

How COMPUTE! Readers Use Their Computers

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The Leading Magazine Of Home, Educational, And Recreational Computing

Special Games Issue

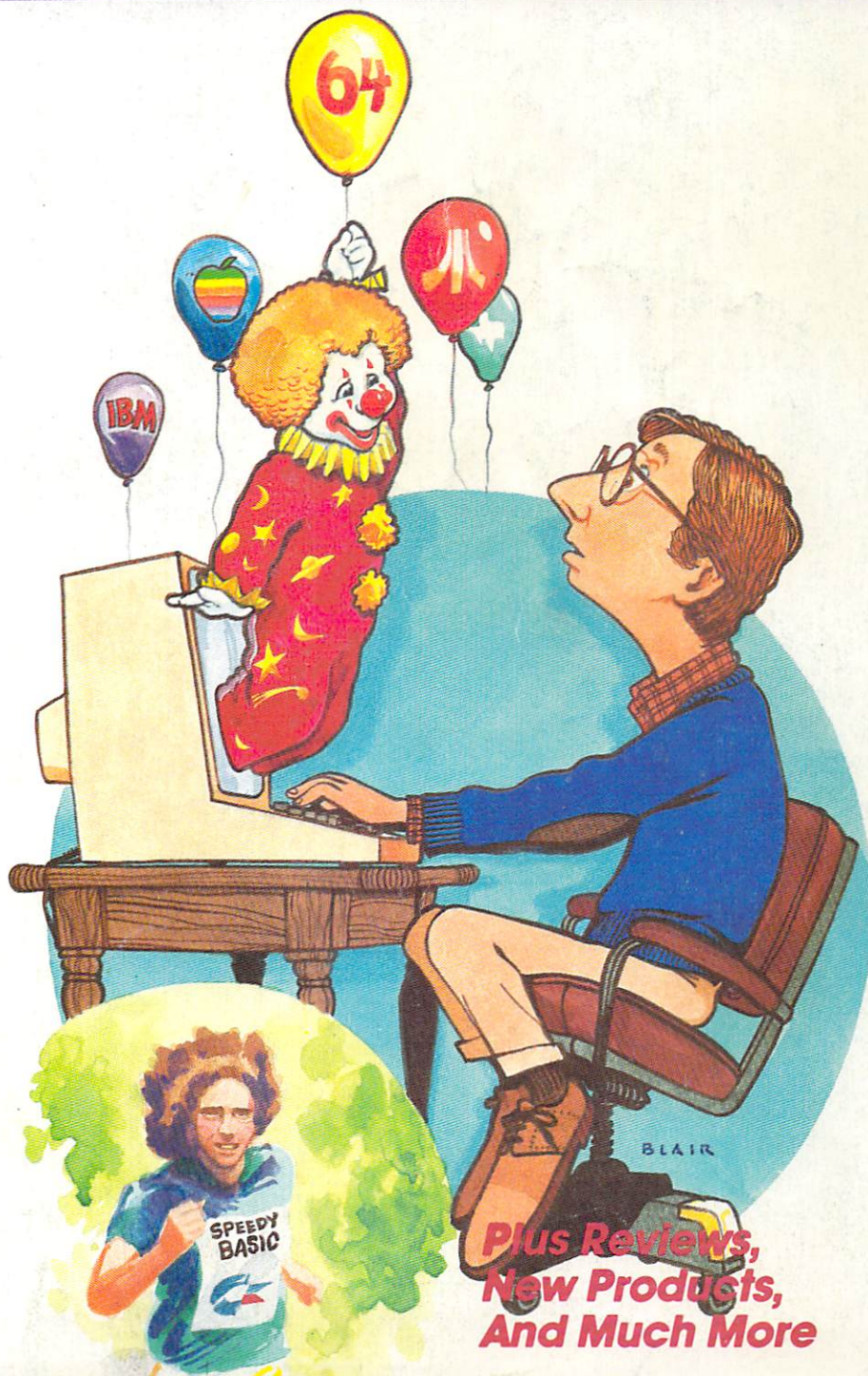
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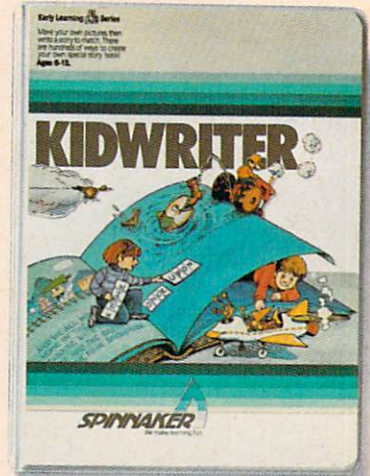
And not just because they're educational, but also because they happen to be a lot of fun to play.

In fact, they're so much fun, parents have been known to sneak in a few hours of play when the kids are asleep.

After all, if your kids are actually enjoying a learning game, there must be something to it. And there is: Fun, excitement and real educational value. That's what sets Spinnaker games apart from all the rest. And what brings parents back for more.

We offer a wide range of learning games for a wide range of age groups: 3 to 14. One look at these two pages will show you how we carefully designed our line of learning games to grow right along with your child.

So if you're looking for a line of learning games that are as much fun to play as they are to buy, consider Spinnaker Games. They're compatible with **Apple, Atari, IBM PC, PCjr, Commodore 64, Coleco Adam** and parents who don't mind their kids having fun while they learn.



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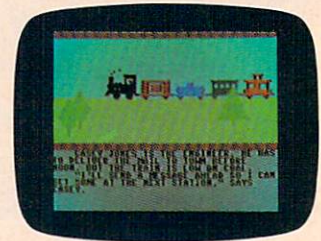
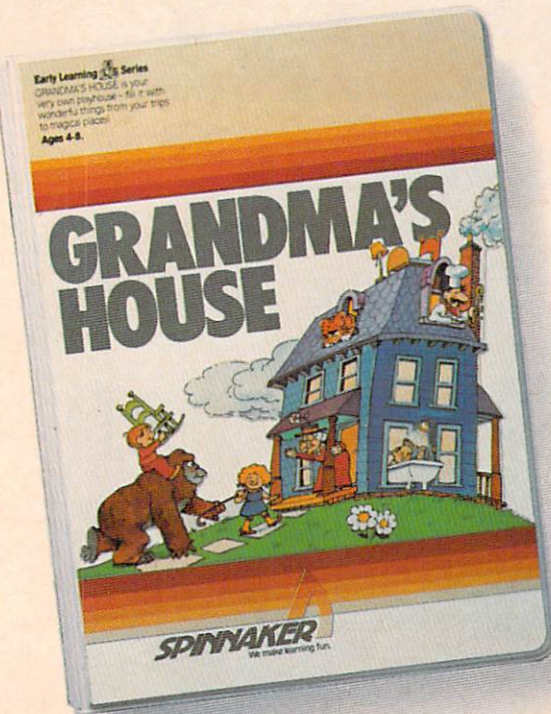
KIDWRITER gives children a unique new format for creating their own stories. With KIDWRITER, kids make colorful scenes, then add their own story lines. It's as versatile and exciting as your child's imagination!

Best of all, while it encourages children to create word and picture stories, it also introduces them to the fundamentals of word processing. KIDWRITER will bring out the storyteller in your children—and in you!

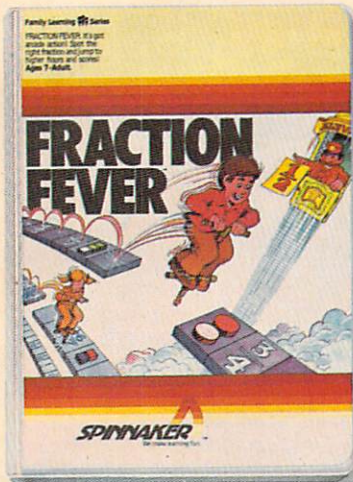
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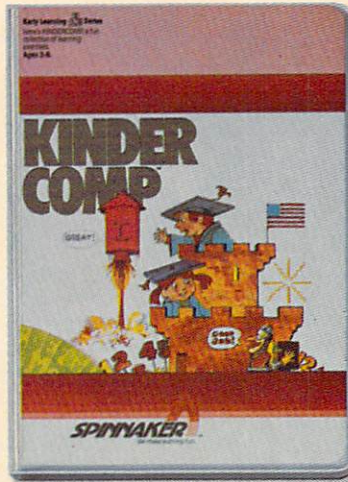
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FRACTION FEVER is a fast-paced arcade game that challenges a child's understanding of fractions. As kids race across the screen in search of the assigned fraction, they're actually learning what a fraction is and about relationships between fractions.

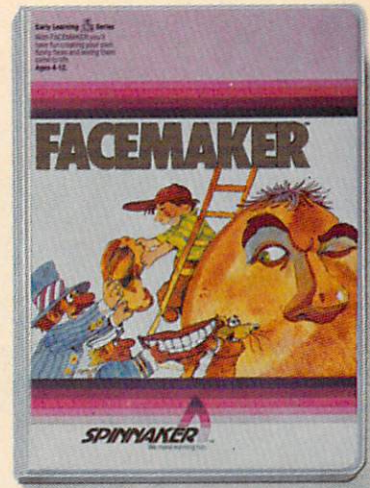
All in all, FRACTION FEVER encourages kids to learn as much as they can about fractions—just for the fun of it!



KINDERCOMP™ Numbers, shapes, letters, words and drawings make fun. Ages 3 to 8.

KINDERCOMP allows very young children to start learning on the computer. It lets your children match shapes and letters, write their names, draw pictures and fill in missing numbers. KINDERCOMP delights kids with colorful rewards—the screen comes to life when correct answers are given.

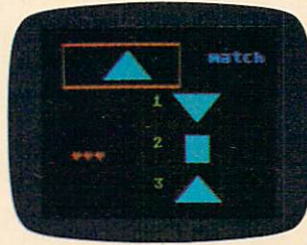
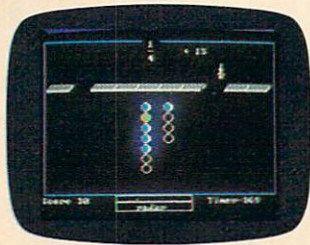
As a parent, you can enjoy the fact that your children are having fun while improving their reading readiness and counting skills.



FACEMAKER™ makes faces fun. Ages 3 to 8.

FACEMAKER lets children create their own funny faces on the screen, then make them do all kinds of neat things: wink, smile, wiggle their ears, and more.

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EDITOR'S NOTES

Rumor has it that Commodore will introduce a new computer (the 264) at the Winter Consumer Electronics Show in January. The unit is expected to be compatible with the 64, and is not intended as a replacement for either the VIC-20 or Commodore 64. Price is expected to come in well under \$500.

The year ahead... We've decided to make some fearless predictions for 1984. 1983 was to be the year of the home computer, and though we feel great progress was made, we're not convinced it's happened yet. We'll give '83 half credit, and project the rest into 1984. First the wrap-up. This past year saw Atari fall from its position of shared leadership to become a more distant runner-up; Texas Instruments withdrew completely from the highly competitive low-end computer scene; Coleco, in great fanfare, launched and stumbled, all at the same time; Commodore greatly increased market share in the midst of controversial quality assurance and delivery problems; and Apple continued to do an excellent job of completely ignoring the low-end market. IBM came through just in time with PCjr to make all the rumor mongers honest, at least if you're willing to wait for delivery.

On this note, the fearless forecast... PCjr's won't really be available in quantity until April or May. Coleco's Adam will be redesigned and substantially modified by June, with additional price increases required. Texas Instruments will reconsider its decision to cease production of the 99. PCjr will soon have an optional keyboard with a "standard" key set. By year end, we'll have at least one system that's 16 bit, 128K RAM, with extended color, sound, and graphics capabilities for less than \$500. Commodore will have the low-end market to itself until one or two Japanese firms begin to duplicate Commodore's success and the price wars will begin again. Apple will continue to successfully ignore the low-end market. At least one company will introduce a PCjr look-alike for half the price. And finally, a "real" forecast: COMPUTE! will continue to grow. Later in the year, we'll look back at these fearless forecasts and keep you posted.

Random News: As of December 16, COMPUTE! Books has six titles on the B. Dalton National Best Seller List of computer titles. We're quite gratified that six of the twenty titles are ours. You TI owners will also be pleased to note that we have several new TI titles to be re-

leased during the spring. By the way, press run for this issue of COMPUTE! is 510,000. We're finally hitting that half million mark in issues printed. We broke the 100,000 barrier in the fall of 1982.

A Correction: In the January "Readers' Feedback," we goofed in our response regarding the differences between the VIC modem 1600 and the new Commodore 1650 modem. We said that the 1650 would only be usable with the 64 because it plugs into the expansion port. Wrong. It plugs into the user port on both the VIC and 64 and does, in fact, work with both. To compound our indiscretion, we said that the 1600 tele-terminal software is not compatible with the 1650. Wrong (in part). The terminal software for the 1600 doesn't support the auto-dial/auto-answer features of the 1650. Otherwise it is compatible.



Editor In Chief

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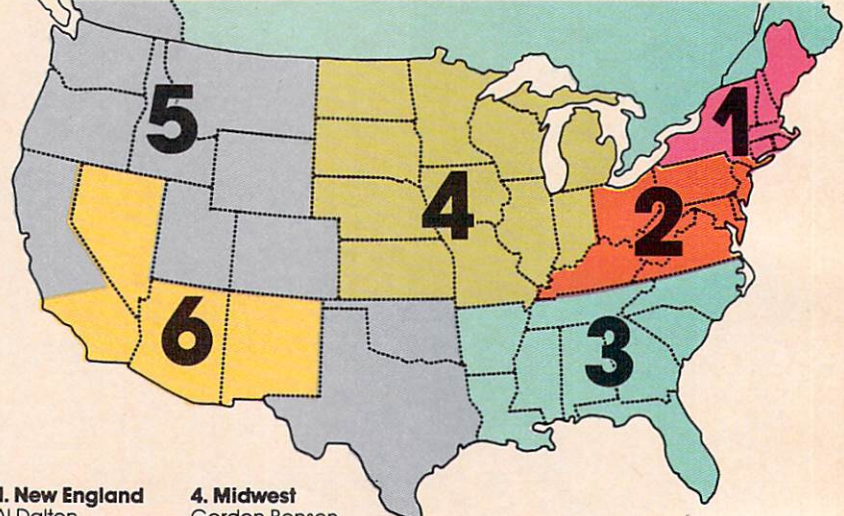
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The Editors and Readers of COMPUTE!

Making Cents

It's unfortunate that most versions of BASIC don't print zero decimal values. For example, if you have a result like \$23.00, the decimal point and zeros are not printed. When you are working with dollar values and want the cents printed, here's a handy one-line routine which you can insert into your program.

```
V$=STR$(X+.001):V$=LEFT$(V$,LEN(V$)-1)
```

For example, if your program computes a value of 23 for the numeric variable X, .001 will be added. Then the result of 23.001 is converted into a string, V\$. The string is then redefined, minus the rightmost character, 1. Now, instead of printing the numeric value X, you print the string representation V\$, and your number will be printed with two decimal places.

Chuck Emerson-Henry

Gummy VIC Keys

I have had a VIC-20 and accessories for about 15 months. It has been satisfactory until recently. Now the key contacts appear to be getting "gummy" and keys will not print without excess pressure or repeated attempts.

Is there any way to clean the key contacts or is this the end of life for VIC-20? I have always stored the VIC-20 under a dust cover in a dry place.

Howard M. Bollinger

Since your warranty has expired, you may want to open up the case to remove and clean the keyboard. You could also try removing the keycaps and spraying TV tuner cleaner into the contacts. Rubbing alcohol may serve in a pinch. Whatever you do, be certain that the power cable is unplugged from the electrical outlet. If all else fails, you will have to take your VIC-20 to a Commodore service technician to get it cleaned.

CP/M And The 64

I have recently purchased a Commodore 64. My primary reason for the purchase was to obtain a system that would offer computer instruction for my children while providing me with a system for business and word processing applications. However, having read countless reviews and

similar articles pertaining to the 64, it appears that its design seriously limits this. Can the Commodore 64 really be used with CP/M software that is readily available? Can the 64 support a printer for truly professional-looking word processing for business applications? Is this system truly flexible for such personal business applications, or is it really just an expanded memory system for enhanced games?

If the Commodore 64 can, in fact, use widely available CP/M software, would it not be to my advantage to standardize on this for all future software and hardware decisions?

C. W. Walker

The Commodore CP/M cartridge does permit the 64 to run the popular CP/M operating system. The cartridge contains a Z80 microprocessor, and the package includes a disk containing the CP/M Operating System. There are a few obstacles, however. First, there is almost no CP/M software yet available in Commodore 1541 format. There are thousands of CP/M programs, but there is no one standard for disk format. Just having CP/M capability does not mean you can insert a CP/M disk and expect to use it. Another limitation of Commodore CP/M is that it does not support 80 columns, whereas most screen-oriented CP/M programs require an 80-column screen. A third drawback to Commodore CP/M is the speed of the 1541 disk drive. While adequate for loading and saving programs or data files, the relatively slow speed of the 1541 (as compared to disk drives on most CP/M systems) might handicap a disk-intensive operating system such as CP/M.

Nevertheless, the Commodore 64 is an impressive machine—even without the CP/M capability. Many powerful programs have been written in Commodore BASIC or 6502/6510 machine language, such as dBASE II, the Last One, and VisiCalc. There are also many professional word processing packages, and interfaces for almost any printer on the market—including letter-quality daisy wheel printers. The 64 can also be considerably less expensive than an equivalent CP/M business machine, depending on your application. And there is plenty of good PET/CBM business software that is easily converted or will run under the PET Emulator.

Expand My Atari 400 Or Buy XL?

I own an Atari 400 and am thinking of expanding

Computers may be the world's best spellers, but they're the world's worst spelling teachers.

Or at least they used to be. Until Chatterbee.

Chatterbee is a unique piece of home computer software that not only makes teaching possible, it makes learning fun. For little people. And big people, too.

If that sounds like something you've never heard of before, you're right. You haven't. Because Chatterbee



does something that no other spelling software can do.

Talk.

It's equipped with a customized version of the S.A.M. speech synthesizer,

developed by Don't Ask for Tronix to provide voice output.

Instead of drawing pictures, scrambling words, beating around the bush or playing "Hangman," Chatterbee teaches spelling the sensible, old-fashioned way.

Each word is spoken, then

put in a contextual sentence. Just like a spelling bee. With one important difference.

Since there's no classroom, there's no pressure. And no embarrassment.

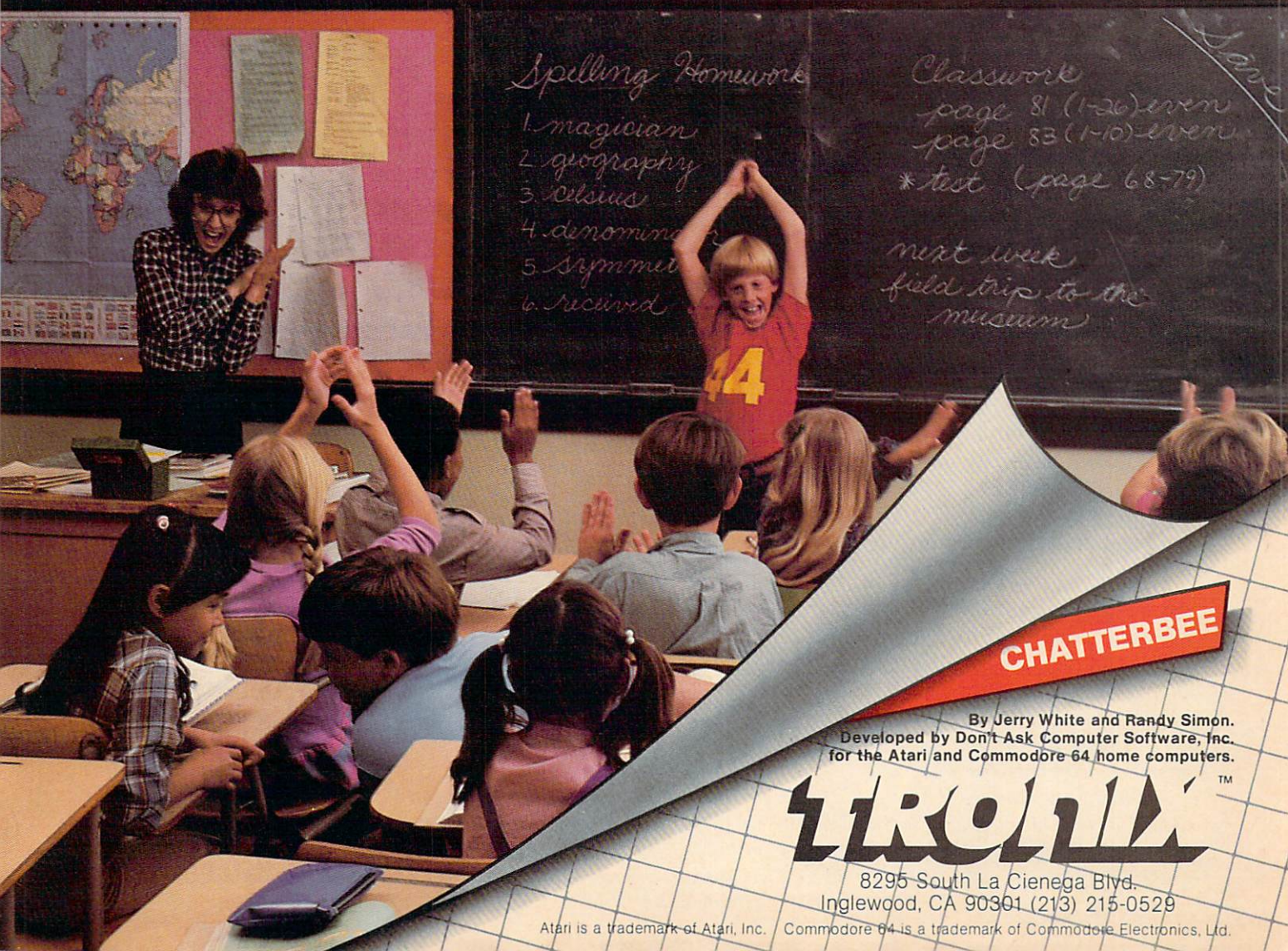
Each of the 2500 words have been selected from current educational literature. And there's an internal scoring system that automatically places each player at the right level of difficulty and challenge.

The external scoring system rewards success and turns the whole thing into a game, complete with music.

Chatterbee. The spelling bee without the sting.

Hear today, spell tomorrow.

Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz



CHATTERBEE

By Jerry White and Randy Simon.
Developed by Don't Ask Computer Software, Inc.
for the Atari and Commodore 64 home computers.

TRONIX™

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Inglewood, CA 90301 (213) 215-0529

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its memory to 64K. Would I be better off buying one of Atari's new models that come with 64K, or a memory expansion board? I've read that the 800XL and the other new computers have an extra interface. How important is this interface?

A. Katz

Before you do anything, you should make sure you really need the 64K. Almost no Atari programs use more than 48K, and most will run with 40K or 32K, even with a disk drive. You may be able to get quite a bargain on a 32K or 48K memory expansion board.

If you want future compatibility with the new XL computers, you should consider buying an XL, since there is no way to fully upgrade an Atari 400 to the specifications of even the Atari 600 XL. The interface you speak of is one reason. It allows direct access to the internal circuitry of the new XL computers, permitting hardware add-ons (in the way that the Apple II does). It is only a potential, though. There are currently no cards to support the expansion slot, and Atari has said that it will only minimally support the expansion port. Further support will have to come from third-party add-on products.

Screen POKES On Expanded VIC

I own a VIC with a 16K expander. Recently, I typed in a program. When I ran the program, I got a syntax error in line 5033, a POKE statement. So, I LISTed 5033 and found that one of the numbers had been replaced by a strange graphics character. I corrected it and LISTed the line again to verify that it was corrected. It was. Yet, when I ran the program again, I found that the same thing had happened in line 5030. I went through this a number of times.

After a while, I just started deleting those lines that showed up with syntax errors. After deleting six or eight lines, the message came: SYNTAX ERROR IN LINE 28527. I didn't even have a 28527 in my program. I LISTed 28527 and got half a screen full of graphics.

Do you have any idea what could be causing this? Could there be something wrong with my computer or expander? I have POKEd that location before (not in this program) with no difficulty.

Dick Berti

Jim Butterfield replies:

The usual reason that programs start to change mysteriously is that they contain errors which make them change themselves. On the VIC, this is often caused by misplaced screen POKES. Commodore's documentation doesn't make it clear how the screen can move around on a memory-expanded machine.

On an unexpanded VIC, your BASIC program would start at memory address 4097 and go up from there. You don't need to know that; but the program must go somewhere, and that's the place. The "screen

memory" is located at address 7680 and up. The manual mentions this, since a number of users like to POKE information to the screen. More on this in a moment.

You've expanded your VIC with 16K memory, and the above addresses shift around. Obviously, you can't still start BASIC at 4097 and have the screen at 7680—if you did, there would be no extra space for BASIC and your extra memory would be wasted. So the system automatically does a flip. It puts the screen memory at 4096, and starts the BASIC program at 4609. Now your BASIC program can occupy memory all the way up to 24575 and you'll have lots of room for big programs.

Most of the time you don't need to know all this. You can just type in your program and everything will be taken care of for you. But there's a possible catch.

Suppose you have a program written to POKE information to the screen of a small VIC. The manual tells us that screen memory is at addresses 7680 up to about 8185, and that's what the POKE statements use; you may have commands such as POKE 7680,1. And suppose you type this program into your 16K expanded machine. The program still says POKE 7680,1—but the screen isn't there any more!

The small problem is that the screen doesn't get its information. The big problem is this—7680 now contains part of your program. When you say RUN, the POKE command changes memory—not the screen, but part of the program itself.

If you know about the problem, you can carefully go through the program lines, spot any location where there is a POKE to addresses in the range of 7680 to 8185, and subtract 3584 from each address. That's about the best way to permanently solve the problem.

Most programs are written for the minimum 5K VIC. Look carefully for screen POKES when you adapt them to your expanded machine.

Insert A Disk With Power Off?

Could you give me the reasons why some programs on disk tell you to insert the disk before turning on the drive and others warn you that doing this may harm the disk? For example, *Zork* says to turn on the drive before inserting the disk (so does the Percom manual), but *Dark Crystal* says to insert the disk, then turn on the drive.

C. Weintraub

It is usually inadvisable to turn disk drives on or off with a disk inserted. There is a chance that, when you turn on the disk drive, there will be a momentary surge of power to the read/write head. This is not too likely, but if it happens, a portion of your disk could be erased. Some systems, such as the Apple II, require that the disk be present in the drive when you turn on the system (the disk drive is powered by the computer).

For the Atari system in particular, you should turn on the disk drive first, insert the disk, then turn

Your ship has just come in.



Aboard the S.S. Slipshod, things are getting a little out of hand.

It seems that the navigator mistook an iceberg for Pittsburgh. With predictable results.

Soon, every state-room on the ship will have an ocean view.

But never fear, 'cause Captain Clutch is here.

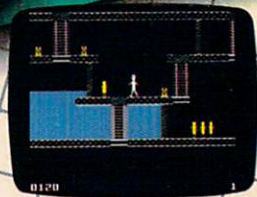
He'll stoke the boilers to keep the game afloat, lead the passengers to the lifeboats and rescue a few bars of gold along the way.

Why, you ask, doesn't the courageous Captain simply pocket the gold and row off into the sunset?

Because our Captain is above that sort of thing, that's why. And besides, the game won't let him. By the way, how long can you tread water?

Developed by Steve Morris.
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on your computer. This will cause the disk to boot (load and run automatically). If you turn on the computer and drive without a disk in the drive, the computer will keep trying to read the nonexistent disk until you insert a bootable disk.

Will The VICmodem Work With PET And 64?

I have a VICmodem. I was wondering what would happen if I plugged the modem into a 64 or Commodore PET. If it wouldn't work, what are the differences between the VIC's User Port and the others?

Seth Major

The VICmodem will work with either the VIC-20 or the Commodore 64. The User Ports of these two computers are nearly identical. The PET/CBM series computers have a User Port also, and that port has the same edge connector as the VIC and 64. The bottom row of pins (A-N) has essentially the same configuration on all Commodore products. However, the top row of pins (1-12) is totally different on the PET/CBM. Also, the VIC and 64 have routines in their operating system ROMs which support serial communication through the User Port. The PET/CBM does not support in ROM any type of communication through its User Port. The VICmodem cannot be used with PET/CBM models.

Whiz Kids And The Real World

I have an Atari 800 computer and I wanted to know if I could connect my 800 with other computers to make one big system. I would also like to make a computer system that would be able to talk and do many programs like they do on the show *Whiz Kids*.

David Smith

The TV show *Whiz Kids* is sometimes unrealistic. One episode had them turning on the sprinkler system in an effort to escape a room they had been locked into (of course the room had a computer terminal in it). There seemed to be no concern that the water cascading from the ceiling would almost instantly short out the terminal they were using.

Nevertheless, the show does feature current technology and trends. With a telephone modem and terminal software, you can call up other computers and exchange information. There are many small bulletin boards which distribute information and even free programs. You can also subscribe to information utilities, such as *The Source* and *CompuServe*. With a telephone and a modem, most computers can communicate with each other.

You can also buy a speech synthesizer, such as the *Alien Group's VoiceBox*, *SAM* from *Don't Ask Soft-*

ware, or the *Votrax Type 'n Talk*. These devices let you program your computer to talk, but do not give the computer any capability for real conversation. Even the most advanced artificial intelligence experts haven't solved that problem yet.

TI-99/4A Disk Drives

Is there any company that makes a TI-99/4A disk drive that does not require accessories?

Eric Chet

TI, in fact, manufactures a "stand-alone" disk drive which has a built-in disk controller, and thus doesn't require the Peripheral Expansion System. This particular drive actually costs a little more than the disk controller card and the disk drive which are housed in the Peripheral Expansion System. If you are thinking of later expanding your system, you may want to spend the difference on the Peripheral Expansion System since TI no longer manufactures any other peripherals which work independently of this unit.

VIC-20 Static

I own a VIC-20. I use it on a black-and-white television. No matter how much fine-tuning I do, I can't get sound other than static. Is there any way this can be corrected? I have the RF Box without any adjusting screw inside.

Chris Nelson

Could be a bad RF modulator. Try another.

64 Lockup Bug

I am having a problem with my Commodore 64 which occurs when I use the DEL key to edit a BASIC program. While I am deleting, the program that I am working on RUNS! Even if I try to use the RUN/STOP key, it keeps going. Then, when it gets to an INPUT statement, the computer will not accept any keys. When I hit a key, even RETURN, nothing happens. The cursor just stays still and blinks.

R. Kasturi

You are describing the infamous 64 keyboard lockup bug. It occurs when you enter a long line at the bottom of the screen, then back up to edit it. There is no way to recover from this lockup short of shutting your machine off, then on again. If you scroll your line up before you try to DEL any characters, there should be no problem, as this lockup will only occur at the very bottom of the screen.

De Re Atari Error

Attention! Anyone owning *De Re Atari*, I have found an error in it. In the section on Display List

Sports Illustrated Sports Special

microcomputer news

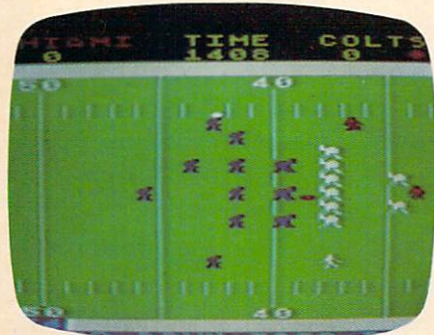
Tuesday, April 1

Four exciting sports games from Avalon Hill

Colts romp over Dolphins, 24-7

Last night's sensational gridiron duel proved there are no underdogs in Avalon Hill's *Computer Football Strategy*.

The Colts ran in the first Miami punt and then capitalized on a Dolphin fumble to jump out to a quick 14-0 lead.



Early in the 1st qtr. with Colts in possession
ATARI SCREEN

Dropped passes, penalties, fumbles... all took their toll in the exciting contest in the home of Ogie Pincikowski, newest armchair quarterback. Says Ogie with some satisfaction, "It's the next best thing to being out on the gridiron itself!"

In Avalon Hill's *Computer Football Strategy* you pit your skills as play caller against the computer or go head-to-head with a live opponent.

Atari® Home Computers 32K Disk (joystick required); Commodore 64® Disk; IBM® PC 64K Disk; TRS-80® 32K Disk and 32K Cassette for Models I/III/IV; Commodore 64® Cassette & Atari® Home Computers Cassette. All Diskettes \$21; Cassettes \$16.

Marciano to spar Ali

Tomorrow night's 15 round *Computer Title Bout* matchup between two of professional boxing's greatest fighters promises to be historic in all senses of the word.

This "Match from the Past", as the bout has been dubbed, is slated to begin at 9pm in the basement of Marvin "Max" Maxwell's house on the outskirts of Baltimore. States Max, "I've always wondered if the incredible boxing skills of Ali could stand up to the sledgehammer fists of the Brockton Blockbuster."

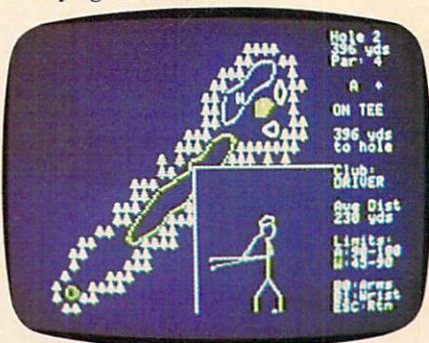
Avalon Hill's *Computer Titlebout* will factor in dozens of variables in deciding the ultimate winner, round by grueling round.

Adds Max, "The game gives you the statistics of hundreds of contenders, and lets you do the pairing up. In fact, you can even create your own fighter. *Computer Title Bout* is a fast-moving game for two players, or solitaire against yourself."

Atari Home Computers 48K Disk for \$30.

Tournament Golf a hole-in-one

"Sixteen feet to the hole and a steep break to the left." Harvey Hornbuster carefully considered his predicament. The entire match had come down to this last putt. Sink it and he's a hero; miss it and he'll be buying the drinks.



Hornbuster teeing off on second hole

Carefully, with a steady hand and just the right twist to the wrists, Harvey took his putt. Looking over his shoulders at the video screen, the other members of his foursome held their breath and stared as the ball steadily approached the hole and then disappeared. A perfect putt!!

Tournament Golf brings you all the tense excitement of a real day out on the links right in your own home. Hooks, slices, muffs, traps, water hazards and rough... it's all there and more, including two challenging 18 hole championship golf courses.

Apple Home computers 48K Disk for \$30. Joystick/Paddles required.

Upstart Cubs Take AH Series in 6

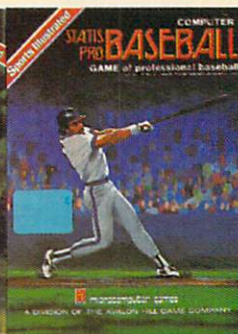
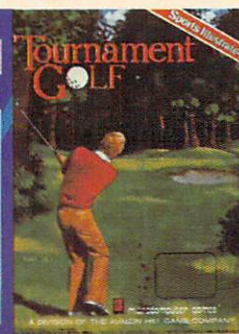
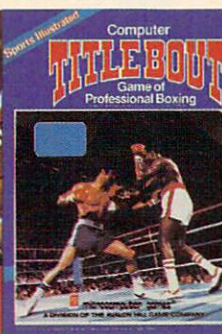
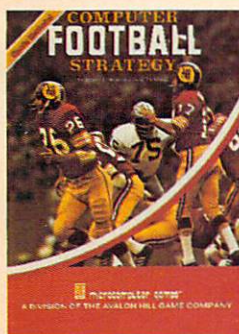
Chicago's stunning victory yesterday in the living room of *Computer Statis Pro Baseball's* AH-League manager Milton Mousehouse didn't surprise the team's owner, Fred Smith. Commented Smith after the victory, "It was just sound management. My lineup selection, pitcher choices and timely substitutions carried me through."

Trailing 4 to 1 going into the ninth inning, the Cubs' bats finally came alive as they pounded in 5 runs to win the game, and the championship, 6 to 4. A good showing for Fred's cubs, especially after dropping the first two games to the defending champions, the Baltimore Orioles.

Added Milton, "Avalon Hill's *Computer Statis Pro Baseball* places you in charge of your favorite ballclub. Your decisions can make an also-ran into a pennant winner. You don't play against the computer. You can, however, play against yourself and have the computer do all the bookkeeping. It will even supply you with a printout of the box-scores after each game, if you have a printer."

Of course, you can also do as Milton and his friends did and organize a league of your own, capping it off with your own championship series. *Computer Statis Pro Baseball* puts you in the dugout, so to speak, especially with Milton's wife Mortina supplying the hot dogs!

Apple Home Computers 48K Disk for \$35; TRS-80 Mods. I/III/IV: 16K Cassette \$25 & 32K Disk \$35.



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Challenge yo

Make beautiful music. Everyone loves music. And anyone who has ever hummed a tune can write one, now. Scarborough has taken the universal language of music and developed a software program that makes it fun and easy to write songs for budding composers of any age.

Even those who don't recognize a single note can be composing songs in 15 minutes. Simulated piano roll graphics and on-screen commands serve as a guide every step of the way — from scales and rhythm to more complex musical forms and theory.

With Songwriter, composing songs is as simple as "do-re-mi." Write a song, change, delete or add a note, change tempo and teach the computer to repeat musical motifs. Even save compositions to play back through the computer or your home stereo. For added fun, there is also a library of 28 popular songs to listen to and experiment with, as well as a series of educational activities for adults and children.

Songwriter is like a word processor for music that will bring the whole family back to the computer, again and again — because Songwriter encourages experimentation and makes the whole process fun. Isn't that why you bought a personal computer in the first place?

Every kid has a song in his heart. (So does the "kid" in every parent!) Help yours express it with Songwriter.

Available for Apple,[®] Atari,[®] Commodore 64[™] and IBM-PC[®] \$39.95



The Scarborough

ur creativity.

Be quick on the draw. PictureWriter is magic! Create any shape or pattern, instantly. Fill areas with glowing colors and even hear pictures set to music.

PictureWriter brings out the artist in anyone. With this program, your child can create his or her own picture gallery and watch the computer redraw the pictures like magic on the screen. PictureWriter also includes a library of masterpieces by other "picture writers" that can be colored, edited and redrawn.

Like all Scarborough programs, PictureWriter encourages experimentation and continually challenges the child to explore new avenues. And all the while, PictureWriter subtly develops the child's familiarity with the fundamentals of step-by-step computer programming.

Getting started is simple. The built-in tutorial zips the artist into the program quickly and keeps him or her creatively occupied for hours.

The possibilities are endless with PictureWriter. In fact, children find it so captivating that parents will probably want to doodle with it, too. And why not?

You can't stay an adult forever.

**Available for Apple® \$39.95
(Soon, Atari®)**



ough System.

You'll grow with us.

Interrupts, page 5-3, there is an example listed in both BASIC and machine language. As it stands, the BASIC program does not work. The problem lies in the data. Simply change the number 141 in line 70 to 142. I arrived at this by hand-assembling and comparing my results with the data. As listed, the STX is STA.

Neil Goldman

Serial Vs. Parallel Printer For The Atari 800

I have an Atari 800 and I am planning to upgrade my system with a disk drive and printer. What is the difference between serial and parallel printer interfaces, and which do I need for the Atari? Is there any advantage, one over the other?

W. E. Westervelt

Serial printers receive information one bit at a time, while parallel printers can receive up to eight bits (one byte) simultaneously, making them faster. Parallel printers are more common, and often easier to interface with a computer. Serial printers require that you set up and specify values such as baud rate, word size, and stop bits, whereas parallel printers all operate according to standardized rules.

Parallel printers are usually cheaper than serial printers; serial is often an option. For your Atari 800, you can use a printer with either the Centronics parallel or RS-232C serial standard, but in either case you need to buy the 850 Interface module, which supplies the necessary conversions for the Atari's nonstandard serial port and the physical connections for the cables. Most software is set up to work with a parallel printer, however, so this may be the best choice. The newest Atari printers attach directly to the nonstandard serial port, eliminating the need for an interface.

Reading Commodore Files With The Kernal

How can I get data off my disk drive via the serial bus? Doing this in BASIC takes too much time. I am aware of the Kernal and its routines ACPTR, TALK, TKSA.

I have tried opening the disk for a read with BASIC, then I SYS to a small machine language program using the above statements. Unfortunately, I only get a string of shifted G's instead of the sequential file I want. I followed the reference manual closely, but still no luck.

Steven A. Bailey

Jim Butterfield replies:

The only Kernal subroutines you need to use for reading from files are:

CHKIN—\$FFC6—connect input;
GETIN—\$FFE4—get a character;

CLRCHN—\$FFCC—clear input to default (keyboard)

Don't forget to read ST (\$96 on PET/CBM, \$90 on VIC/64) to detect end of file. Try the following sample program for reading a file to the screen:

```
100 DATA 162,1,32,198,255
110 DATA 32,228,255,32,210,255,166
120 DATA 144:REM(FOR VIC/64; USE 150 FOR
    {SPACE}PET/CBM)
130 DATA 240,246,32,204,255,96
140 FOR J=828 TO 846
150 READ X:POKE J,X
160 NEXT J
170 INPUT "NAME OF FILE";N$
180 OPEN 1,8,2,N$
190 SYS 828
200 CLOSE 1
```

This is a very simple program, of course, but it will help you see how simple use of the three subroutines can do the job.

Simulating Motion On The Apple

How does the Apple IIe simulate motion without sprites?

Ray Karter

There are a number of ways to simulate motion on the Apple. One way is to repetitively print and erase a character as you move it about the screen. But the smoothest way to simulate motion on the Apple is to use a page-flipping scheme. This is accomplished by alternately switching between two graphics screens upon which two shapes have been drawn. While one screen is being viewed, the shape is redrawn on the second screen in another position. The position chosen depends upon the direction you wish to move the figure. After the second figure has been drawn, you can change certain memory locations (known as switches) to view the second screen. As you might imagine, this technique can also be used for animating figures. For more on this, see Leslie Grimm's "Animating Applesoft Graphics" in COMPUTE!, December 1981.

More On Commodore Double-spaced Listings

Regarding Double-spaced Listings On Commodore Printers ("Readers' Feedback," November 1983), line 15 contains a potential trouble spot. AD is likely to be greater than 32767 in the 64 (unlike PET); hence AD AND 255 may be an illegal quantity. The line should be:

```
15 POKE 55,AD-256*INT(AD/256)
```

There is a simpler way to double-space on Commodore printers—send a line feed:

```
OPEN 131,4:CMD131:LIST:PRINT#131:CLOSE131
[RETURN]
```

A file number in the range 128-255 sends a

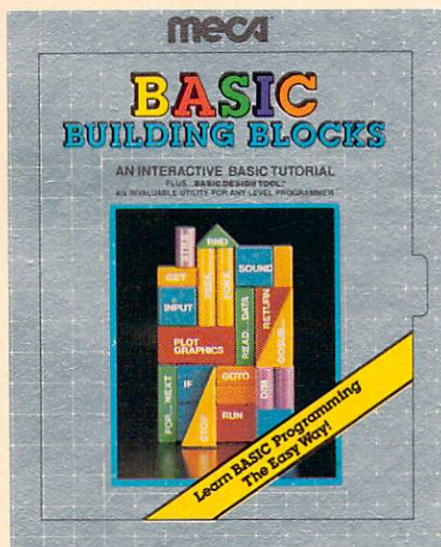
"How MECA experts taught us more Basic in one hour than we learned in 12 hours from a book."

"BASIC BUILDING BLOCKS™ lets us interact with our computer and learn at our own pace. Dad says it's so easy to use, it even eliminates the need for him to read the manual. You should see all the programs Mom has written by herself. I like it because it really gets into the fun of the computer...fast. BASIC BUILDING BLOCKS is like having personal computer experts in our house."

My Dad

My Mom

Me



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- Over 60 sample programs executing so you can see how BASIC commands work, learn program structure and flow of control.
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line feed in addition to a carriage return, which causes double-spacing.

Elizabeth Deal

Another reader, Frederick L. Knapp, writes that the *Commodore 64 Programmer's Reference Guide*, on page 65, advises that "file numbers over 128 were really designed for other uses so it's good practice to use only numbers below 127 for file numbers."

Use of the CMD command is, indeed, a simpler approach to double-spaced listings. (The PRINT# and CLOSE commands are included to tidy things up.) Commodore's cautionary note about the use of file numbers greater than 127 is intended to help you avoid generating an extra line feed, which might cause problems in tape or disk storage and telecommunications applications. Use of the higher file numbers for double-spacing is an exception to this rule.

