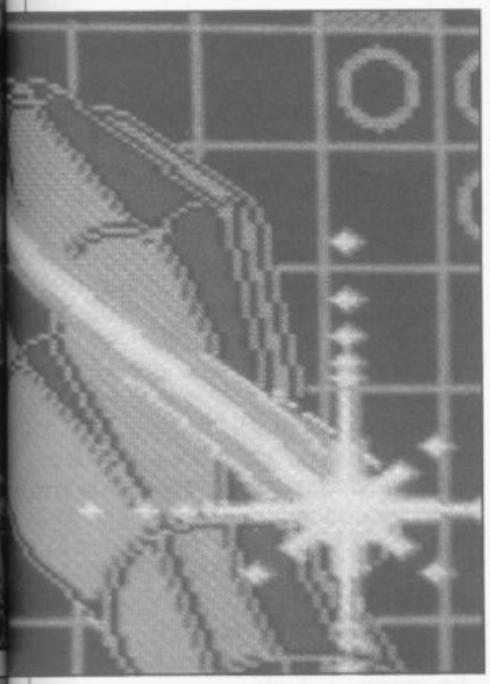
The program allows you to enlarge shapes on the screen. That facility enables you to ensure that Fill texture does not leak out of a shape which has a hole in its border.

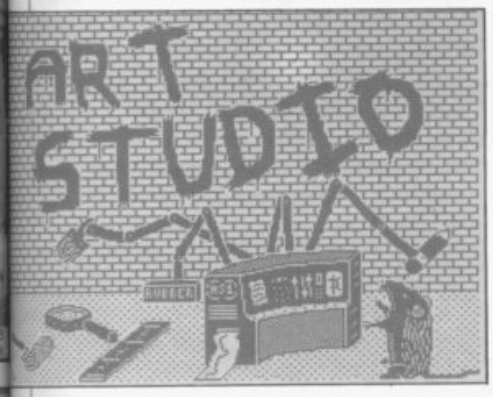
QL Art, from Eidersoft, has the same sort of facilities as **GraphiQL**

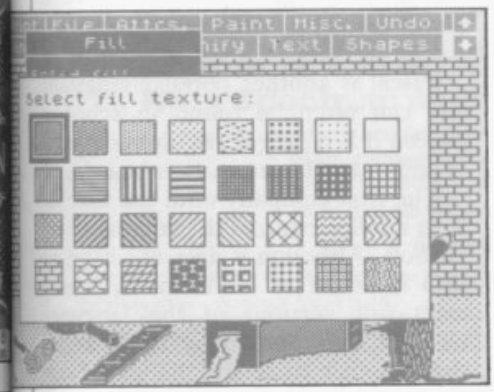


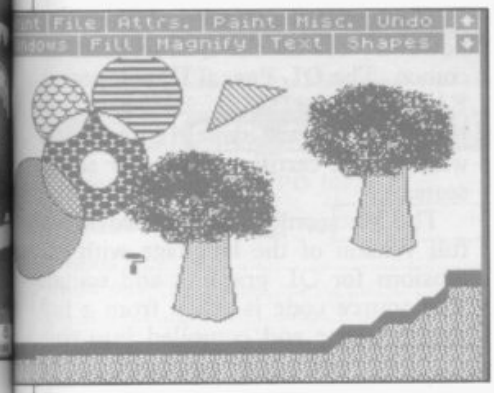












Left, GraphiQL; below left, three screens from The Artist and below right, three from Art Studio

but does not have the same professional edge to it. Unlike the Talent package it is fully menu driven. One of the faults with **GraphiQL** is that you must rely on the instruction manual or special help option for information about user commands.

Illustrator, from Gilsoft, is the long awaited adventure graphics designer for the Spectrum. It is no ordinary package as it produces graphic screens which can be put into adventures designed by Gilsoft's adventure design program **The Quill**. Although the routine can only produce static screen pictures it brightens up the adventures written by its sister program and gives adventure programmers more scope for invention.

White Lightning, from Ocean, is one of the most exciting advances in graphics design packages for the Spectrum that I have seen in the last year. Its aim is to allow you to produce high standard arcade game graphics and, in order to do that, you must use its special Forth-type language. The package combines a sprite generator with a screen layout designer. It is great fun to use and its limitations are only in the mind of the beholder.

A similar package has been produced for the QL, although **Super Sprite Generator**, from Digital Integration, will produce and animate only sprites and not full screen game backdrops.

The program adds extensions to SuperBasic and is run in two parts. The first is the generator and the second the animation routine. It is an excellent package which has been used by professional programmers to produce arcade games. **Night Nurse** from Shadow Games is one example of its use.

Only one good example of a sound toolkit came onto the market last year. **Varitalk** produces speech through the Spectrum Beep unit. Its performance can be enhanced using a loudspeaker or by putting the sound through a tape recorded output channel.

A large number of phonetic sounds are included in the package. Those can be accessed by using a code made up of the first letter of the type of sound required and the number of that sound from a list which has been provided on the cassette inlay. There are no parameters within the program to allow you to set emotion or inflection into the speech. You cannot even get the package to ask a question properly.

Machine code utilities may only appeal to assembly language programmers but that audience has grown larger during the past year, especially within the ranks of those who own a QL.

No less than four QL assemblers arrived on the market during 1985. The most powerful was from Metacomco. **The QL Assembler Development Kit** comprises a full screen editor, together with a three-pass compiler.

The editor can input ASCII code files and so can be used with code Basic programs and even word processor files. Once your assembly code listing has been entered you must save it to microdrive, or disc, and then load it into the assembler program. The package takes approximately two minutes — and three code overlays — to convert the code file into a machine code format.

Also included with the assembler is a library of QDOS calls. Those can be named within you programs. A linker was put into the second version of the assembler package at which time Metacomco dropped the price.

Computer One was also quick to produce an assembler for the QL. The difference between it and the Metacomco program is that it can be loaded into the machine complete with the source editor. You can, therefore, write your assembly program and then convert it to machine code without having to load any overlays from microdrive.

The Sinclair Research assembler is similar to that from Metacomco, but it is not as powerful. Incidentally, the full screen editor in the package was written for Metacomco. GST, the company which wrote the Sinclair assembler, just does not seem to have the knack of producing editors.

Adder Publishing was not as quick to produce an assembler package as Metacomco and Computer One but it did release one after the launch of its classic *QL Advanced User Guide*.

The program was similar in structure to the other products on the market but adheres closely to the notation in the User Guide Book.

It was some time before anyone realised that what the QL market was missing was a debugging tool such as a monitor or disassembler. That was

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soon put right, however, as four companies put monitors onto the market almost simultaneously.

The first program came from Digital Integration. **QL Super Monitor** is an economical package, put out in a cassette format box. It performs its task well and allows to view and alter code in a hexadecimal format.

Computer One was again quick on the scene with a monitor which followed, and was compatible with, its assembler package.

Not to be outdone Hi-Soft also decided that it should bring out a token QL product and opted for Andrew Pennel's **QL MON**. Unlike the Computer One program it is not automatically invoked when the machine is powered-up. Pennel's monitor is a QDOS job and can be called simply by typing a new SuperBasic command, MON. As it is easy to break out of the package back into SuperBasic the monitor can reside in RAM, be called at any time, and not disrupt any of the other tasks being performed by the QL.

The same technique is used in Tony Tebby's **QL Monitor** which is produced by Sinclair Research. The package has all the usual debugging facilities, a one line disassembler, and routines which displays the values of the registers or a block of memory in hexadecimal.

Another good feature of the package is that you can set it to run on any channel or in any window. That means that you could set up several versions of the program within the machine, each of which work on different sections of code.

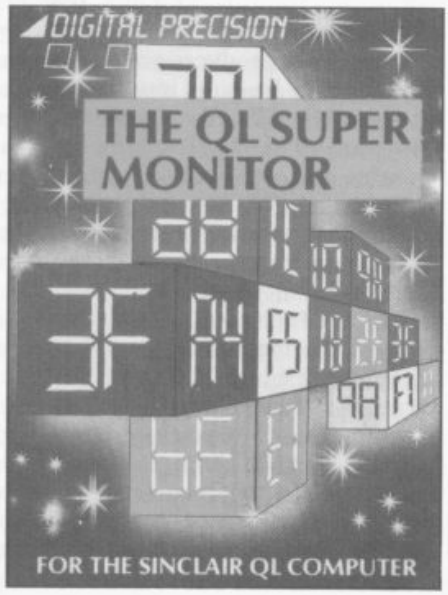
You may prefer, however, not to get tangled up in the web of machine code. That does not mean, however, that you have to stick to SuperBasic, or to buying packages off the shelf. You can still experiment with QDOS and machine code by buying one of the toolkits or SuperBasic extension packages which have just become available.

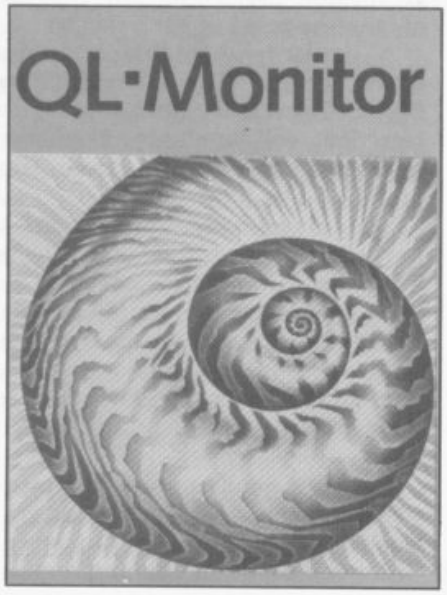
The most famous toolkit, of course, was written by Tony Tebby and can be obtained for the QL from Sinclair Research. It provides a whole spectrum of new SuperBasic commands and run-alone progroms which show the power of the QL multi-tasking operating system.

The main body of **QL Toolkit** comprises SuperBasic extensions which control jobs, allocate or clear memory, and display the status of the system.

A series of separate programs, some in SuperBasic, some machine code, are also included in the package. They provide a user-defined graphics generator, an exceptionally fast back-up utility, and a multi-tasked digital clock which can be run while the package is in operation.

One task which the toolkit will not





do is to check microdrives for errors or repair files which have become corrupt. Those sort of occurrences may be well known to you. They are unfortunate but fairly regular and if you do not have a back-up copy of a file you will usually be in trouble.

The **Cartridge Doctor**, from Talent, does away with many of the problems posed by the microdrives. It checks every sector on a cartridge to see if any errors have occurred and informs you if files have been corrupted.

One you know about an error you can set up the **Cartridge Doctor** to deal with it. The most usual way is to read the file in and display it in ASCII format. A cursor is then provided by the program and you can rewrite any parts of the file which have been damaged. You can even repair the headers of files if necessary.

Machine code is a low level language because you cannot understand it but the computer finds it easy to understand. A high level language, such as Basic, is easy to understand from your point of view — as a user — but needs some translation before the computer can understand it. There are several types of high level language for both the Spectrum and QL.

Although Sinclair Basic, for the Spectrum, is highly respected it does have some faults and one software house, Betasoft has brought out a new version of structured Basic. Many of the additions provided by **Beta Basic** can also be found on machines such as the BBC Microcomputer, Amstrad and QL. They include WHEN and WHILE loops, a real time clock, new graphics commands and instructions to make Interface 1 and microdrives easier to use.

The Betasoft version of Basic is one of the best on the market for any machine. It has undergone several transformations during its relatively short three-year life span.

Pascal is another popular language and can often be found in schools. Indeed it is on the curriculum of some O and A level examination boards.

The first company onto the market with a full version of the language was Hi-Soft. Although it does not have an ISO standard of certification, which most full versions of the language have, it does run many times faster than Sinclair Basic and includes Logo turtle graphics.

The big Pascal launch of the year, however, was for the QL, from Metacomco. The **QL Pascal Development Kit** did receive ISO standard certification — an award which is to Pascal what a BSA certificate is to car safety seats.

The Metacomco package provides a full version of the language with extensions for QL graphics and sound. The source code is taken from a full screen editor and compiled into true

continued on page 76

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68000 code.

It was the first QL product to receive a *Sinclair User* Classic and, indeed, it was the first utility to receive that award for software excellence.

Computer One brought out a version of Pascal which while not up to the standard of the compiler from Metacomco comes a very close second. The first version of the package compiles the source into P-code which, although faster than SuperBasic, requires the Pascal operating system to be in memory. Computer One later amended the program so that code could either be translated into P-code or compiled to form a job which would run without the operating system being present.

The compiler is more user friendly than the Metacomco package — all sections of the screen editor and compiler can be accessed through a menu based program — but the **QL Pascal Development Kit** wins hands down in the features race.

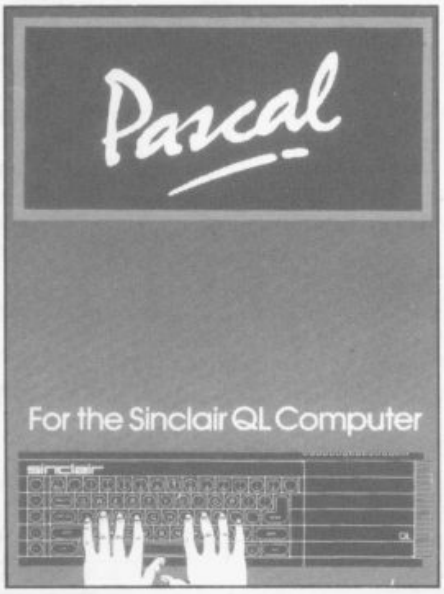
Metacomco and Computer One both brought out versions of the popular artificial intelligence list processing language LISP. The Computer One program is less expensive than the one from Metacomco. Both versions can deal with the QL graphics commands and both are interpreted.

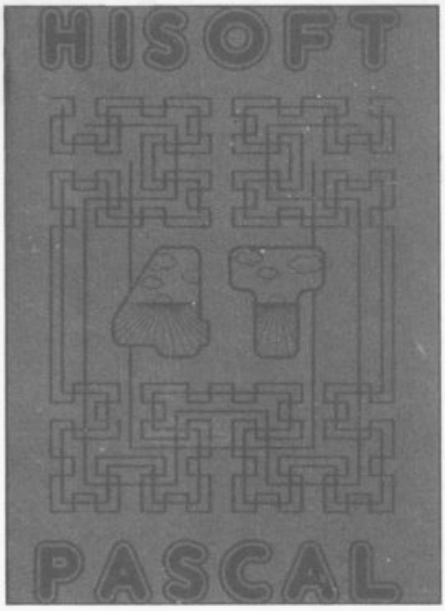
The medium level language C also proved popular with QL software houses during 1985. The first company to bring out a version was GST, which is famous for the 68K/OS alternative QL operating system. Unfortunately the product is a version of public domain RATC, a scaled down version of the original with additions to allow the use of QL graphics and QDOS traps. It is, of course, a compiler but the source must first be typed into a screen editor, run through a compiler which produces assembly language source, and put through an assembler to produce 68008 code. It is an unnecessarily complex operation and the code could be compiled in one go if GST had produced a machine code compiler.

GST also ranks among the companies which brought out QL operating systems in 1985. Its 68K/OS was originally intended to be the QL operating system. The package consists of as ROM board, slotted into the expansion slot at the side of the QL, and several microdrive cartridges.

As operating systems are usually judged on the amount of software available for them 68K/OS is a dismal failure. So far GST has only produced an assembler and word processor for its baby. One wonders what would have happened if Sir Clive had decided to use the GST operating system.

The C/PM-68K operating system from disc drive manufacturer Quest Automation did little better than the





GST product. A few business packages are available for it but, despite the fact that it uses discs or microdrives, few software houses have taken up the challenge to produce anything of note for it.

A large variety of DIY utilities came onto the market in 1985. They teach everything from garden design to touch typing and computer athletics.

Sinclair Research wins our first Most Useless Utility Award for 1985 with **QL Gardener**. While it is obvious to see the benefits of a plant dictionary and garden design package for those who like gardening, and own a QL, with the dearth of QL software the company must be green behind the ears to bring out such a product. Where are all the fantastic business and educational programs which will show off the true power of the 16-bit — or is it 32-bit — machine?

Our second MUU of 1985 award goes to **Car Cure**, a program which aims to diagnose the problems which you may encounter with your car. All you have to do is type in the symptoms of your vehicle's illness and the program will come up with an answer to your problems — maybe. Most of the time it just recommends that you contact a qualified mechanic immediately.

Another car-orientated program which is marginally more useful than **Car Cure** is **Highway Code**. Through a series of multi-choice questions it will teach you about the signs and situations which you may encounter on the road. The graphics are simple, but effective, and the program has been checked by a qualified driving instructor.

If you want to stay fit then **Microfitness** from VO^2 is for you. It will take you through a series of carefully graded exercises culminating in — I hope for your sake — physical fitness. When it was reviewed early in 1985 our own Clare Edgeley found out how unfit she was!

Finally, touch typing programs for beginners came from QL software houses during the past year. Two were produced, one from Computer One and the other four months later, from Sinclair Research. **Touch 'n' Go** from Sinclair Research provides more in the way of graded exercises and a more complex results table.

The utility market is the area in which the QL has done best. There are many languages available for it and a host of machine code utilities which allow the use of the power of the 68008 processor and QDOS.

It is a pity that the same cannot be said of the Spectrum. Very few utilities were produced for the machine and most software houses have moved to other machines. That is unfortunate as the Spectrum still has a lot of power within it which lies untapped because people like you cannot get at it.

Turkeys

We haven't chickened out! The *Sinclair User* team has chosen four prize turkeys — possibly the worst games of '85

Action Biker

CLUMSY COLIN is Mastertronic's junk game compliment to junk food, in the form of *KP Skips*. Drive Colin's flickering white bike around a garish town in search of his friend Martin, to get him to the airport. On the way eat bags of *Skips* thrown on the road by people who, presumably, found them inedible. Lucky for Colin it's all a dream. Even Mastertronic couldn't make us swallow this scenario as realistic.

The bike crashes frequently, the fuel runs out, there's little excitement. Controls are jerky, what actually moves is minute. Good luck and don't dally says Masterchronic at the end of the instructions. Who wants to?

Death Star Interceptor

THE GRAPHICS is not the only incredibly abysmal aspect of this game. System 3 Software has pulled out all the stops to produce what it loosely terms a computer generated voice for the take-off sequence. All three sections of the games take the shoot 'em up category of game to new lows. Once the first stage, take-off, has taken place you must destroy as many aliens as you can while trying to stay awake at the same time. If you manage to keep your eyelids open, then you must drop your bomb down the exhaust port of the Death Star — see, the title of the game does have some relevance to the action. The game also bears a resemblance to the *Star Wars* film, but producer George Lucas is unlikely to take any action against the manufacturer. He would probably say that his film is not a comedy of errors.

911TS

'PORSCHE TODAY, bust tomorrow' goes a traditional proverb of the software industry. Elite's hideous game took the bright idea of producing a tape to promote Dunlop tyres as wrapped round the wheels of a Porsche 911TS rally car.

Throw some old scrolling routines in, pinch some bushes off the graphics from *Grand National* to add decoration, strew the road with logs and then wait for the punters to cough up the cash. Cough up, gag, gulp and throw up — *911TS* is utter trash, and all the more reprehensible for coming from a well-established company.

Rumour has it even the lads at Elite were ashamed of this one.

Therbo

'A CROSS BETWEEN American Football and World War III' — that's what Arcade Software says about **Therbo.** Clearly based on that tired old *Rollerball* theme, you push a futuristic rugby ball along the middle third of the screen to try and score a goal at one end. There are some coloured shapes — described by Arcade as 'shapes that move', I kid you not — which you can shoot at if you feel so inclined.

Unfortunately, for what would have been a dreadful game anyway, the computer makes a lousy opponent. One gentle push and the amazing Therbo will usually chunter into the goalmouth all by itself.

For sheer pointlessness, this one is in a class of its own.

UTILITY
OF THE YEAR
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For The 48K Spectrum

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The Secret Diary of Adrian Mole aged 13¾

Sue Townsend

Program by Level 9

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At the sign of The Dancing Ogre

THE MASTER ADVENTURER Gordo Greatbelly is mystified. Where can his love, the Lady Marion, be and how can she save her? To find the answers to those questions he must question closely those who come to take vitals at his inn the *Dancing Ogre*. One of them is bound to know how he can rescue his sweetheart.

Are you brave enough to take on Gordo's task in this unique adventure game for the 48K Spectrum? If so you must be ready to deal with the tricks and traps which programmer Chris Bourne throws at you and the many artificially intelligent characters who will come into your bar. We wish you luck . . .

Program Printout

Instructions

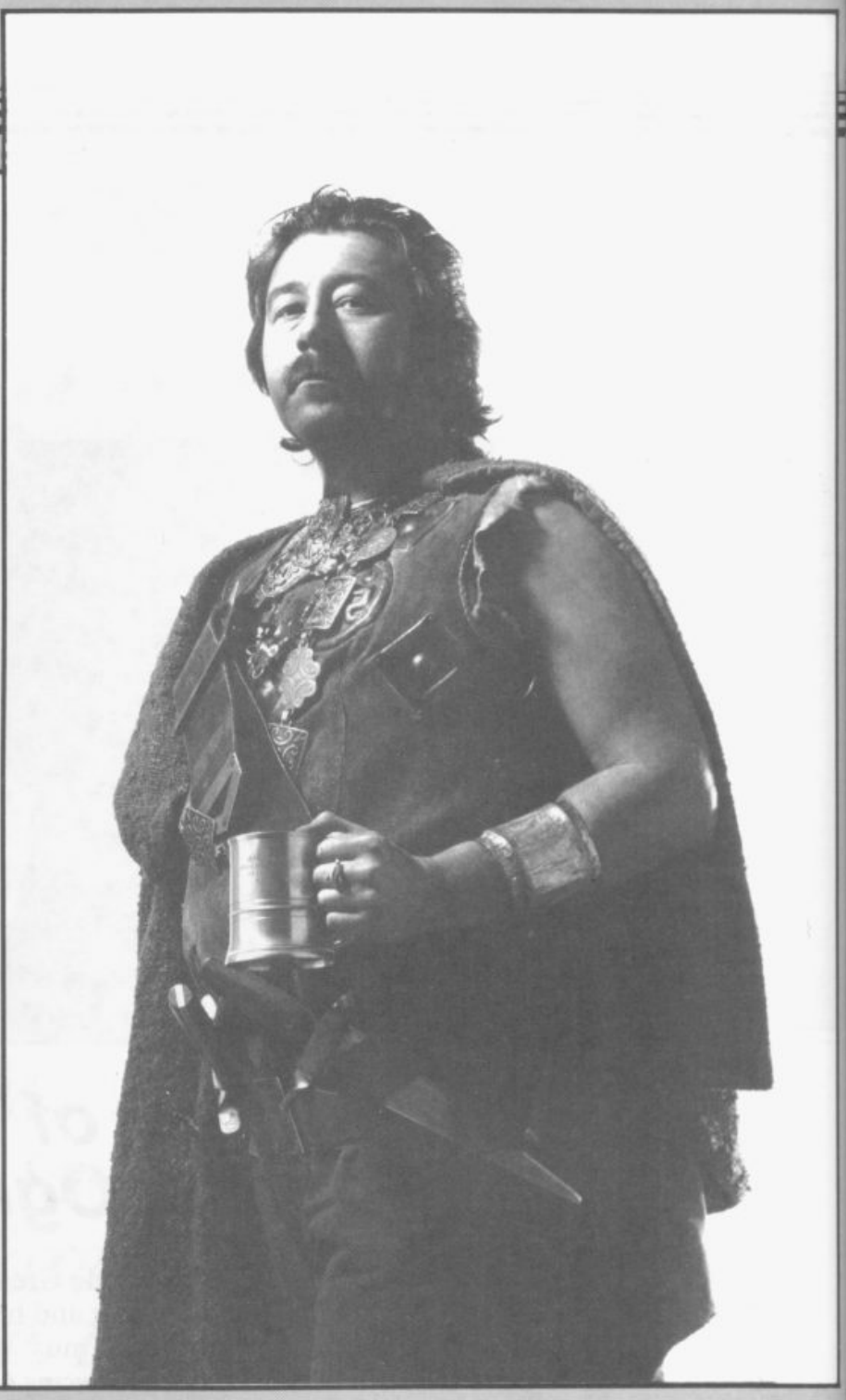
COULD you run the Dancing Ogre tavern as expertly as the great Gordo Greatbelly himself? Here's your chance to find out. The Lady Marion has been captured and locked in prison. To get her out you'll need the password, known only to the adventurers who come to carouse at the Ogre.

Briefly, what's happening in the Ogre is shown in the yellow part of the screen. Your decisions are given in the black part. Press the appropriate number key to choose a decision.

Customers will only give you help if they like you, so keep them happy with advice or free food and drink. But don't be too generous — you've a living to make as well.

To enter the program, type in listing One and SAVE it. Then type in listing Two, RUN, and type in the code. When you have done that correctly, it will automatically be SAVEd. Make sure you use CAPS LOCK throughout.

The program uses special abbreviations for graphics characters. An underlined letter should be entered in graphics mode. For instance, g5 and ig5 indicate the graphics and inverse graphics character on key 5. cc4 and cpc4 are control codes, in this case on key 4. cpc controls paper, and is obtained by pressing the key in extended mode. cc controls ink, and is obtained in the same way, but while also pressing CAPS SHIFT. Finally, 3★sp would indicate 3 spaces. In all those cases, do not enter the brackets which surround the abbreviations.



Machine Code

```
65 32 76 73 67 69 78 67 69 32 70
79 82 32 82 79 66 66 69 82 89 40
32 78 69 69 68 32 65 32 80 73 67
75 32 77 69 32 85 80 87 65 73 84
32 70 79 82 32 41 32 87 79 82 77
41 32 76 73 84 84 76 69 32 66 73
82 68 32 75 78 79 87 83 74 79 73
78 32 41 32 67 76 85 66 73 84 83
32 65 32 83 80 73 67 89 32 80 82
79 66 76 69 77 84 82 65 86 69 76
32 66 82 79 65 68 69 78 83 32 41
32 77 73 78 68 76 79 67 75 32 41
32 87 65 89 32 85 80 32 41 32 83
84 69 80 83 77 85 83 73 67 32 73
83 32 41 32 75 69 89 66 73 84 69
32 40 82 32 76 73 80 40 32 78 69
69 68 32 65 32 66 76 65 78 75 69
84 32 83 79 76 85 84 73 79 78 65
82 84 32 73 83 32 65 76 76 32 66

79 83 72 44 32 71 69 84 32 41 32
80 69 65 82 76 73 78 32 68 85 78
32 68 65 82 65 67 72 44 32 71 69
84 32 79 85 84 32 79 70 32 32 32
41 32 71 79 66 76 73 78 83 32 68
85 78 71 69 79 78 32 73 78 32 41
32 72 79 66 66 73 84 44 32 43 32
41 65 68 86 69 78 84 85 82 69 81
85 69 83 84 32 83 80 72 73 78 88
44 32 43 32 41 83 78 65 75 69 32
73 78 32 67 79 76 79 83 83 65 76
32 32 32 32 32 65 68 86 69 78 84
85 82 69 44 32 42 32 65 32 71 79
79 68 32 32 32 74 79 66 32 73 78
32 72 65 77 80 83 84 69 65 68 44
32 80 65 83 83 32 41 32 71 65 84
69 79 70 32 77 79 82 79 78 65 32
73 78 32 66 79 82 69 68 32 79 70
32 41 32 82 73 78 71 83 44 32 66
82 69 65 75 32 73 78 84 79 32 32
32 77 65 78 72 65 84 84 65 78 32
66 65 78 75 32 73 78 32 32 32 32
32 83 89 83 84 69 77 32 49 53 48

48 48 44 32 42 32 77 89 32 67 65
77 69 82 65 73 78 32 84 69 82 82
79 82 77 79 76 73 78 79 83 44 32
66 82 69 65 75 32 66 65 83 73 76
83 32 65 76 73 66 73 32 73 78 32
83 72 69 82 76 79 67 75 44 32 84
85 82 78 32 73 78 84 79 32 41 73
78 67 82 69 68 73 66 76 69 32 72
85 76 75 44 32 80 85 84 32 79 85
84 32 41 32 32 70 73 82 69 32 73
78 32 73 78 67 65 32 67 85 82 83
69 32 65 82 82 73 86 69 83 32 73
78 32 32 32 38 32 68 69 67 73 68
69 83 32 84 79 32 32 32 76 69 65
86 69 32 38 47 32 87 65 76 75 83
32 85 80 32 84 79 32 32 41 32 66
65 82 32 65 78 68 32 68 69 77 65
78 68 83 32 32 32 46 49 32 45 32
47 32 79 78 32 41 32 72 79 85 83
69 32 32 32 50 32 45 32 47 32 70
79 82 32 72 65 82 68 32 67 65 83
72 32 32 51 32 82 69 70 85 83 69
32 84 79 32 45 32 47 40 32 45 32
```

Listing one

```
  5 LET z=0
 10 LET x=55000
 20 PRINT "Enter decimal code"
 30 INPUT code
 40 LET z=z+1
 50 POKE x,code: PRINT code;
 60 IF z=11 THEN  GO TO 100
 70 PRINT "(sp)";: IF code=0 TH
EN  PRINT "(sp)";
 80 LET x=x+1: IF x=56221 THEN
 STOP
 90 GO TO 30
100 PRINT : PRINT : PRINT "Chec
k row against listing.       If c
orrect, press y.             If i
ncorrect, press n."
110 IF INKEY$="y" THEN  GO TO 1
50
120 IF INKEY$="n" THEN  GO TO 1
60
130 IF INKEY$="" THEN  GO TO 11
0
140 GO TO 110
150 LET z=0: CLS : GO TO 80
160 LET x=x-11: LET z=0: GO TO
20
170 STOP
```

