

Commodore **HORIZONS**

The independent Commodore magazine

75p May 1984

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GAMES AND BUSINESS DISKS UNDER REVIEW**

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Commodore Horizons welcomes readers' contributions — either articles or program listings. Articles should be typed double-spaced with a wide margin. Programs should, whenever possible, be printed out on plain white paper, accompanied by a cassette. We cannot guarantee to return every article or program submitted, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.



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EDITORIAL

ONE OF THE few known jokes about computer giant IBM concerns its initials. Take a step back in the alphabet for each one and you get HAL, the name of the computer which rose to fame in the film "2001 — A Space Odyssey". For the rest it's pretty much a story of grey suited men in white shirts with monster marketing cloth — so imaginative that at first they weren't even sure there was a market for computers.

But funny things keep happening on the way to the computer market. Just when IBM moves into the US home computer industry, Commodore decides to take a ride on some other talk the plane has left hanging on elsewhere. The name of this particular game is plug compatible manufacturing — if you can't beat IBM you join it by building compatible machines. And now Commodore too is plugging in, by signing a deal with the Canadian manufacturer of the IBM-compatible portable machines.

The idea of breaking with tradition seemed to appeal to Commodore. This announcement was followed by news of a semiconductor deal with Intel. Now Commodore has long prided itself on vertical integration, to use another piece of industry jargon. In this instance it means that Commodore makes its own chips, and so can't get burned by outside supply problems. But now it's going to start manufacturing an Intel chip — and surprise, surprise it's the Intel 8088 as used in the IBM PC and assorted look-alikes.

Sitting on this side of the Atlantic all this activity looks a bit bewildering. A new range of micros (including the 386) is announced in Las Vegas, long time boss Jack Trammell rides off into the sunset, senior executives resign, and suddenly the US papers are writing about the possibility of Commodore producing 16-bit IBM compatible machines. Meanwhile up in Northamptonshire, where all those Vics and 64s are meant to come from (you remember the Vics and 64s, don't you — they're the machines you can actually buy), the advance factory is swinging along, but the permanent plant is still being built.

It begins to sound like an army marching out of step. Or maybe it's just a case of the US vainguard being way ahead of the rear. And the side's certainly getting tougher as the back. Dragon Data is launching a startup pack to rival the Vic's, the MSX-standard micros are beginning to arrive and Samurot/Elan/Plan is set to launch its machines under some name (or another). When that permanent factory does get to the front-line it's going to face a hard fight. And what of the vainguard? Are the vainguarders really going to try a player movement, launching 8-bit micros on the one hand and 16-bit IBM clones on the other? It certainly looks as though Commodore wants to have a range of weapons to choose from for the fray.

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China crisis

WE WERE sorry to read your review of China Miner (March edition). Your reviewer must be Billy White with no ear for music, as he only likes say fast about-sing-games. True, the game might not be original, but there is no way it is written in Basic. Your reviewer was right about reaching for the volume control, though — we turned it up! The sound is by far the best we have ever heard on a 64.

We would recommend China Miner to anyone with a 64 — sorry Mike, we can't all be right!
Robert Fedral and
Andy Jones
Petersen
C1901

BEST TO SEE the recent straight, China Miner by Interspace is written in machine code — Peter Goward's comment about Basic won't mean to be taken literally. Perhaps PGM's reviewers are quicker than those of the average human being!

Altered states 2

WITH REFERENCE to the letter in April's *Amateur Back* on converting a CBM 64 bought in England to work in the USA, I thought you might be interested to know how I converted my American 64 to work over here.

In the Programmer's Reference Guide you will find a section on the chip U31. This has an associated crystal, which I changed from the American 1.1943 standard to the British PAL standard.

Next find the chip U30, which is near the Vic chip under a metal screen. Find the mark of jumper next to it and cut it. Then connect U3 to E1. This acts as a voltage selector.

Lastly, replace the original Vic chip with one designed for use in this country, available from CBM. The

composite video and audio signals can be tested through an external RF modulator (as with an American television).
Andrew Newsholm
Chesham
London

Chart toppers

COMMODORE HORRORSTORIES is fields ahead compared to other magazines, but you are sadly lacking in two areas.

Firstly, would it be possible to have a monthly chart for the best selling software for all Commodore computers?

Secondly, have about ratings for new software releases every month, based on the use of graphics, playability, value for money and so on, with all games being given a percentage rating?
Alan A. Economich
Manchester
Cheshire

WHAT do other readers think of Ben's ideas?

Disk drive drawback

I HAVE recently bought a 64 and 1541 disk drive. However, as you are probably aware, of the small amount of software available about 90% is on cassette.

Assuming I can borrow a tape deck, is there a method of copying from cassette to disk — or would this be considered illegal and therefore prosecuted against? If a can't be done, it certainly makes the disk, at least at the present, not nearly as useful as it is implied.

Apart from this, the three programs I have so far located on disk were too near the 400 mark — I could buy a tape deck for not much more!

How about an article on disk-based databases, or even some explanations of the Programmer's Reference Guide — some of the chapters are pretty tough going!
Andrew Davis
New
London

COPYING from tape to disk is illegal, and is usually prosecuted against. This doesn't mean it can't be done — but despite the mass enquiries we've had, we wouldn't be

too popular with the software houses if we told you how to go about it!

Prime ham

DO YOU INTEND to publish any articles on the use of Commodore computers with the value analyzer in mind? As a former "Wim" I would dearly love to justify the expense of my 64 and disk drive as part of my hobby. I've attempted to write a few relevant programs, but CBM Basic is a little different to the Sinclair Basic I'm used to, and the language barrier still has to be conquered — but all in good time!
Steven Stubbly
Sudbury
Suffolk

Sales patter

HAVING recently bought a 64 and C2N cassette unit, the most frustrating problem I had was that games cassettes refused to load.

Finally I met a very helpful salesman in the Microshop in Thurford, who explained that to set up all the cassette units he sells uses an emulational, and can often readily fault in the single moment.

With the bit and you'll see a small cylindrical screw next to the play head. Adjusting this changes the alignment of the head. A counter turn is one direction or the other should enable you to load tapes normally. My husband found that the first adjustment he made put it right, and every tape has loaded perfectly since.
Cynthia Doney
Bendon
Suffolk

Repeat repeat

I WAS interested to see in the March issue Mark Sizer's program to produce key repeats on the CBM 64.

I found that it would not run on my Vic 20, so I examined the structure of the machine language program in relation to the Vic memory map. This quickly revealed the

structure of the program, which uses the 180 hardware interrupt to repeatedly interrupt the repeat program while any main program bring run on the computer.

Those parts of the Vic and 64 memory maps concerned with the program seem identical. It seemed likely that the reason for the program not running on the Vic was a difference in keypoint values. On the Vic, F1 has the value 39, whereas the program looks for a value of 4. F3 has the value 47, whereas the program looks for 5.

So on the Basic program I simply changed the value 4 in line 180 to 39, and the value 5 in line 148 to 47. The program then runs perfectly on the Vic!
Peter Nichol
Suffolk

Quality products

FIRST, THE compliments — you seem to have got it right. Fixing of open-date news, software reviews, and even the listings are readable.

I endorse your campaign to persuade more software houses to support Commodore machines, providing quality does not replace quantity.

I would rather buy a few original games that hold my interest, than lots of poor quality games that end up gathering dust on the shelf.

I would also like to see some articles devoted to new and strategy games like *Business Front*, for the Atari range.

As for "Club Hall Nook", it keeps me laughing. A prize should be given, not for solving the competition, but for finding the bug!

Finally, my wife would like to pass on the following tip to all those never trying to get mid-eyed, unsharpened Vic 20 owners to look POKÉ!
07155,205
E. A. Cross
Newport
Gwent

This is the chance to air your views — send your tips, complaints and compliments to Letters Page, Commodore Horizons, 13-15 Little Newport Street, London WC2N 6LD

Serious side of clubs

Chris Jenkins visits a North London group with an intellectual approach

THERE ARE computer clubs which seem to exist purely to play games, and there are clubs which explore some of the more challenging areas of micro usage. The North London group is one of those which encourages the more intellectual approach — many of the members are professionals in the computer field, and whenever problems a member might face, there's probably an expert in the field available to help.

The Commodore group developed from the North London Computer Hobby Club, which has been around for about five years. Though there is still a hard core of PCs over, the group is turning more and more towards the 64.

The group uses the facilities of the Ilford Community Computer Centre, which is financed by the local council and chamber of commerce. There are sub-groups for business users and the "Sodderington brigade", and the Commodore Users' branch meets every second Tuesday.

Applications

Although the group is not an affiliate of the Independent Commodore Products Users' Group (ICPUG), it's a fertile field for scouting — our technical expert Jack Cohen is a member of the group, and the Membership Secretary of ICPUG.

Group organizer Harry Miles is a senior lecturer in the Department of Business Studies, and an occasional contributor to a number of computer magazines. He explained that although the group would do nothing to discourage enthusiasts whose main interest was in games playing, most members are interested in serious hardware and software applications.

Paul Jay, programmer of Commodore's Fast Action game and a forthcoming art program, is a member. Harry Brownhall, an machine code programmer, is another. He's secretary in the group for his work on Hydris/Packard programmable calculators — apparently he spent so much time on one machine that he wore out several transport cases!

Each member has found an application for the Commodore computers,

which usually goes beyond what the manufacturer intended. A useful source of help and information is John Collins, who was a member of the group even before he became special software projects manager for Commodore. He is often able to provide information on new developments, and acts as an unofficial liaison between ICPUG committee members and Commodore.

The development of a co-operative attitude between ICPUG and CBM is fairly recent in origin, but it's a mutually helpful relationship which the computer clubs exemplify.

Mike Rigold is the club member who largely takes on the role of spokesman. There's a wide range of equipment to maintain — three PCs, two 3040 double disk drives, a 3022 printer, a Vc 30 and 64, not to mention a selection of non-Commodore equipment including Epson, Apple, BBC, Acorn and Zenith machines.

Mike's work for hardware firm Minisport includes the development of boards to provide 80 column displays on the PC, and valuable in-line display boards for the 64.

Roger Deppananti, by profession a chef, demonstrated his program Screen Calc, which runs on the PC and 64. It's a user-friendly menu-driven calculation program, which will cope with fairly complex formula-based calculations in fields such as investment and loans. As a bonus it will perform mathematical calculations and hex/dec conversions. Since the base formula is user-definable, any series of calculations can be programmed to the user's requirements.

In comparison to commercially available programs such as VisiCalc, Screen Calc might be less powerful, but it's certainly easier to use, since all options are continuously displayed on the screen and there's rarely any need to refer to the manual. Roger doesn't use the program for business purposes, though he does use his home computer to print out menus — for meals, that is!

Obviously the North London group includes members with wide ranging interests and backgrounds. The meetings are informal, and most often than not

allow for a local handyman since the latest piece of hardware or software has been directed.

Course of invention on this night was a disk-based voice synthesis program for the 64. Produced by Francis of California, the system uses no additional hardware, and can synthesise a wide range of voice types, by altering the pitch and filter settings of the SID chip. Examples include a little old lady — not very convincing — and an extraterrestrial — perhaps more believable.

The group spent some time experimenting with the system, referring to the handbook only when things became hopelessly confused. The overall verdict on the program was negative — few members were impressed with the quality of the speech synthesis, comparing it with Commodore's own Magic Voice system.

Back-up

With this out of the way, talk turned to the use and abuse of computer systems generally. One member recounted his experience with a company who relied to heavily on their computer that they destroyed credit transaction records when they were compromised, only to find that after a major thunderstorm all their records were wiped clean — a good argument for back-up systems!

Another member, a pharmacist by trade, explained how National Health Service plans to computerise prescription records were being implemented so badly that it takes much longer to use the computer system than it does to use the old-fashioned card index.

Commodore's John Collins had some interesting news about the forthcoming Computer database system, and then discussed the new CBM computers. Understandably the club members are itching to get their hands on the 264, and installing instances of more hardware to come served to when they appear further.

For information on the North London group, contact Harry Miles at the Business Studies Department, Polytechnic of North London, Holloway Road, London N7. ■



Group members studying the latest software

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How to enter: Leaflets with full details of the Challenge and the entry forms are available at Commodore dealers, Commodore User Clubs, most major retail computer shops and in stores with a

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Scope
debuts

Scope, the games design language developed by ISP, is now available for the Commodore 64.

Since our news story in the March edition, the program has been extensively revised, making into a more sophisticated experience gained on the Spectrum version.

Scope adds 48 commands to the 64's version of Microsoft Basic, which deal with sound and graphics in such a way that the writing of original games — not based on any pre-programmed pattern — becomes much more straightforward.

ISP marketing manager Graham Lomas explained that with a limited understanding of Basic, you can use Scope to write games in one tenth of the time you would need if working without it.

"The real breakthrough is that the program you write is then compiled in 100% machine code. The commands themselves are all clearly explained in the manual, and to give you an idea how much time you can save, a simple sound routine using one Scope command plus a pitch amount would take nine separate pages in Microsoft Basic."

Scope users will be able to join a team club with a help hotline, and ISP is negotiating with several large software houses for the rights to use Scope in games designs.

Programmer Allen Proffitt said "We want to make it clear that Scope is a powerful utility with great potential, and ISP will support users of Scope as far as possible.

"Should anyone wish to release a game written with Scope, we will provide any technical help necessary, and as it will obviously reflect well on ISP, we wouldn't be insisting on having publishing rights."

A range of ISP programs in the graphics and programming field will follow over the next few months, and distribution will be through all major software retailers.

COMMODORE is to launch two graphic art packages backed by an international computer art competition.

The contest, launched on March 1st, offers prizes worth a total of more than £150,000.

Top prize is each of the four main time countries — Britain, Germany, the USA and Canada — is a £5,000 endorsement to study computer graphics at an educational establishment of the winner's choice. There are also equipment prizes.

Entries must be generated on the 64 or Vic 20, and can

be a still picture or a dynamic routine of up to 60 seconds duration.

There are three age groups, and sub-sections for abstract or realistic art.

By happy coincidence Commodore is about to launch two art software packages.

The first, 'Ralf Harris' Computer Art, will be available on cassette for less than £30, and also on disk. It's a low-res 'building-block' type program, in which the various graphic characters of the 64 can be placed on the screen under

joystick control, and a wide range of colour effects created from a menu.

Written by "Face Asker" under Paul Jay, the program is expected to appeal largely to younger users.

For the more advanced artist, Tony Hart's Art Master is a 64-res program written by Dave Holden. Again, it's more driven using a joystick and keys, but in this program the full 64-res capability of the 64 is used. Lines, points, boxes, arcs and circles can be drawn, and the full range of colours used to create highly detailed works of art.

Add-on
market
grows

ECONOMY is the key word for several newly-released IBM compatible peripherals.

Seiko's printers, distributed by DDC Business Systems, now include a 64/Vic 20 compatible dot matrix model at the reduced price of £175 + VAT.

The GP1000VC is an 80 column device working at 80 cps, taking a paper width up to 18 inches with tractor feed. The Commodore character set and graphics are fully supported, although there are no true decoders.

Because the interface is serial, the printer is directly compatible with C.B.M. machines. The bad news is that you'll have to move fast to get the GP1000VC — IBM is so discontinuing distribution of the machine soon, but there are still stocks in major retailers.

Even cheaper is the Softec Alphacom system, at £79.99. The Alphacom II printer was originally designed for use with Sinclair computers, and



Philips' new 17-inch monitor, the 1700 — Vic and 64 compatible.

prints on plain 11 cm paper rolls with 64 columns of print at 80 cps. Print can be blue or black, and the full character/graphics set is supported via the special interface.

