The Gazette Talks To The Authors Of *Hitchhiker's Guide* And *Mindwheel*

COMPUTE!'s GAZETTE

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June 1985
Issue 24, Vol. 3, No. 6
02220 $3.75 Canada

FOR **COMMODORE** PERSONAL COMPUTER USERS

Inside The 128

A Hands-On Look
At Commodore's Newest Computer

Screen-40

40 columns for your VIC. With full screen editing and easy graphics.

Dynamic SID Editor

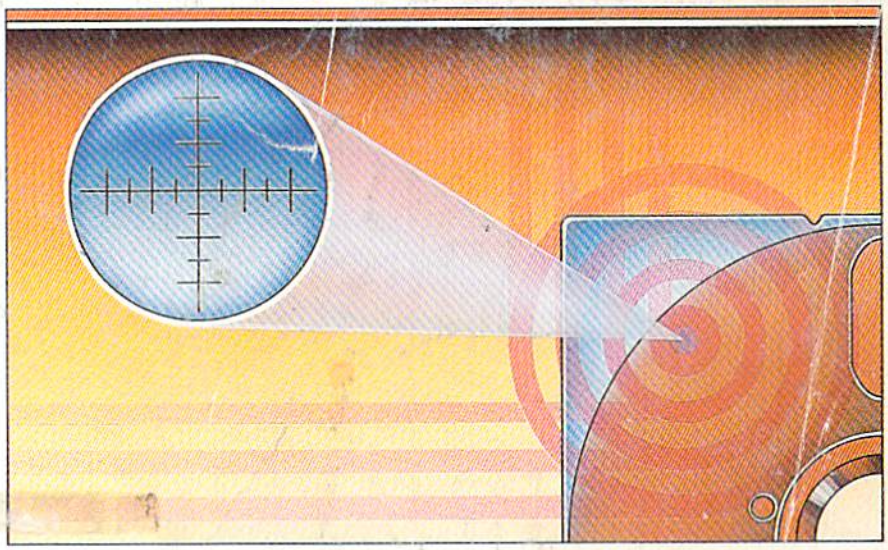
Instantly see and hear what your 64's sound chip can do.

Also In This Issue:

Interview With Paul Goheen, Commodore's Director Of Software

A Guide To Commodore User Groups, Part 2

Plus Reviews, New Products, And More



The Freeze Factory

Four robots run amok in this action-strategy game for the VIC and 64.

Relative Files: Speed And Economy

A step-by-step tutorial that takes the mystery out of using relative files. For 64, VIC, Plus/4, and 16 owners.

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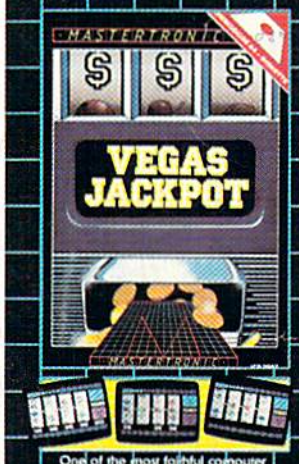
MASTERTR

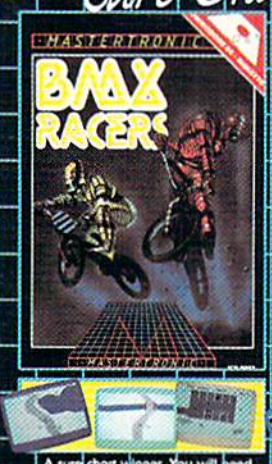
ARCADE-STRATEGY-ACTION

Sure Chart Winners



One of the most faithful computer simulations ever produced of a fruit machine. It incorporates the hold, nudge, gamble and shuffle features found in the real thing.

A satellite retrieval game that includes 16 levels of "low pressure" death awaiting the unskilled astronaut.



A sure chart winner. You will need skill and fast reflexes to beat this one! You can ride on 5 different courses, each course ranges from 8 to 25 different scrolling screens.

Opened to Five Star Reviews in Europe recently this is surely one of the most challenging and unusual games available for the C64. Written by 'Commodore Programmers of the Year' Richard and David Darling. The game has five different spectacular screens with hidden twists — if you get this far you have to retrace your steps through another five of increasing difficulty.

Another unusual arcade – strategy game in which the players strive by weird and wonderful techniques to achieve a state of miniaturisation and hence enter Zycos brain and the game continues in another dimension.

An imaginative three screen multi level arcade adventure that uses very high resolution graphics and will test the abilities of the most experienced games players.

A scrolling multi screen game that takes Commodore graphics to a 'new' state of the art level previously seen only in a handful of other games. Playability is a keyword on this 'five star game'!

A one or two player game with split screen scrolling graphics that realistically simulates off road riding on eight different and challenging courses.

Multi screen arcade action with real twists needing a steady hand and a bold strategic game plan. It will keep your interest alive for hours.

Neat variation on a city bomber theme using excellent scrolling graphic routines that is extremely addictive.

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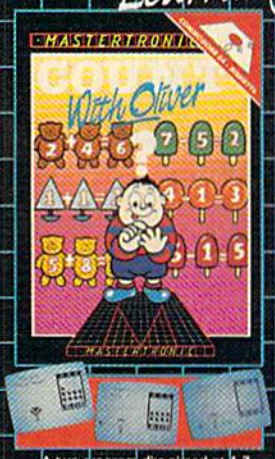
An amazing two program adventure using over 100K of memory that will challenge the most experienced adventure games players. Myriad locations graphically illustrated with thousands of alternative moves will probe the limits of your mind.

EDUCATIONAL

Learning is Fun



A two program disc aimed at 4-7 year old children that introduces the basics of counting, and simple addition and subtraction. At the same time the child is both amused and entertained by the fun aspects of the programs.

These two testing programs were written by college principal Gordon Askew and help to sharpen observational skills and visual memory. Each of the two programs contains three games and are aimed at 4-7 year olds and then from 7 years upwards. The screen graphics and entertainment value guarantee a childs interest and pleasure.

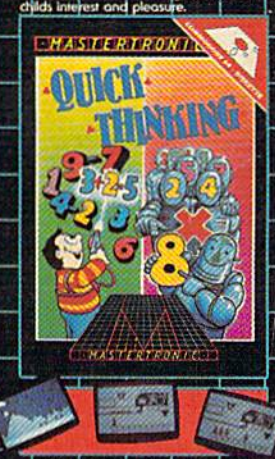
Star Wars' 1983 style with a very fast moving five screen arcade action game with multi skill levels.

A six programme adventure with 180K of memory

A six program adventure in the Third Continent magical fantasy series using over 180K memory could absorb and expand your imagination for months.

Truly 'State of Art' programming in this latest Third Continent adventure. Launched to rave reviews in England. This is a 120K adventure in three programs that comes with a beautifully illustrated 156 page descriptive 'book of shadows' set not to be missed by serious games player.

A very user friendly music creation program which allows The Budding Musician to write "On Screen" using either keyboard or joystick, extensive musical scores with up to 30 notes per page and seven pages in total. After composing your music you then choose to play it back complete on either trumpet, piano, guitar, recorder or trombone or delete and amend.



Double pleasure from two programs that will introduce early learners into the intricacies of multiplication. Age levels range from 6-12 years on game one and from eight upwards on the second game. Several levels of difficulty and choices of speed will sustain interest on the programs for a long time.

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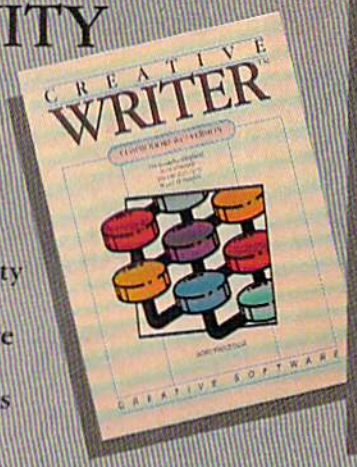

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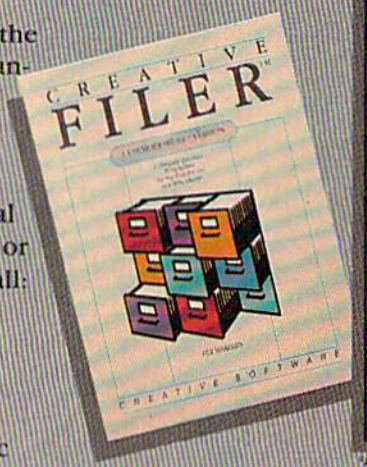

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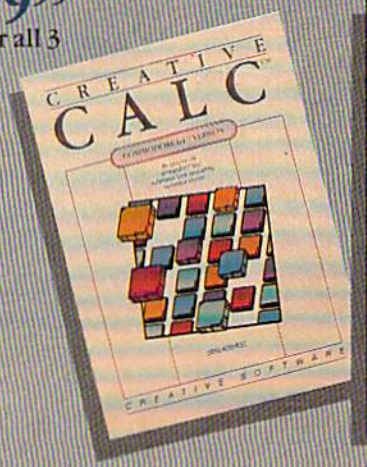

* Commodore 64 Suggested Retail Price

Commodore 64 Comparisons

Word Processors

Features/Benefits	Creative Writer	PFS: Write	Bank St. Writer	Home Word	Cut & Paste
24 Display Lines	Yes	No	No	No	No
Search & Replace	Yes	Yes	Yes	Yes	No
Variable Margin Settings	Yes	Yes	No	Yes	No
Imbedded Print-Format Commands	Yes	No	Yes	Yes	No
Preview Document to Screen	Yes	No	No	Yes	No
Normal Cursor Operation	Yes	Yes	No	No	No
Help Screens	Yes	Yes	No	Yes	No
Delete by Sentence	Yes	No	Yes	Yes	No
Delete by Paragraph	Yes	No	Yes	Yes	No
Use Function Keys	Yes	Yes	No	Yes	Yes
Full Line Headers, Footers	Yes	Yes	No	Yes	No
Copy, Move Text	Yes	Yes	Yes	Yes	Yes
Display Directory	Yes	Yes	Yes	Yes	Yes
Justify Text	Yes	Yes	No	Yes	No
Comment Lines	Yes	Yes	No	No	No
Undo Command	Yes	No	Yes	Yes	Yes
Integrate with Filer	Yes	Yes	No	No	No
Integrate with Calc	Yes	Yes	No	No	No
Suggested Retail Price	49.95	125.00	49.95	69.95	50.00

*Apple II specs used.
IPC version specs used.*

File Managers

Features/Benefits	Creative Filer	PFS Report & File	PhiBeta Filer	Data Manager II
Maximum Records per File	1300[1]	1000	250	660[4]
Maximum Fields per Record	100	50	10	20
Maximum Characters per Data Field	3920[2]	size of form	24	37[5]
Maximum Characters per Record	3920[2]	size of form	240	230
Maximum Files on Disk	144[3]	1	10	1
ISAM File for Fast Retrieval	Yes	No	No	No
Help Screens	Yes	No	No	No
Change Form Without Rewriting File	Yes	No	Yes	No
Report Writer Included	Yes	No	Yes	No
Select Records to Print	Yes	Yes	Yes	No
Derived Fields	Yes	Yes	No	No
Totals	Yes	Yes	Yes	No
User Defined Column Headings	Yes	No	No	No
Print Date and Page Number	Yes	No	No	No
View Catalog of Files	Yes	No	Yes	No
Integrate Report with Word Processor	Yes	N/A	Yes	Yes
Integrate Fields with Word Processor	Yes	N/A	No	Yes
Suggested Retail Price	49.95	149.90	49.95	49.95

[1]Limited only by capacity of disk.
[2]Limited only by number of directory entries allowed by DOS.
[3]Limited only by maximum size of form (98 lines.

[4]Longer field names also reduce amount of data that can be entered into data field.
[5]Calculated on the basis of one record per block.

Spreadsheets

Features/Benefits	Creative Calc	Multi-Plan	Visi-Calc	Insta-Calc	Practi-Calc
Rows	255	255	254	30[6]	254[7]
Columns	64	63	64	20[6]	100[6]
Variable Column Width for Any Column	Yes	Yes	No	No	No
Within Cell Editing	Yes	Yes	No	No	No
12 Digit Accuracy	Yes	Yes	No	No	No
Full-word Menus	Yes	Yes	No	No	No
Free Memory for Spreadsheet	30K	10K	10K	24K[8]	16K
List Directory on Screen	Yes	No	No	Yes	No
Format Text L/R/C	Yes	Yes	No	No	No
Dynamic Memory Allocation	Yes	Yes	Yes	No	No
Auto-recalc Available	Yes	Yes	Yes	No	No
Auto-adjust on R/C Deletion	Yes	Yes	Yes	No	No
Reference Cells by Moving Cursor	Yes	Yes	Yes	No	No
Maximum Formula Length	120	105	80	40	40
Integrate with Word Processor	Yes	Yes	No	No	No
Suggested Retail Price	49.95	99.95	99.95	39.95	54.95

[6]Commodore 80 32 version specs used.
[7]Size of Spreadsheet must be specified at program start–highly inflexible.
[8]Estimated.

CREATIVE SOFTWARE

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These comparisons were made based on programs available and/or specifications given by the manufacturers at time of publication. Creative Software is not liable for omissions or inaccuracies and makes no representation with regard to the continuing accuracy of these comparison charts.

June 1985 Vol. 3, No. 6

FEATURES

REVIEWS

GAMES

EDUCATION/HOME APPLICATIONS

PROGRAMMING

DEPARTMENTS

PROGRAM LISTINGS

* =General, **V**=VIC-20, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16.

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THE EDITOR'S *notes*

People have been waiting for years for the Japanese to begin to compete for the American home computer dollar. Where are they? Why haven't they yet seriously impacted the U.S. personal computer market?

Timing, of course, could be one reason. The Japanese developed MSX, an operating system that lets you control other machines, like video recorders, with your computer. Two or three years ago, computers based on this system would likely have had a big impact in America. Not only are these systems inexpensive, they also allow you to run any MSX software on any MSX computer. No more wishing there was a Commodore version of that great Apple program. And MSX-based games can access impressive video effects directly from video recorders.

But at this year's Consumer Electronics Show, the MSX booth, while impressive, was largely ignored; the Japanese are still minor players in the American computer market.

Perhaps computer technology is developing too rapidly for anything but sheer technical breakthroughs to pull the market forward.

Some observers have claimed that Jack Tramiel more or less single-handedly preempted a significant Japanese impact when he announced the then-drastic price/performance ratio of the VIC-20 computer in 1980.

In his book *The Home Computer Wars*, GAZETTE columnist and former Commodore insider Mike Tomczyk recalls what it was like at the meeting in London when Jack announced the "people's computer."

> Jack stood up and pounded his fist once on the table. The room fell silent. Then slowly, in his deep booming voice, he said: "Gentlemen, the Japanese are coming—so we will become the Japanese!"
>
> We all listened attentively as Jack explained that several Japanese companies (known collectively as Japan, Inc.) were already poised to enter the U.S. market. Japanese companies had already captured the television, radio, and small car markets, and personal computers were next on their list.
>
> "We have to compete with ourselves," he warned. "Always. We have to be like the Japanese. We have to constantly come up with something new, something better. We have to believe that we are the competition. If we do this, no one can get ahead of us."

Jack Tramiel went on to produce the first color computer for under $300, and this might well have been the single most significant factor in delaying a Japanese home computer for American markets. But is the long-awaited invasion only delayed?

Last year there was considerable speculation that the MSX operating system would provide an entrée into America for low-priced computers from Panasonic, Yamaha, and other Japanese electronics giants. MSX *is* impressive in many ways. It's a fixed standard, so software can be designed to run on any MSX computer and will run flawlessly. The MSX version of BASIC is impressive and full of desirable features. The music capabilities of the Yamaha computer, in particular, far outshine anything available on current popular American computers.

But the time for MSX seems to have come and gone. The American computer companies are moving en masse to 16- and 32-bit computers. The heyday of the 8-bit computer is over as Macintosh-like, 68000-chip-based machines are coming onto the market from both Atari and Commodore. MSX is an 8-bit operating system: no pull-down menus, no icons, no high-speed processing, no easy way to address huge chunks of RAM memory.

Of course it would be perilous and foolish to assume that Sony computers will never appear on American desks next to the Sony radios and TVs. But so far, Jack Tramiel's dicta that we must compete with ourselves and must keep coming up with something new have proven effective in checking whatever marketing plans the Japanese companies might have entertained. Few would argue that Commodore's Amiga and Atari's ST computers have any serious competition as the most promising new machines on the current personal computing horizon.

Richard Mansfield

Senior Editor

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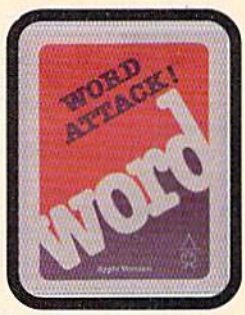

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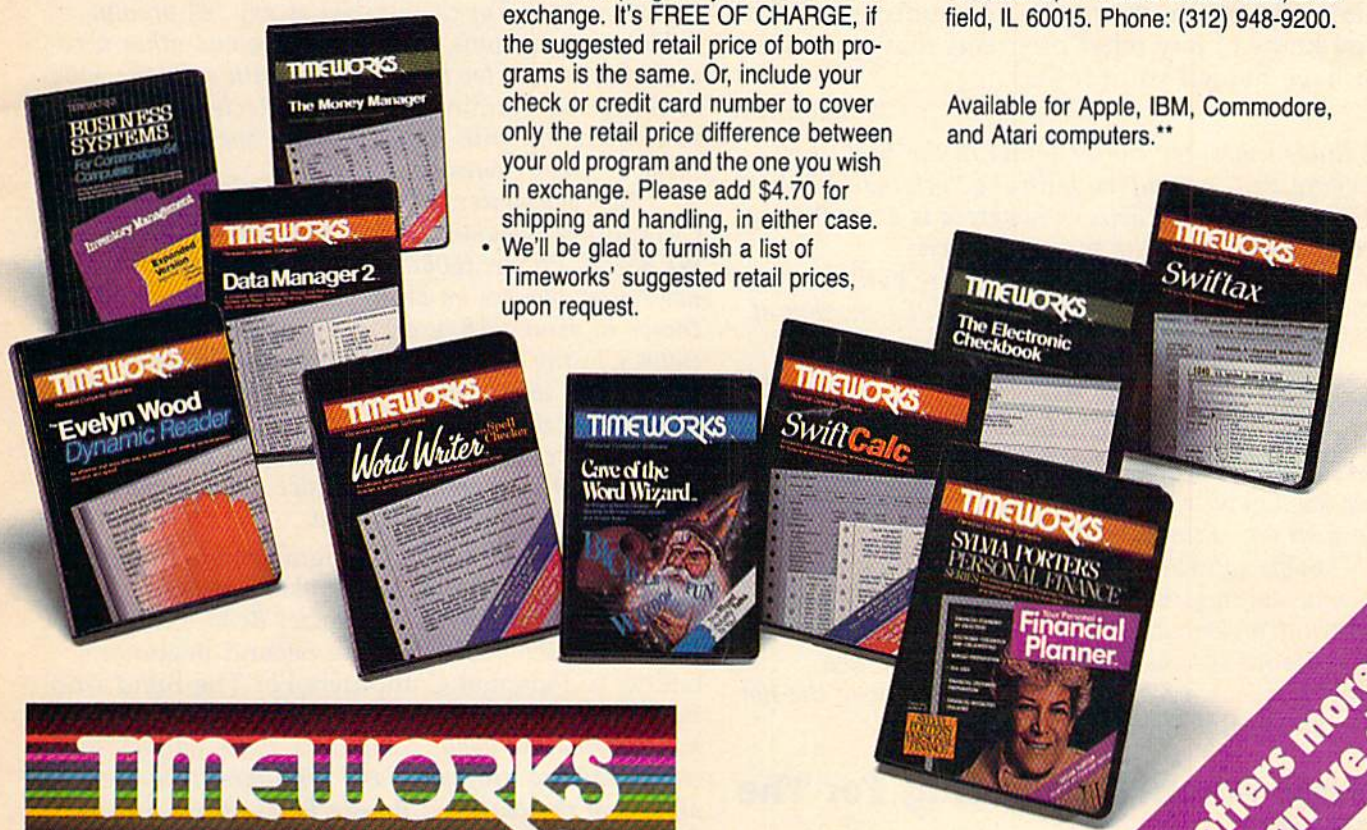

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GAZETTE FEEDBACK

EDITORS AND READERS

Do you have a question or a problem? Have you discovered something that could help other Commodore users? Do you have a comment about something you've read in COMPUTE!'s GAZETTE? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

Secret Messages

We have discovered that the writer of Commodore's *EasyScript* either likes music or has a sense of humor. If you press f1, then CTRL-3, it plays the march "Pomp And Circumstance." Do you know of any other programs that play music or have hidden surprises?

Kevin Snow

A hidden message can be found in the first Commodore PET computers, with the "original ROMs." If you enter WAIT 6502, x (where x is a number between 1 and 255), the screen displays MICROSOFT!, x times. The PETs are built around a 6502 chip, and Microsoft wrote the PET version of BASIC.

A user group in Ireland has discovered something similar in the Plus/4 and 16. Type SYS 52651 and four names appear, perhaps the developers of BASIC 3.6. And if you try to enter or edit line number 350800 on a 64, the computer either locks up or does strange things.

Some software authors include secret messages or unusual bugs in their programs. If a case of copyright infringement is taken to court and the defendant claims it's just coincidence that the two programs look alike, the author can point to the not so coincidental music, message, or bug.

News About Computing For The Blind

In the February issue, "Gazette Feedback" included a letter from the teacher of a blind student whose family owned a 64. She asked if there was software available for blind 64 users. We have discovered that there are several dozen products, software and hardware included, for blind and handicapped computer users. Unfortunately, we do not have the space to list them all. Our thanks go to the several readers who responded with the following information about these helpful organizations:

The Library of Congress offers special services for blind and handicapped people, including information about computer software and hardware. The address is: National Library Service for the Blind and Physically Handicapped, Library of Congress, 1291 Taylor St. NW, Washington, DC 20542. Phone: (202) 287-5100.

Another good source of information is the CompuServe Handicapped User's Database, which features names and addresses of various non-profit organizations, details about commercial products, and articles about how handicapped persons are using computers. Type GO-HUD at any "!" prompt. Telecommunications on CompuServe and other services is possible for blind people, with software such as Smart 64 Terminal *(from Microtechnic Solutions) in conjunction with the COMVoice speech synthesizer (from Genesis).*

Two newsletters are also available: Raised Dot Computing Newsletter, *408 S. Baldwin, Madison, WI 53703. Phone: (608) 257-9595. This monthly newsletter focuses on blind computer users and comes in print ($18/year) and tape ($20/year) editions. Closing The Gap, P.O. Box 68, Henderson, MN 56044, (612) 248-3294, publishes a newsletter every other month. It features news about hardware and software for the handicapped. The publishers also sponsor an annual conference about computer technology for the handicapped.*

The Commodore 64 Programmer's Reference Guide *on cassette tape can be obtained from Recording for the Blind, 20 Roszel Road, Princeton, NJ 08540 (609) 452-0606.* The Second Beginner's Guide To Personal Computers For The Blind And Visually Handicapped *(in print, braille, or cassette) has information about computers, voice output, software, training programs, and resources. It is available from the National Braille Press, 88 St. Stephen Street, Boston, MA 02115, (617) 266-6160. Other computer-related books have been translated to braille by The National Braille Association, Braille Bookbank, 422 S. Clinton Ave., Rochester, NY 14620.*

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Blind and visually-impaired people can sign up for free correspondence courses (tape, braille, or large print), including some that cover computers, from Hadley School for the Blind. The address is 700 Elm St., Winnetka, IL 60093. Phone: (800) 323-4238 or (312) 446-8111 in Illinois.

Two other nonprofit organizations are Center for Computer Assistance to the Disabled (C-CAD) and Disabled Programmers, Inc. (DPI). Their addresses are: C-CAD, 2501 Avenue J, Suite 100, Arlington, TX 76011, (817) 640-6613; DPI, One West Campbell Avenue, Suite 36, Campbell, CA 95008.

Why Does The 64 Pause During Tape Loads?

I have owned a VIC-20 for almost three years. Now that our six-year-old is fighting the rest of us for equal time, we decided to purchase a 64 for the older folks. Your previously published columns have explained why the 64's screen blanks out during cassette operations, but I have never read why the 64 pauses between finding a program and reading it in. Is there any way to shorten the delay?

Larry Smith

Yes. When loading a program from tape and the screen says FOUND "PROGRAMNAME," press the Commodore key in the lower lefthand corner. The program will load without delay.

To make saving and loading even faster (tape at disk speeds), see "TurboTape" in next month's GAZETTE *or the January issue of our sister magazine,* COMPUTE!.

Cutting Off Fractions

In a few programs, I've seen a weird variable, B% (B Percent). What is it and how is it used?

Tom Roth

That's an integer variable. An integer is a whole number—no fractions or decimal points allowed. If you used something like B%=24/5 in a program, the value put into B% would be 4, not 4.8. Integer variables always cut off the fraction, rounding down to the nearest whole number. You can do the same thing to regular numeric variables with the INTeger function: B=INT(24/5).

Integer variables (but not integer arrays) take up the same amount of memory as floating point variables, the ones without a percent sign. And because the computer's math routines are written for floating point numbers, integers have to be converted before and after calculations, which makes them slower to add, subtract, multiply, etc. You cannot use integer variables as the index in a FOR/NEXT loop. Plus, integers cannot be less than −32768 or greater than 32767. If you try to go beyond this limit, you'll get an ILLEGAL QUANTITY ERROR.

With all of these disadvantages, why use integer variables at all?

There are really only two good reasons to use them. Integer arrays *take up much less memory (two bytes per element) than floating point arrays (five bytes per element). (Arrays are a special kind of variable where each item is assigned a number, or subscript.) If your BASIC program is running out of memory and you're using lists of numbers, try integer arrays, B%(9) for example. And if you're writing a machine language program that needs to pick up variable values from a BASIC program, integers are easier to work with because they're stored as a signed high-byte followed by a low-byte.*

A Short Circuit In The Joystick

When I play games with my joystick, they always read the direction as up. Is there some way I can fix the joystick?

Tom Bilan

A joystick contains five switches: up, down, left, right, and the fire button. Heavy use can damage the interior contacts, making them permanently open or closed. If your joystick is held together with screws, and if the switches are "bubble" contacts, you can open it up and pry apart the contacts with a pin. If this fails, you'll have to buy a new joystick.

Checking The Bank's Figures

I would appreciate seeing a program or formula that banks use in figuring interest compounded daily, monthly, or quarterly. For example, a $5000 certificate of deposit for 2 years at 10.35% interest.

Betty G. Carswell

*Finding 10.35% of a number is the same as multiplying by 0.1035. If the bank compounded annually, you could calculate the year's total with PRINT 5000 + (5000 * .1035) or, more simply, PRINT 5000 * 1.1035. But it's a rare bank that pays interest only once a year.*

Compounding 10.35% monthly means the bank pays you 1/12 of 10.35% twelve times a year. After the first month, you start earning interest on the interest. Try running the following short program:

```
10 P=5000:T=2:R1=.1035:C=12:R2=R1/C
20 FORX=1TOT*C:P=P+(P*R2):PRINTX;P,:NEXT
```

Line 10 defines the variables: P is principal, T is term (in years), R1 is the annual rate, and C is how often the interest is compounded (in this case, 12 times a year). Line 20 adds up the interest earned and prints out the intermediate amounts. You can change the variables for different situations; C = 365,

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for example, for daily compounding.

Your answers may vary slightly from the bank's, depending on if the bank rounds to the nearest penny or tenth or hundredth of a penny. For a more complete financial analysis program, see "Home Financial Calculator," in the May issue of our sister magazine, COMPUTE!.

Help From Commodore

I own one of the older 1541 disk drives and I've already had it serviced twice for head alignment. I want to know if Commodore has any type of exchange program for this model disk drive.

Karin L. Martinez

Beginning in March, Commodore established a new national network of 1500 service centers for in-warranty and out-of-warranty equipment. To find out which service center is nearest you, call the toll-free customer support line at 1-800-247-9000, Monday through Friday, 9 a.m.–midnight (Eastern Standard Time). Specific information, such as repair costs, was unavailable at the time of this writing.

You mentioned in your letter that you have an older model 1541, in the white case. The head alignment problem you've been having is not unique to the older models. In fact, many 1541s will go out of alignment with enough heavy use. Many 1541 owners have continued to use their drives, realigning them when necessary. One of the less expensive solutions is to purchase a software disk alignment package (see the October 1984 GAZETTE *for a review of one such product we've found to be consistently effective).*

How Much Memory Is Left?

Is there any PEEK or POKE that would show how much memory you have left on the 64?

Ruben Loera

*Enter PRINT FRE(0), on any Commodore computer, to find out how much memory remains. If you see a negative number, change it to PRINT FRE(0) + 2↑16. If you print the amount of free memory before running a BASIC program, then check free memory afterwards, you can find out how much was used for program variables. The FRE function can also be called from inside a program: 510 IF (FRE(0) − (FRE(0)<0) * 2↑16) < 200 THEN PRINT "LESS THAN 200 BYTES REMAINING."*

There are two causes of OUT OF MEMORY errors. The first is simply running out of memory; either the program is too long or you're using too many variables. The second way to run out of memory is filling up the stack. Every time you begin a FOR-NEXT loop or GOSUB to a subroutine, some important information is put in a section of memory called the stack. Using GOTO to jump out of a FOR-NEXT loop or a subroutine can leave "garbage" on the stack, wasting stack space, and eventually causing an error.

Tape To Disk Transfer

I've built up a large library of programs on tape. I wish to transfer them to my newly purchased disk drive. Is there a routine that automatically reads all programs from tape and puts them on disk?

George Persico

The following program copies a series of programs from tape to disk. Type the program in, save it, then run it and type NEW. If you know how many programs are on the tape, POKE the number into location 2. For example, to copy three programs type POKE 2,3.

If you are unsure of the number of programs, position the tape to just after the last program you want to copy then enter a one line program, like 10 END. Then SAVE "filename",1,2. This places an end-of-tape marker on the tape.

Now place a blank, formatted disk into the drive and type SYS 679. This program copies all program files, including machine language files, but it will not copy sequential files.

The program has no error checking in it and will crash if an error is detected.

```
10 FORA=679TO763:READB:POKEA,B:NEXT:END
20 DATA 169,64,133,3,169,1,162,1
30 DATA 160,1,32,186,255,169,0,32
40 DATA 189,255,169,0,32,213,255,173
50 DATA 60,3,201,5,240,54,201,4
60 DATA 176,226,230,3,165,3,141,80
70 DATA 3,169,16,162,65,160,3,32
80 DATA 189,255,169,2,162,8,160,2
90 DATA 32,186,255,173,61,3,133,251
100 DATA 173,62,3,133,252,174,63,3
110 DATA 172,64,3,169,251,32,216,255
120 DATA 198,2,208,176,96
```

Memory Must Be Continuous

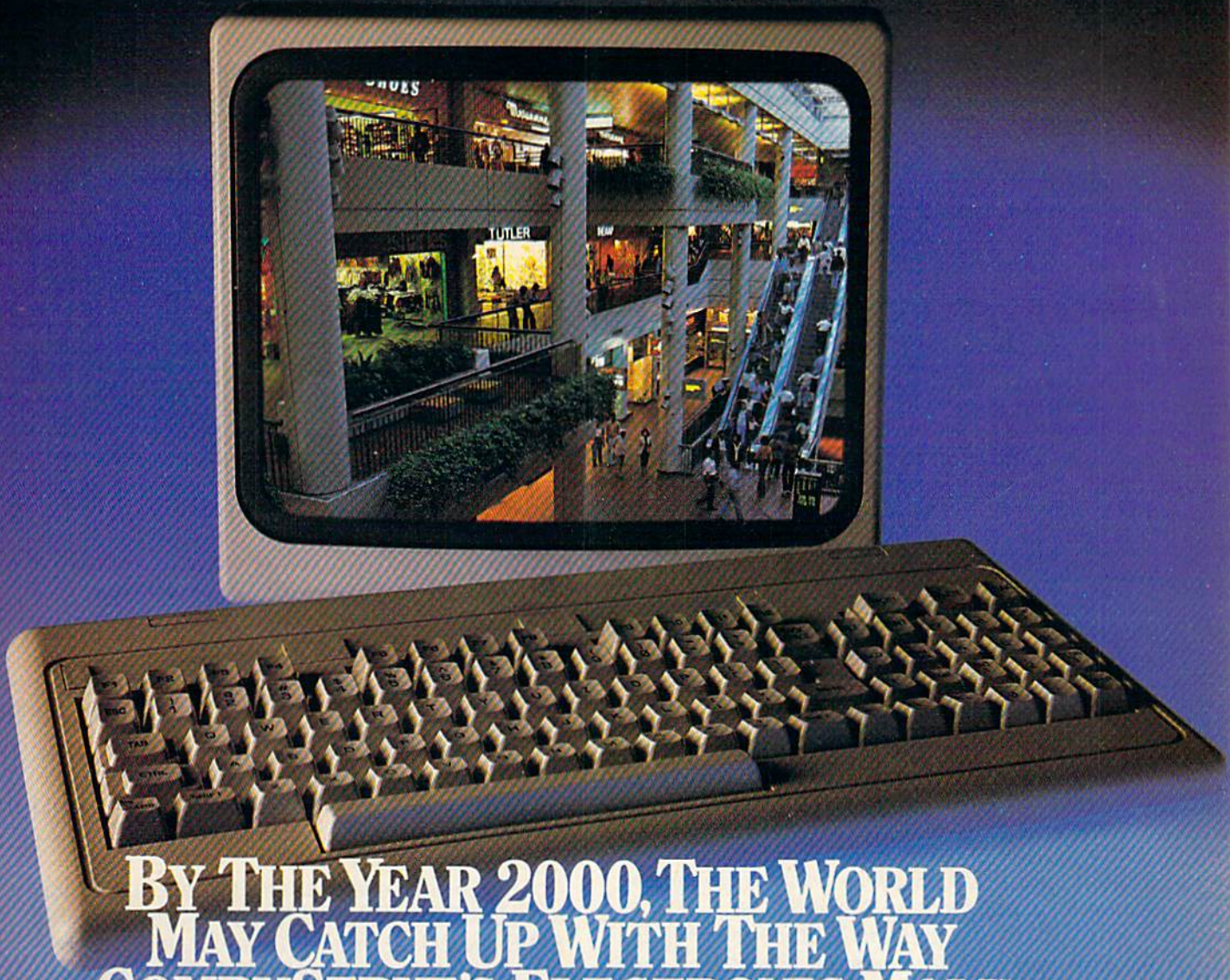
I own a VIC-20 and have 24K memory expansion. Each of three 8K banks has two choices for start address. I know that no 8K bank may have the same address as another bank or a cartridge. But when I use a program that requires expansion, which 8K banks should I select?

Darlene Fogal

When you turn on your VIC, it does a test to see how much memory is in place. It then prints the numbers of bytes available at the top of the screen. Memory used for BASIC programs must be continuous.

An unexpanded VIC uses locations 4096–8191, part of which is screen memory. If you add 8K, it should start at 8192. The next bank should start at 16384, and so on. Select these options if you're running a BASIC program that needs expansion.

Other Commodore computers follow similar



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rules in how they use memory. In the 64, BASIC programs and variables use the continuous locations 2048–40959. There's another 4K of memory starting at 49152, but since it's not right next to BASIC memory, it cannot be used directly for programs and variables. Machine language programs are often put in this section of the 64's memory.

Checking For VICs

Would you please explain the purpose of the short routine that leads off some of the programs I see in your magazine? It begins with SYS 65517 and then PEEKs 781 to see if it contains a 40. Is this some kind of protective device? Under what conditions would location 781 not be equal to 40?

Dick Thompson

When programs are scheduled for the GAZETTE, *editors decide whether or not they should be translated for other computers. Some programs are completely rewritten. But other programs can be translated very easily by changing a few POKEs and formatting the screen for 40 columns on a 64, 22 on a VIC. Rather than printing two almost identical programs, we publish a single program that runs on both the VIC and the 64.*

Memory location 65517 is the beginning of the Kernal routine called SCREEN. The VIC, 64, Plus/4, and 16 use the same Kernal entry points, giving them a measure of compatibility.

If you JSR (Jump to SubRoutine) to 65517 in machine language, the computer checks the layout of the screen. The number of columns goes into the X register, the number of rows into the Y register. The BASIC equivalent of JSR is SYS.

Locations 780–782 are used by SYS for temporary storage of the A, X, and Y registers. PEEKing 781 after a SYS tells you the number from the X register (you can't actually PEEK a microprocessor register, but SYS has stored the most recent value of X into 781). Since the SCREEN routine puts the number of columns there, SYS65517: PRINTPEEK(781) will return 40 on a Commodore 64, 22 on a VIC-20.

It's a way for the program to check which computer it's using. Once the program knows if it's running on a VIC or 64, it makes adjustments for screen format and POKEs.

Double Density Disks

On the 1541 disk drive, formatting a single-sided single-density disk gives you 664 blocks free. Will a double density disk yield twice as many blocks? Also, is there any practical approach to using double-sided disks on the 1541?

James Bourgeois

A 1541 will work with either single or double density disks. Since the double density disks are of higher quality, you may have fewer problems if you use them. Besides, 1541 disk drives store more information than typical single density drives (they're sort of 1½ density). How much data fits on a disk depends on the disk drive, so double density disks will not increase the storage capacity of your 1541.

To answer your second question, true double-sided drives have two READ/WRITE heads, one for the top of the disk and one for the bottom. The disk always spins in one direction. To use both sides of a disk on a 1541 single-sided drive, you'd have to remove it and flip it over. Cutting open a disk reveals a felt-like cloth liner which catches dust particles. If the disk were to rotate backwards, the cloth that usually catches dust would redeposit it, with the potential of ruining the disk and the READ/WRITE head.

Programs Versus Variables

I can't figure out how to save a variable to disk. SAVE A$,8 doesn't work. I've read through the manual, but it doesn't help. How do I do this?

Jeff Alfeld

The BASIC commands for manipulating programs don't work with variables, and vice versa. For example, once a program is in memory, you can put it onto the screen with LIST. But you can't LIST a variable, you must PRINT it.

The SAVE command sends a program to tape or disk. LOAD, in turn, recalls a saved program. But SAVE and LOAD, like LIST, don't work with variables. They're commands that apply to programs only. In the example you gave, if A$ was "John Smith," SAVE A$ would save whatever BASIC program was currently in memory under the name John Smith.

To save a variable, you must open a file, print the variable, number, or string to the file (using PRINT#), and close it:

```
10 A$="THIS IS A TEST"
20 OPEN1,8,2,"TESTFILE,S,W"
30 PRINT#1,A$:PRINT#1,"END OF TEST":CLOSE1
```

The first number after OPEN in line 20 is the logical file number, which can be any number from 0 to 127. This number is used later in the PRINT# and CLOSE statements. It's followed by a comma and the device number (a disk drive is device 8). The third number is the secondary address. For disk files, the secondary address specifies the disk channel which will be used and must be in the range 2–14. The filename is followed by ",S,W" which means it is a sequential file to be written to.

When a disk file is opened, the red light on the drive turns on and stays on until the file is closed. You must always close files when you've finished with them.

Line 30 uses PRINT# to print a string variable

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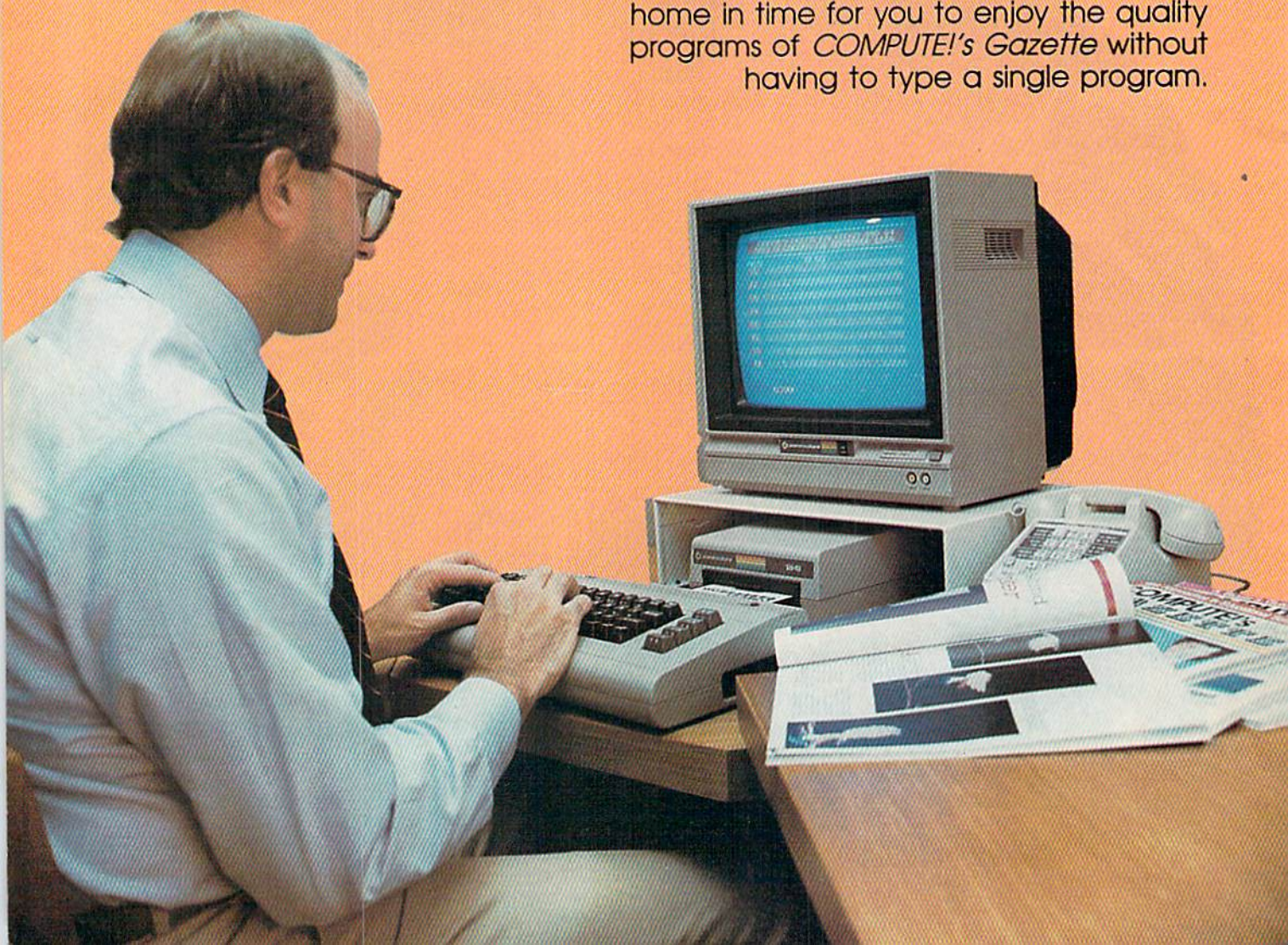

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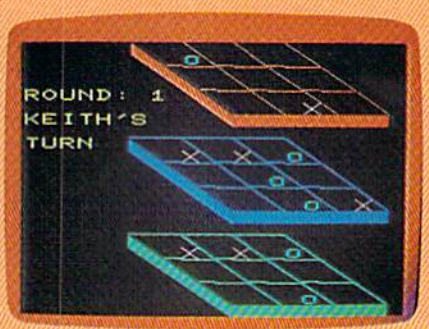

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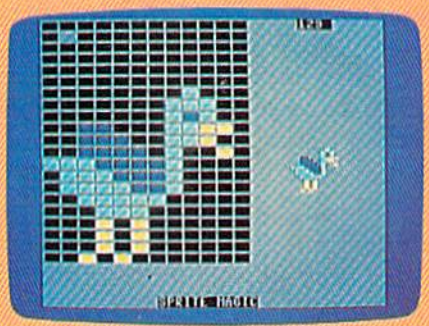

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and a string to the disk file.

To reverse the process, change the filename in line 20 to "TESTFILE,S,R" (R for read). Then, instead of PRINT#, use INPUT#1,A$: PRINT A$ twice, because there are two strings in the file.

Tape files work in a similar way. To open a file for reading, OPEN1,1,0, "TESTFILE" followed by PRINT# and CLOSE. To write, OPEN1,1,1, "TESTFILE" with INPUT# and CLOSE. When using tape, a secondary address of 0 means read, 1 means write.

Using INPUT# on strings longer than 80 characters will return a ?STRING TOO LONG error. In such a case, use GET# instead. It lets you read sequential files a character at a time.

Addressing An Envelope

I recently purchased a Gemini 10X printer and became frustrated trying to print an address on an envelope. The 10X has a paper sensor that turns off the printer when it runs out of paper.

The easiest way to remedy this is to slide a piece of paper under the flap behind the envelope. Then, friction feed the envelope and paper into the printer. It works great.

T. Dan Orr

Thanks for the tip. It will help our readers who have been stymied by the paper sensor. You can also disable the Gemini's paper sensor with OPEN 4,4:PRINT#4,CHR$(27);"8":CLOSE4. Or turn DIP switch 2–1 to OFF (with the power turned off, of course) to make the sensor nonfunctional.

Disabling *Simons' BASIC*

I have found that some programs will not work with the Simons' BASIC cartridge plugged in, possibly because they use the same memory locations. Is there a formula for turning Simons' BASIC on and off, so I don't have to remove it when I do not need it?

Brian L. Moore

The best way to disable Simons' BASIC *is to remove the cartridge entirely when you're not using it. A second way to disable a cartridge without removing it is to use an expansion board. These motherboards, as they are often called, allow you to plug many cartridges in at once. They have switches to let you turn any cartridge on or off.*

There is a third method, from Raeto West's book Programming the Commodore 64, *published by COMPUTE! Publications. Tap RUN/STOP-RESTORE and enter SYS 64760. When the screen shows the normal power-up message, run the following program.*

```
10 FORA=49152TO49159:READB:POKEA,B:NEXT:S
   YS49152:NEW
20 DATA 120,162,255,154,232,76,239,252
```

This is not foolproof—the RUN/STOP-RESTORE combination may cause a program crash. To reenter Simons' BASIC *type SYS 64738. SYS 49152 takes you back to standard BASIC. It's easier and more reliable to remove the cartridge before running any machine language or commercial programs.*

Disk Commands In Machine Language

I've been teaching myself machine language and have run into a problem with disk commands.

When formatting a new disk in ML, I imitate the BASIC command—OPEN15,8,15: PRINT#15, "N0:name,ID": CLOSE15—by using the Kernal routines SETLFS, SETNAM, OPEN, CHKOUT, and CHROUT. The red light turns on but the disk is not formatted. Is there some special way to send commands to the drive?

Vincent Dinh

Those five Kernal routines should work. You may be using SETNAM incorrectly, though. Its purpose is to set the name (hence SETNAM) of the file you want to communicate with, not *the name of the disk. And channel 15, the disk command channel, does not have a name, it's just channel 15. Also be sure you're sending a carriage return (CHR$(13)) after the command line. Clean things up with CLRCHN and CLOSE.*

When formatting a disk in BASIC, it's not necessary to use the PRINT# command. A shorter form is:

```
OPEN 15,8,15,"N0:name,ID":CLOSE 15
```

It's as if you were opening a file called "N0:name,ID." Simulating this in ML makes the translation simpler since it eliminates the need for the CHKOUT and CHROUT routines. The following machine language program will format a disk (note that this is source code, and must be used in conjunction with a machine language assembler):

```
20 SETLFS = $FFBA
30 SETNAM = $FFBD
40 OPEN{3 SPACES}= $FFC0
50 CLOSE = $FFC3
100 LDA #LENGTH:LDX #<COMMAND:LDY #>COMMA
    ND:JSR SETNAM
110 LDA #15:LDX #8:TAY:JSR SETLFS
120 JSR OPEN
130 LDA #15:JSR CLOSE
140 RTS
150 COMMAND .ASC "N0:NAME,ID":LENGTH =* -
     COMMAND
```

This program will not make the formatting process any faster than BASIC, however, because the program that formats disks is inside the disk drive. Whether you use BASIC or ML to send the command, the drive works at the same speed.

