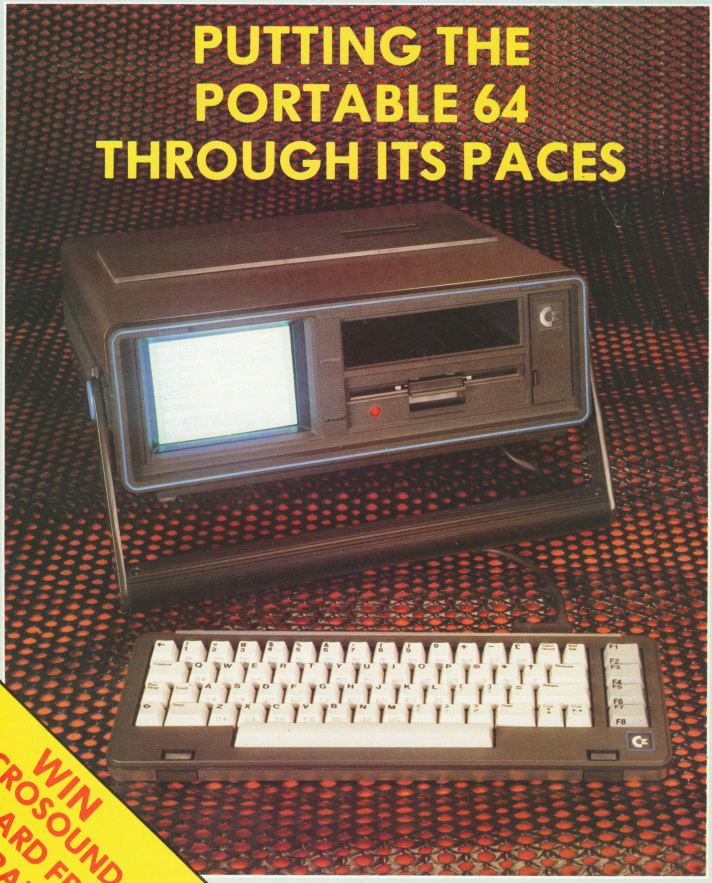
Commodore HORIZONS

The independent Commodore magazine

75p March 1984

ROBOTS COME TO TOWN ● STAR GAMES TO PLAY
CUSTOM CHARACTERS ON THE VIC AND THE 64

PUTTING THE PORTABLE 64 THROUGH ITS PACES



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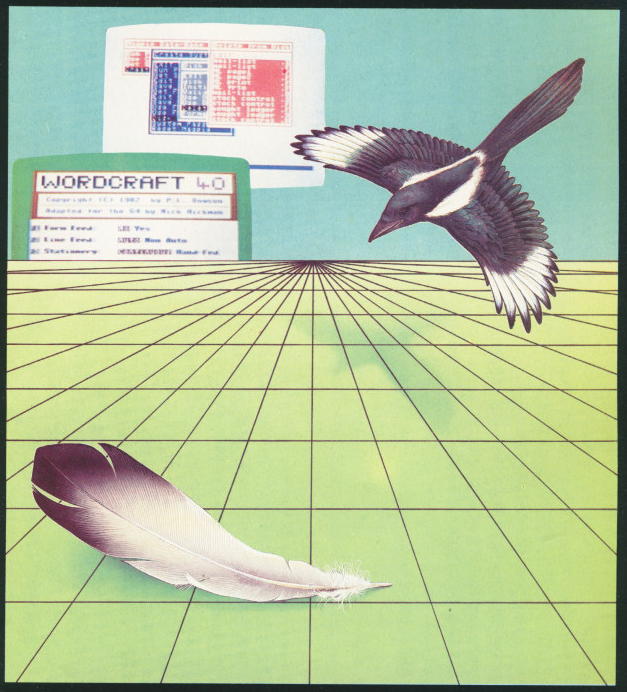
SERIOUS SOFTWARE FOR THE 64

magpie

DATABASE SYSTEM

WORDCRAFT 40

WORD PROCESSOR



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Subscriptions
UK £10.00 for 12 issues, overseas surface (excluding US and Canada) £16.00 for 12 issues, US and Canada air-lifted US$33.95 for 12 issues.

Submitting articles
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.

SUNSHINE

Commodore Horizons is published montly by Sunshine Books, Scot Press Ltd. Typesetting by In-Step Ltd, 77 Farringdon Road, London EC1. Printed by Riverside Press Ltd, Thanet Way, Whitstable, Kent. Distributed by SM Distribution, 16-18 Trinity Gardens, London SW9 (telephone 01-274 8611, telex 261643). ISSN 0265-4164. Registered at the Post Office as a newspaper. © Sunshine Books 1984.

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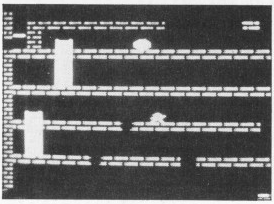

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EDITORIAL

THE BIGGEST EVENT in the micro world this year has been the launch of Sinclair's new micro — whose debut managed to upstage the announcement from Commodore of its own new machines. And in attempting to bring our readers the news about these Commodore machines first we got it slightly wrong — but thereby hangs a tale we'll return to.

Commodore's micros took their bows less than a week before the Sinclair machine was announced. Although Commodore was first it was further away, Las Vegas not being quite as accessible to the UK press as London. Not surprisingly the Sinclair micro attracted a lot of publicity. The quality of the software supplied with the machine attracted particular comment, with this emphasis on integrated software being shared by both Sinclair and Commodore. (The other common theme was incompatibility with previous micros.) The list of packages from Sinclair runs spreadsheet, database, word processing and business graphics — Commodore's list runs (you've guessed it) spreadsheet, word processing, database and graphics. This makes it easy to work out what the "BBC C" will be offering when it arrives this spring — although it's harder to guess the extra facilities it will need to succeed. The Sinclair software comes on Microdrive cassette, Commodore's either built-in or on cartridges.

With a display of bravado Sinclair has dubbed its machine the QL (for Quantum Leap) — Commodore has opted for the more modest 264 and V364, with 64 reflecting the systems' RAM. These titles lead back to our previously mentioned errors. The Commodore machines were launched in Las Vegas on 7th January — before our February issue came out but long after it had been written. We said Commodore would launch the 364 with numeric keypad and built-in speech, and that a cut-down 232 or 116 might follow. Well, it launched the V364 (adding V to emphasise the voice synthesis) and the 264 — which cut back on the keypad but not on the RAM. A 116 is still a possibility, although when these machines will cross the Atlantic remains to be seen.

It also remains to be seen how the QL and the new ". . . 64s" will fare once they are available. To a certain extent they are aimed at the same type of user, at the bottom end of the small business market, and have similar marketing policies. To say the least things are getting crowded. Dragon Data is just one of the other home computer companies moving up — and it will be offering applications software such as Dynacalc running under a multi-user, multi-tasking operating system known as OS-9. Also arriving are a new generation of cheap IBM PC compatible machines.

Obviously the overlap is not total — there's a big difference between plug-in cartridges and disk software running under a Unix-like operating system. It has to be a case of wait-and-see as far as identifying which company has the best idea of this particular market's needs or interests — or whether there are enough divisions within the market to support each company's different offerings. Commodore itself has no doubts. The titles of its new machines may be more bashful than Sinclair's — but it is equally confident of success.

hardware

These prices include VAT and carriage! If software is ordered at the same time a further discount on hardware of 1% is offered for each £15 software bought (limit is 5% extra discount). For example, ordering £75 or more of software at the same time as special package (i) reduces its price by £11.50 to £218.50. Now beat that! And we offer a personal SERVICE as well — always happy to advise!

Product	OUR PRICE	Product	OUR PRICE	Product	OUR PRICE
(a) Commodore 64	£195	(e) 1526 printer	£310	(i) Package (a) + (b)	£230
(b) 1530 cassette unit	£40	(f) Epson FX80	£400	(j) Package (a) + (c)	£387
(c) 1541 disk unit plus Easyscript games	£199	(g) Parallel printer cable + software	£25	(k) Interface to convert any cassette recorder for 64 use — it's excellent	£25
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software selection

This is a selection of some of the best programs for the Commodore 64 from a list of over 500 we can supply, covering the products of 100 + software houses from the UK, rest of Europe, and the USA. A 20-page listing and later updates are available free to customers (otherwise 50p and large SAE, credited against first order). Add 50p p&p for orders under £20, Europe £1.

Please note that the prefix (d) before a price denotes that the program is available on disk (for example d25). The prefix (r) (as in r29) indicates that the program is in cartridge form and costs £29.00. Tape program prices have no prefix. Thus (d29 16) indicates a disk version at £29.00 and a tape version at £16.00.

WORD PROCESSING

PAPERCLIP (d90) is the most sophisticated and versatile wp program for the 64. Very good too is **VIZAWRITE** (r68 d65) which has a spell-check program **VIZASPELL** (d20 if bought with **VIZAWRITE**, else d65). But for casual wordprocessing of extreme sophistication we recommend **HOMEWORD** (d35) which is outstanding value and very easy to master. It uses 'icons' to symbolize menu options (as used by Lisa). Contains several really innovative features. Much further down the scale but ideal as a low cost text editor is **WORD WIZARD** (5.99). Compatible labelling programs are available.

UTILITIES

BACKUP & FILECONE (15) are two programs for duplicating valuable tape programs — the first being capable of copying almost all protected programs. Tape-to-disk and disk-to-disk versions of this truly useful program will be available soon. **1541 BACKUP** (d 13 11) duplicates disk-based program material which is unprotected. **DISKEY** (d36) is a really powerful disk editor. **PROGRAMMER'S UTILITIES** (d14.99) surely represents the best value if you have a disk unit: sprite, character, and sound editors are provided in addition to a PET emulator, and disk copy utilities — a dozen in all! **COMPACTOR** (d10.50 8.50) cuts out all wasteful programming including REMs and spaces. This can speed up programs and salvage memory. Various good quality sprite and character editors are available including **SUPERFONT** 4.00 (6.75) **SPRITE/GRAPHICS EDITOR** (5.99) **SPRITEMAKER 64** (6.75). On the music side **MUSIC COMPOSER** (r9.99), **ULTISYNTH** (14.95), **SYNTHESOUND** (r25 d25) and **MUSIC 64** (d9 6.50) can all be recommended. **GRAPHIX 64** (d13.50 11) helps you to use the fabulous graphics capabilities.

PROGRAMMING AIDS

These range from improvements to C64 BASIC to actual programming aids. **SIMONS BASIC** (r50) adds 114 extra commands and facilities, and the rather better planned program **BC BASIC** (r50 17.95) does much the same. Best of the compilers and excellent value is **PETSPEED** (d50). For tape users there's **DTL-BASIC COMPILER** (35). **POWER 64** (d72) is a most useful programming tool with many easily learnt features. On the machine code front there are numerous monitors and assemblers the best of which is **MIKRO ASSEMBLER** (r53) but **MONITOR** (r29.95) **ASSEMBLER 64** (6.75) **ASSEMBLER DEVELOPMENT** (d24.95) **HESMON 64** (r29) **MASTER-CODE ASSEMBLER** (14.95) and **PAL 64** (d72) — a suite of programs — can all be recommended. If you want to learn about machine code programming we suggest **ASSEMBLER TUTOR** (d29.95 29.95) or Honeyfold's **BEGINNER'S ASSEMBLY LANGUAGE PRORAMMMING** (14.95). A multifunction utility which adds many disk commands of the 64 is the highly recommended **VICTREE** (r56). **ARROW** (r44) has a TIM monitor, Renumber and Delete facilities, and offers a sevenfold increase in tape LOADs and SAVEs.

DATAFILES/DATABASES

Unquestionably the one program to have if you can afford it is **SUPERBASE 64** (d88) which we have on special offer by way of encouragement! This is a sophisticated programmable relational database. Think of what you would like your database program to do — and SUPERBASE will probably be able to do it! Very, very powerful and very, very versatile. **INFODISK** (d73) and **DELPHI'S ORACLE** (d90) are very similar and offer larger individual records but more restricted programming constraints. Multifunction database/wordprocessors include **MAGPIE 64** (r95) **INFOMAST** (d90) and **VIZASTAR** (d99). All these programs are capable of series disk-orientated business applications. **DIARY 64** (r43) is a really excellent 'single page' datafile for tape or disk records.

FINANCE/SPREADSHEETS

CALCRESULT (d110) is a very sophisticated 3D spreadsheet we highly recommend for serious business uses. **PRACTICALC** (d40 35) is very good value. Also: **FUTURE FINANCE** (d75) and **BUSICALC 2** (d79 77). For home accounts there's **BANK MANAGER** (d10 7.50) **HOUSEHOLD FINANCE** (21) **MONEY MANAGER** (9.99) **HOME ACCOUNTANT** (d52.50) **TIME & MONEY MANAGER** (d49). Business account programs are available also. These usually form part of a suite of related business programs. For a low cost example **BUSCOM-1**, **BUSCOM-2**, **BUSCOM-3** and **BUSCOM-4** is an interrelated series for monthly accounts, wages, retail accounts, and stock system respectively (all d21 19 — demonstration versions at d4.50 2.50 each).

RECREATIONAL

We can supply any of the popular games from established software houses and this includes an unbeatable selection of imported material. If there's a program for the 64 . . . we can usually provide it! Also available are a whole series of excellent war and strategy games: **KNIGHTS OF THE DESERT**, **COMBAT LEADER**, **EAGLES** (all d29 29) and others. Learning games for adults include **TYPING TUTOR** (d17.50 15.50) **GRAND MASTER** chess (17.50) and **SPEED READER** (d48). Remember, if you see a software review we can usually provide it! Look out for **ALICE IN WONDERLAND** (d27) and the definitive C64 **FLIGHT SIMULATOR II** (d35). Really goods imports include **PROTECTOR II** (d25 25) **FORT APOCALYPSE** (d23 23) **PITSTOP** (r27.50) **JUMPMAN** (d27.50 27.50) and **JUMPMAN JUNIOR** (r27.50) . . . but there are many others! Interested in adventuring? Highly recommended are the following: **COLOSSAL ADVENTURE**, **ADVENTURE QUEST**, **DUNGEON ADVENTURE**, **SNOWBALL**, **TIME LORDS**, and **TWIN KINGDOM VALLEY** (all 9.50) **THE HOBBIT** (14.50), plus Infocom's **ZORK I/II/III**, **STARCROSS** (all d29). **WITNESS**, **DEADLINE**, **SUSPENDED**, **ENCHANTER**, **INFIDEL**, **PLANETFALL** (all d36). No 64 is complete without **INTERNATIONAL FOOTBALL** (r9.99)!

Our list includes details of EDUCATIONAL, ACCOUNTING, BUSINESS and GAMES programs not possible to itemize here. PLEASE TRY US IF YOU ARE HAVING DIFFICULTY LOCATING A PROGRAM. Please make cheques/POs payable to the Six-Four Supplies Company.

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LETTERS PAGE

Printer error

I PURCHASED from Green's within Debenhams The Vic 1520 Colour Printer for £99.99, which is a very reasonable price for what is a very clever machine.

Taking it home I spent the whole evening trying to get it to work. I took it back to Greens because the computer kept coming up with an error message, "no device present".

The fault turns out to be the manual, which tells you to open channel 4, when it should be channel 6.

I telephoned Commodore and got a very "couldn't care less" attitude; yes, they knew about the error, but they were still sending the machines out. A revised manual would be printed at some time.

D A Welford
Ongar
Essex

Minefield modified

CONGRATULATIONS on a first class magazine for Commodore users. I read your first edition from end to end and look forward to the next edition.

I thought your readers might be interested in some modifications I have done to the program 'Minefield' by Pete Gerrard for the Vic 20. I have 16K expansion fitted and so to save reconfigurating I altered line 20 as follows:

```
20 L=L+1: J=441:
SC=4096
```

Lines 56, 1020, 1420, 1620, 3009, 3015, where POKE7680 occurs, substitute POKE SC.

This program now runs on 16K expansion which also gives scope for some sound to make the program more realistic.

Lines 70, 75, 80, 85 after . . . THEN . . . add GOSUB6000;GOTO . . .

Line 3000 is now (after "explosion")

```
3000 PRINT
"EXPLOSION": GOSUB
6050
```

Add new line 5003

```
5003 GOSUB 7000
```

Sub-routines for sound

```
6000 REM PIP SOUND
6002 POKE36878,15:POKE
36874,245
6005 FOR XX=1 TO 50:
NEXT
6010 POKE36878,0:POKE
36874,0
6015 RETURN
6050 REM EXPLOSION
6052 POKE36877,220; FOR
XX = 15 TO 0 STEP-1
6055 POKE36878,XX: FOR
ZZ = 1 TO 250:
NEXTZZ,YY
6060 POKE36877,0:
RETURN
7000 REM VICTORY
WARBLE
7002 POKE36878,15:FOR X)
= 1 TO 100
7005 POKE36876,INT
(RND(1)*128)+128
7010 FOR YY = 1 TO 10:
NEXT YY,ZZ
7015 POKE36878,0:
POKE36876,0
7020 RETURN
```

More elaboration could be made to these listings as the total number of bytes used is now only 2383, and this can easily be run on the unexpanded Vic-20.

B R P Wedge
Folkestone
Kent

Vic modem ahead?

IN YOUR Dec 83/Jan 84 issue, on the Answer Back page, you printed a letter from Andrew Lewis, and said that the feeling was that the Vic-20 was going to be discontinued, and that there were no plans for a Vic modem.

I am pleased to say that Commodore has informed me that modems for the Vic will be available early in 1984. They also said that they do not envisage phasing out the Vic-20.

D J Welch
New Malden
Surrey

Users in Ireland

IT IS good to see the introduction of your new publication *Commodore Horizons.*

We at the Commodore Users' Group Ireland endorse your proposed campaign to put pressure on software houses to produce material suitable for the Commodore range of computers.

Also, we would like to establish links with similar user groups throughout the world, so it would be appreciated if you would include our name and address in the next available edition of your publication.

Commodore Users' Group
Ireland
c/o William John Murphy
3 Woodlands Drive
Stillorgan
Blackrock
County Dublin
Ireland

Listing problems

SINCE ALL your program listings are straight copies from printers they can be terribly difficult to read. I realise that it would be costly to type them out in full, but think of all the trouble you'd save us committed programmers! If you decide that this is not viable, I would like to see at least a note before all programs suggesting that all the symbols are tried out within a single PRINT statement before attempting to type in the program.

I'd also like to see a series on animation, as this is one thing I am totally hopeless at.

Allan Morris
Bristol
Avon

Just some ideas

FIRSTLY, could you standardise your program print size. That used for Apple Fall is ideal, but Bomber Run is far too small, and it's sometimes impossible to sort out the graphics.

Secondly, how about a series on "programming for beginners"? Something on using reversed graphics and control characters would be useful.

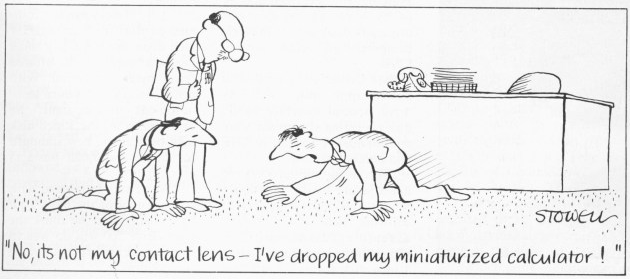
Finally, I hope you will be able to find space for listings for programs on accounts, indexes, and so on, and some musical programmes.

Bob Smith
Chelmsford
Essex

Bits

Correction

Membership of ICPUG costs £10 a year in the UK and Ireland — and £15 upwards overseas.



This is the chance to air your views — send your tips, complaints and compliments to Letters Page, Commodore Horizons, 12-13 Little Newport Street, London WC2R 3LD

NEWS DESK

Business and school packages

SINCE OUR article in the February issue on the shortage of software for the Commodore machines, a number of companies have announced new business and educational packages.

Audiogenic has introduced Magpie, a cartridge-based program with disk back-up which provides a complete database for mailing lists, invoicing, stock control, sales ledgers and so on. At £99.95 Magpie is designed for small businesses wishing to take advantage of the 64's large memory.

Wordcraft 40, Audiogenic's second release, is a word processing package also on a cartridge. It can be used with disk or tape files, and works with many Commodore compatible printers.

Meanwhile Micro-De-Bug are releasing a range of educational software for the unexpanded Vic 20. At £4.95 each, the programs include revision exercises in Physics, Maths, Biology and other scientific subjects at a variety of levels from 11-plus to O level.

Designing your own games

GALACTIC Software has released a Games Designer program for the unexpanded Vic 20.

After demonstrating the potential of the program with three games, Kanga, Zyon and Krazy-Maze, Games Designer allows the user to redefine the characters, backgrounds, music, sound effects and game plan in order to create original games.

Galactic explains that the Vic 20 version, at around £9.50, has been released first to cover the widest possible user market.

A cassette version for the CBM 64, at about £11.50, will soon be available, followed by a disk version, the price of which is not yet fixed.

Games Designer is intended for Vic users with no previous programming experience. It comes complete with an instruction booklet and provides on-screen prompts. Any of the games provided on the cassette can be modified, or new games can be built up from scratch.

Galactic Software encourages users to submit games created using their program for an assessment of their commercial potential.

Like the Quill, an adventure designer from Gilsoft, and Quicksilva's games designer for the Sinclair Spectrum, Galactic's program puts valuable programming expertise in the hands of even the least experienced user. A full review is scheduled for our next issue.

Games for all tastes

FEATURED in the latest crop of games programs for the Commodore 64 are a variety of arcade and adventure style games designed to satisfy all tastes.

Terminal Software has released Hunter, a fast action game set in a maze. Motion of your space fighter is controlled by joystick or keyboard, and the program is fully self-demonstrating.

Stellar Dodger, also from Terminal, is a version of the arcade favourite Lunar Rescue. Again it features sprite graphics and a choice of keyboard or joystick control. The games cost £7.95 each and come in Terminal's by now familiar presentation cases.

In contrast to these outer space battles, Peaksoft has announced the release of the more down-to-earth football management game, The Boss. This 13-screen program comes boxed, with a seven-page tactics booklet which advises you on how to name your club, select a team, buy and sell players, and even spy on other teams!

At £8.95 The Boss should provide hours of entertainment, and to emphasise the point Peaksoft gives a free game saving tape with each program.

Mosaic Publishing has made an entry into the increasingly popular "bookware" field, in which a games or educational program is sold with an accompanying book. At £9.95 per pack, the first release is My Secret File, described as "a personal database for your darkest thoughts". It's aimed at the 7-11 age group, and is based on a best-selling children's paperback.

From Audiogenic comes R Nest, a version of the popular arcade novelty Q Bert. You jump from cube to cube on a three-dimensional pyramid, changing the colours of the cubes; but unlike the original, in R Nest the cubes change colour every time you land on one.

R Nest costs £6.95, and is available only on cassette for the Commodore 64.

ITL Kathmill's Byte Drive 500 three inch disk drive

Three inch disk drives on the way

ITL KATHMILL'S Byte Drive 500 3 inch disk drive will be available for the Commodore 64 by May. The system was originally designed for the Oric computer, and costs around £299.

Byte Drive 500 consists of a power supply unit, 3 inch disk drive, special interface cable, disk operating system software and manual. Capacity is 500K and access time 3ms.

ITL is in the process of negotiating with software houses to transfer applications software such as text editors, assembler/disassemblers, spreadsheets and databases to 3 inch disk format. Later this year some popular games should be available in the same format.

ITL's Tom Boyle commented that the standard 5¼ inch disks used in many small business applications offered fewer bytes per pound. With price erosion and future technological development, he expected to see the 3 inch disk take over as the new standard for home and small business users.

"We're very impressed with the potential of the 64," Tom continued, "and we think the Byte Drive 500 will do well in the market despite the competition."

Christopher Jenkins *reports on Commodore launches at the Las Vegas Consumer Electronics Show*

Unwrapping the new systems

THERE WAS little new hardware to see at the Las Vegas Consumer Electronics Show, apart from Commodore's 264 and V364 micros.

Eight-bit machines based around the 7501 processor, the two micros are meant to complement the CBM 64 rather than to replace it.

With full 64K memories, typewriter-style keyboards and optional built-in software, the micros were described at the January show as applications computers rather than introductory or games machines.

The V364 additionally features a voice synthesiser with a 250 word vocabulary.

Aiming at the small business user, the most impressive features of the new machines are the screen window facilities and the optional built-in software.

The "3-plus-1" package will be available either as a cartridge for the CBM 64 and the new 264 and V364, or built-in to the 264 range. It consists of a word processor, electronic spreadsheet, file management program and business graphics facility.

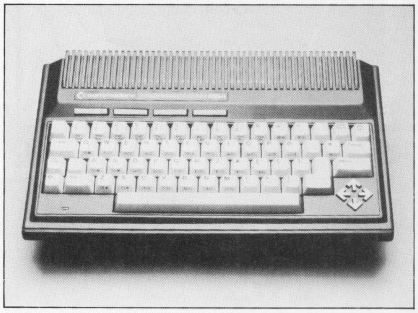
Additionally, the machines feature four separate cursor keys, eight programmable function keys, and a HELP function.

Although most CBM 64 and Vic 20 peripherals should be fully compatible with the 264 series, most software will not be. The 264 series uses an extended Basic with over 75 commands.

The voice synthesis module will also be available as an add-on for the Commodore 64. Voice speed can be adjusted to slow, normal or fast, and there will be additions to the range of vocabulary and types of voice, both on disk and on cartridge.

The 264 series, with its accompanying software, is expected to be available in this country in mid-Summer.

No details of price are yet available, but Commodore will have to consider the challenge posed by, among others, the new £399 Sinclair QL, before deciding what would be the appropriate price range.



The eight-bit 264 — with 7501 processor

All go on software front

ON THE software front, the announcement of the new CBM micros has been accompanied by details of a wide range of business, games and education programs.

