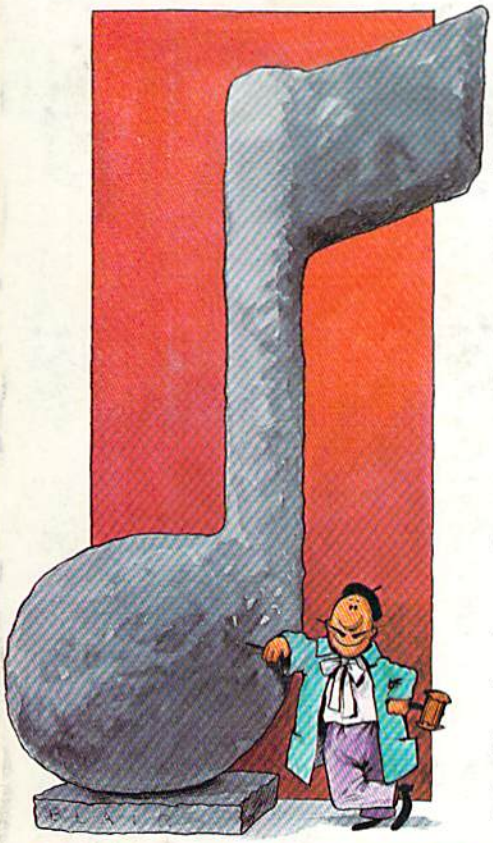
Exploring 64 Sound

COMPUTE!'s GAZETTE

$2.50
May 1984
Issue 11 Vol. 2, No. 5
02220 £1.95 UK $3.25 Canada

For Owners And Users Of **Commodore VIC-20**™ And **64**™ Personal Computers

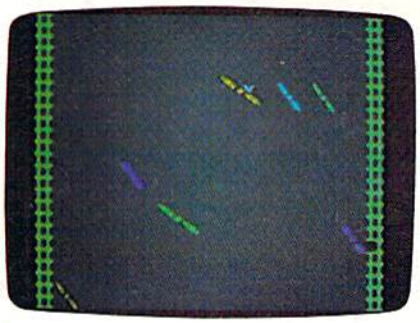


Sound Sculptor

A comprehensive, menu-driven utility that takes all the work out of programming and saving sound on the 64. Simply use the joystick-controlled "mouse" and the function keys to select any sound parameter.

SpeedScript Revisited

Tips on advanced uses of the GAZETTE's favorite word processor.



Sound Story

A unique story presentation which demonstrates the capabilities of sound on the VIC-20.

Also In This Issue

New Column: Home Telecommunications

Power BASIC: Step Lister

Machine Language For Beginners

Props

An innovative and nonviolent game for the 64 which uses machine language animation, eight sprites, and all three voices.

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Dear Susan,

I've discovered something very exciting that I want to share with you. I've always thought assembly language was too complicated for me to learn and I've been doing all my programming in Basic, or buying software that doesn't do quite what I want. You know, Basic is just too slow for a lot of tasks, and I can't find ready made software to do those specialized things I want to do.

Well, I just bought Panther's C64 Assembler and I found out that assembly language is easier than I thought, and it's also fun.

The C64 Assembler is very "friendly" and the documentation is clear and well written. One very nice feature of the manual is a section for the neophyte assembly language programmer that really helped me understand how to use the machine.

Now I'll be able to write those programs myself instead of waiting for some software manufacturer to guess what I'm looking for! My programs will do exactly what I want, and I'll have fun writing them.

The dealer even told me that Panther is looking for good programs in assembly language, and they're willing to publish and pay royalties for useful programs which meet their standards.

As you know, I don't have any experience yet, so I can't compare assemblers, but Jim's seen it and he's a professional assembly language programmer. He says it's the easiest-to-use and the fastest assembler he's seen for any microcomputer. In fact, he said he's going to buy a Commodore 64 just so he can use it.

Come on over to my place when you have time and I'll show off the assembler for you, or go to the dealer down the street to see it. The whole Commodore community is excited about the C64 Assembler.

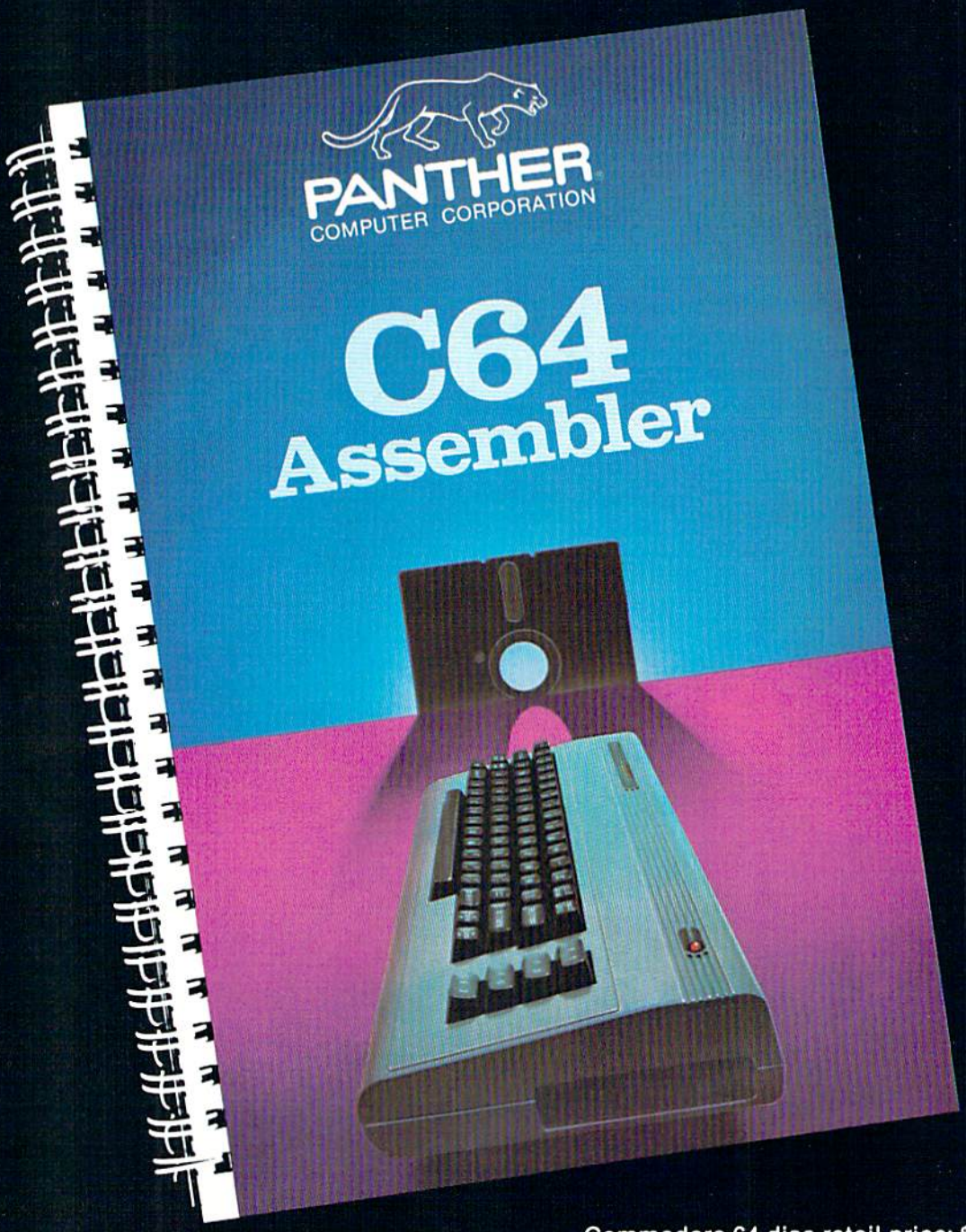
I've got to sign off now. I'm anxious to get back to my assembler and finish the program I'm working on. This is fun!

Let's get together soon,

Bob

Panther Computer Corporation

The Assembler for the Commodore 64.



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Commodore 64 disc retail price: $59.95

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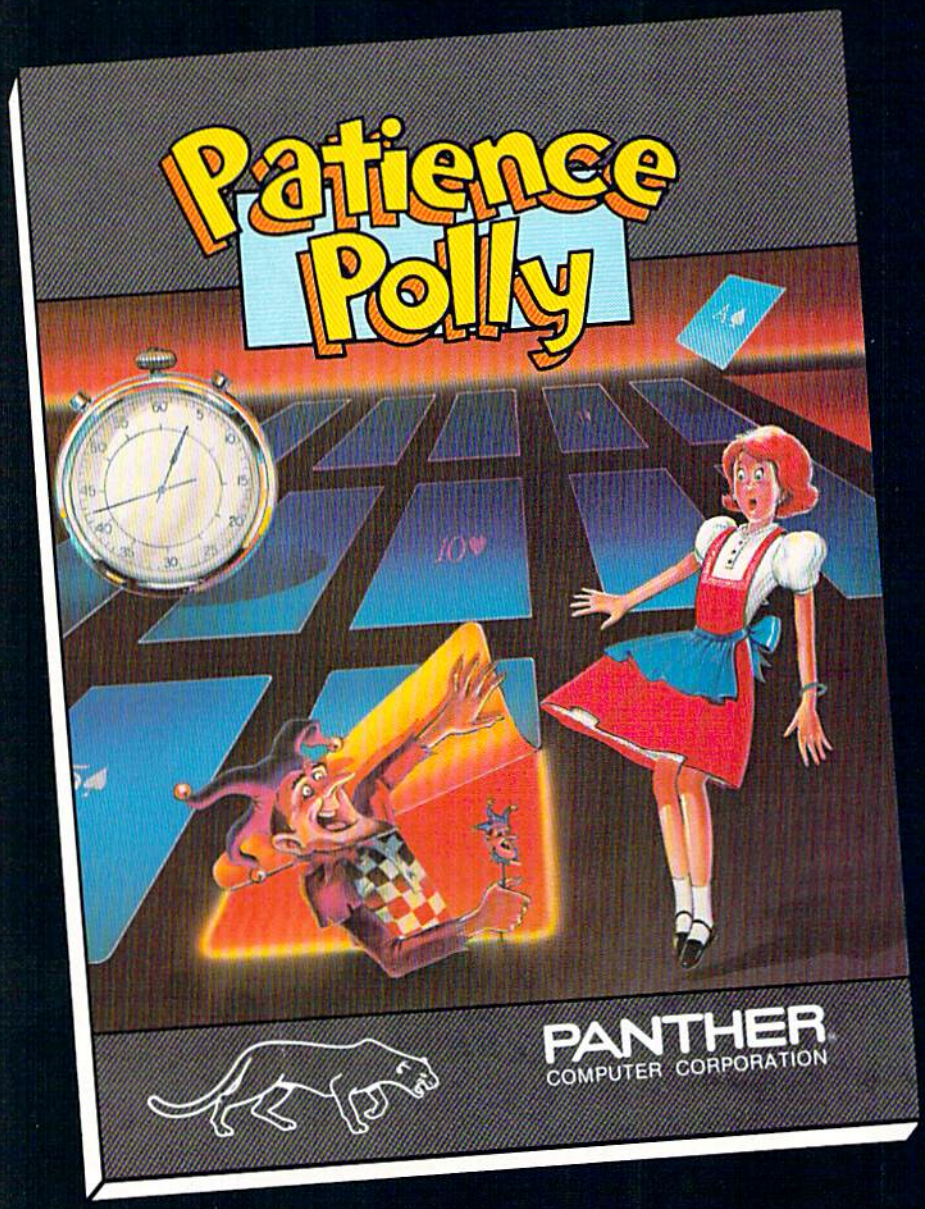
Don't Play this Game.

(Habit Forming)



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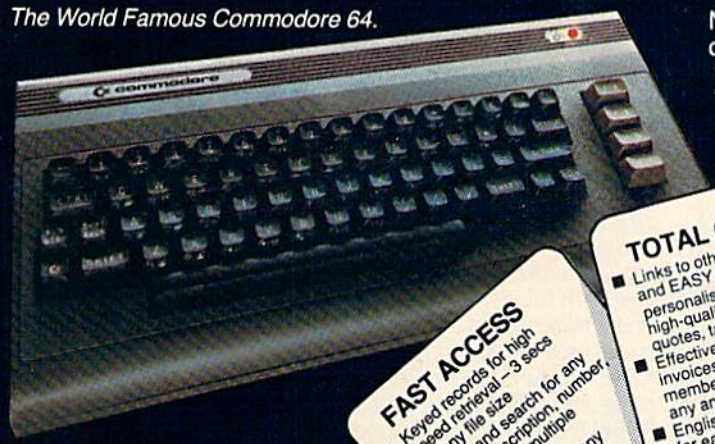

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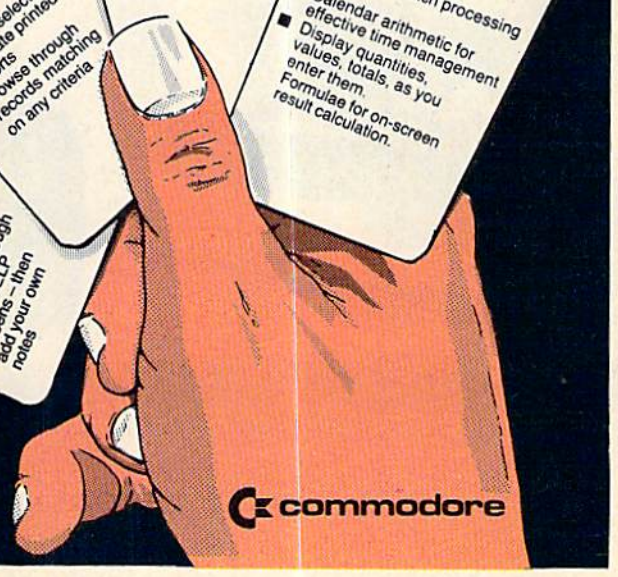

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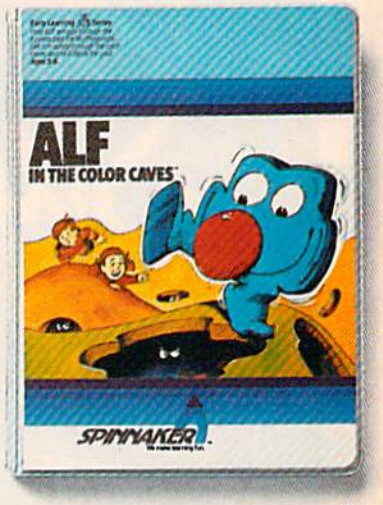

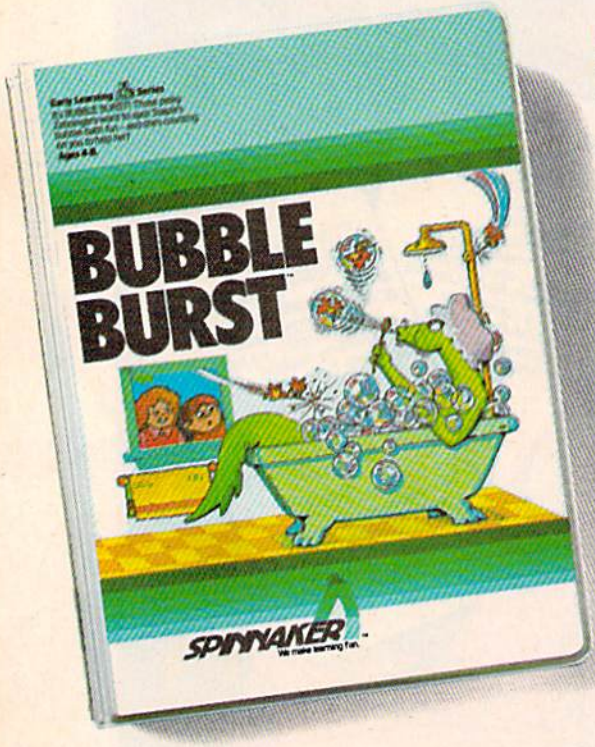

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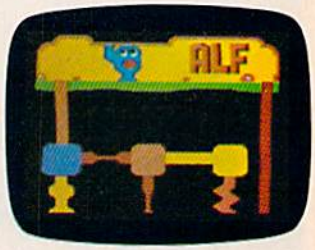

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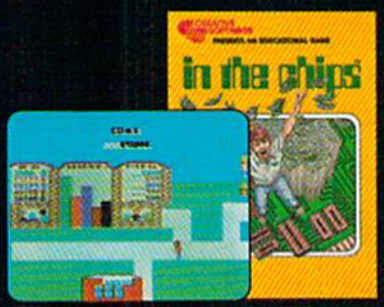

Okay, boss, now what do we do? Research & Development is working 'round the clock coming up with new products, the warehouse is overflowing, the advertising agency wants more money, your customers are fickle, and the competition just slashed their prices. We're all waiting for your decision.

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COMPUTE!'s GAZETTE is published monthly by **COMPUTE!** Publications, Inc., Post Office Box 5406, Greensboro, NC 27403 USA. Phone (919)275-9809. Editorial offices are located at 324 West Wendover Avenue, Greensboro, NC 27408. Domestic subscriptions: 12 issues, $20. Send subscription orders or change of address (P.O. Form 3579) to Circulation Dept., *COMPUTE!'s GAZETTE*, P.O. Box 961, Farmingdale, NY 11737. Second class application pending at Greensboro, NC 27403 and additional mailing offices. ISSN 0737-3716.

COMPUTE! Publications, Inc., One of the ABC Publishing Companies: ABC Publishing, President, Robert G. Burton; 1330 Avenue of the Americas; New York, New York 10019.

THE EDITOR'S *notes*

First things first... As I write this, the final master copy of the May GAZETTE DISK is going to the duplication service. For a variety of good reasons, we have decided that, initially at least, it will *not* be protected. We made that decision several weeks before a recent flood of letters started coming in as a response to my last editorial. I should say I'm gratified to discover that so many of you *read* the Editor's Notes. The first two letters arrived seven working days ago... the torrent escalates; we're into the hundreds now, and as promised, I'm reading them all, some of them several times.

We're a few issues (and I suspect several thousand letters) away from my sharing much of the substantive content of these letters with you, but I've held up this issue's Notes as long as possible to collect as many letters as I could. There have been numerous arguments, both for and against protection. The most frequent argument against protection is the necessity not only of backup copying but also the desire to have the disk reflect the flexibility and tutorial nature of the magazine. That is also our desire, and probably the foremost reason for our decision to carry through with our original inclinations and goals: no protection.

The other arguments are far more mixed, and in this editorial we'll present some of the various points raised. One frequently recurring point is that users have a right to back up their disks, a point we clearly agree with (as does the 1980 amendment to the Copyright Act). Some readers chided us for raising the notion of protecting our disks while concurrently running ads for programs designed to back up disks. It does get confusing. Software vendors currently have the right to protect programs on disk, and the market in large part helps determine their backup policies. Users, on the other hand, have the right to make backup copies for their own security/use. The catch-22 is that while some users may use such programs to generate "bootleg" copies of programs, far more users use them simply to generate backup copies for their personal use. We therefore do accept and publish what we consider to be legitimate advertising which allows a user to do just that.

So the biggest topic area so far has been the need to make personal backups; the need to be able to group programs onto different disks for various uses; and especially the need to be able to alter, enhance, and generally have a good time "fiddling" with the code.

Also, some people were quite surprised that anyone would copy the disk to share; some felt it's perfectly legitimate among friends; and some strongly argued that they can hand out copies as desired (this last group is a small minority, and contains the bulk of the unsigned letters). At this point, I'm just reporting the contents of the letters rather than responding to the points raised. Part of the deal from this end is that we want to collectively put as much time and energy into developing a perspective on GAZETTE DISK as many of you have put into these letters. We should comment now, however, on one point that a few readers have raised—public domain software.

I don't know why, but some readers assume that if a program appears in a magazine, it becomes "public domain," thereby leaving the realm of copyright law. We hold copyright on almost all of the material we publish; very little of what we publish is placed in public domain. The "publication" of a record over the airways no more places it in the public domain than the publication of a program in the GAZETTE.

All in all, the letters and the thoughtfulness you've shown in responding are impressive (regardless of the positions taken). Another frequent comment is the notion that the price is quite fair, and that service will eventually win out.

Finally, here's a quote from one letter's closing lines. It's indicative of the opening/closing comments of many of you, regardless of your positions on the subject at hand.

"You guys do good work. Keep it up."

Thanks. We intend to.

Robert Lock

Editor In Chief

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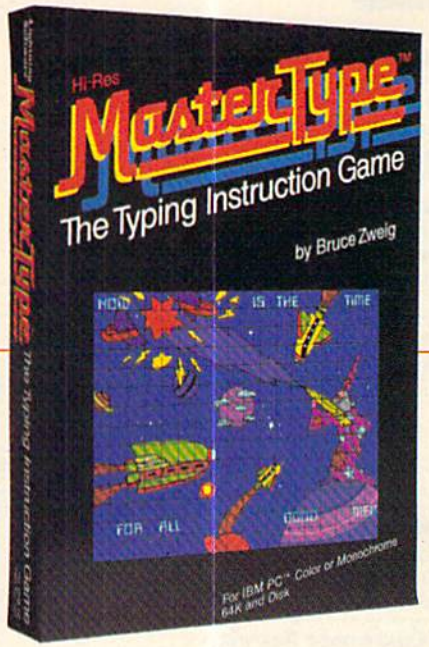

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COMPUTE! Publications, Inc., publishes
COMPUTE! **COMPUTE! Books** ***COMPUTE!'s Gazette***

Corporate Office:
324 West Wendover Ave., Suite 200, Greensboro, NC 27408

Mailing Address:
Post Office Box 5406, Greensboro, NC 27403

Telephone: 919-275-9809
Office Hours: 8:30 AM to 4:30 PM Monday-Friday

Chief Executive Officer Robert C. Lock
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Color Connections On Commodore Monitors

I know that many people have had trouble connecting Commodore's 1701 color monitor to the VIC-20 and the 64. I have read several suggestions on this, but when I recently purchased a 1702 monitor (updated version of the 1701), I found that neither Commodore's instructions nor the past suggestions went far enough.

The 1702 is apparently identical to the 1701 on the outside, and the electrical connections are also identical. A cable was supplied with three phono plugs on the monitor end (white, yellow, and red), and an eight-pin DIN plug on the computer end. Since my year-old 64 has a five-pin DIN plug connection for the monitor, I first purchased a five-pin male DIN plug from Radio Shack (Catalog # 274-003) and consulted the *Commodore 64 User's Guide* for the proper pin connections.

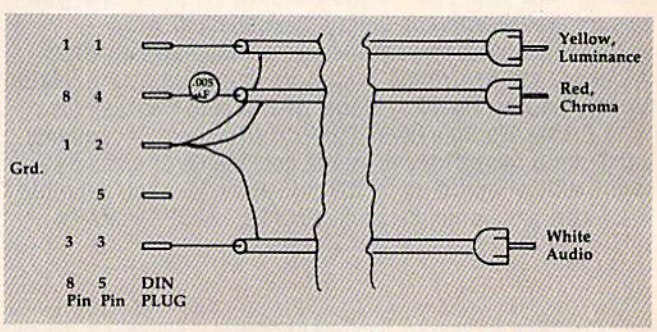
Using this modified cable, I connected to the three phono sockets on the rear of the monitor and tried it out (this is the "best" hookup according to all that I have read). I was disappointed to find out that although it worked well with some colors, other bright colors like yellow caused the monitor to revert to black and white.

Being a TV engineer, I broke out my scope and started to examine the signals. The video signal (pin 4 of the DIN connector) was a combination of about 25 percent luminance and 75 percent chrominance. Since I was feeding this into the chroma input of the monitor, it seems that the luminance component was upsetting the color circuitry. Breaking out my calculator, I found that a 0.005 μF capacitor would pass almost all of the chroma signal, but less than 10 percent of the luminance component.

Again at Radio Shack I discovered a very small 0.005 μF, 50 volt disk capacitor (catalog #272-130). I placed this capacitor in the DIN connector between pin 4 and the wire to the red phono plug. This arrangement gives almost perfect performance and the scope confirms good separation of chroma and luma.

From other letters to the editor that I have read, I suspect that this problem also exists in some VICs and possibly in some of the newer 64s with the eight-pin DIN connectors. A quick test would be to plug the red chroma phono plug into the yellow luma plug input on the back of the monitor. The picture will be very washed-out in appearance and low in contrast, but you should look for horizontal or vertical rolling only. Also, try plugging it into the yellow video input on the front. If a stable picture results with either of these hookups (no horizontal or vertical rolling), your computer has sync and video mixed with the chroma on this output and you should try the 0.005 μF capacitor in series with pin 4 of the five-pin DIN connector or pin 8 of the eight-pin DIN connector.

If you are not experienced and equipped for soldering small assemblies like this, I strongly recommend that you have a qualified technician perform these changes.



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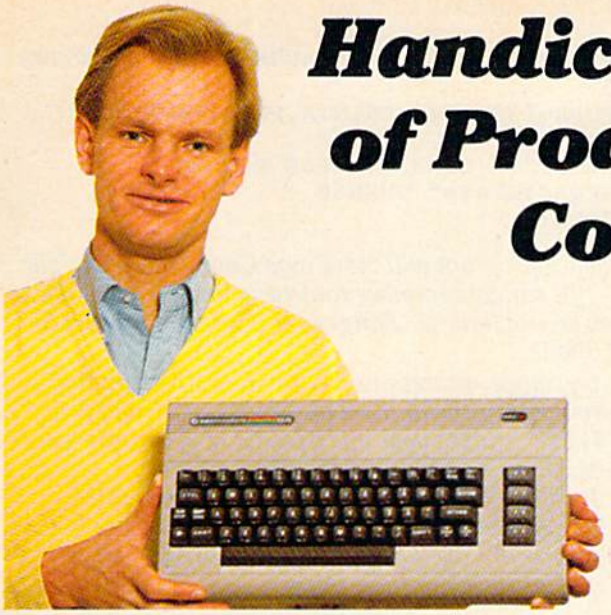

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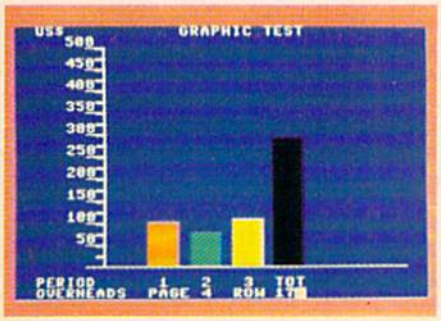

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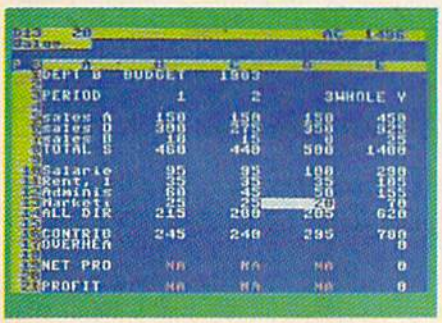

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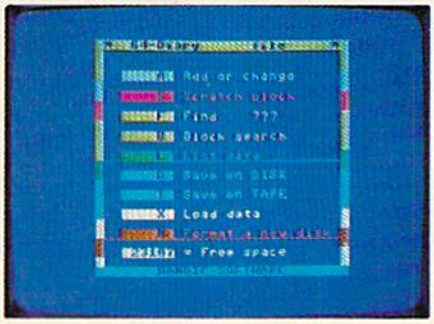

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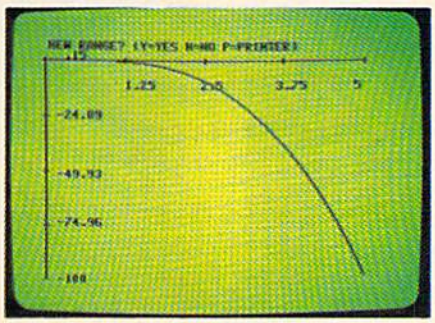

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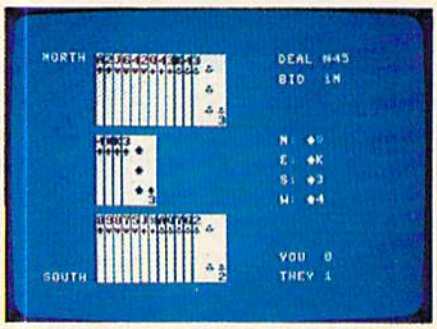

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Thank you for the tip, Mr. Alciatore. We'd like to mention that as of this writing, the new Commodore 1703 monitor should be on the market. The above information should also apply to the 1703. For more information, consult your monitor user's manual, or talk to your Commodore dealer.

Testing For Free Memory

I didn't discover this little tidbit, but I thought it useful enough to be passed on to other readers. To find out how much free BASIC programming memory is available, you type PRINT FRE(0) then press RETURN. However, when the amount of unused memory exceeds 32,000 bytes, the number displayed will be negative. This is confusing to many people. An easy way around this quirk is PRINT FRE(0)+2↑16 then press RETURN. This gives you the actual amount of free BASIC memory in a positive number format.

Mark Cowan

Wafer Drive Update

We've received several letters asking about the Exatron stringy floppies (July 1983) and the Unitronics wafer drive module (September 1983). Neither company is currently manufacturing these products. However, Jim Howell (formerly of Exatron) informed us that his company, A & J Microdrive, is introducing an updated stringy floppy with added features. The new product should be available in May and will sell for $99.50. He also noted that blank wafers are available.

For further information, contact:

A & J Microdrive
1050 East Duane Ave.
Suite I
Sunnyvale, CA 94086

Random Numbers And Machine Language

I would like to know how to derive random numbers in machine language on the Commodore 64. I have looked through the *Programmer's Reference Guide* for possibilities, but have found none. I am currently using part of the timer (memory location 162), but I would like to have a truly random number instead of a constantly increasing one for game programming.

Josh Hickman

Generating random numbers within a machine language program can be done a number of different ways. The easiest way is to use the RND function and the random seed.

The RND function can be found in Kernal ROM at $E097 (57495). If, within a machine language routine, you JSR $E097, the five random seed bytes ($8B–$8F, decimal 139–143) will be "seeded" with random numbers as if an RND statement were used within a BASIC program. Enter this short demonstration program to see how it works:

```
10 PRINT"{CLR}BYTE","VALUE{DOWN}":SYS5749
   5
20 FORA=139TO143:PRINTA,PEEK(A):NEXT

25 PRINT"{2 DOWN} (PRESS RETURN)"
30 GETA$:IFA$=""THEN30
40 GOTO10
```

The above program will work on a Commodore 64. The VIC-20's random number routine is located at $E094, so you would have to change line 10 of the program to SYS 57492.

Of course, processing the random numbers that are produced in the random seed bytes each time you JSR $E097 is up to you, and specific to your program or application.

It should be noted that the numbers generated in the random seed bytes are limited in range. Here is a chart that will give the approximate ranges of values that will be seeded in these bytes.

Byte	Low Value	High Value
139	114	128
140	0	127
141	0	255
142	0	255
143	0	255

For more on random numbers, see "Inside Random Numbers" in next month's issue.

Too Many Peripherals For The 64?

I have several questions I hope you can address.

I have a Commodore 64 and a Datassette at present, and plan on adding two disk drives, a printer, a Rabbit cartridge for the Datassette, and a dedicated color monitor in the near future. My question is, is it possible to have all of these peripheral devices connected to the 64 simultaneously?

Second, what purposes do accessory motherboards serve?

Concerning the 1541 disk drives, I read somewhere that Commodore has had mechanical problems with the head staying in alignment, and had temporarily halted shipments of the 1541s until the problem could be cleared up. I've been wanting to buy a disk drive, but I'll wait until I hear the outcome to this problem.

Donald N. Pering DSC

Yes, your 64 can handle all of the peripheral devices you desire, and more. Using one printer, monitor, and the Rabbit cartridge shouldn't create any problems. However, there are limits to the number of disk drives the 64 can support.

If you decide to use several disk drives and change the device numbers via the hardware method (see your 1541 user's manual), you are limited to four (device numbers 8 through 11). If you change the device numbers via software, the 1541 user's manual says the 64 can handle up to five disk drives and one printer.

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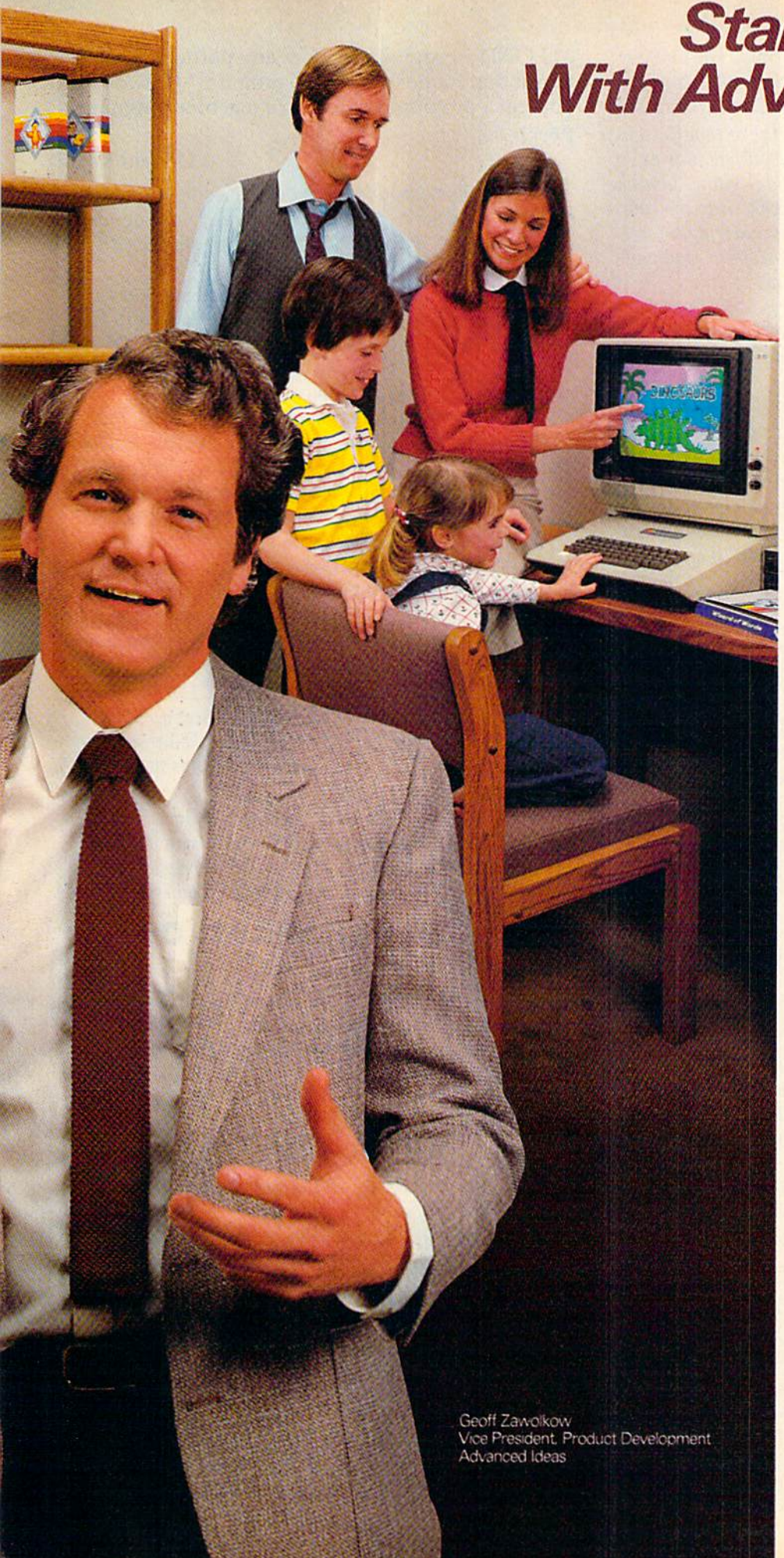

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How to Choose Software for Your Home

"As an educator with over a decade of experience using computers with children, I've found there are key features in a well-designed learning game. One is *extendability.*

Look for enough variety to hold your child's attention over time. Some games are appealing in the short run, but are quickly mastered. Supplementary materials such as disks of added lessons can continue your child's interest and enjoyment.

The ability to modify a program is another form of extendability. Authoring systems can let you create lessons on your own topic areas for any age level and allow children to create and save original work, giving a sense of completion and pride vital to learning."

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more than one ROM cartridge at a time. The motherboards plug into the expansion port and then can accommodate two or more ports to accept cartridges.

The deluxe motherboards offer the option to switch in or out the various expansion port outlets. For example, if you had five favorite cartridge games you like to play, you could plug the motherboard into the computer, and then plug in the five game cartridges (assuming it had at least five slots). You could play game one in expansion slot 1. If you wanted to play game two in the second expansion slot, you would turn off the computer, turn off the switch for slot 1, turn on the slot for expansion port 2, turn on the computer, and game two could be played.

The one big advantage to motherboards is that you don't have to continually plug and unplug cartridges into the computer's expansion port. This might be especially good where young children are playing games on the 64. By being able to switch games on or off on the motherboard, the possibility of the child breaking a cartridge (or the 64) by inserting a cartridge the wrong way would be eliminated.

Concerning your third question, yes, there were apparent mechanical problems with the 1541s. The problem allegedly centered around the step motor—it controls the positioning of the read/write head on the 1541—causing the drive to become misaligned.

However, this problem is now a thing of the past. As a matter of fact, the 1541s we've recently purchased work very smoothly and haven't presented us with any problems. The availability problem of the 1541 disk drives is also a thing of the past, and they, or the new 1542s, should be available at your local Commodore dealer.

Multiple GOTOs?

I have seen a program with the command GOTO 46,52,78 and so on. How can the computer go to all these line numbers at the same time?

Tom Smith

It is not possible to use GOTO with more than one line number. Your computer can execute only one command at a time; when it sees GOTO 500 the program moves to line 500. This is called an unconditional branch.

The program you saw probably used the ON-GOTO command, which is used for conditional branches. For example, you might use this line in a program: ON AZ GOTO 710, 50, 632, 22, 590. The program checks the value of variable AZ. If AZ equals 1, the program moves to line 710. If AZ equals 2, it goes to 50, and so on. Under certain conditions, the program will GOTO one line; under other conditions it will GOTO another. Other conditional commands include ON-GOSUB, IF-GOTO, and IF-THEN. For more details see the user's manual or the Programmer's Reference Guide.

Naming Programs

I understand you need a program name to SAVE or LOAD a program. Is there any particular place to put that name in a BASIC program? How do you get a program name into a machine language program?

Donald Kaja

A program name is optional if you are using a cassette drive. It is, however, a good idea to name your programs, especially if you are SAVEing more than one on each side of the tape.

Disk drive users have no choice; they must name each program they LOAD or SAVE. The name can be up to 16 characters long. If you forget the name of a program, you can look at the disk directory with the command LOAD"$",8 followed by LIST.

Regardless of whether you use tape or disks, the only time you need to give a name to a program is when you LOAD or SAVE (or VERIFY). When a program is SAVEd, the computer automatically saves the name of the program (on a header*) with the program itself.*

You don't have to put the name inside the program. But it is common practice to use REMarks at the beginning of a program to indicate the name of the program, the person who wrote it, and so on. If you enter programs from COMPUTE!'s GAZETTE*, you might also include the title, page number, and issue. For example, you could add this line: 1 REM DYNAMIC SAVE 120 MARCH 1984 GAZETTE. When your computer sees a REMark, it ignores the rest of the line. REMarks take up space in memory, but in most cases a few dozen bytes will not make a difference.*

To put a name in an ML program, you could POKE the ASCII codes into memory, but unless you are familiar with machine language, you might alter part of the program. Simply name the program when you SAVE it.

Where To POKE And SYS On The 64

POKE and SYS seem to be very powerful commands. I am aware that there are 65,535 locations you can POKE and SYS on the 64. Where can I find a list of the important memory areas?

Steve Schmidt

Each byte in memory contains eight bits, each of which can be either on or off. There are 256 different possible patterns; you can POKE numbers from 0 to 255 into the 65,536 locations.

The computer interprets the numbers either as instructions to do something or as data to be used in a program.

The SYS command tells the computer to forget BASIC for a while and execute the machine language (ML) instructions at a certain area of memory. One of the instructions in ML is RTS (ReTurn from Subroutine), which can send the program back to BASIC. SYS is powerful but can easily be used improperly. If you accidentally SYS to a section containing data, your computer may crash, unless you're lucky enough to

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send it to an RTS.

Most ML programs are written using an Assembler, although you can also POKE them into memory directly from BASIC.

If you're programming in BASIC, there aren't a lot of useful SYSes available. It would be possible to LOAD a program by POKEing a few memory locations and then SYSing to the LOAD routine, but it is much easier to simply type LOAD.

POKE can be a useful command, though. POKE XXX, YYY puts the number YYY into memory location XXX. Try changing the screen color by putting different numbers into 53281 (36879 on a VIC).

To understand what happens in each of the various memory locations, you need a memory map. The shorter maps tell you the name of the memory location and a brief description of what it does. More detailed maps contain information on how memory works and the effects of POKEs. You can find memory maps in Commodore's Programmer's Reference Guide *(available for both VIC and 64) and in various COMPUTE! Books, including the recently published* Mapping The VIC *and* Mapping The Commodore 64.

A memory map of the Commodore 64 would show you numerous useful locations to PEEK or POKE. Screen memory (1024–2023) and color memory (55296–56295) control the image on the screen. POKEing to BASIC RAM (2048–40959) can drastically alter the program you have in memory and is not advisable. The stack, found at 256–511, is used by GOSUB-RETURN and FOR-NEXT to remember where to jump. Zero page (0–255) contains many pointers, flags, and vectors.

A More Visible Checksum

Readers using "Automatic Proofreader" might find this discovery useful. My 64 is attached to a TV set that cuts off the top corners of the screen. This is a trivial problem, except when I want to use Automatic Proofreader. POKE 53265,31 lowers the screen enough so the number is visible.

Paul Hollander

Readers who own 64s should note that this POKE also cuts off about half of the bottom line.

Touch Typing Tutor Update

In the January GAZETTE, *we featured programmer Marion Taylor's* Touch Typing Tutor. *Several readers have written asking for further information about this typing tutorial. This can be obtained by writing or calling:*

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Exploring 64 Sound

Selby Bateman, Assistant Editor, Features

Thanks to a microelectronic marvel called SID (Sound Interface Device), the Commodore 64 has the most advanced music and sound creation system available on any home computer. Packed into one tiny computer chip is nothing less than a sophisticated, programmable, three-voice synthesizer.

Imagine yourself at the keys of a music synthesizer. You deftly finger through a Bach concerto or pound out The Pretenders' latest hit. Meanwhile, your Commodore 64 is channeling the keyboard input into nearby speakers, memorizing the music for later playback and print-out, and offering you sounds that range from the clarity of a harpsichord to the whine of an electric guitar.

Sound far-fetched? The Commodore 64 has what it takes to deliver all of that. And a new breed of music software is emerging to help the 64's remarkable sound system live up to its potential while painlessly educating even the most ignorant would-be musicians.

At the heart of this musical scenario is the versatile SID chip, an electronic synthesizer which hasn't been matched by another home computer since Commodore introduced it on the 64 back in 1982. The power of the SID chip lies not so much in its capabilities, which are outstanding, but in its programmability. You can *do* things with the SID that the sound systems on other microcomputers won't allow.

Simply stated, the SID chip works by combining certain sound *waveforms* to make a variety of other sounds through its three independent voices, or oscillators. SID's waveforms are the *triangle*, *sawtooth*, *pulse* (or *square*), and *noise*. These are the frequency configurations from the computer's output.

Sound itself is little more than a type of kinetic energy produced when, for example, air molecules vibrate in response to the vibrations of some other medium. The Commodore 64's voices produce electrical signals which you shape through programming. The resulting electrical impulses can be sent to an amplifier and then to a speaker system, the vibrating medium which makes the sound waves we hear.

For each voice in the 64, you have a choice of the four waveforms mentioned earlier, plus programmable high-, low-, band-, and notch-pass filters; 16-bit frequency resolution over a nine-octave range; variable resonance; synchronization; ring modulation; and volume control. Another important property of the SID is that you can program the *attack*, *decay*, *sustain*, and *release* for the notes of each voice. *Attack* is the rate at which a

Waveform Corporation's Colortone synthesizer keyboard for the Commodore 64. Scheduled for release by May 1, the keyboard will be priced between $200 and $300.

note reaches its peak. *Decay* is the speed at which a note declines from its peak. *Sustain* is the volume (often thought of as the duration) of the sound after the decay. And *release* is the rate at which a note falls into silence.

Bob Yannes, the designer of the SID chip, says there are a couple of reasons why we haven't seen the SID duplicated or surpassed in other personal computers. "No one has really taken the approach of doing the music synthesizer in a computer the way music synthesizers are really done. Most of the people who work with LSI [Large-Scale Integration of computer circuits] don't have that much experience with synthesizers. They don't know what features are important. They don't know what you do with the things that you put in there."

You don't have to be a professional musician to understand that the SID chip's capabilities offer many opportunities for you to affect the forms of sound coming from the Commodore 64. (See *COMPUTE!'s First Book of Commodore 64 Sound and Graphics* and the soon-to-be-published *COMPUTE!'s Beginner's Guide to Commodore 64 Sound*.) To appreciate fully all of this programmability, it helps to understand that the SID is a giant step in the relatively brief history of sound-producing computers.

The first computer sound effects made use of just about any piece of hardware available, producing some rather strange results. For example, innovative computer users wrote programs to make the keys on printers strike in rhythmic patterns. Others altered the sounds from transistor radios by experimenting with the frequency interference created when programs run at high speed in a computer. Even the cassette port on a computer, which is an audio output, has been used to make limited sounds.

Since the primary purpose for sound in personal computers began with the demand for game sound effects, tone generator chips with simple oscillators have been used extensively. These generators allow you to control the pitch and volume, and often have more than a single voice. But none of them has the programmability of the SID. Even Atari's four-voice sound chip, which represented the state of the art in home computer sound for several years, doesn't have the 64's versatility.

Paul Higginbottom, software development manager at Commodore's Dallas, Texas, offices says the SID chip is still a unique component. "We're probably the leader in terms of the way we've packaged that chip and what we've put into it. It was certainly unusual to put that in a micro."

But what excites Higginbottom now is the availability of a growing number of software packages which use the SID chip effectively. "We've been doing a lot of thinking here about what is *not* out there [in music software]. And we've been having a hard time because we think that most people are slowly covering the areas," he says, laughing. "There's some pretty good software out there. There's no question about that."

That's important. As would-be music programmers soon find out, with the Commodore 64 there are plenty of POKE commands to learn and a considerable number of memory locations involved. The values for each location must be entered as well. All of that adds up to a daunting task for beginners.

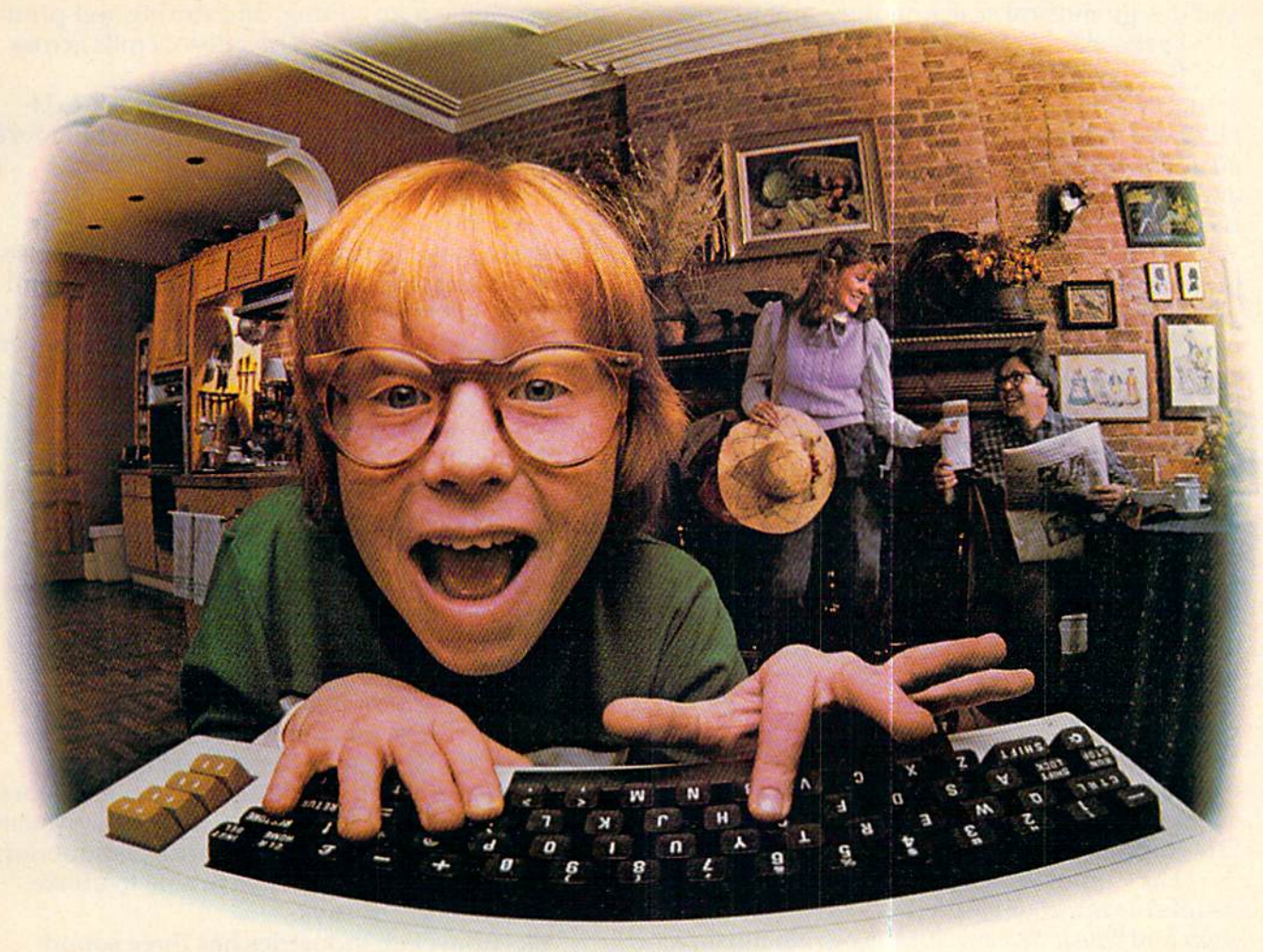
Among the newer software products aimed at simplifying your musical efforts is Waveform Corporation's *MusiCalc*, a series of four interrelated disk-based packages. The programs are based on *MusiCalc 1*, which turns the Commodore 64 into a three-voice synthesizer with advanced features like interactive real-time sequencing, slide controls, modulators, and transposers. The program allows users to play along with preset melodies, or create and store their own music for later playback. *MusiCalc 1* has a suggested retail price of $74.95, and forms the basis for several other related products.

The concept behind the series of products, says Waveform President Thomas McCreery, is for "people to have fun first, and then to learn the skills later." The company wanted to market a product that would easily introduce nonmusicians to a broad range of musical applications, while at the same time allowing the experienced musician plenty of options, he adds.

A key to this in the Waveform packages are companion disk templates, each of which contains over a thousand combinations of sounds and melodies, and has preprogrammed musical scores. Selling for $24.95 each, the first template contains African and Latin rhythms while the second template has new wave and rock rhythms. You hear the music by hooking your Commodore 64 to a television, stereo system, or musical instrument amplifier with RCA-plug patch cords. Waveform plans to offer other templates later, depending on the success of the first two.

MusiCalc 2 ScoreWriter shows *MusiCalc 1* users how their compositions and improvisations would look in standard musical notation, complete with bass and treble clefs, staffs, sharps, flats, and incidentals. Priced at $34.95, *MusiCalc 2 ScoreWriter* translates score sequences into notation that appears on the screen in either one, two, or three voices. Connected to a compatible Epson printer with the Graftrax option or to a Commodore VIC-1525 graphics printer, the *ScoreWriter* permits print-outs of musical scores.

MusiCalc 3 Keyboard Maker, at $34.95, turns the 64's keyboard into a synthesizer keyboard. It also provides a set of 72 scales, which you can structure. The effect is to allow you to arrange



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and design musical scales on the Commodore 64's keyboard.

By May 1, Waveform is scheduled to offer an actual synthesizer keyboard for the 64, which will be priced between $200 and $300. It will come with an interface that allows it to work with *MusiCalc 1*, and lets the user play music and automatically record it on disk for later playback or print-out.

All of this represents quite an extensive line of music software and hardware from one company for the Commodore 64. But it's an indication of just how attractive a product the 64 is when it comes to programming sound. We will probably be seeing even more sound and music programs during 1984, and possibly even other keyboards specifically for the 64. Although Commodore itself has actually shown prototypes of a 64 keyboard, it has so far not put one on the market. But, according to one Commodore official, the company is presently in the development stage on a keyboard and eventually plans to make it available. No dates or product specifications have as yet been announced, however.

Without attempting a comprehensive list of every music program available for the Commodore 64, here are a few of the packages aimed at the SID chip.

The Commodore Software division offers a couple of cartridge-based programs, *Music Composer* and *Music Machine* for the 64. No musical ability or computer knowledge is required for *Music Composer*. The computer keys become a piano keyboard, and special "help" guides cover basic editing through advanced techniques. Similarly, *Music Machine* uses the keys as a music keyboard and requires no previous musical knowledge. Melodies and percussion rhythms may be played at the same time since the program has three keyboard sections. Special musical effects like vibrato, glide, and two-voice harmony are among its options. Each program is available for $19.95.

Electronic Arts has produced *Music Construction Set*, available for $40 on disk. (See "Inside View" in this issue.) Using a menu of music and action icons controlled by your joystick, *Music Construction Set* allows you to build your own compositions, and to play with a variety of options, such as sound, speed, and volume. Flexible cut-and-paste editing techniques are included, and your compositions can be printed out as well. The package also features a dozen compositions ranging from baroque music to rock and roll which may be played and altered.

En-Tech Software sells *Studio 64*, a $39.95 disk-based music package which will write the music you play on the screen, and allow block moves, single note editing, and storing and printing of the compositions. The music scrolls across the screen as it plays.

The Alien Group offers the *When I'm 64 Advanced Music Synthesizer System* for the Commodore 64 on disk or cassette for $29.95. This package converts the top two rows of the computer keyboard into a music synthesizer keyboard. It includes advanced features such as vibrato, pulse-width phasing, attack-triggered filter sweep, and a metronome timing track. The SHIFT and CONTROL keys extend the synthesizer's range to seven octaves. There are thirty prerecorded songs included, with menus and written instructions to help you write and save compositions.

This software package also supports The Alien Group's VOICE BOX Singing Speech Synthesizer, which sells for $129. The VOICE BOX plugs into the user port of the computer and translates text into speech. Used with the *When I'm 64* software, the music may be used with a vocal part, including harmony, if you wish.

Jim Mason, manager of customer relations for the Alien Group, points out that the SID chip is a big advantage for programmers. "It gave us the opportunity to get better sounds from the computer other than whatever kind of generators the Atari and the Apple used. So, the music system that's available for the Commodore 64 is superior. Again, specifically because we're able to utilize the SID system," he says.

Electronic Lab Industries has three sound and music programs for the 64. *Note Pro II*, for $46.95 on tape or $49.95 on disk, lets you control the pitch of all three voices. In addition, it offers high-speed play (up to 450 notes per second), eight-measure treble clef display, eight-octave range, ADSR control, and arrangement capabilities. *Note Pro I* is a less powerful program, giving you control of a four-octave range, and is available for $24.95 on tape and $27.95 on disk. Finally, *Note Pro Bridge*, for $24.95 on tape and $27.95 on disk, is a machine language subroutine which allows you to play *Note Pro* music from within programs.

Quicksilva Ltd. has released *ULTISYNTH 64*, a sound and music package on disk for $39.95 and on tape for $34.95. The program incorporates many of the features found on other packages, including controls for filters, envelope, keyboard, pulse parameters, modulation, synchronization, and other options. As with all music programs for the Commodore 64, *ULTISYNTH 64* encourages you to experiment.

Given the great versatility and programmability of the SID chip, what's the next step? How can it be improved?

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SID designer Yannes, who has worked with synthesizers for years and now runs his own electronic design company, Peripheral Visions, Inc., says that to improve on SID, manufacturers will have to make a quantum leap to a far more complex and expensive type of chip.

"It's hard to justify doing a fantastic sound synthesizer built into any particular personal computer now because to make that quantum leap is going to cost a lot of money," he says. "Just to do a custom LSI chip in general is going to cost a lot of money. Commodore was obviously able to handle that since they have their own design center and processing."

And that may be the answer. As the cost of making computer chips continues to fall, Commodore itself—with its own chip design center—may be the most likely candidate to come up with a new, improved SID.

In fact, Commodore is rumored to be developing just such a new, more efficient synthesizer chip—a super SID. But don't expect to see it this year. According to one industry source, the improved SID will be for a new generation of Commodore computers, not for the 64 or the already announced 264 series (which does not have the SID chip). No matter what happens in the future, however, for now your Commodore 64 continues to be a music-making personal computer second to none.

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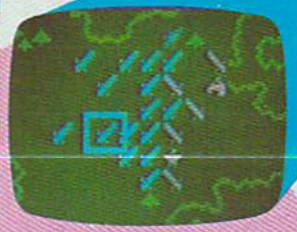

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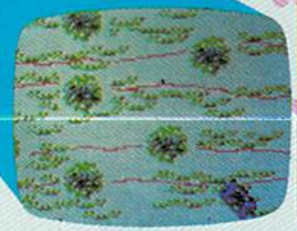

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New Standards For Home Learning

Part 1

Fred D'Ignazio

Recently I read an article by a leading educator in which he called for standards for educational software for the home. "Who must design these standards?" he asked rhetorically. "*We* must design the standards," he answered emphatically, "because *we* are the experts."

But this is not necessarily true. Expertise in using computers in the schools may not carry over into the home.

Why? First, learning at home is not the same thing as learning at school.

Second, we are a long way from realizing the potential of learning using a computer. I have a strong conviction that there are whole realms of computer learning that we have yet to explore. If we were to establish a single set of standards right now, we would stifle software companies' ability to lead us into these new realms.

The Wild, Wild West

Computer learning, especially in an unstructured environment like the home, is a vast, unexplored terrain. It would be foolish to try to define and map this terrain even before we have explored it. We would end up roping off a small part of the territory to confine ourselves in. The rest of the territory, beautiful and vast, would remain beyond our reach and the reach of our children.

The present stage in home computer learning is like the days of the Wild West. We have all sorts of people in the home-learning software industry, including cutthroats, gunslingers, and the like. But we also have pioneers, scouts, traders, settlers, and explorers. And we have gypsylike Indians roaming freely through the whole terrain.

We certainly need some sheriffs and marshals in all this hooting rowdiness, in these gun duels and disorder. But we do not need an outside expert or government official to impose mock order by garrisoning us off and forcing us onto tiny reservations. We still have too much exploring to do.

Structured Vs. Unstructured Learning

According to one expert, over 10,000 companies have already created over 40,000 software packages, any of which, potentially, could be used for learning. And, within another year, this number will double!

Much of the software is excellent. But there is also a lot of junk out there. And there is no way for the average consumer, a parent or a teacher, to separate the junk from programs that will help them or their children—especially since most software can't be previewed before taking it home.

People are concerned. It is natural for them to turn to government policy makers and educational experts for some help and respite. And when the policy makers and experts get involved, it will be natural for them to create a model for home learning based on learning at school.

Unfortunately, this would be a mistake.

Why? First, because learning takes place in school primarily in a structured environment, while learning at home is largely unstructured.

Second, learning at school takes place under the pressure and prod of a teacher's leadership, the school's disciplinary and academic atmosphere, and the competition, opinions, and watchful eyes of one's peers.

In comparison, learning at home is normally done in a psychological vacuum. Parents cannot hope to duplicate the school environment. Most parents do not have the time to play the roles, night after night, of cheerleader, coach, taskmaster, teacher, and friend that a learner, especially a young learner, often finds vital.

Learning at school is curriculum-based, cumulative, and progressive. It follows a well-

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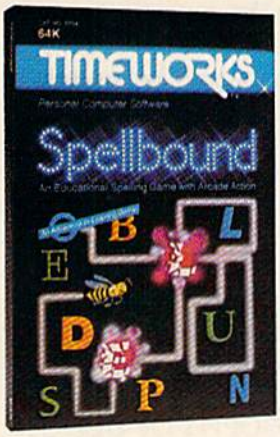

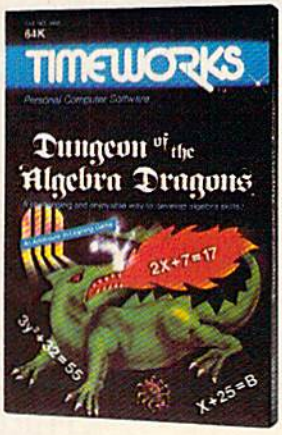

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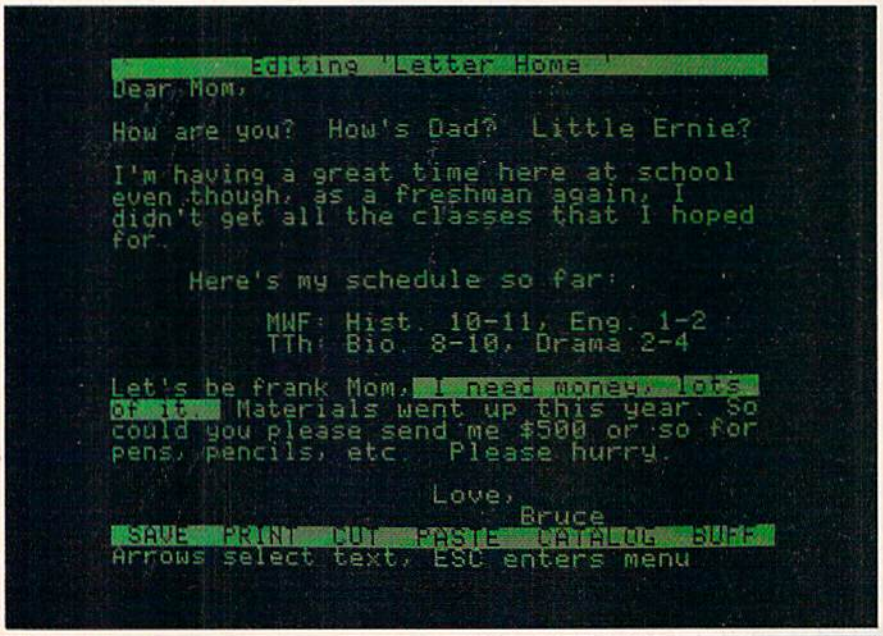

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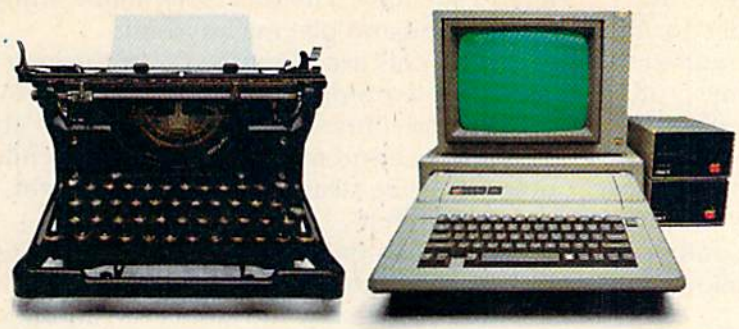

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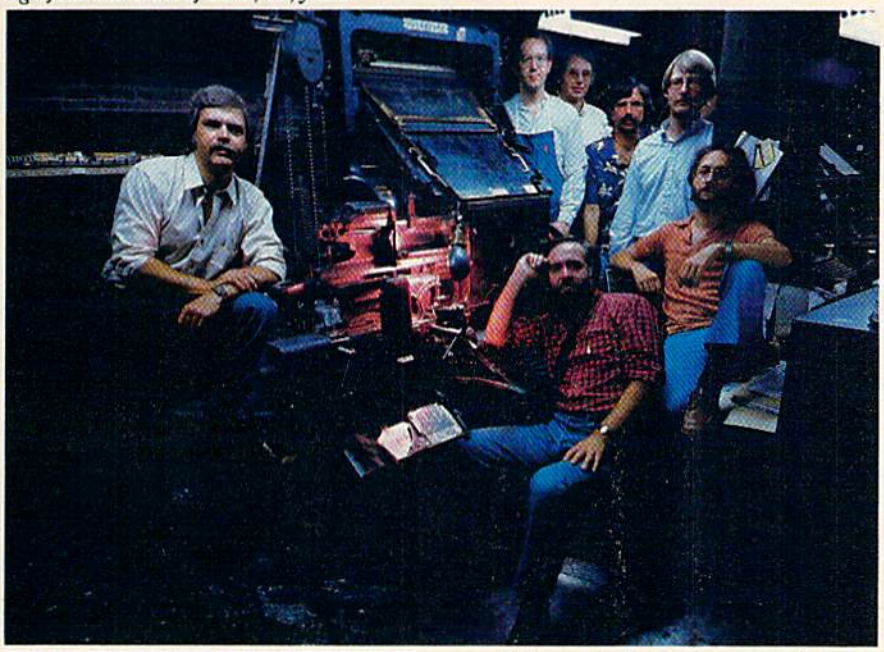
THE CHANGING OF THE GUARD. *Until quite recently we used pens and paper and typewriters to write with, mostly because we knew how to use them. They have been good tools, but limited. You tend to make messes when you work with them, and getting rid of those messes makes extra work. Cut & Paste is an inexpensive and practical alternative. Because it is as easy to use as a typewriter, you really will use it. Which may make it the first sensible word processor for the home. Thus an alleged labor-saving device has come to a position where it really can save a significant amount of labor, i.e., yours.*



THE MEN WHO MADE CUT & PASTE. *The Linotype machine pictured here was the 19th century's most important contribution to word processing technology. It let typesetters compose and rearrange text in the form of metal castings. The importance of Cut & Paste, of course, must await the judgment of history. Nevertheless, the seven men who developed it look confident here. Standing left to right, they are: Norm Lane, Steve Shaw, David Maynard, Dan Silva, Steve Hayes and Jerry Morrison. Seated at the console is Tim Mott, whose idea this was in the first place.*

people who have in common a very lucid philosophy of design.