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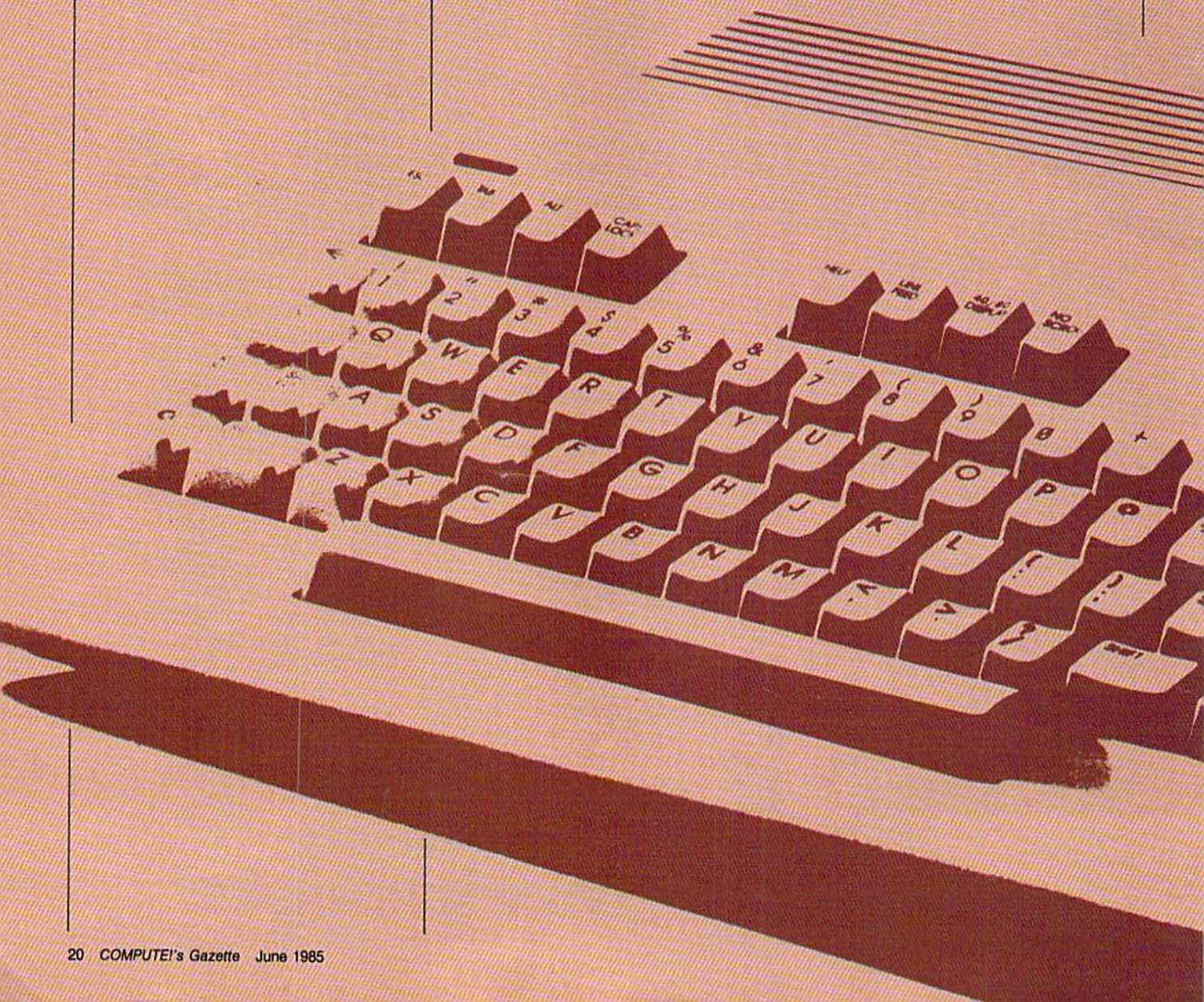
The new Commodore 128 Personal Computer has generated quite a bit of interest, especially by current owners of the popular Commodore 64. Is the 128 a significant enhancement, or just a warmed-over 128K version of the 64? We went to Commodore's headquarters to find out, and came back with a new appreciation for this intriguing machine.



A Hands-On Look At Commodore's Newest Computer

Charles Brannon, Program Editor

Soon after it was introduced, the Commodore 64 proved to be the leader of a new wave of home computers. Even at the original price of $600, the 64 came equipped with as much memory as $2000 business machines, along with arcade-quality graphics, detailed animated sprites, and a unique sound synthesizer that brought realism to what was formerly just bleeps and tones. The 64 became one of the most popular computers ever, selling over 2,000,000 units worldwide.

The 64 is firmly established, with over 6,000 programs to its credit. But as good as the 64 is, we've been waiting three years for an encore. Although it's been high time for an enhancement, no one wants to give up his or her personal software library. Commodore's answer, the Commodore 128 Personal Computer, provides true 64 compatibility, plus a real advance in power and flexibility. The Commodore 128 is literally three computers in one: a Commodore 64 with the familiar 40-column display, sprites, SID chip, and BASIC V2; an enhanced 64

with 128K and all 64 features, plus 80 columns and BASIC 7.0; and a true CP/M-compatible machine, promising the ability to run off-the-shelf CP/M software. And all at a price almost anyone would call reasonable: under $300.

Compared to the 64, the 128's console is much bigger, perhaps to imply more power, but probably necessary to hold the hardware of three computers. The main part of the keyboard is identical to the 64's, except that the function keys have been moved to the upper-right corner and rearranged horizontally. There is a numeric keypad with +, −, ., and an ENTER key (synonymous with the RETURN key). Along the top of the keyboard are ESC, TAB, ALT, CAPS LOCK, HELP, LINE FEED, 40/80 DISPLAY, and four separate cursor keys.

None of these additional keys, not even the keypad or separate cursor keys, function in the 64 mode, for the sake of true compatibility. Adding extra programming in ROM to support these keys in 64 mode might be just enough to prevent some 64 software from working properly. Commodore is staunch on this; anything less than 100% compatibility isn't good enough.

In the 128 mode, the 40/80 DISPLAY key selects which screen mode is used as the default. This key is checked at power-on, when RUN/STOP–RESTORE is pressed, or when the RESET button (found next to the power switch) is pressed. This key has no meaning in 64 mode since 80 columns are not available, again for the sake of compatibility. In either 128 or CP/M mode, the same VIC chip used on the 64 displays 40 columns, graphics, and sprites. The 40-column screen can only be seen on a TV or composite monitor, not on the RGB display.

The RGB monitor displays twice as many pixels and characters as 40 columns, and achieves color purity since the signal is separated into the red/green/blue color components. (A composite signal has all the color information mixed together, which makes it difficult to cleanly separate these colors.) A special video chip is used for 80 columns. The 80-column screen can only be seen on the RGB monitor. All 16 colors are available in 80 columns (although the Commodore-1 color, normally orange, appears as dark purple), as well as reverse video and underlining. Unlike the 40-column mode, there are 512 characters available in 80 columns, which means you can get both uppercase, lowercase, and all keyboard graphics simultaneously.

This 80-column chip is for text only—it does not support bitmapped graphics or sprites. You can redefine the character set, though, and set up a small 640 × 48 simulated bitmapped window. The 80-column video chip uses 16K of dedicated screen memory. None of the 128K memory is used for 80 columns, so in effect this machine actually has 144K of total RAM.

There are three ways to switch between 40 and 80 columns: toggle the 40/80 switch and press RUN/STOP–RESTORE, press ESC-X in BASIC, or enter the command SCREEN 0 for 40 columns, or SCREEN 5 for 80 columns. Remember that these screens are independent. If you have two monitors hooked up, these commands reroute screen printing to the appropriate screen (although both screens remain displayed). Commodore's 1902 monitor is ideal for the 128; it has built-in color composite video, split signal composite video (as used on the rear connections of the 1701/1702 monitor), IBM-compatible RGB, and analog RGB (for use with the Amiga). With the 1902, you must manually flip a switch after you change screen modes.

This can be cumbersome, but Commodore feels that you'll probably stay in one mode or the other, a reasonable assumption. This scheme does let you have two simultaneous displays. Perhaps one screen could show color graphics, while your program listing is displayed on another. One can envision dual-perspective games with each player having his own independent screen.

The 1902 composite/RGB display will probably sell for under $400. The least expensive route, though, is to use a television for 40 columns, and a monochrome (black and white) monitor for 80 columns. Commodore will sell a special cable to connect the RGB port to a monochrome monitor. The cable can be used with Commodore's inexpensive 1901 monochrome display and with other monochrome monitors.

The new 1571 disk drive further amplifies the power of the 128. In 64 mode, the 1571 behaves just like a 1541. The 1571 we worked with was not quite ROM-compatible with the 1541 (our "TurboDisk" program did not work with it), but we were assured that 1541 compatibility, a high priority, was being improved. In the 128 mode, the 1571 shows its true power, boosting storage capacity to 360K (as opposed to 170K on the 1541), and transferring data from seven to ten times faster than the 1541.

The enhanced storage is due to the 1571's double-sided design (there are two read/write heads), so you'll have to use the somewhat more costly double-sided disks. You can still use a 1541 in the 128 mode, and the 1571 can be programmed to be 1541 compatible in the 128

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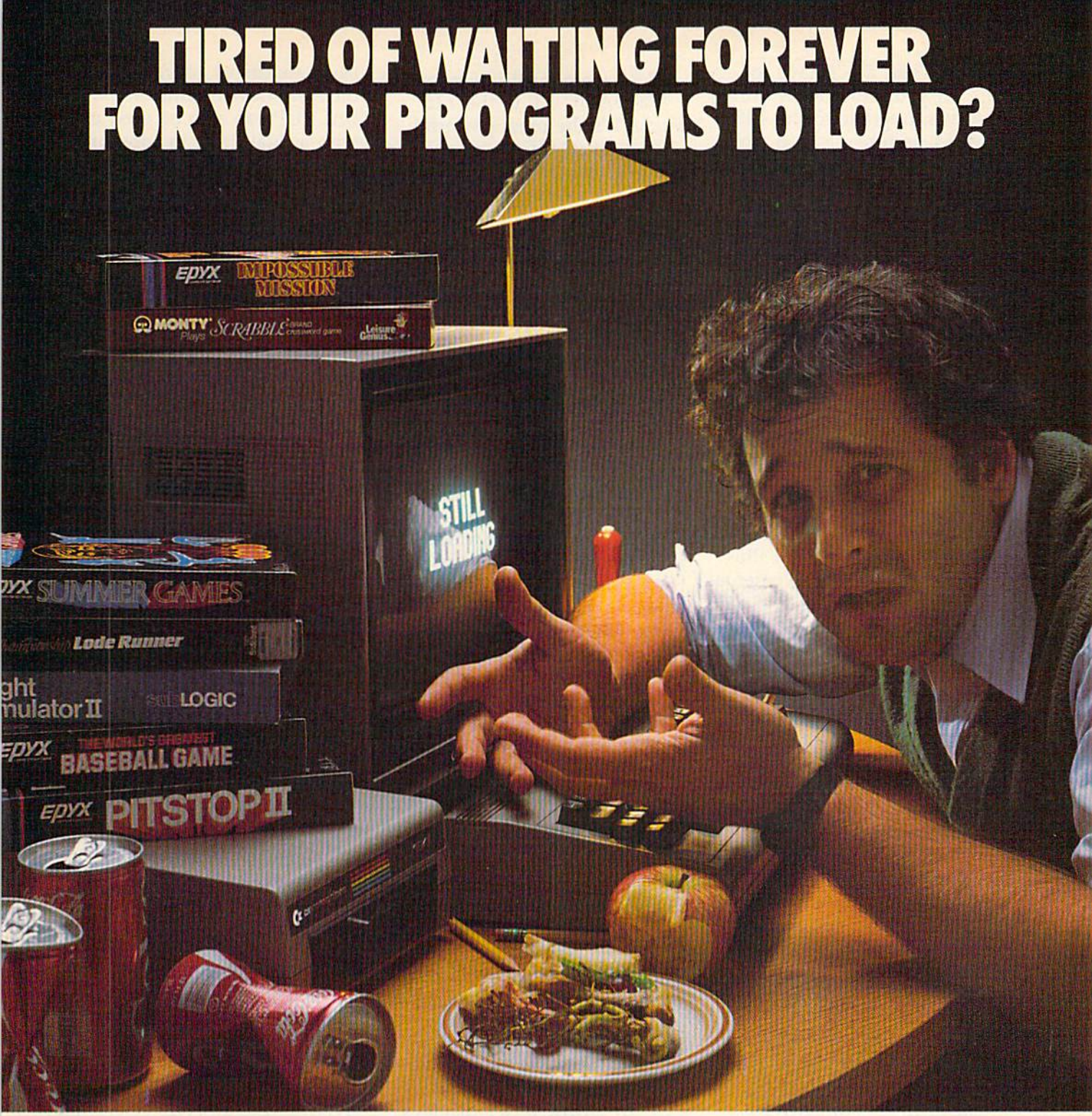

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mode. So you don't have to write off your current disk drive when you upgrade to the 128. Other 64 peripherals also work with the 128, so hold on to your printer and modem if you upgrade.

The 1571 is also optimized for the CP/M mode, although you can use a 1541 drive in the CP/M mode. In CP/M mode, the 1571 can store 410K. Commodore has designed a new version of CP/M called CP/M Plus, which gives newly written CP/M applications the ability to access VIC-chip graphics and sprites, RGB color 80 columns, and the SID sound synthesizer—snazzy features for a CP/M machine. Unlike Commodore 64 CP/M, CP/M Plus is a true native Z80 implementation. The entire system resources are available to CP/M Plus, since the Z80 stays in control. Commodore is busy converting CP/M disks to 1541 format so that they will run both on the 128, and on 64 CP/M with a 1541 drive. But the new drive can be reprogrammed to read many disk formats. When we visited Commodore, it was not known which disk format would be used by default, but a configuration program can be used to let the drive read common CP/M formats, including disks formatted for Osborne and Kaypro machines.

As long as programs conform to CP/M portability guidelines, you'll be able to insert off-the-shelf CP/M software and boot it up (though this won't take advantage of the enhanced options of CP/M Plus). We brought some Osborne disks along with us to Commodore, but the 1571 drive we used was not modified to read our disks, so we were unable to verify this. Commodore indicated that several CP/M software manufacturers were interested in developing new CP/M software for the 128.

We were most impressed by BASIC 7.0 in the 128 mode. It's the most powerful version of BASIC we've seen for personal computers, topping even IBM's Advanced BASIC. With Commodore 64 BASIC as its foundation, it combines the best of *Simons' BASIC*, *Super Expander*, Plus/4, and Disk BASIC 4.0 commands, as well as new commands written especially for the 128. There are over 80 new commands and functions. At the time we visited Commodore, programmers were adding even more commands. And all 128K is available for programming: 64K for the length of your BASIC program, and 64K for storage of variables, strings, and arrays (minus the memory used by the operating system and 40-column screen map). The only thing missing is long variable names; you're still limited to two significant characters.

All disk commands from BASIC 4.0 are supported, permitting 128 owners to run some CBM 4032/8032 programs. These commands replace the need for OPEN 15,8,15: PRINT#15,"command": CLOSE 15. Most disk commands can be used with a dual-drive disk system (with the drives called 0 and 1), and with several drives addressed with different device numbers. SHIFT–RUN/STOP defaults to the disk drive, loading and running the first program on the disk. DLOAD and DSAVE are used to retrieve and store BASIC programs. CATALOG or DIRECTORY displays the disk directory without erasing any program in memory. SCRATCH lets you erase files from disk, but first asks ARE YOU SURE? HEADER is used to format (new) a disk.

COLLECT performs a Validate, freeing up any improperly allocated sectors. COPY and CONCAT let you copy or combine disk files on the same disk or between drives on a dual-drive system (but not with separate drives addressed with different device numbers). BACKUP can also be used only with a dual drive to copy one disk to another. APPEND lets you add new data to an existing file. DOPEN and DCLOSE makes file handling easier, and RECORD makes relative files a breeze. The reserved variables DS and DS$ let you examine the disk error channel. DCLEAR clears all open disk channels.

There's a complete set of programming tools. AUTO starts automatic line numbering, DELETE erases program lines, HELP shows the offending statement after an error message, RENUMBER permits you to renumber any part of a program, TRON and TROFF toggle trace mode, and KEY lets you display the current function key definitions or define your own function keys. You can also conveniently convert from hexadecimal to decimal or vice versa with the functions HEX$ and DEC. In addition to AND and OR, you can now perform a bitwise Exclusive OR (XOR).

Structured programming enthusiasts need never use GOTO again. IF/THEN now has an ELSE clause, as in IF A=1 THEN PRINT "A IS 1":ELSE PRINT "A IS NOT 1." BEGIN/BEND lets you set aside a block of lines that are executed only if a preceding IF/THEN works out as true. DO:LOOP UNTIL, DO:LOOP WHILE, DO UNTIL: LOOP, and DO WHILE:LOOP all execute a block of commands *while* a certain condition is true, or *until* a certain condition proves to be false. EXIT can be used to skip out of a loop.

RESTORE can now be followed by a line number to let you start reading any section of DATA.

TRAP transfers execution to a specified line number when an error occurs. Your program

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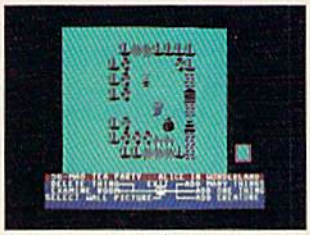

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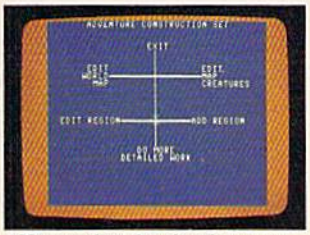

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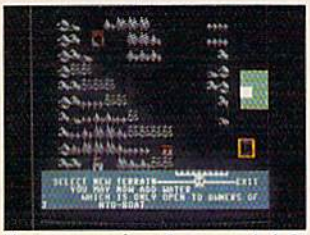

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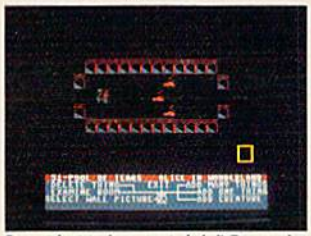
Amazing fact #2: ACS integrates text and graphics. All other products wimp out in this regard.

Characters? How many you want? Make 'em. Break 'em. Cast them into the world without a dime!



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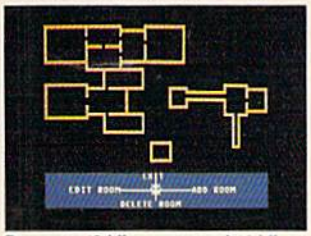

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can examine the error number in the reserved variable ER, the number of the line that caused the error in EL, and the error message with the function ERR$. After you've handled the error, RESUME returns control to the statement after the error, or to any line number.

Text processing is enhanced with INSTR, which finds the position of a substring within a larger string. PRINT USING lets you define a format field for printing, making it easy to set up columnar tables and forms. WINDOW sets up a smaller screen that scrolls independently from the rest of the screen. WINDOW can be used to emulate simple Macintosh-style windowing.

No more POKEs for SID chip sound. BASIC 7.0 includes several commands for music and sound effects. SOUND sets the frequency, duration, and waveform of a sound effect. You can also specify a sweeping effect. PLAY is a mini-language of its own. You can use it to play strings of notes, specifying note names, durations, sharps/flats, dotted notes, and rests. You can use it to synchronize three-voice music, set the filter, and control individual volume for each voice. Each voice can play from a set of predefined envelopes that simulate one of ten musical instruments: piano, accordion, calliope, drum, flute, guitar, harpsichord, organ, trumpet, and xylophone. You can customize these preset instruments with ENVELOPE, customize the programmable filter with FILTER, set the overall VOLume, and the TEMPO of music.

BASIC 7.0 offers a rich vocabulary of graphics commands. GRAPHIC is used to enter either the multicolor 160 × 200 graphics screen, the hi-res 320 × 200 graphics screen, the 40-column text screen, or the 80-column text screen. GRAPHIC allows you to define a text window and can either clear the screen or leave previous graphics in place. SCNCLR can also be used to clear the screen. When you enter a graphics mode, the start of BASIC is moved beyond the end of the graphics screen. GRAPHIC CLR is used to deallocate the memory used by the graphics screen. RGR returns the number of the current graphics mode.

DRAW is used to plot a single point, or draw a single or a connected line to create complex shapes. LOCATE is used to set the position of the graphics cursor without plotting any point. BOX can draw any rectangle or filled rectangle, at any angle. CIRCLE is used to draw circles, ovals, arcs, or any polygon, at any angle of rotation. You can place text anywhere on the graphics screen with CHAR. You can also use CHAR on the text screen to simulate PRINT AT. COLOR is used to set any of the color registers, and the function RCOLOR reads which color is assigned to a color register. PAINT can fill any shape with any color. S SHAPE can "pick up" any block of the screen and store it in a string. This shape can then be copied back to any place on the screen with G SHAPE.

A pixel can be tested with the function RDOT, which returns the color of the pixel at the specified row and column. The WIDTH command specifies the size of pixels plotted. A WIDTH of 2 makes all lines double-wide. And finally, the SCALE command lets you pretend that the screen is actually 1024 × 1024 pixels across and down. You can use this range in your drawing statements, and the coordinates are automatically scaled to fit the actual screen size.

BASIC 7.0 just wouldn't be complete without sprite commands. If you've been stymied by POKE and PEEK for sprite control, as well as the infamous "seam," you'll really appreciate the following sprite commands.

First, BASIC 7.0 includes a simple sprite editor. Just type SPRDEF, and a box appears on the screen. Enter which sprite you'd like to define, then use the cursor keys and the number keys 1–4 to draw squares on the grid. When you're through, the sprite is stored into a reserved section of memory. This memory can be saved to disk with BSAVE, then recalled within your program with BLOAD, eliminating the need for DATA statements.

To set up sprite parameters, use SPRITE. This command turns on the sprite, sets its color, priority, initial X and Y position, and sets hi-res or multicolor for that sprite. You can then use MOVSPR to position the sprite anywhere on the screen. MOVSPR can also be used to set the sprite into motion. After you specify the speed and angle, the sprite moves on its own. Your program continues in the meantime. (Sprites are updated in this mode during the IRQ interrupt.) While a sprite is in motion you can read its position with RSPPOS. You can transfer the sprite pattern into any string, or copy a sprite pattern from a string into any sprite. In combination with SSHAPE and GSHAPE, you can "pick up" a block of the screen and turn it into a sprite, and "stamp" the sprite pattern anywhere on the graphics screen.

SPRCOLOR sets the multicolor registers shared by all sprites and the function RSPRCOLOR reads the sprite multicolor registers. The COLLISION statement transfers control to a specified line number when two sprites touch, or when a sprite touches part of the screen background. Your collision routine can see what

White Lightning

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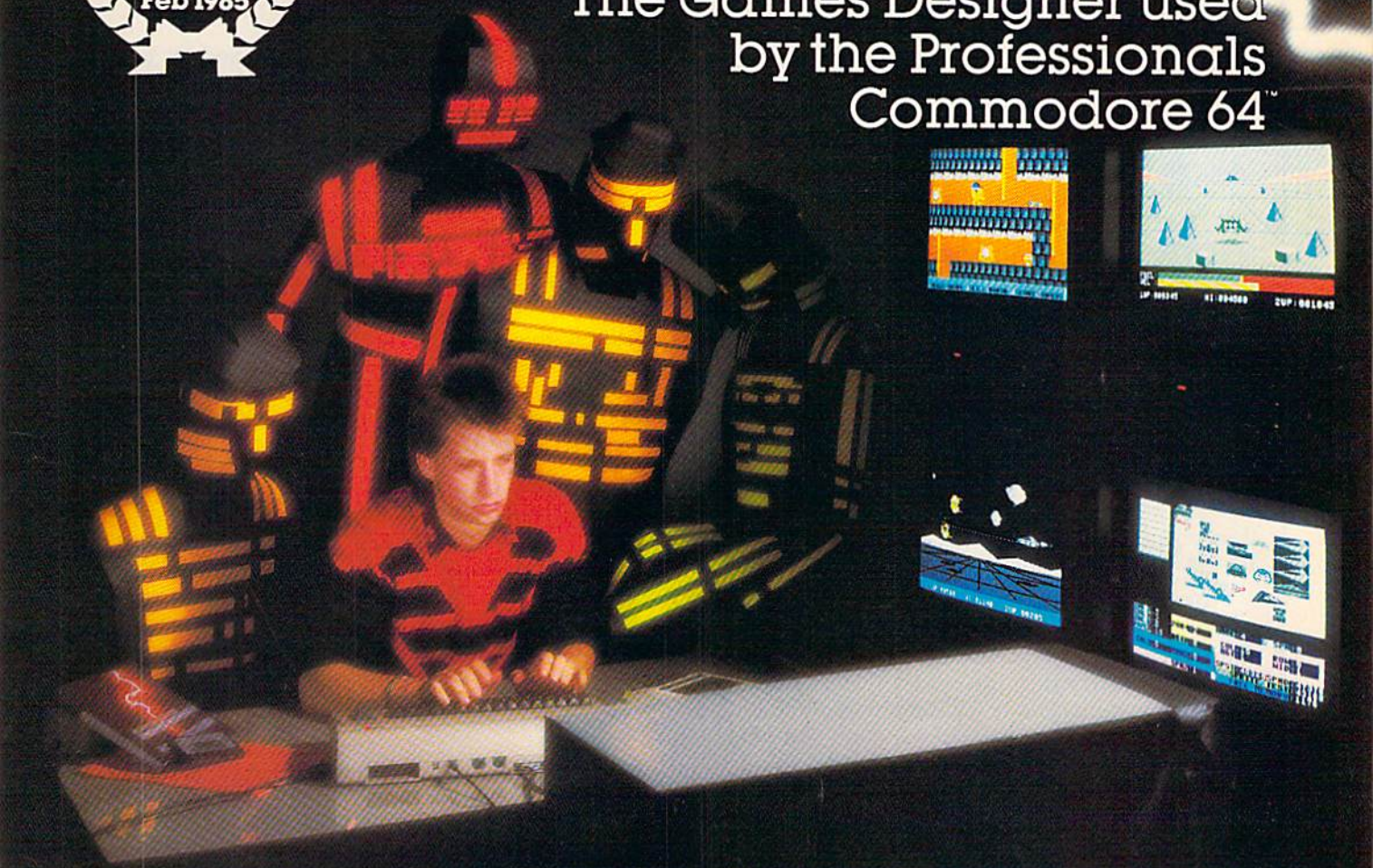

Now, without any knowledge of machine code, you can write fast, smooth, professional, totally original games and market them without paying royalties.

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IDEAL IDEAL is an Interrupt Driven Extendible Animation sub-Language. Once you have mastered IDEAL's easy to learn set of over 100 commands and just a little FORTH, you will be ready to produce arcade-quality games even if you don't know machine code. Up to 255 software sprites, each with its own user-defined dimensions, can be moved around the screen (or memory), scrolled, spun, reflected, enlarged or inverted with amazing speed and smoothness. Operations are possible between screen windows, sprites and sprite windows. Software sprites can even stretch across several screens, so those difficult scrolling landscapes that form the basis of so many games are easy to achieve. White Lightning also adds PLOT, DRAW, POLY and CIRCLE as well as fully supporting the Commodore's own excellent hardware sprites and sound facilities. The IDEAL routines operate in hi-res or 4-color modes.

MULTI-TASKING Because White Lightning uses interrupts, you can effectively run two programs at once. This means, of course, that games like Space Invaders and Defender can be written without complex timing calculations. So while one program smoothly scrolls the landscape, the second animates the other characters. This is undoubtedly one of White Lightning's most powerful features.

MARKETING AND PORTABILITY Although White Lightning uses an integer FORTH as its host language, programs can be written in a combination of Commodore BASIC, FORTH, IDEAL and machine language. The final program will run independently of White Lightning and absolutely no marketing restrictions are imposed.

BASIC LIGHTNING In addition to the White Lightning program itself, the package also includes an extended BASIC. This BASIC adds more than 200 reserved words including all the IDEAL commands, procedures and a full set of structured programming commands. Up to five tasks can be run simultaneously. BASIC Lightning is also available separately.

SPRITE DESIGN White Lightning comes complete with a separate sprite designing program. Two libraries of sprites are included and up to 255 sprites can be designed with loading and saving facilities between sessions.

The package comes complete with two 100-page manuals and a free demonstration program is included to show off the potential of the system.

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Commodore LCD Lap Portable Update

Is there a lap portable computer in your future? Commodore's new LCD portable, introduced in prototype form at the January Consumer Electronics Show (see April GAZETTE), may hold special interest for Commodore 64 and 128 owners.

Originally scheduled for a midsummer entry, the portable is now being held back for release sometime after September, according to Frank Leonardi, Commodore's vice president for marketing. Despite rumors to the contrary, Leonardi confirmed that the portable has not been shelved.

The Commodore LCD has a super fast 80 × 16 liquid-crystal display, 32K RAM, 96K ROM, BASIC 3.6 (a slightly enhanced version of the Plus/4's BASIC), machine language monitor, and, among other features, eight built-in productivity programs (word processor, file manager, spreadsheet, address book, scheduler, calculator, memo pad, and terminal emulator). The portable, which weighs just five and a half pounds and fits in a briefcase, will sell for a reported $600.

During a recent visit to Commodore, the LCD's senior design engineer, Jeff Porter, took the GAZETTE on a tour of the finishing stages of the new machine. Beaming proudly, Porter rattled off a list of features as he showed off another prototype and then dropped in on members of the software design team who demonstrated final modifications:

• The fast LCD display results from a separate custom chip being used solely to handle the screen display. Hence, the 65C102 microprocessor doesn't have to write letters to the screen. "CRTs (cathode ray tubes) use a separate CRT controller chip," says Porter. "We've called this an LCD controller chip. The same principle applies."

• The portable is built to support Commodore 64 peripherals, such as the 1541 disk drive, as well as the new 1571 drive being sold for the 128, and a 3.5-inch Sony-style microdrive planned for possible release later in the year. All Commodore serial peripherals will be compatible.

• The word processor and spreadsheet are truly integrated, using windowing to let you work on either function at the same time via a split-screen display. The spreadsheet also supports independent scrolling in split-screen format, and, according to the spreadsheet engineer, will be faster at moving a thousand cells than *Lotus 1-2-3* on an IBM PC.

• Built-in utilities on the main menu allow copying from the internal RAM disk to an external disk drive, or for downloading over the modem or the RS-232 port.

• The internal 32K CMOS static RAM can be expanded to 64K using standard memory chips. Another 64K of RAM can be added externally.

• The BASIC 3.6 includes a command for talking to the built-in 300-baud modem, through an OPEN statement.

• The screen display has a virtual 25-line display (although only 16 lines show at a time). This allows the user to set up the terminal program to emulate a double-screen size, for example.

• The memo pad and calculator each pop up with a keystroke over any application being run, without destroying the program you're using. In addition, the calculator operates in any of several different modes. For instance, while working in BASIC, the user can call up the calculator and use the programmer's mode for hexadecimal, binary, and other computations.

• With some limitations, the BASIC 3.6 is downward compatible with the 128 BASIC 7.0. Although the portable cannot support all of the 128's features, such as color, it should allow the user to run BASIC programs from the 128 without crashing. Instructions the machine can't handle will be ignored by the portable's BASIC. The BASIC also supports graphic commands, such as high resolution boxes, lines, drawing, etc.—very similar to the Plus/4 capabilities.

• A new battery-powered thermal transfer printer will be available for the LCD portable. The three-pound, 11.7 × 2.5 × 4.5 inch printer works on AA batteries, and can print unidirectionally in Near Letter Quality (NLQ) mode at 22.5 characters per second (cps) and in draft mode at 45 cps. A test of the new printer produced an excellent NLQ image with all but the coarsest Bond paper.

• The portable, as seen this spring, did not support an external video display. But, Porter said, Commodore's design team for the portable has been considering using the same 80-column display chip found in the 128 to provide that capability. The chip might be housed in a cartridge which would plug into the expansion port, he added.

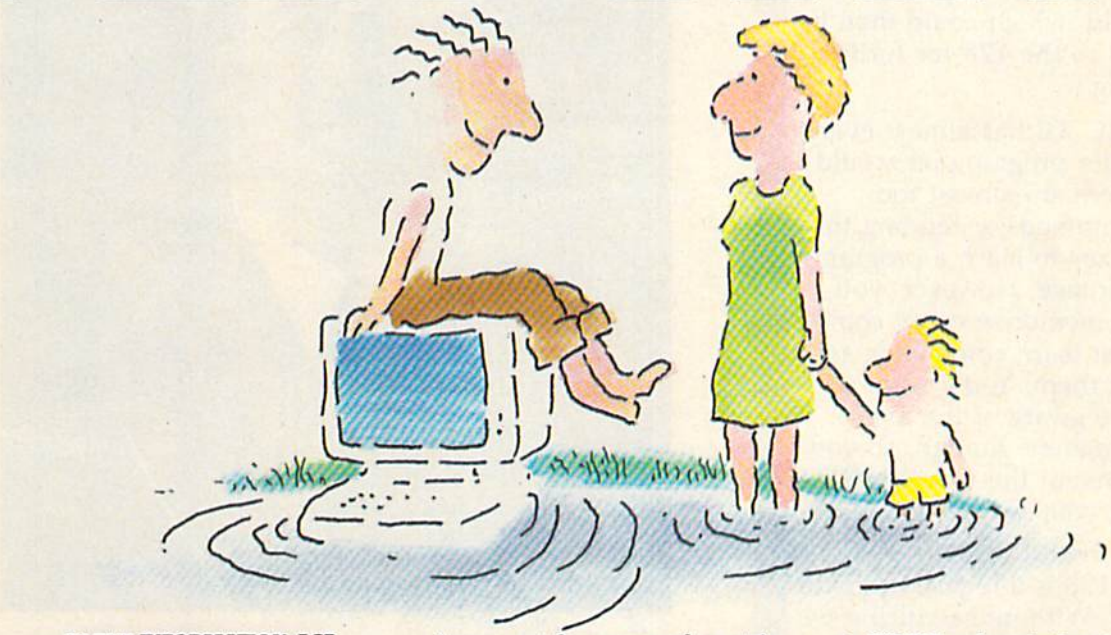
caused the collision with the function BUMP.

No longer are PEEKs, POKEs, or machine language necessary to read the game controllers. The function JOY returns the status of either joystick. POT returns the position of one of the four paddles, and PEN is used to read the X,Y coordinates of the light pen.

A few miscellaneous commands: SLEEP is used as a delay loop, pausing from 1 to 65535 seconds. GETKEY is like GET, but waits for a keystroke. GO64 exits to the 64 mode, but first asks ARE YOU SURE?, since anything in memory in the 128 mode will be lost.

The BASIC 3.6 in the Com-

GET YOUR FEET WET...



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modore LCD lap portable can run BASIC 7.0 programs as long as the programs shy away from PEEKs and POKEs (which shouldn't be needed very much with such a powerful BASIC). Although the LCD lacks sprites and the SID chip, its BASIC is programmed to merely ignore the BASIC 7.0 commands it can't execute, instead of crashing with a SYNTAX ERROR. This is indicative of a possible Commodore plan to pair these machines. The LCD portable would be used to acquire data in the field, which could then be uploaded to the 128 for further processing.

BASIC 7.0 has almost every command a programmer would need. There are almost too many commands, extending the time it takes to learn a programming language. However, you need not memorize every command, just learn commands as you need them. You'll want to at least be aware of the available commands, though, so you won't reinvent the wheel by POKEing your way to sound or graphics.

The 128 is a logical upgrade of the 64. Without sacrificing 64 compatibility, the 128 answers almost anyone's wish list. BASIC 7.0 gives programmers freedom to program without POKEs or cumbersome machine language routines. The 80-column display, 2 MHz microprocessor, 128K of memory (theoretically expandable to a megabyte), CP/M Plus, and fast double-sided disk drive make the 128 a capable business machine, competitive with the much more expensive IBM and Apple computers. As usual, though, we'll still have to wait for software to be written that takes advantage of these features. Although you can use existing 64 and CP/M programs, it looks like you'll have to write your own 128 mode programs for a while.

An Interview With
Paul Goheen
Commodore's Director of Software

Selby Bateman, Features Editor

Paul Goheen, who directs Commodore's software division, can be considered one of the genuine veterans in the post–Jack Tramiel Commodore environment. He joined Commodore during the latter part of 1980, shortly after the launch of the 8032 computer and before the introduction of the VIC-20. Previously a programmer, systems analyst, and consultant in the mainframe and minicomputer arenas, Goheen came to Commodore as a software product manager at a time when Commodore's U.S. computer operations included only about 20 people. In the past few years, he has seen the amazing growth and the many changes which have occurred at the company and in the microcomputer industry in general.

When COMPUTE!'s GAZETTE *recently spoke with Goheen, Commodore was working full tilt to launch the 128 into the retail market by May and June. Also underway was the surprising lap portable computer now planned for an early fall release. Both the 128 and the portable were introduced at the January Consumer Electronics Show (CES). In the wings is the Amiga Lorraine computer, an eagerly awaited powerful and versatile 16/32-bit machine which Commodore has kept under wraps since purchasing the Amiga company last summer. The Amiga is scheduled for a midsummer entrance.*

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Mitey Mo is being hailed as "the best price/performance communications package available." Its software has received the endorsement of the U.S. Commodore Users Group, which gives a money-back guarantee to members. It is truly the industry standard, and no wonder. It's the most user-friendly modem you can buy—it will take you online faster and easier than anything else.

Mitey Mo opens up a world of practical and exciting uses for your C-64. It lets you send and receive electronic mail, link up with community bulletin boards, play computer games with people in distant places, tap into library resources, and much more. All at your convenience.

Until Mitey Mo, Commodore's 1650 Automodem was the obvious choice when you went looking for a modem for your computer. Like Mitey Mo, it has "auto answer"—it receives data while unattended. And both modems are "auto dialers"—you dial right on the computer's keyboard. But that's about where the similarity ends.

Mitey Mo can dial up to 9 numbers sequentially. But suppose you dial a number and find it's busy. Mitey Mo has "auto redial"—it hangs up and redials immediately until it gets through. With the other modem you have to redial each time—and somebody with auto redialing can slip in ahead of you.

Mitey Mo is menu driven. It lists the things you can do on the screen. Select a number and you're on your way. Since Automodem isn't menu driven, you'll be hunting through the manual a lot.

With Mitey Mo, your computer's function keys are programmable—you can save yourself plenty of keystrokes. Not so with the other modem. And only Mitey Mo lets you store data to review or print it later.

Mitey Mo has just one switch, the Smart 64 software does the rest. With the other modem you'll have to remember to check three switches, otherwise you may be answering when you mean to be originating.

Mitey Mo is half the size of the other modem. The very latest technology allows miniaturization and increased reliability, as well. Mitey Mo is so reliable, we gave it a full three-year warranty. The other modem gives 90 days, then you're on your own.

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Auto Redial	YES	NO
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Function Keys Programmable	YES	NO
Upload/Download Text & X-Modem	YES	NO
VT-52/VT-100 Emulation	YES	NO
Menu Driven	YES	NO
28K Software Buffer	YES	NO
Easy-to-Use Manual	YES	NO
Bell 103 Compatible	YES	YES
Multiple Baud Rates	YES	YES
Cable Included	YES	YES
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Warranty	3 years	90 days

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GAZETTE: As Commodore introduces the new 128 computer, what plans are there for the future of the 64, the Plus/4, and the 16?

Goheen: The 128, our acquisition of Amiga, our PC product outside of the U.S., and other products we have on the drawing board are indications that we have expertise outside of the low-end marketplace. The 128 I honestly see as a bridge machine, that is, an introduction, or a taste, of our ability to compete outside of the current bandwidth in which we do business.

What we are doing is preparing for the future, and not the future in terms of moving from one bandwidth to another by discontinuing where we were. We're moving to the future by expanding our marketplaces into other arenas, and at the same time keeping our previous market share in the lower bandwidth. Hardware at Commodore is something that we've exhibited that we do well. And we have the vertical integration and the manufacturing and engineering abilities to put together products in a short period of time and to respond to market changes.

The 64, the Plus/4, and the 16 on an international basis and on a U.S. basis complement each other in terms of sales. We will continue to promote and push those products up to the point where business dictates we look toward other arenas. The 128 will be promoted right along with them. There will be different price points; there will be different opportunities. We can pitch the 128 from two directions that we can't with the 64. The 128 is going to be promoted from a [mass merchandising] point of view, trading on the 64 compatibility. And, "Oh by the way, here are these other expanded areas of the machine that you can grow into on a professional basis." From the specialty store end of the marketplace, the 128 will be vended primarily from its 80-column professional aspects and, "Oh by the way, it runs all these great 64 consumer type products as well."

So, we have the ability with this machine to begin the cross-pollination into other marketplaces and to other forms of distribution. And the Amiga will be the next step in that same direction, at the same time keeping the other end of the business alive.

GAZETTE: So, Commodore doesn't necessarily drop the 64, the Plus/4, and the 16 when the Amiga comes out and when the 128 is selling, as long as there is a market for them.

Goheen: That's entirely correct. We have no plans of discontinuing anything just for the sake of discontinuing it. Our introduction of product and our discontinuance of product is based solely on prudent business decisions. You can't *not* look at the international ramifications of this because we have situations where a product is selling to a certain level in the United States, and it may sell at a much higher level in other countries. So the United States is really to us one facet of an international, or global, business.

GAZETTE: Does Commodore have any plan to make a programmer's reference guide for the Plus/4 and the 16 such as there has been for the 64?

Goheen: There are plans, and actually there is quite an amount of effort that has already been completed on that very subject. The final distribution [of the reference guide]...will follow as a function of where the volume of product is sold.

GAZETTE: Is a programmer's reference guide planned for the 128?

Goheen: That will be likely as well. We plan to be in the book business as much as makes sense from a technical reference manual point of view. We have very good relations with major publishers who have promoted our products in the past. We are also, as a separate topic, working on joint ventures with other companies to take software products and join them with a textbook, and pair the two together, and then work with these publishers in the educational community.

GAZETTE: Will you be working at Commodore and among third party people on developing new CP/M programs for the 128 or will you depend on the vast library of CP/M that is currently available?

Goheen: Our initial blush of the CP/M side of the machine, by design, was to take advantage of the software that is currently on the shelf. Previous to CES, I had already had meetings with all the major CP/M providers. In all cases, people expressed interest. In some cases it was mild interest, and in some cases people were terribly excited. And that really is a reflection of the individual company's interest in keeping that end of their business alive.

From an initial distribution point of view, [Thorn/EMI's] *Perfect* series will be provided from Commodore to address the standard horizontal product areas on the CP/M side of the machine (*Perfect Writer, Perfect Calc, Perfect Filer,* etc.).

With the 128, we are finishing a product that will allow you, via menu, to reprogram the controller inside the [1571] disk drive and make the drive think it is another type of disk drive. And you will be able to take off-the-rack software—Kaypro, Osborne, and some of the other formats that are out there—and put it in the drive, and the drive will read it. We've tried to build enough of that into the machine so it can take advantage of the additional products that are out there.

Without naming names, we have a large library of [third-party CP/M] products here already. And a large degree of them have worked right off the shelf. We just put them in and fire them up, and they go through the configuration, and they operate in totality.

GAZETTE: So there is CP/M software available that you can use with the 1571?

Goheen: That's correct. When we package our product, some of it will be done in a 1541 format so it will be available to the least common denominator Commodore user out there because we have designed the CP/M so it will work with the 1541. Obviously, it works better with the 1571, but it will function and work, and to not exclude any potential customers, we have taken pains to format things a certain way.

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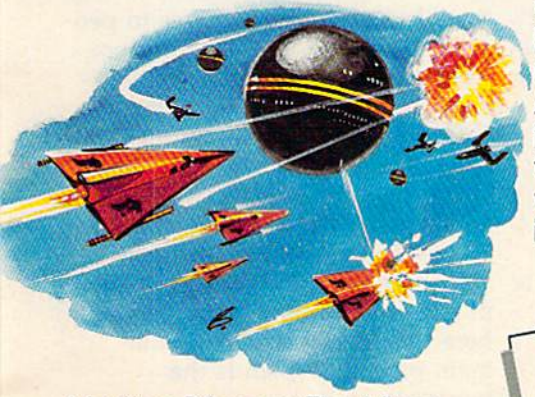

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GAZETTE: So if a person gets a 128 and has a 1541 and doesn't want to get a 1571, he or she will be able to use some of the CP/M software?

Goheen: Right. And there's the upgrade path, too; taking the current 64 owner and having them look at buying a second machine or a replacement, but maybe not wanting to sign off on the additional peripheral initially. They can step up as well.

GAZETTE: How about program translation from the 64 to the 128? Among third party software developers and Commodore itself, is that much of a problem?

Goheen: Commodore 64 products that are on the shelf now are 100 percent compatible with the machine on the 64 side. They will run straight away. From an upgrade path to effectively run right on what I call the middle of the machine—the 128 side of the machine—the BASIC in the 128 is greatly enhanced even over the BASIC we had in the Plus/4. And it is a superset, so all of the BASIC is compatible.

Now that's a dangerous statement, so let me rephrase it. In BASIC, there are two commands—PEEK and POKE—which are throwbacks to machine language. You know, deposit-this-at-this-address type of command. Technically speaking, PEEK and POKE are not considered part of BASIC. But nonetheless, they are quite heavily utilized in some programs [for the 64]. In the programs that do not care to use PEEK and POKE, the BASIC will run straight away. Programs that use those PEEKS and POKEs that look at a specific address; what was at that address in the 64 is obviously not going to be in the same place in the 128. That is the incompatibility from a BASIC point of view.

In the 64, to really get the utmost out of the product in terms of the graphics and sound, one had to use PEEKs and POKEs a lot. You could not be just your average run-of-the-mill weekend programmer to get the utmost out of the box. From that point of view, we produced two products called *Super Expander* and *Simons' BASIC*. There have been other products from other vendors that provide or extend the BASIC to give you commands. Now realizing the awareness and the utilization of those features of the machine in the Plus/4, we extended the BASIC and added commands such as CIRCLE, PAINT, DRAW, LINE, and so on.

In the 128, we've added to that even further, so that in the 128 BASIC and in BASICs after the 128—just looking down the pike—the utilization of the PEEK and POKE will almost become nonexistent because the things that required you to do that before have now been augmented in the BASIC in ROM so one is really not required to use that. So, from a BASIC conversion point of view, if I have a product that required a lot of PEEKs and POKEs on the 64 to make it work, I can probably very simply replace most of those just by using the commands in 128 BASIC.

So the compatibility issue is there, yes, but there are certain caveats one must be aware of. From a developer's point of view, it's a cakewalk. From the weekend programmer's point of view, it will be a little harder, but still very easy.

Now, from an assembler point of view, a machine language point of view, the 128 is a Kernalized machine as was the 64, and the Kernals are very similar, such that you can use most of the atoms you had in your machine language code, and with a reassembly, you can make them work inside the 128.

GAZETTE: You and others at Commodore have spoken of the new approach which the company is now taking in its business relations with dealers, consumers, and the press. Could you briefly characterize the change?

Goheen: Mr. [Jack] Tramiel was an entrepreneur's entrepreneur. The man was an absolute dynamo in terms of energy and enthusiasm, and is someone that I myself honestly am quite glad to say that I had the opportunity to know. He has taken Commodore from what it was up to a very large company.

Marshall Smith (current president of Commodore) is a businessman's businessman. He is a very polished professional individual, and he strategizes, implements plans, follows the plans, takes input, modifies the plan if it's required. He is the gentleman we need to take us from where we are to the next plateau of an even bigger company.

Companies like Commodore, companies like Apple, like IBM—we've probably started to get to the point where we've sold all the computers we're going to sell to the hobbyists and weekend hackers and enthusiasts. Now let's find responsible reasons to sell to people who don't fit into those categories. Let's find some real reasons to continue to sell these machines to people who have a real use for them. And let's try to go forth as a business and not merely enjoy the fruits of selling into an enthusiasts' market.

We *are* in the software business, no ifs, ands, or buts about it. We are in the software business with both feet, and our hearts and minds are in it, and we're primarily here to support the sale of our main product, which is the hardware.

Our [software] product line several months ago was up over 100 titles. Now, in the largest retail outlets, at most there's approximately 350 titles at any store. Out of 350 titles, a major company will at most get 20 of those titles. From a prudent business point of view it makes little to absolutely no sense to have a product line of up over 100 titles. You'll end up eating them. I am shrinking the product line, bringing it into the order it should be.

So my first line of defense again is to insure that the software matches the hardware and the hardware receives a successful launch and really starts to kick off. Past that, we intend to engender as much public support for the machine as we can and anyone who thinks that they would like to develop software for it—no matter even if they're just a little garage shop operation— we'll be glad to try to help them as we have time and resources.

