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Regular readers will no doubt have noticed a change of cover design last month and to complete the package, this month sees some internal changes. *Unequivocally*, the most important of these is my appointment as Editor(!), though the introduction of some new features and rejuvenation of some regulars may be of minor interest to one or two readers.

In response to many requests, we've specially commissioned some exciting new series, some of which see their inauguration inside this issue. They include a novel beginners' course in BASIC, an insight into the world of artificial intelligence and an invaluable guide to translating BASIC programs from one machine to another.

Equally significant is the review of Amstrad's new micro, where we purposely waited until some software was available to ensure that Which Micro readers receive the 'whole story'. Indeed, this reflects a basic tenet of our approach to reporting on the latest news: on those rare occasions when we're not the first, we'll always give you something extra that's worth waiting for — *exclusive* to WM&SR readers.

Paul N Coster *EDITOR*

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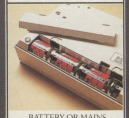

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SIGFILE

Commodore's New Micros





The introduction of Commodore's new pair of home micros came as quite a shock to the industry. The two machines, to be known as the Commodore 16 and the Plus/4, are actually the same machines whose forthcoming appearance has been rumoured for several months under the guises of the 116 and 264.

The Plus/4 is quite an advance for Commodore. The theme behind it is increasingly familiar: for your £249 you get a 64K machine with four integrated applications programs. Data can be transferred between applications — thus you might take some figures from the database manager, incorporate them into the spreadsheet to work on them, use the business graphics package to create charts and graphs of the results, then use the word processor to put the whole lot into a report.

The four applications are based in paged chunks of ROM memory, therefore they do not need to be loaded from cassette or disk before work can start. The principle is familiar to all those BBC Micro users who have a word processor or second language ROM in one of the 'sideways ROM' sockets. A screen 'windowing' facility allows you to keep an eye on two programs at once.

The choice of processor follows that of the Commodore 64 in varying on the 6502 theme. The 7501 is one of Commodore's own developments — like the 6510 used in the 64 it is compatible with the 6502 instruction set, but adds many new features.

The other newcomer is the Commodore 16, which aims to fill the place recently vacated by the now defunct Vic 20. It uses the familiar Vic 20/64 box, along with a modified keyboard. Some earlier reports had suggested that this machine would use a membrane-type keyboard, but Commodore apparently feels that the 'real computer' feel of a typewriter-style keyboard outweighs the extra cost. The layout of the keyboard is considerably altered, with the four cursor movement functions now assigned to four separate keys and moved to the top right of the machine. A 'help' key is provided to highlight any errors made in BASIC programming.

The pricing of the 16 looks extremely competitive. A 'starter pack' consisting of the machine, its dedicated cassette recorder, four miscellaneous cassettes and *Introduction to BASIC* will retail for £129.99.

Two big surprises for programmers are a new BASIC interpreter and the abandonment of the sprite graphics which were such a major sales feature of the Commodore 64. These changes mean that the 16 and Plus/4 are completely incompatible with software for previous Commodore machines. The new BASIC is long, long overdue, but it remains to be seen whether or not the new Version 3.5 comes up to the standards set by the BBC Micro and the Sinclair QL.

The other big question is one of availability — Commodore's current plans are based around the machines coming into the shops in this country in August. On the other hand, it is virtually unknown for *any* new computer to arrive on the day its manufacturers originally predict. We would like to believe that the 16 and Plus/4 will be generally on sale by Christmas, but don't hold your breath, just in case.

The system is available now for the Commodore 64 and Spectrum, and shortly for the BBC/Electron.

Pirates' Prevention

The battle against the villainous breed of software pirates goes on with the Guild of Software House at their first annual meeting vowing yet more intent to destroy the … (expletive depleted). They have set up a special working group to go into battle. Meanwhile Cornwall based Microdeal have launched their exciting new answer to the problem with the dubiously named 'dongle' — some might prefer to call it the Software Key (its alternative title) to avoid causing embarrassment.

An unprepossessing wedge shaped chunk of plastic, the Dongle encapsulates secret uncodeable signals that are the key to playing the company's new Tom Mix programs. As with all anti-piracy devices secrecy is the key (if you'll pardon the pun) since to detail exactly how and why, something of this nature works, immediately detracts from its efficiency.

The Dongle has been developed by Chas Robertson of Northern Software Consultants and Microdeal say it can only be reproduced in a full-scale electronics workshop. Before the computer will load, the key must be fitted into the joystick port where it generates signals specific to each title. It can be adapted for all machines.

Another device has also just been put into operation by Dataclone, one of the industry's biggest cassette duplication companies. Their new system is called Power Load and has been developed by Incentive Software Ltd, who are licensing it exclusively to Dataclone. Details about this are even scarcer but it's claimed that "only by unique software control" can the program be duplicated. It's also reckoned, as an added advantage, that Power Load reduces cassette loading time by around two thirds.

Solo Flight

Since publication of last month's feature on flight simulators, we've been informed that there does exist a version of Solo Flight for the Commodore 64. Indeed, both the Atari and CBM 64 versions are available from Centresoft Ltd, Unit 24, Tipton Trading Estate, Bloomfield Road, Tipton, West Midlands DY4 9AH. Price is £14.95 and further details can be obtained from Centresoft on 021-520 7591.

Programmers' Protection

Within a week of its formation, the Society of Software Authors enticed 50 programmers to crawl out of their machine rooms and sign up with the organisation that's going to fight for their rights.

In the big wide world of software houses there are many discrepancies governing terms of contract, not to mention other little quirks that the naive programmer has to put up with. Says founder Doreen Cox: "Really appalling things can happen to the programmer that is not shrewd in business and is not aware of what little rights he is entitled to." And it is these 'appalling things' the Society aims to fight.

Sadly there is going to be little help for young Johnny, who after hours of staring through thick rimmed glasses at the screen-God, comes up with a masterpiece and then gets it published *and* possibly ripped off. For the Society only welcomes as members those who have had software commercially published.

Doreen Cox, who is herself a programmer, and her band of helpers intend firstly to come up with answers to the following questions: How can you judge how many of your titles have been sold? How do you get software houses to reply when you've sent them a program? What should royalties be based on? The ultimate aim being to come up with a standard basic contract to protect authors.

The group is to set up a software registry where authors can deposit their programs as 'theirs' to be produced in court at a later date if need be, to prove ownership. Since there are no copyright laws as such governing software this seems likely to be next to useless. Says Doreen Cox: "If something is copied exactly then it's easy to prove ownership. In other cases it will be up to the courts to decide." Since few people are likely to be stupid enough to copy something exactly the rights and wrongs are going to be very hard to prove.

Whilst this is going on, the society of Software authors also intend to bring pressure to bear on the Government to produce adequate copyright protection. They are also going to tackle the thorny problem of piracy, though quite how, they are unwilling to say at this stage in case it jeopardises activities.

The Society are hoping their minimum contract requirements will prove acceptable to software houses who could well see this pioneering action as the worm that turned . . .

Membership is £10 and it's hoped regional groups will get underway soon. Anyone wanting further information should write to Doreen Cox, with a SAE, at 7 Meadway Court, Whalebone Lane South, Dagenham, Essex.

A Book At Bedtime

Practical Uses for the Microcomputer in the Home (are there any?) David Hole for one, believes so, as the author of this book of 14 programs that he's convinced you will turn to when you are "Tired of zapping aliens and you feel you should put your microcomputer to some practical use at home".

The practical uses he appears to have come up with so far extend to such mind boggling and exciting feats as organising your telephone numbers, controlling your personal accounts (how much money you haven't got), looking after your gas and electricity bills (though still not telling you how to pay them when you're broke).

Doing these things, he asserts, will ensure your micro earns its keep by doing more than "saving the earth over and over again". Frankly, to be able to save the earth sounds like a lot more fun, but as we all know that's a feat reserved for Superman.

Should you wish to explore these alternative possibilities the book is available from Interface Publications, 9-11 Kensington High Street, London W8 5NP.

Showtime!

Competitions, special offers, promotions and lots of computer goodies to go with the Acorn will be at the second Acorn User Exhibition to be held at Olympia 2 between August 16 and 19. Home, education and business uses will all be covered and entrance fees are £3 for adults, £2 for children on the door, advance tickets £2 and £1 respectively. Further details and tickets from Timothy Collins, Computer Marketplace (Exhibitions) Ltd., 20 Orange Street, London WC2H 7ED.

Relatively Special

Einstein, sweating away over his theory of relativity back at the turn of the century, might with the benefit of hindsight have done better to put his energies into developing computer technology.

But what the hell, he's now got a machine named after him anyway — despite the fact he apparently had nothing to do with it. Or did he? Much searching by Which Micro has unearthed a tenuous link: the scientist's own quaintly simple analysis of the theory quoted in his obituary. Quoth he: "When a man sits with a pretty girl for an hour, it seems like a minute. But let him sit on a hot stove for a minute and it seems like an hour. That's relativity."

An extremely tenuous link? have patience . . . far be it from us to re-write history but taking one of Tatung's primary selling features for the Einstein, could not the quote go something like: "When a man sits loading a Tatung disk driven machine for an hour it seems like a minute. But let him sit and load a cassette driven machine for a minute and it seems like an hour. That's relativity" — and all for £499.



Claiming to have perceived a gap in the market, Tatung have pitched the new machine at the home, business and educational user and see it as more than relatively good value for all three since it incorporates disk drive — the only way for a machine to be these days they say.

All British made, Tatung's development team based in Yorkshire claim it "probably represents the best value for money ever achieved in micro computer capability" combining as it does the best attributes of an advanced home computer with many of the sophisticated features of a large office computer.

The Einstein, which should be on the shelves this month (it's a statutory requirement these days to prefix any new product availability with the words 'should be') is another machine built around the Z80 microprocessor with 64K RAM (separate 16K RAM for graphics) and using three inch compact floppy discs with 500K total capacity. It has a full typewriter style keyboard, wide language range, unusually comprehensive output/input facilities and software support that is growing daily from its 50 program base, covering all accepted necessities for both home and business use.

Peripheral equipment includes a full A4 size printer, a twin disk drive, which when added to the two internal drives will provide 2M bytes of storage and an 80 column display facility together with a special display unit. Other projected developments include a Prestel adaptor and a speech synthesiser.



Racing Away

Lots of fun for motor racing enthusiasts when they buy Atari's Pole Position game for their video games system or Atari home computer system. While stocks last they are giving away a giant sized wall chart of the 1984 Grand Prix Championship. As each round is completed point-scoring drivers can be recorded and there's lots of background info too.

In addition (but this is a bit puzzling) the race for the Championship can be monitored by moving small cars around the race track on the chart's perimeter — what's puzzling is how do you get small cars to stick to it when it's on the wall? Oh well . . .

It's Amazing

Introducing the Which Micro amazing facts file . . !

Did you know there are currently 7,000 home computer software titles currently being marketed by 380 software companies, 92 per cent of which plan to launch at least one new title in the immediate future?

Did you know that 70 per cent of these companies have been in operation for less than two years and that in total they employ some 5,000 people with about 50 per cent of them employing four or less people?

Doubtless you also know that for every one full time programmer there are approximately three part time and contract programmers.

It's astonishing to learn that the mean average number of titles per company is 18 and that two thirds of companies have cash flow problems.

Did you know that the household penetration of microcomputers is confidently expected to grow and could reach 17 to 18 per cent of all UK households by December this year?

Finally, a vast number of software houses could cease to exist in their present form within the next couple of years unless they get their act together. The alternative they face is supplying software to contract for a handful of mega-companies, which would be a sorry state of affairs.

Interesting huh? These and other amazing facts about the software industry are revealed in a recent report from Gowling Marketing Services Ltd who can be reached on 051-236 6036.

Name Dropping

Those unfortunate beings with speech impediments that cause them to drop their Ds as opposed to their Hs, need cause confusion no more. Doric Software have changed their name to avoid any confusion with the name Oric. From now on they are to be called Dorcas Software the title being derived from Dorell Computer Adventure Software which they say reaffirms their policy of producing high quality adventure games, the latest of which, The Runes of Zendos for the 48K Spectrum is to be available soon, and consists of 12 separate, but closely linked adventures, which further develop the text/graphic approach of former release The Oracle's Cave.

Parlez Vous Français?

Knowing the excitable and vociferous nature of the garlic crunchers and onion bearers across the channel, the mind boggles at the scenes that might ensue when once they fall within the grip of adventure games.

A guide manual to interpretation of semaphor will be a pre-requisite to understanding the expansive gestures that will no doubt accompany play.

Knowing furthermore their *penchant* for always being in the right it could be a case of avoiding low flying Orics as the machine fails to come up with what the dedicated 'Frenchie' feels it should.

Undeterred by these potentially catastrophic consequences, Hewson Consultants are steaming ahead on the translation of their adventure, Fantasia Diamond, into the language of lovers.

The translation is in response to an invitation to partake in a competition organised by leading French distributor, Video Telemart Report. Once translated, and the company say they are still some way from a polished French version, the game will be judged in three categories, best scenario, best graphics and animation, and best action.

If it wins one or more categories Hewson have the dubious privilege of having their work distributed by VTR throughout the French speaking world. Should they win, Hewsons say it will represent a substantial breakthrough since no significant English language home computer adventure has been translated into French as yet.

Perhaps it's best to keep it that way . . . Heaven forbid a return gesture in the shape of a Clouseau style French adventure in English . . .

Accent On Invention

The opportunity to fantasize with your Commodore 64 is now at hand. With the addition of just one clever little gadget you're well on the way to viewing the machine as a tall, dark handsome stranger or a buxom blonde, whichever is your preference.

How can this be done you query in awe? Quite simply with the Magic Voice speech module that gives the computer a voice which can be "that of a child or a character, male or female . . ." and because the speech is digitised, inflections and so on are preserved (your plaze or mine, mon petit cheri . . .).

The module contains the data for the 26 letters of the alphabet, plus numbers and a vocabulary of 187 commonly-used words with a diskette containing extra vocabulary on the way.

The unit fits into the 64's cartridge port and provides a cartridge port of its own, this means it will give voice to cartridges that make use of the feature whilst allowing others to work normally.

Commodore are developing an extensive range of talking software beginning with programs to help with child education. In due course they will be moving onto adventures.

Game, Play, Book, Read

You've red the game, now play the book, or play the game and read the book, it really doesn't matter so long as you do both together.

This latest wheeze in software comes from Mosaic Publishing whose bookware packages offer purchasers reading material within which are all kinds of games to play along the central storyline. For instance 'In the Beginning' features the player as a Pre-Cambrian molecule which evolves to the dawn of early man through a 10 level compendium of linked puzzles and computerised board games. All good classic stuff. And classic stuff is the matter in question in one of their other titles Beyond The Arcade, a book aimed at micro owners who this time are not only tired of zapping aliens but also tired of chasing 'blobs'. (Concise Dictionary of slang definition: a score of nought.) It examines adventures, simulations, wargames and large scale play-by-mail games examining the origins of each game genre (who really cares?) as well as providing critical guides to games already available for most popular micros.

Mosaic Publishing Ltd., 187 Upper Street, Islington, London N1 1RQ.

Get Clued In

So, everyone was crying out for something more than shoot-em-up games, huh? So maze games and the like weren't challenging enough, huh? So everyone thinks they're damned smart at the programmers' answer to those who belittled their early efforts at adventure games and similar pursuits.

Not so smart it now seems, or why else would Level 9 Computing feel moved to introduce 'comprehensive'' clue sheets for all their adventure games on the market?

Comprehensive they may be, cryptic they most definitely are, and in that respect probably not a lot of help to those trying to jump on the bandwagon of this latest trendy hobby.

Level 9, unwilling to admit either their games are too hard, or their customers are too dim, politely comment that "even the best players have blind spots and can get stuck on supposedly simple puzzles."

Each clue sheet provides up to 580 entries and is composed of alphabetical lists of the objects, creatures and trickiest locations in each adventure. It's "easy", they say, to find what you're interested in, then look up where it is hidden or how to solve the puzzles concerning it.

But they're pretty smart these Level 9 people, to deter cheats the clue sheets also contain a few red herrings — false clues to false problems to prevent anyone trying to whizz through the game simply using all the clues. Clue sheets, incidentally are available free with a stamped, addressed envelope from Level 9 Computing, 229 Hughendon Road, High Wycombe, Bucks HP13 5PG.

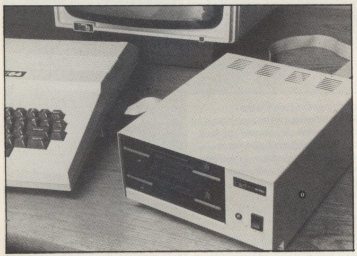
Bit Of An Enigma

First there were shoot-em-ups, then there were mazes, followed by adventures, simulations, epics, and now, introducing The Enigma . . .

From the inappropriately named Brainbox Software (it seems like a pretty dumb idea) Enigma is a new type of cassette based computer game for the Spectrum, BBC and Electron machines.

In most games you have a set of rules. Not so with Enigma, in fact it's the other way round, the game is over when you discover the rule by which it is played — what jolly fun, ha, ha! Whatever will they think of next — a game with no rules, no graphics, just a blank screen, yes, that's something that's not been done before . . .

We digress however, back to Enigma and once the player has discovered all five rules the cassette can be swopped for another with different rules. The original costs £9.95 and further copies £4.



Disk Revolution

Microvitec, recently winners of the Queen's Award for Technological Achievement for their Cub monitors have moved into a wider micro peripherals market by launching a five and a quarter inch floppy disk drive. Single and dual versions will be available for the Dragon 32 and Commodore 64 machines.

The unit has a 500K capacity or double that for the double unit (hardly surprising). Prices are respectively £325 and £525 and further details are available from Microvitec, Futures Way, Boiling Road, Bradford, West Yorks BD4 7TU.

Winning It Big

Just as this issue goes to press, the lucky winners of Spectravideo home computers from our April competition are celebrating — courtesy of Spectravideo — with a 'meal in the city'. They are: David Marfes (Nottingham), Tim Davis (Liverpool) and P. Lucarotti (Derbyshire).

If You Go Down To The Woods

. . . "Me and My Teddy Bear, we play and play all day . . ." whoops, sorry, wrong programme, wrong generation . . . please read "Me and My Micro" etc, etc.

From Playschool to computers, hero of the under fives, Fred Harris, is currently presenting a series entitled Me and My Micro on Sunday mornings on ITV which sets out to unashamedly encourage users of all ages to write their own programs and "get to grips with their machines in the most positive way."

Using games to illustrate the basics of BASIC, the five programmes are intended as building blocks. Users with a difference on the programme include the Vicar who uses his Spectrum to teach 'confirmation candidates' and a grandmother who uses hers to generate knitting patterns — whatever turns you on I guess.

Back-up written material for the show is available from Me and My Micro, Admail 1, Leeds LS3 1YS.

Other TV news, this time from 'the other side' is that Karen Parker is the winner of BBC Superstore's Invent a Game Competition. Her prize, predictably, was a BBC computer and her idea is now being developed with Acornsoft (for BBC and Electron machines) and Mirrorsoft (for Sinclair and Commodore machines).

By Christmas the game will be available entitled Superstore — winner of the BBC Superstore Competition.

Karen is pictured with graphics from her game and the man of many pairs of spectacles, Mike Read.



Read All About It

You've been found out — all you lot sitting at home with a micro that you don't know what to do with. Why else would Express Marketing's Active Computer Learning Packages be selling like hot cakes?

Carefully missing out those they assume are already computer literate, the packages are pitched at five to ten year olds and 19 to 45 year olds who feel they're missing out on something. The packages are described as offering 'hands-on' familiarisation and each one consists of two software cassettes and a course manual designed to give owners a start up knowledge of their machines. ACL promotes a full understanding of computers and computing and eager students can aspire to a certificate from the marketeers which proclaims competence — it's at this stage you realise the machine you've got isn't the one you either wanted or needed, unless of course the person that sold it to you has himself been learning through Express Marketing's similar packages to educate uninitiated sales assistants in the art of computer selling, but that's another story . . .

The ACL package is currently available for the Commodore 64 and the Sinclair ZX Spectrum with others coming on-line soon.

Chris Hedges, the company's MD and brain behind this 'lets-bombard-the-public-with-even-more-confusing-stuff-about-computers', scheme says there is one slight problem that has to be overcome when communicating to the computer illiterate: "Adults don't like to be taught, they don't like to think they are studying or being instructed, but they like to learn and that is how this material is put across."

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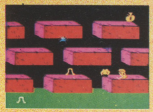
by CHRIS KERRY











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The Accounts Receivable package.

Now, it couldn't be easier to keep your customer accounts under control.

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Using this package in conjunction with the invoicing package, you can also keep tabs on payments received against payments outstanding.

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Average value of the business they do with you, or whether they are good or bad payers.

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☎ Credit card holders, phone 01-200 0200, anytime. Or 0933 79300, during office hours.

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Invoicing			SNB 08
Order Processing			SNB 12
Accounts Receivable			SNB 10
Accounts Payable			SNB 13
Stock Control			SNB 11
Purchasing			SNB 14
Mailing			SNB 09
	TOTAL		

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Amex/Diners/Visa/Access (Delete)

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Address_____
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Signature_____ MW7
Registered No. 1524763 VAT No. 215 8123 85

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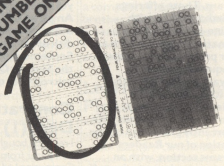
KILOBYTE GRID REF. FRAME 1

B8
B2
A10
C2
C9
A11
B3
C5
C3
A13
A3
A5

£2000 MUST BE WON

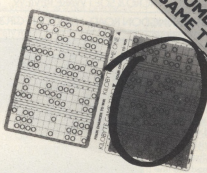
KILO BYTE

FINAL NUMBERS GAME ONE



You have 4 chances to win on Game 1. For Game 1 you should be sinking islands in 4 oceans as indicated. NOTE: Final claims for Game 1 accepted 10.00 a.m. 13 July, 1984.

FIRST NUMBERS GAME TWO



You have 4 chances to win on Game 2. For Game 2 you should be sinking islands in 4 oceans as indicated. NOTE: Final claims for Game 1 accepted 10.00 a.m. 15 August, 1984.

HOW TO PLAY

1. Kilobyte is easy to play. Your Kilobyte card has two games on it. Each game comprises four oceans with 21 Kilobyte islands. Armed with your Kilobyte grid references, you have to sink all of your islands prior to claiming the £1000 treasure.
2. If any of the grid references printed match those on your Kilobyte card (make sure you're playing the correct game) cross them off. And you have four chances of winning — each game is played on four oceans.
3. When you have crossed off all the islands in one ocean and double-checked that all the grid references you have used are for the correct game, you may claim.

HOW TO CLAIM

1. To claim, telephone 01-278 1082 between the hours of 9.00 am and 10.00 am Monday through Friday. Claims made outside these times will be void. (Claims cannot be made on Saturdays and Sundays.)
2. You must have your card with you when making a claim.
3. Make a note of the last grid reference you used — you will be asked this when you telephone.
4. You will have to answer the following three questions.
   a. What does RAM mean?
   b. Which company makes the Electron computer?
   c. Name a programming language.
5. If you can correctly claim that you have sunk all of your Kilobyte islands, you will win a prize. But, in the event of several correct claims, the £1000 will be awarded to the cardholder claiming on the earliest grid reference with which he/she completed his/her card. Remember, we begin at the top of the column and work down.
6. In the event of two or more correct claims on the same grid reference, the £1000 prize will be shared by the winners.

PRIZES

The total prize for each of the two games is £1000.

RULES

EMAP staff and their close families are not eligible for entry. It is not a condition of entry or claiming that entrants prove purchase of WHICH MICRO and SOFTWARE REVIEW.
The Editor's decision is final and no correspondence will be entered into.

KILOBYTE LUCKY DRAW

When both games are completed, you could win a special prize! Hang on to your card and watch August issue of WHICH MICRO and SOFTWARE REVIEW for details.

If you want a copy of the first grid, references printed in the June issue or additional copies of Kilobyte Game Cards. Send a self-addressed-stamped envelope to EMAP Marketing Dept., 8 Herbal Hill, Durrant House, London EC1R 5EJ.

Final Kilobyte Grid References next month. Be sure to order your copy of Which Micro & Software Review NOW.

KILOBYTE GRID REF. FRAME 2

A10
C3
B5
A9
B11
A2
A14
B1
A3
B14
C12
B4
C10
C2
B12
B8
B6
A4
C11
B2
A13
C1

Letters TO THE EDITOR

THE EDITOR, WHICH MICRO & SOFTWARE REVIEW

SCRIPTOR COURT, 155 FARRINGDON ROAD, LONDON EC1R 3AD

Sketchpad Problems

I am writing to complain about the way you set out the "Spectrum Sketchpad" in the May issue of Which Micro. The black writing with a white background was perfect but the white writing with a black background was a disaster. We were not about to read the line numbers, tell the difference between a colon and a semi-colon and white marks (spots) were also stopping us from being able to store this information in our computer's memory. The standards of this printer were poor and I would like to have black writing and a white background. Thank you.
D Ford (aged 13)
Winchester, Hants.

Well, we all make mistakes! Our apologies to all those who had difficulty deciphering that particular section of Spectrum Sketchpad — anyone else who needs a photocopy of that chunk of the original listing should just drop us a SAE with their name and address to Sketchpad Listing, Which Micro, Scriptor Court, 155 Farringdon Road, London EC1R 3AD.

BBC Puzzle

I am puzzled by the operating systems on the BBC Microcomputer. What are they and what do they mean?

I would be most grateful if you could answer my questions.
Lee Coleman
Slough, Berks.

The operating system of a computer is the machine-code program which runs in the background of whatever task the user is attempting. It performs vital, but little-discussed functions like reading the keyboard and ensuring that the characters you type in are the same as the ones which appear on the screen.

Most cassette-based home micros do not allow direct communication with the



operating system, but the BBC is one exception. All commands prefaced by an asterisk, eg, *TV255, *HELP, *FX412,2, bypass BASIC and pass straight to the operating system, which resides in a 16K ROM chip next to the 16K BASIC chip.

The BBC Micro was launched with the 0.1 OS, which did not allow full use of the machine's facilities. The later 1.0 system was an improvement and for the last year or so the 1.2 version has been the 'standard' system fitted to new computers. It is a simple matter for your local dealer to upgrade the OS by exchanging the chips — it takes about 10 minutes and should cost you £10 to £15. To check which version you possess, just type *FX0 and press RETURN.

Printer Priority

I am very pleased with your magazine. Just one niggle, though concerning the 'readers' programs' section. To get the program published, there must be 2 copies, one on cassette, and one on paper.

The cassette copy is OK. But how about the vast majority of us who don't have printers? Surely Which Micro has done enough reviews to have a printer handy?

There are quite a lot of children who have computers (I am one) who would like to see their listing published, but do not have a printer!

We are lucky enough to know someone who has a printer, but he lives in Sussex, which is too far from where we live for us to visit frequently.

So how are we to get our programs published, if we don't have a printer? Those people who have so far sent in programs must be the rare ones who have easy access to printers.
Richard Calder
London SW20

We do see your point about the problems of readers without printers. Our current problem is that we just don't have the resources or the time to list out more than the occasional program. Those offerings supplied complete with machine-printed listings automatically tend to take a higher priority. Although we do frequently review hardware and peripherals, these items are usually supplied on 28 days loan.

Don't despair, however! We are currently planning a major expansion of our Readers' Programs section, with an accompanying increase in staff so that we can produce listings for the Spectrum, Commodore 64, BBC Micro, Dragon 32/64 and Oric 1/ Atmos.



Please Help!

Having decided that I would like to buy a computer, I now face the awesome task of deciding which one best fits my needs. I have in the past done some machine level assembly and high level programming. So the main reason for me wanting to buy a computer is to extend my programming skills. (No doubt I'll end up playing games on it as well.)

To begin with I would only like to spend up to £450 but with this (and perhaps a little more) I would like to buy a disk drive. Later on I would like to expand the system.

Having described the situation that I am in I would be very grateful if you could give me some advice.
D Tamana
Plumstead, London SE18

For developing programming skills in a wide variety of languages, the BBC Micro is hard to beat. It comes with BASIC and a built-in assembler, and versions of FORTH, Pascal, LISP, BCPL and LOGO are available, among others. At the moment it is a little expensive at £400 for the basic computer, adding about £200-£250 for the disk interface and one drive.

Two other machines seem very promising, though they are both rather new and not yet easily available. The Amstrad CPC464 with a monochrome monitor and a disk drive should come out in September for about £429, and the Sinclair QL with its two microdrives costs £400.

Congratulations Dept (1)

I recently bought a Jupiter Ace computer from Boldfield Computing Ltd, which proved to be faulty. After informing them they sent me the postal charge to return the computer. I then returned the faulty one and I received another with a goodwill program, free of charge. Their action was prompt, first-rate and very helpful. If all companies had this attitude, there would be less complaints in your magazine. I cannot praise Boldfield enough in this matter.
Peter Barlke
Boness, West Lothian

Congratulations Dept (2)

I have just received my updated Oric and feel the results are deserving of praise. Being a persevering sort I purchased an Oric 1 in November last year, and after three replacement keyboards was finally satisfied. Then came the Atmos. On the 8th April I wrote to Oric International enquiring about updating. I received information and applied on the 13th April, despatched by Oric 1 keyboard and a cheque for £60 the following day. On the 27th, an Atmos arrived (two weeks inside the 28 day delivery advised — eat your hearts out QL writers!) complete with a new power supply and all connecting leads. To my mind the Atmos exceeds everything written about it. The keyboard is excellent, the manual vastly superior (and very "user friendly") and my existing Oric software loaded with no problems at all.

As I paid just £98 for my Oric 1 originally (including a 4 pack of software) you can imagine just how pleased I am with the Atmos. The extra £60 was well worth it.

So congratulations are definitely due to Oric for an excellent service and a much improved product.
R Leach
Elson, Hants



Programming Choice

I am 13 years old. I have been reading your May issue of *Which Micro* magazine and saw the letter headed 'Which is best". Like the eldest son mentioned in the letter, I also use the BBC Model B at school.

I am interested in the Commodore 64 and I have a couple of magazines about it. The only problem is that I heard the 64 is hard to understand. I would like a computer with a reasonably high memory capacity so that I can do long programs using a computer book and plenty of software available.

Please can you give me any information on what kind of computer that you think would best suit me.

Stephen Clack
Chessington, Surrey

Although the Commodore 64 is very popular, you are right in thinking that its BASIC programming language lacks many features which would make it easier to use. If you want to try programming with graphics and sound, either the Spectrum 48K or the Acorn Electron would seem to be suitable. The Spectrum has a definite advantage as far as memory goes, but the Electron's keyboard is easier to use if you wish to type in lots of program listings.

Wanted High Speed Vic

I have now been programming my Vic 20 for over a year and I am starting to learn machine code.

After reading "How I wrote a successful games program" in the May issue of Which Micro, I would like to know if there is a compiler available for the Vic 20. If so, who produces it and what is its price?

Martin Douglas (aged 13)
Foots Cray, Kent

Sorry to dash your hopes, but we don't know of any compilers for the Vic 20. The small memory size is the main barrier to the development of a compiler. The Vic's big brother, with its 64K RAM has several available. Looks like you will have to persevere with assembler and binary!

Learning Through Pleasure

As an ex-ICL computer programmer, now turned primary school teacher, I cannot help but wonder why so little effort is made to encourage micro owners to try their hand at designing and writing interesting educational software. Time and again, we read that most micro owners use their machines for game playing. Fair enough — but as is demonstrated by magazines such as yours, the real fun can begin once you start to write your own programs.

Why not offer a whole new series aimed at examining the very special problems and requirements of educational software — especially that which could be used to teach younger children?

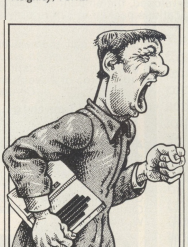
These programs would have to be designed to *teach* something specific. This in itself is a major limitation. The designer has to tread a wary path between writing something that is dull, narrow and uninteresting (but which may well focus very precisely upon the skill, concept or practical experience that constitutes the educational objective) and at the other extreme going all out to arouse interest in the vague hope that something will be learned on the way.