There's a word processing program available for the Vic 20 at £5.95, with a 64 version to come. Contact Softec at 27 Wheaton Road, Bournemouth; phone (0102) 423029.

Electronic giant Philips has released a 12 inch monochrome monitor, priced around £78.00. The 1700 is compatible with the 64 and Vic 20, and has a green screen tint. Special circuitry minimises distortion, and there's a speaker for sound output.

The unit will be available through high street electrical retailers.

There's a modem from GEM, the Telemat 2V25. Fossil and Microsoft can be accessed through the modem, which costs around £84. GEM provides an appropriate hardware interface for the 64, though there's an extra charge of between £15 and £30 for various communications software packages.

The modem operates at 1200/1200 baud (full duplex). For further information contact GEM at North Point, Gifford Industrial Estate, Penrith, Cumbria; phone (0768) 96748.

64

hardware

These include MSX and Osborne MSX2 computers. It is estimated that the system lines a further \$100 million. In fact, the MSX2 line is expected to be the most successful. In fact, the MSX2 line is expected to be the most successful. In fact, the MSX2 line is expected to be the most successful.

Product	Company	Model	RAM Price	Other Notes
MSX200	MSX	MSX200	\$199	MSX200
MSX201	MSX	MSX201	\$299	MSX201
MSX202	MSX	MSX202	\$399	MSX202
MSX203	MSX	MSX203	\$499	MSX203
MSX204	MSX	MSX204	\$599	MSX204
MSX205	MSX	MSX205	\$699	MSX205
MSX206	MSX	MSX206	\$799	MSX206
MSX207	MSX	MSX207	\$899	MSX207
MSX208	MSX	MSX208	\$999	MSX208
MSX209	MSX	MSX209	\$1099	MSX209
MSX210	MSX	MSX210	\$1199	MSX210

software selection

There are three main methods of finding a software package. The first is to visit a computer store and browse through the shelves. The second is to use a computer magazine. The third is to use a computer directory. Each method has its own advantages and disadvantages.

WORD PROCESSING

WORD PROCESSING is the most popular software category. It includes word processing, spelling, and grammar. There are many word processing packages available, each with its own features and price range.

UTILITIES

UTILITIES are software packages that perform specific tasks. They include file management, disk management, and system utilities. These packages are essential for any computer user.

DATABASES/DATABASES

DATABASES/DATABASES are software packages that store and retrieve information. They are used for a wide range of applications, from personal databases to large corporate databases.

There are many software packages available, each with its own features and price range. It is important to choose a package that meets your needs and fits your budget.

There are many software packages available, each with its own features and price range. It is important to choose a package that meets your needs and fits your budget.

FINANCE & BUSINESS

FINANCE & BUSINESS software packages are used for financial management, accounting, and business operations. They help businesses manage their finances and improve their efficiency.

RECREATIONAL

RECREATIONAL software packages are used for entertainment and leisure activities. They include games, puzzles, and educational software.

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Cartridge networks

PLANS FOR networks routing cartridge-based software are beginning to emerge.

The idea is to set up "reading machines" in large retailers. The customer buys a blank cartridge and pays a connection fee, and the software of his choice is downloaded from a master computer. When you're tired of the game you can wipe the cartridge and fill it with a new program, or buy another cartridge.

Prime Software Products is setting up a network called Romex, based on the IBM PC/XT which can store up to 288 master programs. Initially, 40 Romex machines will be operating.

An alternative system is reported to be Commax,

backed by Atari founder Nolan Bushnell. This system is claimed to be more suitable for the transmission of business software as well as games, but initial plans are said to use a modified Cartridge games system to dump software to the IBM, Sinclair and CRM machines.

Prime's Paul Deffy says that charges to retailers would be on a sliding scale, with fees set over a certain figure.

"The 7.6 minute downloading routine will be automatically carried out by the main system overnight. Therefore the terminal stands alone. Once the full system is operating, it will give credibility to the software charts, and give retailers an opportunity to sell software without storage and cashflow problems."



Howard Stannard, general manager of Commodore UK, pictured inside the Kirkby site of C&M's new microcomputer factory. Phase one of the Carby project involves a 50 million investment, and up to 2,000 jobs will be created in the next year. The factory will assemble the Vic 64, and new models.

Games strike back

THE RANGE of games software for the Vic and 64 continues to expand, with several releases from companies new to the CRM machines, as well as offerings from already established firms.

Atarg has released Space Pilot, a version of the arcade favourite Time Pilot, in which you control a fighter craft through five time periods, battling against enemies of increasing ferocity. Galaxia, also for the 64, is a version of Galaxian, with a hundred different screens of action. Each game costs £7.95.

All Atarg games for the 64 are now recorded using Turbo, a Commodore-developed fast-loading routine which means that tape games will load at disk speeds.

Atarg has also released Range and Star Defender for the Vic with MK expansion, at £7.95.

Imagine striking back with Pedro, featuring Mike Glover's imported routine, which allows 28K to be loaded in two minutes.

In Pedro, an abtigue 3D screen shows Pedro the panderer trying to plant seeds in the face of attack from ants, donkeys and other intruders.

Pedro costs £3.95, and comes with a new style insert card which includes screen shots.

From Audiogenic comes a new range of disk-based games, some of which are reviewed elsewhere in this issue. Forbidden Forest, Shaky, Francis Freddie, Arco

Challenge and Pappas total at £12.95.

Thorn-EMI is to return to the games software field with a range of 64 and Vic games, some of which have been seen previously on cartridge. Titles include Submarine Commander, Mine Masters and Computer War for the Vic.

Loading off for the 64 are Slings, a cast character game, and Black Hawk, a combined arcade/strategy flying game featuring advanced graphics.

Thorn's cassette will cost £3.95, and cartridge £9.95. Altrian Data Services, which has produced 30 programs for Atari machines, is now busy transferring them to the Commodore computers. Alley-Oops is a mixture of bowling and Space Invaders for the 64, costing £7.95.

For the 64 and Vic with MK, there's a one-player version of Bridge, again at £7.95. Altrian promises a graphic adventure, Gonzo-Joys, and several educational programs soon.

Pinksoft has released The Hive, for the 64, a football management simulation featuring 13 screens. The package includes a free game save tape, since The Hive is said to be too complex to play in one sitting.

Leads, relative new-comer Mopel launches nine new games, initially on cassette at £7.95, with disk versions to follow. Titles include Fire Ant, Cave Raiders, Labyrinth of the Creator and Choppy Man for the 64, and Ludwig's Lemon Lazers for the Vic 20.

Roll up, roll up

COMMODORE has announced plans for the fifth annual CRM computer show.

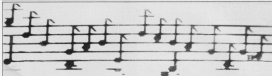
The show will be held in the Novotel Hotel, in Hammersmith, London, from the 7th to the 9th of June.

Among many products on display we've promised the new 264 machine, which boasts 121 colours and inbuilt software. The portable 55-64 will also be on show.

Over 400 exhibitors will be present, demonstrating their ranges of business and games hardware and software, including Audiogenic, Hammersoft, Precision and Atarg.

The user's group ICPLUG will be represented, as will Commodore Horizons. Look for us on stand 30, upper level. More details of the show will be in the next issue of Horizon.





Music, micro, please!

Electronic music expert **David Fox** coaxes sweet sounds from the keyboard of the *64*

WHEN THE LAST Space Invader flies the dust, and Billie the Beagle has waddled off into the sunset, what can you do with your highly venerable home micro? Increasing numbers of enthusiasts are finding new challenges in the world of music, and hanging up their laser pistols in favour of the conductor's baton or even the subjective and here's the theoretical guitar.

The Commodore 64 is particularly well-qualified for a musical career and software houses, hardware designers and musical instrument manufacturers all have 64-compatible products available. Your 64 can make sweet music (or otherwise) in three different ways — using its built-in SID sound chip, using external keyboards and sound-producing hardware, and controlling existing commercial musical instruments such as synthesizers. We'll look at each of these functions in turn.

The 64 is among the most well-endowed in musical terms, having three independent sound generators doubling as white noise generators. White noise is most commonly used for explosions and sound effects in games, but is the main component of percussion sounds if you want to produce some rhythmic backing for your musical efforts. The sound generators have programmable wave-form, which means that you can decide the overall nature of the sound produced — there's here a soft sound with low high harmonics (like water, ebbes or strings) a harder sound with a good mix of higher harmonics (square wave or sawtooth wave). In addition the sounds on the 64 can be invariably filtered, changing the harmonic content, and thus the overall impression produced, and can be ring modulated, producing changing metallic sounds. The use of all these sounds in games will be quite familiar, but it's only a matter of arranging them into single notes and recognizable scales to turn your micro into a musical instrument.

Several software packages are already

available to help define both the exact sound used and the patterns and rates which are played. One of the most flexible is Ultraynth 64 from Quarksoft, costing £14.95 on cassette, which displays all the Commodore's music capabilities in the format of a commercial synthesizer. The menu-driven program, in other words, gives a graphic display of all the details and knobs familiar from a synth such as the classic Minimoog (so beloved of musicians like Rick Wakeman. For one, need to take five of the things on stage set up for different sounds) and allows you to adjust one parameter at a time until you've got the desired sound. Parameters include Attack (the amount of time the note takes to fade in), Decay (the amount of time it takes to fade away if you hold the note), Sustain (the percentage of full volume it'll sound at if you hold the note) and Release (the amount of time taken to fade away if you release the note). These four make up the magic incantation ADSR, which has baffled people since synthesizers were a twinkle in Robert Moog's eye, and which helps to define whether a sound seems like a piano, organ or violin, for instance.

Others

Ultraynth also has a wide range of pitcher (pitch contour) in fact, various filtering options, ring modulation and pulse width control affecting the sound quality of square waves). But there are the limit of its capabilities, because once you've decided the sound you want to use the fun really starts. Ultraynth can then play various automatic rhythms for you to accompany on the computer's key, or even on an optional music keyboard such as the Microsound 64 which we'll look at later). You can obtain some degree of real-time control over functions such as filter positions, sets and create new backing systems, and define files for your compositions. Ultraynth is a lot of fun, certainly giving some valuable insights into music control,

but it's not exactly the sort of thing you can dabble with on a whim — however, the micro equivalent of ballroom scullery are well catered for by another 64 program, Dancing Feet from Artix Computing, costing 15.95 on tape.

Joystick

Dancing Feet may be poorly named, because there's no dancing involved even if there are some spectacular feats of music-making. Basically the program gives you a cross between the intellectual thrill of composition, like Beethoven hunched over his work table with a scratchy quill pen, and the more physical delights of live performance, like Mick Jagger striding up and down the stage making loud gestures with a microphone stand. This all comes about through the magic of joystick control, which implies naturally enough that you need a joystick to run the thing.

The joystick initially allows you to select options from a menu, the first page of which asks you to choose Bass, Horn, Style, Tempo or Ending. Bass patterns available include Jazz, Rock, Blues and Boogie Woogie, and once selected you can go on to specify the other options, choosing appropriate or totally inappropriate settings according to your mood. The list of findings is particularly wide, including as it does The Elvis to down South blues (wah-wah-ah) and The Mozart to pseudo-classical series of deferred elements. Once you've made all the selections the program draws a bar chart and all hell breaks loose as the accompaniment begins, with a percussion line and independent bass line leaving the joystick free to play a melody line over the top. Because the only way you play is all part of the program it's impossible to play a wrong note, and the scale played by the joystick will also compensate for the changes in the backing chords. Circular movements of the joystick produce fast runs while up-and-down motions



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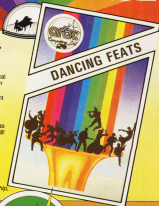
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4 will produce single notes. To finish a musical phrase you only have to return the joystick to its rest position, and to drop an octave you simply hit the fire button. To end a composition, simply release the joystick and hit the space bar, and your chosen melody will take place — this can be after anything up to fifteen minutes of frenetic musical creation, all accompanied by the most eye-catching visual display this side of Top Of The Pops.

It's possible to develop a degree of skill on the Dancing Frenz joystick, although anyone who can produce a particular tune at all must have had an overdose of it. A fun program though, and one which can give you a finished musical product (of sorts) with minimal effort.

Crings

Waster more complex is a cartridge-based system, Music Composer, manufactured by Commodore itself at \$9.99. This comes with a jolly booklet opening with the phrase "Are you tone deaf? Do people cringe when you sing or play an instrument? You have just purchased your salvation — welcome to the wonderful world of electronic music!". Music Composer is intended to be usable by people with 'absolutely no musical ability', which sounds promising, as does the sample tune which comes up together with a musical display on hitting 'I' after loading.

Music Composer lets you get at the 64's three sound sources and displays their activities in three different colours. The top row of the computer keyboard become a musical keyboard with a choice of sounds including callopy organ, organ — a bit low-tech in these sophisticated times, harpsichord and piano, with each of the computer's sound generators being able to give a different effect. The graphic display is a musical staff of five lines and notes are entered using a very simple language based on musical notes (A,B,C etc) together with sharp or flat, and a number to indicate which voice is required. Phrases to be repeated can be entered in brackets and octaves can be

changed with + and - signs, or by specifying a particular octave with the command O.

The handbook gives example notation for a complete song using three voices, and then goes on to defining your own sounds, using a selection of the same sort of effects as those used in Ultravox. Notes entered can be removed and replaced, and the completed piece is shown as a moving graphic display complete with notification of which effects (such as vibrato) are in use, and which waveform is sounding.

Music Composer is very educational in musical terms, even if you do have to do most of the educating yourself — in other words, there aren't many hints on compositional techniques included. There's no rhythmic backing provided except what you might write yourself, but there are few limitations on what can be done with a little time and practice. Some very complex three-part harmony pieces can be produced, and this sort of program is ideal for anybody interested in the counterpart of Bach's style of music. Anybody more interested in Eric Clapton can wait until later.

Hardware

We've looked at the 64's built-in sound facilities and at some programs designed to organize them into a usable form (remembering that due to the odd Commodore Basic, a normal sound routine would involve a lot of POKEing, and so would be fairly unwieldy). These could well appeal to music enthusiasts dabbling in music, but since you've got the electronic music bug, or if you're already a reasonable musician, you'll want a more familiar form of control. A couple of hardware manufacturers are now producing conventional music keyboards which can be used in conjunction with the 64 and with some of the software we've mentioned, one example being Audiographics with its Microsound 64.

Microsound 64 is a full-sized, four-octave keyboard (a decent size for commercial synthesizers) which can control the 64's sound generators, which in turn can be under the control of Ultravox or a

similar sound-defining package. It offers two user-definable real-time controllers (corresponding to the vibrato and pitch bend controls on a more conventional synthesizer perhaps) and a selection of special functions. Eventually these will include 0.8 second single-note real sound sampling, the latest buzz word in the windy world of music technology. The ability to record, modify and replay real sounds as musical patches has proved a great boon to a musical community which was becoming bored with plinky-plinky synthesizer sounds, and now perhaps the commercial success of Yamaha with their 120,000 Fairlight Computer Musical Instrument can be years for a more [14]. Development engineer Glyn Williams was in fact invited to study the Fairlight at the BBC's Radiophonic Workshop, and has incorporated some of the details of its proverbially user-friendly programming into the Microsound. Contact Audiographics at 14, Reading Road, Hareley, Oxted, phone 0891 375446.

Hardware doesn't end with the Microsound however, in fact there is an almost infinite range of musical goodies about to become available for 64 owners. This is due to two connected factors — the popularity of the 64 in America, and the development in the same country of the concept of MIDI, the Musical Instrument Digital Interface.