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GAZETTE: Could you tell us about the service centers for consumers that Commodore has announced—the RCA centers, the Sears stores, the other outlets?

Goheen: The service aspect is being upgraded. We're adding professional service companies to our list. The 128 product, for the first time, will be packaged with several brochures, one of which will point to software products coming from different vendors. So other people's software will be advertised in the box for the first time. There will be a service center brochure in there. There will be a little thing that says "Read Me First." It will say, if you're having the following problems, do the following things. And then if that doesn't pan out, here's some places to get on the horn with. There will be a number of items packed in the 128 that we feel will do one thing: reinforce, on the part of the end user, a positive purchase, make them feel comfortable that they spent their money right.

GAZETTE: If a person has a problem, then he or she can go into one of these service centers instead of having to ship the computer off?

Goheen: Right. Of course, we still have substantial warranties, replacement warranties right across the counter, so if they buy it at a local retail outlet and find something defective or not to their liking, [they get] a new one right across the counter, no questions asked for a length of time. Outside of that window, then, they can utilize the other service things that we have made available to them as well.

GAZETTE: Atari's ST line of computers has created a stir, but many people are also quite interested in Commodore's Amiga. What can you say about the Amiga Lorraine computer at this point?

Goheen: As we stated at CES, the Amiga machine from Commodore will enjoy a mid-1985 launch. I think someone commented—making a play on the cliche—that like a fine wine, we will sell no machine before its time. This is not a hurry-up situation for us because we're quite confident that our 128 machine, against announcements of other companies of their 128 products, is a superior product from a hardware point of view. The Amiga product that we will put on the street will be considerably superior to other products that are being marketed in that same bandwidth.

Things are progressing on schedule. We're being confident, and we're walking right down the path as was designed. So, in terms of launch, mid-85. In terms of what the product will be—it will be quite honestly a yardstick by which all other machines of that type are measured.

GAZETTE: As you look at Commodore software and hardware plans, what's your feeling about the needs of the consumer?

Goheen: We have a crusade here that almost borders on religious fervor to really look at ourselves as people and say, what reason would I have realistically to spend this money and buy this machine, and take it home? What, really, am I going to do with it?

One of the activities we are getting behind substantially—and what I mean by substantially is that we are putting our money where our mouth is here in terms of hardware manufacturing—we have just put a new modem into the marketplace. It's just a little more updated version of our current modem. You'll begin to see that on a marketplace to where it comes out at a price that goes beyond the word competitive. A little later in the year, you'll see a 300 and 1200 baud version....

GAZETTE: The 1670?

Goheen: The 1670. We will be the first company that will provide a truly DC, Hayes-like, very professional 1200-baud "smartmodem." And we will ultimately break the $100 price barrier on that.

GAZETTE: So, you're putting an increased emphasis on telecommunications as a central use for a computer?

Goheen: Yes. I actually think the word *increased* is probably not strong enough. We are highly motivated from the point of view that we have made the manufacturing commitment to build the necessary volumes of hardware products to support this activity.

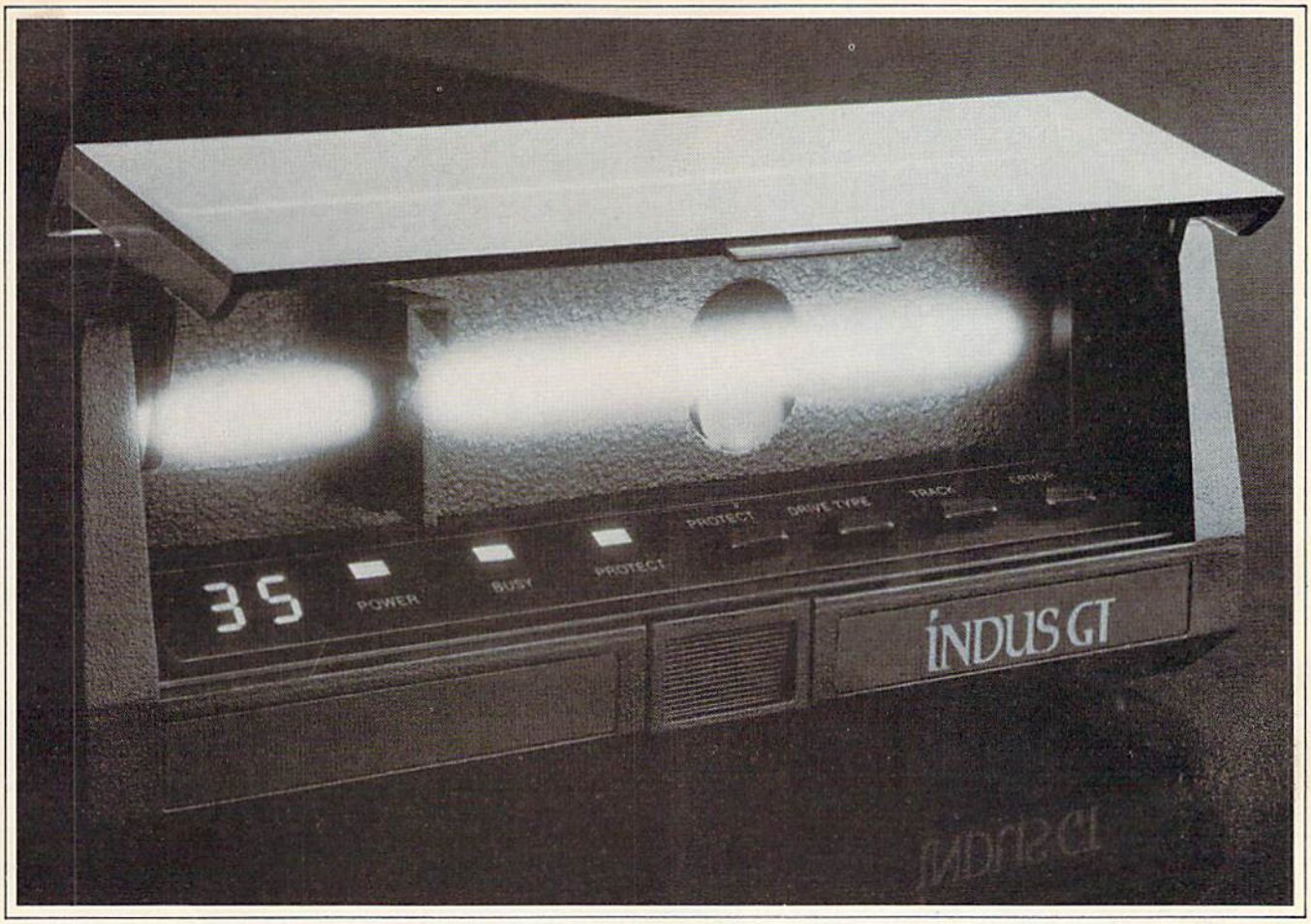
GAZETTE: We know Commodore has been working with Tele-Learning in its Electronic University program as well as several other companies. How are these services to be coordinated?

Goheen: Right now, we have relationships with CompuServe, Dow Jones, The Source. We provide snap packs for the different people—Delphi, Playnet, TeleLearning people. We're looking into getting these specialized databases aligned with one of the major services. And as a sidelight, if we find other people not able to provide the necessary level of service we feel is adequate to promote these specific learning activities online, we are in a position to promote and create a major service on our own. That's something we're looking at as an opportunity as well. That is not to supplant the other people. We are in a position to help promote all of the people on an equal basis at this point and just to generally try to raise the awareness of what telecommunications can mean for you at home on a daily basis.

GAZETTE: We've heard that Commodore's 1660 modem may sell for as low as 30 dollars. A price like that would tie in very well with what you spoke of earlier on the 1670's low price as a 300–1200 bps device.

Goheen: I don't know what the initial pricing will be on the 1670. But the specifics of our 1600 modem [the VICmodem], which is a direct connect modem, right now is enjoying retails in the 30 dollar bandwidth. The 1650 modem is right now enjoying retails of up in the high 40 dollars, and I look for those probably to change with time. And I think initially the 1670 will be considerably more than that just because of the sheer technology in the box.

We as a company normally don't like to shoot our mouth off and not come across. But I do believe you will enjoy some things later in the year that will put that 1670 down in price to where we're certainly going to put a hurt on people in the modem business.



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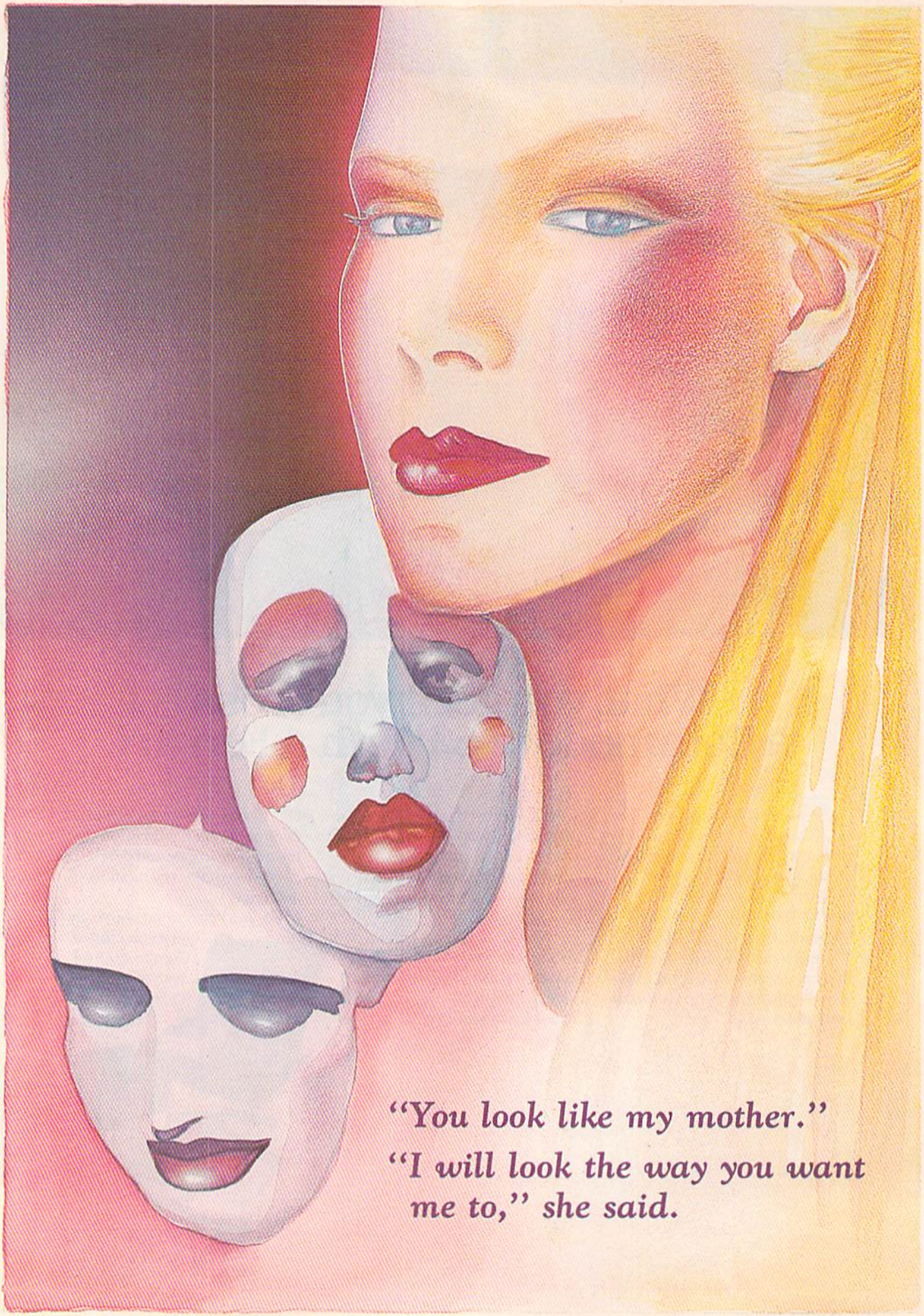


"You look like my mother."

"I will look the way you want me to," she said.

How Writers See Games

Selby Bateman, Features Editor

Electronic novels, interactive fiction, all-text adventure games, living literature. Whatever the names, the landscape of this brand of computer game is changing. New writers and seasoned programmers are together stretching its boundaries with refreshing approaches to plot, writing style, and game interaction. The competition is intensifying.

Imagine a wheel—a colossal, rotating wheel into which is drawn all of the images of a culture: every experience, every event, every object, every person's mind and body. This wheel is a vortex which you must try to manipulate and understand.

"I hope this doesn't sound too fancy," says Robert Pinsky, breaking into his own explanation with a slightly self-conscious laugh.

"It involves the idea of striving for control and mastery, and the world being so complicated that every time you strive you're creating another system that becomes part of this big whirling thing which is everything everybody's ever known or thought or dreamed up to amuse themselves. Jokes and technologies and mythologies and religions and roads and....just everything."

Pinsky pauses again, as if considering the magnitude of such a wheel for the first time. He's describing the underlying concept of a computer game he created—*Mindwheel*, an all-text adventure for the Commodore 64, Apple, Atari, IBM, and IBM-compatible computers. The game represents as unusual a combination of complexities as does Pinsky himself.

You play the game by immersing yourself alternately within the minds of four deceased people: a peace activist rock star, a monstrous dictator, a heroic poet, and a gifted scientist. All of those minds are linked along neural pathways to a common matrix leading to the Wheel and a mysterious Cave Master. You can directly address characters, ask them questions, and travel from mind to mind. The humor is sophisticated, and yet surprisingly accessible; off-screen characters move about at random; and Pinsky's writing presents a rich atmosphere within the game world itself.

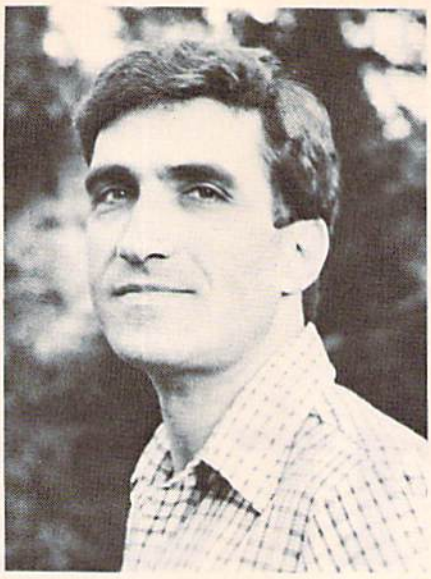
How did this university academic, a magazine poetry editor, scholar, and award-winning poet, get involved with the development of a commercial computer game? Why would a software company, Synapse, seek out Pinsky, someone who had never even played a text adventure game until after he created the concept for

Mindwheel? And how did this nonprogrammer bring his own version of the Wheel to the arena of a computer game?

To understand the answers to those questions is to appreciate how interactive fiction is evolving. Gone forever are the days when an all-text adventure game with simple two-word, noun-verb command combinations and a series of arbitrary puzzles could impress computer game fans. "Kill dragon" and "take sword" have been replaced with more sophisticated programs capable of taking full sentences and separating the nouns, verbs, adjectives, adverbs, and direct and indirect objects.

Most computer adventure games are based on a story. You may be a detective investigating a crime, or a heroic knight in search of a magical unicorn. You have the freedom to make decisions—moving north or south, acting friendly or unfriendly to characters you meet. But obstacles and puzzles hinder your progress. You may need a key to pass through a door, a boat to cross the river, or a map to find your way. By persisting, you discover the answers one at a time to advance to the next level of play. Ultimately, the solution to the game is the solution to the final puzzle.

While an increasing number of these games use graphic images to complement the onscreen text, the oldest computerized interactive fiction is based on text alone. Without having to use valuable and limited computer memory to draw the graphics, the all-text adventures have room for larger vocabularies, more descriptions of scenes, and more powerful *parsers*—the programming routines which break down your English-language commands into numbers the computer can manipulate.



Robert Pinsky, poet, professor, editor, and author of Mindwheel, *a new all-text adventure game for the Commodore 64.*

But more than a year ago, Robert Pinsky knew virtually nothing about these distinctions as he walked the halls of the University of California at Berkeley. The dark-haired poet and professor was more likely to drop the names of Ezra Pound or the Bloomsbury group of writers in his conversations than to mention a Commodore 64 computer or the fortunes of IBM versus Apple. As head of the university's creative writing program and as the poetry editor for *The New Republic* magazine, Pinsky was immersed in writing and teaching far removed from the bits and bytes of computing. His students may have been staying awake past midnight playing *ZORK*, but Pinsky was only marginally aware of the growing computer adventure game field.

Enter Synapse, a computer software company looking for a very special type of writer to work on a new series of interactive games it would call *electronic novels*. These adventures would be packaged as hardback books with a disk in the back. In order to play the game, users would have to learn information from the book.

"What we wanted was to expand the imaginative realm in text adventures beyond what it had been," says Synapse's Richard Sanford. "Up to now we've been looking through blinders, through a very narrow window in text adventures. We wanted to deal with writers whose main stock and trade is to expand the narrow window on reality and to be able to give us a rich imaginative experience."

So the company looked for writers who knew little or nothing about computer games, whose ideas would not reflect the biases which might creep into the mind of someone familiar with *ZORK*, its cohorts of popular adventures, and the highly respected Infocom, Inc., which created and marketed the most successful of those games.

Tell us a story, Synapse said to Pinsky. Then together we'll build a game.

So Pinsky sat in his office and thought about the Wheel, a concept he had first used in a poem called "The Figured Wheel." That was published in his 1984 book of poetry, *History of my Heart*, which early in 1985 won the prestigious William Carlos Williams Award from the Poetry Society of America. As he developed the spiraling concept of *Mindwheel*, Pinsky knew little or nothing of Infocom, the cryptic acronyms ZIL and BTZ, or two programmers, William Mataga and Steve Hales.

What he would later discover is what many hardened game players already know: that Infocom, Inc., of Cambridge, Massachusetts, has set the standard for quality in the field of all-text adventures. Its plots have been the best, its prose the classiest, its parsers the most powerful, and its proprietary programming language—ZIL (*ZORK* Interactive Language)—the most accomplished. Synapse, with its idea for *electronic novels*, was approaching Pinsky

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and other writers with a plan to compete against Infocom in the same market.

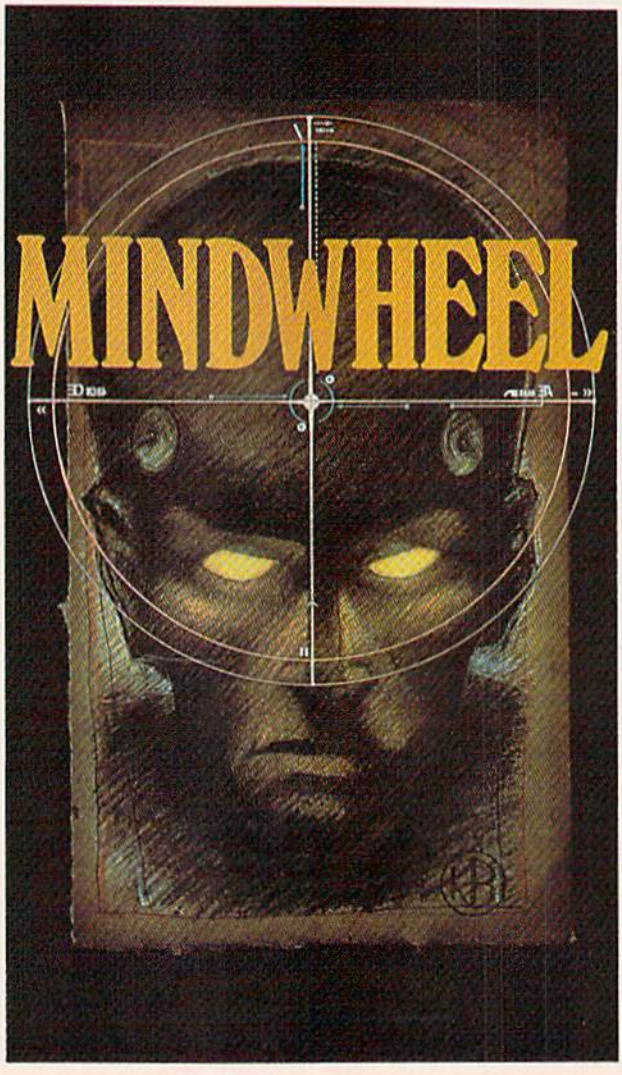
"We were very conscious of what Infocom was up to," says William Mataga, an independent programmer who later worked with Pinsky and programmer Steve Hales on *Mindwheel*. "We had as a goal that we had to do everything that Infocom does, plus one." As Pinsky created a concept, Mataga was independently putting the finishing touches on the underlying programming language BTZ, which appropriately stands for—Better Than *ZORK*.

Many other companies have attempted—and still try—for a slice of the interactive fiction market. None has had as much critical and popular success with all-text adventures as Infocom. Software companies like Bantam and Imagic, with their Living Literature series; Spinnaker, with its Windham Classics and Telarium (formerly Trillium) brands; Activision; Adventure International; and many others have all found the graphics-and-text field more hospitable when it comes to adventures. They argue that the future belongs to adventure gaming which includes increasingly sophisticated graphics as a part of the mix.

Whatever the outcome of that argument, everyone agrees that a game with graphics won't leave enough memory on today's 64K or 128K computers to permit as sophisticated a set of vocabularies, parsers, and underlying programming languages.

Synapse was trying something else quite different by choosing Pinsky. Game developers have increasingly sought big-name authors, primarily in the science fiction and fantasy genres, around which to base their adventure games. Names like Ray Bradbury, Isaac Asimov, Arthur C. Clarke, Michael Crichton, Douglas Adams, and others adorn the boxes of software programs. Some of these authors were heavily involved in the game development and others scarcely at all. No matter what the quality of a particular adventure game, all of those writers have a heavyweight pull in the computer game-playing community. While Pinsky's credentials and success as a talented poet, teacher, and editor are excellent, his visibility among computer game players would naturally be decidedly lower than the mass market superstars listed above.

In order to advance the all-text genre, however, Synapse was convinced that all-star names were not the answer. "A lot of times you may have a game with a [big name] involved, but he only spends two days on it, makes a few comments, and then leaves and goes off to write something else," says Mataga. "A writer's job in the text adventure is a lot of work. We need a writer who will be able to spend the time with us on the game, not just someone who will make a few suggestions on how the game will work, and then leave."



Mindwheel, *packaged in the form of a hardback book with disk, is one of a new breed of electronic novels from Synapse which blur the line between software and books.*

That sentiment is echoed by Douglas Adams and Steve Meretzky, who collaborated on Infocom's text adventure game, *The Hitchhiker's Guide to the Galaxy* based on Adams' book and radio series. (See "Inside View" in the April 1985 GAZETTE.) Meretzky, developer of the popular *Planetfall*, *Sorcerer*, and *Enchanter* Infocom games, worked extensively with Adams to make sure the humor and characterization of *Hitchhiker* remained intact.

"We started off spending a week in Boston, mapping it out, roughing it out, and writing bits of text," says Adams, a British writer whose books in the Hitchhiker series now number four. "Once we

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got the ball rolling, I went back to England, and Steve and I communicated a lot through electronic mail. I would send ideas and bits of text, and he would start building it into the game. I would map out a lot of it broadly, and then bits of it in detail." The collaboration continued as Meretzky flew to London for more detailed work. Later the two worked together on the game once more in Boston, fine-tuning and reacting to the suggestions of game testers. The entire procedure took months, but both men agree the game is better for their mutual involvement.

Adams was one of the first writers to actually use the term "electronic novel," in the original 1977 edition of *The Hitchhiker's Guide*. "As far as I was concerned, it was completely imaginary," he says, laughing. "I didn't even become computer literate until about a year or so ago, whereupon it suddenly swept over me like a tidal wave."

As Pinsky worked with Mataga and Hales on *Mindwheel*, he came to see how his involvement was an important natural component of their creative process. He also became fascinated as a writer with the random interaction which attracts so many adventure game players.

"Once in a while, one of these games will give you goosebumps," he says with a hint of awe in his voice. "A friend played the game and said to a character, 'You look like my mother,' and the game character interpreted it as a command. She said, 'I will look the way you want me to.' My friend got spooked. You hit that once in a while now."

When Pinsky finally had an opportunity to sit down and play a few computer adventure games, what bothered him was that many of them were clever enough but devoid of mood and emotion. "They didn't have much color or aroma; they seemed flat.

"I think that the experience of writing poems was very good for this," he adds. "In poems, you're exposed to just getting it done in a small space. The more short and vivid a message can be, creating a narrative moment with the smallest possible number of words, the better."

Another writer involved with Synapse's series of electronic novels developed feelings similar to those of Pinsky. Jim Paul is a 34-year-old poet whose works have been published in *The New Yorker*, *The Paris Review*, and other magazines, and who also has written articles for *The Washington Post* and *The San Francisco Chronicle*. Currently a Stegner Fellow at Stanford University, Paul is the designer behind *Brimstone*, an all-text adventure based on Sir Gawain of King Arthur's Round Table, with additional material borrowed from Dante and William Blake.

"Writing on a page is a single line of narrative. The reader is a slave to the page," he says. "I had to anticipate paths for the reader. In writing a branching narrative like this, all choices are available at any given moment."

As a writer, Paul is intrigued by the game's ability to recognize synonyms and misspellings of words, translating them accurately. He also finds fascinating the way in which Mataga's BTZ language permits the game to have characters converse and situations develop which the author never wrote. "The computer is smart enough so that it can generate responses far beyond what I can do."

The Hitchhiker's Guide, *another all-text adventure game, is packaged in a distinctive format by Infocom to present the player with more than just a disk and instruction booklet.*

With the adventure game market still growing rapidly, Infocom's Steve Meretzky sees the early dominance of science fiction and fantasy themes giving way to other topics as new writers approach interactive fiction for the first time. "Back during the early days of personal computers, people who had them were the real hackers who tended to be science fiction fans. Therefore, most of them wrote programs which were science fiction or fantasy related.

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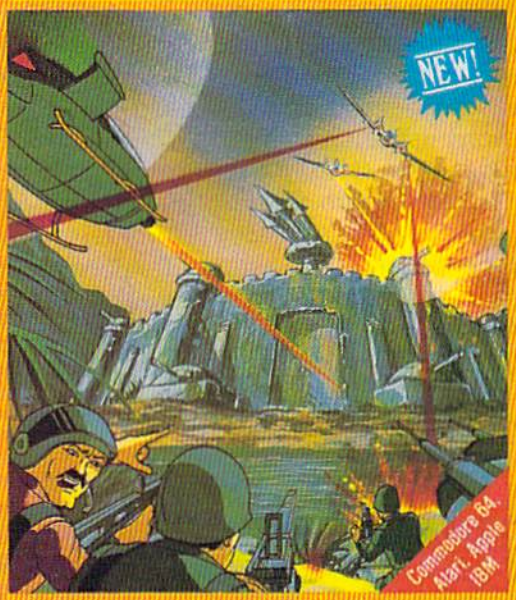

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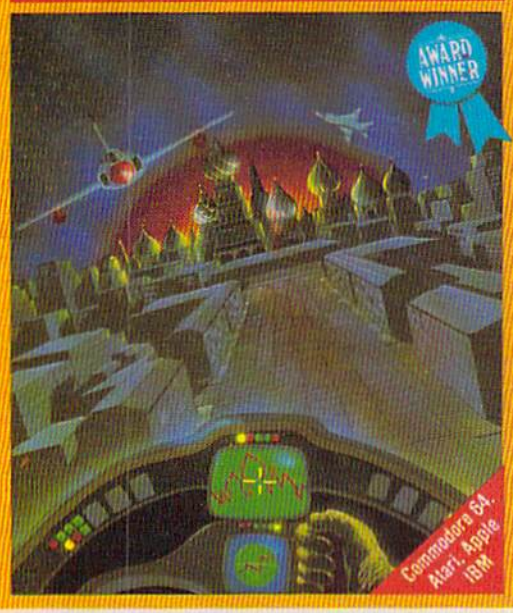

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As the computer market grows, that trend will reverse itself."

Peter Golden, another writer new to the creation of interactive fiction, designed two graphics and text adventures for Imagic/Bantam, *I, Damiano,* based on R. A. MacAvoy's Damiano fantasy trilogy; and *Sherlock Holmes: Another Bow,* both currently available only on IBM and Apple computers.

Although he previously had no involvement with computers, Golden is now impressed by the need within adventure games for a writer's knowledge of structure, word usage, descriptive techniques, and style in order to bring the program to life. It's a challenge he likes. "What compels someone to turn a page in a book is the same thing that compels an interactive fiction player to hit the return key. You have to get someone to turn the page.

Golden's involvement with the Holmes adventure quickly convinced him of the versatility players will see in future all-text formats. *Another Bow* takes place aboard a ship following World War I. Sherlock Holmes and his friend, Watson, must solve six different mysteries. In the course of the story, they meet such famous figures as Thomas Edison, Pablo Picasso, Gertrude Stein, and others. Golden chose Holmes, he says, because "it gave him a chance to be the most literary, to play with history, with style, and with the idea of writing dialogue." Golden also played with different speech patterns, from Southerners to Europeans, and with the idea of voice as used by different characters.

The conclusion Golden draws from his recent involvement is identical to that of Pinsky and Jim Paul: Writers will increasingly involve themselves in interactive fiction, complementing the talents which programmers bring to the genre. And as computer memory capacities rise from 64K and 128K to 512K and higher, the text adventure game will enter realms scarcely imagined today, giving writers even more latitude.

"We're looking out to a very exciting void," says Pinsky. "We don't know what people's imaginations are going to do with this tool. I can certainly see a whole new level of interactivity, actually putting a part of my dream life or fantasy life or emotional life into the game."

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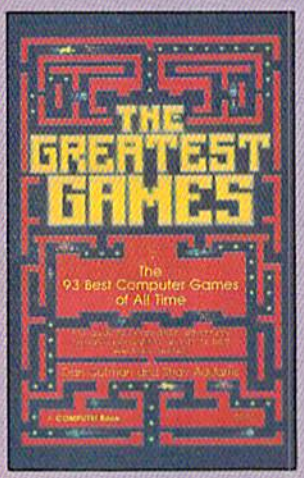

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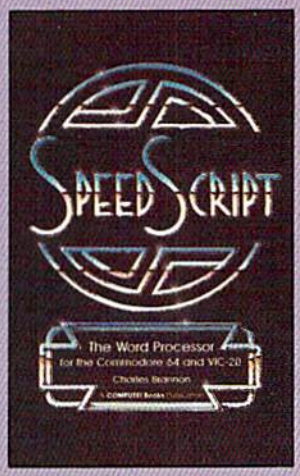

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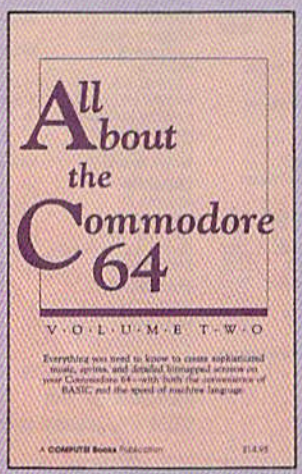

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A Guide To Commodore User Groups
Part 2

The second half of the user group guide includes states N–Z and countries outside the U.S. We will continue to publish updates in future issues. Send additions, corrections, and deletions to:

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Greensboro, NC 27403
Attn: Commodore User Groups

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Mid-Nebraska Users of Commodore (MUC), Bob Luebbe, 3220 W. 13, Apt. 9, Grand Island, NE 68801, (308) 382-1933

Rivercity Commodore Club, Richard d'Autremont, 2742 Newport Ave., Omaha, NE 68112

Greater Omaha Commodore 64 User Group, Bob Quisenberry, 2932 Leawood Drive, Omaha, NE 68123, (402) 292-2753

NEVADA

S.O.G. Commodore User Group, Lee Schram, c/o IC Electronics, 4011 W. Charleston Blvd., Las Vegas, NV 89102, (702) 646-5656

CLONE, Lee Huntley, 6438 E.Goldmine Dr., Las Vegas, NV 89115

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C-64 Users, P.O. Box 4022, Rochester, NH 03867

Monadnock Commodore 64 Users, c/o Paul F. Rule III, RFD No. 1, Rt. 10, Winchester, NH 03470, (603) 352-6722

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Somerset Users Group, Stan Kosciuk, 5 Shasta Pass, Fanwood, NJ 07023, (201) 889-5520

Morris Area Commodore User Group, Bob Searing, 51 Ferncliff Rd., Morris Plains, NJ 07950

RCA Commodore Users Group (RCACUG), William Rowe, 432 Hemlock Lane, Mt. Holly, NJ 08060

Rancocas Valley User Group, M. Eisenbacher, P.O. Box 234, Mt. Laurel, NJ 08054, (609) 267-1912

Info-64 c/o Video Dynamics, Ltd., 16 W. Ridgewood Ave., Ridgewood, NJ 07450, (201) 447-4422

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Commodore 64 Users Group, Thomas Martin, 680 Leigh Terrace, Westwood, NJ 07675, (201) 664-3304

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The Southern New Mexico Commodore User's Group, David Selwyn, P.O. Box 4437, Uni. Park Brch, Las Cruces, NM 88001, (505) 522-7622

The Northern New Mexico Commodore Users Group, David Martinez, 2725 Camino Cimarron, Santa Fe, NM 87501, (505) 471-3110 evenings

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Folklife Terminal Club, John Krebs, P.O. Box 555-C, Bronx, NY 10475

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The Commodore Computer Club of Syracuse, P.O. Box 2232, Syracuse, NY 13220

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Mohawk Valley Commodore User Group, William A. Nowak, P.O. Box 343, Tribes Hill, NY 12177, (518) 829-7576

Utica Commodore User Group, Phil Rothstein, 1801 Storrs Ave., Utica, NY 13501, (315) 733-2244

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Corpus Christi Commodores, Bob McKelvy, P.O. Box 6541, Corpus Christi, TX 78411, (512) 852-4426

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64 User Group, P.O. Box 801828, Dallas, TX 75380, (214) 239-7665

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Lubbock Commodore Users Group, Robert Massengale, 3817 64th Drive, Lubbock, TX 79413

BiStone Users Club, R.G. Gore, P.O. Box 386, Mexia, TX 76667, (817) 562-6808

The Users, Brad Lewis, 209 Altavista, Rockwall, TX 75087, (214) 722-9774

Commodore (Houston) User Group (CHUG), Mary and John Howe, 23502 Creekview Drive, Spring, TX 77379, (713) 376-7000 (713) 721-8542 (tape-recorded meeting info)

The Woodlands Commodore Users Group, Andrew Gardner, 3 Splitrock Rd., The Woodlands, TX 77380, (713) 292-8987

Crossroads Commodore Users' Group, Jerry Guy, 417 Irma Drive, Victoria, TX 77901, (512) 575-0342

Heart of Texas Commodore Home User Group (HOT CHUG), Lt. Mike Stuff, 2100 N. New Rd., Waco, TX 76710

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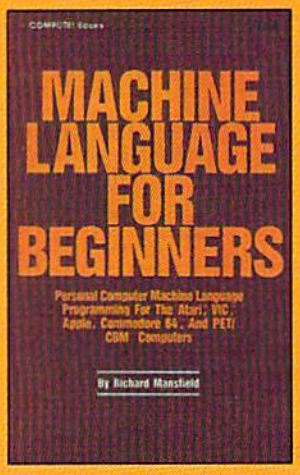

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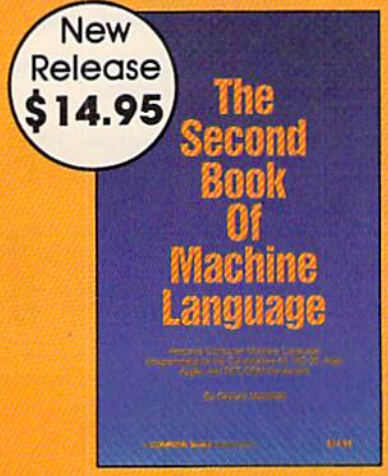

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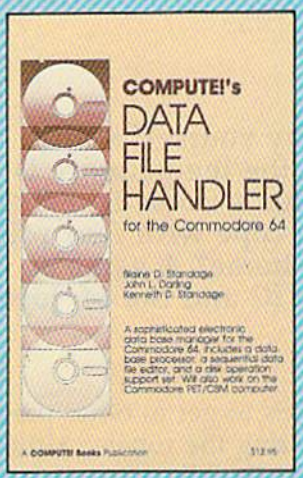

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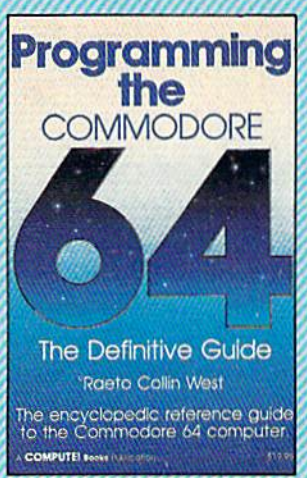

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Playing For Time

The object of the game is to survive as long as possible. Or you can play for high score. Littered about the factory are solid ice cubes, used regularly by the research team. These cubes are your only means of defense. You can temporarily "freeze" any of the robots by sliding an ice cube in their direction. On contact, they'll freeze, but unfortunately, they thaw a second later. You also have to avoid them (remember—they're semi-intelligent and they'll pursue you if they see you). Using a joystick (port 2 on the 64), move to a side of the cube and aim the joystick in the direction you want to send the cube (no need to press the fire button). Your strategy should include moving cubes to get to other parts of the playfield and freezing the robots. Although it's very difficult, it is possible to box in a robot by strategically placing cubes around it.

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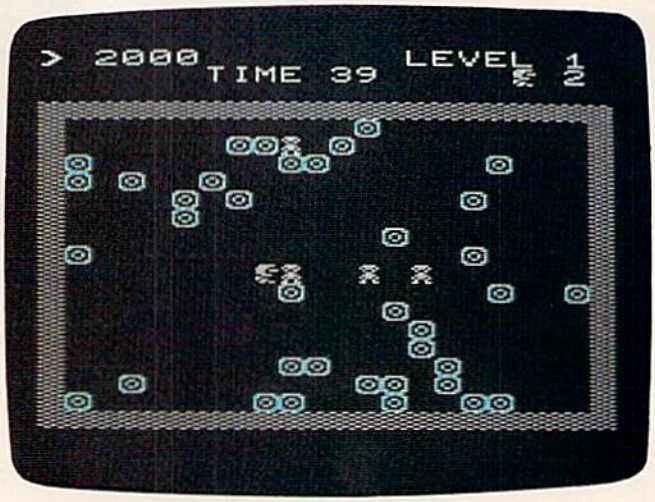
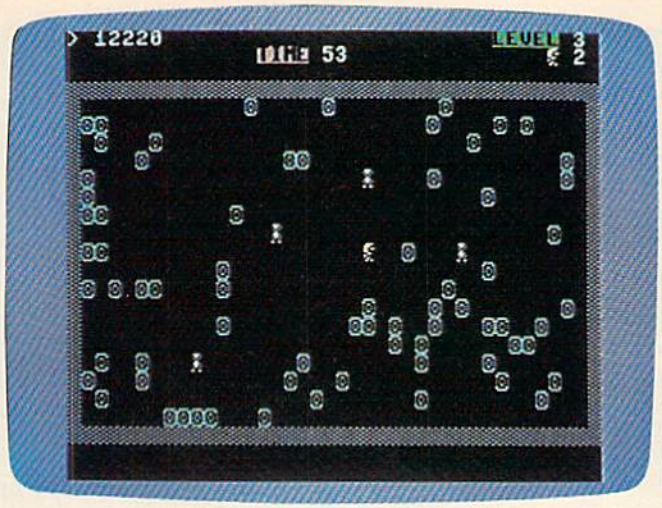


Confronting a robot (VIC version).



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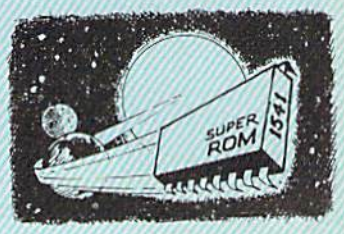

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This Disk has over 100 routines, some of them are routines for protection, smooth scrooling, modem routines, and sound and color routines. They can easily be incorporated into all of your programs. It is also fully documented.

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Squares

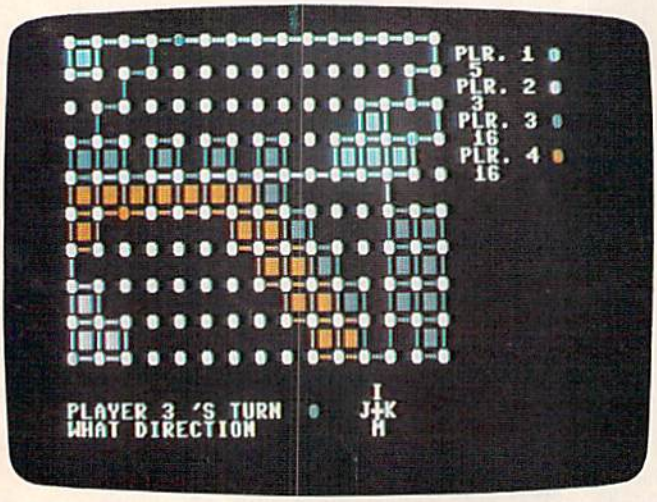
Douglas Fish

Teach your snake well: It will remember each move you make as you try to conquer the board with your squares. A strategy game for one to four players. For the Commodore 64.

At first glance, "Squares" looks a lot like "Dots," the paper and pencil game where opponents take turns connecting dots to try and complete squares. And, as in the paper game, the basic objective is to complete more squares than your opponents. But the similarities end there—in Squares, the dots are connected by an intelligent "snake," which you control.

After loading and running Squares you are asked if each of the four snakes will be player controlled or computer controlled. Moves for the player controlled snakes are entered via the keyboard; the computer snakes move around semi-randomly.

You can move your snake up, down, left, or right by pressing the I, M, J, or K keys respectively (as a reminder, the directions are printed on the screen during the game). When you move your snake between two dots, it leaves a trail in the color of your player.



Players 3 and 4 are tied for the lead, but orange (player 4) is caught in a loop.

With each move you make, you "train" your snake to move in a certain way, depending on the pattern of trails around it. For example, say there are trails to the left of and below your snake, and you move it up. From then on, whenever your snake encounters a pattern in which there are trails to the left and below it, it will move up.

If the snake encounters a pattern it hasn't learned yet, as when you first start the game, it will ask you for a direction. Again, the direction you choose will train the snake for that pattern.

Trapped Snakes

A snake can become trapped, though, if you give it an instruction which forms a loop with a previous instruction. For instance, say you tell it to go right, but when it moves right it enters a pattern where it has been instructed to move left. It then becomes trapped between those two instructions. A trapped snake can be released later, however, if the pattern it's in is changed by another snake.

When your snake completes a square, it fills in with your color, and you earn a point. The game is over when all of the squares are filled or all of the snakes are trapped. Whoever completes the most squares wins the game.

There are a number of strategies you can develop for conquering long rows of squares or avoiding getting trapped. You may find, though, that it's difficult to remember how your snake has been trained for each possible pattern of trails. Also, each game that you play will be unique, so what works for one game may get you trapped early on in the next. Usually, it's a combination of strategy and chance that wins the game.

See program listing on page 133.

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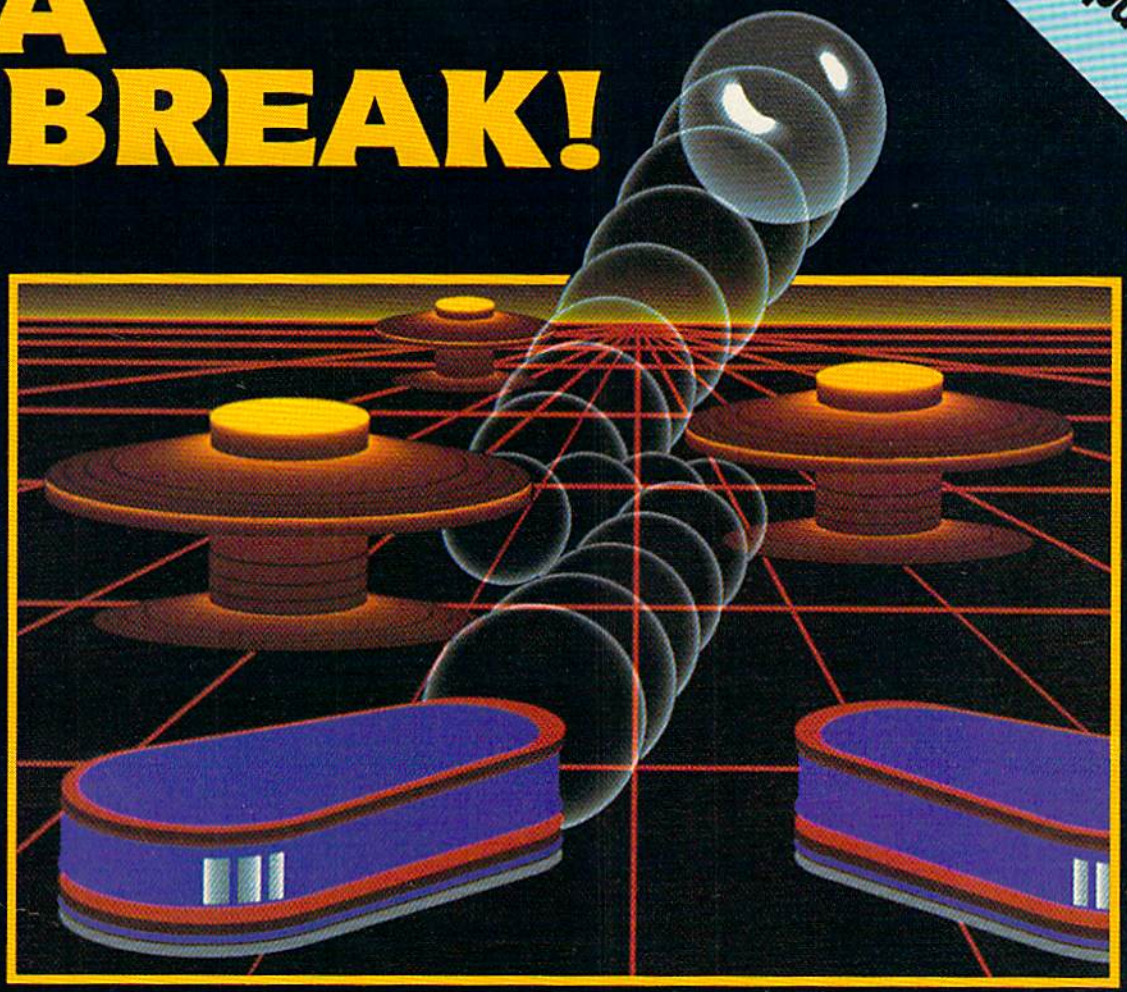

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Real World Software

Part 2: A Survey Of Recent And Upcoming Products

Fred D'Ignazio, Associate Editor

What Is Real World Software?

Last month I introduced the concept of real world software: programs that give an immediate, direct, tangible, and visible benefit to a person's daily life.

This month, we'll look at 106 products for the Commodore 64 that most closely resemble my definition of real world software. After we look at programs now available, I'll tell you my "wish list" for real world software I'd like to see on the Commodore 64.

Biology And Medicine

The Body Transparent (DesignWare) is a variation of the popular "Visible Man" and "Visible Woman" kits. *Creature Creator* (DesignWare) and *Mail Order Monsters* (Electronic Arts) let you play Dr. Frankenstein and assemble your own monsters from different body parts. *Fantastic Animals* (Bantam) and *Operation: Frog* (Scholastic) let you build real animals. *The Incredible Laboratory* (Sunburst) is a monster-building chemistry set.

These programs qualify as real world software because some of them teach anatomy, physiology, and biology; and because all of them teach valuable logic and problem-solving skills children can apply to other areas of their lives.

College Success

This is one of the most obvious real world categories. My choices are *Mastering The SAT* (CBS), *SAT Exam Preparation* and *ACT Exam Preparation* (Krell), *The Perfect Score: SAT Preparation* (Mindscape), and *Lovejoy's SAT & College Preparation Guide* (Simon & Schuster). Studies show that these programs have a direct real-world effect: They help students improve their scores on college aptitude and achievement exams.