Several readers have offered improvements to the published programs, and we have incorporated their suggestions into the revised listings below. These short BASIC Loader programs for the VIC and 64 POKE a machine language program into memory. They are wedged into the Kernal, where they check each output character to see if it is a carriage return. If not, the routine is skipped. If a carriage return is encountered, a second carriage return is sent to the output device to provide double-spacing. While the direct approach is simpler, the wedge routine has the advantage of allowing you to choose single- or double-spacing with a SYS statement in your own programs.

VIC Version

```
10 PRINT"{DOWN} TO START: SYS885" :rem 82
20 PRINT"{DOWN} TO STOP, PRESS" :rem 230
30 PRINT" RUN-STOP/RESTORE" :rem 239
50 FORA=885TO908:READB:POKEA,B:NEXT
:rem 220
885 DATA 169,128,141,38,3,169, 3, 141
:rem 203
893 DATA 39,3,96,201, 13, 208, 5, 32
:rem 43
901 DATA 122,242,169,13,76, 122, 242, 0
:rem 227
```

64 Version

```
10 PRINT"{CLR}{DOWN} TO START, SYS679"
:rem 216
```

```
20 PRINT"{DOWN} TO STOP, PRESS RUN-STOP/R
ESTORE" :rem 161
50 FORA=679TO701:READB:POKEA,B:NEXT
:rem 212
679 DATA 169,178,141,38,3,169,2,141,39,3,
96,201,13,208,5,32,202,241,169,13
:rem 72
699 DATA 76,202,241
:rem 178
```

Assemblers For VIC And PET

I own a VIC-20 and have access to a PET. I am working with machine language, and have two questions:

1. I know how to access the PET monitor. Does it have a built-in assembler and disassembler, and if so, how do you use them?
2. I have Tinymon for my VIC-20. Does Tinymon have a built-in assembler and disassembler?

Barry Courtois

Commodore PETs have built-in monitors with six functions: load, save, display registers, display memory, execute program, and exit to BASIC. Jim Butterfield's "Tinymon" program offers those same functions to the VIC since it has no built-in monitor.

To add assembly and disassembly functions, you need one of the monitor extension programs such as Supermon or Micromon. Supermon for PET was published in COMPUTE! in the December 1981 issue; VIC Micromon (November 1982); Supermon 64 (January 1983).

Cassette Music For The 64?

On the Atari, some of the programs can load an introductory program and play music directly from the cassette to the TV. Is there any way that this can be accomplished with the 64?

Tim Coughlin

The Atari cassette system is stereo—it uses one track for data, the other for sound. There is a direct link between the audio track and the television (or other sound output). The 64 uses a different, monaural cassette technique. There is no way to play sound directly through the TV speaker. Theoretically, sound can be digitized from the cassette unit, but the technique uses far too much memory. It is possible to feed in an audio signal (say from an external cassette recorder) into the SID chip, where it could be filtered and mixed with the other voices. There is no way to simulate the Atari method, however.

COMPUTE! welcomes questions, comments, or solutions to issues raised in this column. Write to: Readers' Feedback, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403. COMPUTE! reserves the right to edit or abridge published letters.



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Dear Mickey,

Believe it or not, this letter is being typed by our new daisywheel! I'm thrilled to announce that the quality of its characters has met our highest expectations.

She's now called PowerType, and she's ready and ready to go!

As you certainly know, this has been a pet project of mine and it's so exciting to see the actual finished product live up to my imagination. It sounds corny, but I guess I almost feel like a proud father.

Send regards to Alan and John and tell them to make room on their shelves! We'll be sending PowerType and literature early next week.

And remember, with PowerType, she's not the way it goes. (Sorry, I'd better stick to sleepwalking.)

All my best,



Computers And Society

David D. Thornburg, Associate Editor

Personal Computers And The Arts

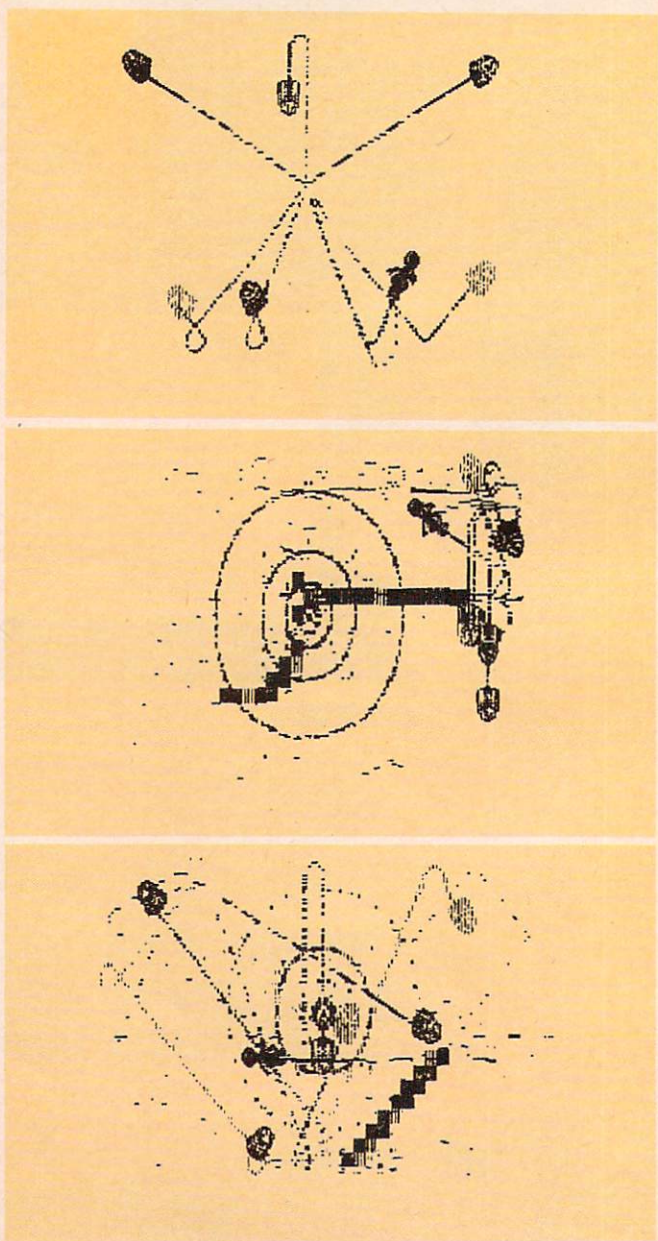
Last month we explored the exciting world of computers in the fine arts that was opened to us by Dale Peterson in his delightful book *Genesis II*. Most of the work described by Dale related to experiments on large computer systems. But, just as the pioneers may have developed interesting tools for the exploration of creative ideas on large computers, today's practitioners are bringing these same tools to personal computers.

Let's look at three products this month. Each can be viewed on several levels. There is an obvious (and marketable) level, and there are other levels, much more subtle and yet more powerful, that can only be seen when the product comes home and is used for a while.

Moondust

I don't know Jaron Lanier's background, but he is a game designer who is also a fine computer artist. He created an "action game" called *Moondust* (published by Creative Software) that is, in reality, a synthesized artistic experience involving diaphanous colors and mellifluous sounds. The *game* aspect of *Moondust* involves planting on the screen a seed that you must drag your players over. As your players cross the seed, colors are spread out on the screen. If you can drag colors to the center of the screen, you get many points for your effort. Because the images are moving all the time anyway, it takes awhile to discover just how your joystick controls the player's motion.

During play, the screen is filled with abstract color patterns that gradually dissolve and merge in many delightful and unpredictable ways. The accompanying music appears somewhat random, but is always melodic—never harsh. The nature of the music changes as you move the joystick, so both sound and graphics are responsive to, but not totally controlled by, the user's actions."





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What the fuss is all about.

Why you're involved.

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real music for your Atari.*



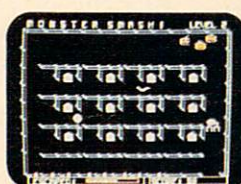
Our star. Our Numero Uno. The Tail of Beta Lyrae.™ Changes as you play. Will drive you out of your mind with unexpected switcheroonies. No one's ever mastered it. But you sure can try...



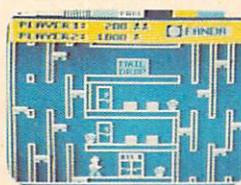
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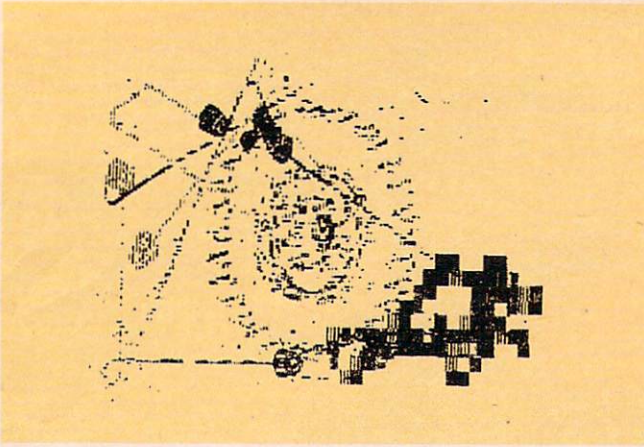
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Because of the "art" nature of this game, there is even a playing mode in which there is no scoring—you play the game purely for the aesthetic experience.

In an era that gives us games for such "pleasant" topics as nuclear war (for example, *Missile Command*), it is refreshing to see a game that appeals purely to our deep human sensitivity to artistic expression.

There is a problem with products of this sort, however. Games like *Moondust* don't have the instantaneous brand-name appeal of the commercially hyped products. As a result, innovative products tend to be seen only by people with a bent for exploring the unknown. *Moondust* deserves a wider audience than that because it is an experience that everyone can enjoy on several levels.

An Adventurous Word Processor

Anyone who has walked past the children's section of a bookstore lately has probably noticed the great popularity of a literary form called interactive fiction. In these books, the reader takes the role of a main character. As the book proceeds, the character has to make several decisions. Based on each decision, the reader is directed to turn to a page where the story continues on a new path dictated by this choice. These books can be read over again, with the reader making different choices along the way.

While not pretending to be great literature, these books capture the hearts and minds of the young, and probably are beneficial in improving comprehension skills (you can't make an intelligent choice if you don't understand what you just read).

Since the idea of "branching" is common to computer systems, it was only mildly surprising (but no less delightful) to see that the "make your own adventure" idiom had been translated to the computer by Scholastic in their disk-based *Microzine*. The Scholastic stories are called "Twist-A-Plot" adventures, and they provide all the flex-

ibility and excitement of their printed counterparts.

And yet, as nice as *Twist-A-Plot* is, I wanted to see a "make your own adventure adventure"—a word processor that lets you create your own adventure stories from scratch.

Fortunately, I wasn't alone.

George Brackett and Scholastic have now developed a product called *Story Tree* that lets anyone write their own adventures with branches at all the right places:

"Just as you start to open the door, you hear a muffled scream ...

The choices are:

- Turn around and run.
- Open the door and walk inside."

Story Tree is not only a fine word processor, but it also encourages children's creativity by allowing them to develop a story in several directions at once.

Rather than stumble over the direction a story should take, *Story Tree* users can follow several branches to their hearts' content. Finished stories can be printed out (complete with page numbers and instructions for all the branches). But even more exciting than this is that *Story Tree* allows the user to write stories in which various branches can be chosen by chance. The weighting among various branches (for example, 20 percent for branch A and 80 percent for branch B) is set by the user and, when the story is later read, the computer will make choices automatically based on the likelihood for each branch. If a story using chance is printed out, the user is told to roll a die to determine which page should be read next.

Aside from the obvious and intended application of *Story Tree*, this program offers a wealth of other applications, many of which are yet to be discovered.

I have created a random limerick generator using *Story Tree*, and it can be easily used by teachers to create CAI materials. For example, a question can be asked. Depending on the choice made for the answer, the user will be automatically directed to review material or to the next phase of the program.

So, in creating a tool whose roots lie in a popular literary form for youngsters, George Brackett and Scholastic have given us a word processor that is also an authoring language whose uses probably transcend the dreams of its designer.

PILOT As A Discovery Tool

The book *Genesis II* explored the computer as a tool for creation in the visual, auditory, literary, and recreational arts. Of all the computer languages that encourage experimentation in each of these areas, few exceed the capabilities of Atari PILOT. But, as we all know, a language can be

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Boy, have you taken a wrong turn. One moment you're gathering treasure and the next you're being eyed like a side of beef.

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The Apshai series is the standard by which all other adventure games are judged. And novices will not survive.

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One player; Temple of Apshai, disk/cassette; Gateway to Apshai, cartridge, joystick control.



STRATEGY GAMES FOR THE ACTION-GAME PLAYER.



greatly enhanced by a book that gives examples of activities that act as springboards for our own discoveries. *ATARI PILOT Activities and Games* by Herb Kohl, Ted Kahn, and Dale Disharoon (Reston Publishing Co.) is one such book. The authors have created a balanced book that explores all facets of Atari PILOT, not just to teach it, but to use it to explore other topics. In discussing creation in the written word, for example, they provide a PILOT-based version of Eliza, a programmed "Psychiatrist" first written by Joe Weizenbaum at MIT many years ago. This program is an example of an empty interaction. The computer asks questions and seems to be responding in a personal way to the user's problems when, in fact, it is responding mechanically, unthinkingly. In other activities, the authors explore the creation of stunning visual patterns, the creation of musical scores, and the creation of games.

This book is far more than a source of programs, however, as it opens the door to a free-form discovery-mode exploration on the part of the user. The reader is constantly being encouraged to think about what is going on. I was flattered to find that some of my favorites, such as "Twenty Questions" (see this column, September 1981) were included.

But my favorite PILOT program in this book

is an activity called "Metagame." The function of this program is to help the reader define a game of his or her invention. While it does not write the game for the user, the program does help clarify some of the issues confronting a game designer.

I have always liked PILOT as a language, and the facility with which Kohl, Kahn, and Disharoon were able to incorporate PILOT activities in such a wide range of applications merely strengthens my regard for it. ©

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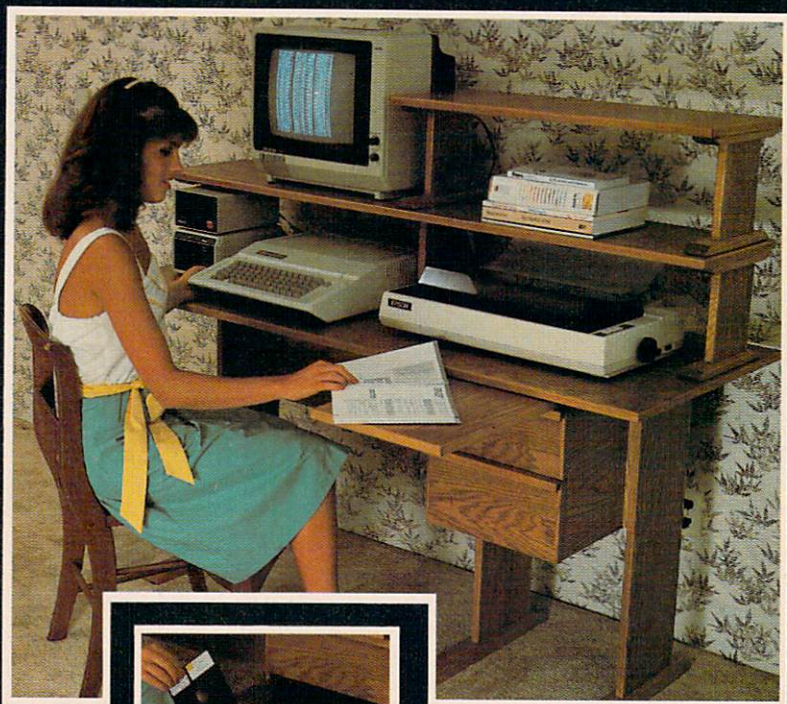
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How COMPUTE! Readers Use Their Computers

Bernie Ghiselin

"What can you do with a home computer?" In December 1982, COMPUTE! published its first reader survey on the many uses computer owners were discovering for this new creative tool. Now, over a year later, we learn that COMPUTE! subscribers are extending their computing skills to even more diverse applications, from Sunday School classes to robotics.

Sid Roberts has become a prisoner of the silicon society and has no idea how it happened. Or even why.

"I'm afraid the proper term is *hooked*," he says, sounding like someone admitting to an addiction.

One day in early December 1982, Roberts was somewhere above the clouds, on board a plane headed from Youngstown, Ohio, to Florida. To pass the time, he opened an in-flight magazine to an article about the Apple computer. "It sounded like something I ought to know more about."

That led to more articles. Then whole books. Not simply about this computer or that, but about the whole digital, binary, algorithmic way of knowing and creating. "I am a constantly curious individual," he says.

Sid Roberts did not understand all he read. But never mind.

In late January 1983 he bought a Commodore 64—and a disk drive, a printer, and a modem. "Two weeks after I bought it, the dealer went out of business." But that made no difference either.

Here He Is, Beguiled

More articles. More books. He spends countless hours at the terminal. Trying this program. Trying that. Experimenting. Fiddling around. "If two days go by and I haven't touched the keyboard, I begin to get withdrawal symptoms."

Now, Sid Roberts is no pinball wizard clutching a handful of quarters, his nose pressed against the damp windows waiting for the game room to open on Saturday morning.

He is a professor of American history at Youngstown State University. He has published on the political uses of power and the role of businessmen as reformers in politics. He is active in civic projects. His wife, Patricia, is a lawyer.

Yet here he is, beguiled by nearly \$1,000 in microcomputer gadgetry that so far hasn't made one practical contribution to his life.

For example, Roberts is an avid gardener. But the computer hasn't made him a better gardener. Nor does he use word processing for academic papers. Since he has access to the university's mainframe computer, he has explored using the computer as a teaching tool. But the university said no; the computer science students need the mainframe. So Roberts went back home. He is working on a program for grading his classes. Does he need the program? Not really.

"I'm not doing anything any quicker than I could with paper and pencil."

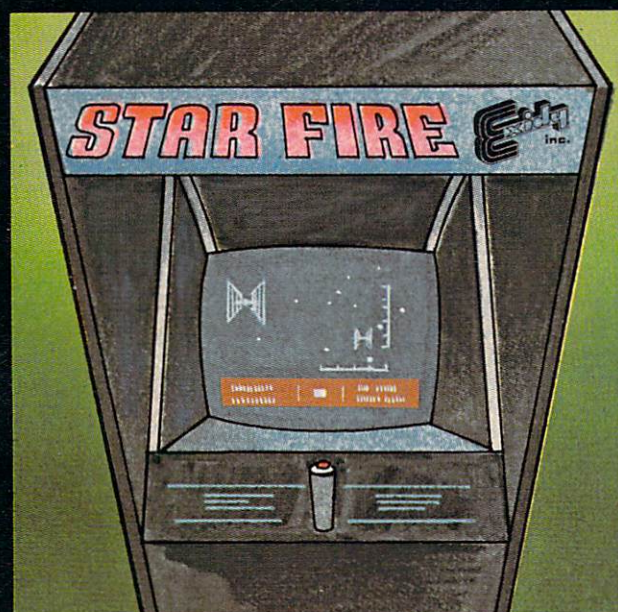
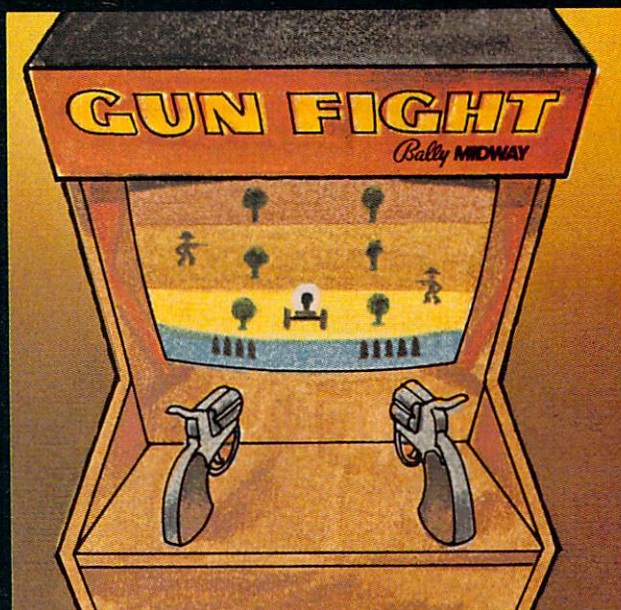
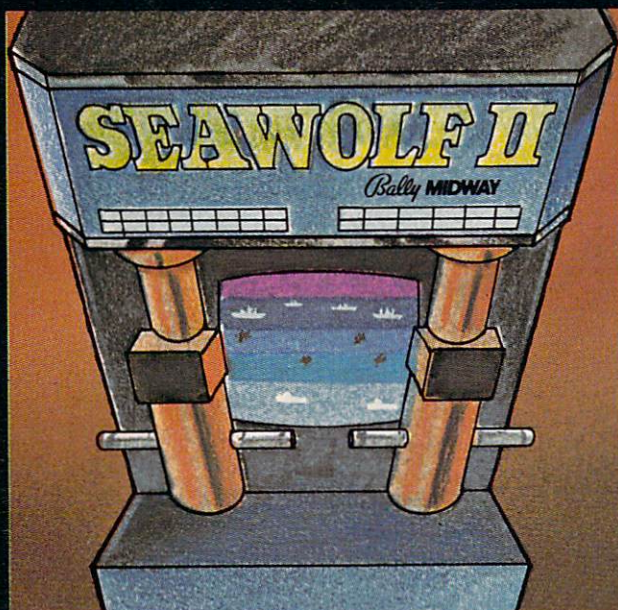
Yet he continues to fiddle about, experiment, and read. He not only joined, but even helped to form, a Commodore 64 users group which at first met in his home. "It's kind of like open heart surgery. You want to tell others it's not as bad as they imagine."

Despite his frustrations, Roberts has no intention of chucking the whole thing. "I am absolutely fascinated by the concept of computing, the mental process. It turns me on."

A Major Phenomenon

"I am not thinking in terms of the utilitarian. I am still interested in the process," he said one evening in early October. "I am like many, many people driven by a sense of curiosity. It's difficult to ex-

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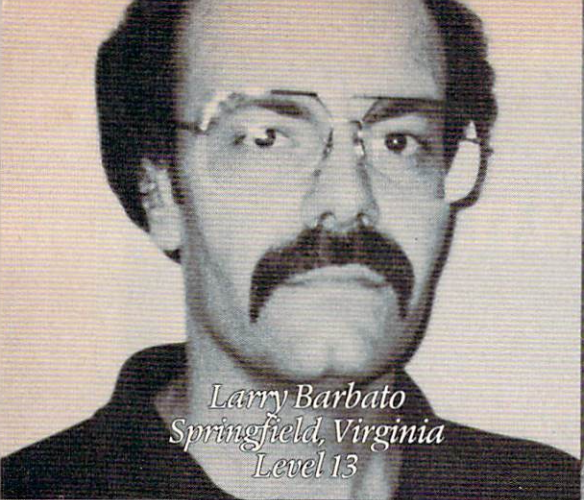
One or two players; joystick controlled; arcade style graphics and sound.



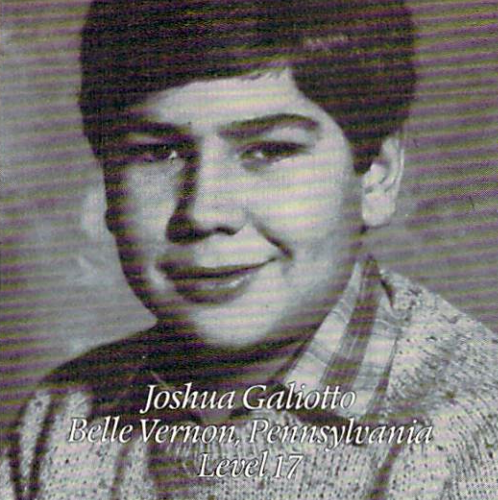
EPYX
COMPUTER SOFTWARE

Strategy Games for the Action-Game Player

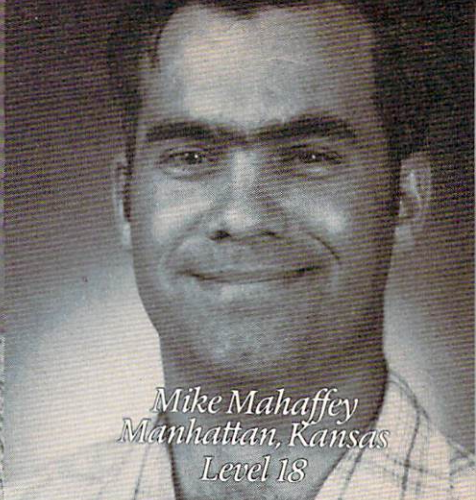




Larry Barbato
Springfield, Virginia
Level 13



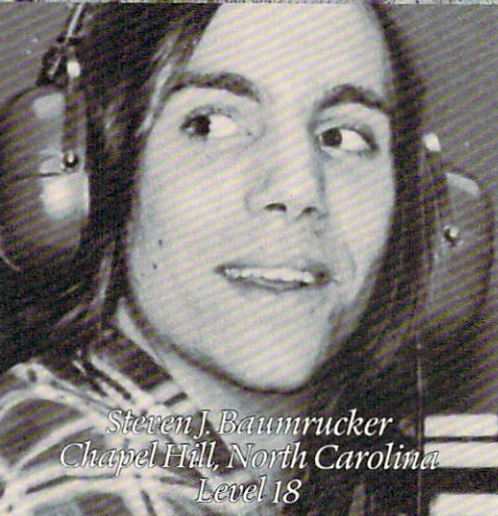
Joshua Galiotto
Belle Vernon, Pennsylvania
Level 17



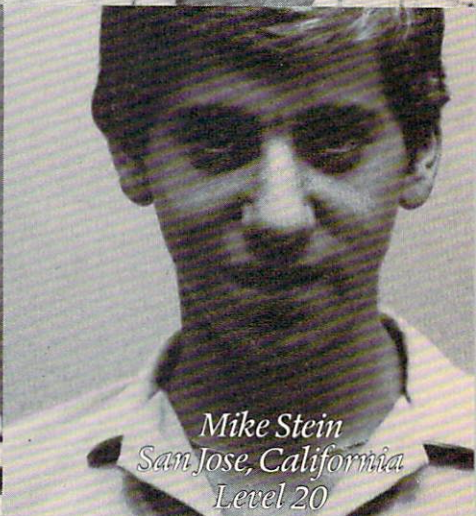
Mike Mahaffey
Manhattan, Kansas
Level 18



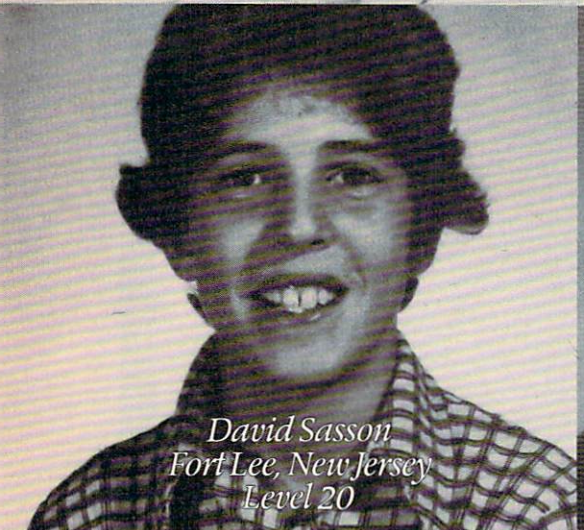
Mark E. Renne
Bozeman, Montana
Level 15



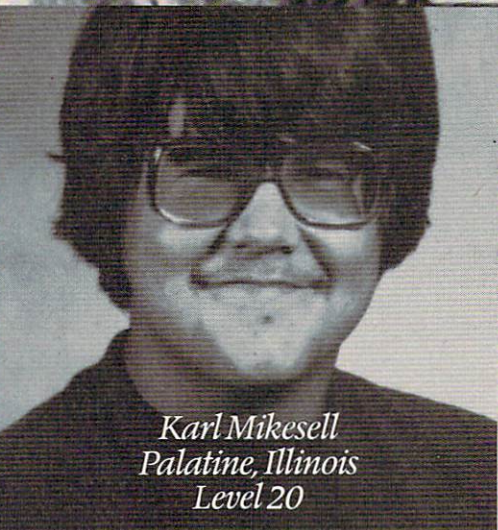
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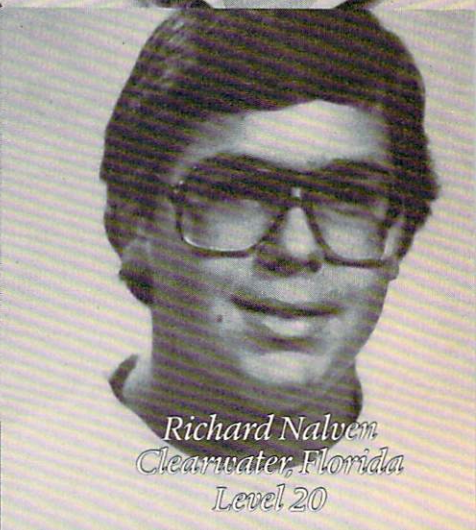
Mike Stein
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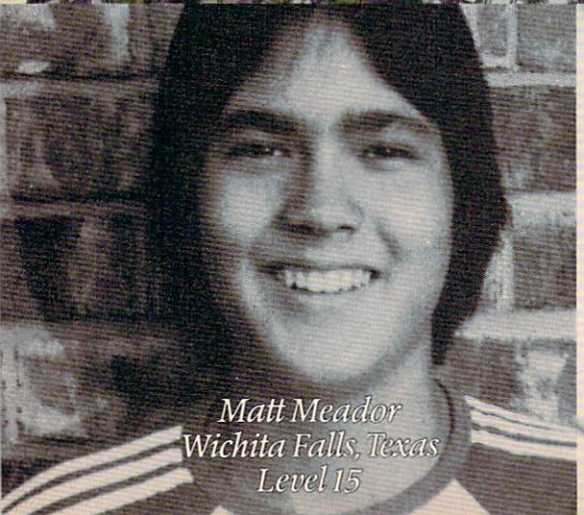
David Sasson
Fort Lee, New Jersey
Level 20



Karl Mikesell
Palatine, Illinois
Level 20



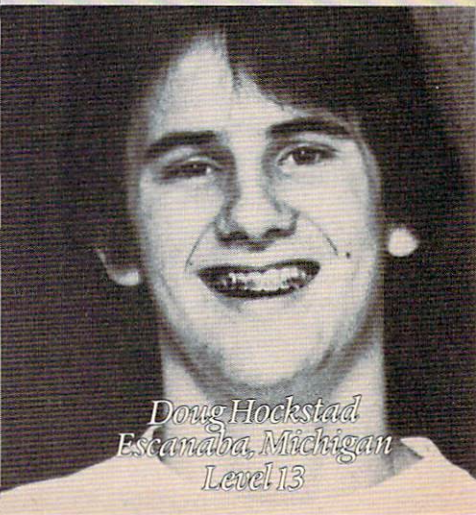
Richard Nalven
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"I have not bought programs because I'm not interested in using the computer to achieve a specific goal. I am interested in using the computer to learn about computers. It's impossible to be a professor in an American university and be oblivious to a major phenomenon."

Roberts shares a certain passion for exploration with many COMPUTE! subscribers.

Throughout October, more than 80 subscribers in 35 states were contacted by phone and asked, mainly, "Why did you buy a computer for your home? What do you do with it?"

In response to this rather presumptuous inquiry, many subscribers laughed and said, "That's a good question," implying they weren't at all sure. ("I know what you're asking and I don't know," said Glenn Haycraft of Omaha.) And then, following this awkward opening, they would list almost as many uses for a computer as there are people to ask.

Chris Hales of Orem, Utah, a masonry contractor, has developed an inventory spreadsheet. Ruth Fritz of Trumbull, Connecticut, a realtor, uses a computer for property management, keeping track of rents, taxes, and such. Robert Sperling of Woodmere, New York, uses a computer for his hobby, buying and selling antique cameras that can sometimes fetch \$8,000 apiece. Like many others, Mike Komar of Wantagh, New York, uses a computer for weight watching. And he's doing pretty well—he's lost 20 pounds.

Like many ham operators, Don Etters of Chester, South Carolina, plans to build an interface between his radio and his computer to translate Morse code into readable English. And Joseph Lepore of West Palm Beach, Florida, a construction salesman, is working on a program to match any dwelling against the state energy code. His program shows a builder the maximum heat load in a house built any of eight ways. "They get a worst case condition," said Lepore.

The list goes on. Subscribers are using microcomputers to handicap the horses, predict the World Series, and plot ballistics, pigeon races, and chess moves. There are countless college students accessing university mainframes and law students using word processing for their course outlines.

Two Main Groups

In general, COMPUTE! subscribers fall into two groups: those who know programming, know what they want and can put their computers right to work. And those like Sid Roberts who feel "this is something I ought to know more about." So they charge off to the local community college to take a course in BASIC and even start into machine language.

Not To Probe The Mysteries Of Refrigeration

In one way or another, Sid Roberts' experiences seem to be shared by many subscribers. They want something more than an ordinary appliance. They don't buy a refrigerator to probe the mysteries of refrigeration. Nor when they buy a TV do they care how J.R. Ewing gets from Dallas into their living room. But when they buy a microcomputer, something happens. They are not content to be passive consumers. They want to be the creators, the programmers. They want to see the genie behind the cursor.

Take Harvey Peters, 28, an auto mechanic in Havelock, Washington, who had no immediate need for a computer nor any knowledge of programming. He bought a VIC-20, took a class, and began teaching himself to program. For the last six months he has been working on an algorithm for character recognition. He wants to teach his computer how to read from an optical camera that uses RAM memory. "I've gotten a fabulous education for what I've put out," he said. "It's gotta be good for something."

Over and over, with only minor variations, COMPUTE! subscribers repeated the same reason for buying. "Why? That's a good question," said David Ficklen of Fort Worth, a machinist. "Because of the challenge. Just to learn about it." Neil Godfrey of Mesa, Arizona, a systems analyst, could chime right in: "Just the curiosity aspect of it," he said. "Just to get into the computer world," said Joel Johnson of Memphis, a psychologist. "So I can be as smart as my 8-year-old paperboy," said Mark Nowlin of Ponca City, Oklahoma.

There is, of course, something other than normal curiosity.

If COMPUTE! subscribers are characteristic, people buy home computers because they see the stagecoach of technology pulling out. They don't want their children abandoned in some educational or professional ghost town. This motive to buy runs through the list, regardless of age, education, or profession. "They need the exposure," said M. J. Plavetsky of Laurel, Maryland. "I feel wherever they go there'll be computers clicking away in the background."

You Won't Be Able To Dig A Ditch

James Marinelli of Norfolk, Arkansas, says he's so busy running a tavern he hasn't had time to learn. But that doesn't matter. The main reason he bought a computer was "so my daughter won't be lost in the world." His daughter, Cindy Mae, is 1.

Brian McGrath of Greenfield, Massachusetts, is somewhat in the same boat. He can't use his Atari 800 in his work. But his children, Tara, 9, Sean, 8, and Brendan, 6, sure can, for writing and



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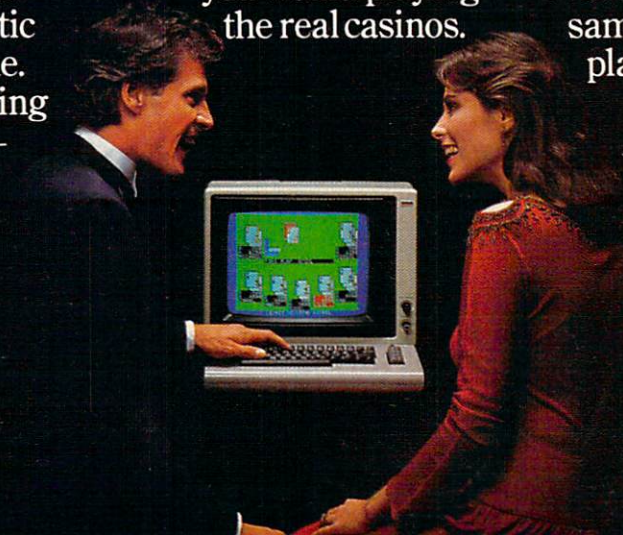
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spelling. His wife, Ann, does the programming. "I don't think you'll be able to dig a ditch in 20 years without a computer," said McGrath.

Ken Blohowiak of Green Bay, Wisconsin, has owned a computer for a year "for my son, first, he's eight, second his mother and third, me," he said. As things turned out, his son, Sean, is the big user. "He does mostly math with it, now has a spelling program. We only have two games. It's not really a game toy for us."

Games were never given as a main reason for buying a home computer. Except for Paul Gallaher, 30, of Chandler, Arizona, who majored in computer science and took masters level work in simulation and visual displays. "I must admit," he said, "my largest motivation is the games. I've always been involved with graphics and computers."

Gallaher's skill with graphics led to teaching his daughter, Dawn, now 3, how to recognize musical notes. He uses color graphics on his VIC-20 and toy xylophone. Dawn has not only learned to associate notes with particular colors; she has also begun learning numbers, pushing the key she needs to get the color she likes. "She only spends ten minutes at a time," Gallaher said, "but she's getting a lot out of the time. I've had her ask for advanced games."

And Gallaher has found other uses. Through a program designed to calculate the true interest on loans and mortgages, Gallaher realized an automobile dealer was less than straightforward on terms for a new car. Gallaher went to another dealer.

Wait. An infant girl asking for advanced computer games? What's going on? Apparently the Sid Roberts syndrome isn't reserved for adults.

Indeed, the kids are gobbling up all the software that parents will buy. For three things: games, programming, and the three R's.

Crystals In A Cave

"I got down on my knees" and begged for a computer, said Toby Applegate, 13, of Ridgeway, Virginia. "I am definitely hooked on the computer." He spends about ten hours a week at the keyboard, either programming his own games or checking his math and algebra homework. "It's made understanding variables a lot easier," he said. "I hope it brings up my grade." His ambition? To write a program good enough to sell.

Mark Unger, 15, of Massapequa Park, New York, is one step ahead of Applegate. He's written a game called "Diver." The object is to swim into a cave, dive down, and retrieve a whole bunch of rare crystals scattered here and there. To do all this, of course, without drowning. "It's basically a maze game," said Mark, "but I thought of it myself." Time needed to write the program? Two weeks.

Mrs. Debbie Olson of Omaha said that when the computer arrived last Christmas, "it was strictly entertainment." Her younger children wanted videogames. But then her son, Robert, 14, rather took over. Not only is he teaching the other kids how to use a computer, he's trying to convert Commodore 64 language for use in a TI-99. "We had to limit him for a while," said Mrs. Olson. "He was spending that much time. He wasn't going outside or anything. Wasn't playing with his friends."

Last Christmas Paul Eitel, 14, of Circleville, Ohio, received a TI-99. He wanted a computer to make his own games. But it was also for school work. And what happened? "I've learned to spell a lot better," he says. Spelling was always a problem; out of 100 students in a spelling bee, Eitel would be the 13th eliminated. After a little help from the computer, he says, "I'm getting 100's on the weekly spelling test."

Royce Osborne of Cedar Rapids, Iowa, said microcomputers, first at school and then at home, made all the difference to his son, Jim, 14. "Before, you used to have to beat him over the head to go to school. Now, he doesn't want to come home."

If the students are doing well, so are the teachers.

Paul Fitzgerald works with emotionally disturbed children at a residential treatment center in West Haven, Connecticut. He has been teaching basic computer literacy and has found that whatever their handicaps, these youngsters have no fear of computers.

"A few can write fairly simple programs," said Fitzgerald. "Nothing real complicated yet, but they keep coming back for more. It thrills me to write a program and get it to do what they want. For some, it's just another arcade game. But it turned out they're all plenty bright."

With his TI-99, Michael Slane of Toledo has found a better way to teach his eighth graders about the Civil War. He's set up the lessons in the form of a football game and divides the class into teams. "As long as you keep answering correctly, you keep the ball," he said. If students talk during the game, their team loses yardage. "That's the only way you can play or you lose control," he said. "There's no doubt they've learned something from it."

That great numbers of young people, from toddlers to teenagers, should develop the Sid Roberts syndrome is no mystery to Bruce Keith of Union Lake, Michigan. "They can approach these things with a totally open mind," said Keith. "It's not overwhelming. They get far more out of it than I ever will."

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sells home interiors and uses their Atari for book-keeping and managing files. It has not only helped their son, Jerry, 10, with his spelling, but "it has improved my chess game," Keith says. "It really is a creative experience. It's like having your garden in your back yard turn out good."

But for squeezing the last byte from a home computer, perhaps few families top James and Deedee Hatch of Belleville, Illinois. Not only is their computer used practically every night, but they even take it to church on Sunday mornings. "It's drastically changed our life," he said.

Hatch is a meteorologist with the Air Force and bought a Commodore en masse with everyone else at his shop, for the group discount. Hatch wanted to crunch some numbers at home. Big numbers. In fact, for eight months Hatch has been trying to develop a new technique for meteorological analysis using Bezier equations. The object is "to find a better way of meteorological analysis by use of the small computer."

The Bezier process is explicit and describes an overall area by temperatures at selected points, whether at the surface or at pressure level. Then the analyst lays a grid over this surface to make a forecast. "An implicit operation has to be done a number of times," said Hatch. "With Bezier, given a scattered field of observations, one overall reading can be made."

At the moment, Hatch is bogged down. "My maximum effort is in the three-dimensional graphics package. And so far as I know, nobody makes a three-dimensional graphics package for the Commodore."

While Hatch waits for the software, his daughters, Susan, 8, and Stephanie, 10, are using the computer for games or to practice long division. Both have taken a summer course offered by the city of Belleville at \$50 each. They learned about the structure of arrays using Apple plotting commands.

In addition, the Commodore has practically become an employee of the First Baptist Church of Belleville, where Hatch is a deacon. It prints labels for the church newsletter and stewardship campaign, writes the deacon notes, and organizes the church budget. On Sundays the computer can be found at Sunday School teaching the Bible. The object is to win "jewels" by answering questions. "The first guy to get 15 jewels, an angel appears," says Hatch. "Its wings are flapping. It talks like a cartoon character. It's used for all ages." Finally, whenever honor is to be given, the dot matrix printer will make a certificate with hearts around the borders.

Not Much TV Anymore

"What's really changed," said Hatch, "is the time we used to watch TV we now spend the time out

here" where the computer has been set up, in a laundry area off the kitchen. "My wife works on arts and crafts and I work on my computer."

Has Hatch extracted the last possible bit from his Commodore? Not at all. "We haven't begun to scratch the surface on the capability of the machine," he said.

Of course, Hatch is atypical. He has 17 years of programming experience and does not have to hunt and peck. But a similar pattern is found generally: Once the computer gets in the door, things change. It begins to kick out the TV and take over.

Why does Sharon McWilliams of Riva, Maryland, have two computers at home? "I have three sons. It saves trouble," she said. While her sons take one Atari for a program predicting the World Series, Ms. McWilliams uses another Atari for her job as a lab technician. "It started out as fun and sort of incorporated into our lives."

At the home of Jonathan Bruns in Broken Arrow, Oklahoma, the computer is so popular that "we kind of have arguments over who uses the machine first," he says. It's time for a second computer, perhaps an Atari. "If we have games, I never have time for my software," which includes figuring his taxes.

The compulsion to compute apparently resides not only in Youngstown, Ohio, but everywhere. Actually, it isn't necessary to look any further than Don Goldsmith of Hale, Michigan, whose appetite for the arcane seems limitless.