For the Vic 20 and Commodore 64, the Edufun series, which will total two dozen programs, is a set of double program packs aimed at the 7-12 age group. Each program plays as a game, but offers practice in areas such as addition, visual problem-solving and shape differentiation.

The Kinder Koncepts series is aimed at the 4-6 age group, and consists of five CBM 64 disks, each with four maths programs and four reading programs.

Talking software using the new Magic Voice module includes two arcade games, Gorf and Wizard of Wor, and two more education programs, A Bee C's and Counting Bee.

For the artistic souls among you, CBM will be making available Commodore 64 and 264 versions of the "painting" system Micro Illustrator. Functions are controlled by joystick or lightpen, with the 64 version using 16 colours and the 264 version utilising all available 128 colours.

Magic Desk 2, for the 264, is an integrated text editor, spreadsheet, file manager and calculator for beginners. It uses icons — small illustrations — rather than text commands to guide the user.

Most interesting for the dedicated games player will be the Gold Medallion series. Commodore software president Sig Hartmann explained: "This designation is reserved for a special category of elite new games that have advanced animated graphics as well as play action that uses thought and strategy."

The Gold Medallion series has kicked off with International Soccer, to be closely followed by a version of basketball and a series of intellectual games.

Commodore UK expects to see most of the 264 series software available here in time for the launch in mid-Summer.

Tramiel takes a pew

JACK TRAMIEL, founder of Commodore, unexpectedly resigned his post as its chief executive and president earlier this year.

He remains as a consultant to the company which he built up through a combination of good business sense and strong management.

Irving Gould, Commodore's chairman, announced that Jack Tramiel's successor would be Marshall F Smith, president of Thyssen-Bornemisza Inc, a concern more noted for its packaging and automotive involvements than for any connection with micro-computers.

Jack Tramiel's 25 years as head of Commodore were marked by his autocratic style of management, and a remarkable rate of company expansion. From its beginnings in a Canadian typewriter repair company, Commodore has grown into an international success, holding 40% of the world market in micros and achieving sales of $1bn.

It is thought that it's the very success of Commodore which has forced Jack Tramiel out. Many stockholders are reported to be unhappy with his individual style of management in the light of Commodore's increasing importance in the world market.

The selection of Marshall Smith by Irving Gould — who is himself Commodore's largest stockholder — seems to confirm this.

Last year a new general manager of CBM UK was appointed — Howard Stanworth, a former managing director of Unigate Dairies.

These appointments suggest that Commodore is determined to retain its top market position by changing its management style. In place of the individualism of Jack Tramiel it seems we should now expect to see a more institutionalised Commodore.

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Widen your Scope

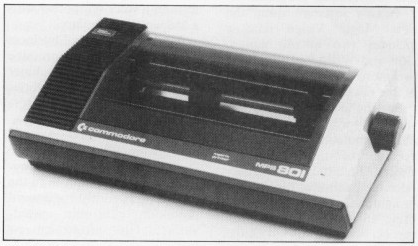
SCOPE IS a computer graphics language developed by ISP which enables you to use machine code without a compiler. After initial successes with the Sinclair Spectrum version, ISP has now announced a CBM 64 version which should be ready by late March.

ISP marketing director Graham Lomax said that the program will cost around £16, and will come with a fully revised and expanded instruction manual.

Scope uses a vocabulary of 40 words which are compiled into machine code to control graphics animation and sound generation, notoriously hard to access on the 64. The program is already being used under licence by a number of software houses for the creation of games.

Graham commented that the great capabilities of the 64, together with the difficulties in programming complex animated graphics on the machine, make it the ideal subject for the Scope program. "It should certainly be even more exciting on the Commodore 64 than on the Spectrum," he added.

CBM printers make their debuts



The MPS 801 — an impact dot matrix printer

COMMODORE is replacing the current 1525 dot matrix printer with the budget priced MPS 801.

At £230, the MPS 801, which can be used with either the Vic 20 or the CBM 64, would be suitable for business applications such as invoicing and label printing, while remaining affordable to the home user for program listing or letter writing.

The MPS 801 can reproduce the full alphanumeric set, and the complete range of Commodore graphic characters. In addition the user can design unique symbols tailored to his needs.

With a print rate of fifty characters per second, the MPS 801 is fairly slow. However, it offers some useful facilities, such as horizontal character enhancement (double width letters) and white-on-black printing, both of which are useful in document presentation.

Paper width can be from 4½ inches to 10 inches, including the tractor holes for the pin feed mechanism.

The £230 price tag includes VAT and the necessary leads to connect the printer to the serial interface socket on the CBM 64 or Vic 20.

● Announced at the CES show in Las Vegas was the DPS 1101 daisy wheel printer, which accepts Triumph-Adler standard wheels. Special characters can be obtained with optional print wheels, and maximum paper width is 13 inches. No price details were available at the time of writing.

If you think you've something newsworthy, call 01-437 4343 and let us know

METAGALACTIC LLAMAS BATTLE AT THE EDGE OF TIME

A fast and original game for the unexpanded VIC. Challenging and colourful, with good sonics and a unique game action and design, this promises to be the most exciting new 3.5K VIC game since the introduction of GRIDRUNNER nearly a year ago.

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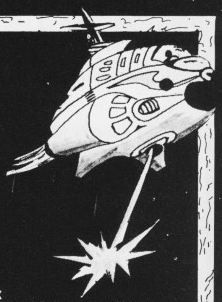

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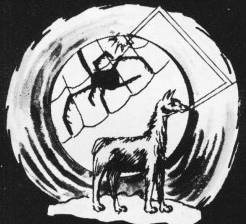
Experience Laser Zone – an utterly NEW totally ORIGINAL masterpiece of Video games design. Learn to control two spaceships at once. Feel the EXHILARATION as, after long hours of practice, you control the two ships so that they function as a smooth, co-operative team! Feel the raw POWER as you lunge for the electro button and BLAST your enemies into expanding clouds of SPACE JUNK!! Feel the humiliation as a carelessly aimed BLAST slams into the side of your last remaining ship!! 8K expansion required.

Available for Commodore 64 **£7.50** and VIC-20 **£6.**



MATRIX

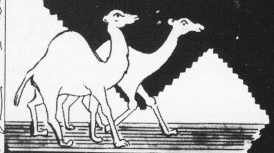
Jeff Minter has taken Gridrunner – the game that topped bestseller charts in USA and UK – and created an awesome sequel.

Graphically superb, it features multiple screens, new aliens and attack waves, mystery bonuses, renegade humanoids, deflexor fields, diagonal tracking, countdown/panic phase and much, much more.

Packed into 20 mind-zapping zones and accompanied by incredible sonics.

8K expansion required.

Available for Commodore 64 **£7.50** and VIC-20 **£6.**



HOVER BOVVER

A totally original arcade game for C64 featuring outstanding graphics and a sound track created by a professional Piano Wizard. Gorkon Bennet has borrowed his neighbour's Air-Mo lawnmower. Mow your way through as many of the 16 lawns as you can before the pursuing neighbour retrieves his mower. Set your dog onto the neighbour to help you out of tight spots and don't annoy the gardener. Try not to plough through the neat flower beds or overheat your mower!

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ATTACK of the MUTANT CAMELS

Planet earth needs you! Hostile aliens have used genetic engineering to mutate camels from normally harmless beasts into 90 foot high, neutronium shielded, laser-spitting death camels!! Can you fly your tiny, manoeuvrable fighter over the mountainous landscape to weaken and destroy the camels before they invade the humans stronghold! You must withstand withering laser fire and alien UFOs. Game action stretches over 10 screen lengths and features superb scrolling, scanner, 1/2 player actions and unbelievable animation! Play this game and you'll never be able to visit a zoo again without getting an itchy trigger finger! Awesome m/c action!

Available for Commodore 64 **£7.50.**

REVENGE OF THE MUTANT CAMELS

At last the long awaited sequel to Attack of the Mutant Camels is available. You are controlling a ninety foot high, neutronium shielded, lazer spitting death camel, leading a rebellion against your evil Zzyaxian overlords. The game features beautiful smooth scrolling graphics and no less than 42 different attack waves, more than any game in video history. The challenge of play will last for months as you battle to see what's on the next wave.

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GRIDRUNNER

Finally true arcade quality on the unexpanded VIC! Shoot down the segmented DROIDS invading the grid. Beware of the pods and zappers! The awesome speed, sound, and graphics gives you the best blast available for unexpanded VIC.

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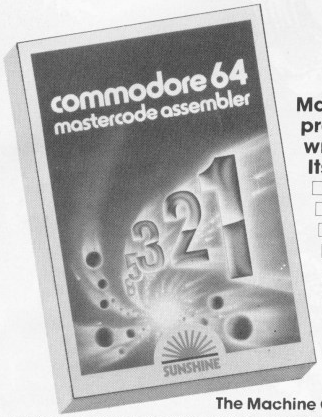

£14.95 inc VAT

Mastercode is a substantial and complex program of use to anyone interested in writing machine code on the Commodore 64. Its features include:

- ☐ Machinecode monitor
- ☐ File Editor
- ☐ Disassembler
- ☐ Assembler

Mastercode is a full two pass assembler. It accepts labels, variables and equations within assembly language programs. It is possible to store programs anywhere in memory, even in parts occupied by the Assembler. Programs can be saved to either tape or disc.

The Machine Code Monitor includes:

■ OUTPUT OF MEMORY TO SCREEN OR PRINTER ■ MODIFICATION OF MEMORY ■ EXECUTION OF MACHINE CODE PROGRAMS ■ SAVING OF MACHINE CODE FILES ON TO TAPE OR DISC ■ LOADING OF MACHINE CODE FILES FROM TAPE OR DISC ■ STEP BY STEP TRACING OF THE EXECUTION OF A MACHINE CODE PROGRAM, INCLUDING DISPLAY OF REGISTER CONTENTS.

The Disassembler will translate into assembly language the contents of any area of memory, whether the 64's ROM or a user program. Output may be sent either to the screen or a printer.

The File Editor includes:

■ ENTRY OF NUMBERED LINES OF ASSEMBLY LANGUAGE INSTRUCTIONS ■ LISTING, INDIVIDUALLY OR IN BLOCKS, OF PREVIOUSLY ENTERED LINES ■ DELETION, INDIVIDUALLY OR IN BLOCKS, OF EXISTING LINES ■ RENUMBERING OF EXISTING LINES ■ SAVING OF ASSEMBLY LANGUAGE FILES TO TAPE OR DISC ■ LOADING OF ASSEMBLY LANGUAGE FILES FROM TAPE OR DISC ■ ADDITION OF A BLOCK OF MEMORY SPECIFIED BY THE USER TO THE USER'S ASSEMBLY PROGRAM

The Assembler allows the translation of assembly language programs into machine code with full error checking, labelling and a range of assembler directives.

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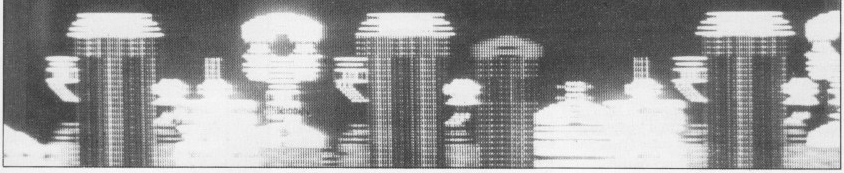
Neoclyps rules

***Pete Gerrard** looks at the latest games for the Vic and 64*



A MIXED BAG of tricks this month from a variety of different suppliers. At the end of it all, the only conclusion you can make is that the same company is perfectly capable of producing a devastating game one month, and a walking disaster the next.

To get the ball rolling, let's take a look at just some of the games currently available for the Commodore 64.

Romik have, over the years, produced some excellent games for the Vic 20, and their first crop of releases for the Commodore 64 threw up a number of surprises. Not least of these is Stellar Triumph, a two player space game which promises over 25 billion game variations within the same £6.99 program.

Any company that can make a boast like that deserves to have its software examined more seriously than most, and Stellar Triumph lives up to all the boasts . . . just!

The scenario is nothing new, a battle in the depths of outer space. The two player idea thus means that you'll have to find another space ace to play the game with, as (infuriatingly) there is no option to play against the computer.

Both of you are in command of little space ships that whizz about the screen, firing off a fusillade of deadly missiles at each other. The battle takes place in the left two-thirds of the screen, while the right hand portion is used for displaying useful things like the score, the amount of time left, and so on.

The time factor is just one of the many options that can be changed. In the centre of the screen you can choose to have a miniscule sun if you wish, or you could have a black hole, or simply nothing at all, which looks remarkably like having a black hole!

The black holes in Stellar Triumph are distinct from the usual ones believed to exist out in space, as they can be given a negative gravity if required. Other options include the speed at which you shoot, the type of motion your ship will have, and even the type of universe that you want to play the game in: now there's generous. Eight options are already built in, and are activated at the end of each game by pressing one of the function keys, either shifted or un-shifted.

To conclude, if you have two joysticks and like nothing better than shooting your closest friend down in flames, this game will give you considerable value for your money.

Back to one player and one joystick for Quasar from Voyager Software, although when playing the game the quasars are conspicuous only by their absence.

According to the blurb, you are in control of the most sophisticated space fighter yet conceived, and your mission is to destroy the Etron rocket base on the planet Hagon. Life, as usual, is made just that little bit more difficult by the intrusion of a number of deadly aliens in the form of three different types of enemy.

On the first screenfull the action owes more than a little to Star Wars, as you race down a tunnel trying to dodge, and shoot, the enemy coming towards you.

SOFTWARE REVIEW

Ingenious use of graphics allows your spaceship (sorry, fighter) to do more than simply dodge from left to right at the bottom of the screen. Moving the joystick in the appropriate direction allows you to bank your fighter, and the shadow of the wing tips as you career about the place alters accordingly.

Surviving that lot takes you onto scfeen two, where you have enemy mines and asteroids to dodge as well as the obligatory aliens. Again, some lovely graphics are used as people at last begin to get the hang of programming the 64.

The third collection of nasties is probably the most difficult of the lot to defy, and some suitably horrible brown meanies come towards you in a very good impersonation of three-dimensional graphics. After that the game follows time honoured traditions and reverts back to the first screen, with everything getting much faster, and much more furious.

If you can afford to wait about half an hour while the game loads (not quite that long, but it seems like it), you'll be rewarded with a game to keep even the most ardent of arcade addicts quiet for a little while. Remember, the fate of the universe rests on your joystick.

Interceptor Software are an odd bunch, and fall neatly into the category mentioned at the start of the review of being capable of producing the best software one month, and the worst the next. And China Miner? This, as you will see, is a difficult one!

The scenario will be familiar enough to anyone who's played computer games before, and in particular those lucky Spectrum owners who've played the marvellous Manic Miner. The plot of China Miner follows roughly the same lines, and it's hard to praise a company who simply copy other people's ideas.

You are Wally the miner, and it is your task to explore the old Jade mine found deep in the heart of China. There are thirty different areas in the mine to explore, and each one is occupied by a distinctly odd set of aliens. As well as exploring caverns, you have to leap across chasms, climb along conveyor belts, beware of floors that collapse underneath you, and collect a number of treasures on each screen before leaving by bumping into a key located somewhere on the screen.

The aliens inhabiting this mine are all very familiar mickey-takes of popular computer game characters. Thus we see little pac-men on legs, a lot of hover mowers from the 64 game Hover Bovver, the man himself Jeff Minter puts in an appearance later on in the game, the well-known animated game character Horace is also in there somewhere, and on every level you'll find something that is familiar.

A good idea for a game, certainly, but regrettably it's all been done before, and done a lot better in the original Spectrum game Manic Miner. Worst of all, it seems to have been written in slow old Basic, and so everything happens at speeds more suitable to snails than Commodore 64s. Finally, the musical background will have you reaching for the volume control on your T.V. set within seconds of starting the game.

Sorry Interceptor, if it was an original game it would be all right, but 64 owners who want a version of Manic Miner for their machine might as well wait until the original program is converted.

As with Interceptor's games, those available from Terminal are difficult to predict, and the most lurid of covers can sometimes reveal the most awful of games. Hunter, from the cover, looks as if it should be a three-dimensional space version of pac-thing. The reality, however, ▶

◀ is not quite like that.

With the option of using either a joystick or the keyboard, the action takes place in a maze, divided up by various blocks around which you and the enemy must move your ships in an effort to destory each other.

The motion of your ship is nicely controlled. Moving the joystick in any direction increases the speed of the ship in that direction up to lunatic level, and releasing the stick allows you to slow down gradually to a halt again. Firing is done, reasonably enough, with the fire button, but that appears to suspend all other movement until the missile either finds its mark or bounces harmlessly into the side of the maze.

If you miss, your score for each alien hit it decreased by one point, from a base score of 20 on screen one, 40 on screen two, and so on.

Some half-dozen aliens are after you to begin with, and journeying through the levels merely increases their speed rather than their number. The last enemy ship on each level mutates into a ship from the next level, so at least you get time to adjust to the new speed at which everything will start to happen.

Displaying a level of intelligence beyond most arcade games, the program starts off by inviting you to type in your name. You can be anonymous if you wish, but at least the program realises that the first person to play the game will inevitably get the highest score!

Overall Hunter, at £7.95, is neither brilliant nor terrible, simply another middle of the road game from a company capable of much better.

Well rescued

Lunar Rescue by any other name is still Lunar Rescue, and Stellar Dodger from Terminal Software is a poorly disguised version of said game. However, just because it copies an existing arcade game, is it to be decried out of hand?

Well, yes and no (as they say). The plot from the original arcade game has been changed a little, presumably to make the life of the programmer that much easier when it comes to handling complicated graphics. You start the game at the top of the screen in a mothership comfortably bobbing along from left to right and back again.

Far below, at the bottom of the screen, there are a number of supply dumps. Your mission is to pilot your interstellar shuttle down the screen to the supply dumps, pick up a few goodies, and get back to the top again.

Docking with the mothership is difficult enough as it is, but Terminal have seen fit to copy another memorable feature of Lunar Rescue. Namely, between the top and the bottom of the screen there float a large number of user-defined characters . . . sorry, asteroids, and these are to be avoided at all costs.

This is not easy, since your shuttle responds to the joystick with the rapidity of molasses, and collisions can often be seen to be inevitable seconds before they actually happen.

Remembering that you've got to press function key 1 to use the joystick, otherwise the game will serenely go off into self-demonstration mode and you'll have to use the keyboard option, this is a reasonable attempt at putting Lunar Rescue onto a home computer. But somehow the game does not match up at all to the original arcade version, and afficionadoes of the real thing will probably not find too much to their liking here.

Quite why the word Super has to appear at the front of a game's title is something that I will never understand. Any game thus describing itself is simply asking for trouble when it comes to a review, but happily Super Gridder, £7.95 from Terminal Software, emerges unscathed from criticism. This is one of those maddeningly addictive games that make you want 'just one more go' before giving up for the day. Before you know it, one more go has become at least ten more games, and the night begins to wear . . .

There is no particular reason why this game should be the success that it is. The graphics are nothing special; indeed they are quite ordinary, and only a few sprites serve to liven up an otherwise dull screen. The use of sound is perfunctory, and serves only to annoy the player, rather than enlivening the action.

The plot of the game is simplicity itself. You are on a grid, represented by a cheshire cat of a sprite that grins happily to itself throughout the game. The grid also features a couple of aliens, which look very like spiders but which are described as being carnivorous scorpions. Whatever they are they are not to be tangled with.

All you have to do is traverse the grid, which is made up of a series of horizontal and vertical lines. Any lines that you pass over changes colour, and completing a box of coloured lines scores ten points. When all the boxes on the grid have changed colour you move on to the next level.

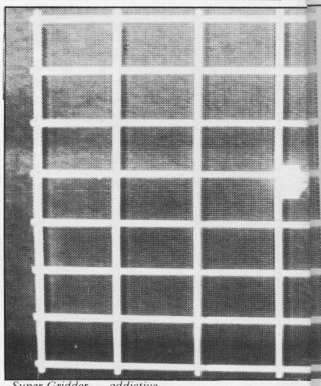
Successive levels don't feature any more scorpions, but do have a variety of differently shaped grids, from squares with holes in the middle to objects which even Pythagoras would have been hard pushed to name.

Completing eight levels takes you back to grid one again, but with three aliens after you this time, and your troubles begin anew.

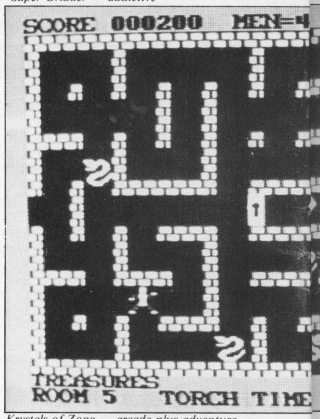
Refreshingly different, this is a very addictive game, and one that (in terms of hours of play versus price of cassette) guarantees you value for money.

On to Krystals of Zong, at £7.95 from Personal Software Services. Confusion reigns over this American import, since the cassette cover refers to it as krystals with a K, whilst the game prefers crystals with a C. Whatever you call it, this is a superb combination of arcade action amidst a challenging adventure scenario.

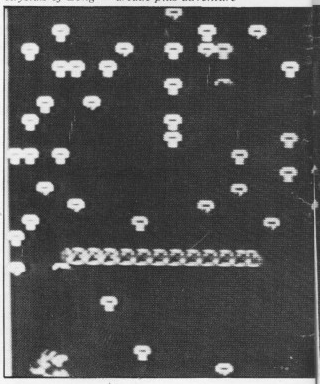
There are eight different levels of play, and on each level the action takes place on a three by three grid of nine different rooms. Depending on which level you're playing, each room is filled with four foul monsters. These can be either snakes, bats, spiders or mummies, and the nice graphics do actually



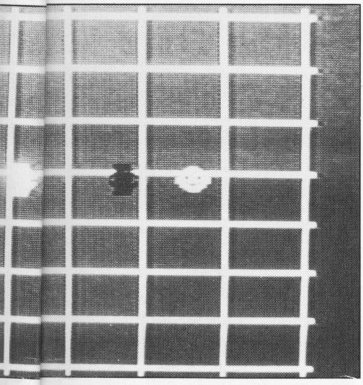
Super Gridder — addictive

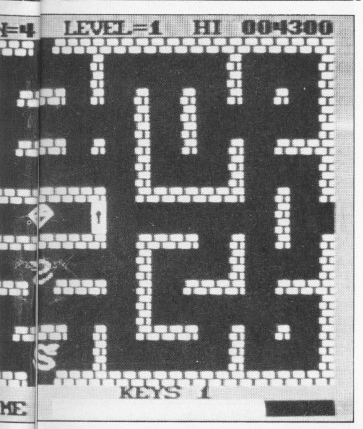


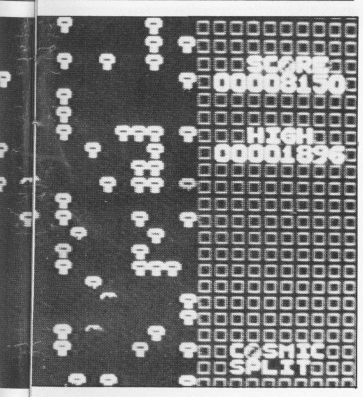
Krystals of Zong — arcade plus adventure



Cosmic Split — copying Centipede







allow you to differentiate from monster to monster.

They're really much of a muchness when it comes to chasing after you, although the mummies are equipped with fireballs, just to make life more interesting. The others merely blunder around after you, displaying little or no intelligence. On the higher levels this is just as well, since they move about like Sebastian Coe while you're still plodding along like a sleepwalker.

On each level the rooms are mazes with a treasure compartment in the centre of each. These compartments hold a variety of different treasures, and the musical effects even go as far as playing 'If I was a rich man' when you acquire one of the more valuable objects.

Also dotted about the rooms are different coloured keys, which allow you to open the treasure chest in the room of the same colour as the key. Opening the treasure chest with a ladder in it allows you to go on to the next level, where the action is inevitably meaner and harder.

Some of the features of traditional adventures are kept, and one of these is known engagingly as 'torch time'. Should your torch run out (and there are a number of refills on each level), all the aliens go a darker shade of grey and seem a mite more evil than usual.

With a whole host of useful ideas incorporated in it (like high scores, freezing the action, and so on), this is one of the better games around for the 64. Would that all the rest could meet the standard of Krystals (or Crystals!) of Zong.

Copy cat

Cosmic Split sounds like the sort of rather ice cream that you might find in Hitch Hikers Guide to the Galaxy, but in real life it is nothing more than a copy of our old friend Centipede, and not a very good copy at that.

For all you budding gardeners who've never heard of Centipede, it is nothing to do with looking after the sort of garden you might find in, say, Neasden (although I don't know ...). This garden is the sort that would be a challenge even to the great David Bellamy.

Using your joystick, you have to manoeuvre the laser cannon around the bottom third of the screen, whilst all the time firing at the hordes of hungry centipedes which trundle down the screen. Being unusually powerful centipedes, collision with even a single part of it means instant death, so you have to be handy on the laser cannon.

Also featured in this version of the game are spiders, snakes, fleas and fireballs (fireballs? In a garden? Oh well, who cares about reality!). Shooting any of these gives you a suitably satisfying bonus, whilst bumping into any of them is the end of another one of your three lives.

All well and good, and so far a fairly authentic copy of the original. However, there is one major difference between this version, presented by PSS, and the one to be found in amusement arcades everywhere. The original game is fun, but this is absolutely b-o-r-i-n-g. There is a good reason for this, since the action is all so deadly slow, that it is hard to work up any enthusiasm for the game at all, and you begin to long for the chance of nipping down the road and putting 20 pence in the nearest arcade game.

If you need to have copies of existing arcade games, and in particular Centipede, there are much better versions about than this. Commodore's own, for instance, is significantly faster, and a few games of that would convince you that Cosmic Split is purely for the rhubarb patch.