Communication

This category includes programs people use as communication tools. All of them are "productivity tools," but I chose them because they're intended primarily for children and other beginning computer users, and because they combine the power of a valuable tool with ease of use. Also, they open up new ways for people to communicate with one another.

SkiWriter II (Prentice-Hall) lets you compose letters and easily send them over the telephone to another person as electronic mail. Penguin's *Graphics Magician* lets you create electronic greeting cards. *Bank Street Writer* (Brøderbund), *Cut & Paste Word Processor* (Electronic Arts), *Mastertype's Writing Wizard* (Scarborough), and Sierra's *Homeword* (with *Homeword Speller)* are excellent, easy-to-use word processors. I also highly recommend *Easy Graph* (Grolier) and Scholastic's *PFS:Report* and *PFS:Write*.

Communication Success

These software packages teach reading, writing, and typing skills. *MasterType* (Scarborough) and *Typing Tutor III* (Simon & Schuster) teach typing. *Magic Spells* (Learning Company) and *Reader Rabbit* (Learning Company) improve young children's vocabulary and reading ability. *Reading Professor* (Commodore) and *The Devil & Mr. Webster* (Krell) teach reading skills to older children and adults. *Grammar Examiner* (DesignWare) and *Grammar, What Big Teeth You Have* (Krell) teach writing and language arts skills to children ages ten and up. And *Welcome Aboard* (Brøderbund) uses Muppets to teach computer literacy.

Crafts

The only program in this category, *Mask Parade* (Springboard), enables children to design and print out their own paper "dress-up" costume, including a hat, face, jewelry and accessories, and feet. They can then color it with paint, crayon, or Magic Marker, and assemble it with glue or string.

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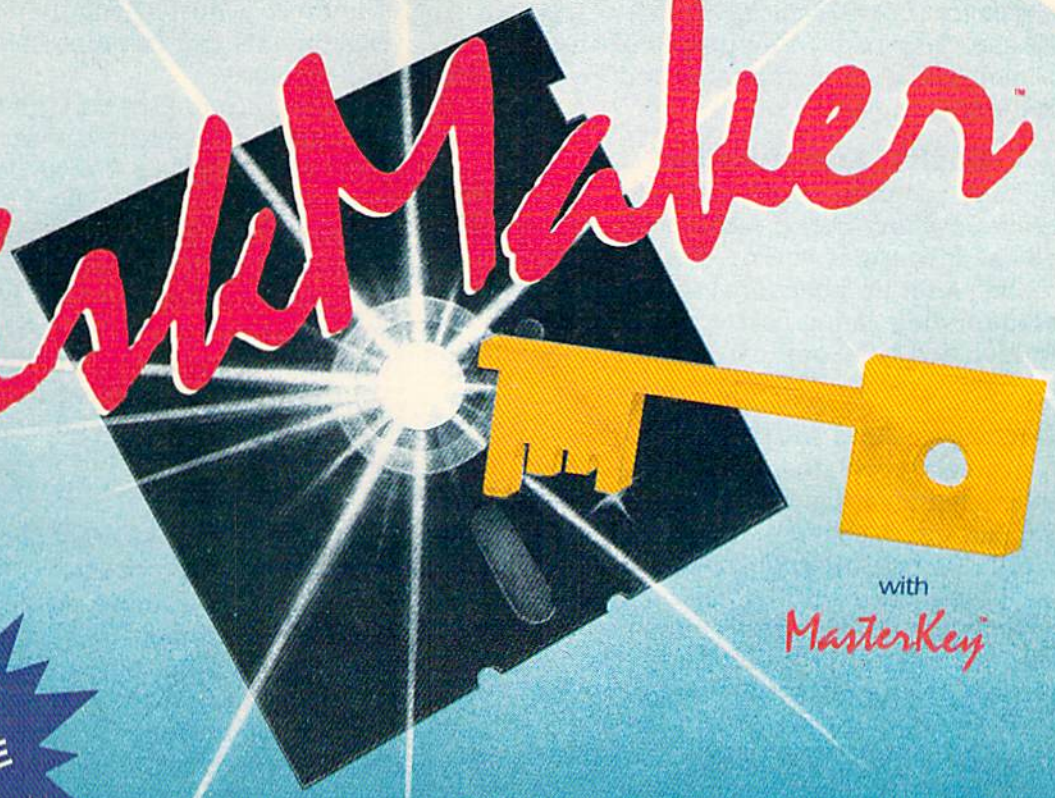

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Dance/Exercise

These programs—*Dance Fantasy* (Fisher-Price), *Breakdance* (Epyx), *Dancing Bear* (Koala), and *Aerobics* (Spinnaker)—let people of all ages choreograph their own dances and exercises and set them to music.

Diet, Health, And Nutrition

The only program in this category, *The Original Boston Computer Diet* (Scarborough), is appealing because it counsels you on diet and nutrition, and helps set up a personal weight-loss regimen based on diet, eating habits, moods, and behavior. Included is a book with readings on nutrition and diet.

Geography And Map-Reading

This category contains programs that teach with challenging games and adventure scenarios. Children can travel through outer space with Mickey Mouse (*Mickey's Space Adventure* from Sierra) and Winnie the Pooh (*Winnie the Pooh in the Hundred Acre Wood*, also from Sierra). *America Coast to Coast* (CBS) features a special plastic keyboard overlay that enhances game play.

Road Rally USA (Bantam) challenges children to map their way from point to point across the U.S. while overcoming hazards and obstacles. And *States & Traits* and *European Nations & Locations* (DesignWare) enables parents and children to make their own lessons on U.S. and European geography.

Hobby

The only program in this category, *Charles Goren: Learning Bridge Made Easy* (CBS) teaches an older child or adult how to play bridge.

Invention And World Builders

These two categories feature open-ended "mad scientist's laboratories" that encourage you to experiment. *Pinball Construction Set* (Electronic Arts) lets you create a pinball machine that operates under new laws of physics. *Rocky's Boots* (The Learning Company) lets you build electronic circuits out of logic gates. In *Chem Lab* (Simon & Schuster) you get to perform over 50 experiments and combine chemicals a thousand different ways.

The Factory (Sunburst) lets you build your own factory. In *Racing Destruction Set* (Electronic Arts) you design your own slot cars, then test your designs by racing them. In *The Great Gonzo in Word Rider* (Simon & Schuster) you help Gonzo the muppet rescue his favorite chicken, Camilla, by using "power words" to construct all sorts of marvelous vehicles to find Camilla. In *Creative Contraptions* (Bantam) you get to build your own Rube Goldberg machines. *Dream House* (CBS) lets you design and build your own house; and *Kids at Work* (Scholastic) lets you be architect and construction crew foreman.

Math Success, Money Management, And Professional Success

The programs in these categories teach math, money management, decision-making, problem-solving, and other practical skills. Many of the programs do this by handing you a tough but exciting job and saying, "Here, you handle this!" But they're not without lots of helpful hints and clues from the programs.

I selected the four Math Success programs because they contained several real world software features. For example, *Success with Math* (CBS) is really a *curriculum* of math programs, each sold separately for $24.95. The programs are for adults and children ages six and up.

Math/Spelling Teacher (CompuTech) offers excellent feedback on how well you're learning math and spelling. It takes a pedagogically sound, step-by-step approach to teaching math concepts and better spelling habits.

Mission: Algebra (DesignWare) is included because, for the first time, I saw some use to learning algebra. I was set down in an interstellar spaceship and told to rescue a stranded ship. To

Companies That Publish Real World Software For The Commodore 64

Alfred Publishing
15335 Morrison Street
Sherman Oaks, CA 91403
(818) 995-8811

Bantam Electronic Publishing
666 Fifth Avenue
New York, NY 10103
(212) 554-9822

Brøderbund
17 Paul Drive
San Rafael, CA 94903-2101
(415) 479-1170

CBS Software
One Fawcett Place
Greenwich, CT 06836
(203) 622-2673

Commodore
1200 Wilson Drive
West Chester, PA 19380
(215) 431-9100

CompuTech
P.O. Box 7000-309
Redondo Beach, CA 90277
(213) 375-6391

DesignWare
185 Berry Street
San Francisco, CA 94107
(415) 546-1866

Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
(415) 571-7171

Epyx, Inc.
1043 Kiel Court
Sunnyvale, CA 94089
(408) 745-0700

Fisher-Price
One Kendall Square
Cambridge, MA 02139
(617) 494-1200

Groller Electronic Publishing
95 Madison Ave.
New York, NY 10016
(212) 696-9750

Koala Technologies
2065 Junction Avenue
San Jose, CA 95131-2105
(408) 946-4483

Krell
1320 Stony Brook Road
Stony Brook, NY 11790
(800) 245-7355

Mindscape
3444 Dundee Road
Northbrook, IL 60062
(312) 480-7667

Penguin Software
P.O. Box 311
Geneva, IL 60134
(312) 232-1984

Prentice-Hall
P.O. Box 819
Englewood Cliffs NJ 07632
(201) 592-2641

Scarborough Systems
25 North Broadway
Tarrytown, NY 10591
(914) 332-4545

Scholastic
730 Broadway
New York, NY 10003
(212) 505-3497

Sierra On-Line
Sierra On-Line Building
Coarsegold, CA 93614
(209) 683-6858

Simon & Schuster
1230 Ave. of the Americas
New York, NY 10020
(212) 245-6400

Spinnaker Software
One Kendall Square
Cambridge, MA 02139
(617) 494-1200

Springboard
7807 Creekridge Circle
Minneapolis, MN 55435
(612) 944-3912

Sunburst Communications
39 Washington Avenue
Pleasantville, NY 10570
(800) 431-1934

The Learning Company
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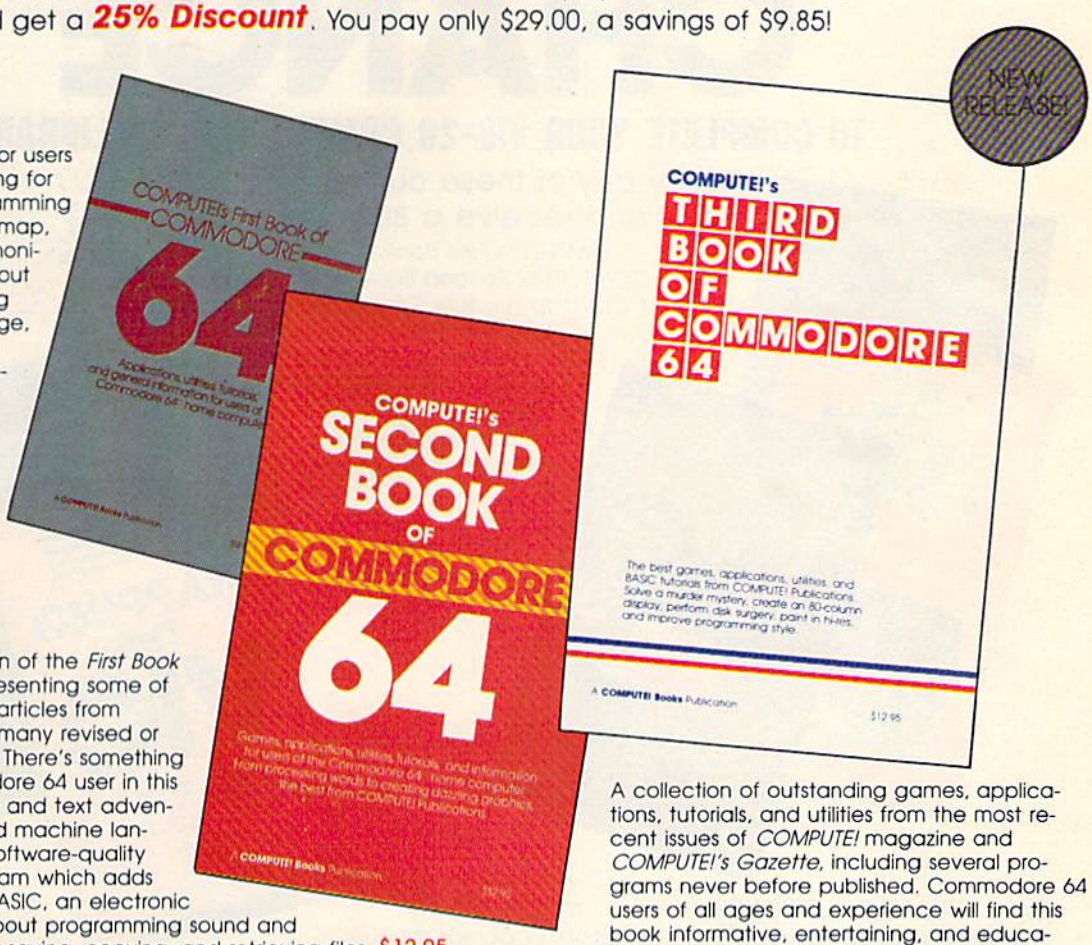

An excellent resource for users of the 64, with something for everyone: BASIC programming techniques, a memory map, a machine language monitor, and information about writing games and using peripherals. This 264-page, spiral-bound book includes many ready-to-type-in programs and games. $12.95

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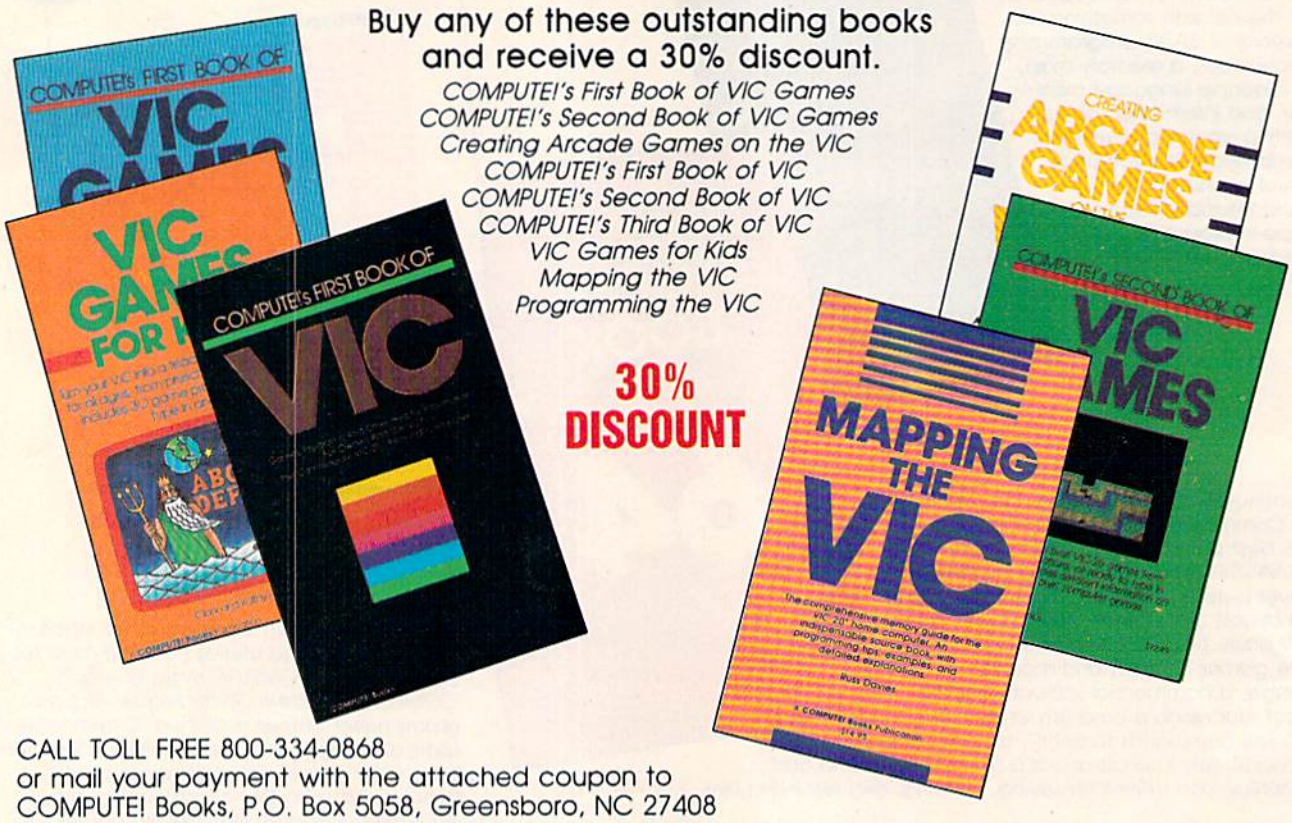

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get there, I had to use algebra..

Survival Math (Sunburst) is included because it consists of several real world simulations in which you apply math skills to everyday life.

The Money Management programs are in the same vein. *Tink's Subtraction Fair* (Mindscape) and *Donald Duck's Playground* (Sierra) teach younger children how to budget, count, and manage money.

Older children and adults can become chief executive officers of the *Whatsit Corp* (Sunburst) and manage its rising and falling fortunes. And *HomeWord Money Manager* (Sierra), *The Financial Cookbook* (Electronic Arts), *JK Lasser's Your Personal Money Manager* (Simon & Schuster), and *JK Lasser's Your Income Tax* (Simon & Schuster) act as "teaching tools" to help you structure, budget, and manage your finances.

The Professional Success programs include two excellent model railroad simulations—*Trains* (Spinnaker) and *Railroad Works* (CBS)—and *National Teacher Exam* (Krell), a preparation program, and *President's Choice* (Spinnaker), a challenging game in which you run the country as president.

Music

All the programs in this category attempt to teach music theory and encourage original composition. But, let the buyer beware: They are not the ultimate music teacher for adults or children. But they are a good start.

Song Maker (Fisher-Price) is notable because it's an introduction to music composition for very young children (ages four to eight). *The Music Shop* (Broderbund), *Music Construction Set* (Electronic Arts), *Bank Street MusicWriter* (Mindscape), and *Songwriter* (Scarborough) are all "teaching tools"—musical word processors with guidelines on how to compose your own music.

Rock 'N Rhythm (Spinnaker) lets you to create music in a studio environment. And *Notable Phantom* (DesignWare) places you in a musical adventure.

Three programs from Alfred Publishing (*Music Made Easy, Practical Music Theory,* and the *Music Achievement Series*) come the closest to being a real music teacher. They are the software versions of Alfred's popular theory and composition workbooks, and diagnostic evaluations.

Organization, Planning, Reference, And Scientific Method

The programs in these four categories are similar in that they all enhance the way you *think.* The database programs in the Organization category—*Friendly Filer* (Grolier), *Phi Beta Filer* (Scarborough), *Homeword Filer* (Sierra) and Scholastic's *Secret Filer* and *PFS:FILE*—are not just electronic card files. They are keys to new ways of thinking about information. With these programs you can use the computer to juggle facts the way you shuffle a deck of cards. They let you sort facts, cross reference them, "hide" them, prioritize them, list them, and compare them, all in a few seconds.

You can buy prerecorded databases for use with two of the programs—*Friendly Filer* and *PFS: File*—on important school subjects.

The Planning program, *Educalc* (Grolier), the Reference program, *Mastertype's Facts & Figures* (Scarborough), and the Scientific Method program, *Survey Taker* (Scholastic) let you play with numbers the way you play with facts using the database programs.

Outer Space, Weather, And People Skills

The programs in these three categories encourage learning valuable skills and knowledge and immediately applying them in the outside world. For example, *Halley Project* (Mindscape) puts kids at the control of a spaceship, teaches them how to navigate the solar system, and how to rendezvous with Halley's Comet (coming in early 1986).

Sky Travel (Commodore) is a miniature planetarium inside your computer and a "roadmap" to the heavens. My nine-year-old daughter, Catie, and I use it to find stars, planets, and constellations. I also recommend *Interplanetary Pilot* from CBS.

One of the weather programs, *Forecast!* (CBS), has taught Catie and me how to set up our own weather station and make forecasts. Another excellent choice is *Weather Tamers* from CBS.

Last, the People Skills program, *Many Ways to Say I Love You* (CBS), is the first program from Mr. Rogers' Neighborhood. It lets parents and children (ages 4 and up) construct and send text-and-animated-picture greeting cards with personalized messages.

Story Maker And Print Shop

The programs in these two categories are some of the most wonderful and rewarding I've found. They let you create your own newsletters, newspapers, stickers, buttons, books, greeting cards, cartoons, plays, and animated picture-and-text adventure stories. Many of the programs are accompanied by ideas-and-activities books and by extensive print materials. And the companies offer supplementary packages with extra materials for new projects.

These are true teaching tools. They guide you with suggestions, activities, adventures, and tutorials. Then, when you're ready, they turn you loose to create imaginative projects on your own.

The Story Maker category includes *Build-a-Book* and *Build-a-Book Refill Kit* from Scarborough; *Just Imagine* from Commodore; *Bank*

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* See Page 13

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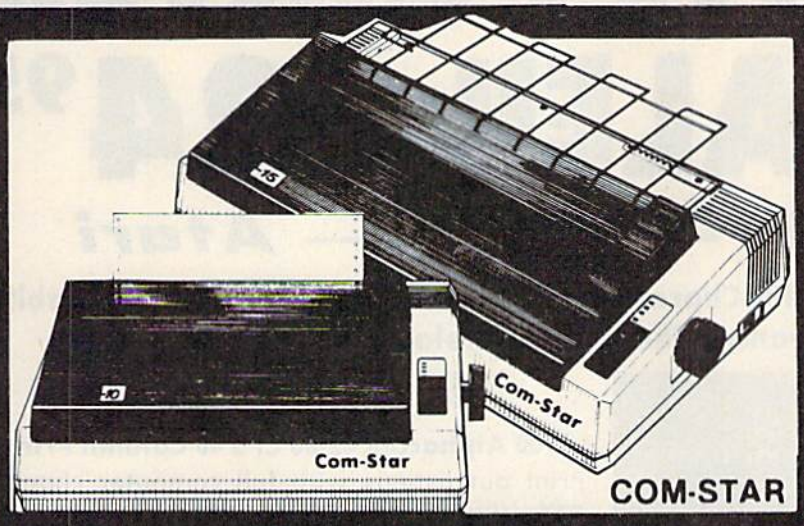

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Has all the features of the 10X COM-STAR PRINTER plus 15½" carriage and more powerful electronics components to handle large ledger business forms! (Better than Epson FX 100). List $599. **Sale $319.00.**

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COM-STAR PLUS+ Print Example: ABCDEFGHIJKLMNOPQRSTUVWXYZ ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890

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Commodore 64 — VIC 20 — Atari

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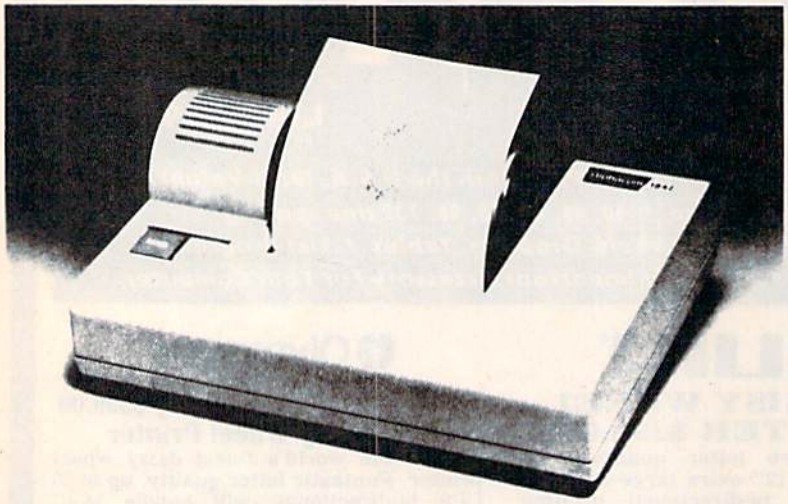

3100 Alphacom 42-80 CPS 40 Column Printer
Print out listings with full computer character sets (interface required, see below). Print in upper and lower case. Comes with a roll of paper and all power adapters needed. Perfect for a spare printer or program lister. List $99.00. **Sale $24.95.**

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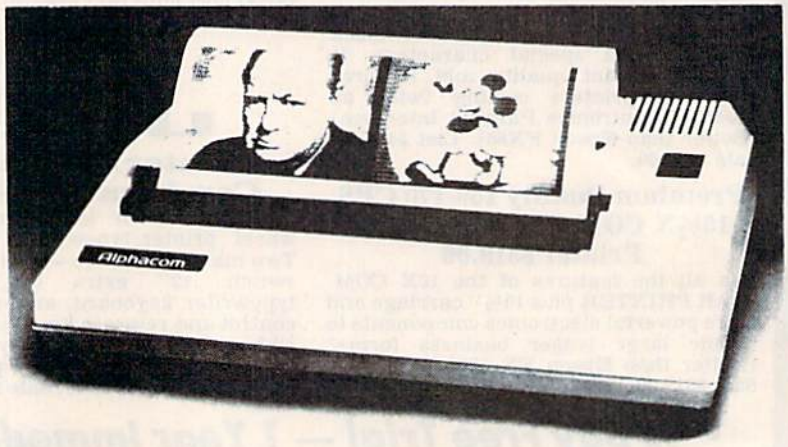
Now you can have a printer for the cost of a large box of paper. This printer prints in upper and lower case with true lower descenders. Comes with 1 roll of paper and power adapter. With the intelligent interfaces (sold below) you can do Ascii graphics as well as Atari or Commodore graphics. Plus you can do underlining and expanded modes. Print out pictures, program listings, word processing pages, etc. Perfect for the student or homeowner. List $199.00. **Sale $39.95.**



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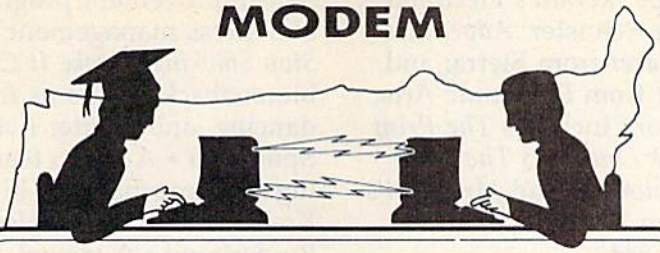
Commodore 64 MODEM

Sale



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Street Storybook, *Show Director*, and *Mr. Pixel's Cartoon Kit* from Mindscape; *Kermit's Electronic Story Maker* from Simon & Schuster; *Adventure Master* from CBS; *Story Maker* from Sierra; and *Adventure Construction Set* from Electronic Arts.

The Print Shop category includes *The Print Shop Graphics Library (Disk One)* and *The Print Shop* from Brøderbund; *Color Me* and *Mr. Pixel's Programming Paint Set* from Mindscape; and *News Room* from Springboard.

Fred's Wish List

These 106 programs are just the tip of the iceberg of a new genre of real world software. Here are some programs now available on other computers that I'd like to see really soon on the Commodore 64:

• A paper airplane construction kit (Simon & Schuster) • *Make Millions* (Scarborough), a factual simulation that challenges you to go from rags to riches while managing everything in real time • Self-improvement programs like diet, nutrition, and stress management programs from Bantam; *Stop Smoking!*; *Make It Click* (using seatbelts); and biofeedback programs from Sunburst • Nutrition, dancing, and "better living" programs from Spinnaker • A piano teacher from Alfred Publishing • Diagnostic tools in math and reading from Krell • A hardware/software science tool kit from Brøderbund • A factual, around-the-world mystery game from Brøderbund that comes with a copy of *The World Almanac* • *Keys to Responsible Driving* from CBS • *Robot Odyssey I* (a robot and microchip construction set) from The Learning Company • *Remember!*, an amazing study aid and homework planner for high school students from DesignWare • *Get Organized!* (Electronic Arts) and *SkiWriter II* with *Mail/Merge* (Prentice-Hall), two easy-to-use, low-cost organizing and communications tools.

Character Assassination

Kent Brewster

This short, easy-to-type-in program can help children and computer newcomers learn their way around the keyboard. Both letter and number recognition are taught. For the VIC and 64.

Quick, where's the Z? Letters and numbers are dropping from the sky, and only by pressing the correct key can you save the city below.

"Character Assassination" is a typing tutorial suitable for almost any age and skill level. It's especially helpful to those learning the keyboard, but can be good practice even for those with some experience.

Preventing Disaster

After typing in the program, type RUN. You are then asked to select a speed. There are ten choices (0–9), with 0 as the slowest and 9 the fastest. After making a choice, be prepared to begin immediately. A multicolored city appears at the bottom of the screen, and your job is to prevent its being destroyed. A random number or letter falls whining from the top left of the screen toward the city. If you press the correct key, it explodes and disintegrates. The next character begins falling one position from the right of the previous one, and so on, until 40 characters (22 for the VIC) have fallen. After the character in the rightmost column has fallen, the action continues back at the left side of the screen. Your score, at the top of the screen, increases according to the speed and accuracy of your response.

If a character reaches the city, it destroys a building with an ominous explosion. The game ends when the city has been destroyed.

After you begin playing, if you find that the level you've chosen is too easy or difficult, press RUN/STOP–RESTORE, then type RUN and select a new level. Student progress can be monitored by jotting down the level and previous high score.

Each version of Character Assassination is only 25 lines, so it can be typed in quickly. Those interested in the programming techniques will find the short listing helpful to study.

See program listings on page 132.

REVIEWS

Bank Street Music Writer

This screen-oriented music editor is designed for that large circle of computer owners who want to make music without getting bogged down in programming details. Many music editing programs are slow and tedious to use, requiring that you type in something like *V1* to choose a voice, *O4* for the octave, *F#* for the pitch, and so on. By letting you compose directly on the screen, *Bank Street Music Writer* makes computer music far more interactive, and less tedious.

The program's editing screen provides a crisp graphics display of the familiar musical staffs, with bass and treble clefs. To enter a note, you move a cursor to the correct spot on the staff, and press 4 for a quarter note, 2 for a half note, and so on. The effect is much like having a "musical typewriter." Each note is played and printed on the screen as soon as you enter it. The cursor then moves right, making it easy to enter a series of notes. Since the Commodore 64 has three voices, you're limited to three part compositions.

All music is displayed in conventional notation; each note, accidental, rest, etc., appears as it would in a piece of sheet music. Most features, such as triplets and dotted notes, are available; and in many ways, this program does with music what a word processor does with text. It's easy to replace or delete notes, copy or repeat whole passages, change waveforms, and review all or part of your work at any time. Finished compositions can be saved to disk for future editing or replay, or output to a printer (on properly configured systems). Since what you see is what you get, it's a snap to transcribe songs from sheet music, or print your own songs in standard form.

Serious musicians, however, may find this package somewhat limited. You can separately control the ADSR (attack, decay, sustain, release) parameters of each voice, but the 64's noise waveform can't be used at all, so true percussion effects are impossible. Nor do you have any way to use the 64's most advanced sound features (filtering, ring modulation, envelope following, etc.). Without filtering, you can use only the 64's standard, unmodulated waveforms; this sharply limits the number of available sounds. After using the program for a while, you may wish it were possible to create a convincing banjo twang, wah-wah effect, or whatever.

To be fair, many users won't miss the advanced features, and the program isn't intended for arcane sound effects, anyway. Termed a *notation*

editor by the publisher, *Bank Street Music Writer* is simply a convenient, well-crafted tool for composing what most people consider "real" music. Within the limits of that design, it performs very well indeed. Given its clear, well-organized instruction manual, practically anyone will be able to produce respectable music at the first sitting.

—Philip I. Nelson

Mindscape, Inc.
3444 Dundee Road
Northbrook, IL 60062
$49.95 (disk)

Allegro

This is a comprehensive music and sound effects package that attempts to harness virtually every feature of the 64's SID chip. The result is a program that's powerful, but rather forbidding in complexity. Its instruction manual contains 75 pages of detailed explanation, and the author warns that no one, not even experienced musicians or 64 programmers, should expect to master the system overnight.

To compose music with *Allegro*, you type statements in a language the author calls "Forte." Here's a short sample of Forte syntax from the instruction manual:

```
&1+ V1 O4 G D F F= D F
```

Once a composition has been entered, it must be compiled (condensed into more compact form), a process that takes only a few seconds for short songs. Then (and only then), the composition can be played. To make changes, you must recall the Forte file, type the corrections, recompile it, list it again, and so on.

In practice, this process is less difficult than it sounds, but the average user may find it tedious to compose music by such abstract methods. Unless you have perfect pitch (or a piano next to your computer), it's hard to know what note to enter next; and translating music from conventional notation into Forte syntax is laborious. Learning to write music with *Allegro* is much like learning to program in BASIC; beginners should

plan to spend a lot of time flipping back and forth in the instruction manual, and correcting the inevitable typing errors.

Needless to say, this type of program is not well suited to the casual or impatient user. Given the complexity of the 64's SID chip, any program that truly implements all its features is bound to be involved. Once you're familiar with the system, however, you can generate anything from a Mozart sonata, to "electronic" music or wholly nonmusical sound effects. Even better, your creations are portable: *Allegro* music or sound effects can be added to your own BASIC programs without significantly affecting BASIC. If you want to squeeze the most out of your 64's sound system, and have the requisite time and patience, this may be the editor for you.

—Philip I. Nelson

Artworx Software, Inc.
150 N. Main Street
Fairport, NY 14450
$39.95 (disk)

Sky Travel

Even though I've always had a special fascination with the night sky, my early ambition to become an astronomer took a back seat when I detoured into chemistry and, later, computers. I never developed more than a rudimentary knowledge of astronomy. But *Sky Travel* promised to change all this. It is billed as, "A Window to Our Galaxy. Learn About the Stars. Ages 12 & Up." But two questions come to mind. Would the program work and would it be the painless way for me to become an expert in astronomy?

Sky Travel comes as a package—a protected disk and entertaining manual (138 pages). The lengthy program does take a long time to load on a 1541 drive. Even though protected, it will load using an MSD drive or an IEEE drive and BusCard II.

The program opens with a view of the night sky as seen in Washington, D.C., at 4:15 a.m. on January 1, 1985. Looking south at an elevated angle of 60 degrees, you observe the outline of the constellation Leo. Your field of view is 72 degrees,

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approximately the angle of your peripheral vision. A number of other constellations and stars are also shown, some with lines joining the stars and others without.

I can read your thoughts. What if you want to look at the sky at a different place or time? You can—the program is replete with options like that and others. For example, the sky can be viewed at any time, date (9999 B.C. to 9999 A.D.), viewing angle, or place on earth. If you want to locate a specific celestial body, like the moon or Venus, the program will locate it for you and center it on the screen. Bothered by the constellation lines? No problem. Out they go. Need more information about prominent objects? Just ask the program, and a moving billboard-like display supplies you with additional data. The options are exercised with the keyboard and/or a joystick from a displayed menu.

In our limited space here, I can highlight only a handful of the many helpful options. One important addition is to allow a printout of the sky display on a Commodore printer (1525 or MPS 801) or emulator. A permanent record is always a nice plus. If you wish, you can make your own sky charts for your area of the country and use them during outdoor stargazing.

It doesn't take much to make your programs run up to 20 times faster.

If you've been writing programs for your Commodore 64, Apple IIe or Apple IIc in BASIC you can take a giant step forward in speed of execution and in programming productivity for just $49.95.

You can get program performance that you only thought possible from machine language programs. While still using a powerful, understandable high-level language. A language that's similar to Pascal, but much easier to learn and use.

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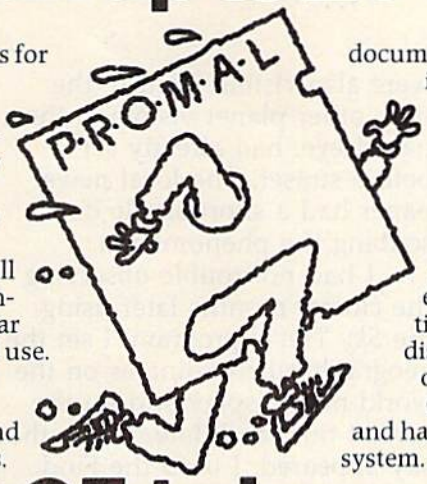
And when you compile your programs, you have a fast one-pass compiler, a recursive descent compiler that can compile a 100-line source program in 10 seconds or less.



$49.95 to be exact.

PROMAL™ also gives you an elegant operating system "Executive," which includes powerful file, program and memory management commands and even I/O redirection.

You get all of that with PROMAL–improved programming productivity, faster compile and run time and power that you may never have thought possible.

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Whether you are just beginning to write or are an experienced programmer, you can be more productive with PROMAL (**PRO**grammer's **M**icro **A**pplication **L**anguage). It's easier to learn than Pascal, C or Forth. It provides you with a full range of powerful structured statements like IF-ELSE, WHILE, REPEAT, FOR and CHOOSE. And, because indentation is part of the language's syntax, it helps you write programs neatly and logically. There are no line numbers to worry about, and since comments don't take up memory space, you can document your programs completely.

COMMODORE 64 BENCHMARK

(Sieve of Eratosthenes)

	PROMAL	BASIC	COMAL	FORTH	PASCAL
Execution Time (secs.)	**30**	630	490	51	55
Object Code Size (bytes)	**128**	255	329	181	415
Program Load Time (secs.)	**3.2**	3.8	6.3	11.2	23.5
Compile Time (secs.)	**8.5**	–	–	3.9	108

PROMAL–a language especially for small systems.

Unlike languages developed for larger systems and squeezed into small systems environments, PROMAL was conceived and developed specifically for the small system. With PROMAL there's finally a language created for the environment in which you work.

Speed up your programs and step up your programming productivity.

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The manual discusses several examples which the new user can try. However, I prefer to use my own as this may give a less biased review. I chose two examples: One, to confirm an unusual arrangement of the planets which occurred recently where I live. Two, to observe again an eclipse of the sun which I remember seeing 15 years ago.

On November 25, 1984, just after sunset in the area where I live, there was an unusual arrangement of four planets around a crescent moon. Three of the brightest natural objects in the night sky (the moon, Venus, and Jupiter) appeared as a brilliant triangle. In addition, Mars and Mercury were also visible. Saturn, the only other planet visible to the naked eye, had already set before sunset. The local newspaper had a short article describing the phenomenon.

I had no trouble observing the cluster months later using the *Sky Travel* program. I set the geographical coordinates on the world map display and set the correct time and date. When the sky appeared, I used the Find command to center the crescent moon on the screen, and there was the cluster almost exactly like the newspaper figure. The only points of difference were that in the *Sky Travel* display, Venus and Jupiter were too close to be resolved, only Jupiter appeared, and the stars and constellations were shown. *Sky Travel* had successfully passed its first test.

On March 7, 1970 my family and I watched a spectacular natural phenomena, a total solar eclipse. At first we watched indirectly using pinholes in paper. Around noon, the moon started its slow journey across the face of the sun. At approximately 1:30 PM, totality was reached, the center of the sun was completely blocked.

I wondered, could *Sky Travel* simulate this memorable event? I set the parameters for the correct date, place, and time. For this example, I had the program scan the clock slowly around the point of totality. The moon slowly swallowed the sun; the sky became like twilight; at totality, the sky was dark. The display showed other features besides the eclipse that I would have looked for if I had this program at that time. For example, Venus was probably visible up and to the left of the moon. *Sky Travel* had successfully passed its second test.

I don't like to be too lavish with my praise, as one might doubt my credibility as an objective reviewer. However, I cannot imagine a better program of this kind. Is it possible that a Commodore 64, a "low end" computer, can do the calculations necessary to predict the night sky thousands of years on either side of the present? Surely this would require a large mainframe costing thousands of times more.

The answer is simple: *Sky Travel* can and does do these predictions in a reasonable amount of time. I verified this by trying the above examples

and several others besides. All the examples worked to my satisfaction, but a friend who is an expert in astronomy did find a minor error—the crescent moon was not lined up at the proper angle with the sun. Nitpicking aside, the program performs admirably.

The second question I had was more difficult to answer. Would this program make me or anyone else an expert in astronomy? As the question is phrased, I don't think so. However, if you do the examples carefully, you can learn a great deal about this subject. And, if you print off sky charts and use them, you'll see things in the night sky you missed before. Not an expert, perhaps, but certainly an educated layman.

If you or anyone you know has the slightest interest in astronomy, run out and buy this program. Lavish praise indeed, but, in my opinion, justified.

—Harvey B. Herman

Commodore Business Machines
1200 Wilson Drive
West Chester, PA 19380
$34.95 (disk)

Raid Over Moscow

Raid Over Moscow may do nothing for U.S.-Soviet relations, but it's an excellent arcade-style strategy game very much in the tradition of *Beach-Head*, an earlier bestseller from Access Software. The basic premise is a nuclear-age nightmare which you must stop: The U.S. has disarmed its nuclear arsenal following further strategic arms limitation talks (SALT IV) between the Soviets and the Americans. The Russians, fearing vulnerability, have hidden nuclear missiles in three Soviet cities—Leningrad, Minsk, and Saratov. Following an escalation of tensions, missiles are launched. Your mission is to destroy the launch sites before missiles reach American cities.

Many fast-action computer games challenge the player to master only one or two kinds of skills. Designer Bruce Carver has included no fewer than five different types of game play, all within the same scenario. Colorful, detailed graphics, well-designed sequences, and subtle strategic elements help make this a very engaging game.

The five game scenarios include piloting your stealth fighter-bombers out of an orbiting space station's hanger, making an attack run against the launch sites, firing at the missile silos, coordinating a commando's attack against the Moscow defense center, and finally trying to destroy the nuclear reactor. You are attacked every step of the way by tanks, missiles, fighter planes, and Soviet soldiers. You're even confronted in the final sequence by armed robots which you must destroy by

ricocheting a disc grenade off of the rear wall of the reactor room and hitting the unprotected back of the robot—four times! Throughout the game, the quality of the 3-D effects are impressive, as are the smoothly scrolling screens and the attention to detail.

One word of warning. Although most of the sequences depict buildings, trucks, tanks, and other objects being destroyed, the attack on the Soviet defense center graphically shows the bodies of soldiers falling to the ground when hit. Parents of young children may find such violence objectionable.

That having been said, it should be emphasized that *Raid Over Moscow* is well-designed and programmed throughout. Of great help is a demo mode which runs through the different sequences. You can take control of the game anywhere in the demonstration to practice your skills. *Raid Over Moscow* is in some ways like playing five different games in one. You'll enjoy the challenges.

—Selby Bateman

Access Software
925 East 900 South
Salt Lake City, UT 84105
$39.95 (disk)

SIMPLE ANSWERS TO COMMON QUESTIONS

Tom R. Halfhill, Staff Editor

Q A

Each month, COMPUTE!'s GAZETTE tackles some questions commonly asked by Commodore users and by people shopping for their first home computer. If you have a question you'd like to see answered here, send it to this column, c/o COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403.

Q. Is it wise to completely fill up a disk? Does that make the programs search and load any slower?

A. Filling a Commodore floppy disk to near-capacity does not significantly slow down the searching and loading process. That's because the disk drive does not have to search the disk *sequentially*, as the Datassette does when it searches for a file on cassette. The Datassette is hampered because files are stored end to end, one after the other. It must wind the tape past all the files at the beginning of the tape to find the ones that follow.

But on a disk, the files are stored in small pieces called *sectors*. All of the sectors are indexed by a *block allocation map*, or BAM. This map keeps track of which sectors on a disk are currently being used to store files. When you enter a SAVE command, the disk drive consults this map to find unused sectors where it can put your program. Then it writes the program name into the directory, with information about where the program was saved. If the program is longer than one block, the disk drive looks for another free sector and writes the second sector's address at the beginning of the first sector.

When you load a program, the disk drive searches through the directory, trying to match the name. When it finds a match, it also finds the location of the first sector and jumps there. The first sector points to the second, the second to the third, and so on. The drive jumps back and forth from sector to sector, reading the program and sending it to the computer. It ignores sectors which do not belong to the file. This method is called *random access*.

Since the disk directory is stored sequentially, it may take a fraction of a second longer to load a program at the bottom of the list. The disk drive has to first look at the program names at the beginning. But once the name is found, programs load at about the same speed.

Often, however, not all of the sectors belonging to a file will be contiguous. That is, the file may be stored in blocks of sectors which are scattered all over the disk. This system might seem illogical, but it's actually the most efficient way to use disk space. Otherwise, there would be gaps of unused space throughout the disk where you deleted short files. To keep from wasting this space, the disk drive saves pieces of longer files in the gaps and then keeps track of where everything is by using the sector pointers.

This means that a nearly full disk which has been heavily used (many files deleted and saved) *will* slow down the searching and loading process a trifle. You can hear this for yourself when the disk drive is loading a long file; if you listen closely, you'll notice the read/write head skipping from place to place as the drive accesses the scattered sectors. However, the slowdown is not significant—probably less than one second in total.

If you wanted, you could clean up a disk with many noncontiguous sectors simply by copying each file one by one to a fresh disk. But the labor involved probably wouldn't be worth

the second of loading time you might save. (Note that a copy program which duplicates a disk sector by sector would simply recreate the original disk, noncontiguous sectors and all.)

There is one way a full disk is significantly slower than a near-empty disk: when listing disk directories. Unlike most floppy disk systems, Commodore disks treat directories as program files—calling a directory is just like loading a program. (That's why the directory wipes out whatever program you had in memory, unless you're using a special utility such as the DOS Wedge.) A full disk usually has many more files, so the lengthy directory takes longer to load than a short directory.

But there's a more important reason why you should avoid filling a disk to capacity. We've noticed that full disks seem more trouble-prone than disks which aren't crammed to the gills, especially when the disks are swapped among several different drives. This is partly because data is recorded on a disk in 35 circular rings called *tracks*, starting from the edge and progressing toward the center. Commodore 1541 disk drives are sensitive to head alignment problems, and sometimes they have difficulty reading the innermost (or outermost) tracks. To be safe, we usually start with a fresh disk when a disk gets about 90 percent full.

Q. In a recent issue of COMPUTE!'s GAZETTE I saw an ad for the Commodore B128. The ad states that the unit is a 128K, 80-column computer with an 8050 dual disk drive that stores one megabyte. I have never seen these two items on the market. Is there such a model, and if so, why isn't it more popular? I would think that it would be. I would also like to know if there is any third-party support.

A. Yes, there is such a system as the Commodore B128 and 8050 dual disk drive. The advertisement correctly listed the specifications, too. Yet, it's also not unusual that you've never seen these models on the market. They have a rather odd history that dates back a couple of years.

At the National Computer Conference and Summer Consumer Electronics Show in June 1982, Commodore pulled out all the stops and announced a lineup of five new computers—ranging from a low-end videogame computer at $179 to a high-end business computer at $2,995. But as it turned out, only one of these computers ever made it on the U.S. market in significant numbers—the Commodore 64 (originally priced at $595).

Among the computers which never quite made it was the B128. As first announced, it had 128K Random Access Memory (RAM), expandable to 256K internally and 640K externally (896K total); a 6509 chip for the central processing unit (compatible with the VIC and 64's 6502/6510); the same SID synthesizer chip found in the 64; 80-column text mode, but no high-resolution color graphics; a built-in tilt-and-swivel monitor; built-in dual floppy disk drives; RS-232 serial and IEEE-488 parallel interfaces; a cartridge slot; Microsoft BASIC; detachable keyboard; and optional Z80 and 8088 microprocessor boards for CP/M and CP/M-86 compatibility. The tentative price was $1,695.

As you can see, this is similar but not identical to the B128 now being advertised (although a few of the original configurations have been reported in Europe). The built-in monitor and dual floppy disk drives have been subtracted, and the detachable keyboard has been combined with the system unit to form a one-piece console. The original keyboard layout (with a generous 94 keys) has been retained. The computer still has 128K RAM, but there's no mention of expandability or optional microprocessor boards. A few other specifications were changed, too.

To our knowledge, only about 20,000 B128s were ever manufactured, approximately 14,000 for the U.S. market. Essentially, the ad you've seen is a closeout sale. To make up for the missing monitor and disk drives, the advertiser is tossing in a separate monochrome monitor and Commodore 8050 dual disk drive. The 8050 is a very high capacity drive originally made for the Commodore PET series computers. It's much faster than a 1541 drive because it connects to the IEEE-488 port, a parallel interface (see last month's column). The advertised system also includes a Commodore 4023 printer and other miscellaneous items for a total price of $895.

Notice that this is about half the original list price for a B128. In fact, the original list price of the 8050 drive alone was $1,795. In terms of hardware, then, it's a hard deal to beat.

But remember that the B128 is not in production and only a relatively small number exist. Aside from the word processing and business programs offered by the advertiser, it's unlikely that any new programs will be developed by software publishers. The only alternative is to write your own, although we've heard that someone in Europe has a program that lets the B128 run most software developed for the Commodore PET 8032.

Consider if the available software is sufficient for your purposes, or if you can write the programs you'll need, before making a decision to buy the B128. If you happen to already have a PET, the deal might be worth it just for the 8050 disk drive.

