

# POPULAR Computing WEEKLY

## Mastertronic's Sega system deal - details of software

Full story on page 6

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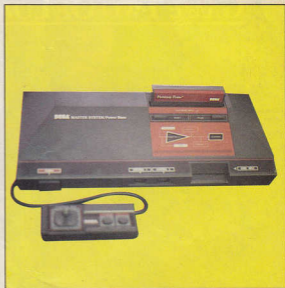
New boss appointed  
at Commodore UK  
Amstrad's PC1640  
in UK next year

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Hisoft's Devpac 2  
Hard discs - who  
needs them?

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Stiffli & Co  
In the Popular  
Hall of Fame



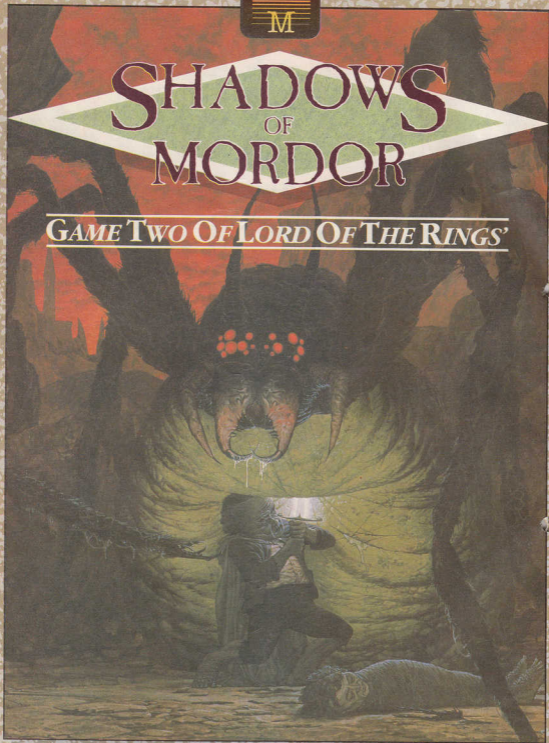
Sega Master System





# SHADOWS OF MORDOR

GAME TWO OF LORD OF THE RINGS'



## MELBOURNE HOUSE

AVAILABLE FOR: AMSTRAD CPC, CBM CASSETTE £8.95 - SPECTRUM £7.95 - CBM DISK £14.95

# June 12-18

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## Programming

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**23 Listings** This week's selection includes the genuine final instalment of Micromon on the Commodore 64 (our apologies to anyone misled by last week's 'final instalment'); and the continuation of the Popular Election program.

Plus Khandal 2 for the Amstrad CPC, the first part of the follow-up to the arcade adventure Khandal, part two of the QL font designer, and VLabel, a labelling program for the ST.

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## Games

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**41 Hall of Fame** All the noise and ruction surrounding Palace Software's *Barbarian* has detracted attention away from Palace's other new release, *Stiffrip* and Co. It shouldn't have done, because *Stiffrip* is worthy of that ultimate accolade, the *Popular* Hall of Fame.



Top: The Hybrid Music System.  
Above: Eidersoft's Atari ST hard disc.  
Below: Killed Until Dead.



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**ABC**

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## A hard case to crack

**B**ank CF2 discs, as used by Amstrad CPCs and PCs are now available individually for £2.95 each.

Boots of Bexleyheath sells Maxell discs, but for some reason they're in plastic bags, not cases.

John Lewis in Oxford Street, London, sells Amsoft discs in hard plastic cases. They're probably also available from other branches of these stores in most places.

Does anybody know where I can buy the plastic cases separately?

I'd also like to mention Reach Out, the new South East London Newspaper by the unemployed for the unemployed. Would anyone like to send us some Amstrad CPC software for review? The address is Reach Out, c/o Room 306, Erith College, Belvedere, Kent.

Paul Brown  
Sidcup

## Over and out

**M**arcus Marr's problem with the following short program demonstrates this for an Epson:

The following short program demonstrates this for an Epson:

```
LPRINT "Hello"
OUT 0,27,45,1 REM Sets underline
LPRINT "Underlined"
OUT 0,28,52 REM Sets italic
LPRINT "Italic"
OUT 0,27,45,0 REM Cancels underline
OUT 0,27,53 REM Cancels italic
LPRINT "Back to normal"
```

Laurence Myers  
Gloucester

## The price of fun

**I**'ve been reading about the computer industry for quite a while now and the one thing that mystifies me is the cost of games.

There are, of course, budget games, but they seem to lack something which would make them as good as full price titles.

I admit that there are some good titles, but they seem a little simplistic. Classics like *Spellbound* have mediocre graphics/sound with windation being a quick way round using a parser.

Codemasters has produced some good games but they are similar: *Red Max*, *BMX Simulator* and an earlier *Darling* create *The Last V8* all have the same controls which seems a bit odd.

Now to the other extreme. The average full price game is about £9 which is a £7 jump. Can this price be justified? The strong answer must be no. In fact, charging nine on a tenner for a computer game makes no sense at all.

The average 11 year old gets £1-£2 pocket money a week, which means saving up for a month or more for a full price game.

Is a full price game four to five times better in quality than a budget game? Yes, in some cases.

Take the current best selling budget game, *BMX Simulator*. It has nice graphics, a great soundtrack and two player option and good gameplay.

The top selling full price game of this year so far is *Gauntlet*, which has hi res title screens, unique gameplay, two player option, good music, 512 rooms, eight-way scrolling and bonus screens.

*Gauntlet* is certainly four to five times better, but this doesn't mean the price should be four to five times higher. My personal opinion is that a fiver would be more realistic.

Simon Harrison  
St Albans

**There is much talk among the software companies at the moment about bringing non-budget software prices down to around £5-£7, although this is unlikely to happen to any great extent until next year.**

## Xen 3 tapes and discs

**T**hank you for publishing my Xen 3 program for Amstrad CPC micros (*Popular*, May 22). I would like to add that if readers do not want to type it in I will provide it on tape or disc (with documentation) for £3.00 and £5.50 respectively. The original Xen and Xen Plus are also included. The address to write to is 41 Fountains Drive, Acklam, Middlesbrough, Cleveland TS5 7LW.

Simon T Goodwin  
Middlesbrough

## The home computer wars

**W**hen will Commodore admit defeat to Atari?

To be honest, I think Tramiel is out to kill them off. As for Commodore itself, it needs a dose of Sugar (as in Amstrad).

Don't get me wrong, I've been a devoted C64 owner since paying £350 back in the Middle Ages, and as for an Amiga, I'd just love to have one. But I can't justify the price, let alone against the 520ST.

Commodore has either to drop out of the home market, or (most unlikely) enforce a pricing policy which is second to Amstrad's, which is what Atari has already done.

S V J Perchard  
Bristol

## Help for T1994/A users

**A**s a regular reader of your excellent journal, I have noticed that Texas Instruments T1994/A users are not all aware of the existence of the International Texas Instruments User Group.

This organisation exists to serve the entire spectrum of user's needs in both the hardware and software fields. It can supply all types of non-commercial software including Forth, C, and Pilot.

Hardware upgrades are available including Ramdiscs, and soon to be implemented is an Eprom module programming service. Regardless of whether they have just the basic console or whether they have an expanded system, the ITUG is there to help. Anyone interested in further details can write to P G Q Brooks, at 96 Banbury Road, Oxford OX2 6JT, or telephone 0865 510822 at any time.

N Bosworth  
Southampton

## Whose Top 20 is it anyway?

**A**s the happy owner of an Amstrad 6128 I like to take advantage of fast loading programs and files from disc (after all, that was why I changed from the 464).

You have seen the adverts which say, "from Boots, WH Smith and all good computer shops", which implies that if a shop has not got it, then it is not a good computer shop.

I have to report that Kingston

Upon Thames, Wimbledon, Slough and Hounslow are not areas with good computer shops selling Amstrad disc games - although, to be fair, in Kingston, both Boots and WH Smith had some, in this Amstrad disc desert, Commodore and Spectrum rule (not OK).

Even if a shop can specially order a game on disc for me, I might as well order it from a mail order source by telephone with a credit card at a discount price.

How realistic can Top 20 software be, if, for example a shop's display is limited to the Top 20? A real 'chicken and egg' situation for browsers.

If shops are not supported, choice will worsen with even fewer chances to try before you buy.

If newsgroups can order papers on a sale or return basis why cannot the software houses do the same for games?

After all, if the software houses have faith in their product, why not risk a little more to achieve for their products the exposure and sales they no doubt feel they deserve?

C J Palmer  
London SW19

**Part of Boots' supply from wholesalers is indeed done on a sale or return basis. However, sale or return is not generally popular with the wholesalers/distributors, which have far more say over which products go into which shop than the software houses themselves.**

## Singlestep success

**A**fter four years of dedication to Basic, I decided that 1987 was going to be the year I would master machine code.

Just as on the previous occasions I had tried, the going started to get really tough. That is, until I bought a copy of Singlestep, by R Wilkinson, on offer in Programming Spotlight, February 12.

Since the day it arrived, my understanding of machine code has increased in leaps and bounds.

Please pass on my thanks to Mr Wilkinson for producing such a professional piece of code.

M Sleight  
Doncaster

## Wafa support?

**I** own a Rotronics Wafadrive and as far as I know there is

no support group in existence to help with queries and supplies of much needed Wafas.

If readers with Wafadrives would be willing to contact me at 19 Churchfield Road, Acton, London W3 7LL. I will attempt to co-ordinate a nationwide user group.

Additionally, if any suppliers of Wafas could give written quotations of their stocks and cost per Wafa, I would be grateful and will pass this information on to members.

Tony Merrigan  
London W3

## End of the debate?

In the recent debate, in your Letters page, concerning the relative merits of the Atari ST and the Commodore Amiga 5000, the availability of software has been discussed. I have not, however, seen any mention of the relative cost of software.

The ST software is usually cheaper than the equivalent A500 software as is amply borne out by your offer for 'C' compilers (*Popular*, May 29). In my opinion this clinches the debate about software in favour of the ST.

The relative merits of the hardware and operating systems will certainly continue to be debated, but it is the software which really counts to the user. After all if the software is not available, and at a reasonable price, you cannot use the hardware to its full potential.

Jon Meredith  
London SE25

## New Spectrum magazine

Your readers may be interested to hear about *Eprom*, a dedicated Spectrum based amateur magazine. Issue one is out now, and has been very well received by all its readers.

*Eprom* features an action packed collection of reviews, hints 'n' tips, maps, interviews, articles, strips, great art work plus loads more. Anyone wishing to obtain a copy should send a PO/cheque for 80p (inc p&p) to *Eprom* at 328, The Maltings, Penwortham, Preston, Lancs PR1 9FD. Issue two of *Eprom* will be out at the end of June, at the lower price of 70p (inc p&p), so it must be worth a look.

T Worrall  
Editor, *Eprom*



Hang on! Aren't we all supposed to be on the same side?

## Stop all that fighting!

If you are a keen programmer, then obviously you will appreciate the merits of the Memotech, if what you want is to play a good range of games then Spectrums and C64s are great machines for a low budget, and the ST is good for those with more money who don't mind waiting a while for the software base to build up. The Amiga may be better in terms of graphics but the difference is hardly enough to start a fight and both are fine for more serious business uses.

To try to make comparisons across the 8/16 bit boundary is pointless. Of course ST games are 'better' than those for the Spectrum or the C64, but what do you expect? And anyway, they are not (in my humble opinion) that much better, not yet anyway. (OK, I've seen *Gold Runner*, it's very, very good, but not, say, twice as good, as equivalent 8-bit games). I've gone on long enough, can we now assume that the arguments are over?

Incidentally, I own an ST... and a Spectrum and a PC compatible, and a Newbrain and I love them all.

Mark Beale  
Sussex

We're sorry but *Popular Computing Weekly* cannot guarantee to reply to all letters requesting a personal answer. It helps us enormously if readers are prepared to have general queries answered on these pages, so, if possible, please do not send SAEs.

PS. Ten to one there will be a letter next week along the lines of "Mr Beale has a point but why did he not mention xxx computer?"

## Not so biased

I enjoyed John Bressenden's item commenting on the new rivalry between Atari's 520STFM and Commodore's Amiga A500.

It did not seem biased to either machine, and before I had even received my copy of *Popular* I had long since decided to purchase the 520STFM.

The following week, however, two people writing in the Letters section appeared to be suffering from tunnel vision.

As far as the capabilities of the A500, which Geoff Hatto thinks are better than the 520STFM, go, one look at the value for money ratio of each machine system will prove the STFM the landslide victor.

Also, W Plummer should try reading a few advertisements - he obviously looks no further than Silica Spok Nobody will pay £400 when they need only pay £318 (*Computer Express*, Herts). The cheapest price I've seen for the A500 is £440.

I saw both machines side by side, and I strongly disagree with all those Commodore owners that the Amiga is a "sensible" machine and "not expensive", because Commodore computers are some of the most user unfriendly around (I know - I own one) and the value for money factor.

D A Simpson

BFPQ 42

(Letter edited for length)

## Correction

Following our review of the Reaktor game *Challenge of the Gobots* (May 29) Anolasoft has asked us to point out that the "software book" is on the reverse of all the games tapes. It's the music cassette which is only available in a limited edition. Furthermore, if the music sounds suspiciously like Robert Schroeder's *Space Detective*, it has every right to do so; the music is by none other than Robert Schroeder himself. Whoops!

# Black goes back

In *Game One* of our readers' versus Colossus chess tournament, the readers have responded as *Colossus* expected at move 19, and developed their bishop, moving it from c8 to f5. *Colossus* has replied by again driving the black queen away. (See diagram for details).

## The next move

Which move would you, playing black, make next?

Send your suggested readers' move to either *Inter-Mediate* (*Popular Chess*), Freeport, Sawbridgeworth, Herts CM21 9YA (no stamp needed), or *Popular Chess*, Unit 2, The Maltings, Sawbridgeworth, Herts CM21 0PG (with a stamp). Please note that Freeport is slower than the normal service, so if you want to save stamp money, get your entry off promptly.

Only one vote per person please, and all entries must reach either address by Wednesday, June 17.

The move which gets the most votes will be entered into the game. Results and *Colossus's* response will be published in two weeks time.

Next week, we return to *Game Two*, where the Readers are playing white.

## Game One

The moves so far:

- |                  |              |
|------------------|--------------|
| 1 P e2-e4        | P c7-c5      |
| 2 N g1-f3        | N b8-c6      |
| 3 B f1-c4        | N g8-f6      |
| 4 N c3-p5        | P f7-e5      |
| 5 P e4-e5        | N e5-e5      |
| 6 B c4-b5+       | P f7-e6      |
| 7 P d5xc6        | P b7xc6      |
| 8 B b5-e2        | P h7-h6      |
| 9 N g5-f3        | P e5-e4      |
| 10 N f3-e5       | B f8-e6      |
| 11 P e2-d4       | P e4-f3      |
|                  | (in passant) |
| 12 N e5xd3       | O d8-c7      |
| 13 N b1-c3       | K e8-g8 o-o  |
| 14 P f2-f4       | Q c7-b6      |
| 15 N c3-a4       | O b6-a4      |
| 16 P c2-c3       | Q d4-d5      |
| 17 K e1-g1 (o-o) | n8-a6        |
| 18 B e2-f3       | Q f5-e5      |
| 19 P d2-b3       | B c8-f5      |
| 20 P c3-c4       | ?            |



# 'Upmarket' PC1640: Amstrad's last chance in United States?

AMSTRAD last week announced full details of its PC1640 range, the upmarket successors to the PC1512, which will be launched in the UK next year.

The machine received its launch at the Comdex exhibition in Atlanta (see *Popular Computing Weekly* June 5).

Observers were expecting the machine to be based on the Intel 80286 processor. But all

the machines will be 8086-based. Indeed, it is now doubtful whether the company will have an 80286 box scheduled within the foreseeable future.

Amstrad is also clearly making a last, major stab at the US market with the new machines, with a UK and European launch not due until the New Year.

"The breadth of product now offered by the combination of the PC1512 and the upcoming

PC1640 models allows us to approach all sections of the marketplace," said Vernon Moore, president of Amstrad's US distributor Vidco.

He added that the new machines would be sold through more specialist dealers than the chainstore retailers used for the PC1512.

All this points to the market position the new machines will occupy here, following their UK

launch.

The PC1640 is clearly aimed at a larger business user than the PC1512, and one ramification of this will be pricing.

"We have not yet set our pricing structure for the PC1640 in Europe, but initial indications are that this model will be significantly more expensive than the PC1512 range," said Amstrad marketing director Malcolm Miller.

# Mastertronic takes Sega risks

MASTERTRONIC'S Geoff Heath promises a bright future for the Sega games console, for which the company recently acquired UK distribution rights.