A game to delight all conservationists is Moby Dick, since the object of this particular exercise is NOT to kill the whale. Okay, you do have to destroy submarines and blow up helicopters, but the whale is definitely to be preserved. With me so far?

This is the sort of game that has you immediately reaching for the next game, to try to forget about it. It isn't the worst game I've ever seen, far from it, but it is a long way removed from being the best.

The usual requirement of arcade games when played with a keyboard is that you have to be at least an octopus in order to be able to reach all the keys in time. With Moby Dick however life is much easier than that, since you have only four options to worry about.

You are in control of a ship that floats along the top (fortunate, that) of the ocean waves. You can either speed the ship up or slow it down, but you can't change direction: you merely have to roll with the waves and keep going from left to right.

Below you a variety of submarines pass by, and these will only start attacking you on level 2. Amongst the submarines there is also to be found that aforementioned whale. By careful releasing of depth charges you can score a few points by destroying the odd submarine, but hitting the whale brings out a menacing green ship which rams you from the right hand side of the screen and condemns you to a watery grave.

But the main point of the game is to fire up at the helicopter which floats across the screen above you. A direct hit and you then have to catch the falling pilot before he too sinks into the ocean depths. This requires you to start moving as soon as the missile is fired, otherwise you haven't got a prayer of reaching the pilot before he splashes into the ocean. And that is basically that. The action isn't particularly fast, there isn't an awful lot to do, and like one or two other PSS games the only amazing thing about this game is that it ever got released in the first place. A good idea badly implemented.

But, PSS's Neoclyps is, as they say, something else. If it wasn't too late to vote for the '64 game of the year', this would push even the brilliant Jumpman from Epyx to a very, very close second.

The graphics are superb, bordering on the unbelievable. Cymbal Software Incorporated, the originators of the program, are to be congratulated on as good and smooth a graphical display as you'll see on any home computer. The use of sound is also very good, and combined with a simple but effective story line, Neoclyps deserves to be one of the biggest sellers of 1984, recommended to all ▶

◀arcade fans everywhere.

The idea of the game is indeed a fairly straightforward one. Being, according to the blurb, a good guy, freedom fighter and renowned star pilot, it is your task to rid the planet Neoclyps from the invading hordes of bad guys.

Since Neoclyps just happens to be one of your colonial planets, you rise to the challenge, and set off in your sturdy spaceship to do battle; but these aliens are crafty. The planet has been split up into four quarters, each populated by a different set of aliens. And there are more than just other enemy craft to contend with.

Each quarter has been fitted out with a number of radar towers which plot your every move, and you have to cleanse the surface of the planet not only of the bad guys, but also of the towers, since these serve only to alert the enemy of your presence.

With scrolling graphics going beyond anything I've seen for the 64, you race about the screen looking for aliens and towers. The rest of the surface of the planet is a mixture of what look life office blocks, space ports, service bays, and other assorted buildings. Usually the towers are hidden amongst these buildings, thus making them difficult to get at.

However, destroying an alien gives you temporary immunity, and it is then that you must swoop down and blast a tower before racing back up into the skies again. Stay down too long, or collide with a tower (even after it's been set on fire), and another of your 12 lives disappears. Twelve lives? Yes, and you'll need every one of them.

This is a great game, and every arcade fanatic with a Commodore 64 should rush out and buy it immediately. Neoclyps just cannot be praised enough.

Now we go on to consider games for the Vic 20. With a little bit of ingenuity and a lot of programming skill it is sometimes quite astounding to see what can be achieved with the unexpanded Vic 20. Remembering that you've only got about 3.5K to play with, Shark Attack, at £5.99 from Romik, proves that you don't need megabytes of memory in order to provide a good, entertaining, and highly addictive, original game.

You are in control of a little whirling blob that blunders about the screen. Using either a joystick or the keyboard, it is your task to fill the screen (or depths of the ocean, as Romik would have us believe) with your net, which sprays out behind you as you move.

Needless to say, it is not quite such plain sailing as it sounds. To make your task more challenging, the water in which you are swimming are full of rejects from the casting couch of Jaws. Just when you thought it was safe to play with a joystick again, you find yourself being chased by four sharks.

They might not look much like our watery friends, but meeting up with one of them is equally deadly, and one of your three lives will go should you be unlucky enough to bump into one.

You can surround them with your net, and indeed this is the key to achieving high scores in this game. But if you don't move for a while, or you spend too long casting your net over ground that you've already covered, the sharks lose patience and chew their way out.

If you manage to cover a fair percentage of the screen with life (or lives) still intact, you move on to the next level. Here everything is more or less the same, but with an important difference. A number of octopi have invaded the watery depths, and although they don't move around at all, they still represent a considerable obstacle as colliding with one of them ... yes, you guessed it, loses you a life.

And so it goes on, with two more octopi appearing at every higher level, until the sea is full of the things. You may get lucky and have an enterprising shark eat one of them, but don't hold your breath.

A good game that makes the most of the unexpanded Vic's limited features.

Blobbing along

Another one for the unexpanded Vic, Quadrant from Romik describes itself as a three dimensional game. While this might be described in unkind circles as stretching the truth a little (or a lot), the main failing of this game is the ludicrous selection of colours that Romik have chosen to display everything in. The action is at times quite simply unviewable, and you haven't got a clue about what's happening. All you know is that, if it moves, fire at it.

The storyline behind some arcade games now is reaching '201 minutes of a Space Idiocy' proportions, but here goes.

For some time now the planet Synlac has been used for its valuable resources of Bariox, whatever that might be. Recently, however, the evil Arcturans have been attempting to take the place over with a mighty secret weapon. You, being the true galactic hero that you are, are sent to do battle with these evil menaces to truth, justice and the Synlac way of life.

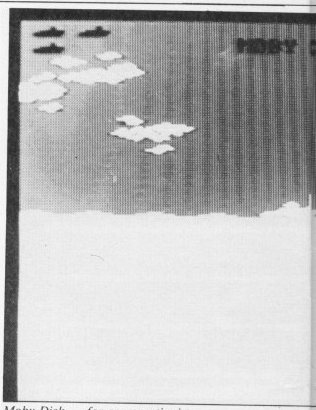
In real life of course it's never like they tell us it's going to be, so in this joystick or keyboard game the story goes something like this.

You have to guide this little blob along the surface of a planet. Now the local council have obviously not been looking after this place, since it's littered with more craters than the M1, and these have to be jumped over at all costs.

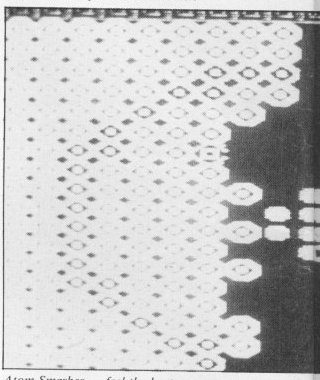
Meanwhile, a wave of odd-shaped objects are swirling about in the skies above, and periodically firing missiles at you. The object of the game is thus to avoid all the craters, whilst seeing off the aliens. You have control over the speed at which your little blob can move, and when to jump and fire.

Seeing off eight waves of these odd aliens takes you onto level two, otherwise known as the Eastern Quadrant, level one of course being the Northern Quadrant. Rather than points our Galactic Hero receives money for every alien destroyed, but alas this is reclaimed by the Vic at the end of the game.

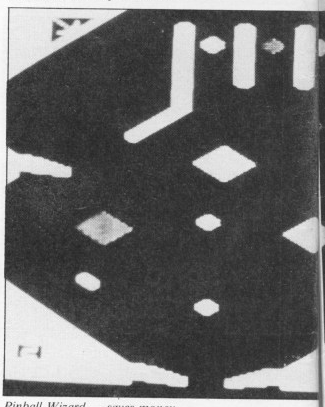
And so it goes on from level to level. Not bad, as Vic games go, but I wish they'd do something about the colour scheme. Also



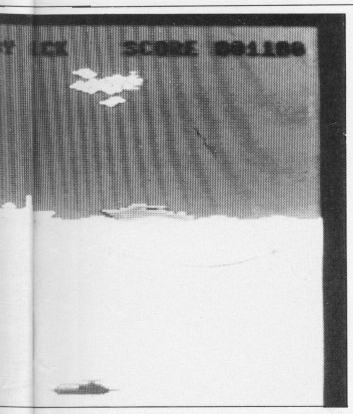
Moby Dick — for conservationists

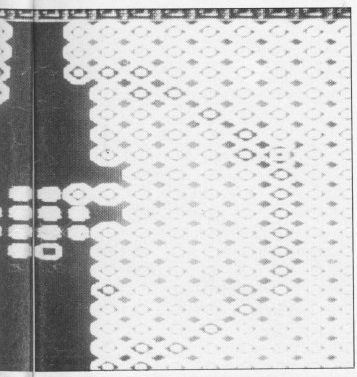


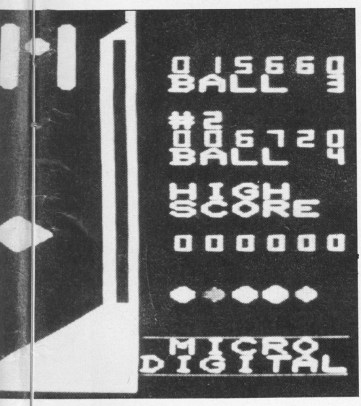
Atom Smasher — feel the heat



Pinball Wizard — saves money







for the unexpanded Vic, Atom Smasher — again from Romik — takes a good few minutes to load, as it comes into the machine in three distinct parts. As well as possibly being the program that takes the longest time to load into an unexpanded Vic, it could also win an award for having one of the most ridiculous story lines of any game for any computer. But having said all that, Atom Smasher is well worth a place in any Vic 20 arcade game fanatic's library.

You are in the heart of a nuclear reactor, which is heading irresistibly towards a cataclysmic meltdown. In order to delay this inevitable fate, you are in command of a miniaturised laser implanted inside the heart of the nucleus. You have to perform all kinds of tasks to try and keep the meltdown at bay.

You can, should you choose, shoot down a proton or two. However, completely disobeying all known laws of physics, shooting a proton brings in a fresh electron to glide about the place (there's only one to begin with), as well as another proton. Perhaps all this additional energy, bearing in mind the law of conservation of same, is being dissipated from you, for make no mistake, this is a fast action game requiring a firm hand on the joystick.

If you shoot an electron nothing noticeable happens, but the meltdown does appear to procede at a faster rate, so however tempting it may be, it's probably wise to resist that temptation.

It is also wise to avoid running into an electron, since that loses one of your three lives, as well as bringing yet another electron into the game. After a while an electronic wall starts encroaching from the side of the screen, and although you can shoot it this will move inwards faster than you can destroy it, and when it reaches the nucleus the game is over.

Some very nice graphics (especially when you lose the game), and good use of sound make this an enjoyable romp for the unexpanded Vic.

Romik's own description of Zorgon's Kingdom as being a cross between an arcade game and an adventure game is perhaps a little misleading. It would be more realistic to call it five arcade games rolled into one, since every level requires far more of the skill and reflexes of the dedicated arcade freak than it does the thinking mind of the true adventurer.

This time you'll require at least 8K of expansion, since there's a lot going on in Zorgon's Kingdom. After a wait of a few minutes, and the scene setting death-defying prose on the screen you're into the game proper.

Strangely enough, the first question you're asked is 'how many lives do you want', with a choice of from one to six. Since only a fool (or very good player) would attempt to get through all five levels with just the one life, this seems a mite superfluous. Still, having selected six lives, into the game proper.

For the first part of the game you have to climb up a number of ladders, and move along walls that crumble beneath you at an alarming rate. Also on the warpath is a bouncing ball, whose touch means instant death. If you successfully get to the top of the screen, it is galling to learn that you hve to do the whole thing again. I know it's in the instructions, but even so...

Should you succeed, everything stops for a quick cigarette while the next part of the game is loaded. When it gets there it's infinitely more complicated than the first part. You have to jump from lift to lift, avoid falling bats, slide down a slope and then finally avoid a few octopi until they mutate and you can catch them. Catch two and you escape to level three, and another wait while that is loaded into the machine.

And so it goes on, avoiding organ pipes, electric wires, and many more hazards before you reach the ultimate level five!

Losing all your lives beyond level one means you have to switch the Vic off and on again before re-loading the first part of the program. However, that is only a minor complaint against what is clearly a very competent piece of programming, making extremely good use of the graphics and imagination (but rather less of sound), and overall at £6.99 this is a good buy.

Pinball welcome

If, like me, you spend a lot of money on pinball machines, you'll welcome pinball wizard, from Terminal Software for the unexpanded Vic 20. Whilst not having the feel of the real thing, this program tries really hard to be a true 'Pinball Wizard'.

Of course, it is too much to expect of any computer-simulated pinball game that you can ever get the feel of a real-live pinball table. Just as the often-seen simulations of one-armed bandits also fall short of the mark, there is something about the mechanical side of life that fascinates so many people about these two particular pastimes.

Still, if it exists it will sooner or later turn up on a computer, and this is a better attempt than most, and it also has the virtue of running on the unexpanded Vic 20.

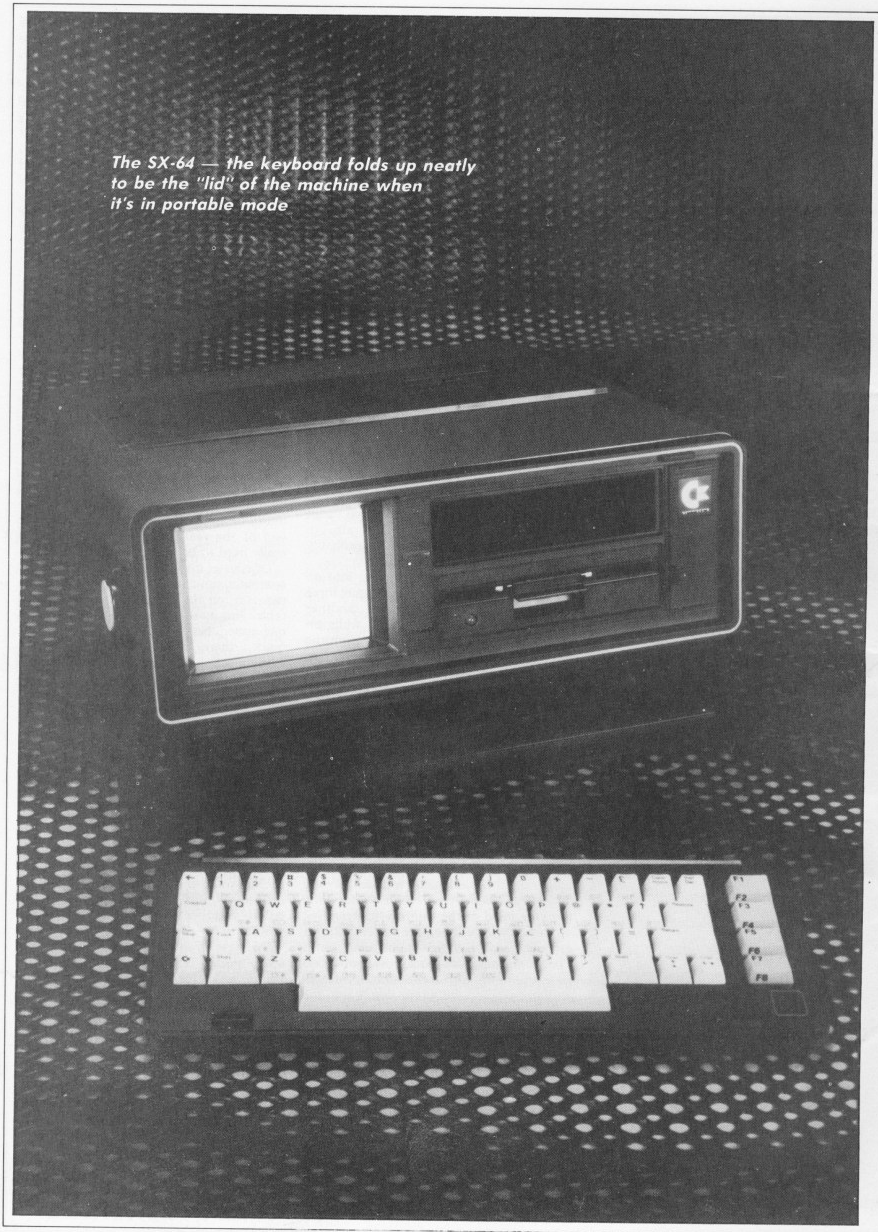
On completion of loading you can opt for either a one or a two player game, and having selected that you have five balls to achieve a marathon score.

The plunger is pulled back by pressing the 'F5' key, and is released by pressing 'F7'. It would appear to be impossible not to send the ball onto the table, as even the merest tap of the key manages to get the ball to scrape into the action.

Pulling the plunger back to its full limit will always give you a handy bonus start of 1,000 points (bit mean on scoring, this game), and after that you can only control the three flippers and hope for the best.

There aren't too many things to be hit in the game, although there is definitely enough to keep it interesting. The program manages a more-than-passable impersonation of Newton's laws of gravity, and it is always satisfying to watch the points total clicking up in rapid fashion.

Although you haven't a chance of getting a replay, as that option isn't included in the game, there are plenty of bonuses and jackpots to go for, and if the local amusement arcade has been closed for the night, pinball addicts should find plenty to keep them entertained in this very good game. ■



The SX-64 — the keyboard folds up neatly to be the "lid" of the machine when it's in portable mode

Putting the portable SX-64 through its paces

Pete Gerrard assesses the price of portability on the SX-64 — and its business chances

EVER SINCE Commodore began its attack on the computer market in 1977 with the very first Pet it's always managed to produce a few suprises.

The Vic 20, when it originally appeared, was hailed as a wonderful home computer. Now although computer journalists are fond of decrying it as a "dinosaur", it continues to sell in vast quantities.

The Commodore 64 was seen by most of the experts to be a "wasted opportunity" on Commodore's behalf. Superb graphics, excellent sound facilities, but a truly awful version of Basic. Nevertheless, the 64 has also managed to sell in extremely large numbers.

Cold feet

In between these two very popular computers, Commodore tried to retain its dominance of the business computer market by launching both the 500 and the 700 series machines. An expensive advertising campaign, and a much-publicised launch that was possibly one of the biggest flops of 1983, couldn't hide the fact that there was simply no demand for them, even if the company could have produced them in the first place.

Never one to admit that it was wrong, Commodore quietly forgot about the 500 and 700 series, and went back to producing even greater quantities of Vic 20s and Commodore 64s.

But somewhere along the line someone must have got cold feet about putting all the company's eggs in the home market. Thus we have the portable Commodore 64, the SX-64, an attempt to regain some ground in the business world, while at the same time retaining most of the features that bought such success to the original 64 machine.

However, it is distressing to report that Commodore never seems to learn from its mistakes. Other companies, for example Sinclair, do at least appear to take some notice of what the rest of the world is saying, rather than ignoring all outside comment and looking purely at the monthly sales figures.

Machines are refined, innovations are made, costs are lowered and the benefits passed on to the people who keep these companies in business, namely you. However, Commodore carries on in its own sweet way, and the portable 64 is the latest result. Put simply, it is a Commodore 64 with an in-built monitor and a single disk drive, selling at a cost of around £900 in the UK.

The monitor is a mighty 5 inches across, and although there are a number of controls built into the machine for adjusting volume, colour, brightness and so on, Commodore appears to have left out a tuning facility. Thus you either have to peer at a very badly focused screen, or open up the computer in the vague hope of finding something to tune it with. For the average business man this would not seem to be a good idea.

The disk drive is, predictably, nothing more exciting than a Vic 1541 drive chopped up and inserted into a different box. There's 170K of storage space per disk, and only a single drive as well, although the design of the machine would suggest that there was originally going to be a model with two drives.

Indeed, the accompanying manual (and Commodore has done every computer book writer in the country a great service here) also hints at a double drive model called the DX-64, and even has a drawing of it. However, sources close to Commodore have informed me that this machine will never now appear, and we're stuck with the single drive version.

The keyboard, which neatly folds up to be the front of the beast when put into portable mode, has exactly the same layout as the original Commodore 64. But, and it's a very big but, the keys are not moulded in the same way.

Commodore may advertise it as a full travelling keyboard, but unfortunately the keys don't travel far enough, and they also have a very "slippery" feel to them. Touch typists would be hard put to achieve their normal speeds using this keyboard.

You do have the added bonus of a little light on the shift-lock key informing you whether it's active or not, but I feel that this is a small advantage considering all the bad things that have happened to the keyboard.

Inside we find that the portable 64 retains most of the features of the standard Commodore 64. Despite having a disk drive built into the machine Commodore still insists on having good old Basic 2.0 as the standard operating system. There is no provision for installing any of the advanced Basic 4.0 disk handling commands such as "Catalog", "Scratch", and so on. Instead, everything has to be done the long way by opening files and printing to files. And loading the disk directory as if it were a program in its own right is truly dreadful, wiping out whatever Basic program happened to be in memory at the time.

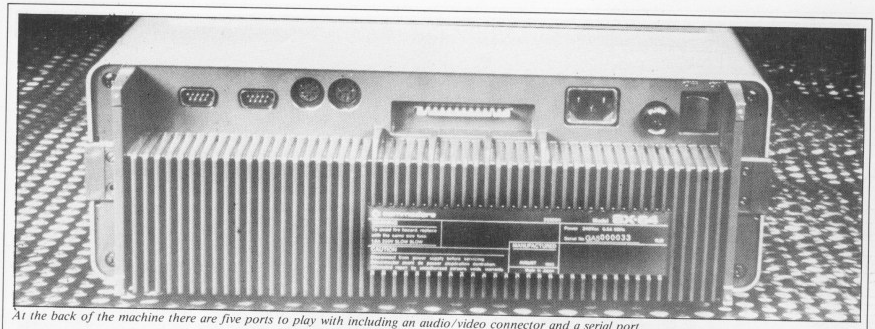
There has been one minor concession made to the fact that the portable 64 does have a disk drive built in. Pressing the shift key in confunction with the Run/Stop key now loads and runs the first program from disk, rather than asking you to press play on tape and then loading and running that program.

So how do you load a program from tape then? The simple answer is that you don't. There is no cassette interface anywhere on the portable 64, although some of the software for handling cassette decks still appears to have been retained in ROM.

Illegal

Commodore claims that, because it's intended to be a business computer, there is no need to have a cassette deck connected up to the portable. But one Commodore employee told me a somewhat different story, about how the machine was developed in Japan. There, it seems, they too decided that a business machine didn't need a cassette deck, and simply chopped the appropriate interface off the circuit board inside the computer.

Realising then that this left them with a lot of redundant software inside the computer's ROM, they re-wrote a few things so that every time anyone tried to load a program from tape, the message "Illegal device number" would appear ▶



At the back of the machine there are five ports to play with including an audio/video connector and a serial port

◀ on the screen.

All well and good, but no-one, least of all Commodore in the UK knows what has replaced all the ROM code that the Japanese took out. Damned clever, these Japanese.

Most people have assumed that the Commodore 64 would be the standard on which Commodore would base its new micros, at least for the next year. Already we have seen that this is not the case, but with the SX-64 it would appear that a fair degree of compatability has been achieved.

All the Commodore 64 disk and cartridge software that I tried worked quite happily on the portable machine, although there were one or two interesting differences between programs.

The popular Supermon, a public-domain machine code assembler/disassembler for the 64, worked pretty well, so long as you remember to change the background colour of the screen before running it. This is purely because the portable starts off with a different background/border combination to the original model.

One program that might have caused difficulties, since it virtually takes over the computer, is the well-known word processor PaperClip. However, this review was printed out from a portable 64 using PaperClip linked up to an Epson PX-80 via the interface Interpod, so that too would appear to work without any major problem.

You'll notice that I said "printed out", not "written on". At £895 one is fairly safe in assuming that this machine is going to hit the business end of the market. If it does some drastic changes will have to be made to the built-in monitor, as it is virtually impossible to clearly read characters on it for any substantial length of time. The display is simply not big enough.

Commodore, quite rightly, points out that the machine can be connected up to a domestic television set, but surely this is defeating the point of having a portable computer in the first place?

Although everything that I tried worked quite happily on the SX-64, the story from Commodore is rather different. It would appear that a number of packages, in particular cartridge-based ones, will not work on the new machine. More importantly, the much-vaunted modem for the original 64 may not function either. This is a serious let-down for a new business machine.

The cost of £895 does seem to be rather high, when you consider that the cost of a Commodore monitor, a Commodore 64 and a Commodore disk drive is about £650. So, for an extra £245 you can get a monitor that you can't read, a lightweight and unfriendly keyboard, have the delightful uncertainty of never knowing whether a program will work or not until you try it, and of course no possibility of using tape-based software. It may be portable, it might have a neat design, but for the extra cost I for one would need a lot of persuading.

The lack of a cassette port will probably induce a few people into piracy, ie making copies of their favourite tape-based programs so that friends unfortunate enough to have an SX-64 can use them all on their disk systems — on their 170K disk system, that is. As I've said, there's no Basic 4 disk commands, no double sided disks (although you can use them if you want to risk it!), and no easy way of performing a disk to disk backup without either waiting hours while you swop disks, or acquiring someone else's disk drive.

On the brighter side

But there are good points, if you look long enough and hard enough.

Of course, the chief selling point of the machine will be its portability (24½ pounds in weight, and fairly easy to carry once you've got it out of the box that it arrives in), with only one wire trailing about the place in the basic configuration, as opposed to the usual mile or two of spaghetti to be found with most computers.

The piece of software that arrives with the computer reputedly costs over £210, which can't be bad. It may be mainly an ordinary financial forecasting package to you and me, but someone somewhere does believe that it really is worth over £210.

Why, then, don't Commodore offer no free software, and reduce the price down to a more reasonable £685? Bearing in mind that that price is still higher than the price of the first Commodore Pet when it was launched, it would be unfair to assume that Commodore has got a large backlog of unsold software that it wants to get rid of.