Computers and the programs they run are tools, they believe. Tools are never noticed unless they are bad tools. When they're good, they become, in effect, invisible. And if you want to make a good tool—an invisible tool—you'd best study the way people use the tools they already have.

As a result of this thinking, Cut & Paste was designed to work much in the same way that you already work with a typewriter or with pen and paper. The most complex and powerful parts of the program are hidden from view. The work they do takes place deep in the machine. All you get to see are the results.

But beyond that, there is something almost indefinable about a good design. Things about it just seem to work crisply. Little touches and features that you notice make you want to smile. If it's really good, it *feels* good.

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marked path laid out by the teacher's learning plan, by the school board, the boards of education and testing, and the committees of accreditation.

On the other hand, learning at home is ad hoc and sporadic; it happens in bursts. There is no curriculum or lesson plan to follow. There are no formal standards to meet, to fail, or to surpass. Learning at home is usually marked by the joy, the pain, or the insight of the moment, rather than the result of a coordinated plan followed over days, months, and years.

A Sense Of What Is Right

At school, a teacher can be a leader because he or she has some sense of what is right. This sense comes from training, years of experience, fellow teachers and colleagues, from the insights gleaned from professional books and magazines, and from attendance at conferences and meetings.

In contrast, at home a parent, as teacher, flies by the seat of the pants. Parents have to trust their gut feelings and their dim memories of being students themselves. Parents can certainly nag and demand that their children sit down and do their work, but they can't get them to learn—unless they can somehow lead them into learning. But how can a parent be a leader unless he or she knows where or how to lead?

A New Curriculum For Home Learning

Parents need guidelines for a home-learning curriculum. But it must be something totally new, unlike any curriculum found in school. And parents need help in making decisions as to which home-learning software they should purchase, and how to derive the greatest benefit from that software for their children.

They can't follow the school model. The school "carrots and sticks" will probably not work at home. Children who learn at home, over the long term, will need more incentive than their mom or dad threatening and nagging them, day after day, week after week. Children who learn at home will need software that inspires them, challenges them, and gives them free rein to learn independently and at their own pace.

Above all else, learning software for the home must be *entertaining*. The incentive for learning must come from learning itself. It cannot be imposed from outside. Otherwise, the long-term effect on the child is likely to be more negative than positive. Children will come to resent enforced learning on the computer just as much as I resented being "strapped into" the piano seat for a half-hour of practice every day when I was growing up. After eight years of this kind of "education" I came to hate the piano. Today, many years later, I still have a mental block about sitting down at the piano and playing anything.

If parents are to succeed over the long run, computer learning at home must be fun, even joyful. And it must be meaningful to the child. The purpose and meaning of what the child is doing must be clear, not just to the parent, but also to the child.

Equally important, the child must have control over the direction and extent of his or her learning. Otherwise the child is an automaton or puppet, and will derive very little satisfaction, pleasure, or real learning from all those accumulated hours in front of the computer.

Opportunities For Home Learning

If school models for education are artificially grafted onto the home, computer learning could become very dreary indeed!

Yet something must be done.

Home learning using computers may soon be the complement to and the extension of learning in the school. Preschool children will learn at home on computers. School-age children will do their homework on computers and get remedial instruction. Handicapped children and those with learning disabilities will get valuable learning assistance from the computer to help them keep up with or even move ahead of their classmates. Talented and gifted children will be able to use the computer as a "Space Shuttle" of learning. They will be able to blast off into new areas, on their own, areas that challenge and stretch them to the utmost. They will be able to free themselves from the fetters and the crippling fear of failure they may feel in front of parents, teachers, and peers.

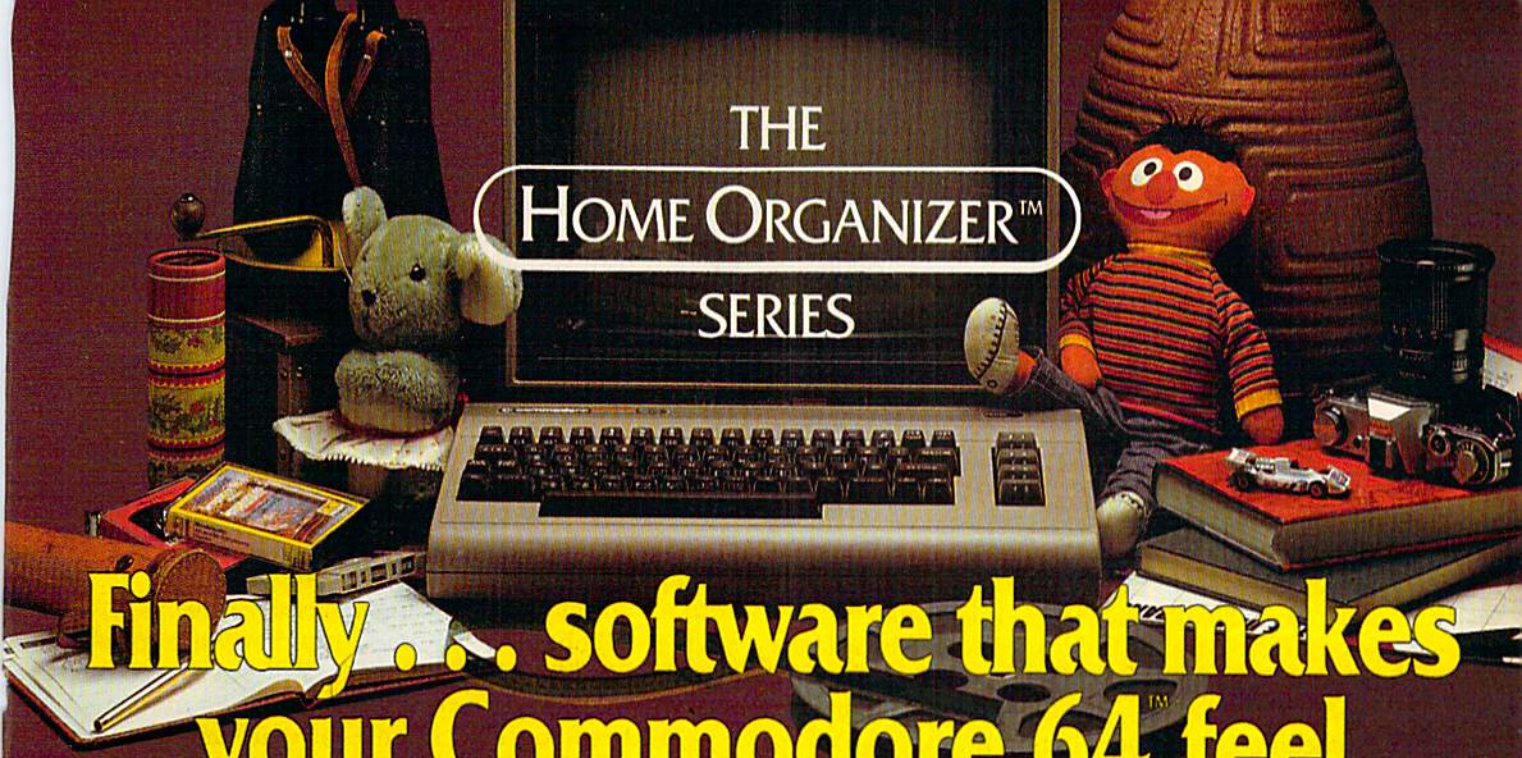
Computer learning at home will also be valuable as an "eleventh period." Children will be able to learn subjects and skills not offered by their school.

Adult computer learning, too, will be important. Schools will be able to provide "continuing education" courses for adults at home, using computers. Adults will be able to acquire valuable job skills and gain academic degrees by using computers to learn at home.

The Free Enterprise Model

Learning at home shouldn't be constricted by a school-like institutional curriculum or standards. Instead, new kinds of curricula and standards should be created, based on realistic conditions that exist in the average home.

Learning at home on a computer should be as diverse as possible to reflect different families' and individuals' interests, personalities, goals,



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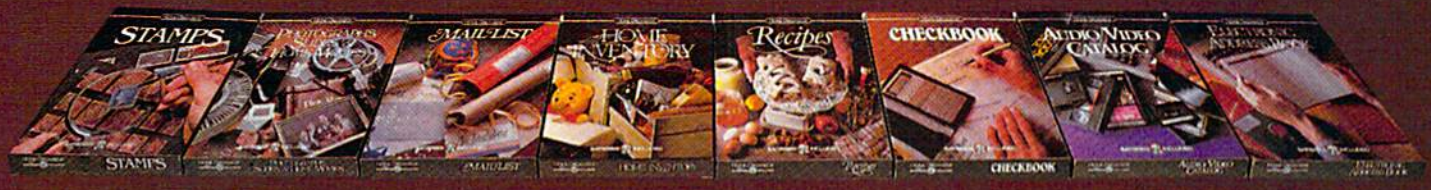

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and abilities. Diversity in computer learning should reflect (and *enhance*) the diversity in people.

Educators need to work along with educational policy makers, parents, children, and computer users to come up with a diversity of new standards, materials, and curricula for home learning.

The best model for home learning might be a *free enterprise model*. Major government bodies, computer users groups, educators, private companies, and consumer groups should each come up with their own packages. There might, for example, be a McGraw-Hill Comprehensive Package of Computer Home Learning Materials, and other packages from Scott Foresman, Addison-Wesley, D.C. Heath, etc. There might also be packages from MECC (the Minnesota Educational Computing Consortium), the Apple Computer Company, IBM, Atari, Tandy, and, of course, Commodore. Consumers Union might have its own package. Children's Television Workshop, CBS Software, Scholastic, Reader's Digest, Sunburst Software, and HesWare might have their own packages.

Each of these packages would compete for the biggest share of computer users. Parents could read evaluations and descriptions of the packages, talk to dealers, and preview the software before choosing the package that was right for them and their family.

Extra-curricular Learning

Not all home learning should be curriculum-based. Not even if we redefine "curriculum" to be something appropriate for homes and families.

Many kinds of software companies should continue producing what they do best—one-shot, maverick programs that are unlike anything anyone has ever seen. These are works of art that delight, charm, entertain, and educate, all at the same time. They might not fit easily into a package or a curriculum, but they deserve to be seen and experienced by every family.

Also, there should be lots of room for content-free, "learning how to learn" software. I would welcome lots of new programs that don't teach us when the Pilgrims landed on Plymouth rock, or how to conjugate a verb in Spanish, or how to solve an algebra problem. Instead they would teach us to be better learners. These programs would help us in all our learning, at home and at school.

Furthermore, learning at home and at school are not always different. I think that many of the unstructured learning exercises targeted at the home could be used in special, unstructured learning times at school. And many types of courseware aimed primarily for the school could be used, with proper materials and parental guidance, in the home. Above all, there should not be a wall separating learning at home from learning at school. Instead, it should be a broad, circular continuum that melts together and meets at either end.

Horse Breeders, Plumbers, And Brain Surgeons

Completely new modes of learning may be discovered yet.

A home-learning curriculum might be devised based entirely on real-world career domains. For example, all computer-based home-learning courses shouldn't just be on *knowledge domains*, such as Algebra I or language arts. Software companies should also offer children full-scale courses on how to be a space shuttle pilot, how to manage a nuclear reactor, how to be a software designer, a fashion photographer, a horse breeder, an archaeologist, a diplomat stationed in Latin America, an executive in a multinational corporation, a plumber, brain surgeon, or a police detective.

In these courses, knowledge domains would be subsidiary to *career domains*. Kids would pick up the physics, math, language arts, and social studies they needed to get their credentials in the various fields. The youngest kids would naturally become junior horse breeders and archaeologists. The models that they would have to master would be simpler, yet for them, no less exciting and challenging.

Older kids would have to work with more complex, lifelike models of the real world and of the careers they were studying. They would work for milestones like Apprentice and Assistant on the way to achieving mastery of the career.

Perhaps work-study internships could even be set up to coincide with advanced home-study programs for teenagers and young adults. Companies and government agencies could open their doors to student interns who had mastered their "career courses." In this way, young people could complement their home learning with on-the-job training and real-world experiences. Employers would benefit by getting to see a crop of enthusiastic, well-trained young people.

The programs of study should be diverse, entertaining, and short enough to encourage children to try as many careers as possible. The programs should be rewarding, playful, and encourage social and emotional skills as well as intellectual skills.

My thanks to the many industry watchers who, through discussions during the recent Consumer Electronics Show, helped contribute to the ideas in this article.

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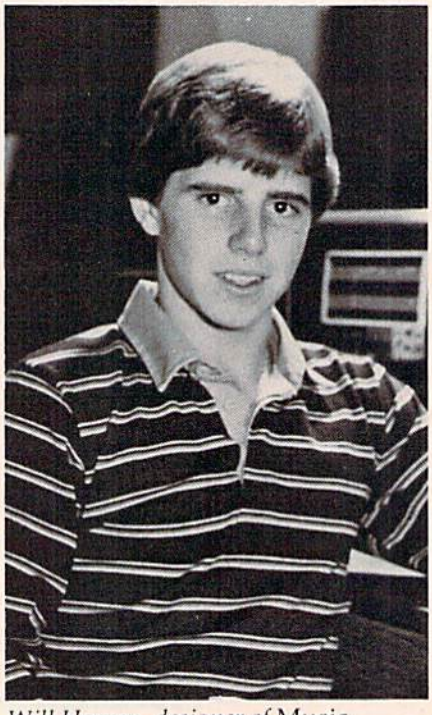
Will Harvey
The Programmer Behind *Music Construction Set*

Kathy Yakal, Editorial Assistant



Will Harvey, designer of Music Construction Set.

Some professional programmers draw a blank when you ask what they do in their spare time. "There isn't any," they say. Not so with the subject of this month's "Inside View," Will Harvey, the programmer behind *Music Construction Set*.

"Programmer" doesn't mean what it used to.

The next generation of program designers will need more than just expertise in BASIC and machine language. As programming itself becomes less complicated, and hardware capabilities allow better graphics, sound, and depth of play, the intricacies of the programs themselves will become more important. The successful designer will be the one who can develop glorious ideas, the "guy with the vision," according to many of today's programmers.

Will Harvey, the designer/programmer of Electronic Arts' *Music Construction Set* has a good chance of being one of those people, considering his early success—and his confidence, technical ability, and emphasis on ideas.

But Will Harvey may decide that he has other plans for the future. "Computers are just another hobby for me," he says. "I wouldn't consider it a profession, or anything that takes precedence over any of my other activities."

Those other activities are many and varied. Seventeen-year-old Harvey is president of the student body at Uplands Senior High School near his home in Foster City, California. A straight-A student, he plays football and basketball, sings in the school chorus, and is an Eagle Scout.

School celebrity? Not really. "People at school know I'm interested in computers. They know I've been in some big magazines," he says. "But that's not a big thing."

Music Construction Set evolved in a rather roundabout way. Harvey bought a Commodore PET about five years ago. "It was the only one I could afford," he says. "It was the kind of thing where you save up money from a paper route, and your parents go half and half with you.

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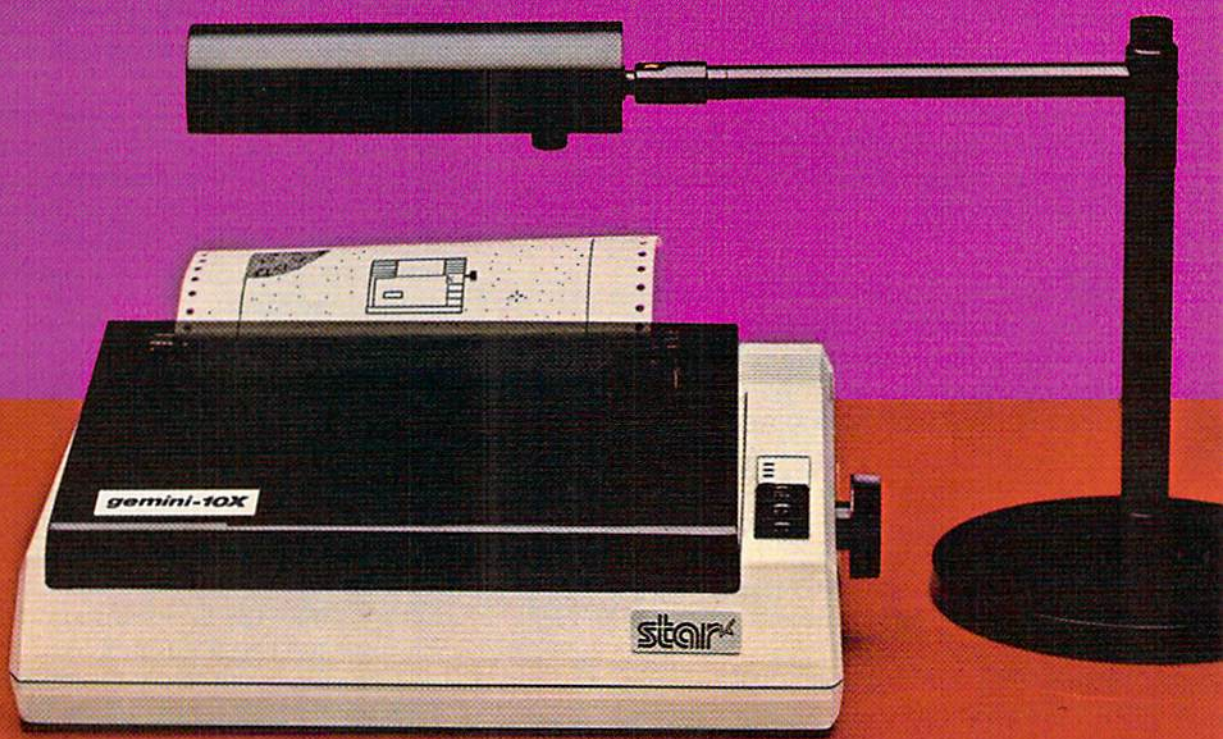


"I just played around with it as if it were a toy at first. I had no serious interest until about two years ago, when I started using it as a tool to program on."

Harvey traded his PET for an Apple at about that time. He was working on a game called *Lancaster*, which was to contain some music. To incorporate music into the program, he created a mini-music construction set. "I had to convert sheet music into numbers the computer could understand," he says. "Originally, it was a tool for me, an interface between me and the computer."

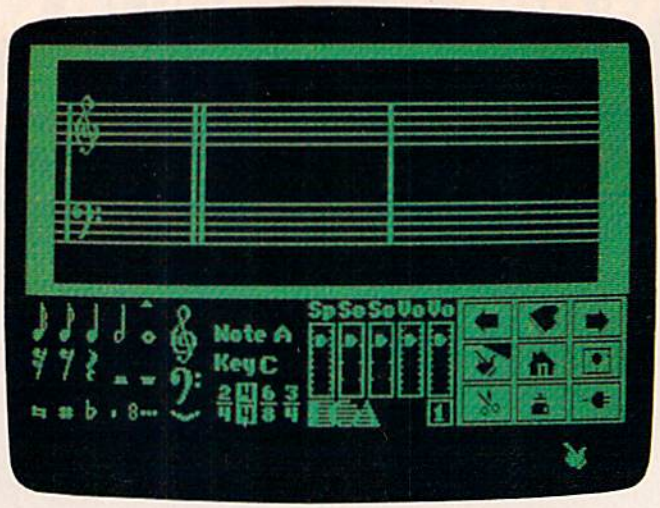
In the process, Harvey found out that creating music on the computer was fun. Having completed *Lancaster*, which was published by Silicon Valley Systems, he set to work on a program that would allow people to learn about and have fun with music.

"I didn't know much about music beforehand," he says. "I went up to people in the school chorus and asked them questions.

"The more I learned and put into the program, the more I realized that this was a fun thing to do. What the program could do for people was to provide an environment where they could learn about composing and playing music without having to learn an instrument."

Another aspect of the program that Harvey discovered later was its use as a tool. "It's very much like a word processor for music," he says. "It lets you move around notes and transpose music, just like you would move around text when you're writing something."

Electronic Arts discovered Harvey through one of its programmers, and published *Music Construction Set*.



By moving the hand (bottom right of the screen) with a joystick, you can easily create and edit your own music.

M*usic Construction Set* lets you do just what the name says. It allows you to compose three-part melodies, listen to them, and print them out. It's easy to use, and uses the graphics and sound capabilities of the Commodore 64 quite well.

You might imagine that its programmer was a technically-oriented tyke who grew up taking apart the toaster and television and anything else he could get his hands on.

That kind of image is inaccurate among today's young programmers. "I'm not an electronics whiz," says Harvey. "I'm not even a computer whiz. I'm just able to take an idea and put it in a fantastic form.

"There's a difference between a computer whiz and a computer artist. A computer whiz is someone who's a very good programmer. A computer artist is someone who designs and fully makes a game. A programmer is just someone who programs it.

"You have to have some technical background, but that's not really what makes a good program."

So what does it take? "I have sufficient background in electronics and computer programming to do it," says Harvey. "But that's not really what makes a good programmer. It's like having writing skills. That doesn't mean you're going to write a good book.

"What you need is lots of imagination and confidence in yourself. I think the biggest thing is enough confidence in yourself so you can take an idea and develop it.

"Once you've got the perfect idea, only then do you say, 'How am I going to do this?' That, in my opinion, is the perfect approach to writing a program. The ideal program doesn't have anything to do with how difficult it is to program, or how impossible. You have to develop the idea around the ideal."

Next fall will probably find Will Harvey attending classes at nearby Stanford University. Studying computer science? "No. I'll probably study the pure sciences, or maybe history. I know as much about computers as I want to know," he says. "Not to say that I know everything, or even a whole lot about computers. I know enough to keep doing what I'm doing right now. I'm sure I'll continue programming."

Harvey is currently finishing up an Atari version of *Music Construction Set*. Beyond that, he's planning two different types of games, one fast-action and one fantasy. He's also working on some programming utilities. "There's still a very wide gap between the way people think and the way computers work," he says. "Resolving that problem will be the ultimate breakthrough. I'm endeavoring to close that gap."

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SpeedScript Revisited

Charles Brannon, Program Editor

Got a question about "SpeedScript"? Find an answer here, along with some tips on advanced uses for this popular word processor.

The letters keep pouring in: The response to "SpeedScript" (COMPUTE!'s GAZETTE, January 1984) is overwhelming. Our readers are well pleased with the speed, power, and low cost of this powerful word processor.

To help answer the deluge of questions brought up by our readers, we'll cover them here in this article.

The Good, Bad, And The Ugly

SpeedScript was extensively tested before we released it. That's good. However, a few changes were made after this testing to improve efficiency. That's also good. But after this change, one command was not adjusted. That's bad. The [n] command, for next page, does its job too well. It feeds on to the next page, and the page after that, the page after that, endlessly. And that's ugly. There's no simple fix for this command; you cannot insert changes in machine language like you can in BASIC. It would require you to retype the entire program. And that would be uglier still.

Fortunately, this command has been fixed on the version of SpeedScript available on the GAZETTE DISK. Those who order the first issue of the GAZETTE DISK, either through subscription or single-copy, will receive as a bonus a revised, updated version of SpeedScript. If you were unable to obtain a copy of the January GAZETTE, which quickly sold out, you can still obtain SpeedScript without even having to type it in. I'd call that quite a deal.

A Hidden Command?

Many readers "discovered" a new command in SpeedScript that sets the line spacing. The [s] command was not mentioned in the article, although there is a cryptic reference to it. There are no hidden commands in SpeedScript, just poorly documented ones! It's just as well that [n] was left off the quick-reference card, but [s] works just fine. First type CTRL-£ (or CTRL-3), then enter [s] and follow it with the number you want for line spacing: 1, 2, or 3. You can use any number, really, if you want something like four or five spaces between lines.

The Deadly Linefeed

SpeedScript will double-space by default, though you can change it with the [s] command. Some people found they were getting triple-spacing, though. Worse still, this threw off paging, so headers and footers would be in the middle of the page. The problem is caused by the *deadly linefeed*.

A carriage return should return the print position to the left, then down a line, simulating carriage return on a typewriter. Two operations are involved, though. Carriage return just returns the carriage (printhead) to the start of the same line. The platen or tractor feed then scrolls the paper up a line. This is called a *linefeed*. The combination is a CRLF, Carriage Return/Linefeed.

The code for carriage return is 13, and on

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most computer screens acts as a CRLF. Many printers are set up like this, too. But some programmers realized that if you could separate carriage return from linefeed, you could overstrike a line. If you returned the carriage without linefeeding, you could underline a whole line by just printing a bunch of underlines after you did a carriage return. You would then send a linefeed by itself (CHR$(10)) to advance the page for the next line.

But if you are not trying to do this little trick, you get a 50-page document all on one line. For SpeedScript, you need the printer to go up a line at each carriage return.

Since printer manufacturers want their printers to be flexible, they allow either option: CHR$(13) performs a carriage return or a linefeed. Since SpeedScript does not send linefeeds (to make life easier), your printer should be set up to make automatic linefeeds. The Commodore printers will always perform a CRLF (although you can send CHR$(141) to return without a linefeed). You can usually open up your printer (or reach through a slot in the back, or under the paper cover) and slide tiny little DIP (Dual In-line Packages) switches to change the way carriage returns work. Get out your manual and a magnifying glass.

Paper Alignment

Other readers find it hard to print a document of several pages. The first page looks okay, but the subsequent pages are off by one line, with the footer appearing not on the bottom of one page, but at the top of the next. This is not a problem with SpeedScript, but with paper alignment. You must have the printhead set so it would print its first line *exactly* at the top of the page. SpeedScript will skip a bit past this, but it is important for the sake of paging, especially if you use headers and footers. Trial and error will teach you where to position the paper.

Gemini printer owners sometimes find that paging is very inaccurate. Their problem is that some Gemini printers (and Epson printers with Graftrax Plus or better) will automatically skip over the paper perforation. The printer may do this while SpeedScript is trying to skip lines to get to the next page.

The trick is to disable the automatic skip-over-perf mode. The code for this on Gemini printers is 56. To send this code, OPEN 4,4:PRINT#4, CHR$(56):CLOSE 4 before you load and run SpeedScript. You can also initialize other printer features this way before you run SpeedScript, but be sure not to turn off your printer, or this will reset all the default modes. Consult your manual for a list of codes you use to change modes on your printer.

You can also change this mode from within SpeedScript. On a separate line enter:

```
[9]=56←
```

Remember that commands, represented here in brackets ([ ]), are obtained by typing CTRL and the English pound symbol (£), followed by the desired letter or number. Commands appear on the screen in inverse video. Now you can embed the [9] by itself on another line, or at the start of a line by itself. Here are three ways:

```
[9]=56←
[9]←
The quick brown fox...←

[9]=56←
[9]The quick brown fox...←
[9]=56[9]The quick brown fox...←
```

I gave all these examples to help those of you who are confused about how to use the programmable numbers. Some of them are predefined, as in [1]=27. If you want to go into emphasized mode on the Epson printer, you would send in BASIC: PRINT#1,CHR$(27);CHR$(69).

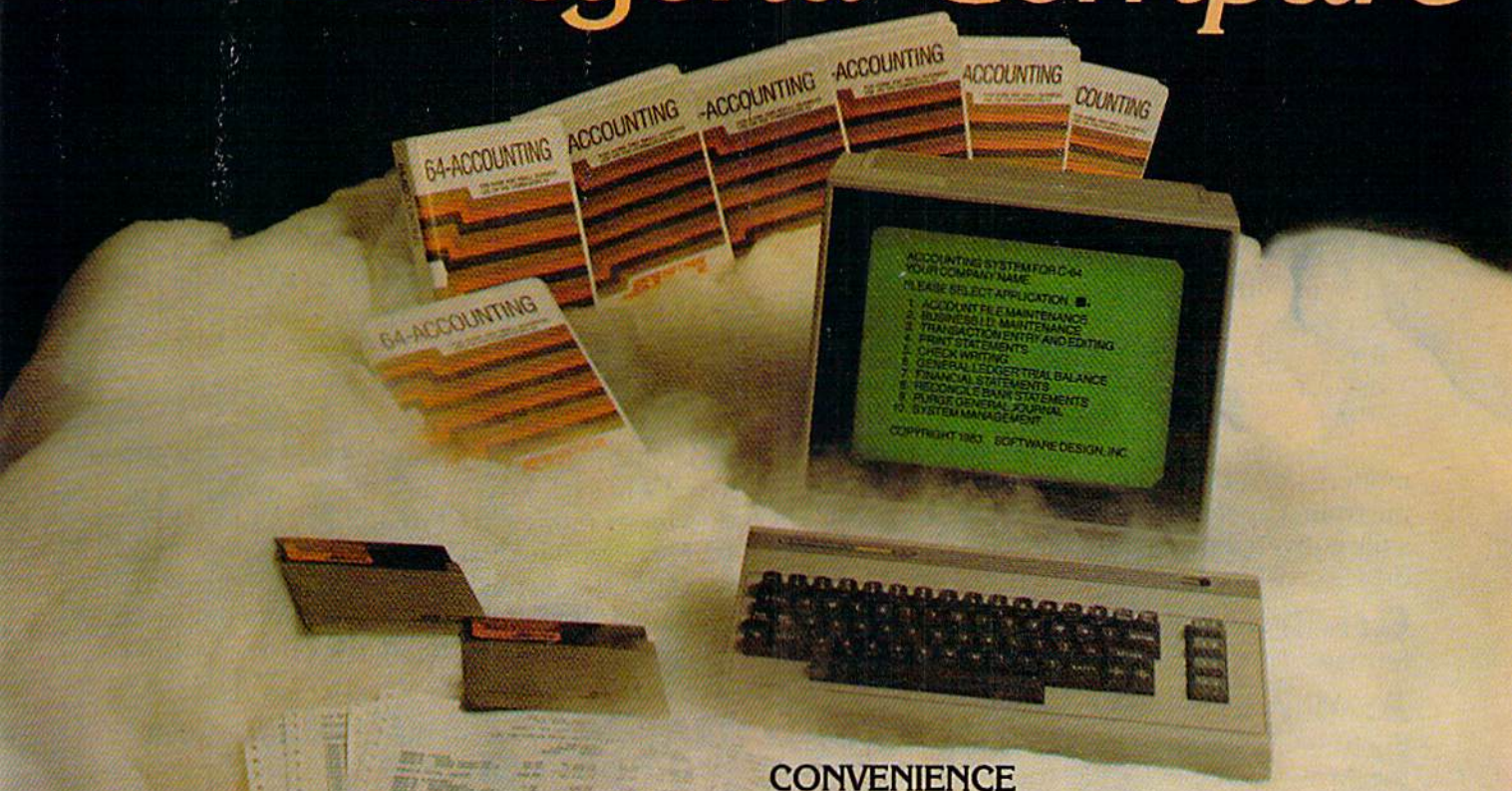
Since CHR$(69) is the code for E, you could also use PRINT#1,CHR$(27);"E". In SpeedScript, you would embed [1]E. The [1] will send out CHR$(27), and the E right after it would then be sent. By the way, be sure you use a capital E, since a lowercase E would be sent as a CHR$(101).

Some interfaces have their own escape commands, so CHR$(27); "E" would either perform an interface command, or it would be ignored. In either case, you wouldn't get Enhanced mode. You may be able to get past the interface by sending ESCape twice: [1][1]E. Otherwise, you may be able to turn off your interfaces's emulation mode and operate SpeedScript in the true ASCII mode by placing an [a] at the top of your document.

On some printers you'll get better performance by adding 128 to the mode code: [1]=155 instead of [1]=27.

Remember that SpeedScript doesn't understand the intent of the programmable numbers. It just sends the codes out. If you sent out a CHR$(12) as a formfeed, the printer would indeed skip to the next page, but SpeedScript thinks it is still on the same page, and will probably try to skip over the perforation in the middle of a page. Double-wide characters are also treated as single-width by SpeedScript. If you center a double-width phrase, SpeedScript will skip to the center position as if the phrase were single-width, then print the double-wide characters off-center. Again, only the printer knows to print double-wide characters. One way to get around it is to pad out the line you want to center with an equal number of spaces. The centering will be based on twice as many characters, but the extra spaces will not be visible.

64 Software Beyond Compare



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Speaking of centering, SpeedScript will always center in the middle of a 8½-inch wide piece of paper. If you had a 40-column printer and changed the left and right margins, centering would not conform to the new page width. SpeedScript thinks the page is 80 columns wide no matter what the left and right margins are. SpeedScript also assumes the page length is always 66, for 11-inch paper. If you have a 40-column printer or 10-inch paper, you have my sympathy. Next time I'll get it right.

Questions And Answers

Many people had the same questions, so I can sum up a good many answers to letters right now:

Q: Is SpeedScript compatible with *EasyScript 64?*

A: No. SpeedScript and *EasyScript* store text within memory and on disk in different ways. You can load an *EasyScript* file into SpeedScript, but you will have to do a lot of work to get it right. Most other word processing files cannot be seen by SpeedScript, either. Many people would also like to be able to send SpeedScript files over a modem in ASCII, or create an ASCII sequential file from a SpeedScript program file. Program 1 is a file conversion program for SpeedScript. A disk drive is required.

Q: Can I save SpeedScript files in "rabbitized" format?

A: Many VIC-20 and 64 owners with tape use the ROM Rabbit from Eastern House Software, or the Arrow from Skyles Electric Works. These programs in ROM add commands to BASIC that permit you to load and save tape programs at a substantially accelerated rate. But these products are not hardware peripherals, and there is no way to treat them as such. In any case, SpeedScript doesn't like ROM cartridges, since they reside within SpeedScript's usable text area.

Q: I am a Francophone, and would like to be able to print letters of the alphabet with accent marks. How do I modify SpeedScript to do this?

A: You don't have to. If you don't need to see them on the screen, you can have them on paper. Just overstrike the letter with an accent mark. Define a programmable number, and use it to print the letter e, the code for backspace (CHR$(8)), then an accent mark, like this:

```
[5]=8[←]
Je suis enchante[5]' de faire votre
connaissance.[←]
```

If you can't do it with overstriking, you may be able to define a character on your printer (see the example in the SpeedScript article).

Q: When I print out something with SpeedScript, it will always skip to the next page after it finishes.

A: Sorry. There's a tradeoff involved: Some people want to go ahead and remove the document from the printer right after they print it, so it's nice that SpeedScript ejects the last page. But the real reason is that SpeedScript must go to the bottom of the last page in order to print the footer, if any.

Q: For several reasons, I want to be able to print out in all uppercase. I could type it all in lowercase, then use CTRL-A to reverse it all, but this seems like a lot of trouble.

A: You don't have to use CTRL-A. Just type it all in lowercase. If you have a Commodore printer or an interface that emulates one, put an [a] at the very top of your file. This will have the effect of reversing upper- and lowercase. If you usually use [a] to get upper- and lowercase, just omit it.

Q: How do you insert a line in the middle of text?

A: A blank line is represented by a carriage return symbol (a back-arrow) on a line by itself. Just go into insert mode (CTRL-I) and press RETURN wherever you want a line break to appear. The text after the carriage return will be pushed down to the next line. If you want to insert a line of text, just put the cursor on top of the carriage return, then type it in.

Q: Can you get more than 80 columns on the printer? I'm using my printer's proportional mode, which can take 100 characters to fill up a line.

A: Just increase the right margin, as in [r]100.

Q: How do you abort a printout?

A: Hold down the RUN/STOP key while the printer is printing. This key is checked for only while text is being printed, not form feeds. You need to hold it down until it "catches." When you let go, you'll be back in SpeedScript. SpeedScript waits for you to let go of the key to prevent you from accidentally inserting spaces into your text.

Q: How can I get SpeedScript to work with an 80-column board?

A: You would need to be a machine language programmer and have a copy of the source listing of SpeedScript. You would also have to have documentation on how the 80-column board interfaces with your machine. SpeedScript updates directly on the screen. It does not go through PRINT, which is all most 80-column boards trap.

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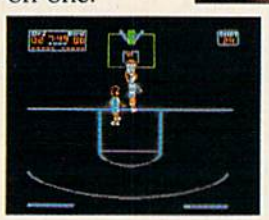

It wasn't easy. When they talked, we listened. When they criticized, we made big changes. When they gave suggestions, we took them.

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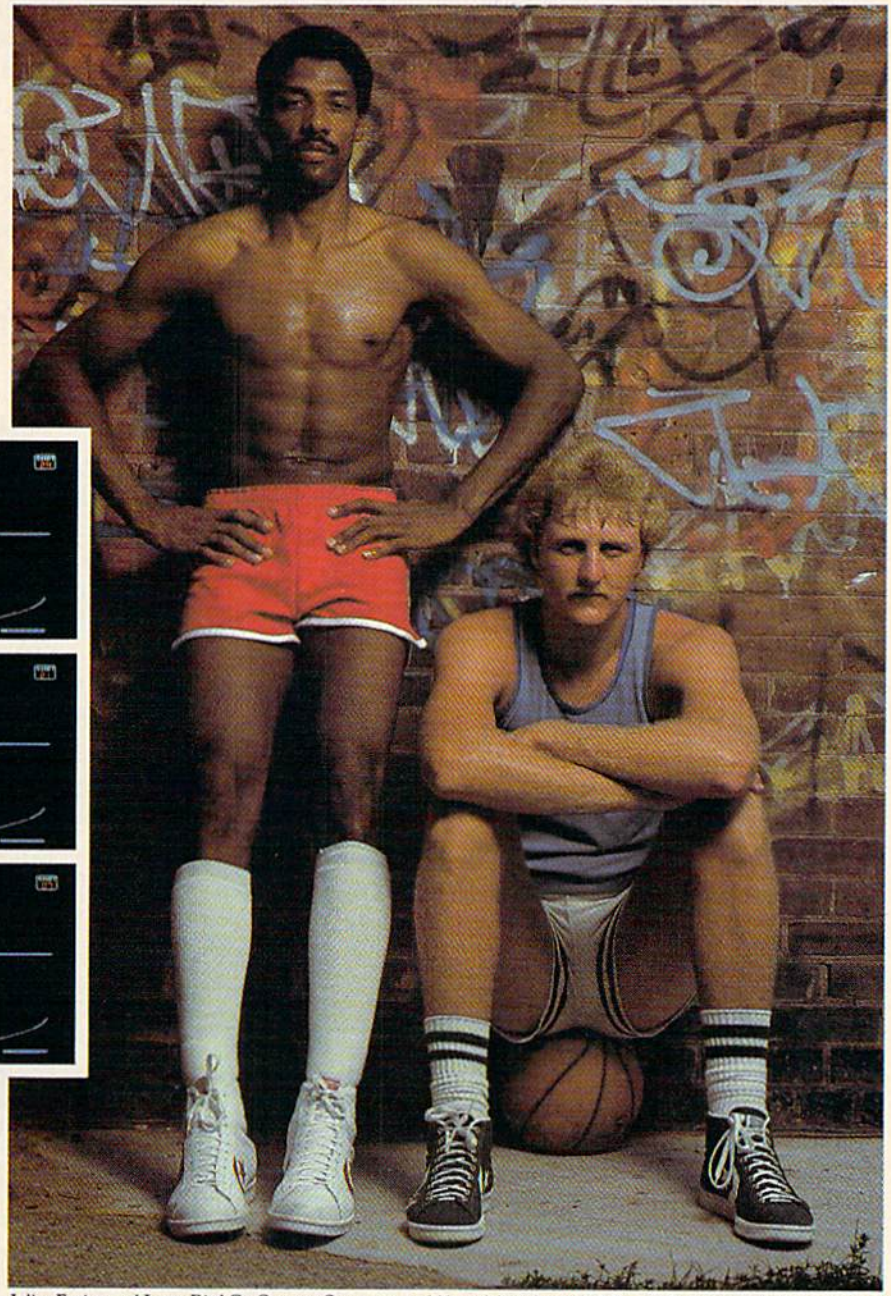

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Hints And Tips

Many people have written in with new ways of using SpeedScript. Also, the more you work with a word processor, the more tricks you learn. Here are some suggestions to make the most of SpeedScript.

If you have a special format line that you always use, save it to disk. You can then call it up every time you start to write. You can also create fill-in-the-blank form letters. If you use some strange character for the blank, you can use Hunt to quickly find it and, while in insert mode, fill in the information. You could have forms for articles, personal letters, business letters, etc. The point is to save repetition.

Although SpeedScript doesn't have search and replace, you can use the cut and paste feature of the text buffer to memorize the string you want to replace with. Use Hunt to find each occurrence, then CTRL-R in insert mode to substitute. You can then use the DELete key to remove the original phrase. (Don't use CTRL-back arrow, since it chains to the buffer.) Sounds a bit klutzy, but after practice you can be quite proficient.

Don't forget that you can use SHIFT-CTRL-P. This will ask you for the device number and secondary address of the printer. Answer with a device number of 3 and a secondary address of 0, and SpeedScript will print to the screen. You can see where line and page breaks occur, as well as how many pages your document runs (if you have a header or footer with [#] embedded).

This may seem trivial, but if you copy SpeedScript as the first file on each document disk you use, it will make life easier. You don't have to remember which disk has SpeedScript on it. Just insert your document disk, LOAD "*",8 and you're in business.

Watch out for repeating keys. SpeedScript is so fast you could insert a paragraph with CTRL-R two or three times before you realize what's happened.

Modifying SpeedScript

We've received more than a few letters asking for an assembly source listing of SpeedScript. We don't have the manpower (or personpower) to mail listings to individuals, not to mention the postage it would take to mail 100 pages of source code. It goes without saying that we can't publish it in the magazine for space reasons. Besides, the source code isn't even commented.

Without the source code, it's very difficult to add anything to SpeedScript, or make significant changes, since it is machine language, but you can overwrite parts of the code. Following the disassembled listing of a mass of raw numbers without labels or remarks is like reading a book upside down.

The following memory locations contain the default settings for several of the printer commands. This was discovered by Ken McEnany for the 64:

Location	Hex	Value	Item
5200	1450	05	left margin
5201	1451	75	right margin
5202	1452	66	page length
5203	1453	05	top margin
5204	1454	58	bottom margin
5205	1455	02	line spacing

A treat, indeed! If you have nonstandard paper, or prefer single-spacing, you can load SpeedScript, use POKE to change a default (such as page length), then save the new SpeedScript back to disk. For example, POKE 5205,1 would be used for single-spacing.

Jeffrey C. Edman owns a Brother CE50 typewriter and an RS-232 interface. Unfortunately, SpeedScript doesn't work with the RS-232 port—or does it? Mr. Edman pored over a disassembly of SpeedScript, and found that his setup would work with the following POKEs:

POKE 659,6 (sets the RS-232 control register)
POKE 660,0 (sets the RS-232 command register)
POKE 7812,2 (changes SpeedScript)

Mr. Edman continues:

"Using a device #2 and a secondary address #2 (in response to the prompt after a CTRL-SHIFT-P) plus true ASCII format (using [a]) will result in an excellent print-out.

"With these changes the output to the printer does not print out approximately the last 120 characters of the text. I get around this by adding greater than 120 spaces to the end of the text."

I hope owners of RS-232 printers can apply these suggestions to get SpeedScript to work with their printer.

This isn't the last time we'll look at SpeedScript. Keep sending in your suggestions. When the time is right for SpeedScript Deluxe, it will owe a debt to the readers of COMPUTE!'s GAZETTE for their many good ideas and constructive criticism.

See program listing on page 141.

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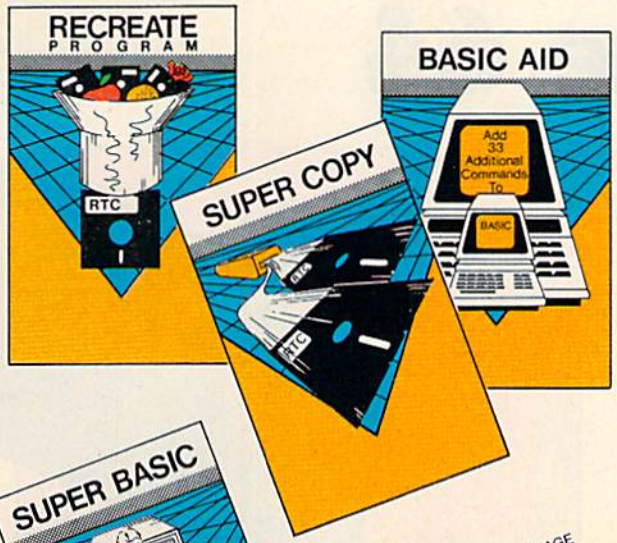

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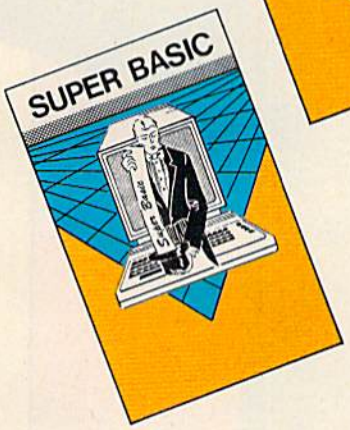

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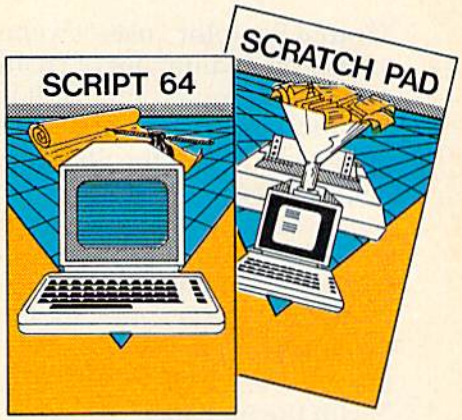

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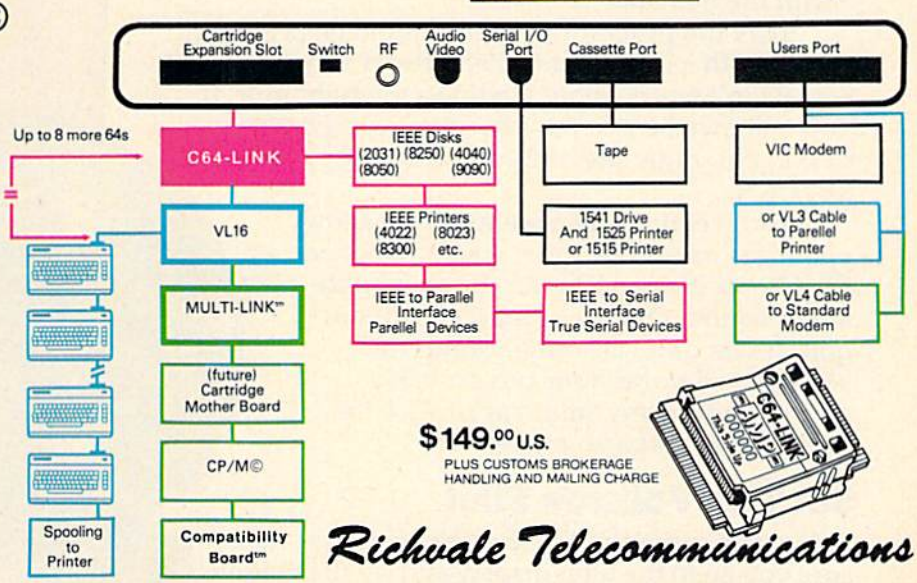

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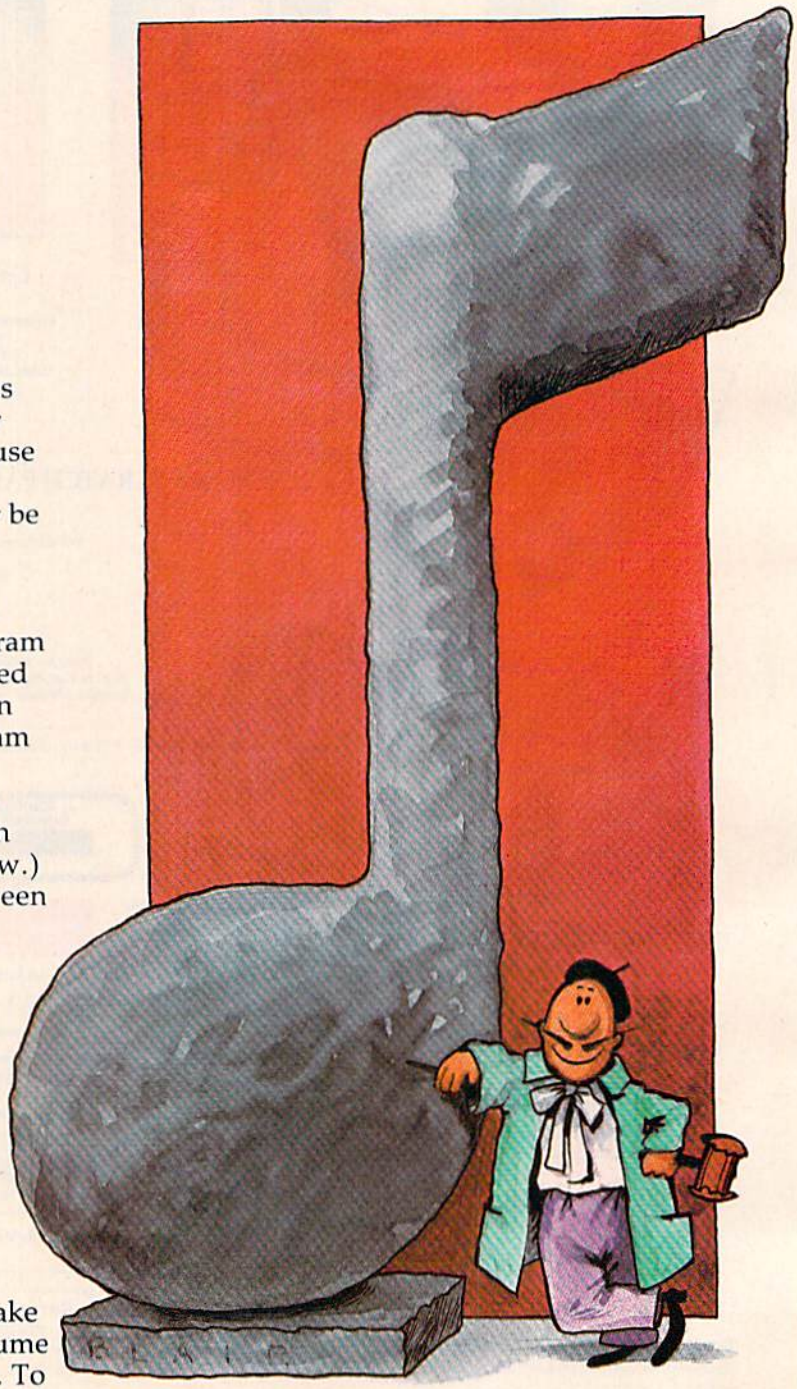
Sound Sculptor For The 64

Todd Touris



With formatted screens and a joystick-controlled pointer, "Sound Sculptor" gives you the ability to quickly and easily create your own music and save your creation.

"Sound Sculptor" uses several graphics screens to take the tedium out of creating data for your music or sound programs. It is not difficult to use and therefore needs little explanation; a basic understanding of the SID chip would probably be helpful, however. The *Programmer's Reference Guide* is a good source of information.

After you have loaded and run the DATA program (Program 1), the main program (Program 2) should LOAD automatically if you have saved Program 2 immediately following Program 1 on the same tape. Disk users should SAVE Program 2 with the filename "2".

RUN the program and you should be presented with a main menu. Press the f1 function key. (Don't worry about loading a file right now.) You will then be asked to choose a sound between 0 and 1250. Enter the one you want and press RETURN.

You will then get a menu which allows you to set one of the three voices, work on the filter settings, clear the sound, choose a new sound, change joystick speed, or quit. If you don't clear the sound, the settings will be random and probably won't produce any sound at all. Use the keyboard to make your selection.

Set The Volume First

Before you jump right to the voice settings, make sure you go to the filter display and set the volume control, or you won't be able to hear anything. To

change the various settings, you simply move the sprite arrow over the appropriate display and press the fire button. When a word or character is in reverse display, it means that the particular setting is on or, if the display is a scale (+ signs), it shows what value that setting contains.

To trigger the voices, you must use the function keys (f1 for voice one, f3 for voice two, f5 for voice three, and f7 for all voices). If the voice is off, it should go through attack and decay and then remain at the sustain level; when the key is pressed again, the sound should be released and fall to zero volume. When pressing the function keys or switching a setting, you must be careful. The program is very fast and the keys are very responsive and sometimes the voice or setting can be triggered twice, so hit the keys quickly.

When you are finished experimenting with the various settings, press the space bar to return to the selection menu. You can continue working on more sounds, or you can press f8 to quit. When you quit, you will get another menu with three options.

Saving Sounds

The first option is to save a series of sounds on tape or disk as a file (depending on your earlier selection). You can load these sounds back for later use by pressing f3 at the beginning of the program instead of going right to the design/review routine. This feature allows you to build a library of various sounds.

Your second choice is to create DATA statements of your sound or sounds. With the program below, you can use these DATA statements to incorporate complex and fast sound effects into your BASIC programs.

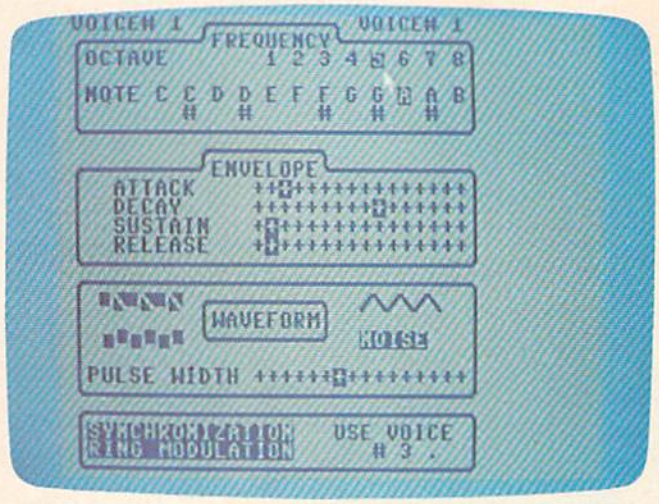
```
1000 FORL=0 TO 42:READDA:POKE828+L,DA:NEX
     TL
1010 DATA 166,2,165,251,133,253,165,252,1
     33,254,224,0,240,16,169,25,24,101

1020 DATA 253,133,253,169,0,101,254,133,2
     54,202,208,240,160,0,177,253
1030 DATA 153,0,212,200,192,26,208,246,96
```

This is a machine language routine that is POKEd into the cassette buffer (starting at 828), but it is relocatable and can be put anywhere in free memory. To use it, you must POKE the values from the DATA statements created by Sound Sculptor into any free memory. For example, you could put the sound data into the block of free memory beginning at 49152 with:

```
10 FORL=0 TO 24:READSND:POKE49152+L,SND:N
   EXTL
```

If you have more sounds, POKE the DATA into memory immediately following the first. Next, POKE the starting address of the sounds into locations 251 and 252. For the example above, this would be accomplished by:

```
20 POKE252,49152/256:POKE251,49152-256*PE
   EK(252)
```



Moving the sprite arrow with a joystick affords easy selection for all sound parameters.

A Fast Sound Switch

This process only has to be done once. Whenever you wish to call upon a certain sound, just POKE the sound number into location 2. For example, POKE 2,1, selects the first sound in memory. Follow this with a SYS 828 (or to whatever memory location you have relocated the routine) and you now have your sound in the SID chip. With this routine you can switch various sounds in and out of the SID at lightning speed. For example, to turn on voice one, use this line in your program: S1 = 54276: POKE S1, PEEK(S1) OR 1. To turn it off, POKE S1, PEEK(S1) AND 254. The same logic would apply to voices two and three, except you would use S2 = 54283 and S3 = 54290.

If you don't want to type in this program yourself, I will make a copy of the program and include the much faster loading ML program. Just send a blank tape, $3, and a self-addressed, stamped envelope to:

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See program listing on page 161.

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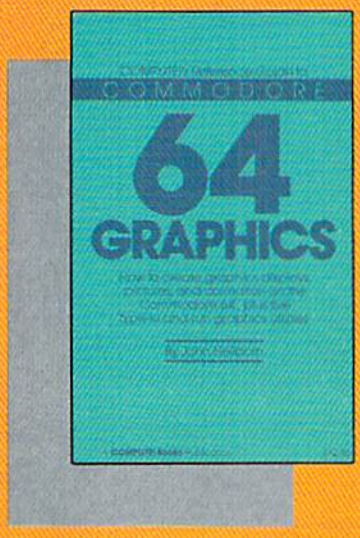

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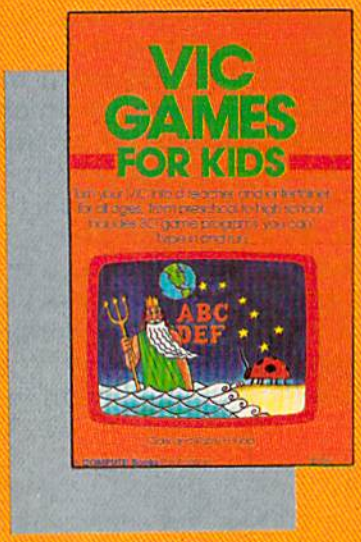

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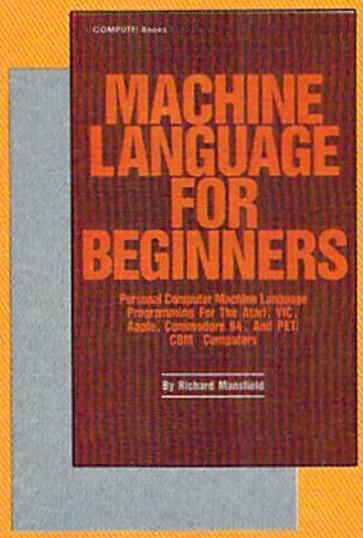

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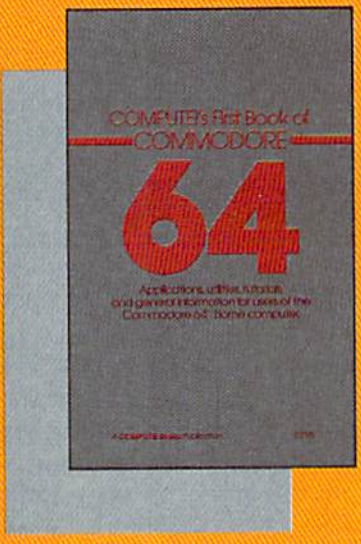

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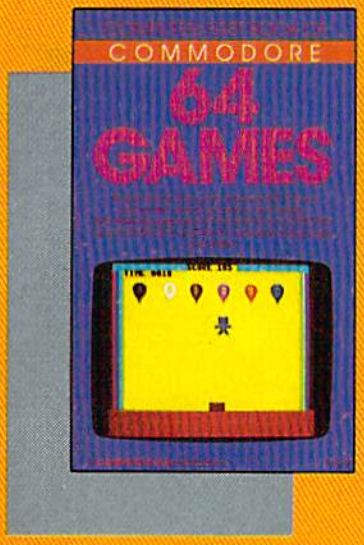

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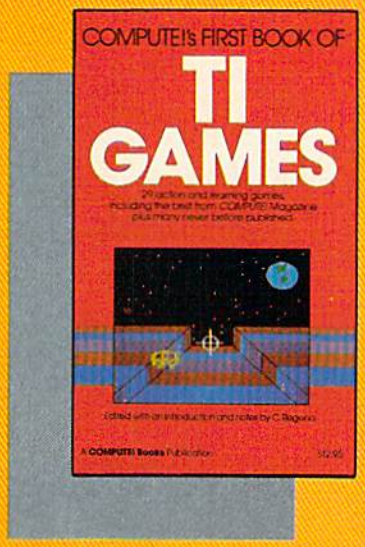

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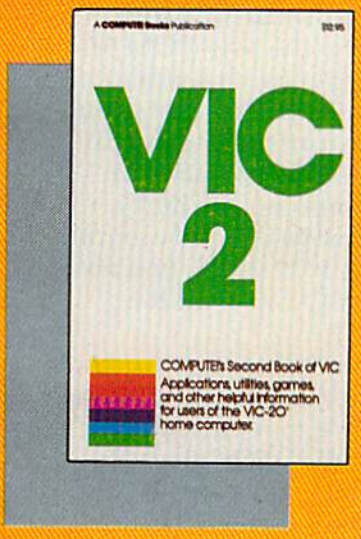

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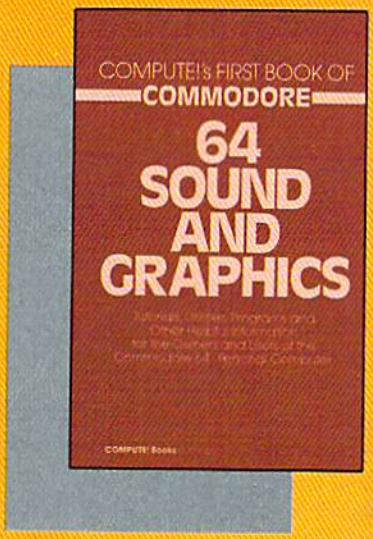

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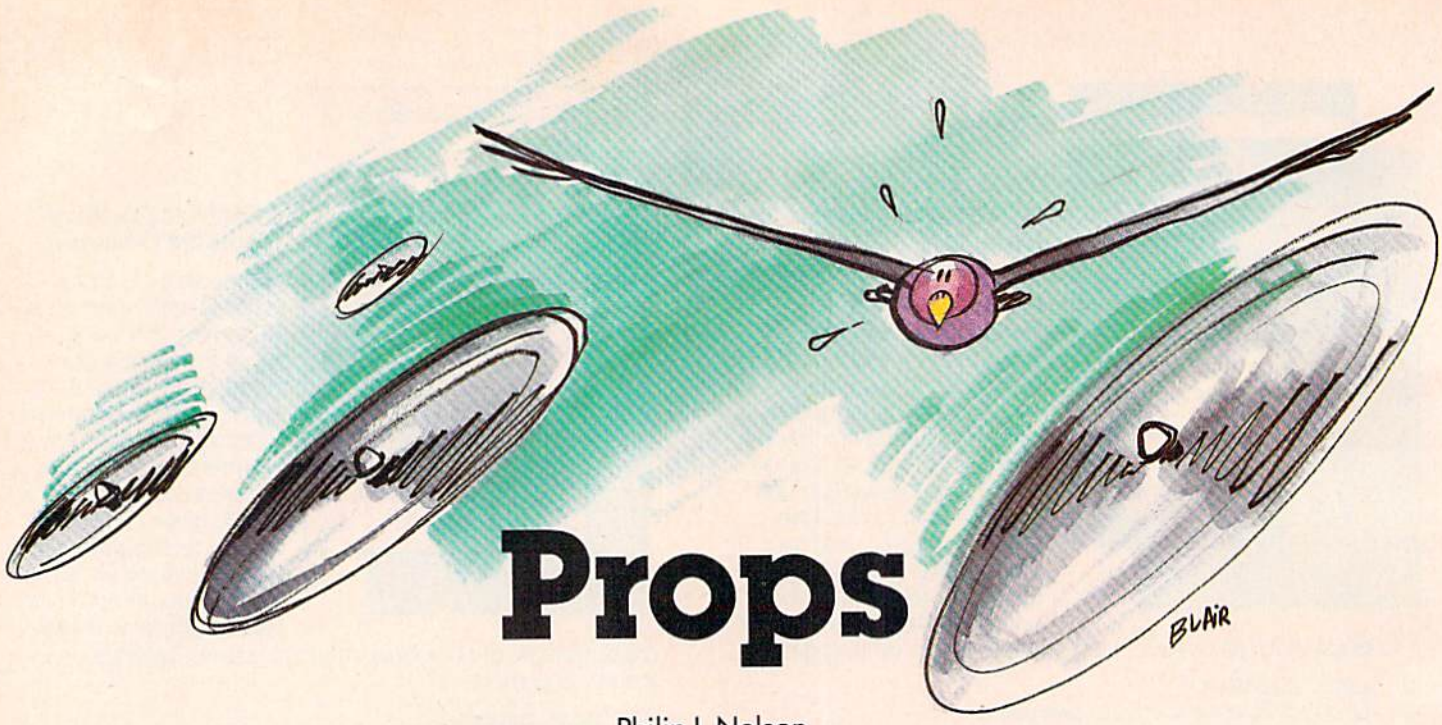

Props

Philip I. Nelson

"Props" is a fast-paced, nonviolent game for the 64 with six levels. Animated in machine language, it uses all eight sprites, programmed characters, and all three SID voices for sound effects.

Included in the article is a detailed program discussion which offers a variety of excellent programming tips and techniques.

You are a lonely pigeon, lost in a dangerous sky filled with whirling propellers. Your mission is to return to your coop and your mate, for a brief rest before flying away again. To make matters worse, every time you leave, and at other uncertain intervals, your mate moves to a new coop.

While in flight, you must avoid getting pulled into the propellers. If that happens, you lose points. Unless you escape quickly, the props may pull you back again and again. The props start in orderly formation, but every collision will bump one out of line; so the worse you play, the more confusing things get.

To play, plug your joystick into port 2. The six skill levels range from leisurely to manic. Whenever you reach home, your score is displayed briefly. If you press the fire button during the score display, the game pauses to let you catch your breath. During the pause, you can change to a different skill level by pressing number keys 1 through 6. To quit, just pause and press the 0 key. If you score well at any given level, the game pauses by itself and lets you pick a new skill level.

The Animation Subroutines

Two main machine language (ML) routines are responsible for virtually all the animation. The first one reads the joystick, moves your bird shape accordingly, and flaps the wings of both birds. The second rotates the eight propeller sprites and moves them up or down. Two additional small routines help program a new character set and fill color memory with white values for the new-ROM 64s.

