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POPULAR

Computing WEEKLY

SPECIAL TAPE OFFER

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This Week

Preview

Andy Pennell looks at the new QL micro from Sinclair. See page 14.

Programming

Roy Masefield examines Newton's third law of motion — the law that enables giant engineering structures to be built. Page 18.

Spectrum

Maurice Gavin explains the principles of navigation by the stars. See page 20.

New releases

This week's releases include *Jericho Road* from Shards Software, *Danger Ranger* from Microdeal and *Stellar Dodger* from Terminal Software. Page 64.

★ STAR
Draughts on
Spectrum.
See page 12.
GAME ★

News Desk

Commodore chief resigns

JACK TRAMIEL, Commodore's founder and the driving force behind the company, has resigned as its president and chief executive.

Tramiel began his business



Former Commodore president Jack Tramiel

career by repairing typewriters in Canada and built Commodore up through the calculator boom of the seventies to its present position where the company holds 40 percent of the world market for low-cost microcomputers.

His decision to resign "for personal reasons" coincides with Commodore's announcement of a record trading year.

It has become the first microcomputer company to report sales of over \$1bn in a single calendar year. This figure — for the year to December 31, 1983 — is more than

Continued on page 5

Quantum leap is now official

SINCLAIR has now formally announced its new £399 QL computer (see *Popular Computing Weekly*, January 12).

First deliveries of the 128K Ram, twin QL microdrive machine, based on the 32-bit 68008 processor, are scheduled for the end of February.

Initially the QL will be sold by mail and orders will be accepted by Sinclair in Camberley from Friday, January 20, onwards.

Each order for the machine should be accompanied by a

further £7.95 to cover postage and packaging. Owners may also choose to pay an additional £35 to join QLUB, the QL User's Group, for a 12-month period.

Members of QLUB will receive a bi-monthly newsletter, and be able to get help with the four software packages from Psion, receive annual upgrades of the software free of charge and be offered peripherals for the QL before non-members.

Continued on page 5



Clive Sinclair (left) and Nigel Searle at the QL launch

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AQUARIUS
SEE PAGE 59

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Continued on page 58

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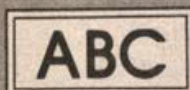
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Editorial

If a week is a long time in politics, it can be an eon in the world of micro-computers.

Following the announcement of two new micros, Commodore were riding high last week. Then Sinclair launched his new QL machine around the 32-bit 68008 processor for just £399. If this did not make the Commodore micros look tame, it at least took some of the gloss away from their launch.

As if this were not enough, Commodore's president and chief executive Jack Tramiel announced his resignation. This is bound to affect the company which Jack Tramiel built up from nothing to a \$1bn turnover. While Jack Tramiel will remain as a consultant to the company, there are likely to be further boardroom changes once a successor is announced.

And, while Commodore is suffering from a certain amount of 'swings and roundabouts', Sinclair is not having things all his own way either. Half-year profits were apparently sufficiently below forecast levels to delay Sinclair's plans for going public later this year. It now looks as if Sinclair will not seek a full stock market quotation until early next year.

However, for all their current hiccups, Commodore and Sinclair can console themselves with the thought that they are becoming the big two in home micros. Even Acorn seems to be slipping behind.

Next Thursday

Next week in Reviews David Lawrence takes a look at the latest software for Commodore 64, including *Revenge of the Mutant Camels* and *Hovver Bover* from Llamasoft.

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When will Bob start hoovering?

ANDROBOT, the American robotics company founded by Nolan Bushnell, will sell its three personal robots in the UK through Prism.

Topo, the mid-price device in the range, will arrive in early February at around £1,500.



Prism's new Topo

Fred (Friendly Robotic Educational Device) — more like a super-Turtle than a personal robot — will be here in late March, and cost £200. Bob (Brains On Board), the most sophisticated of the three, will be launched in the US on

February 15 and will arrive last. Bob will sell in the US for \$2,495 (this compares with \$1,595 for Topo and \$349 for Fred).

Both Fred and Topo are controlled from a computer via an infra-red link. Prism is developing a range of interfaces to connect the robots to the Spectrum, BBC and Commodore 64 computers — in the US both machines work with the Apple II.

Fred is seen as an educational tool to be used, for example, in conjunction with Logo programming. It has a pen holder allowing it to draw and has a high degree of positional accuracy.

Topo is more of a household help. The snag is that, at present, it does little more than drive about, though it has a built-in speech synthesiser which is programmable from the computer.

Said Skip Steveley, Androbot's new president: "Robotics isn't going to become an industry until the units are useful." Consequently, a number of add-on units are planned for Topo including robot arms, a lift to pick things up and software packages to enable the robot to recall its

environment, sensors, an ultrasonic detector, and a flux-gate compass.

By far the most interesting of the machines, though, is Bob, still under development. Bob does not need a computer to operate. It contains its own 8088 processor on board (the same as the IBM PC), with 64K Ram expandable to 256K. Bob also has two Rom chips. One contains the primitive commands such as *Move*, *Rotate*, *Read*, *Stop* (written in PLM and assembler), and the other contains the Forth language. Basic will follow on an optional Rom. Bob also has an 8-slot motherboard option giving up to 640K Ram.



Androbot president Skip Steveley

Says Skip: "When we get Bob out, the applications and third party software will come streaming in. Bob has a Rom cartridge slot so we will be marketing programs on Rom. We are already talking to vacuum cleaner companies about getting Bob hoovering."

Alas poor Oric

THE Oric 1 is dead. Long live the Oric Atmos.

Oric announced this week that it had ceased production of the £139 Oric 1 on Monday, January 16. Curiously enough, Oric started production of its new 6502-based 48K Atmos on the same day.

Although programs written in Basic for the Oric 1 will be compatible with the Atmos machine, the new Rom means that machine code programs may need some alteration.

The machine has several new Basic commands as standard — *Print @*, *Auto Repeat* on each key and improved cassette control including *Verify Store* and *Recall*. The *Grab* command allows programs to use memory normally



The new 6502-based Oric Atmos

Business micro on the advance

THE Advance 86a is a new £400 16-bit home business micro capable of expansion to IBM PC compatibility.

The machine — designed by a UK company Advance Technology — is based around the same processor as the IBM PCjr — the 8086. It has 128K Ram and a full-size professional keyboard with separate numeric pad and 10 function keys.

Interfaces include Centronics, cassette, light-pen and twin joystick ports, and the Advance 86a has tv, composite video and RGB outputs.

It has high-resolution graphics, 16 colours, one sound channel and its own version of the Basic language built-in, addressing 62K Ram.

The 86a can be upgraded to an IBM compatible machine — the 86b — for an extra £980. For this you get twin disc drives, RS232 interface, and 128K more Ram.

Although the first of the new Advance 86 machines are expected to be manufactured in early February, volume production is not scheduled to begin until March.

reserved for the display. At least 44K of Ram is available to the user from Basic.

Priced at £170 the Atmos is viewed by Oric as the successor to the Oric 1. Accordingly, the Oric four-colour printer and the three-inch Hitachi disc drives now scheduled for full production by the end of this month will be styled to match the new machine.

Cross-compilers for 64

OXFORD Computer Systems has announced a pair of cross-compilers for use as Commodore 64 software development tools.

The two packages — *Port-speed* and *X-64* — allow a software house to compile source code or generate object code on the Commodore 8000 series machines and then download the code to run on the Commodore 64.

Details from Oxford Computer Systems, Hensington Road, Woodstock, Oxford.

Sinclair QL

Continued from page 1

Sinclair plans an ambitious list of peripherals for the QL: 0.5M Ram expansion module, Winchester hard disc interface, terminal emulator, analogue/digital interface, modem, parallel Centronics interface and multichannel sound generator and an IEEE-488 interface.

The QL will be manufactured exclusively by Thorn EMI Datatech.

In the autumn the machine will go on sale through retail outlets in the UK and will be launched in North America. In the US it will sell for \$499 and be marketed by Sinclair, initially by mail-order.

Commodore

Continued from page 1

double the previous year's total sales of \$458m.

Commodore's chairman, Irving Gould, announced that Tramiel's successor has been selected and will be named when formal agreement of the appointment has been reached. Tramiel will continue as an adviser to the company.

Commodore steals the show at Las Vegas



THERE was little new hardware at the US Consumer Electronics Show, apart from the 264 and V364 micros from Commodore (see *PCW*, 12-18 January). These 8-bit machines dominated the computer section of the Las Vegas show, held at the Convention Centre on 7-11 January.

Based around the 7501 processor, the two micros have similar capabilities, though the more advanced V364 has an additional speech facility with a 250-word vocabulary built in.

The most impressive features of the new machines were their screen window capabilities (reminiscent of Apple's Lisa) and the accompanying software. The 3-plus-1 package, which consists of a word processor, electronic spreadsheet, file management and graphics facility, will be available as a built-in option or as an additional cartridge for the 264. It will also be offered as a cartridge on the Commodore 64.

Other Commodore software packages announced at the show included *Magic Desk II* — an integrated text-editor, spreadsheet, file manager and calculator for beginners, *Superscript 264* — a multi-function word processor, *Easycalc 264* — a spreadsheet with colour selection, *B/graph* — a simple business and statistics package, and *Commodore Logo* — a language facility which includes seven programmable sprites, music, floating decimal-point arith-



Quicksilver
US President
Carl Zeigler

metic, picture saving and program tracing. The *Logo* package will cost less than \$80, but prices for the other packages have yet to be finalised.

Commodore also revealed that it has signed an agreement to use CompuServe, a large US telesoftware database similar to Prestel and Micronet 800. The agreement, involving CompuServe's Vindex terminal emulator, will enable Commodore users to transfer programs from the CompuServe database to their own micros, providing they have the appropriate modem.

Timex were also present at the show, exhibiting the TS2068 — the US equivalent of the Sinclair Spectrum. Despite an impressive stand, most dealers were sceptical about Timex's ability to make any impression on the US market. Timex refused to disclose figures on sales of the TS2068, but they are widely rumoured to be pitifully small.

However, Timex themselves were undaunted by the speculation and announced a sub-

stantial new range of peripherals. Sinclair's ZX Microdrives appeared in a new guise, as the TS2065. Specifications show little difference from the UK version — access time of 3½ seconds, storage capacity of over 85K per cartridge with a maximum of eight microdrives linked to the computer. The only obvious difference between the two is the silver styled case of the US machine.

Other peripherals of interest included the TS2060 bus expansion unit. It features a standard Centronics parallel interface, for the TS2080 or other 80-column printer, RS232 serial interface with selectable baud rate and high-resolution 80-column black-and-white composite video output. Other features of the unit include a standard RGB video output on a nine-pin D connector, an interface and controller for up to eight Microdrives, local area network

capability, CP/M mode with optional 32K of additional Ram and an auxiliary level audio output. It is expected to be available in June and will cost around \$120.

Timex also unveiled the TS2050 telecommunications modem, which will allow users to access CompuServe and The Source. Although Prestel and Micronet have so far failed to take off in the UK, their American equivalents are proving much more popular.

The Timex modem includes autodial for the computer keyboard, operates at 300 baud and has built-in modular phone jacks. "The TS2050 Smart Modem allows access to data retrieval systems, home banking and shopping, telecomputing and other telecommunications services which greatly expand the uses of a Timex personal computer. At a suggested retail price of



Commodore 264



The TS2068 computer complete with modem, bus expansion unit, microdrives, cassette recorder and 80 column printer.

This US version of Sinclair's Spectrum has 48K Ram, 24K Rom, a 42 key typewriter style keyboard and built in Rom cartridge port. It costs \$199.95, has

four sound channels and a 32 character, 24 line, full colour display.

Normal graphics resolution is 256 × 192, but an enhanced resolution graphics mode (512 × 192) allows a single 64 × 24 character row display or two 32 × 24 displays.

\$120, the TS2050 can be combined with any of Timex's personal computers and provides an affordable interactive telecommunications service for the consumer," said Michael Jacobi, Timex's Vice President of marketing.

Finally, Timex revealed its TS2080 80-column printer. Capable of producing 80 characters a second and 800 words a minute, the printer is a high-resolution, nine-pin impact dot-matrix machine. It includes 228 Ascii characters

However, following the launch of the QL micro last week, Sinclair has decided to market the new machine in the US itself rather than through Timex. This does not bode well for Timex, but it will give Sinclair the chance to tackle the lucrative US market directly. A separate US launch for the QL machine will occur later this year.

Other British exhibitors included Elan, whose Enterprise 64 and 128 micros are due to be launched in April, and

have to be rewritten.

However, Quicksilva US now has a range of games ready for sale including *Aquaplane*, *Bugaboo* and *Purple Turtles* for the Commodore 64 and *Time Gate*, *Xadom*, *Games Designer* and *Ant Attack* for the TS2068.

There was also a sizeable contingent of British visitors to the show, notably Mike Barton of Romik, David Ward of Ocean, Neil Johnson of Microdealer, Terry Cartwright of ECC and Robin Bradbeer.

There was little evidence of the anticipated links between laser discs and microcomputers. But, Coleco announced it is working on an interactive laser disc player that should be available for the Adam by the end of the year. Coleco also announced that it has obtained the home computer rights to the popular arcade game *Dragon's Lair* for a reported \$2m.

Atari, despite the massive losses it suffered last year, refused to be downcast. Its new third-party software division, Atarisoft, released seven new titles for the Commodore 64, IBM PC, Vic20, Apple II and TI 99/4A. The games are *Jungle Hunt*, *Glaxian*, *Moon Patrol*, *Ms Pac Man*, *Pole Position*, *Battlezone* and *Joust*.

Atari also announced a link-up with Walt Disney to produce a two-part game *Captain Hook's Revenge*.

California-based Electronics Arts was responsible for some of the more innovative soft-

ware on display at the show. *MULE* for Atari and Commodore 64 is a multi-player game that combines business



Skyfox by Ray Tobey

simulation and strategy with arcade action. The object of the game is to settle a distant planet where you can search for minerals, buy land, grow food, not to mention bartering and gambling with the other players. *MULE*, in case you're interested, is an acronym for Multi Use Labour Element.

Skyfox is a superb mix of flight simulation and strategy arcade game. Seated in the cockpit of 'one mean flying machine', you have two laser cannons, heat-seeking missiles and land mines at your disposal. You are also equipped with an attack computer plus radar, altitude, fuel and shield indicators, a tactical map and a link-up to your colony's base computer.

But, you have 500 square miles to protect, while the enemy invaders have tanks, fighters, missiles and powerful mother ships.

Electronics Arts also produce *Tesseract Strategy*, a science fiction strategy game for one to three players, *Archon*, a game of medieval fantasy and strategy, and *Axis Assassin*, an arcade action game based on a 3D grid.



Scott Adams (left) and Spiderman

and both normal and italic alphanumeric fonts, together with a standard Centronics parallel interface to enable it to be used on other home micros. Again, it should be available in June, priced around \$325.

British visitors to the show were interested to see the Timex/Sinclair catalogue. Psion's *Flight Simulation* was available on both cartridge and cassette under the TS banner, as were *Vu-Calc*, *Vu-File* and *Vu-3D*. Melbourne House's *Penetrator* was available, as were programs from Steve Hughes and Sunshine.

Software prices, however, tended to be higher than in the UK. The TS version of *Penetrator*, for example, was priced at \$39.95 on cartridge and \$19.95 on cassette. This compares with a UK cassette price of £6.95.

There were fewer British exhibitors at the show than expected, with both Acorn and Dragon/Tano being noticeable by their absence. Sinclair's US division was at the show, but only to demonstrate the flat screen tv launched in the UK in September. Needless to say, no tvs were actually available for sale — production problems appear to have delayed their distribution in both the UK and the US.

Quicksilva. Virgin were also present, sharing the Quicksilva stand.

President of Quicksilva US, Carl Zeigler, explained that the company had been busy converting UK games to run on US tv. Although some machines, like the Commodore 64, are common to both countries, the two tv systems are different. Consequently, parts of the program, such as those dealing with colour,



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Pidentity crisis

I am writing to you from a small dark corner in Pimaniacs UK. My accomplice who does not like Pimania (shock, horror), Jason Scott Warren, is the only person I know to have managed to shoot the dragon himself. He has also let me loose on the game. "FOLLOW DO" is really great.

Oh yes, and before I forget, here is a thing to remember: "The Pi Man has a Pidentity crisis."

Bye for now,
The Nutcracker (Pimaniacs UK)
Alias John Yeates

Mallard
10 La Petite Sente
Le Bourg
St Clement
Jersey

Ten victims

I would like to inform D Claypole and B Vivers (PCW, Vol 2, No 49) that I, too, have rescued 10 victims and have scored 44089 in just under 22½ minutes.

Adam Cohen
Inner Park Road
Wimbledon
London SW19

Piracy files

'CTA piracy files stolen' says headline in PCW, News Desk, 5-11 January. 'Guild of software houses estimated that sales revenue lost because of piracy in 1983 could be over £100m'.

The files were stolen from CTA secretary Nigel Backhurst. In the previous News Desk article about an appeal for funds to continue a legal battle with Waddingtons about *Monopoly*, which was obviously copied without permission by Automata, he was quoted: 'If they (Waddingtons) win, about 80 percent of the games software on the market could become challengeable.'

Does that mean what I think? That about 80 percent of software ideas are stolen, pirated, used without permission — call it what you will — in the first place?!

Isn't this the kettle calling

the frying pan black in the largest possible way? And, as the CTA may find difficulty in finding someone without sin to cast the first stone, perhaps instead they should concentrate on putting their own house in order.

D J Taylor
24 Joicey Road
Gateshead
Tyne & Wear

Arcade emphasis . . . 1

I am a computer user aged 15 and I read your magazine avidly every week. However, this situation is possibly about to change.

The reason for this discontent is the emphasis placed on arcade games. Week after week your letters column is filled with people boasting about their latest high scores in yet another mindless game devoted to shooting beings from outer space. The Open Forum pages are constantly filled with yet more games.

Whilst I realise that there are many people who enjoy playing this type of game I strongly subscribe to the view that everyone has the right to their own taste; I believe there are a growing number of people who, like myself, are turning their backs to the arcade game and are putting their computers to more useful and intelligent uses.

There are admittedly some articles in your magazine devoted to non-games subjects. However, they constitute a minority of the material in the magazine and, when they do appear, they are usually machine specific.

The type of article I would like to see is the sort where you discuss the suitability of, for example, a database for



"It's quantum leap year - let's get married"

the average home user and possibly reviews of some of the software available in this category for each of the popular machines.

I realise that this goes against the grain of what appears to be your publishing policy. However, I would be grateful if you would publish this letter as I would be interested to hear other reader's opinions if they would care to write to me.

Steven Mason
The Grammar School
Scorton
Richmond
N Yorkshire
DL10 6DS

We try and cover a wide mix of subjects in PCW, from games through machine code to serious applications. We should also like to hear from readers if they think the balance is tipped too far one way or the other.

Arcade emphasis . . . 2

There have been many pleas by readers for a high-score section. How about an arcade corner (similar to Tony Bridge's Adventure Corner) where you review the best arcade games, readers write in with their problems and a high-score section is incorporated? What do other readers think?

Hugh Owen-Jones
Brookhill Road
East Barnet
Herts

PS. Can anyone beat 91,200 points on the eighth level of *Lunar Jetman*?

Chequered bug

I believe I have discovered a bug in Psion's *Chequered Flag*. It appears that the best lap time that appears on the screen when the race has ended (either through completing the selected number of laps or crashing) corresponds to the most recently completed lap, not to the lap with the lowest time. I would like to know if anyone else has discovered this, or am I the only one with a dud tape?

P Bookham
52 Cleavelands
Wadebridge
Cornwall

PS My lap record at present is

56.2 seconds on the Cambridge Ring circuit using the Psion Pegasus.

Judging from the letters we have received from other readers, you are not alone in your problem.

Restless morons

Priority one: bigots' letter. I must say I greatly enjoyed reading L Hewelly's letter (Vol 3 No 1). What uncommon intelligence! What!

I fully agree with LH about the stinking little cartoon, and shudder at the thought of all those sub-intelligent waifs scribbling on magazines (do they come from Rhosych?).

I don't know about the educational programs for the Beeb, but then, if you've got a Beeb, surely you're above such trivia? Educational programs would, I suspect, be better aimed at us morons with "hideous little plug sockets" (there's only about a million of us and we'd be ever so grateful). Sum ov uz cud probablee lern tu spel, and forsake our "deviant ways" for ever.

Gordon Rice
379 Liverpool Road
Eccles
Manchester
M30 7HB

PS The morons are restless lately. There's a rumour going round the modems that if you write to:

TONI BAKER
ZX MACHINE CODE USERS' CLUB
37 STRATFORD ROAD
WOLVERTON
MILTON KEYNES
MK12 5LW

and send a stamped, addressed envelope, all will be revealed.

Mk 14 owners

So, Mike Hampson is a veteran because he has a ZX80 (PCW, Letters, 12-18 January). What does that make me, bearing in mind that I moved up to the ZX80 from the Mk14 (cost £39.95 + 8 per cent VAT) and still have both of them? Are there any Mk14 owners left?