All the wonderful sound and graphic capabilities of the original Commodore 64 are still there (why use one POKE when 10 will do?), and most of the ROM-based software appears to have survived the move intact, unlike earlier machines. It still uses the same processor as the 64, namely the 6510, and most of the other internal chips appear to resemble closely their earlier counterparts.

Although there isn't a cassette port sticking out of the back of the machine, there are still quite a number of other interesting ports there. Underneath the machine is the keyboard connector. This healthily long cable arrives in a little box all of its own, and after the first few fumbling efforts is easy enough to connect up.

At the back of the machine are five other ports to play with, including (this really is a business machine) two joystick/light pen/paddle connectors. These are followed by an audio/video connector, a serial port, and the ubiquitous user port, which requires a level convertor before you can access its RS-232 capabilities.

On top of the SX-64 is the cartridge slot, neatly covered by two little hinged doors when not in use. Thus cartridges stick out of the top of the computer when being used, but at least you can't forget that you've got one installed.

According to the people that I've spoken to at Commodore, the company appears to be expecting great things of the SX-64. The advantages of having a built-in monitor and disk drive are great, and at 24½ pounds it is certainly easy enough to carry the machine about from home to office.

As far as delivery goes, at the time of writing (12th January) there are apparently 800 portables on a ship sailing serenely across the ocean towards the UK, and more are supposedly on their way.

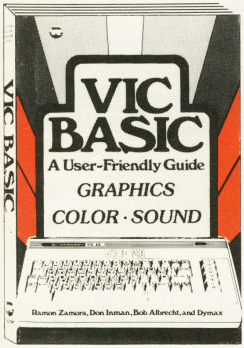
However, nearly £900 is an awful lot of money to pay for what is basically a home computer these days, and the arrival of the Sinclair QL at around £400 may make Commodore re-think its pricing strategy.

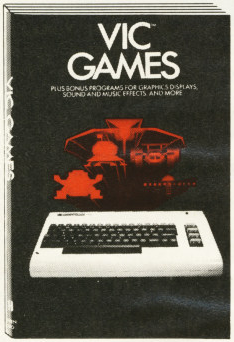
If it doesn't it's liable to have an expensive failure on its hands. One Commodore employee told me that he would definitely buy one when and if they became more readily available. But this is one journalist who definitely won't be buying one! Now, if someone were to give me one . . . ■

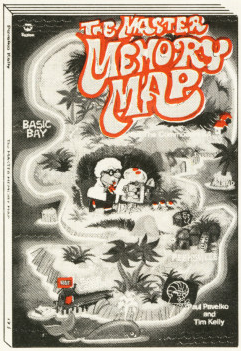
MAKE THE MOST OF YOUR COMMODORE

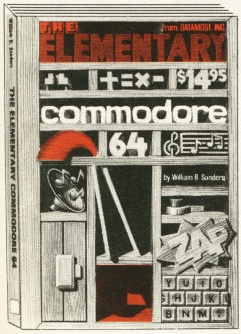
Vic Basic

A step-by-step introduction to the VIC 20 computer and its language, Vic Basic. Teach yourself how to use the Vic to create your own programmes, music and art. Also included are puzzles, exercises and games programmes. **355 pages.**









The Elementary Commodore 64

A beginner's step-by-step introduction to the Commodore 64, basic and how to programme. Includes POKE and PEEK, secrets, formatting text, data manipulation, arrays, editor, graphics and helpful hints. **230 pages.**

Four excellent books for Commodore and Vic 20 owners which explain fully how to obtain the best results from your computer — and fun, too! Learn all about Basic, graphics, how to write your own games, find the useful memory location functions and learn how to programme.

Vic Games

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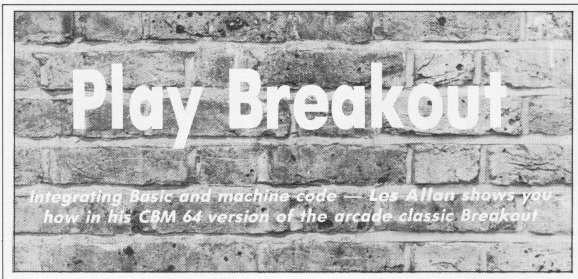


```
10 :
12 REM **** CLEAR SCREEN / SET INITIAL VARIABLES ****
14 PRINTCHR$(147):DIMSC(10),SC$(10)
16 VC=53248:POKEVC+32,0:POKEVC+33,0
18 FORT=1TO25:A$=A$+CHR$(17):NEXT:A$=CHR$(19)+A$:FORT=1TO10:SC(T)=0
20 SC$(T)=CHR$(154)+"**"+CHR$(158)+CHR$(18)+" 64 BREAKOUT "+CHR$(146)+CHR$(154)+
"**":NEXT
22 PRINTLEFT$(A$,13)SPC(8)CHR$(5)"SETTING UP CHARACTER SET"
24 FORT=0TO24:POKE54272+T,0:NEXT
26 POKE54296,15
28 POKE54276,32:POKE54277,24:POKE54278,40:POKE54273,8:POKE54272,147
30 POKE54290,16:POKE54291,136:POKE54292,129:POKE54287,6:POKE54286,147
32 :
34 REM **** PROTECT MEMORY / TRANSFER DATA FROM ROM TO RAM ****
36 POKE52,48:POKE56,48
38 POKE56334,PEEK(56334)AND254
40 POKE1,PEEK(1)ANDZ51
42 FORT=0TO2048:POKE14336+T,PEEK(53248+T):NEXT
44 POKE1,PEEK(1)OR4
46 POKE56334,PEEK(56334)OR1
48 :
50 REM **** SET UP CHARACTERS ****
52 T=0:SUM=0
54 READA:IFA<>-1THENPOKE14336+T,A:T=T+1:SUM=SUM+A:GOTO54
56 T=0
58 READA:IFA<>-1THENPOKE14720+T,A:T=T+1:SUM=SUM+A:GOTO58
60 :
62 REM **** SET UP SPRITES ****
64 T=0
66 READA:IFA<>-1THENPOKE12800+T,A:T=T+1:SUM=SUM+A:GOTO66
68 :
70 REM **** SET UP MACHINE CODE ****
72 T=0
74 READA:IFA<>-1THENPOKE49152+T,A:T=T+1:SUM=SUM+A:GOTO74
76 IFSUM<>96680THENPRINTCHR$(147)CHR$(5)TAB(5)"ERROR IN DATA STATEMENTS   !!!":S
TOP
78 :
80 REM **** START GAME ****
82 POKEVC+24,(PEEK(VC+24)AND240)OR14:POKEVC+17,91:POKEVC+35,14:SYS49152
84 PRINTLEFT$(A$,14)SPC(6)CHR$(129)"YOU HAVE FOUR BALLS TO BREAK"
86 PRINTLEFT$(A$,16)SPC(6)"THROUGH  AS  MANY  WALLS AS"
88 PRINTLEFT$(A$,18)SPC(16)"POSSIBLE"
90 PRINTLEFT$(A$,21)SPC(5)CHR$(156)"USE JOYSTICK "CHR$(31)"[PORT 2]"CHR$(156)" T
O START"
92 POKEVC+23,255:POKEVC+29,255
94 POKE2040,200:POKEVC,67:POKEVC+1,75:POKEVC+39,1
96 POKE2041,201:POKEVC+2,97:POKEVC+3,75:POKEVC+40,3
98 POKE2042,202:POKEVC+4,127:POKEVC+5,75:POKEVC+41,4
100 POKE2043,203:POKEVC+6,157:POKEVC+7,75:POKEVC+42,5
102 POKE2044,204:POKEVC+8,187:POKEVC+9,75:POKEVC+43,7
104 POKE2045,205:POKEVC+10,217:POKEVC+11,75:POKEVC+44,10
106 POKE2046,206:POKEVC+12,247:POKEVC+13,75:POKEVC+45,13
108 POKE2047,207:POKEVC+14,22:POKEVC+15,75:POKEVC+16,128:POKEVC+46,14
110 SUM=0:FORT=0TO7:SUM=SUM+2^T:POKEVC+21,SUM:FORTT=1TO100:NEXTTT,T
112 PRINTLEFT$(A$,9)SPC(32)CHR$(150)" LES ":PRINTLEFT$(A$,10)SPC(32)"ALLAN"
114 T=0:RP=0
116 T=T+1:IFT=10THENPRINTLEFT$(A$,21)SPC(18)CHR$(18)CHR$(31)"[PORT 2]"
118 IFT=20THENPRINTLEFT$(A$,21)SPC(18)CHR$(146)CHR$(31)"[PORT 2]":RP=RP+1:T=0
120 J=PEEK(56320)
122 IFRP<>10ANDJ=127THEN116
124 POKEVC+21,0
126 PRINTLEFT$(A$,9)SPC(32)CHR$(28)"@@@@@":PRINTLEFT$(A$,10)SPC(32)"@@@@@"
128 IFJ=127THEN110
130 POKEVC+23,0:POKEVC+29,0
132 :
134 REM **** SET UP GAME ****
136 PRINTCHR$(147):BA=4:SC=0
138
140 REM **** NEW WALL ****
142 SYS49242
144 :
146 REM **** NEW BALL ****
148 X=184:Y=159:DX=8:DY=8:BX=176:BY=215
150 PRINTLEFT$(A$,25)SPC(2)CHR$(31)CHR$(18)"BALLS LEFT"BA;
152 PRINTSPC(3)"SCORE"SC,"BREAKOUT";
154 POKE2040,209:POKEVC,X:POKEVC+1,Y:POKEVC+39,7
156 POKE2041,208:POKEVC+2,BX:POKEVC+3,BY:POKEVC+40,6
158 POKEVC+16,0:POKEVC+21,3
160 :
162 REM **** MOVE BAT & BALL ****
164 X=X+DX:Y=Y+DY:IFX<32ORX>328THENDX=-DX
166 IFPEEK(56320)=123ANDBX>24THENBX=BX-12
```

STAR GAME

BREAKOUT FOR the Commodore 64, a revival of that classic arcade game, employs user defined graphics to replace the character set and construct the walls. Sprite graphics are used to create the title page and control the movement of the bat and ball. Two machine code routines are used to construct each of the two walls; one for the title page and the other for the game itself.

You are given four balls with which you have to dislodge bricks from the wall by repeatedly hitting the ball with your bat. Points are given for each section of the wall that is destroyed and an extra ball is awarded for each wall broken through.

A score table routine is provided.

Variables

A read data
J value returned by joystick
T general purpose
X ball x
Y ball y
Z pointer for score table position
BA balls left
BX bat x
BY bat y
BZ sprite to character conversion
DX ball increment x
DY ball increment y
RP repeat counter
SC current score
SU SUM of data used in error trap routine
VC video chip start address
A$ "hme-crs dwn 25 times"
SC$ score table name

Machine code routine

49152 load accumulator with red (2)
49154 store contents of accumulator in 900
49157 load x with 250
49159 load y with brick (0)
49161 store red with x increment starting 55295
49164 store red with x increment starting 55545
49167 store red with x increment starting 55795
49170 store red with x increment starting 56045
49173 transfer brick to accumulator
49174 store brick with x increment starting 1023
49177 store brick with x increment starting 1273
49180 store brick with x increment starting 1523
49183 store brick with x increment starting 1773
49186 load accumulator with contents of 900
49189 decrement x register by 1
49190 branch forward 3 if 0
49192 return to 49161 until screen full
49195 load accumulator with space (32)
49197 load x with 36
49199 store space with x increment starting 1465
49202 store space with x increment starting 1505
49205 store space with x increment starting 1545

```
168 IFPEEK(56320)=119ANDBX<320THENBX=BX+12
170 POKE54276,32:POKE54290,16
172 POKEVC+30,0:POKEVC+31,0
174 POKEVC,XAND255:POKEVC+1,Y:POKEVC+2,BXAND255
176 POKEVC+16,INT(X/256)+INT(BX/256)*2
178 IFY=BYAND(PEEK(VC+30)AND3)=3THENDY=-DY:POKE54290,17
180 IFBY<YANDBR>0THENBR=BR-1:IFBR>0THEN148
182 IFBR=0THENBR=4:PRINTLEFT$(R$,13)SPC(14)CHR$(5)" GAME  OVER ":FORT=1TO2500:NE
XT:GOTO204
184 IFYC31THENBR=BR+1:GOTO142
186 IF(PEEK(VC+31)AND1)<>1THEN164
188 BZ=(X-24)/8+(Y-39)*5:IFPEEK(1024+BZ)=32THEN164
190 POKE1024+BZ,32:POKE1064+BZ,32
192 IFDY=-8THENDY=-DY
194 POKE54276,33
196 SC=SC+1:PRINTLEFT$(A$,25)SPC(23)SC;:POKEVC+31,0
198 GOTO164
200 :
202 REM **** SCORE TABLE ***
204 PRINTCHR$(147)
206 POKEVC+32,3:POKEVC+33,3:POKEVC+21,0:POKEVC,0:POKEVC+1,0:POKEVC+2,0:POKEVC+3,
0
208 Z=0:FORT=1TO10:IFSC>SC(T)THENZ=T:T=11
210 NEXT:IFZ=0THEN240
212 POKE198,0
214 PRINTLEFT$(A$,7)SPC(9)CHR$(154)"ENTER TEXT FOR SCORE TABLE"
216 PRINTLEFT$(A$,13)SPC(11)"NAME  ..........";
218 FORT=1TO13:PRINTCHR$(157);:NEXT:PRINTCHR$(31);:INPUTN$
220 IFLEN(N$)>11THENN$=LEFT$(N$,11)
222 FORT=1TO11:Z$=MID$(N$,T,1):IFZ$=CHR$(46)THENN$=LEFT$(N$,T-1):T=12
224 NEXT
226 IFZ=0THEN234
228 FORT=9TOZSTEP-1:SC(T+1)=SC(T):SC$(T+1)=SC$(T):NEXT
230 :
232 REM **** ENTER SCORE ***
234 SC(Z)=SC:SC$(Z)=CHR$(29)+CHR$(29)+CHR$(18)+CHR$(32)+N$+CHR$(32)
236
238 REM **** PRINT SCORE TABLE ****
240 PRINTCHR$(147)TAB(12)CHR$(154)"**"CHR$(30)" SCORE TABLE "CHR$(154)"**"CHR$(1
7)
242 POKEVC+35,4:FORT=1TO10
244 PRINTCHR$(30)CHR$(17)" BREAKER";T;TAB(12)CHR$(5);SC(T)TAB(22)CHR$(158);SC$(T
):NEXT
246 PRINTLEFT$(A$,25)SPC(8);
248 PRINTCHR$(30)"USE "CHR$(5)"JOYSTICK"CHR$(30)" TO RE-START";
250 T=0:RP=0
252 T=T+1:IFT=10THENPRINTLEFT$(A$,25)SPC(12)CHR$(18)CHR$(5)"JOYSTICK"CHR$(146);
254 IFT=20THENPRINTLEFT$(A$,25)SPC(12)CHR$(5)"JOYSTICK";:RP=RP+1:T=0
256 J=PEEK(56320)
258 IFJ=127ANDRP<>50THEN252
260 POKEVC+32,0:POKEVC+33,0:GOTO82
262 :
264 :
266 REM **** CHARACTER SET DATA ****
268 DATA231,231,231,0,126,126,126,0
270 DATA126,102,102,126,230,230,230,0
272 DATA124,102,102,124,230,230,252,0
274 DATA126,102,96,96,224,230,254,0
276 DATA120,108,102,102,230,236,248,0
278 DATA126,96,96,120,224,224,254,0
280 DATA126,96,96,120,224,224,224,0
282 DATA126,102,96,110,238,238,254,0
284 DATA102,102,102,126,230,230,230,0
286 DATA60,24,24,24,56,56,126,0
288 DATA60,24,24,24,28,220,252,0
290 DATA102,108,120,112,248,236,230,0
292 DATA96,96,96,96,224,230,254,0
294 DATA102,126,102,102,230,230,230,0
296 DATA102,118,126,110,230,230,230,0
298 DATA126,102,102,102,230,230,254,0
300 DATA126,102,102,126,224,224,224,0
302 DATA126,102,102,230,230,254,28,0
304 DATA124,102,102,124,248,236,230,0
306 DATA60,102,96,126,6,230,252,0
308 DATA126,24,24,24,56,56,56,0
310 DATA102,102,102,102,230,230,252,0
312 DATA102,102,230,230,230,60,24,0
314 DATA102,102,102,102,230,254,230,0
316 DATA102,102,60,24,60,230,230,0
318 DATA102,102,102,60,24,56,56,0
320 DATA126,70,12,24,240,226,254,0
322 DATA-1
324 DATA126,102,102,102,230,230,254,0
326 DATA24,24,56,24,56,56,126,0
328 DATA60,102,6,12,48,110,126,0
330 DATA60,102,6,28,6,118,124,0
332 DATA6,102,102,102,127,6,6,0
334 DATA126,96,124,6,6,230,252,0
336 DATA60,102,96,252,230,230,252,0
338 DATA126,102,12,24,56,56,56,0
340 DATA60,102,102,60,230,230,252,0
342 DATA60,102,102,62,6,118,124,0
344 DATA-1
346 :
348 REM **** SPRITE DATA FOR TITLE ****
350 DATA255,192,0,255,224,0,240,112
352 DATA0,240,112,0,240,112,0,240
354 DATA112,0,255,224,0,255,224,0
356 DATA240,112,0,240,112,0,240,112
358 DATA0,240,112,0,255,224,0,255
360 DATA192,0,0,0,0,0,0,0
362 DATA0,0,0,0,0,0,0,0
364 DATA0,0,0,0,0,0,0,0
366 DATA255,192,0,255,224,0,240,240
368 DATA0,240,112,0,240,112,0,240
370 DATA240,0,0,255,224,0,255,192,0
372 DATA255,0,0,0,255,128,0,247,192
374 DATA0,243,224,0,241,240,0,240
376 DATA240,0,0,0,0,0,0,0
378 DATA0,0,0,0,0,0,0,0
380 DATA0,0,0,0,0,0,0,0
382 DATA255,240,0,255,240,0,240,0
384 DATA0,240,0,0,240,0,0,240
386 DATA0,0,255,0,0,255,0,0
388 DATA240,0,0,240,0,0,240,0
390 DATA0,240,0,0,255,240,0,255
392 DATA240,0,0,0,0,0,0,0
394 DATA0,0,0,0,0,0,0,0
396 DATA0,0,0,0,0,0,0,0
398 DATA15,0,0,63,192,0,240,240
400 DATA0,240,240,0,240,240,0,240
402 DATA240,0,255,240,0,255,240,0
404 DATA240,240,0,240,240,0,240,240
406 DATA0,240,240,0,240,240,0,240
408 DATA240,0,0,0,0,0,0,0
410 DATA0,0,0,0,0,0,0,0
412 DATA0,0,0,0,0,0,0,0
414 DATA240,240,0,241,224,0,243,192
416 DATA0,247,128,0,255,0,0,255
418 DATA0,0,254,0,0,254,0,0
420 DATA255,0,0,255,0,0,255,128
422 DATA0,247,192,0,243,224,0,241
424 DATA240,0,0,0,0,0,0,0
426 DATA0,0,0,0,0,0,0,0
428 DATA0,0,0,0,0,0,0,0
430 DATA63,192,0,127,224,0,240,240
432 DATA0,240,240,0,240,240,0,240
434 DATA240,0,240,240,0,240,240,0
436 DATA240,240,0,240,240,0,240,240
438 DATA0,240,240,0,127,224,0,63
440 DATA192,0,0,0,0,0,0,0
442 DATA0,0,0,0,0,0,0,0
444 DATA0,0,0,0,0,0,0,0
446 DATA240,240,0,240,240,0,240,240
448 DATA0,240,240,0,240,240,0,240
450 DATA240,0,240,240,0,240,240,0
452 DATA240,240,0,240,240,0,240,240
454 DATA0,240,240,0,127,224,0,63
456 DATA192,0,0,0,0,0,0,0
458 DATA0,0,0,0,0,0,0,0
460 DATA0,0,0,0,0,0,0,0
462 DATA255,240,0,255,240,0,15,0
464 DATA0,15,0,0,15,0,0,15
466 DATA0,0,15,0,0,15,0,0
468 DATA15,0,0,15,0,0,15,0
470 DATA0,15,0,0,15,0,0,15
472 DATA0,0,0,0,0,0,0,0
474 DATA0,0,0,0,0,0,0,0
476 DATA0,0,0,0,0,0,0,0
478 :
480 REM **** SPRITE DATA FOR BAT & BALL ****
```

Continued on page 23

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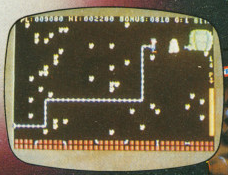

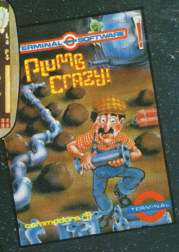

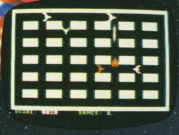

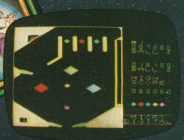

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```
482 DATA0,0,0,0,0,0,0,0
484 DATA0,0,0,0,0,0,0,0
486 DATA0,0,0,0,0,0,0,0
488 DATA0,0,0,0,0,0,0,0
490 DATA0,0,0,0,0,0,0,0
492 DATA0,0,0,0,0,0,0,0
494 DATA0,0,0,63,255,252,63,255
496 DATA252,63,255,252,63,255,252,0
498 DATA0,0,0,0,0,0,0,0
500 DATA0,0,0,0,0,0,0,0
502 DATA0,0,0,0,0,0,0,0
504 DATA0,0,0,0,0,0,0,0
506 DATA0,0,0,60,60,0,0,0
508 DATA126,0,0,126,0,0,126,0
510 DATA0,126,0,0,60,0,0,0
512 DATA0,0,0,0,0,0,0,0
514 DATA-1
516 :
518 REM **** MACHINE CODE DATA ****
520 DATA169,2,141,132,3,162,250,160
522 DATA0,157,255,215,157,249,216,157
524 DATA243,217,157,237,218,152,157,255
526 DATA3,157,249,4,157,243,5,157
528 DATA237,6,173,132,3,202,240,3
530 DATA76,9,192,169,32,162,36,157
532 DATA185,5,157,225,5,157,9,6
534 DATA157,49,6,157,89,6,157,129
536 DATA6,157,169,6,157,209,6,157
538 DATA249,6,157,33,7,157,73,7
540 DATA157,113,7,202,240,3,76,47
542 DATA192,96,162,80,169,0,157,255
544 DATA3,157,79,4,157,159,4,157
546 DATA239,4,169,2,157,255,215,169
548 DATA4,157,79,216,169,6,157,159
550 DATA216,169,8,157,239,216,202,240
552 DATA3,76,92,192,162,40,169,160
554 DATA157,191,7,169,14,157,191,219
556 DATA202,240,3,76,134,192,96
558 DATA-1
560 :
562 :
564 REM ######################
566 REM ######################
568 REM ####              ####
570 REM #### 64  BREAKOUT ####
572 REM ####              ####
574 REM #### COMMODORE 64 ####
576 REM ####              ####
578 REM ####  LES  ALLAN  ####
580 REM ####              ####
582 REM #### 5TH NOVEMBER ####
584 REM ####              ####
586 REM ####      1983    ####
588 REM ####              ####
590 REM ######################
592 REM ######################