MIDI came to light about a year ago as a result of the fact that several million synthesizer owners were choiced off because none of their equipment would work with any other equipment — or more specifically, that of other manufacturers. One company might make the best synthesizer, one the best drum machine and a third the best sequencer, but because musical instrument manufacturers largely avoid their own ways some of these designs would be incompatible. Obviously there was some mileage in making the public buy everything from your own range, but eventually the manufacturers above-board and decided that universal compatibility was the name of the game. The first move was made by Sequential Circuits, makers of the successful



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Proprietor synths, and an agreement was reached with the major American and Japanese manufacturers for a USA (Universal Synthesizer Interface) which eventually developed into MIDI.

MIDI, as its name implies, is only suitable for digital or microprocessor-controlled synths, and is a serial interface rather similar to the RS232C familiar from printer ports and modems. This means that a relatively simple converter will allow your humble micro to speak MIDI, and thus to control anything up to a third of a million pounds worth of high technology keyboards (this is assuming that it's possible to get sufficient Fairlight in the same room — failing that, eighteen Prophet 500's, Roland Jupiter 6's, or King Poly 61's will do nicely).

Sequential Circuits publish a detailed specification for MIDI which all participating manufacturers are expected to follow. This gives the appropriate data bits for the 'flags' which tell instruments what they're going to be asked to do (play a particular note, change a sound or go to a new rhythm pattern for instance) and then the codes for selecting particular notes, sounds or patterns. There are also plenty of free options so that any features unique to a particular instrument can be brought under MIDI control at the manufacturer's discretion. MIDI as it is spoken can account for up to sixteen channels of operation, so most interfacing equipment available allows the user to specify which of sixteen instruments is being controlled at any given time. As we mentioned, MIDI is serial, which doesn't mean that you can only use it at break fast time but that it only accepts one bit of information at a time. Some companies objected that the delays associated with waiting for sufficient information to arrive could become perceptible in a complex system (Hörnerlein, CBS/Fender and Synclavier to name but a few), but these unbelievers are rapidly becoming converted by the fear of being left out, and are getting MIDI'd pretty quickly. Most of these had been experimenting with computer interfacing on their own systems, and so were already familiar with models such as the 64 — CBS/Fender using it to control the powerful Chroma-synth for instance.

Let's look at one 64 sequencer, Sequential Circuits' Model 64 Sequencer. This slots onto the cartridge port and is a little black box ornamented with a few

Prophet 5B under control . . .



. . . from the Model 64 sequencer

LED's and some DIP switches. These are used to adjust the clock source to drum machines and other sequencers from 96 pulses per quarter note (PPQN) to 48, 24, 12 or 6 (8 being needed for the popular Roland drum machines such as the DR80 TR808 Drumatic). The LED's obviate the need for a monitor to good work, obtain, and not one that you get a chance to use often because they show the percentage of memory available, and whether the sequencer's in Record or Replay mode. Sequences are played as normal on the synthesizer's keyboard, and corrected with variable resolution by the computer, which can hold up to nine sequences totalling a few thousand notes and merge these basic patterns as desired. The exact number of notes stored depends on the number of spaces between notes and so on, but the system's fully polyphonic and so can cope with chords, lead and rhythm parts quite happily. Pitch bend and modulation effects can also be stored, and of course completed sequences can be dumped to tape or microdrive (although anyone trying to load his next tune from tape in the middle of a set deserves a gold medal for bravery).

You can use a monitor with the Model 64, in which case you get helpful questions like 'Are you sure you want to erase this pattern?' in addition to musical notes and various displays of compositional options in a memo-driven format. Being entirely software-based it's likely that further developments will follow rapidly, one of the first probably being a stop time sequencer for people who want to enter music one note at a time and/or can't play a keyboard. Further information on the 64 sequencer is probably best gained from Rod Argent's Keyboards at 20 Denmark

Square, London, where they have a constant demo set-up which does amazing things with a Yamaha DX7, Prophet 5B, SCI Six-Trak and a drum machine all at once, and all under the control of a humble 64.

The people who started it all, Moog Music, also have their eye on the 64. Their prototype system is called The Producer, and was recently seen controlling three drum machines and four monophonic basses (with all courtesy of MIDI and a 64. The 64 appears to have ample capacity for composing lengthy pieces in a variety of musical 'languages' and then overdubbing other parts to the musician's delight — certainly the CBS/Fender Chroma provides an amazing compositional system with the Apple, and if the 64 can achieve half of that it would be a valuable tool. The recent Steinberg Music Fair saw MIDI interfaces abound everywhere, most of them compatible with the 64, and it only remains to be seen how many of them will find U.K. adopters — certainly there should be enough competition to force prices in an appreciable downward direction.

Summing up then, the 64 adequately covers all the basic forms of computer and electronic music, so will do in the very near future. Sound effects are very easily produced, although the standard handbook doesn't really go deeply enough into the FORKING declared by a form of Basic originally intended to support games cartridges more than user programs. Several good programs are available to compose your own music and make the most of the 64's internal sounds, and this may give you a taste for further musical exploration. If it does, you could do worse than buying a full music keyboard for the 64, especially as it should seem to be possible to sample sounds.

If you want to go the whole hog, get a MIDI interface and a suitably equipped synth (recently starting at around 6000 for the King Poly 800) and you're instantly at the peak of professional instrument technology. Incidentally, if you already own a small monophonic synthesizer which isn't MIDI-compatible, don't despair, because there are also a selection of MIDI to analogue converters available which will bring almost anything under the control of your 64. So now you've got no excuse for not becoming an accomplished micro musician! ■



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VIOLENCE in the streets, drug abuse in schools, drunken driving, what have they all got in common?

None of them feature in two interesting games for the Commodore 64 from Quiksilver. (Well, it made you read this far at least.)

Beoga-bec (the flea is the first of three £7.95 offerings). From the title alone, you can see that this is not going to be (down) yet another version of *Conan*, *Paradise*, and indeed *Beoga-bec* takes us into a strange new world "a million light years from home". Amazing what can happen when you load a program into a computer.

In this game you take on the role of a flea, who finds himself (thankfully) on the aforementioned planet, deep, deep underground. Colourful vegetation abounds everywhere, multi-coloured spheres of rock pop up all over the place, and will break the top of the screen in a little bit, which you must aim for.

This can be achieved by jumping from shelf to shelf, while trying to avoid the two venom fly traps that live at the bottom of the screen in the most awkward of positions. Venom fly traps being what they are, landing in one means instant death, so these are to be avoided.

Trapped

To make the flea jump, the joystick (or keyboard option) must be moved either left or right, and doing this sets a little indicator in motion. The strength of your jump is determined by the position of the indicator when the joystick is re-centred.

If the flea bumps it held down while the joystick is moved ahead, the screen scrolls in either of the four main directions, so that you can get a flea's-eye view of what you're (dis)astrally about to trap onto.

After a few minutes of bumping into rocks and falling into Venom fly traps, our little flea is also set upon by a dragon, who hammers about the screen only to run up when first warned or expected. The dragon is about as friendly as the fly traps, and so he too must be given a wide berth.

And so it goes on, jumping from level to level. The object of the game is to escape in the shortest time possible, and so far my little flea is still imprisoned a long way underground.

On the Spectrum version it's possible to get out in under 40 seconds, but things happen differently on the Commodore 64, so it looks like my flea will be bumping about for some while yet.

An enjoyable game, and clearly a lot of thought has gone into the use of graphics that run sound, the background tune is irritating in the extreme, although you can turn it off.

Reading the instructions for a Quiksilver game can be rather like dropping into the pages of the *High-Hiders Guide to the Galaxy*, since nothing ever seems to make much sense when you read it for the first time. Purple Turtles, again at £7.95, is no exception.

The purple turtle, an suspicious terrestrial as Quiksilver prefer to call it,

GAMES SOFTWARE

A flea in my chariot

Pete Gerrard gears up and gets into drive overleaf

is an extremely rare beast that lives in the waters surrounding your home.

You start the game on the left hand side of the screen, and rather than looking like a flea you do manage to do a decent impersonation of a human in this one. Above your head in two sixes what looks like an owl, and to keep this owl happy you have to get over to the right hand side of the screen and collect some of the scattered fruit that falls out of the trees on that side.

Between you and the fruit there is a river inhabited by four purple turtles. To cross the river involves leaping onto the back of earth turtles in succession, taking care not to jump just as one of them's about to submerge. This leads you to a watery line if you're not careful, but a good piece of turtle hopping will soon have you picking up the fruit and returning in triumph to your friend the owl.

Your reward for bearing fruit is to see the owl jump up and down in a frenzy of passion at seeing you return, although like most pets you suspect that his ardour is due more to the promise of some food



Misanthropia if it moves, about it



Purple Turtles, an extremely rare species

rather than through any great love and affection for you.

After collecting a number of different fruits, the action begins to speed up a bit. The turtles, so slow and haughty on the first level, rise and fall with greater rapidity, and by the time you've gone through three or four levels there are quite often two or even three turtles on the move at the same time. This leads rapidly to the end of the game, as your man gets submerged in water time after time after time.

At the start of the game you can pre-select your starting level out of nine possible stages, and you can also select the starting speed as well, again from a choice of nine different speeds.

Another fun game, and, as Quiksilver remind us, this is aimed purely at the young at heart, and anyone who's tired of alien hunting. Until you're leapt on a few purple turtles, you haven't lived.

Enough of turtles and fleas and back to the aliens again, in *Misanthropia* for the Commodore 64 from Musical Communications Ltd.

Priced at £7.95 like most of their 64 games software, *Misanthropia* is a game in four different stages. However, since none of the games players at Ches Gerrard ever managed to get beyond stage three, we'll have to restrict our comments to the first 75 per cent of the game.

Hang

Until you get the hang of the game it'll move, shoot it, and if it don't, you might as well shoot it anyway, it's a bit disconcerting to find yourself starting at two screenshots of tightly packed upper case only instructions before the action commences. The astoundingly short loading time could have been spent in reading some instructions on the cassette label card, but since there aren't any, . . .

Once you do get started, you'll find that someone has discovered your defined graphics, since the game is liberally spattered with them.

The first screen is relatively straightforward, a road dash for the exit at the top, as some strange purple and yellow-foggy writhes about the screen in front of you. The purple parts merely impede progress, but the yellow parts are made of sterner stuff, and kill you on contact.

When you get to the top, and discover to your amazement that you've managed to score a whole 170 points while the high-score display has risen to astronomical scores in the mega-millions, level two finds you in the net of something called a Captain, lighting off killer robots and bumping into the eggs to be found in this net.

The robots are a grim lot, although this doesn't prevent them emitting a piercing little wail everytime you kill one of them.

And onto level three, which features more robots than a post's supply of Doctor Who, and getting beyond them has proved sadly impossible. Not through want of trying, but the sheer weight of numbers forced the end of the mission every time.

Not a particularly inspiring game, although it has it's moments.

Kongo Kong is another of Megaw's products, at the same price as Metamorphosis, and you'll never guess what this one's about. What's that? An ape has kidnapped your girlfriend and taken her to the top of a building? You've got to climb ladders and jump over barrels in order to rescue her? Haven't we seen this somewhere before?

Aged

Yes indeed, this is yet another version of Donkey Kong. I think I'd see one more game featuring apes, traps or puzzles, my hopes for the future of the computer industry will take a definite turn for the worse.

The graphics on this are not particularly inspiring, frustrating as it does a few options, and the use of sound really rises above the ordinary. The plot is the same as every other version of Donkey Kong, and the

four screens to be negotiated are identical in concept to the originals, as soon as I saw many different games that it's impossible to keep track on them all.

In fairness, it did have an additive quality that goes with it simply being a version of Kong, if you like that sort of game. Two game-playing friends managed to find it a lot more exciting than I did, so if you have kids around who are just getting interested in computing and you want a few simple games to food their interest on, you could do worse than starting with this.

Any cassette buyer and that bears the words "Another superb game . . ." no promise you won't be able to turn it off" is asking for trouble, bearing in mind the old adage about empty vessels making the most sound.

Fortunately, Grubtop 64, £7.95 from the Sunlock software company, is a lot better than most of the games that come this way, and even if I did have to turn the

machine off in order to write this review, I don't think many people will be seeing them for breath of promise.

The game takes place on a grid of 15 rows by ten squares, and at the start of the game you, Mr. Livestock, must race about the grid and defuse the five bombs that someone has thoughtlessly left there.

Each bomb has a time limit of thirty seconds, after which it will explode. And although you start with just one bomb on the screen, if the count for any bomb gets down to fifteen seconds, a further one will appear.

Bumped

Every square you cross over on the grid disappears, and makes it impossible to backtrack over it, so your route must be plotted carefully. However, there is a bonus which allows you to stroll across squares with certain restrictions, and so get back onto the path again.

Some of the squares you will find

A disk in time

AUDHOGENIC has just released a number of games for the Commodore 64 which have the unusual distinction of being supplied on disk, although users without access to a Commodore drive may purchase copies of the games on cassette. The disk versions will cost you back £12.95, the cassette ones a mere £8.95.

For the extra £4.00 you can only get a disk, but also a surprisingly boring screen display to look at while the main program is loading. People who purchase the cassette versions would be well advised to have a plentiful supply of coffee to hand, since the loading process takes a long time, even on disk. 28K is a lot of programs.

With original ideas for games being thinner on the ground than elected members of the SDP at present, the sight of a game that can load an unusual story-line is enough to send even the most jaded of computer hackers scrambling for the Thesaurus in search of new words to describe the program.

Arctic Challenge places the player back in the 18th century in the capital of the once renowned Arctic empire. Being the poor old fool that you are, you have been sentenced to be a ritual sacrifice to the gods. Such was life in the old days.

You have, however, a chance of escape, and in order to avoid being sacrificed you have to complete an obstacle course known as the Arctic Challenge.

The somewhat gaudy box that the disk is supplied in features on its cover an Arctic maiden whose physical stature is certain areas is, well, interesting, to say the least. Behind her is the Arctic warrior who is trying to avoid being sacrificed. Quite what the maiden has to do with the game is uncertain, unless she puts in an appearance on the screen at some point. If she does, it's in a level far beyond any I've ever

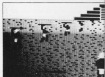
managed to reach.

There are seven levels of play in all, and completing all seven sends you back to the initial one, with the action considerably speeded up. A small illustration on the back of the box containing the disk suggests that on phase three (and again on all seven levels) and back to the start again) we see a level of play that is not to be found on either of the previous two phases. However, some of us haven't managed to get that far . . . yet!

To briefly go through each level, on the first one you have to jump over or dodge under a rain of spears, on the second you must climb up a wall while dodging a collection of rocks pointing down it, the third has you leaping in and out of rooms over a selection of various hazards, the fourth forces you to leap over some "Mexican Funnies" in the guise of various nasty spiders, bears, snakes, and so on. By the time you get to the fifth level you'll be trying to avoid being ambushed by hidden Arctic "mafias", on the sixth you have to swim through a lake of piranhas (which look remarkably like starfish to me), and finally on the seventh you must jump along an exceptionally long bridge which has built into it an alarming number of holes of differing lengths.

The whole game is undeniably addictive, with each level presenting an amusing series of challenges. With high resolution graphics (and a number of sprays) used throughout, and a musical soundtrack that is useful while playing each level as well as being interesting to listen to, Arctic Challenge is one of the best of the new batch of games to appear for the Commodore 64.

So, as to Slinky, Remember Slinky? Those wonderful toys that are impossible to describe to someone who's never seen one. Basically they are an extremely long



Arctic Challenge: undeniably addictive



Remember Funnies: delightful mystery

spring made out of a highly pliable metal, but if you've never seen one there's no point going on.