Paul Adams
(feeling very old)
Hanworth
Middlesex

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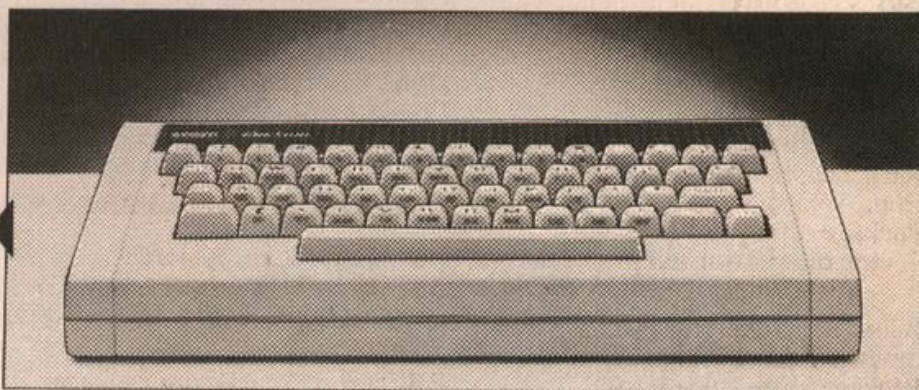
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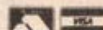
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Draughts

A new game for 16K Spectrum by David Cox

The object of this game is to transpose the red and blue pieces, so finishing with all the red counters on the right and blue counters on the left. A piece can only move diagonally in the direction of the arrow to an empty space or jump over another piece into an empty space. You may start with either colour. All that is necessary to play is to key in the piece number which you wish to move. A 0 will restart the program if you get stuck.

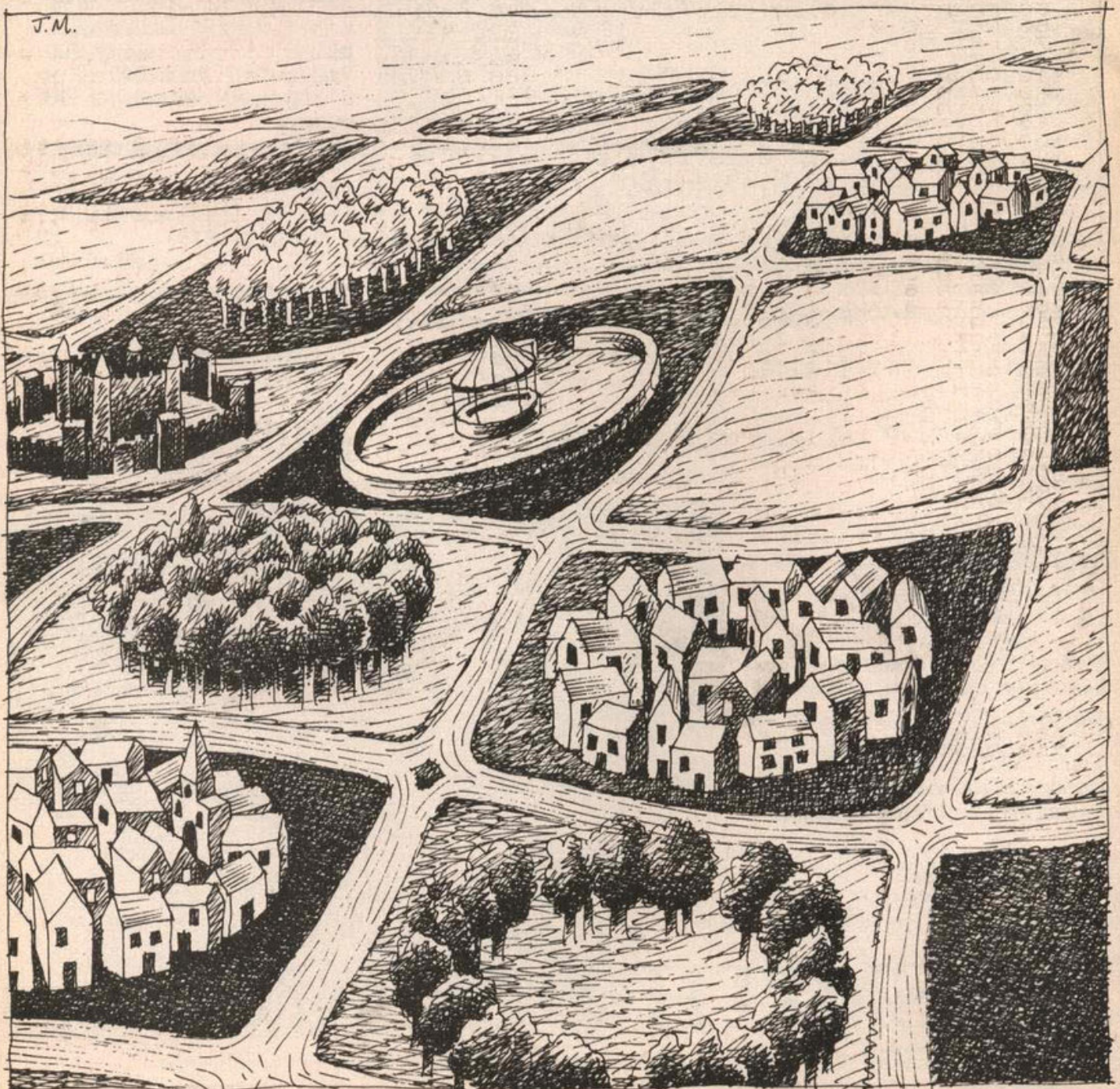
The 16 men and the blank square are stored in sequence as A\$ (17 characters).

Each piece has between one and four possible moves. For example, a red piece on square one can move to square two or three directly, or jump over a piece on two or three to reach a blank square on four or six. These moves are stored in arrays R(17,4) and B(17,4). A 0 is non-existent move.

The chequered board is printed using inverse video and the pieces are over-printed at line L column C, whose values are stored as Data at 520. The type of piece >, < or blank is taken from A\$ which

keeps an up-to-date record of the game.

In line 550 a blank "" is printed as a graphic square and line 560 determines the colour of the arrows. Line 580 checks for a completed game, which takes 52 moves to exchange all the pieces. The main playing routine at 600 notes your move as G and checks A\$ to find which colour piece is there. It then tries each of the four possible moves in R(G,N) or B(G,N) and, when it finds an empty space, moves piece G to it and blanks out the vacant square.



Sinclair takes his cue

Andy Pennell previews the new QL micro from Sinclair

It's here! The latest Sinclair computer has been revealed to the public, much sooner than expected. The Sinclair QL, standing for Quantum Leap, was launched last week, and signals a move upmarket by Sinclair, into the lucrative, but risky professional market. It seems to offer unrivalled specification at the very low cost of £399.

Sinclair do not want the QL to have the games-type image of the Spectrum, so it comes complete with no less than four professional programs, written by Psion. It also has a real keyboard, which is a first for Sinclair.

The QL looks nice, in the statutory Sinclair black, with white legends on the keys. The keyboard has 65 real keys, including a space bar and L-shaped *Enter* key. Another first is that the single-key entry system on the previous ZX models has been abandoned, which means a welcome end to the complicated shift operations and cluttered keytops.

Along the front of the case are two slots and Leds, which are where the Microdrive cartridges go — yes, the QL has two built-in Microdrives, similar to those on the Spectrum, and up to six extra drives can be plugged in the side. Although they use the same cartridges, one machine cannot read the others, without additional software which, although already written, is not expected to be released. The QL Microdrives have a minimum capacity of

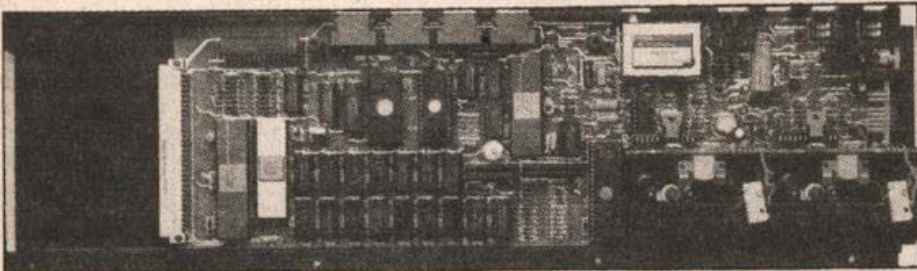
monochrome monitor, but there is no provision for a colour composite monitor (such as the JVC I have just bought), as there was (though undocumented) on the Spectrum.

The QL also has two RS232 ports, which are configured differently so that, in theory, any RS232 device will work, even in full duplex mode (ie, transmitting and receiving simultaneously). This is unlike the ZX Interface 1 RS232 port, which is impossible to use with many modems because of its protocols.

Although it is not intended to be a games machine, it has two joystick ports, which simulate the cursor and function keys, and a Rom cartridge socket, which accepts up to 32K Roms. There is also a 64-way expansion connector at one end, into which the 'forthcoming' peripherals will plug. The first of these will be a half-megabyte (yes — that's 512K!) Ram pack — it should not experience the famed ZX81 wobble though. No price or delivery date has been quoted for this amazing peripheral.

A quart into a pint pot

The QL is about the same size as the Memotech MTX500, but lighter as the case is plastic. Its small circuit board belies the power and ability of the machine. Unlike all previous Sinclair machines, the



100K, which is about 15K more than the ZX variety. This also means that you cannot add ZX Microdrives to the QL — you must use special QL ones. It is not known if QL drives will be as limited in supply as the sought-after ZX ones.

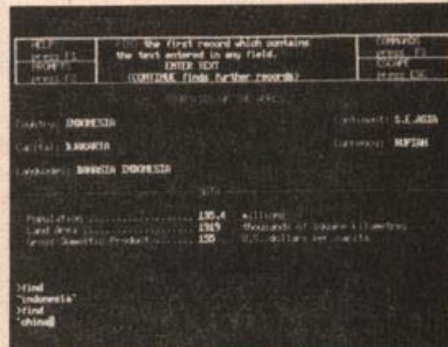
Also built in to the QL is the Networking capability that the Interface 1 gives the Spectrum. So, Spectrum owners who upgrade will be able to use their old computer, by plugging it into the new one. Up to 64 QLs and Spectrums may be interconnected on the network, which, with suitable software, will allow peripherals to be shared by all users.

Users who want a better picture than their domestic tv can display are catered for with a monitor socket. It connects to an RGB colour monitor, or a composite

QL does *not* have a Z80 microprocessor. Instead, they have chosen the Motorola 68008, which is a very close relative of the 68000. Sinclair describe it as a 32-bit chip, and compare it to lesser 8-bit chips such as the Z80 and 6502.

Although the 68008 does have 32-bit internal registers, it has only an 8-bit data bus, like all the others, a bit like squeezing a quart into a pint pot. By their terminology, the Z80 is a 16-bit machine, which not even its best friends would call it. However, the 68008 is a very powerful processor, and a measure of the power is that the very extensive Basic fits into a 16K Rom.

The 68008 can address up to 1Mbyte (that's 1024K, or 64 ZX81 Ram packs), and the QL is supplied as standard with 128K, more than any other micro. The screen display takes up a whopping 32K of



Ram (equivalent to all the Ram in a BBC B or Dragon 32), leaving about 96K free to Basic. With the 1/2M Ram pack, the capacity of the QL rises to a phenomenal 640K.

As well as the 68008 processor, the QL has an Intel 8049 slave processor, which handles all the trivial tasks such as reading the keyboard, controlling the RS232 port, and the sound generation. This leaves the 68008 to get on with the more difficult tasks of running the Basic and the Operating System.

The sound capabilities of the QL are not really much of an improvement over the Spectrum, using a small internal speaker. From Basic it is possible to produce changing sounds 'bouncing' between two frequencies, with control over the fuzziness. As the sound is controlled by the slave processor, programs do not stop while the sound is generated.

The graphics capabilities are very impressive. As the screen takes up 32K, resolution is very good, with two modes — the first has a resolution of 512 x 256, in four colours, and the second mode has a resolution of 256 x 256, in eight colours with flashing. Unlike the Spectrum, each pixel may be a different colour, offering greater potential. Further colours are possible in the higher mode by using 'stipples', but this is recommended for monitors only, and not domestic tvs.

The maximum number of characters per line is 85, but as most tvs cannot display such detail, the maximum for their use is 64 per line. Single or double height characters are available, with up to 25 text lines on the screen.

The Basic that runs on the QL is called, subtly, SuperBasic. It is a very extended version of Spectrum Basic, similar to that on the BBC micro, but with some unique features of its own. Unlike most other real keyboards, there is no *Delete* key to rubout characters — both *Ctrl* and *cursor-left* have to be pressed instead. These keys are conveniently adjacent to one another. The keyboard also has five function keys, but they do not seem to be programmable BBC-style.

I think the most original thing about SuperBasic is the way it handles its variables — as well as numeric and string types, integer variables are allowed, and they can be easily mixed — even between

string and numeric. For example: *Let sum* = "1" + "2" + "3" and *Let sum\$* = 12 + "344" are both valid, as SuperBasic always tries to convert types wherever possible. This seems to have removed the need for the *Val* and *Va\$* functions, and no mention of them is made in the preliminary manual. Although this *coercion* is very useful, it will make program debugging rather harder.

Floating-point variables can have any value from 10^{-618} to 10^{+618} , which is unheard of on calculators, let alone computers. The maximum for most calculators is 10^{+99} , and on computers is around 10^{+38} — again the power of the 68008 is shown, as it is extremely easy to store and retrieve large numbers of bytes, and very fast at multiplication and division.

Structured programmers will be pleased

of parameter, obviating the need for lines of *Int (Rnd * 10 + 15)* etc. There are also double byte *Poke* and *Peek*, and binary *And*, *Or*, *Not* and *Xor*, as well as the regular logical types.

A major facility of the QL is that of windows, similar to those on very expensive machines such as the Apple Lisa. A window is a section of the screen into which characters can be printed, and graphics drawn. They are easily controllable from SuperBasic, using streams, like those on the Spectrum. The size, position and colour of each window can be controlled and each may be cleared, coloured, printed to, and pixel scrolled with ease.

The QL incorporates two Microdrives, using a slightly different format to the Spectrum ones. It enables faster data access, and improved memory capacity —

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Sales	134.88	148.78	157.24	155.12	140.19	140.19	140.19	140.19	140.19	140.19	140.19	140.19	1332.76
Direct Costs	67.44	74.39	78.62	77.56	70.09	70.09	70.09	70.09	70.09	70.09	70.09	70.09	666.38
Gross Margin	67.44	74.39	78.62	77.56	70.09	70.09	70.09	70.09	70.09	70.09	70.09	70.09	666.38
Overhead	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	44.04
Profit	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	30.88
Net Profit	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	30.88

controlling software can be added to the QL.

A major ability of QDOS is the multi-tasking feature, that allows many programs to run simultaneously, using time-slicing. At the QL launch a monitor showed 10 programs running at the same time, but it was not made clear whether they were Basic or machine code.

Supplied free of charge with the QL are four professional packages, written by Psion, of a very high standard indeed. The packages are cleverly named *Quill*, *Abacus*, *Archive*, and *Easel*, and are a word-processor, spreadsheet, database, and graphics package respectively. Although none of the packages has yet been examined in great detail, all have been seen in use, and appear excellent. They are very user-friendly and visually attractive.

The first deliveries of QLs should begin at the end of February, but most people regrettably now take Sinclair delivery dates with a large pinch of salt, because of their record. Shortly we should see the launch of the new Apple and Acorn machines, and it should be interesting to see how the QL shapes up. The Sinclair QL is certainly a Quantum Leap above the present sub-£1,000 micros, but it is a risky market and Sinclair could come unstuck if he fails to produce the goods in the required quantity and quality. □



by the inclusion of *If ... Then ... Else*, procedures, functions, and *Repeat* loops — indeed, so much so that the manual says *Goto* and *Gosub* are redundant instructions, and are only included for compatibility with other (presumably lesser) forms of Basic.

A few idiosyncracies

Most such functions have both 'short' and 'long' forms, the short for single line definitions, and the long for multiple lines. For example, the short form of *For ... Next* loops does not actually require *Next* statements — SuperBasic will automatically repeat the relevant statements. Many Basic interpreters object strongly to loops being left unfinished, by jumping out of the middle of them, so SuperBasic has the *Exit* command, which neatly enables the premature departure from *Repeat* & *For* loops, and procedures.

Spectrum Basic had a few idiosyncracies — the bad ones are not in SuperBasic, but the good ones are. No longer are *Let* and *Then* statements compulsory, array elements now start at 0, and line numbers can go up to 32767. However, the obvious *Ink* and *Paper* (supplemented by the saucily named *Strip*) commands for colour control have been carried over, as have computed *Gotos*, and the neat strong handling. The *Rnd* function can not only create the normal value 0-1, but a value 0-n, or a value n-m, with a simple change

they hold a minimum of 100K each. File-names on each cartridge can have a three-letter identifier, à la C/PM, and each is stored in a directory on the tape, improving performance.

Both the windows and Microdrives are controlled by the QL operating system, called QDOS. It is contained in an amazing compact 16K Rom, which seems to be very powerful. It also controls the Network, supervises RS232, and handles all other input/output. It is also designed to be able to serve Roms in peripherals, such as hard-discs, so other devices and their



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Building bridges . . .

Roy Masfield demonstrates the importance of Newton's third law of motion

I mentioned Newton's three major laws last week and showed the importance of the first in predicting the motions of bodies. The present article concentrates on the third law.

It is the third law that enables us to build large edifices and giant engineering structures in a way that was denied the medieval builders. The idea, embodied in the third law, that action and reaction are equal and opposite, was unknown to the early builders and, as a result, more cathedrals collapsed during or shortly after building than remained standing. A certain amount of headway was made in understanding static forces when the flying buttress was invented, but the real breakthrough came when Newton showed that for any force to be held in equilibrium, an equal and opposite force must be applied. Some people find it hard to believe that if you push against a brick wall, the wall pushes back with the same force. But if you replace the wall by a second person, then it is not at all difficult to see that if he does not push back with an equal force, he will fall over. And, if he pushes back with a greater force, you will fall over!

We can extend the principle to a number of forces all acting at the same point. Let's take just two for a start, as in Figure 1. F_1 and F_2 represent the forces as vectors, ie, their lengths are proportional to the values of the forces. For example, the vector for F_1 could be 5cm to represent a force of 5kg. Now, these two forces can be replaced by a single resultant force (R), found by completing the parallelogram. The stabilising force to produce equilibrium is just one force (E) in the opposite direction, as in Figure 2.

Now, this is easy when there are only two forces. If we have more, then it is easier to consider vertical and horizontal components of the forces. Figure 3(a) shows a force (F) acting at some angle θ to the horizontal, while Figure 3(b) shows the two components $F \cos \theta$ and $F \sin \theta$ in the horizontal and vertical directions (horizontal and vertical are here quite arbitrary — all that matters is that they are mutually at right-angles). You should be able to see that the resultant of these two components is, indeed, our original force F .

If we have a system of several forces, $F_1, F_2, F_3 \dots$ in equilibrium, it follows from the third law that the sum of all the horizontal components must be zero, as must the sum for all the vertical components. So we can write two equations:

$$F_1 \cos \theta_1 + F_2 \cos \theta_2 + F_3 \cos \theta_3 \dots + F_n \cos \theta_n = 0$$

$$F_1 \sin \theta_1 + F_2 \sin \theta_2 + F_3 \sin \theta_3 \dots + F_n \sin \theta_n = 0$$

Such systems of forces will be encountered throughout the engineering world. As an example, take the case of a simple girder construction as in Figure 4. This

structure is supported at the two ends and the load (L) acts at the point shown. Obviously, each support must exert an upward force of $L/2$ to counter the total downward force, otherwise the structure will either sink into the ground or take off.

Each member of the structure will be under either a tensile or compressive force. Compression is indicated by arrows pointing away from each other towards the ends of the member, and tension by arrows pointing towards each other away from the ends.

The calculation of all the forces in the members can be quite tedious, as each point has to be considered separately. We would start at point A, where we have the one known force (F_1) equal to $L/2$, and the two unknown forces U_1 and U_2 at angles θ and zero respectively (see figure 5). So, we can make our two equations:

$$F_1 \cos 270^\circ + U_1 \cos \theta + U_2 \cos 0^\circ = 0$$

$$F_1 \sin 270^\circ + U_1 \sin \theta + U_2 \sin 0^\circ = 0$$

These equations may be solved for U_1 and U_2 . If F is taken as negative for compression, then negative values for the unknowns will imply compression and

positive will mean tension. From point A we can then move on to B, using the value of U_1 as the new F_1 for this point. And so it goes on round the structure.

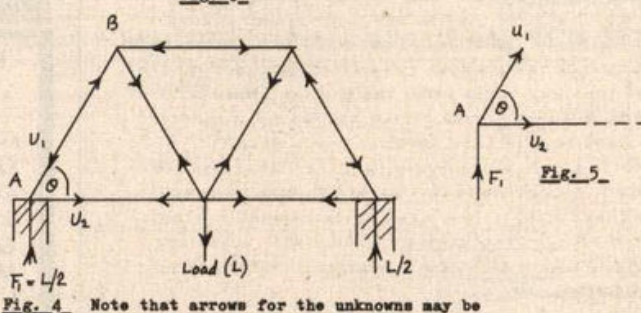
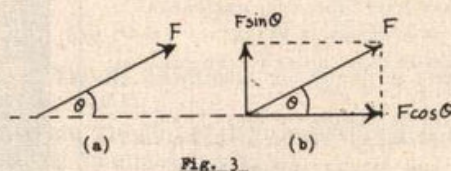
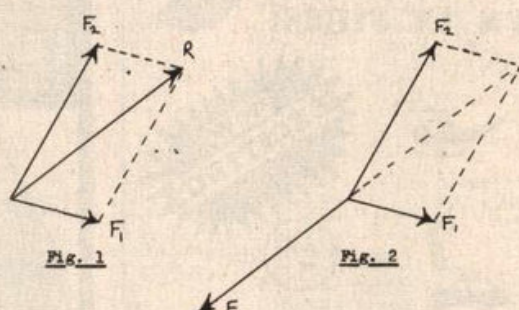
The accompanying program was developed to make all this work as painless as possible. When Run, you will be asked if you want a single force for equilibrium, or two forces in given directions. Then all the known forces are entered. Angles are in degrees, measured anti-clockwise from the east, and forces acting towards the point are compressions (enter c) and away from the point are tensions (enter t). The printout gives values of the forces and whether they are tensions or compressions and, in the case of the single force for equilibrium, the angle.