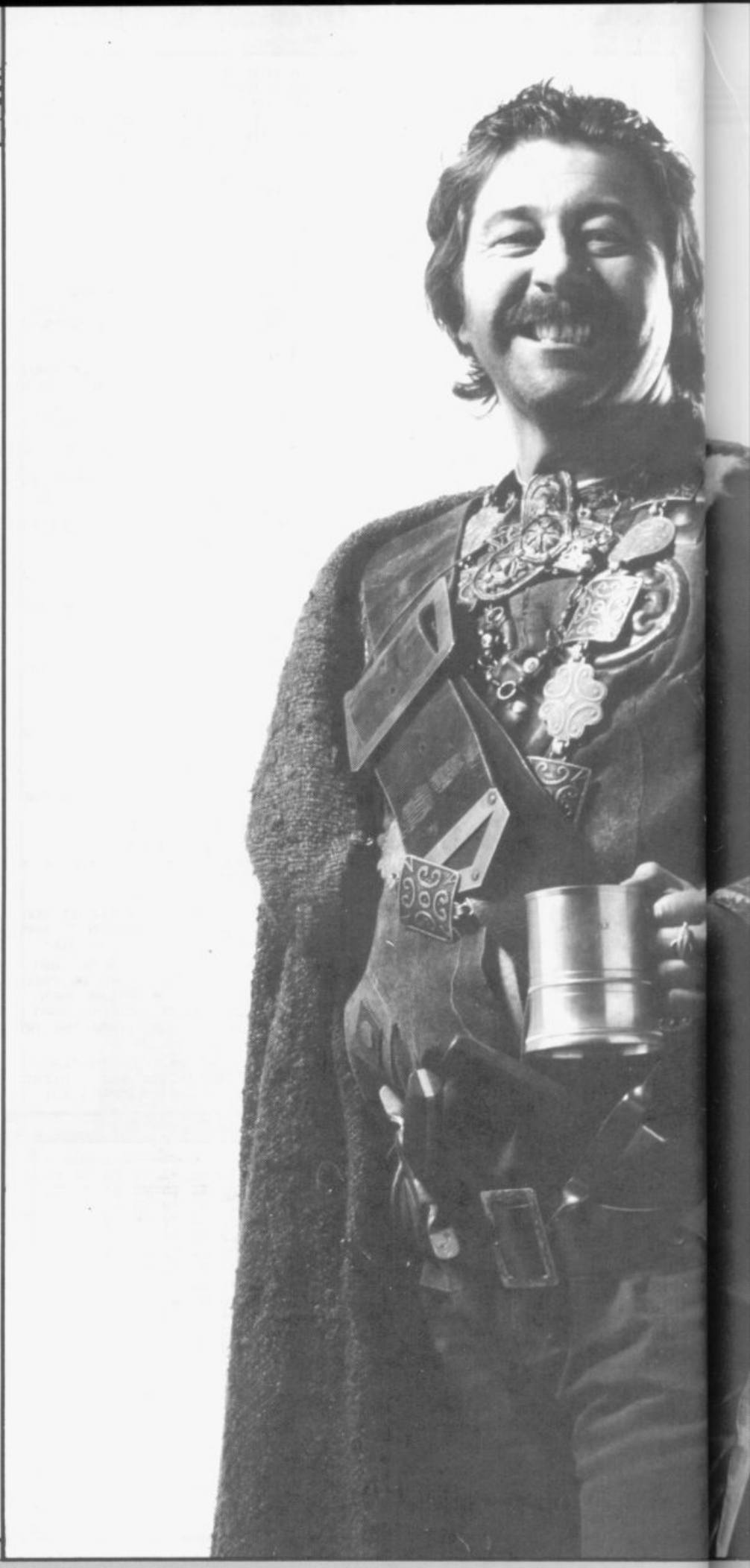
Listing two

```
 10 CLEAR 54999: LOAD "GCO
DE"CODE
 11 LET K=0: LET HO=8: LET MIN=
0: LET ST=10: LET DAM=0: LET M=0
: LET T=0: LET CN=0: LET C=0
 15 DEF FN A()=INT (RND*11)+1
 16 GO SUB 9400
 20 GO SUB 9900
 25 GO SUB 9300
 70 IF CN=0 THEN  GO SUB 9200
 80 IF RND<.5 THEN  GO SUB 9000
 90 GO SUB 9050
100 IF RND<.5 THEN  GO SUB 8400
102 GO SUB 5000
103 GO SUB 3000
110 GO SUB 3300
120 IF HO=12 THEN  GO SUB 3400
130 GO TO 70
3000 REM CHARCHECK
3010 FOR X=1 TO 11
3020 IF A(X,5)=0 THEN  GO TO 305
0
3030 LET A(X,4)=A(X,4)-1*(A(X,4)
>1)
3040 REM  IF A(X,2)<0 THEN  GO S
UB FIGHT
3050 NEXT X
3060 RETURN
3100 RETURN
3200 REM FIGHT
3210 LET P$=A$(C)+" GOES BERSERK
 AND TRIES TO WRECK THE DANCING
OGRE": GO SUB 9800
3220 LET A(C,2)=A(C,2)+10
3230 LET D1=INT (A(C,1)*CN-ST*CN
/2)
3235 IF D1<1 THEN  LET D1=1
3240 LET DAM=DAM+D1
3250 LET T=T+20
3260 RETURN
3300 REM TIME CHECK
3310 LET MIN=MIN+T: LET T=0
3320 IF MIN<60 THEN  GO TO 3350
3330 LET MIN=MIN-60: LET HO=HO+1
3350 RETURN
3400 REM ENDDAY
3410 LET P$="ITS THE*END OF ANOT
HERDAY AT THE OGRE, GORDO": GO S
UB 9800
3415 FOR X=1 TO 11: LET A(C,4)=1
: LET A(C,5)=0: NEXT X
3420 LET M=M-DAM: IF M<0 THEN  G
O SUB 3500
3430 LET P$="INCLUDING DAMAGE YO
U  MADE "+STR$ M+" IN GOLD": GO
SUB 9800
3435 LET CN=0: LET DAM=0: LET T=
0: LET H=8: LET MIN=0
3440 RETURN
3500 REM BUST
3510 LET P$="YOU FAILED TO STAY
   SOLVENT AND LOSE ALL": GO SUB
 9800
3515 PAUSE 0
3520 GO SUB 3600
3600 CLS : PAPER 7: INK 0: PRINT
 "ANOTHER GAME Y/N"
3610 IF INKEY$="Y" THEN  RUN
3620 IF INKEY$="N" THEN  NEW
3630 IF INKEY$="" THEN  GO TO 36
10
3640 GO TO 3610
3700 CLS : INK 6: PAPER 0
3710 PRINT "OK GORDO, WHAT'S THE
 PASSWORD ?"
3720 INPUT P$
3730 FOR X=56200 TO 56209
3740 IF P$(X-56199)<>CHR$ PEEK X
 THEN  GO TO 3800
3750 NEXT X
3760 CLS : PRINT "YOU DID IT GOR
DO! AND YOU EVEN  MANAGED TO MAK
E SOME MONEY INTO THE BARGAIN"
3770 PRINT : PRINT : PAUSE 100:
PRINT M;" GOLD PIECES TO BE PREC
ISE": PAUSE 200: IF M<100 THEN
PRINT "LADY MARION RECKONS THAT
WON'T  BUY MUCH MORE THAN SHE GO
T TO   EAT IN JAIL."
3780 IF M>200 THEN  PRINT "LADY
MARION IS IMPRESSED. SHE  RECKO
NS WITH YOU BY HER SIDE IT WILL
BE THE DANCING HILTON IN NOTIME
AT ALL"
3785 PAUSE 0
3790 GO TO 3600
3800 CLS : PRINT "YOU MESSED IT
UP, FATGUT. LADY  MARION HOPS IT
 WITH THE GRAND  ELF AND YOU GE
T A SWORD IN YOUR BELLY FOR ALL
YOUR TROUBLE"
3805 PAUSE 0
3810 GO TO 3600
4000 REM MINGLING ROUTINES
4100 REM FREE MINGLE OFFER
4110 LET K=4
4120 IF A(C,4)=2 THEN  GO TO 415
0
4130 GO SUB 8100
4149 RETURN
4150 LET P$="": LET LOC=56075: L
ET L=23: GO SUB 9600: GO SUB 980
0
4160 GO TO 4149
4200 LET K=1
4210 IF A(C,4)>2 THEN  GO TO 425
0
4220 GO SUB 8100
4230 RETURN
4250 LET P$="": LET LOC=56054: L
ET L=21: GO SUB 9600: GO SUB 980
0
4260 GO TO 4230
4300 REM OFFER SERVICES
4310 LET P$=A$(C)+" ASKS YOU THI
S": GO SUB 9800
4320 LET P$="": LET LOC=55000+Z(
A(C,6)+12,1): LET L=Z(A(C,6)+12,
2): GO SUB 9600: GO SUB 9800
4330 LET QQ=INT (RND*3)+1
4332 DIM X(3)
4335 FOR R=1 TO 3
4340 LET CL=INT (RND*12)+1
4345 IF R=QQ THEN  LET CL=A(C,6)
4346 LET X(R)=CL
4350 LET P$=STR$ R+"(sp)": LET L
OC=55000+Z(CL,1): LET L=Z(CL,2):
 GO SUB 9600: GO SUB 9700: PAUSE
 100
4355 LET P$=""
4365 NEXT R
4370 GO SUB 8950
4372 GO TO 4375-5*((CC>3) OR (CC
<1))
4375 IF X(CC)=A(C,6) THEN  GO SU
B 4500
4380 IF X(CC)<>A(C,6) THEN  GO S
UB 4900
4390 RETURN
4400 REM ASK FOR HELP
4410 IF A(C,2)>=16 THEN  GO TO 4
440
4420 LET P$="": LET LOC=56098: L
ET L=15: GO SUB 9600: GO SUB 980
0
4430 RETURN
4440 LET P$="": LET LOC=56113: L
ET L=39: GO SUB 9600: GO SUB 980
0
4445 LET K$=CHR$ A(C,3): LET P$=
A$(C)+" SAYS "+K$+"(sp)"
4450 LET LOC=56152: LET L=42: GO
 SUB 9600: GO SUB 9800
4460 GO TO 4430
4500 REM SUCCESS
4510 LET P$="": LET LOC=56113: L
ET L=18: GO SUB 9600: GO SUB 980
0
4520 LET A(C,2)=A(C,2)+10
4530 RETURN
4900 REM FAILURE
4910 LET P$="": LET LOC=55812: L
ET L=33: GO SUB 9600: GO SUB 980
0
4920 LET A(C,2)=A(C,2)-10
4930 RETURN
5000 REM MAIN MENU
5010 LET P$="": LET LOC=55845: L
ET L=102: GO SUB 9600: GO SUB 97
00
5020 GO SUB 8950
```

```
47 40 32 79 70 70 69 82 32 70 82
69 69 32 46 32 32 32 84 79 32 47
40 32 82 69 70 85 83 69 32 84 79
32 45 32 32 32 32 32 47 47 32 65
67 67 69 80 84 83 32 40 82 32 75
73 78 68 32 79 70 70 69 82 47 32
84 72 65 78 75 83 32 40 32 32 32
70 79 82 32 41 32 71 69 78 69 82
79 85 83 32 79 70 70 69 82 47 32
73 83 32 78 79 84 32 86 69 82 89
32 32 72 65 80 80 89 32 87 73 84
72 32 40 32 71 79 82 68 79 49 32
45 32 65 84 32 41 32 66 65 82 32
32 32 32 32 32 32 32 32 32 32 32
32 32 50 32 82 69 83 67 85 69 32
41 32 76 65 68 89 32 77 65 82 73
79 78 32 32 32 32 32 32 32 32 51
32 77 73 78 71 76 69 32 87 73 84
72 32 41 32 67 82 79 87 68 32 32
32 32 32 32 32 32 32 52 32 76 79
79 75 32 65 82 79 85 78 68 32 38
32 73 83 32 68 82 73 78 75 73 78
71 32 73 83 32 69 65 84 73 78 71
```

```
49 32 79 70 70 69 82 32 70 82 69
69 32 68 82 73 78 75 32 84 79 32
47 32 32 50 32 79 70 70 69 82 32
70 82 69 69 32 70 79 79 68 32 84
79 32 47 32 32 32 51 32 79 70 70
69 82 32 40 82 32 72 69 76 80 32
84 79 32 47 32 32 32 52 32 65 83
75 32 70 79 82 32 65 73 68 47 32
73 83 32 65 76 82 69 65 68 89 32
32 32 69 65 84 73 78 71 47 32 73
83 32 65 76 82 69 65 68 89 32 32
32 68 82 73 78 75 73 78 71 47 32
87 73 76 76 32 78 79 84 32 72 69
76 80 47 32 76 73 75 69 83 32 40
32 32 32 32 71 79 82 68 79 32 65
78 68 32 65 71 82 69 69 83 32 84
79 32 32 32 72 69 76 80 73 83 32
79 78 69 32 79 70 32 41 32 76 69
84 84 69 82 83 32 73 78 32 41 32
68 85 78 71 69 79 78 32 80 65 83
83 87 79 82 68 68  0  0  0  0  0
32 72 73 69 82 79 78 89 77 85 83
84  0  0  0  0  0  0  0  0  0  0
```

```
5023 GO TO 5025-5*((CC<0) OR (CC
>4))
5025 GO SUB 5000+100*CC
5030 RETURN
5100 REM BAR OPTION
5110 GO SUB 8900
5120 RETURN
5200 REM RESCUE MARION
5210 GO SUB 3700
5220 RETURN
5300 REM MINGLEMENU
5305 GO SUB 9050
5307 LET P$="YOU SIT WITH "+A$(C
): GO SUB 9800
5310 LET P$="": LET LOC=55968: L
ET L=86: GO SUB 9600: GO SUB 970
0
5320 GO SUB 8950
5322 GO TO 5325-5*((CC<1) OR (CC
>4))
5325 GO SUB 4000+100*CC
5326 LET T=T+15
5330 RETURN
5400 REM BARPINT
5410 LET P$=""
5415 FOR X=1 TO 11
5420 IF A(X,5)=0 THEN  GO TO 544
0
5425 IF A(X,4)>1 THEN  LET P$=P$
+A$(X)
5430 IF A(X,4)=2 THEN  GO TO 550
0
5435 IF A(X,4)>2 THEN  GO TO 555
0
5440 NEXT X
5450 LET P$="YOU HAVE "+STR$ M+"
 IN GOLD"
5455 GO SUB 9800
5460 LET P$="THE TIME IS "+STR$
HO+":"+STR$ MIN
5465 GO SUB 9800
5466 LET T=T+2
5470 RETURN
5500 REM DRINKPRINT
5510 LET P$=A$(X): LET LOC=55946
: LET L=12: GO SUB 9600: GO SUB
9800
5520 GO TO 5440
5550 REM EATPRINT
5560 LET P$=A$(X): LET LOC=55958
: LET L=10: GO SUB 9600: GO SUB
9800
5570 GO TO 5440
6000 REM REACTION
6020 IF A(C,2)<0 THEN  GO SUB 32
00
6030 IF CC=1 THEN  GO SUB 6050
6040 RETURN
6050 IF A(C,2)<15 THEN  GO TO 61
00
6060 IF A(C,2)>14 THEN  GO TO 61
50
6070 RETURN
6100 REM ACCEPTANCE
6110 LET P$="": LET LOC=55756: L
ET L=23: GO SUB 9600: GO SUB 980
0
6120 GO TO 6070
6150 LET P$="": LET LOC=55779: L
ET L=33: GO SUB 9600: GO SUB 980
0
6160 GO TO 6070
7000 REM CHAREATDRINK
7010 LET A(C,4)=(K>2)*2+(K<3)*7:
 LET A(C,1)=A(C,1)+(K<3)*4: LET
A(C,2)=A(C,2)-(K>2)*2
7020 RETURN
8100 REM FREE
8102 LET A(C,2)=A(C,2)+2
8105 LET P$="": LET LOC=55716: L
ET L=21: GO SUB 9600: GO SUB 980
0
8110 GO SUB 7000
8115 GO SUB 6000
8120 LET T=T+5
8125 RETURN
8200 REM SERVE
8205 LET P$="": LET LOC=55711: L
```



```
ET L=5: GO SUB 9600: GO SUB 9800
8210 GO SUB 7000
8215 GO SUB 6000
8220 LET M=M+(K<3)*15+(K>2)*5
8225 LET T=T+5
8230 RETURN
8300 REM REFUSE
8305 LET P$="": LET LOC=55737: L
ET L=19: GO SUB 9600: GO SUB 980
0
8306 LET A(C,2)=A(C,2)-2
8307 LET P$="": LET LOC=55812: L
ET L=33: GO SUB 9600: GO SUB 980
0
8310 GO SUB 6000
8315 LET T=T+1
8320 RETURN
8900 REM BAR
8905 LET P$="": LET LOC=55620: L
ET L=36
8910 LET K=INT (RND*6)+1: GO SUB
 9600
8917 GO SUB 9800
8920 LET P$="": LET LOC=55656: L
ET L=55: GO SUB 9600: GO SUB 970
0
8925 GO SUB 8950
8927 GO TO 8930-5*((CC<1) OR (CC
>3))
8930 GO SUB 8000+CC*100
8935 RETURN
8950 REM ENTERCHOICE
8960 LET C$=INKEY$
8970 IF C$="" THEN  GO TO 8960
8980 LET CC=VAL C$
8990 RETURN
9000 REM CHAREVENT
9010 LET X1=INT (RND*10)+2
9020 IF X1>CN THEN  GO SUB 9200
9030 IF X1<CN  THEN  GO SUB 9100
9040 RETURN
9050 REM CHARCHOOSE
9060 LET C=FN A()
9070 IF A(C,5)<>1 THEN  GO TO 90
60
9080 RETURN
9100 REM CHARLEAVE
9110 LET LV=FN A()
9120 IF A(LV,5)<>1 THEN  GO TO 9
110
9130 LET P$=A$(LV): LET LOC=5559
9: LET L=21: GO SUB 9600: GO SUB
 9800
9140 LET A(LV,5)=0: LET CN=CN-1
9150 RETURN
9200 REM CHARENTRY
9210 LET E=FN A(): IF A(E,5)=0 T
HEN  GO TO 9225
9220 GO TO 9210
9225 LET A(E,5)=1: LET CN=CN+1
9230 LET P$=A$(E): LET LOC=55584
: LET L=15: GO SUB 9600: GO SUB
9800
9250 RETURN
9300 RESTORE 9350: REM SET UP CH
ARACTERS
9305 DIM A(11,6): DIM A$(11,8)
9310 FOR X=1 TO 11
9315 READ A$(x): LET A(X,5)=0: L
ET A(X,4)=1: LET A(X,6)=X
9320 FOR Y=1 TO 2: LET A(X,Y)=IN
T (RND*10)+2: NEXT Y
9325 NEXT X
9330 LET T$=""
9332 FOR X=56200 TO 56209: LET T
$=T$+CHR$ PEEK X: NEXT X
9333 LET T$=T$+"M"
9335 FOR X=1 TO 11: LET T1=FN A(
): LET T2=FN A(): LET S$=T$(T1):
 LET T$(T1)=T$(T2): LET T$(T2)=S
$: NEXT X
9340 FOR X=1 TO 11: LET A(X,3)=C
ODE T$(X): NEXT X
9345 FOR X=1 TO 11: LET T1=FN A(
): LET T2=FN A(): LET T3=A(T1,6)
: LET A(T1,6)=A(T2,6): LET A(T2,
6)=T3: NEXT X
9350 DATA "ABAGGORD","BOILBEAK",
"CROISSEL","DOM DZIN","FIARRACH"
,"HUGH TAB","K'TRASKT","LISSOMEL
","MOR-FAIN","EL NAZIR","ZOM SAF
T"
9355 RETURN
9400 RESTORE 9460: REM LOCATIONS
9410 DIM Z(23,2)
9420 FOR X=1 TO 2
9430 FOR Y=1 TO 23
9440 READ Z(Y,X)
9450 NEXT Y
9451 NEXT X
9460 DATA 0,21,40,55,74,85,104,1
26,147,161,172,197,212,238,282,3
08,344,373,415,464,493,525,553
9461 DATA 21,19,15,19,11,19,22,2
1,14,11,25,15,26,44,26,36,29,42,
49,29,32,28,31
9490 RETURN
9500 REM SPECIAL STRINGS
9505 IF (PEEK LOC)=44 THEN  LET
P$=P$+"HOW DO I"
9510 IF (PEEK LOC)=32 THEN  LET
P$=P$+"(sp)"
9515 IF (PEEK LOC)=38 THEN  LET
P$=P$+"THE DANCING OGRE"
9520 IF (((PEEK LOC)=46) AND (K<
3)) THEN  LET P$=P$+"FOOD "
9525 IF (((PEEK LOC)=46) AND (K>
2)) THEN  LET P$=P$+"DRINK"
9530 IF (PEEK LOC)=47 THEN  LET
P$=P$+A$(C)
9535 IF (PEEK LOC)=40 THEN  LET
P$=P$+"YOU"
9540 IF (PEEK LOC)=41 THEN  LET
P$=P$+"THE"
9545 IF (PEEK LOC)=42 THEN  LET
P$=P$+"GET"
9550 IF (PEEK LOC)=45 THEN  LET
P$=P$+"SERVE"
9555 IF (PEEK LOC)=43 THEN  LET
P$=P$+"DEAL WITH"
9590 GO TO 9630
9600 REM GET CHARACTERS TO P$
9610 FOR X=1 TO L
9611 IF (PEEK LOC)<48 THEN  GO T
O 9500
9620 LET P$=P$+CHR$ (PEEK LOC)
9630 LET LOC=LOC+1
9640 NEXT X
9650 RETURN
9700 PAPER 0: INK 6
9710 FOR X=17 TO 21: PRINT AT X,
0;"(32*sp)": NEXT X: LET L=LEN P
$: PRINT AT 17,0;
9720 FOR X=1 TO L
9730 PRINT P$(1);
9740 IF X=L THEN  GO TO 9760
9750 LET P$=P$(2 TO )
9760 NEXT X: RETURN
9800 PAPER 6: INK 1
9810 FOR X=2 TO 14: PRINT AT X,5
;"(22*sp)": NEXT X
9820 LET L=LEN P$: PRINT AT 3,5;
9830 FOR X=1 TO L
9840 PRINT P$(1);: IF INT (X/22)
=(X/22) THEN  PRINT "(cc2,cpc6,g
5,AAAig5,g5,AAA,ig5,cc1)";
9850 IF X=L THEN  GO TO 9870
9860 LET P$=P$(2 TO )
9870 NEXT X: RETURN
9900 RESTORE 9920
9910 FOR X=1 TO 8: READ A: POKE
USR "A"+X,A: NEXT X
9920 DATA 153,102,153,102,153,10
2,153,102
9930 FOR X=1 TO 64: PRINT "(cc2,
cpc6,ig3)";: NEXT X: FOR X=1 TO
13: PRINT "(cc2,cpc6,g5,AAAig5,2
2*sp,g5,AAA,ig5";: NEXT X: FOR X
=1 TO 32: PRINT "(cc2,cpc0,g3)";
: NEXT X: FOR X=1 TO 6: PRINT "(
32*sp)": NEXT x
9940 BORDER 2: INK 0: PAPER 6: R
EM END SO FAR
9950 RETURN
```

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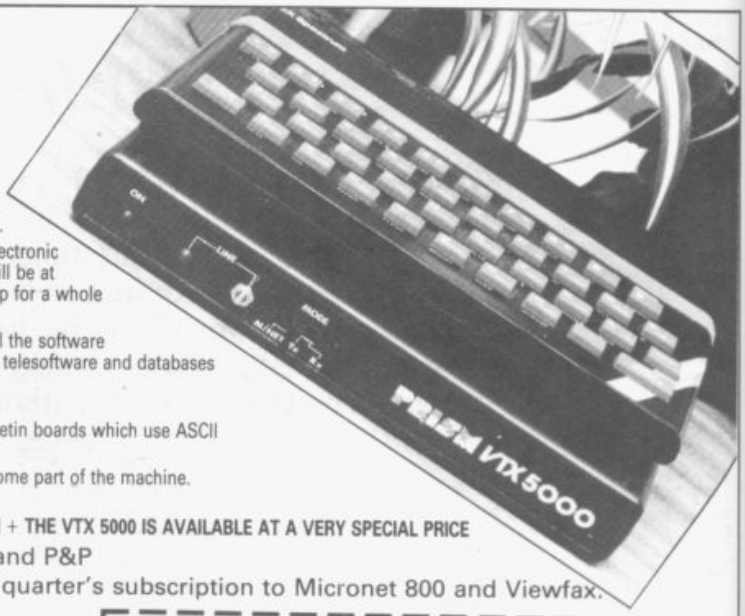

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IN THIS COLUMN I cover two related topics. The first shows you how to create new user defined characters and access them. In the second I discuss the simulation of sprite effects on the Spectrum screen, and in particular explain how to obtain flicker-free moving graphics.

There are two methods for creating new characters other than DRAW, PLOT and CIRCLE commands which are too slow and cumbersome for most purposes. The simplest is the user defined graphics facility in which up to 21 new characters can be defined and assigned, one to each of the letter keys A to U. The form of each new character is stored in eight bytes of the 168 bytes reserved for that purpose above RAMTOP, at the top of memory. The character assigned to a given key can be obtained by pressing the graphics key — CAPS SHIFT 9 — before and after the letter key.

The method of encoding and decoding the eight bytes can be understood with the help of some knowledge of binary numbers. Every character in the Spectrum character set — and every new character created by you — is defined relative to an eight by eight grid. Each element in the grid is called a pixel which can be set to either the INK or the PAPER colour. It is the precise arrangement of INK or PAPER coloured pixels in the eight by eight grid which creates each character.

"You can create new user defined characters and flicker-free moving graphics"

Each of the eight bytes devoted to a character defines the setting of one horizontal line of eight pixels using the following system. The contents of a byte — which lies in the range 0 to 255 in decimal — is read as an eight digit binary number, so there is a one-to-one correspondence between pixels and binary digits. A binary number consists of zeros and ones only. All pixels for which the corresponding binary digit is zero are set to the PAPER colour, whereas all pixels for which the corresponding digit is one are set to the INK colour.

Very often the first and last bytes of the group of eight controlling a given character are zero. Those two bytes determine the top and bottom of the character, and a zero setting ensures that all corresponding pixels are set to the PAPER colour. Thus when the character appears on screen it is separated from other items on the lines above and below. For a similar reason each byte usually contains an even number which is less than 128. As a result, all pixels at the right and left are set to the PAPER colour enabling that character to be distinguished from its fellows on either side.

When the Spectrum is first switched on, the UDG characters are set to a copy of the capital letters on the corresponding key. It is a simple matter to alter those characters. Table

one lists a Basic program which does the job. Also listed in table two are the numeric codes for the letters in the Greek alphabet.

That system is designed to provide a set of 21 new characters at most. Additional sets can be defined by altering the UDG systems variable held at 23675 and 23676. The number in UDG is the address of the first byte of the first graphics character, that is, the character assigned to the A key. When the Spectrum is switched on it is set to 32600 — 16K machine — or 65368 — 48K machine — reserving 168 bytes for the 21 characters between the UDG address and the top of RAM.

In principle UDG can be changed to point to any address in RAM, but the simplest approach is to reduce it by 168 for each additional character set required. It is also necessary to reduce RAMTOP by a similar amount so that the graphics characters do not interfere with the stack, thereby causing the machine to crash.

RAMTOP is normally set to one less than the value of UDG and the CLEAR instruction must be used to alter it. Thus, to create space for one additional set of graphics characters on the 16K machine enter

CLEAR 65199
POKE 23675,176
POKE 23676,254

The CLEAR command moves RAMTOP down to 65199 and the two POKEs reset UDG to

UDG = 176+256★254=65200

That leaves 65536−65200=336 bytes between the address pointed to by UDG and the top of RAM which is enough space for two tables, each 168 bytes long.

The UDG facility is flexible enough for most purposes despite the limitation of 21 characters per set, but the user should also be aware of the technique for redefining the ordinary character set.

There are 96 characters in the ordinary Spectrum character set. That starts with character code 32 — the space or blank character — and ends with the copyright symbol — code 127. They are defined in an analogous fashion to the user defined characters by a table which is held in ROM at address 15616. Each definition is held in eight bytes making the table 768 bytes long.

The address of the beginning of the table is 256 more than the value held in the CHARS system variable, located at 23606 and 23607. Bearing in mind that the code of the first character in the table is 32, it can be seen that the address of the first of the eight bytes defining a given character is PEEK 23606+256★PEEK 23607+8 ★character code.

Creating a new character set from scratch is a complicated task as the shape of each letter or digit must be worked out in detail. The best technique is to move RAMTOP down by 768 bytes, copy the entire Sinclair character table into the area above RAMTOP, and then reset CHARS to point to the new area. That is the function of the program in table three. New characters can then be created as modifications of the Sinclair originals.

There is considerable interest amongst Sinclair owners in techniques for putting sprites on the screen, and that is no doubt spurred on by the many interesting effects generated by professional games companies. Unfortunately, a typical good game takes six months to write and it is impossible to describe fully the techniques used in a single article. All I can do is give a taste of one aspect — how to produce flicker-free sprites.

The word sprite refers to a picture element superimposed on the video signal which is separate from the main body of information taken from the computer's memory map of the screen display. Imagine the existence of special hardware which intercepts

```
10 INPUT " ENTER THE LETTER TO BE REDEFINED "; A$
20 LET A$ = CHR$ (CODE A$ − 32 ★ (A$ › " £ "))
30 IF A$ ‹ "A" OR A$ › "U" THEN BEEP .2,24 : GOTO 10
40 FOR I = 0 TO 7
50 INPUT " ENTER BYTE NUMBER " ; J
60 IF J ‹ 0 OR J › 255 THEN BEEP .2,24 : GOTO 50
70 POKE USR A$ + I , J
80 NEXT I
```

Table 1. A Spectrum program for defining new user defined graphics characters.

the ordinary video signal on its way to the television, and modifies it to create the required picture element.

There is an unreal quality to this idea of changing the video signal from its proper form as derived from the memory map, and that is reflected in the use of the word sprite, with its images of elfs, to describe the effect generated. The form of the sprites — their colour, position and shape — is controlled by the values of various parameters in an analogous fashion to the way in which the system variables control functions in the Spectrum.

The main advantage of a hardware sprite system is that it allows the central processor chip to delegate the creation of multiple moving elements on the screen display, leaving it free to work on other tasks. The result is that games and other programs which use the sprite hardware are able to run faster than they otherwise would.

Thus it may seem surprising that the Spectrum should be popular as a games machine even though it contains no sprite hardware. The reasons for its continuing success are complex but there is one important contributory factor. The Z80 chip at the heart of the Spectrum has a large number of register orientated instructions and 16

```
10 CLEAR 64599
20 FOR I = 0 TO 767
30 POKE 64600 + I , PEEK (15616 + I)
40 NEXT I
50 POKE 23606 , 88
60 POKE 23607 , 251
```

Table 3. A 48K Spectrum program to move the character table above RAMTOP and reset the CHARS system variable to point to the new table. For use on a 16K machine alter the following lines:

```
10 CLEAR 31831
60 POKE 23607 , 123
```

bit instructions which allow it to execute relatively complicated routines quickly.

In contrast, the 6502 at the heart of the Commodore 64 — a sprite machine — has a large number of addressing modes but few internal registers and 16 bit instructions. It is as though the Z80 chip is very good at talking to itself whereas the 6502 is designed to talk to other chips. Thus the Z80 is able, to some extent, to make up for the lack of supporting hardware by working harder itself. Needless to say, good programming techniques are required in order to exploit the extra sophistication of the Z80.

Sprites are moving objects and so a simulated sprite must move around the Spectrum display file, perhaps changing its form as it does so. That means there must be some mechanism for deleting the sprite from its old position and placing it at its new position. The deletion phase normally comes before the placing phase although that is not essential. What is essential is that there must always be one, and only one, version of any given sprite in the display file when the scan is made to transfer the information to the television screen.

To understand how this one and only one rule operates, some knowledge is required of the way in which a TV picture is constructed. In the UK a TV picture consists of 625 horizontal scan lines. Each line is refreshed every fiftieth of a second in an alternating sequence — all odd numbered lines are refreshed in one scan and all even numbered lines are refreshed in the next. That ensures a complete picture is constructed every twenty-fifth of a second.