Michael S. Tomczyk

GOTO And GOSUB:
Two "Messenger" Commands

I once had a good friend at Commodore who had a great way of introducing bad news. First he'd deliver the terrible news. Then when everyone went into a panic, he'd raise his hands in surrender and say, "Hey, I'm only the messenger—don't shoot the messenger!"

This month we're going to take a beginner's look at two BASIC commands that are sort of like messengers. The commands are GOTO and GOSUB, and they both tell the computer where to go.

The Indispensable GOTO Command

It's hard to write even a simple program without using the GOTO command. GOTO does just what it looks like it does—it tells the computer to *go to* a specific line in a BASIC program. You can use it to send the computer backwards or forwards to a *different* line in the program, or you can tell the computer to go back and repeat the *same* line. Here's a short example that makes the computer repeat the same line over and over in an endless loop:

```
10 PRINT "ENDLESS":GOTO 10
```

Enter this line, then type the word RUN and press RETURN. The computer responds by printing the word ENDLESS over and over in a continuous series called a *loop*. To stop the loop, press the RUN/STOP key.

In our example, we begin by printing the word ENDLESS on the screen. The colon (:) is always used to separate two or more BASIC statements used on the same program line.

The phrase GOTO 10 tells the computer to "go to line 10." Thus, when you run this line, the computer responds by displaying the word ENDLESS, then goes back to the same line and prints the word again, and keeps going back in an endless loop until you stop it.

Here's another version of the same example, with the GOTO command on a different line:

```
10 PRINT "ENDLESS"
20 GOTO 10
```

The GOTO command is also used in certain types of *counters*, as in this short example:

```
10 X=X+1: PRINT X;:FOR T=1 TO 100: NEXT
20 GOTO 10
```

Line 10 starts by defining X. If you did not previously give a value to X, it automatically equals 0. This is true of any variable. If we add 1 to zero, the new value is 1. Therefore, X=X+1 is

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the same as X=0+1, which is the same as X=1. So X=X+1 starts out by defining X as the number 1. Until it is redefined, the variable X is the same as the number 1.

PRINT X displays the value of X. Since X equals 1, the number 1 is displayed.

The semicolon (;) causes the numbers to display horizontally. If you remove the semicolon, the numbers will be displayed in a vertical column on the left edge of the screen.

The last part of the line (FOR T = 1 TO 100: NEXT) has nothing to do with counting. This section is a time delay loop which slows down the program. You can insert a FOR–NEXT loop almost anywhere in a BASIC program to slow it down. We used the time delay loop here so the computer pauses briefly after each number is displayed. Otherwise the numbers would zoom across the screen, too fast to read.

Line 20 contains the GOTO command, which sends us back to line 10. But this time when we go back to line 10, the variable X already equals 1, so when we add 1 to X, it's the same as adding 1 to 1. That equals 2, so on the second pass of the loop, PRINT X displays the number 2. The next time the program loops around, X increases to 3, then 4, 5, 6, and so on. That's how a *counter* works.

Don't forget—press RUN/STOP to break out of the counting loop.

Using GOTO To Repeat Programs

One of the most important uses of the GOTO command is in repeating a program or program section after it's run through. This requires that you set up some sort of signal or flag, which activates the GOTO command and repeats the program. Let's look at some different types of end-of-program repeat signals.

We've already been using the automatic repeat function by simply putting the GOTO at the end of the program. You can also cause a program to repeat a specified number of times by wrapping it in a FOR–NEXT loop. To do this, put the FOR part of the loop at the beginning of the section to be repeated and the NEXT command at the end of that section. Here's an example:

```
10 FOR X=1 TO 10
20 N=N+1
30 PRINT "{CLR}HOW MUCH IS 5 TIMES";X: IN
   PUT A
40 IF A=(5*X) THEN PRINT "CORRECT!": C=C+
   1: FOR T=1 TO 500: NEXT
50 IF A<>(5*X) THEN PRINT "WRONG-TRY AGAI
   N.": FOR T=1 TO 500: NEXT: GOTO 20
60 NEXT
70 PRINT C "CORRECT ANSWERS": PRINT " IN"
    N "TRIES"
100 REM: PROGRAM CAN END OR CONTINUE HERE
```

This program is a very crude educational drill which asks a student to multiply the number 5 times 1, 2, 3, and so on up to 10. You could dress up this skeleton program with sound effects, graphics, better spacing, etc., but we'll use it in its present form to demonstrate several programming techniques, including the GOTO command.

Line 10 begins with the FOR part of a FOR–NEXT loop. The loop ends with the NEXT command in line 60. Everything between the FOR and NEXT parts of the loop will be repeated ten times. This is important. You can cause a command or even a whole section of program to repeat or recycle several times by putting it inside a FOR–NEXT loop. You can increase or reduce the number of times the program repeats itself by changing the number 10 in line 10.

Line 20 is the counter which we just discussed. Remember, N starts with a value of 1 and increases each time the program cycles through.

Line 30 displays a prompt message and requests an input. The INPUT command automatically displays a question mark. Putting a semicolon at the end of the PRINT message causes the question mark to appear immediately at the end of the message—otherwise it would appear on the next line down. The answer which is typed in by the program user will be assigned by the computer to the variable A.

Lines 40 and 50 contain IF–THEN statements which set up two *conditions* and tell the computer how to respond. Line 40 prints the CORRECT message if the answer is right—in other words, if the typed-in answer (A) does in fact equal 5 times X. It also uses the variable C as a counter of the correct answers.

IF the answer does not equal 5 times X, THEN a WRONG message is displayed. Note that the "not equal to" sign is created by using the greater than (>) and less than (<) signs together as shown in line 50.

Both IF–THEN statements have a time delay loop at the end of the line, which leaves the message on the screen long enough to be read.

The message in line 50 also includes a GOTO command at the end of the line which, if the answer is wrong, sends the computer back to repeat line 20. This GOTO command causes the program to keep repeating until the user gets the answer right.

Line 60 contains the NEXT command, which wraps up the section we are repeating, and line 70 prints a report of the student's performance on the drill.

Line 100 does nothing in our example. You

can end the program here after it completes its ten repetitions, or you can continue the program. If you continued the program at this point by adding more lines, it will automatically continue after the question is asked the tenth time.

Before we go on, you may want to save the previous program on disk or tape, then type NEW and press RETURN to erase it from your computer's memory to get ready for the next example.

Combining GOTO And GET$

Another type of end-of-program signal allows the user to control whether the program is repeated or continued.

The following program demonstrates how to let the user repeat or continue a program just by pressing a single key.

```
10 PRINT "{CLR}TYPE A NUMBER AND": PRINT
   "PRESS RETURN": INPUT A
20 PRINT "TYPE A SECOND NUMBER": PRINT "A
   ND PRESS RETURN": INPUT B
30 FOR SP=1 TO 10: PRINT: NEXT
40 PRINT "HIT ANY KEY TO": PRINT "REPEAT
   THIS PROGRAM."
50 GET K$: IF K$="" THEN GOTO 50
60 GOTO 10
```

The important lesson here is that this program lets the user repeat the program by pressing any key on the keyboard.

Lines 10 and 20 are self-explanatory.

Line 30 uses a FOR–NEXT statement to insert ten blank lines—actually, it inserts ten PRINT statements, and using the PRINT statement by itself inserts a blank line on the screen when the program runs.

Line 40 contains a prompt message which tells the user what to do next.

Line 50 tells the computer to get a key—in other words, GET K$ tells the computer to watch for any key to be pressed. It follows this key-sensing command with an IF–THEN statement which tells the computer that if a key is *not* pressed, then go back to line 50 and keep looking. The double quotation marks with nothing in between mean "null" or "nothing." If a key is not pressed, then an endless loop is created and the computer keeps looking for a key to be pressed with no result. As soon as a key is pressed, however, the program drops through to the next line.

Line 60 contains a GOTO command because we want the program to repeat. If we wanted the program to continue instead of repeat, we would change lines 40–60 as follows:

```
40 PRINT "HIT ANY KEY TO": PRINT "CONTINU
   E."
50 GET K$: IF K$="" THEN GOTO 50
60 REM: PUT REST OF PROGRAM HERE
```

Using The GOSUB Command

If you want to jump to a line or section of your program and use that section several times, that's where the GOSUB command comes in handy. You can jump down and get a random number, for instance. Or a sound effect. Or even a time delay.

If you're using a lot of the same time delays in your program, you may want to use GOSUB to avoid having to repeat the entire delay loop every time. Here's an example that uses one of my favorite Hemingway quotes:

```
10 PRINT "{CLR}COURAGE": GOSUB 100
20 PRINT "IS": GOSUB 100
30 PRINT "GRACE": GOSUB 100
40 PRINT "UNDER": GOSUB 100
50 PRINT "PRESSURE": GOSUB 100
60 END
100 FOR T=1 TO 400: NEXT: RETURN
```

This example prints each word, then uses the GOSUB command to jump down past the end of the program to line 100 which contains a FOR–NEXT time delay loop. The line (or lines) that the GOSUB jumps to is referred to as a *subroutine*. The RETURN command at the end of the subroutine in line 100 sends the computer back to continue where it left off. Thus, in this program, the computer prints a word, jumps down to the time delay, jumps back for the next word, and so on until the program ends in line 60.

Although the END statement is usually optional, it's necessary in the program above. To see why, delete line 60 and run the program again. After the last word is printed, the computer will crash with a ?RETURN WITHOUT GOSUB ERROR message. This happens because after the computer finishes executing the main part of the program at line 50 it moves into the subroutine at line 100, even though you don't really want line 100 to be executed at that point. You must always have an END or some other statement to separate your subroutines from the main part of your programs.

Here's another example involving random numbers:

```
10 PRINT "{CLR}MULTIPLY TWO RANDOM": PRIN
   T "NUMBERS": PRINT
20 GOSUB 100: PRINT "THE FIRST NUMBER IS"
   : PRINT R: K1=R: PRINT
30 GOSUB 100: PRINT "THE SECOND NUMBER IS
   ": PRINT R: K2=R: PRINT
40 PRINT K1 "TIMES" K2 "EQUALS": PRINT K1
   *K2
50 END
100 R=INT((RND(1)*100)+1): RETURN
```

Line 10 opens by clearing the screen and displaying the opening title. The PRINT command by itself inserts a blank line on the screen.

Line 20 opens by jumping down to line 100 to define a random number between 1 and 100. That number is defined as a variable called R. We then print a message with the random number (R) at the end of the line. Finally, since we want to save that number for use later, we create a new variable K1 and make that equal to R. We have to do this because R is going to change when a new random number is defined.

Line 30 is the same as line 20, except here we get a new random number. To save this number, we create a new variable called K2.

Line 40 uses a PRINT statement to display both random numbers as part of a message, then multiplies the two random numbers together (K1*K2) to get the result, which is displayed on the screen. Note we must go outside quotation marks to print the variables, but inside quotation marks to print the rest of the message.

Line 50 is the end of the program.

Line 100 contains the subroutine, which defines a random number between 1 and 100, then returns to continue the program where it left off.

An Explosive Sound Effect

Finally, for you Commodore 64 owners, here's a GOSUB example which includes an explosion sound effect. Owners of other Commodore computers can substitute any sound effect for lines 100–110.

```
10 PRINT "{CLR}THE": GOSUB 100: PRINT
20 PRINT "HOME": GOSUB 100: PRINT
30 PRINT "COMPUTER": GOSUB 100: PRINT
40 PRINT "WARS": GOSUB 100: PRINT
50 END
100 POKE 54296,15: POKE 54276,129: POKE 5
    4277,14: POKE 54272,149: POKE 54273,6
    8
110 FOR D=25 TO 0 STEP-1: POKE 54296,D: N
    EXT: POKE 54276,0: RETURN
```

Given the fireworks at Commodore which are described in my book, it seemed appropriate to accompany this example with at least some small explosions.

Line 10 clears the screen, prints the word THE and GOSUBs to lines 100–110 for the sound effect. Then it returns and a blank line is printed.

Lines 20–40 work the same as line 10.

Line 50 ends the program.

Lines 100 and 110 contain the sound effect settings. If you're interested in what each POKE value means, I suggest consulting the *Commodore 64 User's Manual* or *Programmer's Reference Guide*.

Richard Mansfield, Senior Editor

ML Mailbag

Here are answers to some of the letters we've received recently. If you have a question about machine language programming, write to: ML Mailbag, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail, we regret that we are unable to reply personally to individual letters.

Can ML Go Anywhere?

Can RAM memory locations 2048–40959 (normally used for BASIC programming) hold a machine language (ML) program?

Yes, any RAM can hold an ML program, but there are a few things to look out for:

1. BASIC uses memory in a dynamic way. For one thing, it stores strings in the highest available RAM memory it can find. So, to protect your ML program, the common solution is to "fool" BASIC into thinking that there's less RAM memory than really exists.

To do this, you can POKE 56, PEEK (56) − (X / 256 + 1), which will lower the "available memory" by X bytes. Just replace the X with the size of your ML program. (Address 56 holds a top-of-memory pointer which changes in steps of 256 bytes.)

2. However, if you aren't going to be using any BASIC, it's not necessary to protect the ML program. Just LOAD "NAME",8,1 and SYS to the ML. Use LOAD "NAME",1,1 if you own a Datassette. (The final 1 on the LOAD command causes the ML program to be loaded in at the address from which it was originally saved. Without the ,1 all programs load in at the start-of-BASIC default address.)

3. Whereas a BASIC program always starts at the same place in RAM, an ML program can be located anywhere. So you need to know the address where the ML program begins to be able to start it running with a SYS to that address.

4. On the 64, there's a nice chunk of RAM which is already protected by the computer from any kind of overlay or invasion by BASIC: 49152–53247. Many people like to put their programs there. Also, 828–1019 is safe if you don't use a Datassette.

Making DATA

How are assembly listings turned into DATA statements?

There are two ways. Doing it the hard way, you PEEK each byte from the start to finish of your ML program. When you know the value of each byte, you can then type each one into DATA statements. The easy way is to give the program below (for the VIC or 64) the starting and ending addresses of your ML program and type RUN. It will build the DATA statements for you automatically. Then, as a kindness, it deletes itself, leaving only the DATA statements.

Datamaker

```
1 INPUT "STARTING ADDRESS";S:INPUT"ENDING
   ADDRESS";F
2 PRINT"{CLR}{2 DOWN}":FORI=STOS+47STEP6
3 IFI>FTHENNEXT:PRINT"GOTO7":GOTO6
4 PRINTI;"DATA";:FORJ=ØTO5:R$=STR$(PEEK(I
  +J)):PRINTRIGHT$(R$,LEN(R$)-1);",";
5 NEXTJ:PRINTCHR$(2Ø):NEXTI:PRINT"S="S+48
  "{LEFT}:F="F"{LEFT}:GOTO2"
6 POKE198,9:FORK=1TO9:POKE63Ø+K,13:NEXTK:
  PRINT"{HOME}":END
7 PRINT"{CLR}{2 DOWN}":FORM=ØTO8:PRINTM:N
  EXTM
8 POKE198,9:FORK=1TO9:POKE63Ø+K,13:NEXTK:
  PRINT"{HOME}":END
```

What's A Checksum?

What is a checksum? How does it work?

It's a way of finding out whether or not data (bytes, files, programs, whatever) was sent with-

out becoming corrupted. Checksums are used in telecommunications, during disk or tape access, and even by our own MLX program to make sure that what you get is what was sent.

There are several checksum schemes, but here's how a simple one would work:

You want to send the numbers 1 2 3 4 5 6 to the disk drive. So you send 1 2 3 4 5 6 21 (note the extra number on the end which is the sum of all the numbers you are sending). As it receives the numbers, the disk drive adds them up. Then, it *checks* its *sum* against the one you sent. If they match, no problem. If not, a LOAD ERROR results.

Obviously this method won't catch transposition errors since the sum of 6 5 4 3 2 1 will be the same as 1 2 3 4 5 6. But it's fairly reliable. Other methods are more sophisticated and can eliminate nearly any errors. No information, however, is totally noise free, even with checksums.

I have a VICMON monitor, and when I try to disassemble a program, sometimes the results look like this:

```
1005 ???
1006 INY
1007 ???
```

What do the question marks mean?

A disassembly is to ML what LIST is to BASIC. It lets you see the program and check for errors.

Disassembly is achieved using a special program called a *disassembler*, which looks at a series of numbers in memory and figures out what they represent as ML instructions. This is the opposite of what an *assembler* does: With it, you type in instructions and the assembler translates them into the pure numbers that the 6502 chip can execute as an ML program.

Every ML instruction can be translated into a number, but not every number translates to an instruction. When a disassembler comes across a number that it doesn't recognize as an instruction, it prints question marks.

If your disassembly results in ???, there are two possibilities. First, you might be looking at RAM memory where no ML program exists. In this case, some of the numbers might translate into ML instructions and others won't. Thus, you'll see ??? interspersed with valid instructions (see example above), but the whole thing will be nonsense. You can recheck your starting and ending address for the ML program to point the disassembler to the actual ML program.

The other possibility is that you've come upon a *data table* within an ML program. Most word processors, spreadsheets, and even BASIC itself are written in ML. Somewhere within these ML programs (usually at the very end), there will be lists of error messages, prompts, etc., which are used by the program. These messages, of course, will not disassemble since they are not a list of ML instructions (a program proper), but rather are raw data.

To see this, try disassembling at address 41118 (49310 on the VIC) and you'll see BASIC's data table list of its own keywords. It will give you lots of ??? because it won't make any sense to a disassembler. Other sections of the BASIC ROM, however, will disassemble normally (and you can learn a good deal about ML by trying to figure out how BASIC performs various tasks).

In your book, you say that BASIC's FOR T = 1 TO 100 STEP 2 can be translated into ML with something like the following:

```
      LDX #1
LOOP  INX
      INX
      CPX 100
      BCC LOOP
```

But what if I wanted to use three variables in the statement, like: FOR T = A TO B STEP C. If A, B, and C are always changing in the program, how could I write this in ML?

You will want to set up some variables in your ML program. It's pretty similar to the way variables are defined in BASIC. Most assemblers allow you to set aside memory for this purpose by using the .BYTE instruction. (On a simple assembler, you'd have to keep track yourself of which addresses you're using, but it's the same idea.) Here's how:

```
FORNEXT LDA A
        CMP B
        BCC STEPS     (if A is still lower than B,
                       keep STEPing)
        JMP FINISH    (otherwise, the routine
                       ends)

 STEPS LDX C          (get the number of STEPs
                       to perform)
 STEP1 INC A
        DEX           (count down 1)
        BNE STEP1     (have we finished this cy-
                       cle of STEPing?)
        JMP FORNEXT(when done with cycle,
                       see if A is yet = B)
FINISH RTS            (return to wherever we
                       came from)

A .BYTE 0   (hold the variable A in this byte)
B .BYTE 0   (hold the variable B in this byte)
C .BYTE 0   (hold the variable C in this byte)
```

This routine has to be a bit more complicated than the one where the STEP size remains constant. Here, we set up a little routine to handle the various possible STEP sizes. Of course, other places in your program would set up the values of A, B, and C before you entered this FOR/NEXT ML routine.

Dynamic SID Editor

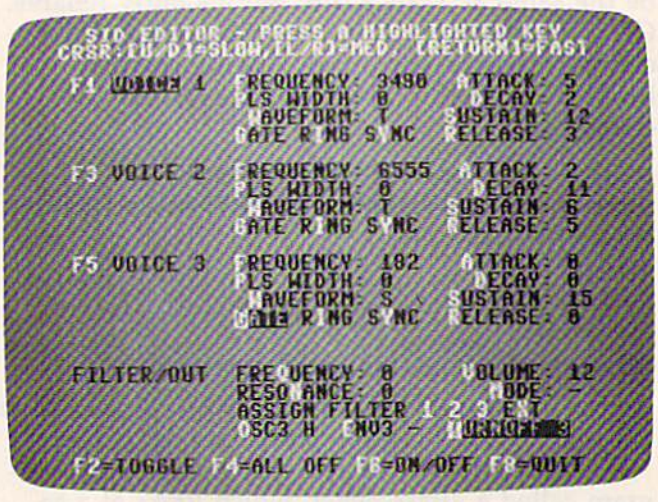
Wayne Eastwood

A host of tedious POKEs and PEEKs are necessary to use the 64's SID chip. This utility provides a menu which lets you instantly select SID values, and see and hear the changes.

The SID, or Sound Interface Device, of the Commodore 64 is a very sophisticated, versatile computer chip. Unfortunately, its sophistication is not readily apparent with the numerous PEEKs and POKEs required to use it.

The *User's Manual* which accompanies the computer is almost no help. The *Programmer's Reference Guide* is much more thorough, but we still must come to grips with the multitude of POKE statements.

"Dynamic SID Editor" takes away the worry about what value goes into which register. It displays a complete log of what is where in the SID at any given moment, and allows you to alter any parameter you wish. All changes take place before your eyes (and ears).



Experimenting with envelopes, waveforms, and filters.

Changing Values In The Menu

After entering and running the program, a full-page menu appears with all SID's registers set to zero and the editor set for Voice 1.

To change a parameter of Voice 1, press the highlighted letter of the desired parameter; for example, F for frequency, G for gate, etc. To change voices, press one of the function keys highlighted in the voice area of the display. To alter the volume or one of the filter parameters, again simply press the highlighted letter. (The filter and volume will function no matter which voice is selected.)

There are three modes of parameter changes the editor will address:

Mode 1. Some parameters are either on or off. For example, if you're set for Voice 2 (f3 was pressed) and press G (for gate), the gate for Voice 2 will turn off if it was on and on if it was off. The editor will display the word "gate" in inverse when the gate is on.

The gate, ring, and sync parameters of each voice work this way, as well as the filter assignment to each voice and the "turn off 3" switch.

Mode 2. Some parameters give you a choice of options. For example, if you are set for Voice 3 (f5 was pressed) and press W (for waveform), the editor will cycle through the possible options and display the selection currently in effect.

The waveform for each voice, the filter mode, and the envelope and oscillator outputs work in this manner.

Mode 3. Most parameters allow a wide range of values from 0 to some maximum level. Frequency, pulse width, the ADSR envelope, resonance, and volume will operate over a range of values. To access this mode, press the highlighted letter of the desired parameter. The word containing the letter will now be displayed in inverse.

Four keys now control the parameter's value:

1. The SHIFT key when pressed causes the increment value to be positive. When not pressed, the increment value is negative.
2. The CRSR–UP/DOWN key sets an increment value of 1.
3. The CRSR–LEFT/RIGHT key sets an increment value of 29.
4. The RETURN key sets a large increment value, larger for large parameter values, smaller for small. This allows quick changing of parameter values and helps compensate for the logarithmic effect of pitch changes.

For example, if Q were pressed (for filter frequency), the word "frequency" in the filter area of the display is displayed in inverse. Pressing SHIFT and either CRSR–UP/DOWN, CRSR–LEFT/RIGHT, or RETURN increments the value displayed.

Program Operation

Keypresses are detected by PEEKing location 203. A value other than 64 indicates a key was pressed. The value determines which key.

To aid in screen display, the PLOT routine in the KERNAL is used, called by SYS MOVE. This routine is read in by lines 50000–50030.

Lines 200–370 are used by mode 3 when a parameter larger than eight bits is required (frequency, pulse width, etc.). It uses variables throughout to increase speed. More statements per line and removing the REMarks will increase speed a bit. Line 260 calculates the next value.

Lines 400–490 are used by 8-bit parameters in mode 3, such as volume. Since the value range is from 0–16, the increment value is always 1. Otherwise, operation is the same as lines 200–370.

Lines 700–830 decode and encode the bits describing a parameter from the byte which carries it.

Lines 900–950 are the cursor plotter.

Lines 1100–1810 make up the key-evaluating routine. If an illegal key is pressed, SID buzzes.

Lines 2000–3060 adjust variables to manipulate the specified parameter.

Lines 4000–4190 manipulate the myriad parameters contained in the SID control byte.

Lines 5000–5550 do for the filter what lines 4000–4190 do for the control byte.

Lines 6000–6996: SID makes available the envelope and wave shape of Voice 3. To make use of these in any way with BASIC is difficult. A short routine read in by lines 50040–50060 and activated by line 50600 puts a SID reading routine into the interrupt stream. The routine checks, 60 times per second, two zero-page locations. If the locations are flagged by the editor, the routine places the current value of the specified parameter into Voice 1 pitch low byte, Voice 1 pitch high byte, or filter frequency high byte.

Of course, the values could be placed in other voices as well, but for simplicity these were the options chosen.

To select, press O or E. You then step through the options. *Note: When you turn off these options (indicated by a - in the display) SID is left with the last value read in the affected bytes. To return to the values displayed, press the space bar.*

Lines 7000–7200 evaluate the various function keys as displayed on the bottom of the screen. Pressing f8 shuts down the editor by turning SID off, restoring the interrupt stream, and clearing the keyboard buffer. If you exit in any other way, enter the following commands:

```
POKE SID+24,0
SYS CS
```

Remember: To make a sound, the volume must have a non-zero value (usually 15) and a voice must have some waveform, some non-zero value in attack, decay, and/or sustain, and the gate must be turned on. If a pulse waveform is selected, there must be a non-zero value in pulse width.

See program listing on page 134.

Screen Assistant

Jay Bromley

If you've discovered a clever timesaving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s GAZETTE. If we use it, we'll pay you $35. Due to the volume of items submitted, we regret that we cannot always reply individually to submissions.

There's a well-known story about a stolen letter. The police thoroughly search the villain's apartment for the letter, but fail to find it. Finally, a detective walks in and looks for the purloined letter in a box of mail, reasoning that the best place to hide something is in plain sight.

What's the most usual thing about a Commodore computer, something you tend to ignore? And what unusual things can we discover there?

Putting Things On The Screen

No matter what you do with the computer, you probably spend a lot of time looking at the screen of your television or monitor. Chances are, you know of two ways to put characters on the screen: PRINTing and POKEing.

What kind of ordinary things does the screen do? For one thing, you probably take screen scrolling for granted. Turn on the computer, press some keys, and eventually the screen fills with characters. At some point, the cursor moves to the bottom. Type more, press RETURN, and the letters on the screen all move up. You expect it to happen, it's a very ordinary occurrence.

Now think about scrolling for a moment. The computer copies line number two to line one, line three to line two, line four to line three, and so on. And the bottom of the screen is cleared.

So there's a general scroll routine hiding in the operating system, with a subroutine for copying lines and a routine to clear a screen line. These routines and subroutines are available to you, for your own programs.

Screen Lines Versus Logical Lines

A Commodore 64 has 40 columns and 25 rows. Each of the 25 rows is a *screen line*, starting at the left edge, ending at the right.

When you're writing a program, you can enter up to 80 characters per line (88 on a VIC). These program lines are called *logical lines*. Logical lines can take up one or more screen lines when you list a program.

There's a table in memory that keeps track of which screen lines are connected. On the VIC and 64, this line wrap table starts at location 217 (217 corresponds to the top line, 218 is the second, and so on). If the high bit (with value of 128) is on, the screen line is the beginning of a logical line. If the bit is off, the line is continued from the previous line.

Remember that screen lines are always single lines, but that logical lines might contain one or more screen lines.

Scrolling Up

You can call the computer's built-in scrolling routine with the following SYS:

```
SYS 59626     (64)
SYS 59765     (VIC)
SYS 57078     (+4/16)
```

This SYS will scroll one or two screen lines on the 64, one to four lines on the VIC, depending on the logical line at the top of the screen. If it's made up of more than one screen line, that's how many lines will scroll. If you want to limit the scroll to a single screen line, type **POKE(218), PEEK(218) OR 128** before the SYS (64 and VIC only).

The 64 and VIC scroll logical lines, but the SYS for the Plus/4 and 16 affects only a single screen line.

There is a quirk associated with the scroll routine. Clear the screen and enter this line on a 64: **PRINT"BEFORE":SYS59626: PRINT"AFTER."** After you press return, BEFORE is printed where the cursor would normally be, but AFTER shows up at the bottom of the screen. And the READY prompt is in the middle of the screen. To avoid this situation, save the position of the cursor before scrolling (see Controlling The Cursor below).

Copying One Line To Another

Part of the scroll routine moves lines up by copying them to the next higher position. Here are the POKEs and SYSes which enable the copying routine:

Commodore 64:
```
POKE781,LT:SYS59888:POKE172,PEEK(60656+LF):
POKE780,PEEK(216+LF):SYS59848
```

VIC-20:
```
POKE781,LT:SYS60030:POKE172,PEEK(60925+LF):
POKE780,PEEK(216+LF):SYS59990
```

Note that this affects screen lines (not logical lines). The variable LF (Line From) is the line you're copying from, LT (Line To) is where it will be copied to. The top of the screen is line number zero, the second line is number one, and so on.

This routine not only copies screen memory, it also takes care of color memory. Unfortunately, we do not have a Plus/4 or 16 equivalent (perhaps our readers can find it).

Clearing A Line

After the computer moves everything up, it finishes a scroll by clearing the lines at the bottom. This is how you can erase any line:

```
POKE781,LN:SYS59903     (64)
POKE781,LN:SYS60045     (VIC)
POKE205,LN:SYS57035     (+4/16)
```

Again, remember that the top line is number zero. This SYS erases screen lines on the VIC and 64, but it affects logical lines on the Plus/4 and 16.

Controlling The Cursor

It's sometimes useful to be able to read the position of the cursor or to move it to a specific row and column.

Read Cursor (64 & VIC):
```
POKE783,PEEK(783)OR1:SYS65520
R=PEEK(781):C=PEEK(782)
```

Set Cursor (64 & VIC):
```
POKE781,R:POKE782,C
POKE783,PEEK(783)AND254:SYS65520
```

In both cases, R is the row, C is the column. The top left position would be row zero, column zero. For the Plus/4 and 16, substitute the numbers 2035–2037 for 781–783.

Scrolling Down

The normal movement of the screen is up, but it's possible to make part of the screen move in the other direction. This program is for the VIC and 64 only.

```
10 PRINT"{CLR}";
20 PRINT"{HOME}{2 DOWN}";TAB(RND(1)*40);"
   Q"
30 POKE218,PEEK(218)OR128
40 PRINT"{HOME}{DOWN}{LEFT}";CHR$(148)
50 IFRND(1)>0.2THEN30
60 GOTO20
```

Line 10 clears the screen. Line 20 moves the cursor to the home position and then down two lines. A solid circle character is then printed in a random position (for the VIC, change 40 to 22).

Lines 30 and 40 make the screen scroll down. First, the second screen line is marked as the beginning of a logical line (218 is the memory location for the second screen line). Then we print {HOME}, {DOWN}, and {LEFT}, which puts the cursor at the end of the first screen line. CHR$(148) is the insert character. By inserting at the end of the first logical (and screen) line, the computer has to make space for the second line. It moves everything on the screen down a notch. The program then loops back.

A Few Suggestions For Games And Applications

These short ideas can be adapted to a variety of programs.

First, if you're working on a word processor or text editor, it helps to be able to move lines around and scroll the screen up and down.

In some programs, you may want to display a message at the top of the screen. In accounting software, for example, you might print "Accounts Receivable" on the top line. To keep it in place,

use the copy-line routine to copy the title from line zero to line one. Then SYS to the scroll routine. The words will remain on the top line. In order to prevent accidental scrolling, check the cursor position and scroll before you get to the bottom line.

The erase-line routine can be modified for a limited window effect. To clear the top half of the 64's screen, enter **FORX=0TO11:POKE781, X:SYS59903:NEXT** (if you have another computer, substitute the appropriate POKE and SYS). And the read/set cursor routine allows you to move to specific positions on the screen.

There are a lot of games that are built around scrolling. In a racing game, the racetrack scrolls toward your car. In an alien invasion game, the spaceships move down a line at a time. Other games use scrolling to move lines full of characters up and down. There are numerous applications for the techniques we've discussed here, and they can add a nice touch to your own programs.

Screen-40

Peter Fortini

Now you can have a 40-column display on any VIC with 8K or more expanded memory. Program editing becomes a breeze. And, as a bonus, graphics are easier too. "Screen-40" allows full-screen editing, is compatible with BASIC, and adds several new tools to a programmer's bag of tricks.

The screen format of the VIC-20 leaves something to be desired for the serious user. Twenty-three rows of 22 characters are not enough to display a large amount of information. BASIC programs are difficult to read and edit when statements are spread over up to four screen lines. Programs written for computers with wider screen formats must usually undergo extensive revision before they can be run on the VIC.

"Screen-40" was written to solve some of these problems by changing the screen format of the VIC to 24 rows of 40 characters. When run, Screen-40 becomes part of the operating system of the computer, supports full-screen editing, and is compatible with BASIC.

System Patches

Because the screen organization of Screen-40 differs radically from the normal screen organization of the VIC, BASIC programs using POKE commands to display graphics on the screen will not work. In addition, since Screen-40 patches into the IRQ, BREAK, NMI, INPUT, OUTPUT, and GET system vectors, it may conflict with other software which also changes these system functions.

The program consumes a total of 7K of RAM (locations 4096–11263) and will therefore run only on VICs with at least 8K of expansion RAM. The 40-column screen is created using the internal memory of the VIC to bitmap the screen. The program is 2K of machine language, plus data for upper- and lowercase character sets designed in a 7 × 4 matrix. An additional 1K is needed for operating system screen memory. With an 8K memory expander, 5K remains free for BASIC programs or other uses. With the 16K expander, 13K is available.

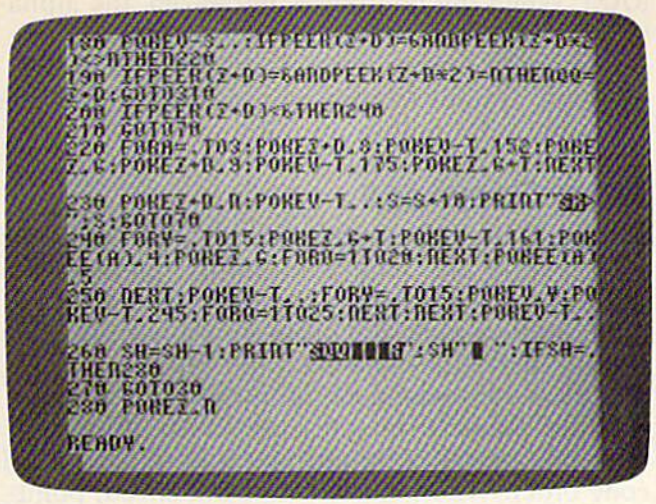
Entering The Program

Since Screen-40 is written in machine language, MLX (published frequently in COMPUTE!'s GAZETTE) is required to type it in. Because Screen-40 occupies the area of memory where BASIC programs like MLX normally reside, you must set aside the memory area for Screen-40 *before* you load MLX. Do this by typing:

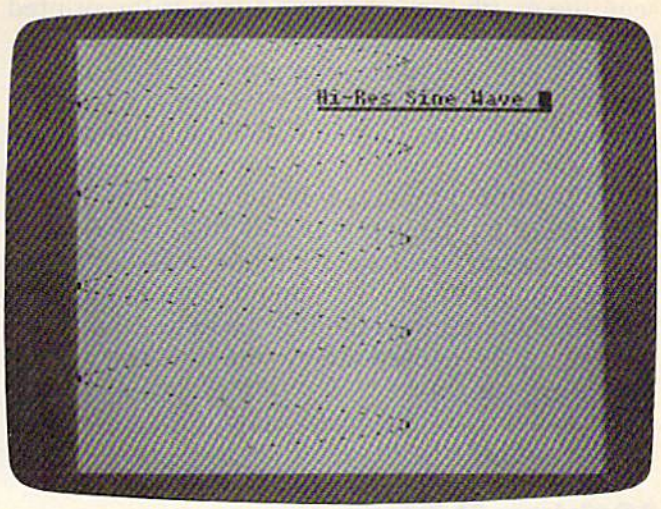
```
POKE 43,1:POKE 44,44:POKE 11264,0:NEW
```

If you choose not to enter all of Screen-40 in one sitting, you must retype this line whenever you load MLX to resume entry.

When MLX starts, it will ask you for a beginning and ending address. The respective addresses are 8192 and 10240. Once these values are entered, you can begin typing in the data from the listing with this article. Be sure you



Programming the VIC in 40 columns.



It's possible to mix characters with hi-res graphics.

have read and understood the instructions in the MLX article.

To use Screen-40, type SYS 8192 and press RETURN.

Editing Improvements

In general, working with Screen-40 is much like working with the normal screen editor of the VIC. You can move the cursor to any screen line, INSERT and DELETE spaces, make changes, and enter lines by pressing RETURN. In a few respects, most noticeably in the way the screen scrolls, Screen-40 differs from the Commodore screen editor. The changes are necessary to maintain reasonable execution speed and to add some improvements.

The cursor blinks as a solid block rather than as the reverse of the character underneath. A line of BASIC is only allowed to extend over two rows of the screen (80 characters instead of the normal 88). Insert mode, in which cursor controls typed following INSERT generate characters in reverse video, is not available. Quote mode, used to program cursor movements in BASIC programs, works normally. Up and down cursor movements wrap around rather than stopping at the top of the screen (in the case of cursor up) or forcing a scroll (cursor down). To force the screen scroll with Screen-40, move the cursor to the bottom row and press RETURN or SHIFT-RETURN.

When scrolling, the screen image jumps upward by eight lines at a time rather than by a single line. Because such scrolling is relatively infrequent and can be made to happen quickly, PRINT and LIST operations using Screen-40 are comparable in speed to the normal PRINT routine. Downward scrolling, invoked when program lines are made longer, behaves normally, but is a bit slower.

Pressing the CTRL key during printing and listing no longer slows down the scrolling. Instead, you can press either the SHIFT or the Commodore key to halt printing operations. Release the key or hold down both keys simultaneously to resume.

When printing graphics characters from the VIC graphics character sets, only the right half of each character is displayed.

Screen-40 disables character-set switching using the SHIFT and Commodore keys. To switch between uppercase/graphics and lowercase/uppercase character sets, press the CTRL and back arrow keys or PRINT CHR$(6). Characters already on the screen are not changed by this action; thus, uppercase, lowercase, and all graphics characters can be displayed simultaneously. However, moving the cursor over any character, restoring the screen image, or scrolling downward will change the character displayed to the current character set, and reverse it if reverse video is in effect.

Fancy Enhancements

Enough space was left over after repeated bouts of program optimization to add some interesting enhancements to the screen operation. If you press the Commodore and CLR/HOME keys, or if the command PRINT CHR$(15) is executed, the contents of the high-resolution display are erased without affecting operating system screen memory. Press the RESTORE key or PRINT CHR$(14) to recover the original screen image. These features are useful for programs which POKE to the high-resolution screen or the operating system screen area for graphics.

For example, you could have a program print some data, clear the display screen with PRINT CHR$(15), and draw a graph in high resolution. When the program ends and you've

seen the graph, you can look again at the printed data by pressing the RESTORE key. Another possibility is to have a program POKE graphics screen codes into the operating system screen memory, and then PRINT CHR$(14) to make them visible.

The entire screen can be scrolled downward one row using the command PRINT CHR$(16).

The color functions are more limited with Screen-40. Pressing CTRL and a color key causes all characters on the screen to change simultaneously to the chosen color. Different parts of the screen can be colored differently by POKEing color codes into color memory locations 37888 through 38127.

Making It Work

The obvious way to get a 40-column screen on the VIC is to pack two characters within the space (eight pixels square) normally used to hold one character. This is, in fact, the format of Screen-40. In order to implement the format, a high-resolution (bitmap) mode was necessary since there is a large number of possible pairs of letters or numbers.

A full-size, high-resolution screen is obtained for Screen-40 in the following way. The control registers of the 6560 video chip are set up for a format of 12 rows and 20 columns of 16 × 8 high-resolution characters. Video screen and character memory are both defined to begin at the start of the VIC's internal RAM. The first 240 bytes of this area are then filled with the numbers 16 through 255. These constitute the contents of screen memory for the video chip. Each value acts as a pointer into the character memory area, causing the video chip to display the contents of 16 bytes as a 16 × 8 block on the monitor screen. The net effect is that the entire contents of the last 3.75K of internal memory are displayed.

BASIC and the operating system also use screen memory to hold program lines for possible editing and as an input buffer. In normal operation, this area coincides with the video screen area. Screen-40 maintains a separate 1K area of memory to accommodate these functions. The operating system screen is readily relocatable by a POKE to location 648.

Subroutines within Screen-40 keep track of the cursor and manage both operating system and bitmapped screen areas. To print a character, Screen-40 enters the screen POKE value for the character into the operating system screen and then transfers the corresponding 7 × 4 pixel image from a character memory area to the high-resolution screen. Screen-40 needs only 4-bit memory blocks for characters and therefore keeps most of them in the unused part of color RAM. When the program is initialized, the alphanumeric character shapes are transferred there from packed storage in the last 384 bytes of the program. Graphics characters are drawn from the character ROM within the VIC.

Easy Graphics

Screen-40 provides a special facility for replacing all or part of the character set with other characters of your own design. The method is only a little different from the ordinary way of using programmable characters on the VIC.

Each 256-byte block of memory (in areas used for character memory by Screen-40) contains the images of 32 characters in screen POKE code order. When the screen is initialized, pointers to these pages are placed in the eight bytes immediately following the system jump vector table. This is an ordinarily unused space within the system. These pointers can be changed at any time using POKE commands. Pressing RUN/STOP–RESTORE will change the pointers back to their Screen-40 values.

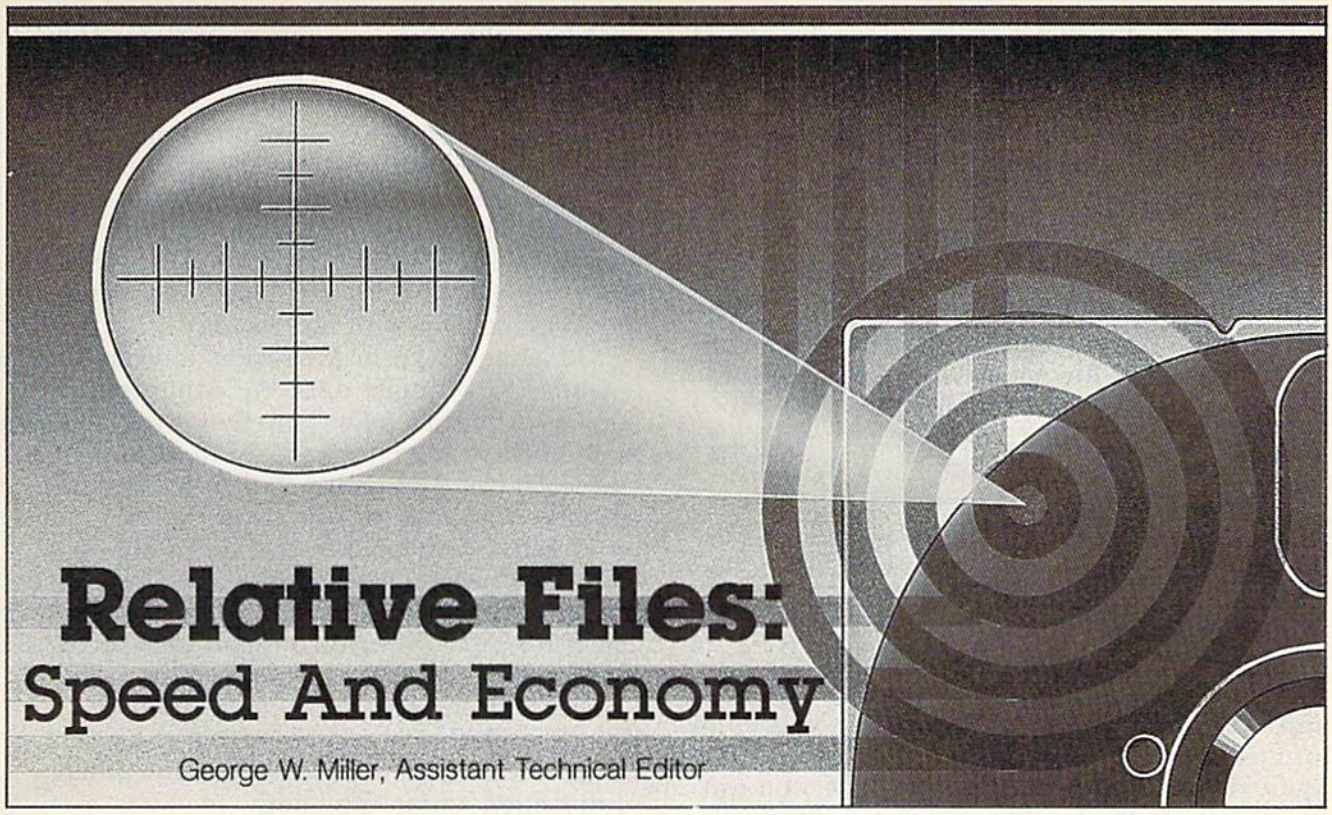
Pointer Location	Set	Characters	Screen Codes
820	Uppercase	Uppercase letters	0–31
821		Numeric symbols	32–63
822		Shift graphics	64–95
823		Commodore key graphics	96–127
824	Lowercase	Lowercase letters	0–31
825		Numeric symbols	32–63
826		Uppercase letters	64–95
827		Commodore key graphics	96–127

Suppose, for example, that you wish to redefine the Commodore key graphics characters. You define the shape of each character with a list of eight values as is usual for programmable characters. The values should range from 0 to 15 since the image will be only four bits wide. Assemble these into a protected 256-byte area of memory starting at a *page* (256-byte block of memory) boundary. Then place the page number into locations 823 and 827. (Addresses 0–255 are page 1, 256–511 are page 2, etc.)

With the screen already in high resolution, direct access to the display memory provides an alternative method for graphics. The display screen is 160 pixels wide and 192 pixels high. The following BASIC subroutine will turn on the pixel at column X, row Y, counted from the upper-left corner of the screen.

```
50 FORX=1TO100:Y=20:GOSUB100:NEXT:END
100 REM PLOT POINT AT (X,Y)
110 X=INT(X):Y=INT(Y)
120 IFX<0ORX>159ORY<0ORY>191THENRETURN
130 BYTE=4352+19*(YAND240)+2*(XAND248)+Y
140 POKE BYTE,PEEK(BYTE)OR2↑(7-(XAND7))
150 RETURN
```

See program listing on page 140.



Relative Files: Speed And Economy

George W. Miller, Assistant Technical Editor

Among disk drive owners, one of the more confusing topics is how to handle relative files. This tutorial starts from the top and walks through each step with program examples along the way. For VIC, 64, Plus/4, and 16 owners with a 1541 disk drive.

Do you have a 1541 disk drive? If so, you have over 163K of extra memory available for variables. Precisely, 167,132 bytes of additional RAM for your VIC, 64, Plus/4, or 16—and it's accessible by using relative files.

The 1541 disk drive stores information in one of several types of files, the most common of which is the program (PRG) file. When you write a BASIC program and want to save it to disk, you enter SAVE "filename",8, and the data (your program) is sent to disk. It's stored as a program file.

Sequential files aren't much more difficult to use. They, too, contain data, which is sent to the file with the PRINT# command.

Using relative files adds just a few more lines to your program. It's not that difficult. But most everyone who has tried to learn how to use them has encountered a variety of frustrations in the process. There's not much information available on how they work. Even the information on relative files in the 1541 User's Manual is incorrect and far from complete.

After several attempts to get a relative file operating correctly, many people just give up. This is understandable because a normally functioning relative file program will sometimes return a disk error, *even when there is no error.*

Let's take a step-by-step tour through the process of creating and using relative files. It's surprising how easy they really are.

Finding A Book In The Library

First, we have to understand the difference between a file, a record, a field, and a character. A file contains one or more records, which are made up of one or more fields. And the fields (as you may have guessed) are made up of characters.

Imagine that you've been hired to catalog a small library of 500 books. You buy a card file and 500 index cards. Each card has room for the author's name (up to 30 characters), book title (30 characters), year published (4 numbers), and identifying number (8 letters).

The entire collection of cards is called the *file*. Each individual card, whether it's blank or filled in, is a *record*. Each category (author, book, year, and number) is called a *field*. Note that records have to be the same size, but fields can be 4 characters long, 8, 30, or any other size. Finally, each field holds letters, numbers, or other *characters*. All told, each record (or card) will hold 72 characters, including blank spaces. This is the record length, the total number of characters used by all of the fields in the record.

Since you have 500 books and 500 cards, you'll have a problem if another book is added

to the library. So you purchase some extra blank cards, just in case you need to update the file.