READY.
```

49208 store space with x increment starting 1585

49211 store space with x increment starting 1625

49214 store space with x increment starting 1665

49217 store space with x increment starting 1705

49220 store space with x increment starting 1745

49223 store space with x increment starting 1785

Address Decml	Hex	Machine Code			Assembly Code Program	
49152	C000	A9	02		LDAIM	2
49154	C002	8D	84	03	STA	900
49157	C005	A2	FA		LDXIM	250
49159	C007	A9	00		LDYIM	0
49161	C009	9D	FF	D7	STAX	55295
49164	C00C	9D	F9	D8	STAX	55545
49167	C00F	9D	F3	D9	STAX	55795
49170	C012	9D	ED	DA	STAX	56045
49173	C015	98			TYA	
49174	C016	9D	FF	03	STAX	1023
49177	C019	9D	F9	04	STAX	1273
49180	C01C	9D	F3	05	STAX	1523
49183	C01F	9D	ED	06	STAX	1773
49186	C022	AD	84	03	LDA	900
49189	C025	CA			DEX	
49190	C026	F0	03		BEQ	3
49192	C028	4C	09	C0	JMP	49161
49195	C02B	A9	20		LDAIM	32
49197	C02D	A2	24		LDXIM	36
49199	C02F	9D	B9	05	STAX	1465
49202	C032	9D	E1	05	STAX	1505
49205	C035	9D	09	06	STAX	1545
49208	C038	9D	31	06	STAX	1585
49211	C03B	9D	59	06	STAX	1625
49214	C03E	9D	81	06	STAX	1665
49217	C041	9D	A9	06	STAX	1705
49220	C044	9D	D1	06	STAX	1745
49223	C047	9D	F9	06	STAX	1785
49226	C04A	9D	21	07	STAX	1825
49229	C04D	9D	49	07	STAX	1865
49232	C050	9D	71	07	STAX	1905
49235	C053	CA			DEX	
49236	C054	F0	03		BEQ	3
49238	C056	4C	2F	C0	JMP	49199
49241	C059	60			RTS	
49242	C05A	A2	50		LDXIM	80
49244	C05C	A9	00		LDAIM	0
49246	C05E	9D	FF	03	STAX	1023
49249	C061	9D	4F	04	STAX	1103
49252	C064	9D	9F	04	STAX	1183
49255	C067	9D	EF	04	STAX	1263
49258	C06A	A9	02		LDAIM	2
49260	C06C	9D	FF	D7	STAX	55295
49263	C06F	A9	04		LDAIM	4
49265	C071	9D	4F	D8	STAX	55375
49268	C074	A9	06		LDAIM	6
49270	C076	9D	9F	D8	STAX	55455
49273	C079	A9	08		LDAIM	8
49275	C07B	9D	EF	D8	STAX	55535
49278	C07E	CA			DEX	
49279	C07F	F0	03		BEQ	3
49281	C081	4C	5C	C0	JMP	49244
49284	C084	A2	28		LDXIM	40
49286	C086	A9	A0		LDAIM	160
49288	C088	9D	BF	07	STAX	1983
49291	C08B	A9	0E		LDAIM	14
49293	C08D	9D	BF	DB	STAX	56255
49296	C090	CA			DEX	
49297	C091	F0	03		BEQ	3
49299	C093	4C	86	C0	JMP	49286
49302	C096	60			RTS	

49226 store space with x increment starting 1825

49229 store space with x increment starting 1865

49232 store space with x increment starting 1905

49235 decrement x register by 1

49236 branch forward 3 if 0

49238 return to 49199 until complete

49241 return to Basic program

49242 load x with 80

49244 load accumulator with brick (0)

49246 store brick with x increment starting 1023

49249 store brick with x increment starting 1103

49252 store brick with x increment starting 1183

49255 store brick with x increment starting 1263

49258 load accumulator with red (2)

49260 store red with x increment starting 55295

49263 load accumulator with purple (4)

49265 store purple with x increment starting 55375

49268 load accumulator with blue (6)

49270 store blue with x increment starting 55455

49273 load accumulator with orange (8)

49275 store orange with x increment starting 55535

49278 decrement x register

49279 branch forward 3 if 0

49281 return to 49244 until complete

49284 load x with 40

49286 load accumulator with reverse space (160)

49288 store reverse space with x increment starting 1983

49291 load accumulator with light blue (14)

49293 store light blue with x increment starting 56255

49296 decrement x register

49297 branch forward 3 if 0

49299 return to 49286

49302 return to Basic program

Please note that standard abbreviations for Basic keywords must be used to satisfy some line lengths that would otherwise exceed a total of 80 characters. These appear on pages 130 and 131 of the *User Manual*. ■

VALH

ALLA

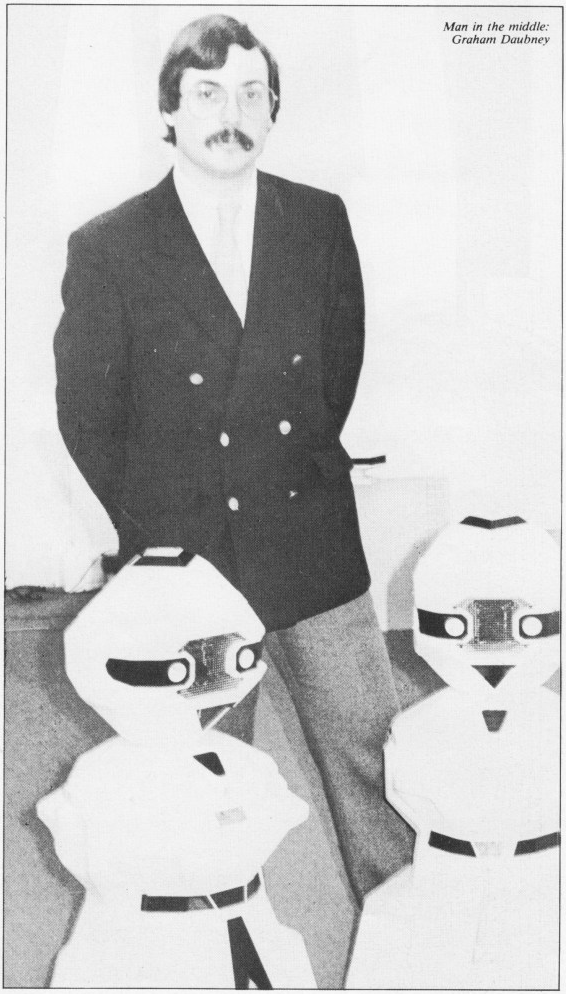
LEGEND

MOVi SOFT

PROFILE

Robots knocking on your front door

***Christopher Jenkins** meets Graham Daubney's mechanical friends*



Man in the middle: Graham Daubney

IMAGINE YOU'RE out for the night, and a sinister figure lurks in front of your empty house. He knocks on the front door, and at the sound a sleek three-foot robot glides from the shadows inside, avoiding all obstacles between it and the door. The robot halts before the door and speaks in a surprisingly human voice: "Hello, my name is Bob. There's nobody in at the moment. Please call back later. Incidentally, should you try to break into the house, I am connected to the burglar alarm system, and will telephone the police immediately . . ."

It may sound a futuristic scenario, but the technology is available now. Graham Daubney is the man whose job it is to develop it into a practical and commercial form. As development manager for Prism Technology he heads a group which intends to put this sort of technology in the hands of the home micro user.

Prism has been well-known for several years — largely as a distributor of Sinclair equipment, as software merchandisers and as the developers of modems and other peripherals for domestic and business uses. Graham holds what he calls "one of the most interesting and challenging jobs in the business". As head of the development group, his task is to work with the group's hardware and software engineers, and with Prism's product managers, to refine new ideas into marketable form. At the moment he's most excited by a range of robots from the American company Androbot, which appeal equally to his marketing sense and his fascination with electronics.

Pets

Graham started in electronic component retailing, and as his interest in the power of the microprocesser grew he progressed to computers, buying one of the first Commodore Pets to be brought into the country. Software distribution experience and a stint as product manager for Atari led to a post on Prism's software division, and in June 1983 Graham became head of the development group, which he is now organising. So fast has been Prism's expansion that the development group will be moving out of the present East London premises, since the building is too small, despite the fact that Prism has only been there for six months. This is some indication of the rapid growth of interest in the high-technology products which Prism develops and distributes.

Prism's latest and most ambitious venture is the development of the robots created by Androbot of America. Growing from an administrative facility founded by Nolan Bushnell, who built up the Atari empire and sold it to Warner Communications in 1979, Androbot first showed its personal robots at the CES show in Chicago last year. The main emphasis was on compatibility with the Apple computers, and the software used was written in Forth, which allows routines to be labelled and recalled with simple keywords, making it ideal for the control of robots. The robots were radio controlled at this stage, which disposed of the necessity for trailing wires but raised problems with wavelength ▶

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licensing and interference. Several companies expressed interest in the development and distribution rights for the Androbot machines, but Prism, with its experience and contacts in software houses, was awarded the contract.

"Our first job", Graham explained, "was to adapt the software for the Commodore 64, Spectrum and BBC computers. Forth has great advantages, but we felt that we should go with Basic until the products are established on the market. Then hopefully robot owners will become interested in Forth, and we can look again at the possibilities of negotiating with software houses to produce programs in Forth." Work on software for the Commodore 64 should be finished by the time you read this article, and versions for the BBC micro and the Sinclair Spectrum will also be available. Prism is looking at other popular micros, since it has no intention of limiting potential sales by restricting the use of the robots to a small selection of micros.

Fred

Having said that, the simplest of the three Androbot machines, Fred, doesn't even need a micro to control him. Fred stands for Friendly Robotic Education Device, and although the name is accurate it seems likely that the name has been devised to fit in with the acronym, rather than vice versa! Fred is undeniably cute. He stands at around 12 inches tall, an angular bowl-shaped body surmounted by a globular head. The casing is formed of tough ABS plastic, and the two-wheel drive precisely engineered to give accurate movements. At the front of the body is a pen-holder assembly which enables Fred to draw patterns. A variety of sensors can be fitted, which enable Fred to detect table edges, or respond to ultrasonic signals. There's also a speech synthesiser with a limited vocabulary as an optional extra.

The control system is now infrared; Androbot decided to avoid the complexities of radio control licensing by dumping the system and going for the less difficult infrared control. The base unit which issues the infrared commands is a flying saucer shape on a small stand, which controls Fred through a sensor dome on his head. The range is about 40 feet, though in good condition the infrared signal will bounce from walls and obstructing obstacles. In one test the signals managed to bounce around an office dividing screen and control a robot 15 feet away on the other side. To make the range of the infrared control system even greater, Prism is developing sub-stations which can be planted in each room of a house, enabling the robot to identify its position and respond to commands from anywhere in the house.

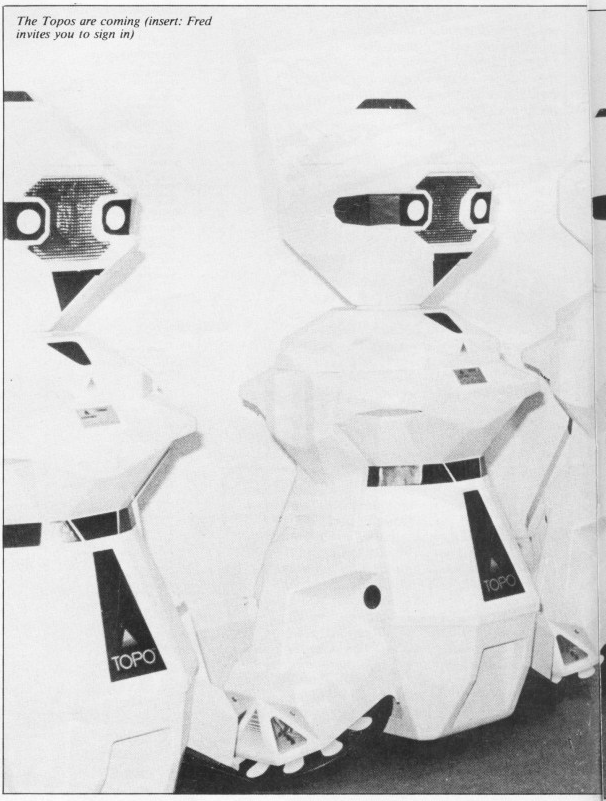
Fred is unique among the Androbots, in that he need not be connected to a computer. He comes complete with a hand-controller unit which enables you to use him straight away with no knowledge of computer systems. This is the feature which Prism think will open up a whole new market for microprocessor technology. Graham Daubney sees Fred as appealing to schools for educational purposes, to micro owners for basic robotics research, and to those with no interest in micros as a kind of super-toy which will, he hopes, stimulate their interest in all kinds of future technological products. Fred will cost around £200 and should be available in April, when some necessary work on the ROM will have been completed.

In the meantime, we should already have met the middle-of-the-range robot, Topo. Topo (short for topological?) is a diffrent order of machine altogether. Like Fred, Topo has infrared communication to and from the computer, and is constructed of ABS plastic and precision engineered metal components. However, though Fred could be regarded as a highly-developed form of the familiar "turtle", Topo is like nothing you've ever seen outside a science-fiction movie. Topo stands three feet tall and is driven on two broad, independently driven discs which give him great stability and precise movement control. He can be controlled through the computer or from a touch-controller mounted on top of his head. Speed, acceleration and deceleration are variable, and control from a joystick on the computer makes possible "Topo races" which have to be seen to be believed!

Perhaps the most impressive aspect of this robot is its speech synthesis capabilities. Most of us will by now have heard the flat, monotonous speech synthesisers which can be connected to the Vic 20 or Sinclair Spectrum to give a fair imitation of a British Rail station announcer gargling underwater. Well, you can forget that kind of thing with Topo; the speech is clear and comprehensible, and the specially manufactured speech synthesis chips allow a range of control over pitch, speed and intonation which can make Topo speak more clearly than many human beings.

Although speech text can be entered into the computer as a series of phonemes, which is the system adopted by most current speech synthesisers, Topo's system features a direct text-to-speech converter

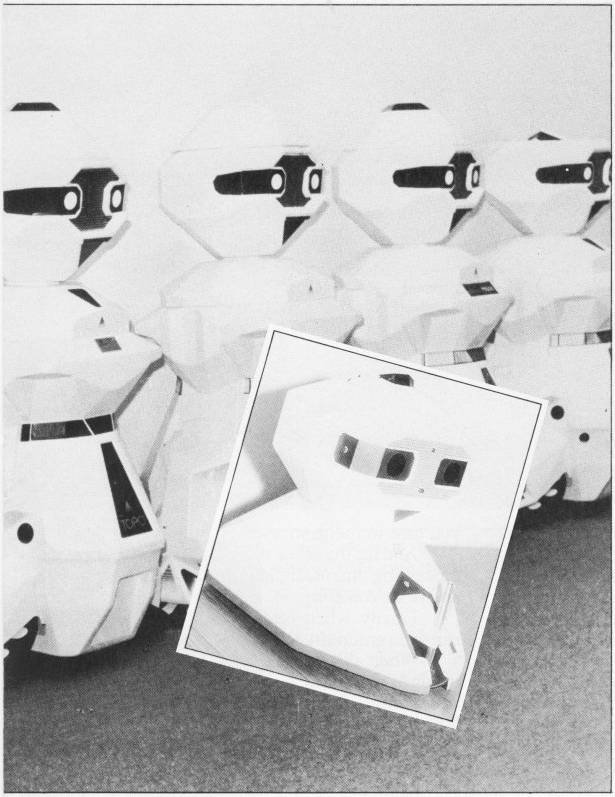
The Topos are coming (insert: Fred invites you to sign in)



which allows the user to type plain English into the keyboard and get convincing results straight away. Pictch can be changed from a high falsetto to a growling bass, and can even be varied within a phrase, so that Topo can be programmed to sing in a way which is guaranteed to make you fall about with laughter on first hearing. A pseudo-random pitch change can be introduced into the speech to give interest to each sentence, and disconcertingly human mannerisms such as sniffs and throat-clearing can be reproduced. Speech strings are stored in a buffer of up to 1,700 characters and can be released at any time with a simple command "Say it". Needless to say, with a little effort Topo can be persuaded to speak in any language, and Prism hopes to offer a speech recognition unit which will make two-way conversations possible.

On switch-on Topo announces himself with "Topo Topo Topo Topo — hello!", and emits a loud bleep if there are any problems with the infrared communications signal. This signal can accommodate 256 control channels, and since each Topo need only utilise seven channels, the possibilities for control of extra peripherals are enormous. Already it's possible to control 16 Topos from one console, either independently or in groups.

Prism's main concern is that the robots should be completely expandable. In offering basic units, then making available optional add-ons, Prism hopes to let people tailor a robot system to their own requirements, leaving open the possibility of further expansion. Graham Daubney explains: "We want to make the robots totally 'open-ended'. We call the add-ons 'growth units', because we think that this is a new field and it should have its own vocabulary. Sensors such as bump switches, ultrasonic and infrared detectors, manipulative arms, and so on, are being developed at the moment, and we're rethinking them from the bottom up. For instance, our approach to the manipulative arm will be quite different to anyone else's — we think there are better ways to design it than basing it on the human arm."



At around £1,500, Topo will be an introduction to robotics which should open up a whole new field for micro users. "The robot is the ultimate peripheral," as Graham says, "but it's a whole lot more than that."

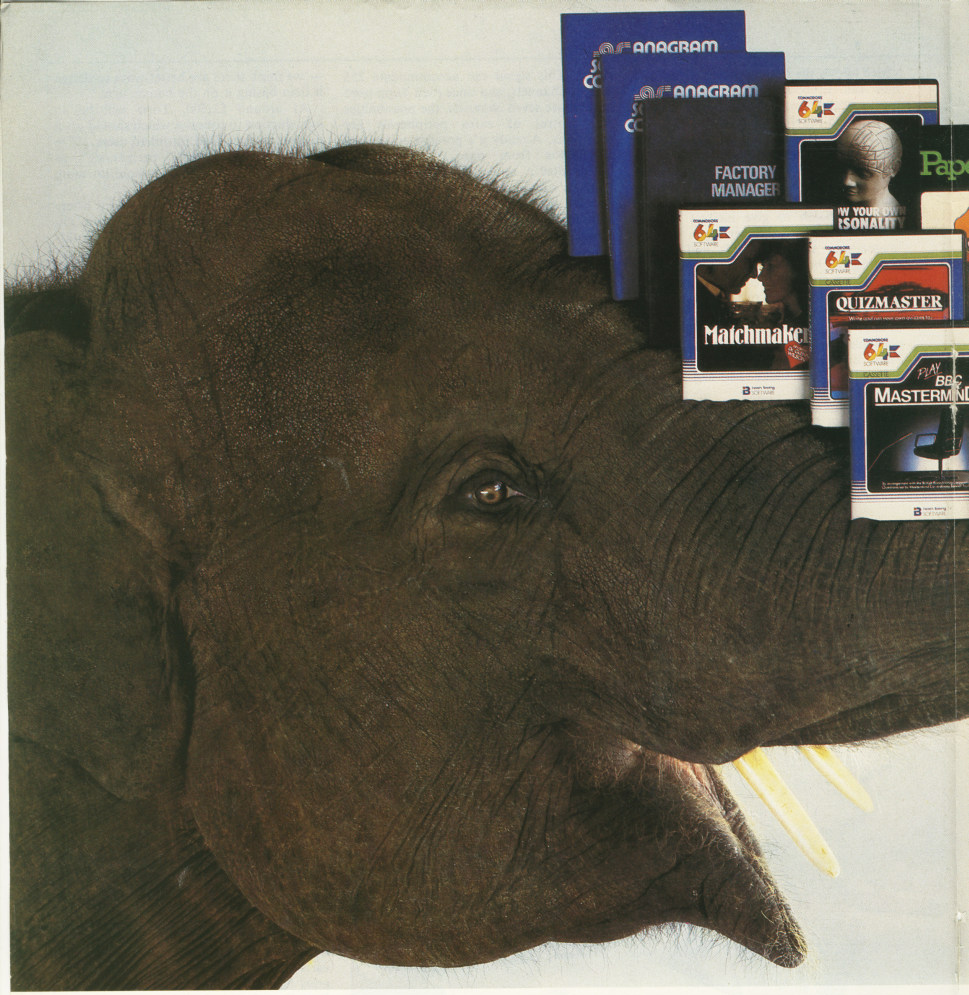
The top of the Androbot range is where we came in, with Bob — "Brains On Board" — who won't be available in this country until a good deal more development work has been done. His superficial resemblance to Topo will be modified by the addition of a four-wheel drive system, a wider range of sensors, and a huge memory capacity of up to three megabytes. The two onboard microprocessors will relegate the user's computer to the status of a command terminal; all the real work will be done by Bob. Speech recognition, speech synthesis and a variety of sensors will be standard, and again there will be a large range of 'growth units' available to expand the system. The basic model, Bob XR, will come first, and more developed units later, but prices haven't yet been fixed. Bob will be able to map a room, and subsequently find his way around it; identify objects with a variety of sensors; and manipulate them precisely.

This is of course only a small sample of the kind of capabilities Bob will have. "It's perfectly possible," Graham says, "that Bob will be able to react to the sound of a telephone, go into the hallway to pick it up, bring the set into the living room, hand the receiver to the nearest person, then wait until the call's finished and take the telephone back. Or, with his Androwagon, he could come to the shops with a pre-programmed list of purchases, and dash around selecting the items by their bar codes, fill up the wagon and roll home. Applications in the fields of security, invalid assistance, and so on, are unlimited. It's just a matter of making the robots available, and then everyone will find their own applications for them, just as they have done with the microcomputer."

Future

Prism's plans for the future include a number of projects which, understandably, Graham was reluctant to discuss at this early stage. "Let's just say that there's a great deal to be done in the home robotics field first. I can see the growth of shops specialising in robots, in the same way that computer shops have developed; and we've got ideas in the field of communications, holography, and computer peripherals at various states of development. I suppose what we're aiming for is the 'soft house' — eventually, domestic systems will all be controlled from a flat screen monitor and a number of terminals."

With the Androbot machines being marketed through conventional retail outlets rather than through computer specialists, it may not be long before there's a robot in every house. As Graham says: "We are at the very forefront in a field which has greater potential than the home computer." ■



The problem with buying a home computer, as you may already have discovered, is there's often very little software to go with it. Or all that is available is games, games and more games.

There's no such problem, however, with the Commodore 64. It has a more extensive range of serious software than any other home computer.

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Acting a bit out of character

*Using your custom-designed character set — **Kevin Bergin***

FOR NEARLY as long as Commodore has been involved in the micro industry it has produced micros which have had some graphics facilities. In the beginning there was the Pet, and now we have the Vic-20 and the CBM-64.

Both the 64 and the Vic have graphics which are usable straight from the keyboard in the same way the alphabet is used. To place the graphics characters on the screen from the keyboard one simply uses either the shift or the logo key and the symbol required.

All of the characters (alphabetic, numeric, graphic and control) are accessable to the user from the keyboard and from memory. The graphics built into the Vic and the 64 may be POKEd onto the screen using the correct codes. The standard graphics are often not what is desired. The user can set up his own characters, or indeed a complete custom character set.

There are some basic principles to be considered when using custom characters. To get the Vic or the 64 to recognise a new character set the memory pointers to the character set must be altered. It is therefore advisable to copy all or part of the character set from ROM to a safe area of RAM. This will enable the user to redefine some of the characters and still use the 64 or Vic character set at the same time.

Two program listings follow, one for the Vic and one for the 64. This article does not explain the design of characters. There are many books that do this adequately. Both of the listings are about the same length and do much the same thing in principle. Although it is easy to see the differences for each machine. The listings were printed on an Epson FX-80 and the control characters have been stripped and replaced with the following shorthand.

CLR	SHIFT/CLR
CD	CURSOR DOWN
CR	CURSOR RIGHT
CU	CURSOR UP
CL	CURSOR LEFT
HOME	CLR
WHT	WHITE
BLK	BLACK
BLU	BLUE

The 64 program should be saved before it is RUN as any mistakes in the first stage of the program may be fatal. There is a long pause at first while the new characters are set up. Line 10 prints a polite message and line 20 locks the 64 into upper case. Line 30 and 40 limit the memory to prevent any Basic program from overwriting the new character set. Line 50 turns off the keyboard interrupt, to prevent the user aborting the program when the character generator is switched in. Line 60 switches in the character generator.

The loop from line 70 to 90 places the first 1024 (1K) characters from the 64's character set into RAM, beginning at location 12288. Line 100 switches in the I/O and line 110 turns the keyboard interrupt on. The locations for the new characters are read in line 120 unless it reads a negative number. The loop from 130 to 160 reads and POKE's the new character data into the locations given in X (D, K, L, M). The data is entered one character at each pass through the loop and line 170 returns for the next character until -1 is encountered.

The character data for the four characters is at lines 190 to 220. The three loops at line 240 to 260 actually remove all of the unwanted characters in the set now in RAM. Line 270 clears the screen and prints a message, and line 280 is a delay loop. Line 290 sets the screen and border colours and clears the screen. Line 300 initialises variables. The loop from line 310 to 390 formats and displays the alphabet on the screen. The variable 'B' controls the characters and the variable 'C' controls the colour of the characters. The variable 'K' causes the program to branch to a routine to check and change the character colour each time the alphabet has been displayed.

Two other variables are initialised at line 400. The loop from line 410 to 480 pokes a D above each occurrence of L in the alphabet, 'D' was previously omitted from the display by line 320. The routine from line 500 to 540 increments C, checks to see its value is not equal to 3, 7 or 13, and if C = 16 it is reset to 0. The variable 'A' is incremented by 60 before returning from the routine.

Tanks a lot

The last part of the routine is to display the new character made up of four different characters. This is now quite simple, as we have positioned the 64's characters in the correct order, and the custom set is just the four characters. By altering the value of location 53272 we can make the 64 look at the new character set. This is done in line 550 by changing the value from 21 (normally) to 29. At this point you should be confronted with a number of tanks on the screen, if not check your entries. Line 560 is a delay loop and lines 570 to 600 reset the 64.

The listing for the Vic achieves something very similar, although not in quite the same

```
 10 PRINT"[CLR][12 CD][12 CR]PLEASE WAIT........."
 20 PRINTCHR$(8)
 30 POKE56,48
 40 POKE52,48:CLR
 50 POKE56333,127
 60 POKE1,51
 70 FORI=0TO1023
 80 POKE12288+I,PEEK(53248+I)
 90 NEXT
100 POKE1,55
110 POKE56333,129
120 READX:IFX=-1THEN240
130 FORI=XTOX+7
140 READA
150 POKEI,A
160 NEXT
170 GOTO120
180 REM *** CHAR. DATA
190 DATA12376,0,12,12,15,15,15,12,12
200 DATA12384,60,60,126,255,255,255,126,24
210 DATA12392,0,48,48,240,240,240,48,48
220 DATA12320,0,0,0,24,24,24,24,24
230 DATA-1
240 FORI=12288TO12319:POKEI,0:NEXT
250 FORI=12328TO12375:POKEI,0:NEXT
260 FORI=12399TO13320:POKEI,0:NEXT
270 PRINT"[CLR][12 CD] AN EXAMPLE OF USER DEFINED
 CHARACTERS!"
280 FORI=1TO3000:NEXT
290 POKE53280,6:POKE53281,7:PRINT"[CLR][BLK]"
300 C=0:B=0:K=0
310 FORA=0TO959
320 IFB=4THENB=B+1
330 POKE1064+A,B
340 B=B+1
350 IFB>26THENB=0
360 POKE1064+A+54272,C
370 K=K+1
380 IFK=26THENGOSUB500
390 NEXT
400 G=11:C=0
410 FORA=1024TO1983STEP80
420 POKEA+G,4
430 POKEA+G+54272,C
440 C=C+1
450 IFC=3ORC=7ORC=13THENC=C+1
460 IFC=16THENC=0
470 G=G+6
480 NEXT
490 GOSUB550
500 C=C+1:K=0
510 IFC=3ORC=7ORC=13THENC=C+1
520 IFC=15THENC=0
530 A=A+60
540 RETURN
550 POKE53272,29
560 FORDE=1TO3000:NEXT
570 POKE56,160:POKE52,160:CLR
580 POKE53272,21
590 PRINT"":POKE53280,14:POKE53281,6
600 END
```

CBM 64 listing