The Atari Super Thermostat

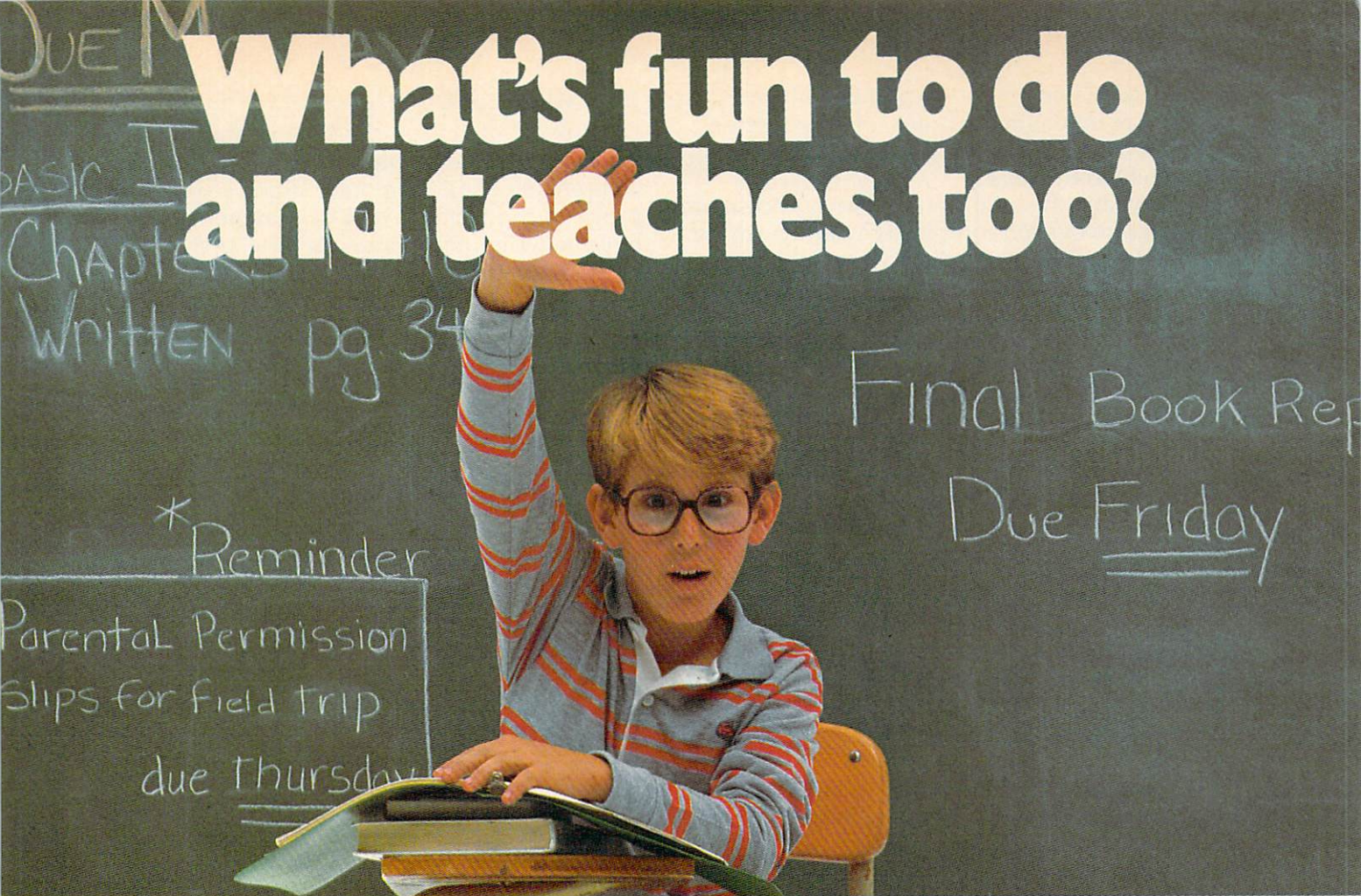
For several months Goldsmith, a customer engineer with Perkin-Elmer Company, has been blocking out a program that would turn his Atari 800 into a complex thermostat. He plans to use the joystick ports which sense switch closure. Each port has four digital inputs, two triggers, and two analogue devices. "In one port you've got a whole lot of potential for doing things," said Goldsmith. His scheme is to install a device at each port, perhaps a varistor or photo transistor, that reads heat resistance levels.

"You can plug in direct or put a chip in between," he added. "You then write a program that interprets this calibration. Depending on how big your system is, you can put the devices at each joystick port. You can have it so it can sense the variation from one end of the screen to the other, the resistance movement.

"You can monitor the efficiency of your house. If you find it's pumping the same amount of heat, but not holding it, then you can look for the leak.

"If it sees the temperature shooting way up in a solar panel, and the temperature coming down, it would conclude there is a blockage some

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place," said Goldsmith. "It might print a message on the screen, or start a motor, or maybe close shutters when it senses the sun is going down in order to hold the heat."

Now, anyone might think that a process control program of such complexity would be quite enough for one computer buff. But Goldsmith, 38, who's been dabbling in electronics since the sixth grade ("I started out being able to do nothing but play *Star Raiders*") has found something else for his computer—robots.

Radio Shack has introduced a robot arm that can be run by a home computer. Goldsmith is fascinated. "I just want to do some robotics work. I don't think it's an impossible job at all.

"It sits on a base with two joystick controls, a bending elbow, a wrist, a squeeze device. You've got to put some sensors on the arms to sense the movements."

Once he got it working, he concedes, the robot arm might be no more practical than a demonstration device or a game. "If nothing else, I can get some PR points with my boss," Goldsmith added. "It looks like it's going to be a real fun project."

Almost all COMPUTE! subscribers believe the home computer movement will grow. The direction is unanimously toward more learning, more involvement, more uses.

The Silicon Society

"I think it depends on the documentation they get together," said Hatch. "There has to be development of a noncomputer jargon so people can program comfortably. The documentation is relatively hard to understand." At his church, he says, he is sometimes approached by members who ask: "We want a computer. Can you tell us why?"

Goldsmith is inclined to agree. "I think it has a potential for being a labor-saving device. It depends on how the technology progresses. Not everybody in the world wants to learn how to program. We're going to have to get to more turnkey systems—be more user-friendly."

Others are downright bullish.

"The coming age is computers," said Sharon McWilliams. "The money and jobs are in computers. That's the way I see things."

And Thomas Townsend, a systems coordinator for a large insurance company in Omaha, said we haven't seen anything yet. "By 1990, close to 80 or 90 percent of all homes will have some computer," he said. "Close to 35 percent will be tied in to some network. To buy groceries, go to the store. All ready for you. Pay bills. Find check balances. They talk about the cashless, checkless society. I think it's gonna be the silicon society."

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The printer sits behind a fold down door that provides a work surface for papers or books while using the keyboard. The lift up top allows easy access to the top and rear of the printer.

A slot in the printer shelf allows for center as well as rear feed printers.

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HYTEC
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What Makes A Good Game?

Charles Brannon, Program Editor
Kathy Yakal, Editorial Assistant

You know what games you like. You may not always know why you like them, but that why is just one of the many things software designers have to consider when they're creating a game.

Remember the television show *American Bandstand*? After a new song was played, Dick Clark asked someone from the audience to rate it. If the song had a good beat and was easy to dance to, it usually got high scores.

The popularity of videogames, like songs, often depends on the quality of several elements. A song may have a good beat and be easy to dance to, but its lyrics may be poorly written. Or maybe there's a beautiful instrumental solo at the end that would have sounded much better at the beginning.

Selling Power

Lists of best-selling software can indicate what videogames have widespread appeal. But a game doesn't have to be on a best-seller list to be considered good. Some very good games may never be seen by more than a handful of people, and some games that really don't have much quality can sell thousands of copies.

When the arcade game *Dragon's Lair* was introduced in the fall of 1983, people lined up to play it, perhaps due to its cartoon-type laser disk graphics. "I don't think it depends on technology, though," says Alex Leavens, of Dynamic Software Designs. "I think it has more to do with the color of socks that people are wearing this year. It's a random kind of thing."

Style Is Essential

Randomness aside, Leavens emphasizes that the programmer's individual technique affects a game's success. "You don't necessarily have to have the most original game idea in the world. There are only so many original ideas," he says.

"You do have to execute it with style.

"There's nothing wrong with working a certain genre. I don't even mind a good clone. But with any game you do, you should put effort and creativity in your genre. You need to take more time thinking about what you can do with the game play idea."

Leavens, who has written several games for home videogame systems, recently cowrote *Boing* with Shirley Russell, published by first Star Software. Though it's a *Q-Bert* look-alike, Leavens emphasizes that the playfield is quite different. "Using imagination and creativity, you can take a game that's already been done and give it a new look and feel."

Telling Tales

Every game has a story line, and you're involved in it, competing with either the computer or another player. Whether you're playing checkers or saving Earth, it's a game. You're trying to win, or at least to avoid destruction.

A justifiable story line is important too, according to Leavens. "You're trying to create a small universe within the game itself," he says. "People want to get involved with the story."

John Garcia, programmer of the Apple version of *Zaxxon*, agrees. "You have to have a good concept, and good concepts are difficult to come by," he says. "Playing a videogame can be like watching a movie, if you've got interesting characters and a good story."

That's not always simple. "What's easy to do on a computer is not subtle," says Garcia. "Blowing up things is easy. But adding the human element to a story line enhances the game."

Looking For More Depth

A few years back, arcade games had timers on them. No matter how well you did, you had to stop when your time ran out. That upset the best players because they could have beaten the machine if they hadn't been stopped.

Arcade games don't have timers anymore. You may have to spend a lot of time to do it, but

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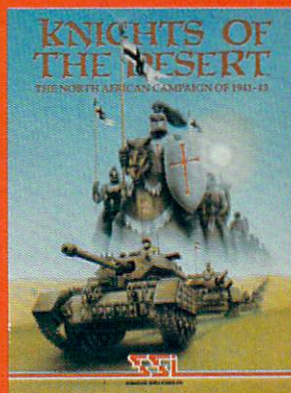
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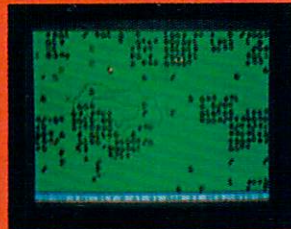
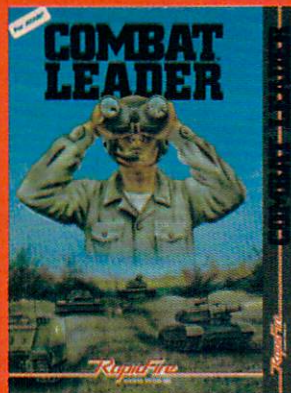


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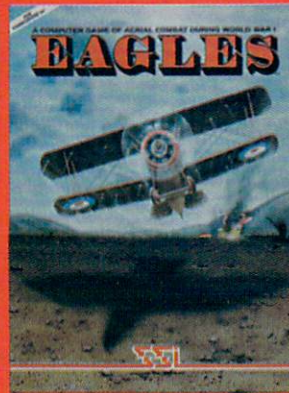
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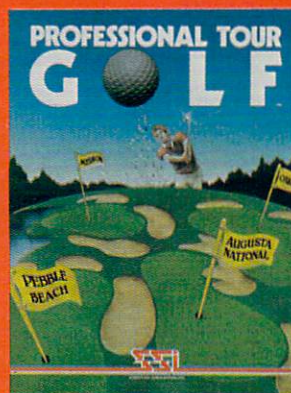
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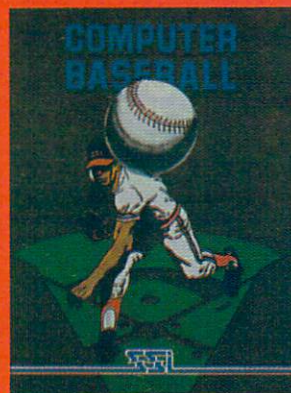
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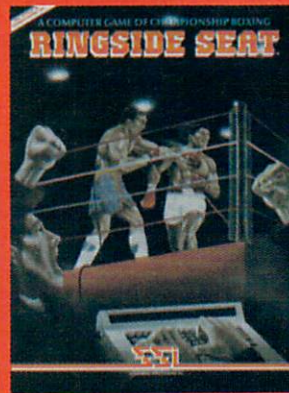
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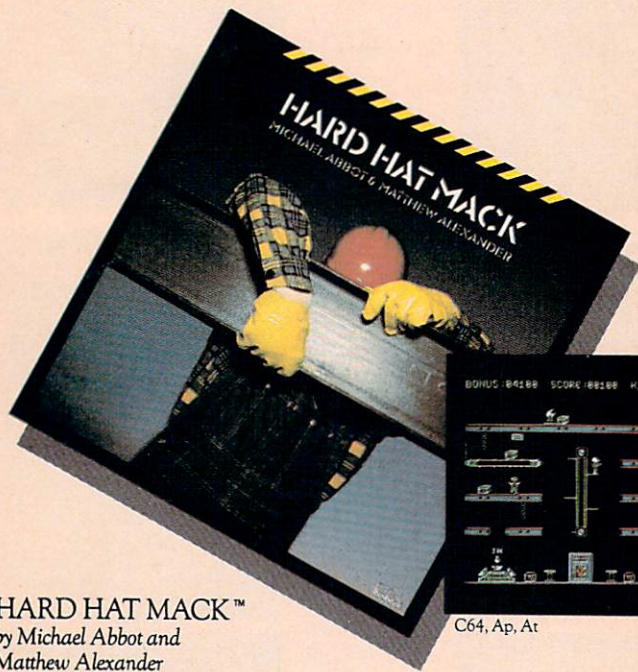
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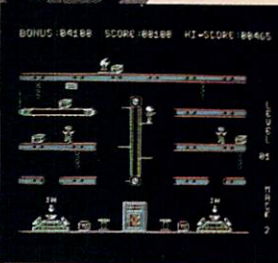
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C64, Ap, At



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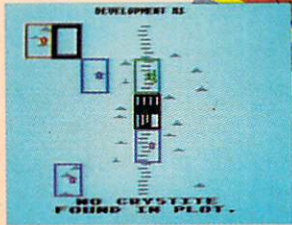


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"May well become the Monopoly of computer games."
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Home Software for the Commodore 64

now you can at least try to beat the machine. We tend to classify good players as the ones who can play the longest. If you're good enough, you can play forever.

But a good game should try to get at what people do well, not turn people into robots. Some people are looking for a richer experience. They want games that make use of the computer's power, not just take away quarters. Games like *Zork*, by Infocom's Marc Blank. Text adventures are a kind of gaming that you won't find in arcades.

Using Capabilities

"Adventure games appeal to the more sophisticated buyers that this industry is seeing these days," says Bob Safir, a product evaluator for software distributor Softsel. "A game that understands and lets you use compound sentences is exciting.

"Games have to go beyond the expected, to challenge more than a player's hand-eye coordination. Computers can do that. Business software takes advantage of the computer's power. You have integrated packages for business that perform several functions. Why not games that do the same thing?"

"One of the things that computers do well is make millions of calculations," says Alex Leavens. "A good programmer should take advantage of that."

Finding A Center

Graphics illustrate a game's story line. From the rather crude visual display of Atari's venerable *Pong*, all the way up to state-of-the-art laser disk technology, graphics have played a major role in the success of videogames.

Where you start in designing a program may have something to do with the quality of the finished product. There is some debate about whether you should design a game around its graphics, or the graphics around the game.

In some games, graphics aren't intrinsic to the game itself. Those games may be visually appealing and make your computer look impressive, but the graphics are extraneous. Their contribution to the game is almost an afterthought.

In other games, like *Q-Bert*, the graphics are the game. Careful attention is paid to shading and dimensions and color. This kind of three-dimensional effect, though not true 3-D, is quite impressive. In the future, many games will likely have a similar look.

An Elusive Element

"Graphics are real nice, but there has to be more than good graphics in a game," says Datasoft's Garcia. "Primarily, it's playability that makes a good game."

Playability is a term many people use when

they rank the elements of a good videogame. What does it mean?

"Playability means that a game is responsive, that it has a good feel," says Garcia. "*Choplifter* is a good example. It looks good but it also plays well. A good game will embody both."

Micro D, a software distributor, values a game's playability highly. "Perhaps most important to us is playability; that is, how the game interacts with the user, and how easy it is to use," says Jim Hafer, a product evaluator for Micro D.

An Audible Difference

Sound is another largely untapped resource, according to Garcia, "I think sound can contribute a lot to a game," he says. "Some game designers are bringing in sound specialists to work on games.

"But sound hardware is really not very sophisticated. The next generation of computers will have better sound chips."

Bob Safir looks carefully at what sound a game is already using. "When we're evaluating the sound on a game, it's important that the program uses the hardware capabilities to their fullest," he says. "How the sound is integrated with the play of the game is also very important."

Variety And Complexity

Another element of a good videogame is constant challenge. Multiscreen games like *Donkey Kong* interest their players by having several levels of skill. And within each screen, there are often a number of levels to climb.

"Multiple levels will appeal to a wider age group," says Softsel's Safir. "The more screens, the more variety. But we have to watch for the entry level of a game. If it's too difficult at the start, players give up easily.

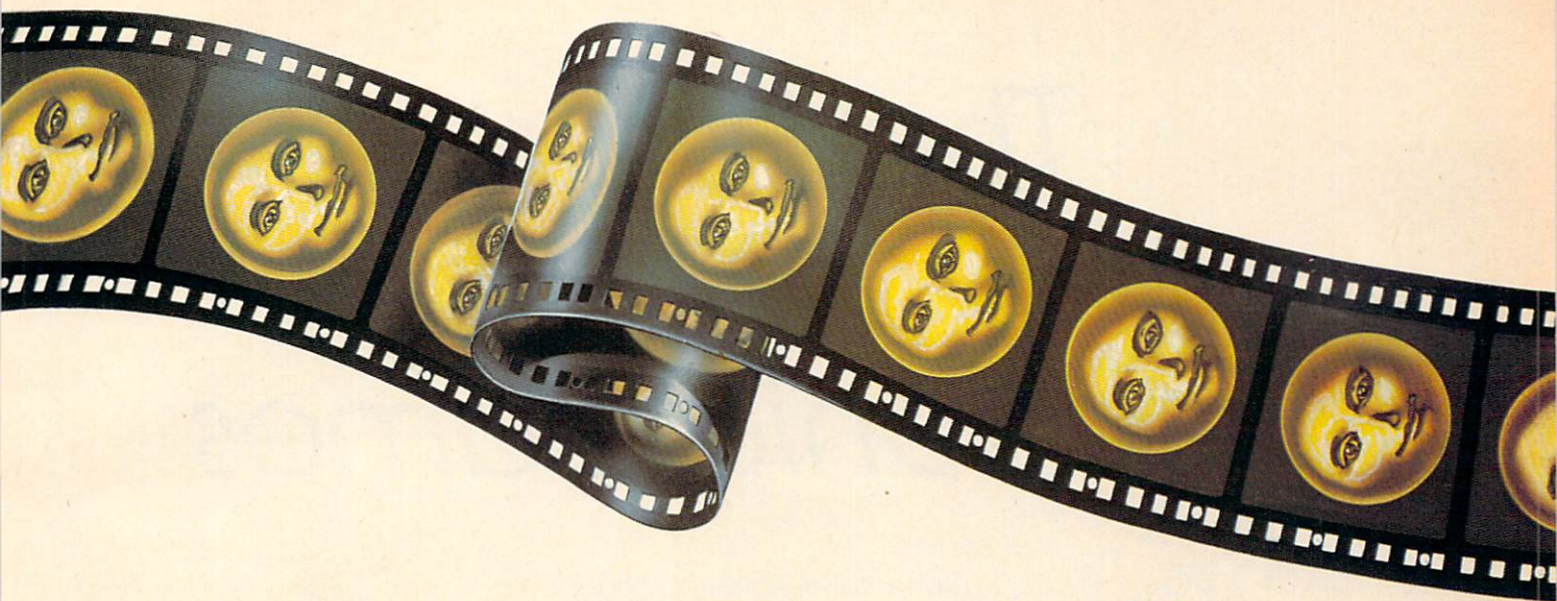
"The same goes for the end of a game. But whether or not you can beat the game is no longer the bottom line. It's the quality of play that's important."

Complexity is another factor. "Simple games don't make it anymore," says Jim Hafer. "You don't want to be able to master a game in two minutes or you won't want to play."

No Limits

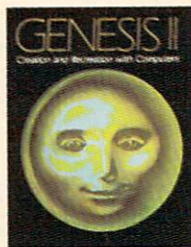
A videogame can be very technically complex, yet lack appeal because player involvement is limited. "*Dragon's Lair* is a very impressive game visually, but I don't think laser disk technology is the wave of the future," says Alex Leavens. "There's no creativity in it right now. It just allows you yes or no answers.

"No matter how gorgeous they look, video disks have a technical limit. Videogames have no limit. They allow the player a much wider kind of decision. That's one of the greatest things about videogames. You can do whatever you want." ©



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The Future Of Electronic Games

Kathy Yakal, Editorial Assistant

Think how much videogames have improved in the past five years. Better graphics capabilities, inexpensive hardware, and hundreds of talented programmers have done a lot to advance state-of-the-art home video entertainment. COMPUTE! asked some of those programmers to outline their ideas about what the future holds for electronic games.

When predicting the future of any creative industry, there are two types of evolution to keep in mind: technological advancement and artistic theory. "The primary thing I would emphasize is artistic development, as opposed to technological," says Chris Crawford, head of the Games Research Group at Atari. "I've read many articles on the subject that are just technical extrapolations. In essence, they take the present and magnify it. But history is not a process of amplification.

"Look at the way television has changed over the last 30 years. We've seen lots of technical developments, but the real advances have been artistic."

Languages And Teams

Creating a videogame is an involved process. The programmer spends weeks, often months, on the design of the game, its characters, and action.

"We cannot keep writing games in machine language, sweating every byte," says Crawford. "I think the next few years will see a race between two processes. I don't know which of these two will develop.

"The first is better languages. The concept of higher level languages—that would let us concen-

trate more on the game itself and less on the technical aspects—is exciting. But high-level languages waste a lot of memory. It may be that we'll have computers so powerful that we can afford to waste that memory."

The second potential trend involves creative teams, groups of five or six people who work together creating different elements of a game. "The artistic teams so far have failed to achieve the unity that's necessary," says Crawford. "Creative people have big egos. That's a necessity. The only way you can really create glorious things is to be able to reject less-than-glorious things.

"Look at how long it took movie studios to become smooth-running operations. Now you have a team of experts, each of whom has their own area of expertise. Because the artists have clearly defined roles, it works."

Can You Imagine A Movie With No People In It?

The answer to creating videogames that will appeal to a wider variety of people is simple, Crawford believes. "It's people, not things," he says. "Those are the magic words. If you look at games right now, they're all about things. There are never real people in them. But can you imagine a movie with no people in it? A book?"

The reason for that, says Crawford, is that things are easier to work with. "What we need is games that focus on human beings, on relationships. Programmers will be creating artificial personalities, characters with which the player can interact.

"Games of this type will break into a larger

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What if you could get small enough to crawl inside your computer and see how all that stuff really works?



IT STARTS with an arcade-style game. You play it for a while and then something happens. The system goes down in a crash. And now your job is to find out why and make things right again.

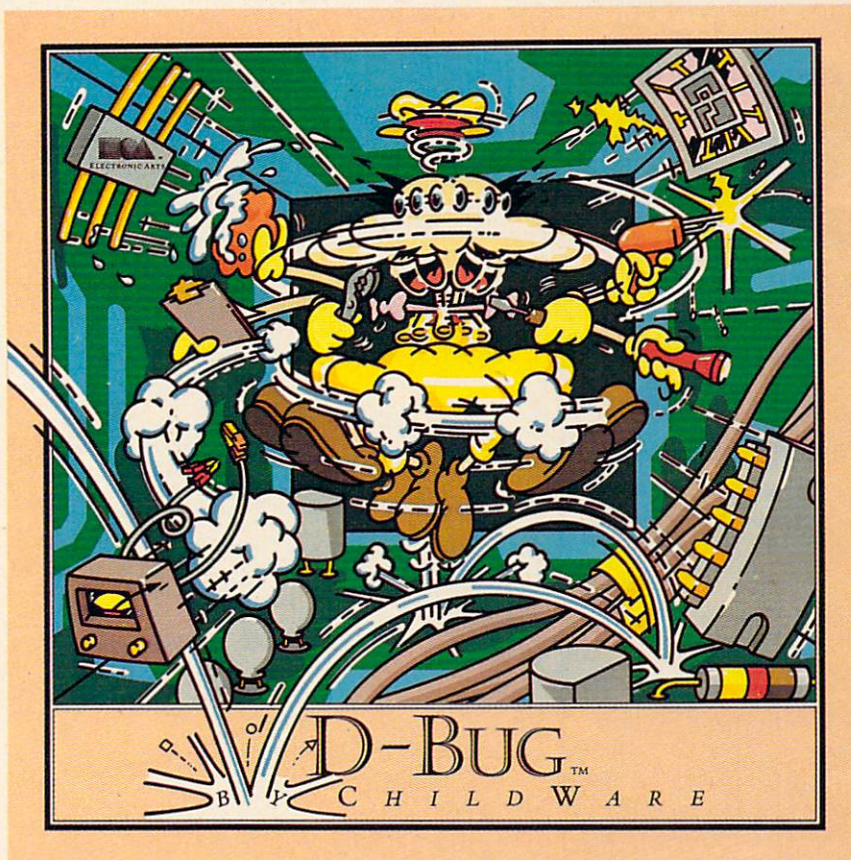
Expert help is available in the form of a strange character named Charlie Fixit. He's got a way of making you small enough to get inside the machine. But being inside is yet another game. There are stray charges to duck, static to avoid, and all sorts of intriguing devices to explore before you can get everything back into working order.

The name of this unusual program is D-Bug™, and it's a wonderful way to introduce your children (and maybe even yourself) to the terminology and basic workings of computers. But beyond this specific knowledge, you'll also learn some fairly subtle skills about how to link causes and effects, and how to develop creative strategies for solving problems.

D-Bug was designed, developed and programmed by ChildWare — pioneers in the field of computer literacy for children. It is just one of an entire line of programs we're publishing that deliberately blur the traditional distinctions between

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marketplace. I'm convinced that it's the wave of the future."

Atari Program Exchange recently released a game by Crawford called *Excalibur* for the Atari 800. In it, the player takes on the role of King Arthur, who is trying to unify England. "You don't just run around England hacking people up," says Crawford. "The emphasis is on interpersonal relationships between Arthur and the other characters, on values like loyalty, credibility, and prestige."

Crawford finds it difficult to categorize this game. "You can't call it an adventure game or a war game," he says. "It's a new genre. I think I've pushed way out into new frontiers with it."

No Back-seat Picassos

In the coming years, advanced programming techniques may make it easier to create games, but this does not mean that anyone will be able to program a good game. "The designer must thoroughly understand the medium," says Crawford. "You can't have someone just coming up with an idea for a game and then have someone else program it. A properly designed game will retain its own unity."

"The greatest artists were all masters of their media. Can you imagine someone like Picasso visualizing a painting and then directing someone else to paint it by saying, 'Oh, put a little splotch of red there, and maybe some yellow over there...?' You can't be a good back-seat game designer any more than you could be a back-seat Picasso."

Sound Improvements

Though sound hardware for electronic games is not very sophisticated right now, it can have a great effect on the impact of future games. "Games today are graphics-intensive and sound-poor. But sound has great emotional power. It reaches straight into people's guts," says Crawford. "Graphics are more cognitive."

"The problem lies in how we're going to use it. Right now, we put little snippets of sound in games. We have learned to use it as auditory feedback. A good sound system requires a lot of memory. The short-term solution to better sound in games would be getting more memory into our computers."

"But I think the day will come when we have a sound track for a game, like we do for movies. Sound will be more integrated into the game."



Chris Crawford

More Time Means More Depth

Games that deal with human relationships, as Crawford foresees, will necessarily take more time to play than current games. "I think games in the home are going to get much longer," he says.

"In the past we have offered people *thrills, action!* That makes for a very fast game. It only takes about ten seconds to blow something up. But character development takes time, and, in the future, you'll be developing relationships with people in games. This will create a richer experience for the player. I look forward to the day when playing a videogame is like reading a book."

Greater Capabilities

Another recent innovative game is *Pinball Construction Set*. Its author, Bill Budge, formed his own company and sold programs for a few years. He now designs games for Electronic Arts.

Though his first designs were basically conversions of arcade games, he feels that people are tiring of those. "Arcades are gradually going to lose their appeal," he says. "Home computer games are getting a lot more involved. There are some real powerful computers coming along, with more memory and more powerful microprocessors."

"Business users have defined what they need computers for. The home user is more vague—he doesn't really know what he wants yet. I think we'll be seeing entertainment software that is more flexible and intelligent."

Putting The Game First

Graphics have a long way to go, according to Budge. "The only thing we have at this point is sprites, and that's very limited. You've got computers whose architecture is very dependent on the sophistication of the graphics chips. Within ten years, you'll have chips that are capable of generating almost TV-quality video."

Sound, Budge believes, will be as important as graphics in games of the future. "I think sound will get better faster than graphics," he says. "We're not even close to the theoretical limits."

As graphics and sound improve, it will not be difficult for anyone to program whatever they want to see in a game. Does that mean people like Budge will be out of a job?

"The name of the game is knowing what



Bill Budge

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to write," he says. "When it's possible for everyone to program, the game itself, the concept, will become the most important thing. The guy with the vision is going to do well."

The Human Element

Budge believes that people need to feel a greater sense of interaction with a computer, and that programmers will have to be sensitive to that. "Right now, if you're a graphics wizard, you have

"There must be 'hooks' in games that address people's minds. The human mind is always demanding at every level, not just visually, but also emotionally and mentally."

a license to write software," he says. "There's a tendency now to make things easy for the programmer, but harder for the user."

Videogames that involve more human interaction will appeal to women. "There's a trend toward games that are more open," says Budge. "It's not just the young boys in schools that feel like they own the computer anymore. It's important to have some women come along who are software superstars.

"It's difficult to think of real interaction with the computer, and to program games that involve it. It's much easier to blow up the alien than to talk to it. I'd rather build things."

Planning Ahead

Fernando Herrera thinks about the future of electronic games every time he sits down at a computer to work on a game. "To make a game successful today, you have to think about what people will want tomorrow," he says. "Every game has to be a little more sophisticated without taking out the fun."

Herrera wrote his first program, *My First Alphabet*, to help teach his visually impaired son, Steve, to read. That educational game won the first Atari Star Award in 1982. Herrera gave up his career in architecture to devote his time to writing software and managing a computer store. He is now the head of design and engineering for his own company, First Star Software.

True Graphics

"In the next few years, people will be demanding more and more realism in graphics," says Herrera. "Games are already stepping from the gadget stage to being real games."

"Graphics have to get better. The earliest graphics were made by using little dots to form pictures. But how many different kinds of monsters can you make with eight dots? People get tired of seeing it. Now we are passing through the stage of cartoon-type graphics, with more realistic ships and creatures and other kinds of things. If we look farther down the road, we will be getting to the stage where we see a kind of movie scene in a game."

Challenging The Intellect

There is a scene in Herrera's game, *Astrochase*, where a spaceman walks out of his house to board the spaceship that will carry him off to fight aliens. As he walks out to his ship, he turns around and waves to his home and family. Though the graphics and fast action in that game might be enough to satisfy most videogame players, Herrera believes little human touches like these will become increasingly important to people.

"There must be 'hooks' in games that address people's minds," says Herrera. "The human mind is always demanding at every level, not just visually, but also emotionally and mentally."

"When you lose a game, it should be a miscalculation of your mind, not your hand. The way many games are now, you keep playing because you get angry with yourself. The game programmers have to make you believe it was your fault. I think we will stop seeing games that, when you lose, you are overwhelmed."

Stretching Different Muscles

Herrera does not mean that games in the future will be easier to beat than they are now. "After you have lost and you come back for more, you have to be able to find more. You want to be able to make better decisions, to correct your mistakes," he says.

"It's like the game tick-tack-toe. After you've found that little secret that lets you win every game, you stop playing because it's not fun anymore. But if you could find a new way to win, you would keep playing. Games are evolving to the point where they are a challenge of the mind, not of the joysticks."

No Bad Guys

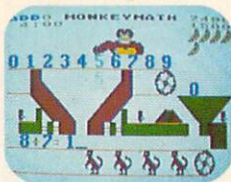
Herrera bristles at the question of violence in future electronic games. "There is no violence in videogames," he says. "Violence, I believe, is one of those arguments against something new. There are two kinds of people—those who move ahead with the times, and those who resist them."

"If you kill a million aliens, that doesn't mean you're a murderer. I don't think videogames are affecting children in a bad way. The computer is the most positive device we have today. Especially compared to television, where you don't have to



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by Dennis Zander

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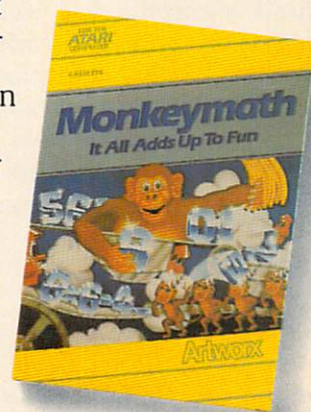
But the part your *child* will like is Monkeymath's arcade-type action and animation, three skill levels and scoring. So, like any good arcade game, kids just can't stop playing it.

In fact, in a recent issue of Antic magazine, David Plotkin called Monkeymath "... one of the most entrancing educational games ever written." (And Monkeynews™ and Monkeybuilder™ our soon to be released reading comprehension and word recognition games will be every bit as entrancing.)

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take an active part."

The positive effects of a computer do not come from strictly educational software, Herrera believes. "Good video-games teach kids how to make decisions, how to analyze things. Violence in games should not be used as an argument against them. Cars actually kill thousands of people every year. Should we ban cars?"



A Long Way To Go Fernando Herrera

Stretching the capabilities of existing computers to their absolute limit is a programmer's responsibility, according to Herrera. "But the computers we have today are very far from what we will have," he says. "Things like telephones and stereos are at the point where they do what we want them to do. Computers are not.

"You still have to do a lot of work to use a computer. You have to hook everything up, turn everything on, load things. These things are still totally unknown to many people.

"The computer has not yet become an extension of you, like the TV has. We will someday be as familiar with computers as we are with the telephone now. And you won't need to know about things like RAM, ROM, and K. You'll probably have an antenna on your roof that can tune you in to a kind of megafile."

Moving Toward Movies

Herrera's prediction that video-games will resemble minimovies in the future is shared by many game designers. One of them is Jon Conrad, a graphic designer who worked on the new arcade game *Bouncer*. "The marketplace up to now has not been involving designers. You generally have one person that writes the program, both technically and artistically," he says.

"In the future, it's going to be like producing a small film. You'll have a writer, director, animator, and art director, all involved in producing one video-game."

Bouncer was produced by such a team. The game has four different scenes, with many characters and possible scenarios in

each scene. Its high-resolution graphics (512 x 384) create visual effects that are some of the most sophisticated that this industry has seen.

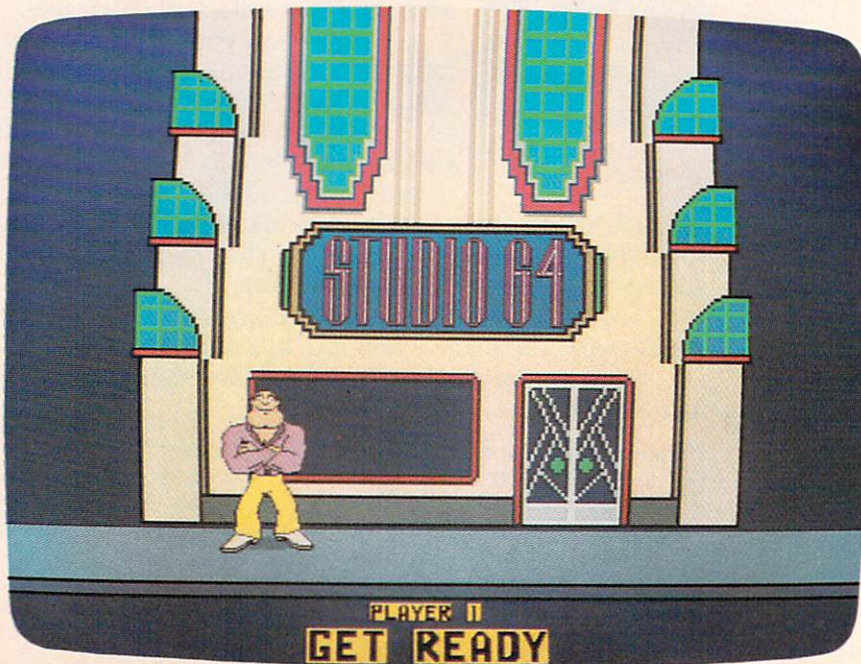
"It's not so much that we're using a new technology as just a more powerful one," says Ulrich Newman, vice president of Entertainment Sciences. "Our architecture lends itself to a more high-level approach to programming."

Allowing More Freedom

Though the technology may not be new, *Bouncer* utilizes the capabilities of existing hardware more than most other arcade games. "What we've done is build a very high-powered computer system" says Newman. "The program takes up two megabytes of memory. There are four processors used to manipulate data. The screen itself requires a lot of processing power. Each screen has 200,000 pixels."

Creating a character in a videogame usually requires the programmer to do a lot of technical manipulation. "Our system does all the grunt work," says Newman. "The data structure allows the designers to specify all attributes of a desired figure. Then the hardware takes over and actually creates the program."

What this means for the finished product is more movement, more interaction, bigger characters, and higher-resolution graphics. It also means that game designers don't have to spend as much time with the technicalities of creating a game, and can work just on those things that affect the actual play of the game. "You're freer to do things than you've ever been before," says Newman. "About 50 percent of a programmer's time right now is spent in doing things that are redundant. We should get that burden off him."



Bouncer, a new arcade game from Entertainment Sciences, contains 500 unique images.

The END of DINKETY-DINK-DINK.

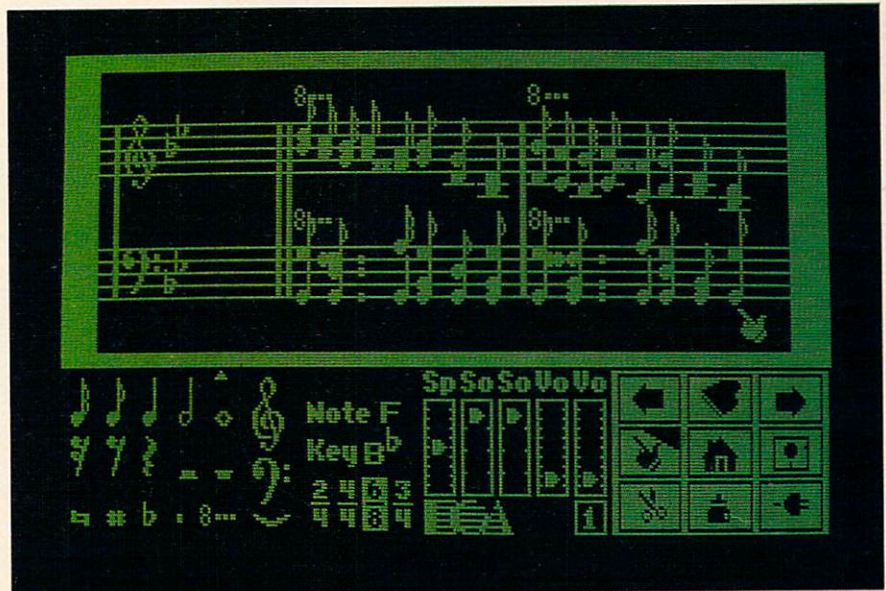
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to the little piano in the lower right and listen, because you'll hear the whole thing played back.

Move those little scales in the middle up and down to vary the music's speed, sound quality, and volume. Use



the scissors to cut out whole measures, then use the glue pot to paste them in somewhere else. Got a printer? Great. Print the score out and show it off to your friends.

But what if you're not up to writing your own stuff yet? No problem. There are twelve pieces of music already in here, from rock 'n roll to baroque. They're fun to listen to, and even more fun to change. (Apologies to Mozart.)

The point is, the possibilities are endless. But if you're still skeptical, visit your nearest Electronic Arts dealer and do the one thing guaranteed to send you home with a Music Construction Set in tow.

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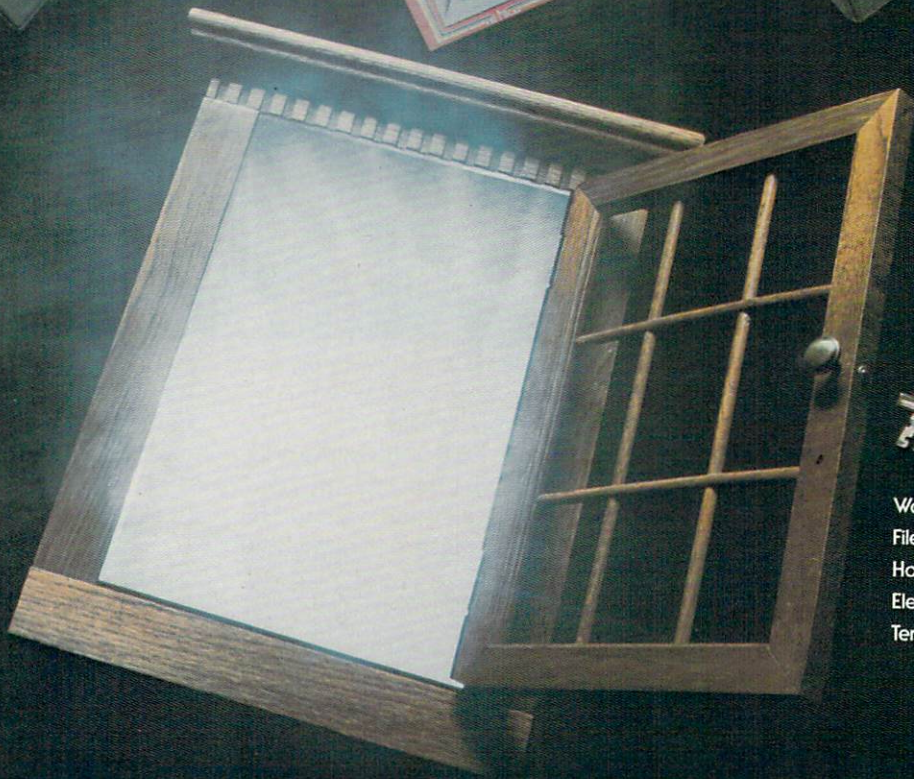
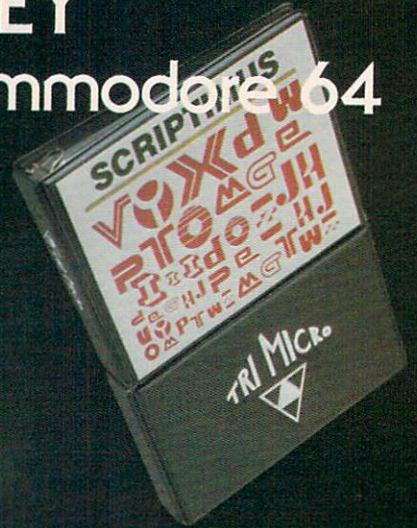
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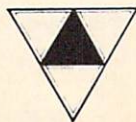
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More Depth On The Horizon

Newman doesn't believe a technology like this will be available on home computers for at least two or three years. "Even then, it will only be in a top-of-the-line machine," he says. "But the basic concept of what we're doing now, the premise of setting XY coordinates and letting the system handle the pixels, is being used now in home systems."

Not only will the quality of videogames improve greatly in the next few years, Newman believes, but also the methods used in getting them into your computer will be different. "I think downloading games over the phone lines will be very popular," he says. "It's far superior to spending 30 or 40 dollars on a cartridge that you may not use that often. If done properly, the phone-game concept can work."

Another trend that Newman foresees is interactive games, games where two computers are hooked together and individuals can play against each other. "When you do that, the game becomes a playing field," he says. "You're playing against a person, not a computer."

If these software designers are representative of the videogame industry's evolution, it appears that we've only scratched the surface of the potential power of videogames. Richer, more intense gaming is on the way. ©

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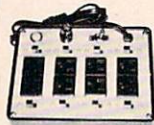
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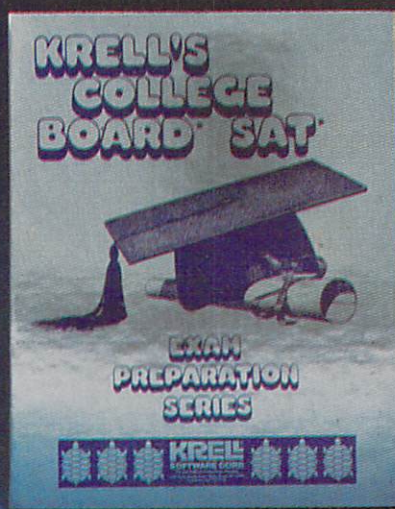
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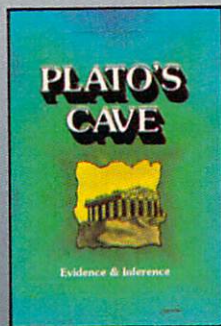
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CIRCUS

Craig Setera

You don't have to run away to join the circus. Here's your chance to be Head Clown and pop clouds of balloons by catapulting your fellow clowns all around the big top. Originally written for the unexpanded VIC; versions also are included for 64, Atari, and TI-99/4A. Joystick required for the VIC, 64, and Atari.

The circus has closed for the evening. It's your job to help the clowns remove the cloud of balloons from the ceiling of the big top, by catapulting them into the air so they can pop all the brightly colored spheres. But a prankster has released one balloon filled with laughing gas. If one of the clowns pops the laughing gas balloon, he's out of the game. Even a clown can't bounce and pop and giggle at the same time.