A scan of half the lines actually takes less than a fiftieth of a second to complete so there is a short delay between the construction of each half picture. That delay allows the electron beam — which writes the picture on the screen — enough time to fly back from the bottom right of the screen to the top left. There is then a synchronisation pulse which ensures that the writing of the next scan starts at the correct instant.

Clearly, if a complete half scan takes about a fiftieth of a second, the maximum amount of time between deleting a sprite from its old position and placing it in its new position is also about a fiftieth of a second. The cost of not replacing the sprite in time is that the sprite image flickers as it disappears and reappears. The timing of the deletion phase is obviously important and the best way to keep track of it is to use the least significant byte of the FRAMES system variable, located at address 23672, as a clock tick. That variable is up-dated every fiftieth of a second in time with the synchronisation pulse of the TV.

Letter	Lower case codes								Upper case codes							
Alpha	0	0	0	56	72	72	60	0	0	16	40	68	124	68	68	0
Beta	0	112	72	112	72	112	64	64	0	120	68	120	68	68	120	0
Gamma	0	0	72	48	32	32	32	0	0	124	68	64	64	64	64	0
Delta	48	64	32	48	72	72	48	0	0	64	96	80	72	68	124	0
Epsilon	0	0	56	64	48	64	56	0	0	124	64	120	64	64	124	0
Zeta	0	56	32	64	64	112	8	48	0	124	8	16	32	64	124	0
Eta	0	0	0	112	72	72	72	8	0	68	68	124	68	68	68	0
Theta	0	48	72	120	72	72	48	0	0	56	68	124	68	68	56	0
Iota	0	32	0	32	32	32	48	0	0	56	16	16	16	16	56	0
Kappa	0	0	72	80	96	80	72	0	0	72	80	96	80	72	68	0
Lamda	0	64	32	16	16	40	72	0	0	64	96	80	72	68	68	0
Mu	0	0	0	72	72	80	32	0	0	68	108	84	68	68	68	0
Nu	0	0	0	72	72	80	32	0	0	68	100	84	76	68	68	0
Xi	0	56	64	112	64	112	8	48	0	124	0	56	0	0	124	0
Omicron	0	0	0	48	72	72	48	0	0	56	68	68	68	68	56	0
Pi	0	0	0	248	80	80	80	0	0	252	72	72	72	72	72	0
Rho	0	0	0	48	72	112	64	64	0	120	68	68	120	64	64	0
Sigma	0	0	0	60	72	72	48	0	0	124	32	16	16	32	124	0
Tau	0	0	0	120	32	32	32	0	0	124	16	16	16	16	16	0
Upsilon	0	0	0	72	72	72	48	0	0	68	40	16	16	16	16	0
Phi	16	16	56	84	84	56	16	16	16	56	84	84	84	84	56	16
Chi	0	0	68	40	16	40	68	0	0	68	40	16	16	40	68	0
Psi	0	0	16	84	84	56	16	16	0	84	84	84	56	16	16	0
Omega	0	0	0	0	84	84	40	0	0	56	68	68	68	40	108	0

Table 2. Eight byte codes for forming lower and upper case Greek characters.

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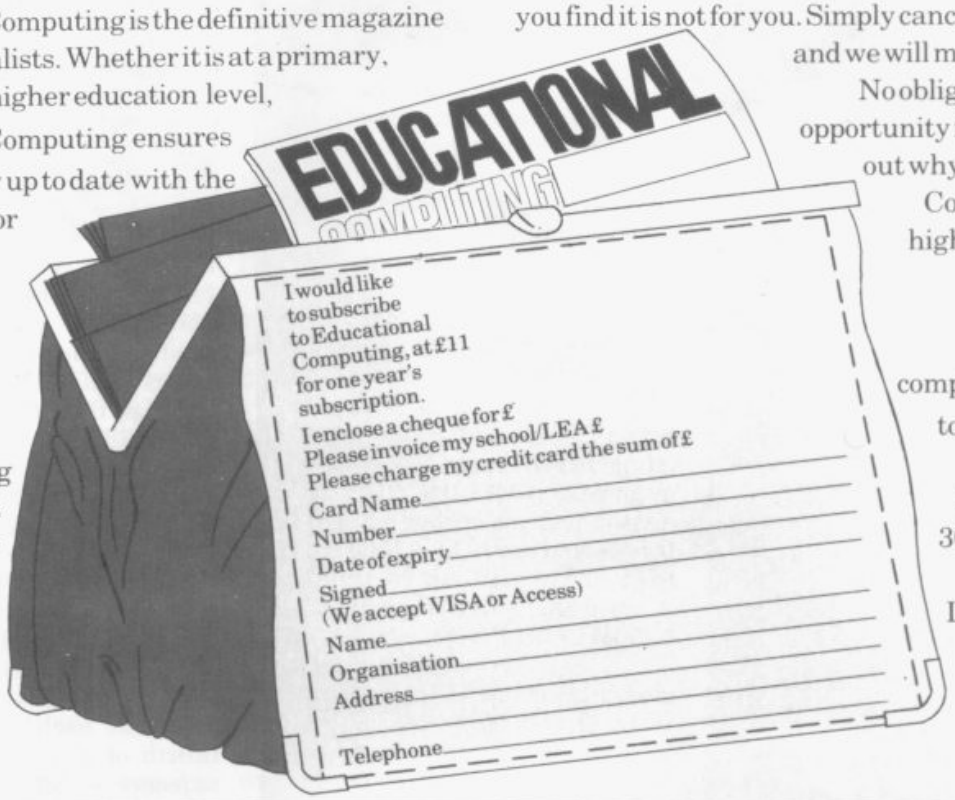

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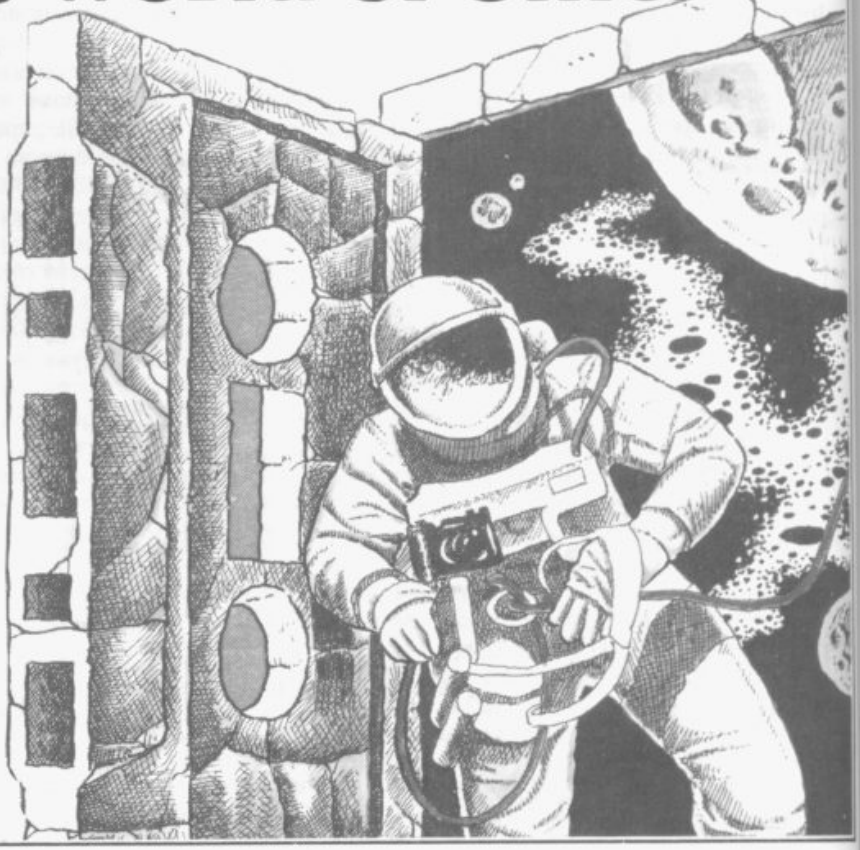


Books

AS THE market becomes more sophisticated, authors have had to cater for the needs of new groups of users.
If hacking is your pastime or machine code is your staple diet then there are books for you. On the other hand, if you prefer a gentle introduction to Basic or SuperBasic you will find that whole shelves have been dedicated to your needs.
John Gilbert sorts through the mountain of computer literature which has kept users happy during the past year.

ALTHOUGH few authors have produced computer books which have reached the best seller lists, technical authors must be amongst the most prolific writers in the world. A literary mountain was produced in 1985 alone, in order to further the knowledge of Sinclair computer owners and the popularity of Sinclair machines.

One author who almost reached the non-fiction best seller lists was Hugo Cornwall with **The Hacker's Handbook,** a slim but explosive book from Century Hutchinson. Hugo Cornwall still remains an enigma, even his name is a pseudonym.

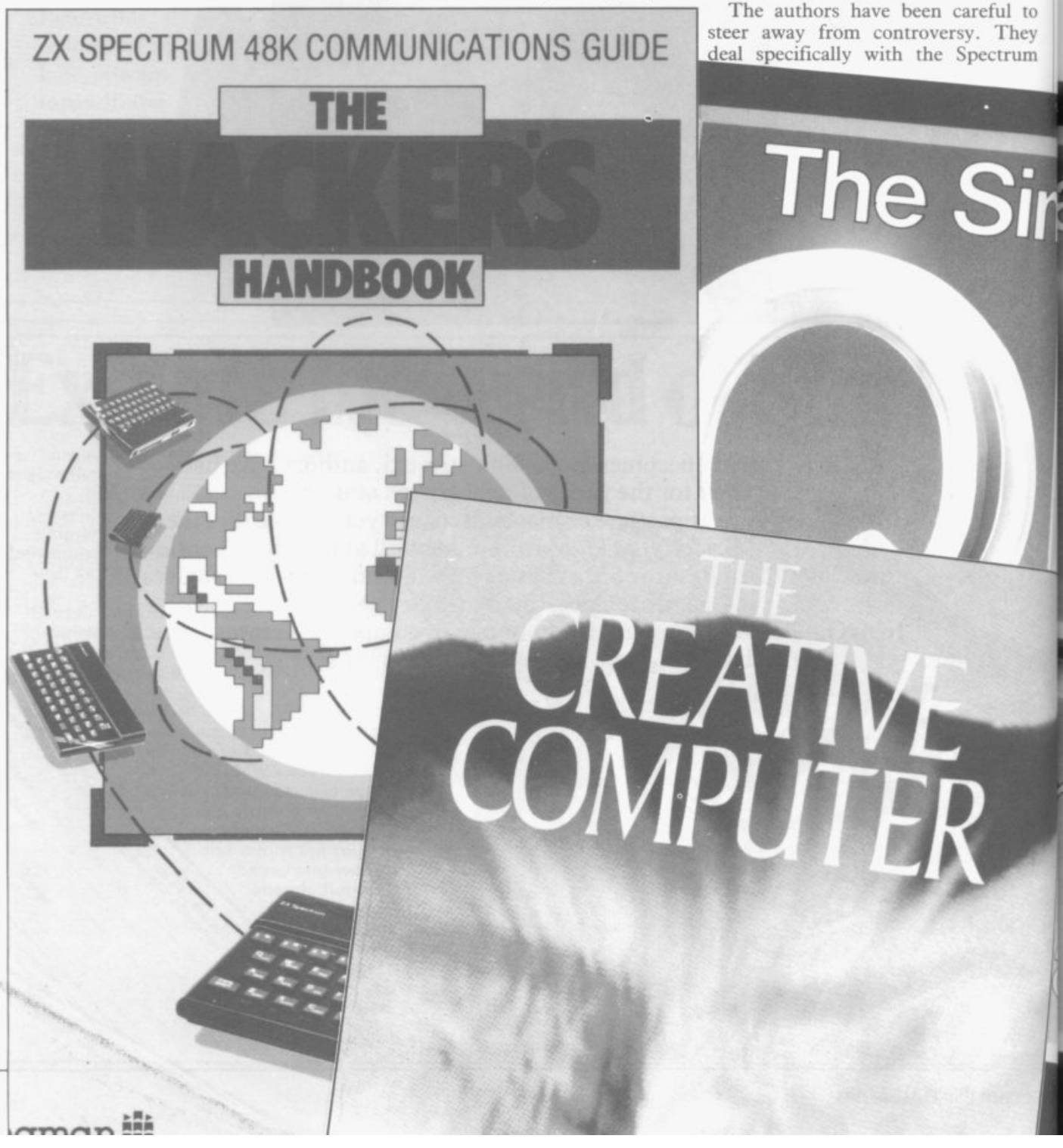
The Hacker's Handbook is a skilful mixture of personal experience, stories from secondary sources and practical information. Indeed, the way in which the book has been written leads me to suspect that Cornwall is a journalist as well as a hacker, or that the book was ghost written by someone from Century Hutchinson.

The practical information in Cornwall's book nearly landed him — her? — in trouble. It begins harmlessly enough with an introduction to innovations in communications technology. Once past that, and some innocuous remarks about his programming experience, Cornwall starts getting technical — and goes way beyond the definition of baud rate.

Although Cornwall gives information on communication protocols and how to go about finding passwords for various types of system, he is careful to point out that hacking is done more as a sport than as a criminal action. If it were more than that, banks would be defrauded daily, and our security installations would be broken into every evening.

The same point is made in a book written by Geoff Wheelwright and Ian Scales, published by Longman. It too is called **The Hacker's Handbook,** although it takes a slightly different angle on the subject.

The authors have been careful to steer away from controversy. They deal specifically with the Spectrum



and how it can be connected to systems such as *Micronet 800* and *Prestel*. An overview is given of both systems together with information on how to connect your computer to a VTX 5000 modem.

The final section of the book takes a look at electronic mail and bulletin boards. Telephone numbers are given to allow access to boards which are open to the public. Although Wheelwright and Scales are not as revealing as Cornwall about the secret world of the hacker, their introduction to the subject is practical and interesting.

Another subject of major interest to the computing public, especially QL owners, has been the secrets contained within the QDOS operating system which has been so highly vaunted by several books. There are no fewer than three titles on the market which jostle for acclaim as the best book about QDOS. They are **The Advanced QL User's Guide** by Adrian Dickens, from Adder; **The QDOS Companion** by Andrew Pennel, from Sunshine; and **The QL Technical Guide** by Tony Tebby and David Karlin, from Sinclair Research.

The books from Dickens and Pennel are very similar in structure. The first to appear was the one from Adder. Dickens managed to obtain the QDOS documentation from Sinclair Research and put together a book using it. The result is, none the less, impressive and, despite the mistakes, provided an introduction to the 68008 chip and operating system. Each QDOS trap was listed and examples of its uses were given.

As well as discussing memory management, graphics, sound and file processing, Dickens also included a chapter in which he showed how SuperBasic worked. Detailed appendices showing the memory map, full 68000 instruction set and microdrive formats were also provided.

Pennel's book differs only slightly from the advanced guide. It arrived on the market four months after Dickens' book and the result was a text full of examples which had obviously been created by the author.

The companion is structured as a graded introduction to multi-tasking, Input/Output, device drives and the QDOS utilities. Information is also included on the 8049 second processor, which acts as a control for the keyboard and sound, as well as an explanation of how to create external ROMs.

The third book, from Sinclair Research, resembles the **QL Advanced User Guide** but was rather a disappointment. It provides all the information that you would require to program QDOS but its style is clinical, with almost no examples to illustrate the wealth of knowledge given by the authors. It is a humourless read and, even as a reference book, lacks depth. The one or two paragraphs used to describe each trap, exception or interrupt are barely enough. Tebby and Karlin could at least have included a section detailing an example of QDOS in action. As it stands, the authors expect readers to share their competence — not a healthy assumption for any technical writer to make.

The Psion business packages, bundled with the QL, did not escape the attentions of authors last year. Three companies brought out books which cater for the business or home user who wants to put **Quill, Archive, Abacaus** or **Easel** to work.

Hutchinson was the first onto the scene with a series of QL handbooks. The series contained one title aimed at **Quill** owners and one aimed at **Archive** owners.

Word Processing with the Sinclair QL, by Mike O'Reilly, is competently written, although it is long-winded and says little. It shows how to power up the QL, how to load in **Quill** and how each of the commands work. It even goes as far as to show how a

letter can be written and reports drafted. Unfortunately it does not go much further.

Database Management on the Sinclair QL, also by Mike O'Reilly and also from Hutchinson, is much the same as the introduction to **Quill.** It does little better than the official Sinclair manual, a damning fault, as that manual leaves a lot to be desired.

The Hutchinson books are not the best on the Psion packages, and it is left to the series of Psion books from Century Communications to fit neatly into that niche. There are four books; one for each of the packages. The book on **Quill,** written by Clare Spottiswood, marked the series as a winner. Even Sir Clive Sinclair stuck his oar in and said that it was one of the most fab things he had ever seen. The simple style, combined with diagrams, cartoons and many useful examples, makes the book a joy to read.

Other titles in the series are similar in style but have different authors. **QL Archive,** by Ian Murray, provides the easiest and most interesting explanation of the database package ever committed to print. It is a delight to read, and the examples provided can be practically useful. Although it arrived late on the scene it should be very successful.

Sunshine also provided a book on the Psion packages, although it combined all four and was different in approach from the titles from Hutchinson and Century. **Quill, Easel, Archive and Abacus on the Sinclair QL,** by Alison McCallum-Varey, may be a bit of a mouthful, but it achieves its aim easily and concisely. The book shows how the four packages can be used together in a business environment. It also shows how to import and export information from them and which of the programs are compatible for each operation.

It was the first book to include comprehensive examples which were worth entering into the Psion packages and which stretched them to their limits. It also showed that the author had an understanding of the QL, while her colleagues in the computer publishing industry showed only their ignorance of the subject.

To be fair, Sinclair Research was to blame for much of the ignorance which authors exhibited after the launch of the QL. Boris Allan is the classic example of a writer so keen to get a book out about the new machine that he forgot the cardinal rule. Wait until a finished product arrives. His book, **The QL Companion** from Pitman can still be found on the bookshelves of WH Smith and Boots.

Anybody who buys it in the hope of learning something new about SuperBasic will be disappointed. It was written with the aid of a preproduction manual. That would have been alright if Sinclair had not decided to change SuperBasic. The language has gone through three transformations so far.

He is not alone, however. Other authors and publishers have made the same mistake. One such disaster was the **QL User Guide,** written by Lionel Fleetwood and published by Sigma Press. The author's object was to produce a book about SuperBasic and the Psion bundled packages. He also took his information from the manual and most of his examples were approximately half a page long — or one page when he was at his most impressive.

The best was yet to come. Fleetwood had obviously intended to write a section on the 68008 chip and QDOS but never quite got around to it. His publisher obviously expected it, as early copies of the book had a slip of paper stuck over part of the back cover. It hid the publisher's blurb about the 68008 section which was to have appeared in the book.

Hutchinson also tried its best to go to the rescue of knowledge-parched SuperBasic users. The company managed to produce a series of five books in what seems to ba a record time of two months.

The first in the series was **Introducing the Sinclair QL** by Garry Marshall. It gave simple explanations on how to plug in and switch on the machine, followed by a résumé of SuperBasic and an equally short section on the four Psion packages.

The other five books — mentioned at the end of this article — ran along similar lines. The authors wrote about the same subjects, but in a different style.

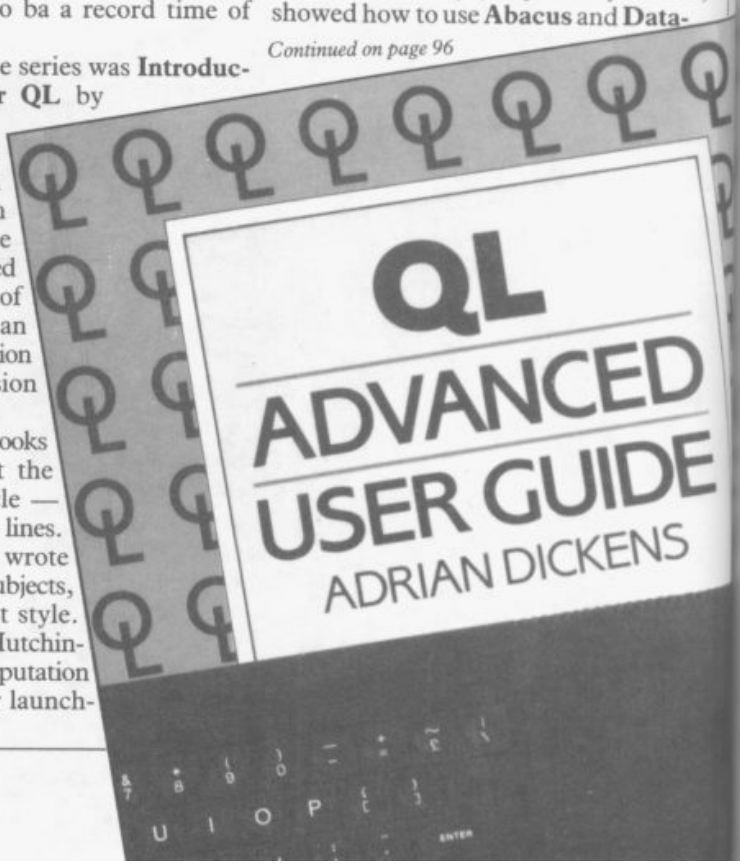
Fortunately, Hutchinson boosted its reputation for QL books by launching another five books, six months after the first part of its series. They dealt with graphics, machine code, business uses and database management.

Machine Code Programming on the Sinclair QL, by Martin Gandoff was the best of the five titles. It provided one of the most readable introductions to the art of 16-bit 68000 programming. Unlike many of the other books which tried to cover the subject, such as **QL Machine Code** from Melbourne House, it dealt specifically with QL hardware and software. The most important chapter of Gandoff's book was the section on exception processing. It showed how to invoke QDOS routines and was followed by an explanation of multitasking which even a newcomer to machine code programming could grasp. It is one of the most outstanding books of 1985.

Using Graphics on the Sinclair QL, by prolific and blunt-styled Garry Marshall, provided another exceptional contribution to the QL book scene. The text deals only with SuperBasic graphics commands but it does explain the different types of screen co-ordinates, windows and scaling windows. The examples provided are still worth running and provide some of the simplest but most effective graphics displays you can obtain on the QL.

The other three titles tied the series of ten books together. **Profiting from the Sinclair QL,** by Barry Miles, showed how to use **Abacus** and **Data-**

Continued on page 96



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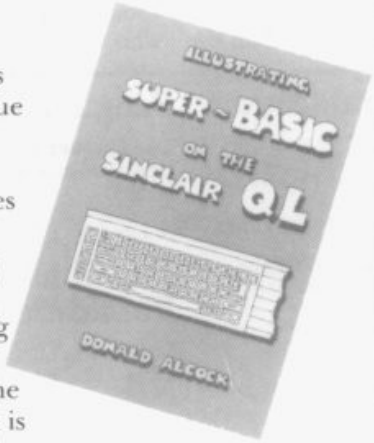

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JOHN and **CATHERINE GRANT**

Complementing the instruction manuals supplied with the ZX81 and the ZX Spectrum, this guide gives advice, supported by many well-written examples, on how to design and write programs for ZX machines. The authors have been closely involved with writing built-in software for the ZX range, and so are well-placed to give many useful tips. For anyone using ZX machines, this book will be the ideal companion.

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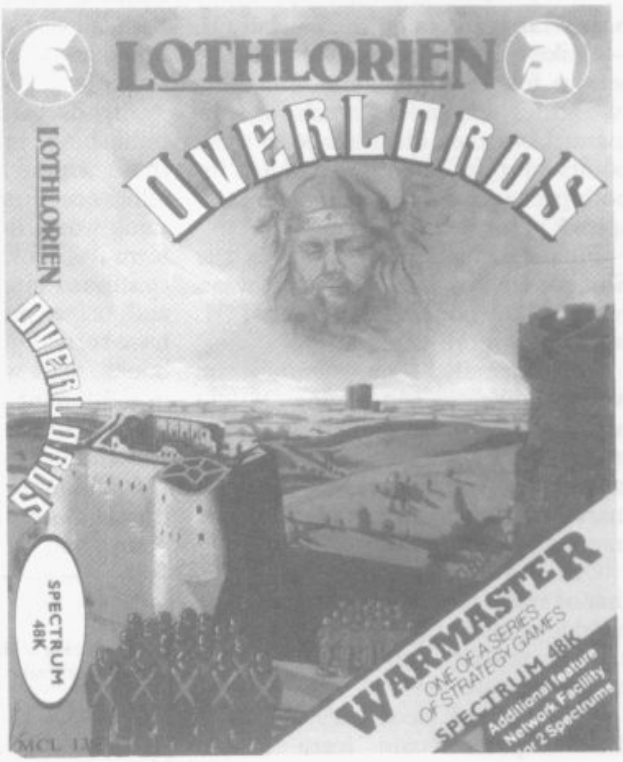

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base Management on the Sinclair QL — Mike O'Reilly performed the same service for **Archive.** Neither of those two titles expanded much on the manual but they did manage to score points on style. The Psion manuals for both packages were sketchy and uninspired.

Finally, **Making the Most of the Sinclair QL,** by Dick Meadows, was a repeat of **Introducing the Sinclair QL** with a few more examples.

Unfortunately, the enthusiasm which publishers had for the QL did not pay off. Only 50,000 QLs were sold worldwide during the year of its launch. As a result, the QL publishing market is not a happy place at the moment.

One area which is looking healthy is that of artificial intelligence. The most notable contribution for the Spectrum came from Keith and Steven Brain — no puns please.

They showed techniques by which the computer could learn simple games, understand English sentence input and construct intelligent replies. Most of the information described algorithm methods and not heuristics. That means the programs which they developed in the book use a method which the computer steps through every time. An heuristic is a method by which the computer learns from its mistakes by trial and error, and a little more about such techniques would have been appreciated.

One book which did deal with heuristics was **The Creative Computer** by Donald Michie and Rory Johnston. It is a general computer book which publisher Penguin/Viking pointed out was unlike anything which had ever been printed. That pronouncement sent reviewers into a flurry trying to obtain a copy.

The premise of the book is that it is possible for computers to take in data and, from that information, produce new data. The authors show examples of intelligent systems, most of which accept knowledge from professionals such as doctors or architects. Those computers can then use that information to diagnose a disease or even find an oil field.

It becomes obvious that all Michie and Johnston are talking about are relational databases, commonly called expert systems.

Nobody wrote a book on true artificial intelligence last year, even though some authors tried to disguise their books as such. True AI is bound up with all sorts of philosophical questions, and consciousness must also be linked with the subject.

Trends within the computer book publishing industry are similar to those within the field of artifical intelligence. Few people have said anything worth listening to. The trend in formula books started in 1984 and continued into 1985. It is still with us and, as a result, computer authors have turned out copies of each other's books, texts which say the same thing in a different way.

Unfortunately, for both publishers and authors the public has caught on. It is no longer willing to put up with a standard of publication which is no better, and sometimes worse, than the pulp fiction of the 1920s.

If both the computer industry and book publishing industry are going to survive then authors had better start coming up with new ideas. There are many fields which have not been covered this year. They include the use of computers as control devices, how to go about connecting your machine to the outside world using telephone or radio links, or even the new graphics science of Fractals. None of those subjects was covered last year, but each expands the use of the Spectrum and QL and the interests of their owners. It is about time publishers thought less about making money on formula books, and more about continuing the interest of those who use computers.