Remember, you can have as many known forces acting at the point as you like, but you can't find more than two unknowns at any one point (you try to solve three or more unknowns with only two equations!). Often there is a dilemma over this, but it can usually be resolved if the structure is symmetrical and symmetrically loaded, as the forces in each half will be the same.

The program is written for the Sinclair Spectrum, but will easily adapt for other machines since no gimmicks are used. So go ahead and design your own bridges and lattice towers and outdo Brunel, Telford and co. ■

Newton's Laws for Static Forces in Equilibrium

(4)



Note that arrows for the unknowns may be put in arbitrarily, since we will not know if they are tensions or compressions until we run the program.


```

5 REM STATIC FORCES IN EQUILIBRIUM
6 REM @ W.R.Masefield 1983
10 CLEAR : CLS : PRINT TAB 2;"STATIC FORCES IN EQUILIBRIUM": PRINT
20 PRINT "For finding the single force      required to give a system of
    several forces acting at a point stable equilibrium,enter 1."
30 PRINT : PRINT "For finding the forces in two      given members of
    rigid structurewhen all forces in the other      members acting at
    that point areknown, enter 2."
40 IF INKEY$ ="" THEN GO TO 40
50 IF INKEY$ ="2" THEN GO TO 300
60 REM Single force for equilibrium
70 CLS : PRINT TAB 2;"SINGLE FORCE FOR EQUILIBRIUM": PRINT : GO SUB
    80: GO TO 140
80 PRINT "Enter known forces as prompted below. Forces towards the
    point are compressions; forces away from the point are tensions.
    All angles in degrees (0-360) are measured anticlockwise from East"
90 INPUT "No. of known forces?";K: DIM F(K): DIM T(K): LET FC=0:
    LET FS=0
100 FOR J=1 TO K: INPUT ("Force F";J;"?");F(J),"Angle?";T(J),
    "Compression or tension (c or t)";F$
110 IF F$="c" THEN LET T(J)=T(J)* PI /180+ PI : GO TO 130
120 LET T(J)=T(J)* PI /180
130 LET FC=FC+F(J)* COS T(J): LET FS=FS+F(J)* SIN T(J): NEXT J: RETURN
140 LET FE= SQR (FC*FC+FS*FS): LET P= ATN ABS (FS/FC)*180/ PI
150 IF FS >= 0 AND FC >= 0 THEN LET P=P+180
160 IF FS >= 0 AND FC<0 THEN LET P=360-P
170 IF FS<0 AND FC >= 0 THEN LET P=180-P
200 CLS : PRINT "Equilibrium Force="; ABS FE: PRINT TAB 12;
    "Angle=";P: PRINT TAB 19;"Tension"
210 LET P=P+180: IF P >= 360 THEN LET P=P-360
220 PRINT TAB 15;"or ";P: PRINT TAB 19;"Compression"
230 PRINT : PRINT "N.B. Tension forces act away from point;
    Compression forces act towards point"
240 PRINT AT 21,0;"Press n for new run, s to stop"
250 IF INKEY$ ="" THEN GO TO 250
260 IF INKEY$ ="n" THEN GO TO 10
270 STOP
300 REM Two unknown forces
310 CLS : PRINT TAB 3;"TWO FORCES FOR EQUILIBRIUM": PRINT
320 GO SUB 80
330 INPUT "Angle of unknown force U1?";P1,"Angle of unknown force
    U2?";P2
340 LET P1=P1* PI /180: LET P2=P2* PI /180
350 LET U1=(FS* COS P2-FC* SIN P2)/( COS P1* SIN P2- COS P2* SIN P1)
360 LET U2=(FS* COS P1-FC* SIN P1)/( COS P2* SIN P1- COS P1* SIN P2)
370 IF U1>0 THEN LET F$="Tension"
380 IF U1<0 THEN LET F$="Compression"
390 IF U1=0 THEN LET F$=""
400 IF U2>0 THEN LET G$="Tension"
410 IF U2<0 THEN LET G$="Compression"
420 IF U2=0 THEN LET G$=""
430 CLS : PRINT "Equilibrium Forces:"
440 PRINT TAB 2;"U1="; ABS U1; TAB 21;F$
450 PRINT TAB 2;"U2="; ABS U2; TAB 21;G$
460 GO TO 230

```


Starry, starry night

Maurice Gavin presents a program for the 48K Spectrum which demonstrates how to navigate by the stars

For thousands of years mariners set their course through the night by the stars. Today these methods are regarded as obsolete with the advent of radar, radio beacons and gyroscopes.

The modern gyroscope may have no moving parts — just laser beams constantly "orbiting" around tiny glass prisms — the slightest movement of which is detectable and used to update the craft's position, in three dimensions if necessary.

But, all these systems need a constant supply of electricity to power them. Any sustained power loss and the mariner may have to dust down his old sextant and use the stars again.

The following program outlines the principles of navigation by the stars from the convenience of an armchair. It effectively inverts the problem by accurately animating the appearance of the northern sky for any hour, month and latitude in the northern hemisphere as *Input* by the user. Two constellations — the Plough (Ursa Major) and the "W" (Cassiopeia) act as hands on a giant star clock with Polaris the north (or pole) star marking the centre of the clock for guidance.

To find the observer's latitude is relatively easy — the altitude of Polaris above the horizon in degrees equals the latitude. At the equator (0° latitude), Polaris hovers on the horizon, whilst at the north pole (90° latitude) Polaris is directly overhead at the zenith (marked Z in the screen display).

The observer's longitude to the east or west of a set line (usually the Greenwich Meridian) proved much more difficult. The solution came in 1762 with John Harrison's ship's chronometer which kept accurate Greenwich Time irrespective of its location on Earth. It was only necessary to deduce the local time by the "clock" stars like the Plough and compare it to Greenwich Time to extract the observer's longitude. For example, a difference of six hours between the two "clocks" is equal to precisely 90° of longitude. Today a common quartz watch is a fair substitute for the Harrison chronometer if left to run at Greenwich Time (GMT) whilst the observer travels abroad.

Full use is made of the Spectrum colour in the display with a flashing beacon on the horizon pointing to Polaris. Each "day" has the correct number of hours of daylight and night-time according to the month and latitude selected — the sky colour changing through each shimmering dawn and dusk. A symbolic sun or moon hangs in the sky as appropriate. With increasing latitude, the animation is shifted up the screen and the user is transported from a tropic isle complete with palm trees to a townscape skyline and finally Arctic iceflows. The program runs in a continuous loop and

a "day" lasts about 40 seconds. The user has four options, via one-touch *Inkey\$* commands, to freeze the animation, *Save* the title "picture" on tape via the *Screen\$* command, to *Copy* the screen to the ZX printer or to rerun for new *Inputs*.

Rem statements are liberally included in the program to indicate its structure. Half the program (from line 2000) contains and handles the three separate sets of data of star positions, hours of daylight (changing the sky colour, etc, at sun-up and sun-down) and the UDG skylines.

A\$ (line 8180) is a mixture from the Spectrum chunky graphics set and UDG *Chr\$* "A" to "F" inclusive. The B\$ string starts with 32 blank spaces and then a mixture of the UDG set and the underline sign (symbol shift 0) to denote the horizon together with a few minus signs (symbol shift J). The final skyline in the C\$ string uses chunky graphics, UDG and *Chr\$* 95.

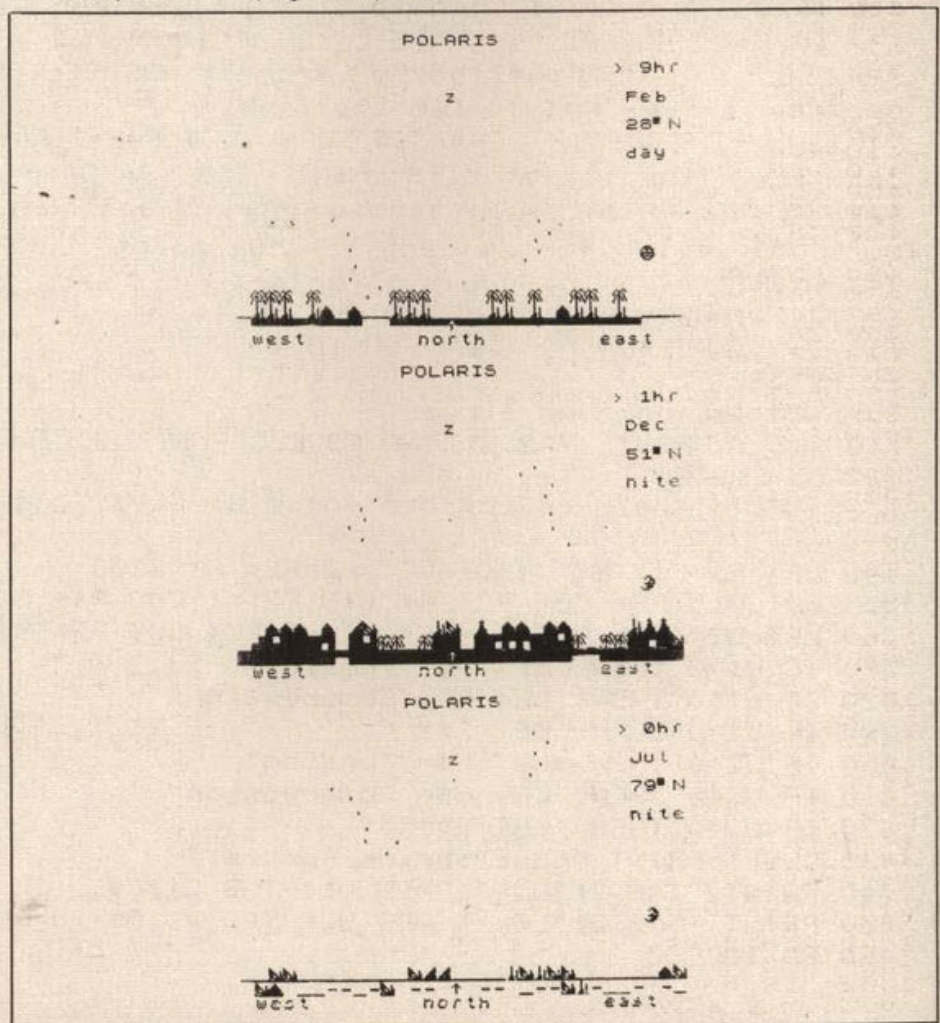
Please note that some of the UDG *Chr\$* are shared within apparently totally different skylines and this is fully acceptable if they are carefully designed for a dual role. For example, the "sloping rooftops" be-

come "icebergs" and the "palm tree trunks" become "chimney pots".

In order to speed up the plotting of the two star patterns (Ursa Major and Cassiopeia) in line 350, all the x and y co-ordinate positions of the 12 stars in 24 separate positions (for each hour of the day) are calculated into the c and d arrays from lines 2130 to 2200 inclusive. This, together with the rest of the *Data*, takes about a minute to *Read* — line 2070 provides a reminder that all is well — when the program is Run. When the program is *Saved* (Goto 9990) it automatically starts on *Loading* (via line 9990) and skips the bulk of the *Data* as this is now contained in the tape program.

The main f loop for plotting the star positions contains two nested loops, eg, z and n. The n loop does the actual plotting and only contains five lines of instructions so as not to slow down the animation. One of the instructions is the *Inkey\$* command, which has its own subroutine from line 430 to 510. The *Poke* 23658, 8 in line 60 sets the capital lock, thus abbreviating the *Inkey\$* selection.

The z loop effectively switches the *Over* command "on" and "off" so that the stars are sequentially plotted then unplotted with a brief *Pause* again controlled by the value of the z loop. Variables S and S1 in line 260 and 270 determine the hour of sunset and sunrise with separate subroutines. ■




```

10 REM *****
  * POLARIS-the North Star *
  * © Maurice Gavin - 1983 *
  *****
20 GO SUB 2000: REM star data
30 GO SUB 7000: REM daylight
40 GO SUB 8000: REM UDG skyline
50 REM -----
60 BRIGHT 1: POKE 23658,8
70 BORDER 0: PAPER 1: INK 9
80 CLS: INPUT "Your latitude (
0-90)";yy: LET LT=1+INT (yy/10):
IF yy<0 OR yy>90 THEN GO TO 80
90 INPUT "Month (1-12)";M: IF M
<1 OR M>12 THEN GO TO 90
100 REM -----
110 LET y2=yy*1.4+17: LET d$=a$
120 IF yy>70 THEN LET d$=b$:
130 IF yy<30 THEN LET d$=c$
140 LET M=INT M
150 LET sun=h (M,LT)
160 LET S=12-sun: LET S1=12+sun
170 LET m$="JanFebMarAprMayJunJ
ulaugSepOctNovDec" (M*3-2 TO M*3)
180 PLOT x,y2: LET y3=y2-y
190 LET M2=m*2: LET M3=m2+17
200 IF M3>24 THEN LET M3=M3-24
210 LET f=1: GO SUB 1500
220 REM -----
230 REM      main loop
240 REM -----
250 FOR f=1 TO 24: OVER 1
260 IF S=f-1 THEN GO SUB 1400
270 IF S1=f-1 THEN GO SUB 1500
280 PRINT OVER 0;AT 2,28;(" " A
ND f<=10);f-1;"hr"
290 LET f1=f+M3
300 IF f1>24 THEN LET f1=f1-24
310 FOR z=0 TO 1: FOR n=1 TO 12
320 IF INKEY$<>" " THEN GO SUB 4
30
330 LET y1=d (f1,n)+y3: IF y1<17
OR y1>174 THEN GO TO 380
340 REM -----
350 PLOT c (f1,n),y1: DRAW 0,1
360 PLOT OVER 0;x,y2: DRAW 0,1
370 REM -----
380 NEXT n: PAUSE 50-(49 AND Z=
1): NEXT z: BEEP .1,f+20: NEXT f
390 GO TO 250: REM repeat loop
400 REM -----
410 REM      inkeys commands
420 REM -----
430 LET x$=INKEY$
440 IF x$="R" THEN GO TO 70
450 IF z=1 AND n=1 THEN GO SUB
480
460 RETURN
470 REM -----
480 IF x$="Z" THEN GO TO 320
490 IF x$="C" THEN COPY
500 IF x$="S" THEN INPUT "press
ENTER to save picture";LINE z$
: SAVE STR$ INT yy+m$3SCREEN$
510 RETURN
1000 REM -----
1010 REM      print screen
1020 REM -----
1030 PRINT AT 0,0: PAPER 4: "
POLARIS - the North Star
1040 PRINT AT 6,28;INT yy;CHR$ 1
30;"N";AT 4,28;m$:AT 4,15;"Z"
1050 PRINT INK;PAPER pa;AT
18,0;d$:FLASH 1:PAPER 3: INK 1
:AT 20,15;"↑";AT 2,27;">"
1060 PRINT AT 21,0: PAPER pa-(1
AND d$=a$);"west      north
      east
1070 PRINT #0; INK 4;"Hold free
e: Screen$: Copy: Run": RETURN
1400 REM -----
1410 REM      dawn/daylight display
1420 REM -----
1430 FOR d=1 TO 5: PAPER d: PAUS
E 5: CLS: NEXT d: LET pa=d-1
1440 PRINT AT 8,28: PAPER 6: FLA
SH 1;"day ";AT 15,29;CHR$ 150
1450 LET ink=1+(6 AND d$=b$)
1460 GO SUB 1000: RETURN
1500 REM -----
1510 REM      dusk/night display
1520 REM -----
1530 FOR d=5 TO 1 STEP -1: PAPER
d: CLS: NEXT d: LET pa=d+1

```

```

1540 PRINT AT 8,28: FLASH 1: PAP
ER 6;"nite";AT 15,29;CHR$ 151
1550 LET ink=0+(7 AND d$=b$)+(4
AND d$=c$): GO SUB 1000: RETURN
2000 REM -----
2010 REM      Cassiopeia & Plough
      stars' hour angle+declination
2020 REM -----
2030 DATA 2,59,10,56,14,61,21,60
,28,64: REM Cassiopeia
2040 REM -----
2050 DATA 165,62,165,57,178,54,1
83,57,193,56,201,55,207,49: REM
Ursa Major (the Plough)
2060 REM -----
2070 PRINT FLASH 1;"Read data..."
2080 REM -----
2090 REM      calc stars 'orbits'
      around Polaris
2100 REM -----
2110 LET r=180/PI: LET z=0
2120 LET x=123: LET y=80
2130 DIM c(24,12): DIM d(24,12)
2140 FOR f=1 TO 24: RESTORE 2030
2150 FOR n=1 TO 12: READ a,b
2160 LET AA=360-a/r+z
2170 LET AB=(b-90)*1.7
2180 LET c(f,n)=x+COS AA*AB
2190 LET d(f,n)=y+SIN AA*AB
2200 NEXT n: LET z=z+.26: NEXT f
2210 RETURN
7000 REM -----
7010 REM      daylight hours/latitude
7020 REM -----
7030 DATA 6,6,5,5,4,4,3,2,0,0
7040 DATA 6,6,6,6,5,5,5,4,4,0
7050 DATA 6,6,6,6,6,6,6,6,6,6
7060 DATA 6,6,6,6,7,7,7,8,8,12
7070 DATA 6,6,7,7,8,8,9,10,12,12
7080 DATA 6,6,7,8,9,10,11,12,12,
12
7090 DATA 6,6,5,4,3,2,1,0,0,0
7100 REM -----
7110 DIM h(12,10)
7120 FOR n=1 TO 6: FOR f=1 TO 10
7130 READ hr: LET h(n,f)=hr
7140 LET h(12-n,f)=hr
7150 NEXT f: NEXT n
7160 FOR f=1 TO 10: READ h1
7170 LET h(12,f)=h1: NEXT f
7180 RETURN
8000 REM -----
8010 REM      UDG skyline/sun/moon
8020 REM -----
8030 RESTORE 8040
8040 DATA 0,16,56,124,254,254,25
5,255: REM rooftop
8050 DATA 38,89,148,178,90,85,14
9,144: REM tree
8060 DATA 16,16,18,18,18,26,58,1
23: REM chimneys or tree trunks
8070 DATA 8,28,8,28,28,62,62,127
: REM church steeple
8080 DATA 128,192,226,242,203,11
1,159,255: REM icebergs
8090 DATA 1,3,7,14,31,63,127,255
: REM roof or iceberg
8100 DATA 60,126,147,219,239,219
,102,60: REM UDG sun (daytime)
8110 DATA 28,38,7,9,63,14,158,12
0: REM UDG moon (night-time)
8120 REM -----
8130 FOR n=144 TO 151
8140 FOR f=0 TO 7: READ d
8150 POKE USR CHR$ n+f,d
8160 NEXT f: NEXT n
8170 REM -----
8180 LET A$="AAA A FE CE D
AA AA CDD BB B
B B B E BB B
B B B E BB B"
8190 LET B$="
CECEE AE EE EFF
--EC-- AE --E --
8200 LET C$="BBB B BBB B
B B BB B CCC CA A CCC C
C C ACC C"
8210 RETURN
9990 REM -----
9990 SAVE "polestar" LINE 40

```


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POPULAR COMPUTING WEEKLY



The die is cast

John Law presents Rainbow Towers — a dice game using colour and sound

This is a dice game for up to four players. It uses low graphics with colour and sound, and a demonstration option is included for first time users. The number of moves taken by each player is recorded.