"We've had enquiries from multiples, big chains, supermarkets, independent computer stores, CTN's (confectioners, tobacconists and newsgents), mail order," he said.

Exact details of availability still have to be worked out, but Heath did confirm software details. Games will cost between £14.99 and £24.99.

Twelve titles out of the existing 30 will be released initially. So far, only four have been finalised - *Choplifter*, *Outrun*, *Space Harrier* and *Zaxxon*.

He added that he was surprised by the amount of interest expressed in the machine so far, and impressed by the quality of Sega's existing and forthcoming software.

There are now three parties pushing games consoles in the UK:

● Mastertronic, which signed

the Sega deal two weeks ago, and takes over from Ariolasoft.

● Atari, which has the XE system, with orders rumoured to be worth in the region of £220,000 and rising.

● Mattel, which recently signed a distribution deal for the Nintendo unit (see separate story).

All three will be fighting hard to get the lion's share of what Geoff Heath sees as perhaps the only growth area in the UK home market this year.

"The computer market is now fairly solid, and in terms of hardware, the only new computer is the Plus 3. And that is only a development of the earlier Spectrums.

"Apart from that there's nothing new. 1988-89 should see the explosion of the 16-bit market - but in the meantime, the only hardware growth area is the games console."

He added that 16-bit machines were still too expensive for a lot of people, who would therefore go with a console until the price dropped.

● Mastertronic has sped to the rescue of racing driver Andrew Ratcliffe.

Ratcliffe, 33, was due to drive his 230mph British built Tiga in this weekend's 24-hour Le Mans race. But his sponsors pulled out last Friday morning.

"I was left without any money or any hope of driving at Le Mans," said Ratcliffe.

"But I'd seen Mastertronic's games in the stores, and thought it would be a perfect match. So I rang them up, and within five minutes Alan Sharam had rung back to say yes."

Ratcliffe couldn't reveal how much money was involved. "Let's just say we're talking telephone numbers - overseas telephone numbers with extension numbers on the back!"

The race takes place this weekend, and runs from 4pm on Saturday to 4pm on Sunday. Ratcliffe will also be appearing at September's PCW Show, so we can expect the Mastertronic connection to continue for some time.

# Mattel scores own goal

MATTEL has had its claims about retailers' plans for the Nintendo games console denied by retailers.

Mattel had announced that many large retailers were due to stock the unit, including Argos, Toys 'R' Us, Woolworths and Dixons (see *Popular Computing Weekly*, May 29).

The story was also covered by industry newspaper *Computer Trade Weekly* last week. But when they found out, a number of retailers - including Woolworths and Dixons - contacted CTW to make vigorous denials of Mattel's claims.

A Mattel spokeswoman admitted that the problem was due to an error.

"All I can say is, where we thought things were confirmed, they weren't confirmed. That is the state of play, and until such time as things are confirmed, we can't say one way or another," she said.

"It certainly will never, ever happen again."

# Commodore finally picks new UK boss

COMMODORE UK has ended its three month hiatus following the departure of general manager Chris Kaday by finally appointing his successor.

Steve Franklin will take up his position on July 1, moving from Granada Business Centres, where he is sales and marketing director.

There are two big questions hanging over the appointment. First, to what extent will Franklin be a puppet of Commodore UK's masters at Commodore Europe in Frankfurt?

Power has become increasingly centralised with CBM with Frankfurt chief Ernest Tarien reporting to chief executive Irving Gould in the US.

In the current set up, Commodore UK is a minor operation run almost wholly from Frankfurt.

It is doubtful that the situation will change dramatically once Franklin takes up the helm at



Steve Franklin

Maidenhead.

Second, what will be his brief? Has Franklin been drafted as an axeman, to carry on where Kaday left off? The UK operation has been slimmed down considerably over the past year, culminating last month in the closure of Commodore Electronics.

# Apple II & PCs get new joystick

CHEETAH has launched a new joystick for the PC and compatibles which can also be used with the Apple II and Ii.

The PC Powerplay has three fire buttons, dual axis sensitivity controls, and comes with a 12 month warranty.

The PC Powerplay costs £24.95. Details from Cheetah Marketing at Norbury House, Norbury Road, Fairwater, Cardiff CF5 3AS, telephone (0222) 555525.



PC Powerplay

## SOFTWARE HOTLINES

American software veers from the dire (try asking US Gold why it hasn't published Epyx's *Barbie Doll* dress kit over here yet - it's had the licence for decades) to the tremendous.

From **Microillusions**, California, via **Haba Marketing**, Feltham, Middlesex, comes the latter in the form of *The Faery Tale Adventure* (sounds almost as cutesy as the *Barbie Doll* game).

*Faery Tale* is a graphic adventure for the Amiga, and the software scene for the Amiga is looking suddenly rosy if there's more like this on the way.

It's a tale of three brothers - Julian, Philip and Kevin. Julian's a bit of a swashbuckler, Philip's a charmer and Kevin is frankly a wimp.

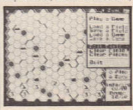
You take their parts as you travel through 17,000 screens of all types of terrain imaginable, doing all those adventurous things, killing monsters, collecting keys, meeting enchanted princesses, slaying a few more monsters... party night for butchers, really.

No-one at Sunshine Towers has worked out exactly what the object of the quest is yet, but we're sure it's something pretty exciting.

The hook of *Faery Tale* is its gameplay and atmosphere generated by the graphics and music. The music is continuous and varied - melodic choral chants for those mellow times in between wholesale slaughter, stirring battle themes for the fighting scenes.

The graphics show you the land and action from a slanted bird's eye view, which is brave of the programmers because the top down angle has produced some ghastly unrecognisable stuff in the past.

Given the Amiga's resolution, capabilities, 20 million colours,



etc, it succeeds. The effect of the animation is that the three brothers float and loll rather than striding briskly into daring deeds, which makes Julian look the world's most laid back warrior, and Kevin even more effeminate than he was to start with.

It's one of the most appealing games we've had in the office for a while, and we think there could be an ST version on its way, so there's hope for other micro owners yet.

More from the US and the board games of Steve Jackson in the micro version of *Ogre*, pictured here.

This comes courtesy of **Orion**, which is also bringing Jackson's *Autoduel* to the UK next month.

In *Ogre*, we're light years away from the world of *Faery Tale*. This is battle in the 21st century with tactical nuclear weapons, board game style, with the help of *Ogre*, a juggernaut of a tank with enough firepower to keep any Geneva talks going until the next Ice Age.

You can either play against the computer (which also gets the *Ogre* on its side), or another person. Out in September for Commodore 64, Atari (8-bits and STs) and Amiga.

The latest news from the **Firebird** stable is that *Elite* is currently being programmed for the PC and compatible machines.

The word is that the programmers are trying for solid fill graphics rather than the wire-framed ones on the 8-bit machines, and if that's achieved on the PCs, it'll be a sneeze to get filled graphics on to the ST version. Sounds worth waiting for.

DIARY  
DATES

## JUNE

12-14 June

**Commodore Show**

Novotel, Hammersmith

**Details:** First public showing of A500 and A2000 Amigas**Price:** £3 adult, £2 children**Organiser:** Database Exhibitions, 061-456 2991

30 June-2 July

**PC User Show**

Olympia, London

**Details:** Hardware and software for all users of IBM PCs and compatibles**Price:** £5**Organiser:** EMAP International Exhibitions 01-608 1161

## JULY

10-12 July

**Amstrad Computer Show**

Alexandra Palace Pavilion, London

**Details:** Displays and demonstrations of all latest hardware, software and peripherals for Amstrad computers**Price:** £3 adult, £2 children, £1 discount for advance booking**Organiser:** Database Exhibitions, 061-456 8835

## SEPTEMBER

23-27 September

**Personal Computer World Show**

Olympia, London

**Details:** Latest hardware, software and peripherals for business and leisure computing**Price:** £3, £2 - (parties over 10)**Organiser:** Montbuild 01-486 1951

Prices, dates and venues of shows can vary, and you are therefore strongly advised to check with the show organiser before attending. *Popular Computing Weekly* cannot accept responsibility for any alterations to show arrangements made by the organiser.

# Commodore to slog it out with Atari at 10th PCW show

FIRST details emerged last week of some of the major exhibitors at September's Personal Computer World show - and there are a few surprises in store.

Arch-rivals Atari and Commodore both have their own 'village' - Atari's has 30 separate stands, with a recording studio and satellite weather receiving system. The Commodore village, in the Addison suite, will be open to everybody, unlike last year. The company will of course be promoting heavily the

new Amigas.

So far Amstrad seems to have the next largest stand, and is more than likely to be showing the new PC1640 (see separate story).

Ironically, the adjacent stand will be booked by Cambridge Computer, whose boss Sir Clive Sinclair sold out Sinclair Research to neighbour Alan Sugar in April 1986.

Sinclair revealed that there will be no new products on show this time round - just the long awaited Z88 portable

(again).

Acorn will also have a major new development on show, in the shape of its Risc-based machines.

A large stand has been booked by EOA. It will be the first time the company has exhibited here since setting up a UK subsidiary of parent company Electronic Arts.

Further details, and announcements about just what the companies will be exhibiting, are expected shortly.

## Three Amigas Microprose picks peripherals boss

ANCO will be demonstrating three new games for the Amiga at the Commodore Show this week.

The three are *Phalanx*, *Demolition* and *Space Battle*, to be followed by the end of July by *Emerald Mines*, *Cruncher Factory*, *Challenger* and *Karate King*.

"We see a considerable growth in the 16-bit market in the next couple of years and especially of the Amiga as the games machine of the decade," said managing director Anil Gupta.

"Therefore the bulk of our efforts will be directed towards the Amiga, although there are a number of releases for the Atari ST and the IBM PC."

*Phalanx*, *Demolition* and *Space Battle* will cost £9.95.

Further information from Anco, 35 West Hill, Dartford, Kent DA1 2EL, telephone (0322) 92531/8.

MICROPROSE is extending its hardware operation with the appointment of John Sage as product manager for the Suncom range of joysticks and other accessories.

Microprose recently announced a sales, advertising and promotion contract with the Chicago-based manufacturer, which makes monitor and printer stands and diskette storage cases, in addition to joysticks.

Sage took up his appointment on June 1, and moved from Leisuresoft, where he had responsibility for its Power Play range of joysticks.

"Previously only part of the Suncom range has been available within the UK although it has had stronger representation in Europe," he said.

"Now we will be promoting the complete range with the first major showing taking place at the PCW show this September."



John Sage

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Piranha

# THE *Big* SLEAZE



## THE BIG SLEAZE

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# Sharp to launch sub-£1000 laptop PC in September

## Communications

News from the world of communications, including an update on Spectre and Microtext comms products for the Spectrum, Miracle's QL modem and Stradcom, an internal modem and sophisticated software for PC clones.

## Spectrum Plus 3 firmware

More on the Spectrum Plus 3; how the disc operating system works and Plus 3 Basic.

## The Psion Organiser

Programs report - where the Psion organiser hand-held computer has found its devotees, and a look at two new software packages for the machine - *Comms Link* and *Pocket Spreadsheet*.

## Airball - new from Microdeal

You want 3D style perspective? You want glorious colours? You want smooth animation? You want to cheer up your ST no end? Take a look at *Airball*, from Microdeal.

## First steps in machine code

Kenn Garrock continues his series, with an explanation of mnemonics and using assembler programs.

SHARP launched a new IBM compatible portable PC at last week's Comdex show in Atlanta, Georgia. Its UK price should be under £1000 when it reaches UK dealers in September.

The PC-4501 - which makes its UK debut at the *PC User* show at the end of the month - is the entry-level model in a range of new additions to Sharp's PC line-up.

It is a battery-powered machine with a backlit Super-twist LCD screen. Standard Ram is 256K, expandable to 1'6MB.

The 4501 has a single 3½ inch floppy drive with 720K capacity, and a second floppy drive can be added internally. A twin floppy machine, the 4502, will be available in October.

MSDOS 2.1K is the bundled



Sharp's PC-4501

operating system, and the 3½ inch drive will enhance the machine's IBM compatibility.

"It's definitely aimed at a newish market," said national sales manager Tony Hall, commenting on the sub-£1000 price tag.

"And as far as the twin-floppy

model's concerned, you know whose market we're aiming at there!"

The PC-4501 and 4502 are two of several new computer-related products which Sharp is releasing between now and the New Year, including printers, scanners and XT-lap-tops.

# Peripherals for yer C64

YORK Electronic Research (YER) has announced an RS232 interface for the Commodore 64.

The product enables users to hook up to a wide range of peripherals such as printers and modems.

It features a cable, 4000 word manual including troubleshooting guide and utility software including a terminal emulator.

The support software comes on tape or disc, and the product costs £29.99 inclusive.

Also from YER is a fast editor/assembler for the C64. It enables code to be repeatedly edited, assembled and executed without waiting for file access.

Source files can be chained together, so that programs of



YER RS232

up to 38k may be assembled in one go. The editor/assembler costs £12.99 inclusive.

Both products are available

from York Electronic Research, The Fishergate Centre, York YO1 4AB, telephone (0904) 610722.

# ST Election special (yawn)

# PC1512 books blitz

ELECTION night saw several radio stations and newspapers using an ST election forecasting program to project the results for real.

The *Election Program* is a dedicated database and statistics program containing majority sizes, opinion poll results, turnout, from the 1983 General Election.

There are, in addition, factors which can take account of tactical voting in favour of any of the four main parties, so that results can be calculated in terms of one particular constituency, a region, the country as a whole, or percentage swing.

The full-colour program was commissioned by Radio Piccadilly for its election night coverage, and a number of regional radio and television stations and newspapers have expressed interest.

Some papers have also been using printouts produced with the program.

"The latest projection gives a hung parliament with the Tories as the largest single party," said Mike Reynolds-Jones, managing director of distributor Software Express, last week.

He added that the projection was changing daily - one forecast before the election suggested the Ulster Unionists could hold the balance of



A politician

power.  
The *Election Program* costs £29.95 from Software Express,

514-516 Alum Rock Road, Alum Rock, Birmingham B8 3HX, telephone (021) 328 2585.

# Activision's new Sierras ready for delivery

ACTIVISION has now sealed its distribution agreement with the U.S. software house, Sierra on Line.

The first two titles to be released under the new arrangement are U.S. chart hits *Kings Quest III* and *Space Quest*.

*Kings Quest III* is the third in

the popular American *Kings Quest* adventure series, and will be available in the UK at the end of June. The price should be around £24.99 for the Atari ST and £29.99 for the Apple II series, Amiga and IBM PC versions.

*Space Quest*, programmed by the same people who con-

jured up the *Kings Quest* series, is a humorous action and adventure space game with the usual destroy enemy star ship type plot.

This game will be released in the UK at the end of July at the same prices as *Kings Quest*.

For further information, contact Activision on 01-431 1101.

SIGMA Press has published two new books for the Amstrad PC1512.

*WordStar on the Amstrad PC1512* is written by John Hughes, author of the popular *Mastering your Amstrad PCW 8256/8512*. This book is aimed at those just starting out in computing, and details the whys and wherefores of how your Amstrad works with WordStar. The book also includes several chapters on similarities with and differences from other versions of WordStar.



## WordStar

The second book, by Paul Davies and Nigel Backhurst, is for both experienced users and newcomers to the MS-DOS/PC-DOS operating systems. *Exploiting MS-DOS on the Amstrad PC1512 and all IBM Compatibles* covers all aspects of MS-DOS usage from getting to grips with the terminology and initial tasks to enhancements such as tape streamers, additional disc drives and CD-ROM.

*WordStar* costs £10.95, and *Exploiting MS-DOS* will set you back £12.95. Both books are marketed and distributed by John Wiley and Sons, and further information can be obtained from Sigma on 0243-770355.

# THE ASSEMBLER'S DREAM

Tony Kendle reviews *Devpac 2*, the latest and most eagerly awaited of the "new wave" assembly language development systems. But does it live up to expectations?

Regular readers will be aware that there is a veritable renaissance underway in the field of assembly language development systems. Suddenly the old reliable standards, familiar in zillions of extremely average programs that have been churned out by almost every software company you could name, have been left behind.

The first of the 'new wave' was *Laser Genius*, written by Oasis for the Spectrum, Commodore 64 and Amstrad CPC. More recently there was *Maxam II* by Anor for the CPC 6128 and Amstrad PCW. However, the one that has been most eagerly awaited by programmers everywhere has to be the upgrade of the evergreen *Devpac*, the tool that has bred a generation of Z80 machine code experts from the earliest days of the Spectrum.

There can be no disputing that HiSoft is the master of almost every different programming language available on home computers, a sort of British Borland. More

than anyone it can claim to know what programmers need, and will find useful, because it has had years of feedback from its customers.