Let's look first at the bird-moving routine (Birdmove), which you could adapt for just about any graphics game. Birdmove animates our bird-shaped character. The routine keeps track of a variable, BIRDLOC, that represents the bird's current screen location. To move the bird around in screen memory (locations 1024–2023), first we put a blank space into BIRDLOC to erase the character.

Next we check to see whether any movement has been requested through the joystick. If so, we change the BIRDLOC variable to represent the new screen location. If not, BIRDLOC stays the same. In either case, we then plant a new bird shape in the updated BIRDLOC screen location.

Setting The Bird's Boundaries

To move the bird left or right, Birdmove will subtract or add 1 to BIRDLOC. To move the bird up or down on the 40-column screen, we subtract or add 40 to BIRDLOC. Before moving our pigeon around in memory, we need safeguards to prevent the bird figure from flying above screen memory into the BASIC program space, or below it into the sensitive zero page of memory, either of which could crash the computer.

Birdmove uses two techniques to confine the bird. The first compares BIRDLOC to absolute

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upper and lower limits. If you try to move lower (<1024) or higher (>2023) than the bounds of screen memory, Birdmove will terminate without changing BIRDLOC.

Collision Detection

The second safeguard is a collision-checker for sideways movement. When you move left, for example, Birdmove holds the updated BIRDLOC position in temporary storage. Before it moves a bird figure into the new location, the routine checks that spot to see which of the three possible characters is there.

If the desired spot contains a space, your bird can move left. If the new spot holds the coop character, the old BIRDLOC is restored and you exit Birdmove without changing position. If neither character is found, then the spot must contain the mate character, so the routine sets a flag to show that the bird has reached home, and ends with the wing-flapping display.

To modify Birdmove for your own games, just add more comparisons to check for as many possibilities as you need. For example, your game might check the desired location and then branch to appropriate routines to score if you've hit a treasure, faint if you've hit a troll, rejoice if you've bumped into a friend, and so on.

The Joystick Flags

The joystick reader at the front of Birdmove is from the *Commodore 64 Programmer's Reference Guide*. It will store flag values in a memory location which you can then PEEK to determine movement. In "Props," the joystick flag values are in the cassette buffer, but you could put them in any safe memory spot. The right/left flag is stored in location 832, and the up/down flag in 833. The value in 832 will be 255 for left, 1 for right, and 0 for no movement. The value in 833 will be 255 for up, 1 for down, and 0 for no movement. Note that leftover flag values will remain in the computer's X and Y registers, though, so if your ML program goes from this routine to one that uses indirect addressing, you should clear the X and Y registers to 0 to keep things straight.

Programmed characters are used to make the birds' wings flap. In lines 62000–63000 of Props, we first copy the character set from the ROM chip into RAM memory beginning at location 14336. Then we create new shapes for characters 90–96 by POKEing new values into the right places in our RAM character set. Character 90 is programmed to serve as our coop character, and the other six are a series of bird shapes.

Each time we call the Birdmove routine, we also flip to the next character in this wing-flapping series to create the illusion of movement. To see all the programmed characters, first RUN the program and then press the STOP key while the instructions are displayed. Hold down the SHIFT key and press CLR/HOME to blank the screen. Now type in this line. You'll have to use abbreviations to fit it all on two lines.

```
PRINT"{CLR}"TAB(255): K=90:FORJ=1024TO1
276STEP42:POKE54272+J,1:POKEJ,K:K=K+1:N
EXTJ
```

Press RETURN and you'll see the coop character and six bird shapes in the upper left of the screen.

Flapping From BASIC

Now let's make our bird flap its wings from BASIC in immediate mode. Type this line and then press RETURN:

```
FORK=1TO100000:FORJ=91TO96:POKE1024,J:F
ORL=1TO30:NEXTL,J,K
```

The bird should be flapping at top left. Press STOP when you've seen enough. While we're at it, let's do the same job with our ML routine. To set things up, type this line and press RETURN.

```
POKE251,0:POKE252,4:POKE834,91
```

This puts information in memory locations which the ML routine uses to position the bird and start the wing-flapping character series. Now type this line and press RETURN:

```
FORJ=1TO100000:SYS49608:FORK=1TO30:NEXT
K,J
```

Using The Routine's Modules

As before, press STOP when you've seen enough. The entire Birdmove routine starts at location 49408 in memory, with its flap portion toward the end of the routine (49608). At certain points during Props (the reunion or a pause), we want the birds to flap their wings without moving. So we just bypass the movement parts entirely, starting at location 49608. If all we want is to place the mate somewhere, without any moving or flapping, we can jump in even later, at 49615. By structuring our ML program in distinct modules, we're able to get maximum use out of what we've written.

Now let's call the whole Birdmove routine to let our bird fly free. First, type this line and press RETURN.

```
POKE834,91:POKE835,0:POKE836,4:POKE837,
230:POKE838,6:POKE251,255:POKE252,5
```

We just positioned the bird and set limits to keep it on the screen. Now enter this as one line.

```
PRINT"{CLR}":FORJ=1024TO2008STEP41:POKE
J,90:POKEJ+54272,1:NEXT:FORJ=1TO100000:
SYS49408:NEXT
```

You'll see the bird wrap around the side of the screen when its way is clear, but stop when it hits a coop character. The up-and-down movement routine contains no collision-checker, though, so moving in those directions will erase any character you encounter.

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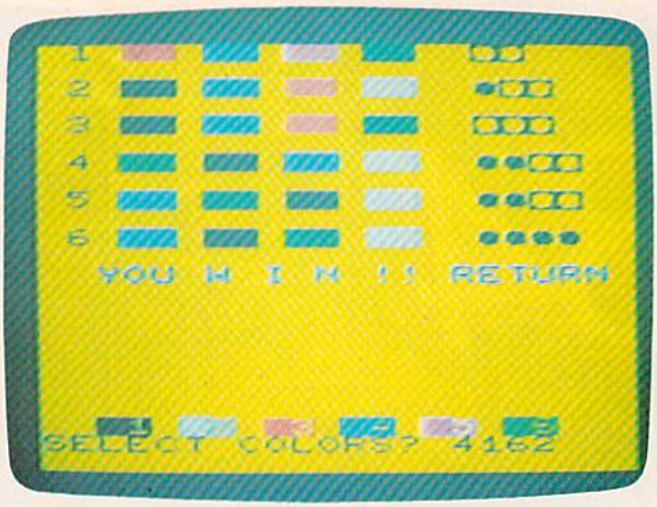

It will take some tricky maneuvering to free this bird from the whirling propellers.

Vary The Difficulty With Delay Loops

Running at full ML speed, Birdmove is fun to play with, but too fast to be practical. Props uses a variable delay loop (pegged to skill level) to slow things down to a manageable speed.

Spritemove, the second big ML routine in Props, handles the sprite animation, moving the eight propellers up or down at the correct speed and twirling them in unison.

Look at lines 2–6 of Props and you'll see something odd. The game works by cycling through these lines, calling the Birdmove routine over and over with the statement SYS 49408. But Spritemove is called only once (SYS 49152) in line 1, while we're setting things up. Yet the sprites move continuously as long as we're playing. How can we make Spritemove work all the time without calling it repeatedly? Easy—just let the computer do it along with its other housekeeping.

Harnessing The Hardware Interrupt

In addition to executing your programs, your computer's processor chip has continual housekeeping to do like updating timers and scanning the keyboard. But it can do only one thing at a time. So occasionally the computer stops doing your work and takes time out for its own. You never notice these *interrupts*, because they happen about 60 times every second.

Like Birdmove, the 64's hardware interrupt routine is just another ML program, starting at location 59953 ($EA31) in memory. By changing one pointer (vector), we can have the computer perform our ML routine first, then on to do its housekeeping as usual—60 times a second.

Memory locations 788–789 ($0314–0315) are specially reserved to hold the address where this interrupt routine begins. When you turn on your 64, it automatically sticks the normal (default) address in these locations. The first part of Spritemove just changes this vector to point the computer to the beginning of our ML program.

At the end of our ML routine, we send the computer on to its normal interrupt program at $EA31, rather than returning to the program as we do in a conventional ML subroutine.

Watch It In Isolation

Such an *interrupt-driven* ML routine will seem to run independent of BASIC. To watch Spritemove in isolation, first RUN Props and press the STOP key when the props move. You'll see the blinking cursor and READY signal, which shows the computer has quit executing our BASIC program. We're back in BASIC immediate mode, but Spritemove is still working along with the interrupts, so our graphics and sound keep going.

We can do anything we'd normally do from BASIC, even call other ML subroutines as we did in the examples above, but there's a limit to how far we can take this technique. Grafting a lengthy ML routine onto our interrupts will make those "time-outs" so long that they slow our BASIC operations down to a crawl.

To stop Spritemove, first clear the screen of character graphics by holding down SHIFT and pressing CLR/HOME. Now type SYS49152 and press RETURN. The props and sound should freeze.

To restart the props, move your cursor up to the same line and press RETURN again. The interrupt vector now points to Spritemove again, and we're back in business. Spritemove (as in "Hawkmen") is designed to alternately change and restore the interrupt vector, every time we call the routine, letting us turn it on or off at will.

The Sprites Are Still There

Note that stopping Spritemove doesn't erase the sprites. If we want them to disappear at certain points in Props, we have to disable their display with the statement POKE SP+21, 0. When that's done, the sprites are all still moving in the sense that Spritemove keeps changing their location registers and shape pointers as always. But none of this is visible since we've commanded the computer not to show it on the screen.

Compared to the interrupt routine, the rest of Spritemove is simple. The BASIC setup portion of Props sets all eight sprites to fixed horizontal locations, giving each a track to run up or down in. Each prop always flies in the same direction—one space up or down on the sprite grid for every execution of Spritemove at skill level 1.

Each sprite has a register (memory location)

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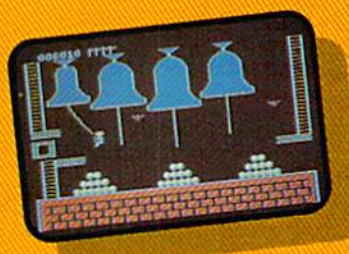

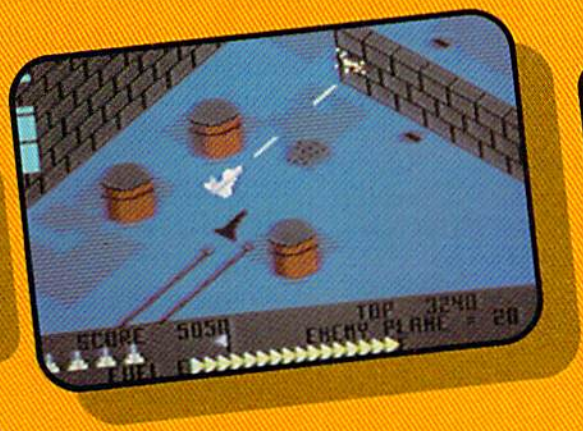

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containing its vertical location. To move the props, Spritemove increments or decrements every vertical location register one or more times, depending on skill level.

Believe it or not, this is simpler in ML than in BASIC. Let's say sprite 1 starts out at vertical location 100. If we start plopping bigger values into its vertical location register, sprite 1 will move down the screen.

Safe Increments Are Assured

In BASIC we'd have to program in a safeguard to make sure we couldn't POKE a value larger than 255 into the register, since that would abort our program with an ILLEGAL QUANTITY error.

But ML lacks the error-checking mechanics of BASIC, and simply won't let you put a number bigger than 255 into any memory cell. Trying to increment a register from 255 to 256 will just flip its value back to 0. Increment that register again, and it'll contain the value of 1, and so on.

The same thing works in reverse—decrementing a register that contains a 0 value will give us the value of 255. This characteristic of ML, which might seem a limitation, is used to advantage in Spritemove, which just keeps incrementing and decrementing the vertical sprite registers blindly. We know ML won't let us exceed the safe 0–255 range which, conveniently enough, the sprites also use for vertical location.

Animating The Propellers

You define a sprite's shape by pointing it to a block of shape information which you've placed in memory beforehand. To rotate the props, we just flip them through a series of related shapes, much as the birds are made to flap their wings. Spritemove points all eight sprites in unison to successive sets of shape data which was stored when we set up Props. Since props are bilaterally symmetrical, we can save memory space and get the effect of an eight-position rotation by flipping them repeatedly through a series of only four shapes.

Just as the computer looks in a special place to find the address of its interrupt routine, Spritemove checks and changes a special spot for the current shape pointer, location 828 ($033C).

We've used other memory registers in the cassette buffer to store things for our ML routines. Locations 832 and 833 hold values received from the joystick, as we've seen. Location 842 holds the home flag: The Birdmove routine will store a value of 1 here if the bird reaches home; otherwise, the register contains a 0.

Passing ML Values To BASIC

This is an example of how to use variables in machine language, and pass information back and forth from ML to BASIC sections of your program. In BASIC, of course, we'd name a variable something like HOME, and say that HOME=1 when home is reached, making sure that HOME=0 at all other times. But ML doesn't recognize names—just numbers inside memory locations. So, in Spritemove we choose a special memory location (842) to represent the condition of our home flag. Then we store a 1 value into 842 as a signal whenever home is reached.

Line 3 of the BASIC program uses the PEEK function to check that same memory location (HM=842) for a nonzero value, branching to the BASIC "home" subroutine at line 20 if that condition is satisfied. Once we've performed our home routine, we set the flag back to 0 in line 24, so that our bird can get lost again.

Synchronizing Sound And Action

Props also creates its filtered and ring-modulated sound effects by passing values from ML to BASIC. When the bird flies around the screen, a soft musical tone is heard, changing constantly in relation to screen position. We start making this sound in line 2 by POKEing voice 1 on. In line 6 we change the pitch of voice 1 by PEEKing into location 251 which, you'll recall, is used by Birdmove to store our bird's screen location. In this simple way, we can link the bird's sound effect to its graphics action.

Voice 2 is always on during the game, set to the noise waveform to make a swooshing sound. The effect of fading in and out is created, not with the volume control (which affects all three voices equally), but with a filter, which we can set to affect any or all of the voices at a given time. In line 1002 of Props we POKE register 54296 with a value of 47. Besides volume, this register lets you select what *type* of filter you want. So we started with a value of 15 for maximum volume in all voices, then added 32 (15+32=47). This turns on bit 5 of the register to activate the *bandpass* filter, which will cut out all but a narrow band of frequencies in the tone of the filtered voice.

Next we have to tell the computer which of the three voices it should send through the filter. Also in line 1002, we POKE the value of 66 into register 54295, which sends voice 2 through the filter and selects a moderate amount of resonance. (If you've never played with filter resonance, try editing line 1002 to substitute the value of 226 instead of 66, to hear the more pronounced effect of maximum resonance.)

A Swoosh Is Filtered Noise

Now the filter's ready to use. Picking the noise waveform for voice 2 gives us a more or less random mishmash of all audible frequencies to work

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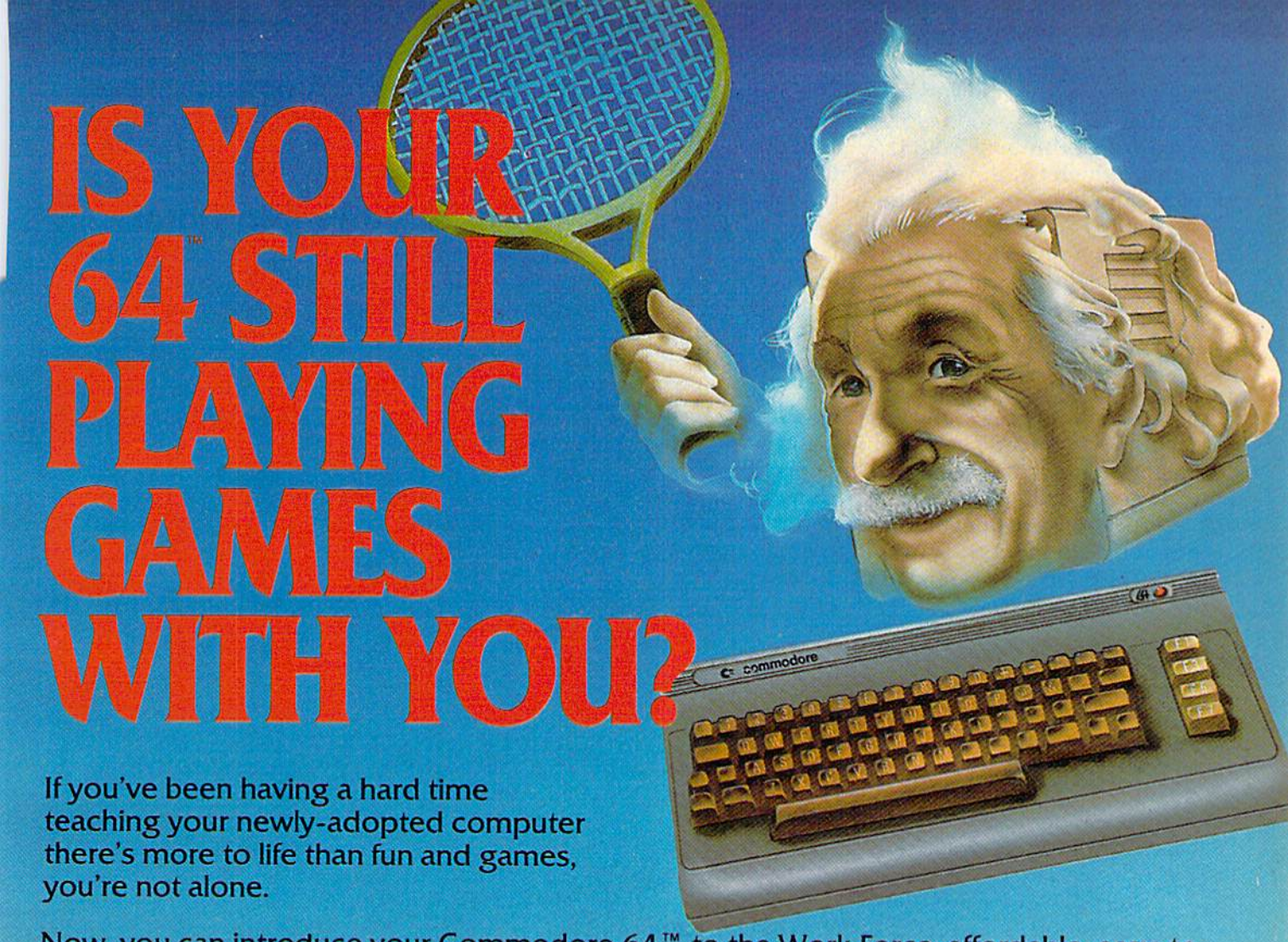

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with. Setting the *cutoff* frequency low will *pass through* a narrow band of low frequency tones for a roaring or rumbling sound, and cut off all other tones. A high cutoff value gives us a narrow band of hissing, high-frequency tones. To make a swooshing sound, we just change the cutoff frequency at high speed, from low to high values.

To tie this sound to the graphics action, we let Spritemove change the cutoff frequency at ML speed. At the very end of SPRITEMOVE is a little routine that stores a value into the filter cutoff frequency register. This value is the same one used to control how many spaces the sprites move each 1/60 second. So at higher skill levels we add bigger numbers to the cutoff frequency register, to sweep the filter from low to high more rapidly.

As with sprite positioning, we can increment forever, without fussing over illegal quantity errors. What we get is a repeated low-to-high sweep in the range 0 to 255.

Filtering Voice Three

The echoing synthesizer tones heard while pausing, or when the bird's mate changes coops, are produced by applying similar bandpass filtering to voice 3. The technique is the same—we sweep the filter cutoff frequency upward, over and over. But instead of noise we're using a triangular waveform, ring-modulated by the pitch frequencies of voice 2 (line 51).

The pitch of voice 3 is linked to the bird's screen position by using the value found in location 251. And the pitch frequency of voice 2 is also swept down over and over, in our familiar 255-to-0 range, by the Spritemove routine.

Unlike the noise waveform, which contains tones at almost every audible frequency, the triangular waveform is rich in certain harmonic frequencies and totally lacking in others. So at certain frequencies the bandpass filter cuts out just about everything, causing silence. Adding ring modulation suppresses the fluty tone we'd otherwise get from a triangle wave, and adds new harmonics for an even stranger effect.

A Two-Voice Sound Effect

One final, important difference between this and the swoosh sound is in the ADSR (attack/decay/sustain/release) envelope. For the prop sound, we set voice 2's sustain value to the maximum of 240 (line 1082), and trigger the ADSR envelope only once at the beginning (line 11050).

With maximum sustain, the tone will never fade out naturally—it only seems to reach silence when our filter is set to its lowest cutoff frequencies. For contrast, we trigger the ADSR envelope for voice 3 every time we make the synthesizer sound, causing the slow, ghostly fade-out.

But you do fancy filtering without mastering ML. Take a look at lines 11050–11058, which govern the animation and sound of wings flapping during the instruction display. Here we're controlling the filter frequency from an entirely different source.

A Special Number Generator

Location 54299 (VM+3) is a very special register that can be made to produce four different number sequences which are handy for controlling sound. It can generate a 0-to-255 sweep like we've used up to now. Or it can sweep from 0 up to 255 and back down again. It can generate random numbers, and can also flip back and forth from 0 to 255 at varying rates.

You choose *which* number sequence you want by selecting one of the four waveforms for voice 3. You control the *rate* at which the numbers change within that sequence by setting the frequency of voice 3.

For a convincing wing-flapping sound, we want the filter to sweep up and then back down again. So we select the up-and-down number sequence by setting voice 3 to a value of 16 in line 11050. To time it to the beating of our birds' wings, we just fiddle with various pitch frequency values for voice 3 (H3 and L3) until we get it right. Note that you don't want to *hear* voice 3—you're only using its pitch values to control the output of voice 2. So W3 is POKEd to 16, which selects the triangle waveform without turning on the gate bit which would make the voice audible (that is, by POKEing W3 to 17).

Once you have Props working, you can learn a lot about the 64's SID chip just by changing the values used in this and other sound sections.

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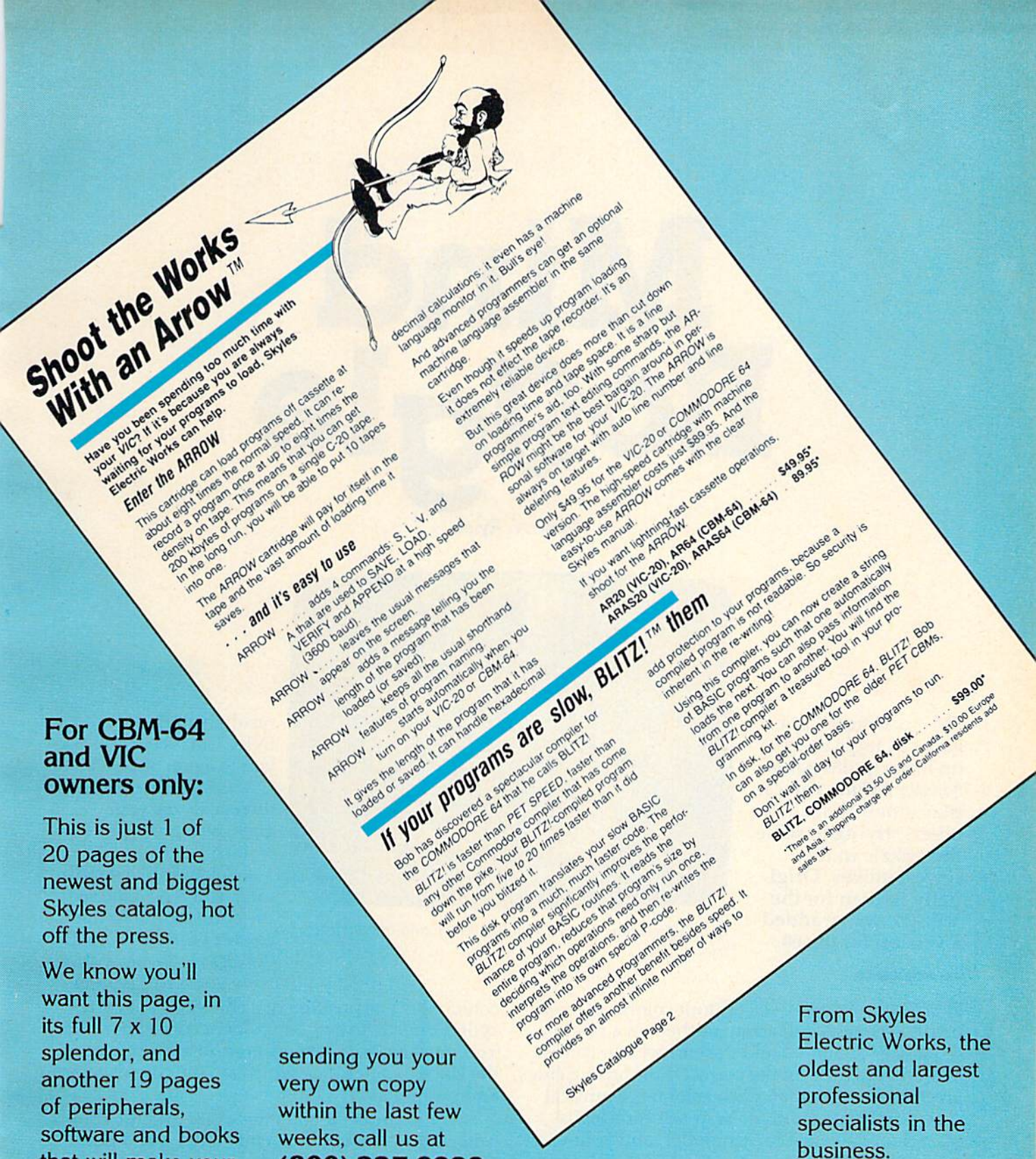
See program listing on page 141.



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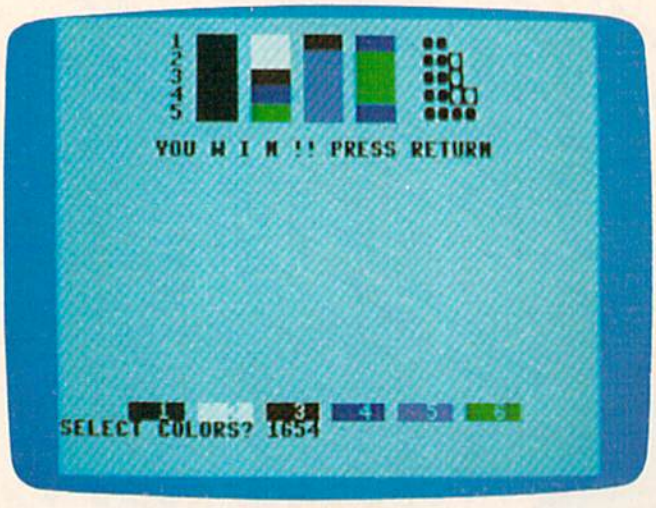
Mind Boggle

James E. Rylee



In the 64 version, the solution has been found in only five tries.

"Mind Boggle" is a game of logic based on the popular game *Master Mind*. You can play alone or against others, trying to solve the puzzle in the fewest moves. Originally written for the VIC-20, we've added a version for the 64.

First "Mind Boggle" selects four colors out of six possible choices and arranges them in a random sequence. You must find the correct four colors and arrange them in the correct order, using clues given by the program. Each color has a musical sound associated with it. Your selection is displayed on the left side by number, and your clues are on the right.

Guess The Colors And Sequence

When the computer asks SELECT COLORS you may enter your guess of four colors by entering the numeric values for the colors indicated and pressing RETURN. Any entry with digits other than 1–6 or more than the four required digits will result in an ILLEGAL INPUT message and ask you to again SELECT COLORS. The computer then analyzes your guess and gives you the results.

A black dot (•) indicates you have guessed the correct color in the correct position. A white dot (▪) indicates you have guessed a correct color only. The position of a clue does not correspond directly to any one color or correct position. You must move the colors around and analyze the clues to determine which are the correct colors and positions.

For example, if you guess 1234 and the computer responds with two white dots, you know two of the numbers are correct, but in the wrong place. If your next guess, 3214, gains two black dots, you can deduce that 3 and 1 were correct and that the hidden code is 3x1x (where x is an unknown number).

The program rates you on your skill or luck. The colors are displayed for you if you do not find them in ten tries. In either case, you can choose to play again. (Answer Y or N.)

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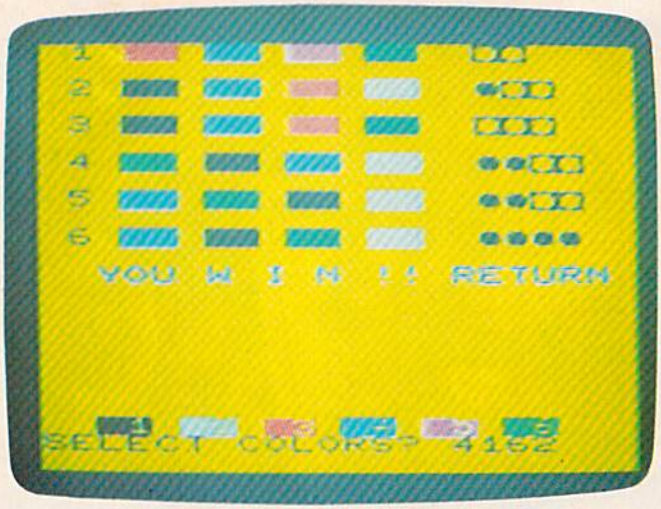

By combining logic and intuition, the player has successfully broken the code (VIC version).

Making It Harder

If Mind Boggle doesn't provide sufficient challenge, a few simple changes will produce a more difficult version. As the game is written, each of the four positions will contain a different one of the six possible colors. If you allow the same color to appear in more than one position, the number of possible sequences soars. Game play remains the same, except that a color may now appear two, three, or even four times.

To accomplish this on the VIC, change these lines in Program 1:

```
1 PRINT"{CLR}{5 RIGHT}{9 DOWN}MIND BOGGLE
  ":CLR                              :rem 178
9 A$="123456":GOSUB13:A1$=R$:A1=VAL(A1$)
10 GOSUB13:A2$=R$:A2=VAL(A2$)
11 GOSUB13:A3$=R$:A3=VAL(A3$)
12 GOSUB13:A4$=R$:A4=VAL(A4$):GOTO16
13 R=INT(RND(1)*6)+1:R$=MID$(A$,R,1):RETU
   RN
```

To accomplish this modification in the 64 version, these lines should be changed in Program 2:

```
300 PRINT"{CLR}{13 DOWN}{13 RIGHT}{BLK}MI
    ND BOGGLE{5 DOWN}":FORT=1TO1000:NEXT
                                   :rem 202
400 A$="123456":GOSUB450:A1$=R$:A1=VAL(A1
    $)
401 GOSUB450:A2$=R$:A2=VAL(A2$)
402 GOSUB450:A3$=R$:A3=VAL(A3$)
403 GOSUB450:A4$=R$:A4=VAL(A4$):GOTO500
450 R=INT(RND(1)*6)+1:R$=MID(A$,R,1):RETU
    RN
```

If you're having trouble telling the colors apart (perhaps you're using a black and white TV set), the following changes to Program 1 will cause the numeric value for the color to be displayed:

```
51 PRINT"{BLK}{RVS}{2 SPACES}1{OFF} ";:PO
   KES2,135:GOTO57
52 PRINT"{WHT}{RVS}{2 SPACES}2{OFF} ";:PO
   KES2,159:GOTO57
53 PRINT"{RED}{RVS}{2 SPACES}3{OFF} ";:PO
   KES2,175:GOTO57
54 PRINT"{BLU}{RVS}{2 SPACES}4{OFF} ";:PO
   KES2,191:GOTO57
55 PRINT"{PUR}{RVS}{2 SPACES}5{OFF} ";:PO
   KES2,201:GOTO57
56 PRINT"{GRN}{RVS}{2 SPACES}6{OFF} ";:PO
   KES2,209:GOTO57
```

For the 64 version (Program 2), change these lines:

```
1700 PRINT"{BLK}{RVS}{2 SPACES}1{OFF} ";:
     POKESO+1,100:GOTO1750
1701 PRINT"{WHT}{RVS}{2 SPACES}2{OFF} ";:
     POKESO+1,124:GOTO1750
1702 PRINT"{RED}{RVS}{2 SPACES}3{OFF} ";:
     POKESO+1,140:GOTO1750
1703 PRINT"{BLU}{RVS}{2 SPACES}4{OFF} ";:
     POKESO+1,166:GOTO1750
1704 PRINT"{PUR}{RVS}{2 SPACES}5{OFF} ";:
     POKESO+1,150:GOTO1750
1705 PRINT"{GRN}{RVS}{2 SPACES}6{OFF} ";:
     POKESO+1,185:GOTO1750
```

A potential flaw in the game will occur if you use any of the cursor keys or cause the screen to scroll: The playing screen could be changed. The game will continue but you won't be able to see the entries which have scrolled off the screen.

See program listings on page 165.

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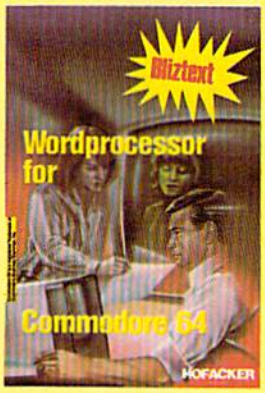

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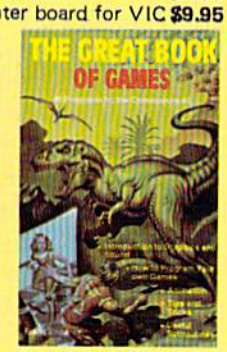

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SuperSprite

Nick Sullivan

Guide "SuperSprite" through the kryptonite barriers using the function keys as cursor controls. For the Commodore 64.

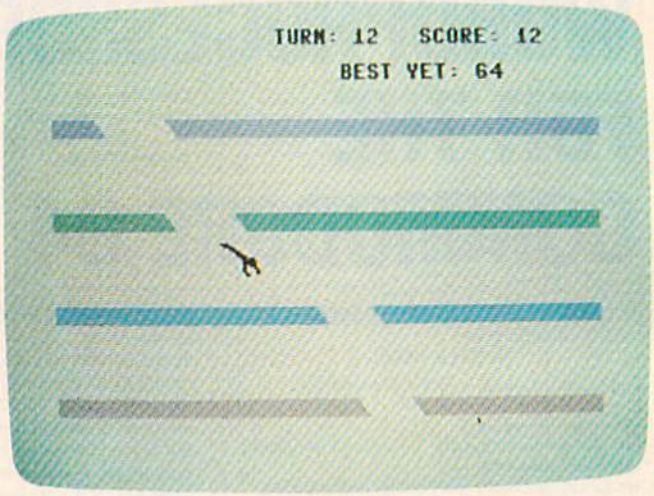
The game "SuperSprite" makes use of two fascinating aspects of Commodore 64 sprite graphics. First, the size of a sprite is doubled at the flip of a bit in either or both of its two dimensions. Second is the ability to detect, by PEEKing a single register, collisions between sprites and other graphic data.

The SuperSprite character resembles a superpowered being with arms outstretched in flight. SuperSprite is not a steady flyer. This is unfortunate, as his flight path is blocked by barriers of kryptonite, impassable except for narrow gaps. The gaps are movable—luckily, for SuperSprite does not wear a helmet—but moving them requires a deft hand at the controls. And that's where you come in.

You are the keeper of the Spritely Gates, and you get 20 turns to manipulate the barriers on the screen so that SuperSprite can make his way to the bottom. If you make it, you increase your score and begin a new turn at the top of the screen.

You will need the four function keys, each of which controls a gap in one of the four barriers. These keys work as cursors to move the gaps into SuperSprite's path so he can fly through. If SuperSprite hits a barrier you lose a turn, and SuperSprite starts over at the top of the screen. Unshifted, a function key will cause its gap to move to the right; a SHIFTed function key moves the gap to the left. Holding the keys down causes them to repeat.

The soothing SuperSprite soundtrack is created by feeding a slightly altered version of SuperSprite's y-position data to the frequency registers of the sound chip. The swooshing sound gets deeper as SuperSprite flies down the screen.



SuperSprite has made it through the first two barriers, but the third will be more difficult.

Special Scoring Technique

Scoring is based on several factors linked through the expressions on lines 210, 590, and 600. The program displays and saves the best score yet achieved by players of SuperSprite on your computer. The record is stored in a location whose contents are displayed in line 10 between the REM keyword and the colon. When you type in the program, the character in this position is the letter A. After you have finished entering the program, but before you save, you should type:

```
POKE PEEK(44)*256+PEEK(43)+5,1
```

This will properly initialize the high-score record for you.

If you break the record, a special message will remind you at the end of the session to SAVE the program so you can preserve your high score. It is good practice to perform a VERIFY to make sure that the SAVE was successful.

See program listing on page 145.

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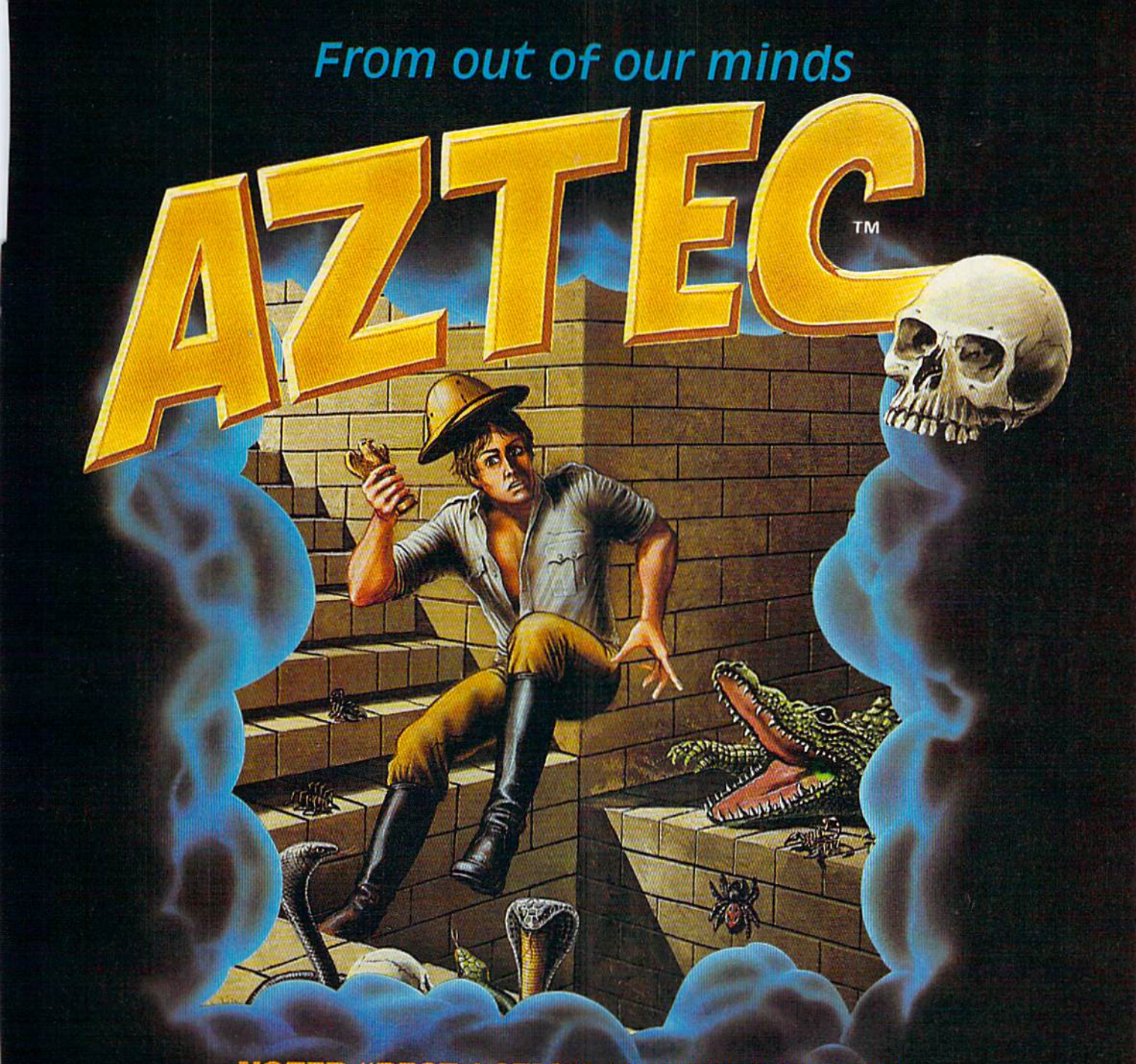

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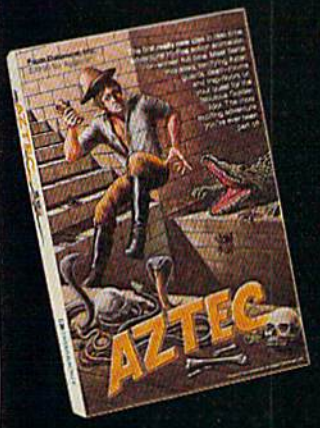

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REVIEWS

Knights Of The Desert For The Commodore 64

Arthur B. Hunkins

Knights Of The Desert, by Strategic Simulations, is a war-game simulation of the North African Campaign of 1941–43. It pits the Axis (Germany and Italy, led by Rommel) against the Allies (mostly British). It is most definitely a real thinker's game.

The entire scenario is well researched and documented (as is usual with Strategic's games). Situations, events, and odds are all based on historical fact. The accompanying booklet is well produced and includes a densely packed, 11-page article detailing every aspect of the two-year campaign.

A Multitude Of Options

Knights Of The Desert is a challenging and instructive game, one with involved strategy and an enormous complex of interacting variables. It has tremendous depth and staying power; once the battle's on, it is even exciting (in a strategic sort of way).

You can play against another person or the computer (the computer is always the Allies); you can select one of six scenarios (from a one-turn battle to the entire campaign); and each player chooses one of ten difficulty levels on each of three different scales. Furthermore, there are three different degrees of winning or losing—marginal, tactical, or strategic.

As even further evidence of the game's sophistication, each "turn" consists of seven different phases per player, along with "limited reaction" options from the opponent during these segments. The seven phases are Operational, Resupply, Depot Movement, Enemy Reaction, Operations, Second Resupply, and Second Depot Movement.

The supply phases are handled in terms of individual units (up to 28 units per player, in different categories—depot, infantry, mobile infantry, armor). Cycling through all of them takes some time. During the Operations phase, the attacking player may choose which units to commit to battle, the battle intensity level, level of risk, and number of air points. The defender specifies level of risk and air points. Additional factors can affect the outcome: morale, defender odds, terrain effects, and a unit cadre factor (which allows some defeated units with good supply lines and high morale to return later

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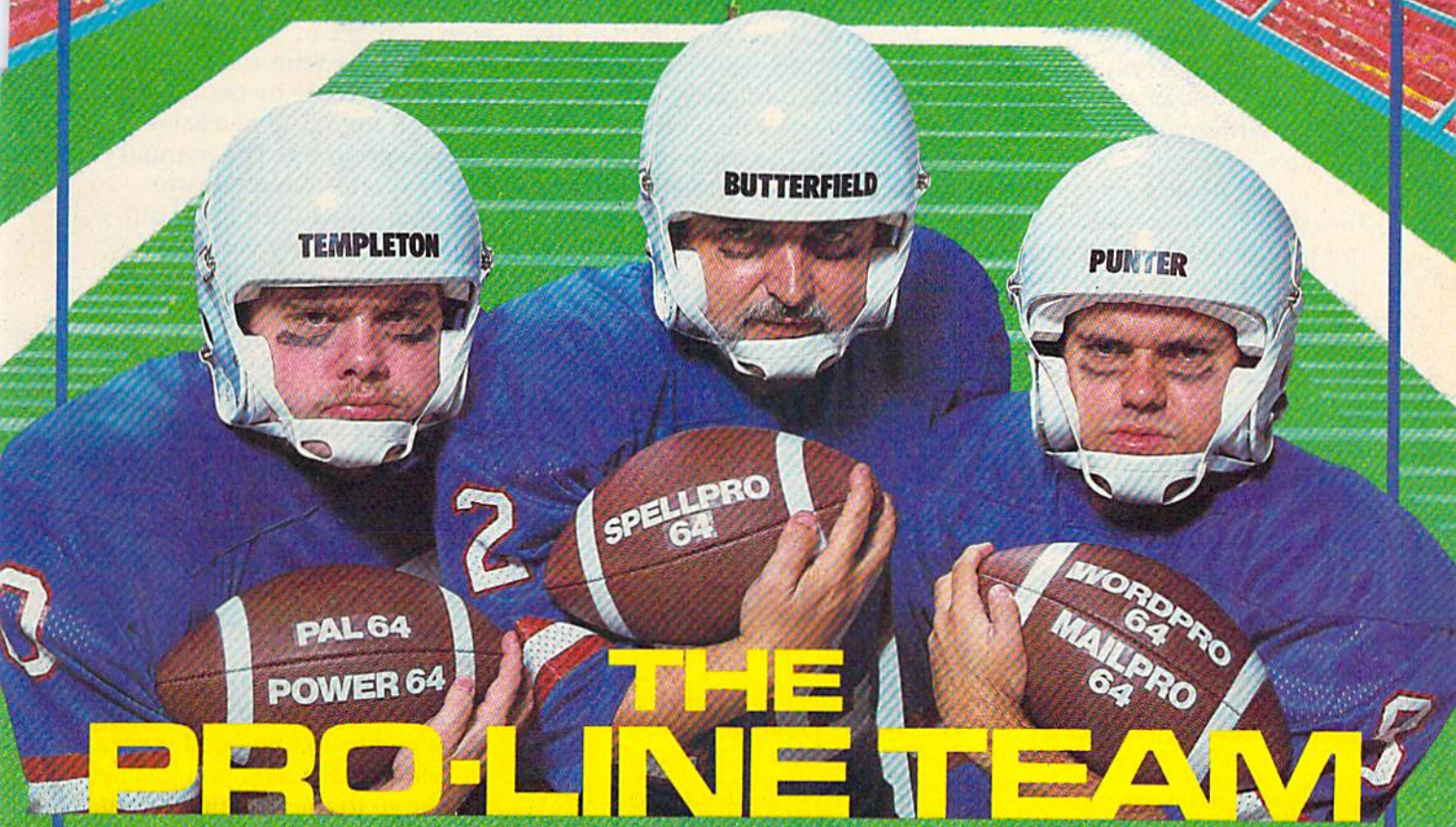

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as fighting units).

Turns begin only after a mobilization segment that includes reinforcement, supply, logistics, and initiative phases. At the end of each player's turn the game may be saved to disk or tape, and continued either then or later.

Few Drawbacks

The graphics are reasonably good, documentation is excellent, but sound effects are nonexistent. The only audio is soft blips when it's time for the player to act, or when an inappropriate key has been pressed.

I encountered a small difficulty in using the program. The documentation is written for the Apple, Atari, and TRS-80. The 64 version adds only a single loose sheet, which I didn't spot until well into my work.

Strategic Simulations has produced more than 20 wargame simulations, the majority of them modeled on historical events. Like *Knights Of The Desert*, each of their games teaches strategy, often within a real-world, educational, and historical context, and teaches it interestingly and well.

Knights Of The Desert
Strategic Simulations, Inc.
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$39.95 (tape or disk)

CodeWriter

Richard E. DeVore

CodeWriter, from Dynatech Microsoftware, Inc., is a program generator that helps you write your own BASIC programs.

You don't need to know how to program to use this product. You simply input your program using normal English, and *CodeWriter* converts it into a BASIC program.

Operation Clearly Explained

The 60-page manual (with an index) illustrates program design, with screen examples every step of the way. The explanations are clearly written and easy to understand. Although *CodeWriter* can be used to create many types of programs, it seems best suited for an application such as a mailing list, data base, accounts receivable, and payroll.

To use *CodeWriter* you need a Commodore 64 and a disk drive. The disk drive may be an upgraded 1540, a 1541, or a 4040 dual drive. A nice extra to have is a printer. The program works with the Commodore 1525 and other printers.

Menus are used extensively: The manual is almost unnecessary. Start by loading Disk 1, the Data Entry System. The first screen to appear is the Main Menu. It allows you to set up the display colors of your television or monitor. It also lets you format a disk to use with the program if you need to do so before loading the program. At this point, you can go back to BASIC, but if you want to put *CodeWriter* to work, select Create a Data Entry System.

Begin With The Screen

Program design starts with your screen layout. From the next menu you can choose to edit or create a screen. After reading the instructions and pressing RETURN, you are ready to design a program.

There is a tutorial that serves as good practice by taking you through the setup of a sales/invoice program. The manual fully explains what you are accomplishing with the input and tells you why you make each entry. The methods of establishing alphanumeric, numeric, money, and date fields are well explained.

Setting Up Fields

Having designed the screen layout, you then determine if input will be from the keyboard or if the program will calculate the figures. This includes totals which the program will handle for you.

Next, you return to the screen format menu, which allows you to change, edit, save, or reload the screen you just set up, or go to the Creation menu. To see how this menu works, you are led through the change and edit options. Then the screen is saved to your formatted disk.

After you have established the screen format and data fields, the Creation menu is accessed. This sets up calculations for the fields. The program asks about each field in turn. It is here that the power of your program is determined. The manual explains how and why the calculations are entered and what each accomplishes in the program.

Having completed this, you are asked for the number of records that will be needed for this program. *CodeWriter* tells you the maximum number of records which can be stored on the disk. Space for them is then set aside on the disk, along with the program title that you select. At this time you choose the field key or fields that the program will use to sort your records.

Error Trapping

You have now reached the error-trapping aspect of program design where many programmers have difficulty. The manual really shines in its explanations of what you should consider and why. A four-page appendix devoted to this subject takes you step by step through the process.

After the error-trapping routine is set up, *CodeWriter* will convert your design into a BASIC program. The process takes from 30 minutes to more than an hour, depending on the size of the application. The final version will run by itself. You don't need to load *CodeWriter* or any other program into memory first.

After conversion, you are prompted to place your formatted disk in the drive and press RETURN. Your program will be saved to disk.

Generating Reports

The ability to create programs is only part of *CodeWriter*'s power. The second part, Disk 2, is the Report Creation System.

Report Creation lets you access the information from your *CodeWriter* programs and print it to the screen or on paper.

The manual shows how to set up a report and how to use fields in the program to extract specific information. Report Creation allows the fields to be manipulated mathematically in the same manner as when you designed the program.

In designing your report, you may use a 40-column or 80-column format. Paging from left to right on the screen, you can design in 80 columns and see the results on the screen as they would appear on paper.

As in the Data Entry System, the computer converts your report design into a BASIC program which is saved on disk.

The program generation does not take as long, usually finishing within 30 minutes.

Although using *CodeWriter* proficiently requires a bit of work and time, the effort is quickly paid back when your custom programs start clearing up the problems you bought your computer to solve.

CodeWriter comes on a double-sided disk, with the Data Entry System on one side and the Report Creation System on the other. Backup disks are available at a low cost after you register the warranty. Dynatech offers a one-year, free replacement warranty and a toll-free hotline to provide help when needed. Upgrades are free to registered owners in exchange for their original disk.

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The Commodore Automodem

Robert Sims, Assistant Editor

The Commodore 1650 Automodem is designed specifically for the VIC-20 and Commodore 64. It plugs directly into the user port, with no need for the special cables and RS-232 interfaces required by most non-Commodore modems.

Like all modems, the Automodem translates your computer's digital signals into sounds which can be transmitted over telephone lines, and translates incoming sounds into the signals your computer recognizes.

But unlike other modems in its price range, it has the ability to automatically dial or answer the phone, for faster and easier telecommunications linkups.

The Function Switches

The Automodem's functions are changed with three switches, which set the modem to originate or answer calls (O/A), to operate in half or full duplex (H/F), and to switch the phone line connection back and forth between the modem and a telephone (D/T).

The modem also has two modular telephone plugs, one for the cord that connects it to the telephone wall plug, and one for a cord from the modem to any modular telephone. This arrangement allows you to connect the modem to the phone line without disconnecting the telephone. To switch from data mode to voice transmission while on-line, pick up the phone handset and move the switch on the modem to the T position. This is useful when you are swapping files with a friend and want to talk between data transfers.

Commodore has included everything you need for basic telecommunications. Besides the 300-baud Automodem, you get a modular cord which connects your phone to the modem, and a cassette tape containing two simple terminal programs (one for the VIC and one for the 64). This software gives you the capability to access bulletin boards and information utilities such as the CompuServe Information Service, but it does not include routines for downloading (receiving) or uploading (sending) files.

VICmodem Software Works, Too

If you already have VICmodem terminal software with these capabilities, it will also work with the Automodem. However, to use the automatic dialing and answering features, you will need software which includes these routines.

The Automodem manual explains clearly how to hook up the modem and put it into operation. It explains how to use the software, and includes a BASIC program you can use to add autodial and auto-answer capabilities to your own software.

One of the few errors in the manual occurs in this BASIC program listing on page 22. Lines 310–350 contain a routine to check for a ring signal and to send the signal that puts the modem on-line (the electronic equivalent to picking up the receiver). As written, the routine detects the ring, but never actually answers the phone. A Commodore representative assured me that if you insert this line:

```
335 IF X=0 THEN POKE B1,32
```

the program will answer the phone properly.

A Duplex Glitch

Another minor error of c nission involves the duplex settings. With the Automodem, you have two ways of choosing the setting: The H/F switch on the modem can be set to half or full duplex, and your terminal software will also have a duplex setting.

Whether you choose half or full duplex will depend on how you are using the modem. To access CompuServe, you set the modem switch and your software to full duplex. But for most bulletin boards, and to communicate with a friend's com-

puter, you use half duplex. It's in half duplex that the problem occurs.

When operating in half duplex, the Automodem sends all data to your screen as it transmits it, and your software does the same. If you set both to half duplex, you will get double letters on your screen, lliikkee tthhiiss. This problem is not mentioned in the manual, but the solution is simple. When you want half duplex, set the modem switch to half and set the software to full duplex (or vice versa). The half-duplex setting is dominant, so you will eliminate the double letters but will still be transmitting in half duplex.

Pulse Dialing

Finally, you should be aware that the Automodem's automatic dialing feature uses pulses only. The modem will work for ordinary dialing on residential Touch-Tone lines, because tone line equipment also recognizes pulses. But pulse dialing is not compatible with some special phone company services. For example, in order to use a telephone calling card without operator assistance, you must be able to generate the tones, using either a Touch-Tone phone or your modem.

Such sophisticated uses require special software and programmable firmware in the modem, at prices double the cost of the Automodem and more.

For most home telecomputing needs, however, the Automodem is more than adequate, and you won't find a better buy in this price range.

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Memo Writer

Mark R. Brown

Here's a mini word processor that's handy for memos, notes, or lists. Written for the 64, we've added a version for the unexpanded VIC.

With "Memo Writer" you can fill the screen with text and then edit it using all of the editing keys you are already familiar with: cursor controls, insert and delete, and home and clear screen.

Since you are limited to one screen of text, the program prevents you from doing anything which would cause you to scroll off the bottom of the screen, thus losing the text at the top. Well, almost anything. If you use the INST key to insert characters on the bottom line, the screen will scroll, so avoid this if possible.

The function keys are used for tabs and selecting print options. You can choose single- or double-spacing and expanded or normal print sizes. There are no set margins, but the tabs can be used to move the left margin.

Two Typing Modes

You can type in either capitals or lowercase letters. The print subroutine PEEKs to see which shift mode you're in and sends the proper control characters to the printer.

The 64 program structure can be divided into five parts:

1. Lines 9–60 handle the input and sort out the control keys from the text input.
2. Lines 100–220 perform the control key functions.
3. Lines 500–780 print the instructions.
4. Lines 800–820 format the screen.
5. Lines 60000–60140 dump the screen contents to the printer. This is a modified version of the screen dump program contained in the VIC printer manual.

You can save about half the work of typing if you leave out line 9 and lines 500–780 and just refer to the program listing for instructions. Line 500 sets the background and border colors; these can be set to your preference.

A Caret Prompt

The caret marks at the left side of the screen help keep track of where you are on the 80-column line. Don't forget to erase them before you print or they'll appear in your printed output. You can eliminate or modify them in line 800.

A side effect of having repeating keys is a possible inconsistency when selecting (toggling) between uppercase and lowercase. This may or may not be an aggravation. To turn off this function, delete POKE 650,128 in line 10.

A Blinking Cursor

There are a couple of tricks in the input routine. POKE 204,0 in line 10 turns the cursor on. Normally you wouldn't have one during a GET and PRINT sequence. POKE 205,3 in line 40 sets the cursor blink countdown timer to a short count, to even out the timing jerks caused by the GET loop in line 20. Without this, typing is not smooth at all. WAIT 207,1 in line 40 waits for the cursor to blink off before printing. This keeps the PRINT statement from leaving reverse characters behind during the cursor blink phase.

The PEEKs in lines 35 and 50 check to see if you are on the last screen line, and keep you from doing anything which would cause the screen to scroll. It should be fairly easy to add any special features you want. This program supports the full graphics character set, but of course it will only print properly on a Commodore-compatible printer. Those with other printers may need to make some changes in the control codes in order to make Memo Writer compatible.

See program listings on page 148.

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C. REGENA

Teaching Music With Computers

One difference between microcomputers like the VIC-20 and Commodore 64 and "big" computers (minis and mainframes) is that micros can play music and create sounds. They can play a variety of tones and three voices at once. They also have a noise generator and can combine music with noise for a variety of sounds—arcade-game noises to three-part classical music.

To program music, you need to keep your manuals handy. In Commodore BASIC there are no PLAY or SOUND commands. Instead there are POKE statements, where different numbers represent the voices and tones. In my column in the August 1983 issue you'll find some programming tips for creating music on the VIC. Programming music on the 64 is more complex—mainly because more options are available. You can control the waveform, attack-decay, and sustain-release. Using different combinations, you can make your Commodore 64 sound like an oboe or a trumpet, a piano or a drum. Gregg Peele, our musician-programmer, has written several GAZETTE articles in past issues to help readers understand the complexities of the 64's music.

Sound And Music In Educational Programs

This month we'll look at the use of music in educational programs. Early programs for computers were mostly "computing"—manipulating numbers for calculations in formulas or business programs. Soon programmers discovered that self-paced instruction and drill work were ideal applications for these machines. Eventually educators worked with programmers or wrote their own programs so that computerized instruction also contained good educational concepts. Color and music were then added to enhance educational programs.

How is sound used in programs? One technique is to use an audio prompt when the user is expected to respond. I usually use an "uh-oh" sound to indicate an incorrect or unacceptable response. You could also use a noise instead of tones. Naturally, a correct response needs a positive reinforcement, like an arpeggio or a happy tune. Adding sound to an educational game will make the game more arcadelike and help to keep the student's interest.

To play music on the VIC and 64, you must first turn on the volume. You can choose a level from 0 to 15, where 15 is the loudest. If I use music in a program and won't be changing the volume, I like to set the volume at the beginning of the program (before any sounds are used):

```
VIC: 110 POKE 36878,15
64:  110 POKE 54296,15
```

For each voice or sound channel there is a different location to POKE the tones. Each tone has a number. You'll find a chart in your user's manual that converts the letter names of the musical notes to numbers for the POKE statements. Variables may be used for the numbers in the POKE statements. The 64 has two values for each note, a high-frequency value and a low-frequency value for each tone. To play the tone, find the numbers needed from the Table of Musical Notes. In one channel, the statements to play a high A are:

```
VIC: 130 S=36876:POKE S,237
64:  130 HF=54273:LF=54272:POKE HF,112:POKE
       LF ,199
```

For the 64 you'll need to choose some of the options also.

```
120 POKE 54277,64:POKE 54278,128:W=54276
140 POKE W,17
```

Timing Methods

The tone will play until you POKE numbers for different tones, turn off the volume, or POKE 0 for the tones (or on the 64 POKE a different number for the waveform). The most common way to play a note for a certain length of time is to

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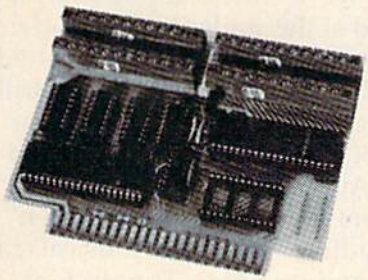

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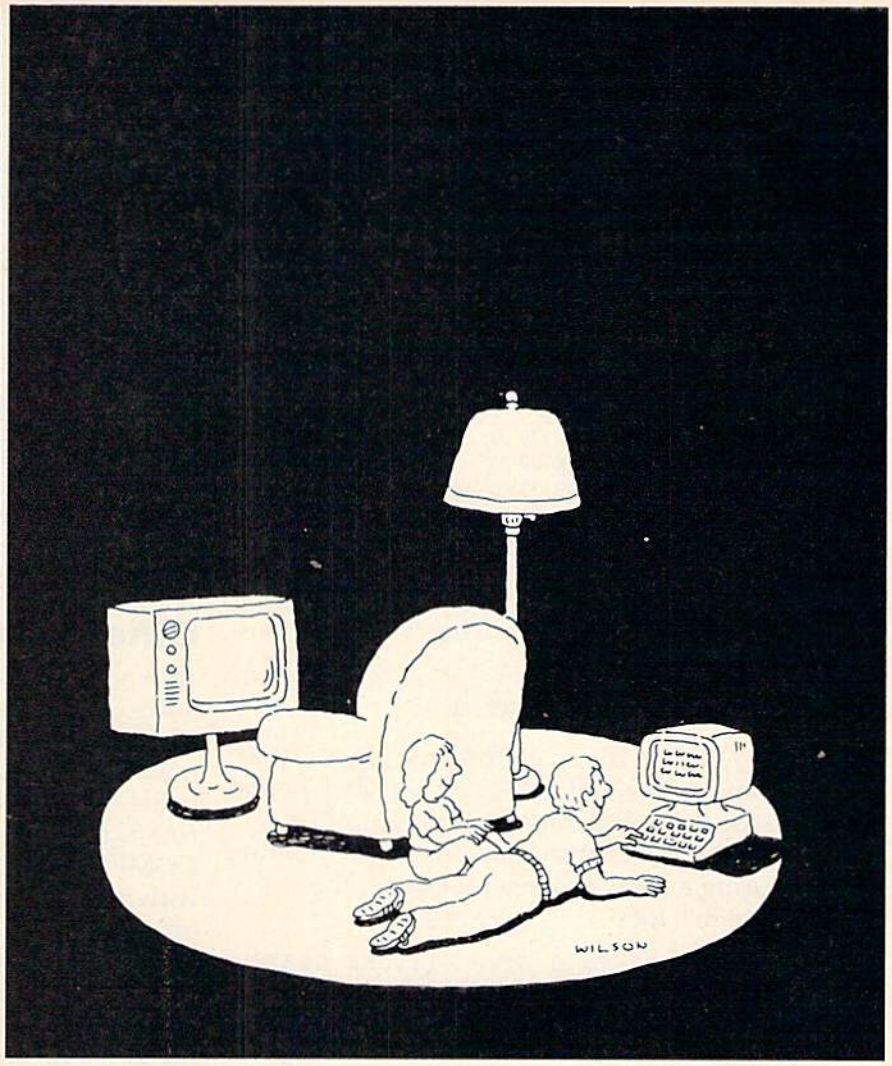

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use a delay loop, then turn off the tone:

```
VIC: 150 FOR DELAY=1 TO 100:NEXT DELAY:POK
     E S,0
64:  150 FOR DELAY=1 TO 100:NEXT DELAY:POK
     E W,0
```

Instead of the delay loop you could draw pictures or do calculations.

It is helpful to put different valued delay loops in subroutines. Then, to play a note of a certain duration, just go to the corresponding subroutine. For example,

```
300 FOR D=1 TO 100:NEXT D
310 FOR D=1 TO 100:NEXT D
320 FOR D=1 TO 100:NEXT D
330 FOR D=1 TO 100:NEXT D:POKE S,0:RETURN
```

For an eighth note, after the tone is chosen GOSUB 330. For a quarter note, GOSUB 320. For a half note, GOSUB 300.

Another method for the delay is to use a variable counter limit:

```
200 FOR D=1 TO L*100:NEXT D
```

where L could be 1 for an eighth note, 2 for a quarter note, and 4 for a half note. You specify L before going to the delay statement.

To create different sounds, instead of holding a tone during a delay loop, set the tone, then vary the volume in a loop.

```
VIC: 400 FOR V=15 TO 0 STEP -1:POKE 36878,
     V:NEXT V
64:  400 FOR V=15 TO 0 STEP -1:POKE 54296,
     V:NEXT V
```

Try this technique with the noise channel to create fun sounds for your games. Of course, with the 64 you need to spend some time experimenting with the various waveforms and the rates of attack-decay and sustain-release.

Practical Applications

There are many practical applications of computer music, especially in education. Since a computer can play an exact tone, you can tune an instrument to your computer. My daughter uses the computer to tune her clarinet. If you play a solo instrument, get the computer to play the accompaniment. Convert the accompaniment music to POKE statements then play or sing along with the computer.

The computer can also help you learn music. By setting a variable duration at the beginning of a song, you can play the song at a slower than normal tempo. The durations of the notes are in proportion, and you can practice the music at a slower rate until you learn the notes. Gradually increase the tempo by changing that one variable in the program, and play along with the computer until you're up to standard tempo. Of course, you can increase the tempo to hear how it would sound, too—have you ever heard "The Entertainer" at triple speed?

I used to teach piano and used the computer for much of the drill work—the computer never lost patience or yelled at the students. The students could work on a program as long as they wished until a concept was learned. One of the first drill programs for my beginning piano students was to learn the names of the notes on the keyboard (VIC version in the August 1983 Gazette).

I use the program "Stepping Up Or Down" to start a student reading music. The musical staff is shown with two random notes. The student needs to determine if the second note is higher, lower, or the same as the first note. The same graphics idea from this program can be applied to a program that teaches intervals. We'll go into more detail on Stepping Up Or Down later.