Notes

10	Initial set up of parameters
60-120	Titles
130	Computer demonstration Y/N
140-170	Input players names
180-330	Print play rods
340-630	Main play loop

380-390	Random colour generation
400-420	Print colour
430	Checks colour for next required
450-550	Move colour down rod if match
560	Sets next colour indicator
570	Checks for winner and prints moves
630-650	Closedown

Variables

PL	Number of players
AS(I)	I=1...PL Players names
N(I)	I=1...PL Next colour indicator
PQ	Final position for printing matched colour
DS	Rainbow string for titles

```

10 GOSUB 660
20 REM RAINBOW TOWERS
30 REM.....BY John Law
40 REM.....November 1983
50 CLS
60 PRINT$;PRINT"  R A I N B O W
  T O W E R S";PRINT$
70 PRINT"GAME FOR A MAXIMUM OF
  4 PLAYERS"
80 PRINT:PRINT"A 6 COLOURED DICE
  THROWN IN TURN"
90 PRINT"ORDER COLOURS TO
  BE PUT ON RODS"
100 PRINT:PRINT"RED";CHR$(143+C(1))
  ;".....BLUE";CHR$(143+C(2));"
  .....DRANGE";CHR
  $(143+C(3))
110 PRINT"YELLOW";CHR$(143+C(4))
  ;".....BLACK";CHR$(143+C(5));".....
  WHITE";CHR$(
  143+C(6))
120 PRINT:INPUT"COMPUTER DEMONSTRATION
  Y/N";YN$
130 IFYN$="Y"GOTO 750
140 CLS:PRINT$;INPUT"HOW MANY PLAYERS
  (MAX 4)";PL:IF PL<0ORPL>4GOTO140
150 FORI=1TOPL
160 LINE INPUT"PLAYERS NAME ";A$(I)
  :A=LEN(A$(I)):IF A>6 THEN A$(I)
  =LEFT$(A$(I),6)
170 NEXTI
180 CLS
190 FOR J=0TO383STEP32
200 FOR I=1TOPL
210 PS=J+2+(I-1)*8
220 PRINT@PS,CHR$(138+C);CHR$(133+C);
230 NEXTI,J
240 FOR I=1TOPL
250 PS=384+1+(I-1)*8
260 FOR J=1TO4
270 PRINT@PS+J-1,CHR$(128);
280 NEXTJ
290 PRINT@PS+64,A$(I);
300 NEXTI
310 IF DEMO<>1THEN PRINT@480,"
  press"+CHR$(128)+"any"+CHR$(128)+
  +"key"+CHR$(128)+
  +"for"+CHR$(128)+"next"+CHR$(128)+
  +"throw ";
320 FORI=1TOPL
330 N(I)=1:NEXTI
340 REM MAIN PLAY LOOP
350 FORJRL=1TOPL
360 REM RETURN TO BACKGROUND COLOUR
370 PRINT@416,S$;
380 R(JRL)=RND(6)
390 HI=C(R(JRL))
400 HJ=HI
410 IFHI<0THENHI=-13:HJ=-14
420 PRINT@416+2+(JRL-1)*8,CHR$(141+HI)
  ;CHR$(142+HJ);
430 IF R(JRL)<>N(JRL)THEN SOUND1,1:
  GOTO 580
440 REM MATCH COLOUR REQUIRED
450 PQ=(13-(R(JRL)*2)):PZ=PQ*32
460 PZ=PZ+(JRL-1)*8
470 CC=143+(C(N(JRL)))
480 PQ=(PQ-1)*32:PQ=PQ+(JRL-1)*8
490 REM PRINT FROM MOVES DOWN RODS
500 FOR MM=2+(JRL-1)*8TOPQ+2STEP32
510 IF MM=320 THENPRINT@MM-32,
  CHR$(138+C);CHR$(133+C);
520 PRINT@MM,CHR$(CC);CHR$(CC);
530 PRINT@MM+32,CHR$(CC);CHR$(CC);
540 SOUND255-(MM/2),1
550 NEXTMM
560 N(JRL)=N(JRL)+1
570 IF N(JRL)>6 THEN PRINT@416+
  (JRL-1)*8,
  "WINNER":PRINT" ";:PLAY"
  ABCDEDCBA":FOR
  LKJ=1TO500:NEXTLKJ:GOTO630
580 IF DEMO=1THEN FORTT=
  1TO300:NEXTTT:GOTO600
590 B$=INKEY$:IF B$=" "GOTO590
600 NEXT JRL
610 MOVES=MOVES+1
620 GOTO350
630 PRINT@480," ";MOVES+1:"MOVES...
  ANOTHER GAME Y/N";:INPUT Y$:IF
  Y$<"Y" THEN GOTO640
640 CLS:FORI=1TO64:PRINTD$;:NEXT:
  PRINT@200,"G O O D   B Y E";
650 END
660 D$=CHR$(128)+CHR$(143):FOR
  I=1TO6:D$=D$+CHR$(143+(16*I)):NEXTI
670 E$=D$+D$+D$+D$
680 FORI=1TO64:PRINTD$;:NEXTI
690 PRINT @200,"RAINBOW TOWERS";
700 S$=STRING$(32,143)
710 C=0:C(1)=48:C(2)=32:C(3)=
  112:C(4)=16:C(5)=-15:C(6)=64
720 MOVES=0
730 FORI=1TO2500:NEXTI
740 RETURN
750 REM SET UP DEMO PARAMS
760 DEMO=1
770 PL=4:A$(1)="FIRST":A$(2)="SECOND"
  :A$(3)="THIRD":A$(4)="FOURTH"
780 GOTO180

```


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Program notes

Program variables

AS: holds user's name for timetable title.
TABLE\$(5,8): holds week's lessons.

DAYS: for day number.
PERIOD: for period number.

Program Procedures

PROCtitle: prints titles.
PROCsetup: sets up arrays and variables.
PROCinputdata: for week's lessons data.
PROCdumpdatatoprinter: dumps screen picture of timetable to Epsom printer or any other printer.
PROCagain: run program again Y/N.

LIST

```

10REM *****
20REM ** TIMETABLE PRINTER **
30REM ** Copyright (c)1983 **
40REM ** Simon C. Pithers **
50REM *****
60MODE7:PROCtitle
70PROCsetup
80CLS:DIM TABLE$(5,8):PROCinputdata
90MODE3:PROCdumpdatatoprinter
100PROCagain
110END
120DEF PROCtitle
130PRINTTAB(7,8);CHR$130;CHR$141;"TIMETABLE PRINTER";
140PRINTTAB(7,9);CHR$130;CHR$141;"TIMETABLE PRINTER";
150PRINTTAB(9,12);CHR$134;"By S. C. Pithers."
160PRINT'''
170INPUT"ENTER NAME",A$:IFLEN(A$)>32 GOTO170
180PRINT"PLEASE TURN PRINTER ON NOW"
190Q=INKEY 300
200VDU2,1,27,1,69,1,14:PRINTA$;" TIMETABLE."
210PRINT'''
220VDU3
230ENDPROC
240DEF PROCinputdata
250PRINTTAB(1,13);"FUNCTION KEYS:"
260PRINTTAB(1,14);"F0 DRAMA F1 MATHS F2 ENGLISH"
270PRINTTAB(1,15);"F3 ECONOMICS F4 FRENCH F5 BIOLOGY"
280PRINTTAB(1,16);"F6 CHEMISTRY F7 P.E. F8 PYHSICS "
290PRINTTAB(1,17);"F9 GERMAN CURSOR KEYS"
300PRINTTAB(1,18);"LEFT COMPUTERS RIGHT MUSIC"
310PRINTTAB(1,19);"DOWN TEC-DRAW UP ART"
320FOR DAYS=1 TO 5
330FOR PERIODS=1 TO 8
340PRINTTAB(5,2);CHR$134;"DAY ";DAYS
350PRINTTAB(1,4+PERIODS);CHR$133;"ENTER PERIOD ";PERIODS;"'S LESSON";
CHR$130;:INPUT TABLE$(DAYS,PERIODS);:PRINT"
360IF LEN(TABLE$(DAYS,PERIODS))>10 GOTO350
370NEXT
380FORX=4TO12:PRINTTAB(0,X);"
":NEXT
390NEXT
400ENDPROC
410DEF PROCdumpdatatoprinter
420CLS
430VDU2,1,27,1,69
440PRINT"*****
450PRINT"* PERIOD * MONDAY * TUESDAY * WEDNESDAY * THURSDAY *FRIDAY
460PRINT"*****
470PRINT"*** 1 ***";TABLE$(1,1);SPC(10-LEN(TABLE$(1,1)));"*";TABLE$(2,1);
SPC(11-LEN(TABLE$(2,1)));"*";TABLE$(3,1);SPC(13-LEN(TABLE$(3,1)));"*";

```


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```

TABLE$(4,1);SPC(11-LEN(TABLE$(4,1)));"*";TABLE$(5,1);SPC(10-LEN(TABLE$(
(5,1)));"*"
480PRINT"*** 2 ***";TABLE$(1,2);SPC(10-LEN(TABLE$(1,2)));"*";TABLE$(2,2);
SPC(11-LEN(TABLE$(2,2)));"*";TABLE$(3,2);SPC(13-LEN(TABLE$(3,2)));"*";
TABLE$(4,2);SPC(11-LEN(TABLE$(4,2)));"*";TABLE$(5,2);SPC(10-LEN(TABLE$(
(5,2)));"*"
490PRINT"*** 3 ***";TABLE$(1,3);SPC(10-LEN(TABLE$(1,3)));"*";TABLE$(2,3);
SPC(11-LEN(TABLE$(2,3)));"*";TABLE$(3,3);SPC(13-LEN(TABLE$(3,3)));"*";
TABLE$(4,3);SPC(11-LEN(TABLE$(4,3)));"*";TABLE$(5,3);SPC(10-LEN(TABLE$(
(5,3)));"*"
500PRINT"*** 4 ***";TABLE$(1,4);SPC(10-LEN(TABLE$(1,4)));"*";TABLE$(2,4);
SPC(11-LEN(TABLE$(2,4)));"*";TABLE$(3,4);SPC(13-LEN(TABLE$(3,4)));"*";
TABLE$(4,4);SPC(11-LEN(TABLE$(4,4)));"*";TABLE$(5,4);SPC(10-LEN(TABLE$(
(5,4)));"*"
510PRINT"*** 5 ***";TABLE$(1,5);SPC(10-LEN(TABLE$(1,5)));"*";TABLE$(2,5);
SPC(11-LEN(TABLE$(2,5)));"*";TABLE$(3,5);SPC(13-LEN(TABLE$(3,5)));"*";
TABLE$(4,5);SPC(11-LEN(TABLE$(4,5)));"*";TABLE$(5,5);SPC(10-LEN(TABLE$(
(5,5)));"*"
520PRINT"*** 6 ***";TABLE$(1,6);SPC(10-LEN(TABLE$(1,6)));"*";TABLE$(2,6);
SPC(11-LEN(TABLE$(2,6)));"*";TABLE$(3,6);SPC(13-LEN(TABLE$(3,6)));"*";
TABLE$(4,6);SPC(11-LEN(TABLE$(4,6)));"*";TABLE$(5,6);SPC(10-LEN(TABLE$(
(5,6)));"*"
530PRINT"*** 7 ***";TABLE$(1,7);SPC(10-LEN(TABLE$(1,7)));"*";TABLE$(2,7);
SPC(11-LEN(TABLE$(2,7)));"*";TABLE$(3,7);SPC(13-LEN(TABLE$(3,7)));"*";
TABLE$(4,7);SPC(11-LEN(TABLE$(4,7)));"*";TABLE$(5,7);SPC(10-LEN(TABLE$(
(5,7)));"*"
540PRINT"*** 8 ***";TABLE$(1,8);SPC(10-LEN(TABLE$(1,8)));"*";TABLE$(2,8);
SPC(11-LEN(TABLE$(2,8)));"*";TABLE$(3,8);SPC(13-LEN(TABLE$(3,8)));"*";
TABLE$(4,8);SPC(11-LEN(TABLE$(4,8)));"*";TABLE$(5,8);SPC(10-LEN(TABLE$(
(5,8)));"*"
550PRINT"*****"
560PRINT"....."
570VDU3
580INPUT "ANOTHER COPY Y/N ";A$
590IF A$="Y" THEN 420 ELSE ENDPROC
600ENDPROC
610DEF PROCsetup
620*FX4,2
630*KEY0 DRAMA:M
640*KEY1 MATHS:M
650*KEY2 ENGLISH:M
660*KEY3 ECONOMICS:M
670*KEY4 FRENCH:M
680*KEY5 BIOLOGY:M
690*KEY6 CHEMISTRY:M
700*KEY7 P.E.:M
710*KEY8 PHYSICS:M
720*KEY9 GERMAN:M
730*KEY12 COMPUTERS:M
740*KEY13 MUSIC:M
750*KEY14 TEC-DRAW:M
760*KEY15 ART:M
770ENDPROC
780DEF PROCagain
790VDU22,7
800PRINT"':PRINT"ENTER Y IF YOU WISH TO RUN PROGRAM AGAIN":A$=GET$:IF
A$="Y"
RUN ELSE END:ENDPROC
810ENDPROC

```


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Getting the message

Boris Allan investigates the different functions of the *input* command

INPUT This command shares many features in common with *Read*, particularly the importance of commas, quotes, and colons.

Following the word *Input*, there may be a string to identify the input required, eg:

```
10 INPUT "TESTING"; AS
```

and two extra lines help to investigate the *Input* command.

```
20 PRINT AS
30 GOTO 10
```

So try the following inputs

```
J
J,
J,
J:
J;
J;
```

For the first entry J is printed, as with the second entry — though with the information *?Extra Ignored*. The routine to accept values for *Input* considers that the comma is a separator, and thus the user has entered two values. Only one value is expected, and so the extra value is ignored (it is not possible to store up values for later *Inputs*).

To the third entry a null string is printed, and the extra (ie, J in this case) is ignored. As the first item the routine encounters is a comma, it assumes a null input. The fourth entry shows that the colon has a similar effect to the comma, as J is printed and the extra ignored.

The fifth input (ie, J;) is output exactly as that (ie, J;). The semicolon is not a separator; in fact, it is treated as an ordinary character.

The final entry shows the use of the double quotes to make the routine aware that the following set of characters is just that, a set of characters. If there is a comma (etc) in the set, it is to be counted. In this case the output is J,.

To illustrate a bug in the *Input* routines, merely hit *Return* after the last item, and the string output is J, again. Hitting *Return* on input does not enter the null string, but the string contains its previous value.

The use of quotes in *Input* allows the input of graphics commands, such as *Clr*, and in this respect the situation has much in common with *Print*.

Change two lines in the program:

```
10 INPUT "TESTING";A
20 PRINT A
30 GOTO 10
```

and then enter:

```
1
2E3
```

```
2,
,8
5:
2/3
```

The first is non-problematical, and 1 is output; the second entry is also without any problems, and 2000 is output. The third entry gives *?Extra Ignored*, and then the answer 2 (the fifth entry 5: is similar). The result of entering the fourth entry is *?Extra Ignored* and the value of A output is 0 — the comma is read as a null (ie, zero) entry.

The input 2/3 is illegitimate, and an error message *?Redo from start* is output. To then enter a valid value is to output the valid value. If, however, 2/3 is entered (and the error flagged) to then merely hit *Return* prints out the value 2.

This is yet another bug. What has happened is that the expression 2/3 had been evaluated as far as the / by *Chrget* (in a similar way to *Val* or *Gosub/Goto*), and then the error flagged. By hitting *Return*, no value is sent to A and the already existing value (ie, the 2 of 2/3) is treated as the proper value.

When a user is entering much information, it is very easy to make such an error, and hit *Return* before the proper time.

Sometimes, when a CMD statement is operative, the *Input* tries to take data from the wrong kind of device (eg, a printer), and *?File data error* is output. If there is a message with the *Input* (eg, *Testing*) then this message is sent to the device, which may produce some complications.

INPUT# This command takes data from some device, in exactly the format expected by the ordinary *Input* command, though there is no message. The file must first be *Opened*.

If the data has been sent to the device by *Print#*, the format is exactly as desired because the two commands are consistent.

Input# is rather more touchy about data types and format than ordinary *Input*, and, though there are no warnings, extra will be

ignored. The routines for *Input* and *Input#* are almost identical, apart from the setting of the file for *Input#*.

Both *Input* and *Input#* use the 80 byte buffer (see *Get* and *Get#*), and this is why *Input* cannot be used in immediate mode — immediate commands are stored in the same buffer.

INT(X) This function converts the floating point expression in parentheses into the integer value which is less than or equal to the result of the expression. None of the standard restrictions on the size of the floating point expression hold (ie, within the bounds -32768 to 32767), because the result of *Int* is still a floating point number, though turned into a whole number.

Note the results of the following expressions:

```
PRINT INT(3.1)
PRINT INT(-3.1)
PRINT INT(4.6 + .5)
PRINT INT (-4.1 + .5)
PRINT INT(1/2)
PRINT INT(-1/2)
```

which are 3, and then -4 (*Int* always rounds down); next are 5 and -4 (rounded to the nearest whole number); and the next pair produce the answers 0 and -1 (note that the *Int* of -1 divided by 2 is -1).

The rounding down is shown by reference to the integer division:

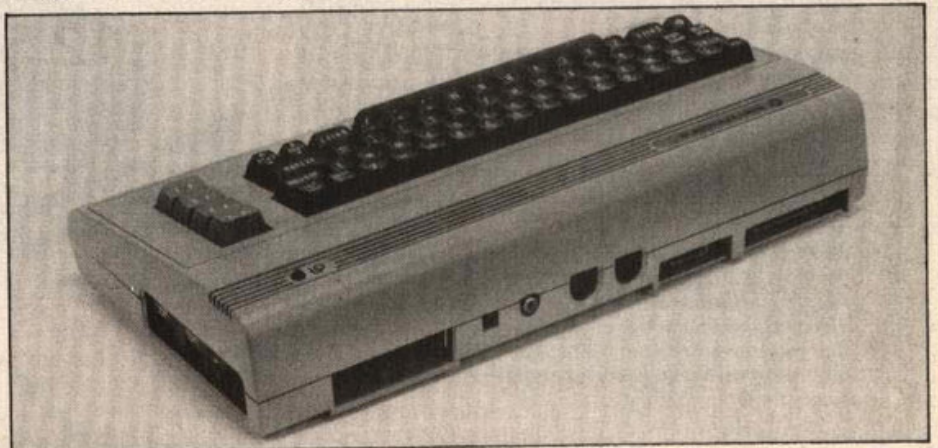
```
X%=-3 : Y%=2 : Z%=X%/Y% : PRINT Z%
```

to which the answer is -2. The two's complement form of the number -3 is 111111111111101, and to divide a binary number by 2 we move all bits to the right, inserting a 0 at the leftmost position (eg, 4 is 100 as a binary number and 2 is 010). Thus, the number becomes 011111111111110.

This number is now a positive number and in two's complement is 32766. It is a poor system in which half a minus number is a plus number, so divide the sign bit reinserted in the leftmost position. The binary number formed from the division by 2 is thus 111111111111110, and as a two's complement number is equal to -2.

The actual *Int* routine works by taking the result from *Fpa #1*, converting it to a four byte integer, and then converting the

Continued on page 32



COMMODORE 64

Continued from previous page

four byte integer into a floating point number in *Fpa #1*, keeping the old exponent.

LEFT\$(S\$,1%) This function takes the string *S\$* and extracts the first 1% characters of that string. The value of 1% can be from 0 to 255, and if it is greater than the length of the string all the string is returned. For example:

```
PRINT LEFT$("1234", 6), LEFT$("1234", 2)
```

outputs the string 1234 and then 12. If the length is zero, then the null string is output.

The routine works by taking the string pointers off the stack, where they are pushed as part of any string evaluation. The length of the string is compared to the value (1%) provided by the function, and the lower value is taken. The string selection routine then uses this information (which has been replaced on the stack) to set up the new string.

LEN(S\$) This function finds the length of the string *S\$* by effectively using the byte which gives the length of the string. The length byte is popped off the stack.

LET is not needed.

LIST This command shows the content of part or all of a program, in a form which is similar to that in which programs are entered.

There are the following alternative methods of *Listing* a program:

LIST

will display all the program;

LIST 200

will display the content of line 200;

LIST 600-800

will display all lines from 600 to 800 (inclusive);

LIST -800

will display all lines up to and including 800; and

LIST 600-

will display all lines from 600 to the end of the program.

If a program has been *Stopped* in some manner, it is possible to *List* and then to *Cont*. However, if the *List* command is within a program, eg:

```
1 PRINT "$$$$$"  
2 REM  
3 REM  
4 LIST  
5 PRINT "#####"
```

to *RUN* this program, *Lists* it out, but the program does not continue to line 5 (and

the *Print*). To use *List* within a program stops all further computation. If you manage to *Stop* the listing part of the way through (easier with a longer listing), *Cont* then moves control to line 5, but the rest of the *List* is lost.

When *Cont* is used after the program has ended, the *List* is reactivated, and the program is listed again. However, the whole program is not re-run, because the first line of \$\$\$\$ is not output — only the *List*. The *Cont* should start the program from where it "finished", but using *List* confuses the issue, and *List* is repeated (and stops the program).

If line 4 is erased, and the program *Run*, then to use *Cont* does nothing — apart from the system telling you it is *Ready*. To alter line 4 to

4 LISY

produces a ?Syntax error in 4; and then trying to *Cont*, gives ?Can't continue error.

The reason for these peculiarities of *List* is that its use within a program involves extensive use of pointers, and, if *Cont* is used, *Cont* tries to use those same pointers. The status of the pointers becomes unclear. This is another bug, not serious, but one which should not happen with a clean Basic.

It is possible to *List* to a device by *Opening* a file and a device and then using *Cmd* (see above). ■

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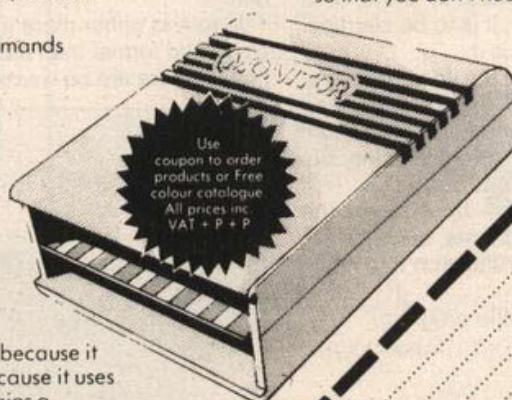
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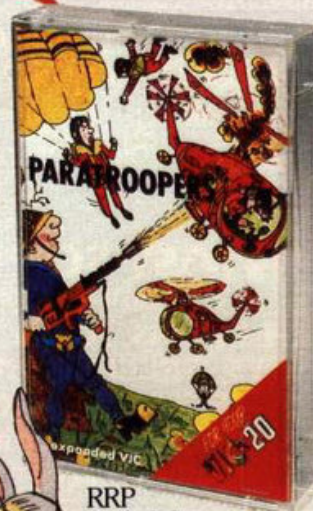
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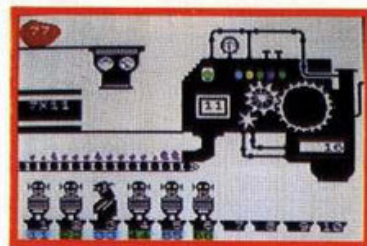
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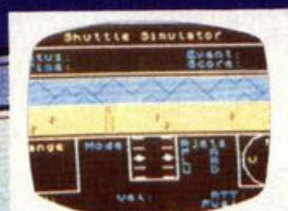
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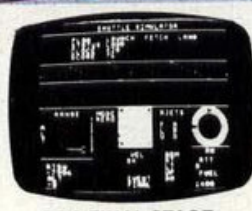
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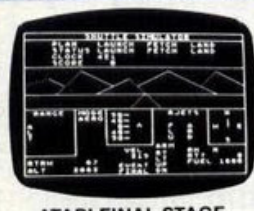
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Mastermind

on BBC Micro

Mastermind is a game of logic and skill. It is a one-player game in which you have to guess the colour code which has been selected by the BBC in the right order. In the game there has been introduced two skill levels and a limit to the number of guesses. After the instructions you are given a display of the board, a colour code, and at the top right-hand of the board you must input your guesses 1 2 3 4 5. After inputting a guess from 1-8 press return; do this for each five of your guesses and then the board will be updated. The proper rules

are included in the game.

Add these lines to make the code even harder to find:

```
345 C = 1
390 FORM = 1 TO 5: FORN = TO 5: IF B(M) =
A(N) A = 1: PRINTTAB(18 + C, lev +
6); "+"
405 IF B(M) = A(M) PRINT TAB(18 + C, lev +
6); "+"
420 NEXT
425 IF A = 1 THEN C = C + 1: A = 0
427 NEXT
```

When the computer tells you your guesses are + -. (correct, correct but in wrong position, incorrect), it will not state which are which. It will only state that one of your guesses are + -. but not which one. So it is up to you to work out what

you have right or wrong.

Main variables

level	Whether a hard or an easy game has been chosen for play
diff	Maximum amount of guesses player can take
A(1) - A(5)	Number of colours picked by computer
B(1) - B(5)	Number of colours picked by player

Proc statements

Procsetup	Draws the screen layout
Proccalc	Randomly picks computers colours
Procgame	The main part of the program, where the player inputs his guesses, the computer checks whether they are correct, and updates board
Procend	Ends game

Game order

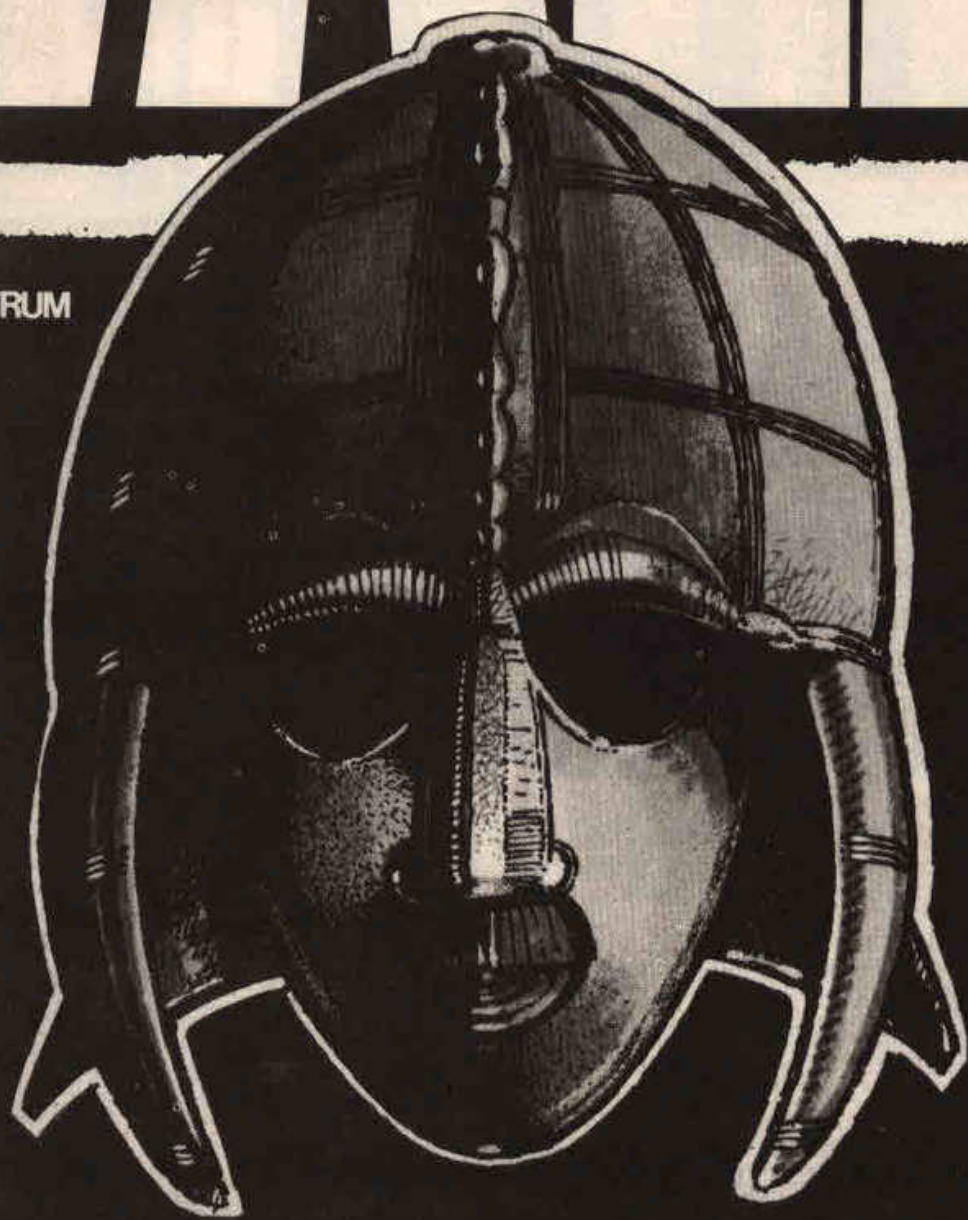
10-150	Prints instructions and sets variables on your inputs to how long you want the game to be and on what level hard/easy
160	Controls procs for game
170-310	Sets up screen
330	Selects computer colours
340-440	Main part of program where the player inputs his guesses at the code, computer updates board, and checks whether players guess was correct
460-490	End of game, returns to start

```
10REM MASTERMIND PROGRAMED BY Michael Pearce FOR BBC A/B 0.s 1.2
15REM IN APROX 6K
30MODE7: @% = 0: PRINTCHR$141; "MASTERMIND": PRINTCHR$141; "MASTERMIND"
40PRINTCHR$136; "By Michael Pearce"
50PRINT "AS THE CODEBREAKER YOU MUST TRY AND"
60PRINT "DUPLICATE THE CODE SET BY THE COMPUTER"
70PRINT "THE CODE CONSISTS OF FIVE COLOURED"
80PRINT "BLOCKS ARRANGED IN A RANDOM ORDER"
90PRINT "THE COMPUTER WILL HELP BY TELLING YOU WHETHER THEY ARE"
100PRINT "+ CORRECT": PRINT "- CORRECT BUT IN WRONG POSITION": PRINT ". INCORRECT"
110PRINT "THE ADVANCED PLAYER SHOULD CHOOSE A DIFFICULT GAME"
120INPUTTAB(0,20); "HOW MANY GUESSES MAXIMUM 1-14 "diff
130INPUTTAB(0,21); "HARD OR EASY H/E "level$
135*FX15,0
140IF level$ <> "H" AND level$ <> "E" OR diff > 14 AND diff < 1 THEN SOUND1, -15, 5, 10: RUN
150PRINT CHR$136; "Any key to continue": A = GET
160PROCsetup: PROCCalc: PROCgame
170DEFPROCsetup: CLS
180PRINTTAB(11,0); "MASTERMIND": PRINTTAB(11,1); "MASTERMIND"
190PRINTTAB(29,0); "GUESSES": PRINTTAB(29,1); "GUESSES"
195PRINTTAB(28,2); "1 2 3 4 5"
200PRINTTAB(0,0); CHR$141 "CODE": PRINTTAB(0,1); CHR$141 "CODE"
210FORN = 5 TO 19 STEP 2
220PRINTTAB(0,N); CHR$(144 + (N-3)/2); CHR$255; CHR$135; (N-3)/2: NEXT
230FORN = 7 TO 20: PRINTTAB(9,N); ". . . . .": NEXT: FORN = 2 TO 22
250PRINTTAB(6,N); VDU150, 181, 135; PRINTTAB(24,N); VDU150, 234, 135, 140: NEXT
260FORN = 7 TO 25: PRINTTAB(N,2); CHR$112: PRINTTAB(N,22); CHR$163: NEXT
270FORN = 4 TO 5: PRINTTAB(8,N); VDU148, 255, 255, 255, 255, 255, 255, 255: NEXT
280PRINTTAB(27,3); CHR$145: PRINTTAB(27,5); CHR$145: PRINTTAB(27,21); CHR$145
290FORN = 28 TO 36: PRINTTAB(N,3); CHR$96: PRINTTAB(N,5); CHR$240
300PRINTTAB(N,21); CHR$240: NEXT: PRINTTAB(0,3); VDU145, 96, 96, 96
310PRINTTAB(0,21); VDU145, 240, 240, 240, 240: ENDPROC
330DEFPROCcalc: DIMA(5): DIMB(5): FORN = 1 TO 5: A(N) = RND(8): NEXT: ENDPROC
340DEFPROCgame: FOR lev = 1 TO diff
350PRINTTAB(27,4); "": FORN = 1 TO 5
351*FX15
355INPUTTAB(26+N*2,4)B(N); IFB(N) > 8 THEN 355 ELSE NEXT
360IF level$ = "E" PRINTTAB(28, lev+6); B(1); " "; B(2); " "; B(3); " "; B(4); " "; B(5)
370PRINTTAB(8, lev+6); FORN = 1 TO 5: PRINTCHR$(144+B(N)); CHR$252: NEXT
380PRINTTAB(18, lev+6); CHR$135
390FORN = 1 TO 5: SOUND1, -15, 200, 1: FORN = 1 TO 5: IFB(M) = A(N) PRINTTAB(18+M, lev+6); "+"
405IFB(M) = A(M) PRINTTAB(18+M, lev+6); "+"
406TIME = 0: REPEAT UNTIL TIME > 10
420NEXT: NEXT
430IF A(1) = B(1) AND A(2) = B(2) AND A(3) = B(3) AND A(4) = B(4) AND A(5) = B(5) THEN PROCend
440NEXT: PROCend
460DEFPROCend: PRINTTAB(3,23); "YOU CLEVERLY BROKE THE CODE"
470IF lev > diff PRINTTAB(3,23); "YOU FAILED TO BREAK THE CODE"
480PRINTTAB(6,24); CHR$136; "ANY KEY TO CONTINUE";
485*FX15
490FORN = 1 TO 20 STEP 5: SOUND1, -12, N, 5: NEXT: A = GET: RUN
```

Mastermind
by Michael Pearce

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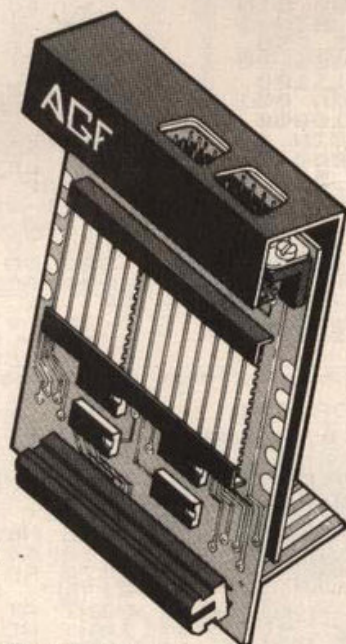
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OPEN FORUM

```

GO TO 120
2040 PRINT AT a(f),b(f); INK 4;"
LET i=f: GO TO 210
3000 PAPER 0: INK 5: BORDER 0: C
LS: PRINT "TAB 5;"
3010 PRINT TAB 5;"
3020 PRINT TAB 5;"
3030 PRINT TAB 5;"
3040 PRINT TAB 5;"
3050 INK 2: PRINT "TAB 3;"
3060 PRINT TAB 3;"
3070 PRINT TAB 3;"
3080 PRINT TAB 3;"
3090 PRINT TAB 3;"
3110 BEEP .5,0: BEEP .5,6: BEEP
.125,3: BEEP .125,3: BEEP .125,3
BEEP .5,12: BEEP .5,10: BEEP
.125,3: BEEP .125,3: BEEP .125,3:
BEEP .5,12: BEEP .5,10: BEEP .1
.25,3: BEEP .125,3: BEEP .125,3:
BEEP .5,-4

```

```

3995 CLS
4000 INK 7: PRINT "A minin
g colony has been attacked by
aliens who are now living in t
he mine shafts. They are trying
to eat the last man of the colo
ny who is at the base of the clif
f. It is your job to stop them b
y causing rocks to fall on the
m or by causing them to run into
rocks that you have shot down i
n their path."
4010 PRINT TAB 10;"7: UP" TAB 1
0;"6: DOWN" TAB 10;"0: FIRE"
4020 PRINT "press any key to co
ntinue": PAUSE 0
4030 CLS: PRINT "TAB 10;"500
RES"; AT 4,10; OVER 1;"
4040 PRINT "100 if rocks fa
ll on alien" "10 if alien collid
es with rocks" "20 new screen i
f you destroy a layer of rock"
4050 PRINT AT 21,0;"press any ke
y to continue": PAUSE 0: RETURN

```

Mine Aliens

Triple

on ZX81

Triple stretches the 1K ZX81 to its limit by being three games in one and it is menu driven. To save bytes Val is used on all numbers and consecutive line numbers further reduce the Goto and Gosub lines. Enter program exactly as listed then save

by Goto 1000, this ensures program will autostart when Loaded.

Program displays on video — 1. FLASH 2. FILUP 3. UFO. Enter 1, 2 or 3 to select game.

GAME 1. A number flashes somewhere on screen. You enter this number and program says if correct or not. Time on video is set by the Pause in line 23. (Press 0 to go to Menu.)

GAME 2. Four areas on video are randomly filled by inverse space. You have to guess which will fill first. (Note: runs for 130 lots, pauses, then returns to Menu.)

GAME 3. For two players. When UFO goes into hyperspace left player presses 1 and right player presses 0 key. When both ready, press Newline key. Faster player will push the UFO over to opponent's side. Left or Right win displayed on video.

(C) COPYRIGHT G.A. BOBKER 1983

```

1 CLS
2 PRINT " 1.FLASH 2.FILUP
3.UFO"
3 INPUT A
4 GOTO A*VAL "20"
20 CLS
21 LET A=INT (RND*VAL "99")
22 PRINT AT RND*VAL "20",RND*V
AL "25";A
23 PAUSE VAL "3"
24 CLS
25 INPUT B
26 IF NOT B THEN RUN
27 PRINT "YES"
28 IF A<>B THEN PRINT "NO.IT W
AS ";A
29 PAUSE VAL "150"
30 GOTO VAL "20"
40 CLS
41 FOR X=VAL "1" TO VAL "130"
42 LET A=INT (RND*VAL "9"+VAL
"1")
43 LET B=INT (RND*VAL "9"+VAL
"1")
44 IF A=VAL "5" OR B=VAL "5" T
HEN GOTO VAL "42"
45 PRINT AT A,B;" ";AT A,B;" "
46 NEXT X
47 PRINT AT VAL "5",VAL "14";"
END"
48 GOTO VAL "71"
60 CLS
61 LET A=VAL "17"
62 PRINT AT A,VAL "2",A-VAL "3
";"
63 IF A=VAL "1" OR A=VAL "33"
THEN GOTO A+VAL "69"
64 FOR B=VAL "50" TO RND*VAL "
150"
65 NEXT B
66 CLS
67 INPUT B
68 LET A=A+VAL "4"*(B=VAL "1")
-VAL "4"*(B=VAL "10")
69 GOTO VAL "62"
70 PRINT "L WON"
71 PAUSE VAL "150"
72 RUN
102 PRINT "R WON"
103 GOTO VAL "71"
1000 SAVE "T"
1010 RUN

```

Triple
by G Bobker

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SPRITES FOR THE DRAGON

Merlin's Sprite Magic offers a whole host of new features for the Dragon

Up to 128 sprites. Size up to 40 x 40 in mode 4, even larger in other modes. Sprite magic uses the 256 x 192 grid for screen addressing. Sprites are programmable for joystick control and/or keyboard control. Sprites may be defined as missiles fired from other sprites in response to fire-button or keyboard. Sprites may be programmed to rebound (like a bouncing ball), or wrap round, or disappear automatically when they get to the edge of the (user defined) screen. A wide range of commands and functions offers comprehensive control of speed, direction, screen edge behaviour and collision detection.

Animation is easily implemented with DRWG function which swaps the drawings being used for sprites and they needn't even be the same size.

Some of the commands are exceptionally powerful . . . MOVEn moves a single sprite, MOVEn,n moves a block of sprites, MOVEM moves all the sprites. All the MOVE commands observe the individual direction, screen-edge, joystick and keyboard instructions for the various sprites. The REPORT function reports how many have crashed. The HIT function reports crashed sprite numbers.

Sprites are non-destructive i.e. they do not leave a "trail". They're fast and they're efficient and they're easy to use.

The Dragon now has its very own BEEP command. This one, however, offers a range of 16 pre-programmed gunshots, explosions, sirens, laser sounds and the like. You can also program your own . . . BEEP (six parameters) lets you generate the kind of noises you have heard on other high quality software.

Keyboard handling has had some attention too . . . optional auto-repeat, INKEY function returns ASCII code, KEY function does the same, but waits for a keypress. CLEAR key clears hi-res screen and homes the print cursor.

We have also included a couple of routines to provide text on the hi-res screen . . . in all 5 PMODES with enhanced cursor controls providing relative as well as absolute positioning, PAGE command, HOLD command (to fix headers or graphics), COLOUR command changes text foreground and background colours etc. The hi-res screen is used just like the Basic text screen, including editing. You can also re-define the character set using the friendly new command CHR(n)=eight row values.

Sprite Magic requires absolutely no knowledge of machine code. The comprehensive manual describes the new Basic commands in full, with lots of examples. As well as the documented demonstration program, the cassette includes Character and Sound Generators, Mate in two (yes you can!), Shooting Gallery and Breakout. Price £17.25 all inclusive.



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OPEN FORUM

Communicator

on Spectrum

Not many microcomputers can communicate directly with their owners using thought waves, but the Spectrum is one that can — well, almost. In Communicator you get a friend to select one of nine squares drawn on the screen, and the

computer then asks you which one was chosen. You will invariably be able to answer correctly, and your friends may even go crazy trying to work out how you do it!

If you're feeling clever then look at the listing, and especially at lines 2035, 3160 and 3180 to try to work out how it's done before reading further. Here, however, is the secret. Ignore all variations in text,

sound and colour. When the computer offers the first possibility look at the position of the flashing indicator within the offered square. This tells you which square was chosen. Thus if the indicator is in the top left of its square then square 1 is the chosen one. If it is in the centre, then square five was chosen. If it is at the bottom centre, then square eight was chosen, and so on.