Each area of the curriculum offers its own peculiar difficulties and its own particular possibilities. Mathematics is by no means the only avenue. What about geography, language, science, history etc. And for those who doubt the feasibility of such a task, a good lead-in to such a series might be a detailed look at how LOGO came into being as a language designed specifically for use by young children.

You might at the same time, redress the balance somewhat by demonstrating that the well known 'Turtle graphics' are but one facet of LOGO.

Surely many micro-owning parents have dabbled with programs written to help their own children? What about their experiences, or the experiences of micro-using children themselves? Come on out into the open, there's a whole new world waiting to be explored..

Alan Sturgess
Keighley, Yorks.



Wallies Unite!

I am very disappointed that you published the intolerant views of J. Hudson (June, Letters) which to me typify the attitudes of many computer users, so ably summed up in the extract from "Micromania" (June).

There are a large number of us Computer Wallies, many like me with postgraduate degrees in Engineering, who are slowly learning how to improve our knowledge and programming technique. We do not find the patronising attitudes of Mr Hudson and his friends conducive to participation in wider computing circles. Nor indeed likely to make us buy the equipment espoused. With supporters like Mr Hudson, Memotech can forget about me ever buying an MTX.

I find that there is a considerable 'knowledge' gap between simplistic stuff, like the recent Sunday Times supplements and the more advanced material in the specialist press. Some friendly advice would assist us.

Given that your article on Wallies mentioned modifications like bypassing the mains transformer, I do not consider Mr Hughes (Letters, May) asking about 39 vs 40 columns to be unreasonable because:

"You can bet the computer manual doesn't say anything helpful."

"You can bet that most computer shop assistants aren't very helpful, either."

The whole area is very reminiscent of the "I want to buy a gramophone" sketch in "Not the Nine o-Clock News".

I will continue to be happy with my ZX81 — one of the best value machines around. I am certain that most users upgrade to a machine with more "chrome" and sex-appeal (and computer club Kudos) and abandon their ZX81s long before they've learned to use more than 10% of its potential.

Every time I look at the TV screen I am aware of the ZX81's limitations but I can still learn about *computing* as opposed to zapping zits in full colour.

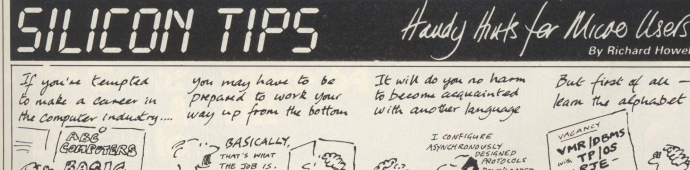
So, Computer Wallies write: come out of the console and continue to ask our stupid questions. The 'experts' will soon be onto the latest craze — Blindfold BMX or whatever it is.

A N Wickens (BSc Eng. MSc)
Whalley, Lancs

SILICON TIPS

Handy hints for Micro Users

By Richard Howell



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— Midweek, 10 May 84

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— Central Press Features, April 84

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— Your Computer, May 84

AVAILABLE FROM: WH Smith and good computer shops nationwide.

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My micro is a: .....
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Dept. ?, 229, Hughenden Road
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An alien saucer flashes onto your view screen. Your ATTACK indicator flashes and a bolt of raw energy smashes into your protective screen. Your screen can only absorb four hits of this intensity. You must fight back!

"The graphics are outstanding...it's 3D impression is superb. The Game itself is first class." **WHICH MICRO?** Brilliant!

"Encounter is a game that will have Arcade game lovers riveted to their screens for hours on end..." **PERSONAL SOFTWARE (USA).**

"The graphics and sound in this 3 dimensional simulation are stunning" **ANALOG.**

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- **For Commodore 64 and all ATARI Computers**



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AMSTRAD'S PACKAGE DEALS

The name Amstrad is most popularly associated with 'budget' hi-fi and portable TVs, though their latest venture into the world of home computing may change all that. We sent Mike Gerrard and David Green out to rural Brentwood to examine the new Amstrad personal computer and its associated software.



One of the first things that hits you upon seeing Amstrad's CPC 464 is that it is a machine designed to take advantage of those lessons learned by other manufacturers, usually to their cost. Apart from a few oddments, which we'll cover later, the result is a neat all-round unit which is apealing to use as well as to the eye.

The keyboard is arranged in three distinct sections, with additional colour coding to isolate specific control functions such as SHIFT and ENTER. The first section consists of a fairly standard 'qwerty' layout with ESCape, TAB, CAPS LOCK and SHIFT (LH) on the left, and DELete, ENTER, SHIFT (RH) and ConTROL on the right. This last key has been placed next to the space bar and is our only complaint about an otherwise completely ergonomic arrangement.

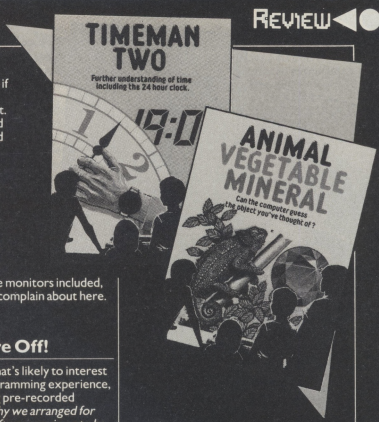
The next section to the right of the 'letter entry' keyboard is the numeric keypad and cursor control keys. These are not only separated from the rest of the keyboard physically, but also electrically so that the number pad can double as a function keypad. An odd little quirk about this section is the position of the COPY key, used when editing, in the centre of the four cursor keys. Possibly the placement of both this key and the previously mentioned ConTROL key is due to the inclusion of a largesize ENTER key, which takes up four single key spaces. Even so, the COPY key may well be in a better place amongst the cursor set, because all five keys will most likely be used together when editing.

The third section houses the cassette drive and controls — no need to connect up an assortment of flying leads. The software for the cassette system includes a rather novel feature called Speedload, where information is loaded at twice the normal rate (2000 Baud instead of 1000 Baud). In this mode, there is more chance of a loading error since no allowance is made for low quality tapes or different signal clarity. In practice, however, the provision of twice speed loading is worth the occasional need to load something again — that's when to switch over to the slower speed.

Initial Screening

Since the Amstrad computer is not available without either the green tube monitor or the colour monitor as part of the package, it is interesting to note that should you wish to operate the computer using your domestic TV as a monitor, you need to purchase the optional power supply and modulator. This highlights the fact that the keyboard unit is powered externally (it has no internal PSU) and supplied with DC via the monitor. So far, we've not heard anything about Amstrad providing a trade-in service for those people wishing to exchange their green monitor for a colour one, so it's just as well to be absolutely sure which one you want before buying. For game playing and colour work, the colour monitor's extra expense is justified — if not, then the green monitor system is best.

Both the colour and green monitors would appear to be fairly standard TV sets, modified and 'cleared out' to act as lightweight, high definition units. And considering that the price of the complete package compares favourably with other micros that don't have monitors included, there was nothing to complain about here.



And They're Off!

The first operation that's likely to interest those with little programming experience, is loading and running pre-recorded software *(which is why we arranged for some on-the-spot software reviews to be done — Ed)*. Before assessing some of the programs, however a few comments about using the machine.

Loading software is kept very simple, as you'd expect with the built-in recorder. You press the ConTROL key and the ENTER key and the screen displays: RUN"

Press PLAY then any key:

Alternatively you can type out RUN" and get the same result. Pressing PLAY on the recorder and then any key sets the recorder running and the program loading. In the dozen or so pieces of software loaded, there wasn't a single loading error, which is quite good considering they were all pre-production copies. Software loads a block at a time, with a message on the screen telling you which block is loading, which is reassuring, though you can also have a loading screen on, or be lazy and have nothing at all, like the Commodore 64.

An excellent feature is how 'difficult' they've made it to break out of programs. To get out of a machine code program you must press SHIFT, ConTROL and ESCape together, which resets the machine as if you'd switched off and on again. The ESCape key is tucked on at top left, not likely to be hit accidentally, but if you do so when running a BASIC program you only return to Direct Mode if you press ESC a second time. If you press SPACE instead then the program will continue running.

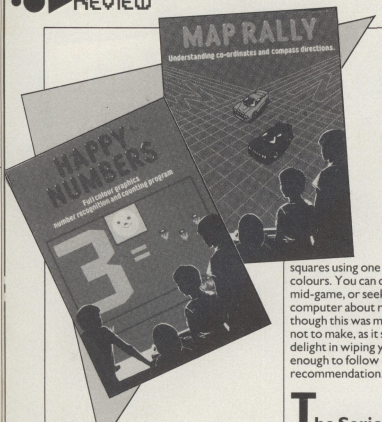
Typing on the machine is a real joy and even at maximum revs there were no letters missed. The feel of the keyboard is great . . . helped by the fact that it's slightly raised, and also helped by the finger-tip indendations in the keys — no slipping off here. The keys had a reasonably solid feel to them, except for one, the SPACE bar, which was rather tinny and a bit wobbly. It was supported just at the centre, rather than for most of its length, and as the machine on display had obviously suffered a lot of arcade-type bashing at the SPACE bar, it had become rather wonky. A little disconcerting, that, as when you're typing at speed you tend to send a finger down in the general direction of the SPACE bar and bash it . . . it needs to be more robust, though it's probably something you could easily solve for yourself in DIY fashion if it bothered you.

Soft Options

The saying 'software sells hardware' would certainly seem to ring true for Amstrad. Our main impression after a few hours with pre-production copies of some of the first 50 titles due in September was of the best of the Spectrum combined with the best of the Commodore 64, and a little more besides. In fact that is just what will be on offer, as Amstrad gave early machines to several software houses to convert the pick of their titles, and despite an emphasis on games with 38 arcade titles, there are also some educational, tutorial and business programs included.

Two of the games, *Roland on the Ropes* and *Roland in the Cave*, might suggest there's a Horace or Cuthbert clone on the way, but these provisional titles are more in-jokes and may change: Roland Perry was really the *agent provacteur* behind the development of the Amstrad's software. Those games, in reality, are versions of Quicksilva's *Fred* and *Bugaboo*, both of which impresed with their sound, speed, colour and all-round smoothness. The character movement was so detailed as to warrant close inspection with a magnifying glass to see just what was going on.

Fred opens with a dramatic rendering of 'High Noon', then you're into the tunnels from which you must escape by swinging round the conveniently-placed ropes and avoiding the convincing ghosts and other



nasties. Fred was under joystick control, and while the Amstrad stick seemed a little stiff at first, any loss of life was definitely down to the player.

Keyboard control is a good test of a machine's responses, and the high standard of this was revealed in *Electro Freddy*, with characters gliding round the screen as if they'd strayed in from an Ultimate game. Here is the perfect game for a machine by Amstrad, as you push hi-fi units onto the conveyor belt at the foot of the screen while avoiding the bespectacled red-bearded man who appears to be throwing portable radios at you — a bit tricky to tell as instructions haven't yet been incorporated. But if you're hit you plummet down to the moving belt and an ambulance whisks you away. The levels get tougher, of course, and all in all it was an impressive if simple game.

Less simple was *Bugaboo*, where we were soon floundering around despite our pride in having got the flea out of the cave in 16 seconds for the Spectrum version. Pride comes before a fall, though, or in this case several falls. As in the 64 version, the graphics have been given depth and a few more hazards added. Winking eyes peer from holes in the background, and this was a game we were very reluctant to pull the plug on, even if another goodie was waiting.

And it was, with Durrell's *Harrier Attack*, already a Spectrum best-seller, and surely set to do the same for Amsoft. With a combination of keyboard and joystick you take your plane from the deck of an aircraft carrier and fly, *Scramble*-style, over a scrolling landscape in an attempt to bomb the enemy camp — not a game for wimps or pacifists. The clear blue sky and white clouds showed the purity of the Amstrad's colours, as good as we've seen on any

Other games due include a brace from Gem and Micromega, with familiar titles like *Mr Wimpey*, *Hunchback*, *Pengwyn* and *Hunter Killer* also on the opening list. Mikro-Gen have provided their *Masterchess* program, which might not offer all the facilities of the best chess programs but does have nine skill levels and the option to alter either the pieces or the squares using one of the Amstrad's 27 colours. You can change skill-level in mid-game, or seek advice from the computer about recommended moves — though this was more a case of which move not to make, as it seemed to take great delight in wiping you out if you were fool enough to follow (or swallow) its recommendation.

The Serious Side

We were less impressed with the educational programs, although it is good to see a company launching some educational software alongside a new micro, and these were far from being the 'quiz' programs that some software houses put out masquerading as education. *World Wise* is a geographical version of the old animal guessing game, where you think of an animal and the computer tries to guess it by asking a series of Yes/No questions such as 'Can it fly?' Here you deal with rivers, mountains etc, ten categories in all, but with only two items under each heading when you start. You must build up the rest yourself, as the computer 'learns' by asking you how it can differentiate between its guess, if wrong, and the item you were actually thinking of. How much the pupil learns through this, though, is uncertain.

For younger children there are *Happy Letters*, *Happy Writing* and *Happy Numbers*. The last prints a number on the left of the screen and the child must respond by pressing the appropriate number key the correct number of times. A smiling face is the reward, a frown if wrong, and it should be reasonably effective for very young children but it is hoped that better material should appear in due course.

The businessman's equivalent of *Happy Numbers* is, we suppose, a spreadsheet program, and *Amscalc* is just that, written in BASIC. If this sounds possibly limiting, bear in mind that the speed of the Amstrad BASIC is one of its strong points, and a faster more complex spreadsheet written in Pascal is on the cards for the future. *Amscalc* needs a longer more in-depth look when its instructional material is also available, but at first sight it seemed easy to use, and certainly coped with graph-drawing quickly enough. On the business/utility side there will also be a word processor, *Amsword*, a home budget program, a Pascal package and an assembler/disassembler.

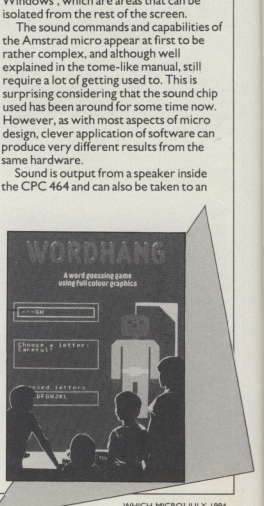
These first impressions, though necessarily brief, indicate that the Amstrad won't flounder for lack of software support. The price level hasn't been fixed yet, but it's more likely to be £7.95 than £5.95. One final thought we had — if these are just the first few items, what will the standard of software be when the machine has been around for a year or so?

Sounds On Display

Apart from all the usual features found in most extended versions of BASIC, the CPC 464 has a more than adequate graphics and sound facility. The resolution and colours available are determined by which mode the machine is in. Mode 1 is the default selection, providing 40 character columns. The other modes give 20 (mode 0) and 80 (mode 2) respectively. The number of colours supported by the three modes also varies from two in mode 2 to four in mode 1 and 16 in mode 0 — these are out of a possible 27 colours, derived from a basic set of nine (the base colour, a bright and a pastel version). It is also possible to make the colours flash by adding an extra parameter to the relevant commands. It is fairly obvious that in the absence of many colours, a high-res screen mode is possible, with the reverse also being true. This becomes particularly noticeable when making use of 'Text Windows', which are areas that can be isolated from the rest of the screen.

The sound commands and capabilities of the Amstrad micro appear at first to be rather complex, and although well explained in the tome-like manual, still require a lot of getting used to. This is surprising considering that the sound chip used has been around for some time now. However, as with most aspects of micro design, clever application of software can produce very different results from the same hardware.

Sound is output from a speaker inside the CPC 464 and can also be taken to an



external amplifier. There are seven parameters used with the sound command, but only the first two *must* be specified — the others default. Briefly, the command gives access to channel (there are three possible), frequency, length of note, volume and its envelope (the way the volume changes over the length of the note), the shape of the wave (called for some obscure reason Tone Envelope) and the amount of noise added to the final sound. Quite an extensve little package, but we'll wait to see if anyone manages to come on with anything spectacular after playing with it for some time.

BASIC Bits

Rather than run through the whole set of BASIC commands — and there's another encyclopaedic manual which does just that — we'll select a few of the more unusual to outline the kind of spread provided by the Amstrad micro.

The commands AFTER, EVERY and REMAIN allow subroutines to be controlled in real time. This makes it possible to insert delayed calls and repeating calls to any particular routine. In other words, what we have here is an 'interrupt processor' under software control, though beginners will probably not need to know much more that that.

Along with the usual INT command for returning the integer part of a real number, there's also CINT, which rounds the number to the nearest integer. CREAL is then the equivalent conversion to real numbers.

Interrupts, mentioned earlier (apart from BREAK), may be disabled and enabled by DI and EI respectively. However, it would seem a much better idea to either make sure programs do not require special priorities to be given to routines, or for other occasions to employ some error trap and re-routing. This latter facility is covered adequately by ERROR, ERR and ERL.

Access from BASIC to I/O ports is provided by INP, OUT and WAIT, where the I/O port address is specified and either a 'look-for-right-number', or a straight I/O operation is performed.

The Amstrad's software also supports a range of graphics specific, joystick control and sound commands which combine to make their BASIC one of the most comprehensive on a machine of this size. Many of the provisions are reminiscent of those provided by higher level string processing languages such as SNOBOL4.

The Round Up

This new CPC 464, Z80-based personal computer contains 64K RAM, of which over 42K is available upon power-on to the user. It has three screen modes with a maximum resolution of 640×240 pixels and the keyboard includes a built-in cassette deck. This accesses an extended character set and 32 user-definable keys.

Sound and graphics are both well catered for, with 27 different (*albeit marginally — Ed*) colours and three channels of 'stereo' sound. Software support for graphics and sound is more than generous and there would seem to be little that you could want to do that is not possible via one or more BASIC commands. Indeed this philosophy seems to have been applied throughout and until production models have been in use for a few months — first machines are expected in the shops towards the end of this month (June) — we'll reserve any final criticisms.

Amstrad CPC 464 with colour monitor	£329
Amstrad CPC 464 with green monitor (monitors not available separately)	£229
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PART 4

SPECTRUM SKETCHPAD

The final part of this exciting graphics enhancer for the Spectrum describes double size characters and screen manipulation.

Over the last three issues we have built up a fully functioning screen editor with many routines to speed up the creation of graphics screens. This month sees the conclusion of the series, with the inclusion of a giant-sized text feature and the 'Page Flipper' routine, but remember that the program has been designed to make it a simple task to add your own subroutines.

```
8000>REM ************************************
8001 REM MODULE 2.8 - PRINT GIANT CHARACTERS
8002 REM ************************************
8010 IF xp>28 THEN  LET xp=28
8020 IF yp>18 THEN  LET yp=18
8030 PRINT #1;AT 0,0;"GIANT-SIZE PRINT MODE              ";"Yprint=";yp;"   -   Xpr
int=";xp;"    "
8040 FOR c=xp TO xp+3: FOR r=yp TO yp+3: PRINT  PAPER cursorp; OVER 1; BRIGHT 1;
AT r,c;" ": NEXT r: NEXT c
8050 BEEP .05,24
8060 IF INKEY$<>"" THEN  GO TO 8060
8070 LET p$=INKEY$: IF p$="" THEN  GO TO 8070
8075 IF p$>"z" THEN  GO TO 8060
8080 FOR c=xp TO xp+3: FOR r=yp TO yp+3: PRINT  OVER 1;AT r,c;" ": NEXT r: NEXT
c
8085 IF p$=CHR$ 12 THEN  GO SUB 8800: GO TO 8030
8090 IF p$=CHR$ 13 THEN  RETURN
8100 IF p$=CHR$ 32 THEN  GO TO 8160
8110 BEEP .05,24: PRINT #1; FLASH 1;AT 0,0;"                WAIT                "
8120 GO SUB 8600
8130 FOR r=1 TO 4: FOR c=1 TO 4: LET k=(VAL L$(r*2-1,c*2-1)*2)+VAL L$(r*2-1,c*2)
+(VAL L$(r*2,c*2-1)*8)+(VAL L$(r*2,c*2)*4)
8140 PRINT AT yp+r-1,xp+c-1;CHR$ (128+k)
8150 NEXT c: NEXT r
8160 LET xp=xp+4
8170 IF xp=32 THEN  LET xp=0: LET yp=yp+4
8180 IF xp=31 THEN  LET xp=3: LET yp=yp+4
8190 IF xp=30 THEN  LET xp=2: LET yp=yp+4
8200 IF xp=29 THEN  LET xp=1: LET yp=yp+4
8210 IF yp>18 THEN  LET xp=31: LET yp=21: BEEP .05,40: RETURN
8220 GO TO 8030
8230
```

Modules 2.8 — Subroutine — Print Giant Characters.
2.9 — Subroutine — Delete Giant Characters.

These two modules are analogous to previous routines with one important exception at lines 8130–8140. It was previously found that the codes for the block graphics characters were inconvenient. Here the codes are extremely useful. If we imagine each block graphic chopped into four small squares we can allocate 1 for an inked quarter and 0 for uninked quarter. We now multiply that 1 or 0 by 2 for the top-left quarter, by 1 for top right, 8 for bottom-left and by 4 for bottom-right. Add these four numbers together then add 128 to the sum and we obtain the code for the graphics character.

By combining 16 block graphics characters to make a giant character, each quarter of a graphics character corresponds to a "pixel" of the giant character. In these 2 lines L$() is sliced up into 16 2-bit by 2-bit portions and the appropriate block graphics character for each portion calculated and printed to the screen.

Testing Modules 2.8 & 2.9

Test these modules in the same way as for the large-size character modules. The main difference is that the giant characters take up a 4 by 4 block of print spaces on the screen. There are therefore four different starting points along a line which must be tested to check that characters are printed in neat columns.

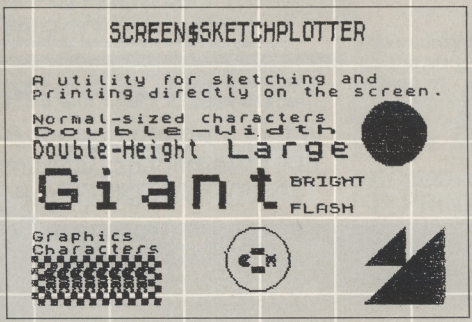
Check the downward displacement of the cursor as you progress from one line to the next. Check also that the delete cursor jumps up correctly when back-deleting from one line to the previous line.

The listing for this program is now complete and ready for use. I do not intend to add any further instructions since all that you need were given with each module. Experience is the best tutor so discover both the strengths and weaknesses of the program by making your own designs.

A useful aid would be to purchase some keyboard overlays and mark up one to use until you have learnt all the control keys. You may have noticed that the control keys are grouped in a relatively convenient way, ie most of the letter keys for pixel mode, the number keys for print mode and keys "p", "o", "i" and "y" (which are grouped together) as shared control keys.

Should you wish to adapt or extend the program there are still approximately 17400 bytes left after running, so you have plenty of spare memory. If you need more control keys the "a" and "u" keys are unused in pixel mode.

Lastly, in order to obtain the maximum value from this program, why not borrow ideas and routines from it and use them in your own programs? Spare parts you might find useful are the error trapping routines used where a number is input, the binary/



```
8000 REM ************************************
8001 REM MODULE 2.9 - DELETE GIANT CHARACTERS
8002 REM ************************************
8010 LET xpd=xp*4: LET ypd=yp
8020 IF xpd=-1 THEN  LET xpd=26: LET ypd=ypd-4
8030 IF xpd=-2 THEN  LET xpd=25: LET ypd=ypd-4
8040 IF xpd=-3 THEN  LET xpd=24: LET ypd=ypd-4
8050 IF xpd>=4 THEN  LET xpd=29: LET ypd=ypd-4
8060 IF ypd<0 THEN  BEEP .05,40: LET ypd=0: LET xpd=0
8070 FOR c=0 TO 3: FOR r=0 TO 3
8080 PRINT AT ypd+r,xpd+c;" ";AT ypd+r,xpd+c;"
8090 NEXT r: NEXT c
8900 LET xp=xpd: LET yp=ypd: RETURN
```

decimal and decimal/binary conversions in modules 0 and 2.5 respectively, the method of printing giant characters using the ZX character set in module 2.8 and the graphics character generator.

Page Flipper

At the beginning of this series I promised a machine code routine which changes screen pages held in RAM. The paragraphs that follow describe just such a routine. Follow the steps given and I am sure you will be impressed with the result.

1. Use the sketchpad to make five screen designs. Save each one to tape making sure you keep a note of the tape counter reading for each design.
2. Enter the Basic program called "pagedemo". This program provides a menu and controls the machine code. Do not RUN it but double-check the addresses in lines 110–160, then save it to tape with SAVE "pagedemo" LINE 10 so that it autoruns on loading.
3. Enter the BASIC program called "code". This program POKEs the machine code into memory and is probably quicker than using an assembler since there are only 36 bytes of functioning code. Double-check the DATA then RUN the program. The machine control code is now in memory.
4. The machine code now in memory will take 6912 byte blocks of memory and place these in the display and attribute areas. We now add the five pages as machine code to make one large chunk of machine code. Wind the tape to the position of the first page and load this with LOAD "" "CODE 58455,6912. Load the second page with LOAD "" "CODE 51542,6912. Load the third page with LOAD "" "CODE 44629,6912. Load the fourth page with LOAD "" "CODE 37716,6912 and the fifth page with LOAD "" "CODE 30803,6912.
5. Now wind the tape containing the Basic program "pagedemo" to a point just after the program recording and save the cumulated machine code with SAVE "mc" CODE 30767,34601. VERIFY this and then wipe the computer memory with RANDOMIZE USR 0.
6. Load the pagedemo program. This will autorun, loading the machine code containing the bytes of the five pages and displaying the menu and instructions. Press any key between 1 and 5 for a rapid block move. Try pressing "6" to see just how slow a BASIC block move would be.

Table 1 — Strings and arrays

L$()	Subroutine at Line 8600 & Oversize Print Routines — holds character to be printed as 8 binary numbers
b$,q$	Subroutine at Line 8600 — used to construct binary number
g$	Subroutine at Line 7400 — holds code of graphics character to be printed
k$	Initialisation — number input as string and converted to variable "byte"
p$	hold character for printing in print routine

(see also Table 2, Part 1 for strings & arrays used in both pixel and print modes.)

Table 2 — Numeric variables

b1,b2	Subroutine at Line 8600 — decimal to binary conversion
byte	Sequentially holds 8 numbers for POKEing user defined characters
c,r	FOR-NEXT variables for column & row in Giant Print Routine
cursorp	paper colour for print cursor
g	Initialisation — holds numeric differences between codes of chosen letter and corresponding graphics character
k	Used to calculate codes of graphics characters making giant letters in Giant Print Routine
peek	Subroutine at Line 8600 — sequentially holds bytes forming character to be printed
xp,yp	co-ordinates of print cursor
xpd,ypd	cursor co-ordinates in print delete routines
xplot,yplot	co-ordinates for plotting in large print routines

(see also Table 3, Part 1 for numeric variables used in both pixel and print modes.)

Using The Routine

With five pages, the 36-byte block move routine in memory and RAMTOP set at 30766, you will have about 6.5K available for a Basic program. Larger BASIC programs will necessitate losing one or more pages. In your basic program use the same RANDOMIZE USR calls as you find in the demo program. The actual pages are stored in the 6912 bytes starting at 58455, 51542, 44629, 37716 and 30803 for pages one to five respectively.

The machine code routine from 30791 to 30802 is as follows:

Mnemonic	*DEC*	*Comments*
LD HL, E4 57	33,87,228	Load HL register pair with base address of source code (58455)
LD DE, 00 40	17,0,64	Load DE register pair with base address of destination (16384)
LD BC, 00 1B	1,0,27	Load BC register pair with no of bytes to be moved (6912)
LDIR	237,176	Move the bytes
RET	201	Return

This moves the first page. for the other pages we need merely to put the base address in the HL register and jump to the fourth byte of the above routine. The code for moving the second page gives the general idea.

Mnemonic	*DEC*	*Comments*
LD HL, 56 C9	33,86,201	Load HL register with 51542
JP 4A 78	195,74,120	Jump to address 30794

```
  1 REM ************************************
  2 REM pagedemo - BASIC control program
  3 REM ************************************
 10 BORDER 7: PAPER 7: INK 0: BRIGHT 0: FLASH 0: CLS
 20 CLEAR 30766: LOAD "" CODE
 30 CLS : PRINT "A demonstration of a machine      code routine to change pages
held as code in the higher                addresses of RAM."'"Press any number key to s
n to   see page, then press any key to return to this menu."
 40 PRINT : PRINT "1) Page 1""2) Page 2""3) Page 3""4) Page 4""5) Page
5""6) Demonstration of BASIC page  change"
 50 PAUSE 0: LET i#=INKEY$: IF i#<"1" OR i#>"6" THEN  GO TO 50
 60 GO SUB 100+VAL i#*10: GO TO 30
110 RANDOMIZE USR 30791: PAUSE 0: RETURN
120 RANDOMIZE USR 30785: PAUSE 0: RETURN
130 RANDOMIZE USR 30779: PAUSE 0: RETURN
140 RANDOMIZE USR 30773: PAUSE 0: RETURN
150 RANDOMIZE USR 30767: PAUSE 0: RETURN
160 FOR x=58455 TO 65367: POKE x-42071,PEEK x: NEXT x: PAUSE 0: RETURN
```

```
 1 REM ************************************************************
 2 REM code - pokes controlling machine code for pagedemo program
 3 REM ************************************************************
10 DATA 33,83,120,195,74,120,33,84,147,195,74,120
20 DATA 33,85,174,195,74,120,33,86,201,195,74,120
30 DATA 33,87,228,17,0,64,1,0,27,237,176,201
40 CLEAR 30766
50 FOR n=30767 TO 30802: READ a: POKE n,a: NEXT n
60 PRINT "Machine code now in RAM."
```



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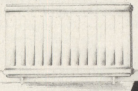



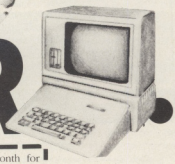

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HARERAISER COMPETITION

In 1979 Kit Williams wrote a book called Masquerade, which started a treasure hunt that was followed by people all over the world. The prize that was offered was the "Jewelled Hare of Masquerade". It was a real treasure, made of gold and precious stones. The hare was sealed in an earthenware jar, and buried in a secret location. A man called Ken Thomas finally solved the clues in the book, and dug up the hare in 1982.

Now a company called Haresoft Ltd, has purchased the hare from Mr. Thomas and embarked on an exciting computer competition.

Six programmers and two designers have spent three months producing a program which they describe as a puzzle, not a game. To give an equal chance to youngsters who cannot travel freely, the hare has not been buried, the winner merely having to pinpoint a certain location. The program is being produced in two parts, each costing £8.95, which will be released with a twelve week period between them. The first tape, (Hareraiser Prelude) will be available in mid-June, and the second tape (Hareraiser Finale) will be available in mid-September. Both tapes will be needed to find the location of the treasure. To overcome the problem of piracy, the tapes include information that the ordinary computer owner will not be able to reproduce. Should copies be taken, the user will not be aware that all the data is not present. As a secondary precaution, each tape has its own registration card, which the purchaser must complete and return to Haresoft Ltd.

The winner must be able to produce both tapes which will correspond to his or her registration number, and send the registration numbers, together with a description of the Hare's location. Purchasers of the first tape who register their personal numbers will be offered the second tape through mail order on the first day of issue.

The program will initially be available for the following: BBC B/VIC 20/ORIC ATMOS 48K/ DRAGON 32/64/CBM 64/SPECTRUM 48K/ & AMSTRAD. State which computer you own.

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NOTE. Winners will be notified within 5 working days and no correspondence will be entered into after that time.

All Abroad

Going on holiday, but worried about leaving your micro all alone at home? Well . . . why not take it with you — Robert Penfold looks at some of the compatibility problems.



In the past, books and board games were taken on holiday to fill in those idle periods, or to help provide indoor activity when the weather failed to live up to expectations. These days, the alternative for the computer enthusiast could be to take a home computer and some suitably engaging software instead, giving an opportunity to demonstrate your computer prowess more widely as well as filling in the dull moments in an interesting way.

In practice things might be less straightforward than you would think. A home-computer is a singularly obstinate piece of equipment. To function properly it requires a power source plus a television or monitor. Provided cartridge software can be used the cassette recorder can be dispensed with, and in the interests of minimising the bulk of the system this is the sensible thing to do.