The result of its work, *Devpac 2*, is a programmer's joy, powerful, streamlined and easy to use. It is unquestionably the best thing available on most CP/M computers - Tatung Finstein and MSX owners in particular take note, this is the assembler package for those machines.

On the Amstrad range there is more competition from *Maxam II*, and it was the Amstrad version of *Devpac 2* which was sent for review, as much as anything because the PCW, with its fast memory drive is getting a reputation as an excellent program development tool.

*Maxam* scores through having its own inbuilt file and disc copy and disc formatting routines which make it a complete self-contained package, although as we will see later this also causes problems. *Devpac* comes with a less comprehensive suite

of HiSoft disc utilities (including a file conversion routine for CPC AMSDOS *Devpac* files) which allow much more flexible file copying and erasing, etc. than can be achieved with the standard commands. The original *Devpac80* files are also included for anyone who wants to gain familiarity with the new modules one by one.

The *Maxam* editor has the merit of being developed from the superb full featured word processor *Protext*, and therefore is very much better than anything seen before in assembler packages. *Devpac's* new editor has less features, but conversely the ones that are there are more closely integrated with the other parts of the development package such as a menu driven system that will call up the assembler and monitor and assemble the current edited file, or one stored on disc.

The assembler can return direct to the editor once assembly is completed or aborted - it may not seem much but such small points of logistics can take on inflated proportions when you are mid-way through an enormous programming project, and this feature is actually very rare.

Best of all is the ability of the program to remember where errors were found on the first or second assembly pass, and return the user direct to the offending line in the source file with suggestions for what is wrong.

*Devpac's* editor works with a wide selection of *Wordstar* compatible controls. For those who cannot abide *Wordstar* these control keys can be re-defined, but as it stands it will appeal to a myriad of die-hard programmers whose fingers are irredeemably locked into configurations such as *Control-KD*. Like *Maxam*, files much larger than can fit in the spare memory can be edited and assembled by using the disc as virtual memory.

The *Devpac* assembler largely conforms to the usual Zilog standards but also has been designed to work with files produced by the Microsoft M80 assembler. The internal format of the files it produces are much more standard than *Maxam's*.

Notable features include conditional assembly, a wide range of arithmetical and logical operators, multiple line comments

```

TEST,GM          LINE:22  COL:1  10F  INSERT
#List on

#N A Simple Program

;Some equates
BDOS          equ    5
STRING_PRINT equ    9

;The code, automatically ORGed at #100
    ld    sp,(BDOS+1)
    ld    de,Message          ;print a message
    ld    c,STRING_PRINT
    call BDOS                 ;by calling the CP/M BDOS
    rst   0                   ;return to calling program or CP/M

;Any old message
Message
    defn  "HiSoft Devpac80 Version 2!"

FREE:47452  #          $
Drive is A:

```

*Devpac 2*: powerful, streamlined and easy to use.

and excellent printer control. Lines of assembly can be directly typed in at the keyboard and automatically inserted at the beginning, or elsewhere, into a disc file undergoing assembly. This is designed to let you add options to a program which you want to use for test purposes without having to alter the original source code.

Unlike many assemblers, Devpac 2 can be installed so that it does not abort on the first pass if errors are found. This allows any second pass errors to be found at the same time ready for editing or listing to the printer. The assembly process can be tested without an object code being produced. Symbol files can be passed to the monitor, or any other standard CP/M pro-

gram now been expanded in various ways to allow the user to be able to define their own pseudo-instruction extensions to the standard Z80 opcodes.

The monitor represents one of the most important advances over the old version. It can of course be used as a symbolic debugger and the disassembly can then be written to a disc file ready for editing etc.

On the large PCW screen a very useful display of information can be presented, 29 lines of disassembly, a command line and an 80 byte hex and Ascii memory display. A range of the standard monitor commands are available such as fill memory range, compare memory with a given entry, set the memory bank, search for a given mnemonic

etc. All of these are extended by a powerful range of arithmetic and logical operators for use in your expressions.

Several types of breakpoint exist - hard breakpoints that terminate the code execution when reached, warm boot breaks that trap any attempt by the code to restart CP/M, watchpoints which count the number of times a certain piece of code is executed, and conditional breakpoints that cause a break when a certain condition is met.

The most notable aspect is that all of this has been accomplished in just 12K and with the aid of some memory switching you are left with a hefty 54K free for your program files (under CP/M plus). It is something like a third as large as Maxam's monitor which possibly is too user friendly, providing the full range of disc management commands instead of preserving every spare byte of memory for the user. Indeed the whole Devpac package is so compact that all three modules easily fit within the memory disc of an unexpanded PCW.

There is no question that Amstrad owners now have two comparable and unprecedented good assemblers to choose from. Each has its own strengths, but in the end most people are likely to vote with their pocket. It is inevitable that the vast majority of potential customers already have assemblers of some sort.

Whilst anyone with an ounce of sense will see the value of upgrading to one of these excellent releases it is hard to imagine that they will ignore the fact that Devpac is almost half the price of Maxam II.

**Product** Devpac 2 Micro Any CP/M - Tatung, MSX, Amstrad 464, 6128, PCW, **Price** £39.95 **Supplier** HiSoft, The Old School, Greenfield, Bedford.

```

GEN00 2.00 Copyright (C) HiSoft 1987
Pass 1 errors: 00

0100          | *List on
0100          |
-----
0100          | *# A Simple Program
0100          |
0100          | *Some equates
0100          |
0005          | *BDOS equ 5
0005          | *STRING_PRINT equ 9
0100          |
0100          | *The code, automatically ORG'd at #100
0100          |
0100          |
0100 ED7B0600          | ld sp,(BDOS+1)
0104 110501          | ld de,Message ;print a message
0107 0305          | ld c,STRING_PRINT
0109 CD0500          | call BDOS ;by calling the CP/M BDOS
010C C7          | rst 0 ;return to calling program or CP/M
010D          |
010D          | *Any old message
010D          |
010D          | *Message
010D          |
010D 4069536F 21          | defm "HiSoft Devpac00 Version 2!$"
Pass 2 errors: 00

Symbol Table used: 00K out of 15N.

Hit any key for menu | Drive is A:

```

On the large PCW screen, a very useful range of information can be presented.

gram, for symbolic disassembly.

A very nice touch is an extension of the CP/M plus virtual discing feature whereby different files can be named as being read from, or written to, different discs by specifying them as found on drive. B, C, D, etc, regardless of how many drives you actually do have fitted.

As well as COM programs, Devpac produces highly standard CP/M REL (relocatable) object code files. These can then be used by any CP/M linker including those usually supplied on the CP/M system disc, and can also be linked to the code produced by other languages such as Pascal or C. Extremely powerful control is given over such files providing relative and absolute symbols and public symbol definitions, etc.

Devpac can be used under either CP/M 2.2 or CP/M Plus and so memory bank switching commands are supported if the program senses that it is running in the latter environment.

Devpac has always been noted for the quality of its macro handling, but this has

```

012C          | SDC HL,DE
012E          | LD SP,#01C3,SP
0132          | LD SP,HL
0133          | PUSH HL
0134          | LD DE,#0104
0137          | LD C,#0F
0139          | CALL #0005
013C          | INC A
013D          | JK NZ,#0152
013F          | LD HL,#0214
0142          | LD A,(HL)
0143          | OR A
0144          | JP Z,#0000
0147          | LD E,A
0149          | LD C,#02
014A          | PUSH HL
014B          | CALL #0005
014E          | POP HL
014F          | INC HL
0150          | JR #0142
0152          | POP HL
0153          | PUSH HL
0154          | EX DE,HL
0155          | PUSH DE
0156          | LD C,#1A
0158          | CALL #0005
0159          | LD DE,#0104
015E          | LD C,#14
0160          | CALL #0005

Command: | Drive is A:

```

```

PC 0100 0070 00 00 00 00 00 00 00 00
SP 0755 0070 00 00 00 00 00 00 00 00
IX 0000 0070 00 00 00 00 00 00 00 00
IX 0000 0078 00 00 00 00 00 00 00 00
HL 0000 0100 18 23 C5 00 00 50 4F 8E .PHO
DE 0000 0100 4E 20 20 20 4D 4F 4E N MON
BC 0000 0110 00 05 00 64 1F 20 21 22 ...d:
AF 0000 0120 23 24 25 26 27 28 29 2A 30XZ(*
           0128 11 00 32 37 ED 52 ED 73 ...27A8s

A1ts
HL'0000
DE'0000
BC'0000 Break
AF'0000 Condition/Scale Count

TR #014
Ints ON

Flags

Bank: 01

```

Screen dumps are easily achieved with Devpac 2.

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# HARD AND FAST

Eidersoft is one of three companies currently producing hard disc drives for the ST. Their Triangel 20Mb Turbo Drive, to use it's full name, is a real step up for ST owners, as Mark Hutchinson discovered.

The 1Mb floppies available for the Atari ST can store a lot of files and, after a few years, you will probably find that you have collected several dozen discs. The problem then arises of finding a particular file amongst the collection. Using a language such as Modula-2, which covers two discs, and trying to find that elusive file to compile with it can become time consuming. One answer is to invest in a hard drive.

Eidersoft, aided and abetted by Computer Concepts, is one of three producers of hard drives for the ST (the others being Atari itself and Supra).

Strangely, even with Eidersoft's liaison with Computer Concepts, the Fast Basic cartridge icon cannot be displayed on the desktop. Computer Concepts came to the rescue with FASTART PRG (part of its bundled software), so the cartridge and drive will work together.

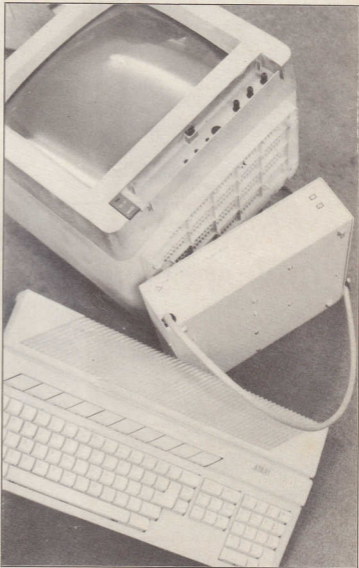
The drive is a grey metal box, about 11 x 11 x 3 inches. The power cable and switch are at the rear and the LEDs and data cable at the front. This can make it awkward to position the unit. I would prefer both cables at the rear and the switch at the front. I would also have liked an additional six inches of data cable.

Turbo drives can be daisy chained using the SCSI interface from Eidersoft. The company now has a second version of the hard disc, with an inbuilt 1Mb floppy, which can be obtained for £872.85.

The drive takes about seven seconds to come up to speed and, apart from the fan, is very quiet. The instructions come in an A5, 24 page ring bound booklet. It has plenty of illustrations, and strangely, for UK producers, a sense of humour. I was sent two discs, one containing the turbo boot programs and the other *Flash-Bak* and *Flash-Cache*. The included *Flash-Bak* program will not work with other drives, but the commercially available version will. I recently received the latest update, version 1.7. I also found that the boot program will not work with the Atari drive (new model).

The first thing I did was to try out the drive to see if any goodies had been left there. No such luck. I went on to format the disc and check for bad sectors. None, which is a great start. Next thing was to partition the disc.

A hard drive of 20 Mb takes a long time to access a program, even with a cache (an area set aside to quickly access often used



Turn your ST upside down with a hard disc drive (centre)

Continued on page 17 ▶

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◀ continued from page 15

files), so it is a handy option to section (partition) the drive into separate logical units. The partition scheme gives nine options of two, three or four drives.

I had worked out before the drive arrived which material I was going to store on it, which made life easy when it came to partitioning; in fact I used the standard 4x5Mb units.

This configuration is easily changed after a back up so there is no need to panic during this option.

I found the drive more reliable than the Atari (old version) yet it seemed slower than the Supra drive. However, I have not rested the Supra drive, but seen it accessing about 20 Neochrome pictures and this may have been all that was on the disc. I have over 200 pictures, all in a condensed form, plus drawing programs and associated files on a logical unit, thus access time would be slower.

The use of folders has always been limited on floppies, but really comes into its own when used on a hard drive. Unfortunately, the current version of TOS limits the computer to accessing 40 folders. This means that, although you can have as many folders as you wish, the ST can only record the use of 40 folders, even if they are now closed.

## HARD AND FAST RULES

The limitation is caused by the inability of the system to clear out the memory used by the folder access routine. However, *Flash-Cache* will allow you to extend the folder-use memory to around 400. If you suddenly find that you have lost directories or have a sudden system crash, then the folder routine is at fault, not your drive. I have experienced this, and all I can say is that panic is a mild variation of what I felt.

System reboot settled the fault, if not my nerves! One point of interest, if you use a cold start give the ST time to settle otherwise no icons are loaded and the boot drive is not accessed.

One of the nice things to come along with the drive was a program called *Autoboot*. This allows you to set up an *Auto* folder on the hard drive where you can store necessary programs, eg, spooler, time set, etc. The program will then load and run the programs in the order they are stored.

Many years ago, I started out on an 8-bit system using tape. I remember the astonishment when I first used a floppy drive. I experienced this feeling again when I tried out the Turbo drive. For speed and ease of use a hard drive is ideal, and the Eidersoft Turbo Drive lives up to expectations.

**Product** *Triangle 20Mb Turbo Drive*  
**Micro Atari ST Price** £688.85 inclusive  
**Supplier** Eidersoft, The Office, Hall Farm, N Ockendon, Upminster, Essex RM14 3QH.

# Why a hard disc?

Every computer owner has a wish list of improvements they'd like for their machine.

If you're a Spectrum or Commodore 64 owner you might have your eye on an ST or an Amiga, and it may be hard to imagine those machines being flawed. But talk to owners of those machines and you'll find they have wish lists of their own.

Most users would head up their list with enhanced colour and graphics, or perhaps more memory, or better sound because those things are obvious and tangible. But if you really use your system, probably the most significant addition is a hard disc drive.

Anyone who has experienced the wondrous changes that accompany a move from tape to floppy disc will have an inkling of what a move from floppy to hard disc entails. Except that the improvements are an order of magnitude greater.

Essentially, a hard disc offers enhanced performance in two areas: speed, and storage capacity. But these features in turn allow other changes for the better.

What differentiates the hard disc from its floppy counterpart is physical construction:

- The floppy disc is made of flexible plastic, coated with a thin layer of magnetic particles. The hard disc is usually made of a light metal alloy, such as aluminium.

- Because floppy discs are capable of holding only a few hundred kilobytes of data, they are designed to be removable. Hard discs are usually enclosed in sealed units.

- Since the hard disc can be permanently calibrated, the disc works to much finer tolerances. This means it can be spun very quickly.

- Furthermore, spinning a floppy disc at high speed causes the disc itself to flutter with the risk of the disc smashing into the read/write head. Since the hard disc is rigid, this fluttering is eliminated. Hard discs generally spin at speeds greater than 3,600 rpm.

- The faster speed means that the drive can read and write data much more quickly.

- Finally, the speed improvement also means that far more information can be held on the disc.

In meaningful terms, all of this means that programs and data will load many times faster than from floppy discs (roughly five to 20 times faster), and one hard disc can hold from five to more than 100 megabytes of data, or the equivalent of around 15 to 30 floppy discs.

As attractive as these advantages are, hard discs also offer improvements in another way. Because they are very fast, software can use them as virtual memory, shuffling data from real memory to disc quickly and relatively painlessly.

So, just as a Ram disc can reduce a pressing need for an extra floppy disc drive, so a hard disc can virtually eliminate the need for extra memory over and above the minimum requirement for a program and a reasonable amount of data.

However, there are prices to pay for this power, and not just in financial terms.

Above all is the fact that hard discs are fragile things. The read/write head travels above the disc at a distance measured in thousandths of an inch – less than the thickness of a human hair. While the disc is spinning at thousands of revs per minute, the slightest fluctuation in the head can cause it to nose dive into the disc, eliminating masses of data and doing the head itself no good at all.

This means that you can't shove the drive to one side while it's in operation, and even the passing of the Number 39 bus can be cause for tension.

Second, important data – as with all discs – should be backed up regularly. With a 360K floppy this is not a problem. With 20Mb of data, it can be a time-consuming affair, but one that shouldn't be avoided.

Finally, the dread question of software protection. As with buying a disc drive for a tape-based system, so with a hard disc for a floppy-based system: the usefulness of the hard disc is obviously greatly reduced if you can't get your favourite programs on there.

But protection schemes can thwart you, even if you're in possession of an effective disc copier (some protection methods defy all copying software, and some copiers won't work with a hard disc).