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Hugo Cornwall
£3.95

QL Archive
Ian Murray
£8.95

QL Quill
Clare Spottiswood
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Geoff Wheelwright and Ian Scales
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Andrew Pennel
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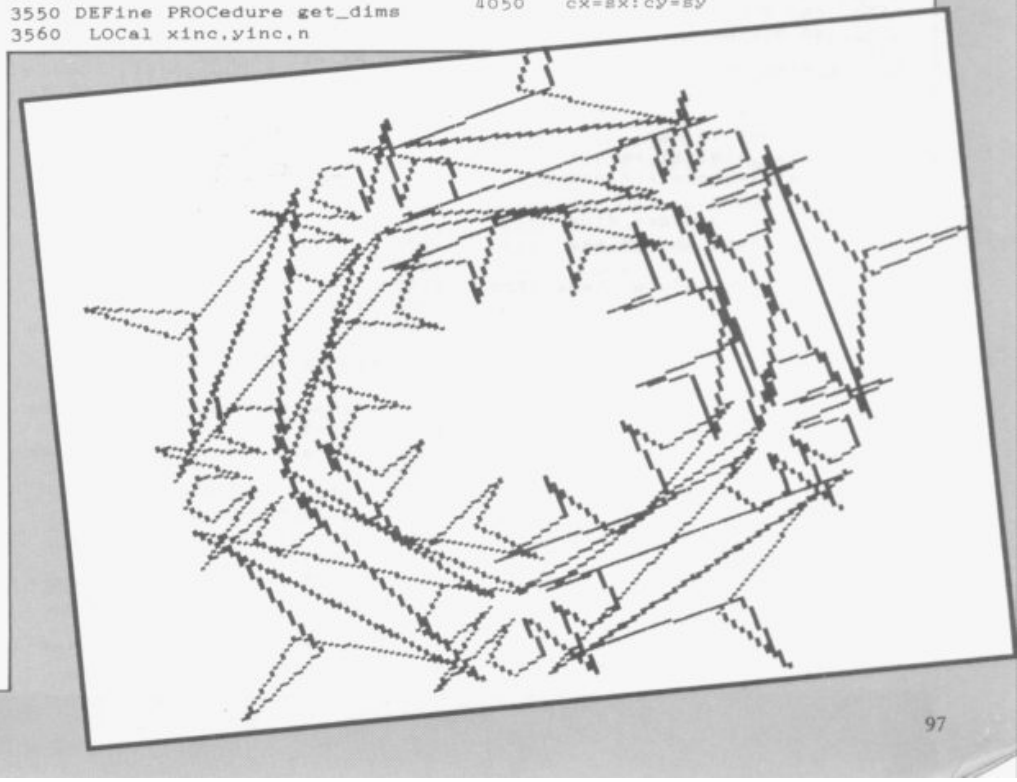
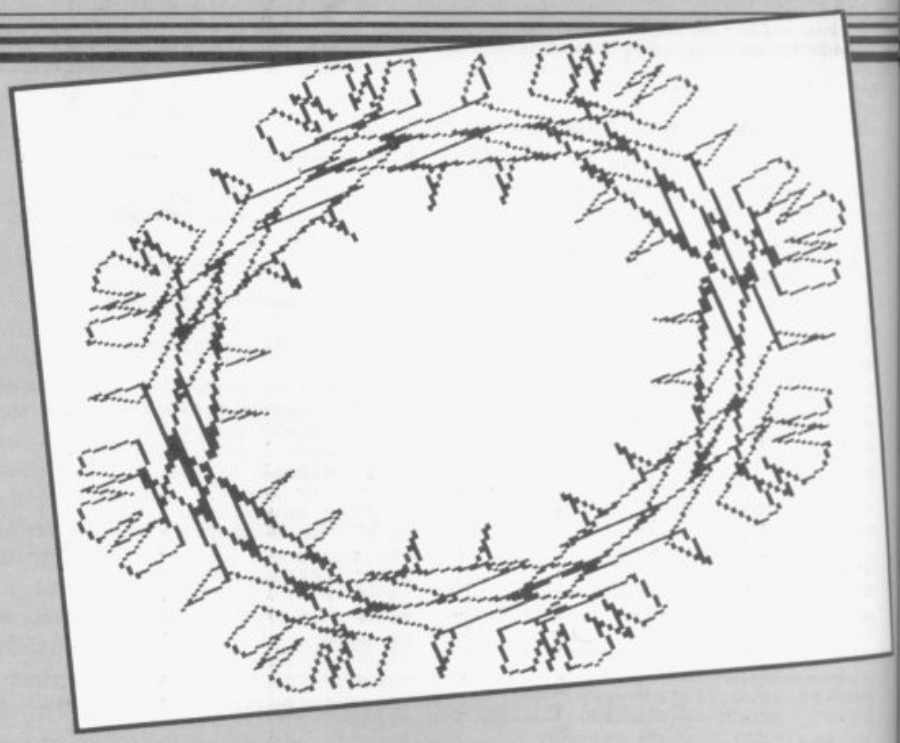
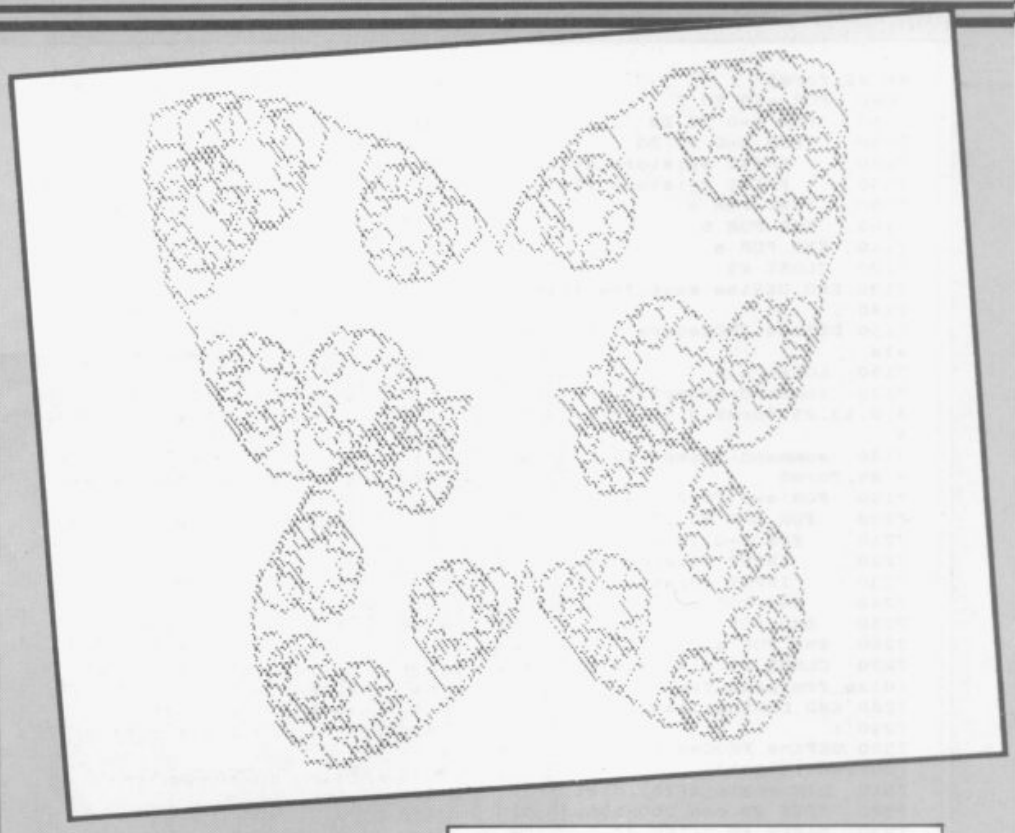
```
2590 :
2600 DEFine PROCedure main_menu
2610  LOCal a
2620  OPEN #3,scr_200x94a36x18
2630  PAPER #3,2:INK #3,0:CSIZE
#3,2,0:CLS #3
2640  PRINT #3;'   MAIN MENU'
2650  WINDOW #3;193,80,40,29
2660  PAPER #3,0:INK #3,7:CSIZE
#3,1,0:CLS #3
2670  PRINT #3\\"    Alter segme
nt"\"    Alter frame"\"    Chang
e segment"\"    Change frame"\"
   Draw fractal"\"    Permanent
store"
2680 END DEFine main_menu
2690 :
2700 DEFine PROCedure select_opt
ion (menu2,strm,strt,tot,mpos,va
nish,old_vanish)
2710  LOCal a,pos
2720  pos=mpos:opos=-1
2730  REPeat loop
2740   OVER #strm,-1
2750   IF old_vanish<>-1 THEN BL
OCK #strm,192,10,0,((strt+old_va
nish+1)*10),7:old_vanish=-1
2760   IF opos>-1 THEN BLOCK #st
rm,192,10,0,((strt+opos)*10),7
2770   BLOCK #strm,192,10,0,((st
rt+pos)*10),7:OVER #strm,0
2780   opos=pos:IF menu2 THEN ca
ll_menu pos
2790   REPeat loop2
2800    i$=INKEY$(-1)
2810    pos=pos+((i$=CHR$(216))*
(pos<(tot-1)))-((i$=CHR$(208))*(
pos>0))
2820    IF i$=CHR$(32) THEN sele
ction=pos:EXIT loop2
2830    IF pos<>opos THEN EXIT l
oop2
2840   END REPeat loop2
2850  IF i$=CHR$(32) THEN EXIT l
oop
2860  END REPeat loop
2870  OVER #strm,-1
2880  IF vanish THEN BLOCK #strm
,192,10,0,((strt+pos)*10),7
2890  OVER #strm,0:mpos=pos
2900 END DEFine select_option
2910 :
2920 DEFine PROCedure call_menu
(no)
2930  LOCal title$
2940  OPEN #5,scr_200x10a36x120
2950  PAPER #5,2:INK #5,0
2960  RESTORE no*10+10000:READ t
itle$
2970  CSIZE #5,2,0:CLS #5:PRINT
#5;title$
2980 END DEFine call_menu
2990 :
3000 DEFine PROCedure UPDATE_FRA
CTAL_MENU (option,value)
3010  PAPER #6,7:INK #6,0:AT #6,
option,20:CLS #6,4
3020  PRINT #6;value;')':PAPER #
6,0:INK #6,7
3030 END DEFine UPDATE_FRACTAL_M
ENU
3040 :
3050 DEFine PROCedure command
3060  OPEN #8,scr_433x26a36x226
3070  BORDER #8,2,2:PAPER #8,0:C
LS #8
3080 END DEFine command
3090 :
3100 DEFine PROCedure prompt (no
,lne)
3110  RESTORE no+20000:READ text
$
3120  AT #8,lne,0:CLS #8,3:PRINT
 #8;text$;
3130 END DEFine prompt
3140 :
3150 DEFine PROCedure directory
3160  command:prompt 2,0:_input
8,0,15,5,dir_$,0,5
3170  OPEN #9,scr_200x196a36x18
3180  PAPER #9,2:INK #9,0:CSIZE
#9,1,0:CLS #9
3190  PRINT #9;'  DIRECTORY OF '
;input_$
3200  WINDOW #9,193,182,40,29
3210  PAPER #9,0:INK #9,7:CSIZE
#9,0,0:CLS #9
3220  DIR #9,input_$:dir_$=input
_$
3230  command:prompt 4,1:PAUSE:C
LOSE #9
3240 END DEFine directory
3250 :
3260 DEFine PROCedure _input (st
rm,px,py,leng,default$,num,min)
3270  LOCal inp$,i,ok
3280  ok=0:input_$=default$
3290  REPeat I_loop
3300   AT #strm,px,py:CLS #strm,
4:PRINT #strm;input_$
3310   inp$=INKEY$(-1):i=CODE(in
p$)
3320   SELect ON i
3330    =10
3340     IF LEN(input_$)>=min TH
EN ok=1
3350    =194
3360     IF LEN(input_$)>0 THEN
input_$=input_$(1 TO(LEN(input_$
)-1))
3370    =65 TO 90,95,97 TO 122
3380     IF num=0 AND LEN(input_
$)<leng THEN input_$=input_$&inp
$
3390    =48 TO 57
3400     IF LEN(input_$)<leng TH
EN input_$=input_$&inp$
3410   END SELect
3420   IF ok THEN EXIT I_loop
3430  END REPeat I_loop
3440 END DEFine _input
3450 :
3460 DEFine PROCedure format_dev
ice
3470  command:prompt 2,0:_input
8,0,15,15,form$,0,5
3480  form$=input_$:command
3490  PRINT #8;" Formatting ";fo
rm$;'.
Please wait'
3500  AT #8,0,13+LEN(form$):FORM
AT #8;form$
3510  AT #8,0,12+LEN(form$):PRIN
T #8;' ':AT #8,0,1:PRINT #8;'
       ':AT #8,0,44:CLS #8,4
3520  prompt 4,1:PAUSE:logo
3530 END DEFine format_device
3540 :
3550 DEFine PROCedure get_dims
3560  LOCal xinc,yinc,n
3570  xinc=0:yinc=0
3580  FOR n=1 TO num_seg
3590   xinc=xinc+dist_s(n)*SIN(a
ngle_s(n))
3600   yinc=yinc+dist_s(n)*COS(a
ngle_s(n))
3610  END FOR n
3620  len_seg=SQRT(xinc^2+yinc^2
)
3630  IF yinc+1=1
3640   IF xinc>=0:horiz=PI/2
3650   IF xinc<0:horiz=-PI/2
3660  ELSE
3670   IF xinc+1=1
3680    IF yinc>0:horiz=0
3690    IF yinc<0:horiz=PI
3700   ELSE
3710    horiz=ATAN(xinc/yinc)
3720    IF yinc<0:horiz=horiz+PI
3730   END IF
3740  END IF
3750 END DEFine get_dims
3760 :
3770 DEFine PROCedure draw(strm,
dist,theta)
3780  LOCal lx,ly
3790  lx=cx+dist*SIN(theta):ly=c
y+dist*COS(theta)
3800  LINE #strm,cx,cy TO lx,ly
3810  cx=lx:cy=ly
3820 END DEFine draw
3830 :
3840 DEFine PROCedure fractal(st
rm,depth,sx,sy,EX,ey)
3850  LOCal scal,theta,n,x1,y1,x
2,y2
3860  IF depth=0
3870   LINE #strm,sx,sy TO EX,ey
3880   RETurn
3890  END IF
3900  scal=SQRT((sx-EX)^2+(sy-ey
)^2)/len_seg
3910  IF ey=sy
3920   IF EX>=sx THEN theta=PI/2
3930   IF EX<sx THEN theta=-PI/2
3940  ELSE
3950   IF EX=sx
3960    IF ey>sy:theta=0
3970    IF ey<sy:theta=PI
3980   ELSE
3990    theta=ATAN((EX-sx)/(ey-s
y))
4000    IF ey<sy THEN theta=thet
a+PI
4010   END IF
4020  END IF
4030  theta=theta-horiz
4040  IF depth=1
4050   cx=sx:cy=sy
```





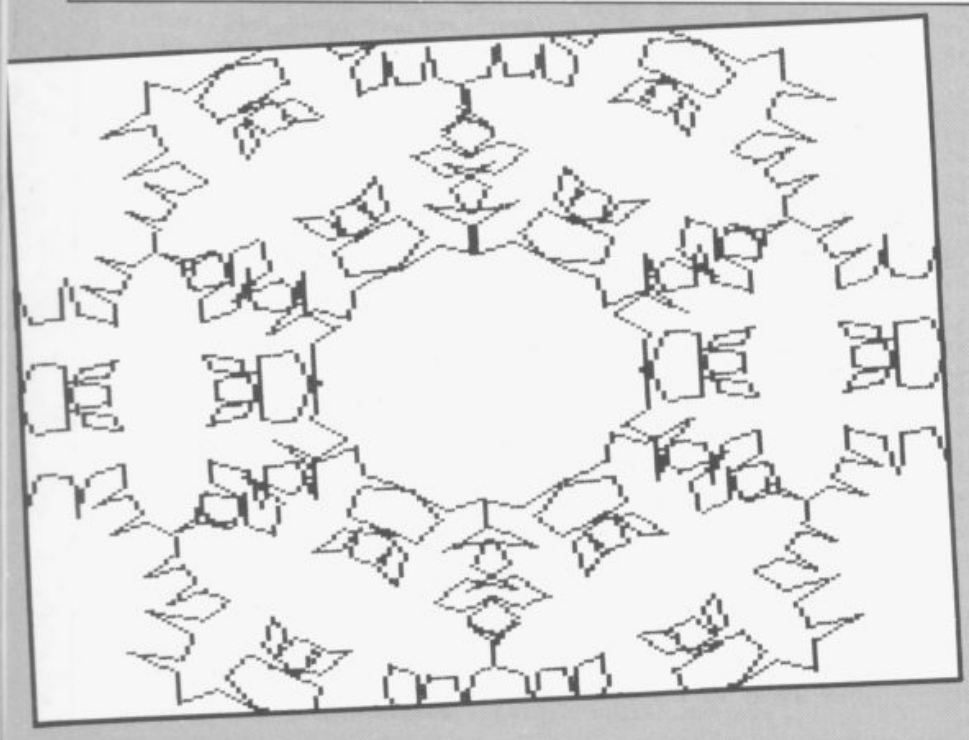
```
4060    FOR n=1 TO num_seg
4070     draw strm,dist_s(n)*scal
,angle_s(n)+theta
4080     IF strm=1 AND (CODE(INKE
Y$)=27 OR esc=1) THEN esc=1:RETu
rn
4090    END FOR n
4100   ELSE
4110    x1=sx:y1=sy
4120    FOR n=1 TO num_seg
4130     x2=x1+scal*dist_s(n)*SIN
(angle_s(n)+theta)
4140     y2=y1+scal*dist_s(n)*COS
(angle_s(n)+theta)
4150     fractal strm,depth-1,x1,
y1,x2,y2
4160     IF strm=1 AND (CODE(INKE
Y$)=27 OR esc=1) THEN esc=1:RETu
rn
4170     x1=x2:y1=y2
4180    END FOR n
4190   END IF
4200 END DEFine fractal
4210 :
4220 DEFine PROCedure init_main
4230  LOCal num,n,angle,dist
4240  RESTORE
4250  DIM store_s(2,20,20),store
_f(2,20,20)
4260  DIM angle_s(20),dist_s(20)
,angle_f(20),dist_f(20)
4270  num_seg=0:num_frm=0:esc=0:
pres_seg=4:pres_frm=3
4280  mode_=4:ink_=7:paper_=0:x_
coord=50:y_coord=50:depth_=2
4290  scale_=100:mpos=0:main=0:d
ir_$='mdv1_':form$='mdv1_'
4300  FOR num=1 TO 10
4310   FOR n=1 TO num
4320    READ dist,angle
4330    store_s(1,num,n)=dist:st
ore_s(2,num,n)=angle*PI/180
4340   END FOR n
4350   FOR n=1 TO num
4360    READ dist,angle
4370    store_f(1,num,n)=dist:st
ore_f(2,num,n)=angle*PI/180
4380    store_f(2,num,n)=angle*P
I/180
4390   END FOR n
4400  END FOR num
4410  FOR num=11 TO 20
4420   FOR n=1 TO num
4430    store_s(1,num,n)=5:store
_f(1,num,n)=5
4440    store_s(2,num,n)=PI/2:st
ore_f(2,num,n)=PI/2
4450   END FOR n
4460  END FOR num
4470 END DEFine init_main
4480 :
4490 DEFine PROCedure change_seg
(num)
4500  LOCal n
4510  FOR n=1 TO num
4520   dist_s(n)=store_s(1,num,n
):angle_s(n)=store_s(2,num,n)
4530  END FOR n
4540  num_seg=num:get_dims
4550 END DEFine change_seg
4560 :
4570 DEFine PROCedure change_frm
 (num)
4580  LOCal n
4590  FOR n=1 TO num
4600   dist_f(n)=store_f(1,num,n
):angle_f(n)=store_f(2,num,n)
4610  END FOR n
4620  num_frm=num
4630 END DEFine change_frm
4640 :
4650 DEFine PROCedure disp_seg (
num)
4660  OPEN#1,scr_220x94a248x18:P
APER 4:INK 0:CSIZE 2,0
4670  AT 0,12:PRINT num;' ':CLS
#4
4680  change_seg num
4690  fractal 4,1,50,50,150,50
4700  change_seg pres_seg
4710 END DEFine disp_seg
4720 :
4730 DEFine PROCedure disp_frm (
num)
4740  OPEN#1,scr_220x94a248x120:
PAPER 4:INK 0:CSIZE 2,0
4750  AT 0,11:PRINT num;' ':CLS
#7
4760  CLS #7
4770  change_frm num
4780  dx=x_coord:dy=y_coord:SCAL
E #7,scale_,0,0
4790  FOR n=1 TO num
4800   x=dx+dist_f(n)*SIN(angle_
f(n))
4810   y=dy+dist_f(n)*COS(angle_
f(n))
4820   fractal 7,0,dx,dy,x,y:dx=
x:dy=y
4830  END FOR n
4840  change_frm pres_frm
4850 END DEFine disp_frm
4860 :
4870 DEFine PROCedure choose_seg
4880  LOCal i
4890  command:prompt 9,0:num=pre
s_seg
4900  REPeat choose
4910   i=CODE(INKEY$(-1))
4920   SELect ON i
4930    =192
4940     IF num>1 THEN num=num-1
:disp_seg num
4950    =200
4960     IF num<20 THEN num=num+
1:disp_seg num
4970    =32
4980     EXIT choose
4990   END SELect
5000  END REPeat choose
5010  change_seg num:pres_seg=nu
m
5020 END DEFine choose_seg
5030 :
5040 DEFine PROCedure choose_frm
5050  LOCal i
5060  command:prompt 9,0:num=pre
s_frm
5070  REPeat choose
5080   i=CODE(INKEY$(-1))
5090   SELect ON i
5100    =192
5110     IF num>1 THEN num=num-1
:disp_frm num
5120    =200
5130     IF num<20 THEN num=num+
1:disp_frm num
5140    =32
5150     EXIT choose
5160   END SELect
5170  END REPeat choose
5180  change_frm num:pres_frm=nu
m
5190 END DEFine choose_frm
5200 :
5210 DEFine PROCedure store_seg(
num)
5220  LOCal n
5230  FOR n=1 TO num
5240   store_s(1,num,n)=dist_s(n
)
5250   store_s(2,num,n)=angle_s(
n)
5260  END FOR n
5270 END DEFine store_seg
5280 :
5290 DEFine PROCedure store_frm(
num)
5300  LOCal n
5310  FOR n=1 TO num
5320   store_f(1,num,n)=dist_f(n
)
5330   store_f(2,num,n)=angle_f(
n)
5340  END FOR n
5350 END DEFine store_frm
5360 :
5370 DEFine PROCedure edit_ (num
)
5380  LOCal n,i,spt,pt,ept
5390  FOR n=3 TO 8:OPEN #n,scr:C
LOSE #n
5400  OPEN#1,scr_433x200a36x18
5410  PAPER 0:INK 7:CLS:BORDER 2
,2:command:prompt 12,0
5420  POINT 60,50:OVER -1
5430  FOR n=1 TO num
5440   LINE TO points(1,n),point
s(2,n)
5450  END FOR n
5460  pt=0
5470  REPeat m_loop
5480   REPeat loop
5490    CURSOR points(1,pt),poin
ts(2,pt),-3,-6:PRINT"o"
5500    i=CODE(INKEY$(-1))
5510    SELect ON i
5520     =192
5530      CURSOR points(1,pt),po
ints(2,pt),-3,-6:PRINT"o":IF pt>
0:pt=pt-1
5540     =200
5550      CURSOR points(1,pt),po
ints(2,pt),-3,-6:PRINT"o":IF pt<
num:pt=pt+1
5560     =32
```

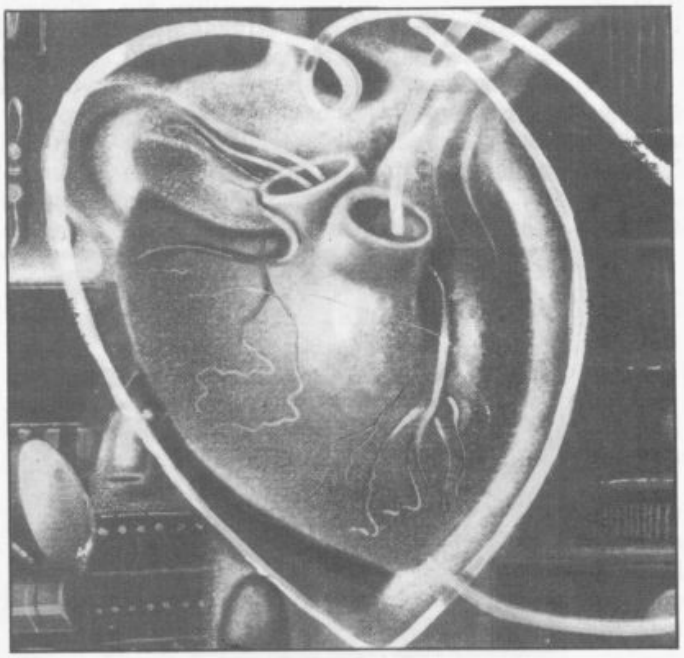
```
5570       EXIT loop
5580      =27
5590       EXIT m_loop
5600      =REMAINDER
5610       CURSOR points(1,pt),po
ints(2,pt),-3,-6:PRINT"o"
5620     END SELect
5630    END REPeat loop
5640    CURSOR points(1,pt),point
s(2,pt),-3,-6:PRINT"o"
5650    spt=pt-1:ept=pt+1
5660    IF pt=0 THEN spt=pt
5670    IF pt=num THEN ept=pt
5680    move_pt points(1,spt),poi
nts(2,spt),points(1,pt),points(2
,pt),points(1,ept),points(2,ept)
5690   END REPeat m_loop
5700   CURSOR points(1,pt),points
(2,pt),-3,-6:PRINT"o"
5710   FOR n=num TO 0 STEP -1
5720    points(1,n)=points(1,n)-p
oints(1,0)
5730    points(2,n)=points(2,n)-p
oints(2,0)
5740   END FOR n:OVER 0
5750 END DEFine edit_
5760 :
5770 DEFine PROCedure edit_s
5780  LOCal points(2,num_seg),x,
y,n
5790  REPeat check
5800   x=0:y=0
5810   FOR n=0 TO num_seg
5820    x=x+dist_s(n)*SIN(angle_
s(n)+PI/2-horiz)
5830    y=y+dist_s(n)*COS(angle_
s(n)+PI/2-horiz)
5840    points(1,n)=x+60:points(
2,n)=y+50
5850   END FOR n
5860   edit_ num_seg
5870   FOR n=1 TO num_seg
5880    x=points(1,n)-points(1,n
-1)
5890    y=points(2,n)-points(2,n
-1)
5900    dist_s(n)=SQRT(x^2+y^2)
5910    IF y+1==1
5920     IF x>=0:angle_s(n)=PI/2
5930     IF x<0:angle_s(n)=-PI/2
5940    ELSE
5950     IF x+1==1
5960      IF y>0:angle_s(n)=0
5970      IF y<0:angle_s(n)=PI
5980     ELSE
5990      angle_s(n)=ATAN(x/y)
6000      IF y<0:angle_s(n)=angl
e_s(n)+PI
6010     END IF
6020    END IF
6030   END FOR n
6040   get_dims:IF len_seg>=1:st
ore_seg num_seg:EXIT check
6050   command:prompt 15,0:PAUSE
6060  END REPeat check
6070 END DEFine edit_s
6080 :
6090 DEFine PROCedure edit_f
6100  LOCal points(2,num_frm),x,
y,n
6110  x=0:y=0
6120  FOR n=0 TO num_frm
6130   x=x+dist_f(n)*SIN(angle_f
(n))
6140   y=y+dist_f(n)*COS(angle_f
(n))
6150   points(1,n)=x+60:points(2
,n)=y+50
6160  END FOR n
6170  edit_ num_frm
6180  FOR n=1 TO num_frm
6190   x=points(1,n)-points(1,n-
1)
6200   y=points(2,n)-points(2,n-
1)
6210   dist_f(n)=SQRT(x^2+y^2)
6220   IF y+1==1
6230    IF x>=0:angle_f(n)=PI/2
6240    IF x<0:angle_f(n)=-PI/2
6250   ELSE
6260    IF x+1==1
```



```
6270     IF y>0:angle_f(n)=0
6280     IF y<0:angle_f(n)=PI
6290    ELSE
6300     angle_f(n)=ATAN(x/y)
6310     IF y<0:angle_f(n)=angle
_f(n)+PI
6320    END IF
6330   END IF
6340  END FOR n
6350  store_frm num_frm
6360 END DEFine edit_f
6370 :
6380 DEFine PROCedure move_pt(sx
,sy,x,y,EX,ey)
6390  LOCal i
6400  command:prompt 11,0
6410  OVER -1
6420  LINE sx,sy TO x,y TO EX,ey
6430  REPeat loop
6440   LINE sx,sy TO x,y TO EX,e
y
6450   i=CODE(INKEY$(-1))
6460   SELect ON i
6470    =208
6480     LINE sx,sy TO x,y TO EX
,ey:y=y+1
6490    =209
6500     LINE sx,sy TO x,y TO EX
,ey:y=y+5
6510    =216
6520     LINE sx,sy TO x,y TO EX
,ey:y=y-1
6530    =217
6540     LINE sx,sy TO x,y TO EX
,ey:y=y-5
6550    =192
6560     LINE sx,sy TO x,y TO EX
,ey:x=x-1
6570    =193
6580     LINE sx,sy TO x,y TO EX
,ey:x=x-5
6590    =200
6600     LINE sx,sy TO x,y TO EX
,ey:x=x+1
6610    =201
6620     LINE sx,sy TO x,y TO EX
,ey:x=x+5
6630    =32
6640     EXIT loop
6650    =REMAINDER
6660     LINE sx,sy TO x,y TO EX
,ey
6670   END SELect
6680  END REPeat loop
6690  prompt 12,0
6700 END DEFine move_pt
6710 :
6720 DEFine PROCedure draw_fract
al
6730  LOCal n,x,sx,y,sy,esc
6740  FOR n=4 TO 8:OPEN #n,scr:C
LOSE #n
6750  IF mode_=8 THEN MODE 8:ELS
E push_menu
6760  OPEN #3,scr_512x256a0x0:PA
PER #3,7,0,1:CLS #3:CLOSE #3
6770  OPEN #1,scr_433x200a36x18
6780  INK ink_:PAPER paper_:CLS:
BORDER 2,2:command:prompt 7,0
6790  SCALE scale_,0,0:sx=x_coor
d:sy=y_coord:esc=0
6800  FOR n=1 TO num_frm
6810   x=sx+dist_f(n)*SIN(angle_
f(n))
6820   y=sy+dist_f(n)*COS(angle_
f(n))
6830   fractal 1,depth_,sx,sy,x,
y:IF esc=1:EXIT n
6840   sx=x:sy=y
6850  END FOR n
6860  save_scrn:IF mode_=8 THEN
MODE 4
6870 END DEFine draw_fractal
6880 :
6890 DEFine PROCedure save_scrn
6900  LOCal a$
6910  command:prompt 5,0
6920  a$=INKEY$(-1):IF a$=="s"
6930   command:prompt 3,0:_input
 8,0,13,15,form$,0,5:form$=input
_$
6940   BORDER #8,0,0:PAPER #8,7,
0,1:CLS #8
6950   SBYTES form$,131072,32768
6960  END IF
6970  command
6980 END DEFine save_scrn
6990 :
7000 DEFine PROCedure save_fract
als
7010  LOCal a,b,c
7020  command:prompt 3,0:_input
8,0,13,25,form$,0,5:form$=input_
$
7030  command:prompt 13,0:OPEN_N
```

```
EW #9;form$
7040  FOR a=0 TO 2
7050   FOR b=0 TO 20
7060    FOR c=0 TO 20
7070     PRINT #9;store_s(a,b,c)
7080     PRINT #9;store_f(a,b,c)
7090    END FOR c
7100   END FOR b
7110  END FOR a
7120  CLOSE #9
7130 END DEFine save_fractals
7140 :
7150 DEFine PROCedure load_fract
als
7160  LOCal a,b
7170  command:prompt 3,0:_input
8,0,13,25,form$,0,5:form$=input_
$
7180  command:prompt 14,0:OPEN_I
N #9,form$
7190  FOR a=0 TO 2
7200   FOR b=0 TO 20
7210    FOR c=0 TO 20
7220     INPUT #9;store_s(a,b,c)
7230     INPUT #9;store_f(a,b,c)
7240    END FOR c
7250   END FOR b
7260  END FOR a
7270  CLOSE #9:disp_seg pres_seg
:disp_frm pres_frm
7280 END DEFine load_fractals
7290 :
7300 DEFine PROCedure input_ (f$
,current,total)
7310  DIM angle_x(20),dist_x(20)
7320  OPEN #9,con_200x196a36x18
7330  PAPER #9,2:INK #9,0:CSIZE
#9,0,0:CLS #9
7340  PRINT #9;'  NUMERICAL DATA
 FOR ';f$
7350  WINDOW #9,193,182,40,29
7360  PAPER #9,0:INK #9,7:CSIZE
#9,0,0:CLS #9:PRINT #9;'Point
   Distance        Angle'
7370  command:prompt 16,0
7380  FOR a=1 TO total
7390   AT #9,a+1,0:PRINT #9;'(';
a;')'
7400   AT #9,a+1,11:PRINT #9;'?'
: _input 9,a+1,12,3,'',1,1:AT #9
,a+1,11:PRINT #9;' ':dist_x(a)=i
nput_$
7410   AT #9,a+1,25:PRINT #9;'?'
:_input 9,a+1,26,3,"",1,1:AT #9,
a+1,25:PRINT #9;' ':angle_x(a)=i
nput_$*PI/180
7420  END FOR a
7430 END DEFine input_
7440 :
7450 DEFine PROCedure get_seg_da
ta
7460  LOCal a
7470  REPeat check
7480   input_ "SEGMENT "&pres_se
g,pres_seg,num_seg
7490    FOR a=1 TO num_seg
7500     dist_s(a)=dist_x(a)
7510     angle_s(a)=angle_x(a)
7520    END FOR a
7530    get_dims:IF len_seg>=1 TH
EN store_seg pres_seg:EXIT check
7540    command:prompt 15,0
7550  END REPeat check
7560 END DEFine get_seg_data
7570 :
7580 DEFine PROCedure get_frm_da
ta
7590  LOCal a
7600  input_ "FRAME "&pres_frm,p
res_frm,num_frm
7610  FOR a=1 TO num_frm
7620   dist_f(a)=dist_x(a)
7630   angle_f(a)=angle_x(a)
7640  END FOR a
7650  store_frm pres_frm
7660 END DEFine get_frm_data
7667 :
7668 REMark FRACTALS DATA
7669 :
7670 DATA 10,90
7680 DATA 80,90
7690 DATA 10,45,10,135
7700 DATA 80,90,80,270
7710 DATA 10,45,20,135,10,45
7720 DATA 70,60,70,180,70,300
7730 DATA 10,90,10,30,10,150,10,
90
7740 DATA 50,45,50,135,50,225,50
,315
7750 DATA 10,90,10,0,10,90,10,18
0,10,90
7760 DATA 40,54,40,126,40,198,40
,270,40,342
7770 DATA 10,45,10,135,10,135,10
,45,10,45,10,135
7780 DATA 40,30,40,90,40,150,40,
210,40,270,40,330
7790 DATA 10,90,10,0,10,90,20,18
0,10,90,10,0,10,90
7800 DATA 35,12.5,35,64,35,115.5
,35,167,35,218.5,35,270,35,321.5
7810 DATA 10,90,10,0,10,90,10,18
0,10,180,10,90,10,0,10,90
7820 DATA 30,22,30,67,30,112,30,
157,30,202,30,247,30,292,30,337
7830 DATA 10,90,10,0,10,90,10,18
0,10,90,10,180,10,90,10,0,10,90
7840 DATA 25,30,25,70,25,110,25,
150,25,190,25,230,25,270,25,310,
25,350
7850 DATA 10,45,10,135,10,45,10,
315,10,45,10,135,10,225,10,135,1
0,45,10,135
7860 DATA 20,18,20,54,20,90,20,1
26,20,162,20,198,20,234,20,270,2
0,306,20,342
9997 :
9998 REMark MENU DATA
9999 :
10000 DATA "  ALTER SEGMENT",3,"
Numerical data","On-screen edit"
,"Main menu"
10010 DATA "   ALTER FRAME",3,"N
umerical data","On-screen edit",
"Main menu"
10020 DATA " CHANGE SEGMENT",3,"
Segment number","Cursor keys","M
ain menu"
10030 DATA "  CHANGE FRAME",3,"F
rame number","Cursor keys","Main
 menu"
10040 DATA "  DRAW FRACTAL",9,"C
hange scale    ("&scale_&")","Ch
ange depth     ("&depth_&")","Cha
nge Y co_ord ("&y_coord&")","Cha
nge X co_ord ("&x_coord&")","Cha
nge ink       ("&ink_&")","Change
 paper     ("&paper_&")","Change
mode      ("&mode_&")","Draw frac
tal","Main menu"
10050 DATA " PERMANENT STORE",5,
"Load fractals","Save fractals",
"Format device","Directory devic
e","Main menu"
19997 :
19998 REMark PROMPT DATA
19999 :
20001 DATA "  Use (CTRL+SHIFT+6)
 and (CTRL+SHIFT+-) to select op
tion.           Press SPACE to ch
oose...."
20002 DATA " Device name ? "
20003 DATA " File name ? "
20004 DATA "                  PRES
S ANY KEY TO RETURN TO THE MENU"
20005 DATA "      Press 'S' to sa
ve screen,          or ESC to ret
urn to menu...."
20006 DATA " Format name ? "
20007 DATA "          Drawing fra
ctal                  Press ESC t
o abort.... "
20008 DATA " Value ?"
20009 DATA "  Use (CTRL+\) and (
CTRL+]) to view options.
  Press SPACE to select...."
20010 DATA "              Copyrig
ht Talent Computer Systems 198
5"
20011 DATA "   Use (CTRL+SHIFT+6
), (CTRL+SHIFT+-), (CTRL+\), (CT
RL+]) and ALT to move point.
   Press SPACE to fix...."
20012 DATA "
Use (CTRL+\) and (CTRL+]) to cha
nge points.
         Press SPACE to move poi
nt or ESC to return to menu.....
"
20013 DATA " SAVING FRACTALS  :
"&form$
20014 DATA " LOADING FRACTALS  :
 "&form$
20015 DATA "                ERROR
:-      YOU CANNOT CLOSE A SEGME
NT
            PLEASE REDO SEGMENT"
20016 DATA "          Type numer
ical value then press ENTER..."
```