Set Standards

When holidaying in Britain it is unlikely that access to a suitable television set will be much of a problem. When going abroad the situation is very different. The world of computing is often criticised for having too many standards and variations on standards, but this is an ailment that is common to most facets of electronics, including television. There are three basic television standards; NTSC, PAL, and SECAM, but there are also some variations on these systems. The one used in Britain is the PAL A UHF system, and there are few other countries which use precisely the same system. In fact, as far as I know, the only other country to use this system is Eire.

There are many other countries (particularly in Europe) which use variations on the PAL system, and television sets for use in these countries should in many cases give a good quality visual display with a computer having a UHF PAL A modulator.

Things are very different when it comes to the sound channel, alas, with the continental PAL systems using a different frequency to the British one. For computers such as the Commodore, Atari, and Memotech, where the sound is produced via the television set, the result is a volume level that makes the Spectrum seem positively thunderous. Indeed, there is likely to be no sound at all. This will not detract from a game to the point of making it unplayable, and with computers such as the BBC, Electron, and Oric where the sound is generated from an internal loudspeaker it will make no difference whatever — one reason for several computer manufacturers opting for internal sound generation and external power supplies, making British versions of the machine easily adapted to foreign markets.

It has to be pointed out that although most countries using a PAL system use one that is compatible with the British system, as far as the picture is concerned there are some countries where negative rather than positive vision modulation is used. Using a set designed for this type of signal with a home computer designed for the PAL A system would not simply give an 'inverse video' display. And since the synchronisation signals would also be of the wrong polarity it is highly unlikely that a steady picture could be obtained.

The Old Favourites

Few people realize that VHF television is alive and well in many countries, and although VHF television is soon to be phased out in Britain, there are a good many places where it is likely to be around for many years to come. These are the countries where a 625 line system is used on VHF, and not our obsolete 405 line system. Unfortunately, a computer having a PAL A UHF output will not work at all with a television set that is designed to receive only PAL VHF transmissions.



Results are likely to be similar with a set designed for NTSC transmissions, and this is the system used in the USA. Apart from having incompatible sound, this system also has 525 rather than 625 lines, and 60 rather than 50 frames per second, giving total incompatibility.

SECAM is the French system, but it is used in a number of countries in Europe, Asia and Africa. It has technical similarities with the PAL system (the two systems were developed from the same black and white system), and some sort of display





might be obtained in some cases, but not a proper colour display. Unfortunately, the SECAM system is often used with vision modulation of the opposite polarity to that used in Britain, giving total incompatibility with a micro designed for use with a PAL A set.

There are no companies producing converters which enable a computer having a PAL A UHF output to be used with television sets designed for other standards, and this is something that could probably not be achieved using a low cost device anyway. Except in the case of the VIC-20 the modulator is an integral part of the computer which cannot be changed easily, and even with the VIC-20 a suitable modulator for the country you are visiting might be difficult to obtain.

Unless you are visiting a country where a suitable UHF PAL system is used at least to some degree (and a number of popular resorts are in countries that fall within this catagory), the best advice would seem to be to take a miniature television set with you.

A list of countries that use a PAL system that is picture compatible with the British PAL system is given below. There is a good chance of being able to use a computer having a UHF PAL A output in one of these countries.

Austria	**Azores**
Belgium	**Cyprus**
Denmark	**Finland**
West Germany	**Gibraltar**
Iceland	**Israel**
Italy	**Madeira**
Malta	**Netherlands**
Norway	**Portugal**
Spain	**Sweden**
Switzerland	**Turkey**

The UK mains supply is about as universal as our television system. Most countries have a mains voltage of around 110 to 120 volts AC, as opposed to our 240 volt AC supply. The UK mains is at a frequency of 50Hz, whereas some other countries use a frequency of 60Hz (the USA for instance). Fortunately, the difference between 50 and 60 Hz is unlikely to be important as far as powering a micro is concerned, and provided the mains supply voltage can be stepped up to 240 volts it should operate the computer properly.

There are special transformers known as auto-transformers which are designed for this task. With one of these practically any item of 240 volt UK mains equipment can be powered from a 110 to 120 volt mains supply. Most of these auto transformers have a variety of input and output voltages so that they can convert any normal mains voltage to any other standard mains voltage. They should be properly cased with input and output connectors that permit safe connection to the mains supply and the powered equipment. However, unless you are reasonably familiar with electrical wiring it is unwise to play around with an auto transformer, and certainly no wiring should be left exposed.

Power Play

Auto-transformers are available in a number of power ratings, but a computer does not consume a great deal of power and a small type rated at about 25 watts or more should suffice. The only snag is that auto-transformers do not seem to be as readily available as they once were.

Computers such as the Spectrum and Oric have a power supply which gives a nominal 9 volt DC output. Battery operation of a computer of this type is quite feasible, but take care not to get the battery polarity wrong (although this does not neccessarily prove fatal for the computer). Home micros are not designed for portability nor to operate from batteries, and consequently they are not built around a CMOS microprocessor and other devices that have a low current consumption. A power source such as six HP11 size cells would be extremely short lived, and even the use of Nickel Cadmium rechargeable batteries would not be too practical as they would need frequent recharging. The use of batteries, although possible in many cases, is therefore of dubious value even for these computers where it can be accomplished without too much difficulty.





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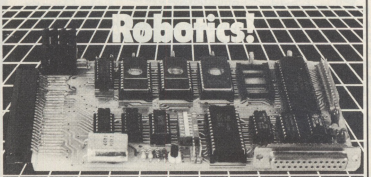

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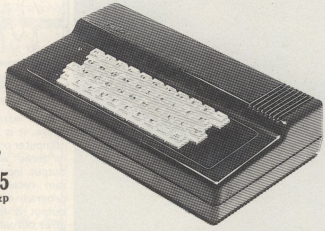

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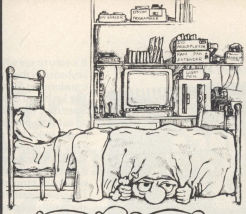


WOT NO USER GUIDE ?

EXPLORING BASIC

Hello John, got a new computer . . . but don't know what to do with it next? Chances are, then, that you haven't yet mastered your machine's BASIC. After the initial excitement of owning a home computer has worn off, most machines are left to gather dust. The idea of learning how to program seems too daunting, but beyond the games available in the shops and the code copied from manuals, lies the world of writing software. We hope to show you that programming isn't boring and academic, but FUN. And you don't need masses of hardware, just a regular home micro.



A Bit Of Theory

Before learning any new computer language, it is helpful to remember that all computer programming can be summed up in three words: input, processing and output. Input is the information the program receives, processing is what the program does with this information and output is the information the program gives out when it has finished processing. Here is an illustration of this represented by a 'Boy meets girl' scenario:

— Boy asks girl "Will you come out with me?"

The question is the input.

— Girl thinks it over . . .

A decision is required, based upon information received from her senses and acquired knowledge of similar situations. She may ask herself specific questions to help make up her mind — Is he good looking? Does he have an interesting disposition? Is he rich? etc.

— A decision is made, which triggers the output.

Girl slaps boy and says "No way, creepo." The process is complete.

The sequence can be summarised as INPUT — EVALUATION — OUTPUT and practically every variation of computer program will follow these three stages in one manner or another.



Time To Decide

Unfortunately, true logic does not prevail in the above situation. Many factors probably bias the girl's judgement. Her mind may contain a vast number of concepts (a database) that construe a desirable model of her ideal man. One approach would then be to compare the boy in question with the requirements imposed upon her by her ideal model.

Computers may be used to formulate an answer to a similar question, but they can only produce a result based upon the criteria they have been told to use. This is where the intricacies of computer programming become apparent. Everything goes well as long as there is a clear understanding of all the steps involved — between the source of the input and the program, internally within the program and between the program and where its output goes. The problems in programming arise when there is a communications breakdown between you and your micro.

Imagine you are in Paris and you want to catch a bus from the Eiffel Tower to the Arc de Triomphe but you don't know which bus to catch and you don't speak any French. You would try to find someone who speaks English, someone who speaks the same *language* as you. The same thing applies in programming — your computer expects instructions in a certain language and expects you to follow certain rules when you give it those instructions. Languages can't be mixed up — you can only program in one language at a time, just as you can only talk in one language at a time (and expect to be understood!). The set of rules you have to follow when programming is called the syntax of the language — the position and structure of instructions. The sentence "Shops to he goes down the" contains the right words, but in the wrong order — a syntax error. People often interpret correctly what they see or hear, even if there are mistakes in it, but computers need to be told precisely, and will act upon what they are given without guessing the parts left out and without ignoring errors in the syntax — the code in the program must be exactly correct.

Before writing a program you must have an idea of what you want it to do or which particular problem you want it to solve. The essence of good programming is to

fully understand a problem, to find a suitable solution that will remain correct for all variations of the problem and that will cope with all possible contingencies.



One Lump Or Two?

On the face of it, making a cup of tea seems a relatively straightforward task. But there are several hidden complexities that must be resolved to enable successful completion of the tasks. The steps might be summarised as:

1. Fill kettle.
2. Boil the water.
3. Pour the boiling water from the kettle onto the required amount of teabags in a suitable sized teapot.
4. Allow the tea to brew for a period sufficient to enable the concoction to be palatable and yet not too cold to be drunk.
5. Pour the tea into the appropriate number of cups.

The five steps described above would be sufficient for most people to make a cup of tea, though in programming terms there is not enough detail. Examining step 1, many questions could arise. Where is the kettle? Is there any water in the kettle already? Is the kettle plugged in? Does the kettle require an external source of heat? Obviously the original steps need revising. Every avenue and alternative must be recognised so that every possible permutation of the solution can be predicted.

It is a highly regarded maxim that the largest portion of time tackling a computer program should be spent on analysing the problem; long before any code is actually written. Once software has been committed to machine it is much more difficult to change logic structures to acount for further requirements which become apparent. When every conceivable permutation of the problem has been identified, the solution can be sought. The sequence of events can be ordered in a way that reflects the intrinsic logic of the program. Returning to our 'cup of tea' example, some possible actions involved in step 1 (fill kettle) can be listed.

1) GOTO kitchen
2) GOTO unit next to sink
3) IF kettle NOT there THEN STOP
4) IF kettle is too full THEN take kettle to sink, pour off a little amount of water, GO back and REPEAT test — is kettle too full?
5) IF kettle is empty OR water is low THEN remove kettle lid, turn off kettle at wall socket, remove plug from kettle, take kettle to sink, pour water into kettle, GO back and REPEAT test — is kettle too full?
6) replace kettle on unit
7) replace kettle lid
8) dry hands
9) insert kettle lead
10) switch on kettle at wall socket
11) turn on kettle switch
12) STOP

Since a computer is a wholly ignorant beast, every detail must be specified, otherwise the procedure will collapse. This can be very tedious, but it is necessary to maintain a level of predictability. There is an enforced stop at point 3 if the kettle cannot be located. It could be written to inform us that there is a serious problem here.

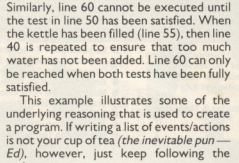
3) IF kettle NOT there THEN GOTO 20
20) OUTPUT "WHERE IS THE KETTLE?!"
21) STOP

In BASIC, the point numbers mentioned above are designated by line numbers. Points 4) and 5) may be rewritten more correctly by using line numbers:

```
40 IF kettle is NOT too full THEN GOTO 50
41 take kettle to sink
42 pour off a little water
43 GOTO 40
50 IF water is sufficient THEN GOTO 60
51 remove kettle lid
52 turn off kettle at wall socket
53 remove plug from kettle
54 take kettle to sink
55 pour water into kettle
56 GOTO 40
60 as point 6) etc . . .
```

The program will continue up to line 50 unless the test in line 40 is successful. Similarly, line 60 cannot be executed until the test in line 50 has been satisfied. When the kettle has been filled (line 55), then line 40 is repeated to ensure that too much water has not been added. Line 60 can only be reached when both tests have been fully satisfied.

This example illustrates some of the underlying reasoning that is used to create a program. If writing a list of events/actions is not your cup of tea *(the inevitable pun — Ed)*, however, just keep following the series.



Back To BASICs

To start writing code it is necessary to have a knowledge of the commands available and how to combine them so the program does the processing required. Two of the most important concepts in writing code are VARIABLES and CONSTANTS.

If you put information into the program, it must be identifiable at a later stage. This is done by using what are called variable names. Within the program, different pieces of information must be given different variable names. We shall use variable names that consist of any letter from A to Z. The key point about a variable is that its value is not fixed — during the processing the value of a variable may change; it could, for example, have another variable added to it.

Constants do not change — they are fixed. Examples of constants are positive and negative numbers, zero and fractions. Thus 1, 15, –3, 1/5, –3/10 are all constants.

Constants may be used to change variables during processing; they may be subtracted from or added to variables. Referring back to the earlier 'tea-making' example *(if we must — Ed)* line numbers were mentioned. These identify the order in which things occur and make moving from one part of the code to another very easy — can you imagine the trouble the postman would have trying to deliver letters if nobody had a number on the front of their house. The example below shows just how these numbers come into use (don't worry if you don't understand it). Check your manual to see if in line 50 you must leave a gap between "I" and "<", and between "<" and "10", because leaving gaps may cause the program to fail on your computer.

```
10 PRINT "NUMBERS PROGRAM"
20 LET I = 0
30 LET I = I + 1
40 PRINT I
50 IF I < 10 THEN 30
60 PRINT "OK, IT'S FINISHED NOW"
70 END
RUN
```

What does this program do? Well, line 10 displays on your screen "NUMBERS PROGRAM" — telling you what the program you are running is called. Line 20 makes the variable I take on the value 0. Line 30 increases the value of I by 1, therefore the first time it changes I from 0 to 1. Line 40 displays on your screen the value of I — in the first case 1. Line 50 checks to see if I has a value lower than 10 and if it does we return to line 30.

So you can see, the program keeps going back to line 30, increasing the value of I by 1, and displaying I until its value reaches 10. At this point line 60 is reached "OK IT'S FINISHED NOW" is displayed on your screen and finally line 70 stops the program run. Contained within the code is the variable, I and three constants, 0, 1, and 10. The first constant, 0, is used to give the variable I a starting value. The second constant is used to change the value of the variable by addition, and the third constant is used to limit the number of times lines 30-40 are carried out.



Next month we'll look at some more BASIC commands and program flow.

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Unofficial Publication

GRAFPAD

Gary Evans assesses British Micro's new graphics tablet for the Commodore, BBC and, as featured, the Spectrum.

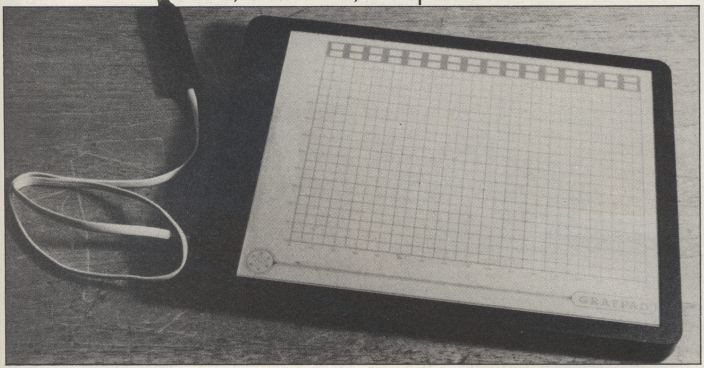


PHOTO BY JEREMY WEBB

As the video display circuitry of computers becomes more sophisticated it means that home micros can generate high definition, colourful graphics that can often truly be called works of art. Unfortunately, to achieve the sort of quality exhibited by the displays incorporated in the better-quality games software means resorting to machine code. This is because the BASIC statements associated with graphics functions are usually incapable of exercising sufficient control over the video display circuitry. The drawback with machine code programming is that even the most simple of displays would take a long time to code. Luckily there are a number of alternative approaches for overcoming the problem of generating high quality displays. The most popular of these is to use a general purpose design package in conjunction with either a joystick or other form of input device which will then act as a pen or paint brush on the screen.

Joysticks are adequate for some applications but for detailed work they can prove insufficient. If you want to get a picture from a piece of paper onto the screen of your micro the best way is to use some form of graphics tablet. These can range from cheap and cheerful pantograph arms which are simply two linked potentiometers that provide a means of inputting co-ordinate information via an A/D converter. A more sophisticated system, and one that is found in professional systems is to use a specially designed 'drawing board' in conjunction with a stylus.

The Grafpad, from British Micro, is just such a piece of equipment. It consists of the tablet itself plus the stylus, connecting cable and cassette-based software. The Grafpad is at present available for three of the most popular micros; the BBC, the Commodore 64 and the Spectrum and it is the latter version that we tried out for this review.

Connecting the pad to the Spectrum is straightforward as there is just one multiway cable that plugs into the expansion port at the rear of the computer. Once the pad is hooked up, the software is loaded by a LOAD"" command and when loading is complete the screen will display a menu of command options. Entering 0 will take you into the DRAW mode of the system. At start up the information window at the bottom of the screen indicates that both the ink and paper colours are black. This, as the manual points out, means that you are not likely to see much happening on the screen. In order to get over this obstacle just hit CLEAR (caps together with shift and C). If you now place the pen on the centre of the pad a white cursor in the form of a cross will appear on the screen. It is now possible to draw lines on the screen by using the pen in conjunction with the enter and break keys. To start drawing a line, the stylus is positioned on the pad and the enter key pressed. This will cause a line to be drawn on the screen as you move the stylus around the pad. Pressing break will terminate the drawing action. An alternative to pressing break is to lift the stylus from the pad, this also ends the drawing mode.

By a combination of modes the Grafpad allows the colour of either individual pixels or pixel groups to be set to various combinations of colours. The system also allows sections of the display to be flashed on and off.

In a review of this length it is not possible to describe all the features of the Grafpad but the 22 page manual that accompanies the system takes the user through all of the options. The range of facilities provided is wide and depending on the artistic ability of the user should allow sophisticated displays to be readily produced. The ability to trace drawings should allow those who are not quite so gifted to transfer drawings to the screen and add their own ideas as to colour etc.

The Grafpad is a well designed piece of equipment. The standard of construction is high and it looks built to last. Anybody wishing to explore the graphics capability of the Spectrum further should find the Grafpad an ideal tool. Even those without much artistic flair should find that, with a bit of practice, they are able to produce impressive displays.

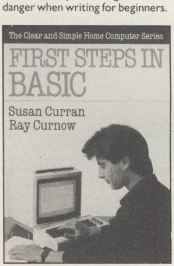
Grafpad is available for £143.75 (exc VAT) from British Micro, Unit Q2, Penfold Works, Imperial Way, Watford, Herts WD2 4YY.

MANUAL OVERRIDE

More books from the Which Micro bookshelf, reviewed in characteristically indomitable style by Nicky Trevett.

First Steps in BASIC
by Susan Curran and Ray Curnow, Windward, price £4.95.

The Clear and Simple Home Computer Series is an impressive collection of books that mostly manage to be what they claim — clear and simple. This is the latest in the series and is no exception, although I have reservations about the tone of the writing which struck me as a shade patronising. This is the danger when writing for beginners.



However, it is still a good introduction to programming in BASIC in the way it approaches and handles the subject for the benefit of the novice. Nothing is assumed, not even access to a computer let alone knowledge of one.

It dutifully points out that there are different kinds of BASIC (one of the appendices attempts to explain some of the differences). The BASIC used in the book is akin to Microsoft BASIC and attempts to pull together the common features of BASICs everywhere. In this it is surprisingly successful — anyone with a micro should be able to make use of the book.

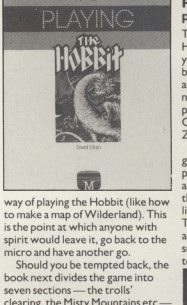
The stated aim is to get the reader writing programs for various everyday applications, like calculating the quantity of wallpaper required to decorate a room. There are copious examples and diagrams to help, together with a number of exercises for the more committed student to solve (answers at the back).

Aspects covered include variables, loops and branches, editing and debugging, data handling and more advanced programming for experienced users.

A guide to Playing the Hobbit
by David Elkan, Melbourne House Publishers, price £3.95

The Hobbit is an excellent adventure game and has many devoted followers. Not all those followers, however, would be well advised to make use of this book — it lets you cheat. No, this is for the faint-hearted and the weak-spirited, those who are too dense or too impatient to find their own way to the dragon's treasure.

The book proffers help in three stages. In part one, you are given general help on the most effective



way of playing the Hobbit (like how to make a map of Wilderland). This is the point at which anyone with spirit would leave it, go back to the micro and have another go.

Should you be tempted back, the book next divides the game into seven sections — the trolls' clearing, the Misty Mountains etc — and gives you advice on more specific problems.

If, after all that, you are *still* stuck in the trolls' clearing, or wherever, you can always resort to section three — a full reference section listing locations, exits and commands to allow you to surmount other problems. As the Hobbit has a number of solutions, it doesn't completely blow the gaff and render the game worthless. But be honest, if you let this little book guide you painlessly through to the dragon's treasure, could you ever look yourself in the eye again?

49 Explosive Games for the ZX Spectrum
by Tim Hartnell, Interface Publications, price £5.95

The prolific *(and elusive — Ed)* Mr Hartnell is at it again. Here we have yet another collection of games, brought together under the auspices of one of the best known names in home computer book publishing (for the ZX Spectrum). Oh, well, bully for games-playing ZX Spectrum owners.

So what do you get? You get a glossy paperback with the usual printed-out listings, which have not always reproduced very well, on the same old themes. There is very little pretence and very little fuss. The programs are mostly in BASIC, although some boast machine code subroutines, and most have only a token introduction.



There has been some attempt at variety — arcade games (Proctor, Snake, Zombie etc), adventure-type programs (Troll and the City, the Doors of Doom), and a section entitled Moving Graphics Games (Tarantula, Duel Cabbageway, Frog on a Log).

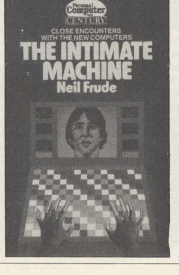
Another section calls itself Leisure Lines and consists of the sort of pastimes you associate with long wintry evenings with Granny — Hangman, cards and so forth. The Lure of the Maze section contains lots of . . . well, mazes. And there is a group of games for two players.

Finally, at page 245, the book tears itself away from games and devotes its last 50 pages to more serious matters, like machine code utilities and structured programming.

The Intimate Machine
by Neil Frude, Personal Computer World/Century Publishing, price £9.95

In the end, and probably sooner rather than later, human beings will come to regard machines as if *they* were human. In fact, some do already, which is inevitable, says Neil Frude, because we as a species are so obsessed with our own nature that we simply won't be able to resist creating machines that are as 'human' as possible.

The idea isn't, of course, particularly new or controversial — we can all be odd and see animals and things as human. We all love science fiction, androids and robots,



and it's well known that serious research is going on into such matters as artificial intelligence, natural language and robotics.

The book is a little disjointed in the way the material is presented, jumping about from art to psychology to technology, looking back into our race's old predilection for tribal rituals and occult practices, pondering our obsession with dolls and puppets, looking ahead to a totally (but benevolently) computerised world. But for all that, it is quite fascinating. There are lots of quotes, many strangely prophetic, from people past and present, and a great deal of food for thought about the direction in which we are heading; wherever that might be.

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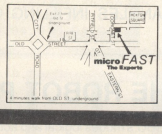

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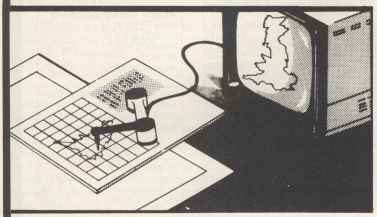

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The obvious use is for drawing maps and diagrams. The transparent tablet allows a book or atlas to be placed underneath to give a tracing facility. The complexity of the diagrams and maps are limited by the graphical capabilities and the memory size of the computer. By using overlays, the latter problem as been overcome to a large extent.

There are however many uses in the sphere of school and home education. It can be used to draw graphs, bar charts, pie graphs, line graphs, etc. It can be used to learn about co-ordinates, polygons and the meaning of vertical and horizontal lines. Using it as a creative medium it can give an awareness of colour, texture and shape. For the computer studies student it can be used for project work and can help with understanding the BBC's modes logical and actual colours, as well as demonstrating a simplified CAD pack. It also provides an example of interfacing on the BBC it can have similar uses in the subject of CDT.

The **Robot plotter** has been used with great success as an alternative to the overhead projector, vufoils can be prepared using the plotter and then displayed on monitors. This has many advantages the vufoils can be produced and easily copied, colour can be used for highlighting, diagrams are simple to draw, and vufoils can be altered without difficulty if required.

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PROGRAM OF THE MONTH

ATTACK OF THE MUTANT RESISTORS

Liverpool is famous for producing games programmers — Geoff Harrison's game for the BBC Micro Model B shows why. The basic scenario is that you have been attacked by an enemy fleet and your craft is badly damaged. Only your laser cannon system is operational. The enemy plans to hijack your ship to their own time zone where they will destroy you, but they will need vital electronic components to perform the three time jumps necessary.

To your horror you see resistors, ICs, transistors and capacitors descending towards the planet. It would have been a novel idea if these components then attempted to join together as a circuit, but alas no — your only hope is to use your laser cannon to shoot them out of the sky before they land and enable the aliens to make a time jump . . .

Program notes:

PROCD — This sets a time delay

PROCPRINT — This prints all invaders at their respective positions

PROCdelete — This makes the invaders disappear periodically (thus flashing)

PROCHECK — Checks to see if your shot has hit the target

PROClives — Checks to see how many jumps have been made, how many more are left, and prints the value

PROCmove — Moves the attackers

PROCV — Where all the alien variables are stored

PROCEXP — Destroys the invader if you have hit it

PROCcheck2 — Checks for aliens hitting the side of the screen

PROCSNUFFIT — Puts you into the time warp

PROCgame over — Prints 'Game Over' — reads keyboard for any key to be pressed to restart.

```
   10 MODE 1
   20 SC=0:LIV=3
   30 VDU 23,224,24,60,24,24,24,24,60,24
   40 VDU 23,225,0,24,60,60,24,36,66,66
   50 VDU 23,226,0,0,254,254,254,0,0,0
   60 VDU 23,227,84,84,84,0,0,84,84,84
   70 VDU 23,228,126,126,126,127,42,42,4
2,42
   80 VDU 23,229,0,16,16,56,56,124,124,2
54
  100 CLS
  110 VDU 23;8202;0;0;0;
  120 DIM A$(10)
  130 A$(1)="        ATTACK"
  140 A$(2)="          OF"
  150 A$(3)="         THE "
  160 A$(4)="  MUTANT RESISTORS"
  170 A$(5)="copyright:G.Harrison"
  180 U=3:P=290
  190 FOR Y=1 TO 5
  200 FOR T=1 TO LEN A$(Y)
  210 COLOURRND(3):PRINTTAB(11,U);RIGHT$
(A$(Y),T)
  220 COLOURRND(3):PRINTTAB(0,U);CHR$(22
4);TAB(39,U);CHR$(224)
  230 NEXT
  240 U=U+2:IF U>9 THEN U=U+4
  250 GOSUBP
  260 P=P+10
  270 NEXT
  280 GOTO 370
  290 SOUND 1,-10,97,10:PROCD:RETURN
  300 SOUND 1,-10,105,10:PROCD:RETURN
  310 SOUND 1,-10,89,15:PROCD:RETURN
  320 SOUND 1,-10,41,15:PROCD:RETURN
  330 SOUND 1,-10,69,20:PROCD:RETURN
  340 DEFPROCD
  350 FOR J=0 TO 500:NEXT
  360 ENDPROC
  370 COLOUR 3:PRINTTAB(0,23);"RESISTOR
   CAPACITOR  I.C.  TRANSISTOR"
  380 COLOUR 2:PRINTTAB(0,25);"    ";CHR$
(224);SPC(12);CHR$(225)
  390 VDU 5:MOVE 770,200:GCOL 0,3:VDU226
:VDU8::GCOL0,1:VDU227:VDU4
  400 COLOUR 3:PRINTTAB(33,25);CHR$(228)
  410 COLOUR 1:PRINT:PRINT:PRINT:PRINT:P
RINT"          Press space to start"
  420 VDU23;8202;0;0;0;
  430 REPEATUNTILGET$=" "
  440 CLS
  450 PRINT''''''''"                Z.......
....LEFT"
  460 PRINT'"                X...........RI
GHT"
  470 PRINT'"                K...........UP
"
  480 PRINT'"                M...........DO
WN"
  490 PRINT'"            SPACE...........FI
RE"
  500 COLOUR 2:PRINTTAB(0,27);"
 Press space to start"
  510 REPEATUNTILGET$=" "
  520 MODE 2
  530 FOR T%=0 TO 1280 STEP10
  540 MOVE T%,0
  550 IF T%<20 THEN CLS
  560 GCOL 0,1:PLOT 85,T%,200+RND(30)
  570 NEXT
  571 FOR T=0 TO 1280 STEP 10
  572GCOL3,4:PLOT69,T,200+RND(900):NEXT
  575 GCOL0,1
  580 MOVE 0,200:MOVE 0,0:PLOT 85,1280,0
  590 MOVE 1280,200:PLOT 85,-1280,0
  600 VDU5
  610 MOVE 620,240
  620 GCOL0,2:VDU229
  630  G=620:H=270:O=0
  640 PROCV
  650 ENVELOPE1,1,0,0,0,0,0,0,126,-1,0,-
3,126,126
  660 ENVELOPE2,6,126,0,0,206,0,0,126,0,
0,-126,126,126
  670 ENVELOPE3,2,6,0,0,255,0,0,126,0,0,
-70,70,70
  675 ENVELOPE4,7,2,1,1,1,1,1,121,-10,-5
,-2,120,120
  680 VDU 23;8202;0;0;0;
  690 IF INKEY(-99) THEN SOUND 0,1,100,1
:O=1
  700 IF O=1 THEN PROCFIRE
  705 IF G<=0 THEN G=1278
  706 IF G>=1280 THEN G=2
  710  IF INKEY(-98) THEN G=G-40
  720  IF INKEY(-67) THEN G=G+40
```

```
  730  IF INKEY(-71) THEN H=H+40
  740  IF INKEY(-102) THEN H=H-40
  745 GCOL3,1:MOVE G-30,H:VDU43
  750 GCOL 0,3:MOVE 370,990:PRINT"SCORE:
"
  760 VDU 4:COLOUR 2:COLOUR 128:PRINTTAB
(12,1);SC:VDU5
  765 MOVE G-30,H:VDU9:VDU127
  770 PROCprint:PROCcheck2:PROClives:PRO
Cdelete:PROCmove
  780  IF POINT(AA,BB)=1 OR POINT(CC,DD)
=1 OR POINT(EE,FF)=1 OR POINT(GG,HH)=1 O
R POINT(II,JJ)=1 OR POINT(KK,LL)=1 THEN
PROCSNUFFIT:LIV=LIV-1:GOTO520
  790 GOTO 690
  800 DEFPROCFIRE
  810 GCOL 1,2:MOVE 645,245:DRAW G-10,H-
10
  820 PROCCHECK
  830 GCOL 0,0:MOVE 645,245:DRAW G-10,H-
10
  840 O=0
  850 ENDPROC
  860 DEFPROCCHECK
  870 IF POINT(G,H)=4 THEN PROCEXP:AA=RN
D(1000):BB=1000
  880 IF POINT(G,H)=5 THEN PROCEXP:CC=RN
D(1000):DD=1000
  890 IF POINT(G,H)=6 THEN PROCEXP:EE=RN
D(1000):FF=1000
  900 IF POINT(G,H)=7 THEN PROCEXP:GG=RN
D(1000):HH=1000
  910 IF POINT(G,H)=10 THEN PROCEXP:II=R
ND(1000):JJ=1000
  920 IF POINT(G,H)=9 THEN PROCEXP:KK=RN
D(1000):LL=900
  930 ENDPROC
  940 DEFPROCV
  950 AA=1280:BB=1280
  960 CC=1000:DD=1280
  970 EE=800:FF=900
  980 GG=300:HH=1000
  990 II=0:JJ=800
 1000 KK=500:LL=800
 1010 ENDPROC
 1020 DEFPROCprint
 1030 GCOL 0,4:MOVE AA,BB:VDU 224
 1040 GCOL 0,5:MOVE CC,DD:VDU 225
 1050 GCOL 0,6:MOVE EE,FF:VDU 226
 1060 GCOL 0,5:MOVE EE,FF:VDU 227
 1070 GCOL 0,7:MOVE GG,HH:VDU 228
 1080 GCOL 0,10:MOVE II,JJ:VDU 224
 1090 GCOL 0,9:MOVE KK,LL:VDU 225
 1100 IF INKEY(-99) THEN SOUND 0,1,100,1
:PROCFIRE
 1110 ENDPROC
 1120 DEFPROCdelete
 1130 GCOL 0,0:MOVE AA,BB:VDU 224
 1140 GCOL 0,0:MOVE CC,DD:VDU 225
 1150 GCOL 0,0:MOVE EE,FF:VDU 226
 1160 GCOL 0,0:MOVE EE,FF:VDU 227
 1170 GCOL 0,0:MOVE GG,HH:VDU 228
 1180 GCOL 0,0:MOVE II,JJ:VDU 224
 1190 GCOL 0,0:MOVE KK,LL:VDU 228
 1200 ENDPROC
 1210 DEFPROCmove
 1220 AA=AA-10:BB=BB-10
 1230 CC=CC-10:DD=DD-10
 1240 EE=EE-10:FF=FF-5
 1250 GG=GG-10:HH=HH-5
 1260 II=II-10:JJ=JJ-4
 1270 KK=KK-10:LL=LL-4
 1280 ENDPROC
 1290 ENDPROC
 1300 DEFPROCEXP
 1310 SOUND 1,2,100,5
 1320 PROCdelete
 1330 SC=SC+10
 1340 ENDPROC
 1350 DEFPROCcheck2
 1360 IF AA<=0 THEN PROCdelete:AA=1200
 1370 IF CC<=0 THEN PROCdelete:CC=1200
 1380 IF EE<=0 THEN PROCdelete:EE=1200
 1390 IF GG<=0 THEN PROCdelete:GG=1200
 1400 IF II<=0 THEN PROCdelete:II=1200
 1410 IF KK<=0 THEN PROCdelete:KK=1200
 1420 ENDPROC
 1500 DEFPROCSNUFFIT
 1510 MM=650:NN=220:OO=650:PP=220
 1520 QQ=650:RR=220:SS=650:TT=220
 1521 VDU4:COLOUR 5:COLOUR 128:PRINTTAB(
0,10);"TIME WARP ";1023+RND(4572);" YEAR
S":VDU5
 1522 Y=0
 1525 SOUND 0,-15,7,150
 1526 FOR P=100 TO 180
 1527 SOUND 1,-1,P,1
 1528 SOUND 3,-5,P,1
 1530 GCOLO,7
 1531SX=640+250*SIN(Y/PI):SY=250+250*COS
(Y/PI)
 1540 MOVE MM,NN:DRAWMM,NN
 1550 MOVE OO,PP:DRAWOO,PP
 1560 MOVE QQ,RR:DRAWQQ,RR
 1570 MOVE SS,TT:DRAWSS,TT
 1571 GCOLO,RND(8):PLOT 69,SX,SY:DRAW SX
+10,SY+10
 1572 GCOLO,RND(8):PLOT 69,SX,SY:DRAW SX
-20,SY+20
 1580 MM=MM+5:NN=NN+6
 1590 OO=OO-10:PP=PP+2
 1600 QQ=QQ+10:RR=RR+2
 1610 SS=SS-2:TT=TT+6
 1612 Y=Y+10
 1620 NEXT
 1625 VDU 19,1,0,0,0,0
 1626 FOR Y=0 TO 100:NEXT
 1627 VDU 19,1,3,0,0,0
 1628 FOR Y=0 TO 100:NEXT
 1631 SOUND 0,4,50,10
 1632 VDU 19,0,3,0,0,0
 1640 ENDPROC
 1650 DEFPROClives
 1660 VDU4:COLOUR 0:COLOUR 130:PRINTTAB(
9,28);CHR$(229);" ";LIV
 1661 IF LIV=0 THEN PROCgameover
 1664 VDU 5
 1665 ENDPROC
 1670 DEFPROCgameover
 1671 VDU 23;8202;0;0;0;
 1672*FX15,1
 1675 COLOUR 1:COLOUR 128:CLS
 1680  COLOUR14:PRINTTAB(7,10);"G A M E"
 1690  COLOUR 9:PRINTTAB(7,12);"O V E R"
 1691 COLOUR RND(3):FOR T=0 TO 19:PRINTT
AB(T,0);CHR$(223+RND(2));TAB(T,28);CHR$(
223+RND(2)):NEXT
 1700 SOUND 1,2,100,100
 1720 COLOUR 12:PRINTTAB(4,20);"Press an
y key."
 1730 REPEAT UNTIL GET$<>""
 1740 RUN
```