Other Piano Drills

Two more music programs teach the treble clef notes and the bass clef notes. First, the letter names of the notes on the staff are shown, then a drill of random notes is presented and the student must name the note. These programs are in the book, *BASIC Programs For Small Computers*, published by COMPUTE! Books. The nice thing about computers with music capabilities is that, as the drills appear on screen, the actual notes can be played so the student hears the tones. You can probably think of many game ideas for learning note names.

Some ideas for other programs are teaching the differences between half steps and whole steps on the keyboard or on a staff. This leads into teaching intervals and then chords. A program could be written to teach the names of chords in which the computer could also play the chords. Programs can teach chord inversions, and the computer can either play the chords a note at a time or together. Teaching differences between types of chords—major, minor, augmented, and diminished, for example—could be another program.

Another possible drill program could ask for the key signature given a certain number of sharps or flats. Draw a staff, then use the # sign for sharps and a custom character for flats. Randomly choose a number of sharps or flats, then let the computer POKE that many sharps or flats onto the screen. The computer could get the student's answer, then play a scale in that key.

Time signatures and rhythms could be incorporated into drill programs. Perhaps a measure with a given time signature could be shown, and the student would need to fill in a missing note to make the meter correct.

Music composition can also be enjoyable on the computer. I have seen several music programs for nonprogrammers in which you design a line by choosing different kinds of notes and rests and

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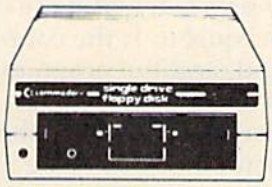

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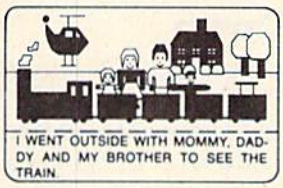

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placing them on the staff, then hear the computer play what you have composed. You don't need to be a musician to enjoy composition—just try things to hear how they sound.

These are just a few ideas of how you can use the music capabilities of computers. I'm sure you have other ideas ready to try.

Stepping Up Or Down

This month's program, Stepping Up Or Down, is designed for students who are just beginning to read music. Students need to associate written music with moving up or down on the keyboard.

This program shows two notes. To get from the first note to the second, do you step up, step down, or stay the same? Press f1 for up, f3 for same, or f5 for down. Ten problems are presented in the program.

The line numbers for both the VIC and 64 versions are related for this program explanation. Line 10 branches past subroutines. Line 10 in the 64 version also POKEs 53281,1 to change to a white screen.

Lines 20–40 contain subroutines. Lines 20–26 print the message to PRESS RETURN, then wait for the student to respond before continuing the program.

Line 30 is a short delay for playing tones for the audible prompt and the "uh-oh" sound for an incorrect response. Line 40 is a delay used in playing the notes shown after the student has pressed the correct answer. The notes are played so the student can hear as well as see the interval.

Lines 100–130 print the title and instruction screen. Line 140 defines L$ for use in printing the musical staff. To type this line, use SHIFT and * to get a horizontal line. For the VIC use 22 lines, and for the 64 use 40 lines.

Lines 150–160 define the tone numbers for playing the notes. The numbers are read in as an array. Two numbers are necessary for each tone in the 64 version. Line 170 defines the B array. The three numbers are the ASCII codes for the keys f1, f3, and f5. Line 175 POKEs values necessary to play music. Line 180 calls the subroutine to wait for the student.

Lines 190–380 present the quiz of ten problems. SC is the score. Line 200 prints the musical staff. Note that after L$ a blank line is printed because L$ ends in the last column. You should see five horizontal lines with blank lines between them if you have typed L$ correctly.

Line 210 chooses a random number for the first note. There are nine possible positions, so INT(9*RND(0)) chooses a number from 0 to 8. P1 is the screen memory location calculated, so line 220 can POKE a red circle representing the note in the chosen position. Lines 230–240 similarly choose the second note.

Line 250 calculates the answer. The SGN function returns a value of +1, 0, or –1 depending on whether the number is positive, zero, or negative. By subtracting N2 from N1 we can determine whether the second note is up, same, or down from the first. I added 2 to the SGN to get an answer (A). B(A) will be the ASCII code of the correct function key pressed. Line 250 also sets a flag FL to zero.

Line 260 plays the audible prompt, a short, high-pitched tone. Lines 270–290 then receive the student's answer, accepting only the f1, f3, and f5 keys.

Line 300 checks the key pressed, and if the answer is incorrect, FL is set equal to 1, the computer plays an "uh-oh" sound, and the program branches back to line 280 for another answer. If the answer is correct, then lines 350–360 play the notes shown and line 370 increments the score if this is the first response.

After ten problems, line 390 prints the score. Although a student must get the correct answer for the program to continue, the score represents answers correct on the first try.

Lines 400–420 present the option to try the drill again, and the program branches appropriately. Line 430 clears the screen and ends the program.

See program listings on page 150.

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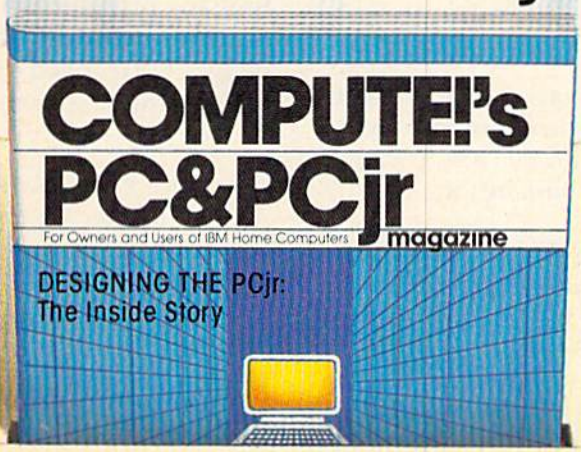

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Speeding Up BASIC

Robert Friesen and Ramunas Motekaitis

If you've discovered a clever timesaving technique, or brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s GAZETTE *for Commodore. If we use it, we'll pay you $35.*

This month, we've combined programming tips from readers Robert Friesen and Ramunas Motekaitis, who have each discovered techniques to make BASIC programs run faster.

Benchmarks are a common way to compare computers: You type a standard program into each computer you want to test and use a stopwatch to determine how quickly each finishes the job. It's a race between computers.

The same technique can be used to test variations of a BASIC routine. And if you own a Commodore, you don't need the stopwatch. You can use the built-in clock. First set it to midnight with TI$="000000" and run the routine. When the computer finishes, you can read the clock by printing the variable TI$ (which gives you hours, minutes, and seconds) or TI (which measures sixtieths of a second).

By testing different ways of doing the same thing, you can discover which is the fastest.

Faster FOR-NEXT Loops

Enter the program below and RUN it.

```
7 TI$="000000"
8 FORZ=1TO10000
9 NEXTZ
10 PRINT TI/60;"SECONDS"
```

This program does nothing—it simply loops 10,000 times—but gives us a standard time (or benchmark) for FOR-NEXT loops. On a 64, the time should be 13 to 14 seconds. An unexpanded VIC is approximately 10 percent faster; the same test takes 12 to 13 seconds.

Now add this line:

```
3 A=1:B=2:C=3:D=4:E=5:F=6:G=7:H=8:I=9:J=10:K=11:L=12:M=13:N=14:O=15:P=16
```

When you RUN the program, you'll find that adding just 16 variables slows it considerably. A 64 uses 19 seconds, a VIC 17 seconds. Variables are stored in the order they are assigned, so every time the program encounters NEXTZ in line 9, it has to search through the 16 variables that come before Z. To speed up the loop, use this line to make Z the first variable in the program:

```
2 Z=0
```

Since Z is now first in memory, the time needed to execute the loop decreases. We're back where we started.

But that's not the best way to make a faster FOR-NEXT loop.

NEXT Without A Variable

You may already know that NEXT will work with or without the variable name. Try the following change:

```
9 NEXT
```

Omitting the Z saves you one byte of memory, and it shaves two seconds off the execution time. Now, if you delete line 2, you might expect the old search-through-sixteen-variables problem to appear. But it doesn't. When you ignore the variable after NEXT, the computer seems to do the same. It sees NEXT without a variable and looks for a FOR. It doesn't need to check variable memory for the value of Z. Using NEXT by itself can save a lot of time, especially in a long program containing lots of variables.

The lesson is clear: Use NEXT alone whenever possible. And if certain variables are used frequently in a program, their values should be defined early.

Faster Multiplication

If you have tried the programs above, type NEW. Then type this short program:

```
7 TI$="000000"
8 FORZ=1TO1000
9 C=3*123.4567
10 NEXT
11 PRINTTI/60;"SECONDS"
```

The program (which loops 1000 times and multiplies two numbers) gives us an idea of how much time it takes a computer to multiply. A 64 takes about 25 seconds to complete the program. A VIC uses 23 seconds. Again, the VIC is faster.

Now replace line 9:

```
9 C=123.4567*3
```

It seems to be almost exactly the same program. Everyone knows that A*B is the same as B*A, right? But when you RUN the program, you will find that it runs one or two seconds faster.

The number 123.4567 contains seven significant digits; the number 3 has just one. If you try different values in line 9, you will discover that if the number with more digits is first, the multiplication is faster.

There is another technique to speed up multiplication. Make the following changes to the program:

```
2 A=3:B=123.4567
9 C=A*B
```

You've cut execution time to just six seconds, saving almost 20 seconds by assigning values to variables before multiplying. When you multiplied with regular numbers (C=3*123.4567) they were stored as ASCII characters. The computer had to translate from ASCII to floating-point before it could do any math—a time-consuming chore. But when you assign the values to variables, it has to translate the ASCII only once.

Change the program once more:

```
2 A=123.4567:B=3
```

Again we find that putting the longer number first speeds up multiplication. The execution time drops from six seconds to less than five. This rule of thumb can be useful when you write a program using the RND (RaNDom) function or pi, both of which are long numbers. And, whenever possible, predefine the variables before you multiply.

You may want to set up other benchmark tests to discover other methods of speeding up BASIC programs. For example, try A∧2 against A*A (multiplying is faster than squaring a number). Or test A%*B% against A*B (integers are slower than floating-point numbers).

SIMPLE ANSWERS TO COMMON QUESTIONS

TOM R. HALFHILL
FEATURES EDITOR

Q A

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by new VIC-20/Commodore 64 users and by people shopping for their first home computer.*

Q. ***I've seen references in articles, books, and Commodore manuals to something called the* Kernal. *It has something to do with programming. Exactly what is the Kernal?***

A. It's not surprising that you've run across this term because it's referred to quite frequently—yet your question is deceptively simple. To understand the Kernal, you must first learn a little about machine language and computer operating systems.

You're right that the Kernal has something to do with programming. It's a tool used mainly by machine language programmers, but rarely (if ever) by BASIC programmers. The Kernal makes it possible to write shorter machine language programs which are compatible with many different Commodore computers.

The term *Kernal* itself means slightly different things to different people. Some use it to describe a Commodore computer's entire *operating system.* An operating system is a complex housekeeping program required by all computers. It performs various routine but vital tasks necessary to the computer's operation. The computer would be helpless without it. The operating system is permanently stored in the computer's ROM (Read Only Memory) chips.

Other people think of the Kernal not as the entire operating system, but as a collection of useful routines (subprograms) within it. Machine language programmers often use these routines to avoid writing similar routines themselves, and to help make their programs work on more than one model Commodore computer.

Let's say someone is writing a machine language program and wants to display a simple message on the screen, such as "Press any key to continue." In BASIC this would be a simple one-line instruction:

```
10 PRINT "PRESS ANY KEY TO CONTINUE."
```

But machine language has no such command as PRINT. Machine language is the lowest-level language—not really a language at all in the same sense as BASIC, but rather the set of very elementary instructions recognized by the computer's main microprocessor chip. BASIC and all other languages are actually large machine language programs themselves, and the PRINT command is made up of many machine language commands.

That's where the Kernal comes in handy. Why go to a lot of programming trouble if there's already a routine built into the computer which does the same thing? The routine is part of the Kernal. The Kernal is full of routines, and one of them prints characters on the screen.

To use this built-in routine, you could execute the machine-language equivalent of a GOTO or GOSUB in BASIC, jumping directly to the routine's starting memory address (analogous to a line number in BASIC). However, this address could vary on different Commodore computers, so the program still might work on only one model.

The solution is the Kernal *jump table.* This is simply a table of memory addresses which *point* to other addresses. You jump to the table address for the print-character routine, and the table passes you along to the routine itself. The jump table is the same for *all Commodore computers,* even though the addresses for the routines themselves might be different.

Think of the Kernal jump table as a series of post office boxes. Someone who moves around a lot within the same city could avoid mail problems by using a post office box as his mailing address. No matter where he moved, his mail would always reach him through the same post office box. Similarly, by maintaining a jump table of common addresses in all its computers, Commodore is free to change the addresses of the operating system routines from model to model. Yet machine language programmers can always be sure their programs will find the routines by using the jump table addresses, which stay the same.

The results are machine language programs which are easier to write, consume less memory, and are transportable among different models.

Kernal routines are almost never used by BASIC programmers because they are more difficult to access from BASIC, and also because BASIC already contains one-word commands which do the same things anyway—commands such as PRINT, GET, PUT, etc.

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Fast Add

J. C. Bye

The author, a parent of young children, wrote this effective math drill program which is very easy to use. For the VIC and 64.

When parents buy a computer, one of the first types of programs they usually attempt to write is a mathematical drill for their children. After acquiring a VIC-20, my first major programming effort was this same project. The result is "Fast Add," a math drill program which provides practice on either one-, two-, or three-digit addition problems. This selection is handled on the initial screen.

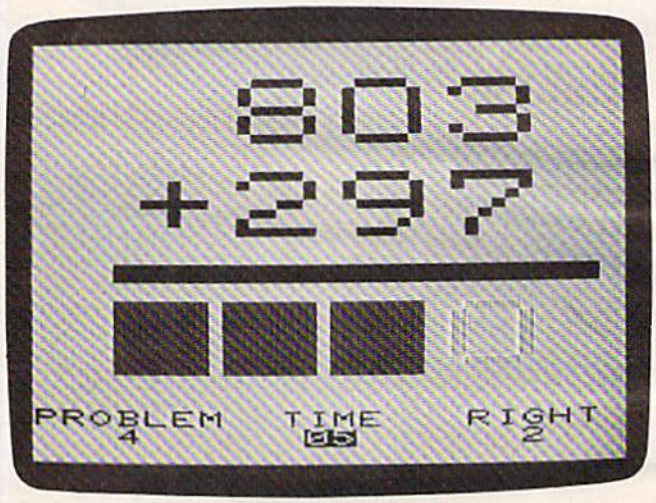
The numbers are large and easy to read. When a problem is presented, squares are displayed so a child can see how many digits must be entered for the correct answer. Answers are entered right to left just as though the problem was being worked with pencil and paper.

A correct answer is rewarded with a short fanfare prior to proceeding to the next problem. An incorrect answer is signified by a contrasting screen, and the entire problem is rewritten. The correct answer is then given, right to left, so that it is easy to see where the error occurred.

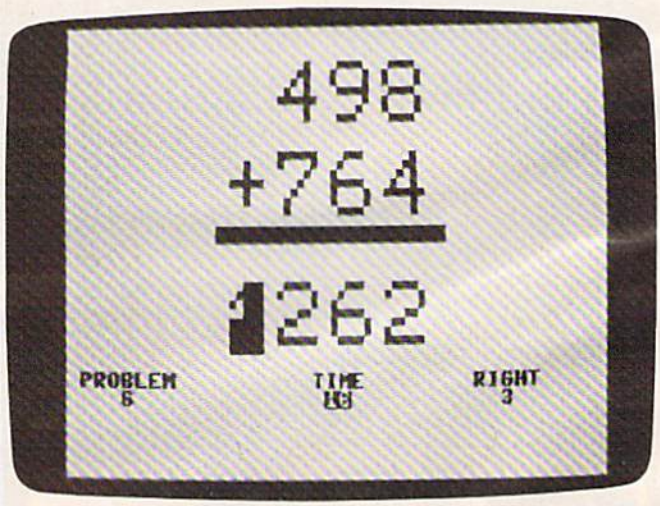
Adding Incentive

Each time the program is run, ten randomly generated problems are presented and thirty seconds are allowed for entry of each answer. A timer at the bottom of the screen counts from 0 to 30 seconds so a child can work in a time frame. Upon completion of the ten problems, a final screen display shows the percentage correct and a timed score provides added incentive to work faster.

The timed score is the total time remaining on all problems multiplied by the number of digits in the problems. That is, the maximum score for one-digit problems is 300, for two-digit problems is 600, and for three-digit problems is 900. A missed problem is counted as no score.



Answers are entered right to left in "Fast Add" (VIC version).



A "1" is about to be entered for a correct answer in the 64 version of "Fast Add."

Program 1 will run on a VIC with any memory configuration; Program 2 is the 64 version. Com-

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VIC Program Structure

Lines	
1–5	initialization
10	initial screen
15–25	setup for each execution
30–35	main routine
40–50	routine for wrong answer
55–65	fanfare for correct answer
70–96	final screen
100–140	generate a new problem
200–240	draw the current problem to the screen
300–370	get the answer and write it to the screen
400–410	read the DATA statements into the arrays
500–510	routine to draw one large character to the screen
1100–1112	DATA statements for large characters
1113	DATA statement for fanfare

plex mathematical calculations have been avoided so that the program can be easily understood and modified. You may wish, for example, to create subtraction and multiplication versions.

If you would rather not type in the program (VIC version *only*), send a blank cassette tape, an SASE, and $3 to:

J. C. Bye
21411 Park Royale Dr.
Katy, TX 77450

See program listings on page 151.

User Group Update

Kathy Yakal, Editorial Assistant

Beginning this month, the GAZETTE will publish a regular update on Commodore user groups. They are listed alphabetically by state. The list is growing so rapidly that it's difficult to run it in its entirety, but we'll try to do so a couple of times a year. If you have already sent us information about your group, please let us know if there are any changes; otherwise, we'll continue to publish it. If you have a new group you want listed, or need to update our information, please write to:

COMPUTE! Publications
P.O. Box 5406
Greensboro, NC 27403
attn: Commodore User Groups

Changes

The *New London Area Commodore Users* has a new name and phone number. Robert Kind, contact person for the *New London County Commodore 64 User Group*, can be reached at (203)446-8491, or by writing P.O. Box 1608, Groton, CT 06340.

Inquiries regarding the *Long Island VIC Society* (L.I.V.I.C.S.) should be forwarded to Lawrence Stefani, 20 Spyglass Lane, East Setauket, NY 11733. (516)751-7844.

The *Metro Knoxville 64 User Club* of Knoxville, Tennessee, now supports all Commodore computers. Its new name is the *Metro Knoxville Commodore User Club*.

The new president and address for the *Triad C-64 Users Group* is George Shelhorse, P.O. Box 10833, Greensboro, NC 27404.

The new address for the *National Science Clubs of America/Commodore User Division* is P.O. Box 10621, Merrillville, IN 46411. Please send an SASE to this new address for information.

All inquiries about *MASSPET* should go to Harry Flaxman, P.O. Box 283, Taunton, MA 02780.

New Listings

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Tom Wyatt
3868-H Rue Maison
Mobile, AL 36608
(205) 343-1178

64/20 Club
Mike Rogalski
1408-A S. Alamitas St.
Monrovia, CA 91016

South Bay Commodore User Group
(suburban Los Angeles)
Lloyd Lehrer
401 9th St.
Manhattan Beach, CA 90266

SixtyFourum
John Damiano
P.O. Box 16098
Fresno, CA 93755

F.T.D. Commodore Club
(Field Training Detachment Instructors only)
Larry Prince
Castle AFB, CA 95342

PUG of the Silicon Valley
Marvin Vander Kooi
22355 Rancho Ventura St.
Cupertino, CA 95014

PET Educators' Group
Palmer Johnson
P.O. Box 454 Station A
Windsor, Ontario,
Canada N9A 6L7

Brockville User Group (BUG)
Bill Maxwell
72 Murray St.
Brockville, Ontario,
Canada K6V 2X1

Budget Wise Computer User Group
Dennis J. Lachance
17 Chaplin Ave.
St. Catherines, Ontario,
Canada L2R 2E4

Quinte Commodore User Group
Wayne Wickson
P. O. Box 477
Belleville, Ontario,
Canada K8N 5B2
(613) 966-7535

Commodore 64 User Group
Walter Scholz
568 Mornington St.
Stratford, Ontario,
Canada N5A 5G9
(519) 271-5704

Fairfield County Commodore User Group
Linda Retter
P.O. Box 212
Danbury, CT 06810

Commodore Computer User Group
Ernest M. Julian
165B S. Bigelow Rd.
Hampton, CT 06247
(203) 455-0108

Tri-State User Group
Russell Prince
2312 Carpenter Rd.
Wilmington, DE 19810
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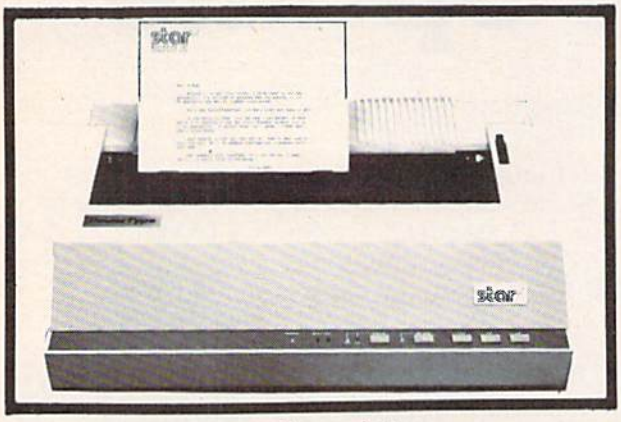

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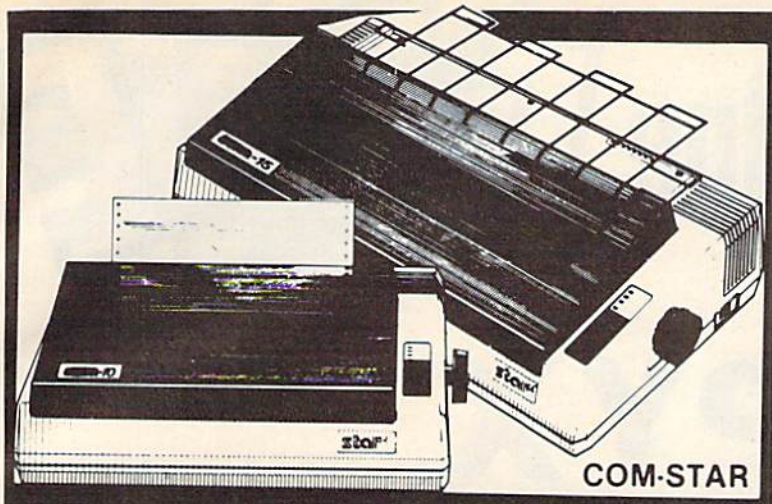

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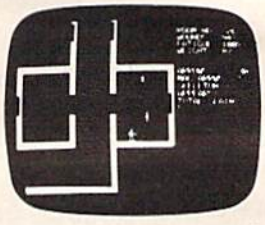

Temple of Apshai — ***(computer game of the year)***. This is the standard by which other adventure games are judged. Full color graphics portray the temple and all its contents — magic, monsters, doomed cities and damsels in distress. Do battle in real time with over 20 monsters, expansion modules will keep your adventure alive in the future. List $39.95. **Sale $24.95**. (tape/disk).

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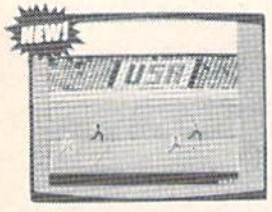

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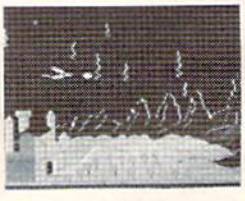

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Serpentine — Awarding winning game. Avoid hostile red snakes and lay your young while getting food to keep you alive. Fantastic strategy game that has become a classic. List $34.95. **Sale $9.95.**

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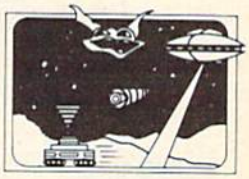
Apple Panic — The fast action computer game hit now comes to the VIC-20. You must dig traps in the brick floor and wait for the wandering apples to fall in.

Then simply beat them on the head to push it through and destroy the apple. Otherwise the apple's will roll right over you and kill you. (Fast action.) List $34.95. **Sale $7.95.**

While They Last

Rat Hotel — Here you get to play the rat. Running and jumping from floor to floor in Hotel Paridisimo you must eat whatever you find but Waldo the maintenance man has set many traps for you that you must avoid. Plus Waldo has an atomic elevator that let's him jump several floors at once. See if you can get to the bottom before Waldo does you in. Fantastic graphics and sound. List $34.95. **Sale $9.95.**

Terraguard — Your mission is to destroy the aliens before their ship has a chance to land. Move your base along the ground and shoot up at them. List $34.95. **Sale $9.95.**



Video Mania — You're in an open field and strange alien creatures are roaming all over. If you stand still too long, they'll collide with you, causing instant annihilation. Your only defense is to destroy them by throwing your electronic, football-shaped alien zapper at them. **Sale $9.95.**

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Up For Grabs — If you like Scrabble you'll love this one. You have to grab letters off a rotating cube before anyone else and then use the letters to make words in a hurry. Fantastic for spelling and vocabulary skills. List $39.95. **Sale $28.00.**

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Step Lister

E. A. Cottrell

"Step Lister" lets you look at your BASIC program lines without repeatedly typing LIST. This is a machine language routine, but it requires no special knowledge to use it. For VIC and 64.

"Step Lister" is a machine language *wedge* (explained below) which allows you to step through a BASIC listing one line at a time.

To see the first line of your program, just type:

```
@0
```

(Entering any other number after the @ will start the listing at that line. There should be no spaces between the @ and the line number, and the @ must be on the left margin.)

Then, press any key, and the next line will be displayed. Press the SPACE bar and hold it down, and the listing will continue scrolling until the space bar is released.

If you wish to stop Step Lister, press RUN/STOP.

Be sure to SAVE the program before you RUN it because the VIC version is self-erasing, and if there are any undetected errors, the computer may crash.

What Is A Wedge?

To understand a wedge, you must first have some knowledge of how BASIC works. When you press RETURN, one of two things happens. If the entered line has a number as the first character, the computer assumes that a BASIC line is being entered. This line is then converted to BASIC *tokens* and put in its proper place in memory. (Tokens are single-byte symbols which represent BASIC commands. To save space and time, the computer stores PRINT, for example, as 153.)

No interpretation of the characters following the line number is made until the program is RUN. If the first character is not numeric, the line is tokenized and placed in the BASIC input buffer at locations 512–600 ($0200–$0258). The interpreter then calls the CHRGET subroutine to get the characters from the buffer and return them for interpretation.

To implement a wedge, the CHRGET subroutine located at 115–138 ($73–$8A) must be altered to go to your machine language program before returning to the interpreter. At the entry point of the wedge, a check is made to see if the special character (in this case, @) has been entered. If it has, the special routine is executed. Otherwise, the character is sent to the interpreter for normal BASIC interpretation and execution.

Using ROM Routines

Step Lister uses many of the subroutines which are part of the BASIC ROM in the VIC and 64. Analyzing some of the subroutines already in the machine can prove useful.

Although the BASIC ROMs in the VIC and 64 are located at different addresses, they are very similar. If you find a subroutine in the VIC, you'll have little trouble finding it in the 64. For example, the subroutine to return to BASIC with READY is at $C474 in the VIC. In the 64 it's located at $A474.

The wedge can be a powerful tool. If you decide to write a wedge program of your own, heed one word of caution: Do not try to alter the CHRGET subroutine with BASIC. You will be changing the way BASIC gets its instructions in the middle of a BASIC program, and this will crash your computer.

See program listings on page 153.

HOME TELECOMMUNICATIONS

ROBERT SIMS, ASSISTANT EDITOR

We are pleased to welcome Robert Sims and his new column, "Home Telecommunications," to COMPUTE!'s GAZETTE.

Robert has a thorough background with the VIC and 64, and has been involved in telecommunications for several years.

Home telecomputing is in a state of rampant growth. There are thousands of new users every month. Understandably, such growth has given rise to a number of myths. Some of the most common mixtures of fact and fiction are:

- Telecommunications is just a vast playground for business executives and professional programmers.
- It's very expensive.
- The information networks want commercial customers; they don't like to bother with beginners on a budget.
- You have to know all about things like ASCII, A and B protocols, and file translation.

Finding What You Need

The purpose of this monthly column is to help dispel these myths, and others, and to help you become an accomplished telecommunicator.

The emphasis here is on communication, on obtaining information for your own use, or to share with others. Although we will examine some technical aspects of the subject in passing, the main idea is to help you find what you need, rather than to talk about how the computers do their job.

Home telecomputing is barely out of the experimental stage, and there is already more information available in more data bases than you can access in a lifetime. In addition, you can choose from a long list of modems and software, each with different features. Your range of choices is limited only by how much time and money you decide to spend.

How Will You Use It?

Users who rush into telecommunications unprepared can find the process frustrating, time-consuming, and prohibitively expensive. So before you commit yourself to a telecomputing system, you should ask the same question you asked before you bought a computer: What will I use it for?

Your investment in hardware and software, the amount of money you must spend on connect charges, and what you ultimately get out of it, can all depend on this question.

The simplest, and least expensive, service available to you is one-to-one communication. You call a friend, hook the computers to the phone line, and swap data and programs or type messages to each other using your keyboards.

The next level of service is the bulletin board system (BBS). It's the electronic equivalent of those notice boards found in laundromats, libraries, and other public places. A BBS is usually run by a computer user or by a user group. You can dial the BBS phone number, hook up your modem, and read the messages left by other users or leave messages of your own.

Some boards have a *chat* feature which allows you to "talk" with the sysop (system operator) via your keyboard.

You can access these two levels with an inexpensive *modem* and a *dumb terminal* program. Copies of such programs are in the *public domain*, and are often available from user groups. (Some manufacturers, like Commodore, provide programs with their modems.)

Transferring Files

So far, all you're basically doing is dialing a phone and typing on the keyboard. Anything you send to anybody else must be entered manually.

You will probably also want to send long messages or programs which you have already typed into your computer or saved on disk or cassette. To send it (or receive it) all at once without

80 Column Smart Terminal
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VIP Terminal ready 11:15:46
Dear Pepper,

You're right. This VIP Terminal is the only terminal for the C 64 worth owning. That freebie software that came with my modem just didn't work, especially with my new smartmodem. The 80 column display alone was well worth the $49.95 - much less the 40, 64 and 106 character displays - and it doesn't need any hardware changes. Imagine 106 characters on 25 lines. Heck, there's more text on my screen than on my uncle's Apple or my dad's I B M - P C!

I put auto-dial to work right away. I auto-dialed Compuserve, but couldn't get through, so I had VIP Terminal redial 'til it got through - it dialed five minutes straight! Then I auto-logged on with one of my 20 programmed keys, and downloaded some graphics screens, and stock quotes for dad. I printed it and saved it to disk as it came on the screen. Wow! And now I can send you my programs automatically. I got yours and they worked right off.

Those icons, - you know, like the Apple Lisa - are a lot of fun. I also like the menus, function keys, highlights, help tables - great for a newcomer like me. And with the many options there isn't a computer I can't talk to.

What's really neat is that Softlaw has a whole VIP Library of interactive programs, including a word processor, spreadsheet and database, which will be out soon. Sis promised me the whole set for my birthday.

I see by the built-in "old clock" on the screen that long-distance rates are down. Got to call that L.A. B B S. Yep, there goes the alarm. Later.

- Lone

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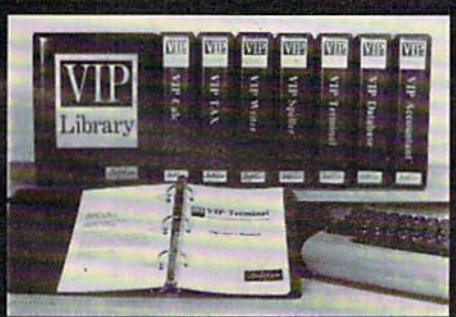

Virtual Memory

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Icons Make Learning Easy

Hi-res technology and sprites allow **VIP Library** programs to bring you task Icons, made famous by the Apple Lisa™ and the Xerox Star™. With these advanced sprite representations of the task options open to the user, even the total novice can, at a glance, perform every task with ease. Just look at the icon and press a key! No programs are easier or more fun to learn and use!

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All **VIP Library** programs are compatible with each other and other computers for easy file transfer. Each uses ASCII, the universal language of computer communications so that files can be sent to and received from other computers without modification! The Library also gives you the benefit of a consistent icon and command structure. Once you have learned one program, the others will come easily.

Professional Displays

The 40-characters-per-line display of the Commodore 64 is inadequate for serious computing. An 80-column display is the industry standard. **VIP Library** programs bring this standard to your Commodore 64 with state-of-the-art graphics, without need for costly hardware modifications. With **VIP Library** programs you can freely choose from four displays: the standard 40 column display, plus a 64, 80 and even a 106 column by 25 line display. With these programs you can have more text on your screen than on an IBM PC or an Apple IIe with an 80-column board! Welcome to the professional world!

Who Is Softlaw?

Softlaw Corporation has years of software experience in micros. We currently offer the full-line **VIP Library** for other micros in the U.S. and in Europe. Now we are bringing this experience to the Commodore 64 so you get ultra-high quality software at very affordable prices.

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AUTHOR'S SUBMISSIONS ARE ENCOURAGED.

retyping it, you will need software which has upload (send) and download (receive) capabilities.

Most dumb terminal software does not have these capabilities, so if you want to upload and download, you'll have to purchase a commercial package, or write the routines yourself. There are terminal software packages available for under $40 which allow you to upload and download. These packages usually offer additional features such as a screen dump to your printer, and include programs to translate your files into the proper formats for uploading, and translate downloaded files to fit your computer's formats.

A Wider Choice

The next level up is the information utility (also called a network). Utilities offer a collection of different, often unrelated, services which are accessible through a single phone number. The CompuServe Information Service, The Source, Dow Jones News/Information Retrieval Service, and Delphi are some examples.

On the utility you will find hundreds of data bases and service companies, providing bulletin boards aimed at different computer brands, conference lines on which you can talk to other users or manufacturer spokespersons, data bases full of public domain programs which you can download, shop-at-home and bank-at-home services, and many others.

Again, you can access this level of service with the least expensive modem and any terminal software (to upload or download, of course, your software must have the capability).

Getting Special Service

Some network services require special software. For example, CompuServe offers *Vidtex*, a terminal software package designed to access special features such as color graphics and screen formatting, in addition to regular services. You can access regular CompuServe services without *Vidtex*, but you won't get the full use of the network. Next month we'll look at this package in more detail.

The next level of service you might want to consider is the *dedicated data base*. If you are a farmer, there are data bases of agricultural information. If you are a doctor, a free-lance writer, a stockbroker, or an environmental activist, there is a data base dedicated to your field. In fact, whatever your profession or interest, you will probably find a data base designed for your use.

Some dedicated data bases are operated by individual companies, for their customers. Some large banks now have phone numbers available which allow customers to hook up their modem-equipped computers. This allows the user to pay bills and transfer money between accounts from home.

The Fees Are Higher

Most dedicated data bases, however, are not inexpensive. Whereas the most popular utilities charge $5 to $8 per hour for connect time in the evening, the usage fees for dedicated data bases are generally much higher. Also, some data bases transmit data at faster speeds than most low-cost modems can accept.

Before you purchase your modem and software, you should decide at what level you will be looking for information. If you buy a simple modem and inexpensive software and then decide to access a dedicated data base, you may find that your system is incompatible because of the wrong transmission rate or special characters missing from the software.

Remote Access

If you want to call (or let others call) your computer from another location to upload data or download from your own files, you will need a modem that automatically answers the phone, and software that allows the remote user to download data from the unattended computer. For this kind of advanced telecommunications, you may want to have a modem with programmable features and special software, so you can use private control codes to lock out uninvited callers.

You may want to use a computer and modem away from home and charge the call to your home phone, using a calling card number to save operator-assistance charges. In that case, you must either dial the call yourself (on a Touch-Tone phone) or have a modem that automatically dials the phone using tones. Some auto-dial/auto-answer modems send tones and some send pulses; some allow you to choose which to send.

If you travel a lot and take your computer with you, you should consider buying a modem which will dial on both pulse and tone phone lines.

Price And Compatibility

Generally, the more sophisticated your needs, the more expensive it will be to meet those needs. It is not necessary to become a telecommunications expert to make a decision about what to buy, but it is necessary to do some homework in order to know if a product or service meets your needs at a price you can afford.

Once you've decided which services, modem, and software you want, ask the service firms if your modem and software are compatible with their access requirements. And while you're at it, you could order their user manuals. They are usually inexpensive and up-to-date, and are your best resources for finding the best route through the many menus you will encounter on the utilities.

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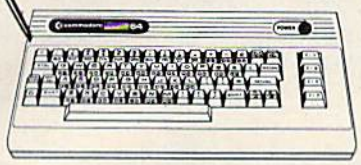

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Home Telecommunications Glossary

A And B Protocols: Two sets of telecommunications guidelines used by the CompuServe Information Service. Protocols include information on how information is to be stored and transmitted, and which special characters are used to control the information exchange.

ASCII (American National Standard Code for Information Interchange): Data is transferred over phone lines as ASCII codes. Several variations exist (including Commodore ASCII) in which nonstandard codes are used. In order for a VIC-20 or Commodore 64 to communicate with a non-Commodore computer, Commodore ASCII must be translated to standard ASCII. This is one of the functions which your terminal program performs automatically.

Data Base: Also called a data bank, it's an organized mass of information.

Dumb Terminal: Software which causes your computer to act as a terminal for a remote computer. A dumb terminal is used as a keyboard only; all processing is done by the host computer.

File Translation: Different services organize files using their own formats. Before you can use them, downloaded files must be translated into a format compatible with your computer and software. Since most telecommunications software makes some provision for file translation, the only thing you need to know is what kind of file it is and which translation program to use.

Modem: Modulator/demodulator. An interface which translates a computer's digital signals into sounds which can be transmitted over telephone lines, and translates incoming sounds into the signals which your computer recognizes.

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Pulse Dialing: When you dial a number on a regular dial phone, you send a set of clicks, or pulses, over the line. A Touch-Tone phone sends tones of different frequencies which represent the numbers 0–9 and some special characters. Pulse dialing will work on a Touch-Tone line, but Touch-Tone dialing will not work on a pulse line.

Screen Dump: Copy the contents of screen memory to the printer.

Other Resources

If your telecomputing needs require you to access dedicated data bases and bulletin boards in some special field of interest, you may want to add some directories to your computer library. They contain categorized listings and descriptions of hundreds of data bases.

Two recently published directories are the *Omni Online Database Directory* and *The Computer Phone Book*.

The Omni directory contains information on more than 1000 commercial and governmental data bases in 50 categories. The *Computer Phone Book* is oriented more toward the home computerist; it lists more than 400 national networks and local bulletin boards. This book also contains information for the beginner on how telecommunications works, and in the case of the national networks, provides tips on how to log on, with facsimiles of the menus you will encounter. Both books include information on connect charges, on-line services, and addresses where you can write for more information.

After 6000 Years

It's easy to be overwhelmed by the massive amount of information available. After facing the complicated choices between modems, software, and services, the temptation might be to restrict your use to brief forays into local bulletin boards and familiar services on the networks.

If you are daunted by that mountain of data, keep in mind that it took 6000 years, more or less, to put it together. Don't expect to have access to the accumulated written knowledge of the human race after spending only a few dollars and a couple of hours at a keyboard.

If you have questions or ideas about subjects you'd like to see covered in this column, write to: Home Telecommunications, COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403. Or send EMAIL. My CompuServe ID is 75005,1553. My Delphi ID is BOZART.*

Omni Online Database Directory
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The Computer Phone Book
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Cassette Beeper

Don Brady

Watching and waiting for programs to load and save is often tedious and time-consuming. This program will signal you when your VIC or 64 is ready for more work.

If you use a Datassette with your VIC-20 or Commodore 64, you know how long it can take to load or save programs on tape. "Cassette Beeper" will change the LOAD and SAVE operations to signal you with a beep when the LOAD or SAVE is completed. You can go on to other work until the beep sounds, instead of just staring at the screen.

Program 1 (the VIC version) locates itself at the top of memory and will remain there until the computer is turned off, or the top of memory pointers (locations 55 and 56) are changed. If the RUN/STOP and RESTORE keys are used, a SYS to the start of the program is needed to reset the LOAD/SAVE vectors. Since the address of the top of memory will vary depending on the amount of expansion RAM installed on the VIC, the program will print the appropriate SYS location. Remember this value in case you need it later to restart the beeper.

Using The Stack

If you have an unexpanded VIC, or are loading or saving a program that uses all available memory, you may want to delete lines 20 and 25 and change the following lines:

```
10 EM=267
15 PT=EM
```

These changes cause the machine language to be located in the operating system's stack so that no BASIC memory is used.

The stack is used for temporary storage by machine language programs, and by the computer's operating system. These changes locate the beeper routine deep enough in the stack to remain untouched by most programs. The program is still there even after other programs have been executed. Even a SYS 64802, which resets the computer, does not affect the program in the stack. After a reset or a RUN/STOP–RESTORE, you'll need to SYS 267 on the VIC to reset the LOAD and SAVE pointers.

The 64 version of Cassette Beeper (Program 2) resides at $C000 (49152) and works just like the VIC version. To start the 64 version, you must RUN Program 2 and then enter SYS 49152. You'll also need this SYS to restart the beeper after a reset or RUN/STOP–RESTORE.

See program listings on page 153.

Young People

COMPUTE!'s GAZETTE wants to know what today's young people are doing with computers. We want our readers to know, too. If you've written an interesting program for the VIC-20 or Commodore 64, share it with us. See the Author Guide elsewhere in this issue, and tell us your age when you submit an article.

MACHINE LANGUAGE FOR BEGINNERS

RICHARD MANSFIELD, SENIOR EDITOR

Mods And Bombs

Our all machine language game is nearly finished. Everything we've done so far—the frame, the enemies, the paddle, and this month's addition, the bombs—is contained in Programs 2 and 3. These are BASIC loader programs, so you can type them in and RUN them without knowing anything about machine language (ML). But our goal is to become familiar with ML, so let's look at Program 1, the routine which fires bombs.

This is a disassembly (a LISTing) of the 64 version, but the VIC version is essentially identical. Lines 49370–49376 take the paddle position address and put it into a new pointer, the bomb position address. When first fired, a bomb will come out of the paddle and, thus, share the paddle's address. Then line 49378 sends us to a subroutine (lines 49423–49436) which subtracts 40 from the bomb position. (This is the only difference between the 64 and VIC versions: The VIC version subtracts 22 since VIC lines are 22 characters long.)

This subtraction has the effect of moving the bomb up one screen line. If we do this repeatedly, in a loop, the bomb appears to leave the paddle and travel up towards the enemies.

The Bomb Image

After RTS (ReTurn from Subroutine), we land up at line 49381 where the Y register is loaded with zero and the A register is loaded with the bomb character, 193. Then STA (253) Y prints a bomb on screen at the correct bomb address. Now we've got to slow things down a bit. Without a delay loop, you'd never see the bombs at all. Line 49387 puts the amount of delay into the X register and Jumps to a SubRoutine. This subroutine (see below) counts down X (and also Y) and serves only to take up some time.

The next job is similar to printing the bomb except that this time (lines 49392–4) we're printing a blank character, the space, number 32. Without this, we'd have a trail of bombs running up the screen. Then, once again we JSR down to the subtract 40 from bomb address routine.

After returning this time, the bomb address pointer (253) is pointing to the next position up screen from the previous bomb print. We cannot just put a new bomb image there without first checking to see if we're up at the top border or have encountered an enemy character. Line 49401 CoMPares this new position against a blank. LDA has put whatever is in this position into the A register for the comparison. In other words, if the character is *not* a blank (32), then we have hit something. BNE (Branch Not Equal) sends us down to 49412 for further comparisons: Is it a border? (224), an enemy? (90). In either case, we go back to the main loop (at 49260). Later we'll add some scoring and visual effects to show that we've hit an enemy character.

If we've not hit anything, however, the BNE at 49403 doesn't send us anywhere. We slide through it to 49405, load in a bomb character, store it at the new bomb position, and JuMP back up to repeat the blank-checkit-printbomb loop. This loop will continue until that BNE forces an exit because we've encountered a border or an enemy. That's it for this month's new routine. However, the game is beginning to take shape and to draw us towards its final form. Sometimes the game itself, not the programmer, dictates required modifications and reveals improvements.

Shrinking The Paddle, Improving The Timer

In the March issue, we drew a paddle that was five characters wide. This would be fine for a game which bounced a ball around the screen and used the paddle to smack it as in Ping-Pong. But we're firing bombs. With such a fat paddle, we can't get near enough to the sides to send bombs at enemies located close to the right or left border. What to do? It's simple; we'll just draw a paddle that's only one character wide. There are four places where the size of the paddle is controlled by the number placed into the Y register (49300, 49313, 49333, and 49351). Those numbers have been reduced this month to shrink the paddle size. You can disassemble the program after running the BASIC loader to see this modification.

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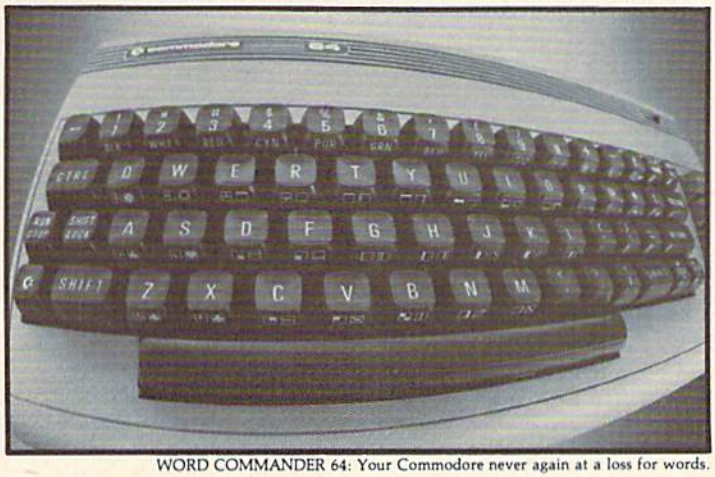

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You have to look very closely to find what we left out of our new word processor. But once you try the WORD COMMANDER 64 you'll discover what's missing. We've taken the *process* out of word processing and put it where it belongs—in our software. With the WORD COMMANDER 64 there's less for you to do and more that it does. And that makes *you* look good.

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The WORD COMMANDER 64 is a complete word processor. We've included every function you'll need and some comforts you'll enjoy. And we didn't hide them in complicated codes or commands that require three hands. Everything about the WORD COMMANDER 64 makes plain sense.

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When you write you probably change your mind a lot. Now changing your text is almost as easy as changing your mind. Like when you want to underline a word or group of words all you do is press "COMMODORE-U" —regardless of the printer control code your printer uses.
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- full word wrap
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- center text
- right justify text
- delete a block of text
- insert a block of text
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- copy a block of text
- three different fonts supported
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- select any character color as well
- select cursor color
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- print headers and footers on every page
- automatically number pages
- print subscripts and superscripts
- underline text
- search for specific text
- search and replace
- change margins, font, or justification from within your document
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The words you need to write represent your ideas; and they flow—one after another. So we designed the WORD COMMANDER 64 to work along with your thought processes. And not slow you down. We did that by making it less complicated and easier to use. So easy you probably already know how to use it.

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MMG micro software

We've also improved the delay timer. In March, this subroutine just LoaDed Y with zero and counted down until Y reached zero again. This month, we've added an outer loop involving X. Not only will this cause much longer delays, but it's also more flexible. Before we JSR to the delay subroutine, we first load X with a number representing the amount of delay we want. See line 49387. This lets us fine-tune the game so that it's challenging yet fair and also gives us greater control over the animation effects.

```
49361   LDY    # 0
49363   DEY
49364   BNE           49363
49366   DEX
49367   BNE           49361
49369   RTS
```

One last modification. In March, the main loop checked for only three keypresses: 1 for left paddle movement, 3 for right, and 0 for exit. This month we've added @ to fire a bomb. Next month we'll take care of one final oddity about the behavior of the paddle (can you spot it?) and add the final animated objects—descending spikes.

Program 1: Fire Bomb

```
49370   LDA    251
49372   STA    253
49374   LDA    252
49376   STA    254
49378   JSR    49423
49381   LDY    # 0
49383   LDA    193
49385   STA  ( 253 )Y
49387   LDX    # 10
49389   JSR    49361
49392   LDA    # 32
49394   STA  ( 253 )Y
49396   JSR    49423
49399   LDA  ( 253 )Y
49401   CMP    # 32
49403   BNE           49412
49405   LDA    # 193
49407   STA  ( 253 )Y
49409   JMP     --->    49387
49412   CMP    # 224
49414   BEQ           49420
49416   CMP    # 90
49418   BEQ           49387
49420   JMP     --->    49260
49423   SEC
49424   LDA    253
49426   SBC    # 40
49428   STA    253
49430   LDA    254
49432   SBC    # 0
49434   STA    254
49436   RTS
```

See program listings on page 154.

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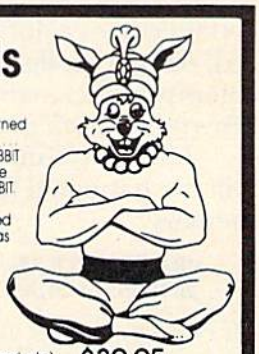

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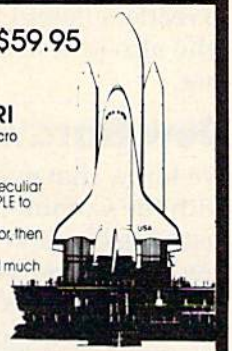

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HORIZONS: 64

CHARLES BRANNON
PROGRAM EDITOR

Mysterious Lockup Revisited

In the January GAZETTE, I documented a strange lockup. The lockup happens when you type two full screen lines at the bottom of the screen (until the cursor wraps around the right margin twice), then try to back up to the long line with INST/DEL. As it DELetes the seventy-ninth character, LOAD, then RUN are fed into the keyboard buffer. If you have a BASIC program in memory, it will be run. Otherwise, READY will appear, with the cursor, but no typing will be accepted. In January, I said there is no way to correct the problem short of turning off the computer (or using the Emergency Reset).

Actually, you can escape the lockup without such drastic measures. Press SHIFT-3, then let go. You'll see "PRESS PLAY ON TAPE." If you have a cassette unit, press PLAY, then RUN/STOP. Now press RUN/STOP–RESTORE. You're saved! The lockup only seems to happen with certain cursor colors: red, cyan, blue, yellow, light red, dark gray, light blue, and light gray. The safe colors are black, white, purple, green, orange, brown, medium gray, and light green.

Tae Kyun Kim also noticed that the lockup will not happen if the following program is in memory.

```
10 OPEN 15,8,15
20 INPUT#15,A$
```

Of course, unless you always type this in, the chances are slim that it will be there. Special thanks to readers Peter Ulrich and Graydon W. Harman who also sent in solutions to the strange lockup bug.

New Hardware

We know that everyone is completely satisfied with the Commodore 1541 disk drive. It's quiet, fast, reliable, and inexpensive. What's that? A few dissenters? Well, if you don't agree, there are some alternatives to the 1541 drive.

There are a few manufacturers that sell disk drives for the Commodore 64, and we can expect more third-party drives in the future. When shopping for a drive, you need to look for several things: compatibility, price, compatibility, reliability, compatibility, speed, compatibility, features, and compatibility. I suppose the point's well-made, but the number one priority *is* compatibility. What good is a $100 warp-speed drive with printer port and five-year warranty if you can't read and write to and from standard Commodore disks? Without compatibility, how can you trade programs with your friends, or load commercial software from the drive?

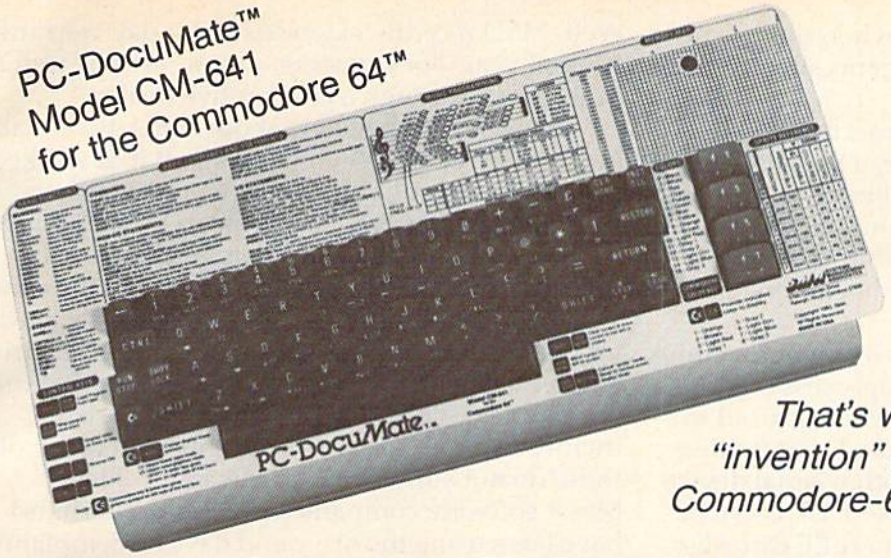
There are several levels of compatibility. First, you should be able to format, read, and write to your own disks. That's taken for granted. You should also be able to load almost any Commodore disk. I say almost because not even 1541s can always read each other's disks. A third level of compatibility is that you should be able to write without harm to any Commodore disk. Again, some flaky 1541s can read but not write to a disk they haven't formatted.

More subtly, the disk should be as much like the 1541 internally as possible. The hardware doesn't have to be the same, but the DOS inside the disk drive should support every tricky 1541 technique, from relative files to Block-Allocate. There's just one complication. If a company used the same DOS as the 1541, there would be a potential copyright violation. Apple and Franklin (who makes an Apple-compatible computer) are still slugging it out in court over the question of ROM copyrights. If it's better to be safe than sorry, the manufacturer will have to rewrite the DOS.

In any rewrite, you leave the security of a debugged, tested DOS. You try to copy all the features and functions of the 1541 DOS, but DOS is not a trivial program. One little error, and you have to face hordes of angry owners with trashed disks.

Considering the difficulty, Micro Systems Development's (MSD) Super Disk Drive is remarkably compatible. We received a unit for review, so I thought I'd give you an early look.

The MSD unit comes in a metal case and is slightly smaller than the 1541. The disk slot is vertical instead of horizontal, and there is a more reliable drive clamp, which centers and grabs onto the inner hub of the diskette. There are two LEDs: power on (green) and drive busy (red). The power on light also flashes between red and green when you get an error. The 1541 also has two LEDs: a green one for power, and a red one that flashes when you get an error, stays steady when



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INCONVENIENT MANUALS

The user's guide was a nuisance and the programmer's reference manual was just plain inconvenient to use. We found the control key combinations confusing and the introduction to BASIC to be too "basic" for our needs. We needed a simple solution to our documentation problems.

So we decided to surround the keyboard of each PC with the information we wanted. We decided to print whatever we needed on sturdy **plastic templates** which would fit the keyboard of either the VIC-20 or Commodore 64.

SIMPLE SOLUTION

This was the simple solution to our problem. Now we could have the essential information right at our fingertips.

On the left side and top of the templates we put **BASIC** functions, commands, and statements. On the lower left we used **key symbols** to remind us of how to use SHIFT, RUN/STOP, CTRL and the "Commodore" key. Over on the bottom right side we put some additional keys to help remember about CLR/HOME and RESTORE. But we were still a little confused.

STILL CONFUSED

We found we were confused about music programming, color graphics, and sprites. On both the VIC-20 and the CBM-64 templates we carefully organized and summarized the essential reference data for **music** programming and put it across the top—showing notes and the scale. All those values you must POKE and where to POKE them are listed.

Then to clarify **color graphics** we laid out screen memory maps showing character and color addresses in a screen matrix. (We got this idea from the manuals.)

For the VIC-20 we added a complete memory address map for documenting where everything is in an expanded or unexpanded VIC.

For the Commodore 64 we came up with a really clever summary table for showing almost everything you ever need to know for **sprite** graphics.

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the drive is busy, and turns off when there is no access. The MSD LED scheme seems slightly more logical.

Included with the drive is a serial cable to attach the drive to the computer, a detachable power plug, and a 45-page "preliminary" manual. No sample disk was included, such as the 1541 test/demo disk which comes with the 1541. The MSD manual is a little better for beginners than Commodore's.

Like the 1541, the MSD has its own operating system, driven by a 6511Q microprocessor (similar to the 6502). It has 4K of RAM, which is used to buffer data. In addition to the serial port (with a second port to let you chain another serial device, such as a printer), the MSD Super Disk Drive has an IEEE-488 parallel bus. With an IEEE cartridge, such as the CIE or VIE sold by MSD, you can significantly speed up disk access to the speed of a Commodore 4040 (dual-drive unit used with the PET/CBM). Unfortunately, this interface was not included in the review package, so we cannot vouch for the speed with a VIC or 64. We did attach the MSD drive to a Commodore 8032 instead of a 4040. The data transfer was fully up to the speed of a 4040, about twice as fast as the 1541.

Compatibility

From all appearances, the MSD drive is completely compatible with existing 1541 disks. I read and wrote to the same disk with both the MSD and a 1541 over a period of about a week. I never got a bad sector, nor a program that wouldn't load.

But when you get to the tricky details, the MSD is not a 1541. Its DOS is a software product, and is constantly being "perfected." When we were using it to make a backup copy of a disk, it would not accept the command to change its device number from 8 to 9, even though this command is mentioned in the manual. This is because we were using a drive which underwent a revision in the DOS. Present drives have had this problem fixed.

MSD says they will offer a practically free upgrade to the DOS whenever a new version is available. You buy a new EPROM chip, and send in your old one for credit. Alternately, you could go through your dealer, who would make the exchange and work with MSD.

Reliability And Speed

The metal case and more positive head-centering lead you to believe that the MSD drive is a heavy-duty piece of equipment. The MSD drive is a little louder during disk access, making metallic clicks and whines instead of the softer plastic-on-plastic sounds of the 1541. This also gives you a feeling of solid, metal construction.

How reliable does MSD think the drive is? Well, MSD recently extended its 90-day warranty to a full year. For servicing, you return the unit to MSD, or go through a cooperative dealer.

It just so happened that our MSD drive malfunctioned on us. When we first got it, it worked perfectly. Later on, though, it would refuse to read any disks after it had been on for an hour or so. Something in the drive was getting very hot. Turning it off and letting it cool restored the drive. The metal case may be a plus, but it makes it harder for heat to escape. It wouldn't hurt the MSD drive to have a small built-in fan. We can't say that this is a problem with all MSD drives. MSD claims their return rate is about 1 percent, and many of these do not suffer from hardware problems. Major software companies such as Brøderbund have been using the drive and have no complaints. If you've used an MSD drive, write us and tell us how it's worked for you.

As mentioned, with an IEEE interface, you can substantially speed things up; but without it, I could hardly detect any difference in speed between a 1541 and the MSD drive. The MSD may be slightly faster, but not appreciably.

The MSD drive we used was a single drive unit. It offers only an IEEE port over the 1541. Otherwise, there are no added features or enhancements. However, MSD also manufactures a dual-drive model.

Why Buy MSD?

Given that the MSD costs more than a 1541, why would you buy it? First, it is less expensive than a 2031 or 4040 if you want to use the IEEE cartridge. Second, the metal case (which blocks moderate magnetism and RF interference) may extend the life of the read/write head. Third, you might want to own a dual-drive model (two drives in one case), not available from Commodore. Fourth, you may not be able to find any 1541s in stock (or one that works). But otherwise, it's up to you.

Micro Systems Development
10031 Monroe Drive
Dallas, TX 75229
$399 (single disk drive)
$695 (dual drive unit)

Although we haven't seen one yet, Concorde Peripheral Systems has its own 1541-compatible disk drive. The Concorde C-321-P comes with a parallel interface to speed up disk access "over 100 percent." Promotional literature does not indicate whether the interface is an IEEE-488.

Reliability is said to be enhanced by the use of "full ball bearing mountings, with no pulleys or belts, helping to minimize spindle run-out and to provide a 10,000-hour mean time between failure rate." Whew! Concorde alludes to a major cause of 1541 failure: spindle run-out. The 10,000 MTBF rate should give you plenty of time to use

GOSUB®

How to do your own maintenance, troubleshooting, schematics, theroy of operation, cleaning hints, conversion from one power source to another and calibration. These topics and many more will make this manual a valued addition to your reference shelf. Whether you are an amateur electronics technician or a seasoned professional, you will be able to realize the full potential of your VIC-1541 by using this manual. Step-by-step instructions will lead you through the proper methods to get your VIC-1541 up and going in a hurry. The manual is 170 pages long, has two foldouts and over 100 illustrations, including:

Block Diagrams
Schematics
Waveforms
Isometric (Pictoral) views
Test point locators

With all these illustrations and the detailed theory for each circut involved, along with step-by-step procedures to follow, the manual is a great time and money saver.

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Section 7 Preventive Maintenance
Section 8 Troubleshooting
Section 9 Schematics and Parts Layout
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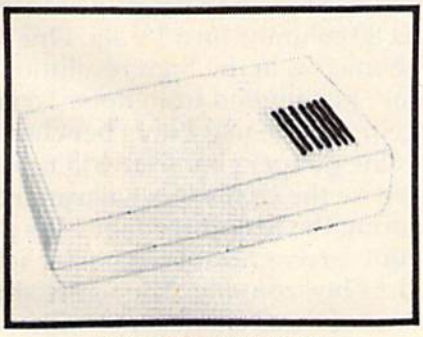
Suggested list price: $39.95



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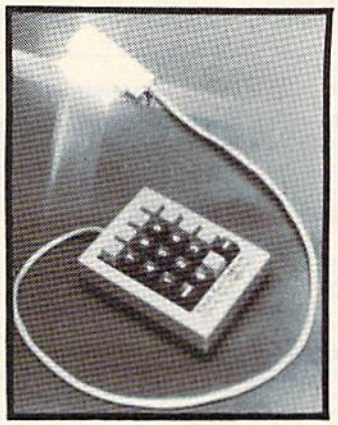

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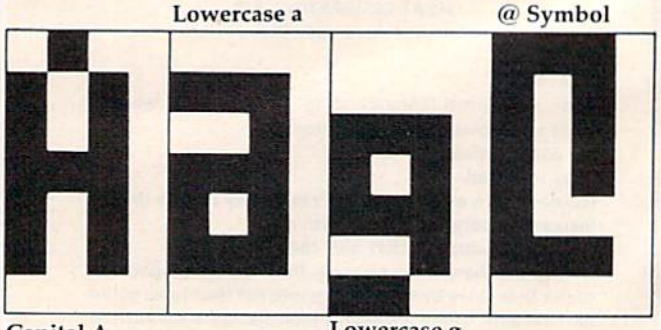
the drive before it and your computer become obsolete. Concorde also says that programs load in one-fifth the time of the Commodore drive.

The Concorde drive attaches to the game port (expansion port for those of you who scorn games), and does not use any of the 64's memory. An extension of the port allows you to plug other cartridges into the interface. You can also attach up to three "slave" drives, which depend on the intelligence of the master drive, so they will presumably be cheaper. The price of the master drive is $356, making it competitive with the 1541 (if the extra speed is worth $100 to you). A half-height, double-sided unit with 384K of storage is also available for $446. We should be receiving a test unit in a few weeks, and I'll give you a full report, including details on compatibility.

Why 40 Columns?

A television can display no more than a certain number of dots on a single line. A dot is formed by a change in the signal going into the TV, and that change can't happen faster than the TV can keep up with it. Either you'll get a picture out of sync, with tearing and rolling, or the TV will just ignore the extra signal changes. This is partly due to electronics that prevent bleedover between adjacent channels.

With 8 dots per character horizontally, 40 columns require 320 dots per line. This is just about the limit of a TV. Eighty columns requires 640 dots per line, and this is too much for a TV (or a color monitor, which has the same limitations). So unless you use less than 8 dots per character, you can't get 80 columns on a TV set. One solution is to draw characters in the high resolution mode. Characters are just plotted from dots. To get 80 columns, we'll need to use 4 dots per character (4 x 80 = 320). One dot per character will need to be blank, otherwise the characters will run into each other, rendering the text unreadable. It's pretty tricky to define a recognizable character set with only three dots horizontally. The figure shows you how some of these characters would look.



There are several word processing and terminal programs which use this technique for 80 col-

umns. Since it is done in software, though, it is in danger of being wiped out or interfered with by other programs you run with it. Many programs do not PRINT to the screen, either. A number representing a character is just POKEd into the character memory, and the video chip is responsible for displaying the character. If software is responsible for displaying the character, it would have to update the screen 60 times a second, reading an area of memory to see what's been changed. Impossible. You just can't update 8,000 bytes 60 times a second. Furthermore, if the software was written for 40 columns, you can't change the screen width and hope the software is smart enough to figure it out.

Why 80 Columns?

Even hardware 80 column cards have this problem—what do you do with it? You can write your own programs to use 80 columns, even edit your programs with it. But don't expect to plug in the card and have your word processor or spreadsheet adapt to the new screen width. Very little commercial software is written for 80 columns, and to be honest, if it wasn't designed for 80 columns, it won't adapt. BASIC programs that use PRINT to display to the screen will still work, but since they're based on a 40-column width, tables and other screen formatting will be skewed all over. It would be like running a 22-column VIC program on your 40-column 64.

This may change in the future, as more companies support the Data 20 Video Pak 80. This cartridge offers generation of 80 columns in hardware. This is true 80 columns, so it won't work with a TV. A monochrome (green screen) monitor, though, does have the necessary bandwidth to resolve 80 columns. Operation of the Video Pak is fairly simple: just plug it into the cartridge port (however, there's no extension to let you chain other cartridges into the Video Pak), then attach a supplied cable from the computer's audio/video port into the cartridge. Turn on the power, and you've got—40 columns.