The idea behind this disk-based game for the 64 is that you are in control of a Slinky, which has to leap about a maze of blocks. By leaping into any one of the blocks you can change its colour, and when every block has been changed to the same colour, you can progress onto level two.

However that's there always a "there-ere" in these games here?!, Slinky's life is

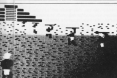
occupied by a skull and crossbones, and the number of these increases as the game progresses. Needless to say, colliding with one of them is not a good idea.

Other squares are inhabited by a number of flags, and while bumping into these will give you an additional set of bonus points, it will also decrease the number of squares you can walk over, so a little bit of strategy comes into it all.

Booted

Finally, the other inhabitant of the grid is known as the big boss. This boss roams about the place, without any sense of purpose at first but with a remarkably homing instinct as the levels get more difficult. Just one boot to begin with, but surviving four or three levels will have the maximum number of four boots chasing after you.

Collide with a boot, and some nice graphics see you literally 'booted' off the screen.



made you that little bit more difficult by a series of 'masses' that leap above the blocks as well. Drops of water, clouds of evil-looking brown gasses, and others all float about the place as well, and if one of them manages to collide with the Slinky then that's the end of one of your lives.

Successfully completing a level brings you to one of the largest gaps between game levels I've ever come across. Happ wave, bubbles fly, ruses play cheerfully in the background, and you could easily give up in boredom before you even get to see

There are nine pre-selectable levels at which you can start the action, although the game will progress to 'infinity', according to the instructions card. Since computer magazine deadlines are considerably shorter than the life of the universe we couldn't test this claim.

The game can be played with either a joystick at the keyboard, and a nice touch allows you to select which keys you want to play with if you go for the latter option. Other prize-worthy features include a constant display of high score and all the other games of interest, the ability to turn the irritating background noise on or off, a pause feature, and a soft demonstration mode just to let you get the hang of everything.

All told, a competent piece of programming that is not the best game you'll ever see on the 64, but one that is certainly far, far removed from being the worst. Well worth seeking out.

Software Projects, the company

level two, I'm all in favour of good use of graphics and sound, but there are limits.

On level two, there are the same 'masses' thing around everywhere, but this time there is an added difficulty. Jumping onto a block changes it's colour as before, but if you jump onto a block a second time it reverts back to its original colour. Thus a little bit of strategy has to be used as well as mere mad wringing about of the joystick, in order to complete the task of changing the colour of all 34 blocks.

Some of the blocks hold hidden bonuses, some hold extremely large holes which Slinksy can prove to falling down, and the game as a whole is quite fun to play. But they should do something about the gap between levels (limiting) and the amount of time it takes to start up a new game after all your lives have been lost, which takes up so much time that it transcends mere irritation and becomes downright annoying.

From the same American company that supplied the previous two Amstrad packages (Cosmi Incorporated) comes Forbidden Forest. It is also written by the same programmer, and in this game there's more so than with Slinksy some of the delays between levels and new games are so long that you begin to wonder if anything is ever going to happen.

But still, enough of gripes and complaints, what about the play?

Being a dedicated archer, you wander out into the middle of the screen to do a little archery practice in the heart of the old forest. But, as night falls, the moon comes out, and strange creatures materialise in the undergrowth around you, you realise that you've made the same mistake that befalls all games players. You've wandered into the Forbidden Forest, where anything can, and will, happen.

In progression you get attacked by giant spiders, an enormous humbling bee, some huge leaping frogs that look very unlike

formed out of the crystals earned on the original Spectrum version of Magic Mirror, have now put out the 64 version of the same program, along with a number of other games for the Vic 20, of which more later.

When amusing Interceptor Micro in the March issue by telling everyone who wanted a version of Magic Mirror for the 64 not to buy their Cosmic Mirror, but rather to wait for the translation of the original, I was harbouring fond thoughts of just how good the translation could be.

Malhed

More memory to play with, better graphics facilities, and an infinitely better sound capability, all hold rich promise for the shape of things to come. After all, if the Spectrum version was so good, surely the 64 version would be . . . exactly the same, unfortunately or at least that's the way of it on the first five levels. ▶

frags, a fire breathing dragon, a gloomy apparition that is protected by a series of domed killer skeletons, an 80 foot long snake, and finally a ghostly demagogue (that's what it says), who only appears during flashes of lightning.

Pressing the fire button on the joystick again will load the bow, and pressing it again will fire an arrow in whatever direction you happen to be pointing in at the time. Delay too long, and the relevant monster will destroy you in a blood-curdling display of fierce graphics.

With some lovely scrolling displays, and excellent use of high resolution graphics and sprites, there isn't a lot that you can fault about this game.

I just wish the programmer would let the player get on with the action, instead of making him/her sit there in sheer boredom as a dancing sprite while a merry race plays in the background. Fun the first time, but annoying after a while.

Still, this is a game that I can certainly envisage coming back to, and if a game's addictive enough to make you want to play it again and again, what else can you say?

At £12.95 all three of these disk games are expensive, although you can get cheaper versions on cassette. The games don't use the disk drive as anything other than a storage medium (if there's no file server going on, and there's no updating of the disk), so if you've got the patience you might as well get the cassette versions.

All three are good (although none of them gives you the option to play the game using the keyboard), and all three make excellent use of the features of the 64. If I had to pick a favourite it would be Arctic Challenge, but even this doesn't come up to the calibre of British games like Revenge of the Mutant Camels, surely the finest game yet written for the 64?

In short, a nice try, and one can only hope and wait for the finer games that are almost certainly still out there somewhere. ■

Twenty levels to explore on this one, rather than the thirty-odd on the Spectrum version, but on my copy of the program everything came to a grinding halt after level five.

Wo'll come back to that point in a moment, but for now, for the benefit of that tiny proportion of the population who won't know what all the fuss is about, the preface.

Minor Willy, progressing around in Starblitz, suddenly finds an odd, forgotten mine shaft. Going to investigate, he finds a lot of deserted mines, now inhabited only by the robots who were instructed to guard and increase them. In each mine shaft there is a different set of robots, but there is also an assortment of treasures.

By gathering a number of keys in each mine, Minor Willy can progress to the next by a door located somewhere (usually pretty inaccessibly) on the screen.

So the idea of the game is to go around collecting goodies, and avoiding all the nasties that get in the way, including of course the robots.

These robots take on some pretty weird forms, like snakes, taller ones, giant European Danes and so on. By using either the keyboard or the joystick, Minor Willy must jump about the place and generally try to explore everything like a good minor should.

However, my copy of the program refused to go beyond level five (Dungeons' Lair), since that point everything appeared in a black screen with a flashing dot in the middle. No obstacles to avoid, no keys to collect, in fact nothing other than a door and a mine.

Assuming that this isn't the case with more copies of the program, if you don't mind looking at a Spectrum-sized screen on a Commodore 64 (no, even that's been shrunk to the same size as the original), this is an excellent product that should sell in healthy numbers.

Drained

Right then, enough of the bit, what's the Vic been doing lately?

The first of two 47.99 programs for the unexpanded Vic 20 from Starblitz Microsystems, there appears to be no apparent reason why this one is called Multitron and the next one Triad, since each name could happily be transferred from one game to the other.

Well, this is only a little Vic, and one mine's) be too hard on it, so assuming that we're stuck with the name Multitron, what is it all about?

Nothing new, I'm afraid, since we start the game in the traditional starfighter battle format, as usual equipped with the latest and most advanced deflection system known to man.

In this case, our starfighter comes complete with one laser cannon. Using either the keyboard or a joystick our trusty machine can be manoeuvred either left or right along the bottom of the screen, and apart from that the only other control is a fire button to unleash the deadly cannon.



Minor Mines in *From the Spectrum*

The amount of cannon fire at your disposal is indicated up at the top left hand corner of the screen. Continuous fire drains the energy of the device, and you'll have to wait while all the energy cells recharge before you can fire again.

Meanwhile, you're a sitting starfighter for whatever wave of little aliens are after you this time.

In all there are six different sets of aliens after you, ranging from cosmic phenomena (things like a souped-up star from Coronation Street) to space turtles, warp engines to the minies, and in between a shower of deadly triangles between which you must hulk and creep.

Surviving each wave of creatures by ray-bombing the deadly triangles, when you find a winding space corridor, which you have to travel along for a while until the next set of nasties puts in an appearance.

Some of these nasties are really nasty, since they will sometimes stop moving about the screen when you fire at them, and wait for your missiles to blast harmlessly by, and then carry on moving again.

The choice of nasties used to stop everything could have done with a bit more thought, as some of the aliens and in particular these fire are rendered almost invisible at times, but I suppose a dedicated starfighter pilot has to get used to things like this.



Triad had not, it's Pity

Quite a reasonable offering.

The second from Starblitz Microsystems for the unexpanded Vic is back on even more familiar territory than is Multitron, since Triad is a version of . . . Oh NO! Space Invaders!

Actually, it's closer to Galaxian than Space Invaders, but Galaxian doesn't seem to invade the great sense of impending boredom that the mere saying of the words Space Invaders seems to.

In all versions of the game, this Vic implementation sticks fairly rigidly to the rules, with a number of rows of little aliens all bobbing about the screen in strict formation. Periodically, some of them will peel off from the main group and come shooting down out of the sky at you, and your little starfighter (equipped with the latest high high blats) must move about the bottom of the screen and protect the universe by shooting the aliens before they can destroy you.

Stuck

Your ship can only move left or right, and it's no good getting stuck in a corner just because a couple of the minies force you to start moving in that direction. For better to have it out with them, and try and blast your way to safety, rather than relying on not getting picked off in the corner some time they come down, because you will almost surely meet the professional fate of all Invader players, namely an untimely demise.

Having said all that, this version of the program is better than most that I've seen, since it does stick fairly rigidly to the original game. If you're going to make a copy of an arcade game you might as well do so religiously. Taking liberties with the original story will probably only make it worse, since it was presumably a success in the arcade because of the way it was written in the first place.

So, if you're going to own a copy of Galaxian for the unexpanded Vic 20, this is the best one I've come across.

It's the same old game in usual, but it's been very well implemented, with some lovely graphics and sound, so if you've got to get one copy that for old times sake, you might as well make it this one.

From the same company that brought us the delights of Minor Mines for the Commodore 64, Software Projects have now gone onto other arenas and come up with Space Invader for the unexpanded Vic 20.

It's nice to see people sticking to the machine in its unexpanded form. If you do have memory expansions, you can always remove it, but games that require an additional 128 or whatever are hard to play if you can only monitor a miserable 512K of memory.

Space Invader is unusual, there is no doubt about that, although the story line waxes off in depressingly familiar style.

You are about to embark on a mission to save the universe and everything it stands for (this is a good idea!) by going out to destroy a few waves of enemy

spacecraft.

Being the space hero that you are, you've been chosen to fly this mission single handed, as there's no two player option. All control is handled by the joystick, with no chance of playing via the keyboard, but as I would imagine that most dedicated games players have joysticks by now, this shouldn't present any problems to most people.

Destroyed

The game has a number of different levels built in, and on starting up on the first screen you see your spaceship sitting serenely on top of some kind of platform. Unfortunately, it looks more like an Cadbury's Creme Egg than a spaceship, but it will work.

However, the enemy spacecraft look remarkably like roars, and it will probably take a couple of games to actually see out what is happening.

To destroy the enemy you don't fire laser cannons at them, nothing so crude as that, in this game you have to breathe on top of them. Since they can do the same to you and thus wipe you out this requires a fair degree of manual dexterity, but the first few screens aren't too difficult.

About the only thing that changes as the levels progress is the background scenery (nothing to write home about), and the speed with which the enemy craft breathe about the place.

Nothing brilliant, and not a game I



Chariot Race: Chariot vs. Chariot

could envisage coming back to it a later date.

Back to ancient times once more, as the scene changes from the depths of space to the roman amphitheatre, and the great chariot races that used to take place there.

For all you Chariot Heaven lovers, Chariot Race from Micro-Artics (exceptional software) they claim, and for once this is no life boater gives you the chance to be the big macho chariot driver, and pound everyone off the track for only \$6.95.

With the choice of either a one or a two player game, this one relies on the keyboard for control, rather than a joystick, for one player and the keyboard for another.

This means that you have to stand rather close to your adversary in a two player game, and in the heat of battle who

knows what might happen!

The game starts with two chariots at the bottom of the screen, driven in superb style, with one driver called Hissler and the other called Dexler. As you start off, the horses begin to gallop, and it becomes obvious that someone has spent a lot of time on this program. The graphics are just superb, and it really is hard to convince yourself that this is an unexpanded Vic.

Enemy chariots, controlled by the Vic, come down the screen as you catch up with them, and the object of the game is to keep going for as long as possible, pushing the other chariots into the side of the track for bonus points as you go along.

Barged

Move too slowly, and the Hissler crowd gets upset and starts throwing footballs onto the track.

After you've scored a certain number of points, or if you're nearing the end of the required 10 laps, the Vic chariots stop being passive runners and start to barge you out of the way, and from then on you'll need a cool head on the reins in order to stay alive.

A great game, that I would recommend anyone to buy. The German team of games testers voted three to one in favour of this being the best game they'd seen for the unexpanded Vic. What else can you say? Buy it! ■

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Data basics

Mike Watts gets down to data bases

DO YOU HAVE a large stack or record collection, a library of reference books or a club with a long list of members?

Do you need to maintain records of staff, work, supplies, customers or a thousand and one other things?

A Data Base is a way of maintaining records like this with a minimum of fuss.

Think of a Data Base as a series of card index cards, each one called a "record", holding complete details of a particular item or person. Each separate section of the card will then contain a separate piece of information, called a "field", relating to the record. The data base management system is a more or less simple program to maintain, add, update, sort, index and retrieve information from the data stored in the data base.

Unlike a card index system, where it is only possible to see the records into order by a single field, the computerized data base is usually able to retrieve information from several fields at a time. For example, let's consider a large collection of LP records. The owner could store them in alphabetical order of artist's name, or alphabetical order of publishing company. He could easily keep a card index with a separate card for each record showing the titles of the various tracks. He might even classify each record, say, by era, mood, jazz, R & B, rock, blues and so on.

The one thing he can not easily do from his card index, when it is sorted in order by artist's name, is produce a list of all the rock music tracks in his collection published by a

particular company.

In contrast, since like these well thought out computerized data base can be the data base thing to stand head. It is worth emphasizing though that only the most powerful systems permit alterations to be made to the structure once data is present.

Time spent in designing the records and their structure is well spent. I have been looking at three recently released data base management systems for the Commodore 64.

In testing all three of these systems I used a simple data base structure to set up a file containing details of some of my own LP record collection. This contained details of the artist, record producer, category, and the title of each track. All three of the programs on test store information on disk as separate records. Speed of accessing the information held within these records varied considerably, and depended to some degree on the way in which the information required was called up.

The first item on the agenda, after the design stage, is, in each case, to load the program and format a data disk. All three programs provide a utility to handle this without apparatus. Inexpensive also uses the data disk for storage of help screens and some other information. In all three cases the set-up procedure stores some index information on the disk, so I would advise that you make use of the built in facilities.

Easy-File (175) from Commodore is supplied in VisiSoft's usual sturdy cardboard box which contains two program diskettes

and a substantial, well written manual. As its name implies, Easy-File is a simple program, designed with the less experienced user in mind. Perhaps it should be thought of as a file manipulation program rather than a data base. It is rather restrictive in the amount of information that it can store, and will not support non-Commodore printers or the CBII 1520 printer pliers.