When the laughing gas balloon is yellow, it's safe to pop, and you are awarded 250 points. But if it's black, watch out. Each row of balloons has a different point value. The blue (bottom) row is worth 50 points, the green (middle) row is worth 75 points, and the red (top) row has a point value of 100.

Whenever you catch a clown on your board, you get 5 points. An extra man is awarded for every 2000 points.

To start the game, press the fire button on the joystick. As you play, you will notice a block moving left to right below the balloons. This block will cause your clown to rebound in the direction from which he came. There also are two platforms, one on each side, that keep the clown within reach of your teeter board. The platforms can be thought of as constructed with upside-down trap doors. When a clown lands on top, he will bounce back, but if he hits the bottom, he will pass through.

"Circus" is a two-part program for the unexpanded VIC. The first program contains the custom character data and play instructions. When it

is finished running, it will NEW itself, so be sure to SAVE it before you RUN it. The second program contains the game. You must LOAD and RUN the second program after running the first program, because the first program sets up the special graphics characters for the second program.

Program 1: Circus, VIC Loader

```
20 PRINT"{CLR}{8 DOWN}{8 SPACES}{RED}C
   {CYN}I{PUR}R{GRN}C{BLU}U{RED}S{BLK}":C
   =0
30 PRINT"{DOWN}{3 RIGHT}PLEASE HOLD ON...
   ":GOTO500000
40 GOSUB1000
45 POKE36869,255
50 PRINT"{CLR}{11 DOWN}{8 RIGHT}{BLK}CIRC
   US"
60 PRINT"{HOME}{9 DOWN}{6 RIGHT}#####
   #":PRINT"{3 DOWN}{6 RIGHT}#####"
70 PRINT"{HOME}{10 DOWN}{6 RIGHT}#{DOWN}
   {LEFT}#{DOWN}{LEFT}#{2 UP}{8 RIGHT}#
   {DOWN}{LEFT}#{DOWN}{LEFT}#"
80 GOSUB2000
85 FORT=1TO3:FORP=1TO7:S=P
90 FORI=38604TO38614:POKEI,S
100 S=S+1:IFS=1THENS=2
110 IFS>7THENS=0
120 NEXT
130 FORI=38635TO38679STEP22:POKEI,S
140 S=S+1:IFS=1THENS=2
150 IFS>7THENS=0
160 NEXT
170 FORI=38702TO38692STEP-1:POKEI,S
180 S=S+1:IFS=1THENS=2
190 IFS>7THENS=0
200 NEXT
210 FORI=38670TO38626STEP-22:POKEI,S
220 S=S+1:IFS=1THENS=2
230 IFS>7THENS=0
240 NEXT
250 NEXTP,T
252 GOSUB1000:PRINT"{CLR}{9 DOWN}";
253 POKE36869,240:PRINT"{RIGHT}INSTRUCTIO
   NS(Y/N)?"":GOSUB2000
254 GETA$:IFA$=""THEN254
255 IFA$="Y"THEN260
```


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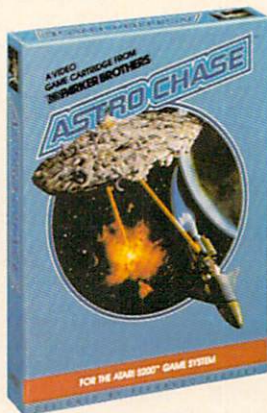
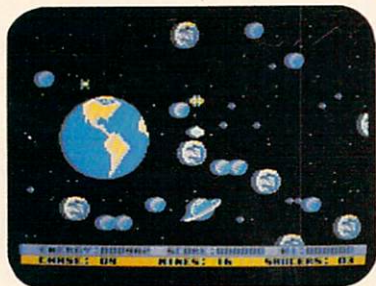
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```

256 IFA$="N"THEN990
257 GOTO254
260 GOSUB1000
270 PRINTCHR$(14);"{CLR}{DOWN}THIS IS THE
  GAME OF{3 SPACES}CIRCUS."
280 PRINT"{DOWN}THE OBJECT OF THE GAME IS
  {SPACE}TO POF ALL OF THE{2 SPACES}BAL
  LOONS."
290 PRINT"{DOWN}THIS IS ACCOMPLISHED
  {2 SPACES}BY MOVING THE JOYSTICKLEFT
  {SPACE}AND RIGHT TO{5 SPACES}CATCH ";
300 PRINT"THE MAN.":PRINT"{DOWN}WHEN THE
  {SPACE}GAME STARTS{2 SPACES}PRESS THE
  FIRE BUTTON TO START."
310 PRINT"{HOME}{20 DOWN}{RVS}PRESS ANY K
  EY"
320 GOSUB2000
330 GETA$:IFA$=""THEN330
340 GOSUB1000
350 PRINT"{CLR}{DOWN}ALL CHECKERBOARD
  {6 SPACES}BLOCKS BOUNCE YOUR MANBACK.
  "
360 PRINT"{DOWN}AN EXTRA MAN WILL BE
  {2 SPACES}AWARDED FOR EVERY 2000POINT
  S."
370 PRINT"{DOWN}THE MOVING BLOCK WILL ALS
  O BOUNCE YOUR MAN."
380 PRINT"{HOME}{22 DOWN}{RVS}PRESS ANY K
  EY{OFF}"
385 GOSUB2000
390 GETA$:IFA$=""THEN390
400 GOSUB1000
410 PRINT"{CLR}{DOWN}BE CAREFUL OF THE OU
  T OF COLOR BALLOON IN"
420 PRINT"THE TOP ROW.{2 SPACES}WHEN
  {4 SPACES}THIS BALLOON IS BLACK IT WI
  LL BLOW UP"
430 PRINT"IN YOUR MAN'S FACE.{3 SPACES}WH
  EN THIS BALLOON IS{2 SPACES}YELLOW,I
  T WILL GIVE"
440 PRINT"YOU 250 POINTS."
940 PRINT"{2 DOWN}GOOD{SHIFT-SPACE}LUCK!!
  !"
950 PRINT"{HOME}{22 DOWN}{RVS}PRESS ANY K
  EY{OFF}"
960 GOSUB2000
970 GETA$:IFA$=""THEN970
980 GOSUB1000:PRINT"{CLR}":GOSUB2000
990 SYS64802
1000 FORI=46TO0STEP-2:POKE36883,I:FORT=1T
  O40:NEXT:NEXT:RETURN
2000 FORI=0TO46STEP2:POKE36883,I:FORT=1T
  O40:NEXT:NEXT:RETURN
50000 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE
  51,PEEK(55):CLR
50010 CS=256*PEEK(52)+PEEK(51)
50020 FORI=CSTOCS+511:POKEI,PEEK(I+32768-
  CS):NEXT
50030 READX:IFX=-1THEN40
50040 FORI=XTOX+7:READJ:POKEI,J:NEXT
50050 GOTO50030
50090 DATA7448,28,62,47,63,63,126,96,0
50091 DATA7456,58,58,18,124,16,56,68,68
50092 DATA7464,128,64,32,16,24,28,38,37
50093 DATA7472,128,64,32,16,8,4,2,1
50094 DATA7480,1,2,4,8,24,56,100,164
50095 DATA7488,1,2,4,8,16,32,64,128
50096 DATA7496,0,0,0,255,24,24,36,36
50097 DATA7504,0,0,0,255,0,0,0,0
50098 DATA7512,170,85,170,85,170,85,170,8
  5

```

```

50099 DATA7520,255,255,255,255,255,255,25
  5,255
50100 DATA7528,170,85,170,85,170,85,170,8
  5
50101 DATA-1

```

Program 2: Circus, VIC Main Program

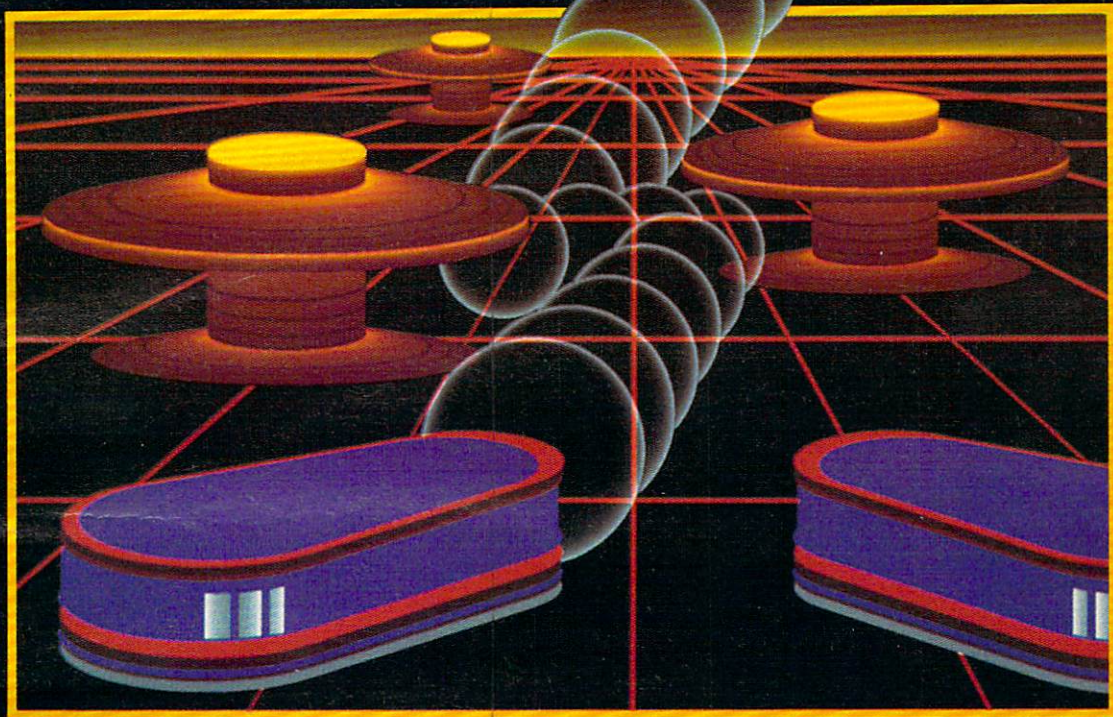
```

0 POKE56,28
1 CLR:S=7834:EX=1:L=3:SC=0:DD=37154:P1=37
  151:P2=37152:POKE36878,15:CL=30720
3 TC$="$ ${19 SPACES}*)"
4 TB$(1)=" &{22 SPACES}%${21 SPACES}& "
5 TB$(2)="{3 SPACES}({19 SPACES}$'
  {20 SPACES}({2 SPACES}"
6 SS$="{9 RIGHT}{3 SPACES}{18 RIGHT}
  {5 SPACES}{19 RIGHT} "
7 SC$="{9 RIGHT}{GRN}###{18 RIGHT}{BLU}##
  ###{19 RIGHT}$"
8 POKE36869,255:T(1)=38:T(2)=40:GP$="
  {HOME}{18 DOWN}"
10 PRINT"{CLR}{2 DOWN}{RED}#####
  #####{GRN}#####{3 SPACES}#####
  ###{BLU}#####{5 SPACES}#####
  {BLK}"
12 FORI=16TO1STEP-1:PRINT"{HOME}{3 DOWN}"
  ;:FORT=1TOI:PRINT"{DOWN}";:NEXT:PRINTS
  C$
14 FORY=1TO75:NEXT:PRINT"{HOME}{3 DOWN}";
  ;:FORT=1TOI:PRINT"{DOWN}";:NEXT:PRINTSS
  $
15 NEXT
16 PRINT"{CLR}{2 DOWN}{RED}#####
  #####{GRN}#####
  {BLU}#####{BLK}"
17 PRINT"{HOME}{DOWN}+++++
  ++"
18 PRINT"{HOME}{21 DOWN},,,,,,,,,,
  ,,,,,";
19 TT=1:D=-1:AO=22:MP=7800:MC=38520:TP=9:
  BA=66:Z=0
20 W=INT(RND(1)*21)+7724
21 PRINTGP$:TAB(TP);TB$(TT)
22 PRINT"{HOME}{16 DOWN}-----{12 SPACES}-
  ----"
23 PRINT"{HOME} SCORE=";SC:PRINT"{HOME}
  {14 RIGHT}LIFE=";L
24 POKEMP,36:POKEMC,0
25 GOSUB88:IFFBTHEN27
26 GOTO25
27 GOSUB88:U=INT(RND(1)*10)
29 IFZ=0ANDU>8THENZ=7:GOTO31
30 IFZ=7ANDU>7THENZ=0:GOTO31
31 IFPEEK(W)=35THENPOKEW+CL,Z
32 OS=S:S=S+1:IFS>7855THENS=7834
33 POKEOS,32:POKES,43:POKES+CL,0
34 IFJ0THENTP=TP+1:IFTP>16THENTP=16
35 IFJ2THENTP=TP-1:IFTP<0THENTP=0
36 PRINTGP$:TAB(TP);TB$(TT)
37 IFD=-1THEN40
38 IFD=1THEN49
39 GOTO37
40 OP=MP:MP=MP+AO:MC=MP+CL:PM=PEEK(MP)
41 IF(OP-7679)/22=INT((OP-7679)/22)ANDAO=
  23THENMP=MP-22:PM=PEEK(MP):MC=MP+CL
42 IFPM=32THEN48
43 IFPM=35THENGOSUB67:GOTO48
44 IFPM=T(TT)THEN56
45 IFPM=43ORPM=45THENMP=OP:D=1:AO=INT(RND
  (1)*3)+21:GOTO27
46 L=L-1:IFL<=0THEN77
47 GOTO16

```

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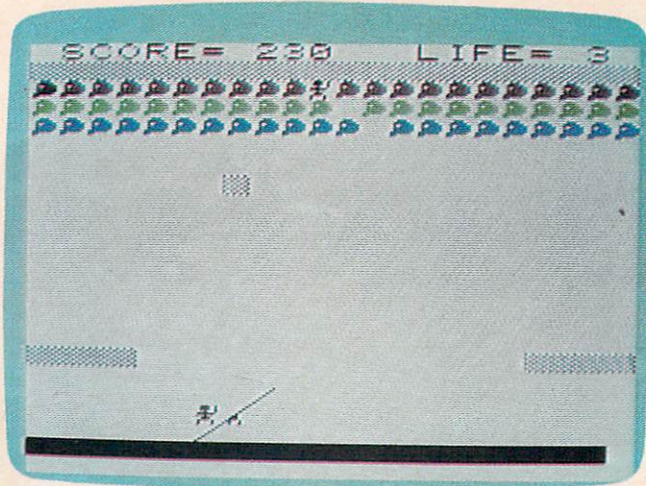


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The man on the seesaw tries to knock out balloons in the VIC version of "Circus."

```

48 POKEOP,32:POKEMP,36:POKEMC,0:GOTO27
49 OP=MP:MP=MP-AO:MC=MP+30720:PM=PEEK(MP)
50 IF(OP-7680)/40=INT((OP-7680)/40)ANDAO=
23THENMP=MP+22:PM=PEEK(MP):MC=MP+CL
51 IFPM=32THEN55
52 IFPM=35THEND=-1:GOSUB67:GOTO55
53 IFPM=45THENPOKEOP,32:MP=MP-AO:MC=MP+CL
54 IFPM=43THENMP=OP:D=-1:AO=INT(RND(1)*3)
+21:GOTO27
55 POKEOP,32:POKEMP,36:POKEMC,0:GOTO27
56 SC=SC+5:POKEOP,32:PRINTGP$;
57 PRINTTAB(TP);SPC(48)" "
58 POKE36876,140:FORT=1TO100:NEXT:POKE368
76,0
59 PRINTGP$;TAB(TP);TC$
60 IFTT=1THENMP=8057+TP:MC=MP+CL
61 IFTT=2THENMP=8055+TP:MC=MP+CL
62 TT=TT+1:IFTT>2THENTT=1
64 D=1:PRINTGP$;TAB(TP);TB$(TT):AO=INT(RN
D(1)*3)+21
66 PRINT"{HOME} SCORE=";SC:PRINT"{HOME}
{14 RIGHT}LIFE=";L:GOTO27
67 POKE36877,140:FORT=1TO50:NEXT:POKE3687
7,0
68 IFMP=WANDC=0THENL=L-1:GOTO16
69 IFMP=WANDC=7THENSC=SC+250:GOTO73
70 IFMP>7723ANDMP<7746THENSC=SC+100
71 IFMP>7745ANDMP<7768THENSC=SC+75
72 IFMP>7767ANDMP<7790THENSC=SC+50
73 IFSC>EX*2000THENL=L+1:EX=EX+1
74 BA=BA-1:IFBA=1THEN16
75 AO=INT(RND(1)*3)+21
76 PRINT"{HOME} SCORE=";SC:PRINT"{HOME}
{14 RIGHT}LIFE=";L:RETURN
77 G$=" G A M E {3 SPACES}O V E R"
78 FORI=2TO19STEP2
79 PRINT"{HOME}{7 DOWN}";TAB(I);MID$(G$,I
,1)
80 FORT=1TO100:NEXT:NEXT:FORT=1TO250:NEXT
82 PRINT"PRESS THE FIRE BUTTON TO PLAY AG
AIN"
83 PRINT"PUSH THE JOYSTICK DOWN TO END"
84 GOSUB88
85 IFFBTHENRUN
86 IFJ1THENPRINT"{CLR}":POKE36869,240:END
87 GOTO84
88 POKEDD,127:P=PEEK(P2)AND128:J0=-(P=0):
POKEDD,255:P=PEEK(P1):FB=-(PAND32)=0)

```

```

89 J1=-((PAND8)=0):J2=-((PAND16)=0):J3=-((
PAND4)=0):RETURN

```

BEGINNING PROGRAMMERS
 If you're new to computing, please read "How
 To Type COMPUTE!'s Programs" and "A
 Beginner's Guide To Typing In Programs."

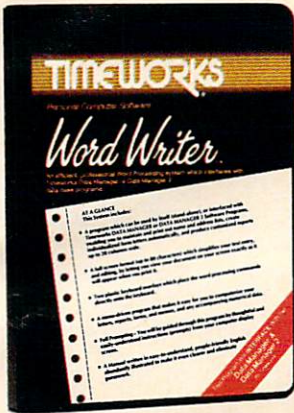
Program 3: Circus, 64 Version

```

1 GOTO800
2 POKE53280,6:POKE53281,1
5 S=1304:EX=1:L=3:SC=0:SO=54272
10 POKESO+24,15:POKESO+5,17:POKESO+6,241:
POKESO,100
20 TC=27:POKE251,112:POKE831,0:POKE832,0:
POKE829,20
30 TB(1)=112
40 TB(2)=197
50 SS$="{19 RIGHT}{3 SPACES}{DOWN}
{4 LEFT}{5 SPACES}{DOWN}{3 LEFT}"
60 SC$="{19 RIGHT}{GRN}###{DOWN}{4 LEFT}
{BLU}#####{DOWN}{3 LEFT}$"
70 POKE53272,(PEEK(53272)AND240)+12
80 T(1)=38:T(2)=40
90 PRINT"{CLR}{2 DOWN}{RED}#####
#####";
91 PRINT"{GRN}#####
{3 SPACES}#####";
92 PRINT"{BLU}#####
{5 SPACES}#####";
100 FORI=16TO1STEP-1
110 PRINT"{HOME}{3 DOWN}";:FORT=1TOI:PRIN
T"{DOWN}";:NEXT:PRINTSC$
120 FORY=1TO75:NEXT
130 PRINT"{HOME}{3 DOWN}";:FORT=1TOI:PRIN
T"{DOWN}";:NEXT:PRINTSS$
140 NEXT
150 PRINT"{CLR}{2 DOWN}{RED}#####
#####";
151 PRINT"{GRN}#####
#####";
152 PRINT"{BLU}#####
#####";
160 PRINT"{HOME}{DOWN}+++++
+++++"
170 PRINT"{HOME}{23 DOWN},,,,,,,,,,
,,,,,,,,,
";
180 TT=1:D=-1:AO=40:MP=1244:MC=55516:TP=1
9:BA=121:Z=0:POKE834,TP
185 W=INT(RND(1)*39)+1104
190 POKE251,TB(TT):SYS49152
200 PRINT"{HOME}{16 DOWN}-----
{26 SPACES}-----"
210 PRINT"{HOME}{6 SPACES}SCORE=";SC:PRIN
T"{HOME}{25 RIGHT}LIFE=";L
220 POKEMP,36:POKEMC,0
230 GOSUB750:IFFBTHEN240
235 GOTO230
240 U=INT(RND(1)*10)
244 IFZ=0ANDU>8THENZ=7:GOTO248
246 IFZ=7ANDU>7THENZ=0:GOTO248
248 IFPEEK(W)=35THENPOKEW+SO,Z
290 POKE251,TB(TT):SYS49434:TP=PEEK(834)
310 IFD=-1THEN330
320 IFD=1THEN410
325 GOTO310
330 OP=MP:MP=MP+AO:MC=MP+SO:PM=PEEK(MP)

```

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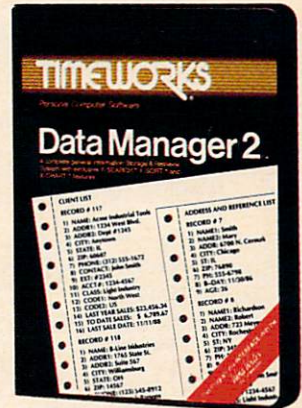
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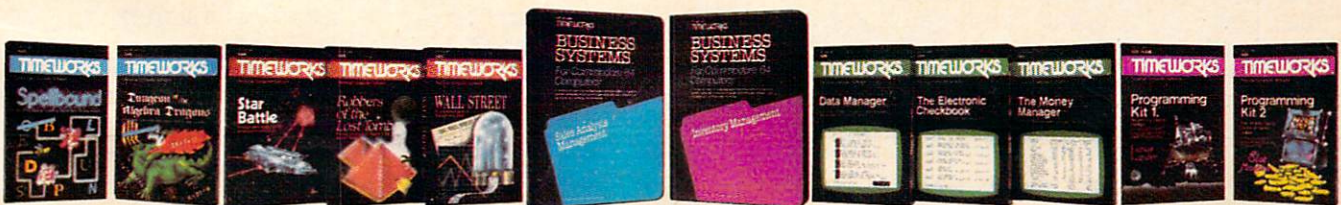
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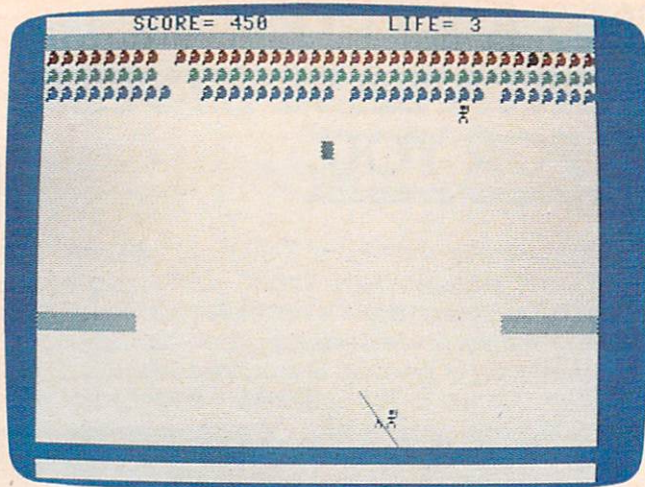


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"Circus," 64 version.

```

335 IF((OP-1023)/40=INT((OP-1023)/40))AND
    AO=41 THEN MP=MP-40:PM=PEEK(MP):MC=MP+S
    O
340 IFPM=32 THEN 406
350 IFPM=35 THEN GOSUB 560:GOTO 406
370 IFPM=T(TT) THEN 460
380 IFPM=43 OR PM=45 THEN MP=OP:D=1:AO=INT(RN
    D(1)*3)+39:GOTO 240
400 L=L-1:IFL<=0 THEN 630
404 GOTO 150
406 POKEOP,32:POKEMP,36:POKEMC,0:GOTO 240
410 OP=MP:MP=MP-AO:MC=MP+SO:PM=PEEK(MP)
415 IF((OP-1024)/40=INT((OP-1024)/40))AND
    AO=41 THEN MP=MP+40:PM=PEEK(MP):MC=MP+S
    O
420 IFPM=32 THEN 450
430 IFPM=35 THEN D=-1:GOSUB 560:GOTO 450
435 IFPM=45 THEN POKEOP,32:MP=MP-AO:MC=MP+S
    O
440 IFPM=43 THEN MP=OP:D=-1:AO=INT(RND(1)*3
    )+39:GOTO 240
450 POKEOP,32:POKEMP,36:POKEMC,0:GOTO 240
460 SC=SC+5:POKEOP,32
480 POKESO+1,10:POKESO+4,33
490 POKE251,TC:SYS49152
500 POKESO+4,32:IFTT=1 THEN MP=1787+TP:MC=M
    P+SO
510 IFTT=2 THEN MP=1785+TP:MC=MP+SO
520 TT=TT+1:IFTT>2 THEN TT=1
530 D=1
540 POKE251,TB(TT):SYS49152
550 AO=INT(RND(1)*3)+39
555 PRINT"{HOME}{6 SPACES}SCORE=";SC:PRIN
    T"{HOME}{25 RIGHT}LIFE=";L:GOTO 240
560 POKESO+1,10:POKESO+4,129:FORI=1 TO 10:
    N EXT:POKESO+4,128
563 IFMP=WANDC=0 THEN L=L-1:GOTO 150
566 IFMP=WANDC=7 THEN SC=SC+250:GOTO 600
570 IFMP>1103 AND MP<1144 THEN SC=SC+100
580 IFMP>1143 AND MP<1184 THEN SC=SC+75
590 IFMP>1183 AND MP<1224 THEN SC=SC+50
600 IFSC>EX*2000 THEN L=L+1:EX=EX+1
605 BA=BA-1:IFBA=1 THEN 150
610 AO=INT(RND(1)*3)+39
620 PRINT"{HOME}{6 SPACES}SCORE=";SC:PRIN
    T"{HOME}{25 RIGHT}LIFE=";L:RETURN
630 G$=" G A M E{3 SPACES}O V E R"
640 FORI=2 TO 19 STEP 2
650 PRINT"{HOME}{9 DOWN}";TAB(I*2-1);MID$
    (G$,I,1)
660 FORT=1 TO 100:NEXT:NEXT
670 FORI=1 TO 250:NEXT
680 PRINT"{2 SPACES}PRESS THE FIRE BUTTON
    TO PLAY AGAIN"
690 PRINT"{5 SPACES}PUSH THE JOYSTICK DOW
    N TO END"
700 GOSUB 750
710 IFFB THEN CLR:GOTO 2
720 IFJ1 THEN SYS 2048:END
730 GOTO 700
750 P=PEEK(56320) AND 15
760 J1=-(P=13)
770 FB=-(PEEK(56320) AND 16)=0:RETURN
800 POKE 53280,6:POKE 53281,1

810 PRINT"{CLR}{12 DOWN}{17 SPACES}{RED}C
    {CYN}I{PUR}R{GRN}C{BLU}U{RED}S{BLK}":
    C=0
820 PRINT"{DOWN}{12 SPACES}PLEASE HOLD ON
    ..":GOTO 1310
830 GOSUB 10000:POKE 53272,(PEEK(53272) AND 2
    40)+12
840 PRINT"{CLR}{12 DOWN}{17 RIGHT}{BLK}CI
    RCUS"
850 PRINT"{HOME}{10 DOWN}{15 RIGHT}#####
    ####"
855 PRINT"{3 DOWN}{15 RIGHT}#####"
860 PRINT"{HOME}{11 DOWN}{15 RIGHT}#
    {DOWN}{LEFT}#{DOWN}{LEFT}#{2 UP}
    {8 RIGHT}#{DOWN}{LEFT}#{DOWN}{LEFT}#"
880 FORT=1 TO 3:FORP=1 TO 7:S=P
890 FORI=55711 TO 55720:POKEI,S
900 S=S+1:IFS=1 THEN S=2
910 IFS>7 THEN S=0
920 NEXT
930 FORI=55760 TO 55840 STEP 40:POKEI,S
940 S=S+1:IFS=1 THEN S=2
950 IFS>7 THEN S=0
960 NEXT
970 FORI=55880 TO 55871 STEP -1:POKEI,S
980 S=S+1:IFS=1 THEN S=2
990 IFS>7 THEN S=0
1000 NEXT
1010 FORI=55831 TO 55751 STEP -40:POKEI,S
1020 S=S+1:IFS=1 THEN S=2
1030 IFS>7 THEN S=0
1040 NEXT
1050 NEXTP,T
1060 POKE 53272,21:PRINT"{CLR}{12 DOWN}";
1070 PRINT"{5 SPACES}DO YOU WANT INSTRUCT
    IONS?(Y/N)"
1080 GETA$:IFA$="" THEN 1080
1090 IFA$="Y" THEN 1120
1100 IFA$="N" THEN 1500
1110 GOTO 1080
1120 PRINTCHR$(14);"{CLR}{DOWN}THIS IS TH
    E GAME OF CIRCUS."
1130 PRINT"{DOWN}THE OBJECT OF THE GAME I
    S TO POP ALL OF THE BALLOONS."
1140 PRINT"{DOWN}THIS IS ACCOMPLISHED BY
    {SPACE}MOVING THE"
1145 PRINT"JOYSTICK LEFT AND RIGHT TO CAT
    CH THE"
1150 PRINT"MAN.":PRINT"{DOWN}WHEN THE GAM
    E STARTS PRESS THE FIRE{4 SPACES}
    {SHIFT-SPACE}BUTTON";
1155 PRINT" TO START PLAYING."
1160 PRINT"{HOME}{20 DOWN}{RVS}PRESS ANY
    {SPACE}KEY"
1170 GETA$:IFA$="" THEN 1170

```

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64, Atari, And TI-99/4A Version Notes For Circus

Patrick Parrish, Programming Supervisor

In "Circus," you must pop the balloons at the top of the tent. On the Commodore 64 and the Atari, two clowns assist you in this task. Using a springboard positioned horizontally with your joystick (joystick #2 on the 64, joystick #1 on the Atari), alternately catapult one and then the other clown into the rows of balloons. On the TI-99/4A (with Extended BASIC), a clown is vaulted to the top of the tent by a trampoline which you wheel about with the < and > keys.

Points are awarded based on the number and location of the balloons you pop. The balloons nearest you are worth 50 points, those in the second row from you give 75 points, and those furthest from you are worth 100 points.

But, in the top row, is a balloon filled with laughing gas. When this balloon is yellow, it is safe to pop. If you succeed you are awarded 250 points. However, if this balloon is black (or green on the Atari) and you try to pop it, look out! A clown is lost, and the tent is once again filled with balloons. On the TI-

99/4A, you lose a clown, but no more balloons appear at this point. In any case, you are given three clowns when the game begins, and you receive an additional clown for every 2000 points.

A Touch Of Havoc

Catapulting the clown to the top of the tent is a real art on the 64 and the Atari. You must catch the clown at the very end of the springboard and hope for the best. By contrast, on the TI-99/4A you have some measure of control over the clown. You'll find that your clown will assume a different direction, depending on where he strikes the trampoline.

To add a little havoc to the game, two platforms which spring the clowns at different angles have been added. On the 64 and Atari, a block also moves across the tent near the first row of balloons which will send the clown flying off in another direction if he should strike it. On the TI-99/4A, instead of a block, three pigeons, formed from sprites, fly across the tent. These pigeons won't collide with your clown, but they will surely distract you.

```

1180 PRINT"{CLR}{DOWN}ALL CHECKERBOARD BLO
CKS BOUNCE YOUR MAN BACK."
1190 PRINT"{DOWN}AN EXTRA MAN WILL BE AW
ARDED FOR EVERY{2 SPACES}2000 POINTS."
1200 PRINT"{DOWN}THE MOVING BLOCK WILL AL
SO BOUNCE YOUR{2 SPACES}MAN."
1210 PRINT"{HOME}{22 DOWN}{RVS}PRESS ANY
{SPACE}KEY{OFF}"
1220 GETA$:IFA$=""THEN1220
1230 PRINT"{CLR}{DOWN}YOU MUST BE CAREFUL
OF THE OUT OF COLOR BALLOON ON THE
{SPACE}TOP ROW."
1240 PRINT"{DOWN}WHEN THIS BALLOON IS BLA
CK IT WILL BLOW"
1250 PRINT"UP IN YOUR MAN'S FACE, WHEN TH
IS BALLOON IS YELLOW IT WILL GIVE ";
1260 PRINT"YOU 250 POINTS"
1270 PRINT"{2 DOWN}GOOD{SHIFT-SPACE}LUCK!
!!"
1280 PRINT"{HOME}{22 DOWN}{RVS}PRESS ANY
{SPACE}KEY{OFF}"
1290 GETA$:IFA$=""THEN1290
1300 GOTO1500
1310 POKE52,48:POKE56,48:CLR
1320 CS=12288:POKE56334,PEEK(56334)AND254
:POKE1,PEEK(1)AND251
1330 FORI=CS+511:POKEI,PEEK(I+40960):
NEXT
1340 POKE1,PEEK(1)OR4:POKE56334,PEEK(5633
4)OR1
1360 FORI=CS+35*8TOCS+46*8-1:READJ:POKEI,
J:A=A+J:NEXT
1365 IF A<>6897 THEN PRINT"ERROR IN DATA
{SPACE}IN LINES 1380-1480":END
1370 GOTO830
1380 DATA28,62,47,63,63,126,96,0
1390 DATA58,58,18,124,16,56,68,68
1400 DATA128,64,32,16,24,28,38,37
1410 DATA128,64,32,16,8,4,2,1
1420 DATA1,2,4,8,24,56,100,164
1430 DATA1,2,4,8,16,32,64,128
1440 DATA0,0,0,255,24,24,36,36
1450 DATA0,0,0,255,0,0,0,0
1460 DATA170,85,170,85,170,85,170,85
1470 DATA255,255,255,255,255,255,255,255
1480 DATA170,85,170,85,170,85,170,85
1500 PRINT"{CLR}":PRINTCHR$(17):GOTO2
10000 I=49152
10010 READA:IFA=256THENGOTO10025
10020 POKEI,A:I=I+1:C=C+A:GOTO 10010
10025 IFC<>21810THENPRINT"ERROR IN DATA L
INES 10030-10580":END
10026 RETURN
10030 DATA 172,66,3,174,61,3,24
10040 DATA 32,240,255,169,192,133,252
10050 DATA 160,0,177,251,32,210,255
10060 DATA 200,192,85,208,246,96,32
10070 DATA 36,32,36,32,32,32,32
10080 DATA 32,32,32,32,32,32,32
10090 DATA 32,32,32,32,32,32,32
10100 DATA 32,32,32,32,32,32,32

```


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```

10110 DATA 32,32,32,32,32,32,32
10120 DATA 32,32,32,32,32,42,41
10130 DATA 42,32,32,32,32,32,32
10140 DATA 32,32,32,32,32,32,32
10150 DATA 32,32,32,32,32,32,32
10160 DATA 32,32,32,32,32,32,32
10170 DATA 32,32,32,32,32,32,32
10180 DATA 32,32,32,32,32,32,32
10190 DATA 32,38,32,32,32,32,32
10200 DATA 32,32,32,32,32,32,32
10210 DATA 32,32,32,32,32,32,32
10220 DATA 32,32,32,32,32,32,32
10230 DATA 32,32,32,32,32,32,32
10240 DATA 32,32,32,32,32,32,32
10250 DATA 37,36,32,32,32,32,32
10260 DATA 32,32,32,32,32,32,32
10270 DATA 32,32,32,32,32,32,32
10280 DATA 32,32,32,32,32,32,32
10290 DATA 32,32,32,32,32,32,32
10300 DATA 32,32,32,32,32,32,38
10310 DATA 32,32,32,32,40,32,32
10320 DATA 32,32,32,32,32,32,32
10330 DATA 32,32,32,32,32,32,32
10340 DATA 32,32,32,32,32,32,32
10350 DATA 32,32,32,32,32,32,32
10360 DATA 32,32,32,32,32,32,32
10370 DATA 36,39,32,32,32,32,32
10380 DATA 32,32,32,32,32,32,32
10390 DATA 32,32,32,32,32,32,32
10400 DATA 32,32,32,32,32,32,32
10410 DATA 32,32,32,32,32,32,32
10420 DATA 32,32,32,32,32,40,32
10430 DATA 32,32,169,0,141,60,3
10440 DATA 173,63,3,141,64,3,24
10450 DATA 105,1,201,41,208,2,169
10460 DATA 0,141,63,3,174,64,3
10470 DATA 169,32,157,24,5,169,43
10480 DATA 174,63,3,157,24,5,169
10490 DATA 0,157,24,217,173,0,220
10500 DATA 170,41,8,208,18,238,66
10510 DATA 3,173,66,3,201,36,208
10520 DATA 2,169,35,141,66,3,76
10530 DATA 116,193,138,41,4,208,15
10540 DATA 206,66,3,173,66,3,201
10550 DATA 255,208,2,169,0,141,66
10560 DATA 3,32,0,192,238,60,3
10570 DATA 173,60,3,201,2,208,197
10580 DATA 96,256

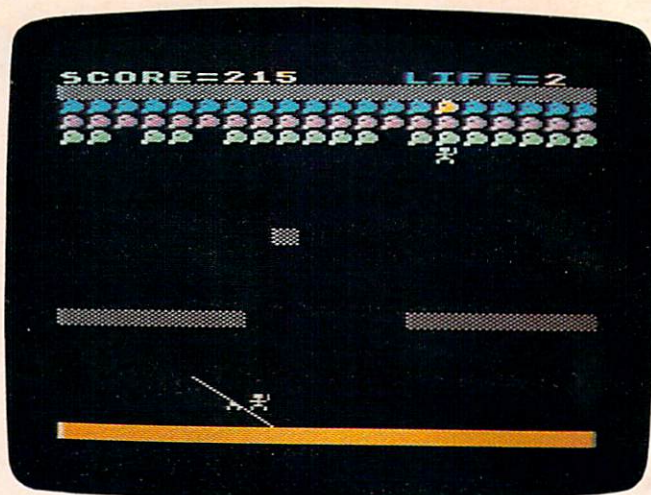
```

Program 4: Circus, Atari Version

```

1 GOTO 800
5 S=0:EX=1:L=3:SC=0
20 TC$=" $ ${17 SPACES})*"
30 TB$=" &{20 SPACES}%${19 SPACES}& "
40 TA$="{3 SPACES}({17 SPACES}$'
  {18 SPACES}({3 SPACES}"
80 T(1)=38:T(2)=40
89 GRAPHICS 17:POKE 756,CHSET/256
90 ? #6: ? #6: ? #6: "#####";
  "###";
91 ? #6: "{20 C}";
92 ? #6: "{10 C} {9 C}";
100 FOR I=16 TO 4 STEP -1
110 COLOR 3:PLOT 10,I:COLOR 4:PLOT 1
  0,I+1
115 IF I=4 THEN 140
120 FOR Y=1 TO 75:NEXT Y
130 COLOR 0:PLOT 10,I+1:COLOR 0:PLOT
  10,I+2
140 NEXT I
150 GRAPHICS 17:POKE 756,CHSET/256: ?
  #6: ? #6: "++++++++";
151 ? #6: "#####";
152 ? #6: "{20 C}";
153 ? #6: "{20 C}";
160 POSITION 0,22: ? #6: ".....";
  ".....";
180 TT=1:D=-1:A0=0:MX=10:MY=5:TP=9:B
  A=60:Z=0
185 W=INT(RND(1)*19)
186 Z=3
188 IF TT=1 THEN TD$=TB$:GOTO 190
189 TD$=TA$
190 POSITION TP,19: ? #6:TD$
200 POSITION 0,15: ? #6: "-----"
  {6 SPACES}-----"
210 POSITION 0,0: ? #6: "score(DOWN)";
  SC:POSITION 13,0: ? #6: "LIFE";L
220 COLOR 4:PLOT MX,MY
230 IF STRIG(0)=0 THEN 240
235 GOTO 230
240 U=INT(RND(1)*10)
244 IF Z=35 AND U>8 THEN Z=3:GOTO 24
  8
246 IF Z=3 AND U>7 THEN Z=35:GOTO 24
  8
248 LOCATE W,2,U:IF U=3 OR U=35 OR U
  =163 THEN COLOR Z:PLOT W,2
250 OS=S:S=S+1:IF S>19 THEN S=0
260 COLOR 32:PLOT OS,10:COLOR 43:PLO
  T S,10
270 IF STICK(0)=7 THEN TP=TP+1:IF TP
  >15 THEN TP=15:POKE 77,0
280 IF STICK(0)=11 THEN TP=TP-1:IF T
  P<0 THEN TP=0:POKE 77,0
288 IF TT=1 THEN TD$=TB$:GOTO 290
289 TD$=TA$
290 POSITION TP,19: ? #6:TD$
310 IF D=-1 THEN 330
320 IF D=1 THEN 410
325 GOTO 310
330 OX=MX:OY=MY:MY=MY-D:MX=MX+A0:IF
  MX<0 THEN MX=19
331 IF MX>19 THEN MX=0
335 LOCATE MX,MY,PM
340 IF PM=32 OR PM=0 THEN 406
350 IF PM=3 OR PM=163 OR PM=99 OR PM
  =131 OR PM=35 THEN GOSUB 560:GOT
  O 406
370 IF PM=T(TT) THEN 460

```



"Circus," Atari version.

```

380 IF PM=43 OR PM=45 THEN MY=OY:MX=
OX:D=1:A0=INT(RND(1)*3)-1:GOTO 2
400 L=L-1:IF L<=0 THEN 630
404 GOTO 150
406 COLOR 32:PLOT OX,OY:COLOR 4:PLOT
MX,MY:GOTO 240
410 OX=MX:OY=MY:MX=MX+A0:MY=MY-D:IF
MX<0 THEN MX=19
411 IF MX>19 THEN MX=0
415 LOCATE MX,MY,PM
420 IF PM=32 OR PM=0 THEN 450
430 IF PM=3 OR PM=35 OR PM=99 OR PM=
131 OR PM=163 THEN D=-1:GOSUB 56
0
435 IF PM=45 THEN COLOR 32:PLOT OX,O
Y:MX=MX+A0:MY=MY-D:IF MX<0 THEN
MX=19
437 IF PM=45 AND MX>19 THEN MX=0
440 IF PM=43 THEN MX=OX:MY=OY:D=-1:A
0=INT(RND(1)*3)-1:GOTO 240
450 COLOR 32:PLOT OX,OY:COLOR 4:PLOT
MX,MY:GOTO 240
460 SC=SC+5:COLOR 0:PLOT OX,OY
480 SOUND 0,200,10,15:FOR I=1 TO 20:
NEXT I:SOUND 0,0,0,0
490 POSITION TP,19:? #6;TC$
500 IF TT=1 THEN MX=TP+3:MY=19
510 IF TT=2 THEN MX=TP+1:MY=19
520 TT=TT+1:IF TT>2 THEN TT=1
530 D=1
538 IF TT=1 THEN TD$=TB$:GOTO 540
539 TD$=TA$
540 POSITION TP,19:? #6;TD$
550 A0=INT(RND(1)*3)-1
555 POSITION 0,0:? #6;"score(DOWN)";
SC:POSITION 13,0:? #6;"LIVES";L
556 GOTO 240
560 SOUND 0,200,12,15:FOR I=1 TO 20:
NEXT I:SOUND 0,0,0,0
563 IF MX=W AND MY=2 AND PM=3 THEN L
=L-1:GOTO 150
566 IF MX=W AND PM=35 AND MY=2 THEN
SC=SC+250:GOTO 600
570 IF MY=2 THEN SC=SC+100
580 IF MY=3 THEN SC=SC+75
590 IF MY=4 THEN SC=SC+50
600 IF SC>EX*2000 THEN L=L+1:EX=EX+1
605 BA=BA-1:IF BA=1 THEN 150
610 A0=INT(RND(1)*3)-1
620 POSITION 0,0:? #6;"score(DOWN)";
SC:POSITION 13,0:? #6;"LIVES";L
625 RETURN
630 G$=" G A M E{3 SPACES}O V E R"
640 FOR I=2 TO 18 STEP 2
650 POSITION I-1,11:? #6;CHR$(ASC(G$
(I)))
660 FOR T=1 TO 50:NEXT T:NEXT I
670 FOR I=1 TO 250:NEXT I
680 PRINT #6;"{3 SPACES}PRESS THE FI
RE{3 SPACES}BUTTON TO PLAY AGAIN
";
690 PRINT #6;" PUSH THE JOYSTICK
{6 SPACES}DOWN TO END{5 SPACES}"
;
710 IF STRIG(0)=0 THEN GOTO 5
720 IF STICK(0)=13 THEN GRAPHICS 0:EN
D
730 GOTO 710
800 POKE 82,0
830 GOSUB 1300
835 GRAPHICS 17:POKE 756,CHSET/256
840 FOR J=1 TO 12
850 POSITION 5,9:? #6;"#0#0#0#0#0#"
855 POSITION 5,10:? #6;"{8 SPACES}#
"
856 POSITION 5,11:? #6;"# CIRCUS 0#"
857 POSITION 5,12:? #6;"{8 SPACES}#
"
860 POSITION 5,13:? #6;"#0#0#0#0#0#"
900 FOR I=1 TO 20:NEXT I
950 POSITION 5,9:? #6;"0#0#0#0#0#"
955 POSITION 5,10:? #6;"#{8 SPACES}0#"
"
956 POSITION 5,11:? #6;"0 CIRCUS #"
957 POSITION 5,12:? #6;"#{8 SPACES}0#"
"
960 POSITION 5,13:? #6;"0#0#0#0#0#"
1000 FOR I=1 TO 20:NEXT I
1010 NEXT J
1060 GRAPHICS 17
1070 POSITION 0,11:PRINT #6;"
{5 SPACES}DO YOU WANT
{5 SPACES}INSTRUCTIONS?(Y/N)"
1080 A=PEEK(764)
1090 IF A=43 THEN 1120
1100 IF A=35 THEN 5
1110 GOTO 1080
1120 GRAPHICS 17:PRINT #6;"THIS IS T
HE GAME OF CIRCUS."
1130 PRINT #6;"THE OBJECT OF THE
{3 SPACES}GAME IS TO POP ALL O
F THE BALLOONS."
1140 PRINT #6;"THIS IS ACCOMPLISHEDB
Y MOVING THE"
1145 PRINT #6;"JOYSTICK LEFT AND
{3 SPACES}RIGHT TO CATCH THE"
1150 PRINT #6;"MAN.":PRINT #6;"WHEN
THE GAME STARTSPRESS THE fire
{6 SPACES}BUTTON";
1155 PRINT #6;" TO START{5 SPACES}PL
AYING."
1159 POSITION 3,20
1160 PRINT #6;"PRESS ANY KEY"
1169 POKE 764,255
1170 IF PEEK(764)=255 THEN 1170
1171 GRAPHICS 17
1180 PRINT #6;"ALL CHECKER-BOARD
{3 SPACES}BLOCKS BOUNCE YOUR M
AN BACK."
1190 PRINT #6;"AN EXTRA MAN WILL BEA
WARDED FOR EVERY{3 SPACES}2000
POINTS."
1200 PRINT #6;"THE MOVING BLOCK
{4 SPACES}WILL ALSO BOUNCE
{4 SPACES}YOUR MAN."
1209 POSITION 3,20
1210 PRINT #6;"PRESS ANY KEY"
1219 POKE 764,255
1220 IF PEEK(764)=255 THEN 1220
1221 GRAPHICS 17
1230 PRINT #6;"YOU MUST BE CAREFUL O
F THE OUT OF COLOR BALLOON ON T
HE TOP ROW."
1240 PRINT #6;"WHEN THIS BALLOON ISG
REEN IT WILL BLOW"
1250 PRINT #6;"UP IN YOUR MAN'S
{4 SPACES}FACE, WHEN THIS
{5 SPACES}BALLOON IS YELLOW ITW
ILL GIVE";
1260 PRINT #6;" YOU 250{3 SPACES}POI
NTS"
1270 PRINT #6;"GOOD LUCK!!!"
1279 POSITION 3,20
1280 PRINT #6;"PRESS ANY KEY"
1289 POKE 764,255