To get into 80-column mode, you have to SYS 36867. The screen clears, and with easy to read characters, you're in 80-column mode. It's surprising how well the normal Commodore editor is supported. You can cursor around, insert and delete, and change lines by pressing RETURN. Scrolling is a little slower, and there is some snow (similar to sparkle) during the scroll.

The function keys are also "live." The f1 key will shift into lowercase mode; f2 will switch back. f3 will erase to end of line; f4 erases to the end of the screen. If you have an RS-232 port already open, you can press f6 to dump the screen to an RS-232 printer. I would have preferred that the

dump work with a printer attached through the serial port. A handy bonus is terminal mode in 80 columns. It's a dumb terminal; it simply lets you communicate with a modem plugged into the user port, with no frills like upload/download.

You can also get an improved 40-column display with SYS 36864. It should be noted that you can switch modes with software. This lets the computer control the cartridge, instead of your having to manually flip switches. An audio connector on the cartridge lets you easily attach your computer to an amplifier or stereo system. There is documentation on accessing the Video Pak from machine language.

One complication with many cartridges is that they have to reside somewhere in the computer's address space—they take up memory. Video Pak 80 resides at $9000–$9FFF, right at the top of user RAM, leaving you 4K less for BASIC programming. You may not mind losing that RAM, given 80 columns, but certain machine language programs may not be so sanguine. They'll try to use the RAM at $9000, and find that it's ROM, crashing both the Video Pak and the machine language program.

If nothing else, you can use Wordmaster 20 from Data 20, included with the Video Pak. It's a functional 80-column word processor, with many commands. It formats on the screen, so you can see how the output will look, but you have to put up with a few inconveniences to get this. A mailing list program is also included, and you can merge data created by the mailing list program with a document on the word processor.

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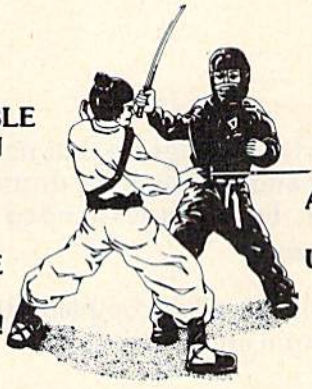

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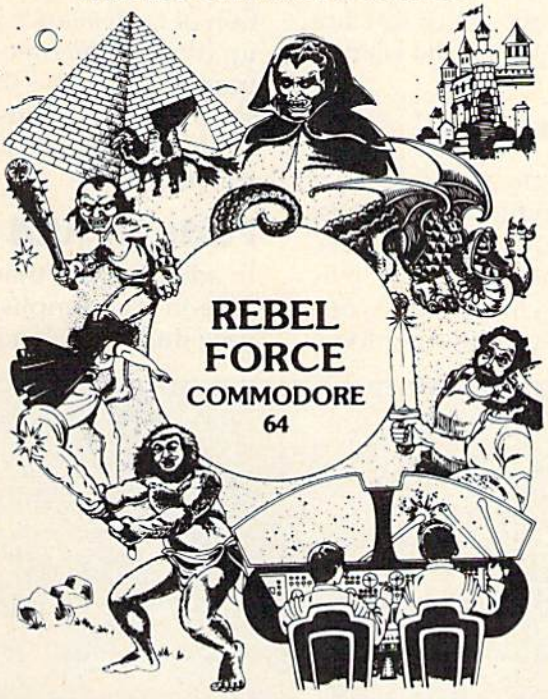

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Sound Story

Bruce Bartlett

Here's a clever program that narrates a story on screen and enlivens the drama with a variety of sounds. For the unexpanded VIC-20.

"Sound Story" tells a complete story in a succession of sound effects, much like an old radio drama.

It was created by listening to natural sounds, analyzing them in terms of pitch, noise, durations, and repetitions, then converting these parameters to program statements.

For best visual effect, be sure that the background on your TV or monitor is black. That is, turn down the brightness control just to the point where the screen background is fully black.

The effects in Sound Story are produced using nested FOR-NEXT loops to control both the duration of repetitive sound patterns and the silences between patterns.

From Crickets To UFOs

The crickets sound is an example. Consider the sound pattern of a cricket chirping (see the figure). It consists of a series of tone bursts and silences. Each tone burst and each silence requires a FOR-NEXT loop for duration. Each chirp consists of five tone bursts and five silences—another loop. The chirps repeat continuously with another loop. Finally, the chirps gradually fade out or decrease in volume as the story ends. That's one more loop.

The dropping ping-pong ball is a series of very short tones and silences. The silences gradually become shorter as the ball loses height with each bounce.

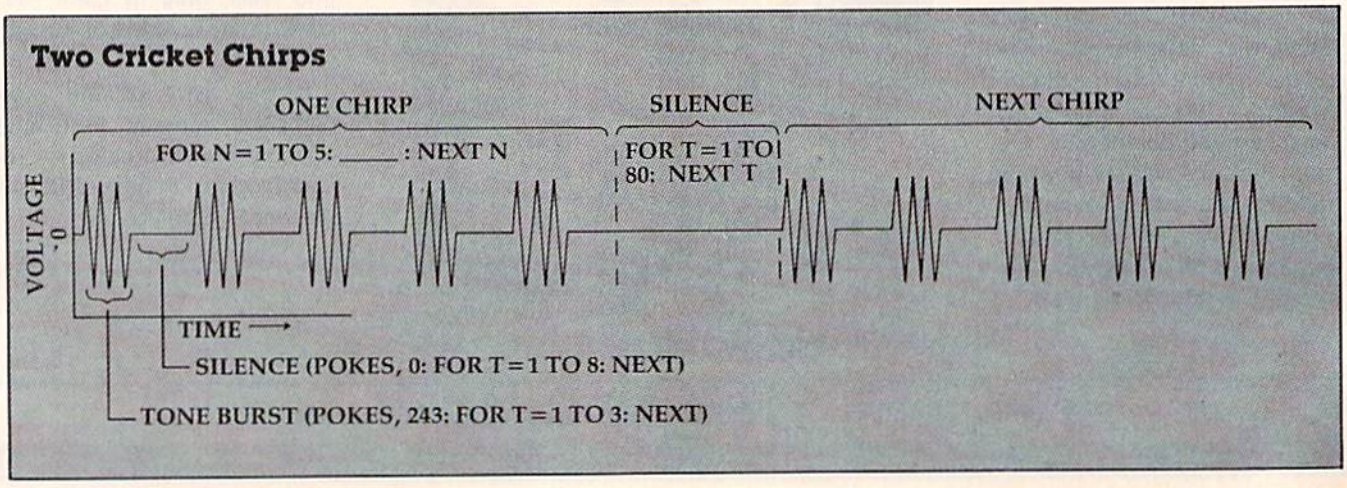
The warble tone in the musical introduction is done by alternating rapidly between two pitches.

Lightning and thunder are simulated by a rapid downward sweep of the noise generator (a thunder crack) followed by low-pitched noise which gradually decreases in volume (thunder rumbling).

The train sound is a series of accelerating puffs or noise bursts. Each puff and silence requires a FOR-NEXT loop for duration. The duration of each silence is long when the train starts up (that is, the train puffs slowly). Gradually the train accelerates—the silences between puffs get shorter, so the puffs speed up. Finally, the train attains top speed, so the puffs repeat rapidly at a constant rate.

Fade In And Out

In addition, the train sound fades in and out. The fade-in is accomplished by incrementing the volume during each noise burst. Another FOR-NEXT



loop slowly decreases the volume, fading out the train sound.

The UFO sound is unusual. It's a series of tone bursts and silences in which the pitch of the tone sweeps up and down. Without the silences between each tone, the effect is less interesting.

Morse code is simulated by a series of tone bursts and silences of random duration.

Here are the functions of the program lines:

Lines 100–120 color the screen and print the title.

Lines 140, 260, 270, 330, 340, 450, 460, 490, 500, 530, 540, and 550 are story captions.

Lines 150–190 are the musical introduction.

Line 190 trills the last note of the intro.

Lines 200–220 sweep the noise rapidly downward and flash the screen white (to simulate lightning).

Line 230 produces a low rumble that fades out (to simulate thunder).

Lines 240–250 perform another lightning-and-thunder subroutine.

Lines 290–320 are the train sound.

Lines 360–440 are the UFO sound, interspersed with screen-color changes.

Lines 470–480 simulate Morse code.

Lines 510–520 simulate a dropping ping-pong ball.

Lines 570–590 display a night sky full of stars.

Lines 600–630 simulate crickets and PRINT "The End."

Line 640 holds The End on the screen for a few seconds, then resets the screen to its normal condition.

The Sound Of Snow

Type in and run the following program. It's the sound of someone walking in deep snow. As a walker steps into snow, the snow gives way with a noise burst. As the walker puts his full weight down, the snow becomes compacted and the bursts increase in frequency. In other words, a footstep or crunch is a series of noise bursts that accelerate like a train, except much faster.

```
10 POKE36878,15:S=36877
20 FORL=15TO1STEP-1
30 POKES,200:FORT=1TOL:NEXT:POKES,0:FORT=
   1TOL:NEXT:NEXT
40 FORL=1TO200:NEXT:GOTO20
```

If you'd rather not type in the program, send $3, a blank cassette with Sound Story printed on the label, and a self-addressed stamped envelope to:

Bruce Bartlett
51941 Jenny Lane
Elkhart, Indiana 46514

See program listings on page 155.

Joystick Control For The 64

Sterling N. Augustine

This tutorial on how to use the 64's joystick ports includes a two-player game, "Chase And Tag," which illustrates the way the joystick ports are read.

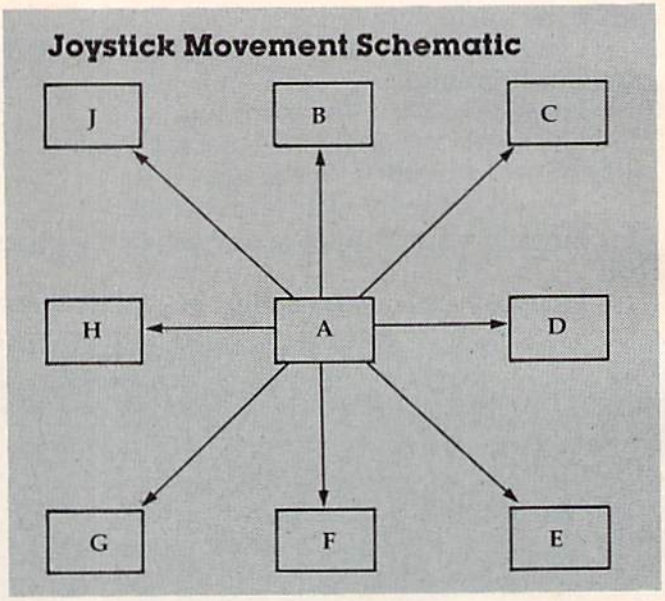
The joystick ports on the 64 transmit data to *registers* at memory locations 56321 (port 1) and 56320 (port 2). A register is a memory location used for input or output instead of storing data. A simple PEEK at one of these locations gives you a value which corresponds to the position of the joystick. Try plugging a joystick into port 1 and RUNning the following:

```
10 PRINT PEEK (56321)
20 GOTO 10
```

Note how fast the value changes as you move the joystick. Now hold the stick in one position and press the fire button. If you play around a bit you will see that each position has two possible values depending on whether or not the fire button is depressed. Below are a table and figure which summarize all possible values for the two port registers, and the joystick fire button status which they represent.

Joystick Control Values

	Control Port 1		Control Port 2	
	W/O Fire	W/ Fire	W/O Fire	W/ Fire
A	255	239	127	111
B	254	238	126	110
C	246	230	118	102
D	247	231	119	103
E	245	229	117	101
F	253	237	125	109
G	249	233	121	105
H	251	235	123	107
J	250	234	122	106



Chase And Tag

"Chase and Tag" is a two-player game using simple keyboard graphics which illustrates the way the joystick ports are read. The object of the game is to score points by touching the opposing player while you are *it*, and to avoid the opposing player while he is *it*. The left player (controlled by the joystick in port 2) is *it* first. The computer keeps track of who is *it*, automatically switching after a point is scored, or after each player has made 100 moves without a tag, whichever comes first. When the player who is *it* catches the other player, a colorful explosion takes place. The game ends when one player scores 20 points.

Here's a breakdown of the program's organization:

Line 40 POKEs the screen border color to purple, the screen background color to light blue, the screen character color to white, erases all variables in memory, and branches to line 700.

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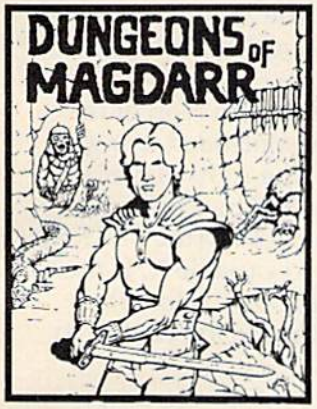

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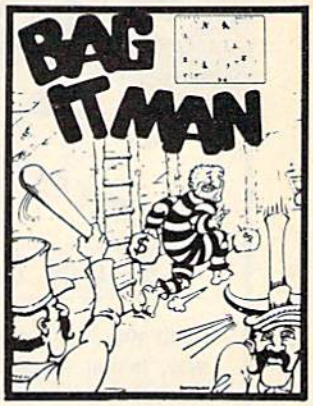

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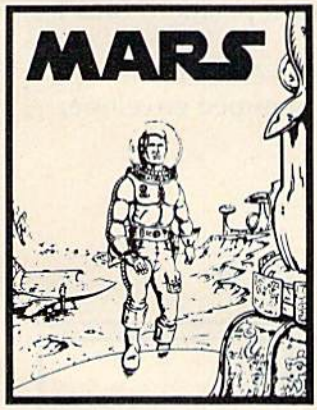

MARS - Your ship crashed on the Red Plane and you have to get home. You will have to explore a Martian City, repair your ship, and deal with possibly hostile aliens to get home again. This is recommended as a first Adventure. It is in no way simple - playing time normally runs from 30 to 50 hours, but it lets you try out Adventuring before you battle the really tough ones. Full Graphics Adventure.

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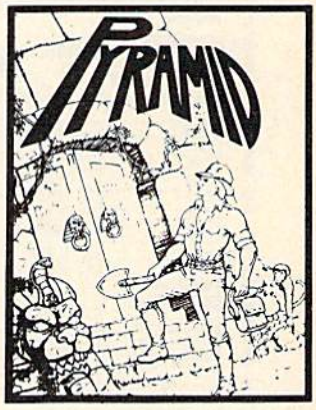

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Lines 700–810 allow the two players to print their initials on the screen above their scores. Values are assigned to several other variables used in the program.

Lines 900–1230 print the title of the game on the screen, draw the playing field, reset both scores to zero, and branch to line 55.

Lines 55–70 POKE the movement values into memory.

Lines 100–290 make up the main loop of the program. Player movement is controlled using the indirect address method. The right player's direction is determined in line 140 by PEEKing location 56321, adding a value 52000 to the PEEKed value and assigning the total to variable X. If the fire button is pressed, the value of X is less than 52245, so the program waits for the fire button to be released.

This trick can be used to confuse the other player so that you can change direction when you are about to be tagged. If the fire button is not pressed, the value 41 is subtracted from the value of X. The result is assigned to the variable M; this is the actual movement step.

For example, assume that the right player's first move will be up and to the left. Joystick position J (see the figure) will put the value 250 into register 56321. PEEKing at this register and adding 52000 to the result will give a value of 52250 to X. PEEKing location 52250 and subtracting 41 from the result (0) assigns the value of –41 to M. Since the move in this example will not take the player outside the border, lines 180 to 200 will allow the player to move to his new screen position: 1422 + (–41) = 1371.

For a copy of the program, send a blank tape or diskette, a self-addressed, stamped envelope, and $3 to:

Sterling N. Augustine
115½ Parkway
Schuylkill Haven, PA 17972

See program listing on page 156.

Print Sound For The VIC-20

Alejandro A. Kapauan

This utility translates letters into music. All you supply is a simple PRINT statement.

"Print Sound" is a machine language (ML) utility that enables you to produce musical tones on the VIC with simple PRINT statements. Using the program requires no knowledge of ML programming, although intermediate ML programmers may be interested in examining the code.

To use Print Sound, type in the BASIC program. Be very careful with the DATA statements, and SAVE the program before RUNning it. When you RUN the program, it prints a greeting, pauses, then plays a few notes. It then plays a short classical tune. If the program fails to work, or if the VIC locks up, LOAD your SAVEd copy of the program, LIST it, and check the DATA statements. Make the necessary corrections and again SAVE the program.

When you RUN the program successfully, VIC device 2 (normally the RS-232 port) is redefined, so that you can print strings of letters to it to play your own music.

Letters Equal Notes

If you examine the program, you will see that logical file 1, which is opened to send data to device 2, is not closed. After RUNning the program, type the command PRINT#1,"ABCDEFGHIJKLM" in the immediate mode. You will hear a chromatic scale. A chromatic scale is the series of 12 notes that are sounded when you play one octave of successive black and white keys on the piano, for example C, C#, D, D#, and so on to the next C. Printing a letter from A to Y will cause a note in the chromatic scale to be played. The letter Z is silent, and produces a rest. Experiment further by printing various alphabetic strings with the command PRINT#1,"string".

To incorporate the utility into your own programs, just include lines 500 to 640, and include a GOSUB630 at the beginning of your program.

The PRINT#1 commands are completed even before the VIC is finished playing all the notes. This is because the notes are placed in the 255 character buffer usually reserved for the RS-232 transmit channel, and an interrupt routine does the actual transfer of data to the VIC sound registers. To synchronize the notes with your program, you may examine the contents of location 983. This location contains the current number of notes in the buffer. Line 50 of the sample program illustrates how to do the synchronization. If you want to close the file to device 2 in your program, wait until the buffer is empty first. Most of the time you can just leave the file open.

The rate at which notes are played can be modified by changing the thirteenth number in line 570 (third from the end), which is normally a 10, to some other value. This number represents the duration of each note in jiffies (1/60 second). Try changing the value to a 5. You'll see how fast the VIC can play a tune.

Since the ML program resides in the cassette buffer, you can issue a NEW command and the utility will not disappear. It will function until you warm start the VIC by holding down the RUN/STOP key and hitting RESTORE. A word of warning for cassette users: You must not perform cassette operations with the utility in place. Warm start the VIC before doing a cassette LOAD or SAVE. Disk users do not have this problem.

See program listing on page 157.

Dan Carmichael, Assistant Editor

Sound On The VIC-20

This month we'll be discussing the fundamentals of sound on the VIC-20. We'll explore the VIC chip, and give you the basics of producing sound and music. So turn up the volume on your monitor and away we'll go.

Sound effects and music can add a lot to a computer program. Think how boring it would be to play a game like *Defender* if you couldn't hear the sounds of lasers blasting and enemy ships exploding. In business applications a "raspberry" sound can warn a user of bad input. Without a warning sound there would often be a potential for compounded errors.

You can communicate with the VIC chip inside your VIC-20 via memory locations 36864 to 36879. It is responsible for controlling the video and audio functions of your VIC. Specifically, memory locations 36874 to 36879 control sound, and by POKEing various values into these locations, you can produce almost infinite combinations of sounds and music on your VIC.

POKEing Values For Sound

The VIC has three separate tone generators, a white noise generator, and a volume control. Each tone generator covers a range of three octaves, but because they overlap, the three together produce a range of five octaves. Sounds are produced on the VIC by POKEing the volume control location and then POKEing any value between 128 and 255 into one of the four sound generators. For ease of reference, these tone generators are often called speakers.

POKEing values below 128 (0–127) into the tone generating locations will produce no sound. This technique can be used to turn off an individual tone generator without turning down the volume. The volume control affects all three tone generators and the white noise generator. You can set the volume to any value between 0 and 15, with 15 being maximum volume. Here's a chart of the memory locations that control sound, and what they do.

Location	Voice Number	Noise Generated	Poke Values	Tone Range
36874	1	tone	128–255	low
36875	2	tone	128–255	medium
36876	3	tone	128–255	high
36877	–	white noise	128–255	noise
36878	–	volume control	0–15	–

Now that you have the basic information, let's POKE around a little and produce some sounds on the VIC. Before we continue, make sure that the volume setting on your TV or monitor is up. If you're using a monitor, make sure that all of the audio connections are made properly.

Enter POKE 36878,15 then press RETURN. This will put the volume at the maximum setting, but you still don't hear anything. Simply turning on the volume doesn't produce sound. To do that, we have to POKE a value into one of the tone generators. Now enter POKE 36874, 128. You should hear a very low tone, the lowest note that can be achieved on the VIC. Why? It's the lowest because we POKEd the lowest legal value (128) into the lowest of the three tone generators (36874). If you POKE values lower than 128 into any of the four sound producing registers, no

sound will be produced. To demonstrate this, POKE 36874,127 with the low sound still on.

Now press RUN/STOP—RESTORE. Among other things, this resets the VIC chip, setting all of the sound registers and the volume control to zero.

Combining Sounds

When producing sound on the VIC, you are by no means limited to using one speaker at a time. To see how to combine sounds, we'll turn on one, two, then three of the speakers simultaneously.

First, let's turn on the volume by POKEing 36878,15. Now, let's turn on the speakers one at a time. POKE 36874,130 produces a very low tone by turning on the lowest speaker. POKE 36875, 175 turns on the second (middle range) speaker, and you should be able to hear both tones at the same time. Now we'll turn on the third or highest speaker by POKEing 36876, 240. This adds a very high tone to the other two.

You can produce some interesting sound effects by using all three speakers simultaneously. You can turn off all three at once by pressing RUN/STOP—RESTORE or by turning off the volume with a POKE 36878,0. When you POKE off the volume, the speaker registers still contain sound producing values, but they're not audible with the volume off.

When working with sound, you are not limited to producing monotones. The frequency (note value) of the sound can be varied along with the volume. Enter and RUN this program:

```
10 POKE36878,15
20 FORA=128TO254:POKE36876,A:NEXT
30 FORA=254TO127STEP-1:POKE36876,A:NEXT
```

Unlike the other three speakers which produce musical tones, the white noise generator produces a hissing sound. For a demonstration, POKE 36878,15:POKE 36877,240. You hear a high-pitched hissing sound. This is known as *white noise*. The white noise speaker operates under the same rules as the other three speakers (turn on volume POKE values between 128 and 255, etc.). The noise speaker can be used to produce sounds such as an explosion or the thrust of a jet plane taking off. Here's a quick demonstration of an explosion:

```
5 POKE36878,15
10 FORA=254TO210STEP-1:POKE36876,A:FORT=1
   TO20:NEXTT:NEXTA
30 POKE36876,0
40 POKE36877,150:FORT=1TO500:NEXTT
50 FORA=15TO0STEP-1:POKE36878,A:FORT=1TO1
   50:NEXTT:NEXTA
```

Now that you have the basics, let's type in a few small sound demonstration programs and see what the VIC can do. On pages 136 through 138 of *Personal Computing on the VIC-20* (the instruction book that came with your VIC), you'll find many sound demo programs. A few of them—like #10: birds chirping, #9: phone ringing, and #12: ocean waves—are especially good. Studying the techniques used in these demonstration programs will teach you a lot about sound on the VIC.

Programming Musical Notes

When you tire of the sounds of exploding spaceships, you can use the VIC to play tunes. Here is a chart of musical notes, and the values you need to POKE to produce them:

C	131		G	214	
C#	140		G#	216	
D	145		A	218	219
D#	151		A#	220	221
E	158		B	222	223
F	161	162	C	224	
F#	166	167	C#	226	
G	173	174	D	227	228
G#	178		D#	229	
A	181	182	E	231	
A#	185	186	F	232	
B	189	190	F#	233	
C	192	193	G	234	
C#	197		G#	235	
D	200		A	236	
D#	203		A#	237	
E	206	207	B	238	
F	208	209	C	239	
F#	211	212	C#	240	

You'll notice that although a few of the notes have one value listed, the majority need two. In some cases, to produce a more pleasant and musically accurate note on the VIC you have to merge two tones. For example, the first G on the chart is achieved by using the two values 173 and 174.

This is done by alternately POKEing a speaker with two different values. For instance, to produce this G you would first POKE in the volume, then POKE the speaker with a value of 173, then a 174, a 173, and so on. This alternate beating of two notes in one speaker serves to correct notes that are slightly sharp or flat.

Here's a recognizable tune to show you how it's done:

```
10 POKE36878,15:S3=36876
20 READA,B,T:IFA=999THENPOKE36878,0:END
30 FORZ=1TOT
40 POKES3,A:POKES3,B:NEXT
50 GOTO20
60 DATA 224,224,100,239,240,50,218,219,50
70 DATA 214,214,50,206,207,50,214,214,150
80 DATA 200,200,150,999,999,999
```

Although the tune might be rather simple, study the programming techniques involved. In this program, both the value (frequency) of the notes

and the length of time the notes are played are READ via DATA statements. During each program cycle three values (A, B, and T) are READ. The note values (A and B) are POKEd into the speaker (S3=36876), and the time delay value (T) is used in the FOR/NEXT time delay loop. The program stops as soon as it reads a value of 999.

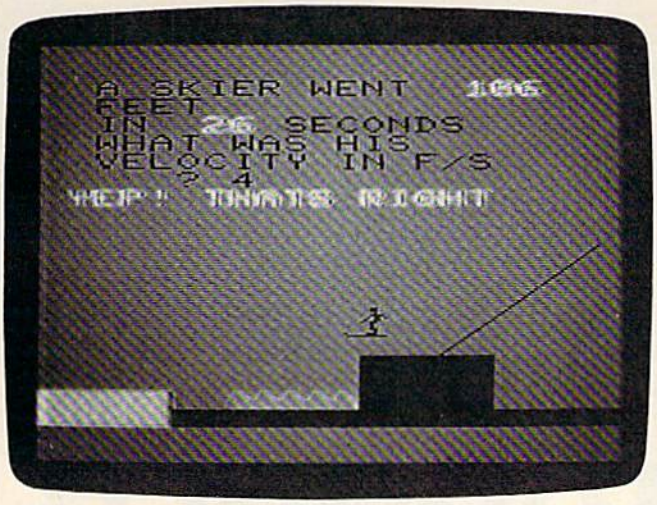
Programming Hints

To save yourself some programming time as well as BASIC memory, set your speaker and volume registers as variables at the beginning of the program. For example:

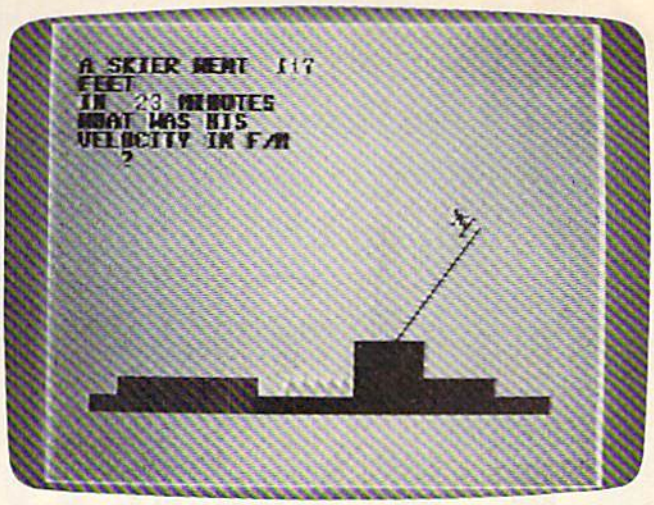
```
10 S1=36874:S2=36875:S3=36876:S4=36877:V=36878
```

In this example, the variables S1 through S4 stand for speakers one through four, and V is the volume. After setting the registers as variables, referencing them in the body of the program is easy. For example, to turn on the volume, POKE V,15, or to POKE a value into one of the speakers, POKE S2,200. This not only saves programming memory, but also simplifies the program logic.

Although the VIC-20 does not have the sophisticated SID (sound interface device) like the 64, it can produce a myriad of sounds. With these techniques in mind you can add sound to that program you're writing, or even compose a symphony.



In the VIC version, a successful ski jump in progress after a correct answer.



The skier's fate hangs in the balance in the 64 version.

Ski Physics

Gerald and Betty Schueler

"Ski Physics" is an educational game that teaches the relationship between velocity, distance, and time. If you answer questions correctly, you can watch the skier make a perfect jump. If your answer is wrong, the ski jumper lands in a bale of hay. For the VIC-20 or Commodore 64.

"Ski Physics" begins by printing short definitions of time, velocity, and distance. The computer then randomly selects a word problem involving the three concepts. You solve the problem, enter the answer, and press RETURN. If the answer is correct, the ski jumper lands safely on a platform. But if you are wrong, the skier falls short and lands in a pile of hay.

You might want to have paper and pencil (or a calculator) handy; some questions require more effort than others. You should enter only numbers for your answer—not the units such as feet, seconds, miles per hour, etc. You can also ignore remainders in the division problems. The computer expects answers that are integers.

How The VIC Version Works

Program 1 plays the opening music, sets up the custom characters in a protected area of memory, and prints the instructions. It then automatically loads Program 2.

In Program 2, line 255 selects four random numbers—A represents the units for each problem (feet, minutes, etc.), B stands for one of three word problems, and variables X and Y are the numbers used in the problems.

Lines 290-300 print the background scene, using the redefined characters from the first program.

Line 315 accepts the player's input (answer). The program jumps to line 360 if the answer is correct; the skier makes a successful jump. If the answer is wrong, the skier fails. The process is then repeated with a new question.

The Commodore 64 version is similar in operation.

Typing In Ski Physics

If you have a VIC-20 with a tape drive, type in Program 1, SAVE, and VERIFY it. Then type NEW (or turn the computer off and then on again). Enter Program 2 and SAVE it immediately after Program 1. To use Ski Physics, RUN Program 1. After it has set up the custom characters, it will automatically load Program 2.

If you have a VIC and a disk drive, enter and SAVE both programs. Before the first program loads the second, you will be asked if you are using tape or disk.

Commodore 64 owners should simply type in Program 3, SAVE it, and RUN.

See program listings on page 157.

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NEWS & PRODUCTS

64 Music System

With *Studio 64*, a music operating system developed by Entech for the Commodore 64, you can compose music and add your compositions to any other program.

The system operates like a music word processor. Notes are written just as they are played, and they scroll across the screen for easy reading. *Studio 64* requires no programming experience. And it teaches the relationship between how music looks and how it sounds.

Add Mus'in, the operating system package of *Studio 64*, adds your compositions to any other program. Simple commands are used. For example, the command "MUSIC" will start the music, "SONG" will start a particular song, "SPEED" will set the tempo, and "FEEL" will change the duration and tempo of the notes.

The *Studio 64* package is available on disk or cassette for $39.95.

Entech Software
P.O. Box 881
Sun Valley, CA 91353
(213) 768-6646

SAT English And Math Aids

SAT English I and *SAT Math I*, Scholastic Aptitude Test preparation aids, have been introduced by Micro Lab for the Commodore 64.

The packages are a part of the company's Micro Learn line of educational products, and include test preparation questions and information designed to aid students who plan to take the SAT test.

The products cost $30 each.

Micro Lab
2699 Skokie Valley Road
Highland Park, IL 60035
(312) 433-7550

Games And Word Processing Programs

Brøderbund Software has released a game for the VIC-20 and two games and a word processing program for the 64.

Lode Runner is a cartridge game for the VIC-20. In *Lode Runner*, you are a galactic commando fighting your way through 24 different game screens, picking up chests of gold hidden in the Bungeling Empire's secret underground treasury. The VIC version also allows you to design screens.

The game has a suggested retail price of $34.95 and requires a joystick.

Operation Whirlwind and *Matchboxes* are two new games for the Commodore 64. The first is a war game which incorporates a chesslike strategy approach as you move your battalion through a series of testing skirmishes and battle actions. *Whirlwind* is priced at $39.95 on disk and comes with a battle map and user manual.

Matchboxes is a memory game in which the player attempts to match identical squares. It has additional modes in which players solve word puzzles and create their own puzzles. It is available for $29.95 on disk.

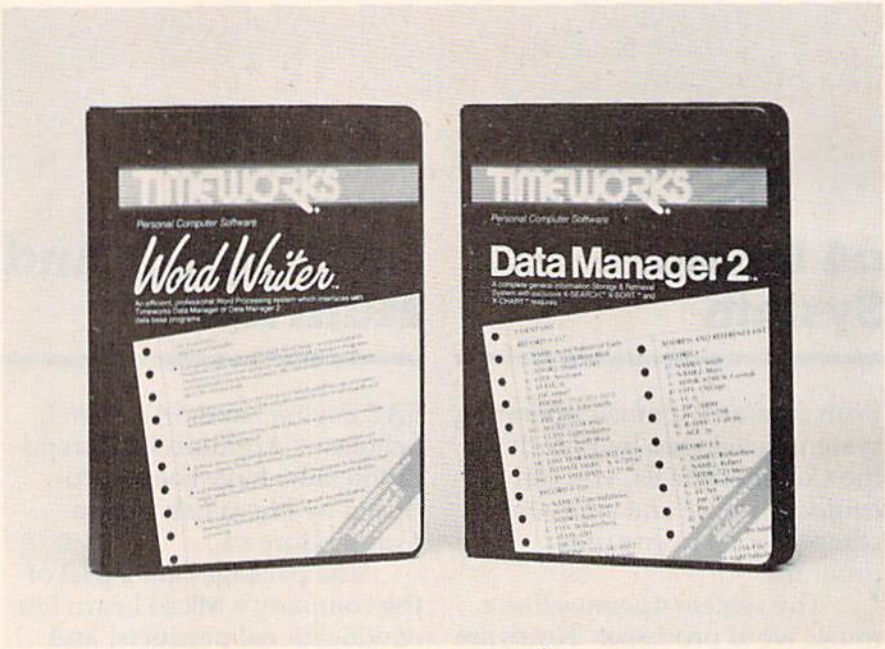
Bank Street Writer is a word processing program now available for the Commodore 64 on disk. Functions and commands are displayed at the top of the screen so that you don't have to memorize function codes.

Features include universal

search and replace, block move and "unmove," automatic centering and indentation, word wrap, a print format routine, and other capabilities. *Bank Street Writer* comes with a tutorial on the disk that teaches word processing basics. A reference manual and back-up disk are included.

The price for *Bank Street Writer* is $69.95.

Bróderbund Software, Inc.
17 Paul Drive
San Rafael, CA 94903
(415) 479-1170



Word Writer *and* Data Manager 2 *from Timeworks.*

Tax, Data, Writing Programs

Timeworks, Inc., has introduced several new packages for the Commodore 64, plus a cassette-to-disk conversion plan.

Swiftax is a menu-driven program that enables the user to prepare annual income tax returns without prior knowledge of computers or accounting. The program guides the user through the tax preparation process, gives instructions on which forms should be completed, and automatically checks tax alternatives such as income averaging.

It prints tax information on each IRS schedule and form, and makes itemized statements for lists of dividends, interests, and other categories that are too long for standard forms.

The suggested retail price for *Swiftax*, which is available on disk, is $49.95.

Word Writer is a word processing package which can be used by itself or interfaced with Timeworks' *Data Manager* or new *Data Manager 2* programs.

The packages allow you to maintain and print out name and address lists, produce customized reports up to 20 columns wide, individually address and print form letters, print name and address files onto standard mailing labels, transfer and print text information onto labels and

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tags, and calculate numerical data from one column to the next.

The *Word Writer* has a full-screen format, with up to 80 characters per line. Two plastic keyboard overlays are included which place the word processing commands directly onto the keyboard. The program has full word processing features such as automatic search and replace, text block movement, automatic word wrap and page numbering, and other standard capabilities.

The *Word Writer* is priced at $59.95 and is available on disk.

Data Manager 2 is a menu-driven information storage package with cross-search features. The program allows you to break down data in a variety of ways and to arrange data alphabetically, chronologically, or numerically. Automatic calculation of mathematical data allows you to perform payroll functions, cost estimates, and similar operations.

Data Manager 2 is priced at $49.95 on disk.

Timeworks is offering an option that will allow Commodore 64 users to convert Timeworks' programs on cassette tape to disk for a charge of $4 (plus $.70 postage and handling). Tapes that are returned must be in good playable condition and be an original program published by the company. Timeworks will then send back a disk version of the program. The disk exchange is for the same program as the one being returned.

Timeworks, Inc.
405 Lake Cook Road
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(312) 291-9200

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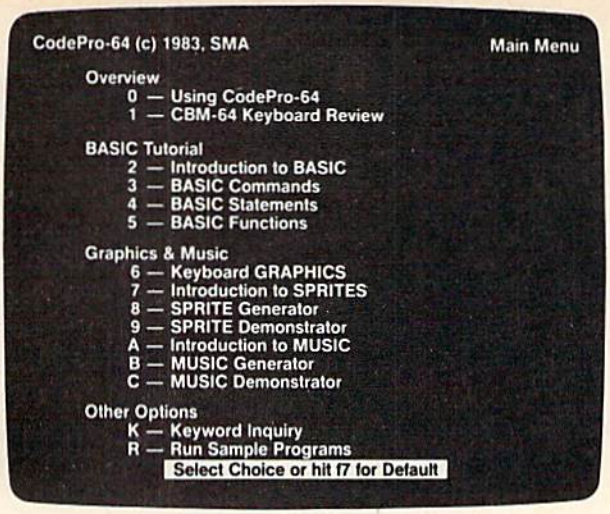

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CodePro-64's extensive tutorial guides you through each BASIC command, program statement, and function. You get clear explanations. Where appropriate, you invoke BasicView to see examples execute and watch their flow charts and variables change.

By seeing graphic displays of program segment execution you learn by visual example. You *learn faster and grasp programming concepts easier* with CodePro-64 because you immediately see the results of your input.

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CodePro-64's sprite generator lets you *define your own sprites* on the screen. You learn how to define sprites and what data values correspond to your sprite definitions. (You can then save your sprite data to a diskette file for use in your own programs.) You can *easily experiment* with different definitions and make changes to immediately see the effects.

We also help you learn to program with sprites by giving you a *sprite demonstrator* so you can see the effect of changing register values. You can experiment by moving your sprite around in a screen segment, change its color and see the effects of your changes. You learn by visual examples.

MUSIC GENERATOR & DEMONSTRATOR

Our *Music Generator* and *Music Demonstrator* will provide hours of instruction and creative enjoyment. From the beginning of your instruction you can *compose simple tunes* on the screen using the generator. Once you've completed a composition you can *save the tune* and its associated SID parameters to a diskette file. Our music sample program can be used alone or incorporated into your own programs to *read the saved music file* and replay your songs.

Our music demonstrator *lets you experiment* with various combinations of music programming parameters and hear the results. All you do is enter rows of SID parameters on the screen to create a particular sound. Then you *hear each sound by playing the "keyboard organ"* in real time as you shift from row to row of SID parameters. By seeing your input and hearing the result you quickly learn how to create new musical sounds and special sound effects.

Whether you're a beginning programmer or an experienced professional, CodePro-64 will help you improve you Commodore 64 programming skills. We're sure because CodePro-64 was developed by a team of two professionals with *over 25 years* of software development experience.

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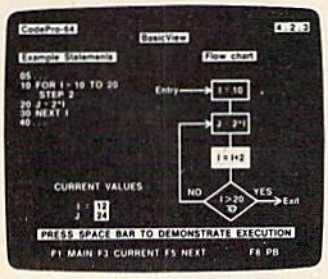

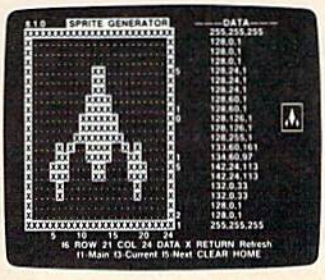

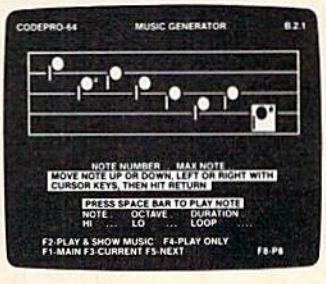

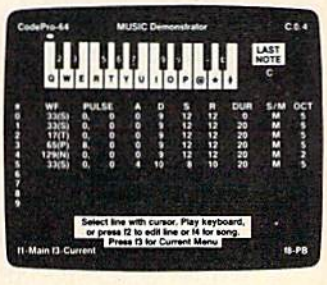

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TOTL.BUSINESS features a disk-based system and *CHICKSPEED*, machine-language routines for fast loading and disk access. The programs are menu-driven and work with any 80-column printer.

Suggested price for *TOTL.BUSINESS* is $95 for the 64 and $85 for the VIC-20. The VIC version requires a minimum of 24K expansion.

TOTL Software has also released *TOTL.SPELLER*, a companion to the company's word processing program, *TOTL.TEXT*. *TOTL.SPELLER* is a spelling checker with a built-in dictionary that checks and corrects the spelling of any document created with the *TOTL.TEXT* package.

Features include an automatic proofreading option which checks an entire document and flags possible errors, audible cues to facilitate unattended operation, compatibility with 80-column boards, disk utilities, and a fast-verify option which displays each suspect word for alteration or addition to the dictonary. The program has a starter dictionary of more than 10,000 words which can be expanded by the user to up to 24,000 words.

The price of *TOTL.SPELLER* is $35 on disk.

TOTL Software, Inc.
1555 Third Avenue
Walnut Creek, CA 94596
(415) 943-7877

Word Processor For 64

Mirage Concepts, Inc., has introduced *Word Processor* for the Commodore 64 computer. Written in machine language, this word processing program allows 80-column screen display without additional hardware.

There are more than 70 available single-keystroke commands; printed page, line, and character counters; word wrap; search, replace, block, and column operations; and a 200-page documentation binder.

Word Processor is available for $99.95.

Mirage Concepts, Inc.
2519 W. Shaw Ave. #106
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16K Memory Plus with battery backup is an expansion device for the VIC-20 which can retain data and programs for up to four weeks in the event of power loss.

Produced by Abaris, Inc., the memory device contains full block switching, reset switch, built-in edgecard receptacle, and write-protect switch. The battery backup retains the programs. Once a program is loaded into memory, the *16K Memory Plus* can be removed and plugged into another VIC-20. Custom routines can be retained in block five memory and will be executed when the computer is turned on.

The price for the *16K Memory Plus* is $89, plus a $3 shipping and handling charge.

Abaris, Inc.
P.O. Box 2501
Vancouver, WA 98668
(206) 694-3455

Educational Game For VIC

PMI, Inc., has introduced a new educational game for the VIC-20 on tape or disk called *Animated Arithmetic* for young children and pupils in remedial classes.

The game teaches addition using color graphics. Users don't need to be able to read. Included in the package are two programs, *Clown Count* and *Addition Express*.

Clown Count teaches children to count by asking them to add the number of boxes the clown is holding. If the answer is correct, the clown juggles the boxes. *Addition Express* teaches addition using express trains traveling along number lines. If the answer is correct, the engine puffs out smoke.

The price for *Animated Arithmetic* is $10.95.

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CodePro-64 is a BASIC tutorial with sprite and music programming instruction for the Commodore 64.

Commodore 64 Tutorial Package

Systems Management Associates has introduced *CodePro-64*, an integrated software tutorial package for the Commodore 64.

CodePro-64 combines 12 instructional topics into one menu-driven system of 16 programs. This BASIC tutorial features instruction on commands, statements, and functions with visual examples. It covers the programming of sprites and music, and provides demonstration programs.

The tutorial is available on two disks, for $59.95, and includes a 140-page reference manual.

Systems Management Associates
3700 Computer Drive
Raleigh, NC 27609
(919) 787-7703

64 Spelling Tutorial

The Spelling Teacher is an educational spelling tutorial program for the Commodore 64 with disk drive.

The program contains four word files at different levels with 100 words per file. Twenty-five words are presented during each spelling session. Words that are misspelled reappear automatically during the next session.

Parents have the option of adding or deleting words. A graphics bar chart displays the last ten scores, and there is one bar chart for each of the word files.

The Spelling Teacher is available for $39.95.

Computer Technology Company
Computech
P.O. Box 7000-309
Redondo Beach, CA 90277
(213) 375-6391

Pro Football On Tape

CMS Software has introduced *Professional Football* on cassette tape for the VIC-20 with 16K or for the Commodore 64.

This strategy game pits the player against the offensive or defensive play-calling of the computer. There are 11 offensive play selections (plus punts and field goals), 11 defensive alignments, full-feature scoreboard, sudden-death overtime for tied games, and a user manual.

The computer selects its own offensive and defensive plays based on down, distance, field position, time remaining, and score. Full statistics are given at half-time and at the end of the game.

The game is available on tape for $16.95 (postage paid).

CMS Software
P.O. Box 4876
Topeka, KS 66604–0876
(913) 267-5864

Games For Commodore 64

Synapse Software has released six of its games for the Commodore 64 computer.

Necromancer is an action game in which you have the power to liberate humanity in a world where evil reigns supreme. *Shamus Case II* is a detective adventure game involving 38 rooms to be searched. *Pharaoh's Curse*, a game with three levels of play and 16 screens, pits you against an evil mummy and the ghost of Rana.

In *Zeppelin*, you maneuver an airship through 250 rooms of an underground cavern. *Picnic Paranoia* is played in a series of 90-second rounds in which you kill invading ants while keeping your food from being pushed off the screen.

Blue Max uses a 3-D diagonal scrolling effect to put you in the open cockpit of a British World War I biplane. After bombing enemy targets, you must land, refuel, and prepare to take off again.

All of the games are available on tape and on disk for $34.95 each.

Synapse Software
5221 Central Avenue
Richmond, CA 94804
(415) 527-7751

COMPUTE!'s GAZETTE *welcomes announcements of new products for VIC-20 and Commodore 64 computers, especially products aimed at beginning to intermediate users. Please send press releases and photos well in advance to: Tony Roberts, Assistant Managing Editor,* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

New product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

Bug-Swatter:
Modifications And Corrections

• The VIC version of "Trenchfire" (March) contains incorrect instructions. Trenchfire was written to run on an unexpanded VIC, but must be entered using Tiny MLX (also in that issue, p. 165) and an 8K (or more) expander. When expansion memory is added, the VIC automatically moves screen memory and start-of-BASIC. The instructions in step one (POKE44,24:POKE24*256,0:NEW) will move start-of-BASIC, but leave screen memory at 4096–4608. As a result, the machine language at 4352–4608 can become garbled by the screen (at the same locations). The correct instructions should be:

Insert the 8K expander, turn on your VIC and enter this line:

```
POKE648,24:SYS58648:POKE642,26:SYS58232
```

Readers who have already typed in the VIC version of Trenchfire do not have to retype the whole program to fix it. To create a patch, follow the instructions above, LOAD Tiny MLX and use a starting address (S) of 4352 and ending address (E) of 4610. Enter the first 43 lines and SAVE to tape or disk. To RUN the game, turn off your VIC, unplug the memory expansion, and turn it back on. Tape users can now LOAD "TRENCHFIRE",1,1 followed by LOAD "PATCH",1,1. If you have a disk drive, substitute ,8,1. You can then start the game with SYS 4352.

• The VIC version of "Typing Derby" (February) fits very snugly into memory, with only a dozen bytes to spare. Readers who encounter an OUT OF MEMORY error should remove any extraneous spaces. Also, the process of crunching the program into memory required the removal of certain lines. Line 100 targets such a line and should be changed to 100 IFPEEK(H1+M+1)<>32THEN16.

• "Space Duel" (December) runs as listed, but gives an unfair advantage to player 2, who gets ten points per hit. Player 1 receives only nine points. To temporarily fix the program, POKE 49664,11 after you LOAD Space Duel, but *before* you SYS 49152. Use MLX's Load, New Address, and Save commands to make a permanent correction. The correction in MLX format is: 49662 003, 105, 011, 141, 078, 003, 083.

• Due to the mechanics of the INTeger function, the final program in "Printing Tables" (page 127, March) will add –1 to negative numbers. Thanks to readers Evie Matheus and H. Flaschka for discovering our mistake. INT rounds a number down to the nearest integer. INT(–77.22) gives a result of –78. To fix this, use ABS and SGN in lines 22–24.

```
22 I$=LEFT$(STR$(SGN(I)),1)+STR$(INT(ABS(
   I)))+"."+RIGHT$(STR$(I*100),2)
24 J$=LEFT$(STR$(SGN(I)),1)+STR$(INT(ABS(
   I)))+"."+RIGHT$(STR$(I*100),2)
```

A simpler method is to add 1 to all negative numbers, to offset the 1 that is subtracted.

```
21 IFI<0THENI=I+1
23 IFJ<0THENJ=J+1
```

The disadvantage to this simpler method is that you cannot use the negative numbers in later calculations because they will be off by 1.

• The 64 version of "Speed Reader" (February) contains a typographical error. Line 640 should be DATA "TO CORRECTING OUR BAD HABITS, BUT THE".

• As noted in February Bugswatter, before entering "64 BASIC Aid" (January), you must POKE52,154: POKE56,154: CLR before you load or run MLX. In addition, MLX will not allow an ending address higher than 40960; use 40959 instead of 40961.

Finally, because it is a machine language program, it must be LOADed to the section of memory it was written for. To do this, use a secondary address of 1 (LOAD "BASIC AID",8,1 for disk, LOAD "BASIC AID",1,1 for tape). After the program is loaded, type NEW (to reset the BASIC pointers) and SYS39852 to begin the program.

• Some readers have reported ?SYNTAX ERRORs in lines 770 and 860 of MLX (January, February, and March). These lines are fine with the spaces properly inserted (ST AND191). Without the spaces, STAND is interpreted as the TANgent function.

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.

Replace Original Proofreader

If you typed in the original version of the Proofreader (October 1983 issue), you should replace it with the improved version below. We added a POKE to the original version to protect it from being erased when you LOAD another program from tape. The POKE does protect the Proofreader, and the Proofreader itself was not affected. However, a quirk in the VIC-20's operating system means that programs typed in with the Proofreader and SAVEd on tape cannot be LOADed properly later. If you LOAD a program SAVEd while the Proofreader was in memory, you see ?LOAD ERROR. This applies only to VIC tape SAVEs (disk SAVEs work OK, and the quirk was fixed in the Commodore 64).

If you have a program typed in with the original Proofreader and SAVEd on tape, follow this special LOAD procedure:

1. Turn the power off, then on.

2. LOAD the program from tape (disregard the ?LOAD ERROR).

3. Enter: POKE 45,PEEK(174):POKE 46,PEEK(175):CLR

4. ReSAVE the program to tape.

The program will LOAD fine in the future. We strongly recommend that you type in the new version of the Proofreader and discard the old one.

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
```

A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in COMPUTE!'s GAZETTE for Commodore are written in a computer language called BASIC. BASIC is easy to learn and is built into all VIC-20s and Commodore 64s.

BASIC Programs

Each month, COMPUTE!'s GAZETTE for Commodore publishes programs for both the VIC and 64. To start out, type in only programs written for your machine, e.g., "VIC Version" if you have a VIC-20. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from another computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as O for the numeral 0, a lowercase l for the numeral 1, or an uppercase B for the numeral 8. Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Braces And Special Characters

The exception to this typing rule is when you see the braces, such as "{DOWN}". Anything within a set of braces is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to "How To Type In *COMPUTE!'s GAZETTE* Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard and STOP key may seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, *so always SAVE a copy of your program before you RUN it*. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1. Type in the program a line at a time, in order. Press RETURN at the end of each line. Use backspace or the back arrow to correct mistakes.

2. Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3. Make sure you've entered statements in braces as the appropriate control key (see "How To Type *COMPUTE!'s GAZETTE* Programs" elsewhere in the magazine).

We regret that we are not able to respond to individual inquiries about programs, products, or services appearing in COMPUTE!'s GAZETTE *for Commodore due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear in the magazine, usually within eight weeks. If you have specific questions about items or programs which you've seen in* COMPUTE!'s GAZETTE *for Commodore, please send them to Gazette Feedback, P.O. Box 5406, Greensboro, NC 27403.*

How To Type In COMPUTE!'s GAZETTE Programs

Many of the programs which are listed in COMPUTE!'s GAZETTE contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to know exactly what to type when entering one of these programs into your computer, we have established the following listing conventions.

Generally, any VIC-20 or Commodore 64 program listings will contain words within braces which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. This would appear on your screen as a "heart" symbol. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's).

If a key is enclosed in special brackets, [ ], you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as necessary.

Rarely, you'll see a solitary letter of the alphabet enclosed in braces. These characters can be entered on the Commodore 64 by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A. You should never have to enter such a character on the VIC-20, but if you do, you would have to leave the quote mode (press RETURN and cursor back up to the position where the control character should go), press CTRL-9 (RVS ON), the letter in braces, and then CTRL-0 (RVS OFF).

About the *quote mode*: You know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following table when entering cursor and color control keys:

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	
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
[1]	C= + 1	
[2]	C= + 2	
[3]	C= + 3	
[4]	C= + 4	
[5]	C= + 5	
[6]	C= + 6	
[7]	C= + 7	
[8]	C= + 8	
{F1}	f1	
{F2}	SHIFT + f1	
{F3}	f3	
{F4}	SHIFT + f3	
{F5}	f5	
{F6}	SHIFT + f5	
{F7}	f7	
{F8}	SHIFT + f7	

SpeedScript Revisited

(Article on page 38.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

File Converter

```
100 PRINT"{CLR}{RVS}{N}{2 SPACES}SPEEDSCR
    IPT FILE CONVERSION PROGRAM{3 SPACES}
    "                                  :rem 25
110 GOSUB410                           :rem 167
120 INPUT"{DOWN}INPUT FILE NAME";I$
                                       :rem 113
130 IFI$=""THEN120                     :rem 211
140 INPUT"{DOWN}OUTPUT FILE NAME";O$
                                       :rem 218
150 PRINT"{DOWN}{RVS}D{OFF}ISK, {RVS}S
    {OFF}CREEN, {RVS}P{OFF}RINTER, {RVS}O
    {OFF}THER"                         :rem 29
160 GETA$:IFA$=""THEN160               :rem 81
170 DV=-(A$="T")-3*(A$="S")-4*(A$="P")-8*
    (A$="D"):SA=7                      :rem 153
180 IFDV=0THENINPUT"DEVICE NUMBER";DV:INP
    UT"SECONDARY ADDRESS";SA           :rem 11
190 PRINT"{2 DOWN}WHICH CONVERSION:"
                                       :rem 192
200 PRINT"{DOWN}1) SPEEDSCRIPT TO COMMODO
    RE ASCII"                          :rem 197
210 PRINT"{DOWN}2) SPEEDSCRIPT TO TRUE AS
    CII"                               :rem 98
220 PRINT"{DOWN}3) COMMODORE ASCII TO SPE
    EDSCRIPT"                          :rem 201
230 GETP$:IFP$<"1"ORP$>"3"THEN230:rem 101
240 ADR=828+VAL(P$)*3-3                :rem 220
250 OPEN15,8,15,"I0":REM REMOVE ,"I0" IF
    {SPACE}YOU'VE CHANGED THE DRIVE'S SPE
    ED                                 :rem 97
260 OPEN1,8,3,I$:INPUT#15,EN,EM$:F$=I$:IF
    EN=0THEN290                        :rem 44
270 PRINT"{DOWN}DISK ERROR FOR ";F$:PRINT
    EM$                                :rem 185
280 PRINT"{3 DOWN}RUN{3 UP}":CLOSE1:CLOSE
    2:CLOSE15:END                      :rem 48
290 IFDV<>8THENOPEN2,DV,SA,O$:GOTO380
                                       :rem 60
300 EX$=",S,W":IFP$="3"THENEX$=",P,W"
                                       :rem 56
310 OPEN2,DV,SA,"0:"+O$+EX$:INPUT#15,EN,E
    M$:F$=O$                           :rem 42
320 IFEN=0THEN380                      :rem 238
330 IFEN<>63THEN270                    :rem 99
340 IFEN=63THENPRINT"{DOWN}";O$;" EXISTS.
    .. REPLACE? {RVS}Y{OFF}/{RVS}N{OFF}:"
                                       :rem 26
350 GETA$:IFA$<>"Y"ANDA$<>"N"THEN350
                                       :rem 45
360 IFA$="N"THEN270                    :rem 36
370 PRINT#15,"S0:"+O$:CLOSE2:GOTO310
                                       :rem 100
380 SYS(ADR):IF(PEEK(144)AND64)THENPRINT"
    {DOWN}DONE.":GOTO280               :rem 26
390 PRINT"I/O ERROR DURING CONVERSION.":I
    NPUT#15,EN,EM$:IFEN<>0THEN270:rem 253
400 GOTO280                            :rem 103
410 FORI=828TO1001:READA:POKEI,A:CK=CK+A:
    NEXT:IFCK=21584THENRETURN          :rem 222
420 PRINT"{RVS}ERROR IN DATA STATEMENTS."
    :END                               :rem 251
430 DATA 076,069,003,076,122,003       :rem 33
440 DATA 076,174,003,032,225,255       :rem 36
450 DATA 240,018,032,216,003,032       :rem 20
460 DATA 095,003,032,183,255,072       :rem 39
470 DATA 032,224,003,104,041,064       :rem 21
480 DATA 240,233,076,204,255,133       :rem 38
490 DATA 251,041,064,010,005,251       :rem 24
500 DATA 041,191,133,251,041,032       :rem 20
510 DATA 073,032,010,005,251,201       :rem 12
520 DATA 095,208,002,169,013,133       :rem 34
530 DATA 251,096,032,225,255,240       :rem 37
540 DATA 221,032,216,003,032,095       :rem 24
550 DATA 003,041,127,201,065,144       :rem 25
560 DATA 018,201,091,176,014,170       :rem 34
570 DATA 165,251,041,128,073,128       :rem 43
580 DATA 074,074,133,251,138,005       :rem 41
590 DATA 251,133,251,032,183,255       :rem 40
600 DATA 072,032,224,003,104,041       :rem 15
610 DATA 064,240,207,076,204,255       :rem 37
620 DATA 032,225,255,240,169,032       :rem 35
630 DATA 216,003,201,013,208,002       :rem 14
640 DATA 169,031,072,041,128,074       :rem 40
650 DATA 133,251,104,041,063,005       :rem 24
660 DATA 251,133,251,032,183,255       :rem 38
670 DATA 072,032,224,003,104,041       :rem 22
680 DATA 064,240,217,076,204,255       :rem 45
690 DATA 162,001,032,198,255,076       :rem 47
700 DATA 207,255,162,002,032,201       :rem 21
710 DATA 255,165,251,076,210,255       :rem 42
```

Props

(Article on page 50.)