And the file can hold only a certain number of cards, perhaps 1200. If the number of books ever grows to 1201, you'll have to split the file in two.

Why Use Relative Files?

Sequential files are easy to understand and handle from within a program. Most programmers use a sequential file whenever it's necessary to store information on a disk from within a program. Since sequential files seem to be easier to deal with, why bother with relative files?

Let's go back to the library for a moment. Someone has asked for a book by Faulkner. If the alphabetized card file were sequential, you would have to look at the cards in order, from beginning to end, A to Z. How much time would it take to find something by Zoroaster?

There are two very good reasons to put information in relative files: speed and economy of memory. A relative file allows faster access to individual records. With a relative file, you can go directly to the location where the information is stored and get *only* the information you're looking for. It's like a card file where you can quickly home in on the card you want.

Perhaps the more important reason for using relative files is that they do not use any of the computer's memory, except what's needed for an individual record. With the appropriate program in memory, a 3.5K VIC can manage a file containing over 163K of information. Instead of worrying about leaving enough memory to handle your data, you're free to write the elegant program you've envisioned.

A Few Rules And Regulations

Programmers commonly start counting at zero. The lowest memory location is zero, and it's found in zero page (the first page of memory). Relative files do not follow this convention. The first record is number one, and the first character in a record is called character number one.

Also, if you have two or more relative files on a disk, you can only have one open at any one time. It's possible, though, to use relative and sequential files at the same time.

Records can have a maximum size of 254 bytes. If you want larger records, you'll have to split them in two. For example, a 400-character record could be split into two 200-character records. The first half of the split records would be in the odd-numbered records (1, 3, 5) and the second half in even-numbered records (2, 4, 6).

The largest number of records you can have is 65,535, although in practice you'll never reach this limit because of the space available on the disk.

When a disk is first formatted, the directory should show 664 blocks free. Blocks, sometimes called sectors, are areas on the disk that can hold up to 256 characters of information from a program or file. Two are used by the DOS, leaving 254 bytes available in each block (the reason for the 254-character limit on records).

Relative files use side sectors to keep track of which sectors contain data. We don't need to understand at this point how they work, but note that a relative file may have up to six side sectors. Each can deal with 120 disk sectors (not records), for a total of 720, more than the number of blocks available on a disk. Filling up a disk would use six blocks for side sectors, leaving 664 − 6, or 658 for your data. Thus 658 blocks of 254 bytes each gives you a grand total of 167,132 characters in the largest possible relative file.

That means you could completely fill a blank disk with 658 records of 254 characters, or 1671 records of 100 characters, or any other combination within the limits.

Managing Them

In a relative file, each data record is numbered, and all records must be the same length. Usually, the fields within the record have a predetermined length. To find a record, all you need to know is the record number. This might be seen as a problem, but we'll look at a few tricks to simplify this process.

Unfortunately, Commodore did not include any direct commands for handling relative files in BASIC 2.0 (the version of BASIC in the VIC and 64).

But we can create and manipulate relative files using familiar file handling commands plus a couple of less familiar disk commands.

The First Step

Let's begin by creating a relative file. It takes three steps:

1. Open the file and establish the record length.
2. Mark the last record in the file.
3. Close the file.

OPEN is the command used for opening any file, including a relative file. The form of the command is only a little different from what you've probably used to send output to the printer or store data in a sequential file:

OPEN 1,8,2, *"filename*,L," + CHR$(*record length*)

This statement begins the same as any other

OPEN statement: "1" is the logical file number, followed by the device number, normally 8 for the disk drive, then the command channel number, in this case, channel 2. Any channel number will do, as long as it's between 2 and 14. *But remember which channel you've used because you'll need the number later.*

Now we add a comma and the name of the file inside quotation marks. Nothing new so far, but here comes the first change. The next item in the command is the unshifted letter ",L,". Note the commas before *and* after the letter L (for Length). This tells the DOS that a relative file is to be opened, and that the record length will be the next piece of information sent. Record length is the size of each record, not the total number of records. Finally, the length of the record is sent using a CHR$ code. Remember, the maximum length is 254.

Setting the record length is absolutely necessary when a relative file is created. When you're expanding a file (adding to the number of records), you should also send the length. When you're working with files already on the disk, you can use a simpler OPEN command:

```
OPEN 1,8,2,"filename"
```

You don't have to tell the disk drive it's a relative file, it already knows. You don't even have to give the record length. It knows that, too. And you don't have to mark it for reading or writing because you can do either.

The next step helps save a little time when using the file. Decide on the total number of records you're going to start with. You can always add more later. Since it does take time for the DOS to create the file on disk, we're going to open the file and create the records *before* we use it to store any data. It's like buying some blank index cards in the library card catalog example above. We don't want to waste time running to the store for a single blank card every time a new book is added to the library.

Positioning A Pointer

There's one more command we need to learn. It looks like this:

```
OPEN 15,8,15
PRINT#15,"P" + CHR$(cn + 96) + CHR$(lb) +
  CHR$(hb) + CHR$(pl)
```

Channel 15 is the disk command channel. We have to open it and send five characters. First, an unshifted P (think of "Position" or "Pointer"). The P tells the drive to look for a certain record. The second character is the channel number (cn) added to 96. If the relative file was opened with OPEN 1,8,2 then the channel number is 2.

The next two numbers specify a certain record, the sum of the low byte and 256 times the high byte. Record 300, for example, would translate to CHR$(44) + CHR$(1), because 300 is 44 + (1*256).

Finally, we indicate which place in the record to start reading or writing. In most cases, this will be CHR$(1), the 1 indicating we want to start at the beginning of the record, at the first character. To skip over the first five characters, send a CHR$(6).

In general, you should open channel 15 first, then open the relative file and position the pointer. Read and write as necessary, then close the relative file and the command channel. OPEN 15 is the first thing to do, CLOSE 15 the last.

A Filing Program

For demonstration purposes, we'll sketch out a simple address file program. Although the program works, it's practical usefulness is minimal. You can use the techniques provided to write a database program using relative files for any purpose you wish—just change the program lines to reflect your requirements, and, perhaps, add some error checking for faulty data input.

It's important to remember that the syntax of the statements for file handling *must* be exact. Any deviation will cause errors, some of which can be difficult to trace.

First, we decide what information to store. For an address file, we'll need the name, street address, city, state, zip code, and we'll include the phone number.

It simplifies things if the length of a field is the same for all records. Decide the maximum number of letters that will be stored in the field representing the first name, middle name, last name, and so on.

It helps to draw an outline on paper first. Here's how we'll set up the fields for the address file:

First Name	**15 characters**
Middle Name	**15 characters**
Last Name	**15 characters**
Street Address	**30 characters**
City	**25 characters**
State (abbv.)	**3 characters**
Zip Code	**5 characters**
Phone Number	**12 characters**
End of File	**1 character**
Total	**121 characters**

Now that we've determined that the total record length will be 121 characters, we're almost ready to begin. To save some program execution time, we'll decide on a file length (number of blank records) to begin with. Remember, we can add to this length at any time, without starting over, by writing to a record number

higher than the current end of file.

Now we're ready to step through the first part of our relative file program.

```
1 REM CREATE RELATIVE FILE
10 PRINT"LENGTH OF RECORD":INPUT RL:RL=RL
   +1
20 PRINT"TOTAL NUMBER OF RECORDS":INPUT R
   N:RN=RN+1
30 HB=INT(RN/256)
40 LB=RN-HB*256
50 OPEN15,8,15
60 OPEN1,8,2,"REL.FILE,L,"+CHR$(RL)
70 PRINT#15,"P"+CHR$(2+96)+CHR$(LB)+CHR$(
   HB)+CHR$(1)
80 PRINT#1,"END"
90 CLOSE1
95 INPUT#15,E,E$:PRINT"{RVS}DISK STATUS:"
   :PRINTE$:CLOSE15
```

In line 10, enter 121 for the record length (RL). This is the number of characters we decided on above, 120 plus the end-of-file marker.

In line 20, let's enter 50 for record number (RN). Of course, you can use a higher or lower number. The only limitation with a large record number is disk space (50 records of 121 characters will use a little more than 6000 bytes of disk space, or about 25 blocks). It's best to store your data on a separate disk dedicated to saving your data.

To position the file on the record, we must open the command channel and tell the DOS what we want it to do. Line 50 opens the channel, line 60 opens a relative file of length RL, and line 70 tells the DOS to position the read/write head of the disk over the proper record.

The record number is transmitted in low byte/high byte order. To make it easier and more flexible, line 30 and line 40 determine the values needed.

Next, we'll write the word END to the last record. This frees the space for the file, and writes 255 to the first byte of each record on the disk. This process can take several minutes, especially for opening a large file.

The file is now created on disk, and can be closed with line 90.

A False Error

We could tie things up here by closing the command channel (CLOSE 15), but if we did, the red light on the disk drive would flash to signal an error. But there really is no error. What happens in this situation is that we wrote to a record number higher than the one on the disk, so DOS sends a RECORD NOT PRESENT error message.

Line 95 reads the error channel and prints out the false error message. Don't be alarmed. All it means is that there was no such record before.

We now have a relative file on disk ready to receive data, and we can begin putting data together for storage.

Preparing The Record

The name Sue contains only three characters, but Annette contains seven characters. It would be convenient if Sue's middle name began at the same point in the record that Annette's middle name begins. To achieve this, we can concatenate the name, filling in the blanks with spaces. (Do not type NEW before typing this in, it is meant to be added to the previous program lines.)

```
99 REM PREPARE TO WRITE FILE
100 RC=RC+1
110 RC$=""
120 SP$="{30 SPACES}"
130 PRINT"FIRST NAME":INPUTNF$
140 PRINT"MIDDLE NAME":INPUTMN$
150 PRINT"LAST NAME":INPUTLN$
160 PRINT"STREET ADDRESS":INPUTSA$
170 PRINT"CITY":INPUTCI$
180 PRINT"STATE":INPUTST$
190 PRINT"ZIP CODE":INPUTZI$
200 PRINT"PHONE NUMBER":INPUTPH$
210 RC$=RC$+LEFT$(NF$+SP$,15)
220 RC$=RC$+LEFT$(MN$+SP$,15)
230 RC$=RC$+LEFT$(LN$+SP$,15)
240 RC$=RC$+LEFT$(SA$+SP$,30)
250 RC$=RC$+LEFT$(CI$+SP$,25)
260 RC$=RC$+LEFT$(ST$+SP$,3)
270 RC$=RC$+LEFT$(ZI$+SP$,5)
280 RC$=RC$+LEFT$(PH$+SP$,12)
```

Lines 210–280 achieve this result, so the string RC$ contains all the data with the correct number of characters in each field.

Each square represents one byte of information. Thick black lines show the beginning and end of each field. Fields are completely full when the file is written—the blank bytes are filled with spaces, as in lines 210–280 of the example program.

FIELD	EXTENT OF FIELD & TYPICAL INFORMATION													
FIRST NAME	S	U	E											
MIDDLE NAME	A	N	N											
LAST NAME	S	M	I	T	H									
STREET ADDRESS	1	2	3		M	A	I	N		S	T			
CITY	A	N	Y	T	O	W	N					STATE		ZIP
					PHONE							O	K	1	2
ZIP CODE (cont'd)	3	4	5	1	2	3	-	4	5	6	-	7	8	9	0

Writing To Disk

To write the data to disk, follow the same outline as in creating the file:

1. Open the file.
2. Position the file on the record to be written.
3. Write the record.
4. Close the file (optional).

The Controversy Over Relative Files

Misconceptions And Misinformation

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The literature about relative files is fraught with confusion. The disk drive manual and various reference books contain misinformation and misconceptions about what relative files are and how they work. Let's examine some of the myths.

Are There Numerous Bugs?

There is only one bug that afflicts relative files (see below). It is rare and can be avoided quite easily. Also, relative files sometimes cause a false disk error, for a good reason.

When working with relative files, remember the limits: a maximum of 254 characters per record, a maximum of 65535 records per file, and 163K characters (658 disk sectors of 254 bytes each) per disk.

Only 720 Records Per File?

This is probably the most common, most repeated misconception. It appears in many books, and the disk drive manual itself hints that you can't have more than 720 records.

Relative files are fast because of side sectors. When you ask to read record number 533, the disk operating system (DOS) uses side sectors to figure out where record 533 is located. It then jumps right to that disk sector and collects the information.

Each of the six side sectors can manage up to 120 disk sectors, for a total of 720, more than enough to cover the maximum 658 sectors available for relative files on a blank disk. Some writers have interpreted this to mean you can have a maximum of 720 records. It's just not true—720 is the maximum number of sectors *(not records) which can be referenced by six side sectors.* And you'll never reach this limit because a disk has only 664 blocks, six of which may be reserved for side sectors.

The maximum number of records is 65535 (although the records would have to be two bytes each, at most, to fit into the limit of 163K bytes per disk).

Ignore All Disk Errors

Wrong again. With one exception, you can ignore any advice which says to ignore disk errors caused by relative files. Three errors are commonly associated with reading and writing relative files:

```
50 RECORD NOT PRESENT
51 OVERFLOW IN RECORD
52 FILE TOO LARGE
```

Error 50 means you tried to access (read or write) a record number higher than the highest record currently on disk. If you're creating a new file, or expanding a file, you can ignore this error (because you actually did access a record that didn't exist). In fact, an error 50 confirms that the creation or expansion of the file was successful. You can stop the blinking of the red error light by reading the error channel (INPUT#15,E,E$). E should be 50, E$ should be RECORD NOT PRESENT.

Error 51 means you tried to send more characters than the file was set up to receive—for example, writing 122 characters to a record that was created to hold 121. See the discussion of carriage returns below for more information.

Error 52 results from attempting to create files that are too big to fit in the remaining space on the disk. If you have other programs or files on the disk, the room for relative files is diminished, one reason to devote a whole disk to a relative file if you expect to store a lot of data.

When storing data in sequential or relative files, it's a good idea to regularly read the error channel. When creating a new file, check for error 50. In other cases, a disk error indicates a problem with the file. But don't ignore disk errors.

Creating A New File

In general, you should create a blank file before you start using it. If you plan to have 60 records, some reference books will recommend writing something to all 60 records. It's not really necessary—all you have to do is write to record 60; the other 59 will be created automatically. Each of the blank records will contain a CHR$(255) followed by a series of CHR$(0)s.

When a relative file is created, you must send the length, with **",L,"+CHR$(record length)**. After that, the record length is optional (unless you're expanding the number of records in the file, in which case you should send the length). It doesn't hurt to add the length, but it's unnecessary.

Always Leave Room For A Carriage Return

This one's right. If you want 15 characters per record, set it up with a length of 16. This is important, because PRINT#, like PRINT, adds a carriage return to the end of each string it sends.

What if you don't add one to the length of the record? Sending 15 characters plus a CHR$(13) makes a total of 16 characters. If you print 16 characters to a record set up for 15, the result is an error 51, OVERFLOW IN RECORD. The disk error light will blink every time you write to a record.

The Pros And Cons Of Field Separators

There are two ways of storing and recalling data from a relative file. The first method is to concatenate the fields and send a long string to the record: **RC$=A$+B$+C$+D$: PRINT#1,RC$**. To read it back into memory, use GET# to read a character at a time. Then the MID$ function breaks the record into the different fields.

The other way is to separate the fields with a carriage return or a comma: **RC$=A$+CHR$(13)+B$+CHR$(13)+C$+CHR$(13)+D$:PRINT#1,RC$**. Now, instead of GET# inside a FOR-NEXT loop, you can set the pointer and then **INPUT#1, A$,B$,C$,D$**. The advantage is that INPUT# is a little faster than GET#. You can also create fields of variable length; you don't have to pad out the fields with extra spaces. The disadvantage is that you can't use any commas or carriage returns within a field. And the record length may have to be a little larger to make room for the separators.

A Bug In Relative Files

The INPUT# command will sometimes fail to read all of the characters in a relative file when you are updating records sequentially. You can eliminate the bug with the simple precaution of positioning the record pointer before and after printing to a record:

```
540 PRINT#15, "P"+CHR$(2+96)+CHR$(103)
    +CHR$(2)+CHR$(1)
550 PRINT#1,"NEW INFORMATION"
560 PRINT#15, "P"+CHR$(2+96)+CHR$
    (103)+CHR$(2)+CHR$(1)
```

As long as the pointer is set before and after printing, you'll never encounter the bug.

The bug is related to *spanning and spill*. Each disk sector holds 256 bytes, numbered 0–255. The first two bytes are used by DOS, leaving 254 for programs and files. A relative file containing 200 characters per record fits into the disk sectors like this:

Sector	Bytes	Record Number
1	0–1	used by DOS
1	2–201	record 1
1	202–255	record 2 (first part)
2	0–1	used by DOS
2	2–147	record 2 (spill)
2	148–255	record 3 (first part)
3	0–1	used by DOS
3	2–95	record 3 (spill)

Record 1 starts at a sector boundary, the beginning of sector 1, and fits entirely into

that sector, while records 2 and 3 are split between sectors (they *span* two sectors). The part that overlaps into the second sector is called the *spill*, because it spills over into the next block.

The bug happens when three conditions are true: 1) You're updating a file sequentially, using a FOR-NEXT loop to read individual records in a file, changing something, and writing the record back to disk. 2) You write only a few characters to a record that begins on a sector boundary (that is, you write fewer than 199 characters to record 1 in the example above). 3) The number of characters put into the boundary record (1) is less than the spill of the record that spans the second and third sectors after the boundary record (record 3).

The problem won't happen again until you have a record beginning on an even boundary.

It sounds complicated, so let's force the bug to happen. First, create a relative file with six records of 252 characters each:

```
10 OPEN15,8,15:OPEN1,8,2,"0:ABC,L,"+CHR$(
   252)
20 PRINT#15,"P"+CHR$(2+96)+CHR$(6)+CHR$(0
   )+CHR$(1)
30 PRINT#1,"LAST RECORD"
40 INPUT#15,E,E$:PRINTE$:CLOSE1:CLOSE15
```

Line 10 opens the command channel and a relative file of length 252. Line 20 positions the pointer to record 6. Line 30 prints "LAST RECORD" to record 6 (creating five blank records) and line 40 closes the files. Next, we'll put something into each record (type NEW before entering this program):

```
10 A$="123456789"
20 OPEN15,8,15:OPEN1,8,2,"0:ABC"
30 FORJ=1TO5:GOSUB500
40 PRINT#1,A$:NEXT
50 REM NOW CHANGE DATA
60 J=1:GOSUB500:PRINT#1,"A"
70 FORJ=2TO5:GOSUB500
80 INPUT#1,B$:PRINT"RECORD #";J,B$
90 B$=B$+STR$(J)
100 PRINT"CHANGED TO ";B$
110 GOSUB500:PRINT#1,B$
120 NEXT
130 FORJ=1TO5:GOSUB500:INPUT#1,C$:PRINTJ,
    C$:NEXT
140 CLOSE1:CLOSE15
499 END
500 PRINT#15,"P"+CHR$(2+96)+CHR$(J)+CHR$(
    0)+CHR$(1):RETURN
```

The subroutine at 500 positions the pointer to record J. First, lines 10–40 print A$ ("123456789") to the first five records. Line 60 changes record 1 (which begins on a sector boundary) to contain a single character "A" (try AB or ABC and see what happens). In lines 70–120, we update records 2–5, inputting B$ and then adding the record number to B$. Line 80 reads the record with INPUT#, prints it to the screen, and adds the string equivalent of number J (STR$(J)).

Finally, lines 130–140 read through the file and print the contents of each record to the screen. Pay close attention to record 3, which has been corrupted.

Now, add this line:

```
115 GOSUB500
```

Subroutine 500 positions the record pointer. Run the program again, and the bug disappears.

Open the command channel, open the relative file, position the pointer on the disk, then write the record. But this time we'll write real data (again, add these lines to the lines previously typed).

```
299 REM WRITE TO FILE
300 OPEN15,8,15
310 OPEN1,8,2,"REL.FILE,L"
320 HB=INT(RC/256)
330 LB=RC-HB*256
340 PRINT#15,"P"+CHR$(2+96)+CHR$(LB)+CHR$
    (HB)+CHR$(1)
350 PRINT#1,RC$
360 CLOSE1
370 INPUT#15,E,E$:PRINT"{RVS}DISK STATUS:
    ":PRINTE$:CLOSE15
380 PRINT:PRINT"ANOTHER ENTRY?"
390 GETG$:IFG$=""THEN390
400 IFG$="N"THEN500
410 IFG$="Y"THEN100
420 GOTO390
```

Line 350 writes the information to the disk, line 370 reads the error channel (if no errors occurred, it should say OK), and line 380 prompts us for another entry.

You may have noticed that we didn't send the end-of-file marker we had planned for. 120 characters were sent to a record that can hold 121. Actually, we did send 121. PRINT# (just like PRINT) always adds a carriage return (CHR$(13)) if the string is not followed by a comma or semicolon. There's a 13 at position

121, the end of the record.

It's a good idea to fill the entire record with information, even if the empty fields are only defined as spaces. If you don't, the record will be padded out with CHR$(0)s.

Reading The File

After the file is written, you are asked if you want another entry. Answering no (press the N key) takes us to the next section: reading the files.

1. Open the file.
2. Position the file on the record to be read.
3. Read the record.
4. Close the file (optional).

Once the data is stored on the disk, reading is fairly simple. If the record contains less than 80 characters, the INPUT# command can be used and the record read into memory, but since we chose a record length of 120 characters, we'll have to use GET# and concatenate to build RC$, as in line 560 below.

Lines 500–660 will read the records from the disk in sequence from the lowest to the highest number. The steps should look familiar by now: Open channel 15, open the relative file (as before, Length is optional), position the pointer, and pluck characters from disk into memory using GET#.

```
499 REM READ RELATIVE FILE IN ORDER
500 FORA=1TORC:RC$="":PRINT"RECORD #";A
510 OPEN15,8,15
520 OPEN1,8,2,"REL.FILE"
530 HB=INT(A/256)
540 LB=A-HB*256
550 PRINT#15,"P"+CHR$(2+96)+CHR$(LB)+CHR$
    (HB)+CHR$(1)
560 FORB=1TO120:GET#1,A$:RC$=RC$+A$:NEXT
570 CLOSE1:CLOSE15
580 PRINTMID$(RC$,1,15)
590 PRINTMID$(RC$,16,15)
600 PRINTMID$(RC$,31,15)
610 PRINTMID$(RC$,46,30)
620 PRINTMID$(RC$,76,25)
630 PRINTMID$(RC$,101,3)
640 PRINTMID$(RC$,104,5)
650 PRINTMID$(RC$,109,12)
660 NEXT
```

When you'd like to read the data from an individual record, it's possible to go directly to that record and read the data:

```
699 REM READ INDIVIDUAL RECORD
700 PRINT"RECORD # TO READ":INPUTRE
710 PRINT"STARTING AT POSITION":INPUTPO
720 HB=INT(RE/256):LB=RE-HB*256
730 OPEN15,8,15
740 OPEN1,8,2,"REL.FILE"
750 PRINT#15,"P"+CHR$(2+96)+CHR$(LB)+CHR$
    (HB)+CHR$(PO)
760 FORA=POTO120:GET#1,A$:PRINTA$;:NEXT
770 INPUT#15,E,E$:PRINT"{RVS}DISK STATUS:
    ":PRINTE$
780 CLOSE1:CLOSE15
790 PRINT"PRESS ANY KEY TO CONTINUE"
800 GETG$:IFG$=""THEN800
810 GOTO700
```

Specify which record you want to see by record number, and the DOS takes care of finding it. It also asks for position. To skip over first names, enter a 16. To see phone numbers only, use 109.

Changing A Record

Changing the data in a relative file is straightforward enough. Start out by opening the command channel and the file, positioning the file over the record, then reading the entire record into memory.

Now make any necessary changes to the data and concatenate to fill out all the fields within the record. Next, reposition the file by using:

PRINT#15,"P"+CHR$(2)+CHR$(*lb*)+CHR$(*hb*)
+CHR$ (*first byte*)

Now use PRINT# to rewrite the record. Finally, *position the pointer to the first character in the record again.* It would seem that this is unnecessary, since we positioned the record prior to writing the data, but unless this step is included, our data may be corrupted. For details about why this must be done, see the accompanying article, "The Controversy Over Relative Files."

The Last Step

A huge amount of data can be stored on disk in relative files, but the data is of no value, of course, unless we can use it.

We could read each record into memory every time we need to reference the information, but with the slow speed of the 1541 disk drive, that could develop into a very slow process, especially as our file becomes longer. This would eliminate the speed advantage of using a relative file.

The easiest way to handle a search through a relative file is to create *index files* for the key fields you'd like to search for information.

These index files are usually sequential files which have already been alphabetized or put into order (using a sort utility) and loaded into an array reserved by a DIM statement. It's not necessary to read the index file into memory until you need it, and the same variables can be used for the values held in several index files for different fields.

Relative files are not only fast and memory-efficient, they can be very flexible. The data is easy to get at and can be rearranged and sorted to fit your file-handling needs, especially if you use sequential index files. With a little practice, you'll become comfortable with them.

Tape Program Rescue

John R. Hampton

This short machine language utility reads a program from tape into memory, allowing you to recover programs that have become unloadable. For the VIC or 64.

The Commodore Datassette is an inexpensive and generally reliable device on which to store programs and data.

But sooner or later, you'll be unfortunate enough to combine a very long program with a bad tape. After saving the program, you won't be able to load it back into the computer. This is one reason to keep backup copies of all important programs.

What do you do if you don't have a backup, and don't feel up to retyping the entire program? "Tape Program Rescue" may be the answer.

Fixing A Bad SAVE

A program on tape can be scrambled or destroyed by a number of things: magnetism, a faulty coating on the tape, or ripped or creased tape. You may not be able to rescue the entire program, but you should be able to recover at least a portion, saving a lot of retyping time.

Tape Program Rescue is written in machine language, but uses BASIC to POKE the program into memory. When you run it, the problem program is loaded from tape into memory, overwriting the BASIC part of Tape Program Rescue. For this reason, you should save Tape Program Rescue before you attempt to use it, or else your typing will be lost.

To use it, load (but don't run) Tape Program Rescue. Then put the problem tape in the cassette drive and fast forward the tape to a spot just before the beginning of the program to be rescued.

Now type RUN. The short ML program rescue routine is POKEd into memory and you should see the CUT PROGRAM OFF AT LINE NUMBER? prompt. Input a line number from the program. Tape program rescue will read up to, *but not including*, that line. The remaining lines will not load into memory. (You can also use this utility to delete the last portion of a program on a good tape.)

You may have to experiment a bit. If you can't load up to line 1100, try cutting off the program at 1000 or 740 or some smaller number. If it works, part of the previously unloadable program will have been loaded into memory and you can save that part to a good tape. You may still have to retype the last part of the program.

Setting Up Memory

Tape Program Rescue loads programs into the same section of memory they were saved from. This means you can't use a 64 to rescue VIC programs, nor can you use a VIC to recover 64 programs. The memory configuration when you rescue must be the same as when you saved. VIC owners should insert or remove memory expansion according to how much was needed for the problem program.

Also, the line number used for cutting off the program must be a real line number. If a program has lines 400 and 410 and you try to cut it off at 405, Tape Program Rescue will not operate properly.

See program listing on page 132.

Charles Brannon
Program Editor

There's a special class of computer peripherals that intrigue and fascinate us all. Printers, disk drives, memory expansion, and monitors are all important parts of a complete computer system, but they're mundane compared to things like voice synthesizers, music keyboards, light pens, and touch tablets. It can be hard to justify the purchase of these computer "goodies" until you begin to use them. They amplify your creativity, a quality hard to distill into dollars and sense.

If a touch tablet doesn't turn you into a computer age Michelangelo, you might want to cheat. Instead of laboriously tracing a drawing pixel-by-pixel, why not just take a snapshot? Point a camera at your subject, and you've got computer graphics.

Video Acquisition

Camera digitization, otherwise known as video acquisition, has been around quite a while (maybe you've seen the digitized picture of computer chips), but its cost has been out of most people's reach, until now. You can now set up your own digitizing studio for $349.95 (including black and white video camera) with COMPUTEREYES from Digital Vision.

COMPUTEREYES is one of those magical black boxes that plugs into the back of your computer (specifically, the user port). You plug any standard (noninterlaced NTSC) video source (video camera, videocassette recorder, laser disc, composite computer signal) into the side of the box. This signal is the same level as Commodore 64 composite video, the same signal used by most color and monochrome monitors. With a video camera, you can digitize almost anything you can focus on. You can plug the video camera into your monitor while you set up the shot, then into COMPUTEREYES when you're ready to digitize. Or if you don't want to shell out $229 for a black and white video camera, you can digitize pictures off your television set (courtesy of the tuner in your VCR). Imagine using a few frames of *Star Trek* in your next videogame.

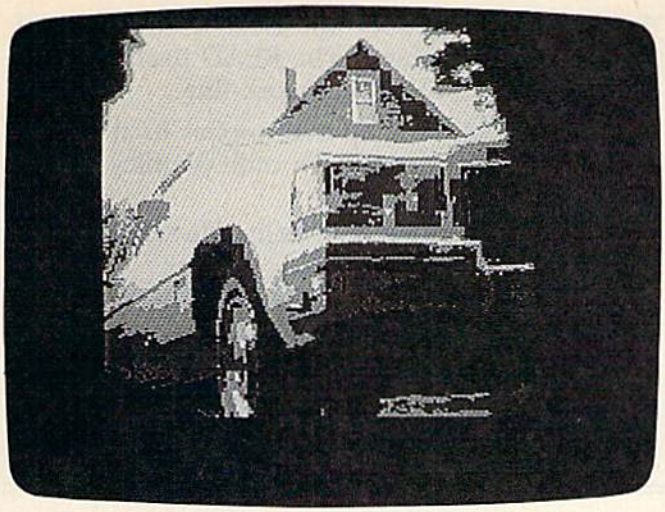
It's really quite easy to use COMPUTEREYES. The standard digitizing program lets you adjust the sync by turning a small knob on the COMPUTEREYES module. You turn the knob until the message IN SYNC appears. This customizes the box with whatever video source you're using. Setting the brightness control is just as easy, but a little frustrating. The program scans slowly across the screen, one vertical line at a time. It takes about six seconds to sweep across the screen.

In the brightness mode, you just get two scales—on and off, or black and white. The screen is very distorted, since the time taken by the 64's VIC chip interrupts the digitizing timing. You try to adjust the brightness control so that only the brightest parts of the subject are lit on the screen. It can take a lot of trial and error to find the right brightness level.

Scanalyze

After you've adjusted the brightness, you're ready to take your first picture. The digitizing program permits three options: Normal Scan, 4-Level Scan, and 8-Level Scan. Normal Scan is similar to the Brightness adjustment, but the screen is blanked for the sake of timing. After six seconds, your picture appears. Normal Scan only makes black and white distinctions; the pictures are extremely high in contrast. The 4-Level Scan performs four scans, each time lowering its threshold for what counts as "white." It merges these scans to get a shaded picture. These aren't true gray scales, but varying dot densities, similar to newspaper photographs. Since four scans are taken, it takes about 25 seconds to take a 4-Level Scan. The 8-Level Scan works similarly, but takes eight scans, each time at a lower brightness threshold.

Don't expect photographic quality. The weak link is not COMPUTEREYES, but the Commodore 64's 320 × 200 pixel high-resolution screen. The pictures are extremely coarse and grainy. However, if you stand a few feet away from the screen, the pixels become smaller, and



A four-level scan of a car in a driveway (courtesy of Digital Vision).

your eye tends to fill in the gaps. You can also print the pictures, then reduce them with a photocopy machine. Reducing a picture makes all the pixels smaller and closer together, giving you more effective resolution. Nonetheless, the pictures do have an artistic quality to them that photographs miss in being too true to life. It's as if they were painted with a broad paintbrush in only five shades.

You can buy additional software disks ($15 each) that permit you to store your pictures in formats compatible with several popular graphics programs: *KoalaPainter, Doodle, Flexidraw,* and *Print Shop*. These packages let you take advantage of the 64's five gray scales (black, dark gray, medium gray, light gray, and white). Although the horizontal resolution is halved, (since multicolor mode must be used) these true gray scales make for more realistic pictures.

A Facial Bias

I found that the best subject is someone's face. The brain is biased towards facial features, which is why it's so easy to imagine the man in the moon. More importantly, the face reflects light subtly, according to facial contours. Even with poor resolution, the various shadows and contours translate well to just five gray scales, producing pictures with depth. Besides, what do people take pictures of anyway? Other people. I've tried to take pictures of landscapes, but the computer's eye is too crude to produce easily recognizable pictures. It works well on closeups, though.

The time required to take a picture can be really frustrating. Just try holding perfectly still for 50 seconds. It's not easy. We're in the early days of computer photography (ask your great-grandmother to tell you about posing for ten seconds for a nineteenth century daguerreotype).

How It Works

COMPUTEREYES is a *slow scan* video acquisition system. It relies on a crucial interaction between the hardware and software. The box doesn't do all the work. You can't just grab complete pictures from the box. For one thing, a picture is displayed as quickly as 1/30 second, too fast for even a machine language program to process 64,000 pixels. Instead, the box sends one vertical column of scanning at a time to permit the software to analyze that column at a more leisurely rate. The scans are taken once per video frame, so it takes about six seconds (5.33 seconds, actually) to make one full sweep. The software is capable of setting the box's brightness threshold for each scan in order to produce gray scales.

What practical use is there for a camera digitizer? You could ask the same question about any camera. Pictures justify themselves. It's just plain fun. There's something fascinating about putting pictures on computers. You've seen the booths at carnivals and shopping malls that take your picture and print it on a T-shirt. They use very similar equipment.

But the fun doesn't stop after you've taken the picture. Load it into your drawing program, and you can alter or modify it as you will. Take your picture and add a mustache and a beard. Erase the hair to see what you'd look like bald. Color it in. Take several pictures and swap body parts around (put Lucy's eyes on Ricky). Photoreduce the picture and use it as a unique snapshot to give to acquaintances.

For business, camera digitization is a great shortcut to presentation graphics. Again, load the picture into a drawing program to touch it up, then add text and merge in graphs.

Programmers can use these pictures in their programs, using them as game backgrounds. Grab smaller elements and turn them into sprites. You can write programs to enhance and smooth out the rough edges in the pictures. If you're really clever, maybe you can write programs to let the computer *really* see, giving it limited visual recognition. For example, a security system could take two scans of a hallway. If both scans are not identical, someone or something is moving around in there.

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1541 Flash! Update

In my review of *1541 Flash!* for the Commodore 64/1541, I stated that I had problems loading some Epyx games, even with the *Flash!* speedup disabled. Bryce Nesbitt, author of *1541 Flash!*, told me that early on he made a change to allow the Epyx games to load with *1541 Flash!* turned off. In addition, he noted that these steps should be followed to load an Epyx game in the *Flash!* mode:

1. Boot up as normal (LOAD "*",8,1 or SHIFT-RUN/STOP).
2. Wait about five seconds.
3. Open the drive door and close it. Repeat until the software "catches." The READ head will move and everything will work fine.

He also sent along a tip that applies to all 1541 disk drives. You can scratch multiple files with the syntax:

```
OPEN 15,8,15:PRINT #15,"S0:file1,file2,file3,etc.":
CLOSE 15
```

This is the same as the normal scratch command, except commas can be used to permit multiple scratches. Be careful with this one. There are quite a few hidden secrets within the 1541 disk drive.

Bug-Swatter:
Modifications And Corrections

• "Disk Handler" (March) does not work correctly because the variable K does not allow updating the next track and sector to be read. Reader Charles M. Shapin has found a solution to this bug: Change K to G in lines 436, 444, and 446.

• Line 37368 in the MLX listing of "MetaBASIC" (April) caused problems for some readers, who saw the second to the last number as a 175. That number is a 176. The corner was accidentally cut off.

Also, reader Harry G. Morgan reports that the LLIST command may not work correctly on some printers. To fix it, load MetaBASIC, type NEW, and SYS36864 to enable MetaBASIC. Enter MEMORY40336–40341. You should see that every other number on the first line is a 4. This is the beginning of a machine language routine equivalent to OPEN 4,4,4. Some Commodore printers require that the last number be either a 0 (OPEN 4,4,0 for uppercase/graphics) or a 7 (OPEN 4,4,7 for upper/lowercase). You can also change the second number if you own a Commodore 1520 Printer/Plotter, which is device number 6 (change the three 4's to 4, 6, and 0, respectively).

To make the change, put the commercial-at sign (@) in front of the line, cursor over to the last four on the line, change it, and press RETURN. Then use the BSAVE command to save the new copy of MetaBASIC.

Also, the DEFAULT function should not be called before using TERMINAL. You can disable DEFAULT by typing MONITOR.

• "1526 Hi-Res Screen Dump" (April) works as published. However, the program was renumbered during testing, and the number 100 in line 130 should have been changed to a 130. Thus, readers who typed the DATA statements incorrectly will see a message that a specific line is wrong. But the line that is reported to be wrong is actually 30 lower than the line containing the mistake. If you made no typing mistakes, this error won't affect the program.

• Although there are no errors in "Disk/Tape Backup" (December 1984), reader Gerald Hass has discovered that the DOS Wedge program should be disabled before running the program. The wedge can interfere with the backup process. And the article did not clearly state that while program and sequential files are backed up, relative files are not.

As mentioned in the article, the program reads files from disk and "packs" the data in a special format for saving to tape. When the file is restored, the information is unpacked. This means Disk/Tape Backup cannot be used for copying an original tape file to disk. For a tape-to-disk copy program, see this month's "GAZETTE Feedback."

• The printer used to list the 64 version of "Pool" (April) put an unnecessary question mark in line 49830. This does not affect the program, since MLX will not allow entry of question marks.

• A semicolon (;) was omitted from the end of line 350 in the 64 version of "Number Quest" (April). The program will run without the semicolon, but the Automatic Proofreader checksum will be incorrect.

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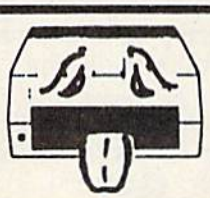

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How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the VIC-20, Commodore 64, Plus 4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. Also, carefully read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We publish two programs, which appear periodically, designed to make your typing effort easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 spaces} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example; enter eight SHIFTed A's). To type {SHIFT-SPACE}, hold down the SHIFT key and press the space bar.

If a key is enclosed in special brackets, ⟦ ⟧, hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + CRSR ↕	
{DOWN}	CRSR ↕	
{LEFT}	SHIFT + CRSR ↔	
{RIGHT}	CRSR ↔	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{F1}	f1	
{F2}	SHIFT + f1	
{F3}	f3	
{F4}	SHIFT + f3	
{F5}	f5	
{F6}	SHIFT + f5	
{F7}	f7	
{F8}	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↕	

For Commodore 64 Only

When You Read:	Press:	See:
⟦1⟧	C= + 1	
⟦2⟧	C= + 2	
⟦3⟧	C= + 3	
⟦4⟧	C= + 4	
⟦5⟧	C= + 5	
⟦6⟧	C= + 6	
⟦7⟧	C= + 7	
⟦8⟧	C= + 8	

The Automatic Proofreader

"The Automatic Proofreader" will help you type in program listings from COMPUTE!'s Gazette without typing mistakes. It is a short error-checking program that hides itself in memory. When activated, it lets you know immediately after typing a line from a program listing if you have made a mistake. Please read these instructions carefully before typing any programs in COMPUTE!'s Gazette.

Preparing The Proofreader

1. Using the listing below, type in the Proofreader. The same program works on both the VIC-20 and Commodore 64. Be very careful when entering the DATA statements — don't type an l instead of a 1, an O instead of a 0, extra commas, etc.

2. SAVE the Proofreader on tape or disk at least twice *before running it for the first time.* This is very important because the Proofreader erases this part of itself when you first type RUN.

3. After the Proofreader is SAVEd, type RUN. It will check itself for typing errors in the DATA statements and warn you if there's a mistake. Correct any errors and SAVE the corrected version. Keep a copy in a safe place — you'll need it again and again, every time you enter a program from COMPUTE!'s Gazette.

4. When a correct version of the Proofreader is RUN, it activates itself. You are now ready to enter a program listing. If you press RUN/STOP-RESTORE, the Proofreader is disabled. To reactivate it, just type the command SYS 886 and press RETURN.

Using The Proofreader

All VIC and 64 listings in COMPUTE!'s Gazette now have a *checksum number* appended to the end of each line, for example ":rem 123". *Don't enter this statement when typing in a program.* It is just for your information. The rem makes the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will confuse the Proofreader, even if you entered the rest of the line correctly.

When you type in a line from a program listing and press RETURN, the Proofreader displays a number at the top of your screen. *This checksum number must match the checksum number in the printed listing.* If it doesn't, it means you typed the line differently than the way it is listed. Immediately recheck your typing. Remember, don't type the rem statement with the checksum number; it is published only so you can check it against the number which appears on your screen.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

Special Tape SAVE Instructions

When you're done typing a listing, you must disable the Proofreader before SAVEing the program on tape. Disable the Proofreader by pressing RUN/STOP-RESTORE (hold down the RUN/STOP key and sharply hit the RESTORE key). This procedure is not necessary for disk SAVEs, *but you must disable the Proofreader this way before a tape SAVE.*

SAVE to tape erases the Proofreader from memory, so you'll have to LOAD and RUN it again if you want to type another listing. SAVE to disk does not erase the Proofreader.

Since the Proofreader is a machine language program stored in the cassette buffer, it will be erased during a tape SAVE or LOAD. If you intend to type in a program in more than one sitting or wish to make a safety SAVE, follow this procedure:

1. LOAD and RUN the Proofreader.
2. Disable it by pressing RUN/STOP-RESTORE.
3. Type the following three lines in direct mode (without line numbers):

```
A$="PROOFREADER.T":B$="{10 SPACES}":FO
RX=1TO4:A$=A$+B$:NEXTX
FORX=886 TO 1018:A$=A$+CHR$(PEEK(X)):N
EXTX
OPEN1,1,1,A$:CLOSE1
```

After you type the last line, you will be asked to press RECORD and PLAY. We recommend you start at the beginning of a new tape.

You now have a new version of the Proofreader (PROOFREADER.T, as renamed in the above code). Turn your computer off and on, then LOAD the program you were working on. Put the cassette containing PROOFREADER.T into the tape unit and type:

OPEN1:CLOSE1

You can now get into the Proofreader by typing SYS 886. To test this, PRINT PEEK (886) should return the number 173. If it does not, repeat the steps above, making sure that A$ (PROOFREADER.T) contains 13 characters and that B$ contains 10 spaces.

The new version of Automatic Proofreader will load itself into the cassette buffer whenever you type OPEN1:CLOSE1 and PROOFREADER.T is the next program on your tape. It will not disturb the contents of BASIC memory.

Automatic Proofreader For VIC And 64

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO
    1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MAD
    E AN ERROR":PRINT"IN DATA STATEMENTS.
    ":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER
     ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

NEWS & PRODUCTS

One member of General Electric's new family of computer peripherals is this combination acoustic/direct-connect modem.

GE Enters Peripheral Market

General Electric has introduced a complete line of computer peripherals, all compatible with Commodore computers.

The Model 3-8100 is a letter-quality thermal transfer printer. The Model 3-8150 interface emulates Commodore printers, and operates in either transparent or emulation mode. Both the printer and interface come with a two-year warranty. The printer retails for $299.95, the interface for $89.95.

The Model 3-8200 is a combination direct connect/acoustic 300-baud modem. It can operate off 9-volt batteries when AC power is unavailable. Price is $119.95.

The GE Program Recorder (Model 3-5156) features a digital program indicator, variable tone and data level controls, and a complete jack pack for interfacing. A Commodore interface cable is included. Suggested retail price is $69.96.

Two combination monitor/TVs are also available. Model 13BC5509 ($489.95) is a 13-inch composite color monitor; Model 12XR5204 ($129.95) is a 12-inch black and white monitor.

General Electric Company, Electronics Park, Syracuse, NY 13221

Circle Reader Service Number 245.

Memory Trainer

The Einstein Memory Trainer, a new release from Avant-Garde Publishing, is made up of five lessons that lead the user through techniques for remembering people's names, lists of words and numbers, and important dates and phone numbers. It also contains a game called *Memory Mix* for applying what was learned in the lessons. For the Commodore 64 with a disk drive; suggested retail is $49.95.

Avant-Garde Publishing Corp., P.O. Box 30160, 1907 Garden Ave., Eugene, OR 97403

Circle Reader Service Number 246.

Printer Interface For Commodore

QR&D Software Research & Development has introduced a parallel interface that plugs into any standard Commodore printer port. The Graphic Printer Cable has a switch-selectable Commodore graphics mode that allows compatibility with most popular printers. It emulates the standard Commodore printers, insuring total compatibility with Commodore software. The GPC is also compatible with software written for use with printers using Cardco interfaces. A 2K buffer is standard. List price of the interface is $129.

QR&D Software Research & Development, One West Lake St., Suite 320, Minneapolis, MN 55408

Circle Reader Service Number 247.

Musical Improvisation Software

Algo-Rhythm Software has released *Cantus, The Music Improvisor*, for the Commodore 64. Created by composer and performer Michael Riesman, the program lets the user select tempo, harmony, rhythm, counterpoint, voice range, and tone color. It then creates a three-voice improvisation, while showing a graphic realtime display of the notes *Cantus* is playing. No musical knowledge is required. *Cantus* is available for $54.00 plus $2.00 shipping.

Algo-Rhythm Software, 176 Mineola Blvd., Mineola, NY 11501

Circle Reader Service Number 248.

3-D Graphics Program

Graph-Tech Software has released *3-D World 64*, a graphics program which enables the creation of complex three-dimensional objects. The designs can then be viewed and altered on the screen or plotted as line-art to the

Commodore 1520 Plotter/Printer. The program also allows the rotation of images on the screen.

3-D World 64 is available on a disk which includes sample images. Also accompanying the program is a 50-page manual. Suggested retail is $39.95.

Graph-Tech Software Co., 1315 Third Ave., No. 4C, New York, NY 10021

Circle Reader Service Number 249.

Home Medical Software For 64

Family Medical Advisor, a new program from Navic Software, can diagnose illness, poisoning, or the effects of drug abuse. The user responds "yes" or "no" to a series of questions in layman's terms. The program analyzes the data with a database of nearly 200 medical conditions, then displays the probable condition along with related disorders with similar symptoms.

The program is on disk only for the Commodore 64, and lists for $38.

Navic Software, North Palm Beach, FL 33408

Circle Reader Service Number 250.

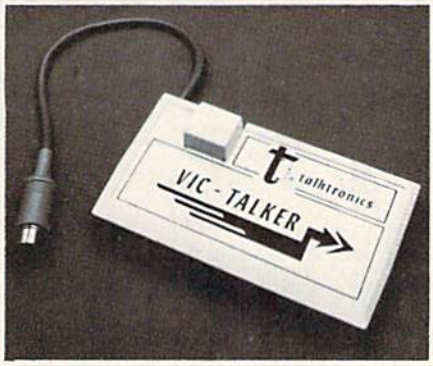
Arcade-Style Word Game

New from DLM is *Boppie's Great Word Chase*, an educational game for children in grades one through eight. Players move the character Boppie up and down ladders and around obstacles to gather letters and build words. The program has eight levels of play, with 256 built-in words of varying length and complexity.

Other options available include selecting one or two players, speed of play, and sound and on-screen instructions. For the 64 with a disk drive; suggested price is $29.95.

DLM, Inc., One DLM Park, Allen TX 75002

Circle Reader Service Number 251.



The VIC-TALKER, *by Talktronics, is a speech synthesis cartridge for the VIC-20.*

Speech Synthesis For VIC-20

The *VIC-TALKER*, from Talktronics, Inc., is a speech synthesis cartridge that works with the unexpanded Commodore VIC-20. It provides unlimited vocabulary translation of text to synthesized speech using advanced English language pronunciation rules and a user-expandable exception memory.

Voice mode options allow the user to "proofread" (by calling out punctuation and symbols in a second voice); use different voice inflections; and sing within a range of seven octaves. Suggested retail price is $89.

Talktronics, Inc., 27341 Eastridge Ave., El Toro, CA 92630

Circle Reader Service Number 252.

Graphics Integrator

Inkwell Systems has released *The Graphics Integrator*, a graphics package which allows the user to convert picture files from one graphics package for use in another, with graphics programs such as *Flexidraw, Doodle, Paint Magic, Koala, Peripheral Vision*, and *Tech Sketch*.