```
10 POKE56,PEEK(56)-2:POKE52,PEEK(56)-2
20 POKE51,PEEK(55):CLR
30 POKE36879,42
40 GOSUB150
50 GOSUB280
60 SC=7680
70 CO=38400
80 CC=0
90 FORA=COTOCO+22*23:POKEA,CC
100 CC=CC+1
110 IFCC=2THENCC=CC+1
120 IFCC=7THENCC=0
130 NEXT
140 GOTO410
150 FORA=7168TO7679
160 POKEA,0:NEXT
170 FORI=1TO4
180 READX
190 FORJ=0TO7
200 READK
210 POKEX+J,K
220 NEXTJ,I
230 RETURN
240 DATA7616,24,24,24,24,60,126,255,255
250 DATA7624,15,31,31,63,63,31,31,15
260 DATA7632,255,255,255,255,255,255,255,255
270 DATA7640,240,248,248,252,252,248,248,240
280 PRINT"[CLR][WHT][ON][5 CR]HANG ON....."
290 POKE36869,255
300 PRINT"[CD][ON]HERE'S A TANK"
310 PRINT"[CD][ON]USING:":PRINT"[CD][ON][4 CR]8
9  : AND  ;"
320 PRINT"[2 CD][10 CR]8"
330 PRINT"[9 CR]9:;"
340 PRINT"[3 CD][3 CR]8"
350 PRINT"[2 CR]9:;"
360 PRINT"[3 CD][17 CR]8"
370 PRINT"[16 CR]9:;"
380 PRINT"[HME][19 CR]8"
390 PRINT"[18 CR]9:;"
400 RETURN
410 FORA=0TO63
420 POKE36864,A
430 FORDE=1TO100:NEXT
440 NEXT
450 FORA=63TO12STEP-1
460 POKE36864,A
470 FORDE=1TO100:NEXT
480 NEXT
490 FORA=0TO151
500 POKE36865,A
510 FORDE=1TO100:NEXT
520 NEXT
530 FORA=151TO38STEP-1
540 POKE36865,A
550 FORDE=1TO100:NEXT
560 NEXT
570 FORDE=1TO1000:NEXT
580 POKE56,29:POKE52,29:CLR
590 POKE36869,240:PRINT"[CLR][BLU]"
600 POKE36879,27
610 END
```

Vic 20 listing

way. Again the character set is a tank, albeit a different one. The characters are printed on the screen rather than poked.

The program first limits the memory to protect the new characters, this is done in lines 10 to 20. Line 30 sets the screen and border colours to red. Line 40 branches to the routine to set up the characters, and line 50 branches to a subroutine to place the characters on the screen. Lines 60, 70 and 80 initialise three variables. The loop from line 90 to 130 pokes a different character colour into each character colour location. Line 140 jumps to 410.

The loop from 150 to 160 clears out the section of memory that has been reserved for the custom characters. The loop starting at line 170 controls the locations the characters are to be poked into. The loop starting at line 190 controls the character numbers. Line 210 POKEs the characters into the location (K = char, X = location). Lines 240 to 270 contain the character data.

The screen is cleared and a message printed at line 300. At this point the discerning reader will notice that although line 300 should have been printed in reverse it was not. This is because the Vic is forced to go to ROM for any reversed characters, and then uses the Vic's character set instead of the custom set. Line 290 changes the pointer to the custom character set. The Vic is now looking at the part of memory starting at location 7168. Lines 300 to 310 print some information, and 320 to 390 print our customized characters on the screen — in this case four tanks.

The rest of the Vic program has little to do with custom characters, and a lot more to do with screen scrolling! This is fairly simple, but effective on the Vic. By altering the relevant registers of the Vic chip we can move the screen around considerably. In fact the whole screen will wrap around. The locations that are used for scrolling are 36864 (horizontal) and 36865 (vertical).

Scrolling along

Lines 410 to 440 move the screen horizontally with a delay loop slowing it down in line 510. The loop from 450 to 480 does the reverse, but leaves the screen centered. The loop from 490 to 520 moves the screen vertically from top to bottom, and the loop from 530 to 560 does the reverse, leaving the screen centered. Line 570 is a delay loop and lines 580 to 610 reset the Vic.

That's just about all for now except for a closing goodie for the 64. If you are using machine code and need some more room, the following program will switch in another 8K of RAM:

```
LDA  $01
AND  #$FE
STA  $01
RTS
```

and back to normal:

```
LDA  $01
ORA  #$01
STA  $01
RTS
```

This little trick is not usable from Basic as the machine will dislike the alterations to location 1 and will go to sleep! ■

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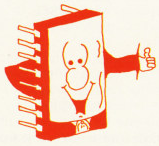

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Looking for some logical answers

***Boris Allan** delves into the basis of machine code*

THE BASIC language implemented on both the Vic-20 and the 64 is that called Basic 2 by Commodore. It is a very old version of the language, and is the same as that on many of the Pets and CBM machines.

For this reason, though the following explanations have been tried out on a 64, all the programs will work on the Vic. The difference between the Vic and 64 is all in the hardware, not in the language. In hardware terms there is a quantum leap forward from the Vic to the 64, but to use the extended facilities of the 64 the user has to descend to using PEEKs and POKEs to control the machine's special facilities.

This means that if a program has been written for the Vic, and the program does not use PEEKs and POKEs, then that program will work on the 64. For example, there is no change to the Basic for the 64 to give an extra set of commands to manipulate sprites. Sprites are a special facility controlled by setting bits within bytes.

The key to controlling effects on the Vic and 64 is the understanding of logical operations, and how logical operators can be used to control bits within bytes. To understand how logical operators function requires an appreciation of binary arithmetic.

The rules for addition of two (one digit) binary numbers are very simple to show:

0	0	1	1	Bit A
0	1	0	1	Bit B
00	01	01	10	Result

And first concentrate on the bit in column 0 of the answer (ie that on the right). Call the result in column 0, the SUM bit, and then produce this pattern:

SUM OPERATOR (Column 0)

Bit A	Bit B	Result
0	0	0
0	1	1
1	0	1
1	1	0

We next call the results in column 1 (ie that on the left) the CARRY bit, and then we can produce a new pattern:

CARRY OPERATOR (Column 1)

Bit A	Bit B	Result
0	0	0
0	1	0
1	0	0
1	1	1

We know, therefore, that if we add 0 and 1, the result is the CARRY bit, then the SUM bit, that is, 01.

If the two inputs are A$ and B$, then SUM$ and CARRY$ can be calculated by program 1, with the RESULT$ being output as CARRY$ + SUM$. The program simply inputs Bit A and Bit B as strings, and calculates the SUM and the CARRY as strings.

If the table for the SUM OPERATOR is examined (it is called a Truth Table) then it is clear that when the two bits are equal, then the sum bit is 0. When the two bits differ in value, then the sum bit is 1. In program 1 a check is made to see if the two bits are the same, ie A$ = B$; if the two bits are the same, the result of the equality check is "true", and the numerical value of truth is −1.

```
 0  PROGAM 1
10  INPUT "BIT A";A$
20  INPUT "BIT B";B$
30  SUM$=STR$ (1+A&=B$)
40  CARRY$=STR$(VAL (A$) X VAL (B$))
50  RESULT$= CARRY$ + SUM$
60  PRINT "RESULT IS ";RESULT$
```

```
 0  PROGAM 2
10
20
30   SUM$=STR$  (NOT  (VAL  (A$) AND VAL (B$) AND (VAL (A$) OR VAL
(B$)))
40  CARRY$=STR$ (VAL (A$) AND VAL (B$))
50
60
      (ALL OTHER LINES AS IN PROGRAM 1)
```

If the two bits are the same, then 1 + A$ = B$ is equal to 1 − 1, that is, 0. The operator STR$ takes the number 0, and turns it into the character "0", or if A$ and B$ are not the same then STR$ turns 1 into "1". We have performed part of an addition of binary numbers, by use of a logical comparison.

When we look at the truth table for CARRY OPERATOR, it is clear that the result is equal to the value of Bit A multiplied by the value of Bit B. The line to produce the CARRY$ actually calculates the string version of the product of the numerical values.

Here is another truth table:

AND OPERATOR

Bit A	Bit B	Result
0	0	0
0	1	0
1	0	0
1	1	1

that for the AND operator provided with Basic 2. It does not take much studying to realise that the AND and the CARRY operations are identical, and so line 40 could be re-written

40 CARRY$ = STR$(VAL(A$) AND VAL(B$))

where the only reason we have the SRTR$ and VALS is because we are not dealing with numbers, but with characters: the characters "1" and "0".

Thus we have (so far) turned an addition into a comparison (with an addition) and a logical operation: the comparison can be changed to:

30 SUM$ = STR$(ABS(A$< >B$))

a sequence in which there is no arithmetic. We can progress somewhat further in turning addition into pure logic.

There is a logical operator called the "exclusive-or" (or XOR, or sometimes EOR):

XOR OPERATION

Bit A	Bit B	Result
0	0	0
0	1	1
1	0	1
1	1	0

which is (more or less) equivalent to "not equal". The truth table for XOR can be produced by combining AND, OR, and NOT, logical operations, and the combination is:

A XOR B is equal to NOT(A AND B) AND (A OR B)

so that line 30 then becomes:

30 SUM$ = STR$(NOT(VAL(A$) AND VAL (B$)) AND (VAL (A$) OR VAL(B$)))

The modified, logical operations only, program is given as program 2.

Line 30 uses the OR logical operation, and the truth table for OR is:

OR OPERATION

BitA	Bit B	Result
0	0	0
0	1	1

Continued on page 37

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1	0	1
1	1	1

And it is worth noticing that if all the 1s were turned to 0s (and vice versa) the OR truth table would be the same as that for AND. To change from 1 to 0, and vice versa, we use NOT. We have discovered that:

A AND B is equal to NOT(NOT(A) OR NOT(B))

and

A OR B is equal to NOT(NOT(A) AND NOT(B))

which, in formal logic, are known as de Morgan's Theorems. To check the truth of the theorems you could construct a test on your computer, using AND, OR, and NOT.

On a computer, at the level of machine operations, arithmetic is performed by use of logical operations, and not by use of arithmetic. Within the 6502/6510 processor there are logic "gates" which are electronic devices with effects which can be displayed by a truth table. Whereas, with a truth table, there are 1s and 0s, the logic gates work with high and low voltages.

Adding a bit is not an apparently straightforward process. Let B1(7) have eight elements (ie it is a vector of eight numbers). We will suppose that B1(7) is an eight bit byte. If bit 0 is that on the right, this is the element B1(0), and bit 7 is shown as B1(7). The intermediate carry bit will be shown as IC, and we will attempt to add a bit value (ie 0 or 1) to the binary number contained in the vector B1. Finally, if the number "overflows" eight bits, then the overflow is placed in C (the final carry bit).

Assume that we already have the number stored in B1, and that we are part way through adding our one bit to B1. We have either 0 or 1 in the intermediate carry bit IC, and the next bit in B1 to be considered is in I'th position. We can calculate the new value of IC by use of the AND operation, and the new value of B1(I) by use of the XOR operation, that is:

NIC = B1(I) AND IC

B1(I) = NOT(B1(I) AND IC) AND (B1(I) OR IC)

IC = NIC

where NIC is used as a temporary variable to hold the new value of IC.

Program 3 shows how the program to add one bit value to a number could be constructed. The value we add to the eight bit number is IC, almost as if the value was a carry from some other mysterious addition.

The calculation of NIC, B1(I), and IC, are as above, and then there is the IF statement. Now, if the carry (ie IC) is equal to zero then none of the later bits in the number will be affected. There is no need for the loop to continue, so the loop counter is set to 7, and thus the loop ends. The final carry is stored in the carry bit (ie C).

```
  0  PROGRAM 3
  5  DIM B1 (7)

 10 FOR 1=7 TO 0 STEP -1: PRINT 'BIT  ';1;:INPUT B1(1): NEXT 1
 20  INPUT 'VALUE TO ADD'; IC
 30  FOR 1 = 0 TO 7
 40  NIC=B1(1) AND IC
 50  B1(1) =NOT (B1(1) AND IC) AND (B1(1) OR IC)
 60  IC=NIC: IF IC=0 THEN IC=7
 70  NEXT 1
 80  C=IC
 90  FOR 1=7 TO 0 STEP -1: PRINT B1 (1);: NEXT 1
100 PRINT: PRINT: PRINT C

  0  PROGRAM 4
  5  DIM B1 (7),B2(7)
  9  PRINT "B1"
 10  FOR I = 7 TO 0 STEP -1: PRINT 'BIT ';1;:INPUT  B1  (I):  NEXT
1
 14  PRINT "B2"
 15  FOR I= 7 TO 0 STEP -1: PRINT 'BIT ';I;:INPUT B2 (I):NEXT I
 20  FOR J=0 TO 7: IC=B2(J)
 30  FOR I = J TO 7
 40  NIC=B1(I) AND IC
 50  B1(I)=NOT (B1(I) AND IC) AND (B1)(I) OR IC)
 60  IC=NIC: IF IC=0THEN IC=7
 70  NEXT I
 80  C = IC OR C
 85  NEXT J
 90  FOR I=7 TO 0 STEP -1: PRINT B1 (I) ;:NEXT I
100  PRINT: PRINT: PRINT C
```

This program emulates what is sometimes known as a "ripple adder" for microprocessors. It would be rather better if it were possible to add two weight bit numbers, as adding one bit value at the left position (bit 0) is rather limited.

Now on to taking bytes. Think what we have to do when we add two eight bit numbers. We have to start at the right, and add the rightmost bit (bit 0) of one byte (say B2) to the other byte (say B1). When that bit value has been added, we move to bit 1 or B2 and add that bit value to B1 — starting at bit 1 of B1. Then we move to bit 2, and so forth.

Program 4 performs this arduous task. First of all, we have to input both B1 and B2, and then we step through the bits for B2. This is the loop with counter J, and the first action in the loop is to set the intermediate carry to the J'th bit of B2.

The inner loop adds IC to the byte B1, and is exactly the same as the loop in program 3, with one alteration. The addition now starts from bit position J, and not bit 0. It would be rather silly to recommence adding at bit 0 of B1 each time, especially as we are adding on bit J of B2 (ie IC = B2(J)).

The next difference comes after the loop. Instead of storing the last intermediate carry (IC) in C, there is the more complex:

C = IC OR C

because if IC is zero, but C is already equal to one, then we do not want to change the value in C from one to zero. By examination of the OR truth table, it can be seen that if either IC or C is equal to one, the result of the OR operation must be one.

The byte B1 is almost like the accumulator in the 6502/6510. One can add to it, and the value stored therein is altered. The byte B2 is like a memory, because it is not altered by the operation.

The machine code instruction is ADC, which means "Add memory to accumulator with carry", and the C variable is equivalent to the machine code "carry" flag (also known as C).

What we have managed to do is to use nothing but logical operations to perform arithmetic. Though we have only added, we can easily subtract if we turn negative numbers into two's complement numbers and add. Multiplication is nothing more than shifting bits, and adding; and though division is somewhat more complex, it is possible.

The importance behind this information is that the 6502/6510 can only use logical operations (the logic gates), and what we have performed so far is just what happens all the time in the microprocessor, when the 64 or Vic are up and running.

Microprocessors are nothing more than logic machines, and an understanding of logic helps a good deal in the appreciation of machine code programming.■

COMMODORE SOFTWARE FILE

National

Robert Campbell from Clive contributes this program for the unexpanded Vic 20.

IN THIS VIC GAME for one or more players you have to bet in an eight horse race. The odds are given before the race and initially each player has £100, but no player is allowed to place less than £5 on any horse. The race is presented graphically complete with fences, and the numbers above the track indicate the numbers of the horses backed.

By altering line 110 the range of odds can be changed.

The program structure is as follows:

1-60	define characters
61-125	set variables including odds
126-172	set up track
173-240	run race Line 215 decides whether horse should fall at fence.
300-309	work out horse's placings
310-340	calculate profit and loss
2000-2110	take bets from players
4000-4020	if other players are broke, state winner

```
  1 DATA0,0,0,255,255,0,0,0,0,0,76,255,255,76,0,0
  2 DATA3,3,3,3,3,3,3,3,78,22,24,0,146,19,132,1
  3 DATA129,66,36,63,63,36,66,129
 50 FORI=7168TO7679:POKEI,PEEK(25600+I):NEXT:FORI=7168TO7207:READA:POKEI,A:NEXT
 60 POKE52,28:POKE56,28:CLR
 61 PRINT"□■MINI-NATIONAL■      ■RHC■■□"
 70 PRINT"HOW MANY PLAYERS":INPUTNP
 71 IFNP>9THEN70
 72 O=NP
 73 FORT=1TONP:PD(T)=1:NEXT
 74 FORT=1TONP:PRINT"NAME":INPUTB$(T):NEXT
 90 FORT=1TONP:P(T)=100:NEXT
100 POKE36879,221:POKE36878,15:PRINT"□"
110 FORT=1TO8:HO(T)=INT(RND(1)*9)+4:NEXT
120 FORT=1TO8:H(T)=7835+22*T:NEXT
125 GOSUB2000
126 TI$="000000":X=0
127 FORT=1TO8:POKEH(T),1:NEXT
128 POKE36869,255
130 FORT=7834TO7855:POKET,0:NEXT
140 FORT=8032TO8053:POKET,0:NEXT
150 FORT=7877TO8031STEP22:POKET,2:NEXT
151 FORT=7864TO8018STEP22:POKET,3:NEXT:FORT=7872TO8026STEP22:POKET,3:NEXT
155 FORT=1TO8:POKE7834+22*T,T+48:NEXT
160 FORT=38576TO38597:POKET,0:NEXT:FORT=38598TO38619:POKET,2:NEXT
161 FORT=38620TO38641:POKET,4:NEXT:FORT=38642TO38663:POKET,6:NEXT
162 FORT=38664TO38685:POKET,0:NEXT:FORT=38686TO38707:POKET,2:NEXT
163 FORT=38708TO38729:POKET,4:NEXT:FORT=38730TO38751:POKET,6:NEXT
170 PRINT"■WINNER"
171 PRINT"■SECOND"
172 PRINT"■THIRD■■■"
173 FORJ=1TONP:PRINTNB(J)"■■";:NEXT:PRINT"■■ "
200 X=X+1:IFX=9THENX=1
201 IFTI$>"000017"THEN310
205 IFH(X)=0THEN200
206 IFRND(1)>.35THEN215
210 IFRND(1)<HO(X)/12THEN200
215 IFPEEK(H(X)+1)=3ANDRND(1)>.77THENPOKEH(X)+1,4:POKEH(X),32:H(X)=0:GOTO200
220 H(X)=H(X)+1:IFPEEK(H(X))=2THENPOKEH(X),1:POKEH(X)-1,32:GOTO300
230 POKEH(X),1:POKEH(X)-1,32
240 POKE36874,200:POKE36874,0:GOTO200
300 W=W+1:H(X)=0
301 IFW=1THENPRINT"■WINNER"X;HO(X)"■■1":FORT=1TONP:IFNB(T)=XTHENNW(T)=1
302 IFW=1THENNEXT
304 IFW=2THENPRINT"■SECOND"X;HO(X)"■■1":FORT=1TONP:IFNB(T)=XANDE(T)THENNW(T)=5
```

Continued on page 41

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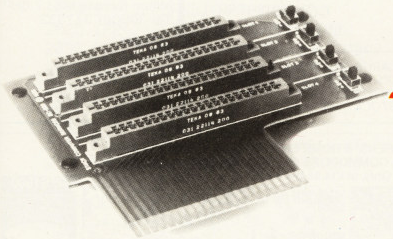

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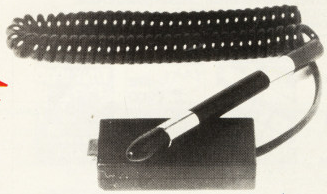

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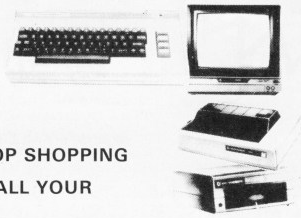

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CMJ/84

```
305 IFW=2THENNEXT
306 IFW=3THENPRINT"■THIRD "X;HO(X)"■■-1":FORT=1TONP:IFNB(T)=XANDE(T)THENNW(T)=5
307 IFW=3THENNEXT
308 IFW=3THEN310
309 GOTO200
310 FORJ=1TONP:IFPD(J)=0THEN321
311 P(J)=P(J)-A(J):IFE(J)THENP(J)=P(J)-A(J)
312 IFNW(J)<>0ANDE(J)THENP(J)=P(J)+2*A(J):P(J)=P(J)+A(J)*(HO(NB(J))/NW(J))
313 IFNW(J)<>1ANDNW(J)<>0THENP(J)=P(J)-A(J)
315 IFNW(J)=1ANDE(J)=0THENP(J)=P(J)+A(J):P(J)=P(J)+A(J)*HO(NB(J))
316 IFNW(J)=1ANDE(J)=1THENP(J)=P(J)+A(J)*(HO(NB(J))/5)
320 IFNW(J)=1ANDE(J)=1THENP(J)=P(J)+A(J)*(HO(NB(J))/5)
321 IFJ<NPTHENNEXT
337 PRINT"■■PRESS 'Y'"
338 GETA$:IFA$<>"Y"THEN338
339 W=0
340 GOTO100
2000 FORJ=1TONP
2001 POKE36869,240:PRINT"■BETTING:"
2010 FORX=1TO8:PRINT"■■"X"■■"HO(X)"■■-1":NEXT
2016 PRINTB$(J)
2020 PRINT"YOU HAVE £"P(J)
2021 IFP(J)<5THENPRINT"YOU ARE BROKE!!":FORT=1TO999:NEXTT:PRINT"■":NB(J)=0
2022 IFP(J)<5ANDPD(J)THENPD(J)=0:O=0-1:IFNP=1THENEND
2023 IFO=1ANDNP>1THEN4000
2024 IFP(J)<5ANDJ<NPTHENNEXT
2025 IFP(J)<5THENPRINT"■":RETURN
2030 PRINT"■WHICH NUMBER":INPUTNB(J)
2031 IFNB(J)>8ORNB(J)<1THEN2030
2040 PRINT"■HOW MUCH(£)":INPUTA(J)
2041 IFA(J)>P(J)ORA(J)<5THEN2040
2044 E(J)=0:NW(J)=0
2045 PRINT"EACH WAY":INPUTA$:IFA$="Y"ORA$="YES"THENE(J)=1
2046 IFE(J)AND2*A(J)>P(J)THEN2040
2050 PRINT"■PRESS 'Y'"
2100 GETA$:IFA$="Y"THENPRINT"■":IFJ<NPTHENNEXT
2101 IFA$="Y"THENRETURN
2110 GOTO2100
4000 PRINT"■"
4010 FORT=1TONP:IFP(T)>5THEN4020
4015 NEXT
4020 PRINTB$(T)" HAS WON":PRINT"WITH £"P(T)
```

Trona

From D. Semmens who comes from Barnsley in Yorkshire — a game for the Commodore 64.

Trona is a version of the Light Cycles game in the film "Tron". The games uses the keyboard for movement, and not joysticks, but it is very easy to alter.

- 0-6 Set the variables and checks the score
- 10-20 Print the playing screen and set the positioning variables.
- 30 Pokes the two players' men onto the screen.
- 40-160 Get keyboard inputs and checks if the two have collided, or anything else that would prove fatal.
- 200-220 Ask if another game is required and if so start one.

```
0 REM"TRON BY D.SEMMENS!!!"
1 Z=0:X=0
5 FORI=1 TO 2000:NEXT
6 IF Z>9 OR X>9 THEN200
10 POKE53281,5:PRINTCHR$(147):PRINTCHR$(144)
12 POKE53281,2:POKE53280,2:P=40:S=-40
14 PRINT"■  PLAYER1";Z;"        PLAYER2";X
16 FORI=1064 TO 1103:POKEI,102:NEXT
17 FORI=1984 TO 2023:POKEI,102:NEXT
18 FORI=1064 TO 1984 STEP40:POKEI,102:NEXT
19 FORI=1103 TO 2023 STEP40:POKEI,102:NEXT
```

Continued on page 43

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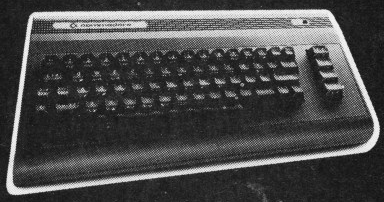

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```
 20 A=1471:B=1494:FORI=1 TO 1000:NEXT
 30 POKEA,81:POKEB,81:POKEB+54272,0
 40 GETA$:IFA$="Z" THEN A=A-1:P=-1:GOTO80
 50 IFA$="X" THEN A=A+1:P=1:GOTO80
 60 IFA$="C" THEN A=A+40:P=40:GOTO80
 70 IFA$="F" THEN A=A-40:P=-40:GOTO80
 75 A=A+P
 80 C=PEEK(A):IFC<>102 AND C<>81THEN100
 90 X=X+1:GOTO5
100 IFA$="." THEN B=B+1:S=1:GOTO150
110 IFA$="," THEN B=B-1:S=-1:GOTO150
120 IFA$=";" THEN B=B-40:S=-40:GOTO150
130 IFA$="/" THEN B=B+40:S=40:GOTO150
140 B=B+S
150 G=PEEK(B):IFG<>102 AND G<>81 THEN 30
160 Z=Z+1:GOTO5
200 PRINT" ANY KEY FOR ANOTHER GAME(RUN STOP KEY   TO STOP GAME)!!!"
210 GETB$:IFB$="" THEN 210
220 GOTO1
```

Player 1 keys;
Z = left
X = right
C = down
F = up

Player 2 keys;
, = left
. = right
/ = down
; = up

Vic ditty

From Richard Barton of Essex, a program the the unexpanded Vic 20.

THIS PROGRAM is written for unexpanded VIC 20 and features more advanced music controls such as pitch controls using offset values, random note durations and pitches, etc.