Like most things connected with the 1541 disk drive, storage and retrieval of information is a long winded process. However, it is slightly compensated for in Easy-File by its quite powerful sort facility. The user is able to sort records into order using three separate keys, in any case alphabetical order of artist's name, producer's name and category. Screen handling is adequately slow.

A request from the user to "find a string" in a specified field is handled reasonably quickly. On the other hand "find a string" in any field seems to take forever.

Some arithmetic facilities are listed, and report generation facilities are quite good for a simple program of this type.

Infodisk 64 (175), from Business Software Systems in Midvale Newbury, is supplied on a double sided Minidisk disk, with sample data and six sample applications on the label side, and the programs themselves on the reverse.

The manual, contained in a plastic ring binder, is fairly comprehensive and contains an excellent index produced from one of the sample application files supplied. Under one file I found the rest of the manual to be somewhat bewildering, sometimes difficult reading and most of the time downright annoying in its approach. Perhaps the style could be more acceptable to a novice user but I feel that a well conceived and well executed program which, if only on price, is obviously aimed at the computer novice and user, deserves to be supported by good documentation.

Better Software Systems supply only one, protected, program disk, making back-up impossible. They are prepared to replace faulty disks free within one month of purchase, but will charge £10 for this between two and six months and £20 after six months from purchase, or if there is evidence of mechanical damage. While this, to my unappreciable, amounts may be understandable, their insistence that faulty disks be returned to them prior to replacement will undoubtedly lead to postal delays and so on.

Generating

Each record in Infodisk 64 is able to hold up to 2000 characters, in up to 100 fields. Record capacity is limited only by disk size, multiple files can be kept on disk.

Report generation facilities are generally very comprehensive. Using any of the information in the files, reports can be output either to the screen or a suitable printer in either page, line or tabulated form. Report formats can be saved to disk.

Selected data can be output in a M-Word compatible sequential format (for instance for storing into a wordprocessing program to produce statements, invoices and so on).

Up to 99 pre-defined calculation are permitted to each file using any of 19 functions

	Superbase	Infodisk	Easyfile
Max size record(Chars)	11000	24000	500
Max No Fields	1271	1000	99
Max size field	2551	1	30
Max No Screens/Rec	41	91	3
Calc. on field	Yes!	Yes!	Yes
Calc on record	Yes!	Yes!	Yes
Calc. Access record	Yes!	Yes!	No
Password protect.	No!	No!	Good
Search by Field	Yes!	No!	Yes
Record	Yes!	No!	Yes
Sort by key	Yes!	Yes!	Yes (3)
Max No. Sort keys	10	11	3
Indexing	Yes!	Yes!	No
File Compression	!	No!	No
Report Facilities	Good!	Yes!	Good
Batch Processing	Yes!	Yes!	No
New drives	Yes!	Yes!	Yes
Disk Utilities	Yes!	Yes!	Yes
Instruction Manual	Good!	Fairly!	Good
Wds to structure	Yes!	No!	No

Commodore 64 data base systems check list

arithmetic, relational, logical, etc.) allowing calculations either on individual records or in batches.

Heaver Software Systems tell me that they will soon be releasing a version on tape. The data produced by both programs will be transferable between versions, and between machines running the programs.

Expensive

Superbase 64 from Precision Software, at £99.95, is the most expensive of the three programs on test. Supplied in a plastic ring binder with two program disks (one for the back-up, to be kept somewhere safe) and an extremely well written, comprehensive manual.

Like Infobase, the manual has an excellent index; but unlike Infobase the style is thoroughly professional without, in my view, being incomprehensible to the novice.

Unlike many so-called Data Base Management programs, Superbase is able to support up to 15 files in each data base. The program is generally very friendly being easy to drive with excellent "pop-up" help.

The user is able to define records, set up separate files and even link them, retrieve records and generally manipulate data.

One of the most powerful features of Superbase is its programming options, which permits the most experienced user to produce applications packages using the 48 commands in the Superbase programming

language. User defined programs have a maximum of 80 in work in, but chaining is possible.

Using the integral disk formatting program to set up data disks will transfer the help screens onto the disk, saving memory. From my brief acquaintance with Superbase it seems that, unlike most similar programs, the perpetual swapping of disks in the 1541 drive has been almost eliminated.

This is the first truly professional database that I have come across for the C64 bit. Precision Software has obviously spent a great deal of time and effort in its production. The authors of the program have, between them, years of experience in a wide range of hardware from main frames down. This experience is reflected in the excellent screen presentation.

Perhaps the other reason for my enthusiasm for this product is its similarity to dBASE II (perhaps the definitive commercial data base). I am told that development of Superbase took place at about the same time as dBASE II.

Precision Software was unique in being able to assist me with using the Commodore 1520 printer. I found the company willing and able to spend time discussing the program and am sure that it would do everything possible to help and more.

All three of these programs are, in their own way, well thought out and written packages for the Commodore 64.

Exec-File is an easy to use file maintenance utility which may well be suitable for

many home users, my major criticism of it is the extremely slow screen handling. It is all too easy to type ahead of the program and waste time recovering from such mistakes. Not a program for the business user and, in my view, somewhat overpriced.

Infobase 64 is an attempt to produce a powerful data base management program in such a way as to be ultra user-friendly. While it is undoubtedly quite powerful, with unlimited field size (within a maximum record length of 2480 characters, I was put off by the documentation. For the price it probably represents good value, but I can not support Heaver Software Systems attitude to the supply of replacement program disks.

Super

Superbase 64 is by far the best thing that I have come across in a long time for the C64 bit. It even (almost) makes using the 1541 drive acceptable. Screen handling is fast and flexible, as is report generation. Precision Software supplies a facility to customise the program to many different printers and world, I am sure, be able to suggest solutions to any problems that may arise. I found them thoroughly helpful.

Like any tool, Superbase must be learnt before it will give of its best. For the user prepared to spend time on this learning phase, it will be extremely good value. Similar commercial programs, running on CP/M machines, cost up to three times as much. ■

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Hungary for an original game

Andromeda Software's David Bishop tells Chris Jenkins the plans for an Eastern games invasion

ONE OF THE greatest faults with the UK software industry — a fault inherited from the American game — is the slavish imitation of arcade games. How many systems have you seen of old favourites like Defender, Pac-Man, Space Invaders, Centipede — and so on? It's understandable that a software maker should choose to copy arcade games: firstly, it saves him the effort of thinking up original play patterns and characters; secondly, it means that the game has been proven on the battleground of the arcades, and therefore carries some assurance of commercial success.

It's rare, therefore, to find truly original computer games, free of the arcade influence — but Andromeda Software has managed to do it, by recruiting programmers from a market which has never been exposed to the concept of the game arcade.

David Bishop explained how Andromeda was developed. "I started off working for Vulcan Electronics, which basically existed to import and distribute chess computers. The managing director, Robert Stein, realised early on that the home computer would become a commodity which could be successfully marketed through multi-specialist shops. Vulcan started up a number of operations in department stores, and moved on to become hardware distributors for Commodore UK. This was the start of a relationship with Commodore which is still very important to us in Andromeda."

David went on to explain how the work of Vulcan Electronics in the field of hardware distribution led to an understanding of the demands of the software market. "Vulcan is now concentrating on the distribution of hardware like joystick interfaces and joysticks, and we're looking at the possibilities of several times the microdisk drives. I have concentrate entirely on Andromeda Software, which was set up partly at the instigation of CRM. It was clear to Robert Stein that there was a great potential source of software available in Hungary, and that although it wouldn't be sensible to try to compete with the established distributors, it would be practical to develop software that license to the various software houses."

Having already formed business connections with Hungary through the distribution of chess computers, Robert knew that there were many programmers who could be made interested in games work. He explained: "All Hungarian business software has to be written in Hungary, as



David Bishop. *Eastern eye*

their business methods are unique. This means that there were many skilled programmers available who had never been exposed to arcade games — because there aren't any in Hungary!"

Although such computers as the Commodore 64 are available in Hungary, they are too expensive for domestic use. "Robot found," David continued, "that some Hungarians had purchased computers while abroad, and the most popular choice was the Commodore 64. There was therefore some knowledge of the capabilities of the machine, though it will be at least two years before the market penetration in Hungary is enough to justify the distribution of games software there."

Competition

From November 1982, Avalonmedia Software began to stimulate interest in game design among Hungarian programmers, and attracted game ideas by running a competition through television advertising. "We had about 1,500 ideas submitted to us, in all kinds of formats. Some came in as sketches, some in complete storyboards. We narrowed these ideas down to three strings, and we're still developing the ideas from the first string — so there's plenty of material left for development, and interest in Hungary is still being stimulated by advertising and competition."

The remaining problem was to adapt the ideas written into playable games. David continued: "We matched up games ideas with the programmers we thought were best suited to develop them. The problem was that although they had plenty of technical skill, they weren't familiar with the requirements of playability — so most of the development work we do is based on the adaptation of a good idea into a good game. The development process needs three elements: the idea, the programmer, and the game designer. We're trying to find game designers both within and out of Hungary, and we're being well supported by Commodore (and) other software houses. Apart from established UK games designers, we're negotiating with the Rabbit games design studio, and of being hardware support for its development work."

Cubes

I asked Robert Stein, himself Hungarian, what aspects of the Hungarian character are revealed in the games themselves. "It's odd that the idea of Hungary doesn't automatically generate any associations in the British mind, but there's more to Hungary than carbonates, cubes and holograms — there's a rich folk tradition which has manifested itself in several forms in the software we're developing. For instance, in the game *Sire Me Brave Knight*, which is going to be released by Commodore, we have a medieval setting with a knight rescuing a maiden. In other games we see little fair ones which are typical of the Hungarian sense of humor — in Occan's Chinese Juggler the little man jumps up and down when he completes a screen, and in Commodore's Dancing Monster we have the ridiculous dancing creature with the elephant's trunk.

"Also typical of Hungarian software is a



unique charm, and a great attention to detail in the graphics. Look for instance at Microsoft's *Caesar the Cat* — there are over 20 frames of animation used to describe the moving cat, and the charm of the character is irresistible."

David Bishop explained more about the process of marketing the games. "Once we've developed the idea to a storyboard stage, and the game designers have worked out some of the play details, we can start to negotiate with the software houses. At this stage there is an element of the auction about the proceedings, since we criterion various offers and can back for the best deal. This doesn't necessarily mean we just go for the biggest cash offer; we try to match each game with a software house which we feel is professional, has good distribution and, most importantly, is committed to the game itself.

"For instance, one space adventure game we were developing was so liked by Personal Software Services that their representatives approached us at a trade fair and showed us ready-developed posters and promotional literature for the game — well, if they were it that badly, who were we to say no! That's going to be marketed as Quartz, and PSS is also doing *Barbelle*, which is a great game for younger players. We like to make

sure that our games are going to be well supported. It's a pity that *Dancing Monster*, which is a very good game, isn't being pushed harder by Commodore — but it's quite understandable. After all, they're in the hardware business primarily, and rarely spend much time in promoting their software."

Complexity

David's knowledge of the software market helps him in the development of the games. He liaises between the UK software houses and the Hungarian programmers, who are more organized into teams with specialties available for consultation on particular projects. "For instance, we have a 3D expert, Gabor Maros, who has developed a 3D billiards game which is exceedingly realistic. He's always called in when one of the teams need advice in this particular area." The dozens of pages of data needed to specify the 3D routine in *Special Billiards* indicates the complexity of the work involved.

The attention to detail shown in the design of graphics means that for the first time, arguably, the whole visual capability of the Commodore 64 is being used in games like *Chinese Juggler*. Here a combination of over-defined graphics, sprites and

Playing cat and mouse with David Bishop



inspiration and of colour and up to something remarkably original and exciting. You control the paghet whose task it is to balance plates on poles, and keep them spinning by steering at intervals in the rods and shaking them. Programmer Iriti Balars is a graduate chemist whose career is in molecular programming, mainly on probability and simulation work. He first used a home computer in 1983, and collaborated on a Chinese Juggler with Emere Rowy, an artist and housewife.

Catby

Iriti's brother Oscar Balars, a professor of music, was also involved. His interest in what comic music found an outlet in writing the mindbogglingly catchy tunes for Chinese Juggler and other games. *Cat and the Cat* also has remarkable music, consisting of a selection of Hungarian folk tunes — it certainly makes a change from middle variations on Bach's *Toccata and Fugue*, or the *Dance March*, which seems to be all there is on offer in other games. On these games the music rapidly becomes boring, and it's a blessing if you're allowed an option to switch it off. On the Hungarian games, the music is an integral part of the charm of the programs.

Although confidence in Atari has recently

been dented by poor market performance, *Autostroma Software* is also involved in the field of games cartridges for home video game systems. For *CRS-Colocotron* it's developing a version of *Succor* which is radically different to IBM's version. "It displays the interesting points of the action on a split-screen, and gives most attention to the full rates of the game. Unfortunately it's unlikely to be adapted for the 64, since it would be in competition with IBM's game — but it will give a good idea of the capabilities of our programmers. We've also been discussing adapting Atari games for Parker; but nothing's really been decided. At the moment the systems we have most confidence in are Commodore's and Sinclair's, so we concentrate on them."

In *Autostroma's* role as developers of original software leaves it free to concentrate on the quality of the game, leaving the marketing and distribution to the software houses. "That's not to make a deal for rights to a game," David explained, "we wouldn't show the game to any other houses. The alternative is that we don't automatically give world-wide rights to one company — for instance, *Dancing Menace* is marketed in the USA by Quicksilver, not IBM. We try to choose the house with the best distribution set-up and marketing plans for each

country. You must remember that the market is very variable: the costs of computers and software, the market penetration and the state of development of the market changes from country to country."

At the moment around 100 people are working on *Autostroma* programs. Liaison with Hungary is maintained by fortnightly visits by either David Bishop or Robert Stein — in fact, Robert was flying to Düsseldorf that evening for a conference. Eighteen programs are in a finished state, and by the end of the year there should be around 32. Although many of the games I saw were in a pre-production state, all seemed to have considerable potential.

Catstrophes

One notable game is provisionally entitled *Catstrophe*. A complex and fast-moving scenario features helicopters ducting to build the tallest possible building in the shortest possible time. The drawback is that natural disasters such as floods, car hijacks and typhoons destroy your building as it's being assembled. The game features excellent sound effects and a typical attention to detail.

Now *Mr Brave Knight* is a multi-screen medieval adventure, in which your mounted knight must leave the perils of a magnificently realised fortress in order to save his fair maiden. Again, the quality and detail of the 3D graphics are remarkable.

Mastemoney features a cute puppy racing around a maze, facing problems of two kinds: intellectual puzzles which have to be solved, and evil monsters which have to be stopped. "We thought of having two versions of this game," commented David, "one for pre-school users and one for more advanced players."

Exatwitter is an idea created from a few rough sketches of a vast interlocking state of platforms and ladders, drawn again in 3D. "Here I added the idea of King Arthur and the search for the sword," explained David. "Other than that's what's needed — a concept around which to base the original idea. The other thing we must get across to our programmers is the concept of the multi-screen game. An idea has to be very, very good these days if it's to limit itself to one screen, and although some of our games, like *Carrot the Cat*, are single screen, we prefer to stick to multi-screen ideas. We could always give some of our programmers a sack full of 64p pieces and turn them loose in an arcade off Liverpool Square — but we'd rather keep their ideas fresh!"

Clearly *Autostroma* will be coming up with a lot more interesting and refreshingly original games in the near future. One set of story boards concerns a game race down a set of rapids. "The idea of that one was that the player should actually fall over-board while playing the game!"