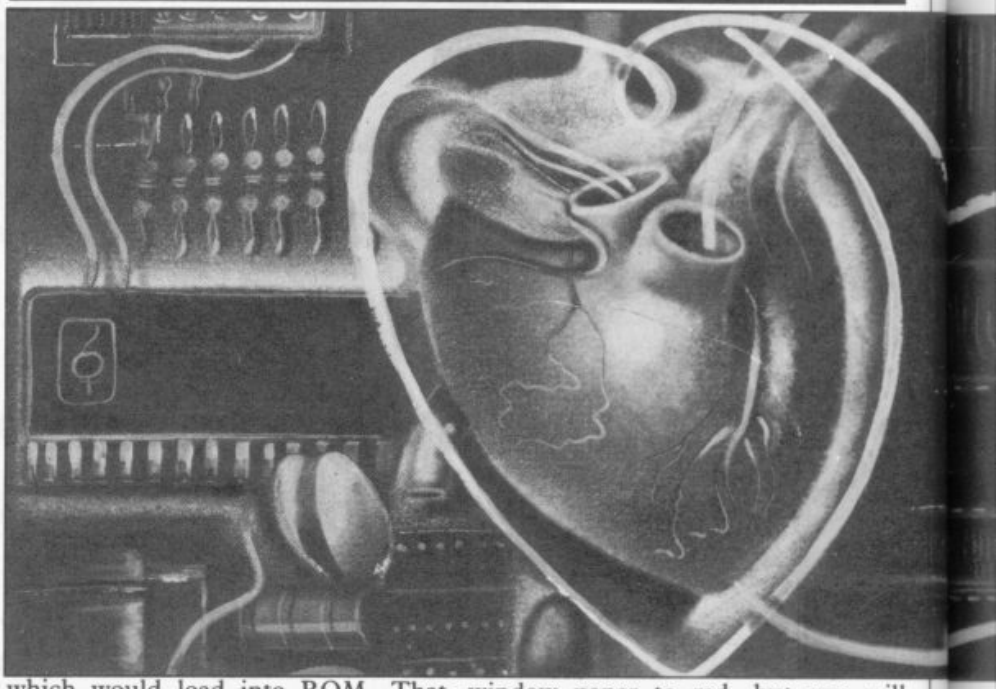




Mysteries of the operating system

THE POWER of both the Spectrum and QL is derived from operating systems which manage memory, handle graphics, deal with sound and implement Basic.
Marcus Jeffery, machine code programmer and technical author, explains how QL QDOS works. He shows how you can tap its resources through utility routines in the ROM which can be accessed using QDOS Traps.
John Lambert, the *Sinclair User* hardware correspondent, completes the overview of operating systems with a look at the important routines within the Spectrum ROM, giving explanations of how they can be used within your own Basic and machine code programs.

QDOS



IT WAS DURING early 1984 that the rumours of Sinclair's super micro began to take concrete form. When the Quantum Leap finally appeared however, it was very different to the one viewed at the early press launch.

The operating system was completely different, and the first buyers were faced with an additional 16K EPROM stuck onto the back of the machine, because Sinclair had not been able to fit SuperBasic onto the EPROM inside.

Although Sinclair was supposed to have learnt from previous mistakes, such as those which plagued the Spectrum, the QL was a bug-ridden disaster which received extremely bad press. However, the unexpected EPROM did finally disappear, and the QDOS operating system was upgraded to version 1.02, having disposed of, at least, the more serious bugs. That was closely followed by the 1.03 version of QDOS, which seems to have eliminated 'most' of the errors, and is still around today.

With all those changes, it would appear to be almost impossible to write any 68008 software, making use of the features of the QL. No sooner had you written it, then the machine version changed. Indeed, the machine version was changing so rapidly that Sinclair included the function VER$, which would tell you which version you had. The most recent of those returns the code JM, although some lucky people have already mistakenly received the JS upgrade. Fortunately, things are not really that bad, thanks mainly to the QDOS operating system. It is that which provides you with a stable interface to the machine, whichever version you may be using.

QDOS is very different from the operating systems found on more traditional micros such as the Spectrum. On those smaller machines the operating system handles all the user input/output, interpretation of command lines and Basic programs, and communication with external devices, such as the cassette, keyboard and screen and so on.

Figure 1. Main memory map

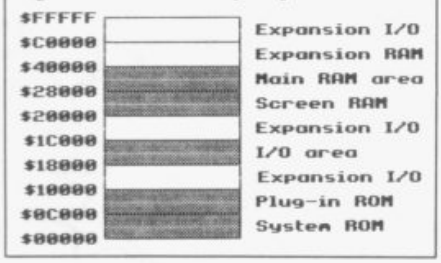
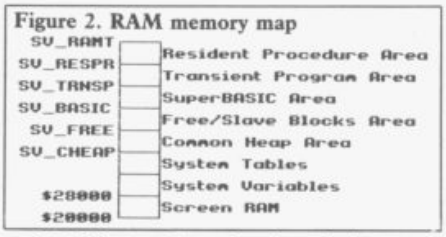


Figure 2. RAM memory map



QDOS, on the other hand, is merely a collection of routines which are available for use if necessary. It is the SuperBasic interpreter which handles all the routine matters normally associated with the operating system. That is just a job, albeit a rather special one, running under QDOS. In fact, when first developed, SuperBasic was to be in the form of a cartridge which would load into ROM. That would have caused no real problems. If you wanted to use SuperBasic then it would obviously take up memory, and if not, then it could be overwritten — it was only a QDOS job.

Before looking at the two main methods of accessing QDOS, a little background information may be helpful.

The standard QL has 128K of RAM, which is located between locations $20000 — $ stands for hexadecimal — and $40000. Below that sits the ROM containing QDOS and the SuperBasic interpreter, the plug-in ROM area and the input/output area, together with a couple of 'reserved holes' — see figure one.

Figure two shows a more detailed breakdown of the RAM area. You can easily check that. For instance, run the program in figure three. The loop numbers may not mean much to begin with, but if you convert them to hexadecimal, you get $20000 to $27FFF — the 32K screen. When the program is running, you will see the screen fill up with random colours.

If you run that in MODE 4, you will get a similar pattern to that which appears when you press the reset button, but MODE 8 gives a flashing abomination. If you can be bothered to wait for that to finish, type in the command CLS. That will set the TV window paper to red, but you will notice that some of the set flash bits can still have an effect.

Although proving that the screen is indeed where it's supposed to be, that is not particularly useful. A much more interesting area of RAM is that set aside for system variables. Those are just like the system variables on the Spectrum, and can provide lots of useful information. They are situated in the area of memory beginning at $28000 — 163840 in decimal. It is unlikely that this area will change, but to be safe, a 68008 TRAP instruction will return the base address, then the system variables can be found as offsets from that. We will see how to

Figure 3.

```
100 CLS
110 FOR byte = 131072 TO 163835
120     POKE byte,RND(0 TO 255)
130 END FOR byte
```

use traps later, but for the present, try typing the following:

Print peek_w(163976)

which should give you the answer zero. Now change the value by typing

poke_w 163976,-1

If you now type in the instruction to reset the value, you should find yourself working in upper-case:

POKE_W 163976,0

Other system variables which you may like to try POKE_W with are

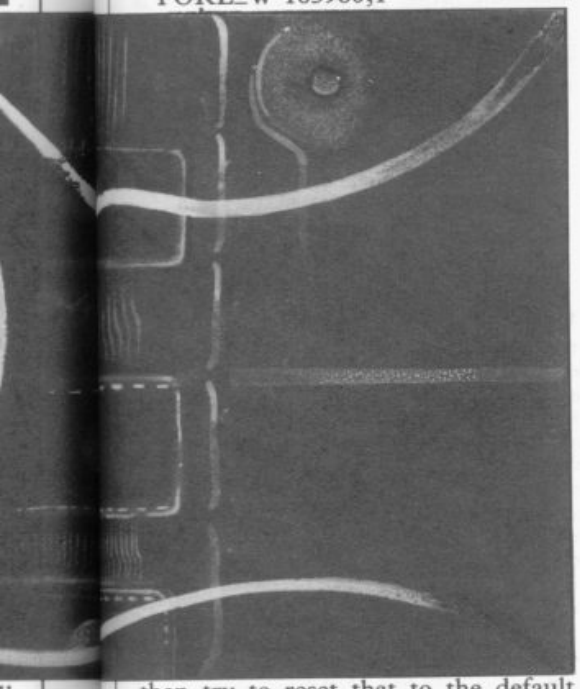
163980 — Key repeat delay (default 30).

and

163982 — Key repeat frequency (default 2).

For example, type

POKE_W 163980,1



then try to reset that to the default value. The keys have a tendency to repeat themsleves before you are able to take your finger off!

Probably one of the most oft-PEEKed Spectrum system variables is the one holding 'the last key pressed'. You will be pleased to know that the QL has a similar location. Try out the following line:

REPeat loop:PRINT PEEK_W (163978)

After hitting the ENTER key, the left hand column of the screen will start filling with the number ten, which just happens to be the ASCII code for the Command Entry key! Hitting other keys, including keys combined with CTRL, SHIFT and ALT, will change the code accordingly.

The system variables also show how memory is divided. You will have noticed that the SuperBasic program area — the top of RAM, and so on — were shown in figure two by their official mnemonics. That is necessary due to the dynamic memory allocation on the QL, meaning that few areas are permanently fixed. However, you can find the values for those mnemonics by PEEKing the appropriate system variables. Those are shown in figure four.

We will now look at the two main methods in which you can access QDOS routines. Those are firstly using standard system traps, and secondly via a number of system vectors.

The system TRAPs make use of the 68008 TRAP instruction, which takes the form

TRAP £n

where 'n' can take any number between zero and 15. Of those, only traps zero to four have been previously defined for access to QDOS, the rest being available for your own routines.

Of those traps, TRAP £0 is a special case for entering Supervisor Mode. The 68008 processor in the QL is able to operate in two modes — User Mode and Supervisor Mode. When in User Mode, which is normally the case, the machine is somewhat restricted in the operations it can perform.

Alternatively, in Supervisor Mode, the alternate A7 register is used for the CPU stack pointer, and it is possible to change the contents of the upper byte of the status register, and privileged instructions, such as RTE — ReTurn from Exception — are available. In general, unless you want to run a trace, which executes a user-written debugging routine after each instruction, or use complex interrupts, that particular trap can be ignored.

Before looking at the other trap instructions in detail, let us see how they can be accessed from SuperBasic or 68008 machine code. QL SuperBasic is not over endowed with routines to use 68008 machine code, but correct use of the RESPR, CALL, POKE and PEEK instructions is sufficient for most purposes.

In general, a QDOS trap will expect to find values in certain registers informing it as to which routine is required — register D0 — and any other necessary parameters. Upon returning from the appropriate routine, some registers may have been set to various values. The SuperBasic CALL instruction is an excellent means of executing a machine code routine. Not only is the routine CALLed, but up to 13 registers may also be set with optional parameters, with the form:

CALL location, D1, D2, D3, D4, D5, D6, D7, A0, A1, A2, A3, A4, A5

The only registers missing from the list are D0 — which is initially set to -15 and should be reset to zero before returning to Basic; A6 — which holds an important value based on an offset from the start of the SuperBasic area; and A7 — which is the user stack pointer. The machine code routine will return to SuperBasic with an RTS instruction.

The CALL instruction is fine for passing parameters to machine code routines, but there is no equivalent facility for returning them. The only reasonable way of doing that is to place the appropriate values into a sequence of spare locations, then PEEK them from Basic.

We can try that out using a small program to call trap one, with register D0 set to zero. That trap has the MT.INF — Manager Trap System Information — and will return the ID of the current job and the QDOS version number.

Figure 4.

Mnemonic	Offset	Decimal	Size	Description
SV_CHEAP	$04	163844	long	Base of common heap area
SV_CHPFR	$08	163848	long	First free space in common heap
SV_FREE	$0C	163852	long	Base of free area
SV_BASIC	$10	163856	long	Base of SuperBasic area
SV_TRNSP	$14	163860	long	Base of transient program area
SV_TRNFR	$18	163864	long	First free space in transient program area
SV_RESPR	$1C	163868	long	Base of Resident Procedure area
SV_RAMT	$20	163872	long	Top of RAM + 1

Notes:

Offset — That is the hexadecimal offset from the start of the system variables area, usually $28000.

Decimal — That gives the decimal address, assuming a start address of $28000 (163840 decimal).

Size — That is the size of the variable for peeking. With memory locations that will always be 'long', so POKE_L should be used.

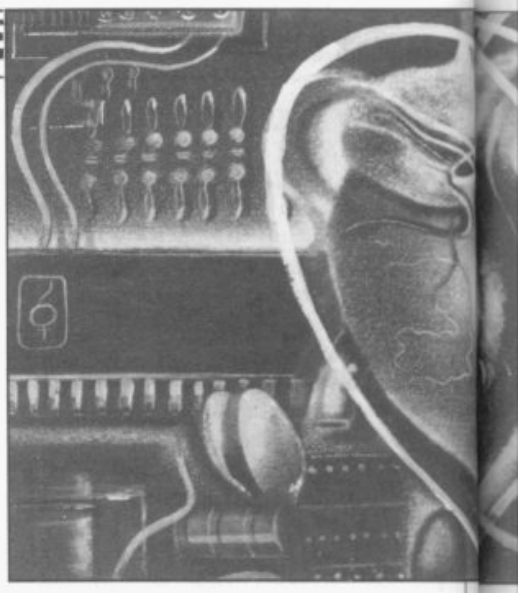


Figure 5.

```
100 CLS
110 mach_code = RESPR(100)
120 load_code
130 CALL mach_code
140 print_registers
150 STOP
160 :
170 DEFine PROCedure load_code
180 RESTORE 290
190 location=mach_code
200 REPeat loop
210    READ wor
220    IF word=-1 THEN EXIT loop
230    POKE_W location,word
240    location=location+2
250 END REPeat loop
260 PRINT"Code enterered."
270 END DEFine load_code
280 :
290 DATA 28672              :REMark MOVEQ    #0,D0
300 DATA 20033                :REMark TRAP     #1
30 DATA 16890,10             :REMark LEA      0C(PC),A0
320 DATA 18640,16382          :REMark MOVEM.L D1-D7/A0-A5,(A0)
330 DATA 28672                :REMark MOVEQ    #0,D0
340 DATA 20085                :REMark RTS
350 DATA -1
360 :
370 DEFine PROCedure print_registers
380 RESTORE 470
390 FOR reg=0 TO 12
400    READ r$:PRINT r$;" = ";
410    PRINT PEEK_L(location+4*reg);TO 20;"  (";
420    FOR ch=0 TO 3:PRINT CHR$(PEEK(location+4*reg+ch));
430    PRINT")"
440 END FOR reg
450 END DEFine print_registers
460 :
470 DATA "D1","D2","D3","D4","D5","D6","D7"
480 DATA "A0","A1","A2","A3","A4","A5"
```

Just type in, and run, the program in figure five. That has been written as a general routine which will load and execute a piece of machine code, then dump the contents of registers D1 to D7 and A0 to A5, the same as the CALL instruction.

In order for that to work, the last instructions in the machine code data should always be:

LEA $0C(PC), A0
MOVEM.L D1-D7/A0-A5, (A0)
MOVEQ #0,D0
RTS

The additional instructions in figure five set register D0 to zero, and execute trap one.

If you look at the registers afterwards, D1 does not look very impressive, but has actually returned the current job number. Since the current job is SuperBasic, job number zero, that is easily overlooked. More interesting is the ASCII code for register D2, which should contain a number, such as '1.03'. That is the QDOS version number, referred to in the introduction. The TRAP #1 calls are known as Manager Traps and are detailed in figure six.

There are only four subdivisions of TRAP #2. Those allow you to open and close a channel, delete a file on a channel, and format a device, such as a microdrive, as detailed in figure seven.

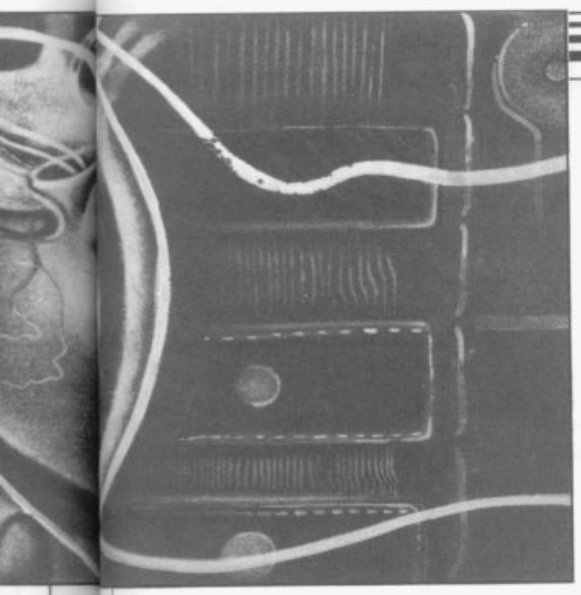
The subdivisions of TRAP #3 are probably the most interesting, being concerned with input/output, especially to the screen display. Those take the form of a host of routines to read and alter windows, colours, text/graphic cursor, and so on. Trap #4 is really for use by the SuperBasic interpreter, converting future trap parameters to relative, rather than absolute, addresses.

Having said all that, it is the machine code programmer who is likely to find the greatest use for those traps. Useful though many of them are, using the SuperBasic command is going to be quicker than loading data, then using the CALL instruction.

The second method of accessing QDOS is via the system vectors. There are a multitude of those, situated from memory location $CO.

Figure 6. TRAP #1

Mnemonic	Reg. D0	Description
MT.INF	$00	Return system information
MT.CJOB	$01	Create a new job in the transient program area
MT.JINF	$02	Return information on a given job
MT.RJOB	$04	Remove a job from the transient program area
MT.FRJOB	$05	Force remove a job from the transient program area
MT.FREE	$06	Find largest allocatable free space in the transient program area
MT.TRAPV	$07	Set job exception table vector
MT.SUSJB	$08	Supend a job
MT.RELJB	$09	Release a job
MT.ACTIV	$0A	Activate a job
MT.PRIOR	$0B	Change the priority of a job
MT.ALLOC	$0C	Allocate area in heap
MT.LNKFR	$0D	Link a free space back into the heap
MT.ALRES	$0E	Allocate resident procedure area RESPR
MT.RERES	$0F	Release the resident procedure area
MT.DMODE	$10	Set or read the present display mode
MT.IPCOM	$11	Send a command to the IPC (Intel 8049)
MT.BAUD	$12	Set the baud rate
MT.RCLCK	$13	Read the clock
MT.SCLCK	$14	Set the clock
MT.ACLCK	$15	Adjust the clock
MT.ALBAS	$16	Allocate Basic area
MT.REBAS	$17	Release the Basic program area
MT.ALCHP	$18	Allocate common heap area
MT.RECHP	$19	Release the common heap area
MT.LXINT	$1A	Link an external interrupt service routine
MT.RXINT	$1B	Remove an external interrupt service routine
MT.LPOLL	$1C	Link a polling 50/60 Hz service routine
MT.RPOLL	$1D	Remove a polling 50/60 Hz service routine
MT.LSCHD	$1E	Link a scheduler loop task
MT.RSCHD	$1F	Remove a scheduler loop task
MT.LIOD	$20	Link an I/0 device driver
MT.RIOD	$21	Remove an I/0 device driver
MT.LDD	$22	Link a directory device driver
MT.RDD	$23	Remove a directory device driver



Machine code programmers will find a number of those vectors useful. Unfortunately, the most generally useful vectors, concerning ASCII to binary and hexadecimal conversion, will not be functioning until version 1.04 — according to Sinclair's manual!

That still leaves one of the most useful features available on the QL — the ability to extend SuperBasic. The vector BP.INIT (at $110) can be used to add a list of procedures and functions to the SuperBasic name table. From then on, those routines can be used in SuperBasic in the same way as the routines built into the SuperBasic ROM.

For example, suppose you wanted to turn the example in figure five into a SuperBasic function. You would first need a table of the following form:

```
DC.W 0          : There are no procedures
DC.W 0          : Zero marks end of
                  procedures
DC.W 1          : We are defining one function
DC.W ptr        : Relative pointer to function
DC.B 6          : Length of function name
DC.B 'VERNO$'   : Name of function
DC.W 0          : End of function definitions
```

Having defined your table, a simple piece of code to point to the table (register A1), then a jump via the BP.INIT vector, will do the rest of the work. That looks something like:

```
LEA       TABLE (PC),A1
MOVE. W   $110,A2
JSR       (A2)
RTS
```

Figure 7. TRAP #2

Mnemonic	Reg. D0	Description
I0.OPEN	$01	Open a channel
I0.CLOSE	$02	Close a channel
I0.FORMT	$03	Format a sectored medium
I0.DELET	$04	Delete a file from a channel

Figure 8. TRAP #3

Mnemonic	Reg. D0	Description
I0.PEND	$00	Check for pending input on channel
I0.FBYTE	$01	Fetch a byte from channel
I0.FLINE	$02	Fetch line of characters (end = $0A)
I0.FSTRG	$03	Fetch a string of bytes
I0.EDLIN	$04	Edit a line of characters
I0.SBYTE	$05	Send a byte to channel
I0.SSTRG	$07	Send a string of bytes
SD.EXTOP	$09	Call an external operation
SD.PXENQ	$0A	Return window size/cursor position (pixel coords)
SD.CHENQ	$0B	Return window size/cursor position (char. coords)
SD.BORDR	$0C	Set window border width and colour
SD.WDEF	$0D	Redefine window
SD.CURE	$0E	Enable cursor
SD.CURS	$0F	Disable cursor
SD.POS	$10	Set text cursor
SD.TAB	$11	Set text cursor horizontal position
SD.NL	$12	Newline
SD.PCOL	$13	Set cursor to previous column
SD.NCOL	$14	Set cursor to next column
SD.PROW	$15	Set cursor to previous row
SD.NROW	$16	Set cursor to next row
SD.PIXP	$17	Set cursor position to pixel coordinates
SD.SCROL	$18	Scroll entire window
SD.SCRTP	$19	Scroll top of window
SD.SCRBT	$1A	Scroll bottom of window
SD.PAN	$1B	Pan entire window
SD.PANLN	$1E	Pan cursor line in window
SD.PANRT	$1F	Pan righthand side of cursor line
SD.CLEAR	$20	Clear all of window
SD.CLRTP	$21	Clear window above cursor
SD.CLRBT	$22	Clear window below cursor
SD.CLRLN	$23	Clear cursor line in window
SD.CLRRT	$24	Clear window to right of cursor
SD.FOUNT	$25	Set or reset the character font
SD.RECOL	$26	Recolour window
SD.SETPA	$27	Set paper colour
SD.SETST	$28	Set strip colour
SD.SETIN	$29	Set ink colour
SD.SETFL	$2A	Set flach mode
SD.SETUL	$2B	Set underline mode
SD.SETMD	$2C	Set write mode (XOR, strip, transparent, ink)
SD.SETSZ	$2D	Set character height, width and spacing
SD.FILL	$2E	Fill rectangle in window
SD.POINT	$30	Plot point
SD.LINE	$31	Draw line
SD.ARC	$32	Draw arc
SD.ELIPS	$33	Draw ellipse/circle
SD.SCALE	$34	Set window scale
SD.FLOOD	$35	Set or reset fill mode
SD.GCURS	$36	Position the graphics cursor
FS.CHECK	$40	Check all pending operations on a file
FS.FLUSH	$41	Flush buffers for a file
FS.POSAB	$42	Position file pointer absolute
FS.POSRE	$43	Position file pointer relative
FS.MDINF	$45	Get information about medium
FS.HEADS	$46	Set file header
FS.HEADR	$47	Read file header
FS.LOAD	$48	Load file into memory
FS.SAVE	$49	Save a file from memory

You can try that out by entering the program in figure nine, which will save a machine code file to 'mdv1_verno'.

At any future date simply type the following:

```
cd = RESPR(100)
LBYTES mdv1_verno,cd
CALL cd
```

Then typing

```
PRINT verno$,
a$ = verno$
```

or whatever, will return the required result.

Figure 9.

```
100 mach_code = RESPR(100)
110 location = mach_code
120 REPeat load_code
130    READ word
140    IF word = -1 THEN EXIT load_code
150    POKE_W location,word
160    location = location + 2
170 END REPeat load_code
180 SBYTES mdv1_verno,mach_code,100
190 :
200 DATA  17402,    10, 13432,   272
210 DATA  20114, 20085,     0,     0
220 DATA      1,    12,  1622, 17746
230 DATA  20047,  9216,     0, 29190
240 DATA  14456,   282, 20116,  8814
250 DATA     88, 22857, 28672, 20033
260 DATA  15804,     4,-26624, 11650
270 DATA -26622, 30721, 28672, 11593
280 DATA     88, 20085,    -1
```

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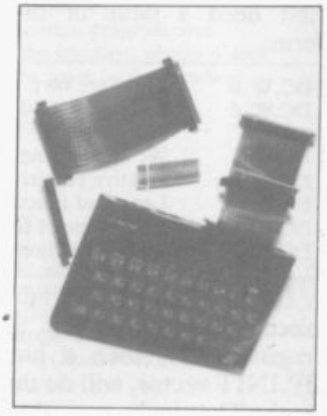

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ZX ROM

TO MANY PEOPLE the Spectrum is typified by a flashing K in the corner of the screen. Few stop to think how the K go there in the first place.

The Spectrum ROM is a complex 16K machine code program which handles all the difficult tasks which go to make up a computer.

Luckily, you do not have to understand what is under the bonnet to be able to use the Spectrum, but once you start delving into machine code, you will find that the ROM contains many useful routines which you can use in your own programs.

You cannot harm the Spectrum by using software, so just type RANDOMISE USR n — where n is from 0 to 16383, the position of the ROM — and see what happens.

The explanations below show some of the ROM routines which you can use within your Basic and machine code programs. Each is introduced with two numbers followed by a name. The first number is the start address of the ROM routine written in decimal and the second is the same number but converted into hexadecimal. The name given by Sinclair Research to the routine follows.

Many of the routines can be run in a Basic program by entering RAND USR followed by an address. Others can only be used within machine code programs. Some require that the Z80 registers are set up with particular values. The information for such set ups are shown in the explanations.

00000 0000 START
RAND USER 0 provides a good way to clear the Spectrum memory without having to pull the plug.

The Spectrum makes full use of the Z80 RST instructions. All of them are used for functions which need to be done quickly:

00008 0008 ERROR-1
When an error occurs the Basic interpreter goes through this address. Used with GET-CHAR and NEXT-CHAR when adding your own Basic commands.

00016 0010 PRINT-A-1
Called with A holding the character to be printed to the current channel. It can be used to print control characters as well as normal ASCII. See CHAN-OPEN.

00024 0018 GET-CHAR
Collect a printable character into A.

00032 0020 NEXT-CHAR
The A register is loaded with the next character to be interpreted.

00040 0028 FP-CALC
Used by the Floating Point Calculator as an indirect jump to 335Bh. The RST 28 should be followed by a byte which represents the operation to be performed on the calculator stack.

That is not as difficult to use as it appears at first sight. It works in a similar manner to Forth; numbers are put on the stack and the operator simply takes the top two and performs the required operation.