This is a small part of a larger computer music project Richard is working on, inspired by an early record of Computer music which was published in the 1950's by Bell Telephone Laboratories using a mainframe computer. The Vic 20 can equal its performance very well, apart from the lack of voices available.

Program notes

Note; the screen display uses cursor-left symbols at the beginning of each printed line.

50 contains the voice pokes.

120, 140, 160, 180, 200,220 re-establish the codes in an inter-changed format to alter the chords.

240 to 290 contain the actual melody instructions.

300 to 310 contain the randomiser instruction for the pitch offsets which are x, y, and z.

320 to 330 contain the randomiser instruction for the note duration.

340 onwards are instructions for the final "ENDING" to the piece.

VARIABLE N is the screen display note index.

VARIABLES C, Q, and M are the note duration variables.

VARIABLES X,Y, and Z are the offset values which re-incremented onto the pitches of noices S1, S2 and S3.

```
 10 REM VIC DITTY.
 20 REM RICHARD BARTON.1983.
 30 REM Z,Y & Z ARE OFFSETS TO PITCHES.
 40 REM C,Q & M ARE NOTE DURATIONS.
 50 S1=36874:S2=36875:S3=36876:POKE36878,6:N=1
 60 PRINT"■■■■■■■■■VIC DITTY"
 70 PRINT"■■                    ■"
 80 FORR=1TO2
 90 PRINT"■■■"N"NORMAL PITCH & TIME"
100 C=200:Q=100:M=500:D=150:X=0:Y=0:Z=0:GOSUB240:N=N+1
110 PRINT"■■"N"VOICES INTERCHANGED"
120 S1=36876:S2=36875:S3=36874:GOSUB240:N=N+1
130 PRINT"■■"N"PITCH VALUES +1"
140 S1=36875:S2=36876:S3=36874:X=1:Y=1:Z=1:GOSUB240:N=N+1
150 PRINT"■■"N"PITCH VALUES -1"
160 S1=36876:S2=36874:S3=36875:X=-1:Y=-1:Z=-1:GOSUB240:N=N+1
170 PRINT"■■"N"PITCH VALUES +2"
180 S1=36875:S3=36874:S2=36876:X=2:Y=2:Z=2:GOSUB240:N=N+1
190 PRINT"■■"N"PITCH INC. RANDOM"
200 GOSUB300:S1=36874:S2=36876:S3=36875:GOSUB240:N=N+1
210 PRINT"■■"N"PITCH+TIME RANDOM"
220 GOSUB300:S1=36875:S2=36874:S3=36876:GOSUB320:GOSUB240:N=N+1
230 NEXTR:GOTO340
```

Continued on page 44

```
240 POKES2,215+X:FORT=1TOC:NEXT:POKES3,225+Y:FORT=1TOC:NEXT
250 POKES3,0:POKES2,209+Z:FORT=1TOC:NEXT:POKES3,223:FORT=1TOC:NEXT:POKES3,0
260 POKES2,201+Z:FORT=1TOC:NEXT:POKES3,209:FORT=1TOC:NEXT:POKES2,191+Y:POKES1,17
6+X
270 POKES3,176+Y:FORT=1TOD:NEXT:POKES3,179:FORT=1TOQ:NEXT:POKES3,183:FORT=1TOD:N
EXT
280 POKES3,191+X:FORT=1TOQ:NEXT:POKES3,195+Z:POKES2,159+Y:POKES1,135+X:FORT=1TO5
```

```
00:NEXT
290 POKES1,0:POKES2,0:POKES3,0:RETURN
300 X=INT(RND(1)*20):Y=INT(RND(1)*20):Z=INT(RND(1)*20)
310 RETURN
320 C=INT(RND(1)*400)+60:Q=INT(RND(1)*100)+60:M=INT(RND(1)*600)+60
330 RETURN
340 S1=36874:S2=36875:S3=36876:N=N+1
350 PRINT"■"N"8 RANDOM PITCHES"
360 FORR=1TO8
370 X=INT(RND(1)*117)+128
380 POKES1,X:FORT=1TO90:NEXT:POKES2,X+5:FORT=1TO90:NEXT:POKES3,X+10:FORT=1TO90:N
EXT
390 POKES1,0:FORT=1TO200:NEXT:POKES1,0:POKES2,0:POKES3,0:NEXT:N=N+1
400 PRINT"■"N"END CHORD"
410 POKES1,205:POKES2,145:FORR=1TO20:POKES3,169:FORT=1TO20:NEXTT:POKES3,178:FORT
=1TO20
420 NEXTT:NEXTR:POKES3,169:FORT=1TO1000:NEXTT
430 POKES1,0:POKES2,0:POKES3,0
440 PRINT"■■  REPEAT? -HIT Y OR N ■"
450 GETA$:IFA$=""THEN450
460 IFA$="Y"THENRUN
470 IFA$="N"THENPRINT"■":END
480 GOTO450
```

Repeat

From Mark Slater of Preston, for the Commodore 64.

THE PROGRAM is written in Basic, but sets its self up as a machine code routine after it has been run. It is located at 0340 HEX (832 Decimal)

The routine makes use of two of the function keys. If F1 is pressed repeat is available on all the keys but if F3 is pressed the keyboard returns to normal.

If a Restore is carried out the routine will not work. To get back into the routine SYS832 must be typed in.

There are two listings: one in Basic for use without an assembler, and one for use with an assembler.

```
 0  0340  78       SEI
 1  0341  AD1403   LDA  $0314
 2  0344  8D2E03   STA  $032E
 3  0347  AD1503   LDA  $0315
 4  034A  8D2F03   STA  $032F
 5  034D  A959     LDA  #$59
 6  034F  8D1403   STA  $0314
 7  0352  A903     LDA  #$03
 8  0354  8D1503   STA  $0315
 9  0357  58       CLI
10  0358  60       RTS
11  0359  A5C5     LDA  $C5
12  035B  C904     CMP  #$04
13  035D  F007     BEQ  $0366
14  035F  C905     CMP  #$05
15  0361  F00B     BEQ  $036E
16  0363  6C2E03   JMP  ($032E)
17  0366  A980     LDA  #$80
18  0368  8D8A02   STA  $028A
19  036B  6C2E03   JMP  ($032E)
20  036E  A900     LDA  #$00
21  0370  8D8A02   STA  $028A
22  0373  6C2E03   JMP  ($032E)
```

Left; with assembler

```
10 REM ************
20 REM *  REPEAT  *
30 REM * (C) 1984 *
40 REM ************
50 REM
80 FORA=832TO886:READB:POKEA,B:NEXT
90 SYS832
100 DATA120,173,20,3,141,46,3,173
110 DATA21,3,141,47,3,169,89,141
120 DATA20,3,169,3,141,21,3,88
130 DATA96,165,197,201,4,240,7,201
140 DATA5,240,11,108,46,3,169,128
150 DATA141,138,2,108,46,3,169,0
160 DATA141,138,2,108,46,3,32
```

Above; without assembler

Gobbler

From Darren Eckersley — for the 3.5K

Vic 20

IN THIS GAME you are a man and you have to eat the diamonds to get to 300 points in three minutes. If you don't a monster comes searching for you, but if you do it prints more diamonds and now you have to get to 600 and so on.

You use U for up, H for left, K for right and M for down. You get 10 points for each diamond but you don't get any points if you get the diamonds with your hands, body or feet.

```
 0 PRINT"□":GOSUB5000:PRINT"□": SC=0:TI$="000000":Z=300
 1 PRINT"□":S=S+300:SC=0:TI$="000000":O=7680:F=F+50
 2 FORG=1TOF:X=INT(RND(1)*510)+1
 3 POKE7680+X,90:POKE38400+X,5
 4 NEXTG
 20 POKE7680+Z,81:POKE7680+Z+22,102:POKE7680+Z+44-1,122:POKE7680+Z+44+1,76
 22 PRINT"■SCORE="SC"■■TIME="MID$(TI$,3,2)"■MINS■"RIGHT$(TI$,2)"■SECS"
 23 IFSC=STHEN1
 24 IFTI$="000300"THENGOTO1090
 25 POKE7680+Z+22-1,74:POKE7680+Z+22+1,75
 26 FORL=1TO100:NEXTL
 27 POKE7680+Z,32:POKE7680+Z+22,32:POKE7680+Z+44-1,32:POKE7680+Z+44+1,32
 28 POKE7680+Z+22-1,32:POKE7680+Z+22+1,32
 30 POKE38400+Z,2:POKE38400+Z+22,2:POKE38400+Z+44-1,2:POKE38400+Z+44+1,2
 35 POKE38400+Z+22-1,2:POKE38400+Z+22+1,2
 40 GETA$:IFA$=" "THEN1
 45 IFA$="U"THENZ=Z-22
 50 IFA$="M"THENZ=Z+22
 55 IFA$="H"THENZ=Z-1
 57 IFA$="K"THENZ=Z+1
 58 IFPEEK(7680+Z)=90THENGOSUB1000
 59 POKE198,0
 60 GOTO20
 1000 POKE36878,15
 1010 FORR=128TO255:POKE36874,R:NEXTR
 1020 POKE36874,0:SC=SC+10
 1030 RETURN
 1090 POKE36878,10
 2000 FORT=1TO506
 2010 IFPEEK(7680+T)=81THEN3000
 2020 IFPEEK(7680+T+21)=81THEN3000
 2030 IFPEEK(7680+T+22)=81THEN3000
 2040 IFPEEK(7680+T+23)=81THEN3000
 2050 IFPEEK(7680+T+44)=81THEN3000
 2060 POKEO+T,42:POKEO+T+21,109:POKEO+T+22,102:POKEO+T+23,125:POKEO+44+T,113
 2061 POKE36875,255
 2070 POKE38400+T,0:POKE38400+T+21,0:POKE38400+T+22,0:POKE38400+T+23,0:POKE38400
+T+44,0
 2080 FORY=1TO100:NEXTY
 2082 POKEO+T,32:POKEO+T+21,32:POKEO+T+22,32:POKEO+Z+23,32:POKEO+T+44,32
 2083 POKE36875,0
 2085 NEXTT
 2090 GOTO2000
 3000 POKE36875,0:POKE36878,8:FORH=255TO128STEP-1:POKE36877,H:NEXTH:PRINT"□":POK
E36877,0
 3010 PRINT"THE MONSTER GOTYOU BUTYOU GOT A SCORE OF"SC
 3015 GOSUB7000
 3020 PRINT"■■■WOULD YOU LIKE ANOTHERGO?"
 3030 GETA$:IFA$=""THEN3030
 3035 IFA$="N"THENEND
 3040 IFA$="Y"THEN■■■GOTO1
 3050 GOTO3030
 5000 Z=400:POKE36865,157
 5010 PRINT"THE OBJECT OF THIS"
 5020 PRINT"GAME IS TO EAT YOUR "
 5030 PRINT"WAY TO 300 POINTS"
 5040 PRINT"BEFORE THE TIME GETS"
 5050 PRINT"TO 3 MINS AND A "
 5060 PRINT"MONSTER COMES AND EATS"
 5070 PRINT"□YOU.YOU GET 10 POINTS"
 5080 PRINT"FOR EACH DIAMOND."
 5090 PRINT"■■■■■■■CONTROLS"
 6000 PRINT"■■■■■■■"
 6010 PRINT"■■■■■■■  U"
 6020 PRINT"■■■■■■■ H  K"
```

Continued on page 47

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```
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```

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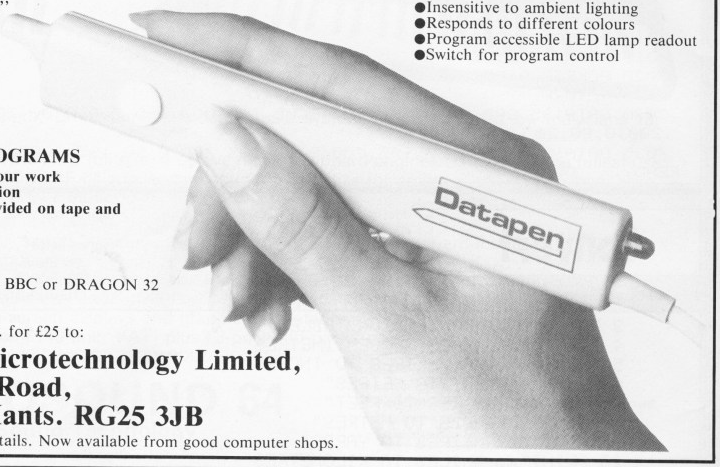

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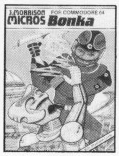

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```
167 IFP$="↑"THEN2060
168 IFP$="T"THEN2070
169 IFP$="."THEN2090
170 IFP$="5"THENRUN
180 IFP$="W"THEN2010
181 END
1000 GOSUB10000
1001 INPUTA:X=(A*2.540)
1002 PRINT"■■■■■■■■"
1003 PRINTX
1004 GOSUB20000
1005 GOSUB5000
1006 GOTO1000
1007 END
1010 GOSUB10000
1011 INPUTC:V=(C*0.3937)
1012 PRINT"■■■■":PRINTV
1013 GOSUB20000
1014 GOSUB5000
1015 GOTO1010
1020 GOSUB10000
1021 INPUTY:L=(Y*0.3048)
1022 PRINT"■■■": PRINTL
1023 GOSUB20000
1024 GOTO5000
1025 GOTO1020
1030 GOSUB10000
1031 INPUTA:S=(A*3.281)
1032 PRINT"■■■■":PRINTS
1033 GOSUB20000
1034 GOSUB5000
1035 GOTO1030
1040 GOSUB10000
1041 INPUTA:B=(A*0.9144)
1042 PRINT"■■■":PRINTB
1043 GOSUB20000
1044 GOSUB5000
1045 GOTO1040
1070 GOSUB10000
1071 INPUTT:S=(T*1.094)
1072 PRINT"■■■":PRINTS
1073 GOSUB20000
1074 GOSUB5000
1075 GOTO1070
1080 GOSUB10000
1081 INPUTD:E=(D*1.609)
1082 PRINT"■■■":PRINTE
1083 GOSUB20000
1084 GOSUB5000
1085 GOTO1080
1090 GOSUB10000
1091 INPUTA:B=(A*0.6214)
1092 PRINT"■■■":PRINTB
1093 GOSUB20000
1094 GOSUB5000
1095 GOTO1090
2000 GOSUB10000
2001 INPUTA:B=(A*4.546)
2002 PRINT"■■■":PRINTB
2003 GOSUB20000
2004 GOSUB5000
2005 GOTO2000
2010 GOSUB10000
2011 INPUTA:B=(A*0.22)
2012 PRINT"■■■":PRINTB
2013 GOSUB20000
2014 GOSUB5000
2015 GOTO2010
2020 GOSUB10000
2021 INPUTA:B=(A*0.03527)
2022 PRINT"■■■":PRINTB
2023 GOSUB20000
2024 GOSUB5000
2025 GOTO2020
2030 GOSUB10000
2031 INPUTA:B=(A*453.6)
2032 PRINT"■■■":PRINTB
2033 GOSUB20000
2034 GOSUB5000
2035 GOTO2030
2040 GOSUB10000
2041 INPUTA:B=(A*0.002205)
2042 PRINT"■■■":PRINTB
2043 GOSUB20000
2044 GOSUB5000
2045 GOTO2040
2050 GOSUB10000
2051 INPUTA:B=(A*0.4536)
2052 PRINT"■■■":PRINTB
2053 GOSUB20000
2054 GOSUB5000
2055 GOTO2050
2060 GOSUB10000
2061 INPUTA:B=(A*2.205)
2062 PRINT"■■■":PRINTB
2063 GOSUB20000
2064 GOSUB5000
2065 GOTO2060
2070 GOSUB10000
2071 INPUTA:B=(A*1016.00)
2072 PRINT"■■■":PRINTB
2073 GOSUB20000
2074 GOSUB5000
2075 GOTO2070
2090 GOSUB10000
2091 INPUTA:B=(A*0.0009842)
2092 PRINT"■■■":PRINTB
2093 GOSUB20000
2094 GOSUB5000
2095 GOTO2090
3000 GOSUB10000
3001 INPUTA:B=(A*28.35)
3002 PRINT"■■■":PRINTB
3004 GOSUB20000
3005 GOSUB5000
3006 GOTO3000
5000 GETA$:IFA$=""THEN5000
5001 IFA$="2"THENRUN
5002 IFA$=" "THENRETURN
10000 PRINT"■■INPUT FIGURE"
10001 RETURN
20000 PRINT"■■2=INDEX
  SPACE=NEW FIGURE"
20001 RETURN
```

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Turtle power

From "DIY Robotics and Sensors for the Commodore Computer" by ***John Billingsley***

IF YOU COME across an inverted soup bowl, wandering about and perhaps drawing shapes on a large sheet of paper, you have met a Turtle. There is no attempt here to go into the intricacies of turtle graphics; instead the principles of the turtle serve as a good excuse for putting a pair of stepper motors to work.

The turtle is a simple "wheelchair" system, propelled by two independent wheels on a diameter. Ball bearings or skids limit the resultant fore-and-aft toppling. To move straight ahead, both wheels rotate in step. To turn on the spot, one wheel rotates forwards while the other rotates backwards at exactly the same rate. If one wheel turns at exactly twice the speed of the other, the turtle will follow a circle with centre one wheel-space from the slower wheel. Accurate movement calls for the motors being driven accurately in step — just the job for stepper motors!

At the centre of a "genuine" turtle is a retractable pen, so that its perambulations can be used to draw shapes, or even graphs and illustrations. Let us think about that problem later.

Top down

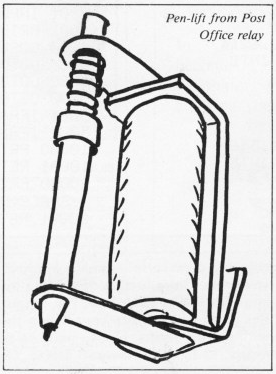
Two stepper motors can be driven with little complication from the eight bits of the user port. With the aid of two multi-Darlington chips plus the experience of the article in December's *Commodore Horizons,* the task of making the motors rotate should give little trouble (a photocopy of the previous article can be obtained by sending a stamped, addressed envelope to this magazine). The more difficult part is to make the software "meaningful", so that a command structure can be based on the desired movements of the turtle without going into the gory details of the number of motor steps required for each gyration. Taking a "top-down" look at the problem, we want to be able to type "advance, 100" to move 100 mm forwards, or perhaps "turn, clockwise, 90". Circles would be nice to add, with perhaps "circle, clockwise, 200, 90" giving 90 degrees of a 200 mm radius circle. It might not even be "over the top" to add Cornu spirals to blend one radius to another — but not just at the moment. With graphics in mind, the further commands "pen, up" and "pen, down" complete the set. The task of working out where the turtle would wind up after a given manoeuvre can be performed on the command sequence by another subroutine, if required, although mechanical tolerances mean that the result will not be particularly accurate after a lengthy perambulation.

The suggested stepper motors are type ID35, made by Philips and distributed by Impex of Kew Road, Richmond, Surrey at a price around £12.00. They have 48 steps per rev, ie 12 electrical revolutions per mechanical revolution. If you drive the motor in half-steps, ie N, NE, E, SE, S, SW, W, NW, you will now have 96 half-steps per revolution of the wheel. Suppose that your wheels are 80 mm in diameter, then they will have a circumference of around 250 mm and each half-step will give you a movement of about 2.6 mm. If you don't mind making or trimming your own wheels, then a diameter of 2*96/pi = 61.1 mm will give exactly 2 mm per half step — but you would be best to buy the nearest larger size from the model-shop and accept a slightly odd scale factor.

When the motors are driven equally in opposite directions, the turtle rotates about its centre. If each wheel makes one revolution, then the turtle will turn through (diameter-of-wheel/separation-of-wheels) revolutions. Make the separation two-and-a-half times the diameter, and each step will give just one degree. If the motors are driven at unequal speeds, the distance advanced will be given by the average of the (signed) numbers of steps, while the turtle will turn through an angle equal to half their difference.

Classy chassis

The "chassis" can be made from plywood or even balsa wood, since it has very little work to do. The skids can be formed from lightweight cupboard ball-catches, although a couple of bent paperclips will really serve the purpose. They should just clear the ground, so that only one touches the ground at a time. Most of the mechanical load will be due to the umbilical cable, and this must be connected to the turtle at a high central point. If you sacrifice some sort of plastic bowl to make a cover, then the cable can safely emerge from a hole in the centre. If, however, your turtle is naked you should mount a mast in the centre — not too tall, or the turtle will topple. The cable should approach the turtle from above, dangling from a supporting string attached to the ceiling.



Pen-lift from Post Office relay

At first sight you will need at least a dozen conductors in the cable, five for each motor, two for a pen-lift plus more for any sensors you may add later. A pinch you can get away with two less, sharing a common positive power line, but this may be a false economy since the resistance of the cable can cause coupling between the motor drives. Ribbon cable is the neatest solution, but far from the cheapest.

Further steps

We can make up an "algorithm" for converting the commands into demanded motor half-steps (from now on, let us call them just steps) as follows. Let us assume a wheel diameter of 61 mm and a separation of 2.5*61 = 152.5 mm.

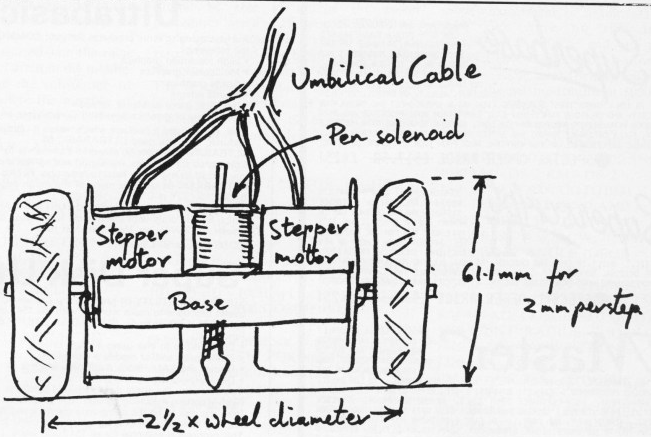
Command	*Left motor steps*	*Right motor steps*
Advance	distance/2	distance/2
Turn, cw	+ angle	− angle
Turn, acw	− angle	+ angle
Circle, cw	angle* (radius/115 + 1)	angle* (radius/115 − 1)
Circle, acw	angle* (radius/115 − 1)	angle* (radius/115 + 1)

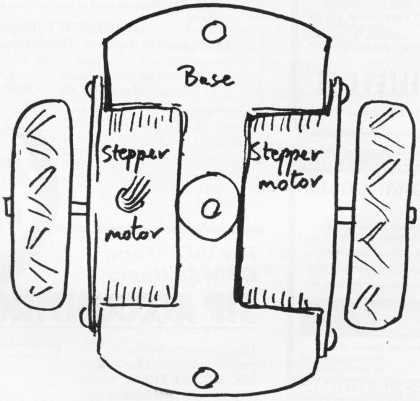
Now the command interpreter must "talk to" a motor control module, which will accept commands in the form of the number of steps each motor must move. An extra command, "speed, 20" can adjust a general variable which need not feature in the syntax. Let us use a subroutine to command the motors, and let us define this at line 8000 onwards.

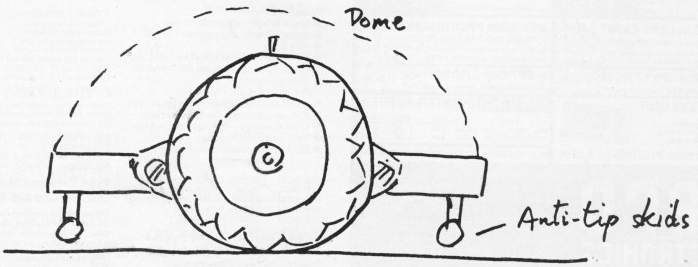
Varying the speed of a single motor can be done with a simple variable delay, but to drive two motors at different speeds calls for a different concept, the 'binary-rate-multiplier'. Suppose that the left motor must move 100 steps, while the right motor must move only 67. Then we first construct the ratio of the two, in this case 0.67. Each time round the loop we step the left motor, but the right motor may or may not need to step. To make the decision we keep adding the ratio to another variable, T, say. If T is now greater than 1, the motor is stepped and T is reduced by 1. Sounds confusing? Then let's try an example.

Left motor position		*T*	*Right motor position*		
	0	0			
Step	1	.67		0	
Step	2	1.34	Step	1,	T = 0.34
Step	3	1.01	Step	2,	T = 0.01
Step	4	.68		2	
Step	5	1.35	Step	3,	T = 0.35
.....					
.....					
Step	97	.99		64	
Step	98	1.66	Step	65,	T = 0.66
Step	99	1.33	Step	66,	T = 0.33
Step	100	1.00	Step	67,	T = 0.00

So we arrive at the end of the movement with each motor having taken the correct number of steps. This is the principle behind most graph-plotting routines for drawing oblique straight lines. The result is slightly improved if T starts with the value 0.5, since this causes the unevenness to be shared ▶


Umbilical Cable
Pen solenoid
Stepper motor
Stepper motor
Base
61·1mm for 2mm per step
2½ x wheel diameter


Base
Stepper motor
Stepper motor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◀ out symmetrically along the line. In the example above, the only occurrence of three right-motor steps in a row is at the end of the movement; had T started with the value 0.5 they would have occurred in the middle.

We can now define the subroutine to MOVE the motors, where the number of steps for the left motor is stored in LM and for the right motor in RM.