Also possible with *The Graphics Integrator* are integration of text and pictures with some word processing programs, creation of stand-alone picture files that can be loaded as programs, and creation of self-running slide shows with some packages. Suggested retail price is $29.95.

Inkwell Systems, 7677 Ronson Rd., San Diego, CA 92138

Circle Reader Service Number 253.

Super Sketch For Disk

Personal Peripherals has released a disk version of the *Super Sketch* graphics tablet for the 64 called the G2150. The tablet enables the user to create color graphics on the screen by moving the stylus over the pad. Also included on the disk are a printer utility and starter art kit. Suggested retail is $29.95.

Personal Peripherals, Inc., 1505 S. Green, Longview, TX 75602

Circle Reader Service Number 254.

Air Traffic Control Simulator

Kennedy Approach, from MicroProse Software, puts you behind the air traffic controls of some of the nation's busiest airports. Your job is to bring all the aircraft in on one runway, keeping the air space safe for approaching planes until it's their turn. *Kennedy Approach* is a speaking simulation; it allows you to communicate with all of the aircraft via computer-generated speech. Suggested retail price is $34.95.

MicroProse Software, 120 Lakefront Drive, Hunt Valley, MD 21030

Circle Reader Service Number 255.

New Product releases are selected from submissions for reasons of timeliness, uniqueness, available space, and general interest. Readers should be aware that News & Products often contains an edited version of material submitted by vendors. We are unable to vouch for its accuracy at time of publication.

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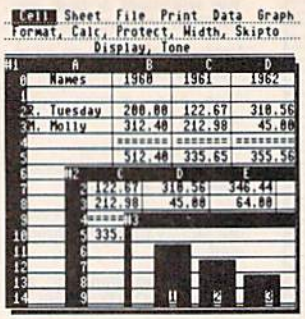

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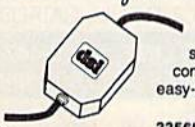

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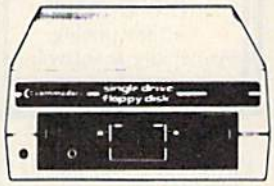

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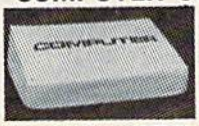

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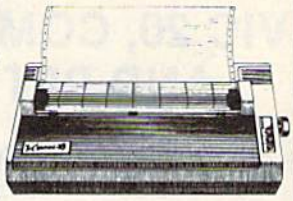

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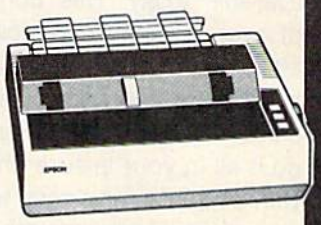

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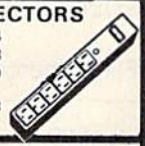

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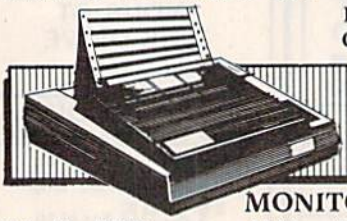

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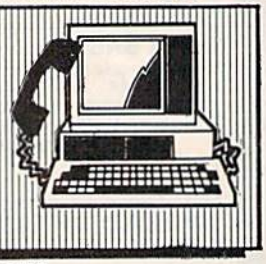

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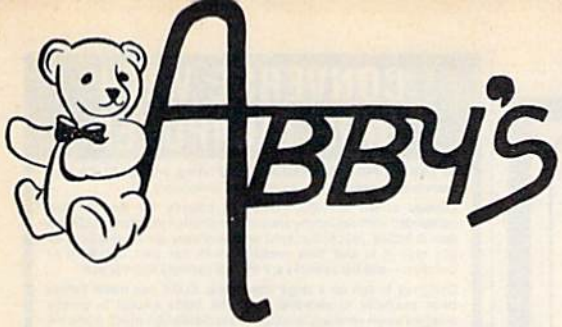

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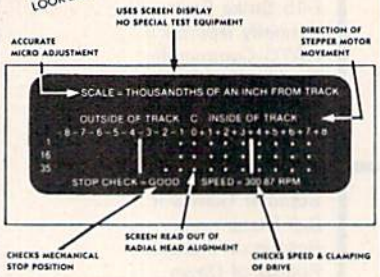

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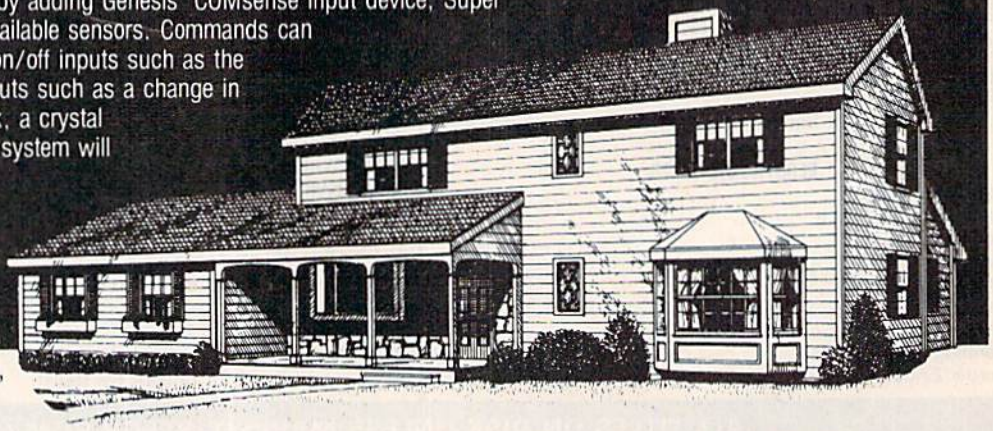

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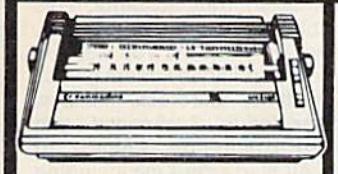

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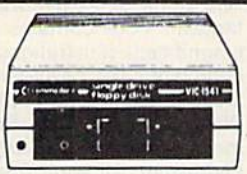

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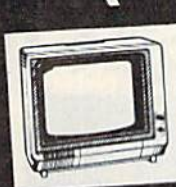

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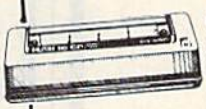

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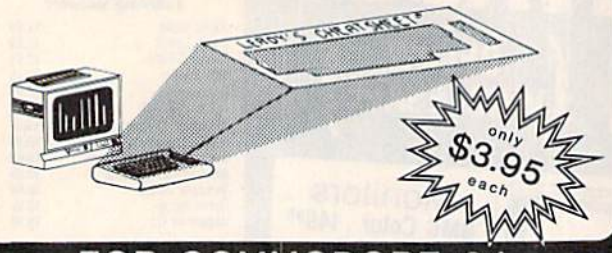

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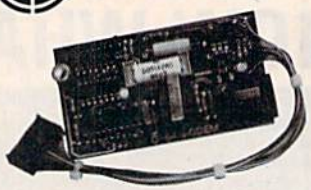

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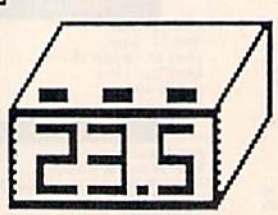

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Power BASIC

(Article on page 103.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Tape Program Rescue

```
100 A=681                                   :rem 174
110 READ H$:IF H$="**" THEN 180             :rem 236
120 FOR I=1 TO 2:J=ASC(MID$(H$,I,1))-48
                                            :rem 21
130 IF J>9 THEN J=J-7                       :rem 72
140 IF I=1 THEN D=J*16                      :rem 102
150 IF I=2 THEN D=D+J                       :rem 70
160 NEXT:POKE A,D                           :rem 240
170 A=A+1:GOTO 110                          :rem 184
180 PRINT"CUT PROGRAM OFF AT":PRINT"LINE
    {SPACE}NUMBER";:INPUT LN                :rem 121
190 H=INT(LN/256):L=LN-H*256                :rem 90
200 POKE 679,L:POKE 680,H                   :rem 90
210 SYS 681                                 :rem 49
220 DATA A9,00,AA,A8,20,BD,FF,E8,8A,20,BA
    ,FF,98,A6,2B,A4,2C,20,D5,FF,A6,2B,A4
                                            :rem 51
230 DATA 2C,86,FB,84,FC,A0,00,B1,FB,85,FD
    ,C8,B1,FB,85,FE,C8,B1,FB,CD,A7,02,D0
                                            :rem 83
240 DATA 08,C8,B1,FB,CD,A8,02,F0,07,A6,FD
    ,A4,FE,4C,C1,02,A0,00,98,91,FB,C8,91
                                            :rem 252
250 DATA FB,A5,FB,18,69,02,85,2D,A5,FC,69
    ,00,85,2E,00,**                         :rem 78
```

Character Assassination

(Article on page 70.)

Program 1: Character Assassination—VIC Version

```
10 D=22:F=30720:G=1:H=32:DIMA%(39):FORA=1
   TO10:READC%(A),S%(A):NEXT:A$="{RVS}
   {BLK}"                                   :rem 222
20 DATA 28,116,30,111,31,167,144,170,144,
   183,156,184,156,188,158,190,159,180,31
   ,181                                     :rem 4
30 F1=36875:F2=36877:K=250:L=2:POKE36878,
   15                                       :rem 123
50 FORA=1TO22:A$=A$+CHR$(C%(INT(RND(1)*10
   )+1))+CHR$(S%(INT(RND(1)*10)+1))
                                            :rem 209
60 NEXT:POKE36879,30:PRINT"{CLR}{9 DOWN}
   {RED}{6 SPACES}{RVS}CHARACTER":PRINT"
   {DOWN}{4 SPACES}{RVS}ASSASSINATION"
                                            :rem 174
70 PRINT"{3 DOWN}{3 RIGHT}{BLU}ENTER SPEE
   D(0-9)":PRINT"{DOWN}{3 SPACES}9 IS THE
    FASTEST":POKE198,0                      :rem 10
80 GETB$:IFB$<"0"ORB$>"9"THEN80             :rem 230
90 S=28-3*VAL(B$):PRINT"{CLR}"SPC(7)"
   {RVS}{RED}SCORE{OFF} 0"                  :rem 67
95 FORA=8164TO8185:POKEA,160:POKEA+F,6:NE
   XT                                       :rem 130
100 FORA=1TO20:PRINT:NEXT:PRINTA$;
                                            :rem 211
110 FL=0:FORA=7724TO7745:POKE649,1:SS=25:
    IFA%(A-7724)=0THEN170                   :rem 97
120 NEXTA:POKE198,0:IFFLTHEN110             :rem 150
130 PRINT"{HOME}{9 DOWN}{OFF}"SPC(7)"
    {BLU}GAME OVER":PRINT"{2 DOWN}
    {3 SPACES}{RED}PLAY AGAIN? (Y/N)"
                                            :rem 15
140 GETA$:IFA$="Y"THENPRINTSPC(9)"{DOWN}
    {BLK}OK":RUN                            :rem 188
150 IFA$="N"THENPOKE828,0:SYS828            :rem 144
160 GOTO140                                 :rem 101
170 FL=1:R1=RND(1):R2=(-(R1<.5)*(RND(1)*9
    +48))+(-(R1>=.5)*(RND(1)*26+1))
                                            :rem 233
180 R$=CHR$(R2-(R2<30)*64):C=A+418:FORB=A
    TOCSTEPD:POKEF1,K-L*SS                  :rem 1
190 SS=SS-1:GETA$:IFA$<>""THENPOKE649,0:I
    FA$=R$THEN220                           :rem 237
200 POKEB-D,H:POKEB,R2:POKEB+F,.            :rem 185
210 FORTD=GTOS:NEXTTD:NEXTB:Q=1:GOSUB230:
    POKEB-D,H:A%(A-7724)=1:NEXTA:GOTO110
                                            :rem 144
220 Q=0:GOSUB230:POKEB-D,H:SC=SC+SS:PRINT
    "{HOME}{RED}{OFF}"SPC(12)SC:NEXTA:GOT
    O110                                    :rem 96
230 POKEF1,0:Z=200:POKEB-D+F,2:FORT=1TO20
                                            :rem 205
240 POKEF2,Z:POKE36864,5+(Q=1):POKEB-D,42
    -4*(PEEK(B-D)=42)                       :rem 41
250 Z=Z-(Q=0)*2:POKE36864,5:NEXT:POKEF2,0
    :RETURN                                 :rem 197
```

Program 2: Character Assassination—64 Version

```
10 D=40:F=54272:G=1:H=32:DIMA%(39):FORA=1
   TO10:READC%(A),S%(A):NEXT:A$="{RVS}
   {BLK}"                                   :rem 230
20 DATA 149,116,150,161,151,184,159,190,1
   53,163,154,181,28,182,129,183,30,163
                                            :rem 218
30 DATA 31,170:POKE53265,23:POKE53280,6:F
   1=54273:V1=54276:K=150:L=2               :rem 183
40 FORA=54272TO54295:POKEA,0:NEXT:POKE542
   77,23:POKE54296,15:POKE54278,241
                                            :rem 54
50 FORA=1TO40:A$=A$+CHR$(C%(INT(RND(1)*10
   )+1))+CHR$(S%(INT(RND(1)*10)+1))
                                            :rem 209
60 NEXT:POKE53281,15:PRINT"{CLR}{9 DOWN}"
   SPC(9)"{RED}{RVS}CHARACTER ASSASSINATI
   ON"                                      :rem 41
70 PRINT"{3 DOWN}{3 RIGHT}{BLU}ENTER SPEE
   D 0-9 (9 IS THE FASTEST)":POKE198,0
                                            :rem 238
80 GETB$:IFB$<"0"ORB$>"9"THEN80             :rem 230
90 S=28-3*VAL(B$):PRINT"{CLR}"SPC(15)"
   {RVS}{RED}SCORE{OFF} 0"                  :rem 114
100 FORA=1TO22:PRINT:NEXT:PRINTA$;
                                            :rem 213
```

```
110 FL=0:FORA=1104TO1143:POKE649,1:SS=39:
    IFA%(A-1104)=0THEN170          :rem 60
120 NEXTA:POKE198,0:IFFLTHEN110    :rem 150
130 PRINT"{HOME}{9 DOWN}{OFF}"SPC(15)"
    {BLU}GAME OVER":PRINT"{2 DOWN}"SPC(11
    )"{RED}PLAY AGAIN? (Y/N)"      :rem 27
140 GETA$:IFA$="Y"THENPRINTSPC(17)"{DOWN}
    {BLK}OK":RUN                   :rem 235
150 IFA$="N"THENPOKE828,0:SYS828   :rem 144
160 GOTO140                        :rem 101
170 FL=1:R1=RND(1):R2=(-(R1<.5)*(RND(1)*9
    +48))+(-(R1>=.5)*(RND(1)*26+1))
                                   :rem 233
180 POKEV1,33:R$=CHR$(R2-(R2<30)*64):C=A+
    840:FORB=ATOCSTEPD:POKEF1,K-L*SS
                                   :rem 130
190 SS=SS-1:GETA$:IFA$<>""THENPOKE649,0:I
    FA$=R$THEN220                  :rem 237
200 POKEB-D,H:POKEB,R2:POKEB+F,J   :rem 213
210 FORTD=GTOS:NEXTTD:NEXTB:Q=1:GOSUB230:
    POKEB-D,H:A%(A-1104)=1:NEXTA:GOTO110
                                   :rem 130
220 Q=0:GOSUB230:POKEB-D,H:SC=SC+SS:PRINT
    "{HOME}{RED}{OFF}"SPC(20)SC:NEXTA:GOT
    O110                           :rem 95
230 POKEV1,129:Z=2:POKEB-D+F,2:FORT=1TO20
                                   :rem 233
240 POKEF1,Z:POKE53270,200-7*(Q=1):POKEB-
    D,42-4*(PEEK(B-D)=42)          :rem 222
250 Z=Z-(Q=0)*2:POKE53270,200:NEXT:POKEV1
    ,128:RETURN                    :rem 146
```

Squares

(Article on page 58.)

```
10 POKE53281,0:POKE53280,0:PRINT"{WHT}"
                                   :rem 198
20 DIMIN(15,4):FORA=984TO1023:POKEA,32:NE
   XT                              :rem 75
30 DR(0)=-40:DR(1)=1:DR(2)=40:DR(3)=-1
                                   :rem 235
40 CL(1)=3:CL(2)=4:CL(3)=11:CL(4)=9
                                   :rem 82
50 P(1)=1360:P(2)=1358:P(3)=1440:P(4)=143
   8:CO=54272                      :rem 150
60 FORX=1TO4:P(X)=1024+INT(RND(1)*15)*2+I
   NT(RND(1)*10)*80:NEXT           :rem 61
70 GOTO560                         :rem 59
80 PRINT"{CLR}";:FORX=1TO10:FORY=1TO15:PR
   INT"Q ";:NEXT:PRINT:PRINT:NEXT:rem 122
90 GOSUB630:PRINTTAB(22);"{DOWN} I{DOWN}
   {2 LEFT}J+K{DOWN}{2 LEFT}M"     :rem 1
100 QF=1:FORPL=1TO4:P=P(PL):CL=CL(PL):Q=0
    :FL=0                          :rem 79
110 P1=P:GOSUB380:P2=SI:LF=0       :rem 195
120 GOSUB470:GOSUB630:PRINT"{2 DOWN}PLAYE
    R"PL"'S TURN";:POKE646,CL:PRINT"
    {2 SPACES}Q{WHT}"              :rem 126
130 PRINT "{21 SPACES}"            :rem 101
140 GOSUB380                       :rem 176
150 IN=IN(SI,PL):IFIN=0THENGOSUB290
                                   :rem 205
160 GOTO500                        :rem 101
170 IFABS(IN)=1THENPOKEP+IN,67:GOTO190
                                   :rem 105
180 POKEP+IN,66                    :rem 114
190 POKEP+CO,1:POKEP+CO+IN*2,CL:POKEP+IN+
    CO,CL                          :rem 117
200 P(PL)=P+IN*2:GOSUB410          :rem 201
210 IF(S1=15)AND(PEEK(X+D)=32)THENPOKEX+D
    ,160:POKEX+D+CO,CL:B(PL)=B(PL)+1
                                   :rem 94
220 IF(S2=15)AND(PEEK(X-D)=32)THENPOKEX-D
    ,160:POKEX-D+CO,CL:B(PL)=B(PL)+1
                                   :rem 102
230 P=P(PL):GOSUB520               :rem 176
240 GOSUB380:IFP1=PANDP2=SITHENLF=1:Q=9
                                   :rem 230
250 IFQ=>9THEN270                  :rem 243
260 Q=Q+1:GOTO140                  :rem 219
270 IFLF=0THENQF=0                 :rem 90
280 NEXTPL:GOTO640                 :rem 130
290 GOSUB630:PRINT"{3 DOWN}WHAT DIRECTION
    ":POKEP+CO,CL:POKE198,0        :rem 95
300 IFTY(PL)=2THENGOSUB340:Q=10:GOTO330
                                   :rem 163
310 GETA$:IFA$<>"I"ANDA$<>"M"ANDA$<>"J"AN
    DA$<>"K"THEN310                :rem 149
320 Q=10:D=(A$="J")*-3+(A$="K")*-1+(A$="M
    ")*-2                          :rem 183
330 IN(SI,PL)=DR(D):IN=IN(SI,PL):RETURN
                                   :rem 190
340 IFSI=15THEND=INT(RND(1)*4):RETURN
                                   :rem 47
350 IFFL=>4THEND=INT(RND(1)*4):RETURN
                                   :rem 50
360 D=INT(RND(1)*4):IF(SIAND2↑D)=2↑DTHEN3
    60                             :rem 80
370 FL=FL+1:RETURN                 :rem 113
380 SI=0:FORX=0TO3:I=PEEK(DR(X)+P):rem 80
390 IFI<>32THENSI=SI+2↑X           :rem 10
400 NEXT:RETURN                    :rem 237
410 S1=0:S2=0:X=(P(PL)+P)/2:IFABS(X-P)=1T
    HEND=40:GOTO430                :rem 60
420 D=1                            :rem 72
430 FORY=0TO3:Z=PEEK(X+DR(Y)+D):IF(Z=66)O
    R(Z=67)THENS1=S1+2↑Y           :rem 46
440 NEXT                           :rem 215
450 FORY=0TO3:Z=PEEK(X+DR(Y)-D):IFZ=(66)O
    R(Z=67)THENS2=S2+2↑Y           :rem 52
460 NEXT:RETURN                    :rem 243
470 GOSUB630:PRINT"{19 SPACES}"    :rem 191
480 PRINT"{18 SPACES}"             :rem 109
490 PRINT"{18 SPACES}":GOTO520     :rem 120
500 IFPEEK(P+IN*2)=81THEN170       :rem 117
510 GOSUB630:PRINT:GOSUB480:GOSUB630:PRIN
    T"{DOWN}ILLEGAL MOVE":GOSUB290:GOTO14
    0                              :rem 201
520 PRINT"{HOME}":FORX=1TO4        :rem 57
530 PRINT TAB(29);" PLR."X;:POKE646,CL(X)
    :PRINT"Q{WHT}"                 :rem 52
540 PRINTTAB(30);B(X):NEXT         :rem 80
550 RETURN                         :rem 122
560 PRINT"{CLR}{6 DOWN}{RVS}{13 SPACES}"SPC(16)"S
    QUARES{WHT}"                   :rem 3
570 PRINT"{7 DOWN}{10 SPACES}{CYN}1. PLAY
    ER CONTROLLED                  :rem 131
580 PRINT"{WHT}{DOWN}{10 SPACES}{GRN}2. C
    OMPUTER CONTROLLED             :rem 69
590 FORX=1TO4                      :rem 34
600 PRINT"{YEL}{HOME}{10 DOWN}{8 SPACES}S
    NAKE "X" (CHOOSE 1 OR 2){WHT}"
                                   :rem 235
610 GETA$:IFVAL(A$)>2ORVAL(A$)=0THEN610
                                   :rem 27
620 TY(X)=VAL(A$):NEXT:GOTO80      :rem 24
630 PRINT"{HOME}":FORQQ=1TO18:PRINT:NEXT:
```

```
    RETURN                          :rem 20
640 IFQF=0THEN100                   :rem 237
650 PRINT"{CLR}{6 DOWN}"SPC(14)"{RVS}G
    AME OVER!{3 DOWN}"              :rem 130
660 FORX=1TO4:POKE 646,CL(X):PRINTTAB(7)"
    {DOWN}PLAYER"X;"...."B(X)" SQUARES"
                                    :rem 183
670 NEXT                            :rem 220
680 PRINT"{3 DOWN}"SPC(10)"{WHT}ANOTHER G
    AME? (Y/N)":POKE198,0           :rem 123
690 GETA$:IFA$="Y"THENRUN           :rem 16
700 IFA$="N"THENPRINT"{CLR}":END    :rem 254
710 GOTO690                         :rem 112
```

Dynamic SID Editor

(Article on page 88.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
100 GOTO1000:REM{25 SPACES}***** 16-BIT C
    ALCULATION *****            :rem 239
200 KK=PEEK(KEY):IFKK=NULLTHEN200 :rem 92
205 REM KEY PRESSED, USE VARS FOR SPEED
                                :rem 39
210 J=BB:Z=PEEK(H+BB):HH=PEEK(SHFT)
                                :rem 142
215 REM CUR-UP=7,CUR-LFT=2,RETURN=1
                                :rem 190
220 ONKKGOTO240,250,230,230,230,230,260
                                :rem 33
230 RETURN:REM NO VALID KEY, KEEP VALUE
                                :rem 87
240 J=INT((Z+BB)*K/CC):GOTO260  :rem 232
245 REM VRY FAST,LARGER FOR HIGHER VALS
                                :rem 107
250 J=K:REM MODERATE INCREMENT  :rem 125
260 Z=PEEK(H)+Z*XX+J*((HH=AA)-(HH>AA))
                                :rem 170
265 REM H SET BY CALLER, ADD INCR :rem 36
266 REM INCR IS POS IF SHIFT KEY DOWN
                                :rem 106
270 IFZ<AATHENZ=AA:REM MIN & MAX VALS
                                :rem 204
280 IFZ>ZZTHENZ=ZZ              :rem 239
290 GOSUB930:REM POSITION CURSOR  :rem 40
295 REM PRINT VALUE IF PITCH OR FILTER
                                :rem 252
300 IFDV<>CCTHENPRINTZ"{LEFT} ":GOTO320
                                :rem 187
305 REM PRINT % OF DUTY CYCLE   :rem 121
310 PRINTINT(Z/4.095)/10"{LEFT}%
    {2 SPACES}"                 :rem 124
315 REM PUT VALUE IN BUFFER     :rem 68
320 POKEH+BB,Z/XX:POKEH,Z-INT(Z/XX)*XX
                                :rem 211
330 IFDV>CCTHEN360:REM BRANCH FOR FLTR
                                :rem 54
335 REM PUT VAL IN SID, BACK FOR MORE
                                :rem 41
340 POKEYY,PEEK(H):POKEYY+BB,PEEK(H+BB)
                                :rem 197
350 GOTO200                     :rem 99
355 REM FILTER IS ODD; 11-BIT VALUE
                                :rem 224
356 REM STORED 3 LOW, 8 HIGH    :rem 252
360 POKEYY,ZAND7:POKEYY+BB,Z/8  :rem 193
370 GOTO200:REM{26 SPACES}***** 8-BIT CAL
    CULATION *****              :rem 154
400 KK=PEEK(KEY):IFKK=NULLTHEN400 :rem 96
405 REM KEY PRESSED, IS IT VALID?:rem 144
410 ONKKGOTO430,430,420,420,420,420,430
                                :rem 38
415 REM NO, RETURN WITH VALUE KEPT:rem 20
420 RETURN                      :rem 118
430 HH=PEEK(SHFT):BB=SBUF+H     :rem 173
435 REM ADD INCREMENT (SAME FOR ANY
                                :rem 11
436 REM VALID KEY), POS IF SHIFT DOWN
                                :rem 102
440 Z=(PEEK(BB)ANDJ)/K+(HH=0)-(HH>0)
                                :rem 6
450 IFZ<0THENZ=0:REM MIN & MAX VALUES
                                :rem 194
460 IFZ>15THENZ=15              :rem 83
470 GOSUB930:PRINTZ"{LEFT}{2 SPACES}":REM
     POS & PRNT                 :rem 51
475 REM MASK ON TO BYTE         :rem 36
480 Z=PEEK(BB)AND255-JORZ*K     :rem 131
485 REM INSERT & GO BACK FOR MORE :rem 65
490 POKEBB,Z:POKESID+H,Z:GOTO400:REM
    {5 SPACES}***** BIT DECODING *****
                                :rem 253
700 YY=PEEK(SBUF+XX):REM VALUE OF BYTE
                                :rem 107
710 Z=INT((YYANDJ)/K):REM VAL OF BIT(S)
                                :rem 30
715 REM MASK VALUES SET BY CALLER:rem 183
720 RETURN:REM{27 SPACES}***** BIT ENCODI
    NG *****                    :rem 97
800 YY=YYAND255-JORZ*K:REM ENCODE :rem 91
810 POKESBUF+XX,YY:REM SET BUFFER:rem 117
820 POKESID+XX,YY:REM SET SID   :rem 76
830 RETURN:REM{27 SPACES}***** CURSOR PLO
    TTER *****                  :rem 69
900 POKECX,WX%(CT)+CL:REM WORD ROW:rem 87
910 POKECY,WY%(CT)+OFS:REM & COLUMN
                                :rem 115
920 GOTO950                     :rem 114
930 POKECX,VX%(CT)+CL:REM VALUE ROW
                                :rem 154
940 POKECY,VY%(CT):REM{5 SPACES}& COLUMN
                                :rem 98
950 SYSMOVE:RETURN:REM MOVE CURSOR:rem 33
996 REM{34 SPACES}** MAIN ROUTINE **
                                :rem 127
1000 GOSUB 50000:REM INITIALIZE
     {10 SPACES}***** KEY INPUT *****
                                :rem 99
1100 KK=PEEK(KEY):IFKK=NULLTHEN1100
                                :rem 188
1105 REM KEY PRESSED, IF SHIFT IS:rem 127
1106 REM DOWN, SKIP ENTRY LEVEL CALC
                                :rem 100
1110 HH=PEEK(SHFT):IFHH=1THEN1500:rem 247
1115 REM ENTRY LEVEL INTO VOICES?:rem 248
1120 IFKK<F1ORKK>F5THEN1500     :rem 129
```

```
1125 REM CHANGE ENTRY LEVEL & CLEAR
                                    :rem 234
1130 EL=KK-4:DV=-1:GOSUB53000:GOTO1100
                                    :rem 224
1496 REM{33 SPACES}***** KEY DISPATCH ***
     **                             :rem 149
1500 IFKK=FTHEN2000:REM FREQUENCY :rem 47
1510 IFKK=PTHEN2000:REM PULSE WIDTH
                                    :rem 145
1520 IFKK=ATHEN3000:REM ATTACK     :rem 51
1530 IFKK=DTHEN3000:REM DECAY      :rem 229
1540 IFKK=STHEN3000:REM SUSTAIN    :rem 182
1550 IFKK=RTHEN3000:REM RELEASE    :rem 144
1560 IFKK=WTHEN4000:REM WAVEFORM   :rem 253
1570 IFKK=GTHEN4000:REM GATE       :rem 168
1580 IFKK=ITHEN4000:REM RING       :rem 186
1590 IFKK=YTHEN4000:REM SYNC       :rem 216
1600 IFKK=QTHEN2000:REM FILTER FREQ
                                    :rem 125
1610 IFKK=NTHEN3000:REM RESONANCE :rem 38
1620 IFKK=VTHEN3000:REM VOLUME     :rem 105
1630 IFKK=MTHEN5000:REM MODE       :rem 176
1640 IFKK=N1THEN5000:REM ASSIGN    :rem 131
1650 IFKK=N2THEN5000               :rem 162
1660 IFKK=N3THEN5000               :rem 164
1670 IFKK=XTHEN5000                :rem 124
1680 IFKK=OTHEN6000:REM OSC3       :rem 171
1690 IFKK=ETHEN6000:REM ENV3       :rem 166
1700 IFKK=TTHEN5000:REM 3 OFF      :rem 158
1705 REM SPECIAL FUNCTIONS         :rem 107
1710 IFKK=F1THENGOSUB7000:GOTO1100:rem 77
1720 IFKK=F3THENGOSUB7000:GOTO1100:rem 80
1730 IFKK=F5THENGOSUB7000:GOTO1100:rem 83
1740 IFKK<>F7ORHH=0THEN1800:REM END?
                                    :rem 178
1750 GETA$:IFA$<>""THEN1750:REM CLR BUF
                                    :rem 214
1760 POKESID+24,0:SYSCS:END:REM END
                                    :rem 159
1800 DV=-1:GOSUB53020:REM NO VALID KEY
                                    :rem 198
1810 GOSUB52000:GOTO1100:REM OOPS
     {8 SPACES}***** 16-BIT EVALUATION **
     ***                            :rem 228
2000 DV=1:IFKK=PTHENDV=2           :rem 238
2010 IFKK=QTHENDV=12               :rem 223
2015 REM DV:1=VOICE FREQ, 2=PLS WDTH
                                    :rem 83
2016 REM 12=FILTER FREQ, CLEAR OLD
                                    :rem 179
2017 REM VARS USED FOR SPEED       :rem 115
2018 REM ZZ=MAX VAL, H=SID REG     :rem 216
2020 GOSUB53020:XX=256:AA=0:BB=1:CC=2
                                    :rem 134
2030 K=29:H=0:ZZ=65535:J=7         :rem 210
2040 IFDV=2THENZZ=4095:H=2          :rem 65
2050 IFDV=12THENZZ=2047:H=21:J=0  :rem 144
2055 REM PRE-CALCULATE BUFFER & SID
                                    :rem 18
2056 REM ENTRY POINTS              :rem 32
2060 YY=SID+EL*J+H:H=SBUF+EL*J+H  :rem 204
2065 REM CALC & DISPLAY VALUES     :rem 208
2066 REM ONCE A NON-VALID KEY IS FOUND
                                    :rem 161
2067 REM IN SUBROUTINE, EXIT WITH KEY
                                    :rem 229
2068 REM VALUE INTACT              :rem 244
2070 GOSUB200:GOTO1110:REM{15 SPACES}****
     * 8-BIT EVALUATION *****       :rem 15
3000 DV=4:H=EL*7+5:J=240:K=16:REM ATCK
                                    :rem 160
3005 REM DECAY, SUSTAIN, RELEASE?:rem 209
3010 IFKK=DTHENDV=5:J=15:K=1       :rem 191
3020 IFKK=STHENDV=6:H=EL*7+6       :rem 200
3030 IFKK=RTHENDV=7:H=EL*7+6:J=15:K=1
                                    :rem 227
3035 REM RESONANCE OR VOLUME?        :rem 5
3040 IFKK=NTHENDV=13:H=23            :rem 5
3050 IFKK=VTHENDV=14:H=24:J=15:K=1:rem 42
3055 REM CLEAR, CALC & DISPLAY VALUES
                                    :rem 99
3056 REM WHEN NON-VALID KEY PRESSED,
                                    :rem 151
3057 REM RETURN WITH VALUE INTACT :rem 15
3060 GOSUB53020:GOSUB400:GOTO1110:REM
     {4 SPACES}***** CTRL BYTE CALCULATIO
     N *****                        :rem 33
4000 DV=-1:GOSUB53020:REM CLEAR    :rem 50
4005 REM SET MASK VALUES           :rem 149
4010 XX=4+EL*7:DV=3:J=240:REM WAVEFORM
                                    :rem 35
4020 IFKK=GTHENDV=8:J=1:REM GATE  :rem 222
4030 IFKK=ITHENDV=9:J=4:REM RING  :rem 244
4040 IFKK=YTHENDV=10:J=2:REM SYNC :rem 56
4050 K=J:IFJ=240THENK=16           :rem 159
4055 REM GO GET VALUE FROM SID BUFFER
                                    :rem 115
4056 REM BRANCH IF WAVEFORM         :rem 87
4060 GOSUB700:IFDV=3THEN4110       :rem 169
4066 REM TOGGLE VALUE              :rem 243
4070 Z=-(Z=0):CL=EL*5:CT=DV         :rem 69
4080 IFZ=1THENPRINT"{RVS}";:REM HIGHLIGHT
                                    :rem 38
4090 GOSUB53070:GOTO4190:REM DISPLAY
                                    :rem 193
4100 REM                           :rem 169
4105 REM INC 0->1,1->2,2->4,4->8,8->0
                                    :rem 77
4110 Z=(Z*2-(Z=0))*-(Z<8)           :rem 31
4120 CT=DV:CL=EL*5:GOSUB930:REM MVE CRS
                                    :rem 111
4125 REM DISPLAY WAVEFORM           :rem 45
4130 A$="-":IFZ=1THENA$="T         :rem 179
4140 IFZ=2THENA$="S                :rem 103
4150 IFZ=4THENA$="P                :rem 103
4160 IFZ=8THENA$="N                :rem 106
4170 PRINTA$                       :rem 190
4180 REM                           :rem 177
4190 GOSUB800:GOTO1100:REM STORE & RTRN
     {2 SPACES}***** FILT/MODE CALCULATIO
     N *****                        :rem 136
5000 DV=-1:GOSUB53020:REM CLEAR OLD
                                    :rem 18
5010 DV=15:CT=DV:CL=0:REM MODE     :rem 36
5015 REM FILTER ASSIGNMENT?       :rem 173
5020 IFKK=N1THENDV=16:H=1:GOTO5500:rem 66
5030 IFKK=N2THENDV=17:H=2:GOTO5500:rem 70
5040 IFKK=N3THENDV=18:H=4:GOTO5500:rem 75
5050 IFKK=XTHENDV=19:H=8:GOTO5500 :rem 40
5055 REM 3 OFF?                     :rem 0
5060 IFKK=TTHENDV=22:GOTO5200      :rem 37
5070 REM                          :rem 176
5075 REM MODE INCREMENT           :rem 127
5080 XX=24:J=112:K=16:GOSUB700    :rem 239
5085 REM INCR 0->1,1->2,2->4,4->0:rem 160
5086 REM PROGRAM MODIFICATION POSSIBLE
                                  :rem 166
5087 REM TO ALLOW MORE THAN ONE MODE
                                    :rem 63
```

```
5088 REM AT THE SAME TIME          :rem 132
5090 Z=(Z*2-(Z=0))*-(Z<4)          :rem 35
5100 GOSUB930:REM MOVE CURSOR      :rem 21
5110 A$=" -":IFZ=1THENA$="LP       :rem 250
5120 IFZ=2THENA$="BP               :rem 165
5130 IFZ=4THENA$="HP               :rem 174
5140 PRINTA$:GOTO5550:REM DISPLAY  :rem 50
5150 REM                           :rem 175
5155 REM TURN 3 OFF                :rem 11
5200 CT=DV:XX=24:J=128:K=1:GOSUB700
                                   :rem 98
5205 REM MASK & TOGGLE             :rem 196
5210 ZZ=128*-((ZANDJ)=0):H=1:GOTO5520
                                   :rem 96
5220 REM                           :rem 173
5225 REM ASSIGN FILTER             :rem 61
5500 CT=DV:XX=23:J=15:K=1:GOSUB700:rem 47
5510 ZZ=H*-((ZANDH)=0):REM MASK & TOGGLE
                                   :rem 17
5520 IFZZ>0THENPRINT"{RVS}";       :rem 202
5530 GOSUB53090:REM DISPLAY        :rem 130
5540 Z=ZANDJ-HORZZ                 :rem 166
5550 GOSUB800:GOTO1100:REM STORE & RTRN
     {2 SPACES}***** I/O INSERT *****
                                   :rem 115
6000 DV=-1:GOSUB53020:REM CLEAR    :rem 52
6005 REM DEFAULT TO OSC            :rem 60
6010 H=OS:CT=20:CL=0:IFKK=OTHEN6030
                                   :rem 119
6015 REM ENVELOPE                  :rem 14
6020 H=EN:CT=21                    :rem 81
6030 J=PEEK(H):REM READ VALUE      :rem 197
6035 REM VALUE SWITCH               :rem 1
6036 REM EITHER 255 (OFF),0 (VOICE 1,
                                   :rem 147
6037 REM LOW),1 (VOICE 1, HIGH), OR 22
                                   :rem 161
6038 REM (FILTER FREQUENCY, HIGH):rem 202
6040 J=-(J=0)-22*(J=1)-255*(J=22):rem 121
6050 POKEH,J:GOSUB930:REM SAVE & MOVE
                                   :rem 184
6055 REM CALCULATE DISPLAY         :rem 88
6060 J=1-(J>0)-(J>1)-(J>22)        :rem 91
6070 PRINTMID$("LHF-",J,1):GOTO1100
                                   :rem 252
6996 REM{33 SPACES}***** FUNCTION KEYS **
     ***                           :rem 8
7000 DV=-1:GOSUB53020:REM CLEAR    :rem 53
7005 REM CANNOT ARRIVE HERE UNLESS:rem 58
7006 REM SHIFT KEY WAS PRESSED, SO
                                   :rem 231
7007 REM F1=F2,F3=F4,F5=F6         :rem 154
7010 H=0:CT=8:J=1:K=1:REM DEFAULT:rem 203
7015 REM F1(F2)=TOGGLE, F3(F4)=ALL OFF
                                   :rem 81
7020 IFKK=F1ORKK=F3THEN7100        :rem 134
7025 REM F5(F6)=ON THEN OFF        :rem 222
7026 REM Z=READ VALUE, SET TO 1    :rem 207
7027 REM WILL CAUSE A TOGGLE TO 0  :rem 51
7028 REM H SERVES TO ADJUST Z      :rem 157
7030 H=1:GOSUB7100                  :rem 2
7040 H=2                           :rem 130
7095 REM VOICE GATES AT SID+4,11,18
                                   :rem 154
7100 FORXX=4TO18STEP7              :rem 79
7105 :REM IF F3, SET TO TURN OFF  :rem 210
7110 :GOSUB700:IFKK=F3THENZ=1      :rem 38
7115 :REM ADJUST FOR F5            :rem 25
7120 :IFH>0THENZ=H-1               :rem 181
7125 :REM CALCULATE DISPLAY ROW    :rem 137
7130 :CL=-5*(XX=11)-10*(XX=18)     :rem 92
7135 :REM DISPLAY AS ON/OFF        :rem 63
7140 :ON(Z<>1)+2GOSUB53060,53070  :rem 255
7150 :Z=-(Z=0):YY=YYAND254ORZ      :rem 39
7155 :REM SAVE IN BUFFER           :rem 112
7160 :POKESBUF+XX,YY               :rem 32
7170 NEXT                          :rem 14
7175 REM MOVE TO SID QUICKLY       :rem 148
7180 FORXX=4TO18STEP7              :rem 87
7190 :POKESID+XX,PEEK(SBUF+XX)     :rem 162
7200 NEXT:RETURN:REM{21 SPACES}** INITIAL
     IZE **                        :rem 218
49995 REM * PUT IN SYSTEM ROUTINES *
                                   :rem 58
49996 REM * CURSOR PLOT ROUTINE *:rem 144
50000 MOVE=679:CX=251:CY=252       :rem 101
50010 FORXX=MOVETOMOVE+7           :rem 61
50020 :READYY:POKEXX,YY            :rem 246
50030 NEXT:REM{27 SPACES}INTERRUPT ROUTIN
     E                             :rem 72
50040 FORXX=712TO760               :rem 167
50050 :READYY:POKEXX,YY            :rem 249
50060 NEXT:REM{27 SPACES}***** VARIABLE A
     SSIGNMENT *****               :rem 59
50100 KEY=203:SHFT=653:NULL=64     :rem 23
50105 REM PEEK(KEY)=VAL OF CURRENT:rem 22
50106 REM KEY DOWN, PEEK(SHFT)>0 IF
                                   :rem 213
50107 REM SHIFT,C=,OR CTRL PRESSED:rem 35
50108 REM PEEK(KEY)=NULL MEANS NO KEY
                                   :rem 179
50110 UP=7:FA=2:LO=1:XX=0:YY=0:ZZ=0:Z=0
                                   :rem 143
50115 REM UP=CURSOR UP/DOWN=SLOW   :rem 46
50116 REM FA=CRSR LFT/RGHT=MODERATE
                                   :rem 183
50117 REM LO=RETURN=FAST            :rem 5
50118 REM NO SHIFT=DOWN, SHIFT=UP:rem 255
50120 KK=0:HH=0:H=0:J=0:K=0:DV=0:CT=0
                                   :rem 131
50125 REM KK HOLDS CURRENT KEY VALUE
                                   :rem 122
50126 REM HH>0 IF SHIFT DOWN       :rem 37
50127 REM DV,CT,CL ARE DISPLAY VALUES
                                   :rem 185
50130 CL=0:AA=0:BB=0:CC=0:SID=54272
                                   :rem 209
50135 REM OP=MOVE INTERRUPT,CS=RESTORE
                                   :rem 229
50140 SBUF=MOVE+8:OP=712:CS=725    :rem 92
50145 REM HIGHLIGHTED KEY VALUES  :rem 189
50150 F1=4:F3=5:F5=6:F7=3          :rem 87
50160 F=21:P=41:W=9:A=10:D=18:S=13:R=17
                                   :rem 177
50170 G=26:I=33:Y=25:Q=62:N=39:M=36
                                   :rem 212
50180 V=31:N1=56:N2=59:N3=8        :rem 235
50185 REM EN,OS USED IN I/O        :rem 215
50190 X=23:O=38:E=14:T=22:EN=254:OS=253
                                   :rem 210
50196 REM{32 SPACES}***** READ SCREEN DAT
     A *****                       :rem 131
50200 DIMWX%(22),WY%(22):REM WORD X,Y
                                   :rem 71
50210 DIMVX%(22),VY%(22):REM VALUE X,Y
                                   :rem 135
50220 DIMWRD$(22):REM DISPLAY STRINGS
                                   :rem 247
50230 FORXX=0TO22                   :rem 5
50240 :READWX%(XX),WY%(XX)         :rem 40
```