```
1 GOSUB1000:GOSUB80:GOSUB50:SYS49152
                                       :rem 241
2 POKEW1,17:SYS49408:C=PEEK(CX):IFCTHEND=
  PEEK(SP+A(C)):GOSUB10                :rem 122
3 IFPEEK(HM)THENGOSUB20                :rem 222
4 FORJ=RTO20-DL:NEXT:BZ=BZ+R:IFBZ=MXTHENB
  Z=.:GOSUB50                          :rem 247
5 IFSK>NTHENGOSUB7                     :rem 212
6 POKEH1,(PEEK(251)/5+9):POKEW1,16:GOTO2
                                       :rem 90
7 KL=KL+R:IFKL>NTHENKL=.:POKEFAST,INT(RND
  (R)*M):POKE845,(.)                   :rem 238
8 IFRND(R)>PTHENPOKEFAST,V:POKE845,(.)
                                       :rem 159
9 RETURN                               :rem 25
10 POKEBD,2:FORJ=RTO40:POKESP+A(C),D:POKE
   W1,129:SYS49608:POKEW1,128:NEXT:rem 31
11 SC=SC-SK:IFSC<RTHENSC=.             :rem 179
12 POKEBD,.:POKECX,.:RETURN            :rem 234
13 REM LINES 7-9 = 'VARY SPEED' RTN
                                       :rem 146
14 REM LINES 10-12 = 'HIT PROP' RTN
                                       :rem 90
20 REM*** 'HOME'                       :rem 59
21 SC=SC+SK+3:IFSC>199THENGOSUB70:GOSUB80
                                       :rem 107
22 POKESP+21,0:PRINTSC$"{6}SCORE:"SC
                                       :rem 202
23 FORJ=100TO1STEP-2:SYS49608:POKEW1,21:P
   OKEH1,J:POKEW1,20:NEXT              :rem 231
24 PRINTSC$"{13 SPACES}":POKEHM,0:POKECX,
   0                                   :rem 171
50 REM*** 'NEW COOP'                   :rem 48
```

```
51 POKESP+21,0:POKEW3,21:POKEH3,PEEK(251)
   :PRINTSC$"{YEL}NEW COOP":PRINT"{HOME}
   {6}";                                :rem 50
52 FORJ=1TO24:PRINT"{RIGHT}Z{36 RIGHT}Z":
   NEXT                                 :rem 120
53 PRINT"{RIGHT}Z{36 RIGHT}Z{HOME}":POKEW
   1,16:POKEW3,20                       :rem 54
54 IFHF=0THENHF=1:GOTO58                :rem 254
55 HF=0:J=1062:FS=40*(INT(RND(1)*25))
                                        :rem 17
56 HI=INT((FS+J)/256):LO=(FS+J)-(HI*256):
   POKE843,LO:POKE844,HI                :rem 124
57 SYS49615:POKEJ+FS+L1,10:PRINTSC$"
   {10 SPACES}":POKESP+21,255:GOSUB100:RE
   TURN                                 :rem 172
58 J=1025:FS=40*(INT(RND(1)*25))        :rem 222
59 HI=INT((FS+J)/256):LO=(FS+J)-(HI*256):
   POKE843,LO:POKE844,HI                :rem 127
60 SYS49615:POKEJ+FS+L1,10:PRINTSC$"
   {10 SPACES}":POKESP+21,255:GOSUB100:RE
   TURN                                 :rem 166
70 REM** NEXT LEVEL                     :rem 86
71 PRINTCHR$(142):FORJ=1TO500:NEXT:PRINTC
   HR$(14):POKESP+21,0:POKEW2,21        :rem 93
72 POKEW1,20:POKEFV,3 :FORK=5TO115STEP2:P
   OKEW3,21:POKEBD,K:POKE646,K          :rem 0
73 POKEH1,K*1.4:PRINTSC$"NEXT LEVEL?":POK
   EH3,K/4:SYS49608:POKEW3,20:NEXT
                                        :rem 253
74 POKEW1,20:POKEFV,66:FORJ=1TO3500:NEXT:
   POKEH3,100:POKEBD,0:POKEW2,129:RETURN
                                        :rem 202
80 REM*** PICK SKILL LEVEL              :rem 232
81 POKESP+21,0:POKEFNA(0),32:KZ=0:rem 193
82 PRINTSC$"{YEL}{3 LEFT}PICK SKILL LEVEL
   "                                    :rem 136
83 PRINTSC$"{8}{2 DOWN}{RIGHT}(1 - 6)"
                                        :rem 181
84 GOSUB200                             :rem 126
85 IFKZ<>1THENSYS49608:GOTO84           :rem 100
86 PRINTSC$"{3 LEFT}{16 SPACES}"        :rem 208
87 PRINTSC$"{2 DOWN}{11 SPACES}"        :rem 28
88 SC=0:RETURN                          :rem 141
100 REM*** PAUSE ROUTINE                :rem 151
101 IFFNB(.)THENRETURN                  :rem 133
102 POKEBD,13:PRINTSC$"{RVS}{YEL} PAUSING
     {OFF}"SC$"{8}{2 DOWN}SCORE:"SC
                                        :rem 253
103 PRINTSC$"{4 DOWN}FIRE=PLAY"SC$"
    {6 DOWN}ZERO=QUIT"                  :rem 32
104 FORJ=1TO1500:NEXT:POKEBD,0          :rem 97
105 SYS49608:S=S+1:IFINT(S/43)=S/43THENPO
    KEW3,20:POKEH3,PEEK(SP+1):POKEW3,21
                                        :rem 170
106 IFFNB(.)=.THEN110                   :rem 167
107 GOSUB200                            :rem 170
108 IFSK>5THENGOSUB7                    :rem 31
109 GOTO105                             :rem 105
110 PRINTSC$"{12 SPACES}"SC$"{2 DOWN}
    {10 SPACES}"SC$"{4 DOWN}{9 SPACES}"
                                        :rem 127
111 PRINTSC$"{6 DOWN}{9 SPACES}"        :rem 132
112 POKEW3,20:POKEBD,2:POKEBD,5:POKESP+31
    ,0:POKEBD,7:POKEBD,3:POKEBD,0:RETURN
                                        :rem 116
200 REM*** SKILL                        :rem 115
201 G=PEEK(197)                         :rem 46
203 IFG=35THEN300                       :rem 210
204 IFG=56THENSK=1:DL=1:POKEFAST,1:POKERO
    T,4:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 110
205 IFG=59THENSK=2:DL=5:POKEFAST,2:POKERO
    T,3:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 119
206 IFG=8THENSK=3:DL=10:POKEFAST,3:POKERO
    T,2:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 111
207 IFG=11THENSK=4:DL=15:POKEFAST,4:POKER
    OT,1:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 160
208 IFG=16THENSK=5:DL=19:POKEFAST,5:POKER
    OT,0:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 171
209 IFG=19THENSK=6:DL=19:POKEFAST,6:POKER
    OT,0:POKE829,0:POKE845,0:KZ=1:RETURN
                                        :rem 177
210 RETURN                              :rem 115
300 REM*** QUIT                         :rem 56
301 POKE49221,2:POKE49228,0:POKE829,0:POK
    E845,0:POKE646,7                    :rem 43
302 FORJ=SP+1TOSP+15STEP2:POKEJ,123:NEXT:
    POKE214,24:PRINT:FORJ=1TO24         :rem 112
303 PRINT:FORK=1TO20:NEXTK,J:POKEW3,20
                                        :rem 189
304 POKEW3,21:PRINTSC$"BYE BYE . . .":FOR
    J=1TO2400:NEXT:POKESP+21,0          :rem 159
305 FORJ=L1TOVM+3:POKEJ,0:NEXT:SYS64738
                                        :rem 244
1000 REM*** INITIALIZE                  :rem 21
1001 REM**ML RTNS: SPRITEMOVE=49152:BIRDM
     OVE=49408:FLAPWING=49608:PUTMATE=496
     15                                 :rem 182
1002 POKE54296,47:POKE54295,66 :POKE53272
     ,21:POKE53281,0:BD=53280:POKEBD,0
                                        :rem 170
1004 GOSUB10000:GOSUB12000:FAST=49221:ROT
     =49228:R=1:N=5:M=7:P=(.98):V=28:MX=2
     00                                 :rem 138
1006 REM*** SET UP SPRITES              :rem 228
1008 POKE53275,255:SP=53248:CX=SP+31:POKE
     CX,0                               :rem 138
1012 FORJ=2040TO2047:POKEJ,221:NEXT
                                        :rem 85
1014 B=80:FORJ=SP+1TOSP+15STEP2:POKEJ,B:B
     =B+20:NEXT                         :rem 187
1016 POKESP+23,0:POKESP+29,24           :rem 186
1018 POKESP,40:POKESP+2,70:POKESP+4,100:P
     OKESP+6,130:POKESP+8,188:POKESP+10,2
     45                                 :rem 24
1020 POKESP+12,20:POKESP+14,48:POKESP+16,
     192                                :rem 75
1022 POKESP+39,7:POKESP+40,3:POKESP+41,4:
     POKESP+42,13                       :rem 180
1024 POKESP+43,7:POKESP+44,3:POKESP+45,13
     :POKESP+46,4                       :rem 189
1025 REM ML VARBLS, ETC IN CASET BUFR
                                        :rem 77
1026 POKE828,221:REM START SPRITE PNTRS
                                        :rem 117
1028 POKE829,1:REM SPRITE ROTATE COUNTR
                                        :rem 153
1030 POKE830,40:POKE831,0:REM LINE VAL
                                        :rem 168
1032 POKE832,0:REM R/L JYSTK FLAG:rem 136
1034 POKE833,0:REM U/D JYSTK FLAG:rem 134
1036 POKE834,91:REM BIRD CHAR VAL:rem 110
1038 POKE835,1:POKE836,4:REM UP LIMIT
                                        :rem 164
1040 POKE837,230:POKE838,6:REM DN LIMIT
                                        :rem 244
1042 POKE841,1:REM SPRITE MOVE COUNTR
                                        :rem 247
```

```
1044 HM=842:POKEHM,0:REM 'HOME' FLAG
                                    :rem 66
1046 POKE843,95:POKE844,5:REM MATE'S FIRS
     T LOCATION                     :rem 61
1048 POKE251,144:POKE252,4:REM FIRST BIRD
      LOCATION - ZERO PAGE          :rem 101
1049 POKE845,0:REM FILTER CUT COUNTR
                                    :rem 165
1050 DIMA(129):A(1)=1:A(2)=3:A(4)=5:A(8)=
     7:A(16)=9:A(32)=11:A(64)=13:A(128)=1
     5                              :rem 235
1052 HF=0:BZ=0                      :rem 6
1054 DEFFNA(X)=((PEEK(252)*256)+PEEK(251)
     )                              :rem 5
1056 DEFFNB(X)=(PEEK(56320)AND16)   :rem 88
1058 SC$="{HOME}{15 RIGHT}{10 DOWN}"
                                    :rem 121
1060 REM*** SOUND VRBLS             :rem 59
1064 L1=54272:H1=L1+1:W1=L1+4:W2=L1+11
                                    :rem 55
1068 L3=L1+14:H3=L1+15:W3=L1+18     :rem 170
1070 FH=L1+22:FV=L1+23:VM=L1+24     :rem 231
1074 REM*** SETUP SOUNDS            :rem 155
1076 POKEL1+5,64:POKEL1+12,15:POKEL1+19,1
     2                              :rem 128
1078 POKEL1+7,255:POKEL1+8,255      :rem 183
1082 POKEL1+6,0:POKEL1+13,240:POKEL1+20,1
     2                              :rem 109
1084 POKEFH,90                      :rem 31
1100 GOSUB11000                     :rem 52
3000 REM*** DRAW COOPS              :rem 215
3004 FORJ=1984TO1024STEP-40:POKEJ+L1,10:P
     OKEJ,90:POKEJ+L1+1,10:POKEJ+1,90
                                    :rem 90
3006 POKEJ+L1+38,10:POKEJ+38,90:POKEJ+L1+
     39,10:POKEJ+39,90:NEXT         :rem 194
3008 FORJ=1024TO1984STEP40:POKEJ+L1,13:PO
     KEJ+L1+1,13:POKEJ+L1+38,13     :rem 204
3010 POKEJ+L1+39,13:NEXT:RETURN     :rem 159
10000 REM*** TITLE                  :rem 213
10001 PRINT"{CLR}{6}"CHR$(142); :rem 19
10002 PRINT"{18 RIGHT}{RVS}£ {*}"
                                    :rem 104
10003 PRINT"{17 RIGHT}{RVS}£{3 SPACES}
      {*}"                          :rem 76
10004 PRINT"{17 RIGHT}{RVS}{2 SPACES}P
      {2 SPACES}"                   :rem 21
10005 PRINT"{17 RIGHT}{RVS}{2 SPACES}R
      {2 SPACES}"                   :rem 24
10006 PRINT"{17 RIGHT}{RVS}{2 SPACES}O
      {2 SPACES}"                   :rem 22
10007 PRINT"{17 RIGHT}{RVS}{2 SPACES}P
      {2 SPACES}"                   :rem 24
10008 PRINT"{17 RIGHT}{*}{RVS} S {OFF}
      £"                            :rem 54
10009 PRINT"{18 RIGHT}{RVS}{3 SPACES}
      {OFF}"                        :rem 121
10010 PRINT"{18 RIGHT}{*}{RVS} {OFF}£"
                                    :rem 249
10011 PRINT"{19 RIGHT}{RVS} {OFF}"
                                    :rem 143
10012 PRINT"{17 RIGHT}{RVS}£{3 SPACES}
      {*}"                          :rem 76
10013 PRINT"{6 RIGHT}{RVS}£{8 SPACES}
      {*}{RIGHT} UCI {RIGHT}£
      {8 SPACES}{*}"                :rem 49
10014 PRINT"{6 RIGHT}{RVS}{2 SPACES}PROPS
      {5 SPACES}- -{5 SPACES}PROPS
      {2 SPACES}"                   :rem 105
10015 PRINT"{6 RIGHT}{*}{RVS}{8 SPACES}
      {OFF}£{RIGHT}{RVS} JCK {RIGHT}
      {OFF}{*}{RVS}{8 SPACES}{OFF}£"
                                    :rem 4
10016 PRINT"{17 RIGHT}{*}{RVS}
      {3 SPACES}{OFF}£"             :rem 226
10017 PRINT"{19 RIGHT}{RVS} {OFF}"
                                    :rem 149
10018 PRINT"{18 RIGHT}{RVS}£ {*}"
                                    :rem 111
10019 PRINT"{18 RIGHT}{RVS}{3 SPACES}
      {OFF}"                        :rem 122
10020 PRINT"{17 RIGHT}{RVS}£ P {*}"
                                    :rem 155
10021 PRINT"{17 RIGHT}{RVS}{2 SPACES}R
      {2 SPACES}"                   :rem 22
10022 PRINT"{17 RIGHT}{RVS}{2 SPACES}O
      {2 SPACES}"                   :rem 20
10023 PRINT"{17 RIGHT}{RVS}{2 SPACES}P
      {2 SPACES}"                   :rem 22
10024 PRINT"{17 RIGHT}{RVS}{2 SPACES}S
      {2 SPACES}"                   :rem 26
10025 PRINT"{17 RIGHT}{*}{RVS}
      {3 SPACES}{OFF}£"             :rem 226
10026 PRINT"{18 RIGHT}{*}{RVS} {OFF}£
      {HOME}{CYN}READING{2 DOWN}{3 LEFT}D
      ATA..."                       :rem 73
10027 Q$="{28 RIGHT}":POKE214,19:PRINT
                                    :rem 121
10028 PRINTQ$"JOYSTICK":PRINTQ$"{2 DOWN}
      {2 RIGHT}IN PORT 2"           :rem 155
10999 RETURN                        :rem 236
11000 REM*** INSTRUCTIONS             :rem 9
11002 PRINT"{CLR}":POKE53272,31     :rem 84
11004 R$="{4 RIGHT}"                :rem 97
11006 PRINT"{6}{4 RIGHT}ZZZZZZZZZZZZZZZZ
      ZZZZZZZZZZZZZZZ"              :rem 136
11007 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 123
11008 PRINTR$"ZZ{YEL} YOU ARE A PIGEON
      {WHT}X{YEL} LOST {6}ZZ"       :rem 245
11010 PRINTR$"ZZ{YEL} IN A DANGEROUS SKY
      {SPACE}FULL {6}ZZ"            :rem 131
11012 PRINTR$"ZZ{YEL} OF WHIRLING PROPELL
      ERS. {6}ZZ"                   :rem 10
11013 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 120
11014 PRINTR$"ZZ{CYN} BACK AT THE COOP, Y
      OUR{2 SPACES}{6}ZZ"           :rem 17
11016 PRINTR$"ZZ{CYN} MATE WAITS FAITHFUL
      LY-- {3}X{6}Z"                :rem 245
11017 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 124
11018 PRINTR$"ZZ{3} WATCH OUT FOR THE P
      ROPS {6}ZZ"                   :rem 164
11020 PRINTR$"ZZ{3} WHILE YOU FLY FOR H
      OME. {6}ZZ"                   :rem 113
11021 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 119
11022 PRINTR$"ZZ{YEL} HIT FIRE BUTTON DUR
      ING{2 SPACES}{6}ZZ"           :rem 140
11024 PRINTR$"ZZ{YEL} SCORE DISPLAY TO PA
      USE, {6}ZZ"                   :rem 189
11026 PRINTR$"ZZ{YEL} OR CHANGE SKILL LEV
      EL.{2 SPACES}{6}ZZ"           :rem 76
11027 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 125
11028 PRINTR$"ZZ{CYN} HIT ZERO KEY DURING
       ANY {6}ZZ"                   :rem 162
11030 PRINTR$"ZZ{CYN} PAUSE TO{2 SPACES}Q
      UIT PLAYING. {6}ZZ"           :rem 130
11032 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                    :rem 121
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11038 PRINTR$"ZZ{YEL} PRESS FIRE BUTTON N
      OW{3 SPACES}{63}ZZ"          :rem 102
11040 PRINTR$"ZZ{YEL} TO CHOOSE SKILL
      {2 SPACES}LEVEL. {63}ZZ"     :rem 101
11042 PRINT"{4 RIGHT}ZZ{25 RIGHT}ZZ"
                                   :rem 122
11044 PRINT"{4 RIGHT}ZZZZZZZZZZZZZZZZZZZZ
      ZZZZZZZZZ"                   :rem 241
11050 POKEW3,16:POKEH3,1:POKEL3,90:POKEW2
      ,129                         :rem 187
11052 SYS49608:POKEFH,PEEK(VM+3)/2:IFFNB(
      0)THEN11052                  :rem 70
11054 PRINT"{HOME}"CHR$(142):FORJ=1TO200:
      NEXT:PRINTCHR$(14)           :rem 205
11056 PRINT"{CLR}":POKEW3,20:SYS49920:REM
       WHITE COL MEMORY            :rem 121
11058 POKE843,254:POKE844,3:POKE251,220:P
      OKEFH,2:RETURN               :rem 44
12000 REM** SPRITE SHAPE DATA      :rem 141
12001 IFPEEK(14081)=8ANDPEEK(15065)=195TH
      ENRETURN                     :rem 161
12287 CK=0:FORJ=14080TO14142:READQ:CK=CK+
      Q:POKEJ,Q:NEXT               :rem 162
12288 DATA 0,8,0,0,24,0,0,56,0,0,56,0,0,5
      6,0,0,24,0,0,16,0,0,16,0,0,0,0
                                   :rem 58
12289 DATA 0,24,0,0,60,0,0,24,0,0,0,0,0,8
      ,0,0,8,0,0,24,0,0,28,0,0,28,0,0,28
                                   :rem 246
12290 DATA 0,0,24,0,0,16,0         :rem 221
12351 FORJ=14144TO14206:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                    :rem 103
12352 DATA 0,0,0,16,0,0,28,0,0,14,0,0,15,
      0,0,7,128,0,3,128,0,1,192,0,0,128
                                   :rem 215
12353 DATA 0,0,24,0,0,60,0,0,24,0,0,2,0,0
      ,3,128,0,1,192,0,1,224,0,0,240,0,0
                                   :rem 238
12354 DATA 112,0,0,56,0,0,8,0,0,0  :rem 44
12415 FORJ=14208TO14270:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                    :rem 106
12416 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
      0,0,0,0,0,0,0,0,0,0,0,0      :rem 232
12417 DATA 0, 0,124,24, 62,255,189,255,12
      4,24, 62, 0,0, 0,0,0,0,0,0,0,0,0,0
                                   :rem 37
12418 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
                                   :rem 82
12479 FORJ=14272TO14334:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                    :rem 118
12480 DATA 0,0,0,0,0,8,0,0,56,0,0,112,0,0
      ,240,0,1,224,0,1,192,0,3,128,0,2
                                   :rem 152
12481 DATA 0,0,24,0,0,60,0,0,24,0,0,64,0,
      1,192,0,3,128,0,7,128,0,15   :rem 145
12482 DATA 0,0,14,0,0,28,0,0,16,0,0,0,0,0
                                   :rem 157
12500 IFCK<>5053THENPRINT"{3 DOWN}ERROR I
      N DATA LINES 12000-12482":END
                                   :rem 119
49000 REM*** POKE PROPMOVE RTN     :rem 250
49151 CJ=0:FORJ=49152TO49310:READQ:CK=CK+
      Q:POKEJ,Q:NEXT               :rem 174
49152 DATA 120, 173, 21, 3, 201, 234
                                   :rem 235
49158 DATA 208, 13, 169, 33, 141, 20
                                   :rem 253
49164 DATA 3, 169, 192, 141, 21, 3
                                   :rem 153
49170 DATA 76, 31, 192, 169, 49, 141
                                    :rem 11
49176 DATA 20, 3, 169, 234, 141, 21
                                   :rem 200
49182 DATA 3, 88, 96, 169, 0, 141:rem 118
49188 DATA 73, 3, 238, 1, 208, 206
                                   :rem 161
49194 DATA 3, 208, 238, 5, 208, 206
                                   :rem 210
49200 DATA 7, 208, 238, 9, 208, 206
                                   :rem 206
49206 DATA 11, 208, 238, 13, 208, 206
                                    :rem 42
49212 DATA 15, 208, 238, 73, 3, 173
                                   :rem 205
49218 DATA 73, 3, 201, 2, 208, 222
                                   :rem 144
49224 DATA 173, 61, 3, 201, 5, 240
                                   :rem 142
49230 DATA 6, 238, 61, 3, 76, 49   :rem 63
49236 DATA 234, 173, 60, 3, 201, 224
                                   :rem 246
49242 DATA 208, 5, 169, 220, 141, 60
                                   :rem 250
49248 DATA 3, 141, 248, 7, 141, 249
                                   :rem 212
49254 DATA 7, 141, 250, 7, 141, 251
                                   :rem 199
49260 DATA 7, 141, 252, 7, 141, 253
                                   :rem 200
49266 DATA 7, 141, 254, 7, 141, 255
                                   :rem 210
49272 DATA 7, 238, 60, 3, 169, 0   :rem 59
49278 DATA 141, 61, 3, 173, 69, 192
                                   :rem 218
49284 DATA 10, 10, 10, 10, 10, 141
                                   :rem 124
49290 DATA 78, 3, 24, 173, 77, 3   :rem 66
49296 DATA 109, 78, 3, 141, 77, 3:rem 119
49302 DATA 141, 22, 212, 206, 8, 212
                                   :rem 236
49308 DATA 76, 49, 234             :rem 237
49350 IFCK<>22679THENPRINT"{3 DOWN}ERROR
      {SPACE}IN DATA LINES 49000-49308":E
      ND                           :rem 210
49400 REM*** POKE BIRDMOVE RTN     :rem 222
49407 CK=0:FORJ=49408TO49643:READQ:CK=CK+
      Q:POKEJ,Q:NEXT               :rem 192
49408 DATA 160, 0, 169, 32, 145, 251
                                   :rem 253
49414 DATA 165, 251, 133, 253, 165, 252
                                   :rem 150
49420 DATA 133, 254, 173, 0, 220, 162
                                    :rem 35
49426 DATA 0, 74, 176, 1, 136, 74:rem 110
49432 DATA 176, 1, 200, 74, 176, 1
                                   :rem 151
49438 DATA 202, 74, 176, 1, 232, 74
                                   :rem 210
49444 DATA 142, 64, 3, 140, 65, 3:rem 102
49450 DATA 173, 64, 3, 201, 1, 240
                                   :rem 142
49456 DATA 18, 201, 255, 240, 3, 76
                                   :rem 208
49462 DATA 116, 193, 165, 253, 208, 2
                                    :rem 54
49468 DATA 198, 254, 198, 253, 76, 73
                                    :rem 85
49474 DATA 193, 230, 253, 208, 2, 230
                                    :rem 47
49480 DATA 254, 160, 0, 177, 253, 201
                                    :rem 45
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49486 DATA 32, 208, 3, 76, 91, 193
                                    :rem 171
49492 DATA 201, 90, 208, 14, 76, 108
                                     :rem 3
49498 DATA 193, 165, 253, 133, 251, 165
                                    :rem 166
49504 DATA 254, 133, 252, 76, 116, 193
                                    :rem 105
49510 DATA 169, 1, 141, 74, 3, 96:rem 109
49516 DATA 165, 251, 133, 253, 165, 252
                                    :rem 153
49522 DATA 133, 254, 173, 65, 3, 201
                                    :rem 250
49528 DATA 1, 240, 39, 201, 255, 240
                                    :rem 250
49534 DATA 3, 76, 200, 193, 162, 0
                                    :rem 151
49540 DATA 165, 253, 208, 2, 198, 254
                                     :rem 59
49546 DATA 198, 253, 232, 224, 40, 208
                                    :rem 107
49552 DATA 243, 24, 165, 253, 205, 67
                                     :rem 56
49558 DATA 3, 165, 254, 237, 68, 3
                                    :rem 172
49564 DATA 176, 34, 240, 32, 144, 38
                                      :rem 6
49570 DATA 162, 0, 230, 253, 208, 2
                                    :rem 195
49576 DATA 230, 254, 232, 224, 40, 208
                                     :rem 98
49582 DATA 245, 24, 165, 253, 205, 69
                                     :rem 63
49588 DATA 3, 165, 254, 237, 70, 3
                                    :rem 168
49594 DATA 144, 4, 240, 2, 176, 8:rem 112
49600 DATA 165, 253, 133, 251, 165, 254
                                    :rem 149
49606 DATA 133, 252, 160, 0, 173, 66
                                    :rem 253
49612 DATA 3, 145, 251, 173, 75, 3
                                    :rem 155
49618 DATA 133, 253, 173, 76, 3, 133
                                      :rem 5
49624 DATA 254, 173, 66, 3, 145, 253
                                      :rem 8
49630 DATA 201, 96, 240, 4, 238, 66
                                    :rem 209
49636 DATA 3, 96, 169, 91, 141, 66
                                    :rem 176
49642 DATA 3, 96                    :rem 241
49650 IFCK<>33160THENPRINT"{3 DOWN}ERROR
      {SPACE}IN DATA LINES 49400-49642":E
      ND                            :rem 205
49662 REM*** POKE COPYCHAR RTN      :rem 233
49663 CK=0:FORJ=49664TO49704:READQ:CK=CK+
      Q:POKEJ,Q:NEXT                :rem 198
49664 DATA 169,0,133,4,169,208,133,5
                                    :rem 252
49672 DATA 169,0,133,6,169,56,133,7
                                    :rem 208
49680 DATA 162,0,160,0,177,4,145,6
                                    :rem 140
49688 DATA 200,192,255,208,247,230,5,230
                                    :rem 193
49696 DATA 7,232,224,16,208,236,160,0,96
                                    :rem 196
49700 IFCK<>4894THENPRINT"{3 DOWN}ERROR I
      N DATA LINES 49662-49696":END
                                    :rem 184
49918 REM*** POKE WHITEMEM RTN      :rem 244
49919 CK=0:FORJ=49920TO49939:READQ:CK=CK+
      Q:POKEJ,Q:NEXT                :rem 207
49920 DATA 162, 0, 169, 1, 157, 0:rem 101
49926 DATA 216, 157, 0, 217, 157, 0
                                    :rem 209
49932 DATA 218, 157, 0, 219, 232, 208
                                     :rem 54
49938 DATA 241, 96                  :rem 93
49950 IFCK<>2607THENPRINT"{3 DOWN}ERROR I
      N DATA LINES 49918-49938":END
                                    :rem 184
62000 REM* COPY CHAR SET TO 14336:rem 239
62002 POKE56334,PEEK(56334)AND254:POKE1,P
      EEK(1)AND251                  :rem 27
62004 SYS49664                       :rem 8
62006 POKE1,PEEK(1)OR4:POKE56334,PEEK(563
      34)OR1                        :rem 237
62400 REM** POKE NEW CHARACTER DATA **
                                    :rem 72
62500 CK=0:FORJ=15064TO15071:READQ:CK=CK+
      Q:POKEJ,Q:NEXT                :rem 160
62501 DATA 0,195,102,60,24,0,0,0  :rem 10
62502 FORJ=15072TO15079:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                     :rem 116
62503 DATA 0,0,195,126,24,0,0,0   :rem 220
62504 FORJ=15080TO15087:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                     :rem 116
62505 DATA 0,0,66,255,153,0,0,0   :rem 225
62506 FORJ=15088TO15095:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                     :rem 125
62507 DATA 0,0,0,90,255,129,0,0   :rem 227
62508 FORJ=15096TO15103:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                     :rem 116
62509 DATA 0,0,0,24,126,195,0,0   :rem 226
62510 FORJ=15104TO15111:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                      :rem 98
62511 DATA 0,0,0,24,60,102,195,129
                                    :rem 119
62512 FORJ=15056TO15063:READQ:CK=CK+Q:POK
      EJ,Q:NEXT                     :rem 112
62513 DATA 255, 60, 24, 24, 24, 24, 60,25
      5                             :rem 235
62600 IFCK<>3255THENPRINT"{3 DOWN}ERROR I
      N DATA LINES 62000-62513":END
                                    :rem 132
63000 RETURN                        :rem 217
```

SuperSprite

(Article on page 64.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
10 REMA:                            :rem 192
20 :                                :rem 156
21 REM{9 SPACES}LIST OF VARIABLES:rem 177
22 REM SP SPRITE PAGE               :rem 223
23 REM V{2 SPACES}BASE OF VIDEO CHIP
                                    :rem 234
24 REM C{2 SPACES}BASE OF COLOR RAM
                                    :rem 156
25 REM SD BASE OF SOUND CHIP         :rem 63
26 REM S{2 SPACES}BASE OF SCREEN     :rem 15
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27 REM HS BYTE TO SAVE HIGH SCORE:rem 138
28 REM CH KERNAL PRINT ROUTINE (CHROUT)
                                    :rem 111
29 REM AR IMAGE OF ACCUMULATOR REGISTER
                                    :rem 127
30 REM BS BEST SCORE YET AT RUNTIME
                                     :rem 49
31 REM ZS OLD SCREEN BASE AND CHAR SET
                                    :rem 140
32 REM ZC OLD BACKGROUND COLOR     :rem 36
33 REM ZE OLD BORDER COLOR          :rem 5
34 REM ZR OLD VALUE OF REPEAT FLAG
                                    :rem 195
35 REM ZL OLD PRINT COLOR          :rem 221
36 REM GL TURN NUMBER IN GAME LOOP
                                    :rem 221
37 REM I AND J{2 SPACES}FOR-NEXT INDICES
                                     :rem 6
38 REM U, U2 AND U$ WORKHORSES    :rem 186
39 REM T1-T9{2 SPACES}CONSTANTS IN GAME L
   OOP                              :rem 55
40 REM B$ GAME SCREEN BUILDING BLOCK
                                    :rem 65
41 REM T$ 16 SPACE INDENT          :rem 86
42 REM W{2 SPACES}EITHER V OR V+1 (SPRITE
    POS.)                           :rem 83
43 REM PS PART-SCORE (ONE TURN)    :rem 74
44 REM TS TOTAL SCORE SO FAR      :rem 110
45 REM FQ QUIT FLAG, SET BY PRESSING *
                                    :rem 137
46 :                                :rem 164
47 REM{9 SPACES}SUBROUTINES        :rem 178
48 REM{2 SPACES}1000 ONE TURN OF THE GAME
                                    :rem 204
49 REM{2 SPACES}2000 PRINT GAME SCREEN
                                    :rem 122
50 REM{2 SPACES}3000 EXIT (OR PLAY AGAIN)
                                    :rem 206
51 REM{2 SPACES}4000 BUILD SPRITE :rem 85
52 REM{2 SPACES}5000 INSTRUCTIONS DATA ST
   RINGS                             :rem 9
53 REM{2 SPACES}6000 PRINT INSTRUCTIONS
                                    :rem 84
54 REM{2 SPACES}7000 FLY SPRITE AHEAD OF
   {SPACE}INSTR.                    :rem 124
55 REM{2 SPACES}8000 WAIT TO RESUME GAME
                                    :rem 217
56 :                                :rem 165
100 REM SEED RANDOM NUMBER GENERATOR, DIS
    ABLE CHARACTER SET SHIFTS       :rem 49
110 U=RND(-TI):POKE657,128         :rem 245
120 REM SAVE OLD ENVIRONMENT, BUILD NEW O
    NE, BUILD SPRITE, PRINT INSTRUCTIONS
                                    :rem 35
130 SP=13:V=53248                  :rem 171
140 POKE2041,PEEK(V+24):POKEV+24,22
                                    :rem 244
150 POKE2042,PEEK(V+32):POKEV+32,7
                                    :rem 199
160 POKE2043,PEEK(V+33):POKEV+33,7
                                    :rem 203
170 POKE2044,PEEK(646):POKE646,0   :rem 56
180 POKE2045,PEEK(650):POKE650,128
                                    :rem 155
190 PRINT"{CLR}":GOSUB4000         :rem 124
200 GOSUB6000:PRINT"{CLR}":POKEV+24,20
                                    :rem 84
210 DEFFNSC(U)=INT(U+U*GL/10)      :rem 205
220 FORI=1TO16:T$=T$+"{RIGHT}":NEXTI
                                    :rem 241
230 B$="{3 DOWN}"+CHR$(13)+"{RVS}":FORI=0
    TO39:B$=B$+" ":NEXTI           :rem 107
240 V=53248:C=55296:S=1024:SD=54272
                                    :rem 151
250 HS=PEEK(43)+PEEK(44)*256+5     :rem 124
260 T1=135:T2=255:T3=230:T4=133    :rem 181
270 T5=5:T6=9:T7=.992:T8=42:T9=32:rem 116
280 BS=PEEK(HS):CH=65508:AR=780    :rem 48
290 REM INITIALIZE CURSORS, PRINT GAME SC
    REEN                            :rem 53
300 E(1)=1269:E(2)=1475:E(3)=1682:E(4)=18
    88                              :rem 164
310 POKEV+21,0:GOSUB2000           :rem 127
320 REM MAKE SPACE FOR SCORE ON SCREEN, S
    ET SOUND CHIP, CLEAR KEYBOARD BUFFER
                                    :rem 38
330 FORI=1080TO1100:POKEI,32:NEXT:rem 237
340 POKESD+4,16:POKESD+11,16:POKESD+18,16
                                    :rem 150
350 POKESD+6,240:POKESD+13,240:POKESD+20,
    240                             :rem 33
360 POKESD+24,15                   :rem 130
370 GETA$:IFA$<>""THEN370          :rem 148
380 :                              :rem 213
390 REM BEGIN 20-TURN GAME LOOP,SET PART
    {SPACE}SCORE TO ZERO           :rem 191
400 FORGL=1TO20:PS=0               :rem 203
410 REM POSITION SPRITE, UNEXPAND IT, ZER
    O THE COLLISION DETECT REGISTER:rem 8
420 POKEV,23:POKEV+1,49             :rem 96
430 POKEV+23,0:POKEV+31,0          :rem 178
440 REM PRINT SCORE INFO, TURN ON SOUND
                                    :rem 76
450 PRINT"{HOME}{DOWN}"T$"TURN:"GL"
    {2 SPACES}SCORE:"TS             :rem 1
460 PRINT"{DOWN}"T$"{5 RIGHT}BEST YET:"PE
    EK(HS)-1                       :rem 146
470 POKESD+4,17:POKESD+11,17:POKESD+18,17
                                   :rem 157
480 REM TURN ON SPRITE, TAKE 1 TURN, GOTO
     570 IF GAME ABORTED (FQ SET):rem 135
490 POKEV+21,1:GOSUB1000:IFFQ=1THEN550
                                    :rem 31
500 REM SCROLL SPRITE OFF SCREEN IF NO CO
    LLISION, OTHERWISE SCREECH TO A HALT
                                   :rem 130
510 IFPEEK(V+1)>T3THENFORI=PEEK(V+1)TO250
    :POKEV+1,I:NEXTI:GOTO550       :rem 111
520 POKESD+4,129:POKESD+11,33:POKESD+18,3
    3                              :rem 201
530 FOR I=72TO20STEP-2:POKESD+1,I:POKESD+
    8,I-3:POKESD+15,I-2:NEXTI       :rem 62
540 REM TURN OFF SOUND. JUMP TO EXIT IF F
    Q SET                          :rem 131
550 POKESD+4,16:POKESD+11,16:POKESD+18,16
                                   :rem 153
560 POKESD+1,0:POKESD+8,0:POKESD+15,0
                                   :rem 197
570 IFFQ=1THENFQ=0:GL=20:NEXT:POKEV+21,0:
    GOTO670                          :rem 1
580 REM CALCULATE PART SCORE FROM SPRITE
    {SPACE}Y POSITION, MODIFY, ADD TO TOT
    AL SCORE                        :rem 39
590 PS=FNSC(INT((PEEK(V+1)-71)/40))
                                   :rem 214
600 TS=TS+INT((PS↑1.4+PS)/2)       :rem 156
610 POKEV+21,0:POKEV+16,0          :rem 179
620 NEXTGL                         :rem 106
630 REM UPDATE HIGH SCORE RECORD, ZERO SO
    UND CHIP, GO TO EXIT (3000)   :rem 103
640 IFPEEK(HS)<TS+1THENPOKEHS,TS+1
                                   :rem 161
```

```
650 FORI=ØTO24:POKE SD+I,Ø:NEXTI :rem 211
660 FORI=1TO500:NEXTI :rem 52
670 GOSUB3000:CLR:GOTO210 :rem 1
680 : :rem 216
970 REM SUBROUTINE--ONE TURN OF THE GAME
:rem 169
980 : :rem 219
990 REM DECIDE WHICH SPRITE POSITION REGI
STER TO ALTER (W) AND BY HOW MUCH (U)
:rem 58
1000 U2=RND(1):W=V+INT(U2*2):U=GL/7+2
:rem 123
1010 REM Y-EXPAND SPRITE IF EXPRESSION TR
UE :rem 162
1020 IFU2>T7ANDPEEK(V+1)<T1THENPOKEV+23,1
:rem 255
1030 REM SET MSB OF SPRITE X-POSITION IF
{SPACE}NECESSARY :rem 24
1040 IFPEEK(W)+U>T2THENPOKEV+16,1:POKEV,P
EEK(V)+U-T2:GOTO1070 :rem 45
1050 REM UPDATE SPRITE POSITION.
{2 SPACES}EXIT IF COLLISION DETECTED
OR 4TH GAP CROSSED :rem 250
1060 POKEW,PEEK(W)+U :rem 198
1070 IF(PEEK(V+31)AND1)ORPEEK(V+1)>T3THEN
RETURN :rem 164
1080 REM CHANGE FREQUENCIES ACCORDING TO
{SPACE}SPRITE Y POSITION AND RANDOM
{SPACE}NUMBER U2 :rem 67
1090 U=232-PEEK(V+1):POKESD+1,U*2/3:POKES
D+8,U+3*U2:POKESD+15,U+3 :rem 70
1100 REM POLL KEYBOARD. EXIT ON *; PAUSE
{SPACE}ON ' '; GOTO1000 IF NOT A FUN
CTION KEY :rem 70
1110 SYSCH:U=PEEK(AR):IFU=T8THENTS=Ø:FQ=1
:RETURN{17 SPACES}:REM EXIT :rem 253
1120 IFU=T9THENGOSUB8000:REM TAKE 5
:rem 97
1130 IFU<T4THEN1000:REM INPUT<F1 :rem 190
1140 REM MOVE LINE RIGHT IF KEY NOT SHIFT
ED (1120) LEFT IF SHIFTED (1140)
:rem 16
1150 U=U-132:IFU<T5THEN1180:REM INPUT F1-
F4 :rem 25
1160 IFU<T6THEN1200:REM INPUT F5-F8
:rem 56
1170 GOTO1000:REM INPUT>F8 :rem 45
1180 E(U)=E(U)+(E(U)=1100+200*U-(U>2)):PO
KEE(U),223:POKEE(U)-1,160 :rem 78
1190 POKE E(U)+4+(U>2),32:POKEE(U)+5+(U>2
),95:E(U)=E(U)+1:GOTO1000 :rem 130
1200 U=U-4:E(U)=E(U)-(E(U)=1064+200*(U)):
POKEE(U)+3+(U>2),95 :rem 227
1210 POKEE(U)+4+(U>2),160:POKEE(U)-1,32:P
OKEE(U)-2,223:E(U)=E(U)-1:GOTO1000
:rem 217
1970 REM SUBROUTINE--PRINT GAME SCREEN
:rem 134
1980 : :rem 12
1990 REM LINE COLORS SET IN LINE 2000. LA
ST COLOR IS FOR PRINTED MESSAGES
:rem 240
2000 PRINT"{CLR}{2 DOWN}{PUR}"B$"{GRN}"B$
"{7}"B$"{3}"B$"{HOME}{BLK}"
:rem 125
2010 FORI=1TO4:POKEE(I)-1,223:POKEE(I)+3-
(I<3),95:FORJ=E(I)TOE(I)+2-(I<3)
:rem 179
2020 POKEJ,32:NEXTJ,I:RETURN{7 SPACES}
:rem 32
2030 : :rem 255
2980 REM SUBROUTINE--EXIT OR RE-ENTRY
:rem 82
2990 : :rem 14
3000 PRINT"{CLR}{DOWN}"T$"{2 RIGHT}YOUR S
CORE:"TS :rem 218
3010 PRINT"{DOWN}"T$"{4 RIGHT}BEST YET:";
PEEK(HS)-1 :rem 218
3020 PRINT"{3 DOWN}{RIGHT}PLAY AGAIN (Y/N
)? :rem 192
3030 GETA$:IFA$=""THEN3030 :rem 175
3040 IFA$="Y"THENRETURN :rem 164
3050 IFA$="N"THEN3070 :rem 132
3060 GOTO3030 :rem 200
3070 IF NOT(BS<PEEK(HS))THEN3100 :rem 112
3080 PRINT:PRINT" CONGRATULATIONS, YOU BR
OKE THE RECORD. :rem 40
3090 PRINT:PRINT" BE SURE TO SAVE THE PRO
GRAM. :rem 1
3100 PRINT:PRINT" SEE YOU AROUND. :rem 11
3110 PRINT"{4 DOWN}" :rem 218
3120 REM RESTORE PREVIOUS ENVIRONMENT
:rem 160
3130 POKEV+24,PEEK(2041):POKEV+32,PEEK(20
42):POKEV+33,PEEK(2043) :rem 186
3140 POKE646,PEEK(2044):POKE650,PEEK(2045
):POKE657,Ø :rem 219
3150 END :rem 160
3160 : :rem 4
3980 REM SUBROUTINE--BUILD SPRITE AT PAGE
13 (LOCATIONS 832-895 IN TAPE BUFFE
R) :rem 103
3990 : :rem 15
4000 FOR I=ØTO41:READU:POKE(64*SP)+I,U:NE
XT :rem 115
4010 FORI=42TO63:POKE(64*SP)+I,Ø:NEXT
:rem 222
4020 POKE2040,SP:POKEV+23,1:POKEV+29,1:PO
KEV+39,Ø:RETURN :rem 180
4030 RETURN :rem 167
4040 DATA 248,Ø,Ø,62,Ø,Ø,7,128,Ø,1,224
:rem 43
4050 DATA Ø,Ø,120,Ø,Ø,62,Ø,Ø,15,112
:rem 132
4060 DATA Ø,7,248,Ø,7,248,Ø,6,120,Ø
:rem 163
4070 DATA 6,12,Ø,6,6,Ø,3,6,Ø,1,128
:rem 103
4080 : :rem 6
4980 REM DATA FOR INSTRUCTIONS PAGE
:rem 140
4990 : :rem 16
5000 DATA"YOUR OBJECTIVE IS TO MANEUVER T
HE :rem 238
5010 DATA"HORIZONTAL LINES SO THAT SUPERS
PRITE :rem 192
5020 DATA"MAY FLY SAFELY THROUGH THE GAPS
. :rem 244
5030 DATA"THE FOUR LINES ARE CONTROLLED B
Y THE :rem 102
5040 DATA"FOUR FUNCTION KEYS ON YOUR RIGH
T. :rem 123
5050 DATA" :rem 6
5060 DATA"PRESSING ONE OF THESE KEYS WILL
CAUSE :rem 199
5070 DATA"THE CORRESPONDING LINE TO SLIDE
RIGHT. :rem 174
5080 DATA"THE SAME KEY SHIFTED WILL CAUSE
ITS :rem 25
5090 DATA"LINE TO SLIDE LEFT.{2 SPACES}PR
ESS THE SPACE :rem 249
```

```
5100 DATA"BAR TO PAUSE, '*' TO ABORT.
                                :rem 229
5110 DATA"                      :rem 3
5120 DATA"A GAME CONSISTS OF 20 TURNS. PO
     INTS ARE                   :rem 75
5130 DATA"AWARDED FOR EVERY GAP SAFELY TR
     AVERSED.                   :rem 233
5140 DATA"THE PAYOFFS INCREASE WITH THE N
     UMBER OF                   :rem 68
5150 DATA"GAPS TRAVERSED ON A TURN, AND W
     ITH THE                    :rem 37
5160 DATA"NUMBER OF TURNS TAKEN.
     {2 SPACES}SUPERSPRITE'S    :rem 131
5170 DATA"FLIGHT SPEED AND NATURAL WAYWAR
     DNESS                      :rem 122
5180 DATA"ALSO INCREASE AS THE GAME PROGR
     ESSES."                    :rem 111
5190 DATA"                      :rem 11
5200 DATA"THE MAXIMUM SCORE IS 253. GOOD
     {SPACE}LUCK.               :rem 104
5210 DATA"                      :rem 4
5220 DATA"{4 SPACES}PRESS{SHIFT-SPACE}SPA
     CE{SHIFT-SPACE}BAR{SHIFT-SPACE}TO ST
     ART{SHIFT-SPACE}GAME.      :rem 204
5230 :                          :rem 4
5980 REM SUBROUTINE--PRINT INSTRUCTIONS
                                :rem 102
5990 :                          :rem 17
6000 POKEV,23:POKEV+1,49:POKEV+21,1
                                :rem 58
6010 GOSUB7000:GOSUB7000        :rem 143
6020 FORW=1TO23:READU$:PRINTU$:GOSUB7000:
     NEXTW                      :rem 220
6030 POKEV+21,0:POKEV,23:POKEV+1,49:POKEV
     +23,0:POKEV+29,0           :rem 152
6040 GETA$:IFA$<>CHR$(32)THEN 6040
                                :rem 103
6050 RETURN                     :rem 171
6060 :                          :rem 6
6980 REM SUBROUTINE--FLY SPRITE DOWN 1 PR
     INT LINE (AHEAD OF INSTRUCTIONS)
                                :rem 243
6990 :                          :rem 18
7000 FORI=1TO8:POKEV,PEEK(V)+1  :rem 83
7010 POKEV+1,PEEK(V+1)+1:NEXT   :rem 210
7020 POKEV,PEEK(V)+1:RETURN     :rem 188
7030 :                          :rem 4
7980 REM SUBROUTINE--ANSWER THE PHONE
                                :rem 81
7990 :                          :rem 19
8000 POKE SD+24,0               :rem 123
8010 SYSCH:IFPEEK(AR)<>32THEN8010:rem 252
8020 POKE SD+24,15              :rem 179
8030 RETURN                     :rem 171
```

Memo Writer

(Article on page 72.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1: Memo Writer—64 Version

```
9 GOSUB500                      :rem 78
10 POKE204,0:GOSUB800:POKE650,128:SP=1
                                :rem 234
20 GETA$:IFA$=""THEN20          :rem 231
22 IFA$=CHR$(34)THEN20          :rem 223
25 IFA$="{CLR}"THENGOSUB800:A$="":GOTO20
                                :rem 171
30 IFASC(A$)<141ANDASC(A$)>132THENGOSUB10
   0                            :rem 197
32 IFA$=""THEN20                :rem 107
35 IFASC(A$)=13AND(PEEK(210)=7)AND(PEEK(2
   09)>151)THEN20               :rem 97
40 POKE205,3:WAIT207,1:PRINTA$;  :rem 85
50 IFPEEK(210)=7AND(PEEK(209)+PEEK(211)>1
   91)THENPOKE205,3:WAIT207,1:PRINT"{UP}"
   ;                            :rem 68
60 GOTO20                       :rem 1
100 X=0                         :rem 86
110 IFA$="{F1}"THENX=5          :rem 133
120 IFA$="{F3}"THENX=10         :rem 179
130 IFA$="{F5}"THENX=15         :rem 186
140 IFA$="{F7}"THENX=20         :rem 184
150 IFA$="{F2}"THENX=25         :rem 191
160 IFX>0THENA$="":FORQ=1TOX:A$=A$+"
    {RIGHT}":NEXTQ:RETURN       :rem 141
170 IFA$="{F4}"THENIFSP=1THENSP=2:POKE198
    4,178:POKE56256,1:RETURN    :rem 154
175 IFA$="{F4}"THENSP=1:POKE1984,177:POKE
    56256,1:RETURN              :rem 206
180 IFA$="{F6}"THENG1=984:TF=14:RW=23:CL=
    40:REM EXPANDED             :rem 238
190 IFA$="{F8}"THENG1=944:TF=15:RW=11:CL=
    80:REM NORMAL               :rem 110
200 A$=""                       :rem 120
210 GOSUB60000                  :rem 9
220 RETURN                      :rem 116
500 POKE53281,0:POKE53280,2     :rem 236
510 PRINT"{CLR}{WHT}{2 DOWN}{13 RIGHT}MEM
    O WRITER"                   :rem 165
530 PRINT"{5 DOWN}{6 RIGHT}THIS IS A SCRE
    EN-ORIENTED"                :rem 200
540 PRINT"{6 RIGHT}WORD PROCESSING PROGRA
    M"                          :rem 105
550 PRINT"{6 RIGHT}USING THE COMMODORE-64
    'S"                         :rem 54
560 PRINT"{8 RIGHT}OWN BUILT-IN EDITING"
                                :rem 144
570 PRINT"{12 RIGHT}CAPABILITIES.":rem 97
590 PRINT"{7 DOWN}{2 RIGHT}HIT ANY KEY FO
    R LIST OF CONTROL KEYS"     :rem 235
600 POKE198,0                   :rem 195
610 GETA$:IFA$=""THEN610        :rem 81
620 PRINT"{CLR}{2 DOWN}{2 RIGHT}F1 F3 F5
    {SPACE}F7 F2{5 SPACES}TAB FROM CURREN
    T"                          :rem 230
630 PRINT"{21 RIGHT}POSITION IN INCRE-"
                                :rem 117
640 PRINT"{21 RIGHT}MENTS OF FIVE."
                                :rem 64
645 PRINT"{DOWN}{3 RIGHT}F4{8 SPACES}SET
    {SPACE}SINGLE OR DOUBLE SPACE"
                                :rem 200
650 PRINT"{DOWN}{3 RIGHT}F6{8 SPACES}PRIN
    T EXPANDED"                 :rem 38
660 PRINT"{13 RIGHT}CHARACTERS" :rem 198
670 PRINT"{DOWN}{3 RIGHT}F8{8 SPACES}PRIN
    T IN NORMAL SIZE"           :rem 124
680 PRINT"{13 RIGHT}CHARACTERS." :rem 246
690 PRINT"{2 DOWN}{RIGHT}ALL EDITING KEYS
     WORK AS NORMAL."           :rem 150
700 PRINT"{RIGHT}TEXT CANNOT SCROLL PAST
    {SPACE}END OF SCREEN."      :rem 238
```

```
710 PRINT"{RIGHT}YOU MAY TYPE IN UPPERCAS
    E/GRAPHICS OR "                  :rem 12
720 PRINT"{RIGHT}UPPERCASE/LOWERCASE MODE
    ; THE PRINT"                     :rem 209
730 PRINT"{RIGHT}ROUTINE WILL AUTOMATICAL
    LY"                              :rem 191
740 PRINT"{RIGHT}SET THE PRINT MODE CORRE
    CTLY."                           :rem 237
750 PRINT"{2 DOWN}{9 RIGHT}HIT ANY KEY TO
     BEGIN"                          :rem 82
760 POKE198,0                        :rem 202
770 GETA$:IFA$=""THEN770             :rem 95
780 RETURN                           :rem 127
800 POKE53281,1:PRINT"{CLR}>";:POKE53281,
    0:FORX=1TO11:PRINT"{2 DOWN}{LEFT}>";:
    NEXTX                            :rem 6
810 PRINT"{2 DOWN}{LEFT} {13 Y}{RVS}MEM
    O WRITER{OFF}{14 Y}{HOME}";:rem 115
820 RETURN                           :rem 122
60000 Q=PEEK(53272):IFQ=21THENG1$=CHR$(14
      5):GOTO60010                   :rem 21
60005 G1$=CHR$(17)                   :rem 142
60010 G1$=G1$+CHR$(TF)               :rem 131
60020 OPEN4,4:WAIT207,1:POKE204,255
                                     :rem 234
60030 FORG0=0TORW:G0$=G1$:G1=G1+CL
                                     :rem 223
60040 FORG2=G1TOG1+(CL-1):G3=PEEK(G2)
                                     :rem 115
60050 IFG3>128THENG3=G3-128:G4=1:G0$=G0$+
      CHR$(18)                       :rem 187
60060 IF(G3>0)*(G3<32)THENG3=G3+64:GOTO60
      100                            :rem 185
60070 IF(G3>31)*(G3<64)THEN60100 :rem 186
60080 IF(G3>63)*(G3<96)THENG3=G3+128:GOTO
      60100                          :rem 47
60090 IF(G3>95)*(G3<128)THENG3=G3+64:GOTO
      60100                          :rem 48
60100 G0$=G0$+CHR$(G3)               :rem 97
60110 IFG4=1THENG0$=G0$+CHR$(146):G4=0
                                     :rem 76
60120 NEXTG2:PRINT#4,G0$:IFSP=2THENPRINT#
      4                              :rem 132
60130 NEXTG0:CLOSE4:POKE204,0        :rem 239
60140 RETURN                         :rem 219
```

Program 2:
Memo Writer—VIC Version

```
9 GOSUB500                           :rem 78
10 GOSUB800:POKE650,128:SP=1:POKE204,0
                                     :rem 234
20 GETA$:IFA$=""THEN20LIST10         :rem 132
21 IFA$=CHR$(20)ANDPEEK(210)=31ANDPEEK(20
   9)>205THENA$=CHR$(157)+CHR$(32)+CHR$(1
   57)                               :rem 58
22 IFA$=CHR$(34)THEN20               :rem 223
23 IFA$=CHR$(13)ANDPEEK(210)=31ANDPEEK(20
   9)>205THEN20                      :rem 19
25 IFA$="{CLR}"THENPOKE204,1:GOSUB800:POK
   E204,0:A$="":GOTO20               :rem 98
30 IFASC(A$)<141ANDASC(A$)>132THENGOSUB10
   0                                 :rem 197
32 IFA$=""THEN20                     :rem 107
35 IFASC(A$)=13AND(PEEK(210)=31)AND(PEEK(
   209)>226)THEN20                   :rem 145
40 POKE205,3:WAIT207,1:PRINTA$;      :rem 85
50 IFPEEK(210)=31AND(PEEK(209)+PEEK(211)>
   227)THENPOKE205,3:WAIT207,1:PRINT"{UP}
   ";                                :rem 113
60 GOTO20                            :rem 1
100 X=0                              :rem 86
110 IFA$="{F1}"THENX=5               :rem 133
120 IFA$="{F3}"THENX=10              :rem 179
130 IFA$="{F5}"THENX=15              :rem 186
140 IFA$="{F7}"THENX=20              :rem 184
150 IFA$="{F2}"THENX=25              :rem 191
160 IFX>0THENA$="":FORQ=1TOX:A$=A$+"
    {RIGHT}":NEXTQ:RETURN            :rem 141
170 IFA$="{F4}"THENIFSP=1THENSP=2:POKE816
    4,178:RETURN                     :rem 201
175 IFA$="{F4}"THENSP=1:POKE8164,177:RETU
    RN                               :rem 253
180 IFA$="{F6}"THENG1=7640:TF=14:RW=11:CL
    =40:REM EXPANDED                 :rem 23
190 IFA$="{F8}"THENG1=7600:TF=15:RW=5:CL=
    80:REM NORMAL                    :rem 109
200 A$=""                            :rem 120
210 GOSUB60000                       :rem 9
220 RETURN                           :rem 116
500 POKE 36879,9                     :rem 58
510 PRINT"{CLR}{RVS}{WHT}{4 DOWN}
    {5 RIGHT}MEMO WRITER"            :rem 241
530 PRINT"{2 DOWN}{2 RIGHT}THIS IS A SCRE
    EN-"                             :rem 199
540 PRINT"{4 RIGHT}ORIENTED WORD":rem 116
545 PRINT"{2 RIGHT}PROCESSING PROGRAM"
                                     :rem 190
550 PRINT"{2 RIGHT}USING THE VIC-20'S"
                                     :rem 247
560 PRINT"{RIGHT}OWN BUILT-IN EDITING"
                                     :rem 197
570 PRINT"{5 RIGHT}CAPABILITIES.":rem 150
590 PRINT"{4 DOWN}{5 RIGHT}{RVS}HIT ANY K
    EY.{OFF}"                        :rem 204
600 POKE198,0                        :rem 195
610 GETA$:IFA$=""THEN610             :rem 81
620 PRINT"{CLR}{4 DOWN}{2 RIGHT}F1,F3,F5,
    F7,F2-TAB"                       :rem 142
630 PRINT"IN INCREMENTS OF FIVE" :rem 184
645 PRINT"{DOWN}{4 RIGHT}F4-SET SINGLE"
                                     :rem 74
647 PRINT"{2 RIGHT}OR DOUBLE SPACING"
                                     :rem 13
650 PRINT"{DOWN}{2 RIGHT}F6-PRINT EXPANDE
    D"                               :rem 54
660 PRINT"{5 RIGHT}CHARACTERS"   :rem 222
670 PRINT"{DOWN}{3 RIGHT}F8-PRINTS NORMAL
    "                                :rem 42

682 PRINT"{4 DOWN}{5 RIGHT}{RVS}HIT ANY K
    EY"                              :rem 14
683 POKE198,0                        :rem 206
685 GETA$:IFA$=""THEN685             :rem 105
690 PRINT"{CLR}{3 DOWN}{3 RIGHT}ALL EDITI
    NG KEYS"                         :rem 166
695 PRINT"{4 RIGHT}WORK AS NORMAL."
                                     :rem 183
700 PRINT"{DOWN}{2 RIGHT}TEXT CANNOT SCRO
    LL"                              :rem 138
705 PRINT"{3 SPACES}PAST THE END OF"
                                     :rem 242
707 PRINT"{5 SPACES}THE SCREEN."  :rem 62

710 PRINT"{DOWN}YOU MAY USE UPPERCASE/GRA
    PHICS OR UPPERCASE/LOWERCASE MODE."
                                     :rem 227
715 PRINT"{DOWN}{2 SPACES}THE PRINT ROUTI
    NE"                              :rem 19
730 PRINT"{2 RIGHT}WILL AUTOMATICALLY
    {4 SPACES}SET THE PRINT MODE" :rem 53
745 PRINT"{2 RIGHT}CORRECTLY."   :rem 144
```

```
750 PRINT"{2 DOWN} {RVS}HIT ANY KEY TO BE
    GIN{OFF}"                          :rem 241
770 GETA$:IFA$=""THEN770               :rem 95
780 POKE198,0:RETURN                   :rem 230
800 PRINT"{CLR}{RVS}>{OFF}";:FORI=1TO5:PR
    INTSPC(79)">";:NEXTI               :rem 182
805 PRINT:PRINT:PRINT:PRINT"{18 SPACES}EN
    D ";                               :rem 213
810 PRINT" {4 Y}{RVS}MEMO WRITER{OFF}
    {5 Y}{HOME}";                      :rem 214
820 RETURN                             :rem 122
60000 REM                              :rem 218
60004 G1$=CHR$(145)                    :rem 191
60010 G1$=G1$+CHR$(TF)                 :rem 131
60020 OPEN4,4:WAIT207,1:POKE204,255
                                       :rem 234
60030 FORG0=0TORW:G0$=G1$:G1=G1+CL
                                       :rem 223
60040 FORG2=G1TOG1+(CL-1):G3=PEEK(G2)
                                       :rem 115
60050 IFG3>128THENG3=G3-128:G4=1:G0$=G0$+
      CHR$(18)                         :rem 187
60060 IF(G3>0)*(G3<32)THENG3=G3+64:GOTO60
      100                              :rem 185
60070 IF(G3>31)*(G3<64)THEN60100       :rem 186
60080 IF(G3>63)*(G3<96)THENG3=G3+128:GOTO
      60100                            :rem 47
60090 IF(G3>95)*(G3<128)THENG3=G3+64:GOTO
      60100                            :rem 48
60100 G0$=G0$+CHR$(G3)                 :rem 97
60110 IFG4=1THENG0$=G0$+CHR$(146):G4=0
                                       :rem 76
60120 NEXTG2:PRINT#4,G0$:IFSP=2THENPRINT#
      4                                :rem 132
60130 NEXTG0:CLOSE4:POKE204,0          :rem 239
60140 RETURN                           :rem 219
```

The Beginner's Corner

(Article on page 74.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1:

Stepping Up Or Down (VIC Version)

```
5 REM STEPPING UP OR DOWN              :rem 1
10 GOTO 100                            :rem 43
20 PRINT"{DOWN}{GRN}PRESS RETURN{BLU}"
                                       :rem 238
22 GETA$:IFA$=""THEN22                 :rem 235
24 IF ASC(A$)<>13THEN22                :rem 243
26 RETURN                              :rem 72
30 FOR D=1 TO 80:NEXT D:POKE S,0:RETURN
                                       :rem 246
40 FOR D=1 TO 500:NEXT D:POKE S,0:RETURN
                                       :rem 36
100 PRINT"{CLR}{BLU}":PRINT"STEPPING UP O
    R DOWN"                            :rem 7
110 PRINT"{2 DOWN}TWO NOTES ARE SHOWN.":P
    RINT"FROM THE FIRST ONE,"          :rem 83
120 PRINT"DO YOU GO UP, GO DOWN":PRINT"OR
     STAY THE SAME":PRINT"TO PLAY THE SEC
    OND?"                              :rem 221
130 PRINT"{DOWN}PRESS{2 SPACES}F1 FOR UP"
    :PRINTTAB(7)"F3 FOR SAME":PRINTTAB(7)
    "F5 FOR DOWN"                      :rem 250
140 L$="**********************"        :rem 6
150 FOR I=0TO8:READF(I):NEXT           :rem 189
160 DATA 232,231,228,225,223,219,215,209,
    207                                :rem 114
170 B(1)=135:B(2)=134:B(3)=133         :rem 218
175 POKE 36878,15:S=36876              :rem 70
180 GOSUB20                            :rem 123
190 SC=0:FOR T=1 TO 10                 :rem 132
200 PRINT"{CLR}{4 DOWN}{BLK}":FOR I=1TO5:
    PRINTL$:NEXT                       :rem 42
210 N1=INT(9*RND(0)):P1=7796+N1*22:rem 96
220 POKE P1,81:POKE P1+30720,2         :rem 72
230 N2=INT(9*RND(0)):P2=7802+N2*22:rem 89
240 POKE P2,81:POKE P2+30720,2         :rem 76
250 A=SGN(N1-N2)+2:FL=0                :rem 16
260 POKE S,237:GOSUB 30                :rem 255
270 PRINT"{3 DOWN}{BLU}F1{2 SPACES}UP":PR
    INT"F3{2 SPACES}SAME":PRINT"F5
    {2 SPACES}DOWN"                    :rem 64
280 GET A$:IF A$=""THEN 280            :rem 87
290 IF ASC(A$)<133 OR ASC(A$)>135 THEN 28
    0                                  :rem 88
300 IF ASC(A$)=B(A) THEN 350           :rem 135
310 FL=1:POKE S,159:GOSUB 30           :rem 56
320 POKE S,135:GOSUB 30:GOTO 280       :rem 6
350 POKE S,F(N1):GOSUB 40              :rem 122
360 POKE S,F(N2):GOSUB 40              :rem 124
370 IF FL=0 THEN SC=SC+1               :rem 28
380 NEXT T                             :rem 46
390 PRINT "{2 DOWN}SCORE = ";SC;"OUT OF 1
    0"                                 :rem 134
400 PRINT "{DOWN}{GRN}TRY AGAIN? (Y/N)"
                                       :rem 89
410 GET A$:IF A$="Y" THEN 190          :rem 171
420 IF A$<>"N" THEN 410                :rem 90
430 PRINT"{CLR}{BLU}":END              :rem 43
```

Program 2:

Stepping Up Or Down (64 Version)

```
5 REM STEPPING UP OR DOWN              :rem 1
10 POKE53281,1:GOTO 100                :rem 244
20 PRINT"{DOWN}{GRN}PRESS RETURN{BLU}"
                                       :rem 238
22 GETA$:IFA$=""THEN22                 :rem 235
24 IF ASC(A$)<>13THEN22                :rem 243
26 RETURN                              :rem 72
30 POKE W,17:FOR D=1 TO 80:NEXT D:POKE W,
   0:RETURN                            :rem 78
40 POKE W,17:FOR D=1 TO 500:NEXT D:POKE W
   ,0:RETURN                           :rem 124
100 PRINT"{CLR}{BLU}":PRINTTAB(10)"STEPPI
    NG UP OR DOWN"                     :rem 144
110 PRINT"{2 DOWN}YOU WILL SEE TWO NOTES.
    ":PRINT"FROM THE FIRST ONE, DO YOU MO
    VE UP,"                            :rem 150
120 PRINT"MOVE DOWN, OR STAY THE SAME TO
    {SPACE}PLAY THE SECOND NOTE?":rem 211
130 PRINT"{DOWN}PRESS{2 SPACES}F1 FOR UP"
    :PRINTTAB(7)"F3 FOR SAME":PRINTTAB(7)
    "F5 FOR DOWN"                      :rem 250
140 L$="********************************
    *******"                           :rem 134
150 FOR I=0TO8:READHF(I),LF(I):NEXT
                                       :rem 93
```

```
160 DATA 44,193,42,62,37,162,33,135,31,16
    5,28,49,25,30,22,96,21,31     :rem 173
170 B(1)=135:B(2)=134:B(3)=133    :rem 218
175 POKE 54296,15:V1=54273:V2=54272:W=542
    76:POKE 54277,64:POKE 54278,128
                                  :rem 134
180 GOSUB20                       :rem 123
190 SC=0:FOR T=1 TO 10            :rem 132
200 PRINT"{CLR}{5 DOWN}{BLK}":FOR I=1TO5:
    PRINTL$:NEXT                  :rem 59
210 N1=INT(9*RND(0)):P1=1280+N1*40:rem 78
220 POKE P1,81:POKE P1+54272,2    :rem 80
230 N2=INT(9*RND(0)):P2=1287+N2*40:rem 90
240 POKE P2,81:POKE P2+54272,2    :rem 84
250 A=SGN(N1-N2)+2:FL=0           :rem 16
260 POKE V1,112:POKE V2,199:GOSUB 30
                                  :rem 235
270 PRINT"{3 DOWN}{BLU}F1{2 SPACES}UP":PR
    INT"F3{2 SPACES}SAME":PRINT"F5
    {2 SPACES}DOWN"               :rem 64
280 GET A$:IF A$=""THEN 280       :rem 87
290 IF ASC(A$)<133 OR ASC(A$)>135 THEN 28
    0                             :rem 88
300 IF ASC(A$)=B(A) THEN 350      :rem 135
310 FL=1:POKE V1,10:POKE V2,143:GOSUB 30
                                  :rem 227
320 POKE V1,8:POKE V2,97:GOSUB 30:GOTO 28
    0                             :rem 102
350 POKE V1,HF(N1):POKE V2,LF(N1):GOSUB 4
    0                             :rem 117
360 POKE V1,HF(N2):POKE V2,LF(N2):GOSUB 4
    0                             :rem 120
370 IF FL=0 THEN SC=SC+1          :rem 28
380 NEXT T                        :rem 46
390 PRINT "{2 DOWN}SCORE = ";SC;"OUT OF 1
    0"                            :rem 134
400 PRINT "{DOWN}{GRN}TRY AGAIN? (Y/N)"
                                  :rem 89
410 GET A$:IF A$="Y" THEN 190     :rem 171
420 IF A$<>"N" THEN 410           :rem 90
430 PRINT"{CLR}{BLU}":END         :rem 43
```

Fast Add

(Article on page 84.)