```

```

1290 IF PEEK(764)=255 THEN 1290
1291 GRAPHICS 0
1295 GOTO 5
1300 DIM T(2),TA$(120),TB$(120),TC$(
120),TD$(120),G$(25)
1301 IF PEEK(106)=155 THEN CHSET=(PE
EK(106)+1)*256:GRAPHICS 17:POKE
756,CHSET/256:RETURN
1305 POKE 106,PEEK(106)-5:GRAPHICS 1
7
1307 POSITION 5,5:? #6;"redefining"
1308 POSITION 5,10:? #6;"CHARACTERS"
1309 POSITION 4,15:? #6;"PLEASE WAI
T"
1310 CHSET=(PEEK(106)+1)*256
1315 POKE 756,CHSET/256
1320 FOR X=0 TO 1023:POKE CHSET+X,PE
EK(57344+X):NEXT X
1330 FOR I=24 TO 111:READ X:POKE CHS
ET+I,X:NEXT I
1370 RETURN
1380 DATA 28,62,47,63,63,126,96,0
1390 DATA 58,58,18,124,16,56,68,68
1400 DATA 128,64,32,16,24,28,38,37
1410 DATA 128,64,32,16,8,4,2,1
1420 DATA 1,2,4,8,24,56,100,164
1430 DATA 1,2,4,8,16,32,64,128
1440 DATA 0,0,0,255,24,24,36,36
1450 DATA 0,0,0,255,0,0,0,0
1460 DATA 170,85,170,85,170,85,170,8
5
1470 DATA 255,255,255,255,255,255,25
5,255
1480 DATA 170,85,170,85,170,85,170,8
5

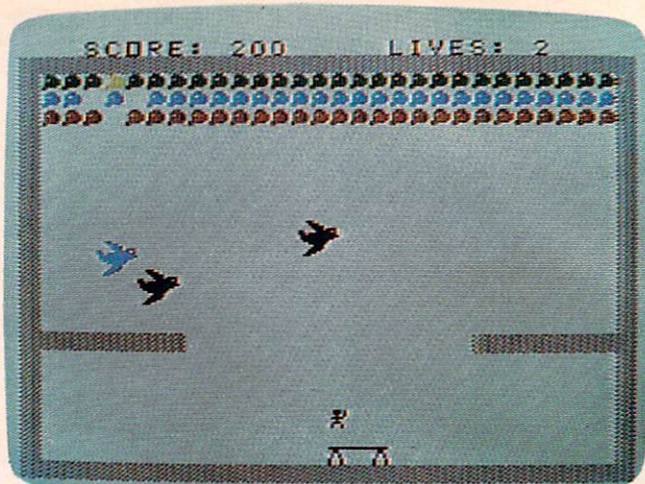
```

Program 5: Circus, TI-99/4A Version

```

10 DIM D1(20),E(20):: RANDOMIZE ::
GOTO 110
20 REM BOING!
30 FOR VOL=1 TO 30 STEP 6 :: CALL S
OUND(-50,VOL+110,VOL):: NEXT VOL
:: RETURN
40 REM SCORE
50 CALL HCHAR(ROW+DY,COL+DX,32):: C
ALL SOUND(10,-5,1):: SC=SC+(H=12
0)*-50+(H=112)*-75+(H=104)*-100+
((H=128)*(M1=1)*250):: BAL=BAL+1
60 IF BAL=84 THEN 150
70 IF (M1=0)*(H=128) THEN GOSUB 820
ELSE DISPLAY AT(1,10):STR$(SC);
80 M1=INT(RND*2):: IF M1=1 THEN CAL
L COLOR(13,11,1)ELSE CALL COLOR(
13,2,1)
90 IF (SC>(2000*VAR)) THEN LIFE=LIFE
+2 :: VAR=VAR+1 :: G1=1 :: GOSUB
820 :: G1=0
100 RETURN
110 GOSUB 430
120 G$=" abc "
130 VAR=1 :: SC=0
140 LIFE=3 :: V(0)=-1 :: V(1)=0 ::
V(2)=1
150 Y=23 :: X=13 :: COL=16 :: BAL=0
:: CALL CLEAR :: CALL SCREEN(1
5)
160 M1=INT(RND*2):: IF M1=1 THEN CAL
L COLOR(13,11,1)ELSE CALL COLO
R(13,2,1)
170 CALL HCHAR(2,2,100,30):: CALL H
CHAR(24,2,102,30):: CALL VCHAR(
3,2,101,21):: CALL VCHAR(3,31,1
01,21)
180 CALL HCHAR(3,3,104,28):: CALL H
CHAR(4,3,112,28):: CALL HCHAR(5
,3,120,13):: CALL HCHAR(5,19,12
0,12)
190 DISPLAY AT(1,3):"SCORE:";SC;TAB
(18);"LIVES:";LIFE
200 CALL HCHAR(17,3,103,7):: CALL H
CHAR(17,24,103,7)
210 DISPLAY AT(Y,X):G$
220 CALL MAGNIFY(3):: FOR T=1 TO 3
:: CALL SPRITE(#T,136,2+RND*12,
RND*90+50,120,0,RND*20+10):: NEX
T T
230 F=RND*27+3 :: CALL HCHAR(3,F,12
8)
240 FOR I=19 TO 5 STEP -1 :: CALL H
CHAR(I+2,COL,32,3):: CALL HCHAR
(I+1,COL,32,3):: CALL HCHAR(I,C
OL,120,3):: CALL HCHAR(I+1,17,9
6):: NEXT I
250 DISPLAY AT(8,4):"PRESS ANY KEY
TO START"
260 CALL KEY(0,K,S):: IF S=0 THEN 2
60
270 FOR G5=4 TO 27 :: CALL HCHAR(8,
G5,32):: FOR J1=1 TO 10 :: NEXT
J1 :: NEXT G5
280 ROW=6 :: COL=COL+1 :: DY=1 :: D
X=0
290 CALL KEY(0,K,S):: IF (K<>44)*(K
<>46) THEN 320
300 X=X+(K=44)+SGN(24-X)*(K=46)*-1
310 DISPLAY AT(23,X):G$
320 CALL GCHAR(ROW+DY,COL+DX,H):: I
F H=32 THEN 400
330 IF H=101 THEN CALL HCHAR(ROW,CO
L,32):: DX=-DX :: GOTO 290
340 IF (H=103)*(DY=-1) THEN CALL HCH
AR(ROW,COL,32):: ROW=ROW-2 :: C
ALL GCHAR(ROW,COL+2*DX,H):: COL
=COL+2*DX+SGN(DX)*(H=101):: GOT
O 320
350 IF (H=100)+((H=103)*(DY=1)) THEN
DY=-DY :: DX=V(INT(RND*3)):: G
OSUB 30 :: GOTO 320

```



A flock of birds provides a distraction in the TI version of "Circus."

```

360 IF (H>96)*(H<100)THEN DX=V(H-97
)::: DY=-DY :: GOSUB 30 :: GOTO
400
370 IF (H=102)THEN GOSUB 820
380 IF ((H=104)+(H=112)+(H=120)+(H=
128))*(FL=1)THEN GOSUB 50 :: GO
TO 290
390 IF (H=104)+(H=112)+(H=120)+(H=1
28)THEN GOSUB 50 :: DY=1 :: GOT
O 290
400 CALL HCHAR(ROW,COL,32):: ROW=RO
W+DY :: COL=COL+DX
410 CALL HCHAR(ROW,COL,96)
420 GOTO 290
430 FOR I=0 TO 3 :: CALL CHAR(104+I
*8,"1C3E2F3F3F7E6000"):: NEXT I
440 CALL COLOR(10,7,1):: CALL COLOR
(11,13,1):: CALL COLOR(12,5,1)
450 FOR I=96 TO 99 :: READ A$ :: CA
LL CHAR(I,A$):: NEXT I
460 DATA 3A3A127C10384444,FF3030484
8848484,FF00000000000000
470 DATA FF0C0C12121212121
480 CALL CHAR(136,"1C0F0703C1EF7F7F
3F0F03070F1E38000000C0DEF0FEFF
CF0E0C0C0800000000")
490 FOR I=100 TO 103 :: CALL CHAR(I
,"AA55AA55AA55AA55"):: NEXT I
500 FOR T=1 TO 20 :: READ D1(T),E(T
):: NEXT T
510 DATA 200,523,200,494,100,466,10
0,494,100,466,100,440,200,415,2
00,392,200,370,200,392
520 DATA 200,440,200,392,100,370,10
0,392,100,370,100,349,200,330,2
00,311,200,294,200,311
530 F=1 :: F1=7 :: F2=13 :: F3=5 ::
T=14
540 CALL CLEAR :: CALL SCREEN(15)
550 DISPLAY AT(8,10):"hp×hp×hp×h" :
: DISPLAY AT(9,10):"p
{8 SPACES}x" :: DISPLAY AT(10,1
0):"h CIRCUS p"
560 DISPLAY AT(11,10):"x{8 SPACES}h
" :: DISPLAY AT(12,10):"hp×hp×h
p×h"
570 FOR R=1 TO 20 :: CALL COLOR(10,
F1,F,11,F2,F,12,F3,F)
580 T=F1 :: F1=F2 :: F2=F3 :: F3=T
:: CALL SOUND(D1(R),E(R),2):: N
EXT R
590 DISPLAY AT(22,3):"INSTRUCTIONS
(Y/N)?" :: ACCEPT AT(22,23)VALI
DATE("YN"):A$
600 IF A$="N" THEN RETURN
610 CALL CLEAR :: PRINT "THIS IS TH
E GAME OF CIRCUS."
620 PRINT :: PRINT "THE OBJECT OF T
HE GAME IS"
630 PRINT :: PRINT "TO POP ALL OF T
HE BALLOONS"
640 PRINT :: PRINT "WITH THE MAN. T
O CATCH THE"
650 PRINT :: PRINT "MAN, POSITION T
HE TRAMPOLINE"
660 PRINT :: PRINT "WITH THE '<' AN
D '>' KEYS."
670 PRINT :: PRINT "ALL BORDERS, BU
T THE BOTTOM,"
680 PRINT :: PRINT "WILL BOUNCE THE
MAN BACK."
690 PRINT :: PRINT :: PRINT "AN EXT
RA MAN WILL BE AWARDED"
700 PRINT :: PRINT "FOR EVERY 2000
POINTS." :: PRINT :: PRINT :: P
RINT "PRESS ANY KEY TO CONTINUE
"
710 CALL KEY(0,K,S):: IF S=0 THEN 7
10
720 CALL CLEAR
730 PRINT :: PRINT "BE CAREFUL OF T
HE BALLOON ON"
740 PRINT :: PRINT "THE TOP ROW WHI
CH CHANGES"
750 PRINT :: PRINT "COLOR. WHEN THI
S BALLOON IS" :: PRINT :: PRINT
"BLACK, IT WILL BLOW UP IN"
760 PRINT :: PRINT "YOUR MAN'S FACE
. IF IT IS"
770 PRINT :: PRINT "YELLOW, YOU WIL
L RECEIVE 250"
780 PRINT :: PRINT "POINTS." :: PRI
NT :: PRINT :: PRINT T
AB(10);"GOOD LUCK!"
790 PRINT :: PRINT :: PRINT :: PRIN
T TAB(4);"PRESS ANY KEY TO STAR
T"
800 CALL KEY(0,K,S):: IF S=0 THEN 8
00 ELSE RETURN
810 REM LIFE-1
820 LIFE=LIFE-1 :: DISPLAY AT(1,25)
:STR$(LIFE):: IF LIFE=0 THEN 87
0
830 IF G1=0 THEN DISPLAY AT(Y,X):"
{3 SPACES}" :: CALL HCHAR(ROW,C
OL,32):: ROW=6 :: COL=17 :: DX=0
:: X=13 :: CALL HCHAR(ROW,COL,9
6):: DISPLAY AT(Y,X):G$
840 IF G1=1 THEN RETURN
850 CALL KEY(0,K,S):: IF S=0 THEN 8
50
860 RETURN
870 DISPLAY AT(8,7):"G A M E
{3 SPACES}O V E R" :: DISPLAY A
T(11,7):"PLAY AGAIN (Y/N)?"
880 ACCEPT AT(11,25)BEEP VALIDATE("
YN"):H$ :: IF H$="Y" THEN 130 E
LSE CALL DELSPRITE(ALL):: CALL
CLEAR :: STOP

```

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Quatrainment

Sean Puckett

Fast thinking and logic are required for "Quatrainment," as you race the clock and plan your moves to match a master pattern. Originally written for the Atari with 16K; versions also are included for VIC (3K expansion or more), 64 TI-99/4A, Apple, IBM PC, and TRS-80 Color Computer. Joystick required on all versions except TI and PC.

The object of "Quatrainment" is to match a pattern generated by the program, using the fewest moves possible and finishing in the shortest amount of time.

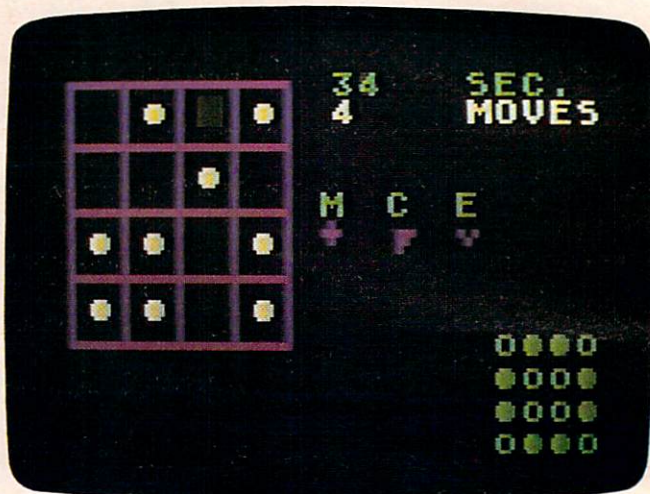
As the game begins, your game board is drawn at the left of the screen, and the master pattern is displayed at the right. A timer and move counter are also displayed.

A cursor appears in one of the squares on the game board. To change your pattern, use the joystick to move the cursor onto the square you want (on the TI and PC, use the arrow keys), then press the joystick button (on the TI, press ENTER; on the PC, press INSERT). Part of your pattern will toggle from on to off, or from off to on, depending on whether you are in the middle, in a corner, or at an edge of the board. The different ways the pattern can change are shown in examples displayed on the screen.

When you match the pattern, your weighted score will be displayed, based on elapsed time and the number of moves you made. The lower your score, the better.

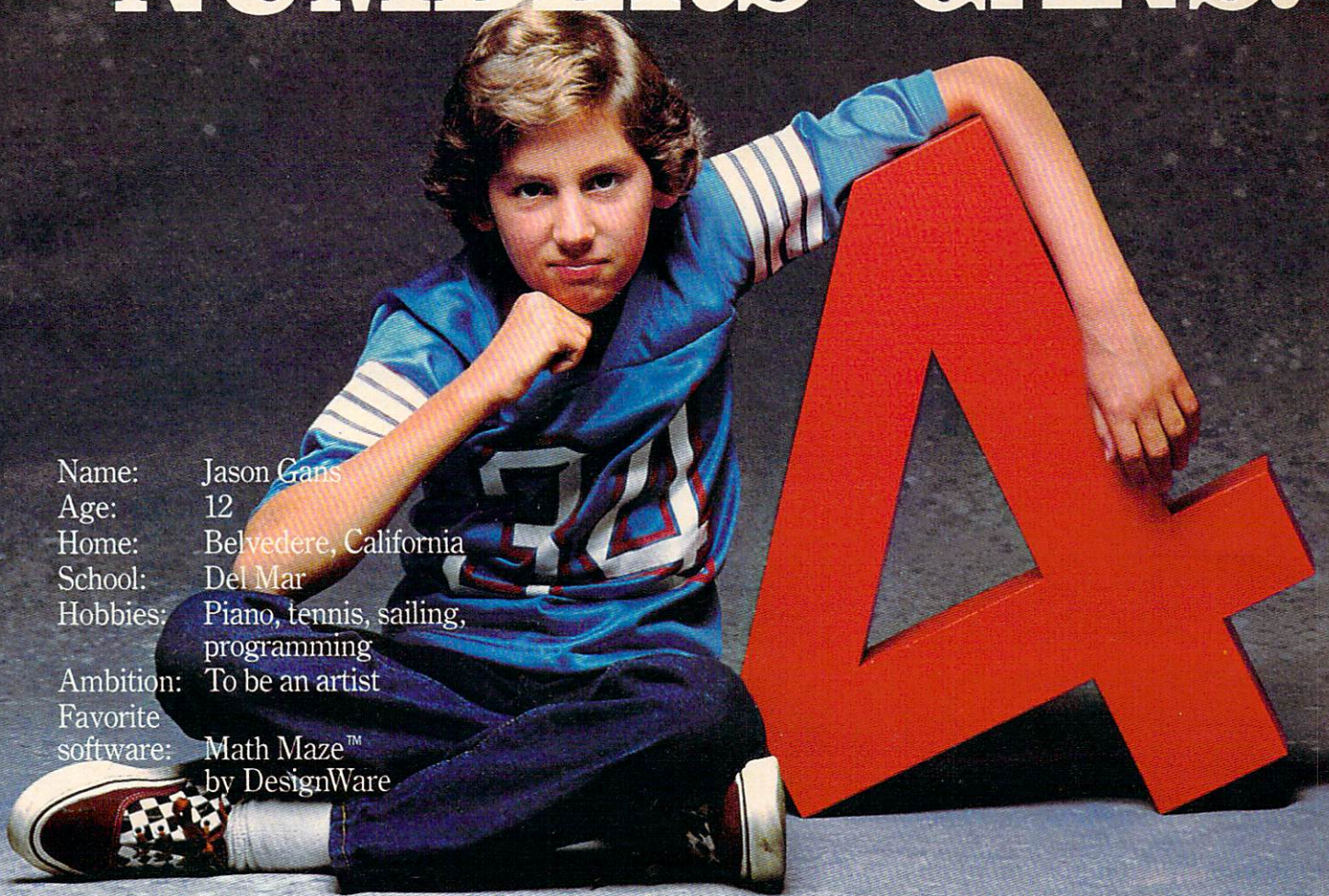
Program 1: Quatrainment, Atari Version

```
1 GRAPHICS 2+16:FOR A=0 TO 10 STEP 2
  :POSITION 0,A: ? #6;"(J) (J) (J) (J)
  (J) (J) (J) (J) (J) (J) (J) (J) (J)
  (J) (J) (J) (J) (J) (J) (J) (J) (J)
  (J)";:NEXT A
2 POKE 708,15:POSITION 4,1: ? #6;"QUA
  TRAINMENT":POKE 712,66
3 S1=50:S2=50:E1=4:E2=6: ? #6:POSITIO
  N 2,8: ? #6;"PRESS (J) START":PO
  KE 764,255
4 FOR A=15 TO 0 STEP -.1:SOUND 0,A*
  15,0,A:SOUND 1,A*15,2,A:NEXT A
5 B=PEEK(709):B=B+16*(B<240)-240*(B>
  240):POKE 709,B
6 A=PEEK(709):POKE 709,PEEK(710):POK
  E 710,PEEK(711):POKE 711,A:FOR D=1
  TO 50:NEXT D:IF PEEK(764)=255 THE
  N 5
7 FOR A=708 TO 712:B=PEEK(A)
8 IF B>15 THEN B=B-16:POKE A,B:GOTO
  8
9 IF B>0 THEN B=B-1:POKE A,B:GOTO 9
10 NEXT A:GRAPHICS 23:GOSUB 30000:DI
  M B(3,3),M$(100),FL(3,3),D(3,3):T
  EXT=ADR(A$):RESTORE
11 FOR R=0 TO 3:FOR RR=0 TO 3:B(R,RR
  )=(RND(0)>0.5):NEXT RR:NEXT R
12 GOSUB 20060:GOSUB 20020:GOSUB 200
  70
13 CX=0:CY=0:CCX=CX*16+8:CCY=CY*16+7
  :CXX=CCX:CYY=CCY:RESTORE 14
14 DATA 2,6,6,3,9,1,1,7,9,1,1,7,5,8,
  8,4
15 FOR R=0 TO 3:FOR RR=0 TO 3:READ Z
  1:FL(RR,R)=Z1:NEXT RR:NEXT R
16 GOSUB 6000
17 GOSUB 7000
18 XP=120:YP=0:C=2:M$="SEC.":GOSUB 2
  0000:XP=120:YP=7:C=3:M$="MOVES":G
  OSUB 20000
20 Q=STICK(0):Z=USR(TEXT,VV,3,CXX,CY
  Y):VA=32*(1-B(CX,CY))+20*B(CX,CY)
  :CXX=CCX:CYY=CCY:VV=VA
21 IF STRIG(0)=0 THEN GOSUB 5000:MOV
```



The object of "Quatrainment" is to make the patterns in the two grids match. Atari version.

THEY CALL HIM "NUMBERS" GANS.



Name: Jason Gans
Age: 12
Home: Belvedere, California
School: Del Mar
Hobbies: Piano, tennis, sailing,
programming
Ambition: To be an artist
Favorite software: Math Maze™
by DesignWare

"Math Maze is neat because you do more than just add and subtract numbers all the time. You've got to find them first. And then get there before you get caught.

"It's got real good graphics. I can even change the background color. And make the math as challenging as I want.

"There's lots of mazes, too. But the best thing is, I can make up my own. So when my friends come over, I've always got something new."

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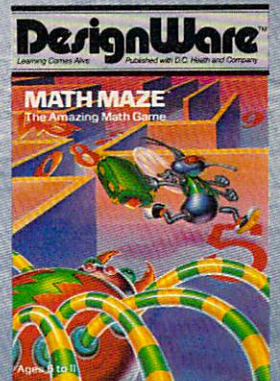
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SPELLING, MATH, OR LANGUAGE Games like *Math Maze*, *Spellicopter™* and *Creature Creator™* inspire youngsters to tap into that fertile idea-field. To actively become part of the program, in effect creating "new" games as they go along. And all the while building up solid skills in the basics. And all the while having a lot of plain old fun.

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As Jason Gans says, "Hey — they don't call me 'Numbers' for nothing, you know!"



DesignWare™

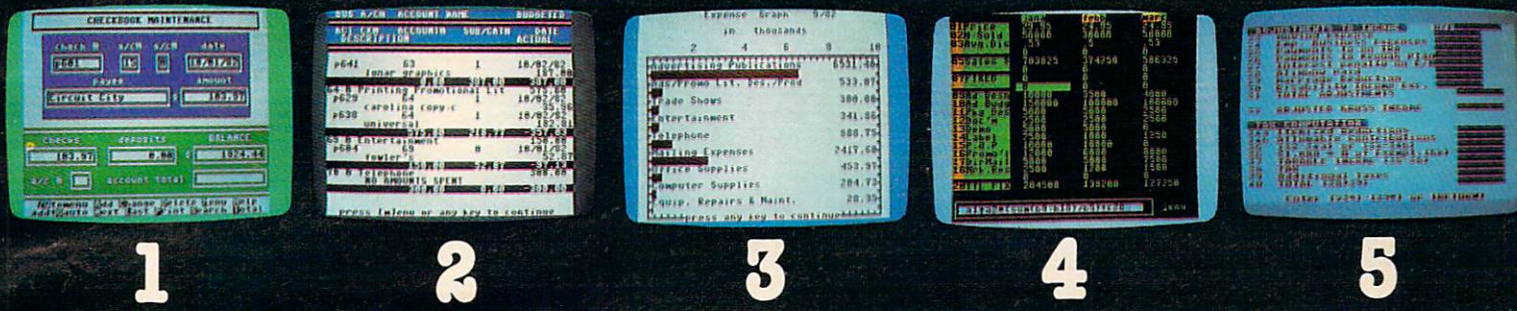
LEARNING COMES ALIVE

```

=MOV+1:M#=STR$(MOV):C=3:XP=80:YP=
7:GOSUB 20000
29 IF PEEK(20)>60 THEN POKE 20,0:TIM
E=TIME+1:M#=STR$(TIME):C=2:XP=80:
YP=0:GOSUB 20000:GOSUB 100
30 CX=CX-(Q=11 AND CX>0)+(Q=7 AND CX
<3):CY=CX-(Q=14 AND CY>0)+(Q=13 A
ND CY<3):CCX=16*CX+8:CCY=16*CY+7
40 Z=USR(TEXT,128+VA,2,CCX,CCY)
50 GOTO 20
100 FOR R=0 TO 3:FOR RR=0 TO 3:IF D(
R,RR)<>B(R,RR) THEN POP:POP:RE
TURN
101 NEXT RR:NEXT R:POP
102 FOR A=200 TO 0 STEP -5:FOR B=A T
O A+50 STEP 5:SOUND 0,B,10,15:PO
KE 712,B:NEXT B:NEXT A:SOUND 0,0
,0,0:POKE 712,0
103 M#="SCORE IS: ":SC=INT(TIME/10)*
INT(MOV/5):M$(LEN(M#)+1)=STR$(SC
):XP=0:YP=80:C=2:GOSUB 20000
107 XP=0:YP=88:C=1:M#="PRESS ANY KEY
":GOSUB 20000:POKE 764,255
110 IF PEEK(764)=255 THEN 110
111 RUN
5000 FL=FL(CX,CY)
5002 R=FL:C=1
5003 IF X(R,C)=9 THEN SOUND 0,0,0,0:
GOSUB 20030:RETURN
5004 X1=CX+X(R,C):Y1=CX+Y(R,C)
5005 B(X1,Y1)=1-B(X1,Y1):FOR G=15 TO
0 STEP -2:SOUND 0,50+50*B(X1,Y
1),10,G:NEXT G:C=C+1:GOTO 5003
6000 DATA -1,0,1,0,0,-1,0,0,4,0
6001 DATA 0,0,1,0,0,1,2,0,0,2,1,1,4,
0
6002 DATA 0,0,-1,0,0,1,-2,0,0,2,-1,1
,4,0
6003 DATA 0,0,-1,0,0,-1,-2,0,0,-2,-1
,-1,4,0
6004 DATA 0,0,1,0,0,-1,2,0,0,-2,1,-1
,4,0
6005 DATA -1,0,1,0,0,1,4,0
6006 DATA 0,-1,0,1,-1,0,4,0
6007 DATA -1,0,1,0,0,-1,4,0
6008 DATA 0,-1,0,1,1,0,3,0
6009 DIM X(9,9),Y(9,9):RESTORE 6000
6010 FOR R=0 TO 9:FOR RR=0 TO 9:X(R,
RR)=9:Y(R,RR)=9:NEXT RR:NEXT R:
R=1:C=1
6020 READ F,G:IF F=4 THEN R=R+1:C=1:
GOTO 6020
6030 IF F=3 THEN 6050
6040 X(R,C)=F:Y(R,C)=G:C=C+1:GOTO 60
20
6050 P=1:XP=80:YP=40:GOSUB 6090:Z=US
R(TEXT,ASC("M"),2,76,30)
6051 P=2:XP=100:YP=40:GOSUB 6090:Z=U
SR(TEXT,ASC("C"),2,96,30)
6052 P=6:XP=120:YP=40:GOSUB 6090:Z=U
SR(TEXT,ASC("E"),2,116,30)
6090 FOR R=1 TO 9:IF Y(P,R)=9 THEN N
EXT R:RETURN
6091 D=X(P,R)*2+XP:DD=Y(P,R)*2+YP:CO
LOR 1:PLOT D,DD:PLOT D+1,DD:PLO
T D+1,DD+1:PLOT D,DD+1:NEXT R:R
ETURN
7000 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1,
1,1,1
7001 DATA 0,0,0,0,0,1,1,0,0,1,1,0,0,
0,0,0
7002 DATA 0,1,1,0,1,0,0,1,1,0,0,1,0,
1,1,0
7003 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,
1,1,1
7004 DATA 1,0,0,1,0,1,1,0,0,1,1,0,1,
0,0,1
7005 RESTORE 7000:S=INT(RND(0)*10+1)
:IF S>1 THEN FOR A=1 TO S*16-16
:READ B:NEXT A
7006 FOR R=0 TO 3:FOR RR=0 TO 3:READ
Z1:D(RR,R)=Z1
7007 Z=USR(TEXT,111-91*Z1,2,RR*8+127
,R*8+63):SOUND 0,Z1*50+50,10,8:
NEXT RR:NEXT R:SOUND 0,0,0,0:RE
TURN
7010 DATA 1,1,1,1,0,0,0,0,0,0,0,0,1,
1,1,1
7011 DATA 0,0,0,1,0,0,0,1,0,0,0,1,0,
0,0,1
7012 DATA 1,0,0,1,0,0,0,0,0,0,0,0,1,
0,0,1
7013 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0
7014 DATA 0,0,0,0,1,0,0,1,1,0,0,1,0,
0,0,0
20000 FOR B=1 TO LEN(M#):Z1=XP+B*8-8
:Z=USR(TEXT,ASC(M$(B)),C,Z1,YP
):NEXT B:RETURN
20020 DATA {0}{R}{W}{R}{W}{R}{W}{R}
{E},! ! ! ! !,{A}{R}{S}{R}{S}
{R}{S}{R}{D},! ! ! ! !,{A}{R}
{S}{R}{S}{R}{S}{R}{D},! ! ! ! !
! ! ! ! !,{Z}{R}{X}{R}{X}{R}
{X}{R}{C}
20021 RESTORE 20020:C=1:FOR R=1 TO 9
:READ M#:YP=R*8-8:XP=0:GOSUB 2
0000:NEXT R
20030 FOR R=0 TO 3:FOR RR=0 TO 3:XP=
R*16+8:YP=RR*16+7:C=3:Z3=32*(1
-B(R,RR))+20*B(R,RR)
20031 Z=USR(TEXT,Z3,C,XP,YP):NEXT RR
:NEXT R
20050 RETURN
20060 FOR A=0 TO 15 STEP 0.1:POKE 71
2,A:NEXT A:POKE 708,0:POKE 709
,0:POKE 710,0:POKE 712,0:RETUR
N
20070 POKE 708,66:POKE 709,216:POKE
710,30:RETURN
20080 FOR A=15 TO 0 STEP -0.1:POKE 7
08,A:NEXT A:RETURN
20090 FOR A=16 TO 30 STEP 0.5:POKE 7
10,A:NEXT A:RETURN
30000 RESTORE 30000:DIM A$(354):FOR
I=0 TO 21:READ X:POKE 1536+I,X
:NEXT I
30001 RESTORE 32500:FOR A=1 TO 354:R
EAD J:A$(A)=CHR$(J):NEXT A:RET
URN
30160 DATA 169,0,133,212,162,8,70,18
6,144,3,24,101,187,106,102,212
,202,208,243,133,213,96
32500 DATA 104,240,10,201,4,240,13,1
70,104,104,202,208,251,169,22,
133,185,76,64
32501 DATA 185,104,133,195,104,201,1
28,144,4,41,127,198,195,170,14
1,22,6,224,96,176
32502 DATA 15,169,64,224,32,144,2,16
9,224,24,109,22,6,141,22,6,104
,104,141,23
32503 DATA 6,104,104,141,24,6,201,4,
144,5,56,233,4,176,247,133,214
,201,0,240

```


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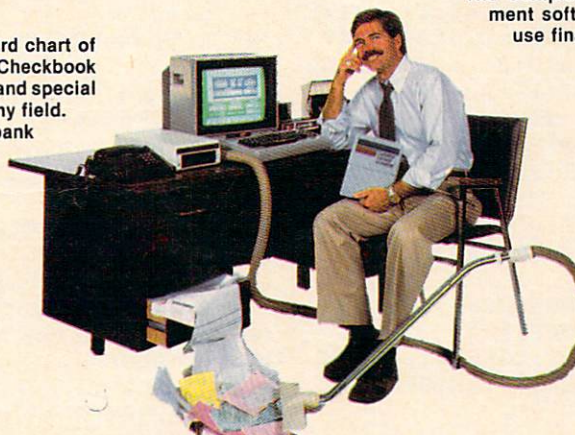
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```

32504 DATA 7,169,4,56,229,214,133,21
4,78,24,6,78,24,6,6,214,24,104
,104,141
32505 DATA 25,6,133,186,166,87,169,1
0,224,3,240,8,169,20,224,5,240
,2,169,40
32506 DATA 133,207,133,187,165,88,13
3,203,165,89,133,204,32,0,6,24
,173,24,6,101
32507 DATA 203,133,203,144,2,230,204
,24,165,203,101,212,133,203,16
5,204,101,213,133,204
32508 DATA 173,22,6,133,187,169,8,13
3,186,32,0,6,165,212,133,205,1
73,244,2,101
32509 DATA 213,133,206,160,0,162,8,1
69,0,133,209,133,208,177,205,6
9,195,72,104,10
32510 DATA 72,144,8,24,173,23,6,5,20
8,133,208,224,1,240,8,6,208,38
,209,6
32511 DATA 208,38,209,202,208,228,10
4,152,72,160,0,132,215,132,212
,166,214,240,88,56
32512 DATA 38,215,202,208,250,177,20
3,5,215,69,215,145,203,165,215
,73,255,133,215,200
32513 DATA 200,177,203,5,215,69,215,
145,203,166,214,6,209,38,212,2
02,208,249,160,0
32514 DATA 24,177,203,101,212,145,20
3,169,8,56,229,214,170,132,212
,70,208,102,212,202
32515 DATA 208,249,240,2,208,135,160
,2,24,177,203,101,212,145,203,
24,165,208,101,209
32516 DATA 160,1,145,203,24,144,9,16
5,209,145,203,200,165,208,145,
203,104,168,24,165
32517 DATA 203,101,207,133,203,144,2
,230,204,200,192,8,208,206,96

```

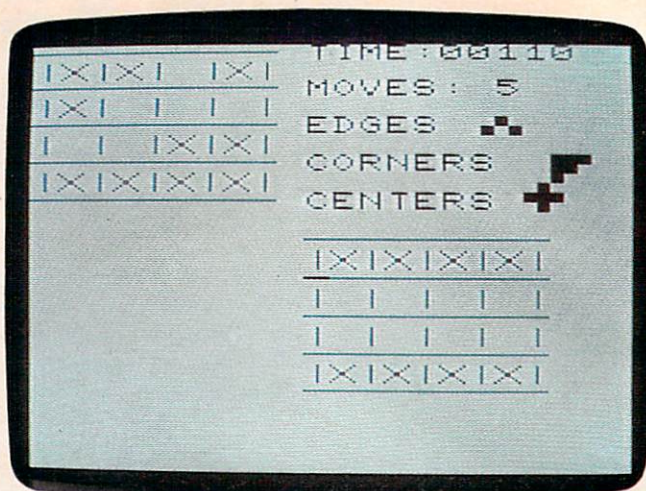
Program 2: Quatrainment, VIC Version (3K Expander, Or Better)

Version by Gregg Peele, Assistant Programming Supervisor

```

8 SR=4*(PEEK(36866)AND128)+64*(PEEK(36869
)AND120):CO=(37888+4*(PEEK(36866)AND128
))-SR
10 PRINT"{CLR}":POKE214,10:PRINT:POKE211,
5:A$="QUATRINMENT":POKE646,0
15 DF=37154:PA=37151:PB=37152
20 FORT=1TOLEN(A$):PRINTMID$(A$,T1,1);:F
ORT=1TO200:NEXT:NEXT:FORT=1TO500:NEXT
30 RN=16:REMFOR RANDOM INITIAL GRID CHANG
E LINE 30 TO RN=RND(0)*15+1
40 PRINT"{CLR}";TAB(10);"TIME:"
45 PRINT"{2 DOWN}{12 LEFT}MOVES:";MO
50 PRINT"{2 DOWN}{12 LEFT}EDGES [D]
[B]"
53 PRINT"{2 DOWN}{12 LEFT}CORNERS
{2 SPACES}{RVS} {OFF}[V]{DOWN}
{2 LEFT}[V]"
54 PRINT"{DOWN}{12 LEFT}CENTERS {UP}[D]
{DOWN}{LEFT}{RVS}[F]{OFF}[V]"
55 PRINT:POKE214,19:PRINT:POKE211,0:REM
{2 SPACES}PRINT"HIT {RVS}FIRE{OFF} IF
{SPACE}YOU MATCH"
100 GOTO140
110 FORL=1TO4:FORB=1TO4:D(L,B)=PEEK(C(L,B
)):NEXTB:NEXTL:RETURN
115 FORT=1TO500:NEXT

```



"Quatrainment," VIC version.

```

120 FORL=1TO4:FORB=1TO4:IFB(L,B)<>D(L,B)T
HENRETURN
130 NEXT:NEXT:SC=VAL(TI$)/16+MO/5:PRINT"
{HOME}{10 DOWN}":PRINT"{RIGHT}MATCHED
11{2 DOWN}"
135 PRINT" SCORE:";PRINT INT(SC);"{DOWN}"
136 PRINTTAB(5)"{3 DOWN}AGAIN Y OR N?"
137 IFPEEK(197)<>11ANDPEEK(197)<>28THEN13
7
138 IF PEEK(197)=11THENRUN
139 END
140 POKE36879,24
150 FORJ=0TO8STEP2
160 FORT=SR+230TOSR+176STEP22:POKET+J,93
170 POKET+CO+J,6:NEXT:NEXT
180 FORJ=0TO8STEP2
190 FORT=SR+230TOSR+8:POKET+J*22,67:POKET+CO+
J*22,6
200 NEXT:NEXT
210 FORJ=0TO8STEP2
215 FORT=SR+230TOSR+230+176STEP22:POKET+J
,93
220 POKET+CO+J,6:NEXT:NEXT
225 FORJ=0TO8STEP2
230 FORT=SR+230TOSR+8+230:POKET+J*22,67:P
OKET+CO+J*22,6
235 NEXT:NEXT
280 FORU=1TO4:FORT=1TO4:C(T,U)=SR+207+2*T
+44*U:NEXTT:NEXTU
300 FORT=1TO4:A(T,1)=SR+21+2*T:A(T,2)=SR+
65+2*T
305 A(T,3)=SR+109+2*T:A(T,4)=SR+153+2*T:N
EXT
310 GOSUB570:X=1:Y=1:GOSUB500
315 TI$="000000"
320 POKEDF,127:GP=PEEK(PB)AND128:JO=- (GP=
0)*4:POKEDF,255:GP=PEEK(PA):IFJOTHEN3
40
321 JO=-((GPAND8)=0)*2:IFJOTHEN340
322 JO=-((GPAND4)=0):IFJOTHEN340
324 JO=-((GPAND16)=0)*3
325 IFJO=0THENJO=5
340 ONJOGOSUB390,410,450,430,470
350 IF-((GPAND32)=0)=0THEN375
360 GOSUB910:MO=MO+1
370 GP=PEEK(PA):IF-((GPAND32)=0)=1 THEN37
0:GOSUB110:GOSUB120
375 PRINT"{HOME}";TAB(15);RIGHT$(TI$,5);"
{2 DOWN}{4 LEFT}";MO
380 GOTO320

```

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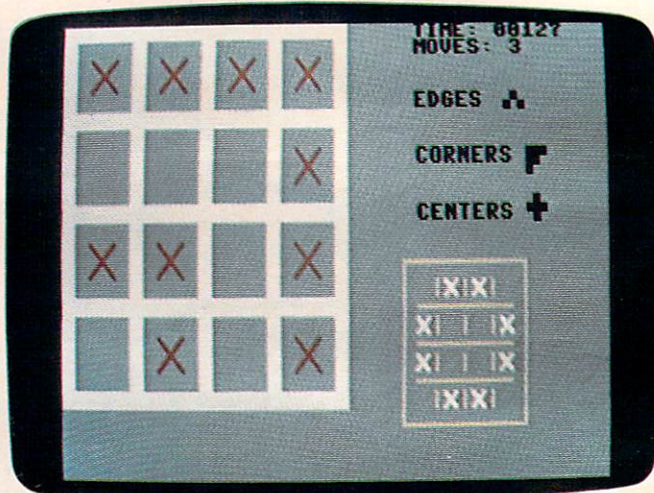
390 IFY-1<=0THEN480
400 Y=Y-1:GOSUB 500:RETURN
410 IFY+1=5THEN480
420 Y=Y+1:GOSUB500:RETURN
430 IFX+1=5THEN480
440 X=X+1:GOSUB500:RETURN
450 IFX-1<=0THEN480
460 X=X-1:GOSUB500:RETURN
470 GOSUB500:RETURN
480 RETURN
490 GOTO320
500 P1=PEEK(A(X,Y))
510 POKEA(X,Y),81
520 POKEA(X,Y)+CO,2:FORT=1TO50:NEXT
530 POKEA(X,Y),P1
535 P1=0
540 GOSUB110:GOSUB120:RETURN
570 WE=INT(RND(0)*8)+1:FORJ=1TOWE*RN:READ
Q:NEXT
580 FORY=1TO4:FORX=1TO4:READQ:IFQ=0THEN600
0
590 GOSUB610
600 NEXTX:NEXTY:GOSUB640:GOSUB680:RETURN
610 POKEA(X,Y),86
620 POKEA(X,Y)+CO,2
630 GOSUB110,120:RETURN
640 FORX=1TO4:FORY=1TO4:B(X,Y)=PEEK(A(X,Y
))
670 NEXTY:NEXTX:RETURN
680 FORY=1TO4:FORX=1TO4:READP
690 IFPTHENPOKEC(X,Y),86:POKEC(X,Y)+CO,0
700 NEXTX:NEXTY:RETURN
710 DATA1,1,1,1,1,0,0,1,1,0,0,1,1,1,1,
1
720 DATA0,0,0,0,0,1,1,0,0,1,1,0,0,0,0,
0
730 DATA0,1,1,0,1,0,0,1,1,0,0,1,0,1,1,
0
740 DATA1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
1
750 DATA1,0,0,1,0,1,1,0,0,1,1,0,1,0,0,
1
760 DATA1,1,1,1,0,0,0,0,0,0,0,0,1,1,1,
1
770 DATA0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,
1
775 DATA1,0,0,1,0,0,0,0,0,0,0,0,1,0,0,
1
780 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0
790 DATA0,0,0,0,1,0,0,1,1,0,0,1,0,0,0,
0
800 REM REVERSE
810 POKEA(C,D),118-PEEK(A(C,D))
830 POKEA(C,D)+CO,2
840 P1=0
860 RETURN
870 REM SET DATA POINTER
910 REM{2 SPACES}WHICH ONES{2 SPACES}TO C
HANGE
920 IFX+Y<>2THEN950
930 FORC=2TO3:D=1:GOSUB810:NEXT:FORD=1TO3
:C=1:GOSUB810:NEXT
940 D=2:C=2:GOSUB810:RETURN
950 IF X+Y<>8THEN980
960 FORC=3TO2STEP-1:D=4:GOSUB810:NEXT:FOR
D=4TO2STEP-1:C=4:GOSUB810:NEXT
970 C=3:D=3:GOSUB810:RETURN
980 IF X+Y<>5THEN1020
990 IF X<>4THEN 1020
1000 FORC=3TO2STEP-1:D=1:GOSUB810:NEXT:FO

```

```

RD=1TO3:C=4:GOSUB810:NEXT
1010 C=3:D=2:GOSUB810:RETURN
1020 IFX+Y<>5THEN1060
1030 IFX<>1THEN1060
1040 FORC=2TO3:D=4:GOSUB810:NEXT:FORD=4TO
2STEP-1:C=1:GOSUB810:NEXT
1050 C=2:D=3:GOSUB810:RETURN
1060 REM CHECK EDGES
1070 IF(X>1ANDX<4)AND(Y=1ORY=4)THENC=X-1:
D=Y:GOSUB810:C=X+1:GOSUB810:GOSUB110
0
1080 IF(Y>1ANDY<4)AND(X=1ORX=4)THEND=Y-1:
C=X:GOSUB810:D=Y+1:GOSUB810:GOSUB110
0
1090 GOTO1160
1100 IFY=1THEND=Y+1:C=X:GOSUB810
1110 IFY=4THEND=Y-1:C=X:GOSUB810
1120 IFX=4THENC=X-1:D=Y:GOSUB810
1130 IFX=1THENC=X+1:D=Y:GOSUB810
1140 RETURN
1150 REM CHECK CENTERS
1160 IF (X=1)OR(Y=1)OR(X=4)OR(Y=4)THEN 12
00
1170 D=Y+1:C=X:GOSUB810:C=X-1:D=Y:GOSUB81
0
1180 D=Y-1:C=X:GOSUB810:C=X+1:D=Y:GOSUB81
0
1190 C=X:D=Y:GOSUB810
1200 RETURN

```



"Quatrainment," 64 version.