```
8000 AL = ABS(LM):AR = ABS(RM):
REM ABSOLUTE VALUES OF STEPS
8010 SL = SGN(LM):SR = SGN(RM):
REM AND SIGNS OF DIRECTIONS
8020 GOSUB 9500: REM DELAY
VARIED BY SPEED
8030 IF AF + AL = 0 THEN RETURN:
REM NO MOVE, GO HOME
8040 IF AR>AL THEN 8200: REM
DEAL WITH THIS SEPARATELY
8100 RA = AR/AL: T = 0.5: REM RATIO
OF MOVES
8110 FOR M = 1 TO AL: REM HERE
WE GO
8120 GOSUB 9000: REM STEP LEFT
MOTOR DIRECTION SL
8030 T = T + RA
8140 IF T>1 THEN GOSUB 9100:
T = T - 1: REM RIGHT MOTOR
8150 NEXT M: RETURN: REM THAT'S
ALL, GO HOME
8200 RAT = AL/AR: T = 0.5: REM
RIGHT MOVE > LEFT MOVE
8210 FOR M = 1 TO AR
8220 GOSUB 9100: REM RIGHT
MOTOR EVERY TIME
8230 T = T + RA
8240 IF T>1 THEN GOSUB 9000:
T = T - 1: REM LEFT MOTOR
8250 NEXT M: RETURN
```

This still leaves us with the "bottom-up" task of writing the motor drivers. We start with housekeeping at line 10000:

```
10000 LP = 0:RP = 0:SP = 100:REM
MOTOR POSITIONS,SPEED
10010 PO = 56577:DD = 56579:REM
PORT, DATA DIR *** CBM 64 or
10010 PO = 59471:DD = 59459:REM
*** Pet
10020 DIM LD(7),RD(7): REM TWO
ARRAYS FOR MOTOR DRIVES
10030 FOR M = 0 TO )
10040 READ J: LD(M) = J: RD(M) = 16*J:
NEXT
10050 DATA 1,5,4,6,2,10,8,9: REM
COILS ARE N-S-E-W
10060 POKE DD,255: POKE PO,0:REM
CONFIGURE OUTPUTS, SET TO
10070 GOTO 100
```

Then we add the motor drivers, and a delay which depends on Speed:

```
9000 LP = (LP + SL)AND 7: REM LEFT
MOTOR NEW POSITION
9010 POKE PO,(PEEK(PO) AND
240) + LD(LP)
9020 REM MIX NEW LEFT MOTOR
DRIVE WITH OLD RIGHT, OUTPUT
9030 RETURN
9100 RP = (RP + SR)AND 7: REM
RIGHT MOTOR NEW POSITION
9110 POKE PO,(PEEK(PO) AND
15) + RD(RP)
9120 RETURN
9500 FOR D = 1 TO 1000 STEP SP:
NEXT
9510 RETURN
```

(Using a modicum of cunning, you should be able to rewrite the motor procedures into a single procedure with two arguments QL and QR preset to SL, SR or zero. You should then be able to tidy up the move procedure to make it less "lumpy". The inelegant procedures here are designed to be easier to understand.)

Before adding the clever stuff, trouble-shoot these modules with a "jiffy program":

```
10 GOTO 10000
100 PRINT "LEFT MOTOR, RIGHT
MOTOR"
110 INPUT LM,RM
120 GOSUB 8000
130 GOTO 100
```

and if the result does not look too good, try something even simpler:

```
100 SPEED = 10:SL = 1
110 GOSUB 9000:GOSUB 9500:
GOTO 110
```

to get down to bedrock. If all else fails, take manual control by POKEing PO to various values, and get out your trusty test meter.

Nuts and bolts

While we are dealing with the nuts and bolts, let us have a look at the pen lift. Having throughly used up the bits of PO TO P7, the only convenient user port bit left is now pin M, position 11 of the connector strip, which is PA2 (CBM 64) or CB2 (Pet). Without wishing to tangle too closely with the intricacies of the Peripheral Control Register of the VIA, it is safe to reveal that POKE DD + 9, 14*16 (POKE $E84C,$EO) will set the Pet's CB2 high, while POKE DD + 9,12*16 will set it low. Now pin M can be wired to another channel of a Darlington chip (using up one of the six spare channels) to give a signal beefy enough to drive a solenoid, and for the 64 we can add:

```
7000 D = PEEK(PO - 1) AND 251: REM
PORT A, BIT 2 LOW: *** CBM 64
7010 IF P = 1 THEN D = D + 4: REM
ENERGISE TO LIFT PEN
7020 POKE PO - 1,D:RETURN: REM
OUTPUT TO PORT A
```

or for the Pet we can instead add:

```
7000 IF P = 0 THEN POKE DD + 9,224:
RETURN:REM ENERGISE TO LIFT
PEN
7010 POKE DD + 9,192:RETURN REM
DEENERGISE, DROP PEN
```

This does not answer your problem of finding a pen-lift solenoid to drive. A commercial solenoid can easily be bought, but is likely to be heavy and over-powered. It does not take much to lift a ball-point, and even less to lift a felt-tipped pen, and you can substitute a little dexterity for a lot of power consumption. An old Post-office relay can, with the removal of the contact assembly, provide more than enough lift. You may need to fiddle a little with the pen height, but provided your wheels are not eccentric you should get acceptable results.

Now we are ready for the command interpreter. This could be written most elegantly and almost incomprehensively with searches in command list. Instead let us try a 'knife and fork' job, which will simply perform each command immediately. It can be adapted later to memorise and edit a command sequence. The task of inputting the command is not made easier by the motley assortment of arguments they can take. We have on the one hand "ADVANCE, 200", and on the other "CIRCLE, CW, 45, 150", so the user will welcome some 'user-friendly' guidance. Let us put the parsing routine at 1000:

```
100 GOTO 1000
1000 PRINT"COMMAND: ";:INPUT A$
1010 IF A$< >"ADVANCE" THEN 1100
1020 PRINT"DISTANCE: ";:INPUT DS
1030 LM = DS/2:RM = DS/2
1040 GOSUB 8000:GOTO1000
1100 IF A$< >"TURN" AND
A$< >"CIRCLE" THEN 1300
1110 PRINT"CW/ACW: ";:INPUT B$
1120 PRINT"ANGLE (DEG): ";:INPUT
AG
1130 IF B$ = "ACW" THEN AG = - AG
1140 IF A$ = "TURN" THEN LM = AG:
RM = - AG: GOSUB 8000:GOTO1000
1200 PRINT"RADIUS: ";:INPUT R
1210 IF B$ = "ACW" THEN R = - R
1220 LM = AG*(R/115 + 1):
RM = AG*(R/115 - 1): GOSUB
8000:GOTO 1000
1300 IF A$< >"SPEED" THEN 1400
1310 PRINT"WAS ";SP;", NEW
SPEED: ";:INPUT SP:GOTO1000
1400 IF A$< >"PEN" THEN 1500
1410 PRINT"UP/DOWN: ";:INPUT B$
1420 IF B$ = "UP" THEN P = 0:
GOSUB 7000:GOTO1000
1430 P = 1:GOSUB 7000:GOTO1000
1500 PRINT"SORRY — CAN'T
RECOGNISE COMMAND"
1510 PRINT"ADVANCE, TURN,
CIRCLE, SPEED, PEN"
1520 GOTO 1000: REM ADD NEW
COMMANDS AT 1500
```

As soon as you are happy that this all works, you will want to modify the command structure so that an array of moves is built up, each move to be executed by a subroutine to interpret it. The routine at 1000 will then plant values of command type, distance/radius and angle into the array, and will have added commands such as PERFORM, STEP, REPEAT, DELETE and ADD to enable you to build up a ballet. You will then also need LOAD and SAVE to preserve the ballet for posterity. If you really get stuck when making these additions, please let me know whether I should include a full program in the next book! You could instead buy a ready-made turtle complete with its software from a specialist firm.

To get the most from a turtle or buggy, it should have a few sensors. This is not too easy on the Pet, since this technique of driving the stepper motors has used up all the easily available interface pins. The addressing methods discussed in my book should ease the situation. If you are only using two channels out of the available eight, then you can gate sensor lines onto the bits which normally carry the motor pattern by selecting an unused channel — you could sense 24 bits this way.

In the case of the 64, life is much easier. First you have the joystick bits available on the games inputs. Next you can add extra channels using the analogue inputs. After reading my book you should even find it easy to adapt your turtle to be light-seeking. The possibilities are endless. ■

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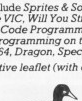

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A good look at business

THE EMERGENCE of home computers as the favourite Christmas present of 1983 left many manufacturers with egg on their faces, as demand far outstripped both supplies and sales forecasts. But Commodore has bounced back with good news, both financial and commercial, at the recent Consumer Electronics Show in Las Vegas.

On the financial front, chairman Irving Gould unleashed a barrage of record sales figures — for the second quarter ending on December 31st, sales, at 425 million dollars, were 140 per cent ahead of the previous year's 176 million dollars; while the aggregate first half sales were over 630 million dollars, compared with 1982's 280 million dollars.

At the show, Irving Gould wouldn't give any details on Commodore's profits, but he did say that these too stand at 'record levels'. For the second half of the year, Gould expects profits to finish at — you guessed it — 'record levels'.

If Commodore keeps up its present sales momentum, and there seems no reason to think they won't, it looks as if sales this year could top 1½ billion dollars — no mean performance when you remember that just five years ago, Commodore barely achieved sales of 70 million dollars.

New York analysts who follow Commodore are divided on their profit forecasting. Depending on whether you think the profits growth will slow down or not, profits for the financial year ending next June are expected to be between 130 million and 175 million dollars. In 1979, they were a mere six million.

But will the bubble shortly burst, particularly when mighty IBM lands in the home computer market with the PC Junior?

Reception of Junior on both sides of the Atlantic has been muted, but even if IBM capitalise on their well-known marketing and distribution strengths and their reputation for reliability, Commodore should survive unscathed — or so think the US analysts.

Says Barbera Isgur at New York stockbrokers Paine Webber: "We think the impending entry of IBM into the home market, coupled with large losses by some industry participants, may have obscured investor confidence in Commodore's continuing capacity to deliver the right product at the right price while maintaining significant growth and profitability."

Irving Gould certainly oozes confidence in the future, and the new product announcements by Commodore at the Las Vegas show testify to the company's shrewd evaluation of present market trends.

Commodore unveiled two new models, the 264 and the V364, which will offer integrated software: graph, writing and spreadsheet programmes encoded on a chip inside the computer. Commodore is confident that the new models won't hurt sales of the 64 — now put at one million — because they "are aimed at a different market and are much more task orientated."

It's nothing new to say that users are increasingly interested in the capability of available software, rather than the merits of their chosen home computer.

But as well as giving a new emphasis to software, Commodore is now aiming much more singlemindedly at the business user with the 264 and V364 and their integrated business software.

If more proof were needed of the value of "task-oriented" business machines, Irving Gould need do no more than turn to a report from the Intelligent Electronics group in Paris, which appeared at the same time as the Las Vegas show. The report emphasises that European businessmen are no longer looking at machines as executive toys — they want solutions to specific problems. Clearly Commodore has taken up this challenge, and will presumably reap the benefits.

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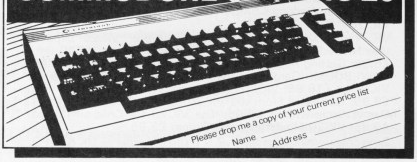

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VIC 20

VIC Innovative Computing (Mel.H) £5.95); VIC20 Exposed (Mel.H) £6.95; 50 Outstanding Programs for the VIC20 (Int.) £6.95; Getting Acquainted with your VIC20 (Int.) £6.95; ZAP! POW! BOOM! (Games for the VIC20) (Int.) £7.95; Kids & the VIC (P-H) £16.95; VIC20 Programmer's Reference Guide (P-H) £9.95; Get More From the VIC20 (Gran.) £5.95; The VIC20 Games Book (Gran.) £5.95; The VIC20 for Children (Sigma) £5.95; VIC20 Mindstretchers (Sigma) £5.95.

Send cheque/money order + P & P (80 per order — UK & BFPO; £1.50 per book — Europe) to:

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Please cut out and send this form to: Classified Department, Commodore Horizons, 12-13 Little Newport Street, London WC2R 3LD

ANSWER BACK

Graphics and games

COULD YOU advise me on which book I should buy to delve further into hi res graphics on the 64?

Also, I typed in Bomber Run from your Dec/Jan 1984 issue and had an everlasting loop between lines 4030 and 4040. Can you explain?
A Hunter
Middlesbrough

ON YOUR first question, try *Graphic Art on the Commodore 64* by Boris Allan, £5.95 from Sunshine Books (which also publishes this magazine).

On the second query, have you tried the joystick in port 2 (next to power supply)? I have checked the subroutine in isolation and it works ok. Try stopping the program in the loop, and query the values of the variables. You should get some clues from testing in this way.

Back to basics

CAN YOU offer any advice on the following probems with the Vic 20? Firstly, why is it not possible to GOTO or GOSUB a variable as in:
100 a = 200: GOTO a?
Secondly, I have written a simple machine code routine to transfer a Basic program to another part of memory so that I can have several Basic programs in the machine at one time. It 'saves' and 'downloads' programs properly and afterwards I can LIST and RUN them until it hits a GET, INPUT or READ statement, when the system crashes.

Several weeks of dissecting the first 'K' of RAM have not helped. In connection with this, how do I access 'NEW' in machine code?
Neil Duncan
Basingstoke

THE BASIC interpreter used in the Vic 20 does not allow such lines. However, you can use computed line numbers as follows:

```
10 rem **** MENU ****
20 ?"CLR RVS 1 RVSOFF this computes line 100"
30 ?"CD RVS 2 RVSOFF this computes line 200"
40 get a$:if A$="" THEN 40
50 a = val(a$):if a>2 or a<1 THEN 40
60 on a GOTO 100,200 (or GOSUB 100,200:END)
100 ?"this is line 100"
110 END (or RETURN if GOSUB used)
200 ?"this is line 200"
210 END (or RETURN if GOSUB used)
```

If you want to use letters for your menu selections then a = asc(a$) – 64 will change a,b,c etc to 1,2,3.

In answer to the second problem, you should save the bytes in $2d and $2e, which point to one byte after the end of the program, and after a "download" put back these bytes so that the Vic knows where the program finishes!

Calling $fd3c will NEW the Vic but leave your machine code intact. It will return you to Basic with the familiar "power on" message (Basic programmers try SYS 64828 for the same effect).

From Pet to 64

PLEASE COULD you tell me if Commodore makes a program which enables you to run Pet software on the CBM 64
Andrew Jones
Swansea

YES, there is a program called the Pet Emulator available from CBM.

Loading error

I HAVE recently purchased a CBM 64 and find it a first class machine. I have, however, run into a problem with a games tape which I cannot load correctly.

In the shop the same tape loads correctly, so do I have a problem with my 64 or tape deck?
Alfred Hendry
Stirling

TAKE YOUR cassette deck to the shop and load the tape onto its 64. If the tape does not load then your deck may need cleaning and demagnetising. If the tape still does not load then your deck is faulty.

If your tape loads successfully then take your 64 to the shop and try loading the tape from the shop's deck to your 64. If unsuccessful then you have a faulty chip in the 64.

The above procedure will isolate the cause of your problem.

Star in eclipse

I TYPED in a program called Dark Star from the CBM 64 games book and played with it for hours with no problems, then I saved the program and verified it ok.

It would not reload correctly although I have no problems with tapes that I bought. Any ideas?
Trevor Edwards
Sheerness

THE CORRECT procedure in typing in listings from books or creating your own programs is to save these programs before attempting to run them, preferably after each 20 lines entered. The reason is that some programs when run corrupt memory in such a way that you cannot save correctly.

It is also possible that you are not using the right quality computer tape. You can buy blank computer tapes at reasonable prices from Boots.

A foreign language

I OWN A CBM 64 and I want to learn to write foreign language programs, but I do not know where to start. Can you help me with the following questions: Which books would be the best introduction to programming? Would any special peripherals be required? And how can I make use of English Phonetic Symbols?
B Arora
London

THE CASSETTE series from CBM, *Introduction to Basic part 1* and *part 2*, and *Using the 64* by Peter Gerrard (published by Duckworths), are good starting points. Initially, you will need a cassette deck for storage at least. Lastly, you will have to define your own character set, and the *Programmers Reference Guide* for the 64 (from CBM) will prove invaluable.

Copying to disk

COULD YOU please tell me if there is a copying program available for the 64?
Steven Kirk
Bedlington

COPYING programs are now supplied with the purchase of the 1541 disk drive; 1541 back up (for single drive users) or copy/all for those who have two 1541 drives.

The 1541 back up requires about 20 minutes to do its work, and the source disk and destination disk have to be removed and replaced several times, since the 64 cannot hold all of the disk data in memory at any one time.

Advice for the Vic . . . 1

I HAVE BOUGHT a Vic Super Expander, but the instructions are in German. Although through trial and error I have found most of the facilities, I could use an English copy as I feel there are some things I'm missing!
C Robilliard
BFPO 42
West Germany

. . . and 2

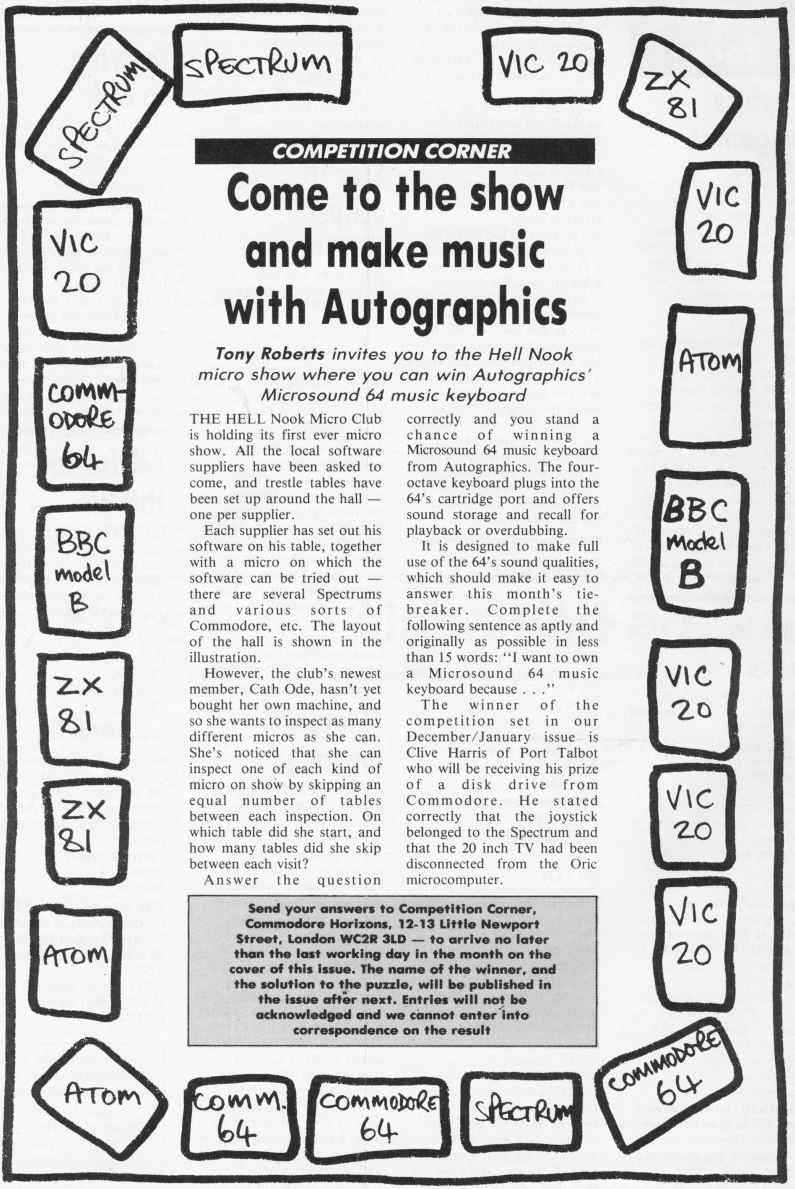
PLEASE COULD you print a list of games cartridges for the unexpanded Vic-20. Also, could you tell me if there is a Skramble cartridge available for the Vic?
Darren Haynes
Plumstead
London

FOR information on Vic games contact Vicsoft at 675 Ajax Avenue, Trading Estate, Slough, Berks, or phone 0753-73638.

For general enquires such as instruction manuals, phone 0753-74111.

If you need help with a technical query or problem write to Jack Cohen, Commodore Horizons, 12-13 Little Newport Street, London WC2R 3LD

SPECTRUM SPECTRUM VIC 20 ZX 81



COMPETITION CORNER

Come to the show and make music with Autographics

***Tony Roberts** invites you to the Hell Nook micro show where you can win Autographics' Microsound 64 music keyboard*

THE HELL Nook Micro Club is holding its first ever micro show. All the local software suppliers have been asked to come, and trestle tables have been set up around the hall — one per supplier.

Each supplier has set out his software on his table, together with a micro on which the software can be tried out — there are several Spectrums and various sorts of Commodore, etc. The layout of the hall is shown in the illustration.

However, the club's newest member, Cath Ode, hasn't yet bought her own machine, and so she wants to inspect as many different micros as she can. She's noticed that she can inspect one of each kind of micro on show by skipping an equal number of tables between each inspection. On which table did she start, and how many tables did she skip between each visit?

Answer the question correctly and you stand a chance of winning a Microsound 64 music keyboard from Autographics. The four-octave keyboard plugs into the 64's cartridge port and offers sound storage and recall for playback or overdubbing.

It is designed to make full use of the 64's sound qualities, which should make it easy to answer this month's tie-breaker. Complete the following sentence as aptly and originally as possible in less than 15 words: "I want to own a Microsound 64 music keyboard because . . ."

The winner of the competition set in our December/January issue is Clive Harris of Port Talbot who will be receiving his prize of a disk drive from Commodore. He stated correctly that the joystick belonged to the Spectrum and that the 20 inch TV had been disconnected from the Oric microcomputer.

Send your answers to Competition Corner, Commodore Horizons, 12-13 Little Newport Street, London WC2R 3LD — to arrive no later than the last working day in the month on the cover of this issue. The name of the winner, and the solution to the puzzle, will be published in the issue after next. Entries will not be acknowledged and we cannot enter into correspondence on the result

VIC 20 VIC 20 COMMODORE 64 BBC model B ZX 81 ZX 81 ATOM ATOM ATOM COMM. 64 COMMODORE 64 SPECTRUM COMMODORE 64 VIC 20 ATOM BBC Model B VIC 20 VIC 20 VIC 20

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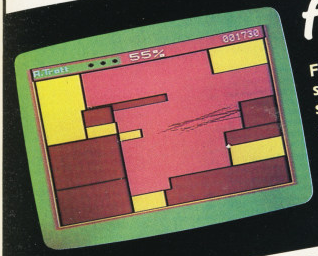
the name to remember



for games

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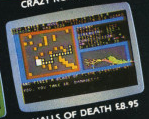
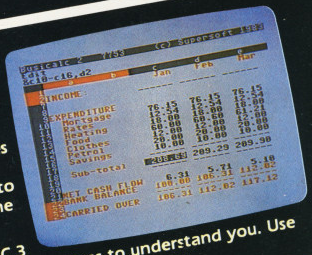


HALLS OF DEATH £8.95

for business

Show your computer who's master with BUSICALC!
Spreadsheet programs are used by large and small businesses to juggle with figures, prepare reports and so on. Some are very powerful indeed. The problem is that they're difficult to learn, and tricky to use – which is why we came up with the BUSICALC series.



Whether you choose BUSICALC 1, BUSICALC 2, or BUSICALC 3 you'll get a program you can understand – and one that almost seems to understand you. Use it in the home, use it for teaching, use it at work – it'll save you time and money.

for programmers

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 £57.50.

There's much more for the 64 in the SUPERSOFT catalogue. Ask your computer dealer for a copy, or phone 01-861 1166.

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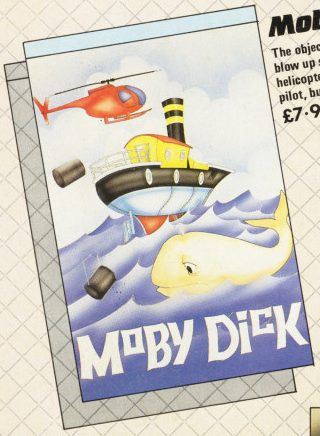

Mobydick

The object of this game is to blow up submarines, destroy the helicopter and catch the falling pilot, but do not kill the whale.

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Neoclyps

You are the GOOD GUY, Freedom Fighter and renowned star pilot. The BAD GUYS, an alien race from distant solar system have invaded NEOCLYPS, one of your colonial planets. Being the good guy that you are, you set off to liberate the Common Folk of Neoclyps from the oppression of the Bad Guys. The Bad Guys have populated Neoclyps with several radar towers which reveal your position to them.

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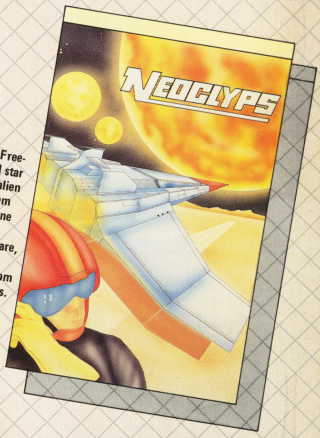

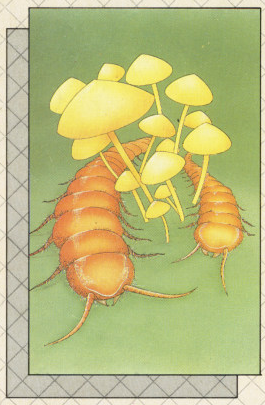

Cosmic Split

You are caught in a vicious jungle of giant insects. Centipedes are attacking you from all sides. Killer fleas are dropping from the sky, and to top things off there's a venemous spider lurking in the background.

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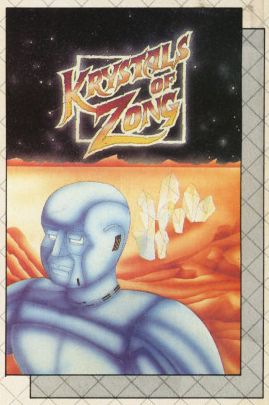

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