The answer to this is in the hands of the software companies. Unprotected software is obviously favourite, followed by external protection, like dongles or entering keywords from a vast manual. Another possibility is the key disc system, where you can work from the copy but at the start of each session you must insert the original floppy disc.

If software houses insist on integral protection methods, it is up to them to provide a hard disc installation program.

As hard discs become more common, a process of natural selection will work against obstructive software companies. Until then you should choose your software with care.

# Taxmen, bank managers and accountants are easy to defeat.



**1st Word Plus** – G.S.T. Professional word processor featuring U.K. spellings and integration of graphics including 1st Mail for full control of form letters etc.



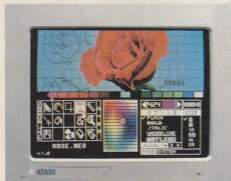
**Superbase Personal** – Precision Software. All the features of GEM combined with full relational database power. Easy to set up, flexible, plus unique picture index facility.



**Fleet Street Publisher** – Mirrosoft. The complete desk-top publishing package. Gives you page make-up combining text and graphics for sophisticated, professional looking documents.



**VIP GEM** – Silica Distribution. VIP Professional is an integrated spreadsheet, database, and graphics package. GEM environment plus Lotus 1-2-3 compatibility.



**Neochrome** – Atari. A powerful, sophisticated painting program for unsurpassed graphics. Work boldly on full screen canvas or in minute detail using Neochrome's magnifier.



**Fastcom** – Atari. A professional communications software package giving access to most major databases worldwide (Integrated ASCII/Viewdata package).

# These other fiends may be a bit trickier.



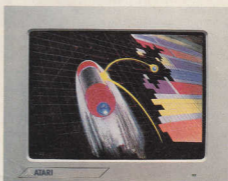
**Gauntlet** - U.S. Gold. Enter a world of monsters, mazes, mystery and combat in the ultimate role-playing fantasy game.



**Tai Pan** - Ocean. Voyage to 19th Century Hong Kong for action and excitement with pirates, smuggling and mutiny.



**Metrocross** - U.S. Gold\* It takes lightning reflexes to get past the potholes, obstacles and forbidden zones to reach the other side. And that's just the beginning!



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So you'll be able to create spectacular colour graphics. Even animate them to make your own films. If you're musically minded, you can compose and play a full symphony.

Or, for those who'd rather write programs than music, the 520 ST supports over thirty programming languages.

In fact, whatever you're looking for in a computer, you'll find it in the Atari 520 ST.

**ATARI 520 ST**  
WORKS HARD · PLAYS HARD



# Playing the numbers game

In this, the second part of Kenn Garroch's introduction to machine code, he explains the principles of binary numbering and basic machine code operations

The idea behind microprocessors is that they can perform functions that would take a great deal of time and effort with dedicated electronic circuits. To this end, they have a number of data handling commands simply for the logical manipulation of data.

All computers work with binary numbers due to the simplicity of designing an electronic circuit to handle on and off as one and zero. All microprocessor commands therefore manipulate binary numbers, usually in the form of bits, nibbles, bytes, and words, ie in the format of one, four, eight and 16 bits respectively. There is also the BCD (Binary Coded Decimal) format which most modern processors can handle with almost as much ease as the other formats.

## Internal registers

The instructions that handle these numbers are pretty much the same on all processors. In fact, processors generally have the same core of instructions, it's the knobs and whistles that make them different. All processors have load and store commands to move data from memory to internal registers and back, eg,

LDA \$OF12 ;6502 instruction to load the accumulator from memory location F12 (hex) or 3858 decimal.

LDA(SOF12) ;is a Z80 instruction that does the same thing.

The only difference between the two processors, as far as load and save go, are the addressing modes available (see last week). These differences can sometimes be major but the ideas are the same.

Another common feature of microprocessors is their ability to manipulate data. In general, they all do it the same way. They

can AND, OR, rotate, shift, add, and subtract. Again, the differences lie mainly in the way in which the information is accessed, ie, the addressing modes.

## Truth table

The AND operation is defined for two bits a and b as:

a	b	a AND b
0	0	0
0	1	0
1	0	0
1	1	1

**“All computers work with binary numbers due to the simplicity of designing an electronic circuit to handle on and off as one and zero”**

This is what is known as a truth table. It gives all the possible combinations of values of a and b, and the result of the operation on each combination. So looking at the AND truth table, the only time a 1 is produced is when both a and b are 1. Otherwise, the result of the AND is 0.

The OR operation is:

a	b	a OR b
0	0	0
0	1	1
1	0	1
1	1	1

Here, whenever one of the inputs is 1, the output is 1. Expanding things a little, the processor takes a binary number, usually eight bits, and performs the operation on another binary number, leaving the result in the accumulator (for most processors).

So the instruction AND # 15, when the accumulator holds 195, works by taking each bit and performing the AND operation on the corresponding bit in the operand. Therefore:

11000111 is the 195 in the accumulator  
00001111 is the 15 to be ANDed  
00000011 is the result in the accumulator after the operation.

This example demonstrates one of the major uses of AND which is masking. If the accumulator were holding two BCD numbers, to get at the lower one, simply ANDing with 15 sets all of the top four bits to zero, and leaves the bottom four alone. Check the AND truth table to see how this works.

## Masking

AND can also be used to turn specific bits off, ie set them to zero. 255 AND 247 makes bit 4 (bits always counted from 0 to 7) zero, ie, it masks it out.

The OR instruction can be used to perform the opposite and turn bits on. 240 OR 2 gives 242 since (1 OR 0 gives 1).

11110000 240 (FO in hex which is more compact)  
OR 00000010 2  
-11110010 242 (F2 in hex, note the easy conversion from binary simply split into sets of 4 and assign hex digits to them)

The AND instruction can also be used as

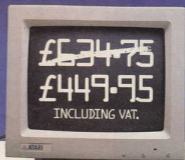
continued on page 22 ►

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◀ continued from page 20

a test to see if certain bits are set within a byte. This is where the processor condition flags come in handy. The zero or Z flag is set (to one) when the result of an operation is zero, and reset (to zero) when the result is non-zero, eg to find if a byte has bit 2 set AND with 4 and branch, jump, call on whatever the Z flag says. In 6502 this would be:

```
AND #2 ;test bit 4 note that bits are
        numbered b7,b6,b5,b4,b3,b2,b1,b0
BEQ label ;branch somewhere if the result
        is zero ie Z=1
```

## The carry flag

Addition and subtraction are just as easy and the use of the carry flag allows numbers to be as large as necessary. Some processors have simple add commands that ignore the current status of the carry, others, like the 6502, use the carry all the time.

The carry flag is set to one when the number in the accumulator is too big to fit, ie,

it is more than 8 bits. The ninth bit is stored in the carry.

## Higher byte

So adding 253 and 12 produces 265 - in binary:

```
11111001 253 or FD in hex
00001100 12 or 0C in hex
00001001 which gives 9 plus the carry
        set - here C=28 or 256
```

To represent this as a two byte number

```
n2.D2 2
r_DS 2
ADD2 LD HL,n1 ;address of LSBt n1
        into HL
        .LSBt of n2 into
        Accumulator
        ADD A,(HL) ;Add the LSBt on n1
        using address in HL
        ;Store LSBt result at
        r
        INC HL ;HL points to next
        byte of n1
        LD A,(n2+1) ;get next byte of n2
        to A
```

## Binary and hex

Binary is a method of representing numbers to base two. Normal decimal numbers are to base ten and work as: 123 is  $(1 \times 100) + (2 \times 10) + (3 \times 1)$  or  $(1 \times 10^2) + (2 \times 10^1) + (3 \times 10^0)$

and each digit is one of ten symbols ie 0123456789

Similarly, binary is to base two: 1011 is  $(1 \times 8) + (0 \times 4) + (1 \times 2) + (1 \times 1)$  or  $(1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)$

and each digit can be one of two symbols, ie 01

Hexadecimal is to base 16 so: A32F is  $(10 \times 4096) + (3 \times 256) + (2 \times 16) + (15 \times 1)$  or  $(10 \times 16^3) + (3 \times 16^2) + (2 \times 16^1) + (15 \times 16^0)$

Here there are 16 symbols needed for each digit so A-F are used for the extra 6 ie 0123456789ABCDEF

The other number system sometimes used with computers is octal which is to base 8 so:

3172 is  $(3 \times 512) + (1 \times 64) + (7 \times 8) + (2 \times 1)$  or  $(3 \times 8^3) + (1 \times 8^2) + (7 \times 8^1) + (2 \times 8^0)$

and the symbols for each digit are 01234567

BCD (Binary Coded Decimal) is a method of coding decimals so that they fit two to a byte. This is straightforward since 0-9 fits within 4 bits (0-15). The processor automatically performs the carry from the low nibble to the high nibble after a BCD operation that produces more than 9. For example 12 in BCD is represented as:

```
00010010 binary = 00010010 or 12
Adding 9 in BCD mode gives
00010010 12
+00001001 9
=00100001 21
```

between 0 and 65535 just add 0 and the carry into the higher byte (presuming its zero) giving:

000000100001001 or 265 (0109 in hex)

The use of extra bytes is known as multiple precision and allows processors to manipulate very large numbers. For instance, a 4 byte number (32 bits) allows values in the range  $0-2^{32}-1$  (bigger than my calculator will represent correctly). So a 2 byte multiple precision add in 6502 is:

```
n1.DS 2 ;.DS is the define space
        command
n2.DS 2 ;the 4 following it sets
        aside 4 bytes
r_DS 2 ;32 bit numbers are
        placed in n1 and n2
ADD2 LDA n1 ;get least significant
        byte (LSBt)
        CLC ;set carry flag to zero
        ADC n2 ;add LSBt of n2 plus the
        carry (=0 now)
        STA r ;put the result of the
        add in LSBt of r
        LDA n1+1 ;get next byte of n1
        ADC n2+1 ;add next byte of n2
        plus carry
        STA r+1 ;store this
        RTS ;return to main program
```

In this routine, the carry flag is initially set to zero, since the 6502 add command always adds the two values plus the carry (as one or zero).

## Immense numbers

At the second add, adding the carry is good since it automatically works out results over 256 from the previous add. The above example can be extended as far as you like to cope with truly immense numbers.

The Z80 version is:

```
n1.DS 2 ;set aside memory space for the
        numbers
```

```
ADC A,(HL) ;Add n1 plus carry
LD (r+1),A ;store at r+1
RET ;end
```

This is as close to the 6502 method as possible. In fact it is easier to use the 16 bit register pairs on the Z80 to provide the neater method:

```
ADD2 LD HL,(n1) ;Get two byte number
        n1 to HL
        LD BC,(n2) ;same for n2 into BC
        ADD HL,BC ;16 bit addition ignore
        carry
        LD (r),HL ;store result (HL) at
        two bytes starting
        at r
        RET ;end
```

**“The thing to remember when programming different processors is to have a good look through their manuals beforehand”**

This is shorter and hence faster. For multiple precision, the Z80 is better moving up in double bytes or words (16 bits) since there is an ADC HL, rp (where rp is a register pair BC DE, etc). The thing to remember when programming different processors is to have a good look through their manuals beforehand. Some things are easier, some are harder but they can always be done.

*Ken Garroch continues this series next week.*

## Khandal 2

Ian Grainger

**K**handal returns in the sequel to Khandal, called *Khandal 2* staggeringly enough. Okay, this is going to be a two listing, four week effort so get your

camping bags out now.

The plot: After collecting the scroll of eternal life in *Khandal 1* and reciting the spell, Khandal himself was teleported to a

parallel universe called Kluto because of a coffee stain on the parchment. Your task now is to collect the teleport pass and present it to the teleport officer.

10 REM Khandal II (return of a legend)	strong."CLS#1:GOSUB 2610	eynes."GOSUB 2610:GOSUB 1670
20 REM Written by Ian Grainger	420 IF starv=70 THEN mess\$="Khandal is getting weak."CLS#1:GOSUB 2610	660 mess\$="you scored "+STR\$(score)+"%":GOSUB 2610
30 REM Copyright 1987	430 IF starv<60 THEN mess\$="Khandal is exhausted."CLS#1:GOSUB 2610:dead=1	670 mess\$="press space to play":GOSUB 2610
40 :	440 IF dead=1 THEN exit=1	680 WHILE INKEY(47)=-1:GOSUB 2770:WEND:CLS#1
50 CLEAR:SYMBOL AFTER 32	450 IF room=7 AND shad=0 THEN CLS#1:dead=1:mess\$="ahh glasshopper, the light is so blite in here. khandal's eyes have been burned out, and he has died of pain."GOSUB 2610	690 IF on1=-1 THEN GOSUB 2770
60 MEMORY &7FFF:LOAD "!data",&9000	460 IF room=16 AND lum=0 THEN CLS#1:dead=1:mess\$="you silly billy! it is too dark to see a thing, you reach for a light switch but put your finger into a 100 00 0V power supply, you die in e/vi seconds!"GOSUB 2610	700 on1=1:WEND
70 GOSUB 1650	470 IF room=19 AND heat=0 THEN CLS#1:dead=1:mess\$="brr...f...f...freezing in here. arahh, you have frozen to a space age snowman."GOSUB 2610	710 END
80 GOSUB 1740	480 WHILE exit=0	720 REM Print Sprite
90 GOSUB 940	490 REM Keyboard Scan	730 POKE &803D,&7C:POKE &803F,&12
100 GOSUB 1990:on1=-1	500 press=0	740 CALL &8000,scr,4,32,&6680
110 WHILE 1=1	510 IF INKEY(34)<=1 AND scr>1scr THEN GOSUB 780:scr=scr-2:dat=spwk(2,anim):anim=anim+wk:GOSUB 720:press=1:GOSUB 2770	750 POK &803D,&14:POKE &803F,&17
120 GOSUB 1070:LOCATE 1,12:PRINT STRING\$(25,32):LOCATE 1,13:PRINT STRING\$(25,32):icn=13:spa=3:col=1:GOSUB 3440	520 IF INKEY(27)<=1 AND scr<19 AND press=0 THEN GOSUB 780:scr=scr+2:dat=spwk(1,anim):anim=anim+wk:GOSUB 720:press=1:GOSUB 2770	760 CALL &8000,scr,4,32,dat
130 room=12:dir=1:anim=1:wk=1:carry=0	530 IF anim<1 OR anim>3 THEN wk=-wk:anim=2	770 RETURN
140 icon=0:scr=&C14C:dat=&921B	540 IF press=0 THEN GOSUB 2770	780 REM Remove Sprite
150 lum=0:heat=0:door=0:shad=0:dead=0	550 IF INKEY(67)<=1 AND on1 AND icon=0 THEN icon=icon-1	790 CALL &8000,scr,4,32,&6680
160 starv=100:score=0	560 IF INKEY(69)<=1 AND on1 AND icon<3 THEN icon=icon+1	800 RETURN
170 WHILE dead=0	570 IF icon<3 AND carry=0 THEN icon=2	810 REM Print door
180 REM Main Loop	580 IF scr<&C19B THEN GOSUB 780:room=room-1:exit=1:scr=&C189	820 GOSUB 2770
190 CLS#2:fst=0:exit=0:starv=starv-1:GOSUB 2770	590 IF scr<&C1B9 THEN GOSUB 780:room=room+1:exit=1:scr=&C19B	830 PAPER 0:PEN 1:LOCATE 13,5
200 PAPER 0:PEN 1:LOCATE 9,10:PRINT STRING\$(12,131)	600 IF INKEY(47)<=1 THEN ON (icon+1) GOSUB 2860,2950,3130,3290	840 PRINT CHR\$(176)STRING\$(2,177)CHR\$(178)
210 left=VAL(LEFT\$(rns(room),1))	610 IF INKEY(18)<=1 AND up+down=0 AND scr<&C14B AND scr<&C14C THEN GOSUB 3470	850 FOR f=1 TO 3
220 right=VAL(RIGHT\$(rns(room),1))	620 WEND	860 LOCATE 13,45
230 up=VAL(MID\$(rns(room),2,2))	630 WEND	870 PRINT CHR\$(179)STRING\$(2,32)CHR\$(179)
240 down=VAL(MID\$(rns(room),4,2))	640 WEND	880 NEXT
250 IF up+down THEN GOSUB 810	650 IF maqic=1 THEN CLS#1:mess\$="magic i night pushes a button in the floor and you are sent off to your home in milton k	890 LOCATE 13,9
260 PAPER 0:PEN 1		900 PRINT CHR\$(183)STRING\$(2,32)CHR\$(184)
270 IF left THEN LOCATE 6,10:PRINT STRING\$(3,131)		910 IF up=1 OR down=1 THEN FOR f=1 TO 4:LOCATE 14,45:PRINT STRING\$(2,143):NEXT
280 IF right THEN LOCATE 21,10:PRINT STRING\$(3,131)		920 GOSUB 2770
290 GOSUB 2770		930 RETURN
300 iscr=&C0000:IF left=0 THEN iscr=&C140		940 REM Initialise
310 rscr=&FFFF:IF right=0 THEN rscr=&C1B3		950 ENV 1,1,15,2,5,-3,4
320 GOSUB 2770		960 ENV 2,1,15,1,4,-2,2,7,-1,4
330 ctr=0:FOR f=1 TO 5		970 ENV 3,1,15,1,15,-1,2
340 IF ch((f-1)*5+3)=room THEN ctr=f:CALL &8000,ch((ctr-1)*5+1),ch((ctr-1)*5+4),ch((ctr-1)*5+5),ch((ctr-1)*5+2)		980 ENV 4,7,2,1,14,-1,4
350 NEXT		990 ENV 5,7,-1,1
360 GOSUB 2770		1000 ENV 6,5,2,1
370 GOSUB 720		1010 ENV 7,15,-1,5
380 ob=obrn(room)		1020 ENV 8,50,-1,40
390 IF obj=0 AND obj<100 THEN col=3:GOSUB 83390		1030 ENT 1,1,-100,1,5,25,3
400 IF starv=98 THEN mess\$="Khandal is very strong and healthy."CLS#1:GOSUB 2610		1040 ENT 2,1,-75,1,4,25,3
410 IF starv=50 THEN mess\$="you are very		1050 DIM in(9,4),tune(2,249),ic(12),ob\$(3,12),ch(25),rns(25),obrn(25),spwk(2,3)