David Bishop is leaving *Autostroma* to form his own public relations company, but will continue his association with *Autostroma* as its PR representative. "It's a fascinating company, because nobody else operates in quite the same way. *Autostroma* is creating a business out of the individual efforts of many talented people." ■



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Caterpillar thriller

Steven Brain makes a meal of games programming



FRED GOES EAT-ABOUT demonstrates how you can write an arcade type game entirely in Basic. The idea of the game is to feed Fred the hungry caterpillar out of the food on each street, using a joystick (in part 2) or over-defined keys. Colliding with your own tail is fatal, and hitting the sides decreases your limited supply of food, but points are clocked up all the time you stay alive. Food also decreases continuously with time, and both the rates at which the score increases and the food decreases are linked to the skill level you've reached. The penalty for hitting the border and the amount of food per block are also affected by the skill level. The current skill level is indicated in two ways — first of all by the colour of the background, and secondly by a character from A onwards on the status line. The game terminates when you run out of food, go off the upper or lower limits of the screen, or run into your own tail. The termination displays tell you whether you've beaten the hi-score.

The title screen displays the hi-score and allows you to select certain options. Sound can be turned on or off SOUND (Y/N), but remember that if the CPU is sounding off then you can't move at the same time as things slow down. KEYBOARD or JOYSTICK may be selected, and if you are going to use the keys you can select whichever you find convenient (CHANGE KEY DEFINITIONS RETURN).

GOTO statements are used to jump to the relevant control routine, and to jump over the sound control lines, depending on the values of variables which can be changed during the title screen. The keys for the relevant directions are listed in strings, so that they can also be changed by selecting the key definition option of the title screen.

Since the Commodore does not produce a clear picture with all combinations of foreground and background colours, this has also been accounted for by READING a series of suitable background colours from a DATA statement containing the colours that produce a good display in combination with black (as most of the display is black). The values for the initial setting up of the sound are also held in DATA statements,

and the pulsating sound is produced by switching the volume on and off during the program.

To aid the user I have enclosed all control characters in the listings in square brackets, and produced a table showing all control characters used in the program and how to obtain them. If there is a number in the square brackets this means the character must be repeated that number of times.

```
CLR: SHIFT-CLR/HOME
C/D: DOWN-CLR/ESC
CR: RIGHT-CLR/ESC
(WHITE) CONTROL-2
(BLACK) CONTROL-1
(HOME) CLR/HOME
RTS (ON) CONTROL-RVS ON
(SHIFT Z) SHIFT-Z
(SHIFT Q) SHIFT-Q
(IBM R) COMMODORE LOGO
KEY-B
```

Now on to the program itself, starting with the set-up routine. Line 1 GOSUB is a routine which initializes the sound parameters, KEYBOARD/JOYSTICK flag (X) and the initial scores (HS, F-GOSUB) SCORES = 2445 = 900

To prevent foreground (mostly black) and background clashes the colours which mix well with black are held in a DATA statement which is terminated by -1.

```
80000 DATA 1,3,4,5,7,11,12,13,14,15, -1
The DATA for the sound settings is held in a DATA statement containing the address to be POKE'd and the value to POKE it with.
```

```
80100 DATA 54206, 0, 54216, 65, 54277, 16, 54278, 8, 54272, 166, 54275, 72, 54268, 8, 54268, 1.
```

First of all, the data pointer must be moved to the end of the background colour DATA (this may not seem very logical until you realize that the background DATA is used repeatedly, but sound DATA only once).

```
80110 FOR N=1 TO 11:READ C:NEXT N
```

Next the sound DATA is READ and POKE'd into place.

```
80120 FOR N=1 TO 9
80130 READ AD,CH
80140 POKE AD,CH
80140 NEXT N
```

The program then RETURNS to the start of the program.

```
80150 RETURN
Finally the title screen is called.
1 GOSUB 30000
```

The title screen is formatted entirely with control characters embedded in PRINT statements. The only exception is that line 30000 POKE's locations 53260 and 53261. This is done to set the border and background colours to black.

```
30000 PRINT "CLR(WHITE) CR:
SHIFT Z": POKE 53260: POKE 53261:0
30010 PRINT "D CR(SHIFT Z) FRED
GOES EAT-ABOUT BY S. BRAIN
(SHIFT Z)"
30015 PRINT "CLR(WHITE) CR:
SHIFT Z"
30020 PRINT "D CR(SHIFT Z) FRED
THE HUNGRY CATERPILLAR"
30030 PRINT "D(AROUND THE
SCREEN IN SEARCH OF FOOD
(SHIFT Q)"
30040 PRINT "D(CR) WHILE
STIRRING CLEAR OF THE BORDERS
(1234 5)"
30050 PRINT "D(CR) GRAND NOT
EATING YOUR OWN TAIL(SHIFT Z)"
30060 PRINT "D(CR) CR:HI-SCORE IS
": HS
30070 PRINT "D(1234 5) CR:HYSTIC
(C) OR KEYBOARD?"
30080 PRINT "D(1234 CR) SOUND
(Y/N)"
30090 PRINT "D(CR) CR) CHANGE
KEY DEFINITIONS(RETURN)"
30100 PRINT "D) CR)
SPACE TO START"
```

A feature of the title screen is that it allows you to select various options which affect the game.

Line 30110 scans the keyboard and puts the result into KE. It then checks if the joystick option has been chosen. If it has been chosen X is set to 1 ready for the program.

```
30110 GET KE:IF KE = "Z" THEN X = 1
Line 30120 sets N to 2 (first value) if the keyboard (C) option is chosen.
```

```
30130 IF KE = "K" THEN N = 2
```

If you press the space bar the program KEYSOUND from the title screen and the game starts.

```
30140 IF KE = "" THEN RETURN
```

If you press Y the program accepts this as a request to keep the sound on, so S is set to 0 (the default value).

```
30150 IF KE = "Y" THEN S = 0
```

If you press N the sound is turned off by setting S to 1.

```
30160 IF KE = "N" THEN S = 1
```

If you press return, then the program jumps to the key definition routine at 30000.

```
30170 IF KE = CHR$(11) THEN XXXX
11100 GOTO 1000
```

As the joystick produces different numbers according to it's position, it is necessary to convert those so that a movement of one position is obtained in each direction. Line 20 sets these conversion values (K) = left, K2 = right, K3 = up, and K4 = down.

```
20 K1 = 447:K2 = 4:K3 = 1:K4 = 2
```

```

1  GOSUB 30000:G2: H=500
2  K18="O":K28="E":K38="I":K48="I/"
3  GOSUB 30000
10  SS=1024:CR=53296:RESTORE:READ B0:BB=L:SC=B
20  K18=K28:K28=K38:K38=K48:K48=K18
100 PRINT "MC"
110 FOR H=0 TO CR+255
120 POKE H,B
130 NEXT H
140 POKE 53299,B0-1:POKE 53291,B0
150 P=PP0(1)+BB+4:LK=2:LP=P:R=64:PD=200
200 FOR H=0 TO 25
210 POKE SS+H,160
220 POKE SS+40+H,255
230 POKE SS+80+H,255
240 NEXT H
250 FOR H=0 TO 220 STEP 40
260 POKE SS+H,255
270 POKE SS+H+20,255
280 NEXT H
290 PRINT "*****SCORE *****SHEET *****OOD *":FO
300 H=H0(1)+15+0
310 FOR H=1 TO H
320 P=PP0(1)+BB+121:POKE SS+P,81:POKE CR+P,B0-1
330 NEXT H
1000 ON X GOTO 10000,11000
1100 IF PEEK(SS+P)/C/32 THEN 2000
1110 IF P=0 OR P=999 THEN 50000
1120 IF P=08 THEN 50000
1200 POKE SS+P,30
1310 ON S GOTO 1300
1320 POKE 54295,15
1330 POKE 54295,0
1300 F0=F0-BK
1310 SC=SC+BB
1400 PRINT "*****":SC:" "
1410 PRINT "*****":CHR$(BK+64)
1420 PRINT "*****":FO
1500 GOTO 1000
2000 IF PEEK(SS+P)=61 THEN 2100
2010 IF PEEK(SS+P)=255 THEN 2200
2020 GOTO 50000
2100 F0=F0+(255-BK):H=H+1:IF H=C2 THEN 40000
2110 GOTO 1110
2200 F0=F0-BK+0
2210 GOTO 1110
10000 J=15-(PEEK(54328)/R/4 15)
10010 IF J=C/8 THEN LP=P:LK=J:P=J+J
10020 IF J=C/1 THEN P=P-1:GOTO 10100
10030 IF J=C/2 THEN P=P+1:GOTO 10100
10070 IF J=C/3 THEN P=P-40:GOTO 10100
10080 IF J=C/4 THEN P=P+40:GOTO 10100
10090 P=LP:R=LK:GOTO 10050
10100 GOTO 1100
11000 SET EA:IF B0<0 THEN LK=BB:LP=P:R=64
11050 IF R=618 THEN P=P-1:GOTO 11100
11060 IF R=620 THEN P=P+1:GOTO 11100
11070 IF R=630 THEN P=P+40:GOTO 11100
11080 IF R=640 THEN P=P+40:GOTO 10100
11090 P=LP:R=LK:GOTO 11050
11100 GOTO 1100
20000 READ BK
30000 PRINT "*****":POKE 53299,0:POKE 53291,0
30010 PRINT "### FRED DOES EXIT-ROUT BY S. BRIDGE"
30020 PRINT "*****"
30030 PRINT "###GULIE PREC THE HUNGRY CRITTERPILLAR"
30035 PRINT "###ROUND THE SCREEN IN SEARCH OF FOOD"
30040 PRINT "###DLE STEERING CLEAR OF THE BORDERS"
30050 PRINT "###AND NOT DRING YOUR OWN TRAIL"

```

4 The Joystick Value (JV) for the joystick is found by the formula:

$JV = 15 - (PDK1+K2+RND10)$

Line 10000 then checks to see if JV < 0 and if so makes Last Position (LP) equal to Position (P). Last joystick position (LK) equal to Joystick Position (JP), and Joystick Position (JP) equal to Joystick Value (JV).

10000 JV = 15 - (PDK1+K2+RND10) AND 15:
10010 IF JV < 0 THEN LP = P:LK =
JP:JP = JV

Lines 10010-10099 compare the Joystick Position (JP) with the different directions (K1, K2, K3, and K4) and P is updated according to the direction.

10020 IF JP = K1 THEN P = P + 1:GOTO 10180

10030 IF JP = K2 THEN P = P + 1:GOTO 10180

10070 IF JP = K3 THEN P = P - 40:GOTO 10180

10080 IF JP = K4 THEN P = P + 40:GOTO 10180

Line 10099 is only reached if the joystick stick does not correspond to a direction. It sets Position (P) to Last Position (LP) and Joystick Position (JP) to Last Joystick Position (LK) before jumping back for retesting at 10020. This means that Fred continues in the same direction until you select another direction.

10099 P = LP:JP = LK:GOTO 10020

Finally 10100 jumps back into the main program loop at 1100.

Lines 110-140 set up the screen for the game itself.

110 PRINT "BLACKBERRY"
110 FOR N = 0 TO 99
120 POKE N,0
130 NEXT N
140 POKE 53280,BG - (POKE 53281,
BG

Line 150 sets the position Fred starts from as a random position along the top row of the screen. Last Joystick value (LK) is set to K4, to ensure Fred is moving down at the start of the game, and A3 is set to K45 for the same reason. Last Position (LP) is set to P and the food allowance set to 200.

150 P = RND(1715) + 40:LK = K4:A3 =
K45:LP = P:FI = 200

Lines 200-240 draw the border.

200 FOR N = 0 TO 99
210 POKE N, 55 + N,189
220 POKE N, 55 + 40 + N,215
230 POKE N, 55 + 968 + N,155
240 NEXT N

250 FOR N = 40 TO 930 STEP 40:
300 POKE N, 55 + N,155

370 POKE 55 + N + 18,203
380 NEXT N

Line 290 PRINTs the status labels along the top of the screen.

290 PRINT "THEMIGRAYS (END) CR)
SCORE:110 CR)HEET(4 CR) FOOD:
"FI)

Line 300 selects the amount of food to be placed on the screen.

300 FI = RND(1715) + 5

Lines 310 to 350 place that food at random positions on the screen.

310 FOR N = 1 TO 50
320 FP = RND(1715) + 12:POKE 55 +

FP, 51:POKE CR + FP,80 - 1
330 NEXT N

Now on to the main program loop. Line 1000 ON GOTOs the relevant routine to update Fred's position (P) according to whether joystick or keys were selected.

1000 ON N GOTO 10000,11000

Line 1100 checks to see if Fred has run into any obstacles (next position out a screen K.HTROUT).

1100 IF P < K.HTROUT + PFC * 12 THEN 3000

Line 1110 checks to see if Fred has wandered off the screen.

1110 IF P < 0 OR P > 999 THEN 3000

Line 1120 checks to see whether you've run out of food.

1120 IF FI < 0 THEN 3000

Line 1200 POKEs Fred into his new position on the screen.

1200 POKE 55 + P,90

Line 1210 jumps over the sound routine if you selected to turn the sound off (S = 1).

1210 ON S GOTO 1300

Line 1220 POKEs the volume to 12 and then line 1230 POKEs it back to 0.

1220 POKE 54,296,15
1230 POKE 54,296,0

Fred's food is decremented by the skill level while his score is incremented by the same value.

1300 FI = FI - BG
1310 SC = SC + BG

Lines 1400-1430 update the score, skill level, and food level displays.