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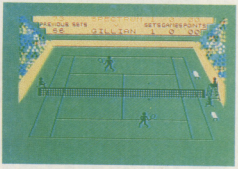

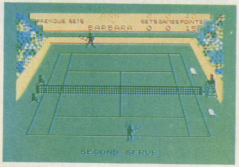



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READERS PROGRAMS

Welcome to the July collection of Readers' Programs. This month, why not try typing in either *Birthday* for the Commodore 64, a useful program to win over the family to computing, or *Village Defence* for the Dragon 32, a well structured arcade game.

We do check the listings but occasionally a little debugging may be required. But if you decide to send us your program PLEASE try to ensure it's bug-free.

We are looking for more good listings and programming tips to fill these pages in the months to come, so if you feel your latest game or utility deserves an airing in *Which Micro*, send it now.

Yes, we do pay for your contributions, the exact amount depending on the length of the listings. As a guideline, it usually averages out at around £50 per printed page.

Send your printed listings to *Which Micro*, Scriptor Court, 155 Farringdon road, London EC1R 3AD together with a copy on cassette.

Please do not send us your only copy as we cannot return it!

BIRTHDAY

Birthday by J. Kelleher, is a marvellous program for someone's birthday and shows good use of the C64's print graphics and music combined. Any sceptics in the family who have doubts about computers will surely be converted by its charm.

Before the birthday person arrives, you have to enter his/her name and also the names of the well-wishers. Then, when requested to continue, the program displays a birthday-type picture, gives a "one-two-three" to start you singing and then plays the tune of "Happy Birthday' and prints out the words on the screen in time with the music. It does this twice. Finally it displays good wishes once again, from itself and the people whose names were entered. Just the thing to start a really happy birthday!

To help with the keying in, the following list of control characters for 'Print' statements is given:

Shift Clear 8, 35, 70, 170, 200, 260, 310, 499, 640, 3000
CRSR Down 10(2), 20, 40(6), 50(3), 60(3), 70(5), 80(5), 170(5), 200(9), 260(9), 310(9), 500(3), 640(7), 3000(4), 3010, 3020(2), 3060(4), 5020(1)
CRSR Right 40(12), 50(19), 70(4), 80(13), 90(13), 110-150(13), 170(14), 200(18), 260(17), 310(17), 500(4), 530(4), 560(4), 600(4), 640(10), 3000(3), 3010(4), 3020(8), 3060(4)

The figures in brackets indicate how many times the character is required.

```
0 REM*********************************
1 REM********* BIRTHDAY **************
2 REM** COPYRIGHT JIMMY AND TERRY *****
3 REM******** KELLEHER ****************
4 REM*****************:*****************
5 REM
6 S=54272:FORL=STOS+24:POKEL,0:NEXT
8 PRINT"■":POKE53281,0 R=1024:P=2023:ZE=8:
10 GOSUB5000:INPUT"■■■NAME OF BIRTHDAY PERSON";NM$
20 PRINT"■PRESS ANY BUTTON TO START"
30 GET A$:IFA$=""THEN30
35 PRINT"■":POKE53281,6:FORJ=1024TO2023:POKEJ,ZE:NEXT
40 PRINT"■■■■■■■■■■■■■■■■■■■■■THIS IS A PROGRAM"
50 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■FOR"
60 PRINT"■■■";TAB(40-(LEN(NM$)+11))/2);NM$;"'S BIRTHDAY"
65 FORXX=1TO2689:NEXT
70 PRINT"■■■■■■■■■■THIS PROGRAM IS A PRESENT FOR YOU"
80 PRINT"■■■■■■■■■■■■■■■■■■■■■■   *   *"
90 PRINT"■■■■■■■■■■■■■■■■■■■■■■ *  *"
100 PRINT"■■■■■■■■■■■■■■■■■■■■■■  *"
110 PRINT"■■■■■■■■■■■■■■■■■■■
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```
500 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]HAP~";:GOSUB1000:PRINT"PY ";:GOSUB1000
510 PRINT"BIRTH~";:GOSUB1000:PRINT"DAY ";:GOSUB1000
520 PRINT"TO ";:GOSUB1000:PRINT"YOU,":GOSUB1000:PRINT:PRINT
530 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]HAP~";:GOSUB1000:PRINT"PY ";:GOSUB1000
540 PRINT"BIRTH~";:GOSUB1000:PRINT"DAY ";:GOSUB1000
550 PRINT"TO ";:GOSUB1000:PRINT"YOU,":GOSUB1000:PRINT:PRINT
560 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]HAP~";:GOSUB1000:PRINT"PY ";:GOSUB1000
570 PRINT"BIRTH~";:GOSUB1000:PRINT"DAY ";:GOSUB1000
580 PRINT"DEAR ";:GOSUB1000:PRINTNM$;:GOSUB1000
590 GOSUB1000:FORXX=1TO100:NEXT
600 PRINT:PRINT:PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]HAP~";:GOSUB1000:PRINT"PY ";:GOSUB1000
610 PRINT"BIRTH~";:GOSUB1000:PRINT"DAY ";:GOSUB1000
620 PRINT"TO ";:GOSUB1000:PRINT"YOU!"
630 FORXX=1TO2:PRINTTAB(24);"YOU!":NEXT
635 GOSUB1000:FORXX=1TO2000
640 ZZ=ZZ+1:IFZZ=1THENPRINT "[BLOCK][BLOCK][BLOCK][BLOCK][BLOCK][BLOCK][BLOCK][BLOCK][BLOCK][BLOCK]NCE MORE!":FORXX=1TO3000:NEXT
645 IFZZ=2THEN2999
650 RESTORE:GOTO499
1000 REMSUBROUTINE TO PLAY TUNE
1010 POKES+24,10:POKES+5,153:POKES+6,69
1020 READHF,LF,ND
1040 POKES+4,17
1050 POKES+1,HF:POKES,LF:FORZ=1TOND:NEXT
1060 POKES+4,16
1070 RETURN
2000 DATA9,56,384,9,56,128,10,89,512,9,56,512,12,78,512
2010 DATA11,158,1024,9,56,384,9,56,128,10,89,512,9,56,512,13,208,512
2020 DATA12,78,1024,9,56,384,9,56,128,18,112,512
2030 DATA15,129,512,12,78,512,11,158,512,10,89,1024
2040 DATA16,109,384,16,109,128,15,129,512,12,78,512
2050 DATA13,208,512,12,78,1024,0,0,0
2999 FORXX=1TO2000
3000 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]OOD WISHES FROM THE COMPUTER!"
3010 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]AND FROM OTHERS)"
3020 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]SUCH AS.";
3025 FORT=2TONM+1
3030 PRINT TAB(17);NM$(T)
3040 PRINT:NEXT
3050 FORXX=1TO4500:NEXT
3060 PRINT"[BLOCK][BLOCK][BLOCK][BLOCK]APPY BIRTHDAY ";NM$;"!"
4000 GOTO4000
5000 INPUT"NO. OF BIRTHDAY WISHERS";NM:DIMNM$(NM+1)
5010 FORT=2TONM+1
5020 PRINT"NAME OF WISHER ";T-1;":";:INPUTNM$(T)
5030 NEXT
5040 RETURN
```

VILLAGE DEFENCE

Village Defence by John and Andrew Garvey, is a bombing type game written for the Dragon 32. The game is written in a structured manner so that any of the routines which are presented here can be used in your own games if so required, routines which keep and update a score table on the high-resolution screen and provide and maintain a high score table being particularly useful.

The game itself is as fast as can be attained using BASIC alone but nevertheless is still very enjoyable, for just when you think that you are in control shooting down the bombs a stray will appear at the right hand side of the screen making it more difficult to win. A good score should be about 1000.

A number of games these days for the Dragon 32 incorrectly assume that all machines can accept double precisor speed. We have therefore decided to include a routine in this game to choose fast or normal speed.

How the program works:

LINE 10 — Sets base for high score table.

LINE 20 — Arrays for Plane, Lazer, Bombs etc.

LINES 30-50 — Data for machine code screen invert and 'music'.

LINE 60 — Present high score table (each entry has 20 characters).

LINE 70 — Replace houses after each game.

LINE 80 — Initialise variables:- Lazer, Plane, Bombs and Score.

LINE 90 — Update score and high score after each game.

LINE 100-480 — Main program loop to move plane, control lazer base, drop bombs and check where bombs are.

LINE 490-580 — Fire lazer and check if bombs are hit.

LINE 590-640 — Blank out items on screen when game over.

LINE 650-710 — Score checking routine to update present score on screen.

LINE 720-790 — Check after game is over if present score is higher than present high score.

LINE 800-870 — If bomb missed then blow up house and update 'miss' indicator on screen.

LINE 880-1390 — Instructions screen display, inverts and 'music'.

LINE 1420 — If DRAGON can take double speed then poke here.

LINE 1430-1510 — Data for sound effects used within the game.

LINE 1520-1580 — Draw, get and puts for plane, lazer and bombs.

LINE 1590-1680 — Array and draw routines to hold numbers for score.

LINE 1700-1720 — Draw routine for letters of score, high score etc.

LINE 1730-1940 — Introduction sequence.

LINE 1950-2330 — Routine to print alphabet onto screen and enable name of person with high score to enter name.

LINE 2350-2420 — String slicing routine to put name of new high score into table.

LINE 2430-2580 — High score table and request for another game or not.

```
10 CLEAR1500,32000:CLS:HS$="0500":HS=500
20 DIM:(17,17),B(28,14),C(25,2):B(.B(.B,7),M(25,20)
30 DATA BE,04,00,6A,B4,CB,40,E7,B0,B5,B6,00,25,F5,39,B6,FF,25,BA,0B,B7,FF,23,FC,,
01,12,3D,FB,FF,20,F7,FF,20,B6,FF,00,BA,B0,B1,FF,27,ED,B6,FF,23,BA,F7,B7,FF,23,39
50 FOR1=32050TO32085:READA:POKE1,VAL("&H"+A$):NEXT
60 HIGH$="00008000  JOHN G.  00007500  SANDRA G.  00007000  ANTONY S.  00006000
ANDREW S.  00002000  UNCLE BILL00001500  CUTHBERT  00001300  WALTER S.  00001100
DENNIS P.  00001000  PHONAL  00000500  GERTRUDE  ":GOTO1740
70 FORF=16TO250STEP50:PUT(F,170)-(F+25,190),M,PSET:NEXTF
80 I=134:Y2=I:Z=24:I=24:Z2=24:I2=24:I4=24:X=104+RND:I=40+RN X2=110+RN:X3=160+RN:X
4=210+RN:SC=0
90 S$="0000":GOSUB670:MISS=3:GOSUB800:IF HS>499THEN GOSUB730
100 Y=Y+2:IF Y>230THEN GOTO110 ELSE PUT(Y-4,B)-(Y+24,22),B,PSET:GOTO120
110 COLOR0,0:LINE(Y-4,B)-(Y+24,22),PSET,BF:COLOR1,0:IF Y>254THEN Y=4
120 I=I+3*((JOYSTK(0)<20 AND I>2)-(JOYSTK(0)>40 AND I<236)):PUT(I,150)-(I+17,167
),4,PSET
130 IF MISS=6THEN GOSUB590:GOSUB610:GOSUB720:GOTO1950
140 R=RND(30)
150 IF I<=50 AND Z<142THEN P=PEEK(&5280): IF P=126 OR P=254 THEN LINE(I+9,149)-(
I+9,Z+10),PSET:A=USR0(2):GOSUB490
160 IF I>50AND I<=100AND Z<142THEN P=PEEK(&5280):IF P=126 OR P=254THEN LINE(I+9
,149)-(I+9,Z+10),PSET:A=USR0(2):GOSUB510
170 IF I>100AND I<=150 AND Z<142THEN P=PEEK(&5280):IF P=126 OR P=254THEN LINE(I
+9,149)-(I+9,Z+10),PSET:A=USR0(2):GOSUB530
180 IF I>150AND I>200AND Z<142THEN P=PEEK(&5280):IF P=126ORP=254THEN LINE(I+9,1
49)-(I+9,Z+10),PSET:A=USR0(2):GOSUB550
190 IF I>200AND I<250AND Z<142THEN P=PEEK(&5280):IF P=126ORP=254THEN LINE(I+9,1
49)-(I+9,Z+10),PSET:A=USR0(2):GOSUB570
200 IF X=Y OR X=Y-1 OR X=Y-2 OR X=Y-3 THEN PUT(X,Z-5)-(X+B,Z+10),C,PSET
210 IF X=Y OR X1=Y-1 OR X1=Y-2 OR X1=Y-3THEN PUT(X1,Z1-5)-(X1+B,Z1+10),C,PSET
220 IF X2=Y OR X2=Y-1 OR X2=Y-2 OR X2=Y-3THEN PUT(X2,Z2-5)-(X2+B,Z2+10),C,PSET
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230 IF X3<Y OR X3>Y+1 OR X3<Y-2 OR X3>Y+3THEN PUT(X,Z)-S(X-8)-A(10),C,PSET
240 IF (A4<Y OR A4>Y+1 OR A4<Y-4)AND A4<>Y+5THEN PUT(X,Z)-S(X-8)-A(10),C,PSET
250 Y=Y+1
260 IF POINT(X+4,Z+4)=5THEN PUT(X,Z-5)-(X+8,Z+10),C,PSET:Z=Z+5
270 IF POINT(X1+4,Z1+4)=5THEN PUT(X1,Z1-5)-(X1+8,Z1+10),C,PSET:Z1=Z1+5
280 IF POINT(X2+4,Z2+4)=5THEN PUT(X2,Z2-5)-(X2+8,Z2+10),C,PSET:Z2=Z2+5
290 IF POINT(X3+4,Z3+4)=5THEN PUT(X3,Z3-5)-(X3+8,Z3+10),C,PSET:Z3=Z3+5
300 IF POINT(A4+4,A44+4)=5THEN PUT(A4,A4-5)-(A4+8,A44+10),C,PSET:A44=A44+5
310 Y=Y+1
320 I=I+1*(JOYSTK(0)=2)AND I<20-(JOYSTK(0)<>2AND I<2)-(JOYSTK(0)<>2AND I<2)&:PUT(X,L)$50-(I+17,167),
A,PSET
330 IF Z!94THEN Z=24:X!=0+RN&AW$ROR(3):MISS=MISS-1:GOSUB800
340 IF Z!194THEN Z1=24:X1=60+RN&AW$ROR(3):MISS=MISS-1:GOSUB800
350 IF Z!294THEN Z2=24:X2=120+RN&AW$ROR(3):MISS=MISS-1:GOSUB800
360 IF Z!394THEN Z3=24:X3=160+RN&AW$ROR(3):MISS=MISS-1:GOSUB800
370 IF A44!394THEN A4=24:A44=160+RN&AW$ROR(3):MISS=MISS-1:GOSUB800
380 IF Z!55AND Z!80AND PPOINT(X+4,Z+12)=5THEN GOSUB800:Z=24:GOTO120
390 IF Z!155AND Z1!80AND PPOINT(X1+4,Z1+12)=5THEN GOSUB850:Z1=24:GOTO120
400 IF Z!255AND Z2!80AND PPOINT(X2+4,Z2+12)=5THEN GOSUB840:Z2=24:GOTO120
410 IF Z!355AND Z3!80AND PPOINT(X3+4,Z3+12)=5THEN GOSUB840:Z3=24:GOTO120
420 IF Z4!155AND Z4!80AND PPOINT(X44+4,Z4+12)=5THEN GOSUB860:Z4=24:GOTO120
430 IF(I!40ANDI!1-SANDX(I+17)THEN MISS=0+AW$ROR(3):GOTO130
440 IF(I!140ANDX1!1-SANDX(I+17)THEN MISS=0+AW$ROR(3):GOTO130
450 IF(I!240ANDX2!1-SANDX(I+17)THEN MISS=0+AW$ROR(3):GOTO130
460 IF(I!340ANDX3!1-SANDX(I+17)THEN MISS=0+AW$ROR(3):GOTO130
470 IF(I!440ANDX4!1-SANDX(I+17)THEN MISS=0+AW$ROR(3):GOTO130
480 GOTO100
490 IFPOINT(I+9,Z+4)=5THEN A=BUR0(1):CIRCLE(I+9,Z+4),6+FOR$=1TO10:NEXT:CIRCLE(I
+9,Z+4),6,2:PUT(I-2,Z-6)-(X+8,Z+9),D,PSET:LINE(I+9,149)-(I+9,Z+2),PRESET:Z=24:X=10
+RN&GOSUB650:RETURN
500 LINE(I+9,149)-(I+9,Z+10),PRESET:RETURN
510 IFPOINT(I+9,Z1+4)=5THEN CIRCLE(I+9,Z1+4),6:FOR$=1TO10:NEXT:CIRCLE(I+9,Z1+4)
,6,2:A=BUR0(1):PUT(I-2,Z1-6)-(I+8,Z1+9),D,PSET:LINE(I+9,149)-(I+9,Z1+10),PRESET
:Z1=24:X1=60+RN&GOSUB650:RETURN
520 LINE(I+9,149)-(I+9,Z1+10),PRESET:RETURN
530 IFPOINT(I+9,Z2+4)=5THEN CIRCLE(I+9,Z2+4),6:FOR$=1TO10:NEXT:CIRCLE(I+9,Z2+4)
,6,2:A=BUR0(1):PUT(I-2,Z2-6)-(I+8,Z2+9),D,PSET:LINE(I+9,149)-(I+9,Z2+10),PRESET
:Z2=24:X2=120+RN&GOSUB650:RETURN
540 LINE(I+9,149)-(I+9,Z2+10),PRESET:RETURN
550 IFPOINT(I+9,Z3+4)=5THEN CIRCLE(I+9,Z3+4),6:FOR$=1TO10:NEXT:CIRCLE(I+9,Z3+4)
,6,2:A=BUR0(1):PUT(I-2,Z3-6)-(I+8,Z3+9),D,PSET:LINE(I+9,149)-(I+9,Z3+10),PRESET
:Z3=24:X3=160+RN&GOSUB650:RETURN
560 LINE(I+9,149)-(I+9,Z3+10),PRESET:RETURN
570 IFPOINT(I+9,Z4+4)=5THEN CIRCLE(I+9,Z4+4),6:FOR$=1TO10:NEXT:CIRCLE(I+9,Z4+4)
,6,2:A=BUR0(1):PUT(I-2,Z4-6)-(I+8,Z4+9),D,PSET:LINE(I+9,149)-(I+9,Z4+10),PRESET
:Z4=24:X4=210+RN:GOSUB650:RETURN
580 LINE(I+9,149)-(I+9,Z4+10),PRESET:RETURN
590 COLOR0,0:LINE(Y-4,B)-(Y+24,Z2),PSET,BF:LINE(I,150)-(I+17,167),PSET,BF:COLOR2
,0
600 PUT(X,Z-6)-(X+8,Z+9),D,PSET:PUT(X1,Z1-6)-(X1+8,Z1+9),D,PSET:PUT(X2,Z2-6)-(X
+8,Z2+9),D,PSET:PUT(X3,Z3-6)-(X+8,Z3+9),D,PSET:A=BUR0(1):PUT(X4,Z4-6)-(X4+8,Z4+
RETURN
610 DRAW"BM90,80;L4G1D4F1R4UL2BR4R5D2U4HL2G1D4F8R8UF2E7BR4BR7UE2F7BR4BR7UE2F7BR
6R6BL4BR7BU6D5F3E3U1BR3NR6D3NR4D3R4BR3U6D7R4U5L2D3R3F7"
620 TIMER=0
630 IF TIMER!5*50THEN630
640 RETURN
650 SC=SC+50:S$=STR$(SC)
660 IF SC!9999 GOTO680
670 N$=MID$(S$,LEN(S$)-3,1):PUT(42,0)-(50,7),BL,PSET:DRAW"BM42,0";SC$(VAL(N$)+1)
:SOUND220,1
680 M$=MID$(S$,LEN(S$)-2,1):PUT(51,0)-(59,7),BL,PSET:DRAW"BM51,0";SC$(VAL(M$)+1
):SOUND220,1
690 L$=MID$(S$,LEN(S$)-1,1):PUT(60,0)-(68,7),BL,PSET:DRAW"BM60,0";SC$(VAL(L$)+1)
:SOUND220,1
700 D$=MID$(S$,LEN(S$),1):PUT(69,0)-(77,7),BL,PSET:DRAW"BM69,0";SC$(VAL(D$)):SOU
ND220,1
710 RETURN
720 IF SC!VAL(MID$(HIGH$,185,5))THEN2460
730 IF SC!HS THEN HS=SC:N$=""
740 NN$=MID$(N$,LEN(N$)-3,1):PUT(140,0)-(148,7),BL,PSET:DRAW"BM140,0";SC$(VAL(
NN$)):SOUND220,1
750 MM$=MID$(N$,LEN(N$)-2,1):PUT(149,0)-(157,7),BL,PSET:DRAW"BM149,0";SC$(VAL(
MM$)):SOUND220,1
760 LM$=MID$(N$,LEN(N$)-1,1):PUT(158,0)-(166,7),BL,PSET:DRAW"BM158,0";SC$(VAL(
LM$)):SOUND220,1
770 DM$=MID$(N$,LEN(N$),1):PUT(167,0)-(174,7),BL,PSET:DRAW"BM167,0";SC$(VAL(DM
$)):SOUND220,1
790 RETURN
800 MS#=STR$(MISS)
810 PUT(242,0)-(251,7),BL,PSET:DRAW"BM242,0";SC$(VAL(MS$)):SOUND220,1:RETURN
820 A=BUR0(3):COLOR0,0:LINE(15,150)-(40,183),PSET,BF:COLOR1,0:MISS=MISS-1:GOSUB80
0:RETURN
830 A=BUR0(3):COLOR0,0:LINE(55,150)-(90,183),PSET,BF:COLOR1,0:MISS=MISS-1:GOSUB8
00:RETURN
840 A=BUR0(3):COLOR0,0:LINE(105,150)-(140,183),PSET,BF:COLOR1,0:MISS=MISS-1:GOSU
B800:RETURN
850 A=BUR0(3):COLOR0,0:LINE(155,150)-(190,183),PSET,BF:COLOR1,0:MISS=MISS-1:GOSU
B800:RETURN
860 A=BUR0(3):COLOR0,0:LINE(205,150)-(240,183),PSET,BF:COLOR1,0:MISS=MISS-1:GOSU
B800:RETURN
870 GOTO100
880 CLS
890 POKE359,60
900 GOSUB1260
910 PRINT@161,"HIT 'W' OR JOYSTICK FIREBUTTON";
920 PRINT@227,"TO CLEAR THE INSTRUCTIONS ";
930 PRINT@290,"AFTER YOU HAVE FINISHED THEM";
940 EXEC32000:EXEC25999
950 GOSUB1260
960 PRINT@96,"VILLAGE DEFENCE";
970 PRINT@197,"THE IDEA OF THE GAME IS TO TRY";
980 PRINT@261,"TO DEFEND THE VILLAGERS HOUSES";
990 PRINT@325,"BY SHOOTING THE BOMBS THAT ARE";
1000 PRINT@389,"BEING DROPPED BY THE BOMBER IN";
1010 PRINT@453,"THE SKY.YOU ARE A ROCKET ABOVE";
1020 PRINT@517,"THE VILLAGE.";
1030 EXEC32000
1040 EXEC32000
1050 GOSUB1260
1060 PRINT@33,"YOU WILL RESIDE A JOYSTICK THAT";
1070 PRINT@97,"MUST BE CONNECTED TO THE RIGHT";
1080 PRINT@161,"HAND PORT.YOU FIRE BY PRESSING";
1090 PRINT@225,"THE FIRE BUTTON.WHEN A BOMB IS";
1100 PRINT@289,"HIT YOU SCORE 50 POINTS.WHEN A";
1110 PRINT@353,"BASE GETS HIT IT WILL BE BLOWN";
1120 PRINT@417,"UP.YOU HAVE 5 BASES TO PROTECT";
1130 EXEC32000
1140 EXEC32050
1150 GOSUB1260
1160 PRINT@33,"WHEN YOU MISS 3 BOMBS THE GAME";
1170 PRINT@97,"WILL END.BUT IF YOUR SCORE HAS";
1180 PRINT@161,"GONE ABOVE 500 THEN YOUR NAME";
1190 PRINT@225,"AND YOUR SCORE WILL BE ENTERED";
1200 PRINT@289,"IN THE HIGH-SCORE TABLE.";
1210 EXEC32000:EXEC32050
1220 CLS0
1230 POKE359,60
1240 POKE359,57
1250 GOTO1400
1260 CLS
1270 POKE1024,142+112
1280 FORA=1TO30
1290 PRINTAA,CHR$(140+112);:NEXT
1300 POKE1055,141+112
1310 FORA=2TO4979STEP32
1320 PRINTAA,CHR$(133+112);:NEXT
1330 POKE1535,135+112
1340 FORA=5107TO4815STEP-1
1350 PRINTAA,CHR$(131+112);:NEXT
1360 POKE1504,139+112
1370 FORA=4807TO2587STEP-32
1380 PRINTAA,CHR$(138+112);:NEXT
1390 RETURN
1400 CLS:PRINT@170,"PLEASE  WAIT";
1410 PRINT@234,"INITIALISING";
1420 FOR A=1TO3:PRINT@234,"INITIALISING";
1430 DATA80,88,27,5D,27,04,C1,03,27,05,C6,02,7E,B5,44,C1,01,26,37,34,12,B6,FF,23
,8A,08,B7,FF,23,7E,01,97,8E,B7,9B,8A,B0,8B,14
1440 DATA4A,B0,8B,10,7A,01,47,26,F3,B6,FF,23,B4,F7,B7,FF,23,35,12,39,B4,01,47,B7
,FF,23,35,14,8A,2A,F0,39
1450 DATA12,12,12,12,12,C1,01,02,26,37,34,32,B6,FF,23,B4,06,B7,FF,23,8E,00,01,86,FD
,B7,FF,23,B6,FF,23,7E,00,B3,01,86,00,9B,25,EB
1460 DATA86,FF,23,B4,F7,B7,FF,23,35,32,39,1F,12,31,3F,26,FC,39,12,12,12,12
1470 DATA12,12,12,12,12,86,FF,27,B6,00,B7,FF,23,7F,01,47,8E,B7,9B,8A,B0,8B,80
,14,86,B0,8B,10,7A,01,47,26,F2,B6,FF,23,B4,F7
1480 DATAB7,FF,23,39,B4,01,47,B7,FF,20,8A,E6,4A,26,FB,39
1490 FORF=0TO190:READA$
1500 POKE32000+F,VAL("&H"+A$):NEXTF
1510 DEF USR=32000
1520 PMODE4,1:SCREEN1,0
1530 DRAW"BM200,96;US5R10FSD5L20"+PAINT(210,95),1,1:DRAW"C2;BR8U7R5D7":PSET(210
,94,2)
1540 GET(198,84)-(223,104),M,G
1550 DRAW"BM200,96;US5R10ESD5L20"+PAINT(210,95),1,1:DRAW"BM100,100AU5F3R1
U3E3R1U3E3R1U3E3R1
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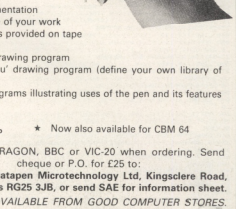

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•**EXPAND** - Lists a program in an easy-to-read form, also allowing 'squashed' programs to be read.

•**INSERT** - Enables BASIC routines on disc or tape to be inserted into or added to the program in memory.

•**KEYLOAD** and •**KEYSAVE** - Load and save the function key definitions.

•**LVAR** - Lists the values of all or some of the variables.

•**MERGE** - Will merge one or more BASIC programs on file into the program in memory.

•**MOVE** - Allows the current BASIC program to be moved to a new page in memory.

•**PARTSAVE** - Saves only a selected section of a BASIC program (useful for later merging).

•**RENUMBER** - Renumbers parts of BASIC programs and moves the renumbered section as necessary.

•**RETRIEVE** - Restores a corrupted program to a form in which it can be listed and edited.

•**SINGLEKEY** - Enables BASIC keywords to be entered quickly, as on the ELECTRON.

•**SQUASH** - Reduces the size of a BASIC program in order to save memory space. A very efficient routine.

•**STATUS** - Displays the values of PAGE, HIMEM, program length, bytes free, etc.

•**TABSTOPS** - Provides a tabulation facility. Up to eight tapstops can be defined.

CARETAKER is supplied with a spiral bound manual, special 'single-key entry' stickers for the key fronts, and easy-to-follow fitting instructions. A full specification is available upon request.