continued on page 24 ►





# PROGRAMMING: SPECTRUM

```

1500 PAPER 3: CLS: BORDER 0: INK 7
1510 PAPER 0: FOR f=1 TO 20: PRINT AT f,
1: " *": NEXT f
1520 PRINT AT 20,23: PAPER 5: INK 0: "
*": AT 21,23: PAPER 1: " *": PAPER 2
: " *": PAPER 6: " *
1530 PRINT AT 1,1: FLASH 1: " ELECTION
NIGHT!": FOR f=0 TO 19: PRINT AT f,25
: " *": NEXT f
1540 LET seat=650
1545 PRINT AT 4,1: "VOTES CAST -": AT 6,1:
"CONSERVATIVE": AT 8,1: "LABOUR": AT 10,1:
"ALLIANCE"
1550 LET tory=0: LET lab=0: LET all=0
1560 IF RND<100*(tory AND seat) THEN L
ET seat=seat-1: LET tory=tory+1
1570 IF RND<100*(lab AND seat) THEN LET
T seat=seat-1: LET lab=lab+1
1580 IF RND<100*(all AND seat) THEN LET
T seat=seat-1: LET all=all+1
1600 LET count=INT (lab/32.5)
1610 FOR f=19 TO (19-count) STEP -1: PRI
NT AT f,23: PAPER 1: " *": NEXT f: PRINT
AT 20,23: PAPER 5: INK 0: INT (100*tory/
650): "X"
1620 LET count=INT (lab/32.5)
1630 FOR f=19 TO (19-count) STEP -1: PRI
NT AT f,23: PAPER 2: " *": NEXT f: PRINT
AT 20,26: PAPER 5: INK 0: INT (100*lab/6
50): "X"
1640 LET count=INT (all/32.5)
1650 FOR f=19 TO (19-count) STEP -1: PRI
NT AT f,29: PAPER 6: " *": NEXT f: PRINT
AT 20,29: PAPER 5: INK 0: INT (100*all/6
50): "X"
1660 PRINT AT 6,14: tory: AT 8,14: lab: AT
10,14: all
1670 IF seat>0 THEN GO TO 1560
1680 IF tory<lab AND tory<all THEN PRINT
T AT 16,1: PAPER 1: INK 6: FLASH 1: "CONS
ERVATIVE VICTORY ": STOP
1690 IF lab<tory AND lab<all THEN PRINT
AT 16,1: PAPER 2: INK 6: FLASH 1: "LAB
OUR VICTORY !!!": STOP
1700 PRINT AT 16,1: PAPER 6: INK 2: FLAS
H 1: "AN ALLIANCE VICTORY !!!": STOP
1750 REM dicey
1760 LET dice=INT (RND*6+1): RETURN
1765 REM pcheck
1770 FOR y=1 TO 3: IF p(y)<100 THEN LET
T p(y)=100
1780 IF p(y)>150 THEN LET p(y)=150
1790 NEXT y: RETURN
1800 REM data for cd
1801 DATA 45
1802 DATA 25
1803 DATA 15
1804 DATA 10
1805 DATA 5
1811 DATA 55
1812 DATA 30
1813 DATA 15
1821 DATA 50
1822 DATA 30
1823 DATA 15
1824 DATA 5

```

```

1831 DATA 45
1832 DATA 25
1833 DATA 15
1834 DATA 10
1835 DATA 5
1900 REM gosub get
1910 LET a=INKEY$: IF a$<"1" OR a$>"5"
THEN GO TO 1910
1920 LET a=WAL a$: RETURN
2000 REM Poll display
2010 PAPER 7: INK 0: FOR f=6 TO 15: PKIN
T AT f,21: " *": NEXT f
2020 LET tory=u(e(1))+n(c(1))+d(1))+p(
1)
2030 LET lab=u(e(2))+n(c(2))+d(2))+p(2
)
2040 LET all=u(e(3))+n(c(3))+d(3))+p(3
)
2050 LET tory=INT (tory*100/(tory+lab+a
11))
2060 LET lab=INT (lab*100/(tory+lab+all
11))
2070 LET all=INT (all*100/(tory+lab+all
11))
2080 LET count=INT (tory/10)
2090 FOR f=15 TO (15-count) STEP -1: PRI
NT AT f,21: PAPER 1: " *": NEXT f
2100 LET count=INT (lab/10)
2110 FOR f=15 TO (15-count) STEP -1: PRI
NT AT f,22: PAPER 2: " *": NEXT f
2120 LET count=INT (all/10)
2130 FOR f=15 TO (15-count) STEP -1: PRI
NT AT f,23: PAPER 6: " *": NEXT f
2140 RETURN
2300 REM Board options and decisions
3100 LET m(party)=m(party)+15
3110 PRINT AT 9,6: "You're at": AT 10,6: "C
entral Office": AT 12,6: "15k goes into": A
T 13,6: "election fund"
3120 RETURN
3200 PRINT AT 8,6: "Do you want to": AT 9,
6: "spend $5k on": 10,6: "personal PR ?"
3210 IF g(party)=0 THEN GO TO 3240
3220 LET a=INKEY$: IF a$<"0" AND a$>"
n" THEN GO TO 3220
3230 IF a$="n" THEN PRINT AT 12,9: "NO !
": RETURN
3240 PRINT AT 12,9: "YES !": PAUSE 25
3250 IF m(party)<5 THEN PRINT AT 14,6: "
NOT ENOUGH": AT 15,6: "MONEY !": RETURN
3260 LET m(party)=m(party)-5
3270 LET p(party)=p(party)+5: INT (RND*6)
3280 GO SUB pcheck: RETURN
3300 PRINT AT 10,6: "Sunday respite": AT 1
2,6: "No exposure": RETURN
3400 PRINT FLASH 1: AT 8,6: "!! DISASTER
!!"
3410 PRINT AT 10,6: "Party Chairman": AT 1
1,6: "gay affair": AT 12,6: "shock horror"
3420 LET p(party)=p(party)-30: INT (RND*1
5)
3430 GO SUB pcheck: RETURN
3500 PRINT AT 8,6: "Discover what": AT 9,6
: "the nation": AT 10,6: "favours in -"
3510 PRINT AT 12,6: "(1) Education": AT 13
,6: "(2) Economy": AT 14,6: "(3) Defense": A

```

```

T 15,6: "(4) Health"
3515 IF g(party)=0 THEN GO TO 3570
3520 LET a=INKEY$: IF a$<"1" OR a$>"4"
THEN GO TO 3520
3525 GO SUB panel: IF a$>"1" THEN GO TO
3540
3530 PRINT AT 9,6: "Massive -": u(1): "X"
: AT 10,6: "Large -": u(2): "X": AT 11,6:
"Moderate -": u(3): "X": AT 12,6: "Small
-": u(4): "X": AT 13,6: "Squeeze -": u(5)
: "X"
3540 IF a$<"2" THEN GO TO 3550
3545 PRINT AT 9,6: "Huge -": n(1): "X"
: AT 10,6: "Moderate -": n(2): "X": AT 11,6:
"Stringent -": n(3): "X"
3550 IF a$<"3" THEN GO TO 3560
3555 PRINT AT 9,6: "Unilat -": f(1): "X"
: AT 10,6: "Multilat -": f(2): "X": AT 11,6:
"Polaris -": f(3): "X": AT 12,6: "Trident
-": f(4): "X"
3560 IF a$<"4" THEN GO TO 3570
3565 PRINT AT 9,6: "All NHS -": i(1): "X"
: AT 10,6: "Large NHS -": i(2): "X": AT 11,
6: "Modt NHS -": i(3): "X": AT 12,6: "Cut N
HS -": i(4): "X": AT 13,6: "No NHS -":
i(5): "X"
3570 BEEP 1,3: RETURN
3600 PRINT AT 10,6: "A mysterious": AT 11,
6: "bmfactor": AT 12,6: "gives $30K !"
3610 LET m(party)=m(party)+30: RETURN
3700 PRINT AT 9,6: "How much money": AT 10
,6: "to spend on": AT 11,6: "canvassing ?"
3710 IF m(party)<5 THEN PRINT AT 12,8: "
NONE !": RETURN
3720 IF g(party)=1 THEN INPUT "": IF
a.m(party) THEN LET a=m(party)
3730 IF g(party)=0 THEN LET a=INT (aipa
rty/2)
3740 LET m(party)=m(party)-a
3750 LET p(party)=p(party)+INT (RND*1.5*
a): GO SUB pcheck: RETURN
3800 PRINT AT 9,6: "TV Debate !": AT 10,6:
"do you attend?"
3810 IF g(party)=0 THEN GO TO 3830
3820 LET a=INKEY$: IF a$<"y" AND a$>"
n" THEN GO TO 3820
3825 IF a$="n" THEN PRINT AT 12,10: "NO"
: RETURN
3830 BEEP .2,5: BEEP .3,15: BEEP .2,9: L
ET a=INT (RND*3)+1
3840 IF a=1 THEN PRINT AT 12,6: "TORY MI
N !": LET p(1)=p(1)+10: LET p(2)=p(2)-5:
LET p(3)=p(3)-5
3850 IF a=2 THEN PRINT AT 12,6: "LABOUR
WIN !": LET p(2)=p(2)+10: LET p(1)=p(1)-
5: LET p(3)=p(3)-5
3860 IF a=3 THEN PRINT AT 12,6: "ALLIANC
E WIN !": LET p(3)=p(3)+10: LET p(1)=p(1
)-5: LET p(2)=p(2)-5
3870 GO SUB pcheck: RETURN
3900 PRINT AT 9,6: "Good write ups": AT 10
,6: "in the press"
3910 LET p(party)=p(party)+INT (RND*12):
GO SUB pcheck: RETURN

```

## Font Designer

Steve Turner

This week features the second half of Steve Turner's Font Designer program. All the instructions were given

in last week's issue but if you missed out, back orders can be ordered through Ann Marie Allan at the Popular offices, 12-13 Little Newport Street, London WC2H 7PP.

```

1150 gosub 10:FOR a=3 TO 0 STEP -1
1160 FOR y=1 TO 0 STEP -1
1170 GOSUB #3,y:CURSOR #3,pos,100:PRINT #3,CMB9(ode);
1180 postpos=20
1190 END FOR y:END FOR a
1195 END DEFINE
1210
1220
1230 REMARK * DRAW A BOX (CMB9) IN THE GRID
1240 DEFINE Procedure box
1250 OVER -1:BLOCK 0,0,9,9:YPOS,7:OVER #cond:read"255
1260 END DEFINE
1280
1290 REMARK * PRINT CHARACTERS ON SCREEN IN A POSITION DEFINED BY IT'S CODE
1300 DEFINE Procedure p_char (s)
1410 line=INT((x-32)/16):col=(x-32)-(line*16):line=line+10:CURSOR #3,col,line;
1420 PRINT #3,CMB9(s):CURSOR #3,2,0:CURSOR #3,col+9,line:PRINT #3,CMB9(s):CURSOR #3,0,0
1425 END DEFINE
1430
1440
1450 REMARK * FIND VALUE OF EXISTING BYTE IN FONT FROM CODE OF CHAR.
1460 DEFINE Function VAL
1470 IF chr=17 THEN open=(ode-128)*9+pos+pos+chr_start+91:ELSE open=(ode-
32)*9+pos+pos+chr_start+15
1480 open=2*7-(open/11):RETURN PREK((open*(ypos/9)))
1490 END DEFINE
1500
1510
1520 REMARK * DRAW CHARACTER GRID
1530 DEFINE Procedure grid
1540 CLG
1550 FOR y=0 TO 85 STEP 8:BLOCK 1,75,1,1,4
1560 FOR y=0 TO 71 STEP 8:BLOCK 8,1,1,y,4
1570 END DEFINE
1580
1590
1600 REMARK * LOAD EXISTING FONT IF NECESSARY
1610 DEFINE Procedure old
1620 CURSOR #3,3,0:CLS2
1630 INPUT #2:;Load an existing set? (Y/N) :as
1640 IF as="" THEN GO TO 1620:ELSE in=CMB9(as)
1650 SELECT ON in
1660 89,121
1670 CLS2:INPUT #2:; Enter Device,Filename :as
1680 LETS=as:chr_start
1690 78,110
1700 FOR a=chr_start TO chr_start+1996:STEP 4:FOR L x,0
1710 8,MAIN:DEF
1720 GO TO 1620
1730 END SELECT

```

```

1740 CURSOR #3,0,0:CLS2
1750 END DEFINE
1760
1770
1780 REMARK *****
1790 REMARK * STANDARD UTILITY SET *****
1800 REMARK *****
1810 REMARK * MAXI 'LOAD' PROC AUTOCOM *****
1820 DEFINE Procedure autocom
1830 LOCAL #0,80:stata:PRINT:;PROGRAM AUTO SUMMER"
1840 INPUT #2:;Enter 'I' COMPLETE:;FILENAME:;OF 'THE':;PROGRAM:;as
1850 OPEN #1,as
1860 REPEAT ALONG
1870 IF EOF(#1) THEN EXIT ALONG
1880 #0:LINE#(F#1):PRINT #2,80
1890 END REPEAT ALONG
1900 PRINT #1:; RUN "CLOSE #1:CLS:CLS2:CLS40:PRINT #0,AUTOCOM COMPLETE"
1910 END DEFINE
1920
1930
1940 REMARK * DEFAULT SCREEN FOR PROG DEVELOPMENT
1950 DEFINE Procedure start
1960 BUCS 4
1970 OPEN #3,scr,512*256*8*8:PAPER #3,0:CLS #3
1980 CLOSE #3
1990 WINDOW #1,235,236-48,20,0:colour(1)
2000 WINDOW #2,235,236-48,256,0:colour(2)
2010 WINDOW #3,470,48,20,256-48:colour(0)
2020 CLS #0
2030 END DEFINE start
2040
2050
2060 REMARK * SET BLACK WINDOW AND RED BORDER
2070 DEFINE Procedure colour(chm)
2080 PAPER #chm,0
2090 IWK #chm,7
2100 BORDER #chm,1,2
2110 END DEFINE
2120
2130
2140 REMARK * SAVE TO M'DRIVE I OR 2
2150 DEFINE Procedure totape
2160 LOCAL #0,as,as2
2170 start:FLASH 1:PRINT:PRINT "Drive 1 or 2"
2180 FLASH #0
2190 INPUT #2:CLG:PRINT "DRIVE :as\;" "Prog name":;INPUT #2:as2
2200 IF as="" I AND as="" I THEN GO TO 2150
2210 CLS
2220 as2="sdv"as2:".as2
2230 DELETE as2:SAVE as2
2240 END DEFINE totape

```

# PROGRAMMING: C64

**Microcom**  
P A Fairclough

At last, the concluding instalment of Microcom, the machine code monitor/utility. There follows a chart giving

some of the more interesting address locations used.