In the following example two numbers — 2 and 2 — are put on to the stack, the operator (+) is added and the result — 4 — is put back on the stack. The last call prints it.

```
LD    BC,2   : put 2 on calculator
                 stack
CALL  2D2B   :
LD    BC,2   : put 2 on calculator
                 stack
CALL  2D2B   :
RST   28     :
DEFB  0F     : code for add
DEFB  38     : code for end
               calculation
CALL  2DE3   : print result
```

The calculator does not perform calculations particularly quickly, by machine code standards. You could write your own dedicated routines which would be much faster, but it is nevertheless very convenient.

00048 0030 BC-SPACES
This specifically makes room in the workspace; BC holds the number of bytes for which to make room. It uses the more general routine at 169E.

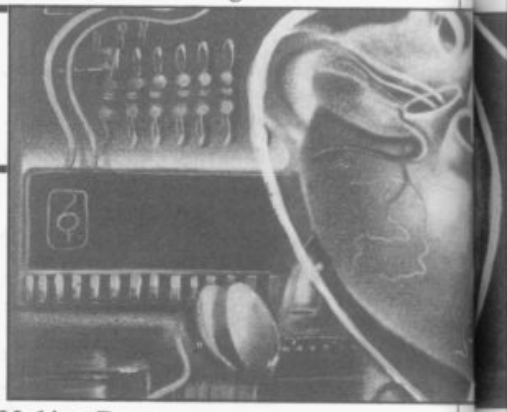
Two interrupt routines were designed for the Spectrum:

00056 0038 MASK-INT
The maskable interrupt routine which is called every 1/50th of a second when the ULA puts out the picture. The system variable FRAMES is updated and the keyboard read.

00102 0066 RESET
The non-maskable interrupt. It was designed to allow external pieces of hardware to control the Spectrum by a jump to the location, pointed to by 23728/9. Due to a misplaced byte any hardware which uses it would cause a system reset.

Reading the keyboard

00654 028E KEY-SCAN
The main keyboard scan routine. A value, representing one of the 40 keys, is returned in E, if pressed. D will hold a value if one of the shift keys is also pressed. If no keys are pressed DE will hold FFFFh. If more than two keys are pressed — or if two keys are pressed and neither of them is a shift — the zero flag is reset.



Making Beeps

00949 03B5 BEEPER
The main Beep routine. Called with DE holding frequency ★ time, in seconds, and HL the number of T states per cycle.

01016 03F8 BEEP
This uses the top two numbers on the calculator stack as parameters. The top one is the pitch, the second the duration.

01134 046E SEMI-TONE
Table of 12 floating point numbers representing the 12 semi-tones in an octave.

ZX81

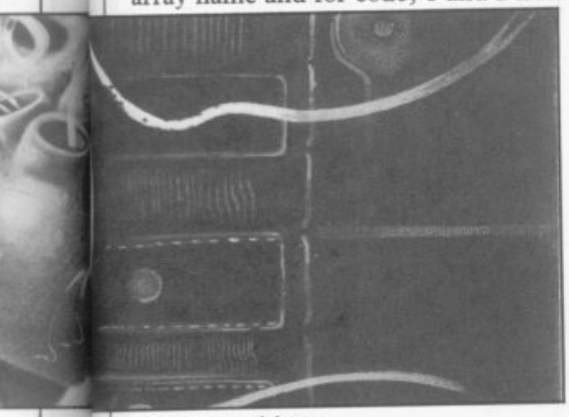
01194 04AA ZX81
Just to prove its heritage, the Spectrum contains a piece of code — 24 bytes — from the ZX81. It is totally useless as far as the Spectrum is concerned but you might be able to do something with it.

The cassette handling routines. Although some people still have problems the cassette port is one of the Spectrum's better features. It can accept a wide range of speeds — plus or minus 20 per cent — and volumes. For interesting border displays try calling various addresses at around 1280 (decimal).

01218 04C2 SA-BYTES
Used to save both the header and data.

A=0 for a header or A=FFh for data. IX holds the start address and DE the length. A header is 17 bytes, the first one holds the type of file, 0=program, 1=numeric array, 2=character array, 3=code bytes.

The next 10 are the filename and the next two the length of the data in the following block. The next four bytes vary according to the file type. For programs, 1 and 2 hold the value of LINE — or 2 holds 80h if LINE is not used — and 3 and 4 the length of the program. For arrays, 2 holds the array name and for code, 1 and 2 hold



the start address.

01366 0556 LD-BYTES
Loads, or verifies, both headers and data. A=0 for headers, A=FFh for data. The carry flag is set for loading and reset to verify. IX holds the address it loads to and DE the length.

02348 092C ME-ENTE
Routine used to merge program lines and variables. The carry flag is set for variables and reset for Basic lines; the zero flag is set if it is a replacement and reset if an addition. HL points to the start of the new item and DE where it is to go.

02466 09A2
The cassette error messages.

Screen and printer routines. Bit 1 of FLAGS determines where it goes.

02548 09F4 PRINT-OUT
Used by RST vector 10H for printing control codes, printable characters and tokens. Register A holds the code on entry. Each type of code has its own routine which can be called separately.

03282 0CD2 PO-SCR-3
Middle of the normal scroll routine but it can usefully be called from Basic to scroll the display upwards by one line.

03405 0D4D TEMPS
Copies the permanent colour system variables to the temporary ones.

03435 0D6B CLS
Clears all 24 lines of the display.

03583 0DFF
You won't find this in the manual, but it is a useful call from Basic to scroll the bottom half of the screen up a line.

0358 0E00 CL-SCROLL
The proper routine which scrolls the screen B lines.

03652 0E44 CL-LINE
Called with B, holding the number of lines to be cleared at the bottom of the screen.

03762 0EB2 COPY
Same as the Basic keyword and copies the screen to the ZX printer. 0ECD copies the printer buffer to the printer.

03807 0EDF CLEAR-PBF
Clears all 256 bytes of the printer buffer.

The main editor routines start at 0F2C. They are used to input to the lower screen and during INPUT.

04264 10A8 KEY-INPUT
Reads a valid key, taking note of the mode, from the keyboard into A. If no key is pressed the carry flag is reset and the zero flag set.

04317 10DD
A partially useful call — part of a larger procedure — which toggles CAPS LOCK on and off.

Initialisation

04535 11B7 NEW
This is used both on power up and when NEW is entered. The only difference is that with NEW RAMTOP, P-RAMTOP, RASP, PIP, and UDG are retained.

04756 1294
The part of the initialisation which prints the Sinclair copyright message.

The MAIN-EXEC routines starting at 12A2. These perform most of the work of the Spectrum, when it is not actually running a program. It, and other parts of the program, call various subroutines as required.

05010 1392
Table of error messages.

05588 15D4 WAIT-KEY
Waits for a valid key press. Calls KEY-INPUT until the carry flag is set.

05606 15E6 INPUT-AD
Inputs a character to A from the current channel. The carry flag is set if a character is input else the zero flag is used to signal EOF.

05633 1601 CHAN-OPEN
Does not open a channel, but makes the channel attached to the stream, whose number is held in A, the current one. In other words,

```
LD    A,3
CALL  1601
```

will direct output via RST 10 to the printer. A can be in the range FEh to 03h.

The streams are: P — printer; S — screen (top 22 lines); K — keyboard (bottom 2 lines); R — reserved (workspace).

Table 1 shows examples of stream use. The cursor representation, translated into a hex number, must be put into the A register before CHAN-OPEN at address 1601h is executed.

A=FDh 'K' — used for prompts and when the screen is cleared.
A=FEh 'S' — used for listings and CLS
A=FFh 'R' — prints data to the workspace. Can be used to simulate keyboard entry.
A=00h 'K' — prints error messages.
A=01h 'K' — selected by input.
A=02h 'S' — normal screen output.
A=03h 'P' — normal printer output.
Examples of stream use
Table 1.

05714 1652 ONE-SPACE
Loads BC with 1.

05717 1655 MAKE-ROOM
BC holds the amount of room needed, HL the address after where it is required. A test is made to make sure there is enough spare space.

06329 18B9
Part of a larger routine which increases HL by 5 and puts the contents of HL in A.

06510 196E LINE-ADDR
On entry HL holds a Basic line number. On exit it holds the address of the line, or the first line after, and DE holds the address of the previous line.

06629 19E5 RECLAIM-1
The opposite of MAKE-ROOM. Reclaims memory space from DE to HL.

Each Basic Line is interpreted by the routines which start at 1B17 in the ROM. Those are preceded by a table of address offsets for each Basic keyword.

07290 1C7A EXPT-2NUM
Uses EXPT-1NUM to evaluate two numbers separated by a comma.

07298 1C82 EXPT-1NUM
Evaluates the number pointed to by CHADD. During syntax checking it checks to see if this is a valid number. When the program is running it puts the number on the calculator stack.

07308 1C8C EXPT-EXP
As EXPT-1NUM but for strings.

07828 1E94 FIND-INT1

Compresses the last value on the calculator stack into register A. It uses the FP-TO-A routine at 2DD5h and reports out of range errors.

07833 1E99 FIND-INT2
Compresses the last value on the calculator stack into BC. It uses the FP-TO-BC routine at 2DA2h and reports out of range errors.

07962 1F1A FRE-MEM
Uses the TEST-ROOM routine at 1F05 to find the amount of free memory. This can be called from Basic by PRINT 65535-USR 7962.

08020 1F54 BREAK-KEY
General routine to test for the Break key being pressed. Returns with the carry flag reset if Break is pressed.

08252 203C PR-STRING
Prints the string, using RST 10, pointed to by DE, of length BC.

08859 229B
Mid-procedure call that sets the border colour to A — into range 0 to 7 — and updates the system variable BORDCR.

08874 22AA PIXEL-ADD
Finds the address of a pixel on the screen. Entered with the co-ordinates in BC. Exited with the address in HL and the position of the pixel within the address in A.

08933 22E5 PLOT-SUB
Plots the point — pixel — pointed to by BC.

10418 28B2 LOOK-VARS
An important routine which searches the variables area for the variable pointed to by CHADD. If this variable exists it returns with the carry flag set and HL pointing to the first letter of the variable name in the variables area. If a match cannot be found the carry flag is reset.

10929 2AB1 STK-STORE
Puts the values in A, E, D, C and B on the calculator stack.

10990 2AEE DE, (DE+1)
Loads DE with the contents of DE+1 and points HL at DE+2.

11249 2BF1 STK-FETCH
Takes the last five bytes off the calculator stack and puts them into B,C,D,E,A.

11400 2C88 ALPHANUM
Sets the carry flag if A holds an alphanumeric character.

11405 2C8D ALPHA
Sets the carry flag if A holds a letter of the alphabet — upper or lower case.

11544 2D18 NUMERIC
Resets the carry flag if A holds a number.

11560 2D28 STACK-A
Converts the number in A to Floating Point form and puts it on the calculator stack.

11563 2D2B STACK-BC
Converts a number in BC to Floating Point form and puts it on the calculator stack.

11682 2DA2 FP-TO-BC
Compresses the last value on the calculator stack into BC. If the value is greater than 65535 it returns with the carry flag set, if negative the zero flag is reset.

11733 2DD5 FP-TO-A
Compresses the last value on the calculator stack into A. If the value is greater than 255 it returns with the carry flag set, if negative the zero flag is reset.

11747 2DE3 PRINT-FP
Prints a Floating Point number. You can use it with STACK-BC as an easy way to print the contents of a register.

```
LD      BC,num    : number to be
                    printed
CALL    STACK-BC  : put on stack
CALL    PRINT-FP  : print it
```

12457 30A9 HL=HL★DE
A useful routine which multiplies HL by DE and puts the result back in HL. BC and DE are preserved.

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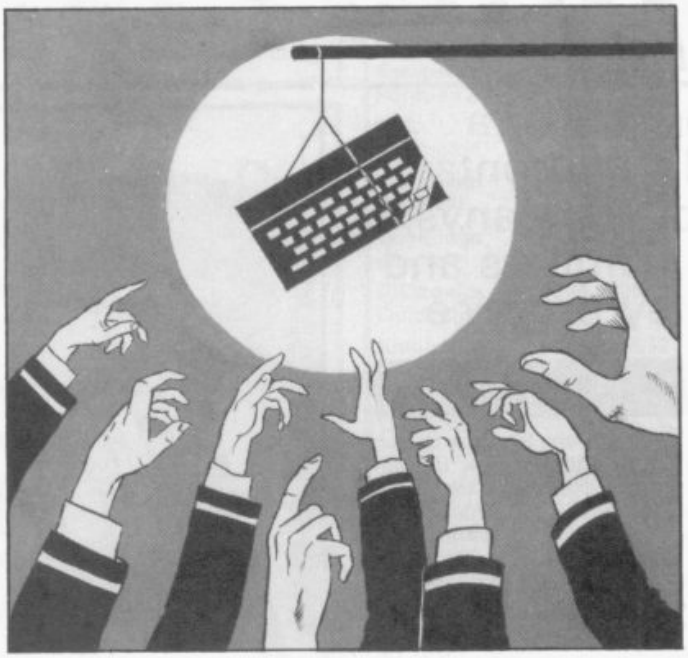


Reference

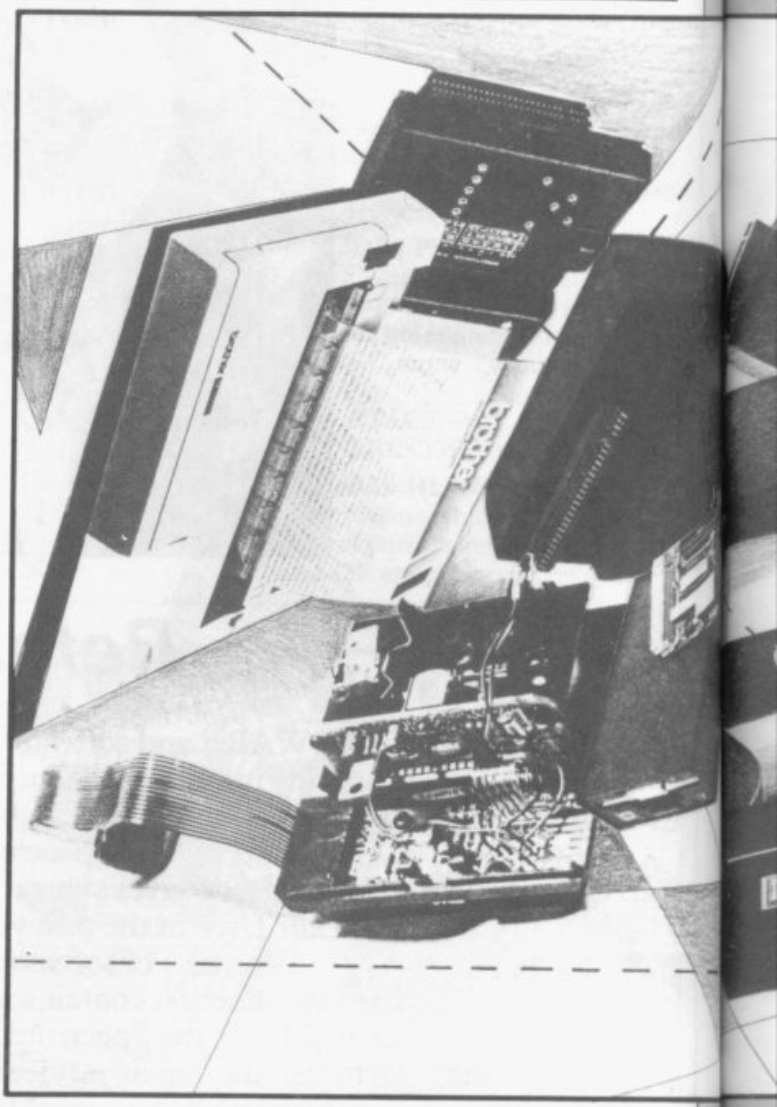
THE HARDWARE and software buyers' guides produced by *Sinclair User* provide immediate and up to the minute information on the products which you can buy for your machine, be it a Spectrum or QL.

The software guide gives star ratings to all the products reviewed in *Sinclair User* in the past year. It is combined with a list of software publishers.

The hardware section contains information on most of the add-ons available for the Spectrum and QL. A list of component manufacturers and repair services make the directory one of the most comprehensive available in any magazine or book.

Hardware and peripherals

Looking for a printer or a joystick? Who do you contact? Below is a list of companys, their telephone numbers and the hardware they produce



INTRODUCTION

IT HAS BEEN estimated that in the 12 months from the launch of the ZX-81 to the launch of the Spectrum a new Sinclair related company was formed every 36 hours. Since then, over three years ago, that pace has scarcely diminished. This booklet contains details of about 300 different items of hardware for the ZX-81, Spectrum and QL.

Due to considerations of space the details given on each product are limited, but you should be able to find almost any type of add-on you could wish for. We have given the telephone numbers of all companies so that you can contact them for further details. The figures in brackets in the comment column are the issue of *Sinclair User* in which a review was published.

When buying hardware, always tell the manufacturer exactly what you want to do with it and whether you will be using it with other add-ons. In that way you can avoid disappointments later. Take note of whether the add-on you want is dead-ended — that is, whether it does not have the user port carried through for further add-ons. If that is so you will need to buy a two-way connector.

There is a limit to how much additional hardware the computer can support, and usually it is no more than two items. If you are using a flexible connector that can also affect add-ons so keep it as short as possible, preferably about 2-3ins.

Try not to keep plugging and unplugging add-ons in the user port, as with the ZX-81 and Spectrum the port soon wears out. It can be built up again with solder but prevention is better than cure. The port can become dirty in use which can lead to the computer crashing at odd moments or behaving erratically.

Lastly, always check that there is a key in the edge connector of the add-on; if it is missing you could damage the computer. Most important, NEVER plug, or unplug, anything into the user port without first turning off the power.

JOYSTICKS All joysticks used on Sinclair machines use the Atari standard. Some have Autofire and some have two independent fire buttons.

JOYSTICK INTERFACES All these interfaces accept standard joysticks. Check that your joystick can make use of any additional features. If buying a programmable interface try it out before buying, as some are easier to program than others.

PRINTERS Many of these printers are available from more than one place. Shop around for the cheapest price — the target prices were taken from current adverts.

PRINTER INTERFACES Check that the interface is the same as your printer, Centronics or RS232. If RS232 check that you can get a suitable cable for it.

KEYBOARDS Adding a full-sized keyboard usually means opening the computer, which will invalidate your warranty.

FAST STORAGE Disc systems tend to be more expensive but you can use the drives on more than one computer and the cost of storage, in pence per K, is quite low.

GRAPHICS AIDS Where possible try before you buy.

SOUND/SPEECH Output through the TV tends to degrade the picture and will not work on a monitor.

RAM Upgrades for the Spectrum are normally 32K.

MODEMS All but the Protek require a wall socket to operate.

MONITORS The Spectrum requires an adaptor to run a monitor — see ***ODDS AND ENDS***.

TAPE DECKS Most domestic mono cassette recorders will work with the ZX-81 and Spectrum. These here have all been designed specifically to work with computers.

INPUT/OUTPUT A selection of the products that these companies produce.

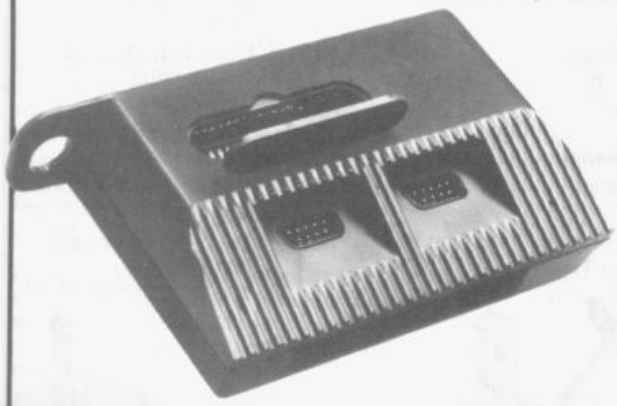
ODDS AND ENDS From flexible connectors to robots, from reset switches to CP/M.

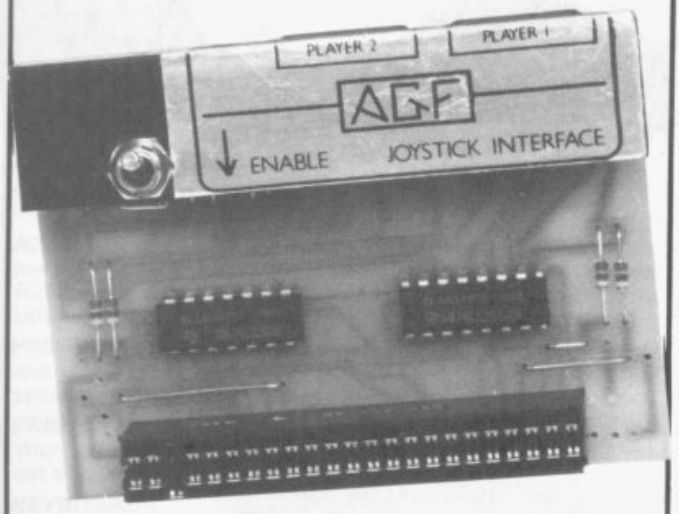
JOYSTICKS

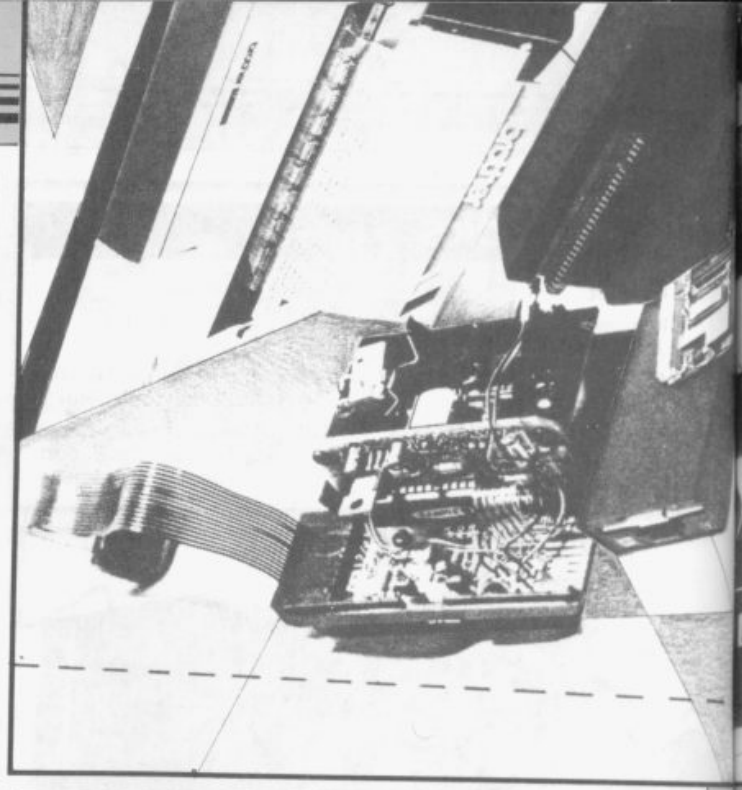
Product	Contact	Price	Comment
Kempston Junior Pro	0234-856633	5.95	Single fire button
AGF Quickshot I	0243-823337	7.95	Old favourite. Two fire buttons. Good value
Cobolt	0751-73315	8.95	Has no base and takes getting used to. Good for track-type games
Consumer Electronic Slik Stick	061-682-2339	8.95	Stick is small and rather stiff
Vulcan Gunshot	01-203-6366	8.95	Hardwearing and imprecise. (May'85)
Dean Superchamp	0344-885661	9.95	Cable winds into base. Stick rather loose. (Oct'84)
Nidd Valley Flightlink	0423-864488	9.95	Two independent fire buttons
RAM Quickshot II	02514-5858	9.95	Old favourite. Stick loosens with use. Autofire
Stonechip Superstick	0252-333361	9.95	
Voltmace 3S		10.00	Two independent fire buttons. Well made. Good value. (Oct'84)
Frel Flightlink	0584-4894	10.50	Two independent fire buttons. Very precise but fire buttons small
Consumer Electronic Starfighter	061-682-2339	10.95	Short but quite good
Eidersoft QL Joystick	01-478-1291	11.95	Standard Quickshot II with QL plug. (May'85)
Kempston Formula 2	0234-856633	11.95	Three fire buttons. Long travel stick. (June'85)
CGL Champion	01-508-5600	11.95	Two fire buttons. Autofire
Kempston Pro 3000	0234-856633	12.75	Two fire buttons. Leaf switches
Cookridge Zipstick	0532-670625	12.95	Two fire buttons, suckers on base
DK'tronics Quickshot II	0799-26350	12.95	see RAM
Kempston Pro 5000	0234-856633	13.50	Ball on joystick and two large fire buttons
Frel Quickshot II+2	0584-4894	13.95	Standard Quickshot with two independent fire buttons. (Oct'84)
CGL Boss	01-508-5600	15.99	Popular American stick. Heavy duty
Kempston Formula I	0234-856633	16.95	Micro switches. Recommended (June'85)
Consumer Electronic Joysensor	061-682-2339	19.95	Uses membrane touch pad. Difficult to get used to
Cookridge Sureshot Supreme	0532-670625	19.95	Fitted with QL plug. Good action. Recommended
CGL Bat Handle	01-508-5600	27.99	Two fire buttons and leaf switches
Cheetah RAT	01-833-4909	29.95	Infra-red remote control with interface (Nov'84)
CGL Super Three Way	01-508-5600	29.99	Two fire buttons and leaf switches. Interchangeable sticks

JOYSTICK INTERFACES

Product	Contact	Price	Comment
CLPS	0930-52204	4.95	QL adaptor for standard joystick. (May'85)
Miracle Systems	0272-603871 x210	4.99	QL adaptor for standard joystick
Bud Pilot	0670-856616	9.95	Kempston compatible. Power-on LED. (June'85)
DK'tronics	0799-26350	9.95	Kempston compatible
Kempston	0234-856633	9.95	Kempston compatible
AGF Protocol 1	0243-823337	10.95	Cursor. Reset switch
AGF Protocol 2	0234-823337	10.95	Kempston compatible. Reset switch
Cheetah Spectrum Interface	01-833-4909	11.50	Dead ended. (£12.75 with extender). Kempston compatible
Bud Interstate 31	0670-856616	11.95	Kempston compatible. Reset, rapid fire
DK'tronics Games Player	0799-26350	12.95	Kempston compatible. Freeze, slow motion
DK'tronics Dual Port	0799-26350	13.00	Sinclair and Kempston compatible. (Mar'85)
Sinclair Interface 2	0276-65311	14.95	Two sockets and ROM slot. (Dec'83)
Datel Games Ace	0782-273815	17.95	Kempston compatible. Auto fire, Beep amp
Kempston Pro	0234-856633	18.95	Kempston, cursor and Sinclair compatible. ROM slot. (June'85)



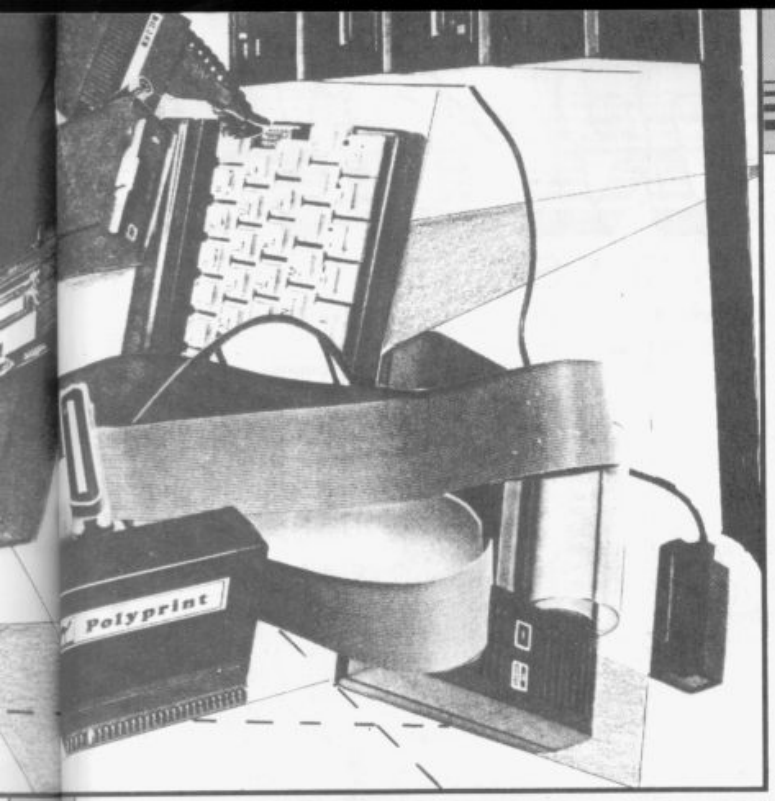




AGF Protocol 3	0243-823337	19.95	Programmable with reset switch
Bud Interstate Pro	0670-856616	19.95	Programmable
Frel Comcon	0584-4894	19.95	Programmable. Two independent fire buttons. (Oct'84)
Kempston Score Board	0234-856633	19.95	Large console and joystick
Nidd Valley	0423-864488	19.95	Programmable. Two independent fire buttons
Datel Turbo Ace	0782-273815	22.95	Cursor, Sinclair and Kempston. Beep amp
DK'tronics	0799-26350	22.95	Tape programmable
RAM Turbo	02514-5858	22.95	Two sockets. Cursor, Sinclair and Kempston compatible with ROM slot. Full rear connector. (Sept'84)
Downsway	03727-27222	23.95	Programmable
Rainbow	0993-5432	24.00	Programmable. Move stick and push button to program. (June'84)
AGF Protocol 4	0243-823337	24.95	Programmable with reset switch. Also Kempston compatible and autofire. (Jan'85)
Stonechip	0252-318260	24.95	Programmable
Page	0705-407908	26.00	Programmable. Move stick and push button to program. Rapidfire. (Sep'84)
Fox Programmable	0493-732420	28.95	Program held in battery-backed RAM. Easy to use. Very good value. (Feb'84)

PRINTERS

Product	Contact	Price	Comment
Dean Alphacom 32	0344-885661	54.95	Thermal. Direct replacement for ZX Printer. (Annual'85)
Epson P40	01-902-8892	109.00	Thermal dot matrix. RS232. Poor quality



Seikosha GP50S	0442-60155	138.00	Plain paper dot matrix. Direct replacement for ZX Printer. (Annual'85)
Tandy CGP 1154	0922-648181	149.95	Serial. Uses four colour pens. Slow. (Annual'85)
Brother HR5	061-330-6531	159.95	Centronics or RS232. Thermal dot matrix. Battery-mains. Best of the cheap printers