```

1 PEM INITIALISE VARIABLES
5 LET AS=" 0 0 0 0 0 0 0 0 0"
10 LET BS=" 0 0 0 0 0 0 0 0 0"
11 PEM LINE 10 - 3 BLOCKS OF 5 SQUARES
20 DIM CS(9): DIM DS(9)
30 LET CS="000111222"
40 LET DS="012012012"
60 BORDER 1: PAPEP 5
1000 REM GIVE INSTRUCTIONS
1005 CLS: PRINT TAB 10;"COMMUNICATOR"
1010 PRINT: PRINT "I AM SPECTRUM, THE ULTIMATE"
1011 PRINT "COMMUNICATOR. I CAN PROJECT MY"
1015 PRINT "KNOWLEDGE DIRECTLY INTO MY"
1016 PRINT "MASTER'S BRAIN. CAN YOU LEARN"
1017 PRINT "TO BE IN TUNE WITH ME TOO?"
1020 PRINT: PRINT "I WILL SHOW YOU 9 SQUARES: AND"
1021 PRINT "THEN PROJECT TO MY MASTER TH"
1022 PRINT "NUMBER OF THE SQUARE CHOSEN."
1030 PRINT: PRINT "PRESS ANY KEY TO SEE THE BOARD."
1100 GO SUB 3900
2000 REM CHOOSE A SQUARE + SEND MESSAGE

```

```

2001 CLS: 30 SUB 3000
2004 LET FS="111111111"
2005 LET FIRST=1
2006 PRINT AT 2,19;"PRESS A KEY"; AT 3,19;"FROM 1 TO 9"
2010 PRINT AT 4,19;"TO PICK A"; AT 5,19;"SQUARE"
2011 PRINT AT 7,24;"OR": PRINT AT 9,19;"PRESS C TO"
2012 PRINT AT 10,19;"LET ME MAKE"; AT 11,19;"THE CHOICE"
2020 GO SUB 3900
2025 LET ES=INKEY$: IF ES="" THEN GO TO 2025
2030 IF ES<"1" THEN GO TO 2025
2031 IF ES>"9" AND ES<>"C" AND ES<>" " THEN GO TO 2025
2034 IF ES<>"c" AND ES<>"C" THEN GO TO 2040
2035 LET CHOSEN=(INT(PND*9))+1: GO TO 2050
2040 LET CHOSEN=VAL ES
2050 CLS
2060 PRINT AT 3,4; FLASH 1;"MESSAGE NOW BEING SENT"
2070 FOR N=1 TO 10
2080 BORDER PND*6
2090 BEEP .1, PND*20
2100 NEXT N

```

SPECIAL CASSETTE OFFER!



Collector's edition of Eye of the Star Warrior for 48K Spectrum



Popular Computing Weekly is offering its readers the chance to buy **Eye of the Star Warrior** — a graphic arcade adventure cassette for the 48K Spectrum written by Tony Bridge and Roy Carnell. All you have to do is cut out this coupon, fill it in, and send it together with the first coupon plus the coupons from the next three issues and £1.25 (plus 30p p&p) to:

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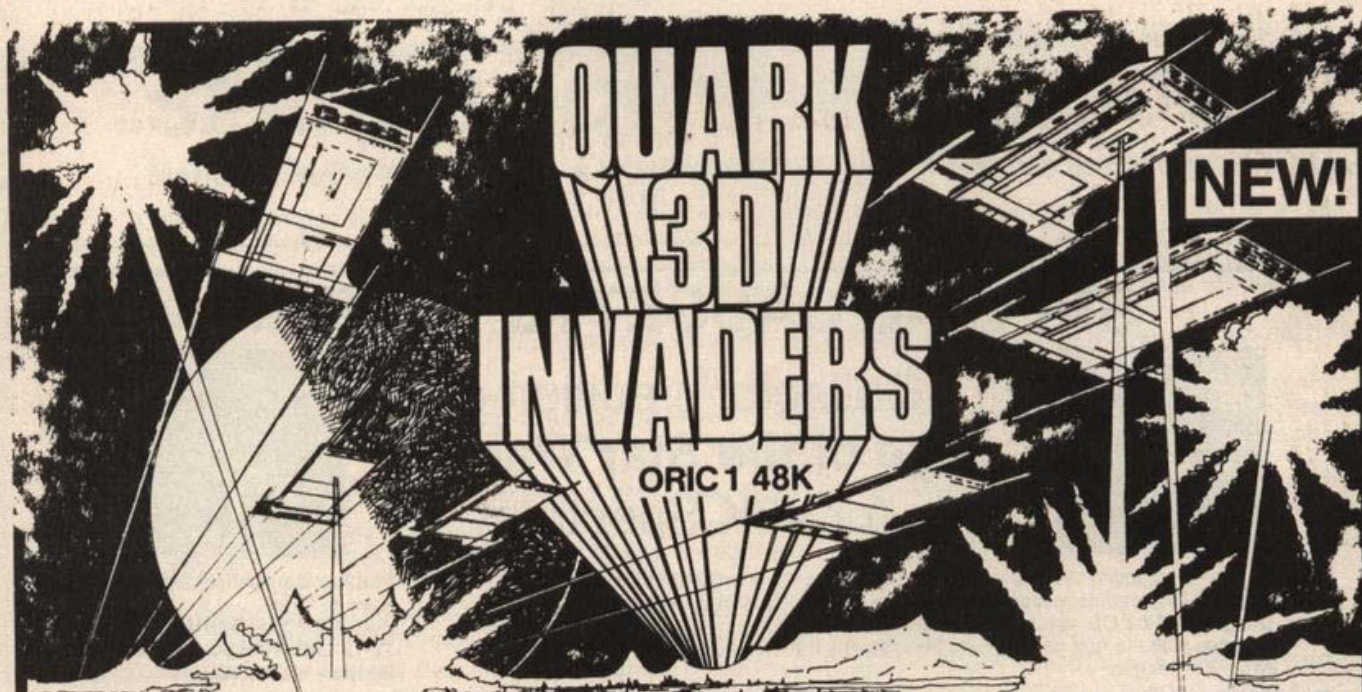
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OPEN FORUM

```

3000 PEM OFFER POSSIBILITIES
3001 CLS
3004 PRINT AT 6,6;"IS MY MASTER READY?"
4200 GO SUB 3900
4210 IF INKEY$ ="n" OR INKEY$ ="N" THE
N GO TO 9100
4220 IF INKEY$ ="y" OR INKEY$ ="Y" THE
N GO TO 2000
4230 GO TO 4210
4500 REM CHOSE CORRECTLY
4510 PRINT AT 9,19;"WELL DONE!"
4520 PRINT AT 11,19;"YOU GOT IT"
4530 PRINT AT 12,19;"RIGHT!"
4540 PRINT AT 14,19;"WONDERS NEVER"
4550 PRINT AT 15,19;"CEASE!"
4560 GO TO 4190
5000 PEM MISSED CORPECT SQUARE
5010 PRINT AT 9,19;"MISSED IT!"
5020 PRINT AT 11,19;"YOU CAN'T"
5030 PRINT AT 12,19;"HAVE BEEN"
5040 PRINT AT 13,19;"CONCENTRATING"
5050 GO TO 4170
9000 PEM SUBROUTINE - DRAW BOARD + NUMBE
R SQUARES
9005 PRINT AT 2,0;B$
9010 GO SUB 3100
9020 PRINT B$: PRINT : PRINT B$
9030 GO SUB 3100
9040 PRINT B$: PRINT : PRINT B$
9050 GO SUB 3100
9060 PRINT B$
9070 FOR N=0 TO 2
9075 FOR M=0 TO 2
9080 PRINT AT 4+(N*6),3+(M*6);N*3+M+1
9085 NEXT M
9090 NEXT N
9095 RETURN
9100 FOR N=1 TO 3
9110 PRINT AS
9120 NEXT N
9130 RETURN
9200 PEM SUBROUTINE - WAIT FOR KEY PRESS
9205 IF INKEY$ <> "" THEN GO TO 3900
9210 IF INKEY$ ="" THEN GO TO 3910
9220 RETURN
9300 PEM SUBROUTINE - SAVE AND VERIFY
9305 SAVE "COMMUNICAT" LINE 1
9310 PRINT "NOW VERIFYING"
9320 VERIFY ""
9330 PRINT "VERIFIED"
9340 RETURN
9100 PEM 0000SET SCREEN FOR EDITING
9105 FLASH 0: PAPER 7: BORDER 7: INK 0:
BRIGHT 0
9110 CLS : STOP
3005 PRINT : PRINT " PRESS ANY KEY TO LE
T ME START"
3006 PRINT TAB 7;"QUESTIONING HIM."
3010 GO SUB 3900
3015 PAPER 4+( RND *3): BORDER RND *7:
CLS

3020 GO SUB 8000
3022 FOR N=1 TO ( RND *15)
3023 BORDER RND *6
3024 BEEP RND /4, RND *(N*2.5)
3026 NEXT N
3030 GO TO 3030+( RND *5)
3031 PRINT AT RND *5,19;"THIS ONE?": G
O TO 3038
3032 PRINT AT RND *5,19;"THIS?": GO TO
3038
3033 PRINT AT RND *5,19;"THAT ONE?": G
O TO 3038
3034 PRINT AT RND *5,19;"IS IT THIS?":
GO TO 3038
3035 PRINT AT RND *5,19;"MAYBE THIS?":
GO TO 3038
3036 PRINT AT 7,21;"(Y/N)"
3060 INK RND *3
3080 IF FIRST=1 THEN GO TO 3160
3090 REM SELECT RANDOM POSITION FOR IND
ICATOR
3100 LET LINE=3+(( INT ( RND *3))*6)+( R
ND *2)
3120 LET COL=2+( RND *2)+(( INT ( RND *3
))*6)
3125 REM CALCULATE WHICH SQUARE IT'S IN
3130 LET THIS=3*(LINE>6)+3*(LINE>12)+(CO
L>5)+(COL>11)+1
3131 REM DISALLOW IF CHOSEN ALREADY
3132 IF FS(THIS)="0" THEN GO TO 3100
3134 LET FS(THIS)="0"
3140 PRINT AT LINE,COL; FLASH 1;"■": GO
TO 3300
3150 PEM POSITION FIRST INDICATOR TO SHO
W CHOSEN SQUARE
3160 LET LINE=3+(( INT ( RND *3))*6)+ VA
L CS(CHOSEN)
3180 LET COL=2+ VAL DS(CHOSEN)+(( INT (
RND *3))*6)
3190 LET FIRST=0
3200 GO TO 3130
3300 INK 0
3400 GO SUB 3900
3500 IF INKEY$ ="y" OR INKEY$ ="Y" THE
N GO TO 4000
3510 IF INKEY$ <> "n" AND INKEY$ <>
"N" THEN GO TO 3500
3520 IF THIS=CHOSEN THEN GO TO 5000
3530 GO TO 3015
4000 PEM CHOSEN CUPRENT SQUARE
4030 IF THIS=CHOSEN THEN GO TO 4500
4150 PRINT AT 9,19;"WONG!": AT 11,19;"
WETCHED"
4160 PRINT AT 12,19;"HUMANS!"
4170 PRINT AT 14,19;"IT WAS": AT 15,19;
"NUMBER ";CHOSEN
4180 PRINT AT 17,19;"O.K., STUPID:"
4190 PRINT AT 13,19;"WANT TO PLAY": AT
19,19;"AGAIN? (Y/N)"

```

Communicator
by S Springett

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OPEN FORUM

Steer

on Dragon 32

The object of the game is to steer a car round a jagged track using one joystick. If the car should collide with the track edge or hit one of the chicanes, then it stops and you have a four-second delay. Times are

recorded and the lowest current time displayed. The program plays a tune to show you when a crash occurs.

The program is easy to run with full instructions embedded into it. It uses high-resolution graphics in colour set one. After a few games you should be more of an expert with the joystick so that this simple game is suitable

for people of all ages.

Program notes

190	Initialise lowest score
210-220	Set high-resolution graphics
230-420	Draw the circuit
430-450	Start the race
460-500	Move the car using the joystick
510	Crash?
520-620	Cross the finish line and times
630-720	Instructions

```

100 ' *****
110 ' ***      STEER      ***
120 ' ***      B Y      ***
130 ' *** MARTIN YEANDLE ***
140 ' ***      POOLE      ***
150 ' ***      (C)      ***
160 ' *****
170 '
180 '
190 L=10000
200 GOSUB 630
210 PMODE3,1:SCREEN 1,1:PCLS
220 COLOR 6,5
230 DRAW "BM20,0R40D20F10H10E20R20
D10U10R20F20R20E20D40G10E10R20
H20U20R40F20"
232 DRAW "D40L20G40U10D10L20H30F10
D20L20H20U20E20L20H10F10G20L20
G20L20D20R20"
234 DRAW "E20R20D20R20F20R20D10U10
R20E20R20D10U10E20F20D20L10R10
G30E10R20D40"
236 DRAW "H10F10L40U10D10L20H20L20
U10D10G20L20U20H10"
240 DRAW "F10D20L40H20G20L20"
250 DRAW "BM0,20R40E10G10F20R20U30
D10R40U10D10F20R20E10G10D20R40
E20H30F10R20"
252 DRAW "D20F10H10G40L20H20L20D20
F10H10U20E20H20L40D20L40D20L20
G20D20F20R20"
254 DRAW "E30G10F20R20F20U10D10R40
U10D10E20R20E20R10L10D20G20D20
R20E10G10L40"
256 DRAW "D10U10H20L20G30E10H20L20
D20F10H10L20D10"
260 DRAW "U10H20G20L20"
270 DRAW "BM10,0R244D191L254U181"
280 PAINT(65,10),8,6
290 PAINT(20,40),8,6
300 PAINT(210,25),8,6
310 PAINT(60,130),8,6
320 PAINT(150,10),8,6
330 PAINT(150,50),8,6
340 PAINT(185,35),8,6
350 PAINT(250,30),8,6
360 PAINT(90,70),8,6
370 PAINT(190,130),8,6
380 PAINT(70,10),8,6
390 PAINT(150,170),8,6
400 COLOR 7,5
410 DRAW "BM10,160D20"
420 COLOR 7,5

```


SOFTWARE FOR THE DRAGON all machine code

MAURICE MINOR — NEW

Out for a quiet drive in your Morris Minor when, you inadvertently wander on to a race track and find yourself in the middle of a Grand Prix. To turn back against the other cars would be suicide. The only thing to do is grit your teeth, grip the wheel, put your foot down and make for the finishing line and safety. If you can avoid the crash barriers and oil slicks, drive fast enough to avoid being run over by Mario and Nelson behind you, then you can think about overtaking the cars in front. Can you make it before your car falls to pieces? Another superb Arcade style game with animated high resolution colour graphics and sound. Requires one joystick.

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VULTURES — (uses one joystick)

FAST MOVING GALAXIAN TYPE GAME in full colour with Hi-Res graphics and sound. A flock of vultures guard their eggs. As they swoop towards you try to kill them, but watch out. Just when you think you have killed them all, the eggs hatch!
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BONKA

ADDICTIVE Arcade style game in full colour. Climb the ladders and dig holes to trap the "Meanies" before they kill you. 4 selectable speeds and choice of 1 to 9 Meanies to start. NO JOYSTICKS NEEDED.
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OPEN FORUM

```

430 DRAW "BM0,0P0"
440 I=0:J=0
450 TIMER=0
460 X=JOYSTK(0):Y=JOYSTK(1)
470 IF X>48 THEN I=I+1:IF I>255 THEN
    I=255 ELSE I=I:Z=PPOINT(I,J):
    DRAW "R1"
480 IF X<18 THEN I=I-1:IF I<0 THEN
    I=0 ELSE I=I:Z=PPOINT(I,J):DRAW
    "L1"
490 IF Y>48 THEN J=J+1:IF J>191 THEN
    J=191 ELSE J=J:Z=PPOINT(I,J):
    DRAW "D1"
500 IF Y<18 THEN J=J-1:IF J<0 THEN
    J=0 ELSE J=J:Z=PPOINT(I,J):DRAW
    "U1"
510 IF Z=6 THEN PLAY "L6CCL12CDEFL
    600GE"
520 CLS:IF I<10 AND J>160 THEN T=
    TIMER/50:GOTO 540 ELSE 460
540 CLS 8
550 PRINT @ 32,"YOUR TIME WAS";T;"
    SECONDS"
560 IF T<L THEN L=T
570 PRINT @ 256,"BEST TIME SO FAR
    IS";L;"SECS"
580 PRINT @ 352,"DO YOU WANT TO PLAY
    AGAIN";
590 F$=INKEY$:IF F$="Y" THEN 210
600 IF F$<>"N" THEN 590
610 PRINT @ 416,"THANKS FOR PLAYING"
620 END
630 / *** INSTRUCTIONS ***
640 CLS 3:PRINT @ 45,"STEER";
650 PRINT @ 96,"IN THIS GAME WHICH
    IS CONTROLLED BY A JOYSTICK, YOU
    MUST TRY TO";
660 PRINT " STEER A LINE ALONG A
    CIRCUIT WITHOUT HITTING THE
    EDGES."
670 PRINT @ 256,"EACH TIME YOU
    COLLIDE WITH THE SIDES, YOUR
    CAR WILL STOP AND"
685 PRINT " DELAY YOU FOR ABOUT
    4 SECONDS."
690 GOSUB 730
680 CLS 4
690 PRINT @ 32,"THE OBJECT OF THE
    GAME IS TO COMPLETE THE
    CIRCUIT AS QUICKLY"
695 PRINT " AS POSSIBLE."
700 PRINT @ 160,"WHEN THE JOYSTICK
    IS IN THE CENTRAL POSITION,
    YOUR CAR"
705 PRINT " WILL BE STATIONARY."
710 GOSUB 730
720 RETURN
730 PRINT @ 482,"PRESS SPACE END
    TO CONTINUE";
740 F$=INKEY$
750 IF F$<>" " THEN 740
760 RETURN

```

Steer
by Martin Yeandle

Microradio

GW6JJN



Amateur tv

Every now and then a program comes along that shines out among the rest. Such a program is ATV, published by the Worthing and District Video Repeater Group; it costs £5.50 from Robin Stephens, 'Toftwood', Mill Lane, Worthing, Sussex. ATV stands for amateur television and, to do the program justice, it was tested by one who knows about such things, Paul G4INP.

This is what Paul had to say: "ATV is probably the most impressive program yet seen in

the amateur radio context. Designed for the 48K Spectrum in conjunction with a fast-scan high-definition TV transmitter, ATV has 36 features which generate first-class pictures to send direct from the micro.

"Amongst the features are: a real-time clock which can be displayed at one of two screen positions and in one of two character sets; two test cards with users call sign inserted; two maps; cross-hatch; flags; colour bars and patterns. User input text may be scrolled across the screen and letters may be magnified. An impressive demo mode is also included.

"From the point of view of an ATV'er, I have no doubt that this program offers an elegant and versatile solution to picture generation. Robin Stephens, the programmer, is to be congratulated on producing a well-designed robust

program which serves its purpose very well and, indeed, shows the Spectrum to be a very good graphics machine in its own right. Robin is G8XEU and can be contacted at the above address; please enclose a SAE with any enquiries."

Although I am not really into amateur television, I enjoy good programming. ATV is written entirely in machine code and in its presentation could teach many software houses a thing or two. For example, there is only one program to load which incorporates its own screen, without the need for loading basic loader plus screen plus program as in most commercial software.

The graphics are breathtaking and when the program draws the Union Jack in high resolution it is hypnotic. The test cards into which one can put one's own callsign are ev-

ery bit as good as those on the telly.

The high-res maps are my favourite, except perhaps for the real time clock display in hours, minutes, seconds and tenths which looks like the kind of thing that is on the screen during Olympic events.

I think it is clear by now that I am very enthusiastic about ATV and I certainly give it full marks.

If it were to be left in demo mode in your high street computer shop, it would sell a lot of Spectrums. W H Smith, take note.

Ray Berry GW6JJN

This series of articles is designed for radio and microcomputer enthusiasts alike. If you have any queries that you want answered, hints and tips to share, or topics that you would like to see covered, write to: Ray Berry, Microradio, Popular Computing Weekly, 12-13 Little Newport Street, London WC2R 3LD.



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Adventure writing

There surely can't be any adventurer who has not occasionally taken time off from trying to squeeze through a narrow cleft in the rock, or open the jewelled egg, to sit and gaze at the screen and wish that he or she could write an adventure for a microcomputer. One or two, of course, don't have to wish, but for the rest of us, the imagination is willing — it is the programming skill that is weak!

Your wish is now granted (at least if you are a Spectrum owner). Some weeks ago (PCW Vol 2 No 50 to be exact), I mentioned *The Quill*. This package, from Gilsoft, is an adventure-writing aid, and does for adventurers what programs like *Hurg* from Melbourne House, and the *Games Designer*, from Quicksilver, do for the arcade fan. *The Quill* sits between the user and the computer's operating system — that is, it handles all the coding for the author, allowing his imagination to run riot.

Many of the adventure-oriented software houses run a similar, self-written program. Scott Adams, for instance, uses his own "generator", merely rewriting the scenario for each adventure. Closer to home, Level 9 operates in a similar way, using their "A-code" compiler as a framework on which to build their excellent adventures. The latest release, *Lords of Time*, was written by Sue Gazzard. Having written the storyline, she then passed it on to Level 9's programming team, who constructed the adventure... and it's another winner!

The Quill, however, is available to anyone with £15. To describe it briefly (refer back to this column in the aforementioned issue, and the December issue of *Micro-adventurer* for more detailed reviews of the program), the author draws a map of his adventure and then constructs a list of the locations, along with all the objects and puzzles, words that the computer should recognise and types them in, using *The Quill*. The program does the rest, and what comes out at the other end is a full-blown, machine-coded adventure.

The framework supplied by *The Quill* takes the standard text form: that is, the location is described, together with the objects to be seen, and then the computer waits for your command. The format used in *The Quill* is of the "I'm in the..." kind,

but the user can easily change this to "You are in...", by using a file already supplied. The difference is subtle, but major, I think.

Colour is under the full control of the user, with text and background colours being easily selected, as well as individual words, which may be highlighted by *Flash*, *Inverse* or *Bright*. Sound is also catered for, although *The Quill* is not particularly ambitious in this area. User-defined graphics may be defined beforehand, from Basic, and then loaded into the database.

All this is very clearly described in the large, 52-page manual. Using this, anyone with the minimum of experience can construct an adventure, with imagination the only limit.

Gilsoft have available, for £2, a demo tape which shows the capabilities of *The Quill*. A new adventure, *Magic Castle*, has also just been released, written with *The Quill*. Unfortunately, I believe it does not do justice to the compiler. It is a good, tough adventure in the traditional mould, complete with torches to be lit, keys to be got, forests and minefields in which to get lost and so on. Such is the reviewer's lot that I haven't ventured far into the adventure, and it may burst into *Zork*-like brilliance in later stages. But so far as I have played it, it is like a steam pudding, satisfying but rather stodgy!

At £6 I find it rather expensive. It would make a good demonstration tape of *The Quill*, but as I've said, Gilsoft already have one available.

Mindbenders from Paul Styles

As for third party adventures written with *The Quill*, Gilsoft don't, I'm glad to say, expect to receive royalties, being content with a mention in adverts and so on. The subject of royalties for the use of compilers in writing games software must be a dead duck — the cost of collecting would outweigh the royalties received. Imagine having to buy a copy of every games tape.

One or two programs have appeared recently written with the aid of *The Quill*, and now reader Paul Styles has sent me a copy of his adventure, *Mindbender*. In his covering letter, Paul admits that "it is an entirely amateur production — I am merely an adventure fan". Merely! Anyway, *Mindbender* is exactly what I hoped would result from *The Quill*. Released from the burden of having to write the code as well as the scenario, with all the headaches that poses for most of us, Paul has come up with a smashing adventure.

The adventure starts in my favourite way, at an innocent location with a not too difficult little puzzle as a teaser, to draw the player gently into the main game. In this case, you are sitting in your office — on the desk before you are a diary, a telephone and, of course, a Quill! You can fiddle about with these for a little while, savouring the comments (try phoning home, or reading the diary), until, after a certain time, the

phone rings. A voice with an odd, lilting accent mumbles something in Welsh. It could be relevant to the adventure, but to me, it looks like "Wales rools OK"! The net result is that you find yourself falling... falling...

The ensuing escapade through some 100 locations is a highly imaginative, well-plotted romp. Styles' fondness for all things Wales-ish crops up from time to time. You cannot just eat any old food when you feel faint and hungry. You'll find a wide choice, but the presence of leeks might ring some bells.

Although the scenario is enjoyable, the puzzles are as tough as any adventurer could wish for. There are none of those awful "Oh dear, you seem to have slipped and broken your neck" remarks. Any accidents you have are a result of your own carelessness, but mostly, you'll find several ways of approaching the various puzzles.

In sum, the environment is tough but entertaining and most actions will have some effect, so that the player can move around fairly fast, although not always with pleasing results. Paul has used *The Quill* to very good effect in writing *Mindbender*, with good use of colours and sound (witness the telephone ringing, an obvious device, but not used before on the Spectrum to my knowledge). I can recommend *Mindbender* as an excellent adventure, and as an encouragement to those of you who may be thinking of trying *The Quill*.

Stop press! Just as *The Corner* went to press, I heard that *Mindbender* is now to be marketed by Gilsoft at £5.95.

The Peterborough company, Applications, has also used *The Quill* to write their latest release, *Denis through the Drinking Glass*, which is a comic adventure about the Iron Husband. Some of you may remember my comments, some months ago, about having to occasionally join the queue in the office to get a chance to see a program. Such is the case here... I haven't actually seen this one, but Graham "Grand Wizard" Taylor is sitting hunched before a monitor, mumbling "Great... Fantastic!" He assures me that it is one of the funniest, and diabolically logical, adventures he has seen.

Applications has also just released *Archimedes' Magic Screw*, in which you have to help him find the secret of the Universe (and the soap). DTDG's follow-up is *The Tebbit!* *The Quill* and Applications seem to have made a perfect union!

See you at the nineteenth, Bill, toodle-pip!

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FOOTBALL MANAGER

Peter May of Dudsbury Road, Sidcup, Kent, writes:

Q Recently, I saw Addictive Games Football Manager and I was very impressed with it. But, my friend has a Spectrum, and I would like to know if it is available for a Commodore 64?

A This game is not available on the Commodore 64 as yet, but with the big Christmas sales of this machine you might see a version sometime this year. You might be interested in another program called International Soccer which is a cartridge available from Commodore for £9.99 and is one of the best simulations I have ever seen.

COMPATIBLE DRIVE

P Buckton of Tollys Mill, Cambridgeshire, writes:

Q Having recently invested in a Commodore 64, I am getting along very nicely. A friend is selling off a Vic20, with a lot of attachments including a disc drive (1540). He is willing to sell me the drive separately. Is the 1540 compatible with my Commodore 64?

A All that will need to be done is that the Rom within the drive will have to be changed. The 1540 is called an intelligent drive because it has its own 6562 cpu, and its own Rom; it also has 2K of Ram. This means that it can get on with such things as formatting discs, while the computer is doing another task. You will have to ask your Commodore dealer to get the correct DOS, otherwise I cannot see that you should have any problems assuming that

the drive is in correct working order.

ROM AND RAM

S Golding of Setters Hill Estate, Baltasound, Unst, Shetland Islands, writes:

Q Being a novice, when it comes to writing programs in Basic, am I right to say that a program is converted to numbers by the Rom and then stored as numbers by Ram? If so, could you enlighten me on the saying that machine code is faster than Basic? Why is this true if machine code consists of numbers?

A Yes and no. The computer stores the commands as a series of one-byte tokens — on the Spectrum these are between 128 and 255. Try these three lines:

```
10 FOR a = 128 TO 255
20 PRINT CHR$(a);
30 NEXT a
```

When a program is Run, the computer will take each phrase in sequence, read it and then call necessary Rom routines to execute it. This reading and executing phrase by phrase is called interpreting. Each phrase is interpreted separately, as the computer progresses through the program.

The process of interpretation takes a long time, hence the use of machine code, which by-passes the calling and reading of each token in turn and deals directly with the cpu. Consequently, it is faster.

A BUS AND A LINE

Matthew Barnes of Reading Road, Twyford, Berkshire, writes:

Q Please could you tell me the difference, if any, between a line and a bus? And could you tell me whether a data bus and data line are different from an address bus and an address line?

A There are four words here that need defining. A line is a single connection between two points. A bus, on the other hand, is several of these connections that run from one group of connections to another. Thus, a group of lines between say the cpu and the Ram would be a bus.

Data and address refer to the type of information carried on the line or bus. A data bus or line carries just that, data. Obviously, address refers to lines that carry addresses.

SPECTRUM PRINTER

S Alrega of Alwyn Drive, Longsight, Manchester, writes:

Q I intend adding a proper printer to my 48K ZX Spectrum. Could you let me know the points I should bear in mind when buying a printer? Is there a place that I can buy second-hand printers? I want the printer to be able to support Spectrum graphics, and user defined graphics.

A There are a few important things to bear in mind when hooking up your Spectrum to a proper printer. First of all, you will need an interface — probably a centronics one is the best to buy — Hilderbay, Kempston, Morex and Tasman all do reliable ones.

The next thing to decide on is the type of printer you need — what will you be using it for? If the answer is mainly program listings and just home uses then probably what you need is a dot matrix printer. You can buy these from around £200 second-hand or £250 new. A big advantage of this type of printer is that, since all the characters are created from dots, there are usually many more options as to what style of print you use, sometimes even a choice of character sets.

However, if you intend to do a lot of word processing and formal letter writing you might feel you need typewriter quality print — in which case go for a daisywheel printer which actually prints in the same way as most typewriters, ie, with a hammer action. These cost around £350 upwards.

So far as the question of graphics is concerned, I'm

afraid the news is not good — what the printer can print depends totally on what characters it, rather than the computer, is supplied with. This rarely includes many graphic shapes and never user defined graphics. If you list programs with these in them, you are likely to get either a space or a question mark printed. Only if someone brought out a printer specially designed for the Spectrum, but using full width plain paper, would you be likely to get all the features you require.

For T Harper of Merseyside and Alison Donald of Stirling, Stellar Services of 8 Firtree Vale, Leeds LS17 7EY markets an astrology program for the 48K Spectrum. The same company also makes astrology programs for the Dragon 32 and 16K ZX81. The ZX81 program comes in two parts, costing £8 and £10, while the Dragon program costs £15. I'm afraid that I have not been able to find an astrology program for the Lynx.

Bob Thomas of Crosby, Liverpool, and F Farmer of Cleethorpes, will be pleased to know that the Tandy CGP 115 can be used with the BBC computer. It would take an article to deal with the subject, which is what we had in Vol 2 No 14 written by Dan Smith.

G Bennet of Newbury, D Hawkins of Great Missenden and Val Jenkins of Carlisle, would like to know if the new Atari range of computers will run existing Atari software. Fundamentally there is not a great deal of difference between the new machines and the old 400 and 800. The new models will run most existing Atari software. They have had the few bugs there were removed, and some new features added. With a completely new, and probably cheaper re-styling of the various units within the system, you get the new X1 range. There are no plans at the moment for the entire range to be available over here.

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem Peek it to Ian Beardsmore and every week he will Poke back as many answers as he can. The address is Peek & Poke, PCW, 12-13 Little Newport Street, London WC2R 3LD.

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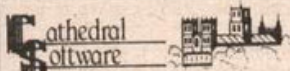
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For sale

48K LYNX includes manual + demotape, all leads, Nimerons, Master Mine, Power Blaster, Colossal Adventure, NILUG membership + Lynx user mags + progs, all £150 ono. Tel: Portsmouth 0705 388167.

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ORIC 1 48K, 3 months old approx, still under guarantee, various games and books, sell for £120. Tel: Hornchurch 42642, after 4.30 pm.

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Computer Swap entries are limited to 30 words. Either fill in the accompanying form and send it to Computer Swap, Popular Computing Weekly, 12-13 Little Newport Street, London WC2R 3LD or telephone 01-437 4343.

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FOR SALE — Atari software, including some latest releases on disc and Rom. All originals, and at less than half-price. Tel: Slough 71392.

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ACORN BBC Disk Drive with around £400 of software, good condition, sell for £165, also DFS £55. Tel: 01-574 4122.

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Wanted

SWAP 12 DRAGON/TANDY cartridges plus some cassette software for colour TV/monitor or swap for printer. Tel: 01-821 1710 after 8 pm.

SPECTRUM GAMES to exchange. Please send your list of available tapes to exchange. I have over 50 top tapes, 15 Norwood Drive, Brierley, Barnsley S72 9EG.

WANTED. Acorn etechron software, eg, Twin Kingdom Valley, Snapper, Pergi etc, also preferably other Acornsoft cassette and books or sound graphics, etc. Tel: Richard 051-733 0090 after 4 pm, cannot collect.

MIRCODRIVE ORDER FORM for sale. Any offers? Also some secondhand software, as new, for swap or sale. Tel: 08823 254 at weekend.

SWAP YOUR VIC20 plus C2N and leads plus joystick for my Amstrad tower stack hi-fi system, double cassette, graphic equaliser and much more worth £250. Tel: Woodford 505 8989.

WANTED. Spectrum 48K software, mainly utilities and business, i.e. stock control, swap or buy. Boursaux 9 Rue, M. Regnier, 75015 Paris, France.

SWAP CBM64 Colossal adventure for level 9 or channel 8 adventure. Tel: 0889 270920, after 4.30 pm.

WANTED. Any Commodore 64 or 48K Spectrum with software. Tel: 01-881 2525 (Wood Green) D. Smith, after 8 pm.

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COMMODORE 64 with/without peripherals. Tel: Chepstow 70942.

WANTED. 48K Spectrum with leads and manuals, perfect condition (no tape recorder needed), willing to pay between £50-£70. Tel: Andy, 958-8643, after 4 pm.

COMMODORE 64 WANTED for around £100. Tel: 021-773 3521.

WANTED. A printer for between £100-£200 or below, write with printout and details to James Main, Chenies House, Top Street, North Wheatley, Retford, Notts. DN22 9DB.

WANTED. Joystick + interface, any make, must be in mint condition, offering 3D Tunnel, Androids Galaxy Attack, Hungry Horace, Intruders, Meteors + Zoom. Write to Derek Scott, 26D Harden Place, Hawick, Roxburghshire.

BBC GAMES FOR SWAP. Paras, Battlezone 2000, Demon Decorator, Hunchback, Attack on Alpha Centauri, Gunsmoke. Tel: Canterbury (0227) 58529.

ZX81s for sale

48K SPECTRUM plus lots of software. Over six months guarantee, £110 on. Tel: Anil, 01-571 2824.

SPECTRUM 48K, £100; £80 of software, seven books. Offers! Tel: 01-892 8611 after 6 pm (Twickenham).

SPECTRUM SOFTWARE BAR-GAINS: Flight Simulation, Arcadia, Cruising, Orbiter, £3 each or £10 for the lot. First offer accepted. Tel: 01-348 3924.

SPECTRUM SOFTWARE for sale. 16K £2.50, 48K £3.00. Titles include: Alchemist, Push Off, Jetpac, Psst, Cookie, Arcadia Galaxians. Send sae to M. Turley, 50 Athol Street, Middlesbrough, Cleveland TS1 4LB.

ZX81, 16K plus DKTronics cased keyboard, 4K graphics Rom, UDG rept. module. All worth £130. Over £100 software. Excellent condition. Sell £85 on. Tel: Swindon 0793 763247.

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ZX81 ORIGINALS FOR SALE. Football Manager, Galaxians, Othello, Fantasy Games, Backgammon, Games-tape 2, £10 the lot or swap Spectrum games. Barnsley 0226 710119 after 6 pm.

SELL ZX81 GAMES including Pacmen, Invaders, ZX Gulp, Flight Simulation, Mazogs, Super Ghooper, Psst, Frogger, Fantasy Games, QS Scrabble, Invasion Force, £3 each tape (Mazogs £6). Tel: Hornchurch, Essex 42642.

ZX81 16K Ram, Hopper, QS Scramble, 3D Monster, Flight, and ZX Gal. also cassette recorder, neat, bargain for £80 on. Tel: (0623) 640829 (Mansfield) or will swap for 48K ZX Spectrum.

ZX81 16K, Filesixty keyboard, software plus 14in b/w portable tv. As new condition, £60 on. Tel: 0742 740208 after 6 pm.

LARGE COLLECTION ZX81 BOOKS, £1.50 each, sae list. Machine code test tool, Artic Chess, Psion Chess, £2.50 each. Pearson, 52 Stocks Green, Castle Acre, King's Lynn, Norfolk.

ZX81, Basic, leads and accessories, £30 on. Tel: (0753) 45306.

16K ZX81 and printer plus two books, manual, cassette, leads and games (3D MM etc), £80. Tel: Llanarman-Ynal (082 43) 259.

SPECTRUM 48K, printer, Ferguson cassette, £200 of software, including: Scrabble, Address etc, £200 for the lot, quick sale. Tel: 01-958 7127 after 8 pm.

48K SPECTRUM, amplifier, joysticks, interface, programmable interface, software including: Jetpac, Atic Atac and magazines, £150 or swap for Commodore 64 and tape recorder. Tel: Minsterworth 494, ask for Martyn.

ORIGINAL SPECTRUM SOFTWARE for sale: Flight Simulation £2.50, Spectrum Computing Nos. 1 and 2 £2 each. Tel: David, Reading (0734) 661401 after 4 pm. Also Horizons for £1.50.

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48K SPECTRUM with £350 of software. Sell for £290 on. Tel: 01-903 4062 after 5 pm.

SPECTRUM SOFTWARE for sale. One-third of original cost plus 50p p&p: Valhalla, Scrabble, Timegate, Chequered Flag, Arcadia Chess, Hunter-Killer (Protect), Harrier, Monopoli, Android 2, Backgammon and many more. Tel: 0702 617608.

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48K SPECTRUM. Mint condition and software including Alchemist, Snowball, Quill and cassette recorder, worth over £300, sell for £200 or swap for Commodore 64 (plus cassette deck). Tel: 01-421 1108, ask for Simon.

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ISBN: 0 946408 04 1

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NEW RELEASES

BLUFF

Over the Christmas period it's possible some of you indulged in a little bit of gambling (I'm not going to name names) — perhaps at cards.

Well, if you thought it was humiliating being blitzed by a human opponent, try being beaten by a machine. *Brag* for the 48K Spectrum does everything a human adversary would do including bluff, except that it does it better.

Brag is actually one of the most entertaining games I've played in ages, simply because the idea of trying to 'out-psyche', ie, bluff, a computer that you have a wonderful hand when in fact it stinks, is so appealing.

The computer doesn't cheat, but you may find it pretty difficult to believe on occasion — my advice would be not to play this game near breakable objects.

Program *Brag*
Price £4.95
Micro Spectrum 48K
Supplier T Lebon Little Brays
Brays Lane
Rochford
Essex SS4 3RP

ROVING EYES



Danger Ranger is a sort of *Manic Miner* for the Dragon 32. The author is Ken Kalish who also wrote *Phantom Slayer* and *Invaders Revenge*.

There are several screens of action as you try to move your hero through the chamber of pasha to the acid chamber, collecting treasure chests as you go.

To leave the first chamber, you must collect 10 keys which are located at the ends of a series of platforms. Attempting to thwart your attempts are floating urns, radioactive bats and roving eyes — these must either be avoided or blasted with your laser.

The joystick is used to make *Danger Ranger* walk left and right or duck and jump. As is common with Microdeal's games, there is a choice of screen colour.

Program *Danger Ranger*
Price £8
Micro Dragon 32
Supplier Microdeal
41 Truro Road
St Austell
Cornwall PL25 5JE

50 SCREENS

Bubble Trouble is an arcade game with definite *Prisoner* overtones, in that the baddies are large balloons that suffocate you on contact.

There, however, the similarity ends. You are a burglar whose aim in life is to steal things — stealing things accumulates points.

Your only defence against the nasty rovers is your fire button which sends them scurrying back to wherever it is that balloons live — the problem is, though, that it only works intermittently, once every 10 seconds in fact.

There are 50 screens of action and a choice of three skill levels. Even the slowest is supposed to be pretty fiendish.

Program *Bubble Trouble*
Price £5.95
Micro Spectrum 48K
Supplier Arcade Software
Technology House
32 Chislehurst Road
Orpington
Kent

HIGH RISE

It may seem a bit surprising, but there are not all that many versions of that old standby *Bomber Run*, also called *Blitz*, on the Commodore 64.

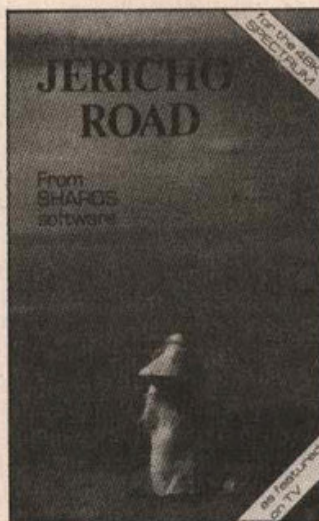
In fact *Bomber Run* by Soft Cell is the first I've seen. It's a version of the one printed in this magazine a few months ago, but now largely converted into machine code and with

other new features.

The idea of the game, simply, is to bomb a space for your aircraft to land in a city of high rise blocks before your fuel runs out — it's a mixture of 'shoot em up' and tactics to score really high points.

Program *Bomber Run*
Price £4.95
Micro Commodore 64
Supplier Softcell
28 Atkinson Drive
Newport IoW

BIBLE BELT



Jericho Road is a text adventure game based on themes from the Bible. The program is set in southern Israel and you must survive Roman occupation and cope with religious persecution.

Your task is to undertake a special mission on behalf of the downtrodden minority and help decode an ancient puzzle.

Other than the religious themes the game is basically a standard text adventure. It understands the usual two-word commands like *Go North* or *Get Donkey* (well, it makes a change from *Get Magic Ring*) and there is a Help routine.

There are apparently several ways of accomplishing your objectives, so the game does not provide a Save routine. For younger players, there is a slightly simplified version of the game on the same tape.

Program *Jericho Road*
Price £5.95
Micro Spectrum 48K
Supplier Shards Software
189 Eton Road
Ilford
Essex IG1 2UQ

TAKE-OFF

There have been a number of letters recently asking for a *Flight Simulator* for the Vic20 which will run on the unexpanded machine. Given the number of different calculations required to produce a simulation that is even half way reasonable, it seemed unlikely to fit one in 3.5K.

However, *Flight 015* is just that, a game in which you take off, fly and land an aeroplane using 10 instruments.

It's supposed to be a difficult game to master and obviously the graphics have to be limited, but all the control instruments are displayed and the Vic's sound is used to great effect.

Program *Flight Zero One Five*
Price £5.95
Micro Vic20
Supplier AVS
Ferranti House
Grafton Way
Basingstoke
Hampshire RG22 6HY

BAITED



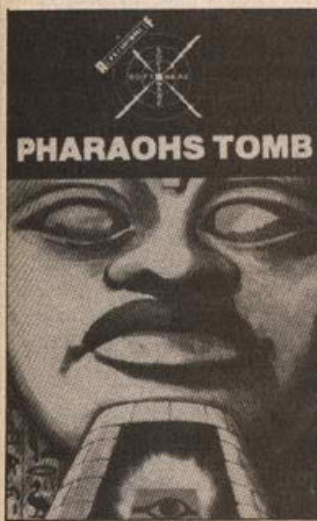
Hooked is a fishing game for the Dragon 32. You might think that fishing is an unlikely sport to be computerised, its appeal depending, seemingly, on outdoor things like the lap of the water, the cry of the birds, the mustard in the sandwiches, still...

Hooked is for one or two players and you must try to catch as many fish as possible by judging the correct positioning and strength for the cast.

Should you actually manage to hook a fish you must then land it, guiding it into the bottom of the landing net. The computer keeps score, allotting points according to the species and weight of each fish caught.

Program *Hooked*
Price £5.75
Micro Dragon 32
Supplier Shards
189 Eton Road
Ilford Road
Essex IG1 2UQ

ANAGRAMS



Pharaoh's Tomb is an adventure game for the Electron. Your task is to find a Pharaoh's mask and 500 pieces of gold.

Puzzles in the game take the form of anagrams and logical reasoning and the input is mainly by single key presses.

Time is of the essence and if you take too long at any point to open the various doors, nasty mummies and spiders are likely to leap out at you. One of the first adventure games for the new machine.

Program *Pharaoh's Tomb*
Price £7.90
Micro Electron
Supplier A + F Software
Unit 8
Canal Side Industrial Estate
Woodbine Street East
Rochdale
Lancashire OL16 5LB

IN TUNE

For a cheap home micro the Oric has pretty good sound, much better than its nearest rival the Spectrum. Despite

this, I have seen very few music editor programs — *Composer* being one of these few.

The program allows the typing in of three-part music in any key, in 3/4 or 4/4 time up to 80 bars. This music may then be modified in many ways and the music saved on cassette.

The cassette inlay folds out to become an instruction sheet and the program comes with a demo tape of Mozart's *Eine Kleine Nachtmusik* which should soothe the most jagged post-Christmas hangover.

Program *Composer*
Price £6.50
Micro Oric 1
Supplier Sector 7 Software
PO Box 8
Newton Abbot
Devon
TQ12 1UE

INGENIOUS

Since I have never been overly impressed with adventures involving magic rings, quests, dwarves, dragons and spells, I am obviously out of touch with the majority of adventure game buyers. Nevertheless, I think that *Dennis Through the Drinking Glass* is the best text adventure I have ever played.

Given the title, one could have been forgiven for thinking that the game consisted of a couple of nice jokes and little more. In fact, it is astonishingly complex and ingeniously planned.

The object of the game is to get Dennis to the Gravediggers Arms, the first task being to get out of number ten without being spotted by Maggie.

Without giving any of the game away, let me just say that I eventually mastered this seemingly simple task after around 10 hours of play. It's reasonably logical in an *Alice in Wonderland* kind of way, but horrendously difficult to figure out.

If anyone else out there is playing Dennis, please send me, in a plain brown envelope, the answers to the following questions: What use is the Lawnmower? Can anything useful be done with the frog? What about the memoirs — how do you open them to the correct page?

This could be the place to

start if you want to try a text adventure. One final point, this game was written using the *Quill* from Gilsoft.

Program *Dennis through the Drinking Glass*
Price £5.50
Micro Spectrum 48K
Supplier Applications
8 St Pauls Road
Peterborough PE1 3DW

POACHED

Peaksoft has been providing Dragon software for quite some time now. Its latest release is a machine code arcade game called *Ossie*.

Ossie is an Osprey with a hard life. For one thing, he is responsible for the feeding of five hungry chicks. For another, poachers keep raiding his nest while his back is turned.

Using either keyboard or joystick, you must make *Ossie* dive for his dinner and fight off the poachers by "plastering" them, which is a euphemism for something fairly nasty that doesn't involve lasers.

Program *Ossie*
Price £6.95
Micro Dragon 32
Supplier Peaksoft
7 Hawthorn Crescent
Burton on Trent
DE15 9QP

VITAL LINK



Terminal Software is building a strong reputation with its Commodore software. The latest release for the Commodore 64 is *Stellar Dodger*.

This is pretty much your standard space game, although very well done. You are, as is often the case, an interstellar shuttle pilot. Your task is to provide the vital link between

your mothership and various supply dumps.

You must not only master docking and landing but also avoid ever-more dense asteroid belts. The game can be played with either joystick or keyboard and will run in demo mode if required.

Program *Stella Dodger*
Price £7.95
Micro Commodore 64
Supplier Terminal Software
28 Church Lane
Prestwich
Manchester M25 5AJ

GOLD GRABBER



Blowtorch Blaster is the unsubtle title of a new arcade game from Touchstone Software.

You play a Luke Skywalker type (Handsome Harry) self-confessed "coolest space pilot in the galaxy".

Your only interest in life is money and you accumulate this by grabbing the gold from a series of planets.

As you might expect, this involves a certain amount of landing and taking off — a difficult task made worse still by sulphur storms, energy bolts and lightning.

Program *Blowtorch Blaster*
Price £5.95
Micro Oric 48K
Supplier Touchstone
61 Highfield Road
Saxilby
Lincoln

New Releases is designed to let people know what software is coming on to the market. If you have a new game or utility which you are about to release send a copy and accompanying details to: New Releases, Popular Computing Weekly, 12-13 Little Newport Street, London WC2R 3LD.

Top 10

Commodore 64

- 1 (1) Frogger (Interceptor Micros)
- 2 (6) King Kong (Interceptor Micros)
- 3 (3) Sprite Man (Interceptor Micros)
- 4 (5) Motor Mania (Audiogenic)
- 5 (4) Lazer Zone 64 (Lamasoft)
- 6 (10) Purple Turtles (Quicksilva)
- 7 (—) Attack of the Mutant Camels (Lamasoft)
- 8 (—) Quintic Warrior (Quicksilva)
- 9 (4) Hover Bover (Lamasoft)
- 10 (8) Grid Runner 64 (Lamasoft)

Dragon 32

- 1 (1) Cuthbert in the Mines (Microdeal)
- 2 (9) Frogger (Microdeal)
- 3 (7) Mined Out (Quicksilva)
- 4 (—) Night Flight (Salamander)
- 5 (2) The King (Microdeal)
- 6 (10) Grid Runner (Salamander)
- 7 (6) Dragonfly 2 (Hewson)
- 8 (—) Ring of Darkness (Wintersoft)
- 9 (—) Talking Android Attack (Microdeal)
- 10 (4) Cuthbert goes Walkabout (Microdeal)

Vic20

- 1 (3) Arcadia (Imagine)
- 2 (4) Wacky Waiters (Imagine)
- 3 (5) Grid Runner (Lamasoft)
- 4 (2) Catcha Snatcha (Imagine)
- 5 (—) Wizard and the Princess (Melbourne House)
- 6 (6) Sky Hawk (Quicksilva)
- 7 (—) Lazer Zone (Lamasoft)
- 8 (—) Matrix (Lamasoft)
- 9 (7) Amok (Audiogenic)
- 10 (—) Plague/Alien Demon (K-Tel)

ZX81*

- 1 (5) QS Scramble (Quicksilva)
- 2 (1) Defender (Quicksilva)
- 3 (6) Asteroids (Quicksilva)
- 4 (2) Invaders (Quicksilva)
- 5 (4) Chess (Psion)
- 6 (8) Space Raiders (Psion)
- 7 (—) Fantasy Games (Psion)
- 8 (8) 1K Chess (Artic)
- 9 (10) Crazy Kong (PSS)
- 10 (—) English Literature II (Sinclair)

*All 16K except where marked. †1K only.

(Figures compiled by Boots/Websters)

Books

- 1 (2) BBC Micro Book, Basic, Sound and Graphics, McGreggor and Watt (Addison-Wesley)
- 2 (3) 30-Hour Basic, Spectrum edition, Prigmore (BBC/NEC)
- 3 (1) Advanced User Guide for the BBC Micro, Bray (Cambridge Micro Centre)
- 4 (—) BBC Disk Companion, Latham (Prentice Hall)
- 5 (7) Using the 64, Gerrard (Prentice Hall)
- 6 (6) Graphics on the BBC Micro, Cryer (Prentice Hall)
- 7 (—) Spectrum Hardware Manual, Dickens (Melbourne House)
- 8 (—) Beyond Basic, Freeman (BBC/NEC)
- 9 (10) Using BBC Basic, Cockrell (John Wiley)
- 10 (—) Mastering the Commodore 64, Greenshields (Interface)

(Figures compiled by Watford Technical Books, Watford 0923 23324 Prestel 28844)

(Last week's position in brackets)

Top 10

BBC*

- 1 (—) Martian Attack (Program Power)
- 2 (7) Killer Gorilla (Program Power)
- 3 (1) White Knight Mk 2 (BBC)
- 4 (—) Escape From Moonbase Alpha (Program Power)
- 5 (—) Hopper (Acornsoft)
- 6 (—) Android Attack (Computer Concepts)
- 7 (4) Dr Who — The First Adventure (BBC)
- 8 (3) Felix and the Fruit Monsters (Program Power)
- 9 (—) Hell Driver (Program Power)
- 10 (—) Moon Rider (Program Power)

*All Model B only.

(Figures compiled by Micro Management, Ipswich 0473 59181)

Spectrum

- 1 (1) Altic Atac (Ultimate)*
- 2 (2) Lunar Jetman (Ultimate)*
- 3 (5) The Pyramid (Fantasy)
- 4 (—) The Alchemist (Imagine)*
- 5 (3) 3D Ant Attack (Quicksilva)
- 6 (—) Penetrator (Melbourne House)*
- 7 (7) Death Chase (Micromega)
- 8 (10) Pool (CDS)
- 9 (4) Jet Pac (Ultimate)*
- 10 (—) Mr Wimpey (Ocean)*

*Requires 48K.

(Figures compiled by W H Smith and Son, London)

Atari

- 1 (1) Zaxxon (Datasoft)
- 2 (3) Enchanter (Infocom)*
- 3 (—) Choplifter (Broderbund)
- 4 (—) The Golden Baton (Channel 5)
- 5 (2) Zork III (Infocom)*
- 6 (6) Firefleet (English)*
- 7 (7) Grid Runner (Lamasoft)
- 8 (—) O'Reilly's Mine (Datasoft)
- 9 (9) Savage Pond (Starcade)
- 10 (4) Preppie (Adventure International)

(Figures compiled by Calisto Computers, Birmingham 021-632 6458)

Book Ends



MICRO GUIDE

As a general guide for people interested in the general concepts behind, and uses for, computers, rather than specific programming information, *The Penguin Computing Book* looks one of the best of its kind.

Whilst covering the usual areas of history of computers, computer languages, etc, and explaining the principles behind semi-conductors and the ubiquitous silicon chip, it also delves into some unexpected and fascinating additional areas.

There are substantial sections on the actual logic of artificial intelligence and analysis of the reasoning used in games like chess — all surprisingly clearly explained.

Other sections explain how expert systems have developed from the idea of knowledge databases. One of very few general computer books that could equally well be read by programming experts.

Book *The Penguin Computing Book*
Price £5.95
Micro General
Supplier Penguin Books
 536 Kings Road
 London SW10 0UH

STEP BY STEP

For some reason, at least 50 percent of the books that arrive in this office are for either the BBC or the Electron — doubtless this fact is full of sociological significance.

Step by Step Basic is no exception in that, on my copy at least, it appears to devote itself to the BBC and the Electron.

Certainly, if you go into any book store you will find that BBC books are usually outweighed by Commodore and Spectrum volumes.

The book itself looks good, covering BBC Basic pretty thoroughly in a number of delineated sections — input, procedures, strings and so on are all explained with examples.

Is it my imagination or is there something about the BBC that brings out the schoolmaster (or mistress) in people? For, as in this case, books on the micro tend to end their chapters with tests on what you've learnt so far — doubtless very useful though.

Books *Step by Step Basic*
Price £5.95
Micro BBC/Electron
Supplier Lifelong Learning
 55 Milton Road
 Cambridge CB4 1XA

This Week

Program	Type	Micro	Price	Supplier
1994	Ad	Spectrum	£9.95	Visions
Address File	Ut	Spectrum	£3.95	SD Micro Systems
Advance to Mayfair	S	Spectrum	£6.00	Assassin
Alchemist	Ad	Spectrum	£5.50	Imagine
Arcturus	S	Spectrum	£6.96	Visions
Armageddon	S	Commodore 64	£9.95	Visions
Banana Drama	S	Commodore 64	£9.95	Visions
Bank Account	Ut	Spectrum	£5.95	SD Micro Systems
Bank Verifier	Ut	Spectrum	£3.50	SD Micro Systems
Central Heating	Ut	Dragon/BBC B	£7.00	Torwood Education
Cymraeg Compiler	Ut	Sharp MZ 700	£14.00	David Computer
Dare Devil Dennis	Arc	BBC B/Electron	£7.95	Visions
Datad	Ut	Dragon 32	£10.95	Datad
Doomsday Castle	Arc	Spectrum	£6.50	Fantasy
Games Designer	Ut	Vic20	£9.95	Galactic
General File	Ut	Spectrum	£5.00	SD Micro Systems
Home Computer Pack	Ut	Spectrum	£5.95	SD Micro Systems
Humpty Dumpty	Ed	Spectrum	£6.25	Widgit
Hunchback	Arc	Commodore 64	£6.90	Ocean
List File	Ut	Spectrum	£3.95	SD Micro Systems
Liverpool	S	Atari	£8.45	Corbishley
Logo Art	Ut	Dragon 32	£6.95	Nobby
Lords of Time	Ad	BBC B	£9.90	Level 9
Maths & Physics	Ed	Sharp MZ 700, 80A/K	£6.00	David Computer
Moonraker	S	Spectrum	£6.00	Assassin
My Secret File	Ut	Spectrum / Commodore	£9.95	Mosaic
Next War	S	Spectrum	£6.00	Assassin
Nightflight II	S	Spectrum	£9.95	Hewson
Pagepro System	Ut	Spectrum	£5.95	SD Micro Systems
Paintbox	Ut	Spectrum	£7.50	Print 'n' Plotter
Paratroopers	Arc	Spectrum/Arc/ CBM64	£5.99	Rabbit
Pengi	Arc	BBC B	£7.95	Visions

Personal Reminder	Ut	Spectrum	£3.95	SD Micro Systems
Played	Arc	Spectrum	£6.00	Automata
Pinball & Cubits	S	Texas TI99/4a	£4.95	Lizard
Play for Planets	S	Spectrum	£4.95	Sugar Loaf
Postman's Knock	Arc	Texas TI99/4a	£4.95	Lizard
Pro Copy 700	Ut	Sharp MZ 700	£10.00	David Computer
Pro Copy A	Ut	Sharp MZ 80A	£10.00	David Computer
Rapedes	Arc	Spectrum	£5.95	Visions
Shopping List	Ut	Spectrum	£3.95	SD Micro Systems
Space Mission	Arc	BBC B	£2.99	Compusoft
Simulation				
Spooks	Arc	Sharp MZ 700, 80A/K	£4.00	David Computer
Sprite Magic	Ut	Dragon	£17.25	Merlin
Star Warrior	Arc	Spectrum	£6.95	Visions
Starship	Arc	Oric	£6.50	Sector 7
Stonkers	S	Spectrum	£5.50	Imagine
Storekeeper	Ut	Shapr MZ 700, 80A/K	£10.00	David Computer
Tense French	Ed	BBC B	£8.65	Sulis
The Last Jedi	Ad	Spectrum	£4.00	Miles Gregory
The Pen and the Dark	Ad	Spectrum/ Commodore	£9.95	Mosaic
Usurper	Ad	Spectrum	£6.00	Assassin
Utility File	Ut	Spectrum	£7.95	SD Micro Systems
Vectors	Ed	Electron	£24.95	Salamander
Winged Warriors	Ad	Spectrum	£5.95	CDS

Key: Ad — adventure/Arc — arcade/Ed — education/
 S — strategy-simulation/Ut — utility

This Week is a new section that covers all the new software coming on to the home micro market each week. All suppliers should send details of their new programs to: This Week, Popular Computing Weekly, 12-13 Little Newport Street, London WC2R 3LD.

Ziggurat



Dull as ditchwater

I have just attended what I am sure will be the last of the big microcomputer shows — the *Your Computer Xmas Fair*.

The decline of The Big Fair was beginning to be felt round about the time of the *Midlands Computer Fair*, early this summer, but the clearest indication was the *Personal Computer World Show* in September. It was at this show that the crowds really began to vote with their feet, and stayed away. It was also at the *PCW* show that exhibitors began to weigh up the cost of coming to the shows in terms of what they actually got out of the whole affair.

In a rather simple-minded manner, exhibition organisers seemed to think that the computer-using public was a never-ending source of shekels. The organisers also seemed to think that the computer exhibitor was willing to continue paying out for the privilege of exhibiting, at increasing rates.

By the time of the *Northern Computer Fair* at Manchester, the cost of entry for an adult was £3, and the price for a child was £2.00. The costs of stalls for exhibitors had also increased at a corresponding rate.

Many of the "big" names in computing were absent and the crowds had diminished — the bubble had truly burst.

The *Personal Computer World Show* was not a flop as such, but it was not as successful as had been promised. What happened was that organisers and exhibitors had begun to believe their own propaganda. They somehow felt that the "micro boom" was not like other booms, they saw it as having some charmed existence.

It has not.

I am in love with computers and computing because of what I can achieve through computers. A good friend of mine, an artist, has recently bought a BBC Model B, and he thinks that programming is more creative than painting. I agree with my friend, and that is why I find computing so engrossing.

All that most exhibitions seem to offer is a chance for young people to play games. That which is of deeper interest is almost nil.

Now, if a person wishes to play computer games, they go to any of the high street stores, and play the games there. There are still black spots — I heard in one shop "Oh, I am sorry you can't try that game out, it takes up too much time" — not, I hasten to add, one of the larger chains.

If people want to play games without paying, they go to retailers: considerably cheaper than most of the "big" computer exhibitions. With many of the larger software houses not exhibiting at shows, and larger retailers not bothering, why should the public bother? For those of us interested in the more creative aspects of computers, most shows have nothing to offer. And so to the *Your Computer Xmas Fair* at Wembley.

Going round, talking to people, both those attending and those exhibiting, there was the very strong feeling of "Never again". Many of the exhibitors had decided in future to attend only one or two shows a year, and those were shows mainly for the trade.

Talking to one exhibitor, he made two very telling comments. First, "They're mainly kids, and they're not buying". The second telling comment was concerned with whether a game he was writing could be called a similar name to the arcade game he was copying. I suggested that the safest way out was to design a totally new game, "But it's so difficult to think of new ideas," he protested.

Could it be, we ask ourselves, that the reason that kids were playing and not buying was that so many games these days seem to be no more than old wine in new bottles?

Could it be that people are staying away because shows are, now, dull as ditchwater? ■

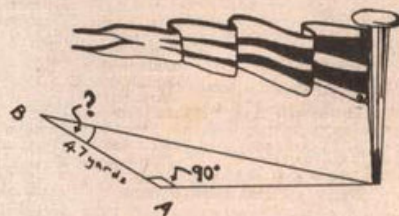
Boris Allen

Puzzle

Ground work

Puzzle No 90

The boys at Greyfriars School recently had to map out the school grounds. As shown in the diagram, they marked out a base line on the ground exactly 47 yards in length.



Using a theodolite, they took the bearing of the school flagpole from point A, which was found to be at exactly right angles to the base line. Moving to point B, by taking a second bearing, they were able to calculate the distance of the flagpole from both ends of the base line.

Curiously, both these distances were found to be an exact number of yards in length.

What was the bearing, in degrees, of the flagpole from point B?

Solution to Puzzle No 85

The following program tests all numbers from 100 to 999 to see if the sum of the first power of the first digit, the second power of the second digit and the third power of the third digit is equal to that number.