Program 1: Fast Add—VIC Version

```
1 DIMA%(2),B%(2),C%(3),R%(3),P%(5),N%(12,
  3,3):T%=22:V=36878:S1=36876:I=RND(-TI)
                                  :rem 122
5 S%=4*(PEEK(36866)AND128)+64*(PEEK(36869
  )AND112):CS=37888+4*(PEEK(36866)AND128)
                                  :rem 113
10 PRINT"{CLR}"TAB(74)"FASTADD":PRINTTAB(
   68)"1, 2, OR 3 DIGITS?":GOSUB400
                                  :rem 20
15 GETA$:IFA$=""ORA$<"1"ORA$>"3"THEN15
                                  :rem 97
20 L%=VAL(A$):Q%=9+L%*2           :rem 199
25 PB%=0:PR%=0:PA%=0              :rem 86
30 GOSUB100:W%=0:FORI=0TOG%:W%=W%+C%(I)*1
   0↑I:NEXT:GOSUB200:GOSUB300:FORI=1TO100
   0:NEXT                         :rem 18
35 IFU%=W%THENPR%=PR%+1:GOTO55    :rem 93
40 POKE36879,8:PRINT"{CLR}{WHT}"TAB(138);
   "W R O N G":PRINTTAB(49)"THE CORRECT"
                                  :rem 14
45 PRINTTAB(50)"ANSWER IS":FORI=1TO2000:N
   EXT:GOSUB200                   :rem 53
50 Y%=14:FORM=0TOG%:X%=Q%-M*4:Z%=C%(M):GO
   SUB500:NEXT:FORI=1TO1000:NEXT:XT%=30:G
   OTO65                          :rem 179
55 POKEV,15:FORI=0TO5:POKES1,P%(I):FORJ=1
   TO50:NEXTJ:IFI=3THENFORJ=1TO75:NEXTJ
                                  :rem 30
60 NEXTI:FORI=1TO50:NEXTI:POKEV,O:rem 202
65 PB%=PB%+30-XT%:PA%=PA%+1:IFPA%<10THEN3
   0                              :rem 143
70 PR%=PR%*10:S$=STR$(PR%):X1%=3-LEN(S$)*
   2:PRINT"{CLR}{BLK}":Y%=3:H%=0  :rem 210
75 FORM=2TOLEN(S$):X%=X1%+M*4:Z%=VAL(MID$
   (S$,M,1)):GOSUB500:NEXT:PB%=PB%*L%
                                  :rem 223
80 X%=X%+4:Z%=12:GOSUB500         :rem 166
85 PRINTTAB(204)"TIMED SCORE":S$=STR$(PB%
   ):X1%=5-LEN(S$)*2:Y%=12:H%=2   :rem 246
90 FORM=2TOLEN(S$):X%=X1%+M*4:Z%=VAL(MID$
   (S$,M,1)):GOSUB500:NEXT        :rem 92
92 PRINTTAB(182)"HIT ANY KEY"     :rem 181
94 GETA$:IFA$=""THEN94            :rem 253
96 GOTO25                         :rem 15
100 FORI=0TO2:A%(I)=0:B%(I)=0:C%(I)=0:R%(
    I)=0:NEXT:R%(3)=0:C%(3)=0     :rem 97
110 FORI=0TOL%-1:A%(I)=INT(10*RND(1)):IFA
    %(I)<>0THENE%=I               :rem 215
120 B%(I)=INT(10*RND(1)):IFB%(I)<>0THENF%
    =I                            :rem 146
130 W%=A%(I)+B%(I)+R%(I):IFW%<10THENC%(I)
    =W%:G%=I:NEXT:RETURN          :rem 64
140 C%(I)=W%-10:R%(I+1)=1:NEXT:C%(I)=1:G%
    =I:RETURN                     :rem 92
200 POKE36879,24:PRINT"{CLR}":H%=0:Y%=2:F
    ORM=0TOE%:X%=Q%-M*4:Z%=A%(M):GOSUB500
    :NEXT                         :rem 41
210 POKE198,0:Y%=7:FORM=0TOF%:X%=Q%-M*4:Z
    %=B%(M):GOSUB500:NEXT         :rem 218
220 X%=Q%-(F%+1)*4:Z%=10:GOSUB500:POKEV,1
    5:FORM=282-Q%TO269+Q%         :rem 45
230 POKES%+M,160:POKECS+M,H%:POKES1,M-30:
    NEXT:POKEV,0                  :rem 17
240 H%=6:Y%=14:Z%=11:FORM=0TOG%:X%=Q%-M*4
    :GOSUB500:NEXT:RETURN         :rem 54
300 U%=0:H%=2:Y%=14:TI$="000000"  :rem 134
310 PRINT"{HOME}{BLU}"TAB(220)TAB(220)"PR
    OBLEM{2 SPACES}TIME{3 SPACES}RIGHT":P
    RINTTAB(2);PA%+1;TAB(17);PR%  :rem 76
320 FORM=0TOG%                    :rem 69
330 XT%=TI/60:IFXT%>30THEN RETURN :rem 32
340 POKES%+472,ASC(MID$(TI$,5,1))+128:POK
    ECS+472,0                     :rem 17
350 POKES%+473,ASC(MID$(TI$,6,1))+128:POK
    ECS+473,0                     :rem 21
360 GETA$:IFA$=""ORA$<"0"ORA$>"9"THEN330
                                  :rem 201
370 X%=Q%-M*4:Z%=VAL(A$):GOSUB500:U%=U%+Z
    %*10↑M:NEXT:RETURN            :rem 94
400 FORI=0TO12:FORJ=0TO3:FORK=0TO3:READN%
    (I,J,K):NEXTK,J,I             :rem 147
410 FORI=0TO5:READP%(I):NEXTI:RETURN
                                  :rem 75
500 POKEV,15:FORI=0TO3:FORJ=0TO3:K=T%*Y%+
    X%+T%*J+I:POKES%+K,N%(Z%,J,I):POKECS+
    K,H%                          :rem 221
510 POKES1,255-X%*J-Y%*I:NEXTJ,I:POKEV,0:
    POKES1,0:RETURN               :rem 3
1100 DATA108,226,226,123,225,32,32,97,225
     ,32,32,97,32,226,226,32      :rem 119
1101 DATA32,108,97,32,32,126,97,32,32,32,
     97,32,32,226,226,126         :rem 232
1102 DATA108,226,226,123,32,32,98,126,108
     ,226,32,32,124,226,226,126   :rem 10
```

```
1103 DATA108,226,226,123,32,108,98,126,10
     8,32,32,97,32,226,226,32     :rem 175
1104 DATA32,32,254,32,32,255,225,32,124,2
     26,251,126,32,32,124,32      :rem 101
1105 DATA225,226,226,126,124,226,127,32,1
     08,32,108,126,32,226,126,32  :rem 56
1106 DATA32,255,226,32,225,98,98,32,225,3
     2,32,97,32,226,226,32        :rem 39
1107 DATA225,226,226,97,32,32,255,32,32,2
     55,32,32,32,126,32,32        :rem 18
1108 DATA108,226,226,123,124,98,98,126,22
     5,32,32,97,32,226,226,32     :rem 190
1109 DATA108,226,226,123,124,98,98,97,32,
     32,108,126,32,226,126,32     :rem 190
1110 DATA32,32,123,32,32,98,252,123,32,32
     ,97,32,32,32,32,32           :rem 110
1111 DATA160,160,160,97,160,160,160,97,16
     0,160,160,97,160,160,160,97  :rem 70
1112 DATA108,123,32,123,124,126,255,32,32
     ,255,108,123,124,32,124,126  :rem 42
1113 DATA215,225,231,235,231,235  :rem 77
```

Program 2: Fast Add—64 Version

```
1 DIMA%(2),B%(2),C%(3),R%(3),P%(5),N%(12,
  3,3):T%=40:V=54296:S1=54272:I=RND(-TI)
                                  :rem 106
5 CS=55296:S%=1024                :rem 201
7 FORL=S1TOS1+24:POKES1,0:NEXTL:POKEV,15:
  POKES1+5,17:POKES1+6,241        :rem 52
10 PRINT"{CLR}"TAB(56)"FASTADD":PRINTTAB(
   91)"1, 2, OR 3 DIGITS?":GOSUB400
                                  :rem 16
15 GETA$:IFA$=""ORA$<"1"ORA$>"3"THEN15
                                  :rem 97
20 L%=VAL(A$):Q%=9+L%*2           :rem 199
25 PB%=0:PR%=0:PA%=0              :rem 86
30 GOSUB100:W%=0:FORI=0TOG%:W%=W%+C%(I)*1
   0↑I:NEXT:GOSUB200:GOSUB300     :rem 93
32 FORI=1TO1000:NEXT              :rem 224
35 IFU%=W%THENPR%=PR%+1:GOTO55    :rem 93
40 POKE53281,0:PRINT"{CLR}{WHT}"TAB(136);
   "W R O N G":PRINTTAB(55)"THE CORRECT"
                                  :rem 243
45 PRINTTAB(56)"ANSWER IS":FORI=1TO2000:N
   EXT:GOSUB200                   :rem 59
50 Y%=14:FORM=0TOG%:X%=Q%-M*4+8:Z%=C%(M):
   GOSUB500:NEXT:FORI=1TO1000     :rem 20
53 NEXT:XT%=30:GOTO65             :rem 48
55 FORI=1TO6:POKES1+4,33:POKES1+1,PI(I):F
   ORA=1TODU(I):NEXT:POKES1+4,32  :rem 99
60 FORJ=1TO50:NEXT:NEXT           :rem 255
65 PB%=PB%+30-XT%:PA%=PA%+1:IFPA%<10THEN3
   0                              :rem 143
70 PR%=PR%*10:S$=STR$(PR%):X1%=3-LEN(S$)*
   2:PRINT"{CLR}{BLK}":Y%=3:H%=0  :rem 210
75 FORM=2TOLEN(S$):X%=X1%+M*4+8:Z%=VAL(MI
   D$(S$,M,1)):GOSUB500:NEXT:PB%=PB%*L%
                                  :rem 66
80 X%=X%+4:Z%=12:GOSUB500         :rem 166
85 PRINTTAB(13)"{9 DOWN} TIMED SCORE":S$=
   STR$(PB%):X1%=5-LEN(S$)*2:Y%=12:H%=2
                                  :rem 93
90 FORM=2TOLEN(S$):X%=X1%+M*4+8:Z%=VAL(MI
   D$(S$,M,1)):GOSUB500:NEXT      :rem 191
92 PRINTTAB(13)"{8 DOWN} HIT ANY KEY"
                                  :rem 6
94 GETA$:IFA$=""THEN94            :rem 253
96 GOTO25                         :rem 15
100 FORI=0TO2:A%(I)=0:B%(I)=0:C%(I)=0:R%(
    I)=0:NEXT:R%(3)=0:C%(3)=0     :rem 97
110 FORI=0TOL%-1:A%(I)=INT(10*RND(1)):IFA
    %(I)<>0THENE%=I               :rem 215
120 B%(I)=INT(10*RND(1)):IFB%(I)<>0THENF%
    =I                            :rem 146
130 W%=A%(I)+B%(I)+R%(I):IFW%<10THENC%(I)
    =W%:G%=I:NEXT:RETURN          :rem 64
140 C%(I)=W%-10:R%(I+1)=1:NEXT:C%(I)=1:G%
    =I:RETURN                     :rem 92
200 POKE53281,1:POKE53280,0:PRINT"{CLR}":
    H%=0:Y%=2:FORM=0TOE%:X%=Q%-M*4+8:Z%=A
    %(M)                          :rem 72
205 GOSUB 500:NEXT                :rem 37
210 POKE198,0:Y%=7:FORM=0TOF%:X%=Q%-M*4+8
    :Z%=B%(M):GOSUB500:NEXT       :rem 61
220 X%=Q%-(F%+1)*4+8:Z%=10:GOSUB500:FORM=
    466-Q%TO453+Q%-1              :rem 156
230 POKES%+M,160:POKECS+M,H%:FORA=1TO5:PO
    KES1+4,33:POKES1+1,M-430      :rem 147
235 NEXT:NEXT:POKES1+4,32         :rem 47
240 H%=6:Y%=14:Z%=11:FORM=0TOG%:X%=Q%-M*4
    +8:GOSUB500:NEXT:RETURN       :rem 153
300 U%=0:H%=2:Y%=14:TI$="000000" :rem 134
310 PRINT"{HOME}{BLU}{19 DOWN} PROBLEM";T
    AB(18)"TIME";TAB(30)"RIGHT"   :rem 178
315 PRINTTAB(3);PA%+1;TAB(31)PR%  :rem 92
320 FORM=0TOG%                    :rem 69
330 XT%=TI/60:IFXT%>30THEN RETURN :rem 32
340 POKES%+819,ASC(MID$(TI$,5,1))+128:POK
    ECS+819,0                     :rem 27
350 POKES%+820,ASC(MID$(TI$,6,1))+128:POK
    ECS+820,0                     :rem 13
360 GETA$:IFA$=""ORA$<"0"ORA$>"9"THEN330
                                  :rem 201
370 X%=Q%-M*4+8:Z%=VAL(A$):GOSUB500:U%=U%
    +Z%*10↑M:NEXT:RETURN          :rem 193
400 FORI=0TO12:FORJ=0TO3:FORK=0TO3:READN%
    (I,J,K):NEXTK,J,I             :rem 147
410 FORI=0TO5:READP%(I):NEXTI:FORQ=1TO6:R
    EADPI(Q),DU(Q):NEXTQ:RETURN   :rem 198
500 POKES1+4,33:FORI=0TO3:FORJ=0TO3:K=T%*
    Y%+X%+T%*J+I                  :rem 171
505 POKES%+K,N%(Z%,J,I):POKECS+K,H%:POKES
    1+1,125-X%*J-Y%*I:POKES1,30   :rem 228
510 NEXTJ,I:POKES1+4,32:RETURN    :rem 139
1100 DATA108,226,226,123,225,32,32,97,225
     ,32,32,97,32,226,226,32      :rem 119
1101 DATA32,108,97,32,32,126,97,32,32,32,
     97,32,32,226,226,126         :rem 232
1102 DATA108,226,226,123,32,32,98,126,108
     ,226,32,32,124,226,226,126   :rem 10
1103 DATA108,226,226,123,32,108,98,126,10
     8,32,32,97,32,226,226,32     :rem 175
1104 DATA32,32,254,32,32,255,225,32,124,2
     26,251,126,32,32,124,32      :rem 101
1105 DATA225,226,226,126,124,226,127,32,1
     08,32,108,126,32,226,126,32  :rem 56
1106 DATA32,255,226,32,225,98,98,32,225,3
     2,32,97,32,226,226,32        :rem 39
1107 DATA225,226,226,97,32,32,255,32,32,2
     55,32,32,32,126,32,32        :rem 18
1108 DATA108,226,226,123,124,98,98,126,22
     5,32,32,97,32,226,226,32     :rem 190
1109 DATA108,226,226,123,124,98,98,97,32,
     32,108,126,32,226,126,32     :rem 190
1110 DATA32,32,123,32,32,98,252,123,32,32
     ,97,32,32,32,32,32           :rem 110
1111 DATA160,160,160,97,160,160,160,97,16
     0,160,160,97,160,160,160,97  :rem 70
1112 DATA108,123,32,123,124,126,255,32,32
     ,255,108,123,124,32,124,126  :rem 42
1113 DATA215,225,231,235,231,235  :rem 77
```

```
1114 DATA 25,50,33,50,42,50,50,250,42,50,
     50,300                          :rem 230
19999 S1=54272                       :rem 218
20000 V=S1+24:FORL=S1TOS1+24:POKES1,0:NEX
      TL:POKEV,15:POKES1+5,17:POKES1+6,24
      1                              :rem 209
20010 POKES1+4,33:POKES1+1,25:FORI=1TO50:
      NEXTI:POKES1+4,32:FORI=1TO50:NEXT
                                     :rem 75
20020 POKES1+1,33:POKES1+4,33:FORA=1TO50:
      NEXT:POKES1+4,32:FORI=1TO50 :NEXT
                                     :rem 250
20025 POKES1+4,33:POKES1+1,42:FORI=1TO50:
      NEXT:POKES1+4,32:FORI=1TO50:NEXT
                                      :rem 7
20028 POKES1+4,33:POKES1+1,50:FORI=1TO250
      :NEXT:POKES1+4,32:FORI=1TO50:NEXT
                                     :rem 59
20030 POKES1+4,33:POKES1+1,42:FORI=1TO50:
      NEXTI:POKES1+4,32:FORI=1TO50:NEXTI
                                     :rem 149
20040 POKES1+4,33:POKES1+1,50:FORI=1TO300
      :NEXT:POKES1+4,32              :rem 216
20050 POKES1+4,33:POKES1+1,66:FORI=1TO300
      :NEXT:POKES1+4,32              :rem 224
```

Power BASIC

(Article on page 95.)

Program 1: VIC Step Lister

```
10 TM = PEEK(56) * 256 + PEEK(55):rem 242
15 TM = TM - 242                     :rem 170
20 LSB= (TM/256-INT(TM/256)) * 256
                                     :rem 219
25 MSB = INT(TM/256)                  :rem 47
30 POKE 55,LSB: POKE 56,MSB          :rem 235
35 POKE 253,LSB+13: POKE 254,MSB     :rem 223
40 FOR I = TM TO TM + 241            :rem 120
50 READ A: POKE I,A: CHK = CHK + A: NEXT
   {SPACE}I                          :rem 50
60 X = 828: FOR I = X TO X + 23      :rem 39
70 READ A: POKE I,A: CHK = CHK + A: NEXT
   {SPACE}I                          :rem 52
80 IF CHK <> 33283 THEN PRINT "DATA ERROR
   ": END                            :rem 255
90 PRINT "SYS" TM "TO INITIATE": NEW
                                     :rem 60
100 DATA162,0,189,60,3,149,115,232,224,23
    ,208,246,0,201,64,240,22,234     :rem 90
120 DATA234,234,234,201,58,176,10,201,32,
    240,7,56,233,48,56,233,208,96:rem 163
140 DATA76,115,0,160,0,185,0,2,201,64,208
    ,243,200,185,0,2,201,0,240,9     :rem 66
160 DATA201,45,208,244,169,171,153,0,2,16
    9,1,133,122,160,1,24,185,0,2     :rem 88
180 DATA32,107,201,32,19,198,160,0,32,121
    ,0,32,107,201,165,20,5,21,208:rem 124
200 DATA6,169,255,133,20,133,21,160,1,132
    ,198,160,1,132,15,177,95,240     :rem 100
210 DATA85,32,44,200,32,215,202,134,1,132
    ,2,173,198,0,240,251,169,0       :rem 242
240 DATA141,198,0,166,1,164,2,200,177,95,
    170,200,177,95,197,21,208,4,228,20
                                     :rem 157
250 DATA240,2,176,44,132,73,32,205,221,16
    9,32,164,73,41,127,32,71,203     :rem 103
270 DATA201,34,208,6,165,15,73,255,133,15
    ,200,240,17,177,95,208,16        :rem 224
290 DATA168,177,95,170,200,177,95,134,95,
    133,96,208,163,76,116,196,16     :rem 164
310 DATA218,201,255,240,214,36,15,48,210,
    56,233,127,170,132,73,160,255,202
                                     :rem 91
320 DATA240,8,200,185,158,192,16,250,48,2
    45,200,185,158,192,48,181,32     :rem 129
350 DATA71,203,208,245,0,230,122,208,2,23
    0,123,173,0,2,201,58,240,10      :rem 21
360 DATA201,32,240,239,108,253,0     :rem 74
370 DATA234,234,234,96               :rem 114
```

Program 2: 64 Step Lister

```
10 TM=49152                          :rem 68
20 FOR I = TM TO TM + 241            :rem 118
30 READ A: POKE I,A: CHK = CHK + A: NEXT
   {SPACE}I                          :rem 48
40 X = 828: FOR I = X TO X + 23      :rem 37
50 READ A: POKE I,A: CHK = CHK + A: NEXT
   {SPACE}I                          :rem 50
60 IF CHK <> 32456 THEN PRINT "DATA ERROR
   ": END                            :rem 254
70 SYS49152                          :rem 107
100 DATA162,0,189,60,3,149,115,232,224,23
    ,208,246,0,201,64,240,22,201     :rem 84
120 DATA58,176,10,201,32,240,11,56,233,48
    ,56,233,208,96,76,116,164,234:rem 169
140 DATA76,115,0,160,0,185,0,2,201,64,208
    ,243,200,185,0,2,201,0,240,9,201
                                     :rem 1
160 DATA45,208,244,169,171,153,0,2,169,1,
    133,122,160,1,24,185,0,2,32,107
                                     :rem 238
180 DATA169,32,19,166,160,0,32,121,0,32,1
    07,169,165,20,5,21,208,6,169     :rem 106
200 DATA255,133,20,133,21,160,1,132,198,1
    60,1,132,15,177,95,240,175,32:rem 144
220 DATA44,168,32,215,170,134,25,132,26,1
    73,198,0,240,251,169,0,141,198
                                     :rem 214
230 DATA0,166,25,164,26,200,177,95,170,20
    0,177,95,197,21,208,4,228,20     :rem 120
250 DATA240,2,176,44,132,73,32,205,189,16
    9,32,164,73,41,127,32,71,171     :rem 120
270 DATA201,34,208,6,165,15,73,255,133,15
    ,200,240,17,177,95,208,16,168:rem 171
290 DATA177,95,170,200,177,95,134,95,133,
    96,208,163,108,6,3,16,218,201:rem 188
310 DATA255,240,214,36,15,48,210,56,233,1
    27,170,132,73,160,255,202,240,8
                                     :rem 251
320 DATA200,185,158,160,16,250,48,245,200
    ,185,158,160,48,181,32,71,171,208
                                     :rem 112
350 DATA245,0,230,122,208,2,230,123,173,0
    ,2,201,58,240,10,201,32,240,239
                                     :rem 214
370 DATA76,13,192,234,234,234,96     :rem 99
```

Cassette Beeper

(Article on page 102.)

Program 1:
Cassette Beeper—VIC Version

```
5 PRINT CHR$(147)"{3 DOWN}{3 SPACES}CASSE
  TTE BEEPER":PRINT                  :rem 253
10 EM=PEEK(56)*256+PEEK(55)-60       :rem 118
15 PT=EM:GOSUB100                     :rem 36
```

```
20 POKE51,LB:POKE55,LB                    :rem 62
25 POKE52,HB:POKE56,HB                    :rem 61
30 PRINT:PRINT"SYS "EM:PRINT"(TO RESET PO
   INTERS)"                               :rem 130
35 PT=PT+21                               :rem 123
40 FORX=1TO7STEP2:GOSUB100:B(X)=LB:B(X+1)
   =HB                                    :rem 220
45 PT=PT+3:NEXT X                         :rem 29
50 FORX=EMTOEM+57                         :rem 63
55 READN:IFN<0THENN=B(N*-1)               :rem 122
60 POKEX,N:NEXT X:PRINT:PRINT             :rem 198
65 SYS EM:SYSB(3)+B(4)*256:NEW            :rem 216
75 DATA 169,-1141,48,3,169,-2,141,49,3,1
   69,-5,141,50,3,169,-6                  :rem 225
80 DATA 141,51,3,96,32,73,245,76,-7,-8,32
   ,133,246,8,72,9,15                   :rem 191
85 DATA 141,14,144,169,240,141,12,144,165
   ,162,105,250,197,162                   :rem 187
90 DATA 48,252,169,0,141,12,144,104,40,96
                                          :rem 222
100 HB=INT(PT/256):LB=PT - HB*256:RETURN
                                          :rem 69
```

Program 2:
Cassette Beeper—64 Version

```
10 I=49152                                :rem 236
20 READ A:IF A=256 THEN END               :rem 169
30 POKE I,A:I=I+1:GOTO 20                 :rem 130
49152 DATA 169,21,141,48,3,169,192
                                          :rem 155
49160 DATA 141,49,3,169,27,141,50 :rem 96
49168 DATA 3,169,192,141,51,3,96  :rem 59
49176 DATA 32,165,244,76,30,192,32
                                          :rem 153
49184 DATA 237,245,8,72,169,0,160:rem 107
49192 DATA 24,153,0,212,136,208,250
                                          :rem 186
49200 DATA 169,15,141,24,212,169,85
                                          :rem 197
49208 DATA 141,5,212,169,170,141,6
                                          :rem 141
49216 DATA 212,169,100,141,0,212,141
                                          :rem 223
49224 DATA 1,212,169,17,141,4,212 :rem 84
49232 DATA 169,16,141,4,212,104,40
                                          :rem 133
49240 DATA 96,256                         :rem 85
```

Machine Language For Beginners

(Article on page 104.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 2: VIC Version

```
10 I=12288                                :rem 236
20 READ A:IF A=256 THEN 50                :rem 55
30 POKE I,A:CK=CK+A:I=I+1:GOTO 20:rem 129
40 END                                    :rem 59
50 IF CK<>38268 THEN PRINT "ERROR IN DATA
   STATEMENTS":STOP                       :rem 202
12288 DATA 160,0,169,8,153,0              :rem 99
12294 DATA 148,153,0,149,200,208          :rem 40
12300 DATA 247,160,0,169,224,153          :rem 33
12306 DATA 0,16,153,228,17,200            :rem 184
12312 DATA 192,22,208,245,169,21          :rem 39
12318 DATA 133,71,169,16,133,72           :rem 251
12324 DATA 162,24,160,0,169,224           :rem 240
12330 DATA 145,71,200,145,71,202          :rem 25
12336 DATA 240,16,24,165,71,105           :rem 242
12342 DATA 22,133,71,165,72,105           :rem 240
12348 DATA 0,133,72,76,38,48              :rem 108
12354 DATA 169,20,133,204,32,155          :rem 36
12360 DATA 224,164,98,185,149,15          :rem 56
12366 DATA 201,224,240,244,169,90 :rem 92
12372 DATA 153,149,15,198,204,208:rem 100
12378 DATA 235,169,214,133,251,169
                                          :rem 155
12384 DATA 17,133,252,32,193,48           :rem 254
12390 DATA 162,10,32,203,48,165           :rem 241
12396 DATA 197,201,0,240,14,201           :rem 237
12402 DATA 1,240,25,201,53,240            :rem 174
12408 DATA 91,201,60,240,86,208           :rem 246
12414 DATA 231,198,251,160,0,177          :rem 40
12420 DATA 251,201,32,240,16,230          :rem 17
12426 DATA 251,76,102,48,160,2            :rem 194
12432 DATA 177,251,201,32,240,25          :rem 30
12438 DATA 76,102,48,230,251,160          :rem 40
12444 DATA 1,169,32,145,251,165           :rem 249
12450 DATA 251,208,2,198,252,198          :rem 51
12456 DATA 251,32,193,48,76,102           :rem 254
12462 DATA 48,160,1,169,32,145            :rem 200
12468 DATA 251,230,251,208,2,230          :rem 33
12474 DATA 252,32,193,48,76,102           :rem 255
12480 DATA 48,160,1,169,120,145           :rem 246
12486 DATA 251,136,208,251,96,160:rem 101
12492 DATA 0,136,208,253,202,208          :rem 36
12498 DATA 248,96,165,251,133,253:rem 112
12504 DATA 165,252,133,254,32,9           :rem 247
12510 DATA 49,160,0,165,193,145           :rem 246
12516 DATA 253,162,10,32,203,48           :rem 239
12522 DATA 169,32,145,253,32,9            :rem 201
12528 DATA 49,177,253,201,32,208          :rem 48
12534 DATA 7,169,193,145,253,76           :rem 10
12540 DATA 229,48,201,224,240,4           :rem 240
12546 DATA 201,90,240,223,76,102          :rem 33
12552 DATA 48,56,165,253,233,22           :rem 254
12558 DATA 133,253,165,254,233,0          :rem 43
12564 DATA 133,254,96,256                 :rem 222
```

Program 3: 64 Version

```
10 I=49152                                :rem 236
20 READ A:IF A=256 THEN 50                :rem 55
30 POKE I,A:CK=CK+A:I=I+1:GOTO 20:rem 129
40 END                                    :rem 59
50 IF CK<>41231 THENPRINT"ERROR IN DATA S
   TATEMENTS":STOP                        :rem 186
49152 DATA 160,0,169,8,153,0              :rem 99
49158 DATA 216,153,0,217,153,0            :rem 198
49164 DATA 218,153,0,219,200,208          :rem 42
49170 DATA 241,160,0,169,224,153          :rem 42
49176 DATA 0,4,153,192,7,200              :rem 99
49182 DATA 192,40,208,245,169,39          :rem 63
49188 DATA 133,71,169,4,133,72            :rem 215
49194 DATA 162,24,160,0,169,224           :rem 255
49200 DATA 145,71,200,145,71,202          :rem 31
49206 DATA 240,16,24,165,71,105           :rem 248
49212 DATA 40,133,71,165,72,105           :rem 246
49218 DATA 0,133,72,76,44,192             :rem 159
```

```
49224 DATA 169,20,133,204,32,158  :rem 45
49230 DATA 224,164,98,185,168,3   :rem 12
49236 DATA 201,224,240,244,169,90 :rem 98
49242 DATA 153,168,3,198,204,208  :rem 56
49248 DATA 235,169,169,133,251,169
                                  :rem 170
49254 DATA 7,133,252,32,199,192    :rem 9
49260 DATA 162,5,32,209,192,165    :rem 1
49266 DATA 197,201,56,240,14,201  :rem 46
49272 DATA 8,240,25,201,46,240    :rem 198
49278 DATA 91,201,35,240,86,208    :rem 7
49284 DATA 231,198,251,160,0,177  :rem 55
49290 DATA 251,201,32,240,16,230  :rem 32
49296 DATA 251,76,108,192,160,2    :rem 7
49302 DATA 177,251,201,32,240,25  :rem 36
49308 DATA 76,108,192,230,251,160:rem 100
49314 DATA 1,169,32,145,251,165   :rem 255
49320 DATA 251,208,2,198,252,198  :rem 57
49326 DATA 251,32,199,192,76,108  :rem 64
49332 DATA 192,160,1,169,32,145   :rem 254
49338 DATA 251,230,251,208,2,230  :rem 39
49344 DATA 252,32,199,192,76,108  :rem 65
49350 DATA 192,160,1,169,120,145  :rem 44
49356 DATA 251,136,208,251,96,160:rem 107
49362 DATA 0,136,208,253,202,208  :rem 42
49368 DATA 248,96,165,251,133,253:rem 118
49374 DATA 165,252,133,254,32,15  :rem 51
49380 DATA 193,160,0,165,193,145  :rem 53
49386 DATA 253,162,10,32,209,192  :rem 52
49392 DATA 169,32,145,253,32,15    :rem 5
49398 DATA 193,177,253,201,32,208:rem 111
49404 DATA 7,169,193,145,253,76   :rem 16
49410 DATA 235,192,201,224,240,4  :rem 35
49416 DATA 201,90,240,223,76,108  :rem 45
49422 DATA 192,56,165,253,233,40  :rem 52
49428 DATA 133,253,165,254,233,0  :rem 49
49434 DATA 133,254,96,256         :rem 228
```

Sound Story

(Article on page 116.)

```
100 POKE 36879,108:V=36878        :rem 115
110 PRINT"{CLR}":FORI=1TO7:PRINT:NEXT:PRI
    NTTAB(6)"{WHT}{2 DOWN}SOUND STORY"
                                  :rem 162
120 FORL=1TO3000:NEXT              :rem 19
130 PRINT"{CLR}":POKE36879,8:FORI=1TO9:PR
    INT:NEXT                      :rem 202
140 PRINTTAB(2)"{CYN}IT WAS A DARK AND
    {5 SPACES}":PRINTTAB(4)"STORMY NIGHT.
    .."                           :rem 118
150 POKEV,15:S=36874:FORL=1TO2000:NEXT
                                  :rem 60
160 POKES,195:FORL=1TO600:NEXT:POKES,201:
    FORL=1TO200:NEXT              :rem 117
170 POKES,203:FORL=1TO300:NEXT:POKES,0:FO
    RL=1TO100:NEXT                 :rem 5
180 POKES,195:FORL=1TO200:NEXT:POKES,0:FO
    RL=1TO200:NEXT                :rem 16
190 FORT=1TO12:POKES,211:FORL=1TO50:NEXT:
    POKES,213:FORL=1TO50:NEXT:NEXT:POKES,
    0                             :rem 140
200 PRINT"{CLR}":FORL=1TO1000:NEXT:POKE36
    879,25:S=36877                :rem 148
210 FORL=250TO200STEP-1:POKES,L:NEXT:POKE
    S,0:POKE36879,8:FORL=1TO100:NEXT
                                  :rem 148
220 POKE36879,25:FORL=250TO200STEP-1:POKE
    S,L:NEXT:POKES,0:POKE36879,8  :rem 26
230 FORL=15TO4STEP-.04:POKEV,L:POKES,130:
    NEXT                          :rem 105
240 POKE36878,15:POKE36879,25:FORL=250TO1
    80STEP-1:POKES,L:NEXT:POKES,0:POKE368
    79,8                          :rem 46
250 FORL=15TO1STEP-.03:POKEV,L:POKES,128:
    NEXT                          :rem 110
260 FORI=1TO6:PRINT:NEXT:PRINT"{3 SPACES}
    SUDDENLY, OFF IN":PRINT:PRINT" THE DI
    STANCE, A TRAIN"              :rem 73
270 PRINTTAB(7)"WENT BY..."       :rem 44
280 FORL=1TO4000:NEXT             :rem 27
290 PRINT"{CLR}":L=1              :rem 243
300 FORD=200TO15STEP-5:L=L+.3:POKEV,L
                                  :rem 6
310 POKES,200:FORT=1TO60:NEXTT:POKES,0:FO
    RT=1TOD:NEXTT:NEXTD           :rem 249
320 FORL=15TO0STEP-.3:POKEV,L:POKES,200:F
    ORT=1TO40:NEXTT:POKES,0:FORT=1TO40:NE
    XTT:NEXTL                     :rem 4
330 FORI=1TO8:PRINT:NEXT:PRINTTAB(4)"THEN
     THE TRAIN":PRINT:PRINTTAB(3)"ENGINEE
    R HEARD "                     :rem 34
340 PRINTTAB(18)"{UP}A":PRINT:PRINTTAB(4)
    "FLYING SAUCER!"              :rem 166
350 FORL=1TO4000:NEXT             :rem 25
360 PRINT"{CLR}":C=36879:POKEC,138:POKEV,
    15:S=36874:GOSUB430           :rem 180
370 POKEC,110:GOSUB440             :rem 28
380 POKEC,25:GOSUB430             :rem 241
390 POKEC,93:GOSUB440             :rem 248
400 POKEC,127:GOSUB430             :rem 29
410 POKEC,76:GOSUB440             :rem 242
420 POKEC,8:POKES,0:GOTO450       :rem 144
430 FORL=180TO254:POKES,L:FORM=1TO5:NEXTM
    :POKES,0:NEXTL:RETURN         :rem 131
440 FORL=254TO180STEP-1:POKES,L:FORM=1TO5
    :NEXTM:POKES,0:NEXTL:RETURN   :rem 30
450 PRINT"{CLR}":FORI=1TO8:PRINT:NEXT:PRI
    NT"{3 SPACES}A SECRET MESSAGE" :rem 7
460 PRINT:PRINTTAB(3)"WAS SENT...":rem 60
470 FORM=1TO30:POKEV,15:POKE36876,200:FOR
    L=1TO(INT(RND(1)*80)):NEXT    :rem 69
480 POKE 36876,0:FORL=1TO(INT(RND(1)*80))
    :NEXT:NEXT                    :rem 42
490 PRINT"{CLR}":FORI=1TO9:PRINT:NEXT:PRI
    NTTAB(5)"A PING PONG"          :rem 0
500 PRINT:PRINTTAB(5)"BALL DROPPED!"
                                  :rem 212
510 POKEV,15:S=36874              :rem 131
520 FORD=200TO0STEP-5:POKES,250:FORT=1TO2
    :NEXTT:POKES,0:FORT=1TOD:NEXTT:NEXTD
                                  :rem 114
530 PRINT"{CLR}":FORI=1TO7:PRINT:NEXT:PRI
    NTTAB(3)"THE STORM ENDED,"    :rem 86
540 PRINT:PRINTTAB(2)"THE STARS CAME OUT,
    "                             :rem 51
550 PRINT:PRINTTAB(2)" AND THE CRICKETS":
    PRINT:PRINTTAB(2)"STARTED CHIRPING...
    "                             :rem 185
560 FORL=1TO5000:NEXT             :rem 29
570 PRINT"{CLR}":POKE36879,104:FORL=1TO20
                                  :rem 27
580 X=INT(RND(1)*506)             :rem 153
590 POKE7680+X,46:POKE38400+X,7:NEXT
                                  :rem 130
600 S=36876:FORL=15TO1STEP-.5:POKEV,L
                                  :rem 27
610 FORN=1TO5:POKES,243:FORT=1TO3:NEXTT:P
    OKES,0:FORT=1TO8:NEXTT        :rem 188
620 NEXTN:FORT=1TO100:NEXTT:NEXTL:rem 206
```

```
630 FORI=1TO10:PRINT:NEXT:PRINTTAB(8)"
    {YEL}THE END{BLU}"              :rem 91
640 FORL=1TO3000:NEXT:PRINT"{CLR}":POKE36
    879,27:END                     :rem 216
```

Joystick Control For The 64

(Article on page 118.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Chase And Tag

```
15 REM{2 SPACES}*{8 SPACES}CHASE AND TAG
    {8 SPACES}*                    :rem 177
40 POKE 53280,4 :POKE 53281,14 :PRINT "
    {WHT}" :CLR :CO=54272:GOTO 700 :rem 52
50 REM *** INDIRECT ADDRESS REGISTERS ***
                                   :rem 85
55 POKE 52254,1 :POKE 52246,2 :POKE 52247
    ,42 :POKE 52245,82 :POKE 52253,81
                                   :rem 193
60 POKE 52249,80 :POKE 52251,40 :POKE 522
    50,0 :POKE 52255,41            :rem 231
65 POKE 52126,1 :POKE 52118,2 :POKE 52119
    ,42 :POKE 52117,82 :POKE 52125,81
                                   :rem 184
70 POKE 52121,80 :POKE 52123,40 :POKE 521
    22,0 :POKE 52127,41            :rem 215
100 REM *** PLAYER MOVEMENT WITH JOYSTICK
     ***                           :rem 85
110 R = 1422 :L = 1385 :P = 0      :rem 117
120 POKE R,81:POKER+CO,0:POKE L,102:POKEL
    +CO,0                          :rem 191
125 P = P+1                        :rem 209
130 IF P = 100 THEN GOTO 310       :rem 61
140 X = PEEK(56321)+52000          :rem 195
145 IF X < 52245 THEN GOTO 140     :rem 188
150 M = PEEK(X)-41                 :rem 128
160 Y = PEEK(56320)+52000          :rem 197
165 IF Y < 52117 THEN GOTO 160     :rem 191
170 N = PEEK(Y)-41                 :rem 132
180 C = (R+M - 1063) / 40 :IF C - INT(C)
    {SPACE}= 0 THEN M = 0 :GOTO 210
                                   :rem 210
190 G = (R+M - 1064) / 40 :IF G - INT(G)
    {SPACE}= 0 THEN M = 0 :GOTO 210
                                   :rem 224
200 IF R+M < 1063 OR R+M > 1822 THEN M =
    {SPACE}0                       :rem 80
210 POKE R,32:POKER+CO,0:R = R+M   :rem 12
220 POKE R,81:POKER+CO,0           :rem 126
225 IF T = 1 AND R = L THEN GOTO 310
                                   :rem 148
230 H = (L+N - 1063) / 40 :IF H - INT(H)
    {SPACE}= 0 THEN N = 0 :GOTO 260
                                   :rem 222
240 B = (L+N - 1064) / 40 :IF B - INT(B)
    {SPACE}= 0 THEN N = 0 :GOTO 260
                                   :rem 206
250 IF L+N < 1063 OR L+N > 1822 THEN N =
    {SPACE}0                       :rem 76
260 POKE L,32 :POKEL+CO,0:L = L+N:rem 250
270 POKE L,102:POKEL+CO,0          :rem 161
275 IF T = 0 AND R = L THEN GOTO 310
                                   :rem 152
280 IF P = 80 THEN POKE 53281,12   :rem 14
290 GOTO 125                       :rem 108
300 REM *** THE EXPLOSION ***      :rem 21
310 FOR B = 1 TO 6                  :rem 4
320 FOR A = 0 TO 15 :POKE 53281,A :NEXT A
                                   :rem 198
330 NEXT B                         :rem 23
340 POKE L,32:POKEL+CO,0:POKE R,32:POKER+
    CO,0                           :rem 145
400 REM *** RESETTING THE PLAYING FIELD A
    ND KEEPING SCORE ***           :rem 212
410 POKE 53281,1 :POKE 1422,81:POKE 1422+
    CO,0:POKE 1385,102:POKE1385+CO,0
                                   :rem 130
420 IF T = 0 AND P = 100 THEN GOTO 610
                                   :rem 214
430 IF T = 1 AND P < 100 THEN GOTO 610
                                   :rem 215
500 REM *** UPDATING THE LEFT PLAYERS SCO
    RE ***                         :rem 121
510 E = E+1                        :rem 185
520 IF E = 58 AND F = 49 THEN GOTO 1300
                                    :rem 4
530 IF E = 58 THEN F = 49 :POKE 1945,F:PO
    KE1945+CO,0                    :rem 56
540 IF E = 58 THEN E = 48          :rem 52
550 POKE 1976,9:POKE1976+CO,0:POKE 1977,2
    0:POKE1977+CO,0                :rem 135
560 POKE 1946,E:POKE1946+CO,0:POKE 1949,3
    2:POKE1949+CO,0                :rem 143
565 POKE 1950,32:POKE1950+CO,0:T = 1 :GOT
    O 110                          :rem 129
600 REM *** UPDATING THE RIGHT PLAYERS SC
    ORE ***                        :rem 205
610 D = D+1                        :rem 184
620 IF D = 58 AND QG = 49 THEN GOTO 1300
                                   :rem 86
630 IF D = 58 THEN QG = 49 :POKE 1980,QG:
    POKE1980+CO,0                  :rem 218
640 IF D = 58 THEN D = 48          :rem 51
650 POKE 1949,9:POKE1949+CO,0:POKE 1950,2
    0:POKE1950+CO,0                :rem 118
660 POKE 1981,D:POKE1981+CO,0:POKE 1976,3
    2                              :rem 52
665 POKE 1976,32 :POKE1976+CO,0:POKE 1977
    ,32 :POKE1977+CO,0:T=0:GOTO 110
                                   :rem 189
700 REM *** ENTERING THE PLAYERS INITIALS
     ***                           :rem 49
710 POKE53281,0:PRINT "{CLR}":POKE53281,1
                                   :rem 141
720 PRINT "{BLK}{3 RIGHT}ENTER THE LEFT P
    LAYERS 3 INITIALS{5 DOWN}"     :rem 224
725 PRINT"{17 RIGHT}";             :rem 151
730 FOR KL = 1 TO 3                :rem 92
735 GETK$:IFK$=""THEN735           :rem 117
737 IFK$>"Z"ORK$<"A"THEN735        :rem 26
739 PRINTK$;                       :rem 218
740 IM$(KL)=K$:NEXT KL             :rem 249
750 POKE53281,0:PRINT "{CLR}":POKE53281,1
                                   :rem 145
760 PRINT "{3 RIGHT}ENTER THE RIGHT PLAYE
    RS 3 INITIALS{5 DOWN}"         :rem 167
765 PRINT"{17 RIGHT}";             :rem 155
770 FOR KR = 1 TO 3                :rem 102
```

```
775 GETK$:IFK$=""THEN775          :rem 125
777 IFK$>"Z"ORK$<"A"THEN775       :rem 34
779 PRINTK$;                      :rem 222
780 IN$(KR)=K$:NEXT KR            :rem 10
800 POKE53281,0:PRINT "{CLR}":POKE53281,1
                                  :rem 141
810 E = 48 :D = 48 :T = 0 :S = 1024 :V =
    {SPACE}1824 :Z = 1863         :rem 121
900 REM *** TITLE ON SCREEN ***   :rem 88
910 DATA 34,32,3,8,1,19,5,32,1,14,4,32,20
    ,1,7,32,34                    :rem 165
920 FOR TT = 1 TO 17 :READ TD :POKE 1874+
    TT,TD :NEXT TT                :rem 134
1000 REM *** DRAWING THE PLAYING FIELD **
     *                            :rem 6
1010 POKE S,108:POKES+CO,0:FOR B = 1 TO 3
     8 :POKE S+B,121:POKES+B+CO,0:NEXT B
                                  :rem 163
1020 POKE S+B,123 :FOR B = 79 TO 799 STEP
      40 :POKE S+B,117:POKES+B+CO,0:NEXT
     {SPACE}B                     :rem 91
1030 POKE Z,126 :FOR B = 38 TO 1 STEP -1
     {SPACE}:POKE V+B,120:POKEV+B+CO,0:NE
     XT B                         :rem 118
1040 POKE V,124:POKEV+CO,0:FOR B = 760 TO
      40 STEP -40 :POKE S+B,118 :NEXT B
                                  :rem 160
1050 :                            :rem 0
1100 REM *** INITIALIZING LEFT PLAYERS SC
     ORE ***                      :rem 244
1110 LE = 1905                    :rem 96
1120 FOR KL = 1 TO 3 :X = ASC(IM$(KL)) :P
     OKE LE,X-64 :LE = LE+1 :NEXT KL
                                  :rem 57
1130 POKE 1949,9:POKE1949+CO,0:POKE 1950,
     20:POKE1949+CO,0:POKE 1946,E :rem 86
1135 POKE1946+CO,0                :rem 230
1200 REM *** INITIALIZING RIGHT PLAYERS S
     CORE ***                     :rem 72
1210 RE = 1940                    :rem 102
1220 FOR KR = 1 TO 3 :X = ASC(IN$(KR)) :P
     OKE RE,X-64 :RE = RE+1 :NEXT KR
                                  :rem 95
1230 POKE 1981,D:POKE1981+CO,0:GOTO 55
                                  :rem 106
1300 POKE53281,0:PRINT "{CLR}":POKE53281,
     1                            :rem 185
1310 PRINT " IF YOU WANT TO PLAY ANOTHER
     {SPACE}GAME"                 :rem 96
1320 PRINT " PRESS {RVS}'Y'{OFF} OR {RVS}
     'N'{OFF}.":POKE198,0         :rem 229
1330 GET AN$:IF AN$="" THEN 1330  :rem 77
1340 IF AN$="N" THEN GOTO 1400    :rem 6
1350 IF AN$="Y" THEN 40           :rem 120
1360 GOTO1330                     :rem 202
1400 POKE53281,0:PRINT "{CLR}" :POKE53281
     ,1:PRINT " BYE"              :rem 165
1410 END                          :rem 157
```

Print Sound For The VIC-20

(Article on page 121.)

```
10 PRINTCHR$(147)"VIC PRINT-SOUND":rem 69
20 GOSUB500                       :rem 119
30 PRINT"SOUND IS NOW DEVICE 2"   :rem 47
40 CLOSE1:OPEN1,2:PRINT#1,"AEHMZLMZZZZZZ"
                                  :rem 187
50 IFPEEK(983)>0THEN50            :rem 16
60 PRINT"A TUNE BY J.S. BACH"     :rem 86
70 PRINT#1,"FHJMKKOMMRQRMJFHJKMOMKJHJFEFH
   "                              :rem 52
80 PRINT#1,"AEHKJHJFHJMKKOMMRQRMJFHJCMKJH
   FAFEF"                         :rem 123
90 END                            :rem 64
500 DATA76,194,3,76,132,3,141,219,3,152,7
    2,165,154,201,2               :rem 236
510 DATA208,47,173,219,3,201,65,48,33,201
    ,91,16,29,56,233              :rem 41
520 DATA65,168,185,220,3,172,215,3,192,25
    5,240,249,172,217,3           :rem 193
530 DATA145,249,200,152,41,255,141,217,3,
    238,215,3,104,168,173         :rem 24
540 DATA219,3,24,96,104,168,173,219,3,76,
    122,242,72,152,72             :rem 97
550 DATA173,218,3,240,15,206,218,3,240,6,
    104,168,104,76,191            :rem 132
560 DATA234,169,0,240,27,173,215,3,240,24
    1,172,216,3,177,249           :rem 188
570 DATA72,200,152,41,255,141,216,3,206,2
    15,3,169,10,141,218           :rem 169
580 DATA3,104,141,10,144,141,11,144,141,1
    2,144,24,144,207,120          :rem 197
590 DATA169,3,141,21,3,141,39,3,169,63,14
    1,20,3,169,66                 :rem 148
600 DATA141,38,3,88,96,0,0,0,0,0,183,187,
    191,195,199                   :rem 52
610 DATA201,203,207,209,212,215,217,219,2
    21,223,225,227,228,229        :rem 69
620 DATA231,232,233,235,236,237,0:rem 128
630 FORI=828TO1013:READJ:POKEI,J:NEXTI
                                  :rem 154
640 POKE36878,15:SYS828:RETURN    :rem 96
```

Ski Physics

(Article on page 125.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1: Ski Physics—VIC Loader

```
5 PRINT"{CLR}{4 RIGHT}{11 DOWN}JUST A SEC
  OND"                            :rem 11
15 POKE51,0:POKE52,28:POKE55,0:POKE56,28:
   CLR:B=7168:C=25600             :rem 183
20 FORJ=0TO512:POKEB+J,PEEK(B+J+C):NEXTJ
                                  :rem 229
25 FORI=216TO255:READA%:POKEB+I,A%:NEXTI:
   FORI=280TO327:READB%:POKEB+I,B%:NEXTI
                                  :rem 140
30 PRINT"{CLR}":POKE36869,240:SC=36879:PO
   KESC,232                       :rem 226
35 PRINT"{BLK}{5 DOWN}{5 RIGHT}SKI PHYSIC
   S"                             :rem 185
50 V=36878:F2=36875:POKEV,15      :rem 85
55 READA%,D%:IFA%=-1THEN65        :rem 229
60 POKEF2,A%:FORT=1TOD%:NEXTT:GOTO55
                                  :rem 56
65 POKEV,0:POKEF2,0:D=1           :rem 117
75 PRINTSPC(69)"{BLK}PRESS THE F1 KEY"
                                  :rem 65
```

```
80 GETA$:IFA$=""THEN80                    :rem 243
85 IFA$=CHR$(133)THENONDGOTO100,140,185,2
   25                                     :rem 177
90 GOTO80                                 :rem 10
100 PRINT"{CLR}":POKESC,200:PRINT:PRINTTA
    B(37)"{BLK}{2 P}"                     :rem 4
105 PRINT"{BLK}{4 SPACES}PO{M}{G}
    {N}M{2 SPACES}N{H}{N}{2 P}":P
    RINT"{BLK}{4 SPACES}{M}{G}{M}
    {G}{N} MN {H}{N}{2 P}"
                                          :rem 23
110 PRINTSPC(47)"{RED}TIME IS DURATION":P
    RINT:PRINT"{BLK}{4 SPACES}IT IS MEASU
    RED"                                  :rem 67
111 PRINT:PRINT"{6 SPACES}IN SECONDS"
                                          :rem 209
112 PRINT"{6 SPACES}MINUTES":PRINT"
    {6 SPACES}AND HOURS":D=2:GOTO75
                                          :rem 197
140 PRINT"{CLR}":POKESC,248:PRINT:PRINT:P
    RINT"{BLK} M{4 SPACES}{P}" :rem 103
145 PRINT"{BLK}{2 SPACES}M{2 SPACES}NL
    {H}{N}{Y}{H} O{N} POMN"
                                          :rem 222
150 PRINT"{BLK}{3 SPACES}MN L L{N}{P}
    {H} L{N} {M}{G}{M}{G}"
                                          :rem 69
155 PRINTSPC(47)"{RED}VELOCITY IS SPEED":
    PRINT:PRINT:PRINT"{BLK}{4 SPACES}IT I
    S MEASURED"                           :rem 94
160 PRINT"{BLK}{4 SPACES}IN FEET/SECOND":
    PRINT"{BLK}{4 SPACES}OR MILES/HOUR":D
    =3:GOTO75                             :rem 142
185 PRINT"{CLR}":POKESC,216:PRINT:PRINT:P
    RINT"{BLK}{3 SPACES}{P}{3 SPACES}
    {P}"TAB(18)"{P}"          :rem 209
190 PRINT"{3 SPACES}{H}M{M}{G}L PON
    M{N}M{H}O L"                          :rem 4
195 PRINT"{3 SPACES}{H}N{M}{G}@
    {M}{G}OP{N} {H}L L":PRINT"
    {3 SPACES}{Y}"                        :rem 155
200 PRINTSPC(46)"{RED}DISTANCE IS LENGTH"
    :PRINT:PRINT:PRINT"{BLK}{3 SPACES}IT
    {SPACE}IS MEASURED"                   :rem 129
205 PRINT"{3 SPACES}IN FEET OR MILES":D=4
    :GOTO75                               :rem 12
225 PRINT"{CLR}":POKESC,168:PRINTSPC(92)"
    *INSTRUCTIONS*"                       :rem 125
227 PRINT:PRINT:PRINT"{2 SPACES}YOU WILL
    {SPACE}BE GIVEN"                      :rem 47
230 PRINT"{2 SPACES}PROBLEMS TO SOLVE":PR
    INT"{2 SPACES}WITH TIME,DISTANCE":PRI
    NT"{2 SPACES}AND VELOCITY."           :rem 94
235 PRINT"{2 SPACES}ANSWER WITH THE":PRIN
    T"{2 SPACES}CORRECT NUMBER." :rem 108
236 PRINT"{2 SPACES}IGNORE REMAINDERS."
                                          :rem 72
237 PRINT"{2 SPACES}DO NOT GIVE UNITS.":D
    =5:PRINT"{3 DOWN}{7 RIGHT}PRESS F1"
                                          :rem 218
238 IFPEEK(197)<>39THEN238                :rem 245
240 PRINT"{CLR}TAPE OR DISK":INPUTT$
                                          :rem 50
245 IFLEFT$(T$,1)<>"T"ANDLEFT$(T$,1)<>"D"
    THEN240                               :rem 192
250 IFLEFT$(T$,1)="T"THENPOKE631,131:POKE
    198,1:END                             :rem 162
260 PRINT"{CLR}FILENAME":INPUTFI$:rem 186
263 FI$="LOAD"+CHR$(34)+FI$+CHR$(34)+",8"
                                          :rem 104
265 PRINT"{CLR}{3 DOWN}";FI$+"{HOME}
    {DOWN}";                              :rem 240
266 POKE631,13:POKE632,13                 :rem 139
268 POKE198,2                             :rem 207
500 DATA96,96,60,31,44,72,142,3,0,0,0,128
    ,16,32,64,128,1,2,4,12,0,0,0,0,0,0,0
                                          :rem 176
505 DATA24,24,8,30,45,76,152,16,16,24,8,5
    6,255,0,0,0,0,0,0                     :rem 52
507 DATA16,15,128,64,32,0,0,0,0,240
                                          :rem 207
510 DATA56,56,124,126,255,255,255,255,74,
    32,136,2,212,21,162,205,255,255,255,2
    55                                    :rem 158
515 DATA255,255,255,255,1,2,4,8,16,32,64,
    128                                   :rem 169
520 DATA231,200,225,150,231,350,0,30,225,
    150,229,175,225,220,229,150,225,175,2
    29,200                                :rem 59
525 DATA228,350,231,200,225,200,231,150,2
    32,250,231,275,228,175,225,400,-1,-1
                                          :rem 217
```

Program 2:

Ski Physics—VIC Main Program

```
240 SC=36879:C=25600                      :rem 49
250 PRINT"{CLR}":POKESC,152:POKE36869,255
                                          :rem 255
255 A=INT(RND(1)*3+1):B=INT(RND(1)*7+1):X
    =INT(RND(1)*26+5):Y=INT(RND(1)*101+50
    )                                     :rem 174
260 IFA=1THEND$="FEET":TT$="SECONDS":V$="
    F/S"                                  :rem 165
265 IFA=2THEND$="MILES":TT$="HOURS":V$="M
    PH"                                   :rem 160
270 IFA=3THEND$="FEET":TT$="MINUTES":V$="
    F/M"                                  :rem 184
280 ONBGOSUB440,470,440,455,470,440,470
                                          :rem 56
285 PRINT:PRINT:PRINT:PRINTTAB(19)"{BLK}[
    £":PRINTTAB(19)"{BLU}]{BLU}("
                                          :rem 254
290 FORN=19TO15STEP-1:PRINTTAB(N)"{BLU}("
    :NEXTN                                :rem 169
295 PRINTTAB(12)"{BLU}'''''":PRINTTAB(12)
    "{BLU}'''''"                          :rem 86
300 PRINT"{PUR}'''''{YEL}{2 SPACES}%%%%%
    {BLU}'''''":PRINT"{PUR}'''''{BLU}''''
    ''''''''''''{2 SPACES}"               :rem 28
305 PRINT"{16 UP}"                        :rem 121
310 Z=7680+(9*22)+20:C=Z+30720:V=36878:F2
    =36875                                :rem 228
315 INPUT"{BLK}{5 SPACES}";S$:S=VAL(S$):I
    FS=KTHEN360                           :rem 144
330 POKEV,15:PRINT"{RED}{2 SPACES}UH UH!
    {SPACE}SORRY{2 SPACES}"               :rem 206
335 FORM=230TO190STEP-1:POKEF2,M:FORT=1TO
    5:NEXTT:NEXTM                         :rem 32
340 Q=5:GOSUB480:POKEV,0:FORN=1TO4:POKEZ,
    32:POKEZ+21,32:POKEZ+22,32:POKEZ+23,3
    2                                     :rem 124
345 POKEZ+22,30:POKEC+22,0:POKEZ+43,35:PO
    KEC+43,0:POKEZ+44,31:POKEC+44,0
                                          :rem 222
350 POKEZ+45,36:POKEC+45,0:Z=Z+22:C=C+22:
    NEXTN                                 :rem 243
354 FORN=0TO4:POKEZ+20+N,38:POKEC+20+N,7:
    NEXTN                                 :rem 81
355 POKE36877,210:FORL=15TO0STEP-1:POKEV,
    L:FORM=1TO50:NEXTM:NEXTL:PP=1   :rem 5
```

```
356 POKE36877,0:POKEV,0:GOTO400    :rem 90
360 POKEV,15:PRINT"{RED} YEP! THATS RIGHT
    ":FORM=190TO230:POKEF2,M:FORT=1TO5:N
    EXTT:NEXTM                     :rem 13
362 Q=10:GOSUB480:POKEV,0:FORN=1TO3:POKEZ
    ,32:POKEZ+21,32:POKEZ+22,32:POKEZ+23,
    32                             :rem 171
364 POKEZ+21,30:POKEC+21,0:POKEZ+42,35:PO
    KEC+42,0:POKEZ+43,31:POKEC+43,0
                                   :rem 217
366 POKEZ+44,36:POKEC+44,0:Z=Z+21:C=C+21:
    NEXTN                          :rem 246
368 POKEV,15:FORL=148TO220STEP.7:POKEF2,L
    :NEXTL:POKEV,0:FORT=1TO500:NEXTT:PP=2
                                   :rem 65
400 PRINT"{CLR}":POKESC,184        :rem 192
405 IFPP=1THENPRINTSPC(134)"YOU LOST THIS
     TIME"                         :rem 171
407 IFPP=1THENPRINTSPC(49)"BETTER LUCK
    {12 SPACES}NEXT TIME"          :rem 63
410 IFPP=2THENPRINTSPC(158)"YOU SOLVED TH
    E{8 SPACES}GIVEN{2 SPACES}PROBLEM"
                                   :rem 61
412 FORT=1TO5000:NEXT              :rem 33
415 D=5:GOTO250                    :rem 90
440 K=INT(Y/X)                     :rem 60
441 PRINTSPC(24)"{BLK}A SKIER WENT {RED}"
    ;Y:PRINT"{BLU}{2 SPACES}";D$   :rem 17
442 PRINT"{BLK}{2 SPACES}IN {RED}";X;"
    {BLU}";TT$                     :rem 230
445 PRINT"{BLK}{2 SPACES}WHAT WAS HIS":PR
    INT"{BLK}{2 SPACES}VELOCITY IN {BLU}"
    ;V$:RETURN                     :rem 144
455 K=X*Y:PRINTSPC(24)"{BLK}A SKIER WENT
    {SPACE}{RED}";X:PRINT"{BLU}{2 SPACES}
    ";V$:PRINT"{BLK}{2 SPACES}FOR {RED}";
    Y"{BLU}";TT$                   :rem 96
460 PRINT"{BLK}{2 SPACES}WHAT WAS HIS":PR
    INT"{BLK}{2 SPACES}DISTANCE IN {RED}"
    ;"{BLU}";D$:RETURN             :rem 242
470 K=INT(Y/X)                     :rem 63
471 PRINTSPC(24)"{BLK}A SKIER WENT {RED}"
    ;Y:PRINT"{BLU}{2 SPACES}";D$   :rem 20
472 PRINT"{BLK}{2 SPACES}AT {RED}";X;"
    {BLU}";V$                      :rem 149
475 PRINT"{BLK}{2 SPACES}HOW MUCH TIME DI
    D":PRINT"{BLK}{2 SPACES}HE SKI IN
    {BLU}";TT$:RETURN              :rem 2
480 FORN=1TO5:POKEZ,32:POKEZ+1,32:POKEZ+2
    2,32:POKEZ+21,27:POKEC+21,0    :rem 122
482 POKEZ+22,28:POKEC+22,0:POKEZ+43,29:PO
    KEC+43,0:Z=Z+21:C=C+21:NEXTN   :rem 116
484 POKEV,0:Z=Z-21:POKEZ,32:POKEZ+1,32:PO
    KEZ+22,32                      :rem 35
486 Z=7680+(14*22)+14:C=Z+30720:POKEZ+1,3
    2                              :rem 248
488 FORN=1TOQ:POKEZ,32:POKEZ+21,32:POKEZ+
    22,32:POKEZ+23,32              :rem 56
490 POKEZ-1,30:POKEC-1,0:POKEZ+20,35:POKE
    C+20,0:POKEZ+21,31:POKEC+21,0:rem 105
492 POKEZ+22,36:POKEC+22,0:Z=Z-1:C=C-1:NE
    XTN:RETURN                     :rem 168
```

Program 3:

Ski Physics—64 Version

```
5 PRINT"{CLR}"                     :rem 153
15 POKE52,48:POKE56,48:CLR:K=12288:PC=563
   34:CP=53272                     :rem 254
16 POKEPC,PEEK(PC)AND254:POKE1,PEEK(1)AND
   251                             :rem 164
20 FORJ=0TO512:POKEK+J,PEEK(53248+J):NEXT
   J                               :rem 68
25 FORI=216TO255:READA%:POKEK+I,A%:NEXTI:
   FORI=280TO327:READB%:POKEK+I,B%:NEXTI
                                   :rem 158
26 POKE1,PEEK(1)OR4:POKEPC,PEEK(PC)OR1
                                   :rem 115
30 PRINT"{CLR}":POKECP,21:BC=53280:BK=532
   81:POKEBC,5:POKEBK,1            :rem 249
35 PRINT"{BLK}{8 DOWN}{13 RIGHT}SKI PHYSI
   CS"                             :rem 212
50 V=54272:FORL=VTOV+24:POKEL,0:NEXT
                                   :rem 16
52 POKEV+5,88:POKEV+4,33:POKEV+24,143:POK
   EV+6,195                        :rem 151
55 READLF,HF,DR:IFLF=-1THEN65      :rem 36
60 POKEV,LF:POKEV+1,HF:FORT=1TODR:NEXTT:G
   OTO55                           :rem 68
65 POKEV,0:POKEV+1,0:POKEV+24,0:D=1
                                   :rem 91
75 PRINTSPC(131)"{BLK}PRESS THE{2 SPACES}
   F1 KEY"                         :rem 103
80 GETA$:IFA$=""THEN80             :rem 243
85 IFA$=CHR$(133)THENONDGOTO100,140,185,2
   25,250                          :rem 116
90 GOTO80                          :rem 10
100 PRINT"{CLR}":POKEBC,6:POKEBK,1:PRINT:
    PRINTSPC(104)"{BLK}{2 P}"      :rem 36
105 PRINTSPC(13)"{BLK}PO{M}{G}{N}M
    {2 SPACES}N{H}{N}{2 P}":PRINTSP
    C(13)"{BLK}{N}{H}{M}{G}{N}
    {SPACE}MN {H}{N}{2 P}"         :rem 95
110 PRINTSPC(92)"{RED}TIME IS DURATION"
                                   :rem 82
111 PRINTSPC(93)"{BLK}IT IS MEASURED"
                                   :rem 38
112 PRINTSPC(55)"IN MINUTES":PRINTSPC(15)
    "AND HOURS":D=2:GOTO75         :rem 154
140 PRINT"{CLR}":POKEBC,4:POKEBK,1:PRINTS
    PC(130)"{BLK} M{4 SPACES}{P}"
                                   :rem 124
145 PRINTSPC(10)"{BLK}{2 SPACES}M
    {2 SPACES}NL {H}{N}{Y}{H} O
    {N} POMN"                      :rem 118
150 PRINTSPC(10)"{BLK}{3 SPACES}MN L L
    {N}{P}{H} L{N} {M}{G}
    {M}{G}"                        :rem 221
155 PRINTSPC(92)"{RED}VELOCITY IS SPEED":
    PRINTSPC(93)"{BLK}IT IS MEASURED"
                                   :rem 115
160 PRINTSPC(13)"IN FEET/SECOND":PRINTSPC
    (13)"OR MILES/HOUR":D=3:GOTO75
                                   :rem 164
185 PRINT"{CLR}":POKEBC,7:POKEBK,1
                                   :rem 166
189 PRINTSPC(129)"{3 SPACES}{P}
    {3 SPACES}{P}{10 SPACES}{P}"
                                   :rem 83
190 PRINTSPC(9)"{3 SPACES}{H}M{M}
    {G}L PONM{N}M{H}O L"           :rem 116
195 PRINTSPC(9)"{3 SPACES}{H}N{M}
    {G}@ {M}{G}OP{N} {H}L L"
                                   :rem 73
196 PRINTSPC(9)"{3 SPACES}{T}"     :rem 132
200 PRINTSPC(91)"{RED}DISTANCE IS LENGTH"
    :PRINTSPC(92)"{BLK}IT IS MEASURED"
                                   :rem 149
205 PRINTSPC(52)"IN FEET OR MILES": D=4:G
    OTO75                          :rem 170
```

```
225 PRINT"{CLR}":POKEBC,13:POKEBK,1:PRINT
    SPC(132)"*INSTRUCTIONS*"      :rem 175
226 PRINT:PRINT:PRINTTAB(11)"YOU WILL BE
    {SPACE}GIVEN"                 :rem 184
230 PRINTSPC(11)"PROBLEMS TO SOLVE":PRINT
    SPC(11)"WITH TIME,DISTANCE"   :rem 21
231 PRINTSPC(11)"AND VELOCITY."   :rem 112
235 PRINTSPC(11)"ANSWER WITH THE":PRINTSP
    C(11)"CORRECT NUMBER."        :rem 158
236 PRINTSPC(11)"IGNORE REMAINDERS."
                                  :rem 225
237 PRINTSPC(11)"DO NOT GIVE UNITS.":D=5:
    GOTO75                        :rem 69
250 PRINT"{CLR}":POKEBC,10:POKEBK,1:POKEC
    P,(PEEK(CP)AND240)+12         :rem 66
255 A=INT(RND(0)*3+1):B=INT(RND(0)*7+1):X
    =INT(RND(0)*21+5):Y=INT(RND(0)*101+50
    )                             :rem 165
260 IFA=1THEND$="FEET":TT$="SECONDS":V$="
    F/S"                          :rem 165
265 IFA=2THEND$="MILES":TT$="HOURS":V$="M
    PH"                           :rem 160
270 IFA=3THEND$="FEET":TT$="MINUTES":V$="
    F/M"                          :rem 184
280 ONBGOSUB440,470,440,455,470,440,470
                                  :rem 56
285 PRINT:PRINT:PRINT:PRINTTAB(29)"{BLK}[
    £":PRINTTAB(29)"{BLU}]{BLU}("  :rem 0
290 FORN=29TO25STEP-1:PRINTTAB(N)"{BLU}("
    :NEXTN                        :rem 171
295 PRINTTAB(22)"{BLU}''''''":PRINTTAB(22)
    "{BLU}''''''"                 :rem 88
300 PRINTTAB(5)"{PUR}''''''''''{YEL}
    {2 SPACES}%%%%%{BLU}''''''''''"
                                  :rem 223
301 PRINTTAB(3)"{PUR}''''''''''''{BLU}'''
    ''''''''''''''''''"           :rem 130
305 PRINT"{15 UP}"                :rem 232
310 Z=1024+(9*40)+30:V=54272:C=Z+V:rem 41
315 INPUT"{BLK}{5 SPACES}";S$:S=VAL(S$):I
    FS=KTHEN360                   :rem 144
330 POKEV+24,143:PRINT"{RED}{2 SPACES}UH
    {SPACE}UH! SORRY{2 SPACES}"   :rem 145
335 FORM=60TO20STEP-5:POKEV,INT(M/3):POKE
    V+1,M:FORT=1TO15:NEXTT:NEXTM  :rem 254
340 Q=5:GOSUB480:POKEV+1,0:POKEV,0:FORN=1
    TO4:POKEZ,32:POKEZ+39,32      :rem 53
341 POKEZ+40,32:POKEZ+41,32       :rem 37
345 POKEZ+40,30:POKEC+40,0:POKEZ+79,35:PO
    KEC+79,0:POKEZ+80,31:POKEC+80,0
                                  :rem 240
350 POKEZ+81,36:POKEC+81,0:Z=Z+40:C=C+40:
    NEXTN                         :rem 243
354 FORN=0TO4:POKEZ+38+N,38:POKEC+38+N,7:
    NEXTN:POKEV,195:POKEV+1,16    :rem 155
355 FORL=15TO5STEP-1:POKEV+24,L:FORT=1TO5
    0:NEXTT:NEXTL:PP=1:POKEV,0:POKEV+1,0
                                  :rem 4
356 GOTO400                       :rem 107
360 PRINT"{RED} YEP! THATS RIGHT ":FORM=0
    TO60STEP2:POKEV,M/2           :rem 130
361 POKEV+1,INT(M/2):NEXTM:POKEV,0:POKEV+
    1,0                           :rem 233
362 Q=10:GOSUB480:FORN=1TO3:POKEZ,32:POKE
    Z+39,32                       :rem 210
363 POKEZ+40,32:POKEZ+41,32       :rem 41
364 POKEZ+39,30:POKEC+39,0:POKEZ+78,35:PO
    KEC+78,0:POKEZ+79,31:POKEC+79,0
                                  :rem 15
366 POKEZ+80,36:POKEC+80,0:Z=Z+39:C=C+39:
    NEXTN                         :rem 8
367 POKEV+24,143                  :rem 122
368 FORM=12TO60STEP4:POKEV,M/2:POKEV+1,M:
    FORT=1TO25:NEXTT:NEXTM:POKEV,0
                                  :rem 182
369 POKEV+1,0:PP=2                :rem 40
400 PRINT"{CLR}":POKEBC,14:POKEBK,1
                                  :rem 202
404 IFPP=2THEN410                 :rem 250
405 PRINT:PRINT:PRINTSPC(171)"YOU LOST
    {2 SPACES}THIS TIME"          :rem 110
406 PRINTSPC(90)"BETTER LUCK NEXT TIME"
                                  :rem 110
407 GOTO415                       :rem 110
410 PRINT:PRINT:PRINTSPC(206)"YOU SOLVED
    {SPACE}THE GIVEN PROBLEM"     :rem 248
415 D=5:GOTO75                    :rem 47
440 K=INT(Y/X)                    :rem 60
441 PRINTSPC(42)"{BLK}A SKIER WENT {RED}"
    ;Y:PRINT"{BLU}{2 SPACES}";D$  :rem 17
442 PRINT"{BLK}{2 SPACES}IN {RED}";X;"
    {BLU}";TT$                    :rem 230
445 PRINT"{BLK}{2 SPACES}WHAT WAS HIS":PR
    INT"{BLK}{2 SPACES}VELOCITY IN {BLU}"
    ;V$:RETURN                    :rem 144

455 K=X*Y:PRINTSPC(42)"{BLK}A SKIER WENT
    {SPACE}{RED}";X               :rem 229
456 PRINT"{BLU}{2 SPACES}";V$:PRINT"{BLK}
    {2 SPACES}FOR {RED}";Y"{BLU}";TT$
                                  :rem 224
460 PRINT"{BLK}{2 SPACES}WHAT WAS HIS":PR
    INT"{BLK}{2 SPACES}DISTANCE IN {RED}"
    ;"{BLU}";D$:RETURN            :rem 242
470 K=INT(Y/X)                    :rem 63
471 PRINTSPC(42)"{BLK}A SKIER WENT {RED}"
    ;Y:PRINT"{BLU}{2 SPACES}";D$  :rem 20
472 PRINT"{BLK}{2 SPACES}AT {RED}";X;"
    {BLU}";V$                     :rem 149
475 PRINT"{BLK}{2 SPACES}HOW MUCH TIME DI
    D":PRINT"{BLK}{2 SPACES}HE SKI IN
    {BLU}";TT$:RETURN              :rem 2
480 FORN=1TO5:POKEZ,32:POKEZ+1,32:POKEZ+4
    0,32:POKEZ+39,27:POKEC+39,0   :rem 140
482 POKEZ+40,28:POKEC+40,0:POKEZ+79,29:PO
    KEC+79,0:Z=Z+39:C=C+39:NEXTN  :rem 152
484 POKEV+24,0:Z=Z-39:POKEZ,32:POKEZ+1,32
    :POKEZ+40,32                  :rem 189
486 Z=1024+(14*40)+24:C=Z+V:POKEZ+1,32
                                  :rem 69
488 FORN=1TOQ:POKEZ,32:POKEZ+39,32:POKEZ+
    40,32:POKEZ+41,32             :rem 65
490 POKEZ-1,30:POKEC-1,0:POKEZ+38,35:POKE
    C+38,0:POKEZ+39,31:POKEC+39,0:rem 141
492 POKEZ+40,36:POKEC+40,0:Z=Z-1:C=C-1:NE
    XTN:RETURN                    :rem 168
500 DATA96,96,60,31,44,72,142,3,0,0,0,128
    ,16,32,64,128,1,2,4,12,0,0,0,0,0,0,0
                                  :rem 176
505 DATA24,24,8,30,45,76,152,16,16,24,8,5
    6,255,0,0,0,0,0,0              :rem 52
506 DATA16,15,128,64,32,0,0,0,0,240
                                  :rem 206
510 DATA56,56,124,126,255,255,255,255,74,
    32,136,2                      :rem 166
512 DATA212,21,162,205,255,255,255,255
                                  :rem 126
515 DATA255,255,255,255,1,2,4,8,16,32,64,
    128                           :rem 169
520 DATA31,21,175,195,16,125,31,21,275,19
    5,16,125,239,19,150,195,16,100
                                  :rem 215
```

```
525 DATA239,19,150,195,16,100,239,19,125,
    209,18,300,31,21,175,195,16,125
                                    :rem 16
530 DATA31,21,170,96,22,200,31,21,230,209
    ,18,115,195,16,400,-1,-1,-1     :rem 13
```

Sound Sculptor For The 64

(Article on page 46.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Tape users: Program 1 automatically loads Program 2. It is recommended that you SAVE them on the same tape.