```
*HELP CARETAKER 1.00
  CURSOR <ON/OFF>
  EXCHANGE (<old> <new) G/S (<length>)
  EXPAND (<start>) (<end>)
  INSERT (<fp> (<lineno>)
  KEYLOAD (<fsp>)
  KEYSAVE (<fsp>)
  LVAR (F)(I)(S)(A)(P)
  MOVE <address>
  MERGE (<fsp> (<fsp>)
  NORMALKEY
  NOTAB
  PARTSAVE (<fsp> (<start>) (<end>)
  RENUMBER (<list) <inc> (<start> <end>)
  RETRIEVE (<bytes>)
  SINGLEKEY
  SQUASH (S)(R)(M)
  STATUS
  TABSTOPS (<columns  >)
OS 1.20
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```



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Acorn Special

Clive Williamson delves into the Acorn 'new releases' file and comes up with some hot news on the Plus 1 expansion unit and Z80 processor for the BBC micro.



Electron Extras

When Acorn designed the Electron micro, they were plainly determined to produce a machine which would have some of the appeal of the BBC Micro, but at a greatly reduced cost. As a result, the 'Elk' is blessed with standard BBC BASIC and seven out of eight of the Beeb's excellent range of graphics display modes, but none of the major expansion ports normally found on the BBC Micro model B! Hence thre is no way to interface the Electron directly with printers, joysticks, or telecommunications hardware, let alone the 'Tube' or a disk drive. To increase the capabilities of the Electron, Acorn has announced an expansion unit called the Electron Plus 1, adding three major features to the micro — a parallel output for connection to a printer with a Centronics compatible interface, four 8-bit analogue-to-digital input channels, which can be used with joysticks, and two cartridge slots for plug-in software such as games, utilities or language ROMs. These can also accept further expansion devices.

Once the Plus 1 is plugged onto the multi-way expansion connector at the back of the Electron, it is secured firmly with two screws, so there is little chance of the machine crashing as a result of the connector coming loose. The unit is styled to blend in with the Electron, having the same width and height as the micro, but only half the depth. Two sockets are fitted to the back of the unit — one for joysticks; the other for the parallel printer connection — and the shielded cartridge slots for Plug-in ROM software are on top of the add-on.

Acorn considered the ability to use printers, joysticks and cartridge software to be the most important expansions for the Electron, and the choice seems a reasonable one. Any further interfaces (such as the RS423 serial port, or the User Port for control applications) will probably be made to fit in the cartridge slots.

The new unit has very little effect on the operation of the Electron, but provides the new facilities (and some new VDU and *FX commands to work them) automatically. It has been designed to be compatible with future expansions for the Electron, and comes complete with its own User Guide describing its operation. Acorn's Electron Plus 1 is not the only expansion unit available for the Electron — several other manufacturers have produced interfaces and expansions of various kinds for the machine — but be warned that other units are not necessarily completely compatible with future official developments.

A printer is normally the first major add-on that people buy for their micros, whether it be for examining and correcting listings of a program under development, simple word processing or to produce pictures by making dot-for-dot screen dumps of the micro's graphic images. The Acorn Electron fitted with the Plus 1 expansion will support a variety of printers as it is fitted with the Centronics parallel printer interface.

Once fitted with the Plus 1, the Electron has a number of commands for use with printers. To switch a printer on, you should use either a VDU2 command, or press the «CTRL» and «B» keys simultaneously, which is the keyboard equivalent of VDU2. VDU3 or «CTRL» and «C» will turn it off again.

One of the *FX calls can be used to govern whether the printer output is sent to the interface — *FX 5,0 causes printer output to be ignored, and *FX 5,1 selects the prallel printer output.

Another FX call, *FX6, can be used to prevent certain characters from reaching the printer. For example, *FX6, 10 will suppress ASCII character 10, the code for a line feed, so that unwanted gaps between lines of print can be stopped on a printer that performs its own carriage return automatically at the end of each line.

The exact codes required to

control printers vary from one type to another, but in general a stream of VDU commands can be used, separated by commas. First, the printer has to be enabled with the VDU2 command, then VDU1 tells the micro to 'send the next character to the printer only'. As an example, the popular Epson FX80 requires two codes to switch on a new style of printing. The first code, a 27, tells the printer to expect a command, while the second governs the exact style. In the case of emphasised print, the control sequence VDU2, 1, 27, 1, 69, 3 would be used. The final VDU3 turns the printer off again.

The manual supplied with the printer should give details of all the control codes, but your dealer — or the printer manufacturer — may be able to help if you have any problems making the machines do what you want!

The Analogue Port

The most common use of the analogue port at the back of the Plus 1 interface will be for the connection of a pair of joysticks, either for use in games-playing or possibly to input graphical information, but this port is also useful for a large number of other applications. It provides the interface for four analogue to digital converter (or ADC) channels and two switches. Under normal conditions, each channel can be sampled every 40ms to see what voltage is applied to it, if any. Each ADC can measure fluctuating voltages in the range 0 to 1.8 volts, and the results are 'digitised', and passed into the micro as a numerical value. These numbers can be read with the ADVAL statement for use in programs. With the right sensors, this 'sampling' of the 'outside world' can be extended to include voltages proportional to temperature, pressure or sound.

The sampling is performed to a resolution of 8 bits, which means that 256 different levels can be detected between the maximum and minimum voltage. This is somewhat poorer than the BBC Micro's 12 bit resolution, but more than adequate for most games-playing.

A typical joystick is fitted with two potentiometers (like volume controls), and these are connected to a movable stick and control varying voltages proportional to its front-to-back and side-to-side positions. The voltages are sampled regularly by the software so that values from the ADCs can be used in the game or application.

Normally, the micro samples each analogue channel in sequence, looking at a new one every 10ms. As there are four channels, each is sampled once in 40ms. The processing in the micro is interrupted while this is done, and it is sometimes possible to speed programs up slightly by turning all, or some of the channels off! Turning unwanted channels off has the added advantage that those remaining would be sampled more often.

The command *FX16 is used to switch the ADC channels on and off — *FX16,0 disables all ADC channels, *FX16,1 enables channel 1 only, *FX16,2 enables channels 1 and 2, *FX16,3 enables 1, 2 and 3, and *FX16,4 enables all four ADC channels.

ROM Cartridges

The Plus 1 expansion has two sockets which will accept special plug-in cartridges containing either normal software such as games, utilities or application programs, or complete languages which replace BASIC on the Electron.

In the case of normal software, the cartridges hold BASIC or machine code programs, in a similar form to the way they would be held on an ordinary cassette. The advantage here is that they can be loaded into memory almost instantly, using a filing system built into the Electron called the ROM filing system. Once a cartridge is plugged in, and the micro switched on, the ROM filing system is automatically operational.

The commands for loading are the same as for the cassette filing system, (eg *CAT, LOAD, CHAIN) but this system is 'read only', ie you cannot save data in the ROMs. Any attempt to use the cassette filing system to save a program or data will fail unless you enter *TAPE first. This switches from the ROM to the cassette filing system. To go back to using the plug-in ROM, you should enter *ROM or you can reset to the ROM filing system by pressing CTRL and BREAK together.

Sideways ROMs

One of the most important trends to emerge in programming for the BBC Micro is undoubtedly the shift towards software based in sideways ROMs — or firmware — as it is otherwise known.

These sideways or paged ROMs can also be developed for the Electron, and can be plugged into the the cartridge sockets in the same way as the normal software mentioned above. The system offers a unique opportunity for software writers to develop long programs such as word processors, spreadsheets and programming languages in machine code, and these can be programmed into a ROM chip, fitted inside a ROM cartridge, and can then be switched by a simple command (ie *SHEET, *WORD, etc) to run instead of the BASIC language in the micro.

If one or more language ROM cartridges is plugged into the Plus 1, the one nearest the keyboard will be selected in preference to BASIC when the micro is switched on. To get back to BASIC, you simply enter *BASIC at the keyboard. The language ROM cartridges occupy the same area in the micro's memory map — ie &8000 to &C000 — as BASIC. Hence the name sideways ROMs, as they lie 'to the side' of that area until selected.

A wide range of software is currently available in ROM form for the BBC Micro including word processors (like Acornsoft's VIEW), spreadsheets, databases, the BCPL, FORTH, and Pascal languages and terminal emulators for telecommunications use. It seems likely that similar programs will be released for the Electron in due course. Programs such as VIEW that make extensive use of the function keys in the BBC versions may have to be changed for the Electron, as it is not possible to combine the CONTROL and SHIFT keys with function keys on the smaller computer.

Last Words

The Electron Plus 1 is certainly a worthwhile upgrade for the 'Elk', as it provides an interface for two of the most popular add-ons for any micro — joysticks and a printer — and offers the additional advantage of connecting plug-in ROM cartridges, giving almost instant access to software.

The Plus 1 means that the Electron can be put to much greater use, and goes at least part of the way towards Acorn's optimistic ideal that their micro is the perfect home companion for all the family. (Sounds like a pet rock doesn't it!) What we could do with now is a large range of software for the machine. At £59.90, the unit is good value, and a selection of cartridge software is available, starting at £12.99.

BBC Back-up

Following hot on the heels of the 6502 Second Processor for the BBC Micro, Acorn have now unveiled the Z80 version, which has been designed to give existing BBC Micro owners access to the vast catalogue of CP/M software which is now available. The BBC Micro has been surprisingly slow to generate serious business applications software, so the Z80 Second Processor is bound to please anyone with a BBC machine who needs to run this type of program; especially as the add-on comes bundled with a host of CP/M software for just £299! The CP/M operating system (version 2.2) is supplied with the processor, and a range of languages and applications software is also included in the asking price.

Like the 6502 version, the Z80 Second Processor has 64K of RAM, of which roughly 55K is available for programs! Acorn runs the Z80 at 6MHz, which is quite fast for this chip, and the dual processor operation makes the BBC Micro one of the fastest CP/M machines around.

The processor is connected via a simple ribbon cable to the micro's 'Tube' interface, and downloads software through the main machine. That software then runs at high speed, leaving the BBC machine itself to handle all the operating system functions, the screen display, and any necessary inputs and outputs. Because the work-load is shared between two processors, some programs will run substantially faster with a second processor fitted — particularly those which use the screen or disks a lot.

Free Software

The Z80 Second Processor comes complete with an extensive package of CP/M software, valued by Acorn at

around £3000, which consists of two versions of BASIC that run under CP/M (BBC BASIC version II and a Business BASIC, similar to Microsoft's), the CIS-COBOL language and utilities, and enough application programs from two software houses to keep most small businesses happy. An American-based firm called Chang has supplied an integrated word processor *MemoPlan*, a spreadsheet with graphics *GraphPlan* and a personal database *FilePlan*.

The free package is completed by two programs from a British company, Compact Accounting. They have delivered their powerful systems generator called *Nucleus*, and *Accountant*, based on their own *Nominal Ledger* which runs on machines like the IBM PC and ACT Sirius. A huge wad of manuals — ten in all — is supplied with the processor to guide the owner through all the software, and a set of reminder cards show function key use and give hints on the use of each program.

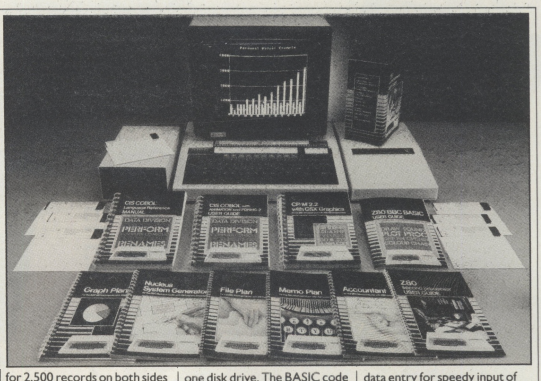
There should be no difficulty obtaining the usual CP/M software favourites to run on the Z80 Second Processor, as Acorn have implemented the standard 2.2 version of CP/M and the GSX-80 Graphics System. It will be easy for software houses to re-configure their products in a format suitable for the BBC Micro's disk system, and Software Ltd is already involved with Acorn on a project to do this.

Hands On The Z80

Switching on the second processor and the BBC Micro, you are greeted by the words *Acorn Tube Z80 64k 1.20* so you can tell at once something is different! A '*' indicates that the system is waiting for CP/M to be 'booted', and this is done by inserting a system disk in Drive A (that's drive 0, to BBC users!) and pressing the Control and Break keys together. Once this has been carried out, the BBC Micro acts like a normal CP/M machine, giving the 'A>' prompt. The letter 'A' indicates the logged drive.

When using the *Compact* software, the boot is achieved from a 'Start of Day' disk before moving on to use *Nucleus* or *Accountant*. Both programs are written in BASIC, so the 'Start of Day' disk also holds the Business BASIC needed to run them.

Accountant has the capacity for 2,500 records on both sides of a 400K disk, and is menu driven, giving a Nominal Ledger, Sales Daybook and Purchases Daybook. The ledger holds details of all sales and purchases, and can generate a wide variety of reports, including month-end and year-end accounts. *Accountant* copes with VAT, and is suitable for small to medium-sized companies using a computer system for the first time.



Compact's Nucleus

Nucleus is a system generator which can generate data-handling programs tailored to suit individual needs. In other words, it generates customised data-base programs, written in BASIC, which can then be used like any other software on the BBC Micro with a Z80 processor. In the recent past, programs like *Nucleus* were sold to small software houses and hardware suppliers, who then used them to create applications for their clients. Getting a program like this free with the Z80 processor is little short of amazing, since it will enable inexperienced users to generate their own programs with remarkable ease — no programming skills are needed.

There is a set procedure to be followed when creating your own software, where the parameters for the database are set up, and it is even possible to add extra files which automatically 'link in' to the basic system. You can create as many linked files as you like, as long as the whole database doesn't exceed the capacity of one disk drive. The BASIC code generated by Nucleus can be used on other machines, as long as the disk format can be made compatible, and the programs can readily be examined and deciphered, as they contain plenty of 'REM' statements to indicate what is going on.

Powerful report generation facilities can also be created, making the whole system a must for any small business needing to handle lots of data. The only tedious aspect of using this software is the constant 'Is this OK?' style of checking entries — but it is an important safeguard at the database creation stage of the proceedings. Nucleus normally sells for £495 so its inclusion makes Acorn's Z80 package look even better value.

Chang Software

The remaining business software for the Z80 has been supplied by Chang Laboratories Inc. Most exciting is the *MemoPlan* wordprocessor, which is function key driven and can hold up to 80 pages of text on a 400K disk. It has a sensible range of print options, including continuous or single sheet stationary and multiple copies, and saves data to disk automatically. *MemoPlan* can be linked to *FilePlan's* files to create standard letters and address labels, and also has the facility to edit two documents at once on a split screen, and transfer data between them.

FilePlan itself has flexible field lengths, and uses sort lists to retain the results of anlysing the database. It also features coded data entry for speedy input of information, and ranges can be defined to check the accuracy of numeric data. Graphplan is a menu-driven spreadsheet with extensive statistical and mathematical commands.

Its results can be integrated with *MemoPlan* in tabular form, or graphically presented as line graphs, bar charts or pie charts. These can be displayed on screen in black and white or colour, and screen dump routines are included to give hard copy on some makes of printer and plotter.

One niggling point about all this is that to use *MemoPlan* to the full an additional piece of software called *DocuPlan* must be purchased from Chang themselves. This allows indexing and much greater flexibility in the way the *MemoPlan* files can be formatted, but Acorn did not consider it necessary to include it in the basic software bundle — pretty clever eh?

Round Up

The Z80 Second Processor adds greatly to the power of the BBC Micro, allowing much more complex and useful software to be run on the machine. It opens up a huge range of CP/M business applications software to BBC Micro owners, and at a very reasonable cost, especially when the value of the 'bundled' software is considered. CP/M can be a difficult operating system to use, therefore Acorn has arranged that support will be provided for the product through a limited number of specially trained dealers.

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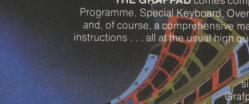

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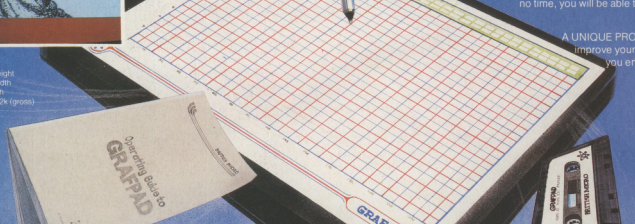



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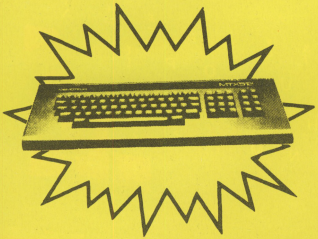

MTX 500 computer. The MTX's 24k ROM has several languages such as MTX Basic Logo and Noddy ROM routines include an assembler/dis-assembler with screen display of the Z80 CPU registers, memory and program which can be manipulated from the keyboard. Pascal is available as an add-on ROM pack. The MTX 500 has 32k of user RAM as standard (64k on 512) expandable to 512k plus 16k of video RAM controlled by a separate video processor. Soon available FDX and HDX systems.

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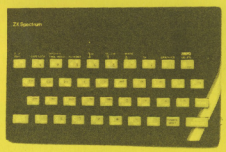

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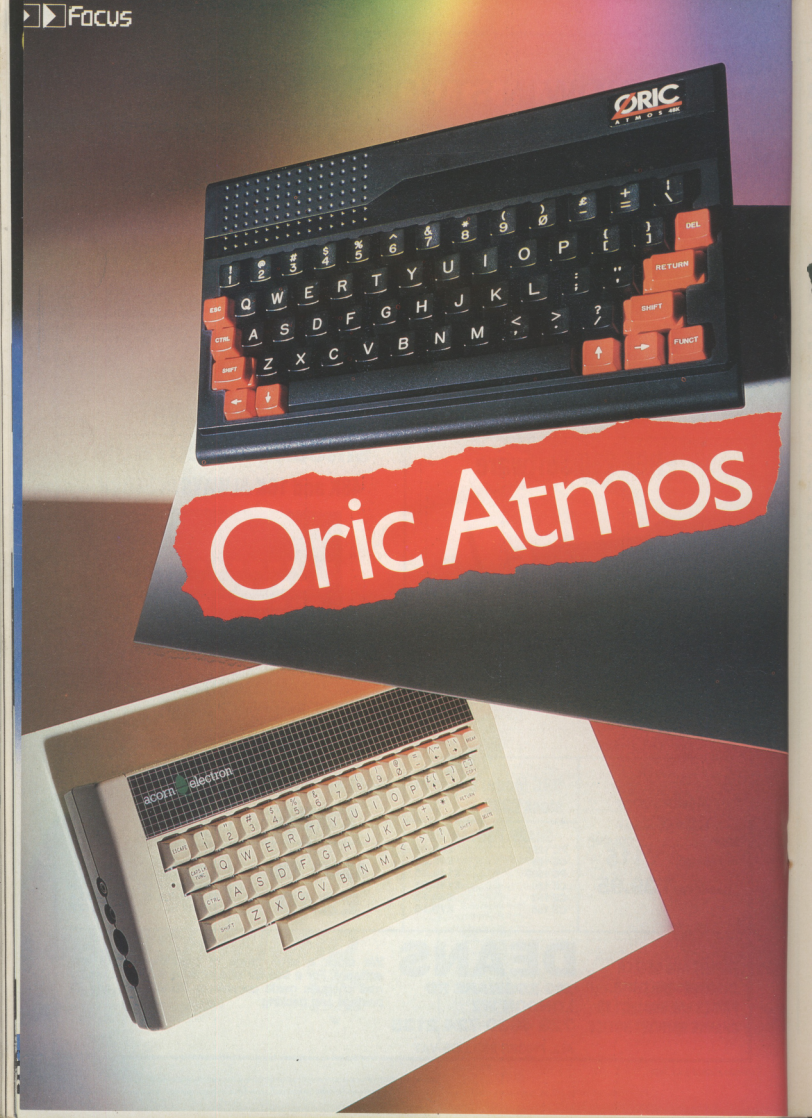

ORIC
ATMOS 48K
Oric Atmos
acorn electron

VS Acorn Electron

Simon Craven confronts two direct competitors within the hotly-contested 'under £200' price range.

Anyone in the market for a home micro in the £150-£200 market can hardly plead ignorance of the leading sales features of the Oric Atmos and the Acorn Electron. Both are subjects of high-profile TV advertising campaigns which dominate Channel 4's commercial breaks, yet although they are now being aimed at the same potential user, each represents a very different design philosophy.

The Atmos and Electron are based on earlier computers from the same companies. Whereas the Atmos is an upgrade, aiming to push the Spectrum-class Oric 1 into a less Sinclair-dominated market with the addition of a very welcome typewriter-style keyboard and the elimination of the BASIC bugs which plagued programmers for so long, the Electron is a downgrade, essentially a version of the best-selling BBC Micro, simplified to reduce the cost to a level where more home micro users will be able to consider it.

Class War

With this class of computer, the battle for your money opens with the 'goodies war'. The Atmos emerges from the clash of the specification sheets well ahead of the Electron. The all-important memory question is the main reason why. As Oric is so fond of pointing out, their machine has ". .. a large memory which stays large".

Out of the 48K RAM the Atmos starts out with, a hefty 41K is free for BASIC programming as long as the display is text-only. But even when the high-resolution graphics screen is in use you still get a thoroughly respectable 37K to play with — more than the Electron has in the whole computer.

The Electron inherits the memory shortage which is the Achilles' Heel of its big brother, the BBC Micro. Even on the BBC machine, you never have more than 27.5K of BASIC program space, and once you start using the higher-resolution display modes this can shrink to 7.5K. The Electron's architecture is similar, except that it the best you can hope for is a mere 20.5K — only half the figure boasted by the Atmos.

The reason the Electron doesn't match the BBC Micro in this respect is that for cost reasons the Teletext-compatible display mode (7) has been deleted. This uses a special character generator chip to provide colour and limited graphics without devouring memory, but the expense of this component meant its loss on the Electron.

Where the Electron strikes back is in the flexibility of its graphics. Having seven screen modes (0 to 6 are unchanged from the BBC equivalents) means that at some further cost in memory, virtually any combination of text or graphics resolution can be obtained. Text may be displayed in a choice of 20, 40 or 80 columns across, though the provision of the eighty-column mode is of questionable benefit to home users who will probably be using an ordinary TV set rather than a specialised monitor.

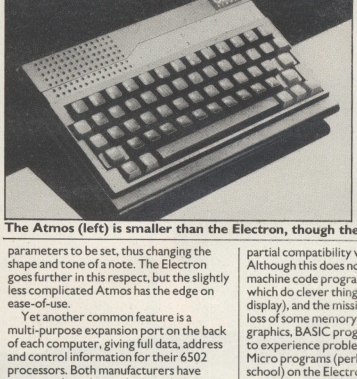
Hangers-On

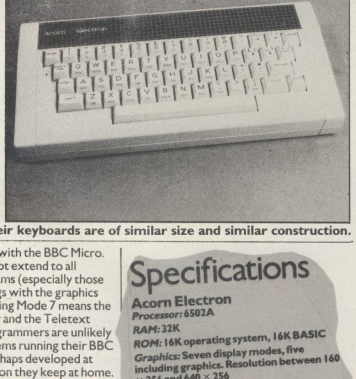
When it comes to interfaces, the two rivals show some similar thinking. Each has the mandatory cassette port and TV output, but a feature which is still unusual in this market is the provision of a RGB colour monitor outlet on each. The Electron even offers a composite video outlet for high resolution monochrome monitors (when the 80 column display option really comes into its own for serious programming work).

Both these computers have been further enhanced for use with monitors by the inclusion of on-board loudspeakers of reasonable quality. These prevent the computer from going silent when a monitor is used as the display device, as would be the case with a system which fed the sound through the TV loudspeaker. The sound facilities themselves are very similar, and very good. The Oric is particularly easy to make sound effects with — how many micros go PING when yoy type in PING and hit RETURN?

Real noise addicts will be pleased to learn that both machines allow envelope

PHOTOGRAPH BY TERRY BEDDIS





The Atmos (left) is smaller than the Electron, though their keyboards are of similar size and similar construction.

parameters to be set, thus changing the shape and tone of a note. The Electron goes further in this respect, but the slightly less complicated Atmos has the edge on ease-of-use.

Yet another common feature is a multi-purpose expansion port on the back of each computer, giving full data, address and control information for their 6502 processors. Both manufacturers have announced products which exploit this interface. Oric's is a miniature disk drive (review next month), and Acorn's is the Plus One expansion unit which adds connectors for analogue joysticks, cartridge software and a printer (p. 49).

Oric supplies you with a Centronics type parallel printer interface as standard, as well as a couple of 9-pin D type sockets which are wired to accept any of the vast number of Atari/Commodore compatible joysticks. These are features which many home micro users will want, and the prospect of having to lay out a large amount of extra cash for them is likely to tilt potential buyers away from the Electron.

Acorn makes a big thing of the Electron's partial compatibility with the BBC Micro. Although this does not extend to all machine code programs (especially those which do clever things with the graphics display), and the missing Mode 7 means the loss of some memory and the Teletext graphics, BASIC programmers are unlikely to experience problems running their BBC Micro programs (perhaps developed at school) on the Electron they keep at home.

Where a BBC facility is not included in the Electron, the smaller machine will either ignore a BASIC command to use that facility or do the next best thing instead. For example, typing MODE 7 will put the machine into mode 6, and accessing the missing sound channel diverts the call to one of the other channels. Whatever happens, the program should keep running, even if it is slightly less impressive on the Electron (and quite a bit slower to run).

Running Over Relatives

The other way round there are no problems at all — Electron programs run quite happily on the BBC machine, so writing your program at home and showing it off at school will not cause any embarrassing compatibilty problems.

The Atmos is not quite as compatible with the Oric 1 as many observers had expected. The ROM containing the machine's operating system and BASIC interpreter had to be rewritten substantially to rid it of the bugs which plagued the earlier computer, and as a result, machine code programs which call ROM routines might well crash because those routines have been moved. BASIC programs are more likely to work, though they may well need minor rewriting if the originals were written to allow for the bugs and compensate for them.

Now that the Oric's BASIC is properly sorted out, it is a sound, competent version bearing the usual distinct resemblance to one of Microsoft's earlier interpreters. Although it has been superficially rejuvenated with the addition of a REPEAT ... UNTIl loop and a few other features, it in no way matches the elegant sophistication of the Electron's BBC BASIC.

BBC BASIC's virtues include some very nice structure and control mechanisms to make logical, well organised programming the natural way to go about things. For the advanced programmer, it also allows a degree of direct access to the operating system which is very unusual in a home computer. If you are a newcomer to computing, this is a very good language to start learning with, especially as unlike most BASICs it does not make it difficult for the programmer to move on to more specialised languages. The Electron comes with the same built-in assembler used by the BBC, so it is very easy to mix BASIC with machine code.

Most potential buyers of one of these micros will not have previous experience with computers, and this is where the standard of documentation is all-important. The manuals supplied with the Atmos and the Electron are both well above average, and even a complete newcomer need have little to fear. If anything, the Electron has the edge, as it comes with a much more comprehensive introductory cassette than the Oric, as well as an extra book introducing the fundamentals of BASIC programming. Both these computers show up the inadequacy of the documentation included by some other manufacturers.

Comment

What we have here are two well-designed, mature, sensible computers with no glaring defects. It's nice to know that they are both British, especially as they both show many foreign competitors a thing or two.

Making a choice depends on the main use for which the computer is intended. If you see yourself as an 'end user' type who does not really want to know how or why the machine does what it does, the Atmos is probably for you. Although neither is in the same category as the Spectrum or Commodore 64 when it comes to commercial software availability, a reasonable number of games and utilities can be found for each, though the Atmos has a slight edge.

If your main interest is in the computer itself, then the Electron's case is hard to ignore. It is a real programmer's machine with its exquisite BASIC and built-in assembler, though the need to spend more money on the expansion unit so that you can plug in a printer for program listings is an irritation. If you have access to a BBC with printer at school or college, then the solution is obvious.

Specifications

Acorn Electron

Processor: **6502A**
RAM: **32K**
ROM: **16K operating system, 16K BASIC**
Graphics: **Seven display modes, five including graphics. Resolution between 160 × 256 and 640 × 256**
Colour: **Eight colours, plus flashing combinations**
Sound: **One music channel, one white noise channel, on-board speaker**
Price: **£199 including VAT**

Oric Atmos

Processor: **6502A**
RAM: **48K**
ROM: **16K BASIC and OS combined**
Graphics: **Text mode — 40 × 28 characters, Graphics mode — 240 × 200**
Colour: **Eight colours**
Sound: **Three channels, on-board speaker**
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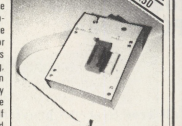

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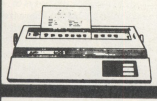

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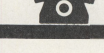

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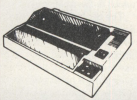

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AI FOR MICROS

Contrary to popular belief, Artificial Intelligence is NOT the sole domain of high-flying computer experts — it's open to anyone with a micro and the right motivation. Chris Naylor begins this new series with some ideas to get you started.

The phrase 'artificial intelligence' conjures up visions of arcane boffins working with esoteric concepts, incomprehensible to the average computer user, who pause only occasionally to deliver grand pronouncements on their work which, in general, leave everyone about as mystified about the subject as they were before. In reality, artificial intelligence is a game which any home micro user can play. The intelligence which you try to implant in your machine might be somewhat artificial, but when it comes to the intelligence you need to do the implanting, you'll find that something similar to everyday commonsense will get you quite a way along the road.

For many people, the real problem in tackling any AI project is simply the question: what is AI? And it's a good question, mainly because there aren't any really good answers. AI has always concerned itself with the age-old problem of trying to 'breathe life into the monster'. Of trying to get the machine to do something more than it seems to be doing at the moment. Of trying to make the machine, somehow, *intelligent*. And it's on that word 'intelligent' that the problem hangs. For psychologists cannot, in general, agree just what it is that consitutes *human* intelligence — so what would constitute *machine* intelligence? Some goal is set for the machine, so that if it succeeds and completes the task, then we'd have an intelligent machine. And then, after a bit of messing around (ie, research) someone does make the machine achieve the specified goal. At which point the onlookers all breathe a big sigh of relief and say: "Ah! So *that's* how you do it! That's really quite simple — that isn't intelligent at all!" And then the process starts all over again with some new goal being defined and, somehow, true machine intelligence never, ever, really seems to be accepted as having materialised.

Clever Tricks

All the time the boundaries of what the machine can do are being expanded and, almost without anyone admitting it, the machines really and truly are becoming more and more intelligent.

This is the game that anyone can join in — because one common definition of artificial intelligence is that it's the Department of Clever Tricks. The research workers in AI are those who think of new tricks for the computer to perform and although this definition is sometimes used in a derogatory way there's no reason why it should be. After all, clever tricks are still clever; and a computer that can perform cleverly has plenty of reason to claim to be intelligent.

There's another good reason why anyone can join in the game — anyone can buy a computer these days. AI doesn't have to be carried out on giant mainframe machines using arcane languages and, to prove that point, you only have to consider that AI first began to surface as a subject in the late Fifties and early Sixties. In those days any machine with 48K of memory on it *was* a giant mainframe machine. Paper tape and punched cards ruled. Disks were rare. So, if you have a 48K machine (or thereabouts) and cassette storage, you have a machine which the early AI pioneers would have given their eye-teeth for. If you have a floppy disk drive as well, then your machine configuration would leave those early researchers standing bug-eyed at the prospect of what might be achieved.