1400 PRINT "THEMIGRAYS (END)
CR)FC:"

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```

30000 PRINT "*****HI-SCORE IS ",HS
30070 PRINT "*****OYST(DK/L) OR KEYS(K) "
30080 PRINT "*****SOUND (W/N) "
30090 PRINT "*****CHRGD KEY DEFINITIONS (RETURN) "
30100 PRINT "*****PRESS SPACE TO START "
30110 GET K$:IF K$="" THEN W=1
30120 IF K$="K" THEN S=2
30130 IF K$=" " THEN RETURN
30140 IF K$="Y" THEN S=0
30150 IF K$="H" THEN S=1
30160 IF K$=CHR$(13) THEN 30090
30200 GOTO 30110
30300 PRINT "*****I,F=" :GOSUB30400 :K1=K0
30310 PRINT "*****O,I=" :GOSUB30400 :K2=K0
30320 PRINT "*****S,F=" :GOSUB30400 :K3=K0
30330 PRINT "*****C,W,N=" :GOSUB30400 :K4=K0
30340 GOTO 30090
30400 GET K$:IF K$="" THEN 30400
30410 PRINT K$
30420 RETURN
40000 READ SC:SC=SC+1
40010 IF SC>1 THEN 100
40020 RESTORE:READ SC
40030 GOTO 100
50000 PRINT "*****YOU WERE PREMATURELY ZAPPED"
50010 IF SC=5 THEN 51000
50020 PRINT "*****THAT WASN'T BAD BUT YOU DIDN'T BEAT THE***** HI-SCORE OF ",HS
50030 PRINT "*****OUR SCORE WAS ",SC
50040 FOR N=1 TO 2000:NEXT N:GOTO 5
51000 PRINT "*****WELL DONE, YOU BEAT THE OLD HI-SCORE BY *****",SC-HS
51010 FOR N=1 TO 2000:NEXT N:HS=SC:GOTO 5
50000 DATA 1,2,4,5,7,11,12,13,14,15,-1
60010 FOR N=1 TO 11:READCH:NEXT
60000 DATA 54296,9,54276,65,54277,16,54278,0,54272,169,54273,72,54269,9,54288,1
60010 FOR N=1 TO 5
60020 READ RD,CH
60030 POKE RD,CH
60040 NEXT N
60050 RETURN

```

```

140 PRINT "HOMEBEATS ON(24 CR)
"CHR$(BK)+44
140 PRINT "HOMEBEATS ON(19 CR)
"30

```

Line 1300 loops back for the next move to line 1000.

1500 GOTO 1000

The next section deals with collisions. Line 2000 detects whether the object Fred hit was food (screen code 81).

2000 IF F1&8255 = F1 = 81 THEN 1100

Line 2000 detects whether Fred hit the border (screen code 215).

2010 IF F1&8255 = F1 = 215 THEN 2200

If Fred didn't hit the borders or food, he must be off the screen or have eaten himself, so the program goes to line 3000 (to end game routine).

3000 GOTO 30000

The screen is cleared upon termination and the border and background colours set to black.

30000 PRINT "CLR(8WHITE(8 CD)";POKE

1280,SPK(8 512)8

The message "YOU WERE PREMATURELY ZAPPED" appears, and a test is made to see if you beat the hi-score. If you did beat the previous hi-score the program jumps to line 51000.

50010 PRINT "8 CR) YOU WERE PREMATURELY ZAPPED"

5020 IF SC=HS THEN 51000

A message appears telling you by how much you beat the hi-score. After a short delay the program jumps back to line 5.

51000 PRINT "KIDWELL DONE, YOU BEAT THE OLD HI-SCORE BY(SC-HS) CR)50 CR)HS

51010 FOR N=1 TO 2000:PRINT N:HS = SC:GOTO 5

Fred's food

If you failed to improve on your performance a suitable message appears, and a timing loop is executed before the program jumps back to line 5.

5000 PRINT "O(8THAT WASN'T BAD BUT YOU DIDN'T BEAT

TH(82008 CR) HI-SCORE OF "HS

50010 PRINT "C(888 CR)YOUR SCORE WAS "SC

50020 FOR N=1 TO 2000:NEXT N:GOTO 5

Line 2100 adds (215 minus the still level) to Fred's food reserve, the amount of food left is documented, and a check is made to see if Fred has run off the food on the current screen. (NF must be less than 2, rather than 1, as you could have started on top of a piece of food!)

2100 FD = FD + (215 - BK)/NF = NF - 1:IF NF<1 THEN 40000

As long as there is still food on the

screen, line 2100 jumps back into the main program loop at 1110.

1110 GOTO 1100

If the current screen is cleared then the new Background (BG) colour is READ out of the DATA statement at 60000 and the still level (BK) is incremented by 1.

60000 READ BK:BK = BK + 1

If the end of DATA marker (-1), which has been added to the end of the list of background colours, has not been reached, then the program loops back to line 100 which redraws the new screen.

60010 IF BK> -1 THEN 100

If it has been reached, then the DATA is RESTORED and the original Background colour is READ again, but the still level still rises.

60020 RESTORE:READ BK

60030 GOTO 100

When Fred crashes into the borders his food reserve must decrease so FO is decremented by BK*2. Line 2210 then jumps back into the main program loop at 1110.

2200 FO = FO - BK*2

2210 GOTO 1110

Hopefully, from these notes and a close study of the complete program listing, you'll be able to pick up some tips which should help you to improve your own game programming skills. ■

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THE ADVANTAGES of speed and power gained by using machine language are offset by the difficulties in writing and using it. One of the major difficulties is that, unlike Basic, machine code cannot normally be LISTed. This makes it hard to follow the course of the program, or to correct errors made in the writing process.

For these reasons it is standard practice to use a machine code "monitor" program, often combined with an "assembler", which allows the codes and addresses used in the machine language program to be displayed on the screen.

In the early days of personal computing the only machine language monitors available were likely to be in Basic, but as they were considered to be slow, cumbersome and space-consuming (which they were!) they quickly gave way to machine-code monitors such as Supervisor (and later Extramon) in the CROM machines. However, the proliferation of different machines now means that different versions are required for the three Basic systems in the Pico, as well as different Basics in the Vic 20, CBM 64, CBM 700 etc. This proliferation can be confusing and frustrating — for instance Extramon is widely available for the Pico but only Supervisor for the C64.

Look-alike

Starting with the Basic assembler/disassembler given in Russi Wex's *Table Programming for PET/CBM* I decided to write a Basic "look-alike" to Supervisor which incorporated some of the features of Extramon and would run on any CBM machine, and should adapt quickly to any other 6502 machine (such as BBC, Apple, Oric etc). Basic assemblers/disassemblers can be written to optimise on speed and their slowness is only relative to the lightning speed of machine code; the examples in the program here will disassemble each instruction to the screen (CBM 4001) at a rate of around 100 instructions per minute, so each instruction takes about 0.44 sec. Assembly

AND CARTER BY R. G. CARTER

```

1  CLAY 00 000000
2  LAY 000000 000000 000000 000000 000000 000000 000000 000000 000000 000000
3  END PAGE
4  LAY 00 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
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100 LAY 00 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000

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your mother...'

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by Keith and Steven Brain

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```

1000 REM SET UP MAZE-POKE36879.0
1010 PRINT"SCORE"
1020 PRINT"0"
1030 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1040 PRINT"00"
1050 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1060 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1070 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1080 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1090 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1100 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1110 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1120 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1130 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1140 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1150 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1160 PRINT"00,00 00,00 00,00 00,00 00,00 00"
1170 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00,00 00"
1180 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1190 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1200 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1210 PRINT"00,00 00,00 00,00 00,00 00,00 00,00 00"
1220 PRINT"SCORE"-"S
1225 RETURN
2000 PRINT"COM INSTRUCTIONS"
2010 PRINT"COUNT THE DOTS AND THE"
2020 PRINT"DIAMONDS TO SCORE AS"
2030 PRINT"MANY POINTS AS YOU CAN"
2040 PRINT"IN TWO MINUTES."
2050 PRINT"WATCH OUT-THE GHOSTIE"
2070 PRINT"WILL EAT YOU AND THE"
2080 PRINT"DIAMONDS."
2090 PRINT"MOVEMENT:-"
2100 PRINT"2-LEFT 4-RIGHT"
2110 PRINT"6-UP 8-DOWN"
2120 PRINT"GOOD LUCK"
2130 PRINT"PRESS A KEY"
2140 GET#:[P#=""THEN2140
2150 RETURN
2500 N=36879
2510 FOR I=25510128STEP-1
2520 POKEN,I
2525 FOR J=1TOS NEXIZ
2530 NEXT J
2535 POKEN,B
3000 FOR I=1TOS500:NEXIZ IPRINT"COM"
3010 IFSOHNTHENS=5
3015 PRINT"YOUR SCORE WAS"S
3040 POKE198,0
3055 PRINT"GOOD BYE,HOPE YOU"
3056 PRINT"ENJOYED PLAYING."
3060 END

```

String

This program for the VIC with Super
Expander

STRING CRAFT is an entertaining
graphics program which displays shifting
patterns of lines. A more colorful

display can be obtained by changing line
180 to GOTO 10, and a more detailed
screen can be produced by changing the
line in line 3000 to a higher numerical
value.

Keep Pipes of Windows, Games, and

```

0 REM ##STRING CRAFT##
1 REM##BY TONY PIPE##
2 REM### JHH 84 ###
10 W=-25:O=68:Y=25:Z=-20:S=0
20 GRAPHIC2:COLORS,B,1,7

```

```

30 R=INT(RND(1)*1824)+1
40 B=INT(RND(1)*1824)+1
50 C=INT(RND(1)*1824)+1
60 D=INT(RND(1)*1824)+1
70 GOSUB5050

```

Continued on page 20

```

80 A=A+1:B=B+1:C=C+1:D=D+2
90 IFR=C0000=>1024THEN200
100 IFR=C0000=>1024THEN300
110 IFC=C0000=>1024THEN400
120 IFD=C0000=>1024THEN500
130 BRNG: A, B TO C, D
140 GOTO80
200 GOSUB5000
210 M=L
220 IFR=C0THENM=L
230 GOTO80
300 GOSUB5000
310 N=L
320 IFR=C0THENM=L
330 GOTO80
400 GOSUB5000

```

```

410 M=L
420 IFC=C0THENM=L
430 GOTO80
500 GOSUB5000
510 Z=L
520 IFR=C0THENZ=L
530 GOTO80
5000 L=INT(RND(1)*500)+1
5010 S=S+1
5020 IFS=20THENGOSUB5050
5030 RETURN
5050 S=0:SCNCLR
5060 Q=INT(RND(1)*7)+1
5070 REG10M
5080 RETURN

```

Colours

Don Warner from Had wrote the program for the Commodore 64. COLOURS makes it possible for you to run quickly through all the possible combinations of background colour and

character colour. The program uses the extended background colour mode — set by line 140 — which means that the example characters and their background colours can be changed without affecting the values of the instruction characters, main background or border.

The panel background colour and character colour can be changed with keys

B and C. The appropriate colour codes appear beneath the panel. To move from one colour to another, move the asterisk at the bottom of the screen with <and>, then push B or C. An arrow means that the colour code has been transferred. Push <en> and the asterisk will return. Note that lines 250 and 270 must each have 24 spaces.

```

100 REM ** COLOUR COMBINATIONS **
110 PRINT " "
115 P=1900
120 POKE53280,B
130 POKE53281,I
140 PRINT"#####COMMODORE 64 - HYRILABLE COLOURS"
150 PRINT"#####"
160 POKE53265,PEEK(53265)OR64
170 POKEP,42
180 POKEP+54272,6
200 POKE546,C
210 POKE53283,B
220 PRINT"#####"
230 PRINT"#####"
240 PRINT"##### @ A B C D E F G H I J K L M N O "
250 PRINT"##### P Q R S T U V W X Y Z + - = * "
260 PRINT"##### # ; : = , / 1 2 3 4 5 6 7 8 9 "
270 PRINT"##### > [ ] < > ? 1 2 3 4 5 6 7 8 9 0 "
280 PRINT"#####"
290 B=STR$(B)
295 C=STR$(C)
300 PRINT" "
310 PRINT"#####BACKGROUND COLOUR NUMBER = "B" "
320 PRINT"#####CHARACTER COLOUR NUMBER = "C" "
330 PRINT"#####"
340 PRINT"#####"
350 PRINT"##### 1 1 1 1 1 "
400 GETA:IFR=" "THENH00
410 IFR="B"ORR="C"THEN500
420 IFR=" ", "ORR=" ", "THENZ=1:GOTO400
430 GOTO400
440 IFR=" ", "THENP=P+2:POKEP-2,32
450 IFR=" ", "THENP=P-2:POKEP+2,32
460 IFF(1568)THENP=1900
470 IFF(1938)THENP=1938
480 POKEP,42
485 POKEP+54272,6

```

Continued on page 43

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```

490 S=(P-(988))/2
495 GOTO400
500 IFR#="B" THENB=B+1
510 IFR#="E" THENE=E
520 IFR#="B" ANDQ=1 THENQ=0
530 IFR#="B" THENQ=0
540 IFR#="C" THENC=C+1
550 IFC="E" THENC=0
560 IFR#="C" ANDQ=1 THENQ=0
570 IFR#="C" THENQ=0
580 B=S:POKEP,30:Z=0:GOTO200
590 C=S:POKEP,30:Z=0:GOTO200
600 GOTO400

```

Renumber

Alexander Ladin from Petaluma, California, sends this program for the Commodore 64.

THIS USEFUL utility will renumber all

Basic statements in routines you have written, so that outside line numbering will become clear. Load this routine before you begin writing your program, and build up your new program "underneath" it. To call the renumbering routine, use GOTO 32767 or RUN 32767.

The routine will terminate when it has

renumbered all your lines (to 99, 99, 99 and so on, and then itself in Basic again). It can then be deleted. Note that the program does not deal with GOTO and GOSUB statements, which still have to be renumbered manually. All occurrences of GOTO and GOSUB will be reported on the screen with line references.

```

32767 K=2949:HE=10:PRINT "C" :REM PRINT= CLEAR SCREEN
32770 IC=PEEK(K):BC=PEEK(K+1):CC=PEEK(K+2):DC=PEEK(K+3)
32780 DL=CN+DN*256
32790 IF DL=32767 THEN GOTO 32800
32800 CC=INT(HE/256):DC=INT(HE-CN*256)
32810 POKEK+2,IC:POKE K+3,CC
32820 J=RB+DN*256:K=K+4
32830 FORA=KTOJ:IF PEEK(A) = 137 OR PEEK(A) = 141 THEN GOTO 32850
32840 GOTO 32860
32850 PRINT " ("HE+"OL")":R=J
32860 NEXTA
32870 K=J:HE=HE+18:GOTO 32770
32880 CLR
32890 END

```

Pools

Bob Morrison of Reading, Berkshire, sends this program for the Commodore 64.

POOLS CHECK enables pools contractors to determine winning lines. The program is based on a checking list from a major pools company, which

chooses twenty numbers. The checking list consists of 56 columns, each consisting of a different combination of these numbers.

The numbers chosen appear on the screen in bars, and the result is entered in the form X for a score draw, 0 for a no-score draw, A for an away win and W for a home win. When the results have been entered, they are compared with the columns in the checking list. Should a

winning line be found, the results pattern is printed on the screen as a secondary check together with the number and profile of the winning column or columns. At the same time the number of winning permutations is computed for each of the divided categories. These are summarized on the screen when the checking is completed. If no winning line is found, this is also displayed.

```

10 T=0:IFPEEK(41)=4THENT=0
20 HB="B POOLS CHECK █":PRINT"TAB(4+T):HB
30 LHM="0000001415242832353840424446474950525455":LH=LEN(LHM)/2
40 PRINT"ENTER RESULT NOWINST NUMBER ON COUPON"
50 PRINT"R X=SCORE D=NO-SCORE A=AWAY W=HOME"
60 PRINTTAB(2+T):R NUMBER RESULTM
70 FORI=1TOLH:NB=HID*(LH/2+I-1.2):PRINTTAB(4+T):VAL(CHE):TAB(12+T):INPUTO#
80 P#R#O#B:NEXTI
90 PRINT"TAB(T):FINDING WINNING LINESM"
100 FORJ=1TO6:READL#
110 FORI=1TOLH:SB=HID*(LH/2+I-1):IFSB=O*O*THENI*O
120 R#R#I#P#O#B:I,I
130 IFR#="X" THENR#R#I
140 IFR#="D" THENR#D+I
150 IFR#="W" THENR#R#I

```

Continued on page 23

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Do-it-yourself solution to noise

Is your computer suffering the effects of mains "noise"? If so these tips from K Corwell could make your life easier — with a little constructional effort you can beat the buzz for good, and save your programs without frustration

FROM VARIOUS letters in the popular computing magazines it is evident that there are fellow sufferers from the effects of mains noise. I can well remember that sinking feeling, wondering whether I should get the edit on tape before losing the program. As well as being frustrating, noise can cause very mysterious occurrences. In my own case, one favourite was that whenever command one typed produced "an error", while on other occasions all signs seemed to be in the bag. Before going on to show how the effects of mains noise can be isolated, a word or two to consider just what it is.

I use the word "noise" generally, and perhaps a bit loosely, to mean either short disconnections of the supply, or high frequencies introduced into the mains supply by switching on other equipment, particularly motors. The high frequency noise can travel some distance along mains cables and is not necessarily generated in one's own home.

Short breaks in the mains supply are noticeable if the lights are on, and occasionally such short breaks will cause the TV picture to break up or even disappear momentarily. Mine notices are very resilient to breaks of this sort. I have never had any trouble from this although my lights do blink occasionally.

The effects that do cause trouble, and to which many machines are susceptible, are the high frequency components that occasionally appear. These components may be present on either the live or neutral lines or both.