Useful address locations.	8C420	Interpret address.
Address	8C442	Interpret character - converts it to a displayable form.
30002	8C46C	Memory input.
30003	8C488	Character memory input.
30004	8C4C9	Assemble routine (the big one).
30005	8C63B	Breakpoint routine.
30006	8C658	Routine to handle J command in Walk.
30007	8C676	NMI handler. Used by Go, Quick and Walk.
30008	8C722	Quick routine.
30009 - 30046	8C726	Walk routine.
	8C72A	Go routine.
3C000	8C7B3	Number routine.
2C045	8C842	Out routine.
8C097	8C855	Print routine.
8C0E2	8C93C	Kill breakpoint routine.
8C0E7	8C94D	Display registers routine.
8C166	8C972	Output a binary number.
8C19C	8C985	Change registers routine.
8C239	8C9F8	IRQ handler.
8C278	8CA1C	Check for instant commands.
8C2D0	8C8A6	Scrolls the screen down by one line.
8C311	8C8F6	Disassemble routine.
8C3FE	8C8FC	Exchange bases routine.
	8C8DC	Tap handler routine (E.g., Load & Verify).
	8CF86 - 8CFFF	Vectors to text, IRQ, BRK and NMI.

10467	DATA08,40,09,10,22,44,33,D0,458	10475	DATA23,24,53,1B,23,24,53,19,360
10468	DATA08,40,09,62,13,78,A9,00,487	10476	DAT0A1,00,1A,5B,5B,A5,69,24,675
10469	DAT0A21,81,82,00,00,59,4D,91,603	10477	DAT0A24,AE,AE,AS,AD,29,00,7C,890
10470	DAT0A92,86,4A,85,9D,2C,29,2C,773	10478	DAT0A0,15,9C,6D,9C,A5,69,29,753
10471	DAT0A23,28,24,59,00,58,24,24,360	10479	DAT0A53,84,13,34,11,A5,69,23,608
10472	DAT0A00,1C,8A,1C,23,5D,8B,1B,488	10480	DAT0A0,88,62,5A,48,26,62,94,920
10473	DAT0A01,9D,8A,1D,23,9D,8B,1D,845	10481	DAT0A88,54,44,C8,54,68,44,E8,976
10474	DAT0A01,00,29,19,AE,69,A8,19,697	10482	DAT0A94,00,B4,08,84,74,B4,28,804

```

10483 DATA6,74,F4,CC,4A,72,F2,A4,1268
10484 DATA8A,00,AA,A2,A2,74,74,74,980
10485 DATA72,44,68,B2,32,B2,00,22,726
10486 DATA00,1A,1A,26,26,72,72,88,492
10487 DATAC8,C4,CA,26,48,44,44,A2,1006
10488 DATAC8,0D,0D,48,45,58,20,3D,548
10489 DATA20,24,0D,44,45,43,20,3D,378
10490 DATA20,0D,42,49,4E,20,3D,20,387
10491 DATA25,0D,43,48,52,20,3D,20,396
10492 DATA22,0D,20,20,50,43,20,322
10493 DATA20,4E,56,2D,42,44,49,5A,538
10494 DATA43,20,41,43,20,58,52,20,465
10495 DATA59,52,20,53,50,0D,4D,49,529
10496 DATA43,52,4F,4D,4F,4E,20,56,580
10497 DATA33,20,28,43,20,27,38,358
10498 DATA37,20,50,41,46,0D,09,07,331
    
```

```

10499 DATA08,08,1D,18,41,42,43,44,335
10500 DATA45,46,47,48,49,4B,4C,4D,583
10501 DATA4E,4F,50,51,52,53,54,56,653
10502 DATA57,58,2C,3A,3B,27,FC,CA,772
10503 DATA3B,C6,9C,C1,D0,C2,FC,C0,1464
10504 DATA39,C2,2A,C7,58,C2,FE,C3,1223
10505 DATA3C,C9,BC,CD,CE,C3,B3,C7,1481
10506 DATA42,C8,55,C8,22,C7,4D,C9,1062
10507 DATABC,CD,9C,C1,BC,CD,26,C7,1372
10508 DATAC1,C9,C9,C4,6C,CA,85,C9,1429
10509 DATASB,C4,FB,C9,76,C6,45,C0,1364
10510 DATA1C,CA,58,C6,41,CF,4A,CF,1069
10511 DATA51,CF,59,CF,61,CF,7E,CF,1221
    
```

READY.

## PROGRAMMING: ATARI ST

### VLabel

David Gristwood

When a disc is first formatted an optional label consisting of eleven characters, can be written to the disc. This name is that one which appears

when Show Info is selected from the desktop. The problem is that once a disc has been formatted you cannot change the label, unless you use VLabel of course.

The volume label is stored on the disc in the same way as a file or directory entry. However, it contains a special attribute which marks it as a volume label, so that it does not appear on a normal directory search.

VLabel checks that a disc is present by

first reading the BIOS Parameter Block (BPB), which contains information describing the layout and use of all the sectors on the disc. The root directory, which is where the volume label is stored, starts immediately after the second copy of the File Allocation Table (FAT). On both the 360K and 720K disc the root directory occupies sectors 11 to 17.

The second part of the listing follows next week.

```

V
/*
*****
** Program : VLABEL.C for Atari ST.
** Function : Change/add (disk) volume label.
** Written  : 4 May 1987
** Author   : David Gristwood
** Version  : 1.0
** Depends  :
** Copyright (C) David Gristwood and
**           Bvline Software Limited, 1987.
*****
*/

#include "handle.h"
#include "hwind.h"
#include "hpglib.h"

#define ON 1 /* boolean true */
#define OFF 0 /* boolean false */

#define ESC 27 /* ASCII escape */

#define SECTOR_SIZE 1024 /* max sector size */
#define RWADD_READ 0 /* rwadd() read flag */
#define RWADD_WRITE 1 /* rwadd() write flag */
#define RW_IOCTLIN 0x85 /* virgin marker */
#define RW_LABEL 0x86 /* label attribute */

typedef unsigned char byte;
typedef int boolean;

typedef struct
{
    short sectors; /* sector size (bytes) */
    short csize; /* cluster size (sectors) */
    short cbytes; /* cluster size (bytes) */
    short rlen; /* root directory length (sectors) */
    short fat; /* FAT size (sectors) */
    short fatsec; /* sector # of second FAT */
    short dstart; /* sector # of first data cluster */
    short ncl; /* # of data clusters on disk */
    short flags; /* BPS Parameter Block */
} BPB;

BPB *bpb; /* active BPB */

short const1[12];
short in[128];
short ptain[128];
short inb[128];
short ptout[128];

short handle;
short *bpb_handle;

short *wpp_out[57];
short *wpp_in[12];
    
```

## Scroll Clear

Paul Hutchison

This routine for the Amstrad CPC clears the screen by scrolling the entire display off the top of the screen. Use *Call* &4B00.

```

10 MEMORY &AAPP
20 A=43776
30 READ B$:IF B$="-" THEN END
40 POKE A,VAL("&"+B$)
50 A=A+1
60 GOTO 30
70 DATA 00,3E,19,32,00,AB,06,01
80 DATA 3E,00,CD,4D,BC,3A,00,AB
90 DATA 3D,0B,32,00,AB,C3,06,AB,-1
    
```

## Type

Alastair Scott

This Amstrad CPC routine provides the missing CP/M command, *Type*. The syntax is *Type, filename*.

While the Ascii file being listed to the screen, pressing *Tab* will pause the listing.

```

100 'TYPE command
110 'by Alastair Scott
120 MODE 1:MEMORY &7FFF
130 FOR a=&8000 TO &8052
140 READ b$:POKE a,VAL("&"+b$):c=c+PEEK(a)
150 NEXT:IF c<>9787 THEN PRINT CHR$(7)"ERROR
    IN DATA!":END
160 CALL &8000:PRINT":TYPE,<filename>
    command initialised. ":PRINT:END
170 DATA 01,09,80,21,53,80,C3,D1,BC,0E,80,C3
180 DATA 13,80,54,59,50,C5,00,3D,20,38,DD,6E
190 DATA 00,DD,66,01,46,23,5E,23,56,EB,11,57
200 DATA 80,CD,77,BC,30,24,CB,67,28,20,CD,FF
210 DATA BB,CD,4E,BB,CD,80,BC,30,12,CD,5A,BB
220 DATA AF,CD,1B,BB,FE,FC,28,07,FE,09,CC,18
230 DATA BB,18,E9,C3,7A,BC,3E,07,C3,5A,BB,00
    
```

## Slow Text

Malcolm Sargent

This BBC routine will make all output to the screen scroll up slowly giving you a chance to examine it before it whizzes past.

```

10 REM SLOW PRINT BY M. SARGENT
20 SPEED=10
30 JUMP =(I&20E AND &FFFF)
40 ?&70=SPEED
50A=&B00
60FOR P=0 TO 3 STEP 3
70P%=A
80(OPT P
90PHP:PHA:TXA:PHA:TYA:PHA
100LDA &70:BEQ salo
110TAX:LDY#0
120.LOOP NOP:DEY
130BNE LOOP:DEX
140BNE LOOP
150.sal0 PLA:TAY:PLA:TAX:PLA:PLP
160JMP JUMP
170]
180NEXT
190?&20E=A MOD 256
200?&20F=A DIV 256
    
```

# We want your programs!!

**Y**es, this is your chance to get rich and famous. Well, famous anyway, as *Popular Computing Weekly* is looking for contributions to the Programming pages.

What sort of thing are we looking for? You name it - anything original from games to utilities, applications and the like, written in Basic, machine code or anything else you can think of.

Programs for any computer will be considered, not just the old

faithfuls (Spectrum, Amstrad, QL, Commodore, etc), so send those listings in. What we need is a working copy of the program on tape or disc, plus an accompanying article or documentation that you would anticipate going with the piece, normally not over 2000 words.

Alternatively, send in your short programs to the Bytes and Pieces page - what could be easier?

In return, we'll pay the princely sum of £25/page for the main

programming pages and £10 for each Bytes & Pieces contribution we publish. Plus the fact that your name will be indelibly carved in the *Popular Programming Hall of Fame* till time immemorial. What more could any true programmer ask?

Just send your masterpieces in to **Duncan Evans, Technical Editor, Popular Computing Weekly, 12-13 Little Newport St, London WC2 7PP** and he'll assess them post haste.



with Kenn Garroch

## C for confusion

E J Searle, of Exeter, writes:

**Q** Some six months ago I decided, after purchasing an Atari 520 STM, that I would attempt to learn the C language in the hope that it would give me more access to the power of the Atari.

I purchased a GST C compiler on grounds of cheapness and having read a review in your magazine which said that it was ideal for beginners. Since then I have been trying to access the libraries, ie, AES, VDI, SUPER & TOS LIB. I wrote to GST but all it suggested was that I should purchase its Fractal generator which includes full C access including Gem library access. I also enquired whether updates to the compiler were provided but I didn't get an answer. Can you help?

**A** The GST C compiler appears to use run time libraries, ie, the libraries contain preassembled code. The drawback with this is that you cannot root around inside the library files themselves to see what the various functions do.

However, the library functions should be documented in the form of what they do, what arguments should be passed to them, and what they return.

For more details about what the functions do, a book such as *The Concise Atari 68000 Programmer's Reference Guide* by Katherine Peel, published by Glentop Publishers, Standfast House, Bath Place, High Street, Barnet, Herts, 01-441 4130, or *The Anatomy of the Atari ST No. 2* by K Gertis, L English, and R Bruckmann, published by First Publishing, 20B Horseshoe

Park, Horseshoe Road, Pangbourne, Berks, 07357 5244, contains the C bindings for the functions.

For example:  
`scm-logbase);`

Where `scm` is a long int, gets the logical screen base address. All you have to do is include the XBIOS library in the C program. This is done with the `include` command although you will have to check how to use `include`, as you may already be using it for `stdio.h` and `stdio.lib`.

A magazine such as *Popular's* sister magazine *ST Update* will also be of use since it contains example C programs as did *Popular's* own series on C a few weeks back. Not having used GST C, I don't know the full details about how to access GEM, AES, etc. However, you might try the following demo:

```
include GEMVDI.LIB
/* use the gem vdi library name included
with GST C */
int contr[12];
int intIn[12];
int ptsIn[12];
int intOut[12];
int ptsOut[12];
main()
{
  int handle;
  psysarray[12], work_in[11],
  work_out[57];
  int x,g,term;
  for (i=0; i<10; i++)
    work_in[i]=i;
  work_out[10]=0;
  v_open(work_in, &handle, work_out);
  /* open workstation */
  psysarray[0]=12000;
  psysarray[1]=12000;
  psysarray[2]=12000;
  psysarray[3]=20000;
  psysarray[4]=16000;
  psysarray[5]=20000;
  psysarray[6]=16000;
  psysarray[7]=12000;
  psysarray[8]=12000;
  psysarray[9]=12000;
  /* set up poly line array of vertices you
  may have to reduce these */
  v_line(handle, 5, psysarray);
  /* draw a poly line */
  vg_locator(handle, 16000, 16000,
  5, 5, 8190);
  /* pause for button or keypress */
  v_cls(handle);
  /* close workstation */
}
```

## Spectrum crashes

Les Rothera, of Leeds, writes:

**Q** My set-up is a Spectrum Plus, two microdrives, Alphacom 32 printer, Tasman B interface, Silver Reed I/F44 interface, Silver Reed EX44 Daisy-wheel typewriter/Printer, and a Taxan K-12 Monochrome monitor.

**Using Tasword III for wordprocessing etc. I find that having got everything ready to boot to the EX44, when I do go to print, a couple of lines will be printed and then the system locks up. Sometimes I can get a complete run through the print sequence without any bother, and at other times it is a stop-go situation all the way through. I have had the Spectrum Plus, interface I, Microdrives, and Tasman B interface checked out locally and pronounced fit and well. The Silver Reed and its I/F44 interface were checked out some twelve months ago and also given a clean bill of health.**

**I am at my wits' end as to what to do next. Can you supply an answer to my problem?**

**A** There are a couple of possibilities, but from your description it sounds like a crash.

The Spectrum Plus could well be suffering from a power failure, or possibly is being overloaded. Try waggling the power plug on the Spectrum. If it is loose, it will give the crash you describe. Make sure that you waggle the whole length of the cables including the plugs at both ends. If this has no effect then try the interfaces where they connect to each other.

Alternatively, vibration from the printer may be the cause of the problem, so try moving this to a different position (say the floor) where it cannot affect the rest of the equipment. Presumably it has worked before and so will work again.

If there is an overload problem, try running the printer with as little other equipment attached to your Spectrum as possible, such as only the printer and its interface, and see what happens. If things work correctly, add more of your gadgets until problems occur. This should give you a pointer to the problem and its solution.

If all else fails you will have to resort to carting the whole lot to your local Mr. Fixit and have him check out the whole kit and kaboodle. The individual parts of your hardware may be fine but when put together, there may be a problem that doesn't appear on the individual pieces.

## Hair tearing on Spectrum

John E Wells, of London E7, writes:

**Q** Though a middle-aged computer moron, I may be able to help Sean of Westmeath (Peek & Poke, May 15).

I suspect that my setup is similar to his - except that I have an issue three Spectrum.

One of the problems with the Opus is the dreaded 'I/O error' which tells you nothing except that it doesn't work.

After much hair tearing and changing the stepping Rom to little effect, I have found a system that, so far, has generally proven effective, though why I know not.

Simply format a disc. I keep a spare disc handy, formatted or not, since the act of formatting seems to 'kick start' the Opus, and the error report disappears: `FORMAT "m"; "Hail Mary" ENTER`

I did you not.

**A** Some say sticking your tongue out of the corner of your mouth works just as well - and for some it does. Try anything is the rule in this sort of situation.

## Isolation ward

John Mitchell, of Wishaw, Scotland, writes:

**Q** I am retired and have a DAI computer for a hobby. I wish to experiment and control stepper motors via the computer's RS232 or DCE outlets.

Please can you help me with clear information or a source of information on how to completely isolate my computer from any external circuit mistakes while experimenting?

I am keen to experiment but I do not want to do any damage as a result of my ignorance.

**A** I am no expert on the DAI but I presume that one of the outlets you mention is able to put out controllable signals between 0 and 5 volts as

continued on page 30 ▶

## ◀ continued from page 29

on and off. If this is the case, an opto-isolator will isolate the computer from any voltage surges that might arise during the course of your experiments.

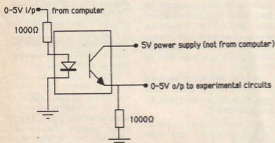
To isolate the computer, you will have to attach the isolation circuits directly to the machine. However, these are pretty straightforward and so should not cause any problems.

An opto-isolator is a chip containing a light emitting diode (LED) and a photo-transistor. When the diode is off, the tran-

sistor is off and no current flows between the collector and the emitter (the lead with the arrow on it is the emitter - the arrow pointing out means NPN). When the diode is turned on, the transistor comes on and current can flow from the collector to the emitter.