So, you've got the kit and you've got some common sense — in which case there's no reason at all why you shouldn't implement some existing AI research on your own micro or even carry out some research (ie, start messing around) with your own ideas.

Of all the current AI activities the best-known current development is in the field of expert systems. The aim here is to develop programs which can mimic, or even replace, human experts in some fields. For instance, you could have a doctor program which would replace your GP (up to a point) and that would be an expert system. Such systems are very far from being an idle dream. Although expert systems are often developed in the newer logic langauges, such as Prolog, several have been written in BASIC and 48K is plenty of storage in which to fit quite a substantial expert. The only problem is how to do it — and it's here, as with much of AI, that common sense comes to the fore.

The most usual approach, in general, is to split the problem into two parts — the inference engine and the knowledge base. The inference engine is the 'thinking' part of the expert system and corresponds to what most people normally think of as the program. The knowledge base is the data — the subject matter about which the expert system shall think.

By splitting the problem up in this way you finish up with a program which can reason about a very large number of different things. All you have to do is to unplug one knowledge base and plug in a knowledge base on a different subject and the expert system becomes expert in a new field.

The problem lies in designing a suitable general-purpose inference engine and working out a format for the knowledge bases that might go with it.

Talk, Talk

Probably next down the list of well-known AI activities is the area of natural language. After all, it would be nice if you could just speak to your computer and it could speak back to you, wouldn't it?

Unfortunately, this is a much harder problem to crack than appears at first glance and the reason for this is a reason common to most problems in AI — that there are two ways of tackling AI problems. There is the simple way, in which you think the problem is easy and implement a fairly easy solution. And there is the hard way, which results from finding out that the simple method has severe limitations in its performance.

In the case of language recognition, for instance, the simple way is to store in the machine a 'template' corresponding to different spoken words. When you speak to the machine it attempts to match what you've just said with its internal set of templates and then takes some pre-programmed action according to the result. This method works reasonably well and several devices are available for home micros which you can buy and which will enable you to do this.

The problem is that the machine doesn't really understand what you've said to it. Say 'dog' to the computer and get it to print out the word 'cat' on the screen everytime it hears the word and it will never realise that it's wrong to do this.

To really understand speech in the way that *we* understand speech the computer has to have a much more thorough model of the world in its memory so that it can not only respond to what you say, but understand it as well. This is a very difficult problem — but it's a programming problem which you, as a programmer, could tackle if you wished to.

This is one reason why speech synthesis (getting the computer to talk) isn't nearly so difficult as speech recognition. The need for intelligence on the computer's part is much less when all it has to do is speak and *you* have to listen to it and understand what it's saying than when you speak and *it* has to understand *you*.

Having reached the stage of a

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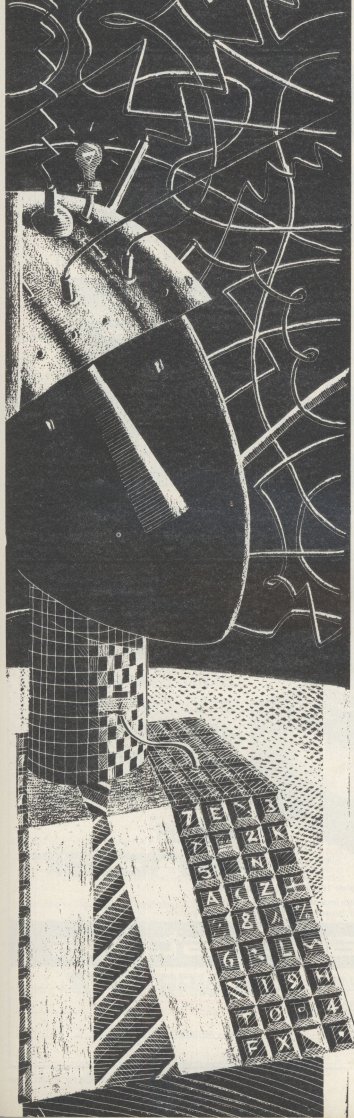

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computer which could, in some way, speak and listen the obvious next step is to get a computer which can see. And, like the natural language problem, this can be harder than it at first appears. You can buy kit which will enable you to rig up a video camera to the input port on your computer and place an image in memory. So, at some level, the computer can see. But can it make sense of what it sees? If you approach the camera can it recognise that this is you and respond accordingly? Like speech recognition the computer often needs an internal model of what it might see and what those sights might mean, within its memory, in order to be able to do this. But in AI labs around the world success is gradually drawing closer simply as a result of clever programming. Again, there is no reason why you shouldn't try your hand at a bit of clever programming in this general area.

Of course, life would be a lot easier if you didn't have to specify the programs in minute detail. It would be better by far if you could simply let the machine learn how to be intelligent for itself — and that is the field of machine learning. How to get computers to learn for themselves without having to be explicitly programmed in advance. This applies almost to any field of AI — expert systems, language processing, visual work — if the computer could just be shown a few examples and told what they were this would be much easier (and much more interesting) than having to spell it all out in BASIC. Several machine learning programs are coming onto the market now in one form or another, but this is an area where you really could do a very good job by yourself in BASIC. Many of the methods used are quite well-known and, more to the point, easy to understand and program. And, if you can't find a method which already exists for the problem you have in mind then the answer's simple — think up a method of your own. After all, that is what is called research.

Finally, if you had a machine which could act as an expert advisor, could understand speech and talk to you, could see and understand what's around it and could learn from experience, why not simply call it a robot? Mount it on a chassis and give it the ability to move around and, finally, you've got something that Dr Frankenstein would have been proud of. Or, at any rate, you have if you can get it to work.

Maybe your research into artificial intelligence will never produce anything to equal R2D2 or HAL — but maybe nobody else's research will either. The important thing is to have a go and find out what you can achieve. Because the most important point about AI is not any of its esoteric or arcane aspects — but simply the fact that AI is fun.

It's that which really makes it interesting.

A Psychiatrist

Just to whet the appetite here's a program which acts as a kind of sympathetic psychiatrist. Not a very good one, but one which illustrates some points and which can be fun to play with and modify.

Basically, the program starts up by asking you in line 40 to tell the computer a little about yourself.

When you input something (in free format natural language) into S$ in line 50 the program then scans through its knowledge base looking for any keywords in your input. The knowledge base starts in line 1000 and consists of easily-modified DATA statements. Each DATA statement starts with a keyword (such as 'KILL') and is followed by something which the psychiatrist is going to ask you if it hears that keyword (eg 'HOW LONG HAVE YOU WANTED TO KILL?).

If your input doesn't include any keywords the program simply gives you a prompt to keep you talking (in line 90).

So that you can add any number of new items to the knowledge base without having to specify in advance how many it contains there is a stop code in line 2000 (DATA 999). The program knows it has scanned the entire knowledge base looking for keywords when it reads this stop code.

Note that the program is very simple but can be quite entertaining. With some additions and modifications it could be (moderately) convincing to anyone who didn't know how it worked.

```
]LIST

  10  REM: SHRINK
  20  HOME
  30  PRINT  SPC( 11);"THE DOCTOR I
      S ";: INVERSE : PRINT "IN";
      NORMAL : PRINT : PRINT
  40  PRINT "TELL ME A LITTLE ABOUT
      YOURSELF...";: PRINT
  50  INPUT S$: PRINT
  60  FL = 0
  70  RESTORE
  80  FOR A# =
  90  IF A# = "999" THEN : PRINT "I
      TELL ME MORE...";: PRINT : GOTO
      50
 100  FOR I = 1 TO LEN (S$) - LEN
      (A#) + 1
 110  IF A# = MID$ (S$,I, LEN (A#
      )) THEN I# = I : I = LEN (S$
      ) - LEN (A#) + 1
 120  NEXT
 130  READ Q$
 140  IF FL = 0 THEN 80
 150  IF FL = 1 THEN  PRINT Q$; PRINT
      : GOTO 80
1000  DATA  KILL,HOW LONG HAVE YO
      U WANTED TO KILL ?
1010  DATA  MOTHER,DO YOU GET ON
      WELL WITH YOUR MOTHER ?
1020  DATA  FATHER,HOW DO YOU FEE
      L ABOUT YOUR FATHER ?
1030  DATA  DON'T,COULD YOU EXPLAI
      N WHAT SORT OF ?
1040  DATA  HATE,DO YOU FEEL THAT
      HATE IS REASONABLE ?
1050  DATA  FEELINGS,CAN YOU DESC
      RIBE THESE FEELINGS IN MORE
      DETAIL ?
1060  DATA  TIME,DOES THIS DATE B
      ACK TO SOME SPECIFIC EVENT ?
2000  DATA  999
5000  REM  (C COPYRIGHT CHRIS HAYL
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```

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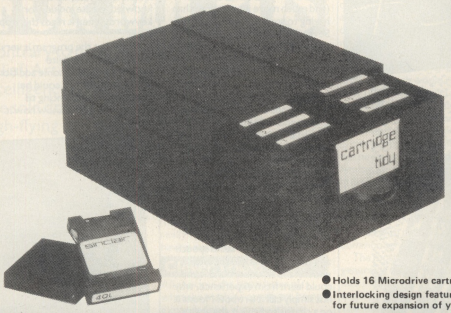

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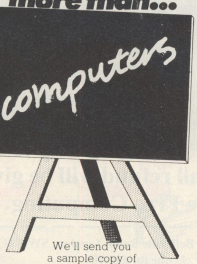

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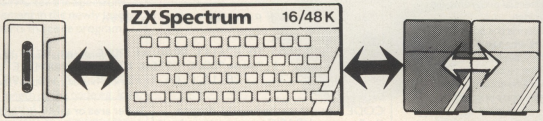

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One of the main reasons for laying out good money on a microdrive for the Spectrum is fast loading of programs and data. However, although it is easy to transfer your own programs from cassette to microdrive cartridge (by loading from cassette into memory and then saving to cartridge), it is very different when you try to transfer commercial programs, on cassette, to cartridge.

The first problem is the addition of extra systems' variables when using an Interface I and the need for data buffer areas when reading and writing to cartridge. Assuming these problems are overcome, there is also the problem of the copy protection which is incorporated within most commercial software. This article was conceived as a guide to solving these kinds of problems.

Search And Display

Before any investigation of a program can be made, you need a range of software utilities and tools. The first of these is a monitor program which permits the following:

Display of memory contents in HEX and ASCII
Disassembly from location to location
Memory content modification
Search for sequence of bytes

The second requirement is a program to read and display the contents of the header label on a cassette. This label-data shows, for a BASIC program, the name, total length of program and variables and most importantly the auto-start line number. For a machine code program, it shows the name, load address and length of the code.

Most software consists of a short BASIC program which loads and autoruns. This program loads up the rest of the software, usually machine code, and then starts the main program. Other variations include a BASIC program with the code in a REM statement, a BASIC program with headerless parts, a BASIC program which pokes the code into its required locations and the programs which appear to be all code and are loaded with LOAD "" CODE. This last method works, despite the Spectrum's BASIC manual stating that it can't be done.

The easiest to transfer are programs where the machine code part is above about 25000 in the memory map. The BASIC program is loaded from cassette, followed by the line which loads the machine code (suitably modified to load from microdrive), then the BASIC is saved to cartridge with an autorun line number obtained by examining the label. The label reader will have displayed the load address and length of the machine code program which can now be loaded into memory, then saved to cartridge. When loading the code from cassette, remember to lower RAMTOP to below the start address with a CLEAR command.

Short Stop

If the machine code part of the software starts below 25000, when you try to load an error message stating that there is not enough memory to allow loading appears. This is caused by the extra 58 system variables and the 595 bytes required by the microdrive for loading and saving. The solution to this problem is to load the code into a higher address and then move it down to its correct address before running.

A short machine code program has to be placed in memory, either in the printer buffer area or above the code, to move it down to its correct location. Since this also causes the BASIC program to be overwritten, the main program has to be started from this block-move program. However, that should present no problem.

Figure 1 shows the general form of a program which will move code from one memory location to another and then start the program running. It is relocatable and can be placed anywhere in memory.

Let's use an imaginary program to describe the steps in detail to transfer this type of program to cartridge.

1. Load BASIC program and examine. It should be something like

   10 CLEAR 23999 : LOAD "" CODE : RANDOMISE USR 24000

2. Use a label reader to obtain the load address and length of the code program eg load address 24000, length 30000
3. Modify the BASIC program as shown in *fig 2*. The program now loads the code into address 27000, then pokes into the printer buffer a program to move the code back down to its correct address and start it running. Save this BASIC program with an autorun number of 10.
4. Load the machine code from cassette into memory using LOAD "" CODE 27000 and save to cartridge using SAVE * "m";1;"name"CODE 27000,30000

The software can now be loaded and run from microdrive with a simple load command: LOAD * "m";1;"basicname"

Variations include programs which load a screen and/or load in several code parts. The screen can usually be discarded and the several code parts examined for length and start address as before. If they load in below the RAMTOP address, then load each into memory at a higher address and save it to cartridge. Modify the BASIC program to load back from cartridge to the correct address.

```
fig 2.      Load Program

10 CLEAR 26999
20 FOR x=22530 TO 22544: READ a: POKE x,a: NEXT x
30 LOAD *"m";1;"name"CODE 27000,30000: RANDOMIZE USR 22530
40 DATA 243,33,120,105,17,192,93,1,48,117,237,176,195,192,93
```

```
fig 3.      Load Program - 2nd Version

10 CLEAR 26999
20 FOR x=62400 TO 62414: READ a: POKE x,a: NEXT x
30 LOAD *"m";1;"name"CODE 32768,15000: RANDOMIZE USR 62400
40 DATA 243,33,0,128,17,0,64,1,152,58,237,176,195,168,97
```

```
fig 1.        Shift Program

DI                      : disable keyboard
LD  HL,address 1        : start of code to be moved
LD  DE,address 2        : position to be moved to
LD  BC,size             : no. of bytes to be moved
LDIR                    : move them
JP  address             : start of program
```

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ESS . . . . . .



Staying together

There is one form of program which appears to be all code. This consists of a BASIC program and a code program which have been saved to cassette together with the system variables. When the program completes its loading, the system variables NEWPPC and NSPPC tell the Spectrum to execute a statement in the newly loaded program which starts the code program running.

Let's run through these steps using an example.

1. Use the label reader to obtain name, load address and length of the code eg, load address 16384, length 15000

2. Load the program into memory but higher up the memory map, typing LOAD "" CODE 32768

Now save to cartridge using SAVE "name" CODE 32768, 15000. As a result of the change in the load address, all addresses are now 16K higher than they would be from a normal load.

3. Examine locations 9C54h and 9C4Ch to determine the start of the BASIC program and variables area. Add 40h to both values and replace in 5C54h and 5C4Ch.

4. Type LIST and the BASIC program should be displayed and will be something like:

```
1 REM lot of characters
10 SAVE "name" CODE 16384,15000:
   RANDOMISE USR 25000
```

The REM contains the code of the program and may be unlistable. If you have difficulty listing the BASIC, try LIST 2, LIST 5, LIST 10, etc. If this still fails then you will have to search the memory for the sequence of bytes which represents : RANDOMISE USR address. For the start address 25000, the sequence in hex would be 3A F9 C0 32 35 30 30 30.

The important information to be found is the start address of the code program.

5. Create a BASIC program as shown in *Fig. 3* which is similar to *Fig. 2* but uses different addresses and pokes the block move program into a different area of memory. Save this program as before and the software can be loaded and run by entering LOAD *"m";1;"basicname"

```
fig 4.   Data Values

 10 DEF FN h(x)=INT (x/256)
 20 DEF FN l(x)=x-FN h(x)*256
 30 CLS
 40 INPUT "CORRECT LOAD ADDRESS ";c
 50 INPUT "NEW LOAD ADDRESS ";n
 60 INPUT "SIZE OF CODE ";s
 70 INPUT "START ADDRESS ";r
 80 PRINT : PRINT
 90 PRINT "243"
100 PRINT "33 ";FN l(n);" ";FN h(n)
110 PRINT "17 ";FN l(c);" ";FN h(c)
120 PRINT "1 ";FN l(s);" ";FN h(s)
130 PRINT "237 176"
140 PRINT "195 ";FN l(r);" ";FN h(r)
```

No matter how the software is stored on cassette the principle of transfer is to obtain the load address, start address and length of the code parts, then if necessary use a block move routine to move the code to its correct locations after loading from cartridge. The program in *Fig. 4* will generate the values required in the DATA statement if you enter the addresses and the length of the code.

The last program in *Fig. 5* shows a menu program which loads when RUN and ENTER are pressed. It displays the name of four games and asks you to select a game. The program then loads the appropriate game and then runs it.

```
 fig 5.     Games Menu
 10 CLS
 20 CLEAR 27000
 30 PRINT AT 5,12;"GAMES MENU"
 40 PRINT AT 8,5;"1   INTRUDER"
 50 PRINT AT 10,5;"2   LOONY DIGGER"
 52 PRINT AT 12,5;"3   ROCKET-LOAD"
 54 PRINT AT 14,5;"4   ALIENS"
 60 PRINT AT 20,5;"type in game number"
 70 INPUT x
 80 IF x)4 THEN  GO TO 10
 90 GO TO x*100
100 LOAD *"m";1;"pen"CODE 32768
110 RANDOMIZE USR 32768
120 STOP
200 LOAD *"m";1;"mm"CODE 32768
210 POKE 35136,0
220 RANDOMIZE USR 33792
230 STOP
300 LOAD *"m";1;"j0"CODE 28672: LOAD *"m";1;"j1"CODE 23424
310 LOAD *"m";1;"j2"CODE 23728: LOAD *"m";1;"j3"CODE 23672:
RANDOMIZE USR 28672
320 STOP
400 FOR x=32400 TO 32414: READ a: POKE x,a: NEXT x
410 LOAD *"m";1;"gal"CODE 39936,8732: RANDOMIZE USR 32400
420 DATA 243,33,0,156,17,0,92,1,32,34,237,176,195,53,106
430 STOP
```

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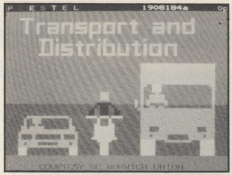
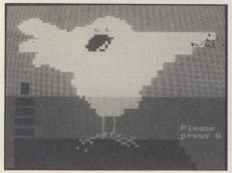




Ever wondered what you can use the BBC's Teletext display for? Why not construct your own version of the mighty Prestel database? Ken Young examines some products which help you do just that.

Unless you've got a few spare millions stashed under the floorboards, the chances are you won't be hotfooting it down to the Stock Exchange to put in your bid for British Telecom this summer. More's the pity — along with all those smart red phone boxes you could have become the proud owner of one of the world's healthiest viewdata systems.

This is, of course, Prestel that huge database at the end of the phone line which is claimed by BT to be ideal for entertaining visiting relatives and a whole lot more.

Now that its use is becoming more widespread there is a growing interest in Local Viewdata software allowing users to create a Prestel-like database on their own computers at low cost.

If you've ever hooked up to Prestel or Micronet, or tuned into Ceefax, Oracle or Fourtel, and thought the immortal words 'I could do that', then Local Viewdata software is for you.

The basic thinking behind such software is to give more power to the user, by allowing you to create your own viewdata system on disk, designing your own pages or copying them from other systems. This kind of copying is not illegal I hasten to add and is an excellent way of creating your own electronic magazine using Teletext graphics and text.

Mode 7 Teletext

Most users of the BBC micro will have experimented with Mode 7, the teletext compatible display mode which games programmers often use to display the instructions for the game. Mode 7 is very economical in memory usage and provides good visual effects with full colour text and a low resolution graphics display.

The teletext screen consists of 25 lines of 40 characters. One of the fundamentals of its operation is the positioning of control characters that change the colour of text, produce a new background colour, give double height lettering and so on.

Whole teletext screens can be created in BASIC fairly easily, if somewhat laboriously. Text is placed using the PRINT statement and interspersed with control codes using either the CHR$ or VDU statements. For example:

```
10 MODE 7
20 PRINT CHR$(129); "THE TEXT IS RED"
```

produces red text on a standard black background.

To make life easier the red function keys, in combination with SHIFT generate the control codes for colour change (129 to 137).

Graphics are produced by introducing the control code for the graphics colour required. Following this, each graphics block must be specified by its own code. The easiest way to do this is to locate the appropriate block in the table given in the User Guide. Alternatively it is possible to calculate the code by adding the values of each of the cell blocks to be lit.

Creating teletext screens in this way gives an insight into the programming implicit in viewdata software. By using conditional branching statements whole screens can be routed together so that when the program is RUN the reader can select which screen (frame) to view next.

The ISMEC Software

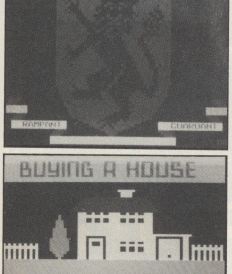
The ISMEC package comes on floppy disk with a nine page booklet and insert strip which fits neatly under the clear panel above the keyboard. It has been designed primarily for school use to enable classes to create databases from Prestel and broadcast Teletext, one of the main advantages being that Prestel can be accessed during off peak phone times and sections of the database saved for day time use.

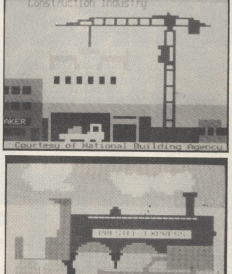
Pressing SHIFT BREAK automatically loads and runs the local viewdata system presenting the user with the page zero welcome frame. Leading off this frame are a number of frames which serve as a good introduction to using the system for those unfamiliar with Prestel. It covers the routing from one frame to another, moving between frames, and moving directly to a particular page.

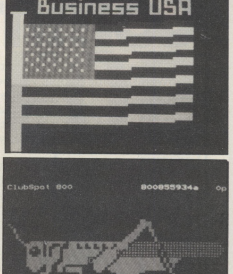
Create Your Own Database

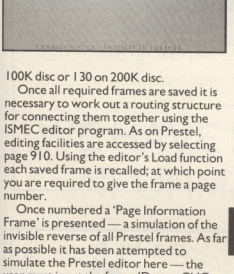
The ISMEC software was designed with Micronet 800 users in mind. Consequently the method of creating a database from Prestel frames assumes the user to have a modem or accoustic coupler and Micronet communications software. For saving Teletext frames the teletext adaptor and software is required.

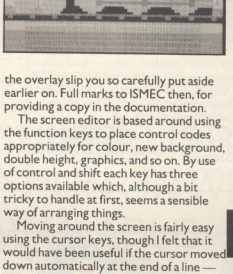
Once on line to Prestel, frames are saved to disk by pressing F5 and selecting option 2 (save a frame). Each frame must be given a file name which can get confusing later on if you don't keep notes on the names you use. It's also important to have an idea which frames you want to use in advance, as it is quite a long process saving them to disk if you are also hunting around for the one that got away. As to maximum size — about 50 frames can be saved on a

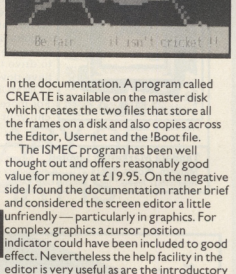












100K disc or 130 on 200K disc.

Once all required frames are saved it is necessary to work out a routing structure for connecting them together using the ISMEC editor program. As on Prestel, editing facilities are accessed by selecting page 910. Using the editor's Load function each saved frame is recalled; at which point you are required to give the frame a page number.

Once numbered a 'Page Information Frame' is presented — a simulation of the invisible reverse of all Prestel frames. As far as possible it has been attempted to simulate the Prestel editor here — the user must input the frame ID, user CUG (for simulating private pages), user access, frame type, frame price, and the ten routing selections (0-9).

On confirmation of the page information details you are returned to the frame to edit if necessary. The whole process is fairly straightforward although I found that some frames needed to be saved from scratch due to corruption.

When the database is complete, the format file for each frame can be deleted and the database accessed by running the USERNET program and accessing frames as if it were a Prestel database.

Designing Frames

Creating your own frames is more fun, and of course can be done without the hardware needed to go on line.

The ISMEC editing software, accessed by selecting page 910 when running the Usernet program, offers the kind of facilities a Prestel Information Provider uses, as well as some options not found on the Prestel software.

The E(nter) function allows a totally new frame to be created. After specifying the desired frame number and giving routing details you are presented with a blank frame and can work according to the screen editor.

At this point you rapidly hunt round for the overlay slip you so carefully put aside earlier on. Full marks to ISMEC then, for providing a copy in the documentation.

The screen editor is based around using the function keys to place control codes appropriately for colour, new background, double height, graphics, and so on. By use of control and shift each key has three options available which, although a bit tricky to handle at first, seems a sensible way of arranging things.

Moving around the screen is fairly easy using the cursor keys, though I felt that it would have been useful if the cursor moved down automatically at the end of a line — instead it is necessary to press return each time.

Another awkward feature is encountered when using double height characters — the line must be typed twice instead of appearing instantly in the usual way. The advantage with this however, is that two-colour double height can be used.

Graphics, though quite straightforward, require a lot of patience. First you need to select graphics mode, next design the graphics block using the letters Q, W, A, S, Z, and X. Exit the graphics definition mode and finally print the block anywhere on the screen by selecting the 'present graphic' option.

Deletions and insertions are simple enough using the delete key and shift delete respectively. I have also been assured that full line insert and delete is available on a more recent version of the software. Once out of the screen editor you are able to A(lter) any frame or C(opy) it onto a new frame as well as D(elete) any undesirables.

The editor also has a F(ilial) function that lists all pages descended from a particular page in your database. This can be quite handy in keeping track of a database as it grows.

Finally, a T(ransfer) function is available to transfer frames to another disk. This I worked out by the old faithful method of trial and error — due to the lack of details in the documentation. A program called CREATE is available on the master disk which creates the two files that store all the frames on a disk and also copies across the Editor, Usernet and the !Boot file.

The ISMEC program has been well thought out and offers reasonably good value for money at £19.95. On the negative side I found the documentation rather brief and considered the screen editor a little unfriendly — particularly in graphics. For complex graphics a cursor position indicator could have been included to good effect. Nevertheless the help facility in the editor is very useful as are the introductory frames that are provided.

If you are more Teletext orientated there is a simplified program called DATEXT from Optima software consisting of an Editor program and Datext program which displays the pages created. This is available for £9.95 on tape and £10.95 on disk.

One to watch out for is the release in July of a program created by a body known as the Information Technology Consultancy Unit, based in London. Under the name Communitel, they expect to be retailing viewdata software which includes an impressive list of facilities: editor, local search, carousel, telesoftware formatter, viewdata host, and bulk update software. Such software opens up tremendous possibilities for all kinds of viewdata systems to be created as very reasonable expense.

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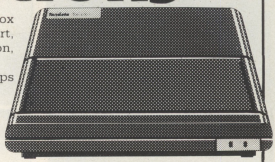

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There are almost as many different versions of BASIC as there are computers — programs written on one machine must be modified to run on another. In the first part of this new series, Adam Denning explores some of the quirks of variables in the different dialects.

BASIC -DIFFERENCES-

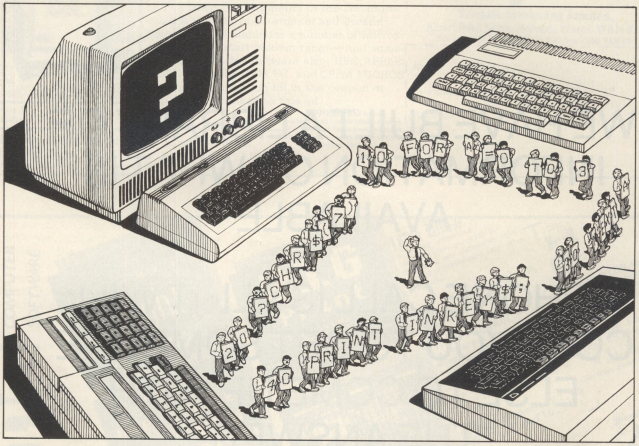

ILLUSTRATION BY MARTIN HANDFORD



Every home computer comes equipped with one thing — the BASIC language. This should mean that every home computer understands the same language, but if you type SOUND –15,0,200, 15 into anything other than a BBC Micro it is unlikely that you'll get anything more noisy than a *syntax error* report. And typing PRINT "Which Micro" (7 TO) into any non-Sinclair computer won't get you very far either. So much for compatibility.

This is one of the criticisms directed at BASIC when programmers get together. It just isn't portable between machines, and an awful lot of a programmer's time can be taken up changing a program written for one machine to use it on another. This series aims to make that process rather simpler and a great deal less painful.

Since the introduction of the BBC Micro, with its famous BBC BASIC, structured programming has become a bigots' buzz-word, and this trend is accelerating now that Sinclair has given us a working version of the QL's SuperBASIC.

What structured BASICs offer over a more conventional dialect is the ability to use programming structures that are not really part of the traditional BASIC language, such as user-defined procedures and functions and a host of control structures like REPEAT . . . UNTIL and WHILE . . . WEND.

Converting these advanced structures into native BASIC structures such as subroutines and FOR . . . NEXT loops can be very arduous, and it is often less time-consuming to start all over again and use an entirely different programming logic.

An equally great problem is caused by the various ways in which computers handle strings. The 'old' way is to use the Microsoft LEFT$, RIGHT$ and MID$ funtions to split strings into sections, but Sinclair characteristically went its own way, coming up with a more logical and far more powerful assignation method using numbers to refer to a string's component parts. Naturally this is totally incompatible with other BASICs.

Then there are the special functions that each computer offers, such as sound and graphics. The graphics resolution of each computer is rarely the same, yet most

games programs depend upon this information. The Spectrum has a resolution of 256 × 192 and a colour resolution of 32 × 24, while the BBC boasts eight different screen modes each with its own resolution up to a maximum of 640 × 256 with two colours rather than the Spectrum's eight. The QL has a 512 × 256 resolution, with an enormous number of colours and effects. Converting from one to the other is a programming feat in itself.

Sound on the Spectrum is renowned for its meek one-channel BEEP, the QL uses the same keyword but is a whole lot more powerful, the BBC Micro has four channels and the portuous ENVELOPE statement, and the Commodore 64 manages to be the most powerful of the lot but relies on a confusing variety of POKEs to get anywhere.



What structured BASICs offer over a more conventional dialect is the ability to use programming structures that are not really part of the traditional BASIC.

The main factor to be aware of more than anything else is that computers should always be suspected of being totally different and nothing can be presumed. More to the point, if your job is to convert anything other than the most simple program from one machine to another you MUST have a printed listing of the original, the User Guides of both machines, a lot of coffee, a lot of cigarettes if you are addicted to the noxious weed, and a great deal of patience. Only then does skill come into it.

Perhaps the BASIC programmer is lucky — conversion of programs written in machine code from one machine to another has an even more basic rule — don't do it if you value your sanity!

To start off, we'll look at the types of variable available on different machines, and what to do when you encounter a type of variable that simply doesn't exist on the machine that you're converting the program to. Every machine has at least three types of variable — the *numeric* variable for manipulating numbers, the *string* variable for playing around with characters, and the *array* for creating data structures and matrices. Luckily the nomenclature for each tends to be the same across machines. The name of a numeric variable consists of at least one letter, but the more advanced BASICs allow variable names to be any combination of alphanumeric characters so long as they don't start with a number. Upper and lower case don't usually make much difference, but on the Acorn computers they do. This means that var I and VAR I are NOT equivalent on the BBC Micro or Electron, but on the Spectrum they are.

To find a BASIC without floating point arithmetic these days is very rare, and most micros keep to the well-defined standard of a range of 10^{39} as the maximum number (except the QL which has a precision of 10^{615}, which is a little over the top perhaps).

Not all computers have *integer* variables, though. These are *numeric* variables that can hold only whole numbers, usually in two-byte or four-byte format, giving an integer range of –32768 to 32767 and –2147483365 to 2147483365. These are generally easy to replace with normal numeric variables, but beware the odd cases where the ability to divide three by two and get an answer of one is deliberately made use of.

Computers that support integer variables also tend to support two integer mathematical functions — DIV and MOD. A DIV B can be replaced by A/B in most cases, and in those in which it can't, use INT (A/B) instead. MOD (or sometimes REM) is a little more difficult, but A MOD B can always be replaced by A — B * INT (A/B). The main reason for using integer variables is that processing is in general a lot faster than for floating point variables, so if you are replacing integer variables with floating point ones, be aware that this is sure to contribute to a reduction in speed. In some cases this is bad enough to necessitate a re-think of the program logic or even a machine code subroutine to get the speed back.

String variables follow approximately the same rules as numeric variables as far as their names go, but computers suporting long string variable names are few and far between. The terminating character of a string variable is in all cases a $ sign — meaning string. While in general string concatenation and creation follow the same pattern across the board, so that things like LET a$ = CHR$141 + "Blurg" + CHR$13 tend to make sense to all machines; methods of more advanced string manipulations do not. This mainly



Perhaps the BASIC programmer is lucky: conversion of programs written in machine code from one machine to another has an even more basic rule — don't do it if you value your sanity.

affects conversions between Sinclair and other computers, so a method of implementing LEFT$, RIGHT$ and MID$ is needed for Sinclair machines. Try these:

```
LEFT$(a$,3) = a$(1 TO 3) or a$(TO 3)
RIGHT$(a$,3) = a$(LENa$–3 TO LENa$) or a$(LENa$–3 TO)
MID$(a$,3,1) = a$(3)
MID$(a$,3,6) = a$(3 TO 3+6) = a$(3 TO 9)
```

Obviously the equations can also be used when converting the other way. A more difficult function to implement is INSTR, which returns the position of one string within another (with FALSE returned if the string isn't present). This GOSUB routine should do it:

```
9000 FORa=1 TO LENa$
9010 IFa$(a TO LEN(b$))=b$ THEN RETURN
9020 NEXTa:IFa>=LENa$ THEN a=0
9030 RETURN
```

This is a subroutine that is roughly equivalent to a=INSTR(a$,b$), but it is a



The name of a numeric variable consists of at least one letter, but the more advanced BASICs allow variable names to be any combination of alphanumeric characters so long as they don't start with a number.

little naughty in that it jumps out of a FOR . . . NEXT loop if a match is found.

Arrays can be of two types — numeric or string. Computers with integer variables usually support integer arrays too, but on the BBC Micro these are specifically meant for interfacing machine code programs with BASIC, so a statement like DIM A% 500 reserves 500 bytes (actually 501) and puts the address of the first byte in A%. To simulate this on other computers you would normally reserve bytes in the normal way (such as lowering RAMTOP on the Spectrum) and assign a variable analogous to A% to hold the first reserved address.

Numeric arrays invariably take up a great deal more space than string arrays, so if a programmer has dimensioned a very large array on (say) a Spectrum, it may not fit inside a BBC — especially if the program uses high resolution graphics too. The method of dimensioning and accessing arrays is fairly consistent, but some BASICs allow you to declare more than one array in the same DIM statement. Others don't, so if you see