Brother M1009	061-330-6531	199.95	Centronics and RS232, dot matrix. Good features, slow. Target price £187.45
Statacom Sakata SCP800	01-661-2266	207.00	Plotter using Tandy four colour pen system. Cheap
Smith-Corona Fastext 80	01-900-1222	224.25	Poor RX80 imitator. (March'85)
Olivetti JP101	01-785-6666	228.00	Ink jet. Quiet but blurred print. (Annual'85)
Seikosha 100	0442-60155	228.00	Centronics dot matrix. Noisy with poor print
Microline μ80	0753-72331	229.00	Budget printer without a budget price. (Annual'85)
Shinwa CPA80	0932-242777	229.00	Centronics dot matrix. RX80 imitator
Smith-Corona TP1	01-900-1222	235.00	RS232 daisy wheel. Target price £217.35
Brother EP44	061-330-6531	253.00	Thermal portable typewriter with RS232. Good print but slow
Seikosha 250	0442-60155	270.00	Centronics dot matrix. Noisy with poor print
Epson RX80	01-902-8892	286.00	Standard by which other low cost printers measure themselves. Target price £212.75. (Annual'85)
Mannesman Tally MT80	0734-788711	299.00	Good looks, few features. (Annual'85)
Daisy Step 2000	0932-242777	332.00	Centronics daisywheel. Good value at target price of £258.75
Kaga KP810	0442-60155	366.85	Centronics dot matrix. Many features including NLQ and 3K buffer. Target price of £282.90
Canon PW1080A	0279-26777	367.00	Centronics dot matrix. Very fast with many features, NLQ, 2K buffer and programmable characters. Target price £286.35. (Annual'85)
Dyneer DW16	0753-72331	378.00	Daisywheel. Can accept Epson and Diablo codes. (Annual'85)
Silver Reed EXP500	0734-752273	378.35	Daisywheel. Reasonable speed. Target price £326.60
Brother HR15	061-330-6531	445.00	RS232 daisywheel. Includes 3K buffer. Target price £401.85
Epson FX80	01-902-8892	503.70	Dot matrix. Many features, programmable characters, proportional spacing and 2K buffer. Target price £361.10

PRINTER INTERFACES

Product	Contact	Price	Comment
Datel Inter Printer	0782-273815	29.95	Centronics. Includes cable. Tape software

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Sanyo DR202 Data Recorders	£41.95
Spectrum on/off Switches	£5.95
Datex DR6	£24.95
Dk'tronics Lightpen	£19.95
Currah Speech	£29.95
Currah Slot	£14.95
Dk'tronics 3 Channel Sound Synthesiser	£29.95
Rotronics Carrying Case	£34.95
Fergusion 3T31 Digital Data Rec	£29.95

JOYSTICKS

Quickshot II	£8.75
Gunshot II	£9.95
Arcade (Steel Shaft)	£17.95
Arcade Turbo	£22.95
Competition Pro	£19.95
Quickshot II with Interface	£16.95

Price reductions will automatically be made on mail order products when they occur. All popular computers and peripherals stocked. Please ask for prices of Products

PRINTERS

Alphacom 32	£69.95
Timex Thermal	£79.95
Brother EP22 Printer/Typewriter	£159.95
Brother EP44 Printer/Typewriter	£229.95
Brother HR5 Thermal	£119.95
Brother M1009	£199.95
Tractor Feed for Brother M1009	£17.50
Mannesmann Tally MT80+	£242.95*
Canon PW1080A	£375.95*

*Inc Free Lead

INTERFACES

RAM Turbo	£22.95
Dk'tronics Programmable	£22.95
Dk'tronics Dual Port	£13.00
RAM MkII	£9.95
AGF Protocol Programmable	£29.95
Com Com	£19.95
DK'tronics Centronics Printer Interface	£39.95
Kempston Centronics Printer Interface	£39.95
DK'tronics 56-way ext cable	£9.95

WAFADRIVE

Rotronics Wafadrive	£128.95
Wafadrive Cartridges 16K	£3.50
64K	£3.65

All prices include VAT, post and packing. Cheques + PO's made payable to:
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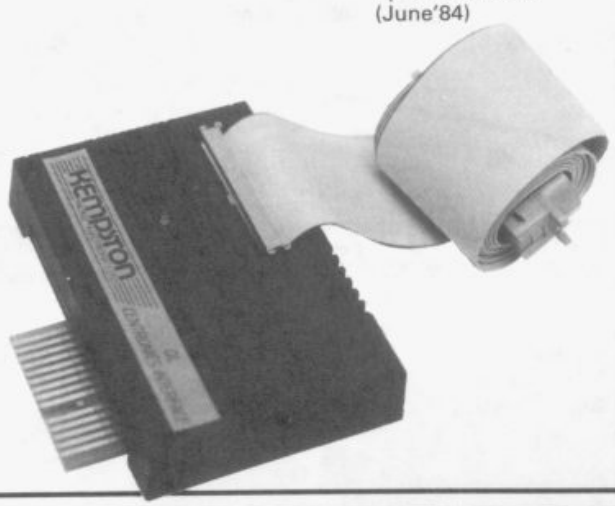
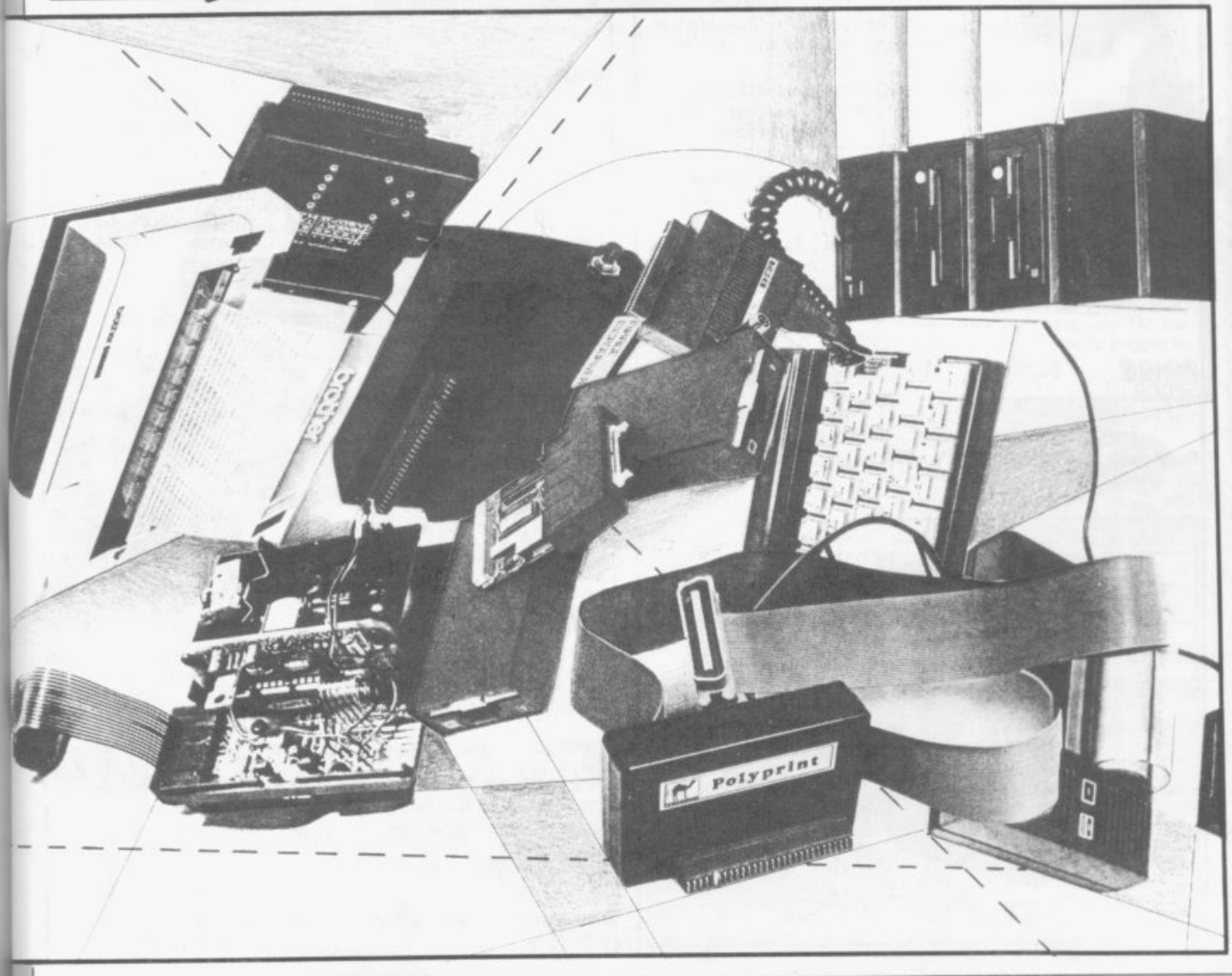
4 Systems

68 FOXWOOD CLOSE, FELTHAM, MIDDLESEX TW13 7DL TEL: 01-844 1399

Kempston S	0234-856633	29.95	Centronics. Includes cable. Tape software. Compatible with commercial software
Watford Morex	0923-40588	34.44	Centronics and RS232. Cable £9.00 extra. Tape software. (Nov'83)
Euroelectronics ZX Lprint III	0684-292448	34.95	Centronics and RS232. Cable £9.95 extra. Eprom software. (June'84)



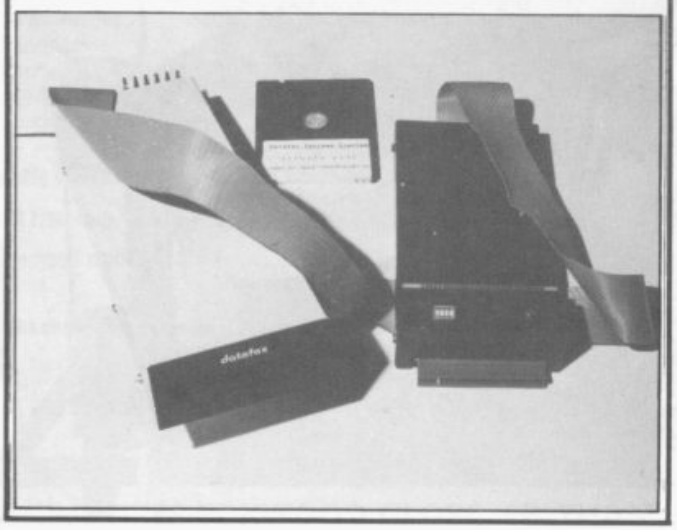
Camel Print-SP	0223-314814	34.94	Centronics. Includes cable. Tape software. (Jan'85)
Tasman	0532-438301	39.90	Centronics. Includes cable. Tape software. Compatible with commercial software. Copy to many printers
DK'tronics Centronics	0799-26350	39.95	Centronics. Includes cable. Tape software. Expensive. Limited Copy. (Mar'85)
Kempston E	0234-856633	39.95	Centronics. Includes cable. Eprom software. Good features. (Mar'84)
Camel PolyPrint	0223-314814	51.69	Centronics. Includes cables. Eprom software and seven international character sets in ROM to screen or printer plus Tasword 2 setting
Miracle Systems QL	0272-603871 x210	29.95	RS232 to Centronics. First and least expensive. Adaptor, £5.00, for use on Spectrum. (Aug'84)
Downsway QL	03727-27222	31.95	RS232 to Centronics. 9600 and 19200 baud. Switchable. (May'85)



Care Electronics	0923-777155	49.95	RS232 to Centronics. QL. Switchable 75-9600 baud
Technology Research	0784-63547	49.95	RS232 to Centronics. QL. (April'85)
CST Q-Pi	0223-323302	49.99	QL. Centronics — lets you use PAR in place of SER. Good value

SPECTRUM FAST STORAGE

Product	Contact	Price	Comment
Eprom Services Cartridge System	0532-667183	34.95	Uses Eproms for storage. Microdrive-type commands. Programs can be made to auto-run on power up
EMS	0733-75025	65.00	(£199 with drive) old Primordial Peripherals stock
Statacom	01-661-2266	75.00	(£240 with drive). Uses top 8K of memory. Cheap. (Feb'85)
LMT	01-367-0035	79.95	Includes Centronics port
Rotronics Wafadrive	0494-452757	99.95	Includes two tape drives, RS232 and Centronics ports plus software. Slow but has edge on microdrive. (Dec'84)
Servicon Dynamics Quickdisc	0594-542021	99.95	Includes RS423 and RGB. Uses 2.8in disc. Slow but good
Sinclair Research Microdrive	0276-685311	99.95	Includes tape drive, RS232 and network plus software. Slow. (Dec'84)
Technology Research Beta	0784-63547	109.25	Very popular, uses little memory. Now with proper filing system and format in ROM. Recommended. (Jan'85)
Watford SPDOS	0923-40588	125.35	Technically very good system. Includes software. Good value. (Jan'85)
Servicon Dynamics	0594-542021	149.44	(£264.38 with 3in drive). Expensive



Gordon Microframe	0292-280467	149.50	Includes motherboard system. Expensive as just a disc interface but good if you want extra cards
Timex	01-340-0310	199.00	Includes 3in drive, RS232 port. Poor manual but good system. CP/M upgrade. (April'85)
Opus Discovery	0737-65080	199.95	Includes 3½in drive, Centronics and joystick ports. Uses microdrive commands — commercial software on disc. Recommended. (May'85)

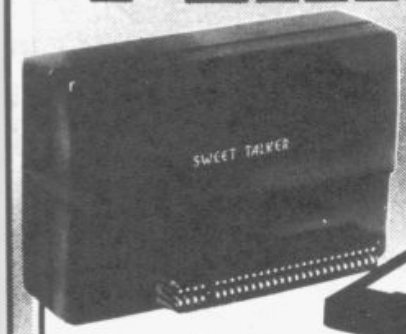
QL FAST STORAGE

Product	Contact	Price	Comment
Micro Peripherals	0256-473232	113.85	(£194 with 3½in drive). Toolkit on disc. Good value. (June'85)
Silicon Express	0533-374917	113.85	(£249 with 80 track, double sided 5¼in drive), includes Toolkit
Computamate Q-Disk	0782-811711	149.00	Made by CST. The first available, now seems over priced. Includes Toolkit. (April'85)
Medic	0256-460748	249.95	Includes drive and Centronics port
Quest	04215-66488		CP/M 68K system
Cumana	0483-503121	TBA	Based on OS9 operating system, due to have a host of extras
Technology Research	0784-63547	TBA	Will include Centronics interface and RAM

KEYBOARDS

Product	Contact	Price	Comment
Sinclair Research Spectrum Plus kit	0276-685311	20.00	(£30.00 if fitted by Sinclair). Has to be a bargain at the price. (June'85)
Kelwood K-Board	0709-63242	28.05	Unimpressive, unprofessional. (Oct'84)

PERIPHERAL POWER

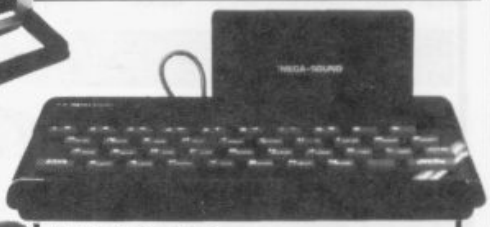


CASSETTE/DATA RECORDER

For your home computer, will allow easy loading of even the most stubborn program. Features include single key record, mains/battery, accepts standard computer leads and 5 pin DIN connector. Also provides exceptional audio quality for fine listening.
(Batteries not included) **£24.95**

CHEETAH" SWEET TALKER"

Based on an allophone system, program any word or phrase, providing unlimited speech. Now make your Spectrum talk.
Compatible with Interface I & II and Spectrum + ... **£24.95**



MEGASOUND

For 48K Spectrum and ZX Spectrum +. Achieve amazing sound capabilities that your Spectrum has been lacking. Just plugs into the user port at the rear of your computer and amplifies sound through your T.V. **£10.95**

SPECTRUM JOYSTICK INTERFACE

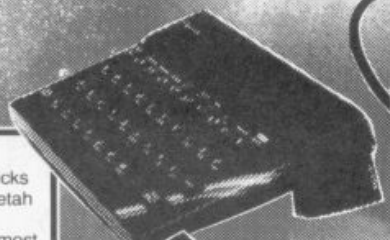
Simply plugs into the user port at the rear of the computer and accepts any Atari style joystick including Quickshot and Kempston.
Comes without rear edge connector at **£11.50**
or with connector which allows other peripherals to be stacked up at **£12.75**

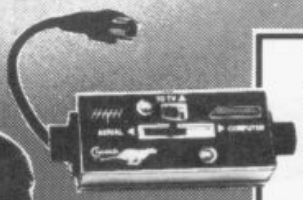
56 WAY EXTENSION CONNECTOR

Cheetah's 6" long extensio- cable enables Spectrum periphe.. to be distanced from your computer .. **£7.95**

32K RAMPACK

Upgrade your 16K ZX Spectrum now! The Cheetah 32K Rampack simply plugs into the user port at the rear of your computer and increases the memory instantly. to 48K **£39.95**





AERIAL SPLITTER

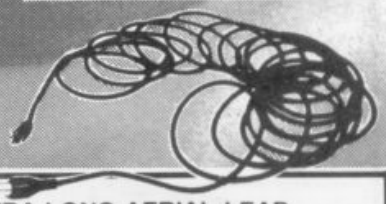
Cheetah's neat splitter unit complete with self adhesive pad allows you to keep your T.V. and computer aerial leads plugged in without disturbing the picture **£2.25**

R.A.T.

Conventional joysticks are dead! The Cheetah Remote Action Transmitter is the most sophisticated computer controller available! Infra red transmission - so there are no leads trailing across the living room. Touch control, extremely fast, can be used with Cheetah RAT/ Kempston compatible software. Complete with receiver/ interface. **£29.95**

HI-STAK FEET

These instantly applied stick on feet for your ZX 81, Spectrum, New Brain, VIC, TRS etc. tilt the computer and make your keys easier to see and more enjoyable to use, allowing smoother programming. **£2.99**



EXTRA LONG AERIAL LEAD

Over 15' long. Our super lead will allow you to sit back away from your T.V. and enable you to play games in the comfort of your armchair. **£1.50**

All Cheetah Peripherals have rear edge connectors for compatibility with all Sinclair accessories.

Prices include VAT, postage & packing.
Delivery normally 14 days.
Export orders at no extra cost.
Dealer enquiries welcome.
Cheetah, products available from branches of
John Menzies WHSMITH Rumbelows
WOOLWORTH Spectrum dealers
and all good computer stores.

Cheetah Marketing

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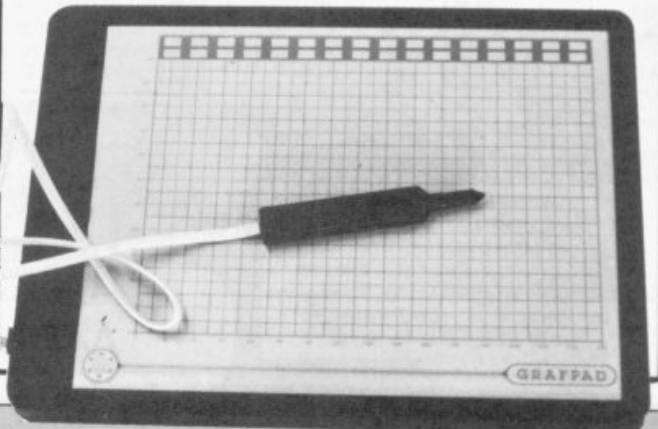
Cheetah MARKETING LTD.
1 Willowbrook Science Park
Crickhowell Road, St Mellons, Cardiff
Tel: (0222) 777337. Telex: 497455

DK'tronics	0799-26350	37.50	Hugely popular. Proper keys, good value. Printed caps £6.00 extra. (August'84)
LMT LMT68FX2	01-367-0035	39.95	Due soon. Printed caps, 68 keys
Maplin	0702-552911	44.95	Also DIY version. Plugs into back of Spectrum. Old fashioned. (June'84)
Kappa Keyboards		48.00	56 keys crammed into old case, joystick port. (Jan'85)

Nordic Executive	051-678-9993 051-606-0088	49.45	Good value. (Feb'85)
AMS Lo>>Profile	0925-62682	49.95	Numeric Pad. Membrane. Large case. (Aug'84)
Saga Saga 1	04862-69527	49.95	Good looks. Lots of keys but no single functions. (Oct'84)
Mancomp MO184	061-224-1888	54.95	Bad feel to keys, overpriced (Feb'85)
Fox Cheetah 68FX1	0493-732420	59.95	Reasonable but overtaken by new version. See LMT (Dec'84)
Microboard Lazer 62	0483-38006	59.95	Lots of keys, lots of functions. Expensive. (June'85)
Stonechip	0252-333361	59.95	(£39.95 without extras). Beep amp, Load/Save. No need to open Spectrum. (Oct'84)
Transform	01-658-6350	69.95	Rolls Royce of keyboards. Three colour printed caps, good feel to keys. Recommended. (June'84)
Transform	01-658-6350	79.95	New model with shifted cursor keys and restyled case

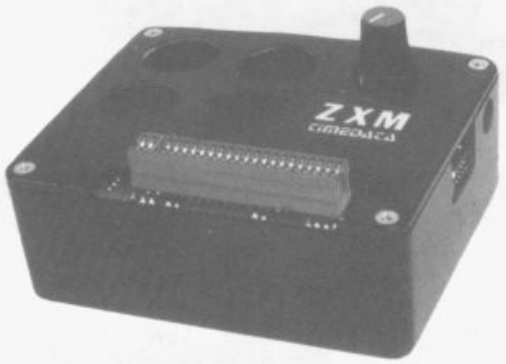
GRAPHIC AIDS

Product	Contact	Price	Comment
Pixel Pad	01-994-6477	4.95	A3 sheets. (June'84)
Format 4	0306-880014	5.99	Re-usable sheets
Print 'n' Plotter Jotter	01-660-7231	9.00	100 A3 sheets
Format 4	0306-880014	16.95	Ring binder of grids
Datel Lightwriter	0782-273815	16.95	Cheap light pen
Trojan	0792-205491	17.25	Good light pen. (June'84)
DK'tronics	0799-26350	19.95	Light pen. (Sept'84)
Datapen	0256-770488	29.00	Good light pen. (Nov'84)
RD Digital Tracer	07073-31051	59.50	A4 (A3 £75.50). Could be better. (Feb'85)
SMC QL Mouse	01-441-1282	69.95	Includes interface and software with icons
Saga Graphics pad	04862-22977	80.44	Needs interface (£29.95). Good value
British Micro Grafpad	0923-48222	143.75	Recommended. Good software. (Feb'85)
Touchmaster	0656-744700	149.95	Limited. (Mar'85)



SOUND

Product	Contact	Price	Comment
Compusound Tele-sound	0527-21429	9.95	Outputs beep through TV. (Mar'84)
Cheetah Mega-Sound	01-833-4909	10.95	Outputs beep through TV. Loud. (April'85)
Stonechip Echo Amplifier	0252-333361	10.95	Beep amp and Load/Save switch
Zeal Sound Booster	0246-208555	14.50	External beep amp with Load/Save switch
DK'tronics	0799-26350	14.95	Beep amp. Loud
Timedata ZXM	0268-418121	24.95	Three channel sound and joystick port. (Dec'83)
Bi-Pak Zon X	0920-3182	25.95	ZX-81 amp needs adaptor (£6.80) for Spectrum
William Stuart Synthesiser	098 -064-235	29.32	(£22.43 kit). Three channel sound
DK'tronics 3 Channel	0799-26350	29.95	External speaker, poor software. (Mar'85)
Petron Trichord	0626-62836	29.95	Three channel and Beep amp. (Mar'84)
Datel-Digital Sampler	0782-273815	49.95	Many features and worth twice the price



SPEECH

Product	Contact	Price	Comment
Cheetah Sweet Talker	01-833-4909	24.95	Standard allophone. Good demo software
DK'tronics Speech Synthesiser	0799-26350	24.95	Allophone system. Includes text-to-speech software
Timedata ZXS	0268-418121	24.99	Allophone system. Needs external amp. (Dec'83)
Currah µSpeech	0799-26350	29.95	Output through TV. (Dec'83)
DCP Speech Pack	0442-64225	29.95	Good digitised speech. Additional ROMs £12.95
Datel Vox Box	0782-273815	34.95	Output through TV. Beep amp and Kempston joystick port
William Stuart Chatterbox II	098-064-235	44.85	(£37.95 kit). Beep amp, also ZX-81 version
Orion Data Micro Command	0273-672191	49.95	Speech recognition. Includes microphone and software. (June'84)
William Stuart Big Ears	098-064-235	56.35	Speech recognition. Includes microphone and software. Needs port.

SPECTRUM RAM

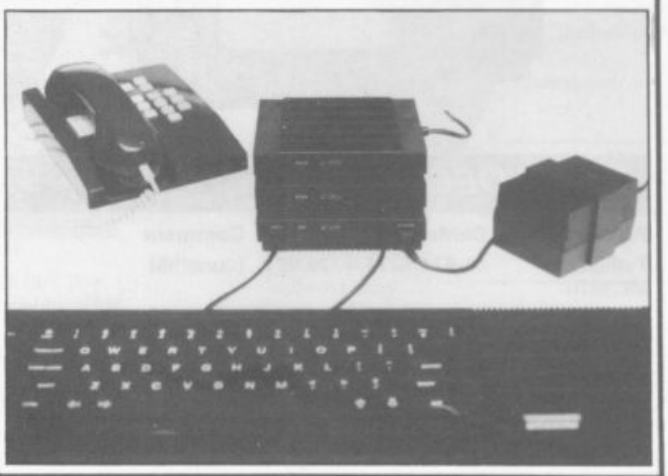
Product	Contact	Price	Comment
RAM	02514-5858	21.95	Issues 2 and 3
Fox	0493-732420	22.90	Issues 2 and 3
Midwich	0379-4131	24.95	Issues 2 and 3
East London Robotics SP48B	0483-505605	27.00	Issues 2 and 3. Also 80K version and Forth. (June'84)
DK'tronics	0799-26350	30.00	
Cheetah	01-833-4909	39.95	External RAM. (July'83)

QL RAM

Product	Contact	Price	Comment
QL+	0372-67282	86.25	64K
		132.25	128K
		172.50	256K
		316.25	512K
Quest	04215-66488	115.00	64K
		185.00	128K
		349.00	256K
		579.00	512K Can use as RAM Disc
Simplex Data	01-575-7531	99.90	64K
		198.00	256K
		396.00	512K

MODEMS

Product	Contact	Price	Comment
Protek 1200	0506-415353	59.95	Needs interface (£24.95). Audio. Prestel and 1200/1200. Will work on other computers with different interface. (Feb'85)
Prism/Modem House VTX5000	0392-69295	69.95	On offer at £49.95. Prestel and user-to-user. Bargain at price. (Nov'83)
Miracle Technology WS2000	0473-51785	149.44	All the features you are ever likely to need but needs interface (£45.94). Good value. (April'85)
Compak Data	0792-473697	160.00	For the QL. 1200/1200. 1200/75 (Prestel), 75/1200 and 300/300, direct connect. Includes printer interface and 2K buffer



MONITORS

Product	Contact	Price	Comment
Citadel 101QL	01-951-1848	79.93	12in green screen. Cable extra. (May'85)
Phillips	01-658-6350	86.25	12in green screen. Good picture on QL
Hantrex Boxer	01-778-1414	99.95	12in green screen. Reasonable. (May'85)
Citadel MVM12G	01-951-1848	102.93	12in green screen. Poor picture. (May'85)
Taxan	01-658-6350	114.94	12in green screen. Swivel base with clock £20.00
Opus 1302-2	0737-65080	199.95	14in RGB for QL. Includes cable. (Dec'84)
Microvitec 1431-MZ	0274-390011	259.00	14in RGB. Spectrum interface. (Dec'84)
1451-DQ3		295.00	14in RGB for QL. Swivel tilt stand £22.99. (Dec'84)
MBS Vision QL	0442-60155	299.00	12in RGB for QL. Overrated. (April'85)
Centel	0274-736386	299.00	14in RGB for QL. Good picture
Sanyo	01-658-6350	314.64	14in RGB for QL

TAPE DECKS

Product	Contact	Price	Comment
Twillstar MC3810	01-574-5271	25.95	(June'85)
Cobolt Data Recorder	0751-73315	19.95	
Cheetah Data Recorder	01-833-4909	24.95	
Binatone Data Recorder	01-903-5211	29.95	(June'85)
W H Smith CPD 8300	01-353-0277	34.95	Can cause problems when loading tapes saved on this from another machine
Challenge Research Sprint	0707-44063	69.95	Loads and saves at 4× normal speed. Cannot handle commercial turboload tapes. (Dec'84)

INPUT/OUTPUT

Product	Contact	Price	Comment
Camel I/O Port	0223-314814	21.28	Popular, almost the standard
Prommer-81S		28.69	Low cost Eprom programmer for 2K and 4K Eproms
Prommer-SP		34.44	Low cost Eprom programmer for 8K and 16K Eproms. (Annual'85)
Rom-SP		34.44	Eprom holder, up to 16K. Autostart. (May'84)
Bloprom-SP		103.44	Full feature Eprom programmer
Cramic-SP		103.44	16K battery-backed RAM
Datel Robo Tek	0782-273815	29.95	Four output, eight input, includes cables
DCP InterSpec	0442-64225	49.95	Four switch inputs, four relay outputs, eight-bit port in, eight-bit port out and eight-bit eight channel 10ms A to D. Good value, well made
Eprom Services QL Eprom Holder	0532-667183	14.95	Plus programs in Eprom available. Good. (May'85)
ROM Board		14.95	For up to 16K. Sits in ROM space. (Mar'83)
Eprom Programmer		54.95	Full feature Eprom programmer. Also full range of A-D, D-A and I/O cards

BACK ISSUES

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In Search Of Adventure. A new series started by Richard Price.
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A special letter published from Sir Clive.

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Menu drive your Spectrum programs.
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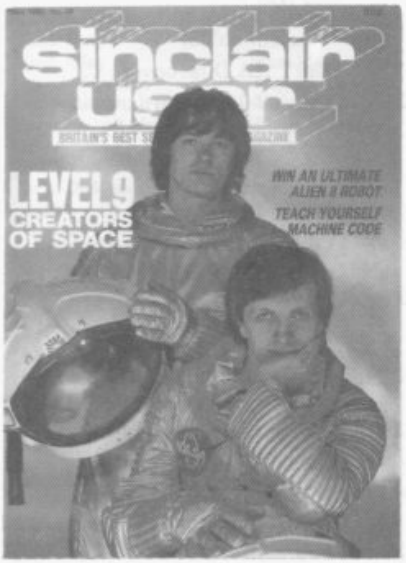

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Level 9 Interview.
Teach Yourself Machine Code.
Reviews of Herberts Dummy Run, Overlords, Gyron and Formula One.
Sinclair Surgery tackle special Spectrum problems.

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Exclusive interview with Sir Clive.
A new series for programmers called Intelligent Adventuring. Latest news on QL scene. The great software chainstore massacre.