```
50250 :READVX%(XX),VY%(XX)          :rem 39
50260 :READWRD$(XX)                 :rem 101
50270 NEXT:REM{27 SPACES}***** DISPLAY SC
      REEN *****                    :rem 213
50300 PRINT"{CLR}{OFF}{2 SPACES}SID EDITO
      R - PRESS A HIGHLIGHTED KEY:rem 120
50310 PRINT"CRSR:[U/D]=SLOW,[L/R]=MED, [R
      ETURN]=FAST                   :rem 17
50320 FORXX=0TO10STEP5:REM VOICES 1-3
                                    :rem 235
50325 :REM 0=F1,5=F3,10=F5          :rem 93
50330 :A$=RIGHT$(STR$(2*XX/5+1),1):rem 97
50335 :REM MOVE CURSOR              :rem 51
50340 :CT=0:CL=XX:OFS=-3:GOSUB900   :rem 2
50345 :REM PRINT "VOICE"            :rem 102
50350 :PRINT"{WHT}F"A$"{7} "WRD$(0)XX/5+1
                                    :rem 152
50355 :REM Z DETERMINES DISPLAY TYPE
                                    :rem 194
50360 :FORYY=1TO10:Z=1-(YY<8)-(YY=3)
                                    :rem 137
50370 : CT=YY:OFS=0:GOSUB900        :rem 161
50380 : PRINTWRD$(YY)" "MID$(" 0-",Z,1)
                                    :rem 242
50390 :NEXT                         :rem 122
50400 NEXT                          :rem 56
50410 REM                           :rem 222
50415 REM FILTER & VOLUME STUFF     :rem 47
50420 CT=11:CL=0:GOSUB900           :rem 186
50430 PRINTWRD$(11)                 :rem 77
50440 FORXX=12TO22:IFXX<>16THEN50460
                                    :rem 195
50445 :REM ADDITIONAL PROMPT        :rem 219
50450 :PRINT"{13 SPACES}ASSIGN FILTER
                                    :rem 114
50455 :REM A$=DEFAULT DISPLAY       :rem 222
50460 :A$="":IFXX<15THENA$=" 0      :rem 93
50470 :IFXX=15ORXX=20ORXX=21THENA$=" -
                                    :rem 29
50480 :CT=XX:GOSUB900:REM MOVE CURSOR
                                    :rem 69
50490 :PRINTWRD$(XX)A$              :rem 64
50500 NEXT:PRINT                    :rem 0
50510 PRINT" {WHT}F2{7}=TOGGLE {WHT}F4{7}
      =ALL OFF {WHT}F6{7}=ON/OFF {WHT}F8
      {7}=QUIT";                    :rem 195
50515 REM DISPLAY VALUES DEFAULT    :rem 207
50520 EL=0:OEL=EL:DV=-1:ODV=DV      :rem 75
50598 REM{32 SPACES}***** INSERT I/O INTO
       INTERRUPT *****              :rem 54
50600 POKEEN,255:POKEOS,255:SYSOP   :rem 48
50996 REM{32 SPACES}***** CLEAR SID & BUF
      FER *****                     :rem 188
51000 FORXX=SIDTOSID+28             :rem 194
51020 :{2 SPACES}POKEXX,0           :rem 109
51030 :{2 SPACES}POKESBUF+XX-SID,0
                                    :rem 214
51040 NEXT                          :rem 57
51050 RETURN:REM{25 SPACES}***** ERROR BU
      ZZ ****                       :rem 72
52000 POKESID+23,0:REM NO FILTER    :rem 115
52010 POKESID+24,15:REM FULL VOL    :rem 108
52020 POKESID+1,10:REM VOICE 1      :rem 182
52030 POKESID+5,0:REM NO A/D        :rem 52
52040 POKESID+6,240:REM FULL SUS    :rem 121
52050 POKESID+4,0:REM GATE OFF      :rem 224
52060 POKESID+4,33:REM SAW ON       :rem 163
52070 FORXX=1TO80:NEXT:REM DELAY    :rem 20
52075 REM RESTORE OLD VALUES        :rem 186
52080 POKESID+23,PEEK(SBUF+23)      :rem 0
52090 POKESID+24,PEEK(SBUF+24)      :rem 3
52100 POKESID+1,PEEK(SBUF+1)        :rem 145
52110 POKESID+5,PEEK(SBUF+5)        :rem 154
52120 POKESID+6,PEEK(SBUF+6)        :rem 157
52130 POKESID+4,PEEK(SBUF+4)        :rem 154
52140 RETURN:REM{25 SPACES}***** HIGHLIGH
      T CURRENT ENTRY *****         :rem 235
52995 REM LINE 53000 CLEARS OLD VOICE
                                    :rem 33
52996 REM LINE 53010 HIGHLIGHTS NEW
                                    :rem 233
52997 REM LINE 53020 CLEARS OLD ENTRY
                                    :rem 65
52998 REM LINE 53040 HIGHLIGHTS NEW
                                    :rem 238
52999 REM                           :rem 246
53000 CT=0:CL=5*OEL*-(CT<11):GOSUB53070
                                    :rem 215
53005 REM CL=ROW OFFSET             :rem 108
53010 CL=5*EL*-(DV<11):GOSUB53060   :rem 77
53020 CT=ODV:CL=5*OEL*-(CT<11)      :rem 217
53030 GOSUB53070                    :rem 122
53040 OEL=EL:ODV=DV                 :rem 164
53050 CT=ODV:CL=5*OEL*-(CT<11)      :rem 220
53060 PRINT"{RVS}";                 :rem 28
53065 REM NO CHANGE FOR THESE VALUES
                                    :rem 90
53066 REM GATE, RING, ETC           :rem 109
53070 IFCT<0ORCT>14THEN53110        :rem 149
53080 IFCT=3ORCT=11THEN53110        :rem 150
53090 GOSUB900:REM PLOT             :rem 119
53100 PRINT WRD$(CT)                :rem 127
53110 PRINT"{OFF}";:RETURN:REM{15 SPACES}
      ***** PROGRAM DATA *****      :rem 166
59998 REM CURSOR MOVE ROUTINE       :rem 55
59999 REM                           :rem 253
60000 DATA24,166,251,164,252,76,240,255
                                    :rem 178
60096 REM                           :rem 233
60097 REM                           :rem 234
60098 REM INTERRUPT ROUTINE         :rem 222
60099 REM                           :rem 236
60100 DATA120,169,226,141,20,3,169
                                    :rem 177
60110 DATA2,141,21,3,88,96,120,169
                                    :rem 182
60120 DATA49,141,20,3,169,234,141:rem 130
60130 DATA21,3,88,96,166,253,48,6:rem 150
60140 DATA173,27,212,157,0,212,166
                                    :rem 181
60150 DATA254,48,6,173,28,212,157:rem 146
60160 DATA0,212,76,49,234           :rem 255
62992 REM                           :rem 240
62993 REM                           :rem 241
62994 REM SCREEN DISPLAY DATA       :rem 226
62995 REM                           :rem 243
62996 REM WORD START X, WORD START Y,
                                    :rem 145
62997 REM VALUE START X, VALUE START Y,
                                    :rem 20
62998 REM WORD                      :rem 50
62999 REM                           :rem 247
63000 DATA3,4,3,4,VOICE             :rem 7
63010 DATA3,13,3,23,"{WHT}F{7}REQUENCY:
                                    :rem 160
63020 DATA4,13,4,23,"{WHT}P{7}LS WIDTH:
                                    :rem 96
63030 DATA5,14,5,24,"{WHT}W{7}AVEFORM:
                                    :rem 93
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```
63040 DATA3,30,3,37,"{WHT}A{7}TTACK:
                                    :rem 173
63050 DATA4,31,4,37,"{WHT}D{7}ECAY:
                                    :rem 95
63060 DATA5,29,5,37,"{WHT}S{7}USTAIN:
                                    :rem 42
63070 DATA6,29,6,37,"{WHT}R{7}ELEASE:
                                    :rem 7
63080 DATA6,13,6,13,"{WHT}G{7}ATE:rem 225
63090 DATA6,18,6,18,"R{WHT}I{7}NG:rem 251
63100 DATA6,23,6,23,"S{WHT}Y{7}NC:rem 248
63110 DATA19,1,19,1,FILTER/OUT    :rem 232
63120 DATA19,13,19,23,"FRE{WHT}Q{7}UENCY:
                                    :rem 16
63130 DATA20,13,20,23,"RESO{WHT}N{7}ANCE:
                                    :rem 237
63140 DATA19,30,19,37,"{WHT}V{7}OLUME:
                                    :rem 60
63150 DATA20,32,20,37,"{WHT}M{7}ODE:
                                    :rem 124
63160 DATA21,27,21,27,"{WHT}1{7}  :rem 84
63170 DATA21,29,2,29,"{WHT}2{7}   :rem 41
63180 DATA21,31,21,31,"{WHT}3{7}  :rem 78
63190 DATA21,33,21,33,"E{WHT}X{7}T:rem 17
63200 DATA22,13,22,18,"{WHT}O{7}SC3
                                    :rem 51
63210 DATA22,21,22,26,"{WHT}E{7}NV3
                                    :rem 54
63220 DATA22,29,22,29,"{WHT}T{7}URNOFF 3
                                    :rem 125
63230 REM{32 SPACES}*** END OF PROGRAM **
      *                             :rem 98
```

The Freeze Factory

(Article on page 54.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: The Freeze Factory—VIC Version

```
10 HS=0                             :rem 105
20 EG=0:RESTORE:GOTO470             :rem 199
30 POKEDD,127:IF((PEEK(P1)AND8)=.)THEND=W
   :GOTO170                         :rem 202
40 IF((PEEK(P1)AND16)=.)THEND=-T:G=2:GOTO
   170                              :rem 93
50 IF((PEEK(P1)AND4)=.)THEND=-W:GOTO170
                                    :rem 62
60 IF((PEEK(P2)AND128)=.)THEND=T:G=.:GOTO
   170                              :rem 99
70 FORA=.TO3:IFZ>E(A)THENIFPEEK(E(A)+W)=N
   THENI=W:GOTO90                   :rem 8
80 IFZ<E(A)THENIFPEEK(E(A)-W)=NTHENI=-W
                                    :rem 183
90 IFZ>E(A)THENIFPEEK(E(A)+T)=NTHENI=T:GO
   TO110                            :rem 138
100 IFZ<E(A)THENIFPEEK(E(A)-T)=NTHENI=-T
                                    :rem 218
110 IFPEEK(E(A)+I)=NTHENPOKEE(A),N:E(A)=E
    (A)+I:POKEE(A)+C,T:POKEE(A),5:rem 132
120 IFE(A)+I=ZTHEN240               :rem 201
130 POKEE(A),4:NEXT                 :rem 115
140 HH=HH+1:IFHH>HTTHENHH=.:H=H-1:IFH<0TH
    EN280                           :rem 86
150 PRINT"{HOME}{DOWN}{10 RIGHT}{RVS}";H;
    "{LEFT} "                       :rem 94
160 GOTO30                          :rem 51
170 POKEV-3,245:IFPEEK(Z+D)=NTHENPOKEZ,N:
    Z=Z+D:POKEZ+C,7:POKEZ,G:POKEV-3,.:GOT
    O210                            :rem 236
180 POKEV-3,.:IFPEEK(Z+D)=6ANDPEEK(Z+D*2)
    <>NTHEN220                      :rem 76
190 IFPEEK(Z+D)=6ANDPEEK(Z+D*2)=NTHENQQ=Z
    +D:GOTO310                      :rem 178
200 IFPEEK(Z+D)<6THEN240            :rem 151
210 GOTO70                          :rem 51
220 FORA=.TO3:POKEZ+D,8:POKEV-T,152:POKEZ
    ,G:POKEZ+D,9:POKEV-T,175:POKEZ,G+T:NE
    XT                              :rem 155
230 POKEZ+D,N:POKEV-T,.:S=S+10:PRINT"
    {HOME}{RVS}>";S:GOTO70          :rem 32
240 FORY=.TO15:POKEZ,G+T:POKEV-T,161:POKE
    E(A),4:POKEZ,G:FORO=1TO20:NEXT:POKEE(
    A),5                            :rem 214
250 NEXT:POKEV-T,.:FORY=.TO15:POKEV,Y:POK
    EV-T,245:FORO=1TO25:NEXT:NEXT:POKEV-T
    ,.                              :rem 29
260 SH=SH-1:PRINT"{HOME}{2 DOWN}{3 LEFT}
    {RVS}";SH"{LEFT} ":IFSH=.THEN280
                                    :rem 225
270 GOTO30                          :rem 53
280 POKEZ,N                         :rem 157
290 PRINT"{HOME}{11 DOWN}{6 RIGHT}{RVS}
    {WHT}GAME OVER":PRINT"{9 DOWN}{RVS}
    {3 SPACES}PRESS {CYN}FIREBUTTON";
                                    :rem 116
300 WAIT37137,32,32:GOTO20          :rem 196
310 POKEV-3,200:POKEV-3,220:POKEQQ,N:QQ=Q
    Q+D                             :rem 197
320 IFPEEK(QQ)=NTHENPOKEQQ+C,3:POKEQQ,6:G
    OTO310                          :rem 8
330 POKEV-3,.:IFPEEK(QQ)<6THENPOKEQQ+C,3:
    POKEQQ,6:S=S+1000:PRINT"{HOME}{RVS}>"
    ;S:GOTO350                      :rem 114
340 QQ=QQ-D:POKEQQ+C,3:POKEQQ,6:GOTO30
                                    :rem 164
350 FORY=240TO255:POKEV-2,Y:POKEV-2,.:NEX
    T                               :rem 126
360 FORA=.TO9:POKEQQ+C,T:POKEQQ,11:POKEV-
    4,235:POKEZ,G+T:POKEQQ,10:POKEZ,G:POK
    EV-3,200                        :rem 224
370 POKEV-4,.:NEXT:POKEQQ,4:POKEV-3,.:EG=
    EG+1:IFEG>3THEN390              :rem 179
380 GOTO30                          :rem 55
390 EG=.:FORY=128TO255:POKEV-3,Y:NEXT:POK
    EZ,N:FORA=.TO3:POKEE(A),N:NEXT:Z=7910
                                    :rem 246
400 FORY=.TO3:FORO=240TO255:POKEV-3,O:FOR
    A=1TO20:NEXT:NEXT:NEXT:POKEV-3,.
                                    :rem 234
410 FORY=8141TO7702STEP-1:IFPEEK(Y)=6THEN
    POKEY+C,T:POKEV-4,240:POKEY+C,3:S=S+2
    5                               :rem 189
420 POKEV-4,.:PRINT"{HOME}{RVS}>";S:H=60:
    NEXT:FORY=140TO255:POKEV-3,Y:NEXT:POK
    EV-3,.:POKEZ,G                  :rem 199
430 POKEZ+C,7:HT=HT-T:IFHT<1THENHT=1
                                    :rem 44
```

```
440 SH=SH+T:PRINT"{HOME}{2 DOWN}{3 LEFT}
    {RVS}";SH:LV=LV+1:PRINT"{HOME}{DOWN}
    {3 LEFT}{RVS}";LV                  :rem 149
450 FORY=1TO10:B=7768+INT(RND(T)*352):IFP
    EEK(B)=NANDB<>ZTHENPOKEB+C,3:POKEB,6
                                       :rem 3
460 NEXT:POKEV-2,144:S=S+(H*10):PRINT"
    {HOME}{RVS}>";S:POKEV-2,.:GOTO30
                                       :rem 114
470 POKE36869,240:PRINT"{CLR}{5 DOWN}
    {RIGHT}{BLK}{RVS}THE FREEZE FACTORY!!
    {OFF}"                             :rem 220
480 PRINT"{3 DOWN}{7 RIGHT}SCORE:":PRINT"
    {DOWN}{7 RIGHT}"S:IFS>HSTHENHS=S
                                       :rem 170
490 S=0:PRINT"{2 DOWN}{5 RIGHT}HIGH SCORE
    :":PRINT"{DOWN}{7 RIGHT}"HS        :rem 115
500 POKE36879,28:PRINT"{4 DOWN}{RVS}
    {2 RIGHT}PRESS {BLU}FIRE{BLK} TO PLAY
    "                                  :rem 65
510 WAIT37137,32,0:WAIT37137,32,32:rem 83
520 POKE52,28:POKE56,28:POKE51,.:POKE55,.
    :FORX=7424TO7432:POKEX,.:NEXT      :rem 17
530 FORX=7168TO7263:READD:POKEX,D:NEXT:V=
    36878:POKEV-9,255:POKEV,15:T=1:W=22:P
    OKEV+T,8                           :rem 142
540 PRINT"{CLR}{WHT}{RVS}> 0":PRINT"
    {8 LEFT}{RVS}LEVEL 1":PRINT"{6 RIGHT}
    {RVS}TIME: 60":C=30720             :rem 128
550 FORA=TTO50:POKEV-2,240:B=7768+INT(RND
    (T)*352):POKEB+C,3:POKEB,6:POKEV-2,.:
    NEXT                               :rem 250
560 FORA=7746TO7767:POKEA,7:POKEA+C,4:NEX
    T:FORA=7768TO8120STEPW:POKEA+C,4:POKE
    A,7                                :rem 85
570 POKEA+21,7:POKEA+21+C,4:NEXT:FORA=812
    1TO8140:POKEA+C,4:POKEA,7:NEXT:rem 85
580 FORA=.TO15:POKEV,A:POKEV-4,225:FORY=1
    TO75:NEXT:NEXT:POKEV-4,.           :rem 173
590 N=32:P1=37151:P2=37152:DD=37154:Z=791
    0:H=60:SH=3:E(.)=7902:E(T)=7914:E(2)=
    7800                               :rem 226
600 E(3)=7998:POKEZ+C,7:POKEZ,.:HT=4:LV=1
                                       :rem 191
610 PRINT"{HOME}{2 DOWN}{4 LEFT}{YEL}@
    {WHT}{RVS}";SH:GOTO30              :rem 178
620 PRINT"{HOME}{2 DOWN}{4 LEFT}{YEL}@
    {RVS}{WHT}";SH                     :rem 221
630 DATA62,120,119,112,28,96,88,54,62,120
    ,127,60,112,120,48,28,124,30,238,14,5
    6,6,26                             :rem 84
640 DATA108,124,30,254,60,14,30,12,56,60,
    90,36,24,60,90,36,102,60,90,36,90,60,
    24,36,195                          :rem 220
650 DATA126,195,153,165,165,153,195,126,2
    04,51,204,51,204,51,204,51,0,34,0,136
    ,0,34,0                            :rem 111
660 DATA136,68,0,17,0,68,0,17,0,0,24,60,1
    26,219,219,126,60,0,0,60,126,255,153,
    126,60                             :rem 59
```

Program 2: The Freeze Factory—64 Version

```
10 PRINT"{CLR}{12 DOWN}"SPC(14)"PLEASE WA
   IT":POKE53272,28:POKE56,48:CLR:rem 233
20 POKE56334,0:POKE1,51:A=2047:B=12288:C=
   53248                               :rem 33
30 FORI=.TOA:POKEI+B,PEEK(I+C):NEXT:POKE1
   ,55:POKE56334,1                     :rem 206
40 EG=0:RESTORE:GOTO520                :rem 197
50 IF((PEEK(P1)AND2)=.)THEND=W:GOTO190
                                       :rem 17
60 IF((PEEK(P1)AND4)=.)THEND=-T:G=2:GOTO1
   90                                  :rem 46
70 IF((PEEK(P1)AND1)=.)THEND=-W:GOTO190
                                       :rem 63
80 IF((PEEK(P1)AND8)=.)THEND=T:G=.:GOTO19
   0                                   :rem 3
90 FORA=.TO3:IFZ>E(A)THENIFPEEK(E(A)+W)=N
   THENI=W:GOTO110                     :rem 51
100 IFZ<E(A)THENIFPEEK(E(A)-W)=NTHENI=-W
                                       :rem 224
110 IFZ>E(A)THENIFPEEK(E(A)+T)=NTHENI=T:G
    OTO130                             :rem 181
120 IFZ<E(A)THENIFPEEK(E(A)-T)=NTHENI=-T
                                       :rem 220
130 IFPEEK(E(A)+I)=NTHENPOKEE(A),N:E(A)=E
    (A)+I:POKEE(A)+C,T:POKEE(A),5:rem 134
140 IFE(A)+I=ZTHEN260                  :rem 205
150 POKEE(A),4:NEXT                    :rem 117
160 HH=HH+1:IFHH>HTTHENHH=.:H=H-1:IFH<0TH
    EN310                              :rem 82
170 PRINT"{HOME}{DOWN}{18 RIGHT}";H;"
    {LEFT} "                           :rem 54
180 GOTO50                             :rem 55
190 POKEU2,40:IFPEEK(Z+D)=NTHENPOKEZ,N:Z=
    Z+D:POKEZ+C,7:POKEZ,G:POKEU2,.:GOTO23
    0                                  :rem 91
200 POKEU2,.:IFPEEK(Z+D)=6ANDPEEK(Z+D*2)<
    >NTHEN240                          :rem 24
210 IFPEEK(Z+D)=6ANDPEEK(Z+D*2)=NTHENQQ=Z
    +D:GOTO350                         :rem 175
220 IFPEEK(Z+D)<6THEN260               :rem 155
230 GOTO90                             :rem 55
240 FORA=.TO3:POKEZ+D,8:POKEU1,152:POKEZ,
    G:POKEZ+D,9:POKEU1,175:POKEZ,G+T:NEXT
                                       :rem 251
250 POKEZ+D,N:POKEU1,.:S=S+10:PRINT"
    {HOME}{YEL}>{WHT}";S:GOTO90        :rem 100
260 FORY=1TO15:POKEZ,G+T:POKEU1,161:POKEE
    (A),4:POKEZ,G:FORO=1TO20:NEXT:rem 233
270 POKEE(A),5                         :rem 0
280 NEXT:POKEU1,.:FORY=1TO15:POKEV,Y:POKE
    U1,245:FORO=1TO25:NEXT:NEXT:POKEU1,.
                                       :rem 48
290 SH=SH-1:PRINT"{HOME}{2 DOWN}{3 LEFT}
    {OFF}";SH"{LEFT} ";:IFSH=.THEN310
                                       :rem 153
300 GOTO50                             :rem 49
310 POKEZ,N                            :rem 151
320 PRINT"{HOME}{11 DOWN}{RIGHT}
    {14 SPACES}{RVS}{WHT}GAME OVER{OFF}
    {13 SPACES}"                       :rem 80
330 PRINT"{12 DOWN}{RVS}{12 RIGHT}PRES
    S FIREBUTTON";                     :rem 236
340 WAIT56320,16,16:GOTO40             :rem 201
350 POKEU2,100:POKEU2,120:POKEQQ,N:QQ=QQ+
    D                                  :rem 105
360 IFPEEK(QQ)=NTHENPOKEQQ+C,3:POKEQQ,6:G
    OTO350                             :rem 16
370 POKEU2,.:IFPEEK(QQ)<6THENPOKEQQ+C,3:P
    OKEQQ,6:S=S+1000:PRINT"{HOME}{YEL}>
    {WHT}";S:GOTO390                   :rem 220
380 QQ=QQ-D:POKEQQ+C,3:POKEQQ,6:GOTO50
                                       :rem 170
390 FORY=120TO135:POKEU2,Y:NEXT:POKEU2,.
                                       :rem 32
400 FORA=.TO9:POKEQQ+C,T:POKEQQ,11:POKEU2
    ,135:POKEZ,G+T:POKEQQ,10:POKEZ,G
                                       :rem 205
```

```
410 POKEU2,100:POKEU2,.:NEXT:POKEQQ,4:POK
    EU2,.:EG=EG+1:IFEG>3THEN430   :rem 247
420 GOTO50                        :rem 52
430 EG=.:FORY=64TO128:POKEU2,Y:NEXT:POKEZ
    ,N:FORA=.TO3:POKEE(A),N:NEXT:Z=1524
                                  :rem 139
440 FORY=.TO3:FORO=35TO55:POKEU2,O:FORA=1
    TO10:NEXT:NEXT:NEXT:POKEU2,.  :rem 47
450 FORY=1902TO1185STEP-1         :rem 238
460 IFPEEK(Y)=6THENPOKEY+C,T:POKEU2,120:F
    ORTD=1TO25:NEXT:POKEY+C,3:S=S+25
                                  :rem 167
470 POKEU2,.:PRINT"{HOME}{YEL}>{WHT}";S:H
    =60:NEXT:FORY=5TO25:POKEU2,Y:NEXT:POK
    EU2,.:POKEZ,G                 :rem 58
480 POKEZ+C,7:HT=HT-T:IFHT<1THENHT=1
                                  :rem 49
490 SH=SH+T:PRINT"{HOME}{2 DOWN}{3 LEFT}"
    ;SH:LV=LV+1:PRINT"{HOME}{DOWN}
    {3 LEFT}";LV                  :rem 118
500 FORY=1TO10:B=1184+INT(RND(T)*700):IFP
    EEK(B)=NANDB<>ZTHENPOKEB+C,3:POKEB,6
                                  :rem 238
510 NEXT:POKEU2,72:S=S+(H*10):PRINT"
    {HOME}{YEL}>{WHT}";S:POKEU2,.:GOTO50
                                  :rem 117
520 POKE53281,1:POKE53272,21:PRINT"{CLR}
    {5 DOWN}{RIGHT}{CYN}{RVS}{9 RIGHT}THE
     FREEZE FACTORY!!{OFF}{BLK}"  :rem 5
530 PRINT"{3 DOWN}"SPC(17-LEN(STR$(S))/2)
    "SCORE: "S:IFS>HSTHENHS=S     :rem 86
540 S=0:PRINT"{3 DOWN}"SPC(15-LEN(STR$(HS
    ))/2)"HIGH SCORE:"HS          :rem 176
550 POKE53280,4:PRINT"{7 DOWN}{RVS}
    {11 RIGHT}PRESS [13]FIRE{BLK} TO PLAY"
                                  :rem 155
560 FORA=54272TO54296:POKEA,0:NEXT:V=5429
    6:U1=54273                    :rem 9
570 U2=54280:POKE54277,17:POKE54284,17:PO
    KE54278,255:POKE54285,255     :rem 225
580 POKE54276,129:POKE54283,33    :rem 157
590 WAIT56320,16,0:WAIT56320,16,16:rem 87
600 PRINT"{CLR}":POKE53281,0:FORX=12544TO
    12561:POKEX,.:NEXT            :rem 174
610 FORX=12288TO12383:READD:POKEX,D:NEXT:
    POKE53272,28                  :rem 2
620 T=1:W=40:PRINT"{CLR}{YEL}>{WHT} 0":PO
    KEV,15                        :rem 140
630 PRINT"{8 LEFT}{RVS}{GRN}LEVEL{WHT}
    {OFF} 1":PRINT"{14 RIGHT}{RVS}[13]TIME
    {OFF}{WHT} 60":C=54272        :rem 224
640 FORA=TTO70:POKEU2,20:B=1184+INT(RND(T
    )*700):POKEB+C,3:POKEB,6:POKEU2,.:NEX
    T                             :rem 91
650 FORA=1144TO1183:POKEA,7:POKEA+C,4:NEX
    T:FORA=1184TO1904STEPW:POKEA+C,4
                                  :rem 33
660 POKEA,7:POKEA+39,7:POKEA+39+C,4:NEXT:
    FORA=1905TO1943:POKEA+C,4:POKEA,7:NEX
    T                             :rem 123
670 FORA=1TO15:POKEV,A:POKEU2,5:FORY=1TO7
    5:NEXT:NEXT:POKEU2,.          :rem 236
680 N=32:P1=56320:Z=1524:H=60:SH=3:E(.)=1
    510:E(T)=1534:E(2)=1724       :rem 202
690 E(3)=1204:POKEZ+C,7:POKEZ,.:HT=4:LV=1
                                  :rem 174
700 PRINT"{HOME}{2 DOWN}{4 LEFT}{YEL}@
    {WHT}";SH:GOTO50              :rem 162
710 PRINT"{HOME}{2 DOWN}{4 LEFT}{YEL}@
    {WHT}";SH                     :rem 203
720 DATA62,120,119,112,28,96,88,54,62,120
    ,127,60,112,120,48,28,124,30,238,14
                                  :rem 199
730 DATA56,6,26                   :rem 21
740 DATA108,124,30,254,60,14,30,12,56,60,
    90,36,24,60,90,36,102,60,90,36,90
                                  :rem 89
750 DATA60,24,36,195              :rem 14
760 DATA126,195,153,165,165,153,195,126,2
    04,51,204,51,204,51,204,51,0,34,0
                                  :rem 96
770 DATA136,0,34,0                :rem 157
780 DATA136,68,0,17,0,68,0,17,0,0,24,60,1
    26,219,219,126,60,0,0,60,126,255
                                  :rem 34
790 DATA153,126,60                :rem 170
```

Screen-40

(Article on page 92.)

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

See instructions in article before entering this program.

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8192 :120,076,069,032,065,048,154
8198 :195,194,205,000,002,004,094
8204 :016,018,022,255,155,129,095
8210 :100,173,190,164,255,162,038
8216 :000,160,044,024,032,156,184
8222 :255,169,040,141,136,002,005
8228 :120,032,138,255,160,005,234
8234 :190,009,032,185,016,032,250
8240 :157,020,003,169,032,157,074
8246 :021,003,136,016,239,032,245
8252 :249,253,088,076,030,033,021
8258 :032,141,253,032,023,032,067
8264 :032,091,228,032,164,227,078
8270 :165,043,164,044,032,008,022
8276 :196,169,216,160,032,032,121
8282 :030,203,169,055,032,013,080
8288 :228,076,129,227,072,138,198
8294 :072,152,072,173,029,145,233
8300 :016,037,045,030,145,170,039
8306 :041,002,208,003,076,222,154
8312 :254,044,017,145,032,234,078
8318 :255,032,225,255,208,006,083
8324 :032,036,032,108,002,192,022
8330 :169,014,141,119,002,169,240
8336 :001,133,198,104,168,104,084
8342 :170,104,064,234,234,032,220
8348 :234,255,032,000,033,076,018
8354 :239,234,165,153,201,003,133
8360 :240,014,076,245,241,165,125
8366 :153,208,003,076,166,036,048
8372 :201,003,208,003,076,158,061
8378 :036,076,042,242,072,165,051
8384 :154,201,003,208,013,173,176
8390 :141,002,240,004,201,003,021
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8396 :144,247,104,076,215,035,001
8402 :076,133,255,234,234,234,096
8408 :083,067,082,069,069,078,152
8414 :045,052,048,032,032,032,207
8420 :032,032,032,032,032,032,164
8426 :032,032,032,032,032,032,170
8432 :032,032,032,032,032,032,176
8438 :032,032,032,032,032,032,182
8444 :032,032,013,000,165,204,186
8450 :208,025,198,205,208,021,099
8456 :164,211,177,209,078,134,213
8462 :002,176,005,238,134,002,059
8468 :169,160,032,093,035,169,166
8474 :032,133,205,096,162,007,149
8480 :134,205,189,208,037,157,194
8486 :052,003,189,216,037,157,180
8492 :137,002,202,016,241,138,012
8498 :157,240,015,202,224,015,135
8504 :208,247,189,192,037,157,062
8510 :000,144,202,016,247,142,045
8516 :145,002,162,003,134,154,156
8522 :160,000,132,153,140,134,025
8528 :002,140,135,002,032,096,231
8534 :037,173,136,002,009,128,059
8540 :168,169,000,170,148,217,196
8546 :024,105,040,144,001,200,100
8552 :232,224,024,208,243,169,180
8558 :255,149,217,202,032,050,247
8564 :035,202,016,250,169,000,020
8570 :133,211,133,214,165,211,165
8576 :056,233,040,144,002,133,224
8582 :211,166,214,165,211,180,001
8588 :217,048,006,024,105,040,068
8594 :133,211,202,169,039,180,056
8600 :218,048,002,169,079,133,033
8606 :213,181,217,041,003,013,058
8612 :136,002,133,210,189,016,082
8618 :038,133,209,189,248,037,000
8624 :133,244,189,224,037,133,112
8630 :243,096,162,023,198,214,094
8636 :016,192,134,214,048,188,212
8642 :230,214,162,023,228,214,241
8648 :176,180,169,000,240,174,115
8654 :164,211,230,211,192,039,229
8660 :144,225,208,002,230,214,211
8666 :196,213,144,217,198,214,120
8672 :160,000,132,211,132,212,047
8678 :070,201,166,214,232,224,057
8684 :024,208,003,032,189,034,214
8690 :181,217,016,244,134,214,224
8696 :048,132,169,000,133,199,161
8702 :240,224,164,211,240,010,063
8708 :136,192,039,208,002,198,011
8714 :214,132,211,096,166,214,019
8720 :240,009,198,214,032,135,076
8726 :033,164,213,132,211,096,103
8732 :032,000,034,164,211,196,153
8738 :213,176,043,200,177,209,028
8744 :136,032,091,035,200,208,230
8750 :242,164,213,177,209,201,228
8756 :032,208,004,196,211,208,143
8762 :007,192,079,240,220,032,060
8768 :085,034,164,213,136,177,105
8774 :209,200,032,091,035,136,005
8780 :196,211,208,244,169,032,112
8786 :076,091,035,166,214,232,128
8792 :134,242,224,024,144,007,095
8798 :032,189,034,198,214,208,201
8804 :005,173,146,002,208,017,139
8810 :022,217,086,217,022,218,120
8816 :056,118,218,169,079,133,117
8822 :213,202,076,159,033,165,198
8828 :172,072,165,173,072,162,172
8834 :024,202,032,159,033,228,040
8840 :242,144,014,240,012,189,209
8846 :015,038,133,172,181,216,129
8852 :032,027,035,048,234,032,044
8858 :050,035,162,022,228,242,125
8864 :144,015,181,218,041,127,118
8870 :180,217,016,002,009,128,206
8876 :149,218,202,208,237,166,072
8882 :242,032,106,034,104,133,061
8888 :173,104,133,172,096,165,003
8894 :172,072,165,173,072,162,238
8900 :017,134,244,162,022,134,141
8906 :173,160,000,132,243,132,018
8912 :172,177,172,145,243,200,037
8918 :208,249,230,244,232,224,065
8924 :032,208,234,162,255,232,063
8930 :224,016,240,028,032,159,157
8936 :033,022,217,024,180,225,165
8942 :016,001,056,118,217,189,067
8948 :024,038,133,172,152,009,004
8954 :128,149,225,032,027,035,078
8960 :048,223,032,050,035,232,108
8966 :224,024,208,248,165,201,052
8972 :233,008,133,201,006,217,042
8978 :056,102,217,162,016,134,193
8984 :214,144,155,041,003,013,082
8990 :136,002,133,173,160,039,161
8996 :177,172,145,209,144,004,119
9002 :032,093,035,056,136,016,154
9008 :243,096,032,159,033,160,003
9014 :039,169,032,145,209,136,016
9020 :016,251,169,020,133,216,097
9026 :169,000,160,007,145,243,022
9032 :136,016,251,169,016,024,172
9038 :101,243,133,243,144,002,176
9044 :230,244,198,216,208,232,132
9050 :096,145,209,133,206,138,249
9056 :072,152,072,165,209,162,160
9062 :255,232,221,016,038,208,048
9068 :250,152,233,040,048,002,065
9074 :232,168,032,173,033,152,136
9080 :041,062,024,042,042,042,117
9086 :144,003,230,244,024,101,104
9092 :243,144,002,230,244,133,104
9098 :243,152,041,001,168,185,160
9104 :200,037,133,216,169,000,131
9110 :006,206,038,199,006,206,043
9116 :042,006,206,042,013,135,088
9122 :002,170,189,052,003,133,199
9128 :207,036,216,160,007,177,203
9134 :243,005,216,133,241,177,165
9140 :206,041,015,080,004,010,024
9146 :010,010,010,069,241,166,180
9152 :199,208,002,069,216,145,007
9158 :243,136,016,227,132,241,169
9164 :070,199,104,168,104,170,251
9170 :169,002,133,205,096,133,180
9176 :215,138,072,152,072,169,010
9182 :000,133,208,165,215,048,223
9188 :019,201,032,144,063,032,207
9194 :112,036,201,096,144,004,059
9200 :041,223,016,018,041,063,130
9206 :016,014,201,255,208,002,174
9212 :169,254,201,160,144,038,194
9218 :041,127,009,064,166,199,096
9224 :240,002,009,128,164,211,250
9230 :032,091,035,196,213,208,021
9236 :007,192,079,240,003,032,061
9242 :085,034,032,206,033,104,008
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9248 :168,104,170,165,215,024,110
9254 :088,096,162,024,221,056,173
9260 :038,240,025,202,016,248,045
9266 :162,007,221,040,038,240,246
9272 :005,202,016,248,048,225,032
9278 :165,212,208,014,138,032,063
9284 :103,036,240,215,224,004,122
9290 :144,012,165,212,240,008,087
9296 :165,215,016,182,009,064,219
9302 :208,174,032,094,036,076,194
9308 :031,036,189,104,038,072,050
9314 :189,080,038,072,096,162,223
9320 :000,157,000,148,232,208,081
9326 :250,096,201,034,208,006,137
9332 :069,212,133,212,169,034,177
9338 :096,169,000,133,199,096,047
9344 :173,135,002,073,004,044,047
9350 :169,000,044,169,004,141,149
9356 :135,002,096,162,000,134,157
9362 :242,032,123,034,006,217,032
9368 :056,102,217,076,120,033,244
9374 :133,208,165,213,133,200,186
9380 :208,008,165,214,133,201,069
9386 :165,211,133,202,138,072,067
9392 :152,072,165,208,208,100,057
9398 :165,198,133,204,141,146,145
9404 :002,240,247,120,234,078,085
9410 :134,002,164,211,177,209,067
9416 :032,093,035,032,228,255,107
9422 :201,131,208,016,120,162,020
9428 :009,134,198,189,047,038,059
9434 :157,118,002,202,208,247,128
9440 :240,212,201,013,240,005,111
9446 :032,215,035,144,203,164,255
9452 :213,132,208,177,209,201,096
9458 :032,208,003,136,208,247,052
9464 :200,132,200,160,000,132,048
9470 :211,132,212,140,146,002,073
9476 :166,214,181,217,048,001,063
9482 :202,032,159,033,228,201,097
9488 :208,008,165,202,133,211,175
9494 :197,200,176,035,164,211,237
9500 :177,209,133,215,041,063,098
9506 :006,215,036,215,016,002,012
9512 :009,128,144,004,166,212,191
9518 :208,004,112,002,009,064,189
9524 :230,211,032,112,036,196,101
9530 :200,208,019,169,000,133,019
9536 :208,162,003,228,153,240,034
9542 :004,228,154,240,003,032,219
9548 :250,033,169,013,133,215,121
9554 :104,168,104,170,165,215,240
9560 :201,222,208,002,169,255,121
9566 :024,096,185,128,038,153,206
9572 :000,150,074,074,074,074,034
9578 :153,128,150,169,006,153,097
9584 :000,148,185,000,039,153,125
9590 :000,149,074,074,074,074,051
9596 :153,000,151,192,216,144,212
9602 :003,153,000,149,200,048,171
9608 :228,208,213,096,174,141,172
9614 :002,224,002,240,003,076,177
9620 :087,033,162,023,032,173,146
9626 :033,032,062,035,202,016,022
9632 :247,096,133,206,138,072,028
9638 :152,072,076,116,035,162,011
9644 :023,032,159,033,160,039,106
9650 :177,209,032,162,037,136,163
9656 :016,248,202,016,240,076,214
9662 :126,033,007,021,020,025,166
9668 :000,204,000,000,240,015,143
9674 :000,000,000,000,000,027,229
9680 :149,150,130,131,151,150,045
9686 :039,131,010,000,004,010,152
9692 :004,004,220,235,000,008,179
9698 :064,072,128,136,192,200,250
9704 :000,008,064,072,128,136,128
9710 :192,200,000,008,064,072,006
9716 :128,136,192,200,017,017,166
9722 :018,018,019,019,020,020,108
9728 :022,022,023,023,024,024,138
9734 :025,025,027,027,028,028,166
9740 :029,029,030,030,000,040,170
9746 :080,120,160,200,240,024,074
9752 :064,104,144,184,224,008,240
9758 :048,088,128,168,208,248,150
9764 :032,072,112,152,144,005,041
9770 :028,159,156,030,031,158,092
9776 :076,079,065,068,013,082,175
9782 :085,078,013,141,020,148,027
9788 :019,147,017,145,029,157,062
9794 :018,146,014,142,006,016,152
9800 :015,014,255,255,255,255,097
9806 :255,255,249,223,027,046,109
9812 :119,139,193,183,205,255,154
9818 :124,122,136,133,127,142,106
9824 :149,170,255,255,255,255,155
9830 :255,255,033,033,034,034,234
9836 :033,037,033,033,033,033,054
9842 :036,036,036,036,036,036,074
9848 :037,037,255,255,255,255,190
9854 :255,255,064,160,224,160,220
9860 :160,160,064,000,068,196,012
9866 :068,068,068,064,068,000,218
9872 :074,170,032,064,128,128,228
9878 :224,000,064,170,046,074,216
9884 :046,170,064,000,036,166,126
9890 :168,238,034,044,036,000,170
9896 :224,138,194,036,036,168,196
9902 :074,000,068,138,136,196,018
9908 :168,170,068,000,228,036,082
9914 :032,064,064,064,064,000,218
9920 :066,164,164,068,164,164,214
9926 :066,000,068,162,162,098,242
9932 :034,162,068,000,000,010,222
9938 :068,078,004,074,064,000,242
9944 :000,000,068,078,004,064,174
9950 :192,000,000,032,064,128,126
9956 :064,036,012,000,000,000,084
9962 :224,014,224,000,000,000,184
9968 :000,128,064,032,064,132,148
9974 :004,000,064,162,034,068,066
9980 :068,008,072,000,204,170,006
9986 :170,238,238,136,238,000,254
9992 :004,010,074,046,106,170,162
9998 :106,000,140,138,202,172,004
10004 :170,170,204,000,004,010,066
10010 :072,168,136,170,068,000,128
10016 :044,042,106,170,170,170,222
10022 :108,000,014,008,072,172,156
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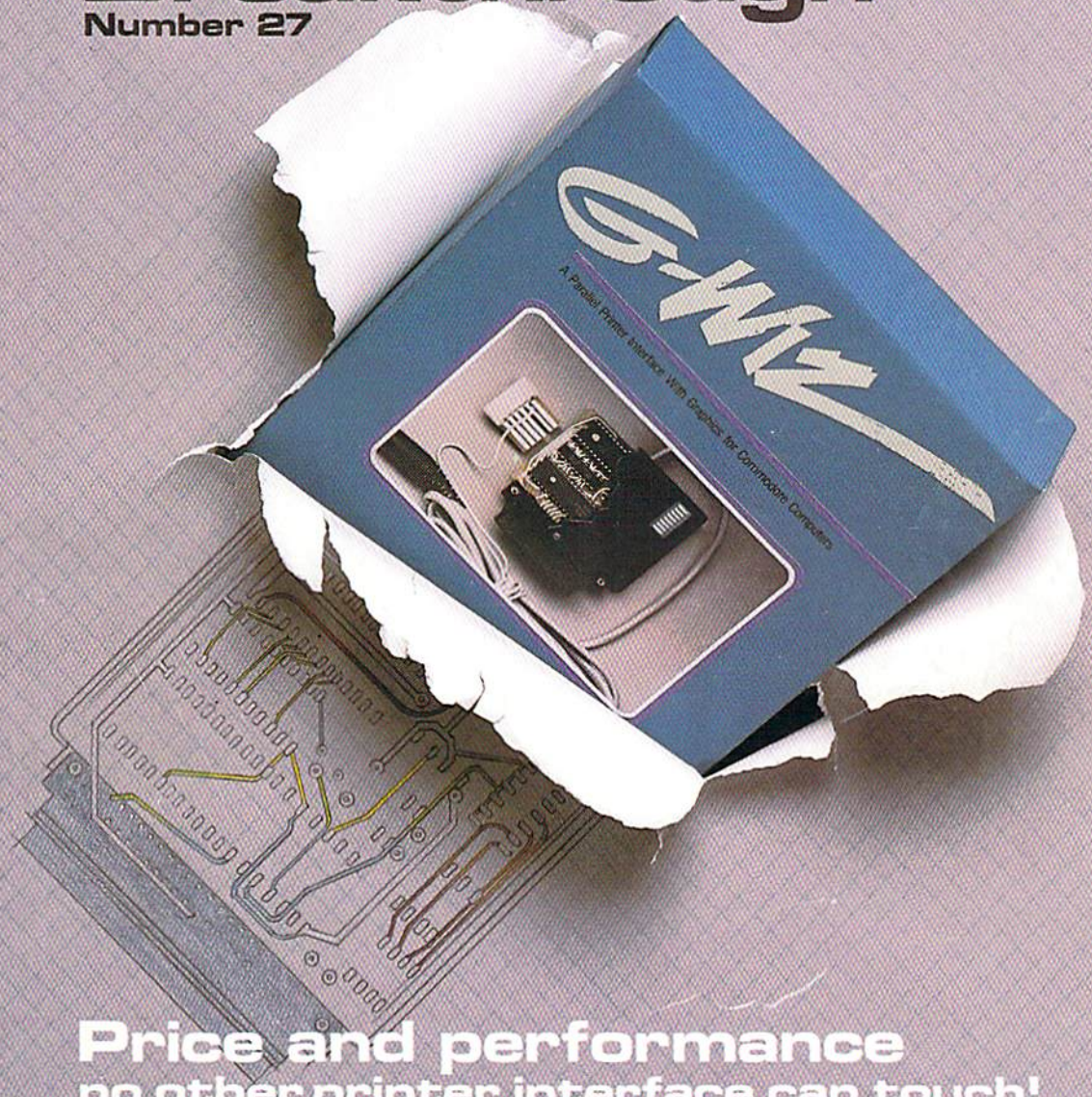
Number 27



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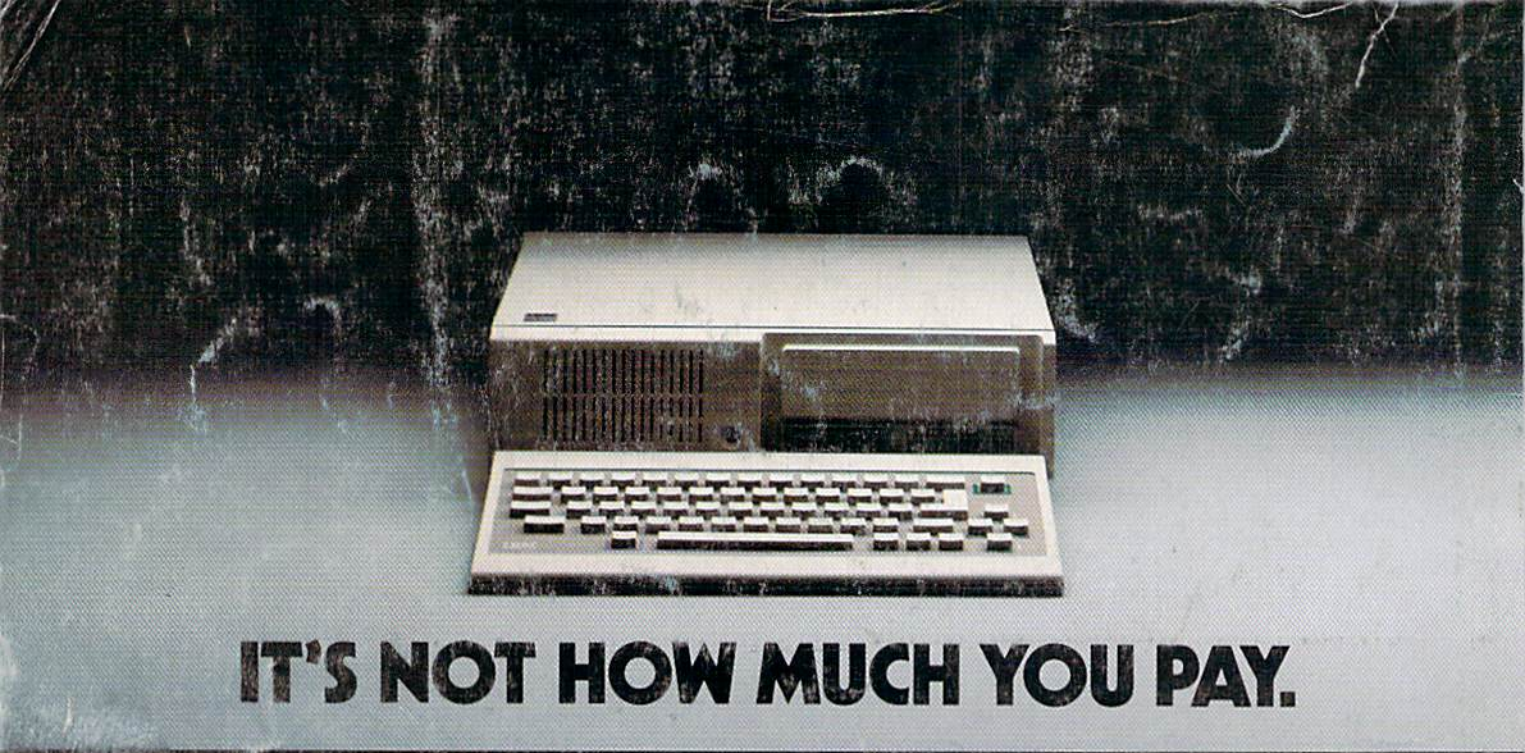

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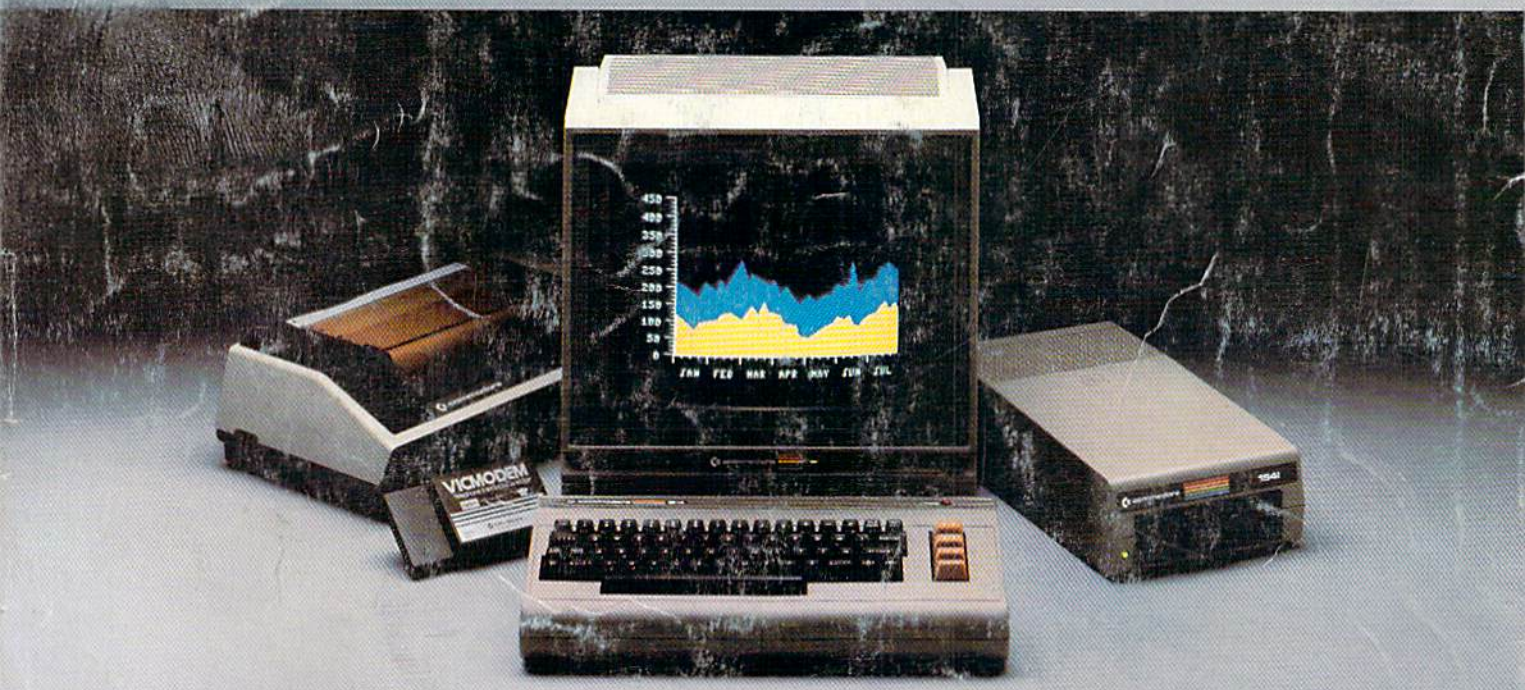

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COMMODORE 64

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