Program 3: Quatrainment, 64 Version

Version by Gregg Peele, Assistant Programming Supervisor

```

10 PRINT"{CLR}":POKE214,10:PRINT:POKE211,
13:A$="QUATRINMENT":POKE646,0
20 FORT1=1TOLEN(A$):PRINTMID$(A$,T1,1):F
ORT=1TO200:NEXT:NEXT:FORT=1TO500:NEXT
30 RN=16:REMFOR RANDOM INITIAL GRID CHANG
E LINE 30 TO RN=RND(0)*15+1
40 PRINT"{CLR}";TAB(26);"TIME:"
45 PRINT"{DOWN}{14 LEFT}MOVES:";MO
50 PRINT"{3 DOWN}{14 LEFT}EDGES {D}
{B}"
53 PRINT"{3 DOWN}{14 LEFT}CORNERS {RVS}
{OFF}{V}{DOWN}{2 LEFT}{V}"
54 PRINT"{2 DOWN}{14 LEFT}CENTERS {UP}
{D}{DOWN}{LEFT}{RVS}{F}{OFF}{V}"
100 GOTO140
110 FORL=1TO4:FORB=1TO4:D(L,B)=PEEK(C(L,B
))-9:NEXTB:NEXTL:RETURN

```

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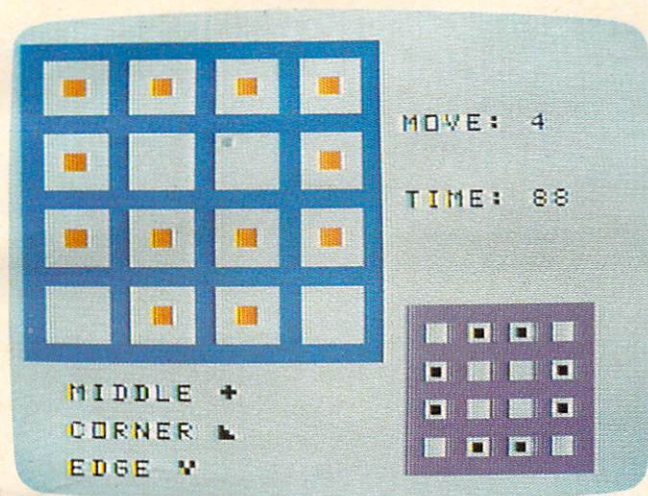
115 FORT=1TO500:NEXT
120 FORL=1TO4:FORB=1TO4:IFB(L,B)<>D(L,B)T
HENRETURN
130 NEXT:NEXT:SC=VAL(TI$)/16+MO/5:PRINT"
{CLR}{6 DOWN}"TAB(10)"YOU HAVE MATCHE
D IT!{DOWN}"
135 PRINTTAB(15);"SCORE:";INT(SC);"{DOWN}
"
136 PRINTTAB(11);"PLAY AGAIN Y OR N?"
137 IFPEEK(197)<>39ANDPEEK(197)<>25THEN13
7
138 IF PEEK(197)=25THENRUN
139 END
140 CO=54272:POKE53281,12:POKE53280,0
150 FORJ=0TO20STEP5
160 FORT=1024TO1804STEP40:POKET+J,160
170 POKET+54272+J,1:NEXT:NEXT
180 FORJ=0TO20STEP5
190 FORT=1024TO1024+20:POKET+J*40,160:POK
ET+54272+J*40,1
200 NEXT:NEXT
210 POKE 1569,79:POKE1569+CO,7:POKE1577,8
0:POKE1577+CO,7
220 POKE1889,76:POKE1889+54272,7:POKE1897
,122:POKE1897+CO,7
230 FORT=1609TO1849STEP40:POKET,116:POKE
{SPACE}T+CO,7:POKET+8,106:POKET+8+CO,
7:NEXT
240 FORT=1570TO1576:POKET,119:POKET+320,1
11:POKE T+CO,7:POKET+320+CO,7:NEXT
250 FORJ=0TO4STEP2:FORT=1611TO1611+240STE
P40:POKET+J,66:POKET+CO+J,7:NEXT:NEXT
260 FORT=1650TO1650+6:POKET,64:POKET+CO,7
:POKET+80,64:POKET+80+CO,7
270 POKET+160,64:POKET+160+CO,7:NEXT
280 FORU=1TO4:FORT=1TO4:C(T,U)=1528+2*T+8
0*U:NEXTT:NXTU
290 DATA106,1111,1116,1121
300 FORT=1TO4:READ E:A(T,1)=E:A(T,2)=E+20
0:A(T,3)=E+400:A(T,4)=E+600:NEXT
310 GOSUB570:X=1:Y=1:GOSUB500
315 TI$="000000"
320 JO=15-(PEEK(56320)AND15):IF JO<>1ANDJ
O<>2ANDJO<>4ANDJO<>8THENEND=5:GOTO340
330 D=LOG(JO)/LOG(2)+1
340 ONDGOSUB390,410,450,430,470
350 IF(PEEK(56320)AND16)THEN375
360 GOSUB910:MO=MO+1
370 IF(PEEK(56320)AND16)=0THEN370
375 PRINT"{HOME}";TAB(32);RIGHT$(TI$,5);"
{DOWN}{5 LEFT}";MO
380 GOTO320
390 IFY-1<=0THEN480
400 Y=Y-1:GOSUB 500:RETURN
410 IFY+1=5THEN480
420 Y=Y+1:GOSUB500:RETURN
430 IFX+1=5THEN480
440 X=X+1:GOSUB500:RETURN
450 IFX-1<=0THEN480
460 X=X-1:GOSUB500:RETURN
470 GOSUB500:RETURN
480 RETURN
490 GOTO320
500 P1=PEEK(A(X,Y)):P2=PEEK(A(X,Y)+1):P3=
PEEK(A(X,Y)+40):P4=PEEK(A(X,Y)+41)
510 POKEA(X,Y),213:POKEA(X,Y)+1,201:POKEA
(X,Y)+40,202:POKEA(X,Y)+41,203
520 POKEA(X,Y)+CO,2:POKEA(X,Y)+1+CO,2:POK
EA(X,Y)+40+CO,2:POKEA(X,Y)+41+CO,2
530 POKEA(X,Y),P1:POKEA(X,Y)+1,P2:POKEA(X
,Y)+40,P3:POKEA(X,Y)+41,P4
535 P1=0:P2=0:P3=0:P4=0:GOSUB110:GOSUB120
540 RETURN
570 WE=INT(RND(0)*8)+1:FORJ=1TOWE*RN:READ
Q:NEXT
580 FORY=1TO4:FORX=1TO4:READQ:IFQ=0THEN60
0
590 GOSUB610
600 NEXTX:NEXTY:GOSUB640:GOSUB680:RETURN
610 POKEA(X,Y),77:POKEA(X,Y)+1,78:POKEA(X
,Y)+40,78:POKEA(X,Y)+41,77
620 POKEA(X,Y)+CO,2:POKEA(X,Y)+1+CO,2:POK
EA(X,Y)+40+CO,2:POKEA(X,Y)+41+CO,2
630 RETURN
640 FORX=1TO4:FORY=1TO4:B(X,Y)=PEEK(A(X,Y
))
650 IFB(X,Y)=32THENB(X,Y)=B(X,Y)-9:GOTO67
0
660 B(X,Y)=B(X,Y)
670 NEXTY:NEXTX:RETURN
680 FORY=1TO4:FORX=1TO4:READP
690 IFPTHENPOKEC(X,Y),86:POKEC(X,Y)+CO,1
700 NEXTX:NEXTY:RETURN
710 DATA1,1,1,1,1,0,0,1,1,0,0,1,1,1,1,
1
720 DATA0,0,0,0,0,1,1,0,0,1,1,0,0,0,0,
0
730 DATA0,1,1,0,1,0,0,1,1,0,0,1,0,1,1,
0
740 DATA1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
1
750 DATA1,0,0,1,0,1,1,0,0,1,1,0,1,0,0,
1
760 DATA1,1,1,1,0,0,0,0,0,0,0,0,1,1,1,
1
770 DATA0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,
1
775 DATA1,0,0,1,0,0,0,0,0,0,0,0,1,0,0,
1
780 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0
790 DATA0,0,0,0,1,0,0,1,1,0,0,1,0,0,0,
0
800 REM REVERSE
810 POKEA(C,D),109-PEEK(A(C,D)):POKEA(C,D
)+1,110-(PEEK(A(C,D)+1))
820 POKEA(C,D)+40,110-PEEK(A(C,D)+40):POK
EA(C,D)+41,109-PEEK(A(C,D)+41)
830 POKEA(C,D)+CO,2:POKEA(C,D)+1+CO,2
840 POKEA(C,D)+40+CO,2:POKEA(C,D)+41+CO,2
:P1=0:P2=0:P3=0:P4=0
860 RETURN
870 REM SET DATA POINTER
910 REM{2 SPACES}WHICH ONES{2 SPACES}TO C
HANGE
920 IFX+Y<>2THEN950
930 FORC=2TO3:D=1:GOSUB810:NEXT:FORD=1TO3
:C=1:GOSUB810:NEXT
940 D=2:C=2:GOSUB810:RETURN
950 IF X+Y<>8THEN980
960 FORC=3TO2STEP-1:D=4:GOSUB810:NEXT:FOR
D=4TO2STEP-1:C=4:GOSUB810:NEXT
970 C=3:D=3:GOSUB810:RETURN
980 IF X+Y<>5THEN1020
990 IF X<>4THEN 1020
1000 FORC=3TO2STEP-1:D=1:GOSUB810:NEXT:FO
RD=1TO3:C=4:GOSUB810:NEXT
1010 C=3:D=2:GOSUB810:RETURN
1020 IFX+Y<>5THEN1060
1030 IFX<>1THEN1060
1040 FORC=2TO3:D=4:GOSUB810:NEXT:FORD=4TO
2STEP-1:C=1:GOSUB810:NEXT

```

```

1050 C=2:D=3:GOSUB810:RETURN
1060 REM CHECK EDGES
1070 IF(X>1ANDX<4)AND(Y=1ORY=4)THENC=X-1:
D=Y:GOSUB810:C=X+1:GOSUB810:GOSUB110
0
1080 IF(Y>1ANDY<4)AND(X=1ORX=4)THEND=Y-1:
C=X:GOSUB810:D=Y+1:GOSUB810:GOSUB110
0
1090 GOTO1160
1100 IFY=1THEND=Y+1:C=X:GOSUB810
1110 IFY=4THEND=Y-1:C=X:GOSUB810
1120 IFX=4THENC=X-1:D=Y:GOSUB810
1130 IFX=1THENC=X+1:D=Y:GOSUB810
1140 RETURN
1150 REM CHECK CENTERS
1160 IF (X=1)OR(Y=1)OR(X=4)OR(Y=4)THEN 12
00
1170 D=Y+1:C=X:GOSUB810:C=X-1:D=Y:GOSUB81
0
1180 D=Y-1:C=X:GOSUB810:C=X+1:D=Y:GOSUB81
0
1190 C=X:D=Y:GOSUB810
1200 RETURN
1210 PRINT"YOU WIN "

```



"Quatrainment," TI version.

Program 4: Quatrainment, TI-99/4A Version

Version by Patrick Parrish, Programming Supervisor

```

100 GOTO 150
110 FOR I=1 TO LEN(H$)
120 CALL HCHAR(ROW, COL+I, ASC(SEG$(H$, I, 1)))
130 NEXT I
140 RETURN
150 DIM W(10, 4, 4), MASTER(4, 4), M(4, 4), U(4, 4)
160 RANDOMIZE
170 GOSUB 2010
180 GOSUB 2150
190 GOSUB 1740
200 GOSUB 1830
210 R=2
220 C=3
230 KHAR=112
240 KHAR=225-KHAR
250 CALL HCHAR(R, C, KHAR)
260 TIME=TIME+1
270 IF TIME<5 THEN 320
280 H$=STR$(INT(TIME/5))
290 FOR I=1 TO LEN(H$)

```

```

300 CALL HCHAR(9, 25+I, ASC(SEG$(H$, I, 1)))
310 NEXT I
320 CALL KEY(0, K, S)
330 IF S=1 THEN 350
340 GOTO 240
350 CALL HCHAR(R, C, 112)
360 IF K<>69 THEN 390
370 R=R-SGN(R-2)*4
380 GOTO 250
390 IF K<>83 THEN 420
400 C=C-SGN(C-3)*4
410 GOTO 250
420 IF K<>88 THEN 450
430 R=R+SGN(14-R)*4
440 GOTO 250
450 IF K<>68 THEN 480
460 C=C+SGN(15-C)*4
470 GOTO 250
480 IF K<>13 THEN 280
490 MOVE=MOVE+1
500 H$=STR$(MOVE)
510 FOR I=1 TO LEN(H$)
520 CALL HCHAR(5, 25+I, ASC(SEG$(H$, I, 1)))
530 NEXT I
540 Z=U((R-2)/4, (C-3)/4)
550 ON Z GOTO 560, 670, 780, 890, 1000, 1110, 1180, 1250, 1320
560 CALL GCHAR(R-3, C+1, H)
570 CALL HCHAR(R-3, C+1, D-H)
580 CALL GCHAR(R+1, C-3, H)
590 CALL HCHAR(R+1, C-3, D-H)
600 CALL GCHAR(R+1, C+1, H)
610 CALL HCHAR(R+1, C+1, D-H)
620 CALL GCHAR(R+1, C+5, H)
630 CALL HCHAR(R+1, C+5, D-H)
640 CALL GCHAR(R+5, C+1, H)
650 CALL HCHAR(R+5, C+1, D-H)
660 GOTO 1390
670 FOR I=1 TO 9 STEP 4
680 CALL GCHAR(R+1, C+I, H)
690 CALL HCHAR(R+1, C+I, D-H)
700 NEXT I
710 CALL GCHAR(R+5, C+1, H)
720 CALL HCHAR(R+5, C+1, D-H)
730 CALL GCHAR(R+5, C+5, H)
740 CALL HCHAR(R+5, C+5, D-H)
750 CALL GCHAR(R+9, C+1, H)
760 CALL HCHAR(R+9, C+1, D-H)
770 GOTO 1390
780 FOR I=-1 TO 7 STEP 4
790 CALL GCHAR(R+1, C-I, H)
800 CALL HCHAR(R+1, C-I, D-H)
810 NEXT I
820 CALL GCHAR(R+5, C+1, H)
830 CALL HCHAR(R+5, C+1, D-H)
840 CALL GCHAR(R+5, C-3, H)
850 CALL HCHAR(R+5, C-3, D-H)
860 CALL GCHAR(R+9, C+1, H)
870 CALL HCHAR(R+9, C+1, D-H)
880 GOTO 1390
890 FOR I=-1 TO 7 STEP 4
900 CALL GCHAR(R+1, C-I, H)
910 CALL HCHAR(R+1, C-I, D-H)
920 NEXT I
930 CALL GCHAR(R-3, C+1, H)
940 CALL HCHAR(R-3, C+1, D-H)
950 CALL GCHAR(R-3, C-3, H)
960 CALL HCHAR(R-3, C-3, D-H)
970 CALL GCHAR(R-7, C+1, H)

```

```

980 CALL HCHAR(R-7,C+1,D-H)
990 GOTO 1390
1000 FOR I=1 TO 9 STEP 4
1010 CALL GCHAR(R+1,C+I,H)
1020 CALL HCHAR(R+1,C+I,D-H)
1030 NEXT I
1040 CALL GCHAR(R-3,C+1,H)
1050 CALL HCHAR(R-3,C+1,D-H)
1060 CALL GCHAR(R-3,C+5,H)
1070 CALL HCHAR(R-3,C+5,D-H)
1080 CALL GCHAR(R-7,C+1,H)
1090 CALL HCHAR(R-7,C+1,D-H)
1100 GOTO 1390
1110 CALL GCHAR(R+1,C-3,H)
1120 CALL HCHAR(R+1,C-3,D-H)
1130 CALL GCHAR(R+1,C+5,H)
1140 CALL HCHAR(R+1,C+5,D-H)
1150 CALL GCHAR(R+5,C+1,H)
1160 CALL HCHAR(R+5,C+1,D-H)
1170 GOTO 1390
1180 CALL GCHAR(R-3,C+1,H)
1190 CALL HCHAR(R-3,C+1,D-H)
1200 CALL GCHAR(R+1,C-3,H)
1210 CALL HCHAR(R+1,C-3,D-H)
1220 CALL GCHAR(R+5,C+1,H)
1230 CALL HCHAR(R+5,C+1,D-H)
1240 GOTO 1390
1250 CALL GCHAR(R+1,C-3,H)
1260 CALL HCHAR(R+1,C-3,D-H)
1270 CALL GCHAR(R+1,C+5,H)
1280 CALL HCHAR(R+1,C+5,D-H)
1290 CALL GCHAR(R-3,C+1,H)
1300 CALL HCHAR(R-3,C+1,D-H)
1310 GOTO 1390
1320 CALL GCHAR(R-3,C+1,H)
1330 CALL HCHAR(R-3,C+1,D-H)
1340 CALL GCHAR(R+1,C+5,H)
1350 CALL HCHAR(R+1,C+5,D-H)
1360 CALL GCHAR(R+5,C+1,H)
1370 CALL HCHAR(R+5,C+1,D-H)
1380 REM CHECK WORK VS MASTER GRID
1390 FOR I=0 TO 3
1400 FOR J=0 TO 3
1410 CALL GCHAR(I*4+3,J*4+4,H)
1420 M(I,J)=H-120
1430 FL=0
1440 IF M(I,J)=MASTER(I,J) THEN 1480
1450 I=3
1460 J=3
1470 FL=1
1480 NEXT J
1490 NEXT I
1500 IF FL<>1 THEN 1530
1510 GOTO 230
1520 REM YOU WIN
1530 FOR I=220 TO 880 STEP 30
1540 CALL SOUND(50,I,3)
1550 NEXT I
1560 H$="YOU WIN!"
1570 ROW=11
1580 COL=19
1590 GOSUB 110
1600 SC=INT(TIME/5)*INT(MOVE/5)
1610 H$="SCORE="&STR$(SC)
1620 ROW=12
1630 COL=19
1640 GOSUB 110
1650 H$="AGAIN ?"
1660 ROW=14
1670 COL=19
1680 GOSUB 110
1690 CALL KEY(0,K,S)
1700 IF S=0 THEN 1690
1710 IF (K<>89)*(K<>78) THEN 1690
1720 IF K=89 THEN 180
1730 STOP
1740 FOR I=0 TO 3
1750 FOR J=0 TO 3
1760 RANDOMIZE
1770 Z=INT(RND*2)
1780 M(I,J)=Z
1790 NEXT J
1800 NEXT I
1810 RETURN
1820 REM SET UP WORK GRID
1830 FOR I=0 TO 3
1840 FOR J=0 TO 3
1850 CALL HCHAR(I*4+3,J*4+4,120+M(I,J))
1860 NEXT J
1870 NEXT I
1880 RETURN
1890 READ A,A#
1900 IF A=-1 THEN 1970
1910 CALL CHAR(A,A#)
1920 GOTO 1890
1930 DATA 97,0000000000000000,98,FF
      FFFFFFFFFFFFFFFF,104,FFFFFFFFFFFF
      FFFF
1940 DATA 112,0000000000000000,113,
      00003C3C3C3C0000,114,0018187E7
      E181800
1950 DATA 115,0000C0C0F0F0FCFC,116,
      0066666618181800,120,000000000
      00000000
1960 DATA 121,FFFFFFFFFFFFFFFF,-1,A
1970 CALL COLOR(9,5,1)
1980 CALL COLOR(10,13,1)
1990 CALL COLOR(12,9,1)
2000 RETURN
2010 CALL CLEAR
2020 CALL SCREEN(10)
2030 PRINT TAB(9);"QUATRINMENT"
2040 FOR T=1 TO 10
2050 PRINT
2060 NEXT T
2070 PRINT TAB(8);"ENTERING DATA"
2080 PRINT
2090 PRINT TAB(6);"...PLEASE WAIT..
      ."
2100 PRINT
2110 PRINT
2120 GOSUB 1890
2130 GOSUB 2420
2140 RETURN
2150 CALL CLEAR
2160 CALL SCREEN(15)
2170 PRINT TAB(18);"MOVE: 0"
2180 SC=0
2190 TIME=0
2200 MOVE=0
2210 PRINT
2220 PRINT
2230 PRINT
2240 PRINT TAB(18);"TIME: 0"
2250 FOR T=1 TO 9
2260 PRINT
2270 NEXT T
2280 PRINT TAB(2);"MIDDLE ";CHR$(11
      4)
2290 PRINT
2300 PRINT TAB(2);"CORNER ";CHR$(11
      5)

```



```

2310 PRINT
2320 PRINT TAB(2);"EDGE ";CHR$(116)
2330 FOR I=0 TO 4
2340 CALL HCHAR(I*4+1,2,98,17)
2350 CALL VCHAR(1,I*4+2,98,17)
2360 NEXT I
2370 FOR T=0 TO 4
2380 CALL HCHAR(T*2+15,20,104,9)
2390 CALL VCHAR(16,T*2+20,104,7)
2400 NEXT T
2410 GOTO 2680
2420 FOR K=1 TO 10
2430 FOR I=0 TO 3
2440 FOR J=0 TO 3
2450 READ W(K,I,J)
2460 NEXT J
2470 NEXT I
2480 NEXT K
2490 FOR I=0 TO 3
2500 FOR J=0 TO 3
2510 READ U(I,J)
2520 NEXT J
2530 NEXT I
2540 D=241
2550 RETURN
2560 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1,
1,1,1
2570 DATA 0,0,0,0,0,1,1,0,0,1,1,0,0,
0,0,0
2580 DATA 0,1,1,0,1,0,0,1,1,0,0,1,0,
1,1,0
2590 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,
1,1,1
2600 DATA 1,0,0,1,0,1,1,0,0,1,1,0,1,
0,0,1
2610 DATA 1,1,1,1,0,0,0,0,0,0,0,0,1,
1,1,1
2620 DATA 0,0,0,1,0,0,0,1,0,0,0,1,0,
0,0,1
2630 DATA 1,0,0,1,0,0,0,0,0,0,0,0,1,
0,0,1
2640 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0
2650 DATA 0,0,0,0,1,0,0,1,1,0,0,1,0,
0,0,0
2660 DATA 2,6,6,3,9,1,1,7,9,1,1,7,5,
8,8,4
2670 REM SET UP MASTER GRID
2680 RANDOMIZE
2690 F=INT(RND*10)+1
2700 FOR I=0 TO 3
2710 FOR J=0 TO 3
2720 CALL HCHAR(2*I+16,2*J+21,112+W
(F,I,J))
2730 MASTER(I,J)=W(F,I,J)
2740 NEXT J
2750 NEXT I
2760 RETURN

```

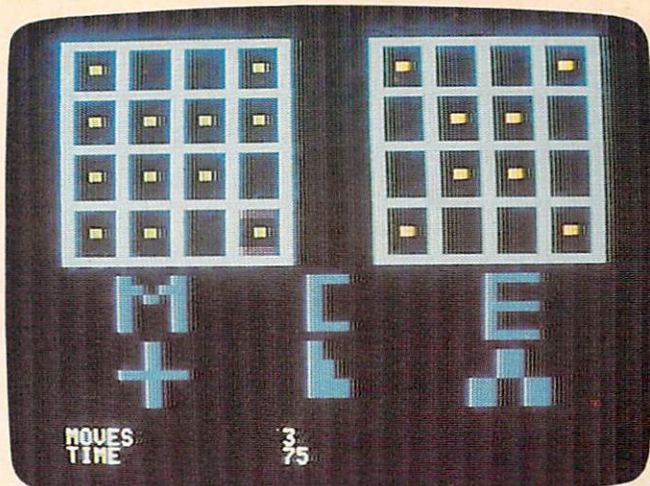
Program 5: Quatrainment, Apple Version

Version by Chris Poer, Editorial Programmer

```

5 TEXT : HOME : FLASH : VTAB 7: HTAB 1
7: PRINT "QUATRINMENT"
10 INVERSE : VTAB 12: HTAB 12: PRINT "
PRESS ANY KEY TO BEGIN": VTAB 7: HTAB
19: GET XX$: NORMAL
20 GOSUB 1000
30 GOSUB 1100
35 GOSUB 1300
50 P1 = INT ( PDL (0) / 64):P2 = INT
(PDL (1) / 64):X = P1 * 4 + 2:Y =

```



"Quatrainment," Apple version.

```

P2 * 6 + 3
60 COLOR= 1: HLIN P1 * 4 + 1,P1 * 4 +
3 AT P2 * 6 + 1: HLIN P1 * 4 + 1,P
1 * 4 + 3 AT P2 * 6 + 5
70 COLOR= 0: HLIN P1 * 4 + 1,P1 * 4 +
3 AT P2 * 6 + 1: HLIN P1 * 4 + 1,P
1 * 4 + 3 AT P2 * 6 + 5
80 IF ( PEEK ( - 16286) > 127 OR PEEK
( - 16287) > 127) THEN GOSUB 1200
: GOSUB 2100:MOV = MOV + 1: VTAB 2
2: HTAB 17: PRINT MOV
90 TC = TC + 1: IF TC > 10 THEN TIME =
TIME + 1:TC = 0: VTAB 23: HTAB 17:
PRINT TIME
100 GOTO 50
1000 GR : COLOR= 6: HLIN 0,16 AT 0: HLIN
24,39 AT 0: HLIN 0,16 AT 6: HLIN 2
4,39 AT 6: HLIN 0,16 AT 12: HLIN 2
4,39 AT 12
1010 HLIN 0,16 AT 18: HLIN 24,39 AT 18
: HLIN 0,16 AT 24: HLIN 24,39 AT 2
4
1020 VLIN 0,24 AT 0: VLIN 0,24 AT 23: VLIN
0,24 AT 4: VLIN 0,24 AT 27: VLIN 0
,24 AT 8: VLIN 0,24 AT 31
1030 VLIN 0,24 AT 12: VLIN 0,24 AT 35:
VLIN 0,24 AT 16: VLIN 0,24 AT 39
1040 RETURN
1100 FOR R = 0 TO 3: FOR RR = 0 TO 3:B
(R,RR) = INT ( RND (1) * 1 + .5):
NEXT : NEXT
1110 COLOR= 12: FOR RR = 0 TO 3: FOR R
= 0 TO 3: IF B(R,RR) = 1 THEN PLOT
RR * 4 + 2,R * 6 + 3
1120 NEXT : NEXT
1130 FOR I = 1 TO 10: FOR C = 0 TO 3: FOR
R = 0 TO 3: READ Z1:E(I,C,R) = Z1:
NEXT : NEXT : NEXT
1140 S = INT ( RND (1) * 10 + 1): FOR
C = 0 TO 3: FOR R = 0 TO 3:D(C,R) =
E(S,C,R): NEXT : NEXT
1150 COLOR= 9: FOR RR = 0 TO 3: FOR R =
0 TO 3: IF D(R,RR) = 1 THEN PLOT
RR * 4 + 25,R * 6 + 3
1160 NEXT : NEXT
1170 FOR A = 1 TO 9: FOR I = 1 TO 6
1180 READ Z1,Z2:X1(A,I) = Z1:Y1(A,I) = Z2
1190 NEXT : NEXT : RETURN
1200 IF (P1 = 1 OR P1 = 2) AND (P2 = 1
OR P2 = 2) THEN A = 1: GOSUB 2000
: RETURN

```

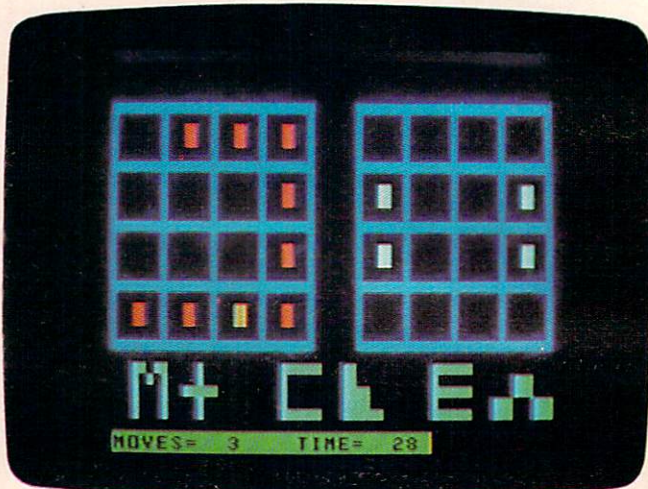
```

1210 IF (P1 = 1 OR P1 = 2) AND P2 = 0 THEN
A = 2: GOSUB 2000: RETURN
1220 IF (P1 = 1 OR P1 = 2) AND P2 = 3 THEN
A = 3: GOSUB 2000: RETURN
1230 IF (P2 = 1 OR P2 = 2) AND P1 = 0 THEN
A = 4: GOSUB 2000: RETURN
1240 IF (P2 = 1 OR P2 = 2) AND P1 = 3 THEN
A = 5: GOSUB 2000: RETURN
1250 IF P1 = 0 AND P2 = 0 THEN A = 6: GOSUB
2000: RETURN
1260 IF P1 = 3 AND P2 = 0 THEN A = 7: GOSUB
2000: RETURN
1270 IF P1 = 3 AND P2 = 3 THEN A = 8: GOSUB
2000: RETURN
1280 A = 9: GOSUB 2000: RETURN
1300 COLOR= 2: VLIN 26,31 AT 4: PLOT 5
,27: PLOT 6,28: PLOT 7,27: VLIN 31
,26 AT 8
1310 VLIN 33,39 AT 6: HLIN 4,8 AT 36
1320 VLIN 26,31 AT 18: HLIN 18,20 AT 2
6: HLIN 18,20 AT 31
1330 VLIN 33,38 AT 18: VLIN 35,38 AT 1
9: VLIN 37,38 AT 20
1340 VLIN 26,31 AT 31: HLIN 31,34 AT 2
6: HLIN 31,34 AT 29: HLIN 31,34 AT
32
1350 VLIN 37,39 AT 30: VLIN 37,39 AT 3
1: HLIN 32,33 AT 36: HLIN 32,33 AT
35: HLIN 32,33 AT 34: VLIN 37,39 AT
34: VLIN 37,39 AT 35
1355 PRINT : PRINT
1360 VTAB 23: PRINT "MOVES";: PRINT ,M
OV: PRINT "TIME";: PRINT ,TIME: RETURN

2000 FOR I = 1 TO 6
2005 IF X1(A,I) = 1 THEN 2030
2010 IF SCRN( X + X1(A,I),Y + Y1(A,I)
) > 0 THEN COLOR= 0: PLOT X + X1(
A,I),Y + Y1(A,I):B((Y - 3 + Y1(A,I)
) / 6,(X - 2 + X1(A,I)) / 4) = 0:
GOTO 2030
2020 COLOR= 12: PLOT X + X1(A,I),Y + Y
1(A,I):B(((Y - 3 + Y1(A,I)) / 6),(
(X - 2 + X1(A,I)) / 4)) = 1
2030 NEXT : RETURN
2100 FOR R = 0 TO 3: FOR RR = 0 TO 3: IF
B(R,RR) < > D(R,RR) THEN RETURN

2110 NEXT : NEXT
2120 SC = INT (TIME / 10) * INT (MOV /
5)
2130 TEXT : HOME : VTAB 10: FLASH : HTAB
16: PRINT "YOU HAVE WON": VTAB 13:
HTAB 11: PRINT "YOUR SCORE IS ";S
C; " POINTS"
2140 NORMAL : END
20000 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1,
1,1,1
20010 DATA 0,0,0,0,0,1,1,0,0,1,1,0,0,
0,0,0
20020 DATA 0,1,1,0,1,0,0,1,1,0,0,1,0,
1,1,0
20030 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,1,
1,1,1
20040 DATA 1,0,0,1,0,1,1,0,0,1,1,0,1,
0,0,1
20050 DATA 1,1,1,1,0,0,0,0,0,0,0,0,1,
1,1,1
20060 DATA 0,0,0,1,0,0,0,1,0,0,0,1,0,
0,0,1
20070 DATA 1,0,0,1,0,0,0,0,0,0,0,0,1,
0,0,1
20080 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0
20090 DATA 0,0,0,0,1,0,0,1,1,0,0,1,0,
0,0,0
20110 DATA 0,0,-4,0,4,0,0,-6,0,6,1,1
20120 DATA 4,0,-4,0,0,6,1,1,1,1,1,1
20130 DATA 4,0,-4,0,0,-6,1,1,1,1,1,1
20140 DATA 4,0,0,-6,0,6,1,1,1,1,1,1
20150 DATA -4,0,0,-6,0,6,1,1,1,1,1,1
20160 DATA 0,0,0,6,0,12,4,0,4,6,8,0
20170 DATA 0,0,0,6,0,12,-4,0,-4,6,-8,
0
20180 DATA 0,0,0,-6,0,-12,-4,0,-4,-6,
-8,0
20190 DATA 0,0,0,-6,0,-12,4,-6,4,0,8,
0

```



"Quatrainment," Color Computer version.

Program 6: Quatrainment, TRS-80 Color Computer Version

Version by Chris Poer, Editorial Programmer

```

1 DIM W(10,3,3),X1(10,6),Y1(10,6),D
(4,4)
5 CLS(0)
10 A$=" T N E M N I A R T A U Q"
12 FOR I=1 TO 25:FOR A=37 TO 61-I:FOR
T=1 TO 15:NEXT T:PRINT@A-1,"
";:PRINT@A,MID$(A$,I,1);:NEXT A:
NEXT I
15 PRINT@294,"HIT ANY KEY TO BEGIN."
;
16 IF INKEY$="" THEN 16 ELSE CLS(0)
20 GOSUB 1000
30 GOSUB 1100
40 GOSUB 1300
50 P1= INT(JOYSTK(0)/16):P2=INT(JOY
STK(1)/16):X=P1*7+3:Y=P2*5+2
60 SET(P1*7+3,P2*5+2,2):SET(P1*7+3,
P2*5+3,2):SET(P1*7+4,P2*5+2,2):S
ET(P1*7+4,P2*5+3,2)
70 IF B(P2,P1)=1 THEN SET(P1*7+3,P2*
5+2,4):SET(P1*7+3,P2*5+3,4):SET(
P1*7+4,P2*5+2,4):SET(P1*7+4,P2*5
+3,4):GOTO90
80 RESET(P1*7+3,P2*5+2):RESET(P1*7+
3,P2*5+3):RESET(P1*7+4,P2*5+2):R
ESET(P1*7+4,P2*5+3)
90 IF PEEK(65280)=254 OR PEEK(65280
)=126 THEN GOSUB 1200:GOSUB 2100
:MOV=MOV+1

```

```

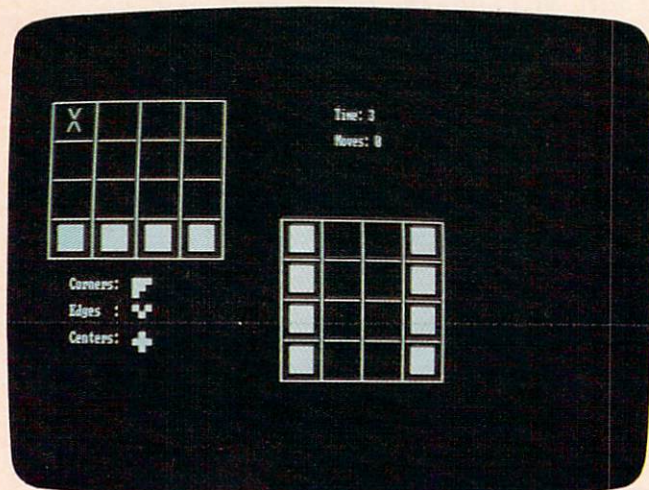
95 TC=TC+1:IF TC=7 THEN TC=0:TIME=T
IME+1
97 PRINT@448,"MOVES=";MOV;"
(3 SPACES)TIME=";TIME;
100 GOTO 50
1000 FOR I=0TO19:FOR J = 0 TO 28 ST
EP 7
1010 SET(J,I,3)
1020 NEXTJ:NEXTI
1030 FOR I = 0 TO 28: FOR J = 0 TO
20 STEP 5
1040 SET(I,J,3)
1050 NEXT J:NEXTI
1060 FOR I = 0 TO 20 : FOR J=35 TO
63 STEP 7
1070 SET (J,I,3)
1080 NEXT J: NEXT I
1090 FOR I = 35 TO 63: FOR J = 0 TO
20 STEP 5
1092 SET(I,J,3)
1097 NEXTJ:NEXTI:RETURN
1100 FOR R = 0 TO 3: FOR RR = 0 TO
3:B(R,RR)=RND(2)-1:NEXT RR:NEX
T R
1110 FOR R = 0 TO 3: FOR RR = 0 TO
3: IF B(R,RR)=1 THEN SET(RR*7+
3,R*5+2,4):SET(RR*7+3,R*5+3,4)
:SET(RR*7+4,R*5+2,4):SET(RR*7+
4 ,R*5+3,4)
1120 NEXT RR:NEXT R
1130 FOR I=1 TO 10: FOR C=0 TO 3:FO
R R=0 TO 3:READ W(I,C,R):NEXT
R:NEXT C:NEXTI
1140 S=RND(10):FOR R=0 TO 3:FOR RR=
0 TO 3:D(R,RR)=W(S,R,RR):NEXT
RR:NEXT R
1150 FOR R=0 TO 3: FOR RR=0 TO 3
1160 IF D(R,RR)=1 THEN SET(RR*7+38,
R*5+2,5):SET(RR*7+39,R*5+2,5):
SET(RR*7+38,R*5+3,5):SET(RR*7+
39,R*5+3,5)
1170 NEXT:NEXT
1175 FOR A=1 TO 9:FORI=1 TO 6:READZ
1,Z2:X1(A,I)=Z1:Y1(A,I)=Z2:NEX
T I:NEXTA:RETURN
1200 IF (P1 = 1 OR P1 = 2) AND (P2=
1 OR P2=2) THEN A=1:GOSUB 2000
:RETURN
1210 IF (P1 = 1 OR P1 = 2) AND P2=0 T
HEN A=2:GOSUB2000:RETURN
1220 IF (P1=1 OR P1=2) AND P2=3 THE
N A=3:GOSUB 2000:RETURN
1230 IF (P2=1 OR P2=2) AND P1=0 THE
N A=4:GOSUB2000:RETURN
1240 IF (P2=1 OR P2=2) AND P1=3 THE
N A=5:GOSUB 2000:RETURN
1250 IF P1=0 AND P2=0 THEN A=6:GOSU
B 2000:RETURN
1260 IF P1=3 AND P2=0 THEN A=7:GOSU
B 2000:RETURN
1270 IF P1=3 AND P2=3 THEN A=8:GOSU
B 2000:RETURN
1280 A=9:GOSUB 2000:RETURN
1300 FOR I= 22 TO 26:SET(33,I,6):SE
T(34,I,6) :SET(3,I,6):SET(12,I
,6):SET(24,I,6):SET(46,I,6):SE
T(7,I,6): NEXT I
1310 SET(4,22,6):SET(5,23,6):SET(6,
22,6)
1320 FOR I=1 TO 5:SET(24+I,22,6):SE
T(24+I,26,6):SET(46+I,22,6):SE
T(46+I,24,6):SET(46+I,26,6):SE
T(9+I,24,6): NEXT I
1330 SET(35,24,6):SET(35,25,6):SET(
35,26,6):SET(36,24,6):SET(36,2
5,6):SET(36,26,6):SET(37,26,6)
:SET(37,26,6)
1340 SET(38,26,6):SET(38,26,6):SET(
55,26,6):SET(55,25,6):SET(56,2
6,6):SET(56,25,6)
1350 SET(57,26,6):SET(57,25,6):SET(
58,24,6):SET(58,23,6):SET(59,2
4,6):SET(59,23,6):SET(60,24,6)
:SET(60,23,6)
1360 SET(61,26,6):SET(61,25,6):SET(
62,26,6):SET(62,25,6):SET(63,2
6,6):SET(63,25,6)
1370 RETURN
2000 FOR I=1 TO 6
2010 IF X1(A,I)=1 THEN 2040
2020 IF POINT(X+X1(A,I),Y+Y1(A,I))>
1 THEN RESET(X+X1(A,I),Y+Y1(A,
I)):RESET(X+X1(A,I)+1,Y+Y1(A,I
)):RESET(X+X1(A,I),Y+Y1(A,I)+
1):RESET(X+X1(A,I)+1,Y+Y1(A,I
)+1):B((Y-2+Y1(A,I))/5,(X-3+X1
(A,I))/7)=0:GOTO 2040
2030 SET(X+X1(A,I),Y+Y1(A,I),4):SET
(X+X1(A,I)+1,Y+Y1(A,I),4):SET(
X+X1(A,I),Y+Y1(A,I)+1,4):SET(X
+X1(A,I)+1,Y+Y1(A,I)+1,4):B((Y
-2+Y1(A,I))/5,(X-3+X1(A,I))/7)
=1
2040 NEXT I:RETURN
2100 FOR R=0 TO 3:FOR RR=0TO3:IF B(
R,RR)<>D(R,RR) THEN RETURN
2110 NEXT RR:NEXTR
2120 CLS(1):PRINT@234,"YOU HAVE WON
":PRINT@328,"YOUR SCORE IS ";I
NT(TIME/10)*INT(MOVE/5)
2130 PRINT@392,"PLAY AGAIN (Y/N)";:
INPUT A$:IF A$="Y"THEN 5
2140 END
20000 DATA 1,1,1,1,1,0,0,1,1,0,0,1,
1,1,1,1
20010 DATA 0,0,0,0,0,0,1,1,0,0,1,1,0,
0,0,0
20020 DATA 0,1,1,0,1,0,0,1,1,0,0,1,
0,1,1,0
20030 DATA 1,1,1,1,1,1,1,1,1,1,1,1,
1,1,1,1
20040 DATA 1,0,0,1,0,1,1,0,0,1,1,0,
1,0,0,1
20050 DATA 1,1,1,1,0,0,0,0,0,0,0,0,
1,1,1,1
20060 DATA 0,0,0,1,0,0,0,1,0,0,0,1,
0,0,0,1
20070 DATA 1,0,0,1,0,0,0,0,0,0,0,0,
1,0,0,1
20080 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0
20090 DATA 0,0,0,0,1,0,0,1,1,0,0,1,
0,0,0,0
20100 DATA 0,0,-7,0,7,0,0,-5,0,5,1,
1
20110 DATA 7,0,-7,0,0,5,1,1,1,1,1,1
20120 DATA 7,0,-7,0,0,-5,1,1,1,1,1,1,
1
20130 DATA 7,0,0,-5,0,5,1,1,1,1,1,1
20140 DATA -7,0,0,-5,0,5,1,1,1,1,1,1,
1
20160 DATA 0,0,0,5,0,10,7,0,7,5,14,0

```

```

20170 DATA 0,0,0,5,0,10,-7,0,-7,5,-
      14,0
20180 DATA 0,0,0,-5,0,-10,-7,0,-7,-
      5,-14,0
20190 DATA 0,0,0,-5,0,-10,7,0,7,-5,
      14,0

```



The object of "Quatrainment" is to change the upper grid to match the lower grid. The large X in the IBM version (shown above) designates the base location for changes in the upper grid.