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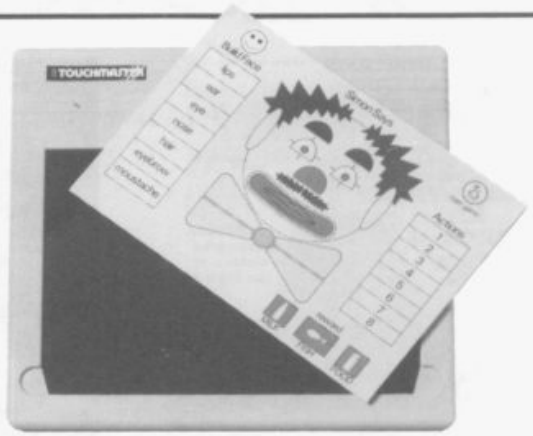
Please post to: Sinclair User Back Issues Department, Priory Court, 30-32 Farringdon Lane, London EC1R 3AU.

Multitron I/O Port	0527-44785	15.98	Standard I/O port. (Feb'84)
Orme Electronics Eprom Card	087257-2842	21.25	Toolkit in Eprom. (Sep'83)
Indescomp Domestic Controller	0462-37171	49.95	Four inputs, four outputs (via relays) available through Spectrum group. (July'84)

ODDS AND ENDS

Product	Contact	Price	Comment
Steve Adams Eve Adaptor	01-254-1869	9.00	Adaptor for ZX-81 add-ons on Spectrum
Adapt	01-504-2840	29.95	Good RGB interface
AGF ROM Slot	0243-823337	7.95	For games cartridges, as Interface 2
B & R Electrical	0279-34561	10.45	Mains filter. (Feb'84)
CLPS Flexible Connector	0930-52204	8.50	Also three way £12.50. (Aug'84)
Microdrive Lead		8.50	6in. (Dec'84)
RS232 Lead Spectrum		10.95	Cheaper than Sinclair
RS232 Lead QL		10.00	(Dec'84)
Monitor Lead QL		2.50	QL to aerial or phono. (May'85)
Commotion Beasty Interface	01-804-1378	49.95	Drives up to four servos for robotics
CST IEEE-48	0223-323302	195.50	Up to 16 instruments
Camel Nike	0223-314814	19.95	Battery back-up in case of power failure. (Dec'84)
Censcot Fatherboard		17.50	Tray for computer, tape deck etc. (April'84)
Cheetah 56 way extender	01-833-4909	7.95	Flexible connector
Aerial Splitter		2.25	For TV and computer
15ft aerial lead		1.50	

Computer-world	01-778-0479	4.99	Reset switch
Dixonmyne	0273-201568	105.00	Computer Table. (April'85)
DK'tronics Microdrive lead	0799-26350	5.95	6in
Currah μSlot		7.95	Two way solid extender
Rom Cartridge		9.95	Cartridge slot



56 way extender		9.95	Flexible connector
Eidersoft The Switch 2	01-478-1291	2.49	Reset and on/off switch
Glanmire Electronics	01-366-3245	38.50	Real Time Clock
GST 68K/OS	0954-81991	99.95	Original QL operating system. Little support
Hawnt	021-784-2485	7.99	Flexible connector
Intergalactic Robot Zero 2	01-359-2539	79.95	Kit (£99.95 built) updated Zeaker turtle
Kelan Prototype Kit	0423-883672	9.50	With PCB, case, socket for joystick. (April'84)
Kelwood Backpack	0709-63242	27.50	Load/Save switch, Beep amp, mains socket
Maplin Easy load	0702-552911	9.95	DIY. Filters tape signal. Good value. (Sept'84)
Mega Rule	01-930-1612	2.99	Magnifying ruler. (May'85)
Miracle Systems	0272-603871 x210	39.00	Two way motherboard for QL
Nidd Valley Slomo	0423-864488	4.95 14.95	Reset Switch. Slows computer. Good. (Feb'85)
PI Computers		4.90	QL Dust cover
Print 'n' Plotter	01-660-7231	2.95	10 keyboard overlays for Spectrum
Adventure Planner		4.50	A must for the serious adventurer
Rainbow	0993-5432	4.95	Reset switch
Rexel Starter Kit	0628-37222	11.49	Tape head cleaner and flowchart template
Simplex Data Expansion Console	01-575-7531	49.50	QL. Two way motherboard
Skywave Forth	0202-302385	67.85	Fig Forth in ROM plus RS232 and Centronics
Softeach	0734-64261	3.95	Keyboard overlay
TEC	0527-74567	4.95	Reset switch
TV Services XK System	0223-311371	20.95	(£15.00 kit). Up to 4Mb of paged memory
Transform Microdrive Box	01-658-6350	5.95	Smart box for 20 cartridges. (Nov'84)
Spectrum Monitor Lead		11.50	The only one. (May'85)
RGB Interface		45.00	With through port. Socket to monitor same as QL for ease of use
Tree Top Designs	01-464-4464	47.95	Case inc Load/Save and reset switches
YF Products	01-979-8753	5.45	Reset switch

Buyer's Guide

Choosing a game or utility? Each program has a star rating for value

THE Gilbert Factor has been replaced by a star rating, the basis of which is value for money. Programming, graphics, speed, presentation and addictive qualities are taken into account.

Guide to ratings:
★★★★★24 carat. Buy it
★★★★Value for money
★★★Nothing special
★★Over-priced
★A rip-off

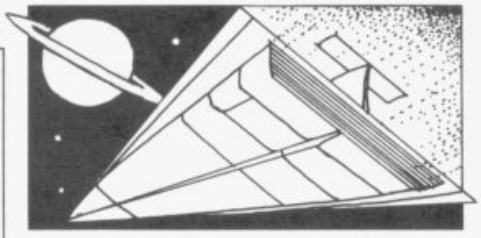
SPECTRUM 16K

Adventure

Planet of Death	Artic	3★

Arcade

Arcadia	Beau Jolly	3★
Arcadian	J K Greye	3★
Black Hole	Quest	3★
Blind Alley	Sunshine	4★
Cosmic Guerilla	Crystal	4★
Crazy Cranes	Voyager	3★
Crevasse and Hotfoot	Microsphere	4★
Cyber Rats	Silversoft	4★
Death Chase	Micromega	3★
Earth Defence	Artic	3★
Escape	New Generation	4★
Fireflash	Abacus	3★
Fruit Machine	DK'tronics	3★
Galaxians	Artic	3★
Gnasher	Mastertronic	2★
Godzilla and Martians	Temptation	4★
Ground Attack	Silversoft	3★
Horace and the Spiders	Sinclair	4★
Horace Goes Skiing	Sinclair	3★
Hungry Horace	Sinclair	4★
Invasion Force	Artic	4★
Jet Pac	Ultimate	5★
Luna Crabs	Micromega	4★
Maze Chase	Hewson	4★
Meteor Storm	Quicksilva	4★
Meteoroids	DK'tronics	4★
Micro Mouse	Lothlorien	3★
Millypede	Add-on	4★
Mined Out	Quicksilva	4★
Mr Wong's Loopy Laundry	Artic	3★
Muncher	Silversoft	3★
Orbiter	Silversoft	4★
Pengy	Micromania	2★
Planetoids	Sinclair	3★
Proteus	Abacus	3★
Rider	Virgin	3★
Road Toad	DK'tronics	4★
Sentinel	Abacus	4★
Sheer Panic	Visions	4★
Sir Lancelot	Melbourne House	4★
Space Intruders	Quicksilva	4★
Space Raiders	Sinclair	3★
Spec. Scramble	Work Force	4★
Spectipede	Mastertronic	3★
Spectral Invaders	Bug-Byte	4★
Spectral Panic	Hewson	3★



Strike Four	Spectresoft	2★
Tank Battle	dk'tronics	4★
Train Game	Microsphere	5★
Winged Warlord	CDS	3★
Yomp	Virgin	4★

Business

Finance Manager	OCP	5★
Survey II	Lobos	3★
Vu-Calc	Sinclair	4★
Vu-File	Sinclair	4★

Education

Chess Tutor	Artic	4★
Estimator Racer	Psion	4★
Firework Music	Soft Cottage	4★
Integration	University	4★
Money	Poppy	4★
Number Painter	Psion	4★
Regression	University	4★

Language

Beta Basic	Betasoft	5★

Practical

Countries of the World	Hewson	4★
Cycle Planner	Medidata	2★
Map of the UK	Kuma	4★

Puzzle

Flippit	Sinclair	4★
Hanoi King	Contrast	4★
Lojix	Virgin	2★
Nowotnik Puzzle	Phipps	4★

Simulation

Air Traffic Controller	Hewson	3★
Airliner	Protek	3★
Golf	Virgin	4★
NightFlite	Hewson	3★
Print Shop	CCS	4★
Pro-Golf	Hornby	4★

Strategy

Dallas	CCS	3★
Dictator	DK'tronics	4★
Heathrow	Hewson	4★

Traditional

Bridge Tutor	CP Software	4★
Bridgemaster	Serin	5★
Las Vegas	Temptation	3★
Pool	Bug-Byte	4★
Reversi	Sinclair	4★

Utility

Auto Sonics	Buttercraft	3★
Basic Utilities	Jaysoft	3★
Dietron	Custom	3★
Disassembler	DK'tronics	4★
Editor/Assembler	Picturesque	4★
Extended Basic	CP Software	4★
FP Compiler	Softek	5★
Friendly Face	Monitor	4★
Letterfont	Allanson	4★
Machine Code Test Tool	OCP	4★
Master Toolkit	OCP	4★
MCoder	PSS	4★
Print Utilities	Sinclair	4★
Slow Loader	ELR	5★
Sound FX	DK'tronics	3★
Spec. Editor/ Assembler	Picturesque	4★
Spec. Monitor	Picturesque	4★
Spectrum Super Toolkit	Nectarine	4★
Supercode	CP	4★
Trace	Texgate	4★
TT-S	Timedata	4★

SPECTRUM 48K

Adventure

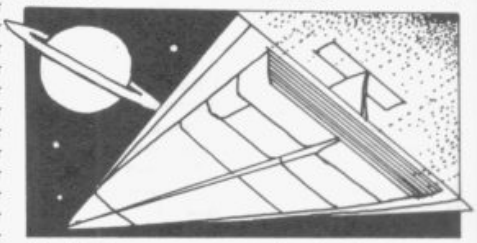
Abyss	CCS	3★
Adventure 1	Abersoft	3★
Alchemist	Beau Jolly	4★
Amulet	Sentient Software	2★
Ancient Quests	Mirrorsoft	4★
Ashkeron	Mirrorsoft	3★
Assignment East Berlin	Sterling Software	2★
Atlas Assignment	Virgin	4★
Black Crystal	Mastervision	4★
Black Planet	Phipps	4★
Bored of the Rings	Delta 4	5★
Caesar's Travels	Mirrorsoft	2★
Castle Blackstar	CDS	4★
Classic Adventure	Melbourne House	4★
Colditz	Phipps	4★
Colossal Caves	CP Software	4★
Confidential	Radar Games	4★
Crystal Frog	Sentient Software	3★
Curse of the Seven Faces	Imperial Software	3★
D. Mouse in Black Forest	Creative Sparks	4★
Dead at the Controls	Artic	2★
Demon Lord	MCE	3★
Detective	Arcade	4★
Diamond Quest	CCS	2★
Diamond Trail	Gilsoft	4★
Doomdark's Revenge	Beyond	5★
Dun Darach	Gargoyle	5★
Dungeon Master	Crystal Comp.	4★
Dungeons of Doom	Temptation	2★
El Dorado	Atlantis	4★
Emerald Isle	Level Nine	4★
Erik the Viking	Level Nine	4★
Espionage	Modular Resources	2★
Espionage Island	Artic	3★
Eureka	Domark	3★
Everest Ascent	Shepherd	3★
Eye of Bain	Artic	4★
Fantasia Diamond	Hewson	4★
Flight from the Dark	Hutchinson	4★
The Fourth Protocol	Century/Hutchinson	5★
Frankie goes to Hollywood	Ocean	5★
Frog Face	Positive Image	4★
Ghoulies	IMS Software	4★
Golden Apple	Artic	4★
Gremlins	Adventure Int	3★
The Great Space Race	Legend	2★
Halls of Things	Crystal Comp.	5★
Hampstead	Melbourne House	5★
Here comes the sun	Alligata	4★
Heroes of Karn	Interceptor	3★
Hobbit	Melbourne House	5★
Ice Station Zero	8th Day	3★
Inca Curse	Artic	3★
Inferno	Shepherd	4★
Invincible Island	Shepherd	4★
Island	Crystal	2★
Jericho Road	Shards	4★
The Jewel of Power	Slogger Software	4★
Jewels of Babylon	Interceptor	2★
Jungle Adventure	CCS	2★

Kentilla	Micromega	3★
Key of Hope	Games Workshop	4★
King Arthur's Quest	Hill MacGibbon	2★
Knight's Quest	Phipps	3★
Leopard Lord	Add-on	2★
Lords of Midnight	Beyond	5★
Lords of Time	Level Nine	4★
Mad Martha	Mikro-Gen	4★
Malice in Wonderland	Sentient Software	3★
The Magic Sword	Database Pubs	3★
Mountains of Ket	Incentive	4★
Murder at Manor	Gemtime	4★
Odyssey of Hope	Martech	3★
Operation Nightingale	Softly Softly	3★
Oracle's Cave	Doric	4★
Orc Slayer	Gamma Software	3★
Paradox	Runesoft	1★
Perseus and Andromeda	Channel 8	4★
Phineas Frogg	Mirrorsoft	4★
Pimania	Automata	4★
The Prince	CCS	4★
The Prisoner	Spoof Software	3★
Project X	Compass Software	4★
Quest	Hewson	4★

Quetzalcoatl	Virgin	4★
Red Moon	Level 9	5★
Return of the Joystick	Delta 4	3★
Return to Eden	Level Nine	4★
Runestone	Games Workshop	4★
Runes of Zendos	Dorcas Software	3★
The Sandman Cometh	Star Dreams	4★
Satan's Pendulum	Minatron	4★
Scoop	Sentient Software	3★
Se-Kaa of Assiah	Mastervision	2★
Sherlock	Melbourne House	5★
Ship of Doom	Artic	4★
Snowball	Level 9	5★
Spoof	Runesoft	4★
Subsunk	Firebird	4★
Superspy	Shepherd	3★
System 15000	Craig Comm.	5★
Temple of Vran	Incentive	4★
Terrormolinos	Melbourne House	5★
The Final Mission	Incentive	4★
The Helm	Firebird	4★
The Talisman	Games Workshop	4★
The Wild Bunch	Firebird	2★
Timesearch	Millenium	3★
Tir Na Nog	Gargoyle	5★
Titanic	R&R	3★
Tower of Despair	Games Workshop	3★
Transylvanian Tower	Shepherd	3★
Twin Kingdom Valley	Bug-Byte	4★
Underworld	Orpheus	3★
Urban Upstart	Shepherd	4★
Valhalla	Legend	5★
Vampire Village	Terminal	2★
Velnor's Lair	Quicksilva	4★
Volcanic Dungeon	Mastervision	3★
Warlord	Interceptor	3★
War of the Worlds	CRL	2★
Waydor	IMS Software	2★
Width of the World	Mosaic	2★

Arcade

Abu Simbel Profanation	Gremlin Graphics	4★
Action Biker	Mastertronic	1★
A Day in the Life	Micromega	4★
A View to a Kill	Domark	4★
Ad Astra	Gargoyle Games	4★
Adven. of a St Bernard	Mastertronic	4★
Airwolf	Elite	2★
Alcatraz Harry	Mastertronic	2★
Alien 8	Ultimate	5★
Android Two	Vortex	5★
Ant Attack	Quicksilva	5★
Arabian Nights	Interceptor	4★
Archon	Ariolasoft	2★
Arena 3000	Microdeal	3★
Armageddon	Silversoft	2★
Astronut	Software Projects	4★
Atic Atac	Ultimate	5★
Automania	Micro-Gen	3★
Avalon	Hewson	5★
Base Invaders	Work Force	3★
Battle Zone	Quicksilva	3★
Bazam	Alan Firminger	3★
Beach Head	US Gold	4★
Bear Bovver	Artic	4★
Birds and Bees	Bug-Byte	4★
Black Hawk	Creative Sparks	4★
Blade Alley	PSS	3★
Blue Max	US Gold	3★
Blue Thunder	Foundry Systems	3★
BMX Trials	Lainlan Software	2★
Booty	Firebird	4★
Boulder Dash	Front Runner	3★
Brian Bloodaxe	The Edge	4★
Brian Jack's Challenge	Martech	2★
Bristles	Statesoft	3★
Bruce Lee	US Gold	4★
Buck Rogers	US Gold	2★
Bugaboo	Quicksilva	4★
Buzz Off	Electric	3★
Caesar the Cat	Mirrorsoft	4★
Carnival	Eclipse	3★
Carpet Capers	Terminal	3★
Cauldron	Palace	5★
Cavelon	Ocean	4★
Centipoid Plus 3	Orwin	3★
Chaos	Games Workshop	4★
Chequered Flag	Sinclair	5★
Chinese Juggler	Ocean	3★
Chocolate Factory	Hill MacGibbon	3★
Chuckie Egg	A & F	5★
Chuckie Egg II	A & F	3★
Chuckman	CCI/Add-on	4★
Close-In	Pulsonic	2★
Codename Mat	Micromega	5★
Confuzion	Incentive	4★
Corridors of Genon	New Generation	5★
Crusoe	Automata	3★
Cyclone	Vortex	4★
Cylu	Firebird	4★
Daley's Decathlon	Ocean	5★
Dangermouse in D. Trouble	Creative Sparks	4★
Death Chess 5000	Artic	4★
Death Star Interceptor	System 3	1★
Defusion	Incentive	3★
Defusion/Worms	K-Tel	2★
Demon Chase	Mansfield	2★
Deus Ex Machina	Automata	5★
Devil Rides In	Mastertronic	4★
Dimension Destructors	Artic	4★
Dodge City	Phoenix	4★
Don't Buy This	Firebird	2★
Dr Franky and the Monster	Virgin	3★
Dragonfire	Cheetahsoft	3★
Dragontorc	Hewson	4★
Driller Tanks	Sinclair	2★
Drive In	Fantasy	2★
Dynamite Dan	Mirrorsoft	5★
Energy 30,000	Elm	2★
Eric and the Floaters	Sinclair	3★
Everyone's a Wally	Mikro-Gen	4★
Exodus	Firebird	2★
Falcon Patrol II	Virgin	3★
Falklands Crisis	Lainlan Software	2★
Fantastic Voyage	Quicksilva	4★
Frankenstein 2000	Icon	2★
Frank N Stein	PSS	4★
Fred	Quicksilva	3★
Froot Loop	NTD Software	3★
Galaxy Attack	Sunshine	2★
Ghostbusters	Activision	4★
Ghost Rider	Positive Image	2★
Giant's Revenge	Thor	2★
Gift from the Gods	Ocean	3★
Gilligan's Gold	Ocean	3★
Glass	Quicksilva	4★
Glug Glug	CRL	3★
Go To Hell	666	3★
Havoc	Dynavision	1★
Harry Goes Home	Pulsonic	3★
Helichopper	Firebird	2★
Hellfire	Melbourne House	4★
Herbert's Dummy Run	Mikro-Gen	4★
Hickstead	CCS	2★
High Noon	Work Force	5★
Highway Encounter	Vortex	5★
Hunchback	Ocean	4★
Hunchback II	Ocean	3★
Hypersports	Imagine	4★
Icicle Works	Statesoft	2★
Invasion Body Snatch.	Crystal	5★
Jack and the Beanstalk	Thor	3★
Jasper	Micromega	3★
Jet Set Willy	Software Projects	5★
Jet Set Willy II	Software Projects	3★
Jump Challenge	Martech	3★
Killer Knight	Phipps	3★
Knight Lore	Ultimate	5★
Knockout	Alligata	2★
Kokotoni Wilf	Elite	3★
Komplex	Legend	2★
Krakatoa	Abbex	4★
Kung-Fu	Bug-Byte	3★
Laser Zone	Quicksilva	4★
Laserwarp	Mikro-Gen	3★
Lazy Jones	Terminal Software	2★
Les Flics	PSS	3★
Locomotion	Mastertronic	4★
Lode Runner	Software Projects	3★
Loony Zoo	Phipps	3★
Lunar Jetman	Ultimate	5★
Magic Roundabout	CRL	2★
Manic Miner	Bug-Byte	5★
Matrix	Salamander	4★
Maziacs	DK'tronics	4★
Metabolis	Gremlin Graphics	4★
Metagalactic Llamas	Salamander	4★
Mighty Magus	Quicksilva	2★
Minder	DK'tronics	4★
Mission Impossible	Silversoft	3★
Mission Omega	Pulsonic	2★
Monkey Biznes	Artic	4★
Moon Cresta	Incentive	3★
Moons of Tantalus	Cornhill	3★
Monty is Innocent	Gremlin Graphics	4★
Mr Wimpey	Ocean	4★
Mummy Mummy	Lothlorien	3★
Munnery's Mergatroids	Abacus	3★
Mutant Monty	Artic	4★
New Cylon Attack	A&F	3★
Nicotine Nightmare	Atlantis	2★
Night Gunner	Digital Integration	3★
Nodes of Yesod	Odin	4★
Nonterraqueous	Mastertronics	3★
1994	Visions	2★
911TS	Elite	1★
Olympimania	Automata	3★
On the Run	Design Design	3★
Orion	Software Projects	3★
Paws	Artic	4★
Pedro	Beau Jolly	4★
Penetrator	Melbourne House	5★
Pi-Balled	Automata	4★
Pi-Eyed	Automata	3★
Pitfall II	Activision	3★
Potty Pigeon	Gremlin Graphics	3★
Psi-Spy	Postern	3★
Pssst	Ultimate	4★
Psytron	Beyond	5★
Pyjamarama	Mikro-Gen	4★
Pyramid	Fantasy	4★



Quackshot	Creative Sparks	3★
Rapscallion	Bug-Byte	3★
Reactor	Gemini	4★
Revenge of the K. Tomatoes	Visions	3★
Rider	Virgin	3★
River Rescue	Creative Sparks	2★
Robot Riot	Silversoft	3★
Rocco	Gremlin	3★
Rocky Horror Show	CRL	3★
Roland's Rat Race	Ocean	4★

Rommels Revenge	Crystal	5★
Sabre Wulf	Ultimate	5★
Saimazoom	Silversoft	3★
Shadowfire	Beyond	5★
Shadowfire Tuner	Beyond	4★
Skooldaze	Microsphere	5★
Scuba Dive	Durrell	5★
Select 1	Computer Records	4★
Skull	Games Machine	3★
Sky Ranger	Microsphere	2★
Snapple Hopper	Macmillan	3★
Software Star	Addictive Games	2★
Sorcery	Virgin	4★
Space Station Zebra	Beyond	3★
Spectron	Virgin	3★
Spellbound	Beyond	4★
Splat	Incentive	4★
Sports Hero	Melbourne House	3★
Spy Hunter	US Gold	4★
Spy vs Spy	Beyond	5★
Stagecoach	Creative Sparks	4★
Starbike	The Edge	3★
Starion	Melbourne House	4★
Stop the Express	Sinclair	4★
Strangeloop	Virgin	5★
Submarine Strike	Pulsonic	3★
Super Pipeline II	Taskset	3★
Tachyon Command	Century Software	1★
Tank Trax	Mastertronic	2★
Tapper	US Gold	5★
Technician Ted	Hewson	4★
Terrahawks	CRL	3★
That's the Spirit	The Edge	4★
The Covenant	PSS	2★
The Guardian	PSS	3★
The Pyramid	Fantasy	4★
The Snowman	Quicksilva	4★
Therbo	Arcade Software	2★
3D Bat Attack	Cheetahsoft	3★
3D Lunattack	Hewson	3★
3D Seiddab Attack	Hewson	3★
3D Starstrike	Realtime software	4★
3D Tank Duel	Real Time	3★
3D Tunnel	New Generation	5★
Tiler Tim	Microwish	3★
Time Gate	Quicksilva	4★
Timebomb	CDS	4★
Tobor	Add-on	4★
Tornado Low Level	Vortex	5★
Toy Bizarre	Activision	3★
Trashman	New Generation	5★
Travel with Trashman	New Generation	4★
Traxx	Quicksilva	4★
Tribble Trubble	Software Projects	4★
Trom	DK'tronics	2★
Turtle Timewarp	Softstone	2★
Tutankhamun	Micromania	4★
Two-Gun Turtle	Lothlorien	4★
Underwurlde	Ultimate	5★
Wheelie	Microsphere	4★
Witch's Cauldron	Mikro-Gen	4★
Wizard's Lair	Bubble Bus	4★
Wizard's Warriors	Mastertronik	2★
World Series Baseball	Imagine	3★
Worm Attack	Pulsonic	1★
Worse Things Happen at Sea	Silversoft	4★
Wrath of Magra	Mastervision	4★
Wriggler	Romantic Robot	4★
Xadom	Quicksilva	2★
Xavior	PSS Software	3★
Zenji	Activision	4★
Zig-Zag	DK'tronics	4★
Zombie Zombie	Quicksilva	4★

Business

Address Manager	OCP	4★
Banker	Andic Software	3★
Bank Account System	K Gouldstone	4★
Bizzicom	Merlin	1★
Collector's Pack	Sinclair	4★
Database	Microl	4★
Decision Maker	Collins	3★
Electric Office	Fisher Software	2★
Entrepreneur	Collins Soft	3★
Heathplanner	Heath Computing	4★
Home Budget	Kuma Computers	3★
Investment, Insurance, Information	Inform	3★
Invoicing/Accounting	Transform	4★
Keyfile	Keysoft	4★
Lifeline	William Stuart	2★
Masterfile	Campbell	5★
Micropen	Contrast	3★
Mini Office	Database Pubs	4★
Money Manager	Creative Sparks	3★
Multi-File	ISP	3★
Omnicalc	Microsphere	5★
Personal Banking System	Hilton	4★
Personal Financ. Profile 2	McGraw-Hill	3★
Projector 1	McGraw-Hill	4★
Sales Ledger	Hestacrest	4★
Spectext	McGraw Hill	4★
Spreadsheet	Microl	4★
Stock Manager	OCP	4★
Superfile	Transform Ltd	3★
Tasprint	Tasman Software	4★
Tasword	Tasman	4★
Tasword II	Tasman	5★
The Unitrust Program	Michael Slatford	3★
UNISTAT	University Software	3★
Va£Track	Morley Davies	4★
Word Processor	Quicksilva	1★

Education

Angle	Chalksoft	3★
Angle Turner	Arnold Wheaton	4★
Antony and Cleopatra	Akadamias	4★
Astro Maths	Scisoft	3★
Biology	Longman	4★
Blockbuster	Compusound	4★
Bodyworks	Genesis	2★
Castle	L'Ensouleiado	4★
Castle of Dreams	Widgit	4★
Castle Spellerous	Sinclair	4★
Chess Tutor 1	Sinclair	4★
Clown	Englefield Software	2★
Cortes	L'Ensouleiado	3★
Dinosaurs	Piper	3★
Disease Dodgers	Sinclair Research	5★
Dyslexia Beater	Dunitz	4★
Eiffel Tower	Chalksoft	3★
Electronic Learner's Guide	ETST	3★
French	Longman	4★
French is Fun	CDS	3★
Friend or Foe	Longman	3★
Viking Raiders	Firebird	3★
German is Fun	CDS	4★
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Highwire	Englefield Software	2★
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Virgin Games, 2-4 Vernon Yard, London W11
V0^2, 9-10A The Bridge, Walsall, West Midlands
Vortex software, Vortex House, 24 Kansas Avenue, off South Langworthy Road, Salford, M5 2GL
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Winters, 24 Swannington Close, Cantley, Doncaster, South Yorkshire
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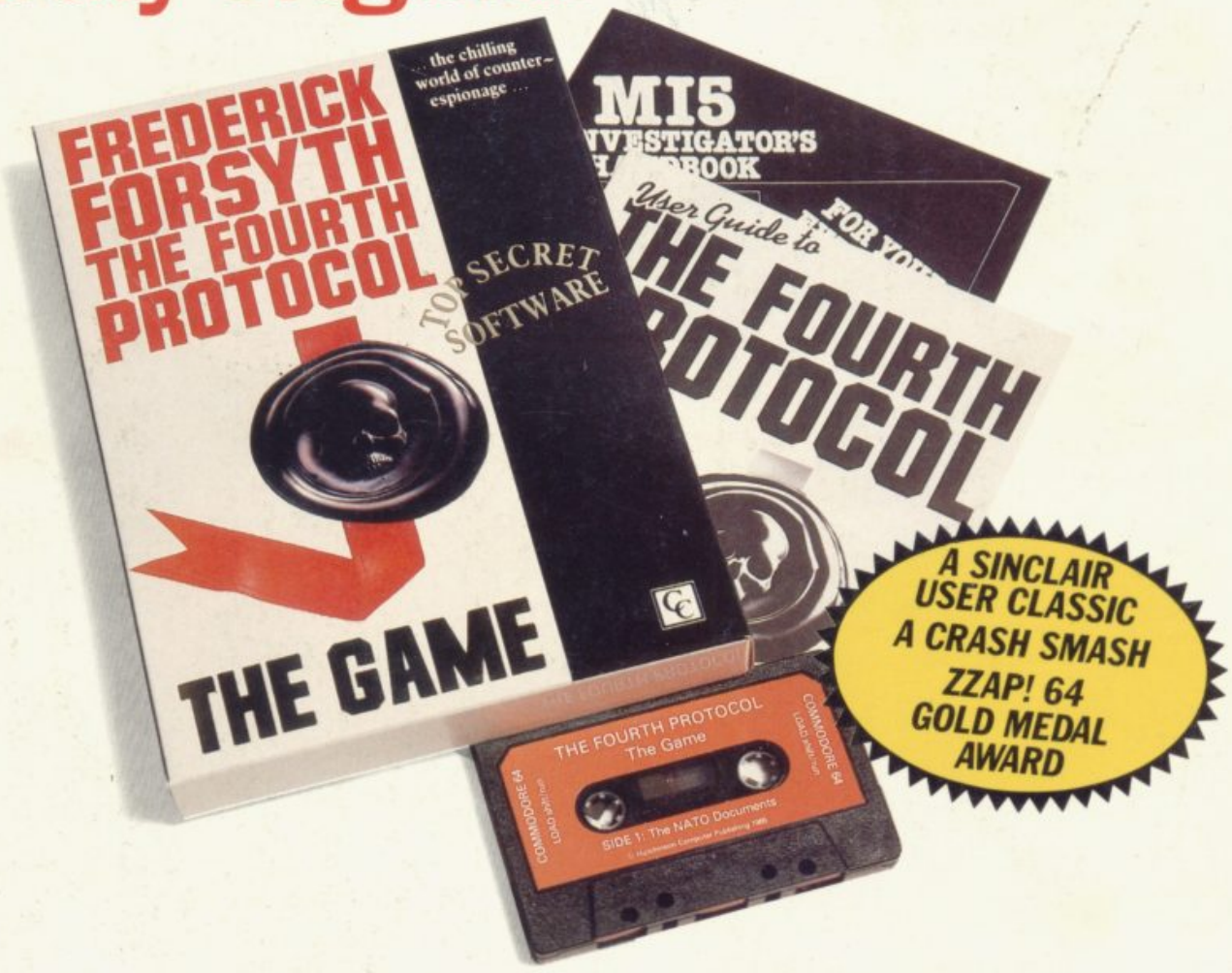

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