```
10 DIM a(20), b(2,5), c$(23)
```

you would have to replace this with

```
10 DIM a(20):DIM b(2,5):DIM c$(23)
```

or even

```
10 DIM a(20)
20 DIM b(2,5)
30 DIM c$(23)
```

if your BASIC doesn't have multi-statement lines.

String arrays follow the same rules, but some interesting things can occur. If you dimension a string array as something like DIM a$(10,8) on your BBC, then each of the ten elements of a$ is instantly made equal to a string of eight character4s, and even if you typed LET a$(1) = "xy" you would find that a$(1) is actually "xy ", while if you typed LET a$(1) = "Too many characters", a$(1) becomes "Too many". This is not true on most other computers.

Next month we'll look into the thorny subject of converting defined procedures and functions into subroutines, and REPEAT . . UNTIL loops into GOTOs (who needs structured programming anyway!).

ILLUSTRATION BY MARTIN HANDFORD

SPRITES FOR THE DRAGON

- UP TO 128 NON DESTRUCTIVE SPRITES
- SIZE SINGLE PIXEL TO 1600 PIXELS
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- AUTOMATIC MAZE RUNNING MODE
- AUTOMATIC JOYSTICK/KEYBOARD CONTROL
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- 6 FREE DEMONSTRATION PROGRAMMS
- COMPREHENSIVE MANUALS

Some time ago, we decided to add text printing facilities to the Dragon's Graphics Screens. Although it took 3 weeks of hard work we did it for all five PMODES. We made the characters redefinable, but we did not call them sprites, because they are not, they're just redefinable characters. Then we decided to add some sound effects and user definable sounds. After another week or so, we had done that as well.

Next, we thought we would give the Dragon some sprites. We required multi-coloured sprites of any reasonable size or shape and we wanted to be able to move them without obliterating whatever else might be on the screen. We quite fancied being able to control sprites from the keyboard or joystick with just a single command, and we thought it would be nice to be able to fire sprites with the joystick buttons. No sprite system worth its salt would ignore collisions, we thought, so we would have to have a collision detection as well. Also, we wanted the sprites to be fast, versatile and easy to use, with lots of functions so that the control programme would know where all the sprites were, and what they were doing. Another brainwave was to include an automatic maze running feature where all the sprites chase, (or run away from) a particular sprite, so that it would be easy to write THAT kind of programme. Then we thought we would like to have easy animation, preferably looked after automatically, by the sprite handling system. Finally, just to make the whole idea totally impractical, it would have to be driven entirely from Basic, without any tedious Peeking and Poking.

We did it, it took months, but we did it. The author of the two top selling Dragon games in a recent best sellers list, has described Sprite magic as the best piece of software he has ever seen.

Popular Computing Weekly said "Excellent" and "Superb". Dragon World said "Quite simply the best Dragon utility available on the market today". Personal Computer News said "Fantastic" and "if you've got a Dragon, what on earth are you doing without Sprite Magic".

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SOFTWARE FROM FLITE:

CARTESIAN
can graph the simplest of functions

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Naturally if CARTESIAN can handle the functions above, then it can also take care of quadratics, cubics, trig. functions, polynomials, circles and elipses.

CARTESIAN is available for the BBC 'B', Acorn Electron, Apple 11e and Apple Europlus.

PRICE:
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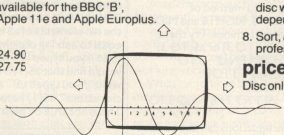
Disc: £27.75



Cartesian is fun to use, which should go a long way towards ensuring that it is used, and it is both powerful and flexible enough to be of real benefit to any serious student of mathematics.
—Hobby Electronics

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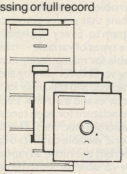

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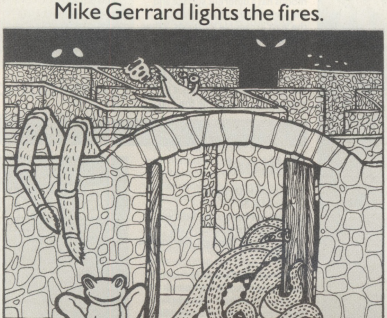
Soft Release Special

Sprite Magic

An exciting graphics utility to rekindle the flames of down in the mouth Dragons. Mike Gerrard lights the fires.



There have been at least two pieces of software recently advertised as doing amazing things for your Dragon's graphics capabilities, but which we have somehow mysteriously been unable to obtain review copies. This approach reflects badly on anyone who does actually produce such a piece of software and people are inclined to think, "Well it sounds good, but does it actually exist, and if it does then can it really do all that it claims?" *Sprite Magic* does exist, does do everything it claims to do, *and* does it well. Its quite simply one of the best utility programs yet to appear for the Dragon, considerably improving the machine's attraction. It offers the kind of features that the Dragon 64 should have incorporated to improve on the 32's sound and graphics.

What *Sprite Magic* delivers includes up to 128 moveable, flicker-free sprites, which can be custom-designed using the 8 × 8 grid in the character generator — one of the seven demonstration programs that come with the main program. There is a pre-defined character set with *Sprite Magic*, mostly upper and lower case letters and a few graphics characters like tanks and ducks to give you ideas, but obviously the main attraction will be in designing new ones for games and animation.

If, so far, this sounds just like any of the other character generators that are on the Dragon market, then consider some of the 40 or so new BASIC commands that are at the user's disposal in order to manipulate these sprites. The main commands are DGET and SGET, similar to GET, which are used to initialise the sprites. They work in combination with SPUT (to display them), and the MOVE command, to set the specified sprite(s) in motion. You can move a single sprite, a block of them (used together to design buildings, giant letters or whatever), or every sprite on the screen, with the SPEED command specifying the number of units on the 256 × 192 grid through which the sprites are to move. FLETCH is the command to place them under keyboard control, and STIX for joysticks.

Moving into MAZE mode ensures that all sprites will chase one particular sprite, unless you implement the command FLEE when the opposite applies . . . does this sound like any arcade game you know? If you want this kind of effect but not in the form of a maze then you can use the CHASE ON/OFF command instead. You can have automatic collision detection, if you wish, and this is cleverly implemented in that if you have left a border round the edge of your sprite design, collision only applies when the objects, rather than the borders, touch.

When a sprite reaches the edge of the screen you can instruct it to disappear, wrap around or bounce back (degree of bounce being variable), combining this with any of the 16 pre-programmed sound effects.

For these a BEEP command has been included and the given sounds can be altered as regards length, cycles, start volume, change of volume during sound, and whether to have a square wave or a pseudo white noise type of sound. While the range of built-in effects concentrates rather too heavily on the gunfire/explosion/smash kinds of sounds, the number of ways in which you can alter the parameters (another demo program, this) ensures this isn't too restricting. Fairly quick experimentation produced the rumble of an impending earthquake, and something approaching the sounds only dogs are popularly supposed to hear. Also useful for collisions and explosions is the DRWG function, with which one sprite can be replaced by another, slightly different — or even completely different, if you wish — while the ANIMATE command will automatically run through any number of previously designed graphics, up to a maximum of eight, the whole sequence being run through each time the MOVE command is implemented. Thus you could have the simple two-drawing alternation of a space invaders movement, or a more complex running character.

Even useful commands like BREAKOFF and BREAKON — to disable the BREAK key — seem rather minor when compared to the program's main functions — the way in which sprites move about the screen has really to be seen to be believed. Provided you have designed them properly, then the characters are genuinely flicker-free and smooth-moving — pressing two cursor keys simultaneously can provide you with a perfect sliding diagonal movement.

Our one initial criticism of *Sprite Magic* was that the auto-repeat keyboard response was so hot that frequently hitting a key once produced two characters on the screen before you knew it, though even this facility can be altered so that you can specify the time-delay before the auto-repeat comes into effect.

The program occupies 4K of memory at the top of RAM, but in most applications you would surely be able to recoup most of that simply because *Sprite Magic* allows you to do in one line what would normally take several to even approximate — you still wouldn't get the same smooth effect. The potential for visual enhancement is quite large. Educational programs as well as games could be made much more visually appealing, while livening up title screens is another application that immediately springs to mind — letters could be made to change colour, explode or bounce round the screen with minimum effort and maximum noise. It really does give an arcade-style pep to BASIC programs.

Computer: Dragon
Price: £17.25
Supplier: Knight Software, 93 High Street, Eston, Middlesbrough, Cleveland TS6 9JD

SOFT RELEASE



Gravitor

Computer: Oric 48K/Atmos
Price: POA
Supplier: Severn Software, 5 School Crescent, Lydney, Gloucester GL15 5TA

This is another excellent new game from Severn Software. It places you in control of a space ship which you must pilot through the three stages of the game. The ship is controlled by using the left and down cursor keys for left and right rotation and the up and right cursor keys for thrust and tractor beam.

In the first stage of the game, the 'Home Base Stage', your ship is placed in a tunnel at the bottom of the screen. At the top there are four moons that you have to land on. Your ship must be guided carefully through the tunnel, without touching the sides, and then up to one of the moons. Between the tunnel exit and the moons a UFO flies across the screen and colliding with this is also fatal.

Reaching a moon puts you into the second stage of the game. The screen display switches to a picture of the lunar surface. Your job here is to pick up four fuel cells that lie on the surface. This calls for very careful manipulation of the controls as touching the ground is (you guessed it!) fatal. There are gun emplacements on the moons and these fire in fairly random directions. The UFO also hovers menacingly at the top of the screen.

Once the four cells have been picked up you must fly off the top of the screen. This returns you to the first screen and you must then visit the remaining moons. Each of the moons has a different surface and the fuel cells are usually placed in the least accessible locations. When you have collected all 16 fuel cells, stage three, 'The Reactor Stage', starts. We did not manage to collect more than 3 fuel cells so we cannot say much about it but it appears you must guide the ship through the spiral negative universe tunnel to collect another fuel cell.

The laws of gravity have been programmed into the game so that the ship will move realistically when it is near a planet. In later levels the laws are reversed to make things more interesting.

This is a very addictive game although it does not use very much colour in its screens. If you are looking for something a little different that will take more than an evening to master, this is it.



RULE OF THUMB

Each review carries our exclusive "Rule of Thumb" to give you an instant guide to how we rate it. Our chart shows how the system works.


Brilliant!


Better than most — probably a good bet.


Only average, but no major faults.

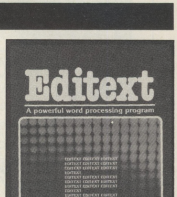

Noticeable, though not crippling, defects.


Contains flaws which affect the program's value.


Avoid at all costs.

Editext

Computer: Dragon
Price: £13.70
Supplier: Nectarine Software, W. Foulsham and Co Ltd, Yeovil Road, Slough, Berkshire SL1 4JH



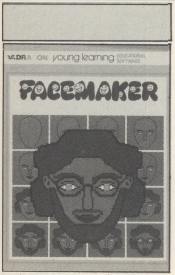
The prospect of a word processing package as cheap as this seems promising, as do the features listed on the cover (automatic wordwrap, find and replace facility, edit characters, lines or blocks), but unfortunately the old adage of 'You get what you pay for' proves its worth yet again. Take the automatic wordwrap, for example. The program does this when you are entering text, by reading whether a character is printed in the last print position on each line, and if one is then the whole string of characters is transferred to the next line. Fine, mostly, but the program should identify a full-stop and know that in this instance it doesn't need to transfer the characters.

The find and replace facility is limited in that you have to check through perhaps three times, covering various combinations of upper and lower-case (eg, FIND, Find and find), and when this is put into effect the automatic wordwrap does not adjust itself, so you must edit the entries anyway. Nor is editing easy. If you go into the Edit mode from the menu, the question you are first asked is 'Edit which line number?' As the cassette version will hold up to 450 lines (just over 2000 words, say) and the disk version 250 lines, you will need a remarkably good memory to edit a particular line, unless you have printed out your incorrect text already, or check the 'View lines' option before starting to edit.

The BASIC program hasn't incorporated the very simple routine which applies automatic repeat to the Dragon's keys, and which also improves the general keyboard response. As the 20-page instruction manual says: "Touch-typists will find that *Editext* enables them to sustain high typing speeds, within the limits of the Dragon's keyboard capabilities." Dragon 64 owners might not experience problems, but those with 32s know it cannot keep up with touch typing, or even fast two-finger typing.

The character set hasn't been redefined, so you must work with the Dragon's own large layout, the lower case letters shown in inverse video. There are options to save and load text from tape or disk, to format and print text, but even with the line and block editing you need to know the line number(s) you wish to amend, instead of working direct on a displayed text. If you want to word process, you'll have to spend £40-£50 on the packages that Microdeal and Dragon Data publish. It's worth it in the end, which *Editext* isn't.





Facemaker

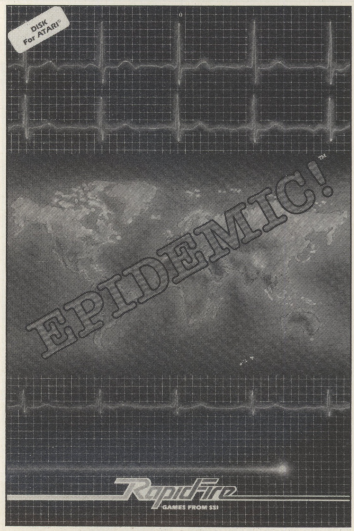
Computer: Dragon
Price: POA
Supplier: Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan SA13 2PE

With a million potential faces contained in the program, *Facemaker* is aimed at the 4-11 age range, the children slowly building up a face, feature by feature, by reading and responding to the questions on the screen. Although it is in the 'Young Learning' series, the educational value is probably more of a by-product of something that's simply fun to do. Learning in this way is a good thing, as the child picks up knowledge incidentally, though even the originators of the program seem a little uncertain as to quite what that knowledge will be, in this case. The introduction of new vocabulary seems to be the main aim mentioned, but it will also serve to develop reading skills, and we can imagine it being used as a good source for encouraging story-writing by having the children inventing a character and then writing about him or her.

We invented a character called Frederick to test the program out. . . *Facemaker* beings by asking you your name, the text being done in large face on the high-res screens. You're then asked to think of the person you wish to draw, and questions about the person's features follow on once you've stated whether it's male or female. Dark or fair? Size of eyes? Shape of nose? You have to type in one of the options given each time, and periodically the partly-made face is displayed for you to check and consider whether you'd like to go back and alter anything.

The potential for fun soon starts to develop. "Is Frederick bald? Answer Yes, No or Partly." Having made him partly bald, you can still give him very long hair if you wish, and shoulder-length wavy hair with one large ear-ring in Frederick's left ear made him a very distinctive character indeed. We then hid his baldness with a very fetching schoolgirl's hat.

As you can see, it's a program that will give children lots of fun, and we can imagine it going down very well both at home or in the classroom. Fun is something often in very short supply, so it's wise to make use of it where you can and encourage children to use their imagination at the same time, which *Facemaker* certainly does. Dragon-owners with young children ought to be looking seriously at this excellent 'Young Learning' series.



Epidemic

Computer: Any 48K Atari
Price: POA
Supplier: Home Entertainments (Atari) Centre, 212-213 Broad Street, Birmingham

The year is 1989 and the deep space probe Toyota XVI has just confirmed that a shower of asteroids heading straight for Earth are carrying a deadly virus. Your task is to control the outbreaks of the virus and contain the epidemics to the best of your ability.

The game starts with a status update display showing which continents are infected, what level of epidemic has been attained, the type of remedy in use and the number of people that have died so far. The next display shows the asteroids as a radar target and their speed, course and distance from Earth. The third display is a visual representation of the world and which areas and to what level they have been infected. The fourth display allows you to select your options for the current turn in progress.

The number of options is limited by the level of difficulty at which you are playing. The easier games allow you two, but then fewer asteroids are hitting the Earth and the disease is more easily contained. The higher levels allow three options but the asteroids are then coming in thick and fast and the disease can spread from one continent to another.

The disease is contained by allocating one of eight cures to the region. The cures vary as to the time taken to start working and their effectiveness. Curing an epidemic to below a certain level will put that region into a 'Stasis' condition. The region cannot be re-infected but the population will continue to die off. If the region is not cured in the initial period it will go into a pneumonic level where the cures are more drastic. Failure to cure within a certain number of days will result in the destruction of that region.

When the disease is in its pneumonic condition it will spread like wildfire to other adjacent regions so you may decide to initiate one of the other play options. This is fairly drastic. You have the option to "nuke 'em till they glow". Drastic? Yes! But it will eventually save more lives in the long run.

The third option is to fire a missile at one of the incoming asteroids. To do this you will return to the radar display and select one of the asteroids, bearing in mind its course, height and the fact that if an asteroid crashes into the sea it is rendered harmless.

During the options phase of the game you can also call up an update on the regions. This will show you such things as the original population, the current population and the number of casualties. It will display the remedies available to you and, by means of a graph, the effectiveness of the remedy in action.

The game ends after a set number of turns or after you have cured the world of all its ills. You are rated according to how long it took you and the number of people that died in the epidemic.

This is the sort of game I always enjoy playing. It sets an exciting challenge that the arcade games do not. It also sets one or two imposing questions — do I lay waste to an entire continent to save another close by? If the continents in question happen to be China and Australia then perhaps you won't, China having many times the population of Australia. The graphics displays are good and all the information is set out in a manner that is easy to assimilate. The player manual is good and often humorous. I'd recommend it to anyone who wants a break from arcade games and who is not into war or chess type strategy games.

Synther 7

Computer: Dragon
Price: £10.95
Supplier: Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan SA13 2PE

If you're tired of the Dragon's rather limited sound facilities, and provided you have some musical knowledge, you could do worse than invest in this cassette that turns your keyboard into quite a versatile instrument . . . in fact into five different instruments: lute, krumphorn, jninni, hogfife and gamba. If that sounds like a rather exotic firm of solicitors, it's nothing to the exotic noises they actually produce.

The six pages of instructions describe the lute sound as being like that of a ukelele, though to us it was more the straightforward piano, which can be stretched to an organ by varying some of the commands. The krumphorn is a much higher-pitched sound, while the jninni is deeper and more echoey. The hogfife sounded about as pleasant to us as someone scratching their nail down a blackboard, and finally the gamba is so deep and sombre as to make you think instantly of Vincent Price and horror-movie soundtracks.

One thing that must be said is that there's no facility to enable you to place these sounds in your own programs, despite the instructions talking of 'Phasing lasers' and 'Pinball alley', though what you can do is record them on tape for posterity. This is where the musical knowledge is needed, because while it's good fun to mess about with the commands and see what sounds you can pull out of the hat, the long-term users will be those who can already play the piano and so produce tunes on the range of instruments.

The range of notes covered, across the top two rows of keys, is from C below middle C to C above middle C, though different octaves can be obtained by use of the down arrow and Enter keys to decrease or increase. You can also alter the volume, vibrato, decay (rate of fade), attack (volume rise at beginning of each note) and the effect of damping the sound, amongst other features. Bending a note up or down is possible, too, and this can be used to create quite astonishing sound effects, particularly with the deeper notes possible. Quite how important it is for you to be able to produce the sound of a motor bike fading into the distance, or a laser, is up to you. Useful and valuable for the knowledgeable, then, but less so for the average dabbler.





Logichess

Computer: 96K Lynx
Price: £11.95
Supplier: Camsoft, 33A Bridge Street, Cambridge CB2 1UW

The arrival of a Lynx chess game is long overdue. However Logichess only goes part way towards making up for this deficiency, since it will only run on the 96K Lynx.

As you might expect Logichess is a machine-code game, loaded with the title "LC2.2".

Once loaded the program first asks if you wish to play white or black. Typing "S" tells the program to play against itself if you are feeling lazy.

Most other programs then ask what level of play you wish to compete on — this normally reflects the amount of time for which the computer is allowed to reflect on possible moves. Logichess gives an infinitely variable adjustment of playing strength by asking you to enter the time (in minutes) allowed for 40 moves. Therefore entering 40 would give a minute per move. This makes the program suitable for playing tournament games. Entering "A" instructs the program to analyse without any time limit, which is useful for analysis and correspondence chess.

The board display is conservative, retaining the black-white convention. The squares are numbered A1 to H8 and moves can be entered by using suitable start and finish co-ordinates (eg, E2E4) or by using more conventional chess notation (ie, Qg5xg3). The letters used for the pieces are straightforward but can even be changed if wished since you are told the necessary memory locations.

All the time the program is analysing moves, these are displayed on the screen. If you get tired of waiting then pressing "B" instructs the computer to move immediately. There are also many other functions which include "CM" (Counter-Move) where the program will print out what moves are anticipated in its own analysis. RM (Remove) where the game is taken one move back. RU (Run) where Logichess moves without a move from you and SW (Switch) where you can change sides. You also have the option of offering a draw (DR) or resigning (RS) and the program also includes an extensive Editor (ED) for setting up the board. A complete list of all moves can be called up at the end of a game.

Logichess is written for Camsoft by Kaare Danielsen and seems to provide an excellent opponent for beginner and expert alike. Our only reservation is that you need a 96K machine to play the game. What about a version for the 48K Lynx? Camsoft, it's your move next!

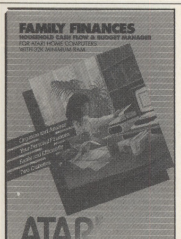


Panik

Computer: 48K and 96K Lynx
Price: £9.90
Supplier: Camsoft, 33A Bridge Street, Cambridge CB2 1UW

The name "Panik" cannot disguise its similarity to other aptly named games on other micros. Its lack of originality however should not bother the Lynx owner unduly since no other similar implementation exists as yet for the Lynx. Panik is another game which makes great use of ladders; perhaps Freud would have had something to say about that if he was still with us.

Anyway, you are trapped in a labyrinth of floors, your only means of escape being interconnecting ladders to other floors. Stallking the corridors are . . . wait for it . . . Horrific Digesting Monsters resembling obese Pac-men. Your only means of defence against these inflated bundles of hot-air are to dig holes in the floor and create traps for them to fall into. Having temporarily trapped the monster, you can make its incarceration permanent by using your pick once



Family Finances

Computer: Atari 400/800 and XLs (32K, disk required)
Price: £29.95
Supplier: Atari (UK) Ltd.

I must admit to never really feeling the need to keep track of my home finances. Perhaps I never have enough of the green stuff to keep track of. What I have had a need for is a program that will allow me to itemise expenses and print out a detailed statement at the end of the year, all nice and neat for my accountant. Family Finances would seem to fulfill that need and more.

To get the numbers out of the way first Family Finances allows you as many as 100 expense entries in 13 categories and 20 income entries in 13 categories. It will record your annual household income and expenses up to a maximum of 999,999.99 dollars (I should be so lucky).

This is an American program, so dollars it is. Perhaps Atari ought to be thinking of altering the program to take account of the XL series ability to print the pound sign. The program itself comes in two parts, Family Cash Flow and Family Budget. Atari has overcome the eternal problem of program and data disk swapping by allowing you to copy the program onto your own disk. This disk is then used as a combined program and data disk.

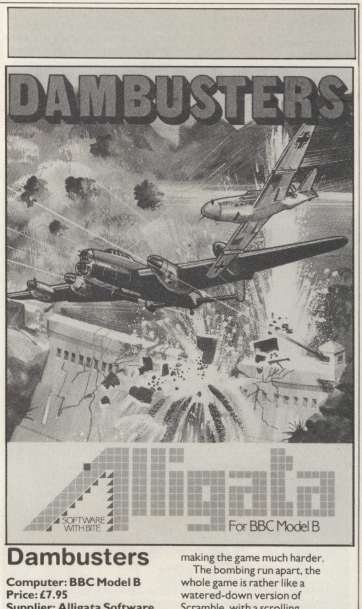
Setting up the disk to your requirements is simplicity itself. The instruction manual is very well written and the program is menu driven and safety checks are enforced where necessary.

The cash flow disk is divided into two parts, Expenses and Income. Both have virtually the same basic menu and functions available from the menu include Reviewing data, entering, changing and deleting data and finally print hardcopy. Each data entry can include the date, description of expense and the cash amount. Using the information gathered the computer can also detail finances by the year or by the month, displaying incomes set against expenses or accumulated totals.

The Family Budget program allows you to set up and maintain a budget using the information entered in the cash flow program. After setting up an initial budget base the program will compare your hypothetical budget with the actual figures and show you where you are under or over-spending. This, if you are dedicated enough to keep to the budget figures, will allow you to allocate certain monies, by the month or by the year to your expense titles.

The cash flow program is excellent but unless you are prepared to go all out the budget program I can see little use for it in a family environment. As both disks are packaged together then you could suck it and see. The program really comes into its own when the owner is self employed and has to keep strict tabs on all his income and expenses for the revenue men.





Dambusters

Computer: BBC Model B
Price: £7.95
Supplier: Alligata Software Ltd, 178 West Street, Sheffield S1 4ET

The theme behind *Dambusters* is the famous Second World War raid on the giant dams of Germany's industrial heart, the Ruhr valley. Your task is to manoeuvre your bomber into position over the scrolling landscape and drop your bomb at exactly the right moment.

As keen students of history will recall, the original attack was carried out with a novel design of bouncing bomb, which skipped over the underwater torpedo nets in the reservoir and struck the lip of the dam. The game reproduces these elements, making it difficult to aim the bomb accurately.

To ease the task you have two sighting devices. A pair of converging searchlights shines on to the surface of the water, so that when the attacking aircraft is at the right altitude the two lights merge into one. Horizontal range from the dam is taken care of by a digital rangefinder — when this reads zero, press the button and a hit is assured. The rangefinder does not appear on some levels, however, making the game much harder.

The bombing run apart, the whole game is rather like a watered-down version of Scramble, with a scrolling landscape, gun emplacements and enemy fighters to dodge or shoot at, and four-way control of the aircraft on the screen. The graphics are rather basic, consisting of various user-defined characters along with a jagged green line representing the ground and a blue line representing the surface of the lake. Another drawback is the awkward control keys (no joystick option) which cannot be reselectable by the player.

We're not sure how long this game will hold the attention of most arcade freaks, as it is fairly easy and our testers were up in the high score table after only a couple of minutes.



again to fill in the hole.

The display makes good use of colour, though using a black and white television is a slight disadvantage since the colour of the monsters indicates your possible score and the number of levels through which the monster must fall before he meets his maker. Red monsters only have to fall through one level, green through two levels whilst black ones have to plummet three levels to be killed. If by accident or design one monster should fall on top of another then both are killed instantly. Unfortunately there is no provision for joysticks.

Digging and filling holes is by using 'D' for Dig and 'F' for Fill, although simultaneously pressing SPACE and L has the same effect as DIG and SPACE and P can be used to FILL. The sound can be muted or restored by pressing the 'S' key, and the game can be halted, to answer the phone or to take tranquillisers by pressing 'H'.

With its lack of joystick provision and the difficulty in remembering the necessary keys to control movement, the game is satisfactory rather than outstanding. The display however provides another fine example to those critics who say that the Lynx is not suitable for fast action games. Anything faster would be more than just a Panik, it would be . . . !



Fruity

Computer: Dragon
Price: POA
Supplier: Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan SA13 2PE.

We do wonder on occasion why some pieces of software are ever published, and who buys them. It might be an interesting and challenging exercise for someone to try to write a program to turn his or her Dragon into a fruit machine, but we can't imagine many people spending several pounds to buy someone else's largely BASIC program.

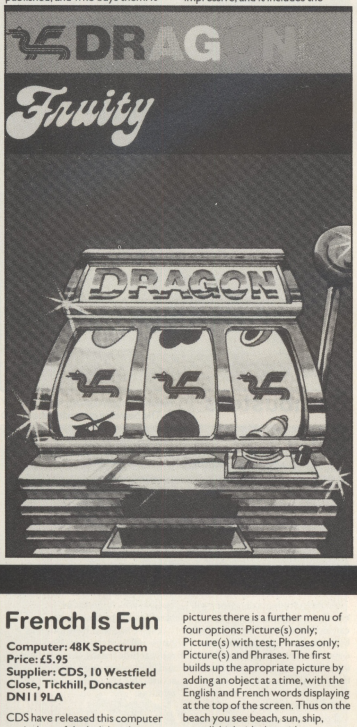
Not that there's anything wrong with the program itself: it's colourful, the graphics are impressive, and it includes the favourite nudge and hold features, but a gambling game where you can't cash in your winnings seems to lack a certain something — maybe it'll appeal to those who always lose, which, come to think of it, must mean everyone.

You begin with 20 credits, optimistically referred to as 10p pieces, and pressing the Space bar sets the wheels in motion. The various winning combinations are all displayed above and to the right of the display window, and include the usual bells, bars, fruit and pound signs, with the added bonus of a few red dragons — get three of those in view for an extra-high 'take'. As we said, these graphics are very well done and spin around most effectively, and even more realistic is the way your credits slowly get whittled away until you're encouraged to keep playing by a little win.

If you win over two credits on a game you can either gamble or collect these, and this applies when you're awarded nudges too. To use the nudges you press the number of the reel that you wish to nudge, and the up or down arrow for the direction in which you wish to nudge it. The reel numbers flash to offer you a hold, occasionally, and to use this you again press the appropriate number key, or the Clear key to cancel a hold.

In the top right-hand corner of the screen there is a Fetures Table, a 3 × 3 block containing the various symbols on the reels. The centre-row symbols are lit up on this, and then cleared or held randomly. You earn extra credits if you happen to get three in a row, but of course these credits are as illusory as all the others and although we enjoyed playing the game for a few minutes, its long-term appeal would appear to be about as limited as your chances of winning on a real fruit machine.







Carnival Massacre

Computer: Atari
Price: £7.95
Supplier: Creative Sparks (Thorn EMI)

It's carnival day and everyone is enjoying themselves on the Ferris wheel and the Big Dipper. Two nasties are out to put a stop to all of this innocent pleasure, namely Butcher Bill and Ruthless Rick. Your name is Super Sam and it is your place in the game to stop the nasties from murdering the happy crowd. Butcher Bill rides high above the Ferris wheels in a cable car. In the car with him is a supply of bombs which he throws down on the hapless citizens on the Ferris wheel. When hit by a bomb they will fall out.

Super Sam is on the ground, underneath the wheel. His job is to catch the people as they fall out of the Ferris wheel. He must also dodge the bombs as they fall. After the wheel has been cleared Sam is armed with a gun and he can shoot

French Is Fun

Computer: 48K Spectrum
Price: £5.95
Supplier: CDS, 10 Westfield Close, Tickhill, Doncaster DN11 9LA

CDS have released this computer equivalent of the holiday phrase-book, with a matching cassette called *German Is Fun*. The opening menu invites you to choose from nine options, these being a house scene, countryside, beach, cafe, street or school scene, an opportunity to run through all the scenes consecutively, or to see sections on numbers and time.

If you elect to have one of the pictures there is a further menu of four options: Picture(s) only; Picture(s) with test; Phrases only; Picture(s) and Phrases. The first builds up the apropriate picture by adding an object at a time, with the English and French words displaying at the top of the screen. Thus on the beach you see beach, sun, ship, seagull, high tide, low tide, windsurfer, beachball, bucket and spade, parasol, windbreak, towel, radio and music (a quick burst of that familiar *chanson*, 'I do like to be beside the seaside'). The graphics are quite good, but some of the words are displayed far too quickly for them to sink in, and the program is not very generous with its instructions. Only by pressing a key do you discover that you can skip through the drawing and words.

The second option allows you to go through the words and be tested on either French into English or English into French, while the third option offers 15 useful phrases in English, with their French translations available by pressing the 'C' key. As regards pronunciation, though, you appear to be on your own, so it helps if you can speak French before you try to learn it with this tape. The fourth option combines the first and third together.

One fault is that some words and objects are displayed without their gender being indicated, and there's a slight contradiction in the numbers section where the French for 90 is given as *quatre-vingt-deux* initially, but as *quatre-vingts-deux* on the revision. With typical English bluntness the sample sentence for requesting food in the cafe is 'I'll have steak and chips.'

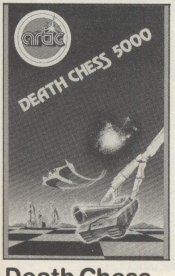
Despite these little quibbles, *French Is Fun* does a reasonably creditable job of giving anyone a small holiday vocabulary, though when you can get a pocket phrase book giving you a hundred times the information at about one fifth of the price, you really have to ask whether this is the most effective way to use your micro.



Bill out of the cable car. In the second screen Bill is assisted by Rick who plants bombs on the roller coaster. Once again you must save the falling punters. The game goes on like this *ad infinitum*. Things do get trickier for Sam and there are little touches on each screen to make things more difficult.

I hate to say it but this one will bore the pants off most people. Its case is not helped by the repetitive music which will drive you crazy after a while. You can, of course, turn the sound down but then you cannot hear the bombs drop.

Nice graphics, good sound if you can stand it but the game and subject matter leave a little to be desired.



Death Chess 5000

Computer: 48K Spectrum
Price: £6.95
Supplier: Artic Computing, Main Street, Brandesburton, Driffield YO25 8RL.

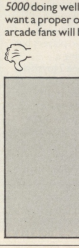
Death Chess 5000 is an exciting-sounding title for a game, and a promising idea: when certain captures take place you go into one of six arcade games before returning to the chess game itself. We can't imagine Grand Masters taking to it, but for your average home micro owner it could provide a bit of fun. Your average home micro owner, though, should also be aware that it's impossible to get a chess program *and* six arcade games into one machine, and this is what lets the software down.

You can elect to play an ordinary chess game at the start, and this offers you seven levels of play with response times ranging from 2 seconds to several minutes. The copyright notice of 1982 also suggests the chess program is taken from an earlier Artic release, with the 'death' element added. The program will recommend a move if you're stuck, and you can also load a previously saved game or arrange the board yourself if you wish.

You can then set options after you've chosen whether to play ordinary or death chess, though one drawback is that you can't go back to switch from one to the other without reloading. While the program seems to play a reasonable game, it obviously can't provide as tough an opponent as one without attempts to add arcade games. The graphics are also a little unclear, with the board only occupying about a quarter of the screen.

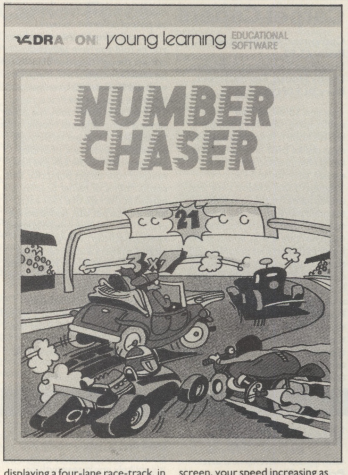
If you elect to go for death chess then the pawns become tanks, with the king, queen and bishops looking like refugees from *Space Invaders*, making it initially confusing to keep track of what's what. Not that you can take this version of chess too seriously, with the constant interruptions and reaching for the joystick every two minutes (you can have keyboard, Kempston or Interface 2 for control).

To describe the games as 'arcade' is stretching a point, as they are all extremely simple and scarcely set any challenges. If one piece captures its opposite number then you get one of five games, according to the pieces, but if a piece takes a different piece then you get the most boring game of all, which is simply you firing up through a wall at an invader firing down at you. Obviously you get this quite a lot, and it becomes tedious in the extreme. Hard to see *Death Chess 5000* doing well — chess lovers will want a proper opponent, and arcade fans will be disappointed.



Number Chaser

Computer: Dragon
Price: POA
Supplier: Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan SA13 2PE



Another in the Dragon Data 'Young Learning' series originating with Applied Systems Knowledge Ltd, and a valuable addition to the educational range as it is a program designed to teach the important but sometimes neglected skill of estimation in numbers, and aimed at children from 4-11; although judging by the difficulty we had with the hardest of the four skill levels that upper limit is fairly open-ended.

To use *Number Chaser*, a child needs to have gone some way towards mastering the multiplication tables, and the program's intention is to develop that skill so that the child has some understanding of the answer he or she is giving (ie, it is one thing to be able to parrot that the answer to five times six is thirty, but for a younger child estimation is important to reinforce where that number comes in the scheme of things: is it nearer to 29 or to 39?). For older children the value changes towards something of more practical use in everyday life: if we've tried to multiply 60 × 29, is the answer likely to be just under 1800, just under 18000, or what? A difference of a factor of ten might seem one that nobody could get wrong, but a surprising number of people do, as any trip abroad with its attempts to convert a foreign currency will tell you.

Number Chaser works by displaying a four-lane race-track, in which you can race a motor cycle, jalopy, stock car or racing car, according to the difficulty level. At the top of the screen a multiplication sum appears, with four possible answers underneath, one above each lane of the track. You must move your vehicle by joystick or keyboard into the lane with the number nearest the sum's answer, and if you're correct you move slightly ahead of the vehicle chasing you, or if incorrect you slip back a little. Slip back too far and there's an almighty crash and a flashing screen, while if you continue to get questions right you inch forward to the top of the screen, your speed increasing as displayed on a speedometer at the bottom, until you reach the top and enter the home straight to cross the finishing line and be greeted by several people running out to clap their hands in congratulations. You're also given a time for completing the course, and a grading for it.

Questions range from 2 × 3 and 5 × 5 on the simplest level, for example, up to 56 × 73 and 55 × 61 on the hardest. A well-designed and useful program, that's also fun to play — worth buying.

Carpet Capers

Computer: 48K Spectrum
Price: £5.95
Supplier: Terminal Software, Derby House, Derby Street, Bury BL9 0NW

Terminal Software is an unfortunate name for a company, but we hope it doesn't predispose us to dislike their products. After being unimpressed with their earlier 'adventures', *Vampire Village* and *Space Island*, their first arcade game for the Spectrum sounded more promising from the cassette cover: nine screens of fast machine code action, sound effects, high-res flicker-free graphics, and so on. The scenario, too, seemed designed to appeal to our sense of humour: you're meant to be laying white carpets at the Manor, and keeping yourself well provided with tea and sandwiches at the same time, though unfortunately your apprentice is a bit on the simple side and insists on tearing the carpets up again, while rival firms are trying to muscle in on the action and lay carpets of different colours.

As well as keyboard control you're told you have a joystick option, though they don't say which joysticks are supported. It worked with our Kempston, however, and we were soon on the first screen, The Hall and Cloakroom, the other screens being different rooms in the Manor, which you get to through connecting doorways, provided you've picked up the key and have reached your target points for that room. Points, or rather pounds, are earned at the rate of £1 for each square of carpet laid, with a bonus of £50 if you can manage to cover a rival carpetfitter. There are also tacks, hammers and cutters lying round the place, which you can also collect, and the tea and food you'll need to keep going.

As you move your character round the screen, the square behind you changes to white, and the first thing you learn is not to carpet yourself into a corner, otherwise you have to wait for your apprentice to get round to removing the carpet that's hemming you in. The game is fun for a while, but we soon became tired of it. The graphics are of the simplest matchstick-man variety, and when you get to later screens where there are several rival carpetfitters also bouncing round the place, it's hard to tell quite what is going on and which particular little matchstick figure you're actually trying to control with the joystick.



World Cup

Computer: 48K Spectrum
Price: £6.95
Supplier: Artic Computing, Main Street, Brandesburton, Driffield YO25 8RL

At first we couldn't decide whether this piece of software was two years early or two years late in appearing, but we looked forward to it anyway, being a graphics representation of a World Cup knockout tournament for between one and nine players. In the first round there are 16 teams competing, so you may find yourself drawn against the computer or a friend, if there are several of you playing. For the solo player, the computer provides an opponent every time as you try to battle your way through to the final — having chosen your team from the 40 names on offer — including such stalwart footballing nations as Iran and Tasmania (don't write in, we know Tasmania isn't a nation).

Control is by the keyboard, which is tricky for two players but not impossible, or using a Kempston or Interface 2 joystick. You can elect to have the music on or off, with off being an appropriate description of the abysmal attempt at reproducing the theme from 'Match of the Day'. Other features include Pause, Abort, and a Practice Mode of one game before you embark on the World Cup proper — your teams being composed of six-a-side.

The most important question, though, is just how good is it? The answer, unfortunately, is 'not very'. We hestitate to say this as there is a great deal of programming skill gone into producing the game, and it's unlikely you'd get anything better out of a Spectrum, but after the joys of the Commodore Soccer cartridge, this does leave a lot to be desired. The ball tends to go ballooning out of play quite a lot, and it's often hard to tell whether it's going away from you or nearer to you because of the perspective. Your control is with the player nearest the ball, and an awkward by-product of that is that sometimes players take throw-ins to themselves, as they are obviously nearest the ball at the time. it's also sometimes very unclear what's going on when two or three players get close together due to the fact that the graphics characters overlap, with players even disappearing completely on occasion. There is also a distinct advantage in the computer's favour, as its players can catch you when running from behind, but your players can't catch the computer's. The half-time break is also much too long, but this gives Artic time to plug their other software.

A group of friends could have a great deal of fun with this game, as long as you don't mind its limitations, but it's Division Two software rather than Division One.

Quack a Jack

Computer: Oric 48K/Atmos
Price: POA
Supplier: Severn Software, 5 School Crescent, Lydney, Gloucester GL15 5TA

Red Jack the famous Pirate Duck needs your help. He is trapped in the palace dungeons and needs you to guide him out and, of course, grab as much money as possible.

The screen display shows the floor of each dungeon you enter. These are, quite naturally, made up of flagstones which, quite unnaturally, crumble as you walk over them thus isolating parts of the dungeon if you are not careful. Once you arrive in a dungeon you have to break a certain number of eggs that appear in random positions by walking over them. Once they have been broken you go to the next level.

Dungeons being the nasty places they are, tend to contain unsavoury characters and these are no exception. Cooking pots are placed randomly on some flagstones — walking over one of these results in Duck Soup! Fortunately cooking pots do not move (until level 13 that is) but chasers do. Each level has a number of these scattered around and they pursue you with increasing speed and accuracy as you move up through the levels. Finally there is money to be found on some of the flagstones and walking over it will give you extra points. As you rush around the dungeon breaking eggs and erasing flagstones you may find yourself trapped by your own trail. If this happens you can sometimes rotate a row of flagstones to create a path to get you out of trouble.

As if all this were not hard enough, if you do not break the eggs within a certain time (a clock ticks away at the top of the screen) they hatch into Terraduckttiles. These have a great liking for duck and cannot be avoided.

There is no limit to the number of screens so the game might seem a little repetitive after a while but the quality of the graphics and sound certainly make it worth buying.

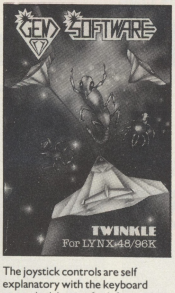
Twinkle

Computer: 48K and 96K Lynx
Price: £7.95
Supplier: Gem Software, The Maltings, Station Road, Sawbridgeworth, Herts

With the almost tranquil title 'Twinkle' you might be forgiven for thinking this was an educational game for the under-fives. Apart from a certain galactic connection, there the similarity ends. Twinkle is a fast action game which would leave the under-fives still sucking their thumbs.

Apparently you have just detected waves of unarmed aliens. Although they have no means of direct attack (which you have), they are heavily shielded and consequently can survive a head on collision which would prove fatal to your craft. There are three different types of challenge, the easiest (!) of which is the straightforward destruction of a wave of aliens. The second is the need to refuel by successfully docking with a moving tanker at the same time as navigating a force field. The third challenge involves the alien ships once again but this time they are even more difficult to destroy.

With this type of game a joystick is an essential requirement. The Lynx equipped with a suitable interface can cope with this and Twinkle has the option of being joystick or keyboard controlled.



The joystick controls are self explanatory with the keyboard controls alaiowing for left or right-hand players. You are given five ships and there are three skill levels. There is also a Hi-Score Table but unfortunately this cannot be saved from game to game.

The presentation of the game is what we have come to expect from Gem Software — excellent. Whilst others have been quick to criticise the Lynx for its faults — slow screen handling etc — Gem has gone out and developed games which not only are outstanding on the Lynx but which dwarf similar games on other micros.



Carrier Force

Computer: All Ataris
Price: £44.95
Supplier: Home Entertainment (Atari) Centre, Birmingham. 021-643 9100

Carrier Force is a major advance in the realm of wargames for the home computer. The price is high but the amount of detail packed into this game is incredible.

Carrier Force takes you to the Pacific in 1942. This was the time that the great Carrier battles were being fought by the Americans and the Japanese. All four of the major battles feature as scenarios in the game. Santa Cruz, Solomons, Coral Sea and Midway can all be recreated down to the finest detail.

All the ships and planes that took part in the engagements are available to the players, even down to the lowly seaplane tenders. The game does not, however, loose any playability. Most of the ships will be grouped into task forces, but if you want to break up a task force then the option is available to you.

You have further options in the game set-up — two player or one player, the computer playing the Japanese. There are four levels of difficulty, a choice of scenario and a historical or random set-up.

The name of the game is to locate the enemy fleets before they can locate you. My nails have been chewed to the quick when the Japanese have located my carrier forces and I am still in the dark, groping around with my seaplanes desperately trying to find theirs. Once located the battle is only just beginning. You must now manage your airborne resources to the full. Each carrier has a limited operations capability and this will vary depending on how close you can sail your task force into the wind. Juggling incoming and outgoing flights can become a full time operation. I have often loaded the decks with a strike only to realise, usually too late, that a flight must land. Losing a dozen planes when they ditch in the ocean is a major blow to your chances. Each aircraft has a limited range, and once again this must be taken into account when flying off an attack group. The result of flying too far is a watery end.

Combat is taken care of by the computer. Each aircraft has a bomber accuracy level and ship strikes will depend on this level. Surface combat between ships can also take place with the same degree of complexity.

Included in the game box are full rules and two plastic covered maps with which you can keep track of the action. Games can be saved and resumed later. This is an essential feature as games can take anything from four to ten hours to complete.

A complex but satisfying simulation for all fans of wargames. The number of strategy options open to players is immense and it will take many hours of play before you explore them all.



Olympic Skier

Computer: Commodore 64
Price: £5.99
Supplier: Mr Chip, 9 Caroline Road, Llandudno, Gwynedd LL30 3BL.

Here at *Which Micro*, there are two kinds of people, the skiing nuts and those who wouldn't go within a hundred yards of the *piste*. The former category spends the whole year waxing lyrical about their last skiing holiday and their next skiing holiday, so you can imagine the interest caused by this new game.

Fortunately for Mr. Chip, your hyper-critical office experts were greatly impressed, and even some of the non-skiers could be seen having a go.

You control the skier using either the keyboard or the joystick (joystick is easier), as he jinks down the slalom course turning between the flags and avoiding the obstacles. Up and down movement of the stick controls the speed of the skier, but even travelling as slowly as possible it is a real challenge to complete the slalom successfully.

Scoring is on a timed basis, but accuracy must come first as there are severe penalties for missing turns, and you are disqualified if you miss more than three.

After the slalom comes the ski jump. This is perhaps the trickiest event, as only a perfect landing allows your jump to gain points. You have to press the fire button frantically to gain speed as you slide down the take-off ramp. and then manoeuvre yourself into the right attitude for a perfect landing.

The third and final event is the downhill. This time there are no pairs of flags to manoeuvre between, but piles of logs block the way and you have to jump over them to stay in the running.

Throughout the game the graphics are first-rate, and the sound effects are as good as only the Commodore 64 can make them. A rich vein of humour runs through the game, and this is one of the elements which makes it unusually compulsive. For example, every time you hit an obstacle, a helicopter whirrs overhead and picks you up on a stretcher.

One of the most addictive games available for the 64, this should find its way on to the shelves of every Commodore fan.







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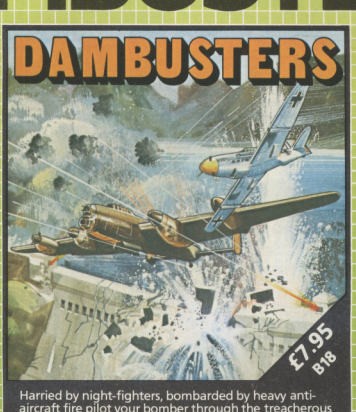

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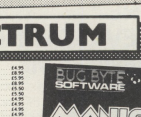



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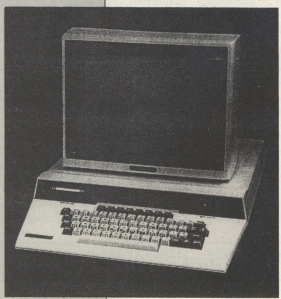


Price: **£499**
Use: **Home/office**
Colour: **Yes**
Interface: **RS232, Centronics and others**
Supplier: **Tatung, Bridgnorth, Shropshire WV15 6BQ.**

The Einstein is another entrant to the growing 'professional computing' market. It is aimed between conventional home computers and small business machines, by offering the features required for serious use of a computer system.

For your £499 you get a Z80 based micro with 64K of user RAM, a separate 16K screen display and an 8K ROM chip. One 250K (unformatted) three inch disk drive is supplied as standard — one peculiarity of the three inch format is that the other side of the disk can be used for storage, purely by flipping it over. This effectively halves the number of disks you will need to buy. Even adding a second drive and Tatung's £240 TM-01 monitor does not raise the cost over £1000.

The hardware specification of the Einstein is very conservative, but this could well be seen as an advantage when more sophisticated designs have recently been noteworthy for development and delivery problems. The Z80A central processor, the Texas Instruments video processor and the GI sound chip are all well known — indeed, the specification is generally similar to that of the MSX machines soon to appear.

A useful side benefit from the use of a Z80 processor is the potential for running the CP/M operating system.

Tatung has not followed in Amstrad's footsteps by licensing CP/M directly, but the proprietary operating system, Tatung/Crystal DOS, is claimed to provide an environment in which CP/M programs can run. It is not yet clear whether Tatung intends to provide the 80 × 24 character screen display normally required for CP/M software, or whether the software will have to be adapted to suit the machine's standard 40 × 24 or 32 × 24 displays.

RADIONIC CNS

Price: **£200**
Use: **Home**
RAM: **16K**
Colour: **No**
Language: **BASIC**
Interface: **Centronics + own**
Supplier: **Radionic Microsystems Ltd Avondale Workshops Woodland Way Kingswood, Bristol.**

One of the applications many people would like to tackle with their home micros is controlling and monitoring various environmental aspects of their homes. This normally requires a high degree of electronic knowledge to handle the interfacing of the computer to (say) a light switch — the potential hazards of messing about with mains electricity are obvious.

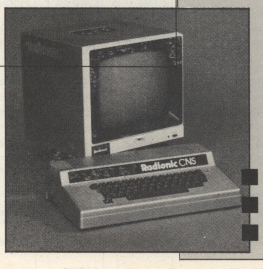
The Radionics CNS, however, goes a long way towards making this kind of application safe and simple enough for most reasonably intelligent enthusiasts to have a go.

From the point of view of the existing computer enthusiast, the CNS may seem a little crude. It is a Z80 machine running the Tandy level II variant of Microsoft BASIC, and all the old Tandy programs will run. This means a reasonable amount of games and utility software is available, though the low-resolution monochrome display now looks rather dated.

Where the CNS comes into its own, however, is as a computer for controlling external devices. The essentials are all there — a Centronics printer interface so that you can get a hard copy of whatever the computer has been doing, a set of ten control ports which can receive impulses and send them back in response, and a real-time clock which lets you time the computer's actions precisely. The number of control ports can be expanded to 22 internally or 25 using an expansion interface.

One of the most insidious problems facing a computer which is expected to run non-stop for several weeks at a time is the risk of overheating. Radionics claims to have overcome this with a large heat-sink connected to the metal case of the machine.

The documentation includes details of several projects, and if you are unsure of your soldering abilities, Radionics will sell you the circuitry ready-made. Similarly, if you don't want to type in the program listings, the control software can be supplied on cassette.



Machine	List price	Typical price	Use	RAM	ROM	Interface	Max no cols on screen at one time	Max cols
Amstrad	£329 col £229 green	£329 £229	Home/bus	64K	32K	Parallel	27	27
Aquarius	£49	£49	Home	4K	8K	Own		
Atari 600XL	£160	£160	Home	16K	24K	RS-232C	128	256
Atari 800XL	£250	£250	Home	64K	24K	RS-232C	128	256
Acorn Electron	£199	£199	Home/education	32K	32K	Own (plus 1)	Full colour TV	
BBC Model A	£330	£330	Home/education	16K	32K	RS-23 & centronic	Full colour TV	8
BBC Model B	£399	£399	Home/education	32K	32K	RS-423	Full colour TV	
CGL M5	£150	£150	Home	20K	16K	Own	16	
Colour Genie		£168	Home	32K	16K	RS-232C		
Commodore 64	£229	£199	Home/business	64K	20K	RS-232C	16	16
Commodore Vic 20	£140	£140*	Home	5K	8K	Own	8	8
Dragon 32	£169	£140	Home	32K	16K	Parallel	8	8
Dragon 64	£229	£175	Home	64K	16K	Parallel & RS-232	8	8
Lynx 48K	£225	£199	Home	48K	16K	Serial	8	8
Lynx 96K		£299	Home	96K	20K	Serial*	8	8
Memotech MTX500	£315	£275	Home	32K	32K	Parallel	16	16
Oric 1 16K		£80	Home	16K	16K	Parallel cassette		8
Oric 1 48K		£140	Home	48K	16K	Parallel		
Oric Atmos	£170	£170	Home	48K	16K	Centronics exp port, Hi-Fi RGB Monitor UHF TV cassette		8
Sharp MZ700	£250	£240	Home/business	64K	4K	Own		8 ful 8 ba
Sinclair QL	£399		Home/business	128K	32k cartridge	RS-232C		(4
Sinclair Spectrum 16K	£100	£100	Home	16K	16K	Own		(8
Sinclair Spectrum 48K	£130	£130	Home	48K	16K	Own		
Spectravideo SV318	£186	£186**	Home	16K	32K	Own	16	16
Tandy MC10	£69.95	£69.95	Home	4K exp 20K	32K	RS-232C	8	8
TRS-80 Colour 16K	£160	£140	Home	16K	32K	RS-232C	8	8
TRS-80 Colour 32K	£250	£200	Home	32K	32K	RS-232C	8	8
Sinclair ZX81		£45***	Home	1K	8K	Own		

** with starter pack **cassette £39 ***special offer "starter pack" includes 16K*

no cols reen at ime	Max no cols	Max text display	Max graph resolution	Languages supplied	Sound channels	On board speaker?	Operating system	Supplier
	27	80	200× 640	BASIC				Amstrad
				BASIC	3	Yes	BASIC	0277 228888
	256	40 × 24	320 × 192	BASIC	4	Yes	BASIC	Atari 01 900 0511 Atari Helpline 0753-24561
	256	40 × 24	320 × 192	BASIC	4	Yes	BASIC	Atari 01 900 0511
olour		40 × 25		BASIC	1	Yes	BASIC	Acorn Computers 0223 210111
olour	8	40 × 25* mode 6	320 × 256	BASIC	2	Yes	BASIC	Acorn Computers 0223 210111
olour		40 × 25*	640 × 256	BASIC	2	Yes	BASIC	Acorn Computers 0223 210111
		32 × 24	256 × 192	BASIC	3		BASIC	Computer Games 01-508 5600
	16	40 × 25	520 × 300	BASIC	3	Yes	BASIC	Commodore 0753 79292
	8	33 × 23	500 × 220	BASIC	3	Yes	BASIC	Commodore 0753 79292
	8	32 × 16	256 × 192	BASIC	TV		Microsoft BASIC	Dragon Data 0656 744700
	8	32 × 16	256 × 192	BASIC	TV		Microsoft BASIC	Dragon Data 0656 744700
	8	40 × 24	256 × 252	BASIC	1	Yes	Lynx	Camputers 0223 315063
	8	40 × 24	256 × 252	BASIC	1	Yes	BASIC	Camputers 0223 315063
	16	28 × 40	256 × 191	BASIC	3	No	BASIC	Memotech 0993 2977
	8	28 × 40	200 × 240	BASIC				
				BASIC				
	8	40 × 28	240 × 200	BASIC		Yes		Oric Products International 0990 27641
	8 full col 8 backgrnd	40 × 25	80 × 50	SuperBASIC	1	Yes	BASIC	Sharp 061 295 2333
	4	85 × 25	512 × 256 256 × 256	BASIC		Yes	QDOS	Sinclair Research 0276 685311
	8			BASIC				Sinclair Research 0276 685311
				BASIC				Sinclair Research 0276 685311
	16	16 × 32	256 × 192	BASIC	3			Spectravideo 01-330 0101
	8	16 × 32	256 × 192	BASIC	1			Tandy 0922 648181
	8	16 × 32	256 × 192	BASIC	1			Tandy 0922 648181
	8	16 × 32	256 × 192	BASIC	1			Tandy 0922 648181
				BASIC				Sinclair Research 0276 685311

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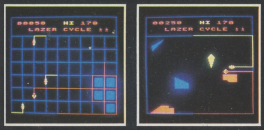

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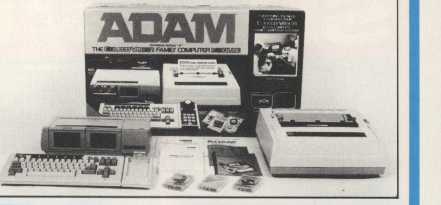

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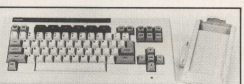

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COMPATIBILITY WITH COLECOVISION: By using high speed interactive microprocessors in each of the modules, the Coleco Adam is designed to take additional advantage of both the 32K ROM and 16K RAM memory capability in the Colecovision. If you do not already own a Colecovision Console (£199 inc VAT), then you will need to purchase this when you initially purchase your Adam Computer package (£499 inc VAT), making a total purchase price of £598 inc VAT).

WHAT IS COLECOVISION: Colecovision is one of the worlds most powerful video game systems, capable of displaying arcade quality colour graphics of incredible quality on a standard Colour TV set. The console (see picture bottom left) accepts 24K ROM cartridges such as Turbo and Zaxxon and is supplied with the popular Donkey Kong cartridge and a pair of joystick controllers. Colecovision has a range of licenced arcade hits available such as: Gorf, Carnival, Cosmic Avenger, Mouse Trap, Ladybug, Venture, Smurf, Pepper II, Space Panic, Looping, Space Fury, Mr Do, Time Pilot, Wizard of Wor and many others. So there you have it, Adam plus Colecovision the unbeatable combination. Send the coupon below for your FREE copy of our 12 page Colour brochure giving details on the complete Adam system.

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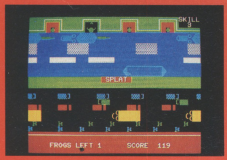

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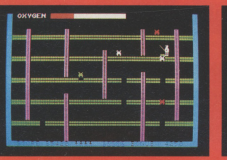

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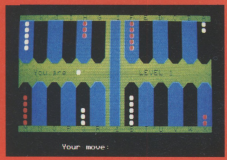

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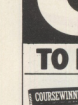

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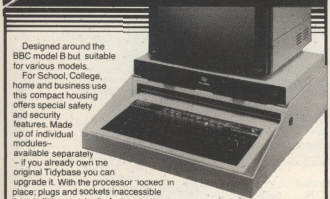

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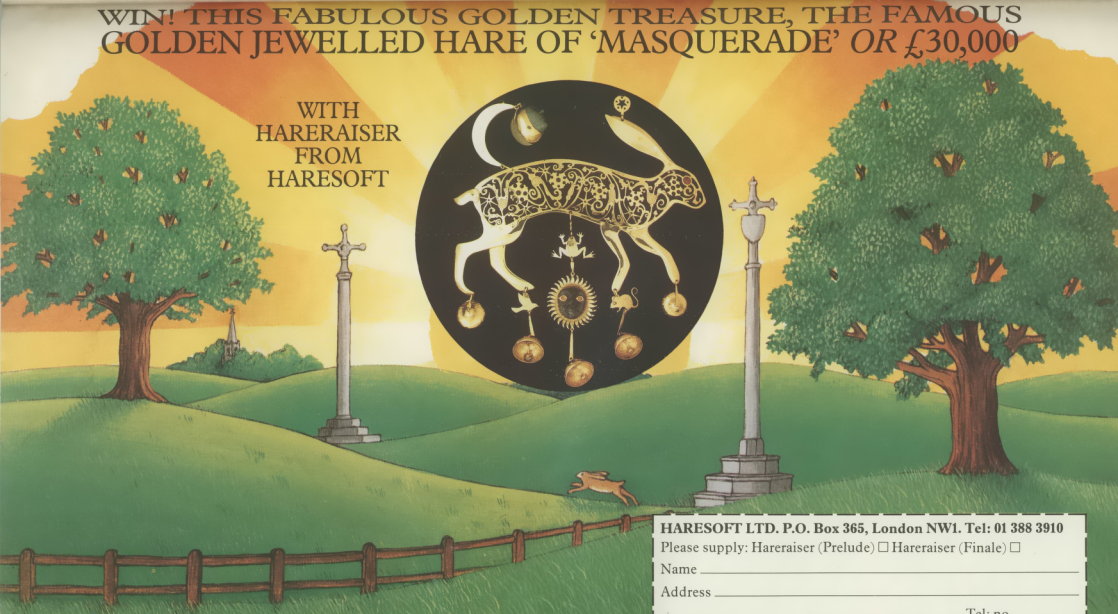

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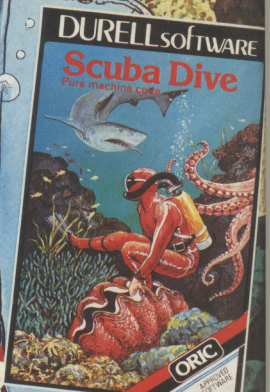

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