```

10 CLS
20 GOSUB 1000
30 REM ROUTINE TO SETUP SCREEN
40 COLOR 7,0
50 CLS
60 KEY OFF
70 WIDTH 80
80 GOTO 160
90 FOR TR = STY TO STY+12 STEP 3
100 FOR T = STX TO STX+28 : LOCATE T
R,T : PRINT CHR*(196) : NEXT
110 NEXT TR
120 FOR TR = STX TO STX+28 STEP 7
130 FOR T = STY TO STY+12 : LOCATE T
,TR : PRINT CHR*(179) : NEXT
140 NEXT TR
150 RETURN
160 STX = 2 : STY = 2 : GOSUB 90
170 STX = 40 : STY = 11 : GOSUB 90 : Y
A = 1 : XA = 1
180 LOCATE 2,2:PRINT CHR*(218):LOCATE
2,30:PRINT CHR*(191)
190 LOCATE 11,40:PRINT CHR*(218):LOCA
TE 11,68:PRINT CHR*(191)
200 LOCATE 14,2 :PRINT CHR*(192):LOCA
TE 14,30:PRINT CHR*(217)
210 LOCATE 23,40:PRINT CHR*(192):LOCA
TE 23,68:PRINT CHR*(217)
220 FOR T2 = 9 TO 28 STEP 7 : LOCATE
2,T2 : PRINT CHR*(194) : NEXT
230 FOR T2 = 9 TO 28 STEP 7 : LOCATE
14,T2 : PRINT CHR*(193) : NEXT
240 FOR T2 = 47 TO 63 STEP 7 : LOCATE
11,T2 : PRINT CHR*(194) : NEXT
250 FOR T2 = 47 TO 63 STEP 7 : LOCATE
23,T2 : PRINT CHR*(193) : NEXT
260 REM SET UP ARRAYS FOR THE POSITI
ONS ON THE FIRST GRID

```

```

270 DIM AX(4),BX(4),B(4,4)
280 FOR T = 1 TO 4 : READ X : AX(T)
= X : BX(T) = X +38 : NEXT
290 FOR T = 1 TO 4 : READ Y : AY(T)
= Y : BY(T) = Y +9 : NEXT
300 DATA 4,11,18,25,3,6,9,12
310 GR#= STRING*(4,219)+CHR*(31)+STRI
NG*(4,29)+STRING*(4,219)
320 GP#= CHR*(28)+CHR*(92)+CHR*(47)+C
HR*(31)+CHR*(28)+STRING*(4,29)+CHR*(2
8)+CHR*(47)+CHR*(92)+CHR*(31)+CHR*(28
)
330 SP#= STRING*(4,32)+CHR*(31)+STRI
NG*(4,29)+STRING*(4,32)+STRING*(4,29
)+CHR*(30)
340 LOCATE 16,6:PRINT"Corners: "+CH
R*(219)+CHR*(219)+CHR*(223)+STRING*(3
,29)+CHR*(31)+CHR*(223)
350 LOCATE 18,6:PRINT"Edges : "+CH
R*(223)+CHR*(220)+CHR*(223)
360 LOCATE 20,6:PRINT"Centers: "+CHR
*(220)+CHR*(219)+CHR*(220)+CHR*(29)+C
HR*(29)+CHR*(31)+CHR*(223)
370 REM set up patterns for gridb
380 I = -32768! : PRINT CHR*(11); "Pr
ess any key to Start"
390 IF INKEY# = "" THEN I= I+1+(I=327
67)* 65535! : GOTO 390
400 RANDOMIZE I :PRINT CHR*(11);"
" :CL = 0
410 WE = INT (RND(I) *8) +1 :FOR J =
1 TO WE * 16 :READ Q :NEXT
420 FOR X1 = 1 TO 4 : FOR Y1 = 1 TO
4 : READ Q : IF Q THEN LOCATE BY(Y1),
BX(X1):B(X1,Y1) = 1 :PRINT GR#
430 NEXT : NEXT
440 FOR X1 = 1 TO 4 : FOR Y1 = 1 TO
4 : READ Q : IF Q THEN LOCATE AY(Y1),
AX(X1):A(X1,Y1) = 1 :PRINT GR#
450 REM use this line for random beg
inning patterns
460 REM FOR X1 = 1 TO 4 : FOR Y1 = 1
TO 4 :H= RND (1): Q = -(H>.5): IF Q
THEN LOCATE AY(Y1),AX(X1):A(X1,Y1) =
1 :PRINT GR#
470 NEXT : NEXT
480 DATA 1,1,1,1, 1,0,0,1, 1,0,0,1,
1,1,1,1
490 DATA 0,0,0,0, 0,1,1,0, 0,1,1,0, 0
,0,0,0
500 DATA 0,1,1,0, 1,0,0,1, 1,0,0,1, 0
,1,1,0
510 DATA 1,1,1,1, 1,1,1,1, 1,1,1,1, 1
,1,1,1
520 DATA 1,0,0,1, 0,1,1,0, 0,1,1,0, 1
,0,0,1
530 DATA 1,1,1,1,0,0,0,0,0,0,0,1,1,
1,1
540 DATA 1,0,0,1,0,1,1,0,0,1,1,0,1,0,
0,1
550 DATA 1,1,1,1, 0,0,0,0, 0,0,0,0,1,
1,1,1
560 DATA 0,0,0,1, 0,0,0,1, 0,0,0,1,0,
0,0,1
570 DATA 1,0,0,1, 0,0,0,0,0,0,0,0,1,0
,0,1
580 DATA 0,0,0,0, 0,0,0,0,0,0,0,0,0,0
,0,0
590 DATA 0,0,0,0, 1,0,0,1,1,0,0,1,0,0
,0,0
600 REM cursor movement for board a

```

```

610 LOCATE AY(YA),AX(XA) :PRINT GP#
620 CL = CL+1: IF CL >=83 THEN CL =
0 :KL = KL + 1 :LOCATE 3,50 :PRINT "T
ime:"KL:LOCATE 5,50:PRINT "Moves:"MO
630 E$ = INKEY$ : IF E$ = "" THEN 620

```

```

640 IF LEN(E$) = 2 THEN E = ASC(RI
GHT$(E$,1)) ELSE 620
650 IF E = 82 THEN GOSUB 780 : GOSUB
950 :MO = MO + 1 :LOCATE 5,50:PRINT"M
oves:"MO

```

```

660 LOCATE AY(YA),AX(XA):IF A(XA,YA )
=0 THEN PRINT SP# ELSE PRINT GR#
670 DX =--((-E=75))+E=77):DY = -((-
E=72))+E=80)

```

```

680 YA = YA +DY:IF YA =5 THEN YA = YA
-4

```

```

690 IF YA = 0 THEN YA = YA +4
700 XA = XA +DX:IF XA = 5 THEN XA = X
A -4

```

```

710 IF XA = 0 THEN XA = XA +4
720 LOCATE AY(YA),AX(XA):PRINT GP#
730 GOTO 620

```

```

740 REM reverse grid a
750 LOCATE AY(YA),AX(XA):IF A(XA,YA)T
HEN :A(XA,YA)=0:PRINT SP#:RETURN:ELSE
:PRINT GR#:A(XA,YA)=1

```

```

760 RETURN
770 REM where to go

```

```

780 IF (XA=YA) AND ((XA=4) OR (XA =1
))THEN 840

```

```

790 IF (XA+YA=5) AND XA * YA = 4 THEN
840

```

```

800 IF (XA>1 AND XA<4) AND (YA=1 OR Y
A=4) THEN 930

```

```

810 IF (YA>1 AND YA<4) AND (XA=1 OR X
A=4) THEN 920

```

```

820 GOTO 940
830 REM corner

```

```

840 XT=XA :YT = YA :GOSUB 750:IF XA =
1 THEN FOR XA = XT+1 TO XT+2: GOSUB
750 :NEXT :XA = XT

```

```

850 IF YA = 1 THEN FOR YA =YT +1 TO Y
T+2:GOSUB 750 :NEXT :YA = YT

```

```

860 IF XA = 4 THEN FOR XA = XT-2 TO X
T-1 :GOSUB 750 :NEXT:XA =XT

```

```

870 IF YA = 4 THEN FOR YA = YT-2 TO Y
T-1 :GOSUB 750 :NEXT:YA =YT

```

```

880 IF XA =1 THEN XA = XT +1 ELSE XA
= XT-1

```

```

890 IF YA =1 THEN YA = YT +1 ELSE YA
= YT-1

```

```

900 GOSUB 750 :XA = XT :YA = YT :RETU
RN

```

```

910 REM edge

```

```

920 XT=XA:YT=YA:YA= YT-1 :GOSUB 750:
YA = YT+1:GOSUB 750 :YA = YT: XA = XT
+(XT=4) -(XT=1):GOSUB 750:XA=XT:YA =
YT :RETURN

```

```

930 XT=XA:YT=YA: XA = XT-1 :GOSUB 750
:XA = XT+1:GOSUB 750 :XA =XT: YA = YA
+(YA=4) -(YA=1):GOSUB 750:XA=XT:YA =
YT :RETURN

```

```

940 XT = XA : YT = YA: GOSUB 750 : X
A= XT+1 :GOSUB 750:XA = XT-1 :GOSUB 7
50: XA = XT:YA = YT+1:GOSUB 750 : YA
= YT-1:GOSUB 750 :YA = YT :RETURN

```

```

950 FOR T = 1 TO 4 : FOR T1 = 1 TO 4
: IF A(T,T1) <> B(T,T1) THEN T=4:T1=4
:RETURN

```

```

960 NEXT:NEXT

```

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```

970 SC=KL/16+MO/5:LOCATE 7,50:COLOR 3
1: PRINT "YOU WON" :LOCATE 8,50:PRINT
"Score : "INT(SC):COLOR 7:LOCATE 9 ,50
:PRINT"Play again Y or N"

```

```

980 A$ = INKEY$:IF A$= "" THEN 980
990 IF A$ = "Y" THEN RUN ELSE END
1000 LOCATE 13,28:PRINT "Q U A T R A
I N M E N T" :FOR T = 1 TO 5000:NEXT
:CLS
1010 RETURN

```

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COMPUTE!

Gotcha!

Doug Smoak

"Gotcha!" will keep you on the run as you scramble for dollars while avoiding the dread Collector. Originally written for the unexpanded VIC; versions are included for 64 and Atari. Joystick required.

The idea in "Gotcha!" is to get all the money you can lay your hands on, and outwit the Collector while you're at it. But you'd better be quick, because he's not that interested in the money itself. He wants to catch *you*.

You begin the game inside a diamond pattern in the middle of the screen, with the Collector on your heels. Once out of the diamond, you're free to move up, down, and diagonally in your effort to grab the dollars and elude the Collector.

If you get trapped near a side, you can run off the screen and wrap around to the other side, but beware—the Collector knows where you are, and he comes onto the screen headed straight for you. You might not see him in time to escape, and it's Gotcha!

You have the advantage of moving in eight directions, while the Collector only moves in a straight line across the screen. If you survive until all the money is gone, you move on to the next round, where there is more money with a higher score value. The screen changes to a maze after the first round, restricting your movement and making it easier for the Collector to track you down. If you survive 18 rounds (no one ever has), you can retire or play again.

On the 64 version, plug your joystick into Port 2; on the Atari version, use Controller Port 1.



The player tries to gather up dollar signs while avoiding the monster in the VIC version of "Gotcha!"

Program 1: Gotcha!—VIC Version

```
1 GOTO56
2 K=INT(.5+(ME-7767)/44):J=0:ET=K*44+7767
  :CH=-1:E1=2:IFRND(1)<.5THENET=ET-21:CH=
  1:E1=3
3 IFPEEK(ME)=36THENGOSUB50
4 IFPEEK(ET)=36THENIT=IT+1
5 IFME<7702THENME=ME+22
6 IFME>8163THENME=ME-22
7 POKEOM,32:POKEME,M1:POKEME+30720,7
8 IFPEEK(ET)=M1THEN52
9 POKEOT,32:POKEET+30720,2:POKEET,E1
10 IFIT=>(30+RD*10)THENPRINT"{CLR}":RD=RD
  +1:MT=0:OM=0:OT=0:GOTO72
11 POKEDD,127:P=PEEK(P2)AND128:J0=- (P=0)
```

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 Commodore

```

12 POKEDD, 255:P=PEEK(P1):J1=-((PAND8)=0):
J2=-((PAND16)=0):J3=-((PAND4)=0)
13 IFJ0THENDX=1:M1=1
14 IFJ1THENDY=22
15 IFJ2THENDX=-1:M1=0
16 IFJ3THENDY=-22
17 OM=ME:ME=ME+DX+DY:DY=0:DX=0
18 IFME<7702 THENME=ME+22
19 IFME>8164 THENME=ME-22
20 IFPEEK(ME)<>32ANDPEEK(ME)<>36THENME=OM
21 OT=ET:ET=ET+CH:J=J+1:IFJ=>22THEN2
22 GOTO3
23 POKE36879,8:PRINT"{CLR}{RVS}{WHT}SCORE
{OFF}"SC:IFRD=0THEN41
24 IFRD<19THENGOTO26
25 POKE36869,240:PRINT"{CLR}YOU MADE IT!!
!!":GOTO25
26 UR$="E F":UL$="H G"
27 POKE36879,8:PRINT:FORT=1TO10:PRINT"
{PUR}DDDDDDDDDDDDDDDDDDDDDDDD":NEXT
28 PRINT"{HOME}{2 DOWN}":OV$="{8 RIGHT}":
AP$=""
29 FORT=1TO4:PRINTOV$UR$AP$UL$
30 AP$=AP$+"{4 RIGHT}":OV$=OV$+"{2 LEFT}":
NEXT
31 AP$=AP$+"{4 LEFT}":OV$=OV$+"{2 RIGHT}":
32 FORT=1TO4:PRINTOV$UL$AP$UR$
33 AP$=AP$+"{4 LEFT}":OV$=OV$+"{2 RIGHT}":
NEXT
34 FORT=1TO30+(RD*10)
35 SP=RND(1)*398+7744
36 IFPEEK(SP)=32THENPOKESP,36:POKESP+3072
0,5:GOTO38
37 GOTO35
38 NEXT
39 DD=37154:P1=37151:P2=37152:ME=7932:V=3
6878:S=36875:IT=0
40 FORT=225TO177STEP-4:POKES,T:FORTT=30TO
0STEP-1:POKEV,TT/2:NEXTTT:NEXT:GOTO2
41 PRINT"{RED}{HOME}{4 DOWN}{10 SPACES}FH
"
42 PRINT"{DOWN}{8 SPACES}FDDDDH"
43 PRINT"{DOWN}{6 SPACES}FDDDDDDDDH"
44 PRINT"{DOWN}{4 SPACES}FDDDDDDDDDDH"
45 PRINT"{DOWN}{4 SPACES}GDDDDDDDDDDDE"
46 PRINT"{DOWN}{6 SPACES}GDDDDDDDDDE"
47 PRINT"{DOWN}{8 SPACES}GDDDDDE"
48 PRINT"{DOWN}{10 SPACES}GE"
49 GOTO34
50 POKES,235:FORT=1TO5:POKEV,3*T:NEXT:POK
EV,0:IT=IT+1:SC=SC+10*(1+RD)
51 PRINT"{HOME}{RVS}{WHT}SCORE{OFF}"SC:RE
TURN
52 PRINT"{CLR}{WHT}{RVS}{7 SPACES}GOTCHA!
!"
53 POKES,0:POKEV,15:FORT=200TO240:POKES-1
,T:NEXT:FORT=1TO50:NEXT
54 FORT=240TO126STEP-1:POKES-1,T:NEXT:POK
EV,0
55 RD=0:OM=0:OT=0:FL=1:GOTO70
56 PRINT"{CLR}{5 RIGHT}{8 DOWN}JUST A MOM
ENT":POKE56,28:POKE52,28:CLR
57 FORI=0TO511:POKE7168+I,PEEK(32768+I):N
EXTI
58 READX:IFX<0THEN65
59 FORI=XTOX+7:READJ:POKEI,J:NEXTI:GOTO58
60 DATA7168,48,18,156,120,24,40,36,34,717
6,24,81,58,28,24,20,36,68
61 DATA7184,60,230,126,30,30,30,254,124,7
192,60,103,126,120,120,120,127,62
62 DATA7200,255,255,255,255,255,255,255,2

```

```

55
63 DATA7208,255,254,252,248,240,224,192,1
28,7216,1,3,7,15,31,63,127,255
64 DATA7224,255,127,63,31,15,7,3,1,7232,1
28,192,224,240,248,252,254,255,-1
65 POKE36869,255:POKE36879,110:PRINT"
{YEL}{CLR}{6 DOWN}{7 SPACES}{RVS}GOTCH
A!!"
66 PRINT"{CLR}{RVS}USING THE JOYSTICK
{4 SPACES}{DOWN}GATHER AS MUCH MONEY
{2 SPACES}{DOWN}AS YOU CAN WITHOUT"
67 PRINT"{RVS}{DOWN}BEING GOTTEN BY {OFF}
{RED}C{RVS}{YEL}."
68 PRINT"{DOWN}{RVS}YOU ARE {OFF}{YEL}A
{RVS}. THE NUMBER{DOWN} AND VALUE OF T
HE {GRN}$YEL'S {DOWN} INCREASE WITH
{SPACE}EACH"
69 PRINT"{RVS}{DOWN}ROUND.":GOTO72
70 PRINT"{RVS}{2 DOWN}SCORE"SC:PRINT"
{RVS}{DOWN}HIGH"HS:IFSC>HSTHENHS=SC:GO
SUB78
71 IFRD=0THENS=0
72 FORT=1TO500:NEXTT:PRINT"{RVS}{2 DOWN}P
RESS THE TRIGGER TO":PRINT"{RVS}PLAY";
73 IFFL=1THENPRINT"{RVS} AGAIN, Q TO QUIT
"
74 P=PEEK(37151):FB=-((PAND32)=0)
75 IFPEEK(197)=48 THEN POKE198,0:SYS4096
76 IFFB=0THEN74
77 FL=0:GOTO23
78 FORT=1TO1000:NEXT:FORCT=1TO3:PRINT"
{RVS}{2 DOWN}{2 SPACES}A NEW HIGH SCOR
E!!"
79 POKEV,15:FORT=190TO245:POKES-1,T:NEXTT
:FORTT=1TO200:NEXTTT:POKES-1,0:NEXTCT
80 RETURN

```

BEFORE TYPING...

If you're new to computing, please read "How To Type COMPUTE!'s Programs" and "A Beginner's Guide To Typing In Programs."

Program 2: Gotcha!—64 Version

```

20 POKE56,48:POKE52,48
30 FORI=54272TO54296:POKEI,0:NEXT:POKE542
96,15:POKE54277,17:POKE54278,136
40 GOTO1180
50 K=INT(.5+(ME-1183)/80):J=0:ET=K*80+118
3:CH=-1:E1=66
51 IFRND(1)<.5THENET=ET-39:CH=1:E1=67
52 IFPEEK(ME)=36THENGOSUB1050
53 IFPEEK(ET)=36THENIT=IT+1
54 IFME<1064THENME=ME+40
55 IFME>2023THENME=ME-40
56 POKEOM,32:POKEME,M1:POKEME+54272,7
57 IFPEEK(ET)=M1THEN1100
58 POKEOT,32:POKEET+54272,2:POKEET,E1
59 IFIT=>(30+RD*20)THENPRINT"{CLR}":RD=RD
+1:MT=0:OM=0:OT=0:GOTO1510
60 P=PEEK(DD):J1=15-(PAND15)
63 IFJ1=1THENDY=-40:GOTO74
64 IFJ1=2THENDY=40:GOTO74
65 IFJ1=4THENDX=-1:M1=0:GOTO74
66 IFJ1=5THENDY=-41:M1=0:GOTO74
67 IFJ1=6THENDY=39:M1=0:GOTO74
68 IFJ1=8THENDX=1:M1=65:GOTO74
69 IFJ1=9THENDY=-39:M1=65:GOTO74

```


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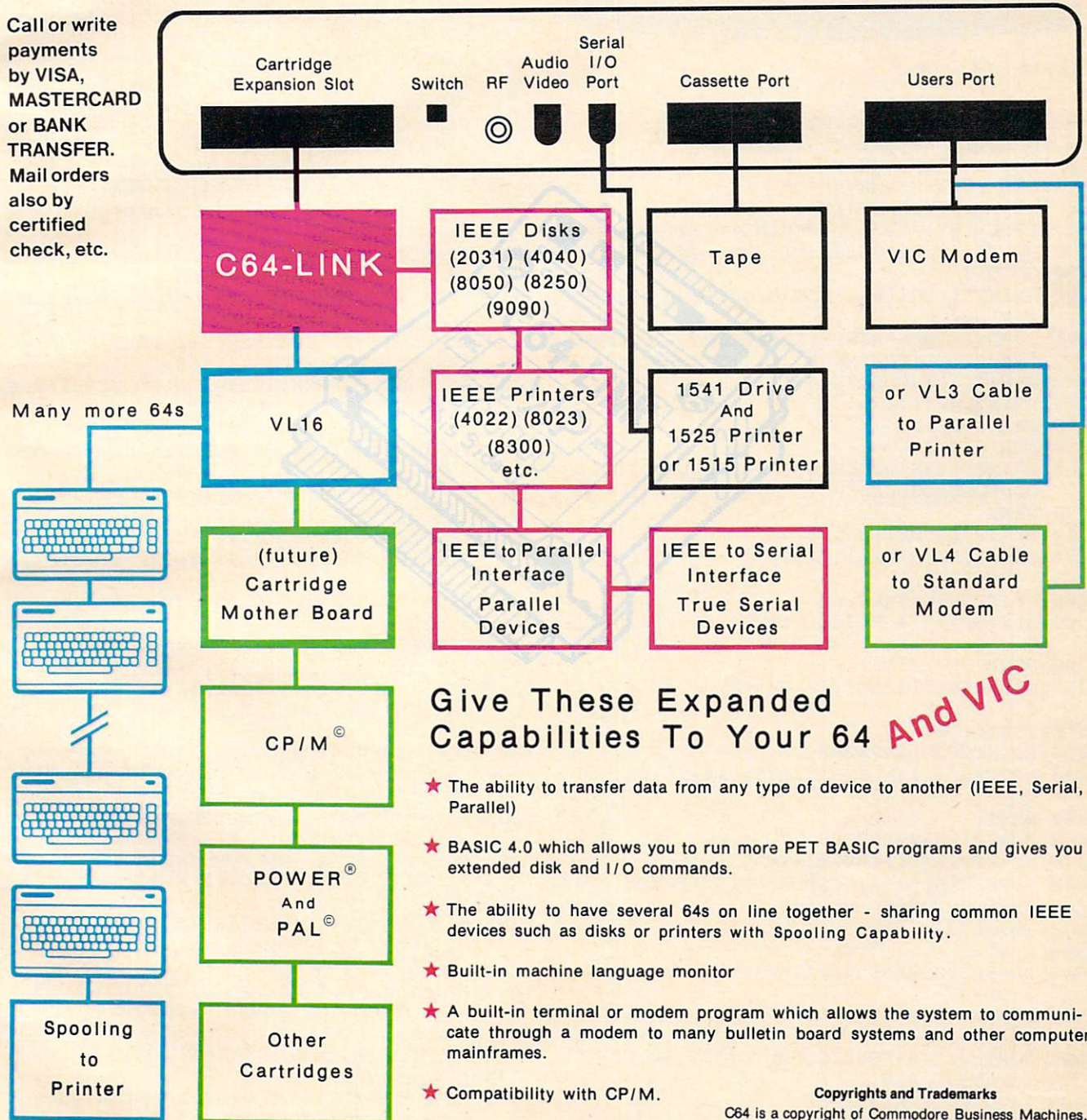
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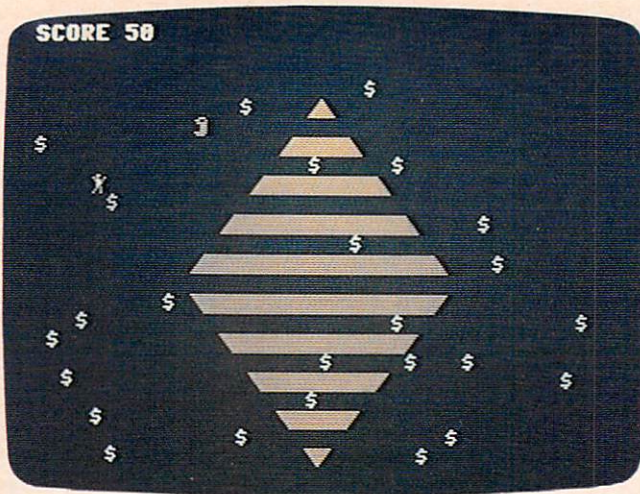
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"Gotcha!" 64 version.

```

70 IFJ1=10THENDY=41:M1=65
74 OM=ME:ME=ME+DX+DY:DY=0:DX=0
80 IFME<1064THENME=ME+40
81 IFME>2023THENME=ME-40
82 IFET>2023THENET=ET-40
85 IFPEEK(ME)<>32ANDPEEK(ME)<>36THENME=OM
180 OT=ET:ET=ET+CH:J=J+1:IFJ=>40THEN50
190 GOTO52
200 PRINT"{CLR}{WHT}SCORE{OFF}"SC:IFRD=0T
HEN1000
201 IFRD>18THENPRINT"{CLR}{RED}{12 DOWN}
{14 RIGHT}YOU MADE IT!!!!":GOTO201
202 UR$="E F":UL$="H G"
210 PRINTCHR$(147)
300 PRINT:PRINT
350 FORT=1TO12
360 PRINT"{CYN}DDDDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDD"
370 NEXT
372 PRINT"{HOME}{DOWN}"
374 OV$="{17 RIGHT}":AP$=""
375 FORT=1TO5
380 PRINTOV$UR$AP$UL$
385 AP$=AP$+"{4 RIGHT}":OV$=OV$+"{2 LEFT}
"
390 NEXT
395 AP$=AP$+"{4 LEFT}":OV$=OV$+"{2 RIGHT}
"
410 FORT=1TO5
420 PRINTOV$UL$AP$UR$
430 AP$=AP$+"{4 LEFT}":OV$=OV$+"{2 RIGHT}
"
440 NEXT
460 FORT=1TO30+(RD*20)
470 SP=INT(RND(1)*879)+1064
480 IFPEEK(SP)=32THENPOKESP,36:POKESP+542
72,5:GOTO500
490 GOTO470
500 NEXT
505 DD=56320:ME=1562:IT=0:V=54276:HF=5427
3:LF=HF-1
555 POKEV,17:FORT=1TO50:POKEHF,RND(0)*38+
34
600 FORTT=1TO5:POKELF,RND(0)*20+40:NEXTTT
:NEXTT:POKEV,16
609 IFRD>0THENME=ME-80
610 GOTO50
1000 PRINT"{RED}{3 DOWN}{19 RIGHT}FH"
1002 PRINT"{DOWN}{17 RIGHT}FDDDDH"

```

```

1004 PRINT"{DOWN}{15 RIGHT}FDDDDDDDDDH"
1006 PRINT"{DOWN}{13 RIGHT}FDDDDDDDDDDDDDDH
"
1008 PRINT"{11 RIGHT}{DOWN}FDDDDDDDDDDDDDD
DDDH"
1010 PRINT"{DOWN}{11 RIGHT}GDDDDDDDDDDDDDD
DDDE"
1011 PRINT"{DOWN}{13 RIGHT}GDDDDDDDDDDDDDE
"
1012 PRINT"{DOWN}{15 RIGHT}GDDDDDDDDDE"
1014 PRINT"{DOWN}{17 RIGHT}GDDDDDE"
1016 PRINT"{DOWN}{19 RIGHT}GE"
1018 GOTO460
1050 POKEV,17:POKEHF,51:FORT=1TO5:POKELF,
2*T:NEXTT:IT=IT+1:SC=SC+10*(1+RD)
1060 POKEV,16:IFRD=0THENPRINT"{HOME}{WHT}
SCORE"SC:RETURN
1065 PRINT"{DOWN}{GRN}SCORE"SC"{2 UP}":RE
TURN
1100 PRINT"{CLR}{WHT}"TAB(17)"GOTCHA!!"
1101 POKEV,17:FORT=40TO75:POKEHF,T:POKELF
,2*T:NEXT:FORT=1TO50:NEXT:POKEV,16
1102 FORT=34TO12STEP-1:POKEHF,T:POKELF,T/
2:NEXT:POKEV,16
1130 FL=1:RD=0:OM=0:OT=0:GOTO1501
1180 POKE53280,15:POKE53281,15:PRINT"
{CLR}{10 DOWN}"TAB(10)"{RED}JUST A M
OMENT PLEASE"
1200 PRINTCHR$(142):POKE52,48:POKE56,48:C
LR
1210 POKE56334,PEEK(56334)AND254:POKE1,PE
EK(1)AND251
1220 FORI=0TO511:POKE12288+I,PEEK(53248+I
):NEXTI:POKE1,PEEK(1)OR4
1225 POKE56334,PEEK(56334)OR1:POKE53272,(
PEEK(53272)AND240)OR12
1230 READX:IFX<0THEN1300
1240 FORI=XTOX+7:READJ:POKEI,J:NEXTI:GOTO
1230
1250 DATA12288,48,18,156,120,24,40,36,34,
12808,24,81,58,28,24,20,36,68
1260 DATA12816,60,230,126,30,30,30,254,12
4,12824,60,103,126,120,120,120,127,6
2
1270 DATA12832,255,255,255,255,255,255,25
5,255
1280 DATA12840,255,254,252,248,240,224,19
2,128,12848,1,3,7,15,31,63,127,255
1290 DATA12856,255,127,63,31,15,7,3,1,128
64,128,192,224,240,248,252,254,255,-
1
1300 POKE53280,0:POKE53281,0
1380 PRINT"{CLR}{WHT}{3 DOWN}{13 RIGHT}**
GOTCHA **{4 DOWN}"
1400 PRINT"{YEL}{RIGHT}USING JOYSTICK #2,
YOU MUST GATHER AS{2 SPACES}"
1401 PRINT"{RIGHT}MUCH OF THE MONEY AS YO
U CAN WITHOUT{DOWN}{4 SPACES}BEING C
AUGHT BY{RED} C."
1402 PRINT"{YEL}{RIGHT}{DOWN}YOU ARE{CYN}
A.{YEL} THE NUMBER AND VALUE OF
{DOWN}{3 SPACES}"
1403 PRINT"{RIGHT}THE [4]$(YEL)'S INCRE
ASE WITH EACH ROUND.":GOTO1510
1501 PRINT"{2 DOWN}SCORE"SC:PRINT"{DOWN}H
IGH"HS:IFSC>HSTHENHS=SC:GOSUB1550
1505 IFRD=0THENSC=0
1510 PRINT"[8]{4 DOWN}{RIGHT}PRESS THE
{SPACE}<TRIGGER> TO PLAY";
1512 IFFL=1THENPRINT"[8], Q TO QUIT"
1515 P=PEEK(56320):FR=PAND16

```

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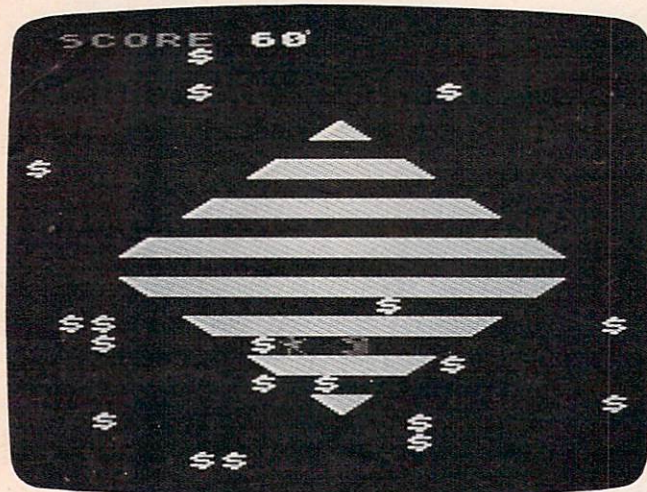
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```

1516 IFPEEK(197)=62THENPOKE198,0:SYS2048
1518 IFFR=16THEN1515
1520 FL=0:GOTO200
1550 FORT=1TO1000:NEXT:FORCT=1TO3:PRINT"
{RED}{10 RIGHT}{2 DOWN}{2 SPACES}A N
EW HIGH SCORE!!":NEXT
1551 POKEV,17:FORTT=40TO200:POKEHF,TT/2:F
ORI=1TO10:NEXTI:POKELF,TT:NEXTTT
1560 POKEV,16:RETURN

```



"Gotcha!" Atari version.

Program 3: Gotcha!—Atari Version

```

20 GRAPHICS 1+16
30 SCR=PEEK(88)+PEEK(89)*256
40 DIM UR$(30),UL$(30):GOTO 1180
50 K=INT(.5+(ME-SCR-99)/40):J=0:ET=
K*40+SCR+99:CH=-1:E1=199
51 IF RND(0)<.5 THEN ET=ET-19:CH=1:
E1=200
52 IF PEEK(ME)=4 THEN GOSUB 1050
53 IF PEEK(ET)=4 THEN IT=IT+1
54 IF ME<SCR+20 THEN ME=ME+20
55 IF ME>=SCR+460 THEN ME=ME-20
56 POKE OM,0:POKE ME,M1
57 IF PEEK(ET)=M1 THEN 1100
58 IF ET<SCR+20 THEN ET=ET+20
59 POKE OT,0:POKE ET,E1
60 IF IT>=(30+RD*7) THEN ? #6;CHR$(1
25):RD=RD+1:MT=0:OM=0:OT=0:GOTO 1
510
61 M=STICK(0):GOTO 60+M
65 DY=21:GOTO 75
66 DY=-19:GOTO 75
67 DX=1:M1=134:GOTO 75
69 DY=19:GOTO 75
70 DY=-21:GOTO 75
71 DX=-1:M1=133:GOTO 75
73 DY=20:POKE 77,0:GOTO 75
74 DY=-20:POKE 77,0
75 OM=ME:ME=ME+DX+DY:DY=0:DX=0
80 IF ME<SCR+20 THEN ME=ME+20
81 IF ME>=SCR+460 THEN ME=ME-20
85 IF PEEK(ME)<>0 AND PEEK(ME)<>4 TH
EN ME=OM
180 OT=ET:ET=ET+CH:J=J+1:IF J>=20 TH
EN 50
181 IF ET>SCR+460 THEN ET=ET-20
185 IF ET<SCR+20 THEN ET=ET+20
190 FOR I=1 TO 15:NEXT I:GOTO 52
200 ? #6;"{CLEAR}":M1=133:POSITION 1

```

```

,0:PRINT #6;"SCORE";" ";SC:IF RD
=0 THEN 1000
201 IF RD>18 THEN POSITION 4,10:PRIN
T #6;"YOU MADE IT!!!":GOTO 201
202 ? #6;CHR$(125):UR$="*+":UL$="/
-"
300 X=0:Y=3
350 FOR T=1 TO 10
360 POSITION X,Y:PRINT #6;")))))))))
)))))))))"
370 Y=Y+2:NEXT T
372 X=7:Y=5:Z=7:POSITION X,Y:? #6;UR
$;UL$
374 FOR T=1 TO 4:X=X-2:Y=Y+2:IF X<0
THEN 390
375 POSITION X,Y:? #6;UR$:POSITION X
+Z,Y:? #6;UL$
380 Z=Z+4
390 NEXT T:Z=Z-4:X=X+2:POSITION X,Y:
? #6;UL$:POSITION X+Z,Y:? #6;UR$
400 FOR T=1 TO 3:X=X+2:Y=Y+2:Z=Z-4
410 POSITION X,Y:? #6;UL$:POSITION X
+Z,Y:? #6;UR$
450 NEXT T
460 FOR T=1 TO 30+(RD*7)
470 SP=INT(RND(1)*380)+SCR+60
480 IF PEEK(SP)=0 THEN POKE SP,4:GOT
O 500
490 GOTO 470
500 NEXT T
505 ME=SCR+249:IT=0
600 FOR T=29 TO 96 STEP 2:SOUND 0,T,
10,15:FOR TT=0 TO 10:NEXT TT:NEX
T T:SOUND 0,0,0,0
610 GOTO 50
1000 X=9:Y=5:POSITION X,Y:? #6;"+"
1002 POSITION X-2,Y+2:? #6;"+)))/"
1004 POSITION X-4,Y+4:? #6;"+)))))
)/"
1006 POSITION X-6,Y+6:? #6;"+)))))
)))/"
1011 POSITION X-6,Y+8:? #6;"-)))))
)))*"
1012 POSITION X-4,Y+10:? #6;"-)))))
))*"
1014 POSITION X-2,Y+12:? #6;"-)))))*"
1016 POSITION X,Y+14:? #6;"-*"
1018 GOSUB 1570:GOTO 505
1050 IT=IT+1:SC=SC+10*(1+RD):SOUND 1
,30,10,15:FOR I=1 TO 5:NEXT I:S
OUND 1,0,0,0
1060 POSITION 1,0:PRINT #6;"SCORE";"
";SC:RETURN
1100 ? #6;CHR$(125):POSITION 6,12:?
#6;"GOTCHA ! !":FL=1
1101 SOUND 0,243,10,15:FOR I=1 TO 15
0
1102 NEXT I:SOUND 0,0,0,0
1130 RD=0:OM=0:OT=0:GOTO 1501
1180 POSITION 0,11:? #6;"JUST A MOMEN
T PLEASE"
1210 ST=(PEEK(106)-8)*256
1220 FOR K=0 TO 511:POKE ST+K,PEEK(5
7344+K):NEXT K:POKE 756,ST/256
1230 READ X:IF X<0 THEN 1300
1240 FOR I=X TO X+7:READ J:POKE I+ST
,J:NEXT I:GOTO 1230
1250 DATA 40,48,18,156,120,24,40,36,
34,48,24,81,58,28,24,30,68
1260 DATA 56,60,230,126,30,30,30,254
,124,64,60,103,126,120,120,120,
127,62
1270 DATA 72,255,255,235,255,255,255
,255,255

```

```

1280 DATA 80,255,254,252,248,240,224
,192,128,88,1,3,7,15,31,63,127,
255
1290 DATA 104,255,127,63,31,15,7,3,1
,120,128,192,224,240,248,252,25
4,255,-1
1300 ? #6;"{CLEAR}":POKE 712,13:POKE
708,7
1380 POSITION 7,1:? #6;"GOTCHA"
1400 POSITION 0,4:? #6;"USING THE JO
YSTICK, GATHER AS MUCH OF
{3 SPACES}THE MONEY AS YOU CANW
ITHOUT BEING CAUGHT"
1401 POSITION 0,11:? #6;"YOU ARE %"
1402 POSITION 0,13:? #6;"YOU PLAY AG
AINST ?":GOTO 1510
1501 ? #6;"{CLEAR}":POSITION 6,1:? #
6;"SCORE";" ";SC:POSITION 6,3:?
#6;"HIGH";" ";HS:IF SC>HS THEN
HS=SC:GOSUB 1550
1505 IF RD=0 THEN SC=0
1510 POSITION 2,20:? #6;"TRIGGER TO
BEGIN":IF FL=1 THEN POSITION 6,
22:? #6;"[Q] TO QUIT"
1512 POKE 764,255
1516 Z=PEEK(764):IF STRIG(0)<>0 AND
Z<>47 THEN 1516
1518 IF Z=47 THEN POKE 764,255:GRAPH
ICS 0:END
1520 POKE 712,0:POKE 708,13:FL=0:GOT
O 200
1550 FOR CT=9 TO 11:POSITION 1,CT:?
#6;" A NEW HIGH SCORE!!":NEXT C
T
1560 FOR T=243 TO 109 STEP -2:SOUND
0,T,10,15:FOR TT=1 TO 5:NEXT TT
:NEXT T:SOUND 0,0,0,0:RETURN
1570 FOR I=1 TO 30+(RD*10)
1580 SP=INT(RND(0)*440)+SCR+20
1590 IF PEEK(SP)=0 THEN POKE SP,4:GO
TO 1610
1600 GOTO 1580
1610 NEXT I:RETURN

```

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THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

Program Forms

As you might be discovering, computer programming is one of the most seductive of hobbies. You create a basic outline, a skeletal program which works, but you keep seeing ways to make it more efficient, attractive, or powerful. And you can sit into the night, transforming programs, oblivious as the moon silently crosses the sky.

When you write a program it can easily be used as a *form* for other programs—many new programs can evolve out of the original structure. Let's write a metric conversion quiz, then take a close look at it to see what other programs it could become.

Program 1 is a simple quiz structure. It starts off by READING the first item in the DATA statements (*inches*, in this case) and memorizes that word as E\$. It then checks to see if E\$ is the word *end*. If so, it goes up to line 200 where it prepares to start the quiz over again. This method allows us to put in as many questions as we want by listing one per DATA statement. The alternative, using a FOR/NEXT loop, would require that we know in advance how many DATA statements we are going to use. The program wouldn't be as easily expanded that way.

Then line 30 puts a random number between 1 and 10 into the variable X, and line 40 reads the remaining two DATA items in line 500: 2.54 and centimeters. Now we're ready to ask the first quiz question. Line 50 will ask: X inches is equal to how many centimeters? Notice that we chose easily remembered variable names: M\$ for Metric word, E\$ for English, CF for Conversion Factor, TRY for the player's guess. Such names make programming easier.

Line 60 calculates the answer (A). The conversion factor, multiplied by X, will always give the correct answer in metric measurements. That's the way we set up the DATA. A is rounded off to two decimal places with the INT formula (see last month's column if this is unclear to you). In line 70, we get the player's guess and, if it's right, line 80 announces that happy fact, raises the player's total score (T), and goes up to line 100 (which

itself just sends us back to start the second cycle of the quiz in line 10). Why GOTO 100 instead of GOTO 10? As is often the case, you solve a programming problem in several perfectly acceptable ways. This IF/GOTO structure is rather common, though, when you want to jump over something. Notice that line 90 does not need to test TRY to see if it equals A or not. Line 80 already did and, if it did equal A, line 80 would force the computer to jump up to line 100, and line 90 would never be activated.

When the quiz has finished all its cycles and has come to the word END, line 200 prints the score and if the player wants to try again, line 220 clears out all the variables (CLR resets T to zero and allows you to start reading the DATA from the bottom again). We could have used RESTORE which starts us over on DATA, but then we'd have had to add T=0. CLR is easier.

Going The Other Way

As it stands, this quiz prints the familiar English measurements and asks us to provide metric answers. How hard would it be to go in the other direction?

Program 2 reverses the quiz. You need only change these three lines.

Program 2: Metric To English