Disk users: SAVE Program 2 as "2". Program 1 must be LOADed and RUN before using Program 2.

Program 1:
Sound Sculptor—ML Loader

```
80 PRINT"{CLR}":PRINT:PRINT"{6 SPACES}PLE
   ASE WAIT ONE MOMENT..."          :rem 201
90 REM SPRITE CREATOR               :rem 52
100 POKE2040,11:FORL=0TO24:READSP:POKE704
    +L,SP:NEXTL:POKE53287,0         :rem 205
110 FORL=25TO63:POKE704+L,0:NEXTL   :rem 17
200 REM ML PROGRAM POKER            :rem 168
210 FORL=49152 TO 50702             :rem 169
220 READ DA:POKE L,DA:CK=CK+DA:NEXT
                                    :rem 87
230 IF CK<>211739 THEN PRINT "ERROR IN DA
    TA STATEMENTS":STOP             :rem 38
240 PRINT"{CLR}{13 RIGHT}{11 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK"     :rem 108
250 GET T$:IF T$=""THEN250          :rem 119
255 IF T$<>"D"ANDT$<>"T"THEN250     :rem 200
260 IF T$="D"THEN 380               :rem 46
300 POKE 631,76:POKE632,207:POKE633,13:PO
    KE198,3                         :rem 189
350 FOR T= 1 TO 1000:NEXT:GOTO1000:rem 82
380 POKE50660,8:POKE50662,8         :rem 255
400 POKE631,76:POKE632,207:POKE633,34:POK
    E634,50:POKE635,34:POKE636,44   :rem 36
405 POKE637,56                      :rem 255
410 POKE638,58:POKE639,13:POKE198,9:rem 9
1000 REM SPRITE DATA                :rem 150
1010 DATA48,0,0,56,0,0,60,0,0,62,0,0,45,0
     ,0,36,0,0,4,0,0,2,0,0,2        :rem 11
40000 REM ML DATA                   :rem 139
49152 DATA 32,140,197,160,0,177     :rem 252
49158 DATA 78,153,0,212,200,192     :rem 252
49164 DATA 25,208,246,32,93,194      :rem 10
49170 DATA 165,197,201,60,240,23    :rem 44
49176 DATA 169,16,45,0,220,208      :rem 207
49182 DATA 225,165,2,240,6,32       :rem 150
49188 DATA 86,192,76,0,192,32       :rem 172
49194 DATA 48,192,76,0,192,96       :rem 177
49200 DATA 162,21,189,24,197,202     :rem 46
49206 DATA 205,1,208,48,8,189       :rem 163
49212 DATA 24,197,205,1,208,48      :rem 205
49218 DATA 4,202,16,236,96,189      :rem 217
49224 DATA 48,197,133,75,232,189     :rem 68
49230 DATA 48,197,133,76,108,75      :rem 14
49236 DATA 0,234,162,15,189,72      :rem 209
49242 DATA 197,202,205,1,208,48     :rem 254
49248 DATA 8,189,72,197,205,1       :rem 173
49254 DATA 208,48,4,202,16,236      :rem 206
49260 DATA 96,189,88,197,133,75      :rem 32
49266 DATA 232,189,88,197,133,76     :rem 79
49272 DATA 108,75,0,234,96,24       :rem 161
49278 DATA 173,0,208,233,142,144     :rem 49
49284 DATA 247,74,74,74,74,141      :rem 224
49290 DATA 249,207,32,175,192,76     :rem 65
49296 DATA 96,196,96,234,234,24      :rem 26
49302 DATA 173,0,208,233,74,144     :rem 249
49308 DATA 245,41,240,160,3,81      :rem 199
49314 DATA 253,41,240,81,253,145     :rem 45
49320 DATA 253,32,175,192,76,140     :rem 50
49326 DATA 196,160,3,177,253,74      :rem 12
49332 DATA 74,74,74,10,170,160      :rem 204
49338 DATA 0,189,0,197,145,253      :rem 216
49344 DATA 232,200,189,0,197,145     :rem 52
49350 DATA 253,24,169,8,237,249      :rem 14
49356 DATA 207,170,240,15,177,253:rem 103
49362 DATA 74,145,253,136,177,253:rem 112
49368 DATA 106,145,253,200,202,208
                                    :rem 143
49374 DATA 241,96,24,173,0,208      :rem 210
49380 DATA 233,144,144,8,169,128     :rem 59
49386 DATA 32,32,193,76,198,195      :rem 25
49392 DATA 169,64,32,32,193,76      :rem 223
49398 DATA 181,195,24,173,0,208      :rem 11
49404 DATA 233,144,176,8,169,32       :rem 7
49410 DATA 32,32,193,76,215,195       :rem 3
49416 DATA 169,16,32,32,193,76      :rem 217
49422 DATA 232,195,169,4,32,32      :rem 207
49428 DATA 193,76,249,195,169,2      :rem 27
49434 DATA 32,32,193,76,10,196      :rem 211
49440 DATA 160,4,81,253,145,253     :rem 253
49446 DATA 96,234,234,24,173,0      :rem 211
49452 DATA 208,233,133,144,245,170
                                    :rem 147
49458 DATA 169,0,160,2,145,253      :rem 209
49464 DATA 200,177,253,41,240,72     :rem 48
49470 DATA 145,253,138,162,5,136     :rem 54
49476 DATA 10,145,253,200,177,253:rem 100
49482 DATA 42,145,253,136,177,253:rem 110
49488 DATA 202,208,241,200,177,253
                                    :rem 151
49494 DATA 41,15,145,253,104,24     :rem 254
49500 DATA 113,253,145,253,76,193:rem 101
49506 DATA 194,96,234,162,0,32      :rem 210
49512 DATA 133,193,76,208,194,162:rem 109
49518 DATA 1,32,133,193,76,228      :rem 212
49524 DATA 194,162,2,32,133,193      :rem 0
49530 DATA 76,246,194,162,3,32      :rem 211
49536 DATA 133,193,76,10,195,24      :rem 8
49542 DATA 173,0,208,233,133,144     :rem 43
49548 DATA 214,74,74,74,157,245      :rem 20
49554 DATA 207,160,5,173,245,207     :rem 53
49560 DATA 10,10,10,10,13,246       :rem 130
49566 DATA 207,145,253,200,173,247
                                    :rem 155
49572 DATA 207,10,10,10,10,13       :rem 130
49578 DATA 248,207,145,253,96,234:rem 122
49584 DATA 169,0,160,1,145,253      :rem 208
49590 DATA 24,173,0,208,233,133     :rem 251
49596 DATA 144,240,10,145,253,76     :rem 56
49602 DATA 28,195,234,24,173,0      :rem 206
49608 DATA 208,233,133,144,225,74:rem 103
```

```
49614 DATA 74,74,74,74,162,1      :rem 116
49620 DATA 168,240,6,138,10,136   :rem 253
49626 DATA 208,252,170,138,77,251:rem 110
49632 DATA 207,141,251,207,32,254 :rem 94
49638 DATA 193,76,88,195,96,173   :rem 39
49644 DATA 0,208,233,133,144,248  :rem 49
49650 DATA 10,234,234,141,252,207 :rem 89
49656 DATA 32,254,193,76,48,195   :rem 25
49662 DATA 173,252,207,77,251,207:rem 109
49668 DATA 41,240,77,251,207,160  :rem 56
49674 DATA 2,145,253,96,173,0     :rem 164
49680 DATA 208,233,133,144,248,74:rem 108
49686 DATA 74,74,141,253,207,32   :rem 11
49692 DATA 65,194,76,68,195,169   :rem 39
49698 DATA 64,32,65,194,76,44     :rem 183
49704 DATA 196,169,32,32,65,194   :rem 17
49710 DATA 76,61,196,169,16,32    :rem 219
49716 DATA 65,194,76,78,196,169   :rem 38
49722 DATA 128,32,65,194,76,27    :rem 221
49728 DATA 196,160,3,77,254,207   :rem 16
49734 DATA 141,254,207,76,124,197:rem 112
49740 DATA 234,234,234,234,24,169:rem 104
49746 DATA 128,113,251,145,251,136
                                  :rem 152
49752 DATA 208,246,96,234,234,165:rem 116
49758 DATA 197,201,3,48,247,201   :rem 10
49764 DATA 7,16,243,201,4,208     :rem 156
49770 DATA 4,32,137,194,96,201    :rem 213
49776 DATA 5,208,4,32,149,194     :rem 171
49782 DATA 96,201,6,208,4,32      :rem 111
49788 DATA 161,194,96,32,137,194  :rem 77
49794 DATA 32,149,194,32,161,194  :rem 67
49800 DATA 96,169,1,160,4,81      :rem 111
49806 DATA 78,145,78,141,4,212    :rem 216
49812 DATA 96,169,1,160,11,81     :rem 160
49818 DATA 78,145,78,141,11,212     :rem 9
49824 DATA 96,169,1,160,18,81     :rem 170
49830 DATA 78,145,78,141,18,212   :rem 10
49836 DATA 96,41,15,170,160,16    :rem 212
49842 DATA 169,43,145,251,136,208:rem 110
49848 DATA 251,232,138,168,169,171
                                  :rem 170
49854 DATA 145,251,96,169,5,133   :rem 17
49860 DATA 251,169,7,133,252,160  :rem 55
49866 DATA 3,177,253,76,173,194   :rem 25
49872 DATA 169,117,133,251,169,5  :rem 65
49878 DATA 133,252,160,5,177,253  :rem 63
49884 DATA 74,74,74,74,170,76     :rem 184
49890 DATA 176,194,169,157,133,251
                                  :rem 172
49896 DATA 169,5,133,252,160,5    :rem 219
49902 DATA 177,253,41,15,170,76     :rem 7
49908 DATA 176,194,169,197,133,251
                                  :rem 176
49914 DATA 169,5,133,252,160,6    :rem 211
49920 DATA 177,253,74,74,74,74    :rem 227
49926 DATA 170,76,176,194,169,237:rem 129
49932 DATA 133,251,169,5,133,252  :rem 53
49938 DATA 160,6,177,253,41,15    :rem 216
49944 DATA 170,76,176,194,169,173:rem 128
49950 DATA 133,251,169,4,133,252  :rem 52
49956 DATA 160,1,177,253,74,74    :rem 222
49962 DATA 74,74,170,76,176,194   :rem 27
49968 DATA 169,237,133,251,169,5  :rem 74
49974 DATA 133,252,160,2,177,253  :rem 57
49980 DATA 74,74,74,74,170,76     :rem 181
49986 DATA 176,194,169,181,133,251
                                  :rem 175
49992 DATA 169,6,133,252,160,3    :rem 215
49998 DATA 177,253,41,15,170,76   :rem 22
50004 DATA 176,194,234,234,169,78:rem 108
50010 DATA 133,251,169,5,133,252  :rem 32
50016 DATA 169,1,162,1,160,2      :rem 86
50022 DATA 72,49,253,240,29,138   :rem 252
50028 DATA 168,177,251,201,127,16 :rem 95
50034 DATA 7,169,128,24,113,251   :rem 247
50040 DATA 145,251,232,232,232,232
                                  :rem 125
50046 DATA 104,10,224,17,240,3    :rem 180
50052 DATA 76,100,195,96,138,168  :rem 57
50058 DATA 177,251,201,127,48,234 :rem 97
50064 DATA 169,128,24,113,251,145 :rem 93
50070 DATA 251,76,122,195,49,253  :rem 50
50076 DATA 240,11,138,168,177,251 :rem 98
50082 DATA 201,127,16,14,76,80    :rem 195
50088 DATA 194,138,168,177,251,201
                                  :rem 158
50094 DATA 127,48,3,76,80,194     :rem 164
50100 DATA 96,169,170,133,251,169 :rem 98
50106 DATA 6,133,252,162,6,169    :rem 199
50112 DATA 64,160,4,76,154,195    :rem 202
50118 DATA 169,189,133,251,169,6  :rem 60
50124 DATA 133,252,162,5,169,128  :rem 43
50130 DATA 160,4,76,154,195,169     :rem 0
50136 DATA 90,133,251,169,6,133   :rem 250
50142 DATA 252,162,6,169,32,160   :rem 246
50148 DATA 4,76,154,195,169,109    :rem 12
50154 DATA 133,251,169,6,133,252  :rem 42
50160 DATA 162,6,169,16,160,4     :rem 147
50166 DATA 76,154,195,169,153,133:rem 110
50172 DATA 251,169,7,133,252,162  :rem 45
50178 DATA 15,169,4,160,4,76      :rem 109
50184 DATA 154,195,169,113,133,251
                                  :rem 149
50190 DATA 169,7,133,252,162,15   :rem 251
50196 DATA 169,2,160,4,76,154     :rem 159
50202 DATA 195,169,45,133,251,169:rem 102
50208 DATA 7,133,252,162,15,169   :rem 251
50214 DATA 128,160,3,76,154,195   :rem 253
50220 DATA 169,201,133,251,169,4  :rem 37
50226 DATA 133,252,162,9,169,64     :rem 1
50232 DATA 160,3,76,154,195,169     :rem 2
50238 DATA 25,133,251,169,5,133   :rem 250
50244 DATA 252,162,9,169,32,160   :rem 252
50250 DATA 3,76,154,195,169,105     :rem 1
50256 DATA 133,251,169,5,133,252  :rem 44
50262 DATA 162,9,169,16,160,3     :rem 152
50268 DATA 76,154,195,234,162,49  :rem 64
50274 DATA 160,0,169,95,133,251   :rem 252
50280 DATA 169,4,133,252,138,145  :rem 47
50286 DATA 251,200,200,232,192,16 :rem 81
50292 DATA 208,246,160,1,177,253  :rem 47
50298 DATA 162,255,232,234,74,208:rem 104
50304 DATA 251,138,10,168,24,169  :rem 44
50310 DATA 128,113,251,145,251,96 :rem 88
50316 DATA 162,0,160,0,169,167    :rem 195
50322 DATA 133,251,169,4,133,252  :rem 37
50328 DATA 189,112,197,145,251,200
                                  :rem 147
50334 DATA 200,232,192,24,208,244 :rem 84
50340 DATA 160,3,177,253,74,74    :rem 203
50346 DATA 74,74,10,168,24,169    :rem 212
50352 DATA 128,113,251,145,251,96 :rem 94
50358 DATA 234,234,32,96,196,32     :rem 6
50364 DATA 140,196,32,193,194,32  :rem 50
50370 DATA 198,195,32,181,195,32  :rem 57
50376 DATA 215,195,32,232,195,32  :rem 50
50382 DATA 249,195,32,10,196,32     :rem 1
50388 DATA 208,194,32,228,194,32  :rem 58
50394 DATA 246,194,32,10,195,76     :rem 7
```

```
50400 DATA 0,192,234,234,234,32  :rem 235
50406 DATA 28,195,32,48,195,32   :rem 211
50412 DATA 88,195,32,27,196,32   :rem 212
50418 DATA 44,196,32,61,196,32   :rem 209
50424 DATA 78,196,32,68,195,76   :rem 227
50430 DATA 0,192,30,134,24,142   :rem 182
50436 DATA 139,150,126,159,250,168
                                 :rem 153
50442 DATA 6,179,172,189,243,200  :rem 51
50448 DATA 230,212,143,225,248,238
                                 :rem 145
50454 DATA 46,253,66,74,82,90    :rem 166
50460 DATA 122,130,130,138,138,146
                                 :rem 133
50466 DATA 146,154,170,178,186,194
                                 :rem 165
50472 DATA 202,210,226,234,234,242
                                 :rem 131
50478 DATA 234,234,125,192,149,192
                                 :rem 158
50484 DATA 101,193,109,193,117,193
                                 :rem 151
50490 DATA 125,193,248,192,224,192
                                 :rem 155
50496 DATA 41,193,24,193,16,193    :rem 7
50502 DATA 234,234,83,90,91,98   :rem 211
50508 DATA 107,114,115,122,123,130
                                 :rem 124
50514 DATA 147,154,187,194,211,218
                                 :rem 152
50520 DATA 176,193,33,194,41,194  :rem 52
50526 DATA 197,193,49,194,235,193:rem 120
50532 DATA 14,194,57,194,234,234  :rem 52
50538 DATA 234,234,234,234,234,234
                                 :rem 145
50544 DATA 3,3,4,4,5,6             :rem 49
50550 DATA 6,7,7,1,1,2             :rem 45
50556 DATA 77,253,207,41,240,77    :rem 5
50562 DATA 253,207,145,253,96,234:rem 103
50568 DATA 234,234,234,234,173,0  :rem 45
50574 DATA 220,74,176,15,160,50   :rem 250
50580 DATA 204,1,208,208,5,160    :rem 191
50586 DATA 241,140,1,208,206,1    :rem 190
50592 DATA 208,74,176,15,160,242  :rem 51
50598 DATA 204,1,208,208,5,160    :rem 200
50604 DATA 49,140,1,208,238,1     :rem 144
50610 DATA 208,74,176,15,162,24   :rem 250
50616 DATA 236,0,208,208,5,162    :rem 197
50622 DATA 255,142,0,208,206,0    :rem 186
50628 DATA 208,74,176,15,162,255  :rem 57
50634 DATA 236,0,208,208,5,162    :rem 197
50640 DATA 23,142,0,208,238,0     :rem 136
50646 DATA 208,174,244,207,160,0  :rem 43
50652 DATA 200,208,253,202,208,248
                                 :rem 138
50658 DATA 96,169,1,162,1,160     :rem 159
50664 DATA 1,32,186,255,165,2     :rem 154
50670 DATA 162,0,160,199,32,189    :rem 2
50676 DATA 255,169,128,133,157,96:rem 120
50682 DATA 169,0,166,251,164,252  :rem 52
50688 DATA 32,213,255,96,169,78   :rem 22
50694 DATA 166,253,164,254,32,216:rem 105
50700 DATA 255,96,0,0,0,239        :rem 43
```

Program 2:

Sound Sculptor—Main Program

```
10 GOTO330                                :rem 48
15 INPUTB,E:S=B*25+9758:F=9758+E*25+25:L=
   9                                      :rem 119
16 IFB<0ORE>125ORB>ETHENPRINT"BAD INPUT":
   GOTO15                                 :rem 246
20 PRINT"{CLR}{2 DOWN}":FORI=STOS+47STEP6
                                          :rem 224
21 IFI>FTHENNEXT:L=3:PRINT"QK="QK":QB="QB
   ":GOTO35":GOTO35                       :rem 126
25 PRINTI;"DATA";:FORJ=0TO5:PRINTPEEK(I+J
   )"{LEFT},";:NEXTJ:PRINTCHR$(20):NEXTI
                                             :rem 4
30 PRINT"QK="QK"{LEFT}:QB="QB"{LEFT}:S="S
   +48"{LEFT}:F="F"{LEFT}:L="L"{LEFT}:GOT
   O20"                                   :rem 70
35 POKEQK,L:FORK=1TOL:POKEQB+K,13:NEXTK:P
   RINT"{HOME}":END                       :rem 105
40 PRINT"{CLR}{2 DOWN}":FORM=0TO7:PRINTM:
   NEXTM                                  :rem 121
45 POKEQK,8:FORK=1TO8:POKEQB+K,13:NEXTK:P
   RINT"{HOME}":END                       :rem 66
50 A=PEEK(61)+256*PEEK(62)+3:POKE786,INT(
   A/256):POKE785,A-256*PEEK(786):rem 250
55 IFERTHENPOKEA-2,0:POKEA-1,0:POKE45,PEE
   K(785):POKE46,PEEK(786)                :rem 128
56 IFERTHENCLR:QK=198:QB=630:GOTO15
                                          :rem 210
60 REM VOICE DISPLAY                      :rem 214
65 PRINT" VOICE#"V"UCCCCCCCCCI VOICE#"V:P
   OKE2,0                                 :rem 206
70 PRINT" UCCCCCCCCKFREQUENCYJCCCCCCCCCI
                                          :rem 238
75 PRINT" BOCTAVE{7 SPACES}1 2 3 4 5 6 7
   {SPACE}B                               :rem 5
80 PRINT" B{28 SPACES}B                   :rem 155
85 PRINT" BNOTE C C D D E F F G G A A BB
                                          :rem 7
90 PRINT" B{7 SPACES}#{3 SPACES}#
   {5 SPACES}#{3 SPACES}#{3 SPACES}#
   {2 SPACES}B                            :rem 75
95 PRINT" JCCCCCCCCCCCCCCCCCCCCCCCCCCCCCK
                                          :rem 6
100 PRINT"{10 SPACES}UCCCCCCCCI  :rem 246
105 PRINT" UCCCCCCCCKENVELOPEJCCCCCCCCCCI
                                          :rem 140
110 PRINT" B{2 SPACES}ATTACK{4 SPACES}+++
   ++++++++++++B                          :rem 45
115 PRINT" B{2 SPACES}DECAY{5 SPACES}++++
   ++++++++++B                            :rem 224
120 PRINT" B{2 SPACES}SUSTAIN{3 SPACES}++
   +++++++++++++B                         :rem 157
125 PRINT" B{2 SPACES}RELEASE{3 SPACES}++
   +++++++++++++B                         :rem 124
130 PRINT" JCCCCCCCCCCCCCCCCCCCCCCCCCCCCCK
                                          :rem 44
135 PRINT" UCCCCCCCCCCCCCCCCCCCCCCCCCCCCCI
                                          :rem 58
140 PRINT" B @M@M@M UCCCCCCCCI{2 SPACES}N
   MNMNM{2 SPACES}B                       :rem 228
145 PRINT" B{8 SPACES}BWAVEFORMB
   {10 SPACES}B                           :rem 184
150 PRINT" B OLOLOL JCCCCCCCCK{2 SPACES}"
   ;                                      :rem 226
151 PRINT"NOISE{3 SPACES}B{10 SPACES}B
   {28 SPACES}B"                          :rem 44
155 PRINT" BPULSE WIDTH ++++++++++++++++B
                                          :rem 135
160 PRINT" JCCCCCCCCCCCCCCCCCCCCCCCCCCCCCK
                                          :rem 47
165 PRINT" UCCCCCCCCCCCCCCCCCCCCCCCCCCCCCI
                                          :rem 61
170 PRINT" BSYNCHRONIZATION{3 SPACES}USE
   {SPACE}VOICE B                         :rem 192
```

```
175 PRINT" BRING MODULATION{6 SPACES}#"SR
    ".{2 SPACES}B                    :rem 54
180 PRINT" JCCCCCCCCCCCCCCCCCCCCCCCCCCCCK
    ";                               :rem 142
185 PRINT"{HOME}"                    :rem 130
190 A=(V-1)*7:S=S+A:POKE254,S/256:POKE253
    ,S-256*PEEK(254)                 :rem 221
195 SYSVCH                           :rem 127
200 GOTO455                          :rem 105
205 PRINT"{CLR}";:POKE2,255          :rem 153
210 REM FILTER DISPLAY               :rem 83
215 PRINT"{RVS}CCCCCCCCCCCCFILTER SETTING
    SCCCCCCCCCCCCCC{OFF}"            :rem 79
220 PRINT"UCCCCCCCCCCCCIUCCCCCCCCCCCCCCCCCI
                                     :rem 16
225 PRINT"BFILTER TYPEBBCUTOFF FREQUENCYB
                                     :rem 209
230 PRINT"B{11 SPACES}BB++++++++++++++++B
                                     :rem 252
235 PRINT"B HIGH PASS BJCCCCCCCCCCCCCCCCCK
                                     :rem 233
240 PRINT"B{11 SPACES}BUCCCCCCCCCCCCCCCCCI
                                     :rem 151
245 PRINT"B BAND PASS BBVOICES{2 SPACES}F
    ILTEREDB                         :rem 182
250 PRINT"B{11 SPACES}BB 1{3 SPACES}2
    {3 SPACES}3{3 SPACES}E{2 SPACES}B
                                     :rem 41
255 PRINT"B LOW{2 SPACES}PASS BJCCCCCCCCC
    CCCCCCCK                         :rem 189
260 PRINT"JCCCCCCCCCCCCKUCCCCCCCCCCCCCCCCCI
                                     :rem 11
265 PRINT"{13 SPACES}B{3 SPACES}RESONANCE
    {4 SPACES}B                      :rem 110
270 PRINT"{13 SPACES}B++++++++++++++++B
                                     :rem 124
275 PRINT"{13 SPACES}JCCCCCCCCCCCCCCCCCK
                                     :rem 18
280 PRINT"{RVS}CCCCCCCCCCCCCCCCCCCCCCCCCCC
    CCCCCCCCCCCCCC{OFF}";            :rem 194
285 PRINT"{13 SPACES}UCCCCCCCCCCCCCCCCCI
                                     :rem 28
290 PRINT"{13 SPACES}B{3 SHIFT-SPACE}
    {SHIFT-SPACE}VOLUME{5 SHIFT-SPACE}B
                                     :rem 70
295 PRINT"{13 SPACES}B++++++++++++++++B
                                     :rem 131
300 PRINT"{13 SPACES}JCCCCCCCCCCCCCCCCCK
                                     :rem 7
305 PRINT"{13 SPACES}UCCCCCCCCCCCCCCCCCI
                                     :rem 21
310 PRINT"{13 SPACES}B{RVS}VOICE #3 OUTPU
    T{OFF} B                         :rem 40
315 PRINT"{13 SPACES}JCCCCCCCCCCCCCCCCCK
                                     :rem 13
320 S=S+21:POKE254,S/256:POKE253,S-256*PE
    EK(254):SYSFCH:GOTO455           :rem 247
325 REM INITIALIZATION               :rem 166
330 SS=9758:POKE78,30:POKE79,38:SN=0:VCH=
    50360:FCH=50405:POKE53236,10     :rem 10
335 POKE53248,24:POKE53249,50:POKE51,29:P
    OKE52,38:POKE55,29:POKE56,38     :rem 5
340 PRINT"{CLR}"                     :rem 251
345 PRINT"{11 DOWN}"TAB(7)"WELCOME TO SOU
    ND SCULPTOR"                     :rem 127
350 FORL=1TO2000:NEXT                :rem 23
355 PRINT"{CLR}"                     :rem 1
360 PRINT"{3 DOWN}"TAB(15)"{RVS}MAIN MENU
    {OFF}"                           :rem 109
365 PRINT"{2 DOWN}"TAB(14)"CHOOSE ONE:"
                                     :rem 63
370 PRINT"{2 DOWN}"TAB(7)"{RVS}F1{OFF} DE
    SIGN/REVIEW SOUNDS"              :rem 226
375 PRINT:PRINTTAB(7)"{RVS}F3{OFF} LOAD S
    OUND FILE "                      :rem 124
380 GETA$:IFA$<"{F1}"ORA$>"{F3}"THEN380
                                     :rem 235
385 ONASC(A$)-132GOTO430,670         :rem 38
390 REM JOYSTICK SPEED               :rem 97
395 PRINT"{CLR}{12 DOWN}{3 SPACES}SELECT
    {SPACE}A SPEED BETWEEN 0 AND 15."
                                     :rem 228
400 PRINT"{4 SPACES}0 - SLOWEST{6 SPACES}
    15 - FASTEST"                    :rem 160
405 INPUTPS                          :rem 204
410 IFPS<0ORPS>15THENPRINT"NUMBER NOT ACC
    EPTABLE":GOTO405                 :rem 165
415 POKE53236,16-PS:GOTO455          :rem 64
420 STOP                             :rem 220
425 REM SOUND DESIGN/REVIEW          :rem 195
430 PRINT"{CLR}"                     :rem 251
435 PRINT"{11 DOWN} WHICH SOUND DO YOU WI
    SH TO WORK ON?"                  :rem 177
440 PRINT"{2 SPACES}(NUMBER BETWEEN 0 & 1
    250 PLEASE)                      :rem 67
445 INPUTSN                          :rem 206
450 IFSN<0ORSN>1250THENPRINT"NUMBER NOT A
    CCEPTABLE":GOTO445               :rem 11
455 POKE53269,0:PRINT"{CLR}{RVS}SOUND #";
    SN"{OFF}{HOME}{3 DOWN}"TAB(15)"CHOOSE
     ONE:"                           :rem 53
460 S=SS+SN*25                       :rem 45
465 POKE79,S/256:POKE78,S-256*PEEK(79)
                                     :rem 186
470 PRINT:PRINTTAB(8)"{RVS}1{OFF} - DISPL
    AY VOICE #1"                     :rem 117
475 PRINT:PRINTTAB(8)"{RVS}2{OFF} - DISPL
    AY VOICE #2"                     :rem 124
480 PRINT:PRINTTAB(8)"{RVS}3{OFF} - DISPL
    AY VOICE #3"                     :rem 122
485 PRINT:PRINTTAB(8)"{RVS}4{OFF} - DISPL
    AY FILTER SETTINGS"              :rem 235
490 PRINT:PRINTTAB(8)"{RVS}5{OFF} - CLEAR
     SOUND"                          :rem 139
495 PRINT:PRINTTAB(8)"{RVS}6{OFF} - NEW S
    OUND NUMBER"                     :rem 221
500 PRINT:PRINTTAB(8)"{RVS}7{OFF} - CHANG
    E JOYSTICK SPEED"                :rem 28
505 PRINT:PRINTTAB(8)"{RVS}8{OFF} - QUIT"
                                     :rem 222
510 GETC$:IFC$<"1"ORC$>"8"THEN510 :rem 69
515 ONVAL(C$)GOTO520,525,530,535,540,430
    {SPACE},395,550                  :rem 19
520 V=1:SR=3:POKE53269,1:GOTO65      :rem 87
525 V=2:SR=1:POKE53269,1:GOTO65      :rem 91
530 V=3:SR=2:POKE53269,1:GOTO65      :rem 89
535 POKE53269,1:GOTO205              :rem 60
540 FORL=0TO24:POKES+L,0:NEXT:GOTO455
                                     :rem 91
545 REM QUIT                         :rem 197
550 PRINT"{CLR}{7 DOWN}"             :rem 117
555 PRINT TAB(14)"CHOOSE ONE:"       :rem 218
560 PRINT:PRINTTAB(6)"{RVS}F1{OFF} - SAVE
     SOUND FILE"                     :rem 177
565 PRINT:PRINTTAB(6)"{RVS}F3{OFF} - CONV
    ERT TO DATA STATEMENTS"          :rem 198
570 PRINT:PRINTTAB(6)"{RVS}F5{OFF} - END"
                                     :rem 181
575 GETA$:IFA$<"{F1}"ORA$>"{F5}"THEN575
                                     :rem 248
580 ONASC(A$)-132GOTO610 ,585,685:rem 247
585 PRINT"{CLR}{8 DOWN}"             :rem 142
```

```
590 PRINT"{2 SPACES}ENTER SOUNDS YOU WANT
    TO CONVERT"                    :rem 196
595 PRINT"{6 SPACES}(START,END)";:rem 145
600 ER=1:GOTO50                    :rem 115
605 REM SAVE SOUNDS ROUTINE        :rem 176
610 PRINT"{CLR}{8 DOWN}"           :rem 131
615 PRINT"{2 SPACES}ENTER SOUNDS YOU WISH
    TO SAVE"                       :rem 209
620 PRINT"{6 SPACES}(START,END)";:rem 134
625 INPUTB,E:IFB<0ORE>1250ORB>ETHENPRINT"
    BAD INPUT":GOTO625              :rem 16
630 S=B*25+9758:F=9758+E*25+25     :rem 49
635 POKE79,S/256:POKE78,S-256*PEEK(79):PO
    KE254,F/256:POKE253,F-256*PEEK(254)
                                   :rem 117
640 INPUT"WHAT DO YOU WISH TO NAME THE FI
    LE";NM$:IFNM$=""THEN640        :rem 254
645 T=LEN(NM$):POKE2,T             :rem 58
650 FORJ=1TOT:POKE50944-J+T,ASC(RIGHT$(NM
    $,J)):NEXTJ                    :rem 213
655 SYS50659                       :rem 168
660 SYS50692                       :rem 161
665 PRINT:PRINTNM$" FILE HAS BEEN SAVED":
    PRINT"THANK YOU":END            :rem 16
670 REM LOAD ROUTINE               :rem 199
671 IFPEEK(50660)=1THEN PRINT"{CLR}":POKE
    2,0:SYS50659:SYS50682:GOTO430  :rem 38
673 INPUT"{7 RIGHT}FILENAME";NM$:T=LEN(NM
    $):POKE2,T:IFT=0THEN673        :rem 168
674 FOR J=1TOT:POKE50944-J+T,ASC(RIGHT$(N
    M$,J)):NEXTJ                   :rem 219
675 SYS50659:SYS50682              :rem 232
676 IF ST=66 THENPRINT"{7 RIGHT}FILE NOT
    {SPACE}FOUND":GOTO673          :rem 237
679 GOTO430                        :rem 118
680 REM END                         :rem 89
685 PRINT"{CLR}THANK YOU":END      :rem 139
```

Mind Boggle

(Article on page 60.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1: VIC Version

```
1 PRINT"{CLR}{5 RIGHT}{10 DOWN}MIND BOGGL
  E":CLR                           :rem 195
2 FOR T= 1 TO 2000:NEXT            :rem 185
3 DIMC(4),G(4)                     :rem 205
4 S1=36875:S2=S1+1:POKES1+3,15:POKES1+4,1
  20:X=0                           :rem 197
5 PRINT"{CLR}{19 DOWN}"            :rem 220
6 PRINT"{2 SPACES}{BLK}{RVS} 1{OFF} {WHT}
  {RVS} 2{OFF} {RED}{RVS} 3{OFF} {CYN}
  {RVS} 4{OFF} {PUR}{RVS} 5{OFF} {GRN}
  {RVS} 6{OFF}{BLK}"               :rem 174
7 PRINT"{BLK}I CHOOSE 4 COLORS NOW":FORL=
  1TO100:POKES2,INT(RND(1)*128)+128:FORM=
  1TO10                            :rem 210
8 NEXTM:NEXTL:POKES2,0:GOSUB106    :rem 36
9 A$="123456":R=INT(RND(1)*6)+1:A1$=MID$(
  A$,R,1):A1=VAL(A1$)              :rem 202
10 R=INT(RND(1)*6)+1:A2$=MID$(A$,R,1):IFA
   1$=A2$THEN10                    :rem 174
11 A2=VAL(A2$)                     :rem 221
12 R=INT(RND(1)*6)+1:A3$=MID$(A$,R,1):IFA
   1$=A3$ORA2$=A3$THEN12           :rem 193
13 A3=VAL(A3$)                     :rem 225
14 R=INT(RND(1)*6)+1:A4$=MID$(A$,R,1):IFA
   1$=A4$ORA2$=A4$ORA3$=A4$THEN14  :rem 215
15 A4=VAL(A4$)                     :rem 229
16 X$="":POKES1,135:FORL=1TO100:NEXTL:POK
   ES1,0:INPUT"SELECT COLORS";X$   :rem 138
17 IFLEN(X$)<>4THENGOSUB106:GOTO93
                                   :rem 118
18 FORE=1TO4:V=VAL(MID$(X$,E,1))   :rem 116
19 IFV<1ORV>6THENGOSUB106:GOTO93    :rem 76
20 NEXTE                           :rem 230
21 X=X+1:B=0:W=0:AA$=A1$+A2$+A3$+A4$
                                   :rem 143
22 FORJ=1TO4                       :rem 218
23 G(J)=VAL(MID$(X$,J,1))           :rem 86
24 C(J)=VAL(MID$(AA$,J,1))         :rem 125
25 IFG(J)=C(J)THENB=B+1:G(J)=0:C(J)=0
                                   :rem 77
26 NEXTJ                           :rem 241
27 FORJ=1TO4:IFC(J)=0THEN33        :rem 136
28 H=0:FORK=1TO4                   :rem 208
29 IFC(J)=0THEN32                  :rem 217
30 IFC(J)<>G(K)THEN32              :rem 193
31 H=1:G(K)=0:C(J)=0                :rem 41
32 NEXTK:W=W+H                     :rem 135
33 NEXTJ                           :rem 239
34 ONXGOTO35,36,37,38,39,40,41,42,43,44
                                   :rem 49
35 PRINT"{HOME} 1 ";:GOTO45        :rem 148
36 PRINT"{HOME}{2 DOWN} 2 ";:GOTO45
                                   :rem 184
37 PRINT"{HOME}{4 DOWN} 3 ";:GOTO45
                                   :rem 220
38 PRINT"{HOME}{6 DOWN} 4 ";:GOTO45:rem 0
39 PRINT"{HOME}{8 DOWN} 5 ";:GOTO45
                                   :rem 36
40 PRINT"{HOME}{10 DOWN} 6 ";:GOTO45
                                   :rem 63
41 PRINT"{HOME}{12 DOWN} 7 ";:GOTO45
                                   :rem 99
42 PRINT"{HOME}{14 DOWN} 8 ";:GOTO45
                                   :rem 135
43 PRINT"{HOME}{16 DOWN} 9 ";:GOTO45
                                   :rem 171
44 PRINT"{HOME}{18 DOWN}10 ";       :rem 26
45 X1=VAL(LEFT$(X$,1)):X2=VAL(MID$(X$,2,1
   )):X3=VAL(MID$(X$,3,1)):X4=VAL(RIGHT$(
   X$,1))                           :rem 87
46 P=0:T=0                          :rem 34
47 P=P+1:ONX1GOTO51,52,53,54,55,56
                                   :rem 140
48 P=P+1:ONX2GOTO51,52,53,54,55,56
                                   :rem 142
49 P=P+1:ONX3GOTO51,52,53,54,55,56
                                   :rem 144
50 P=P+1:ONX4GOTO51,52,53,54,55,56
                                   :rem 137
51 PRINT"{BLK}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,135:GOTO57                   :rem 56
52 PRINT"{WHT}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,159:GOTO57                  :rem 180
53 PRINT"{RED}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,175:GOTO57                  :rem 202
```

```
54 PRINT"{CYN}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,191:GOTO57                    :rem 76
55 PRINT"{PUR}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,201:GOTO57                    :rem 66
56 PRINT"{GRN}{RVS}{2 SPACES}{OFF} ";:POK
   ES2,209:GOTO57                    :rem 205
57 FORL=1TO99:NEXTL:POKES2,0:FORL=1TO250:
   NEXTL:ONPGOTO48,49,50              :rem 1
58 ONTGOTO79,80,81,82                :rem 198
59 PRINT" ";:IFB=0THEN66             :rem 141
60 GOSUB91                           :rem 80
61 ONBGOTO62,63,64,65                :rem 169
62 PRINT"{BLK}Q";:GOTO66             :rem 180
63 PRINT"{BLK}QQ";:GOTO66            :rem 134
64 PRINT"{BLK}QQQ";:GOTO66           :rem 88
65 PRINT"{BLK}QQQQ";:GOTO95          :rem 44
66 IFW=0THEN73                       :rem 88
67 GOSUB92                           :rem 88
68 ONWGOTO69,70,71,72                :rem 198
69 PRINT"{BLK}{RVS}Q{OFF}":GOTO73    :rem 34
70 PRINT"{BLK}{RVS}QQ{OFF}":GOTO73
                                     :rem 235
71 PRINT"{BLK}{RVS}QQQ{OFF}":GOTO73
                                     :rem 189
72 PRINT"{BLK}{RVS}QQQQ{OFF}"        :rem 178
73 PRINT"{BLK}{HOME}{20 DOWN}":PRINT"
   {21 SPACES}"                      :rem 61
74 PRINT"{HOME}{20 DOWN}"            :rem 163
75 IFX<>10THEN16                     :rem 196
76 FORL=1TO15:FORM=200TO220+L*2:POKES2,M:
   NEXTM:NEXTL:POKES2,0              :rem 154
77 PRINT"{HOME}{19 DOWN}":PRINT"
   {3 SPACES}";                      :rem 219
78 T=T+1:ONA1GOTO51,52,53,54,55,56
                                     :rem 129
79 T=T+1:ONA2GOTO51,52,53,54,55,56
                                     :rem 131
80 T=T+1:ONA3GOTO51,52,53,54,55,56
                                     :rem 124
81 T=T+1:ONA4GOTO51,52,53,54,55,56
                                     :rem 126
82 PRINT"{4 SPACES}":PRINT"{BLK}CORRECT C
   OLORS RETURN"                     :rem 154
83 IFPEEK(197)<>15THEN83             :rem 139
84 GETT$:PRINT"{RED}{CLR}{2 DOWN} TOO BAD
    YOU MISSED!":PRINT"{2 DOWN} {BLU}10 T
   RIES IS ENOUGH."                  :rem 0
85 FORL=1TO6:POKES2,160:FORM=1TO400:NEXTM
   :POKES2,0:FORM=1TO400:NEXTM:NEXTL
                                     :rem 89
86 GETT$:PRINT"{CLR}{2 DOWN}{BLK}
   {2 SPACES}WANT TO PLAY AGAIN?":PRINT:P
   RINT:PRINT"{5 SPACES}YES OR NO?"
                                     :rem 207
87 IFPEEK(197)=11THENGETT$:GOTO4     :rem 226
88 IFPEEK(197)=28THENPOKE36879,27:GOTO90
                                     :rem 157
89 GOTO87                            :rem 25
90 GETT$:PRINT"{CLR}{9 DOWN}{8 SPACES}
   {YEL}{RVS}CHICKEN{OFF}":PRINT:PRINT:ST
   OP                                :rem 61
91 FORL=200TO254:POKES2,L:NEXTL:POKES2,0:
   RETURN                            :rem 57
92 FORL=200TO128STEP-1:POKES1,L:NEXTL:POK
   ES1,0:RETURN                      :rem 210
93 PRINT"ILLEGAL INPUT!":POKES1+2,200:FOR
   L=1TO500:NEXTL:POKES1+2,0         :rem 110
94 FORL=1TO999:NEXTL:GOSUB106:GOTO16
                                     :rem 76
95 PRINT:PRINT:PRINT"{GRN}{2 SPACES}YOU W
   I N !! RETURN"                    :rem 248
96 FORM=250TO240STEP-1:POKES2,M:NEXTM:FOR
   M=240TO250:POKES2,M:NEXTM:POKES2,0
                                     :rem 105
97 IFPEEK(197)<>15THEN96             :rem 148
98 PRINT"{CLR}{5 DOWN}"              :rem 42
99 IFX=1THENPRINT"{RED}{5 SPACES}LUCKY GU
   ESS!":GOTO104                     :rem 27
100 IFX=2ORX=3THENPRINT"{GRN}{6 SPACES}EX
    PERT!!!":GOTO104                 :rem 177
101 IFX=4ORX=5ORX=6THENPRINT"{BLU}
    {4 SPACES}PRETTY GOOD!":GOTO104
                                     :rem 26
102 IFX=7ORX=8THENPRINT"{PUR}{9 SPACES}SO
     SO!":GOTO104                    :rem 101
103 PRINT"{2 SPACES}YOU BARELY GOT IT!"
                                     :rem 201
104 FORL=1TO50:FORM=248TO253:POKES2,M:NEX
    TM:FORM=253TO248STEP-1:POKES2,M:NEXTM
    :NEXTL                           :rem 3
105 POKES2,0:GOTO86                  :rem 135
106 PRINT"{2 UP}":PRINT"{21 SPACES}":PRIN
    T"{2 UP}":RETURN                 :rem 220
```

Program 2: 64 Version

```
100 DIMC(4),G(4):POKE53281,15        :rem 41
101 SO = 54272:FOR T=SO TO SO+24:POKET,0:
    NEXT:X=0                         :rem 48
102 POKESO+24,15:POKESO+5,17:POKESO+6,241
                                     :rem 181
300 PRINT"{CLR}{13 DOWN}{14 RIGHT}{BLK}MI
    ND BOGGLE{5 DOWN}":FORT=1TO 1000:NEXT
                                     :rem 231
340 PRINT"{CLR}{20 DOWN}"            :rem 79
350 PRINT "{4 RIGHT}{BLK} {RVS}{2 SPACES}
    1 {OFF} {WHT}{RVS}{2 SPACES}2 {OFF}
    {RED}{RVS}{2 SPACES}3 {OFF} {BLU}
    {RVS}{2 SPACES}4 {OFF} {PUR}{RVS}
    {2 SPACES}5 {OFF} {GRN}{RVS}
    {2 SPACES}6 {OFF}{BLK}"          :rem 4
365 PRINTSPC(6)"{BLK}I AM CHOOSING 4 COLO
    RS NOW{BLK}":FORL=1TO100         :rem 54
366 POKES2,INT(RND(1)*128)+128:FOR M=1 TO
     10:NEXTM:NEXTL:POKES2,0:GOSUB4050
                                     :rem 228
400 A$="123456":R=INT(RND(1)*6)+1:A1$=MID
    $(A$,R,1):A1=VAL(A1$)            :rem 37
401 R=INT(RND(1)*6)+1:A2$=MID$(A$,R,1):IF
    A1$=A2$THEN401                   :rem 22
402 A2=VAL(A2$)                      :rem 17
403 R=INT(RND(1)*6)+1:A3$=MID$(A$,R,1):IF
    A1$=A3$ORA2$=A3$THEN403          :rem 41
404 A3=VAL(A3$)                      :rem 21
405 R=INT(RND(1)*6)+1:A4$=MID$(A$,R,1):IF
    A1$=A4$ORA2$=A4$ORA3$=A4$THEN405
                                     :rem 63
406 A4=VAL(A4$)                      :rem 25
500 FOR T= 1TO 1000:NEXT             :rem 27
510 POKESO,100:POKESO+1,100:POKESO+4,17:F
    ORL=1TO100:NEXTL:POKESO+4,16     :rem 23
540 POKE214,21:POKE211,5:PRINT:PRINT"
    {34 SPACES}"                     :rem 30
550 X$="":POKE214,21:POKE211,0:PRINT:INPU
    T "SELECT COLORS";X$             :rem 157
600 IFLEN(X$)<>4THENGOSUB4050:GOTO3300
                                     :rem 48
700 FORE=1TO4:V=VAL(MID$(X$,E,1)):rem 162
705 IFV<1ORV>6THENGOSUB4050:GOTO3300
                                     :rem 10
```

```
710 NEXTE                                :rem 28
900 X=X+1:B=0:W=0:AA$=A1$+A2$+A3$+A4$
                                         :rem 197
901 FORJ=1TO4                            :rem 16
902 G(J)=VAL(MID$(X$,J,1))               :rem 140
903 C(J)=VAL(MID$(AA$,J,1))              :rem 179
904 IFG(J)=C(J)THENB=B+1:G(J)=0:C(J)=0
                                         :rem 131
905 NEXTJ                                :rem 39
906 FORJ=1TO4:IFC(J)=0THEN912            :rem 244
907 H=0:FORK=1TO4                        :rem 6
908 IFC(J)=0THEN911                      :rem 69
909 IFC(J)<>G(K)THEN911                  :rem 54
910 H=1:G(K)=0:C(J)=0                    :rem 95
911 NEXTK:W=W+H                          :rem 189
912 NEXTJ                                :rem 37

1000 ONXGOTO1100,1105,1110,1115,1120,1125
     ,1130,1135,1140,1145                :rem 60
1100 PRINT"{HOME}{7 RIGHT}{DOWN} 1 ";:GOT
     O1200                               :rem 36
1105 PRINT"{HOME}{7 RIGHT}{2 DOWN} 2 ";:G
     OTO1200                             :rem 59
1110 PRINT"{HOME}{7 RIGHT}{3 DOWN} 3 ";:G
     OTO1200                             :rem 73
1115 PRINT"{HOME}{7 RIGHT}{4 DOWN} 4 ";:G
     OTO1200                             :rem 96
1120 PRINT"{HOME}{7 RIGHT}{5 DOWN} 5 ";:G
     OTO1200                             :rem 110
1125 PRINT"{HOME}{7 RIGHT}{6 DOWN} 6 ";:G
     OTO1200                             :rem 133
1130 PRINT"{HOME}{7 RIGHT}{7 DOWN} 7 ";:G
     OTO1200                             :rem 147
1135 PRINT"{HOME}{7 RIGHT}{8 DOWN} 8 ";:G
     OTO1200                             :rem 170
1140 PRINT"{HOME}{7 RIGHT}{9 DOWN} 9 ";:G
     OTO1200                             :rem 184
1145 PRINT"{HOME}{7 RIGHT}{10 DOWN}10 ";
                                         :rem 192
1200 X1=VAL(LEFT$(X$,1)):X2=VAL(MID$(X$,2
     ,1)):X3=VAL(MID$(X$,3,1))           :rem 174
1210 X4=VAL(RIGHT$(X$,1))                :rem 141
1220 P=0:T=0                             :rem 125
1300 P=P+1:ONX1GOTO1700,1701,1702,1703,17
     04,1705                             :rem 49
1400 P=P+1:ONX2GOTO1700,1701,1702,1703,17
     04,1705                             :rem 51
1500 P=P+1:ONX3GOTO1700,1701,1702,1703,17
     04,1705                             :rem 53
1600 P=P+1:ONX4GOTO1700,1701,1702,1703,17
     04,1705                             :rem 55
1700 PRINT"{BLK}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,100:GOTO1750                :rem 108
1701 PRINT"{WHT}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,124:GOTO1750                :rem 232
1702 PRINT"{RED}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,140:GOTO1750                :rem 254
1703 PRINT"{BLU}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,166:GOTO1750                :rem 10
1704 PRINT"{PUR}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,150:GOTO1750                :rem 129
1705 PRINT"{GRN}{RVS}{3 SPACES}{OFF} ";:P
     OKESO+1,185:GOTO1750                :rem 12
1750 POKESO+4,17:FORL=1TO99:NEXTL:POKESO+
     4,16:FORL=1TO250:NEXTL              :rem 29
1751 ONPGOTO1400,1500,1600               :rem 158
1761 ONTGOTO2072,2073,2074,2075          :rem 175
1800 PRINT" ";:IFB=0THEN2000             :rem 62
1810 GOSUB3100                           :rem 14
1820 ONBGOTO1900,1901,1902,1903          :rem 149
1900 PRINT"{BLK}Q";:GOTO2000             :rem 108
1901 PRINT"{BLK}QQ";:GOTO2000            :rem 62
1902 PRINT"{BLK}QQQ";:GOTO2000           :rem 16
1903 PRINT"{BLK}QQQQ";:GOTO4000          :rem 228
2000 IFW=0THEN2060                       :rem 12
2010 GOSUB3200                           :rem 8
2020 ONWGOTO2050,2051,2052,2053          :rem 151
2050 PRINT"{BLK}{RVS}Q{OFF}":GOTO2060
                                         :rem 216
2051 PRINT"{BLK}{RVS}QQ{OFF}":GOTO2060
                                         :rem 170
2052 PRINT"{BLK}{RVS}QQQ{OFF}":GOTO2060
                                         :rem 124
2053 PRINT"{BLK}{RVS}QQQQ{OFF}"          :rem 19
2060 PRINT"{BLK}{HOME}{15 DOWN}":PRINT"
     {21 SPACES}"                        :rem 70
2062 PRINT"{HOME}{9 RIGHT}{15 DOWN}"
                                         :rem 178
2065 IFX<>10THEN500                      :rem 83
2066 POKESO+4,32:FORL=1TO15:FORM=200TO220
     +L*2:POKESO+1,M:NEXTM:NEXTL         :rem 37
2068 POKESO+4,32                         :rem 145
2070 PRINT"{HOME}{14 DOWN}":PRINT"
     {10 SPACES}";                       :rem 225
2071 T=T+1:ONA1GOTO1700,1701,1702,1703,17
     04,1705                             :rem 40
2072 T=T+1:ONA2GOTO1700,1701,1702,1703,17
     04,1705                             :rem 42
2073 T=T+1:ONA3GOTO1700,1701,1702,1703,17
     04,1705                             :rem 44
2074 T=T+1:ONA4GOTO1700,1701,1702,1703,17
     04,1705                             :rem 46
2075 PRINT"{4 SPACES}":PRINT"{BLK}
     {5 SPACES}CORRECT COLORS{2 SPACES}PR
     ESS RETURN"                         :rem 139
2080 IFPEEK(197)<>1THEN2080              :rem 20
2085 GETT$:PRINT"{RED}{CLR}{9 DOWN}
     {10 RIGHT}TOO BAD YOU MISSED!"
                                         :rem 56
2086 PRINT"{2 DOWN}{10 RIGHT}{BLU}10 TRIE
     S IS ENOUGH."                       :rem 124
2090 POKESO+4,33                         :rem 141
2096 FORL=1TO6:POKESO+1,80:FORM=1TO400:NE
     XTM:POKESO+4,32:FORM=1TO400:NEXTM
                                         :rem 243
2098 NEXTL:POKESO+4,32                   :rem 89
3000 GETT$:PRINT"{CLR}{8 DOWN}{9 RIGHT}
     {BLK} WANT TO PLAY AGAIN?{2 DOWN}"
                                         :rem 170
3005 PRINT "{15 RIGHT}YES OR NO?":rem 186
3010 IFPEEK(197)=25THENGETT$:POKE198,0:GO
     TO101                               :rem 1
3012 IFPEEK(197)=39THEN3014              :rem 12
3013 GOTO3010                            :rem 196
3014 GETT$:PRINT"{CLR}{10 DOWN}{15 RIGHT}
     {BLK}CHICKEN!!"{2 SPACES}:PRINT:PRIN
     T:END                               :rem 129
3100 POKESO+4,17:FORL=100TO154:POKESO+1,L
     :NEXTL:POKESO+4,16:RETURN           :rem 187
3200 POKESO+4,17:FORL=100TO48STEP-1:POKES
     O+1,L:NEXTL:POKESO+4,16:RETURN
                                         :rem 40
3300 PRINT"{UP}ILLEGAL INPUT!{UP}":FORL=1
     TO500:NEXTL                         :rem 60
3301 FORL=1TO999:NEXTL:GOSUB4050:GOTO500
                                         :rem 6
4000 PRINT:PRINT:PRINT"{BLK}{7 RIGHT}YOU
     {SPACE}W I N !! PRESS RETURN":rem 24
4005 POKESO+4,33:FORM=180TO100STEP-5:POKE
     S2,M:NEXTM:FORM=100TO200STEP 5
                                         :rem 176
```

```
4006 POKESO+1,M:NEXT M:POKE SO+4,32
                                    :rem 49
4010 IFPEEK(197)<>1THEN4005         :rem 14
4011 PRINT"{CLR}{10 DOWN}{9 RIGHT}";
                                    :rem 20
4015 IFX=1THENPRINT"{RED}{5 SPACES}LUCKY
     {SPACE}GUESS!":GOTO4020      :rem 164
4016 IFX=2ORX=3THENPRINT"{GRN}{6 SPACES}E
     XPERT!!!":GOTO4020           :rem 28
4017 IFX=4ORX=5ORX=6THENPRINT"{BLU}
     {4 SPACES}PRETTY GOOD!":GOTO4020
                                    :rem 133
4018 IFX=7ORX=8THENPRINT"{PUR}{9 SPACES}S
     O SO!":GOTO4020              :rem 208
4019 PRINT"{2 SPACES}YOU BARELY GOT IT!"
                                    :rem 3
4020 POKESO+4,33:FORL=1TO20:FORM=148TO200
     STEP5:POKES2,M:NEXTM         :rem 131
4021 FOR M=200TO 148STEP-5:POKESO+1,M:NEX
     TM:NEXTL:POKESO+4,32          :rem 14
4030 GOTO3000                     :rem 195
4050 PRINT"{32 SPACES}":RETURN    :rem 180
```

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

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COMPUTE!'s Gazette for Commodore

AUTHOR GUIDE

COMPUTE!'s Gazette for Commodore is looking for interesting, useful articles aimed at beginning to intermediate VIC-20 and Commodore 64 users. If you have an article idea or a good original program, we'd like to see it. Don't worry if you are not a professional writer. We are more concerned with the content of an article than its style. Simply try to be clear in your writing and check your program for any bugs.

COMPUTE!'s Gazette for Commodore is a consumer-oriented magazine for VIC-20 and Commodore 64 users who want to get the most out of their computers in a non-technical way. It is aimed primarily at home users, not all of whom necessarily want to become expert programmers. If your article covers a more advanced or technical topic, you may choose to submit it to our companion publication, **COMPUTE!**. If you submit an article to one of our magazines and we believe it would be more suitable to the other, we will transfer your submission to the right editors. The basic editorial requirements for publication are the same for both magazines; so are the payment rates.

The following guidelines will permit your good ideas and programs to be more easily edited and published. Most of these suggestions serve to improve the speed and accuracy of publication:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to either the VIC-20 or Commodore 64, please state which one. In addition, please indicate the memory requirements of programs.

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* The tape or disk should be labeled with your name and the title of the article. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I=1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

6. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing "Revision" on the envelope and the article.

7. All lines within the text of the article should be spaced so that there is about 1/2 inch between them. A one-inch margin should be left at the right, left, top, and bottom of each page. No hyphens should be used at the ends of lines to break words. And please do not justify. Leave the lines ragged.

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11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. *COMPUTE!'s Gazette* for Commodore pays between $75 and $1000 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance of an article. Following submission (Editorial Department, *COMPUTE!'s Gazette* for Commodore, P.O. Box 5406, Greensboro, NC 27403) it will take from four to six weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. Rejected manuscripts are returned to authors who enclose an SASE. We do not consider articles which are multiple submissions. If you wish to send an article to another magazine for consideration, please do not submit it to us.

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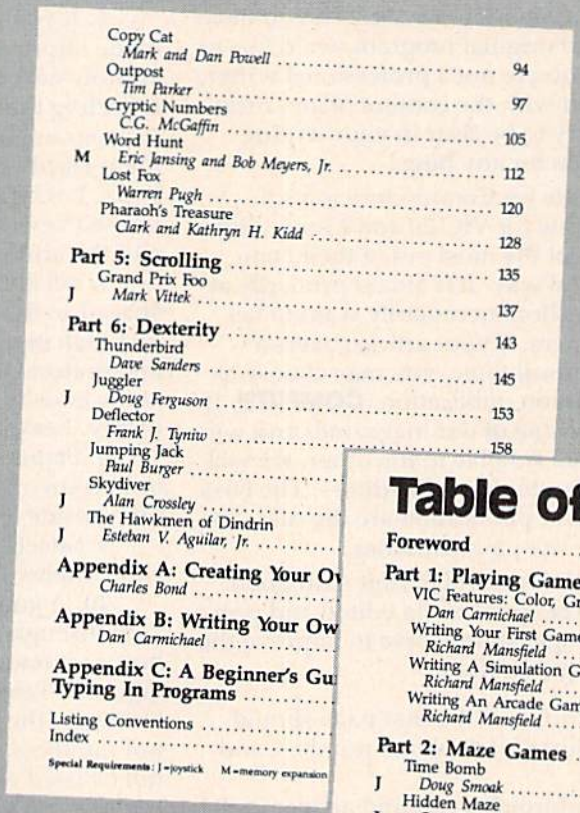

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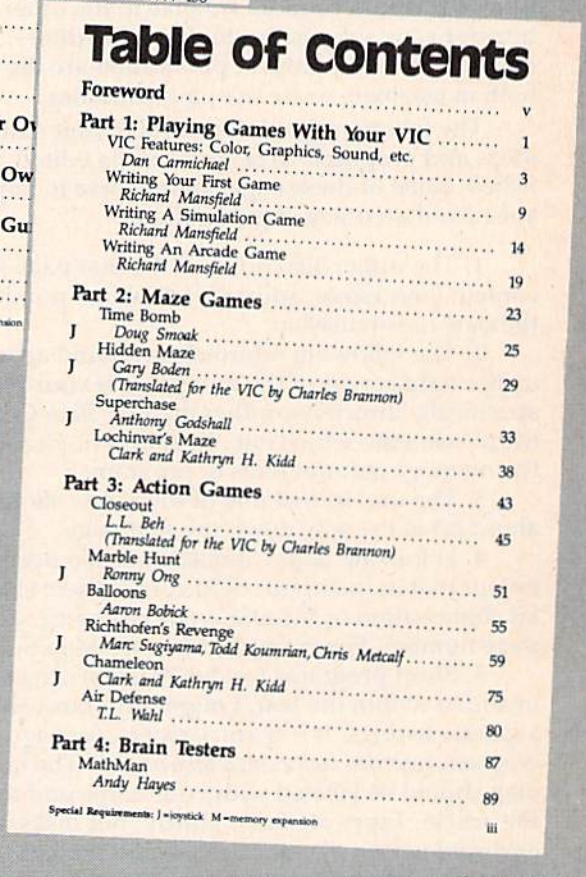

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