It is necessary to include resistors in the external circuit to limit the amount of current flowing through the device. For the LED, a resistor with a value of

Diagram one



When you know which IC you need, get the cheapest NPN transistor with IC that fits the bill. With transistors, switching speed (the time taken to go from on to off) is what you pay for and in this situation, the switching speed is quite slow so, you don't need to get anything too flash.

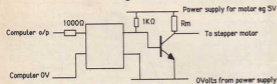
Turning the LED on causes

power supply line to the collector (the one without the arrow).

Now, when the LED is off, the photo-transistor is not conducting and the output is connected to the power supply line via the resistor giving a high output. This output is fed to the input of the power transistor, which is turned on pulling the output to the 0V line, giving a zero volts output.

Turning the LED on causes

Diagram two



about 1000Ω gives a current of 5mA which is enough to turn it on. Incidentally, the current is worked out with the formula:

$V = R \times I$  where V is the voltage, R the resistance, and I the current.

In the first diagram, the output circuit is wired so that when the LED is off, ie, 0V input, the output transistor is off and consequently, the output is 0V. When input voltage goes to 5V, the LED comes on, the photo-transistor conducts, and effectively connects the resistor to the 5V power line, pulling the output voltage up to 5V.

the photo-transistor to conduct pulling the voltage input to the power transistor down. This turns off the power transistor and makes the output to the stepper motor equal to the power supply voltage.

The power transistor also needs a current limiting transis-

tor which is Rm. The value of this depends on the amount of current that power transistor can conduct. Again, the formula  $V = R \times I$  is used. If the power transistor is capable of 500mA then the value of Rm is:

$Rm = \text{Power supply voltage} / \text{Collector to emitter current}$   
 $Rm = 5/0.5 = 10\Omega$

Also make sure that the resistor and external power supply can handle this amount of current. The current that flows through the transistor from collector to emitter, following the arrow, is known as the collector emitter or CE current (sometimes shown as Ic). Check the maximum power consumption of the motor before deciding on the transistor.

When you know which IC you need, get the cheapest NPN transistor with IC that fits the bill. With transistors, switching speed (the time taken to go from on to off) is what you pay for and in this situation, the switching speed is quite slow so, you don't need to get anything too flash.

The only part of the circuit that is connected to your com-

### Parts for the opto-isolator diagram 2

Opto isolator WL 35Q  
 1000Ω resistor M1k  
 Power transistor Ic 15A MJ2955  
 Rm 1Ω P1Q - gives 5 Amps output current approx

puter is the LED, everything else is separate, including the power supply for the stepper motor, photo-transistor, etc.

The maximum voltage that the opto-isolator can stand before it breaks is about 1500V which is more than you are likely to use so whatever you experiment with (as long as its not high energy physics) should not be able to harm the DAI.

I don't know of any books specifically for the DAI. However, there is quite a good book for the BBC micro which will give you a lot of information on the hardware side. Try *Interfacing and Robotics on the BBC Micro* by Ray Bradley from Micropress, Castle House, 27 Lon-

don Road, Tunbridge Wells, Kent.

The only drawback of the book is that programs are written in BBC Basic and 6502 machine code. You will have to convert the programs to use them.

## The other half

Ron James, of Ribbleson, Preston, Lancs, writes:

**Q** Having been involved in radio communications for many years with simplex (single frequency) walkie talkies and duplex (double frequency) walkie talkies, I am trying to formulate in my mind where the 'half duplex' used in computer terminology fits in with my understanding of radio communications. It is a term I had never come across until becoming involved with computers.

**A** As far as I can see, half duplex is more or less the same as simplex. With full duplex, there are two frequencies, allowing both communicators to transmit and receive at the same time. With computer communications, full duplex is the same as with radio except that the transmission speeds are taken into account, ie, the baud rate (changes in state per second or sometimes bits per second).

The difference arises when you look at the medium through which the computers are communicating, ie, telephone lines.

Here, unlike radio communications, there is a set bandwidth in which all signals have to fit. For normal BT lines, the limitations are such that normal full duplex is limited to 1200/75 baud (transmit and receive). Unless you use a special phase shifting equalising modem, these two speeds are the limit.

To get higher speeds on both transmitter and receiver, half duplex is used. Here, only one communicator talks at once allowing speeds such as 1200/1200 baud to be used. Since these are both the same speed, this is effectively simplex.

The phrase 'half duplex' covers situations where the speeds are different but there is only one transmitter at a time, eg, it is possible to have 300/1200 half duplex, or 300/75 half duplex.

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Technical editor Duncan Evans relies on you for the programs section. It needn't be that machine code masterpiece that NASA was promising you vast sums for, what we're looking out for is handy routines, utilities, anything that you've concocted that makes your life easier as a programmer that you'd like to pass on to others.

Don't make your programs too long, please - it's best if we can print the full listing in one week, and a four part listing is probably the largest we can accept. If they're very short, then so much the better, they'll fit neatly into our Bytes and Pieces page.

## Features

We're also particularly interested in articles about programming, which should be sent to Christina Erskine. If you think you could explain technical

areas of computing to a wider audience then do let us know.

We also welcome articles on any aspect of home computing, although we cannot feasibly accept anything longer than 2000 words. It's worth checking by phone or letter first that your piece will be suitable, but we're open to all ideas.

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For even less money, we'd like to hear your views, comments and opinions on our Letters page, and our columnists are always on the look-out for hints and tips and comments on their own areas of the magazine.

Mark Jenkins welcomes correspondence of a musical nature for Soundcheck, Martin Bryant is interested in any queries or views regarding computer chess, and our communications correspondents will be happy to answer questions about modems and networks (mark your envelope 'Comms').

Any technical or programming problems you're encountering can be addressed to Kenn Garroch. Kenn tries to help as many people as possible in Peek and Poke, but cannot undertake to give personal replies.

## How to submit

For features, it is almost always

better if you write or telephone first to discuss your ideas with us. Your articles should be typed or word processed, preferably in double spacing, using one side of the paper only.

Please don't write more than 2000 words for an article. Program notes should explain what your program achieves and how it works, but, again, please keep them concise.

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## Where to send them

All submissions should be sent to *Popular Computing Weekly*, 12-13 Little Newport Street, London WC2H 7PP. If you mark which department your letter is destined for on the envelope it will help us process them much more quickly.

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# Ample new software on the BBC

The BBC Micro/Master series has been churning forth musical software since the Hybrid Music 500 system was upgraded. Here, Mark Jenkins reviews some of the new products.

**M**R F G Smith of Newcastle-upon-Tyne has written in explaining that he's a confirmed Commodore 64 fan but recently got hold of an Atari 130XE outfit very cheaply in a Lasky's clear-out sale. He has several music add-ons for the 64 and would like some similar units for the XE.

As far as I know, the only products available at the moment come from 2-Bit Systems, who have a drum sampler and a useful Midi control system. The most professional packages come from Hybrid Arts in the States, but these aren't being imported at the moment, although you could ask Syndromic Music (the importer of Hybrid's 16-bit packages) for more information.

2-Bit markets *Midi Master*, which comes complete with a very simple Midi interface (just a multi-pin connector leading to DIN in and out plugs) and offers an eight-track polyphonic sequencer plus sound editors for the Casio CZ-101 and Yamaha DX-100 synths. The system is available on tape

or disc for £27.50 including p&p. If any other companies have 8-bit music products perhaps they'd like to send them in for review.

Now on to the BBC Micro/Master series, which is putting on a spurt in musical terms following the upgrading of Hybrid Technology's Music 500 system to the Music 5000 specification, their release of the Music 4000 keyboard, and Peartree's introduction of the Music 7000 system.

The Music 5000 (£161 or £69 as an upgrade) boasts many software changes over the original 500 system and is compatible with the Music 4000 keyboard (£169 with software). Music 5000 has 16 voice channels (although the sounds themselves are generated in software) and many preset sound parameters which can be combined to create new voices.

The language used, Ample, allows you to define any set of parameters or any pattern of notes under a single name using the command MAKE. Ample is in some ways similar to Forth so is quite capable of creating computer games and text adventures with music as well.

It's now possible to create music in real time using the real-time sequencer page and to mix it (controlling stereo pan, volume and tone of each sound) using the mixer page. You can still compose using Ample though, and in fact you can convert Ample files into real time music, real time music into conventional musical notation on the screen, and notated music entered from the computer keyboard into Ample

without some fiddling with the RS432 port, so the drum kit has to be good.

Music 5000 is multi-tasking so you can make a lot of changes while the music is playing, although this doesn't include loading a new "module" from the program disc. Overall the 5000 system is a very flexible and impressive alternative to the sort of extended Midi system some users may find attractive.

It's equally well suited to educational purposes, serious composing, part-time dabbling and composing for games. It will be a more serious proposition for the ambitious when Midi and better drum synchronisation are added using the Music 2000 interface to be shown at the Acorn User show.

Peartree's Music 7000 has little connection with what Hybrid is doing now; it's basically an old Music 500 with a version of Ample on cassette (Hybrid refused permission to market it on Proms) and separate software offering a modified mixing desk page, a sound shaper

page for creative synthesis (rather more visual than the Music 5000 approach), the ability to print out the music state (Music 5000 can do this too if you have a print Rom), lightpen and mouse compatibility, and so on.

An existing Music 500 (now being given away free with the Master series micros by some dealers) can be updated to a Music 7000 for £39.95, or you can buy both hardware and software for £79.95, although deliveries aren't expected until after the Acorn User show at the end of July.

*Hybrid Technology, Unit 3, Robert Davies Court, Nuffield Road, Cambridge CB4 1TP, 0223 316910.*

*Peartree Computers, Peartree House, No. 1 Blackstone Road, Stukeley Meadows Industrial Estate, Huntingdon, Cambs PE16 6EF, 0480 50595.*

*2-Bit Systems, 44 Morcom Road, Dunstable LU5 4EG.*

*Syndromic Music, 24-26 Avenue Mews, Muswell Hill, London N10 3NP, 01-444 9126.*



The Hybrid music system

The sounds are similar to those from a reasonably expensive Casio keyboard with the added advantage of various stack and detuning modes to make terms such as BigModg seem entirely justified.

The new Music 4000 keyboard is similar to the Symphony released a few years ago, and in fact it's possible to upgrade a Symphony to use it with the Music 5000 for £47. A multicore cable connects keyboard to micro and a footswitch carries out various functions.

The four-octave, full-sized keyboard isn't velocity-sensitive but responds pretty well to all playing techniques. Performance parameters such as microtonal or reversed scales are set on the screen and you can program in a chord or a whole sequence of notes to be played with a single finger.

In Split mode each key produces a different sound, repeated in each octave; this is ideal for playing a 'kit' of drum sounds while you're programming a piece, and in fact the drum sounds available are surprisingly powerful. At the moment it's difficult to link up an external drum machine

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ed parser as *The Pawn*; however, while the graphics on the Amiga and Atari ST versions are distinctly nifty, and those on the Commodore 64 pretty damn good, the PCW version's graphics (and this is after you make allowances for monochrome, etc) are a disappointment. Rather blurred and fuzzy.

Of course, if you're a purist who thinks graphics are an irrelevance in adventures, then the delights of the plot and the parser will keep you happy for months.

**Program** *Witch Hunt Type Text*

**Adventure Price** £14.95 (disc) **Supplier** Classic Quests, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex.



See Amstrad CPC for comment.

**Program** *Psi-5 Trading Company Type Arcade Adventure Price* £19.99 **Supplier** US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

Welcome conversion of one of US Gold's more intelligent releases.

### Amstrad CPC

**Program** *Witch Hunt Type Text Adventure Price* £14.95 (disc) **Supplier** Classic Quests, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex.

Classic Quests is a new label from Supersoft: *Witch Hunt* its debut product. You play Filbur Apse in this text only adventure; your only attribute is your obnoxious personality and your quest is to retrieve it after a wizard turns you into someone nice.

If this sounds somewhat off-beat for the traditional text adventure genre, rest assured that witches, wizards and spells are all there in abundance.

**Program** *Destructo Type Arcade Price* £1.99 **Supplier** Bulldog/Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Bump Set Spike Type Arcade Price* £1.99 **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Throne of Fire Type Arcade Adventure Price* £8.95 (tape) **Supplier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.

About time, too.

**Program** *Enterprise Type Arcade Adventure Price* £8.95 (tape) **Sup-**

**plier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.

**Program** *Bubbler Type Arcade Adventure Price* £9.99 (tape) **Supplier** Ultimate/US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

See panel for comment.

**Program** *Kat Trap Type Arcade Price* £8.95 (tape), £14.95 (disc) **Supplier** Streetwise, Domark Software, 24 Hatfield Road, London SW19 3TA.

**Program** *Nemesis the Warlock Type Arcade Price* £8.95 (tape) **Supplier** Martech Software, Bay Terrace, Pevensey Bay, East Sussex BN24 6EE.



### Apple II

**Program** *Guild of Thieves Type Text Adventure Price* £19.99 **Supplier** Rainbird Software, 74 New Oxford Street, London WC1A 1PS.

**Program** *Silicon Dreams Type Adventure Compilation Price* £19.95 **Supplier** Rainbird Software, 74 New Oxford Street, London WC1A 1PS.

Level 9's classic (ie, very old, but still very good) trilogy, comprising *Snowball*, *Return to Eden* and *Worm in Paradise*. Be warned, though, there's one of those Rainbird novels in the package.

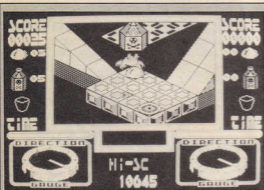
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**Program** *Powerdown Type Arcade Price* £1.99 **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Universal Hero Type Arcade Price* £1.99 **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

continued on page 43 ►



The industry's most enigmatic gamers are back with yet another in their endless series of 3-D Spectrum arcade adventures; but is it any improvement on the last few disappointments?

Ultimate's *Bubbler* is, in fact, something of a departure. While it retains many of the typical Ultimate features, it goes for a much more complex playing area than the usual maze of tricky chambers. Bubbles seem to be in vogue these days, what with Softtek's *Bobby Bearing*, Firebird's *Parabola* and Microdeal's *Airball* - perhaps it's because they're easy to design.

Whatever, the plot of *Bubbler* is pretty straightforward stuff; collect poison bottles, corks and mystery bubbles in order to trap the monsters threatening your city, and free it from the spell of an evil sorcerer - or something like that.

On each side of the screen are the counters and icons so beloved of Ultimate, while at the bottom are two direction gauges. These feature rotating arrows which indicate your current direction of movement; pretty helpful when you're a featureless blob.

Your ability to fire bubbles of goop will help you fight off the scuttling crabs, spinning aliens, flying saucers and other horrors which assail you on your quest. All these are pretty standard Ultimate fare. More interesting is the background, which is an eight-way scrolling network of slopes, planes, pipes, platforms and spikes, adding up to one of the most complex playing areas in any Spectrum game.

The masking as sprites disappear behind objects is clever too. While *Bubbler* looks good and seems agreeably complex, there isn't much in it which hasn't been seen before, both in Ultimate games and in several imitators - some of them cheaper than £8.99.

Chris Jenkins



Hall of Fame

Program *Stifflip & Co* Type Graphic  
 Adventure Micro Commodore  
 64/128 Price £9.99 (tape), £12.99  
 (disc) Supplier Palace Software, 276  
 Pentonville Road, London N1 9NL



# TONGUE IN CHEEK, STIFFLIP

Palace Software's releases are few and far between; when they do emerge, though, they tend to be good. Witness the excellent chop 'n' slash simulator *Barbarian*, and now the equally excellent (though, completely contrasting) *Stifflip & Co.*

Rarely have I seen the idea of the 'icon-driven adventure' implemented with such style and sense of humour. The synthesis of the two forms is managed with great skill, both the graphic and adventure elements being novel and advanced enough to capture the imagination of the most jaded player.

Bonuses are the excellent music and effects by Richard Joseph; well up with your Hub-

bards and your Whittakers if you ask me. *Stirring* patriotic



themes and good spot effects.

*Stifflip* is set in the days when the sun never set on the British Empire, when Englishmen were all gentlemen and when Johnny Dago could expect a visit from a gunboat if he stepped out of

line and, yes, it is all tongue in cheek.

Against this scene is played out the drama of the greatest threat to the empire since the Kaiser, Count Chameleon's Rubbertronic Ray, which would take the stiffness out of upper lips, neutralise the starch in wing-collars and radically alter the bounce of cricket balls.

You, Viscount Stifflip, together with companions Col R. G. Barchie, Prof Braindeth and Miss Primbotton, have travelled to the state of Banarnia to investigate the disappearance of the rubber crop. At the left hand side of the screen are the action icons, the middle is occupied by comic-style drawings of the action, and the characters you

wish to control are selected from the sketches on the right.