There are two principle solutions to the problem, one of course noticeably cheaper than the other. However neither solution is so expensive that one needs to continue the frustration of lost programs. As I said earlier I was in the situation at one time that I could not be certain of completing an edit before losing the program. Now that situation has completely changed. It works perfectly and I only save really complicated edits before losing.

The first solution to the problem is a simple filter, such as shown in Fig. 1. This consists of two inductors, L1 and L2, which are in series with the live and neutral from the mains. On the equipment side one capacitor, C1, is connected between live and neutral and two others C1 and C2 are connected from live and neutral

respectively down to earth. This configuration is very effective and is the one most commonly used for a wide variety of equipment which either generates interference or is susceptible to it. To simplify the way in which it works one may imagine the inductors as offering a barrier to the noise while the capacitors bypass any remaining noise to the earth line.

The first solution to the problem is a

simple filter, such as shown in Fig. 1. This consists of two inductors, L1 and L2, which are in series with the live and neutral from the mains. On the equipment side one capacitor, C1, is connected between live and neutral and two others C1 and C2 are connected from live and neutral respectively down to earth. This configuration is very effective, and is the one most commonly used for a wide variety of equipment which either generates interference or is susceptible to it. ▶

Figure 1

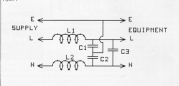
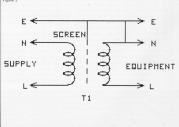


Figure 2



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A fast-paced action game where you control a character named Boss. The goal is to reach a certain point in a futuristic world. The game features a variety of enemies and obstacles.

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■ To simplify the way it works, one may imagine the inductors as offering a barrier to the noise whilst the capacitors bypass any remaining noise to the earth line.

The second solution, which is more expensive and correspondingly more effective, is an isolating transformer as shown in Fig. 2. T1 indicates the transformer, the primary of which is connected to the supply and the secondary to the equipment. A screen between the two windings further enhances the isolation. A toroidal transformer is most convenient because of its small size and low losses. This arrangement is very effective and indeed is the one I use.

Having discussed the two schemes we now come to the construction. This is quite straightforward for either and the components are readily available.

To consider the construction of a filter unit first, Fig. 3 shows a constructional diagram. The capacitors C1, C2, C3 are in fact incorporated into one small module with three wires coming out, two coloured black (BK) and one coloured green/yellow (GY). The two inductors are also incorporated, the module having four wires, two black and two blue (BL).

I constructed a unit from a standard double surface mounting box with two 13

amp sockets. These are available from electrical shops and many of the chain stores. The two modules are small enough to fit into the space behind the sockets. A length of 3 core mains cable (3 or 4 amp) with a reliable plug completes the unit. The connections between this and the blue leads from the inductor module can be made by means of a small screw connector if one does not have access to a soldering iron. The connections are all shown in Fig. 3. It is important that the two black wires are connected to the socket and the two blue ones to the mains supply via the cable and plug.

Difficulty

The chief difficulty is getting the live and neutral connections the right way round because they are not distinguished on the inductor module. Some form of simple continuity test is required to find out which of the blue wires is connected to which of the socket connections. This is most easily done with a multimeter or lamp and battery.

I have suggested using a ready made box, but this has the disadvantage of having only two sockets. A few words about plug sockets and boxes later on. The inductor unit will handle up to 4 amps, which will be sufficient for the

equipment. The plug for the supply should be fixed at 3 amps.

The second arrangement is just as easy to build, the only problem being that the transformer is too large to go into anything like the surface mounting box that I suggested for the filter unit. A piece of cardboard and a few minutes carpentry will solve this problem however. It does also mean that the box can be made big enough to accommodate more than two sockets. Standard 13 amp sockets can be used. Fig. 4 shows the wiring. The two connections to the supply being coloured orange (OR) and the two connections to the socket being red (RD). There is no right and wrong way round for the wires this time so long as the orange wires go to the supply and the red to the socket. Again, a small screw connector may be useful for connecting the transformer wires to the mains cable. Connections to other sockets are indicated by the arrows. Yes, the staining is correct — the neutral and earth connections of the socket are connected together. Fit a 3 amp fuse in the supply plug for this arrangement also.

The transformer is rated at 80va which is usually sufficient for the micro, a small black and white TV, a tape recorder and printer. However if one is using a large colour TV then it should be run direct from the mains supply, preferably from the same point that the transformer unit is plugged into. Use a two way adapter if necessary.

As an alternative to 13 amp sockets, which are rather large, 6 amp sockets are available which are about one and a quarter inches square. They make a neater job altogether, but remember plugs will be required as well. The sockets clip into a rectangular hole.

So which to use, the filter or the transformer? The best answer I can give is that if you have only an occasional problem, then the filter should be sufficient. Otherwise go for the transformer.

Suppliers

Here's a selection of suggested suppliers, along with catalogue numbers and approximate prices. Contact them for further details.

The filter items and small plugs and sockets may be obtained from M5 Components Ltd, Zephyr House, Waring Street, West Newwood, London, SE27 9EH, cat no. 201, suppression 40.40; cat no. 204, suppression 11.70; cat no. 1065, socket 10.00; and cat no. 1066, plug 11.25.

A plastic box large enough for the transformer and fuse of the 6 amp sockets (which it will have to be) cat no. 101 is — cat no. 4099, grey plastic box, 100x110x50mm, 11.94.

For the transformer, try IEP Electronics Ltd, Graham Bell House, Roper Close, Canterbury, Kent, CT2 7LP.

Transformer; part no. X1296, cost 18.46. Check prices and availability of the components with the suppliers before sending money. ■

Figure 3

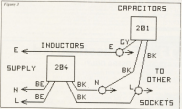
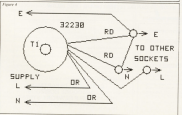


Figure 4



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Joining the contest

ON THE FACE of it, little has changed recently in Commodore's world. Last year's apparent middle pass among home computer makers, which had many cutting first prices and then their own throats, has now taken Texas as well as Texas Instruments and Mostel out of a market where some survivors are still recovering from financial wounds.

Losing rivals in this way will no doubt please Commodore, whose remaining competitors, like Atari and Coloco, are financially far from strong. Better still for Commodore, the downward pressure on prices seems to have ceased while demand for home computers — which pundits think will reach a 2.5 billion dollar market in 1984 — is still rising.

But recent events suggest that chairman Irving Gould and new chief executive Marshall Smith have only half their attention focused on the home computer market.

Commodore has signed licensing agreements with both Boro-Comers, makers of the Hyperion IBM look-alike portable computer, and with chip manufacturer Intel, which makes Commodore's own entry into the market for IBM-compatible five machine look-over more likely.

Boro-Comers appear to be a useful partner. Montreal-based Comers and Boro Management merged last October to create a group with sales of around 180 million dollars in the top five league of Canadian hi-tech companies after Northern Telecom, Marconi and Mostel.

The deal with Boro-Comers is that a Commodore affiliate, Commodore Electronics, will develop, make and market computers based on

Hyperion technology.

Comments on the present Hyperion IBM look-alike are mixed. Some critics are very impressed with the 256K Hyperion's compact size, capacity as compared to the basic 64K PC, the fact that it is available at all in the UK, and its versatile operating system. Another critic called it "little more than an attractive toy", but then he did write for IBM PC fans.

Much more important though from Commodore's point of view are the present trends in the portable computer market. IBM's determination to extend its mainframe dominance into personal computers is reflected in a 20% UK price cut aimed at ACT which is hardly demand-stimulated — if anything, IBM is struggling to meet demand.

It's no different with portables. In mid-February, IBM launched its own portable which instantly halved the share price of rivals like Eagle and Compag, even though component shortages mean many IBM dealers will only get "three per cent" per month for some time.

Commodore will produce the 8088 chip used in the IBM PC and IBM compatibles apparently "Yes is over us", which points to an early debut for a Commodore IBM look-alike. However, with Intel chips in short supply, the attraction of becoming a second source for hungry manufacturers will not be lost on Commodore — if it can be arranged.

IBM is talking hard to Intel itself, and has much greater bargaining power than Commodore — IBM holds roughly 30% of Intel's shares.

Commodore would appear to have pre-empted problems but they would do well to tread carefully in the portable market. America has a low affinity with IBM, apparently blind to quality, and while Commodore may possibly sit on top of the home computer pile with their one billion dollar sales, they should not forget that IBM is (long-five times the size — and quite capable of inflicting heavy losses on Commodore.

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ANSWER BACK

Machine monitor

I AM TRANSFERRING all my programs to disk, but am not sure how to go about transferring machine code programs. Can you help?
*T. J. Davies
Pennywell*

YES! CAN USE a machine code monitor program to transfer machine code programs from tape to disk, but it will not transfer protected programs since their code is usually tape specific.

In the monitor, enter
1. "FBI, NAME" #1
The start address of your program will be an 8000 (this byte and 8001 are the first, and the end address at 8000 (this and 8001) disk. You then enter

5 "PRG NAME", #8, start address, end address + 1, and repeat for each program.

Research work

I USE A CBM 8008 and 8050 dual-drive system, with a Kinks Fluorizer printer in my unit, mainly for word processing using Wordcraft 80. Since I'll be using the system in research work, I want to set up a parallel system to continue word processing.

Is there a cheap, viable system based on CBM equipment? I know the screen format of the 64 is half that of the 8008. I also want to use the main system for database work.

*Dr Gordon Christie
Middleton College
Oxford*

I WOULD RECOMMEND, by Precision Software, would be one solution. It includes Superbase for your database work, Superword 2 for word processing, plus a user extensible spelling checker.

It has the ability to create printer definition files (fully explained in the manual), which can be read by the Superword 84 program available from CBM. The database can be read by

CBM's Superbase 84, as long as the CBM 84 screen format is changed to 80 columns.

To set up, you would need a CBM 84 (8100), a 4 MB (824) disk drive (8100), Superdisk 8008 (8700), Superbase 84 (8900), Superword 84 (8750), and Superword (8200) — total around £1,500.

From printer . . .

I'M NOT SATISFIED with the performance of my Vic 1510 printer, and want to replace it with a new one with a printer of better specifications.

My minimum requirements are print speed of at least 80 cps, type face with dot descenders, print width of 12 cps, able to accept paper up to 80 inches wide, capable of printing well on loosely stationary, and with a manual control knob to turn the paper backwards and forwards. What would you recommend, and what interface would be needed?
*John W. Swanson
Chigwell*

THE EPSON 8200T is in the ball, and can be used with the Virginal interface available at around £40 from Ben Electronics, 106 Fife Road, Fleet, Hants, phone 02514 5858. Check with them if it will run with the software you wish to use.

. . . to printer

I HAVE A Vic 20, and have been offered a Seikosha GP100 printer. Will this printer run on the Vic 20? If so can loads be purchased? Or would it be expensive to convert the printer?
*P. J. Hinks
Parsloes*

YES! GP100 printer can be bought from Seikosha compatible with a Vic compatible interface.

Therefore you should contact Seikosha's distributors to check if the interface on the printer you have been offered is of the correct type.

If not they will be able to quote prices for changing the interface. Contact IBM Business Systems, 13-14 Epsom

Common, Windsor Road, Weyton super-Mans, Aylesbury phone 0294 877714.

Keeping Pets

AS YOU KNOW the Pet 4016 has limited graphics capabilities and, because of the market it was aimed at, little games software. Are there any means of upgrading the graphics?

When can I obtain a list of educational games intended for Commodore machines and compatible with the Pet? And what would be the best source of software?

*G. Pate
Wood Green
London*

YOU COULD TRY using a high-resolution board, obtainable from Supersoft at Manchester House, Gaining Road, Waltham, Hants. Telephone 01800 13000. For software, John BPPUG has the article in February's issue.

RPLUG has a free software library of public domain programs for all versions of the Pet, and also for the Vic 20 and 64. You pay postage and packing, and supply the cassette or disks.

Multiper- plexity

THE Vic Programmer's Reference Guide mentions multiplexing equipment, which allows the Vic picture to be blended with a picture from another source. Could you give me some information about multiplexing equipment, as regards costs, where to purchase and how to use it?
*S. Givley
Huge*

FIRST & FIFTH write about multiplexing. A TV picture is not built up, so many people believe, of 625 lines output in order from the top to the bottom of the screen.

The picture consists of two halves, of 312 lines each. Lines 1, 3, 5 and 8 are scanned, then 2, 4 and 6, and so on. This is called interlacing, and if you blend a Vic picture with another in this way you lose half the definition.

I would think therefore that although it can be done, it is

not a practical proposition. If anyone knows of practical multiplexing equipment, and can quote suppliers and cost, please let me know.

Monitor machine

I RECENTLY managed to get hold of the monitor from a table-top style arcade game. My problem is that the input to the monitor is 8048, but my 64 has only a composite output. What's the best and cheapest way around this problem?
*Barry Nightingale
St Mary's Cox
Kent*

UNFORTUNATELY the 64 only generates composite video, and 8048 does not exist separately.

You can, however, use an external sequencer to split composite into RGB, and this should solve your problem. A large specialist video or computer store should be able to help.

Games advice

I'DE HAD my Vic 20 for a little while, and now I want to start to learn how to program my own games. The problem is I haven't any idea how to go about it.

Could you advise me on any books I could buy?
*John Allen
Kewington
London*

I WOULD RECOMMEND you buy the Programmer's Reference Guide for the Vic 20, available from Commodore as large computer shops, as are the useful introductions in their parts 1 and 2.

The way most people find out how to create programs is by examining published programs and experimenting with them to see the results of changing parts of the program.

If you need help with a technical query or problem write to:
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THE HILL. Monk Miro Club has decided to enter for this year's Miro Mini competition, to make a maze on wheels which will run around a maze, hunting for a target square.

Deidara has made a "mouse" called Charlie, and Kinnosuke has programmed it — pretty simply at first. All Charlie did was roll forward from one of the corner starting squares for a fixed distance, turn left or right (randomly on the first corner, thereafter alternately), roll forward the same fixed distance, and so on.

Strangely, when they tried out the mouse on their test maze, it reached the target square after the same number of turns, whichever corner starting square it began from.

If Charlie hits a wall, it has to stop, which skidding, and it's time to turn left or right again.

Now the problem remains: the target square has fallen off — can you work out where the target square is?

Simply give the number/letter code for the target square and complete the letter/number sentence in an apt, amusing and original manner in 10 words or less.

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While the turtle is out on its explorations you can sit in its drawing beautiful multi-coloured pictures. You can vary the colours and line widths on these drawings by simply changing the pen the turtle is using — and this can be done from the outside without opening the shell.

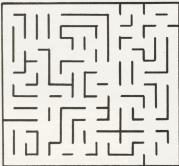
Apart from being a valuable educational tool (the drawing about maths as well as computers), the turtle is ideal for encouraging children's imaginations. It's even been known to persuade the most computer-shy of adults to start playing with the keyboard. And to add to the turtle's power Commodore is providing its Logo language as part of the prize.

The turtle comes as part of a complete package including the remote control computer which is linked to your 64, a keyboard, a manual and the first part of what Valiant intends to become an encyclopedia of turtle knowledge.

The winner of our March competition is Reginald Masall of Thornbury, whose prize is a Microboard 64 keyboard from Auto-graphics.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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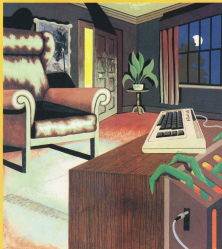
MIKRO is a full 6502/6510 *ASSEMBLER* with the power that professional programmers need, yet so simple to use that we recommend it to beginners! The *MIKRO* cartridge has many other facilities including editing commands and a machine language monitor, all for £51.50.

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