```
10 FOR N = 100 TO 999
20 LET NS = STR$ N
30 LET T = VAL NS(1) + VAL NS(2) * VAL NS(2) + VAL NS(3) * VAL NS(3) * VAL NS(3)
40 IF T = N THEN PRINT N
50 NEXT N
```

This reveals that, apart from 175, there are three other three-digit numbers with this property: 135, 518 and 598.

Winner of Puzzle No 85

The winner is: P Jordan, Kingshurst, Birmingham, who receives £10.



SEE US AT THE

10th
ZX MICROFAIRSaturday 4th February
Alexandra PalaceA PUBLIC STATEMENT
FROM AUTOMATA

WITHOUT PREJUDICE :-

At time of writing, the case of AUTOMATA U.K. LTD. versus WADDINGTONS GAMES LTD. (see Popular Computing Weekly Dec. 22nd 1983) is unresolved, regarding our computer game "GO TO JAIL". We hereby declare that "GO TO JAIL" for 48K Spectrum, is back on the market, in brand new packaging & reformatted loader display, at £6. We apologise to anyone awaiting copies. Whilst Waddington's Injunction that was threatened for Dec. 16th 1983 was withdrawn, this important Test Case is still due to come before the High Court in the near future. AUTOMATA publicly thanks the following Companies and Individuals for their solidarity in helping us fight for the rights of the Software Industry, and for putting their money where their mouth is. We hope 1984 continues to be the Year of Cooperation within the Industry. We will announce the outcome of this legal battle as soon as it has been resolved.

MANY THANKS TO:

Tansoft, PSS Software, Fox Electronics, M.C. Lothlorien, P. Podrio, Dominic Sparks, Michael Bere, Adam Hulbert, CDS Microsystems, Shards Software, Lee Spencer, Artic, I. Greeves, Prentice Hall, Spectadraw, Paul Goggin, Tim Wreford, Phillip Bragg, Greg Jewell, D. Malsey, Temptation Software, M. Davies, Britannia Software, IMS Software, Salamander Software, DK'Tronics, R & R Software, Bug-Byte, A & F, Mark Tilson, David Stevens, Microgen, Your Computer, MK83, Rabbit Software, JD Tronics, Mogul, Dangerous Dave, Xavier Wierdo, Mark & Ruth Allen, Lance Suchard, Crystal Computing, CRL, Mine of Information, Computasolve, Boris Allen, The Staines & Stanwell Computer Club, J. Bowers, Paul Laird, D. Barnett, Malcolm Jarvis, Computer Choice, David Lawrence, Simon Shoester, AH Software, Pac-Man, Paul Cooper, Silversoft, J. Goldberg, J. Rowe, J. Sherman, Mike O'Sullivan, Microchip Micky, Micromania, S. Shooter, special thanks to Nigel Backhurst: the Computer Trade Association.

THE PIMAN'S MAD BINGE HAS TAKEN HIM FROM FASHIONABLE NIGHT-LIFE SOCIETY THROUGH SKID ROW TO THE GUTTER, AND NOW RIGHT DOWN THE DRAIN... AND EVEN THE SEWER RATS AVOID HIM!



MEANWHILE, AT CHEZ PI...



LADY CLAIR? I'M HARRY VAULTING AND I'M HEADING THIS SMALL DELEGATION OF COMPUTER SOFTWARE MOGULS WHO...