As with a conventional adventure, you can speak to other characters, give and take objects, light, explore your surroundings and check your status. All these functions and many more are selected from the main icons.

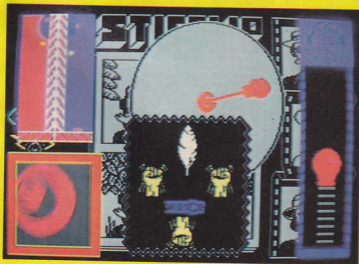
The fight screen is a complex affair requiring you to build up your power and aim at the centre of a movie target in order to throw the most effective punch. You can also opt to run away or hit below the belt - not sporting, but sometimes effective.

Dialogue with other characters such as General Moustachio appears in speech bubbles, and normally sounds like something from a Biggles novel, while other characters such as the swarthy barman, native and monkey can offer help, advice and clues - or a biff on the nose.

The adventure itself is as complex as you might desire; it took me ages just to work out how to pay General Moustachio the airport tax and get on to the second scene, but after that things started moving at a fair pace, ending with my untimely demise in a jungle animal trap. Back to the start; alternatively, there's a Ram save facility which will avoid hours of trouble.

Most impressive is the character-switching function by which you can abandon one player, switch to another character, and try to solve any given problem from another direction; using different objects, trying different responses to questions and so on. This makes the game almost infinitely variable.

Chris Jenkins



Above right: the title screen.

Above left: the status screen shows your strength, and what percentage of the game you have played. Left: the fight screen, where you get to biff people on the nose.

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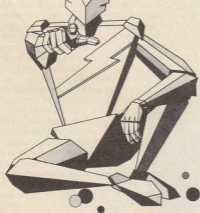
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**Program Witch Hunt (Plus 4 only) Type Text Adventure Price £12.95 (tape), £14.95 (disc)** **Supplier** Classic Quests, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex.

See Amstrad CPC for comment.

**Program Thrust Type Arcade Price £1.99** **Supplier** Firebird Silver, 74 New Oxford Street, London WC1A 1PS.



Conversion of one of last year's arcade shoot 'em up games.

**Program GWNW Type Arcade Price £1.99** **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.



## Commodore 64/128

**Program Colossus 4 Bridge Type Card Game Simulation Price £11.95 (tape), £14.95 (disc)** **Supplier** CDS Software, CDS House, Beckett Road, Doncaster DN2 4AD.



Bridge simulation for those who can't stay on speaking terms with human bridge partners - this one is packaged excellently for beginners or near-beginners.

**Program Wonder Boy Type Coin-op Conversion Price £9.99 (tape), £14.99 (disc)** **Supplier** Activision, 23 Pond Street, London NW3.

See panel for comment.

**Program Colony Type Arcade Price £1.99** **Supplier** Bulldog/Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program Magmax Type Arcade Price £8.95 (tape), £12.95 (disc)** **Supplier** Imagine Software, 6 Central Street, Manchester.

**Program Witch Hunt Type Text Adventure Price £12.95 (tape), £14.95 (disc)** **Supplier** Classic



Quests, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex.

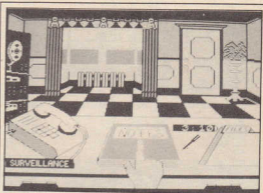
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**Program Hyperforce Type Arcade Price £1.99** **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program Wiz Type Graphic Adventure Price £8.95 (tape), £14.95 (disc)** **Supplier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.



I hope you like Agatha Christie, because if murder mysteries are not your thing you won't get much fun out of *Killed Until Dead*.

What goes on is this: five of the world's best selling murder mystery writers, known as the Murder Club, have booked into the Gargoyle Hotel for their annual reunion. During the conference they will all try to bump each other off to lay claim to being the world's greatest murderer. Your task, as Hercule Holmes (really!) is to prevent these nefarious acts from taking place, and to get the vital information that will enable you to arrest a suspect.

There are four basic steps to solving the case, the first of which is checking the profiles of the guests, getting to know who dislikes who and what. And why!

Part two concerns break-ins, where the suspects leave their rooms and go a wandering in the night. You have to answer a few questions from a security guard before you can get to do anything useful like tape record meetings or attend them personally.

Step three is actually using your tape recorder to garner useful hints and clues as to the goings on.

The penalty for failing to arrest the right person before midnight is death. Yours and the victims.

There are a few problems with the game. The first is that this was a disc based game so converting it to a tape system has resulted in lots of messing about with the two tapes. The second is that a lot of the notes given in play are riddled with American jargon.

Still, if you can cope with these two things, and you like mysteries, then I think you'll find *Killed Until Dead* intriguingly good.

Duncan Evans

continued on page 45 ▶

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**Program** *Kat Trap* Type Arcade Price £8.95 (tape), £14.95 (disc) **Supplier** Streetwise, Domark Software, 24 Hartfield Road, London SW19 3TA.

See Spectrum for comment.

**Program** *Frankenstein* Type Adventure Price £8.95 (tape), £14.95 (disc) **Supplier** CRL, 9 Kings Yard, Carpenters Road, London E15.



**Program** *Oink!* Type Arcade Price £8.95 (tape), £14.95 (disc) **Supplier** CRL, 9 Kings Yard, Carpenters Road, London E15.

*Oink!* is a fanzine/comic with a wholly unhealthy obsession with pigs - or a hilariously funny obsession, depending on whether you've

been amassed into the *Oink!* cult or not.

This is the game of the comic. Thus you'll either be licked to bits by it or completely bewildered.



**Program** *Zolyx* Type Arcade Price £1.99 **Supplier** Firebird Silver, 74 New Oxford Street, London WC1A 1PS.

## IBM PC and Compatibles

**Program** *Witch Hunt* Type Text Adventure Price £14.95 (disc) **Supplier** Classic Quests, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex.

See Amstrad CPC for comment.

**Program** *Rock n' Wrestle* Type Wrestling simulation Price £19.95 **Supplier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.

## MSX

**Program** *10th Frame* Type Ten-pin bowling simulation Price £9.99

(tape) **Supplier** US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

**Program** *Bubbler* Type Arcade Adventure Price £9.99 (tape) **Supplier** US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

See panel for comment.

**Program** *Flash Gordon* Type Arcade Price £2.99 (tape) **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Voidrunner* Type Arcade Price £2.99 (tape) **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Stormbringer* Type Arcade Price £2.99 (tape) **Supplier** Mastertronic, 8-10 Paul Street, London EC2A 2JH.

## Spectrum

**Program** *Roundheads* Type Strategy/wargame Price £8.95 **Supplier** Lotherien, Argus Press Software, Victory House, Leicester Place, London WC2H 7NB.

**Program** *Wolfen* Type Arcade Price £1.99 **Supplier** Bulldog/Mastertronic, 8-10 Paul Street, London EC2A 2JH.

**Program** *Wiz* Type Graphic adventure Price £7.95 **Supplier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.

**Program** *Enterprise* Type Arcade Adventure Price £7.95 **Supplier** Melbourne House, 8-10 Paul Street, London EC2A 2JH.

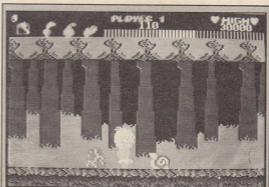
**Program** *Killed Until Dead* Type Arcade Price £8.99 **Supplier** US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

See panel for comment.

**Program** *Bubbler* Type Arcade Adventure Price £8.99 **Supplier** Ultimate/US Gold, Units 2 and 3, Halford Way, Halford, Birmingham B6 7AX.

See panel for comment.

**Program** *Kat Trap* Type Arcade Price £8.95 **Supplier** Streetwise, Domark Software, 24 Hartfield Road, London SW19 3TA.



Remember *Hunchback*? Scrolling landscape from right to left, side on view, holes to jump over, things to avoid. That was all three or four years ago.

Now, tart up the landscape, provide a few weapons to collect and use, sprinkle on a bit of platform and ladders and substitute a small golden haired boy for the hero and what have you got? *Wonder Boy*.

The storyline has small brat bouncing through the unfriendly landscape to rescue his girlfriend. In defence of Activision I should say the light first dawned over *Wonder Boy's* nappy in the arcades with Sega's original.

From a technical point of view the game is quite reasonable, the graphics are nice, the animation and scrolling good. Unfortunately from an entertainment viewpoint it is mind numbingly uninspiring. The music is routine and monotonous and the whole affair generates little excitement or interest.

Duncan Evans

## CHARTS

### Top Twenty

- 1 (1) BMX Simulator
- 2 (3) Four Great Games
- 3 (2) Football Manager
- 4 (20) Paperboy
- 5 (7) Feud
- 6 (6) Enduro Racer
- 7 (4) Gauntlet
- 8 (-) Barbarian
- 9 (5) Six Pack
- 10 (8) Konami's Coin-op Hits
- 11 (11) Army Moves
- 12 (13) Ollie and Lisa
- 13 (9) Five Star Games 2
- 14 (14) 180
- 15 (17) Head Over Heels
- 16 (15) Milk Race
- 17 (-) Big 4
- 18 (16) Vampire
- 19 (-) Curse of Sherwood
- 20 (-) Leaderboard

All figures compiled by Gallup/Microscope

**Code Masters**  
**Microvalue**  
**Addictive**  
 Elite  
 Bulldog  
**Activision**  
 US Gold  
 Palace  
 Elite  
 Imagine  
 Imagine  
 Firebird  
 Beau Jolly  
**Mastertronic**  
 Ocean  
**Mastertronic**  
 Durell  
**Code Masters**  
**Mastertronic**  
**Access/US Gold**

# HAVE HUMANS OUT-GROWN THEIR USE?

**R**obots, and more specifically, the Android have gripped the imagination of scientists and sci-fi enthusiasts since the dawn of rational thought.

To create a perfect being in our own image is now much closer to being a reality than Mary Shelley, the author of *Frankenstein*, could ever have imagined.

Two recent technological developments have helped to bring this dream a step closer. The first is the development of the 'bio-chip'; and the second the imminent perfection of the use of superconductors at room temperature.

Briefly, the bio-chip uses organic molecules, such as proteins, to channel the flow of electric current through a circuit, instead of inorganic materials such as the silicon chip. Already, laboratory experiments have shown bio-chips to have a potential for memory far greater than that of silicon-based chips.

One drawback, however, is that they tend to be slower in operation than traditional chips. These bio-chips, therefore, can be considered as similar to the way in which our own biological brains work.

We also, have a far greater memory capacity than a computer-brain. However, we do suffer from the problems of slower interaction between circuits (try beating a computer at mental arithmetic). It would appear, therefore, not to be unreasonable for us to consider the bio-chip as the basic building block of a future human 'look-alike' android.

Computers based on bio-chips (because of their greater memory capacity pro rata) could be much smaller. With further technological advance, it's conceivable that a computer the size of a human brain could have similar faculties and attributes to that

of a 'real' human brain.

Imagine now a latex being with a bio-chip brain: sub-microprocessors dotted around his body to gather information from input devices in eyes, ears, fingertips and feet. Further bio-chips to generate speech and output movements through limbs, wrists, waist, fingers and most importantly - the opposable thumb. A cooling system to aid the heat sinks and dyed red for effect.

What do we have? We have an android! Furthermore, an android who, from the outside at least, is indistinguishable from a human, and equally as intelligent and sensitive. What rights would this being have? Should it be allowed to vote? Or go to a disco? Does it need an MOT? The questions are endless.

But think on. Recent advances in the development of superconductors, and the sudden influx of money into Japanese companies with an interest in the product, suggest that we will soon have superconductors that work, not at near-absolute zero, but rather at room temperature. Superconductors, for the uninitiated, are materials that allow electric currents to flow with negligible resistance, thereby increasing the speed and cost effectiveness of an operation dramatically.

Imagine, if you will, therefore, an android whose brain consists of superconducting circuitry of heuristic design (ie, it learns from its own experiences) and with a bio-chip backup for memory storage.

This android would be astonishingly more intelligent than a human being (and learning all the time) and - provided it can arrange its own maintenance (android doctors based on expert systems perhaps) it will be permanently in peak condition.

Andrew G Stephenson

## Puzzle No 261

What is the millionth digit?

By this I mean that if you were to write out every number starting with one and proceeding upwards, at which point would you write the millionth digit?

For example the first 21 digits would be:

123456789101112131415

By continuing in this way you can determine in which number the millionth digit would occur, and what that digit is?

(Of course, it is not difficult to find the result by a process of logical deduction - but can you do it by computer?)

## Solution to Puzzle No 256

The fourth triangle in the series is one having sides of 193, 194 and 195 units length, and an area of 16,296 square units.

The standard formula for finding the area of a triangle of which the dimensions of the three sides is known is

$$\text{Area} = \text{SQR}(S * (S-A) * (S-B) * (S-C))$$

where A, B, and C are the sides, and S is half the perimeter, ie,  $(A+B+C)/2$

This formula is used in line 30 of the program. Starting with a triangle with smallest side 3 units, line 20 computes the sides B and C, and the value of S. This information is then used to calculate the area. If this value is integral (a whole number) the results are printed and variable T is incremented by one to keep a tally of the number of such triangles found. When this value reaches 4, the program stops.

```
10 A=3:T=0
20 B=A+1:C=B+1:S=(A+B+C)/2
30 AREA=SQR(S*(S-A)*(S-B)*(S-C))
40 IF AREA=INT(AREA) THEN PRINT
50 IF T=4 THEN END
60 A=A+1:GOTO 20
```

## Winner of Puzzle 256

This week's winner is P E Webber of Salisbury Wilts, who will receive £10.

## Rules

The closing date for Puzzle 261 is July.

## HACKERS

& what a nail-biting climax to the election this has turned out to be, but, thanks to advanced

psychological software, we can now say that the most likely winners are... the Communist Party.



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# WOOLWORTHS

## TOP 30

# COMPUTER SOFTWARE

JUNE 1987



AMSTRAD



COMMODORE



POSITION	TITLE	SOFTWARE HOUSE	MACHINE TYPE	PRICE
1.	6 Pack	Elite	Spectrum	9.95
2.	Enduro Racer	Activision	Spectrum	9.99
3.	6 Pack	Elite	C64	9.95
4.	World Games	U.S. Gold	Spectrum	8.99
5.	Star Raiders II	Electric Dreams	C64	9.99
6.	Saboteur 2	Durrell	Spectrum	7.95
7.	Auf Wiedersehen Monty	Gremlin	Spectrum	7.99
8.	Auf Wiedersehen Monty	Gremlin	C64	9.99
9.	Sentinel	Firebird	Spectrum	9.95
10.	Nemesis Warlock	Martech	Spectrum	7.95
11.	Enduro Racer	Activision	C64	9.99
12.	Samurai Trilogy	Gremlin	C64	9.99
13.	Mag Max	Ocean	Spectrum	7.95
14.	Big 4	Durrell	C64	9.95
15.	Metrocross	U.S. Gold	Spectrum	8.99
15.	Enduro Racer	Activision	Amstrad	9.99
17.	Arkanoïd	Ocean	C64	8.95
18.	Gauntlet	U.S. Gold	Spectrum	8.99
19.	Arkanoïd	Ocean	Spectrum	7.95
20.	Gunship	Micropross	C64	14.95
21.	Army Moves	Ocean	Spectrum	7.95
22.	Konami Coin Op	Imagine	Spectrum	9.95
23.	Paperboy	Elite	Spectrum	7.95
24.	Leaderboard	U.S. Gold	Spectrum	9.95
25.	Metrocross	U.S. Gold	C64	9.99
26.	Konami Coin Op	Imagine	C64	9.95
27.	6 Pack	Elite	Amstrad	9.95
28.	Ranorama	Hewson	Spectrum	9.95
29.	5 Star Games Vol. 2	Bea-Jolly	Spectrum	9.95
30.	Paperboy	Elite	C64	9.95



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This is your chance to really find out as you take on the role of Road Runner in this comic, all action extravaganza that recreates these nail biting chases and the fast moving excitement to perfection. Speed through canyons and along the highways following the trail of birdsseed left for you to feed on (is this the first trick???). Dodge your way round the crushing trucks, cowardly plans his sleazy Wile E. Coyote got in store for you as he lurks in hiding, cowardly awaiting his moment to enjoy a succulent roast of "Road Runner and French Fries". We're sure you'll overcome all the dirty tricks he can throw at you with ease, agility and grace and a haughty "Beep Beep". Overcome them that is if you've got nerves of steel, the reflexes of a wildcat and the speed of the fastest bird on two legs, otherwise its sorry, goodnight and "Burp Burp"!!!



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SPECTRUM 48K TAPE £8.99 AMSTRAD TAPE £9.99 DISK £14.99

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