```
50 PRINT X;M$" IS EQUAL TO HOW MANY "E$
60 A=X/CF:A=INT(A*100+.5)/100
90 PRINT"NO, THE ANSWER IS "A;E$
```

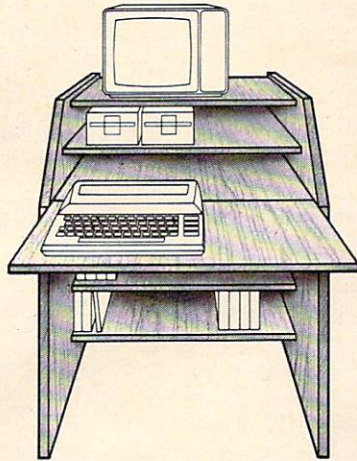
Line 50 simply transposes M\$ and E\$. Line 60 divides rather than multiplies. Line 90 prints the correct E\$ in the event of an error.

Program 3 is a considerable transformation, but still retains the essence of Program 1. Here, rather than asking about a mathematical relationship, we use the first two DATA items of each series to provide clues. The third item, C\$, is the answer we're looking for. Neither the computer nor the player does any calculation. It's just factual knowledge we're after this time.

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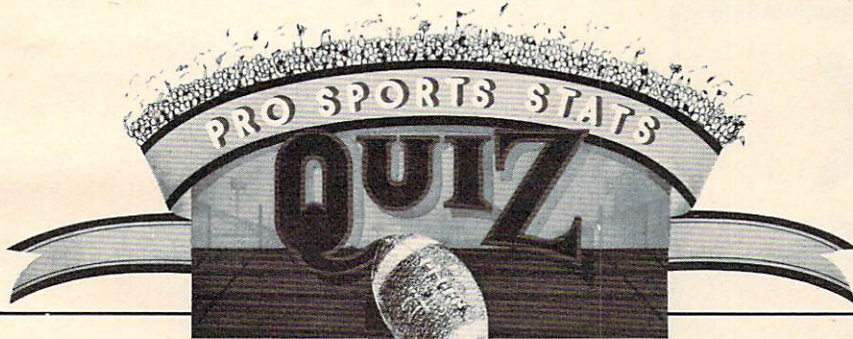
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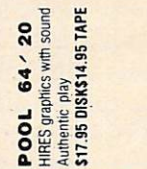
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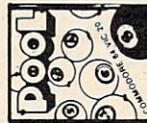
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Notice that the DATA statements can again be as extensive as you want; just end with END. Also, in this type of "word problem" quiz, it helps to repeat the quiz format as you write in each DATA line. Here the form is: A\$ is a B\$ in C\$. That's why we need the leading *the* in four out of the five DATA lines. Each question will sound right to the player if you word the clues correctly.

Clearly, this programming form could be used in many ways. You could quiz about relationships (DASHIELL HAMMETT was the HUSBAND of ?); truisms (NECESSITY is the MOTHER of ?); history (DARIUS was the KING of ?); and many others. Or you could change this fill-in-the-blanks style test to multiple-choice. Simply expand the DATA statements to include, say, three possible answers. Print them out with the questions. And have the correct answer (number 2, for example) be one of the DATA items.

Beyond that, you can create flash card simulations, true-false tests, logic relationships (PULL is to PUSH as LIFT is to ?)—even reading comprehension tests with full paragraphs and questions about the text. Adding some sound effects and animated characters can make school lessons very appealing to children. And, following this basic form, you can easily enter new DATA for different lessons every week.

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Users of TI console BASIC (without Extended BASIC) must make several adjustments to published program listings, these included. You must have only one statement per line, the THEN in IF/THEN structures can only reference a line number, and there must be spaces between all BASIC commands and variables. For example, line 20 in Program 1 will work correctly since the THEN sends the computer to line 200. But line 80 will need to reference some other lines which you must create within the program to accomplish what line 80 does in Program 1 as printed.

Program 1: English To Metric

```

10 READ E$
20 IF E$ = "END" THEN 200
30 X = INT(RND(1)*10)+1
40 READ CF: READ M$
50 PRINT X;E$ " IS EQUAL TO HOW MANY "M$
60 A=X*CF:A=INT(A*100+.5)/100
70 INPUT TRY
80 IF TRY = A THEN PRINT"CORRECT.": T=T+1
   :GOTO 100
90 PRINT"NO, THE ANSWER IS "A;M$
100 GOTO10
200 PRINT"YOU GOT "T" CORRECT.{2 SPACES}W
   ANT TO PLAY AGAIN? (Y/N)
210 INPUT AS$
220 IF AS$="Y"THEN CLR: GOTO 10
500 DATA INCHES,2.54,CENTIMETERS
510 DATA FEET,30.48,CENTIMETERS
520 DATA YARDS,.9144,METERS
530 DATA MILES,1.609,KILOMETERS
540 DATA PINTS,.4732,LITERS
550 DATA QUARTS,.9464,LITERS
560 DATA GALLONS,3.785.LITERS
570 DATA POUNDS,4.448,NEWTONS
580 DATA END
  
```

Program 3: Geography

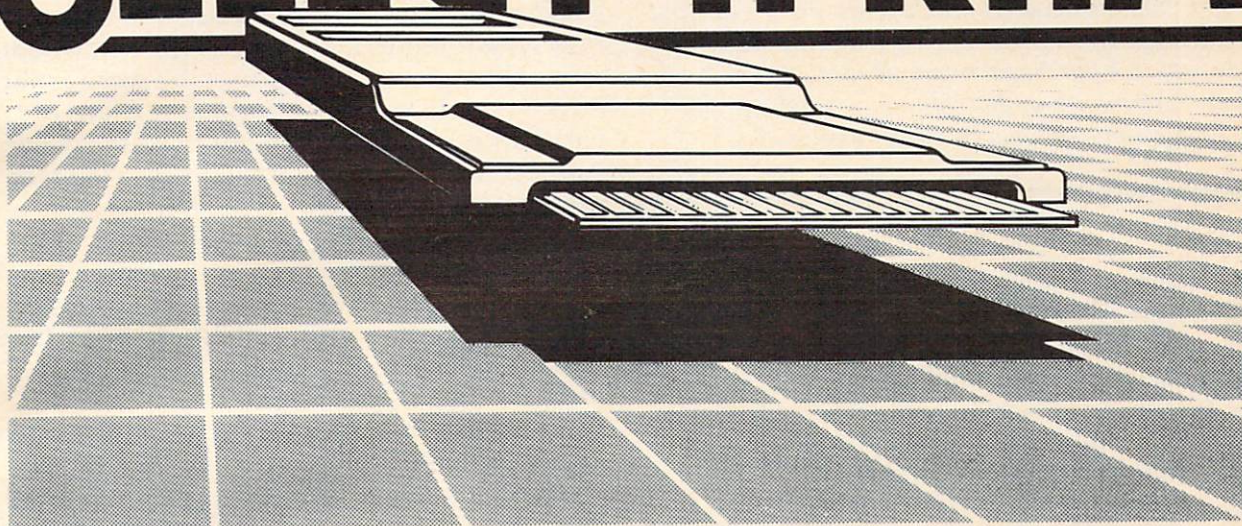
```

10 READA$
20 IF A$ = "END" THEN 200
30 READB$,C$
40 PRINTA$;" IS A ";B$;" IN"
50 INPUT TRY$
60 IF TRY$ = C$ THEN PRINT"CORRECT.": T=T
   +1:GOTO 10
70 PRINT"NO, THE ANSWER IS "C$
80 GOTO 10
200 PRINT"TOU GOT "T" CORRECT.{2 SPACES}W
   ANT TO PLAY AGAIN? (Y/N)
210 INPUT AS$
220 IF AS$="Y"THEN CLR: GOTO 10
500 DATA THE GOLDEN GATE,BRIDGE,SAN FRANC
   ISCO
510 DATA THE TAJ MAHAL,BUILDING,INDIA
520 DATA PERTH,CITY,AUSTRALIA
530 DATA THE GREAT PYRAMID,MONUMENT,EGYPT
540 DATA THE VOLGA,RIVER,RUSSIA
550 DATA END
  
```

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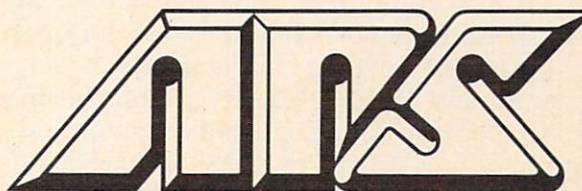
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Questions Beginners Ask

Tom R. Halfhill, Features Editor

Are you thinking about buying a computer for the first time, but you don't know much about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! will answer questions commonly asked by beginners.

Q I have some questions about computer languages. First, what are the different languages? Second, what do they stand for (example: BASIC = Beginner's All-purpose Symbolic Instruction Code)? Third, can the VIC use any of these languages without a special cartridge, disk, cassette, or adapter?

A It would be impractical to list *all* of the different computer languages in this column—there are scores of them, maybe even as many computer languages as human languages. However, just as most human communication is expressed in a half-dozen or so common languages (Mandarin Chinese, English, Spanish, Russian, Hindi/Urdu, Arabic), most programs are written in a like number of computer languages.

Probably the most common computer languages are BASIC, COBOL (Common Business-Oriented Language), FORTRAN (FORmula TRANslator), Pascal (named after French mathematician Blaise Pascal), APL (A Programming Language), Forth (a "fourth-generation" language), LISP (LISt Processor), Logo (a graphics-oriented derivative of LISP), PILOT (Programmed Inquiry, Learning, Or Teaching), Ada (named after Ada Lovelace, thought to be the first computer programmer), and C (a Bell Laboratories language with a refreshingly short name).

Not all of these languages are common on personal microcomputers, and some of them are highly specialized. For example, Ada is a Department of Defense language implemented largely on mainframes. COBOL is a very popular business language because of its English-like syntax and record-handling structures. FORTRAN is favored by scientists and engineers because of its mathematical functions. Many educators choose to teach programming with Pascal because it encourages structured programming. Classroom

teachers often find that PILOT's input and answer-matching routines make it ideal for writing educational programs. LISP is used by some artificial intelligence researchers. Various versions of Logo with turtle graphics are taught to young children. And BASIC has become virtually the standard programming language on small computers used in millions of homes and schools.

Actually, in a strict sense, these aren't "computer languages" at all. They are as foreign to computers as Chinese or English. Instead, they are languages which people have invented to program computers more easily.

The only true computer language is *machine language*, literally the language of the machine. Machine language is a set of very elementary instructions recognized by the computer's Central Processing Unit (CPU), its "brain." All the other computer languages mentioned are, themselves, written in machine language. For this reason they are referred to as *high-level* languages, because they are far removed from the actual machine's way of processing. A single instruction in a high-level language is made up of several simple machine language instructions.

High-level languages were invented because machine language programming can be more time-consuming, particularly for beginners. Generally, today's programmers use machine language to achieve greater program speed or compactness.

Almost all home/personal computers, including the VIC, can use languages other than the built-in BASIC. However, since a language is itself a large program, it must be loaded into memory from either tape or disk, or by plugging in a cartridge. Popular second languages for home computers include Logo, PILOT, and Forth.

Q Is there some command or series of instructions that can be used in direct mode to get a printer to work? Do all instructions to a printer have to be in a program or a word processing package?

A You can indeed send instructions and even text to a printer in direct mode. In some forms of BASIC (such as the Atari and TRS-80

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dialects) the command is LPRINT. It works just like the PRINT statement, except output is diverted to the printer instead of the screen. Here are some valid LPRINT statements:

```
LPRINT "HELLO, THIS IS A TEST."
X=10:Y=20:Z=30:LPRINT X+Y*Z
X=365:LPRINT "THERE ARE ";X;" DAYS IN A YEAR."
```

In Commodore BASIC, you must first open a channel to the printer, then use a special form of the PRINT statement to send output along that channel:

```
OPEN4,4:PRINT#4,"HELLO, THIS IS A TEST."
CLOSE4
```

You can send commands to the printer the same way. Printer manuals tell which codes activate which features. For example, to switch an Epson MX-80 into the expanded text mode:

```
LPRINT CHR$(14)
```

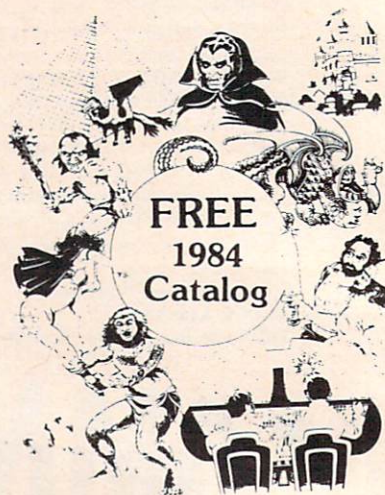
or

```
OPEN4,4:PRINT#4,CHR$(14):CLOSE4
```

Similar codes can be sent to switch on italics, underlining, condensed text, double-strike modes, etc., and to switch them off again on printers that support these features. ©

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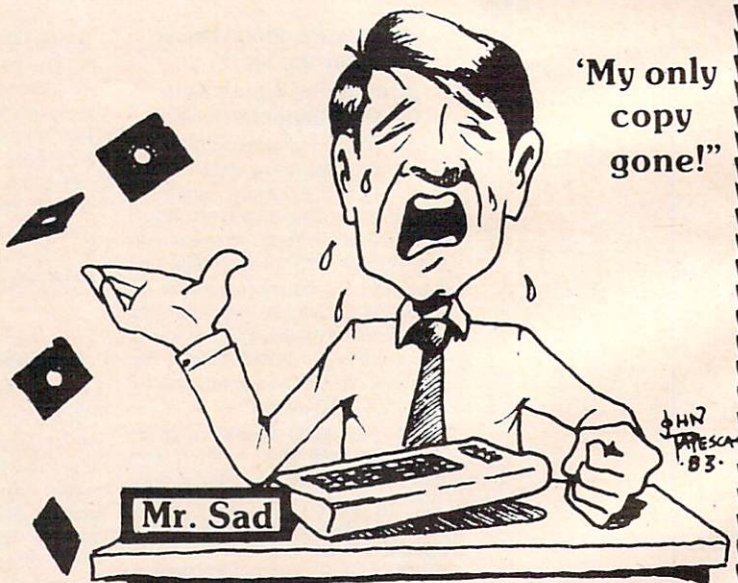
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The Book Of The Future: Electric, Unending, And Written In RAWM

Recently I went to a book publishers' conference in Baltimore and ran into an editor friend from a major New York publisher. My friend is an avid home computer user, and he edits science fiction books.

He loves to look into his editor's crystal ball, then tell what he sees there. When he looked into the future, he saw computers everywhere. But he didn't see books. He didn't see words, either, just pictures—computer-generated pictures—and sounds. "In the future, all novels, all information, all knowledge," he told me earnestly, "will be conveyed by computers electronically in the form of pictures and sounds."

According to my friend, "Computers can already read books to people automatically, so why should people learn how to read? Reading is becoming an obsolete skill, like speaking Latin."

Human Computers

Was my friend right? After all, look at what computers and calculators have done to people's computing skills. The word *computer* used to mean a person who could do arithmetic calculations swiftly inside his or her head. Most adults today still walk around with little multiplication tables inside their heads, along with a jumble of rules about how to do addition, subtraction, division, and other basic numerical operations.

But we don't use these rules too often anymore. We have slim calculators that fit inside our checkbooks, shirt pockets, and purses. Whenever we have to do any serious computing, we pull out the calculator, punch a couple of buttons, and get the answers we need. Why should we re-

member how to do arithmetic when a tiny electronic brain will remember for us?

Of course, most of us don't make a decision to abandon arithmetic. But, we are abandoning it nevertheless. The less often we practice, the more rusty our skills become, and the rules and tables inside our head begin to fade.

Annex To The Brain

The same thing is happening in our schools. Calculators are becoming as common as pencils and paper in math class. Teachers can rationalize this by explaining how they free their students to examine the concepts and theories behind the numbers. The calculators take care of the numbers, so the students can focus on the axioms, concepts, and rules underlying mathematics.

When a student uses a computer, math ceases to be a painful discipline of mechanically manipulating numbers and formulas. Instead it becomes a beautiful language—a dynamic, active process, a vocabulary of symbols that describe the world. A student doing math on a computer feels like a chemist working in a laboratory creating a bubbling, popping, hissing, odiferous chemical reaction. Math has texture, tangibility, and feel. It is alive and evolving. Young people can explore the world of mathematics using computer-enhanced tools, and they no longer have to get bogged down in a swamp of computational details.

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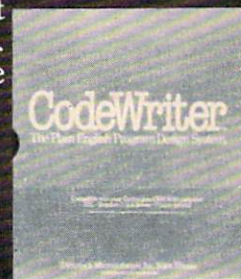
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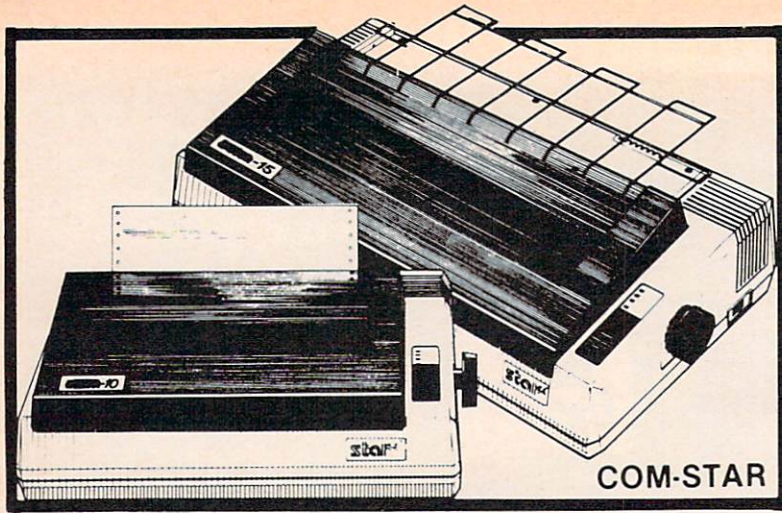
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machines because the world was getting too complicated for human brains to handle alone. Computers are an extension to the human brain. They amplify the power and speed of the brain in areas where the brain is the slowest and weakest. With the help of an "annexed" computer brain, a human brain can handle vast numbers of details; it can order and structure huge quantities of information, and perform arithmetic at lightning speeds.

Books That Are Hot

Numbers are just symbols. Pictures are symbols, too. So are musical notes. Letters and words, too, are symbols.

Computers are extraordinary symbol handlers. Researchers at several universities recognize this and are starting what are coming to be known as "electronic book" projects. The researchers believe that printed books, the dominant means to transfer information, ideas, and images since the 1500s, will soon be succeeded by electronic books—an amalgam of the personal computer, the TV set, the stereo, and the telephone.

Electronic books must have all of paper books' desirable attributes. Electronic book "players" and cartridges must be inexpensive, portable, and personal.

Electronic-book researchers share the opinion of my editor friend, at least in part. They feel that electronic books of the future can't rely solely on words. Instead they must make use of the full symbol-handling and interactive potential of the computer.

For example, they must be *hot*. According to Marshall McLuhan, a "hot" medium appeals to people's senses, the more senses the better. Electronic books may not have the same texture and smell of printed, paper books. But they will have hot substitutes—animated color cartoons, music, sound effects, and voices.

And they must be interactive. Readers interact with printed, paper books with the use of their memories and imaginations. Readers will interact with electronic books more explicitly—by answering the book's direct questions, by keying in information, by making choices and decisions.

"Participatory" books are on the horizon: participatory textbooks, participatory novels, and interactive mystery stories. The first generation of computer "electronic book" programs already runs on personal computers in the form of educational simulations and electronic adventure games.

Build-Your-Own-Book Kits

Electronic books of the future will be interactive, multimedia entities. But they will also be something more. They will not be static creations whose final form appears when they are first published.

Instead they will be more like "build-it-yourself" book kits—like the new breed of arcade-game builder kits (for example, *Pinball Construction Set* from Electronic Arts and *Loderunner* from Bröderbund). They will be malleable, ongoing, and evolutionary. They will invite modification, polishing, and alteration.

More than 40 years ago, the great American scientist Vannevar Bush came up with an idea called Memex. Memex was to be, in part, an electronic book. It was to be a book that would never be fully written. Each time a person explored new associations, new information, and new knowledge, the book would grow and evolve.

Bush's ideas have been developed even further by Dr. Alan Kay, head scientist at Atari, and Dr. Andries Van Dam, at Brown University, in Providence, Rhode Island. Kay and Van Dam are using modern microelectronics technology to build electronic books in their laboratories.

Already, experimental desktop and lap-sized electronic books exist that include the best features of books and computers. And they are not a "read-only" medium (ROM)—they are a "read-and-write" medium (RAWM). They allow multi-authors. When a book is "published" in silicon, it will have lots of space in its "margins" for readers to make comments and annotations. Some books will even permit copies to be made, and alterations to the original book's content. In a sense, the books will never be completely written. Each new reader can become the book's author and change the book while he or she is reading it.

When readers make changes, they won't be working in only one medium—for example, print. Instead, they will be able to use a "book editor" program to alter all aspects of the book—its text, sound effects, its (static and animated) illustrations, its music, and voices.

The book will be a multimedia creation, and it will evolve in all media.

Mortal Foes

These speculations give little solace to librarians and to other book lovers. Lovers of printed, paper books are not about to jump on the electronic-book bandwagon. They still like bound-and-printed books too much.

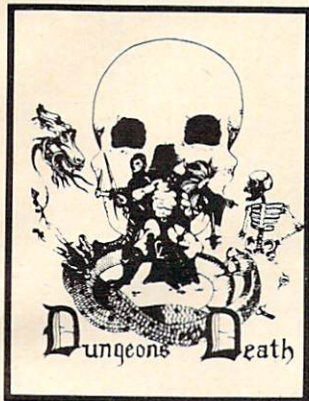
Over the last couple of years I have spoken at several librarians' conferences. Many librarians have approached me and expressed the fear that my editor friend's vision of the future may come true.

Actually the librarians have two fears. They are worried that electronic books will supplant printed, paper books. And they are worried that the new computerized books will rely only on pictures and sounds and not on words.

The librarians' fears are well-founded. Paper

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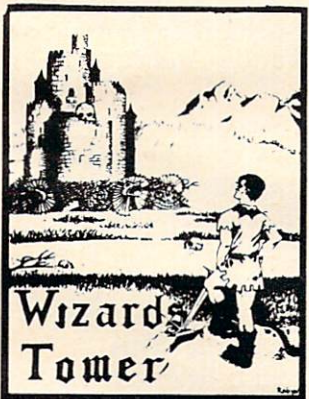
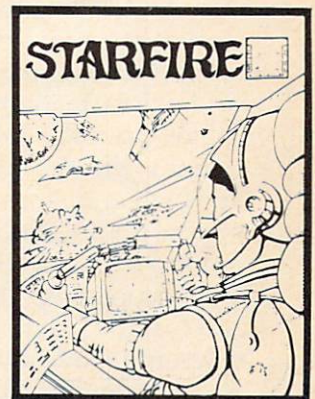
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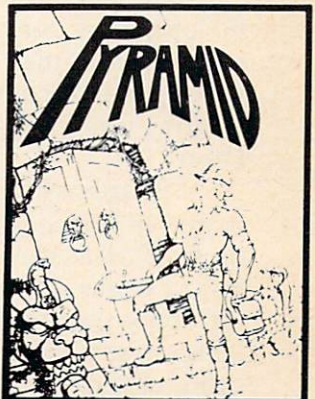
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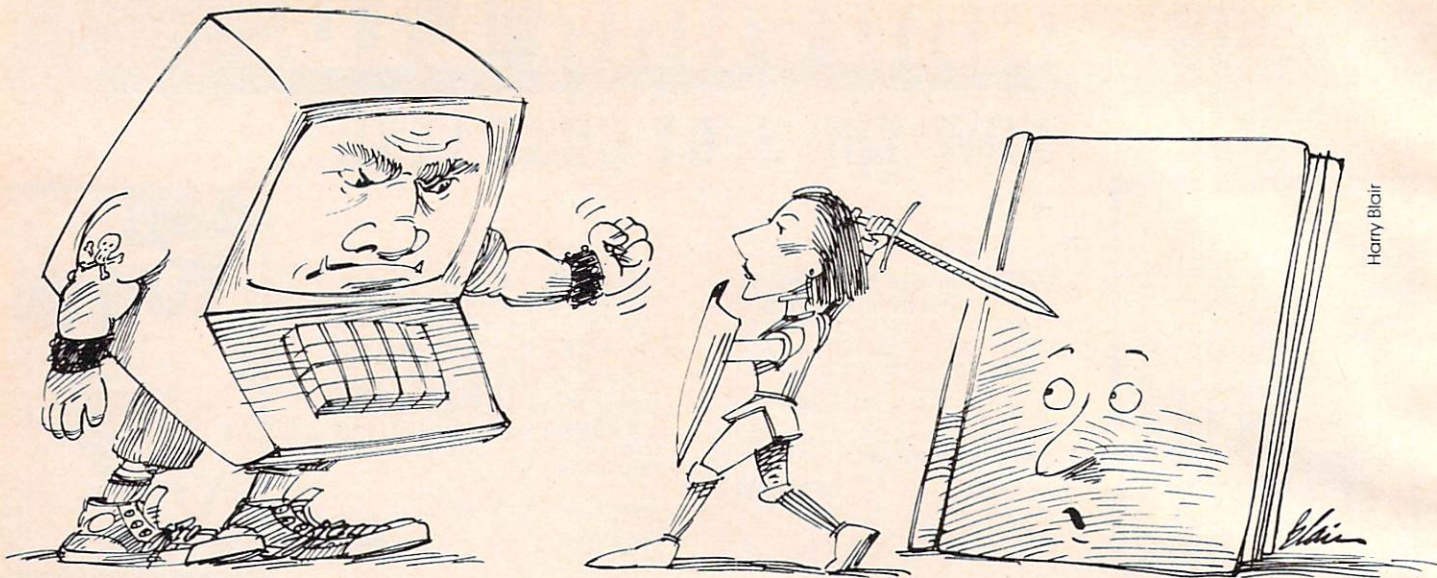
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is increasingly expensive as a medium for information storage and communication, while silicon is rapidly becoming less expensive. Second, the kind of information that paper can store is limited—chiefly printed symbols, photographs, and illustrations. But the kind of information that can be digitized and stored in silicon is unlimited. Music, voices, photographs, works of art, as well as printed text and other symbols, can all be stored in a silicon book. Then they can be altered, copied, and instantly transferred across thousands of miles and made available to other human beings at only a small cost.

This has the librarians worried. If words are no longer the dominant, or even most important, medium of human communication, reading and writing may become obsolete skills, just like calculating numbers, and speaking and writing Latin.

Librarians and other book lovers are not going to just sit back and watch this happen. They see themselves as caretakers, guardians, and protectors of books—of printed media, in general. They feel that a gigantic battle is looming on the horizon between printed media, on one hand, and non-print, electronic media, on the other. Books and computers, they feel, are mortal foes that will soon be locked in battle.

And when the battle is over, only one foe will remain—the computer. Books already published will yellow and crumble, destroyed by the acid in their pages, and no new paper books will ever again be published.

With the emergence of the electronic book, the era of the printed, paper book may soon be over.

The Rise Of The Electronic Librarian

The gradual move from paper to silicon is inevitable. But it is not going to happen overnight. Nor

does it have to mean the end of books, the end of words, or the end of librarians.

Recently I gave a speech at the annual convention of the Virginia Educational Media Association (VEMA), at Virginia Beach, Virginia. The title of my speech was "The Role of the Librarian in Helping Students, Parents, and Teachers Use Computers and Robots."

In my speech I expressed the hope that librarians would see themselves in a broader role. Librarians are not just caretakers of books and magazines. Rather, they are guardians of information, knowledge, wisdom, stories, tales, lives, art, music, and culture. They are the caretakers of civilization. How civilization is stored is not important as long as it is protected and readily accessible to all people.

Many librarians now call themselves *media specialists*. They are the guardians of the media on which civilization is stored—all media. They make it possible for children and adults to access civilization through those media.

As the 20th century comes to an end, it is a fact that more and more of our civilization is being digitized and stored on electronic media. This does not mean that librarians must be trained technologists and engineers. Nor does it mean they must become computer programmers, electronic technicians, and videodisc mechanics.

They just have to be able to use the new machines, because they are the doorways, the windows to the information. And they must be able to help others use these machines. As the bulk of our civilization shifts into an electronic format, it is up to the librarians to keep the doorways and windows open for the rest of us.

I have listed below some of the computer- and robot-related services that librarians can provide. I have suggested a pathway librarians can follow to create an electronic library of the future.

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In my vision of the future, books, words, and librarians have a very important role to play.

The Armchair Computer

Most adults are not ready to approach computers. And most children have only a limited opportunity to spend time with computers. By mid-1984, even though all elementary and secondary schools in the U.S. will have at least one computer, each student will be able to spend only 15 minutes with a computer per week.

Yet many children and many adults want to learn more about computers. How can they learn more?

They can start by reading magazines and books. Children and adults can become armchair computer experts by reading the many excellent beginners' books and magazines about computers. The books and magazines will make the time a beginner spends on the computer more productive and exciting.

Computer Etiquette

Books and other print materials can also teach people how to use computers ethically. Computer literacy courses sometimes focus exclusively on a narrow skill such as BASIC programming and little attention is devoted to such pressing social issues as software piracy, computers and alienation, and computer crime. Good books and magazine articles can focus on these issues and broaden the scope of children's and adults' computer literacy.

Software Evaluation

Hundreds of computer programs and dozens of new computers have appeared in the last couple of years. Children and adults who are interested in computers are bewildered by all the choices open to them.

Libraries can perform a major public service by acquiring good software and hardware review materials published by such organizations as:

EPIE Institute

Box 620
Stony Brook, NY 11790
516/246-8664

School & Home Courseware Inc.

Dept. 750
1341 Bulldog Lane
Fresno, CA 93710
209/227-4341

The Micro Center

Dept. M G
P.O. Box 6
Pleasantville, NY 10570
800/431-2434
914/769-6002

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Woodcliff Lake, NJ 07675
201/391-7555

Jack L. Hartman & Co.

2840 Peters Creek Road
Roanoke, VA 24019
703/362-1891
800/336-5962

Computers On TV

There are more and more computer programs on television—on network TV, cable TV, and public television. Librarians can contact the local TV station to find when computer programs will be aired. Then they can ask permission to videotape programs for use in the library. Programs can be used as part of classroom assignments on computers, by computer clubs, parent-teacher groups, and for in-service training of school faculty and administrators. Or the librarian could tape several programs and organize a unit during library period on the "electronic library of the future—the pros and cons."

Public TV, in particular, has a number of excellent programs on computers. One program I have participated in is the Educational Computing Profile, a monthly, half-hour, magazine-format show produced by Kentucky Educational Television, in Lexington, Kentucky. Every month the show is sent, via satellite, to public TV stations all over the country on the Public Broadcasting System (PBS). To find out more about the show, contact:

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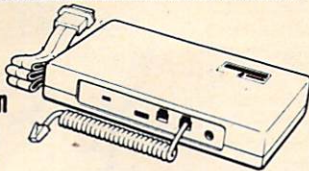
A Software Library

Many librarians are creating a computer-and-robots section for their libraries. The section has print materials focusing on robotics, programming, computer literacy, computer ethics, computers and society, and software and hardware evaluations. It also has a growing selection of personal computers and computer *software*. Children and their parents can check out the software and use it in the library or at home. Teachers can check out the software and use it in their classes. Each software package comes in an envelope with a photocopy of one or more recent reviews and evaluations.

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Library Robots

Almost all librarians can use more help. Many librarians are "adopting" robot mascots. A robot can act as a librarian's assistant and "public relations agent."

A librarian who adopts a robot can't expect it to shelve books or file cards in the card catalog. Today's robots are too primitive for that kind of assignment. But there is still a lot they can do.

Robots are extremely powerful attention-getters.

A talking robot can lead library activities and announce upcoming library events.

A mobile robot can roll around the room carrying a sign or wearing a billboard advertising the library's new books or attracting the kids' attention to the librarian's messages and new services.

When a robot arrives from the factory, it is usually "naked." Kids in art class can design a wardrobe for the robot. The robot can wear the school emblem and the school colors. It can wear special costumes for holidays like Halloween, Easter, Chanukah, and Christmas.

Children can design a musical language for the robot, and teach it library manners.

A robot makes a terrific librarian's assistant, and it is one of the less expensive computer peripherals. Robots like the Tiny Turtle from Harvard Associates and FRED and TOPO from Androbot are less than \$500. (FRED is only \$200.) For more information, write or call:

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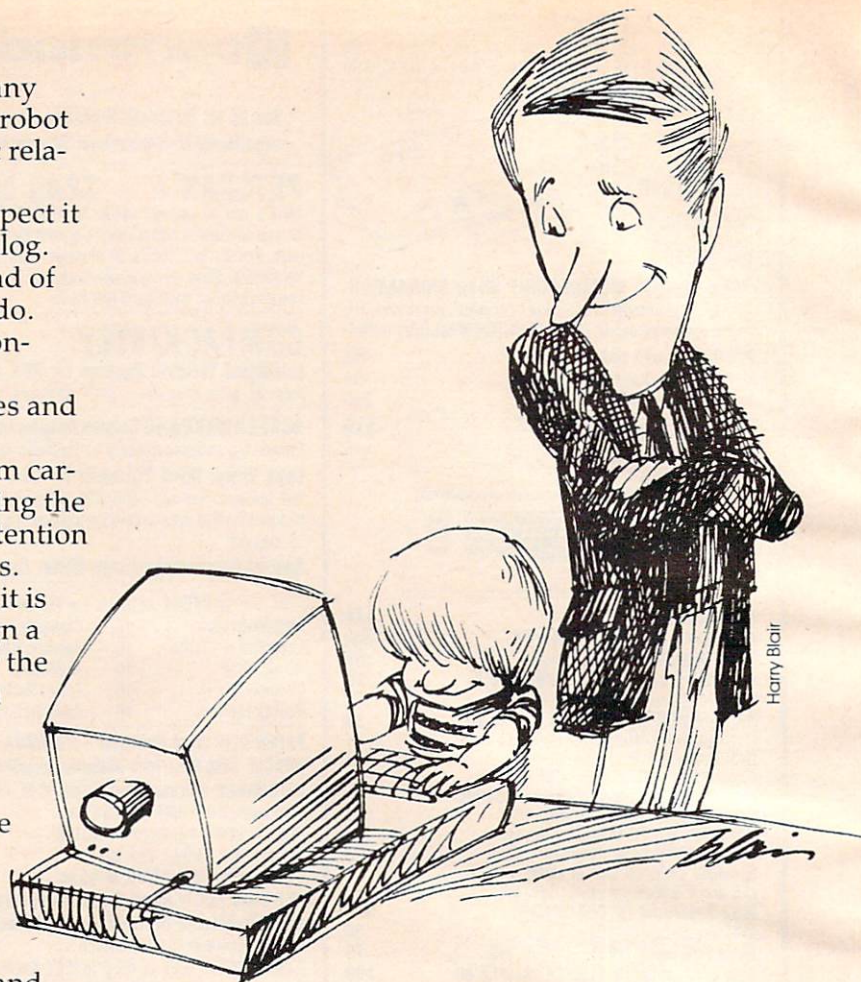
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Computer Intimacy

Everyone is pressing children and adults to become computer literate, but before anyone can truly become computer literate, they must first become computer *intimate*. To be computer intimate they don't need to know how the computer works, only how to make it work. They must be comfortable and relaxed with the computer and be able to use it to work, learn, or play.

Often there isn't time for children to become intimate with a computer during the school day. There are just too many students and too few computers. And adults who are interested in computers are frequently too fearful and wary of computers to shop for one in a relaxed and objective manner.



Harry Blair

Also, the first experience many people have with computers is pretty dreary. They are expected to dive immediately into the technical details of computer programming, or they are subjected to a dry, textbookish CAI program to learn vocabulary words or arithmetic skills, or they are shown a screen full of numbers or dull, uninteresting files and records.

Most people first use computers in a class or on the job. Thus, they must learn something serious or work-related.

But a computer in a library is different. It is there as a resource, a tool, a thoughtful, challenging game, and *as a way to spend one's time learning about things one wants to learn about.*

A library is a place where a person can become intimate with computers.

Librarians should look for computer programs which are attractive, easy and enjoyable to use, and which children and adults can use for hobbies, supplementary, self-motivated and self-guided learning, and for personal enrichment.

The library computer can become each person's personal learning companion and tutor.

Homework And Community Loan

Libraries can also buy computer programs that turn the computer into a general-purpose tool to help students with class assignments and

homework. The computer can have a word processing program so students can work on book reports in the library. It can have graphics and music "builder kits" to help kids with art and music assignments. Children and adults can use data management, listmaker, calendar, and time management programs as electronic notebooks and to schedule and prepare assignments. New computer math tools help children with math classes in arithmetic, geometry, algebra, and trigonometry.

Libraries can also work with parents in the community to get donations of old computers, programs, and computer equipment. Everything can be cataloged, then loaned to low-income families in the community who are interested in computers but unable to afford them.

Computer And Robot Activities

Older students can program the library robot to become a tutor for younger children. The robot can teach directionality, counting, letters of the alphabet, spelling, colors, and other basic kinds of knowledge and skills.

Older students can form a library software department and write software to help the library—especially learning programs for different classes in school, and programs that maintain an electronic data base of computer and robot resources available at the library. Librarians should especially encourage team programming projects where groups of students work together.

Students can be encouraged to use the library computers to create their own electronic "choose your own adventure" stories. The program listings for the stories can be printed out and bound by the art classes and put on a special bookshelf in the library. The stories should be public domain so that students can copy the original stories, add to them, change them, and make them into new stories. The stories can become ongoing, evolving electronic books.

The Electronic Library

Each personal computer in the library should have a modem or acoustic coupler attached. This device lets the library computer talk to electronic data banks and information services via the telephone. These services are an electronic "annex" to the library.

Most information services are easy to use and relatively inexpensive. There is no need to organize elaborate, formal projects around these services at first. It is very educational for librarians and child and adult patrons to "browse" through these services and the information they offer. After everyone becomes comfortable using the electronic library, activities and uses will suggest themselves naturally.

Watch Me!

Perhaps the greatest justification for having computers and robots in libraries is so the librarians can learn more about these devices—in the manner they choose and at their own pace. They can control and regulate the influx of new technology rather than be overwhelmed by it.

The best way for librarians to become comfortable with the new technology is for them to look over the shoulders of the children who are teaching the robot and computers new tricks. They'll pick up the children's love and enthusiasm for these machines quickly, and they'll find themselves learning how robots and computers work. Pretty soon they'll be dreaming up new projects for the computers and thinking about adopting a second robot.

As more and more of our knowledge, information, stories, and culture are converted to an electronic format, it will be up to the librarian to acquire the machines and the expertise to give everyone access. These machines and the librarian's expertise are the windows and doorways to the information people need. The librarian's job is to be there to make sure that the windows and doorways are open wide so that the riches stored inside these machines are available to everyone. ©

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Learning With Computers

Glenn M. Kleiman

Potentials And Limitations

This month marks the beginning of the third year of the "Learning With Computers" column. During the past 24 months, we have discussed many of the ways computers can be used in education and we have reviewed many programs and publications. These columns were intended to provide readers with information about specific applications and products that would help them use computers as educational tools.

In this and next month's columns, we will step back from the specifics to get a broader perspective. This month we'll consider the nature of computers, their potential educational applications, and their limitations. Next month we'll explore issues educators face when incorporating computers into their schools.

The Nature Of Computers

In order to understand what computers can and cannot do, it is helpful to know something about their basic nature. Two main points are essential to begin understanding computers. The first is that computers are tools for working with information—words, numbers, pictures, and sounds. Tools expand our capabilities. Some tools, such as hammers and pulleys, expand our physical capabilities. Other tools, such as telescopes and telephones, expand our sensory capabilities. Computers are tools that expand our mental capabilities.

Other machines, such as tape recorders and calculators, also help us work with information. However, each of these machines is limited to performing specific operations (such as storage or calculation) upon specific types of information (such as sounds or numbers). An advantage of computers is that they can perform a wide variety of processes upon all types of information. Computers can help us store, retrieve, organize, com-

pare, modify, communicate, and analyze words, numbers, pictures, and sounds.

The second important point about computers is that in order to do anything at all, they must be given instructions in the form of a *program*. A program is a set of detailed, step-by-step instructions, written in a language the computer can process. Computers obey the instructions in a program exactly. They have no common sense or knowledge of how things are typically done. They cannot interpret a vague or ambiguous instruction, no matter how obvious it would be to a person. Therefore, whenever you hear "The computer did....," you should interpret it to mean "The computer was programmed to do...."

Each program tells the computer how to perform certain functions. The remarkable flexibility of computers is due to their ability to follow the instructions of an infinite variety of different programs.

The Potential Of Computers In Education

The flexible information processing capability of computers makes them potentially useful in a wide variety of educational applications. They can facilitate teaching and learning at all levels, from preschool children mastering the alphabet to doctors learning new diagnostic techniques. And they can be used effectively in all subjects.

Computers open new ways of developing thinking and problem-solving skills, and they provide new possibilities for learning through active exploration. They can make lessons, drills, tests, and record keeping more efficient, thereby freeing teachers to spend more time providing individualized instruction. They can make many types of lessons more interesting and motivating for students, and they can make enormous

amounts of information readily available.

The widespread availability of computers could lead to fundamental changes in classroom teaching and learning, more successful remediation of learning problems, new means of educating handicapped individuals, and expanded opportunities for self-directed and home-based education.

Seven Categories

We can divide the educational applications of computers into seven general categories:

1. Computer tools for creative writing, art, and music. Computerized word processing makes creating and revising any type of writing much easier. It encourages students to write, revise, and edit more, and thereby leads to improved writing. Students can also use computers as a new way to create art and music. Computer art makes new possibilities, such as animations and special effects, readily available to children. Students can also create their own musical compositions and experiment with notes and rhythms, even if they haven't yet learned to play any instrument.

2. Computer tools for gathering, organizing, and analyzing information. Personal computers can be connected to large computers via modems and telephone lines and then used to access all sorts of information. Once the needed information is obtained, computers can be used to store, organize, and analyze it.

3. Computer programming. By learning to program, students acquire a better understanding of the nature of computers. Programming also helps students develop their thinking and problem-solving skills, as well as careful, systematic work habits. In addition, many students find that controlling a computer by writing their own programs is fun and exciting.

4. Computer simulations. Simulations enable students to explore situations and events created within the computer. For example, students can learn about the business world by managing a simulated business. Complex interactions and effects over long periods of time can be simulated almost instantly. Students can perform many types of simulated explorations and experiments that would be too expensive, dangerous, or time-consuming to perform in actuality. Simulations encourage active, exploratory learning, and they can lead to insights into phenomena that cannot be brought into the classroom in any other way.

5. Computerized playful exercises for the mind. These are games, puzzles, and creative tools which help children develop reading, math, memory, problem-solving, and other mental abilities.

6. Computerized lessons. Computers make it possible to tailor lessons appropriate for each individual. Good instructional programs present information, ask questions, give immediate feedback, provide information to clarify students' misconceptions, and adjust the difficulty and speed of presentation to each student's level.

7. Computerized drill and practice. Computers have special advantages for repetitive drill work. They can continuously adjust the level of the drill to be appropriate for each individual, and they can immediately let the student know whether each response was correct or incorrect, slow or fast. Furthermore, computers never show signs of fatigue or impatience, no matter how many repetitions a student needs.

One of the critical questions teachers, parents, and school administrators face is: In which of these ways should computers be used? Unfortunately, the easy answer—all of them—is not feasible with available budgets, time, and personnel. We will discuss this question further next month.

The Limitations Of Computers

While computers can serve many valuable educational functions, they do not magically solve all problems. They don't help us decide what to teach or how to teach it. Computers can be used whether we choose to emphasize basic reading, writing, and arithmetic skills; rote memorization; or thinking skills. They can be used in the most competitive settings and the most cooperative ones, in the most structured classrooms and the most open ones. They can be used in conjunction with the best teaching practices and the worst. Depending upon how we use them, computers can bore or motivate, intimidate or encourage, threaten or challenge.

The introduction of computers does not solve the issues of equal opportunity in schools. In fact, it brings these issues into sharp relief. Will computers be available in the inner-city schools as well as the suburban schools? Will computers be introduced in a way that will encourage boys to learn programming but discourage girls? Will computers be used to direct remedial students in drills, but to encourage creativity and problem-solving for others? That is, will some children learn to be directed by computers while others learn how to direct computers?

Computers are tools, not decision makers. No matter how powerful computers become, they can never resolve the difficult, classical issues of education—what we choose to emphasize in schools, what teaching methods we employ, how we organize our schools and our classrooms, what standards we set for students, and how we can best distribute the limited resources available for education.

Micros With The Handicapped

Susan Semancik & Wini Benvenuti

Special Education Applications

Educational handicaps can be devastating, not only to a student's personal and career development, but also as obstacles to achieving a high self-esteem, as well as gaining peer group respect.

We know from our mail that computer applications in special education are of great interest to our readers, so we will be exploring ways the computer can be used to help and evaluate special education students. The Delmarva Computer Club has purchased an Atari computer and tape recorder, which will be loaned to a special education teacher for use in one of our local public elementary schools.

The Atari was chosen for several reasons: a) relatively inexpensive; b) ability to easily display different sized and colored letters, numbers, and characters; c) ability to play taped voices over the TV set; d) sound capability; e) standard joystick interface; and f) familiarity of several club members with the system.

By working closely with the teacher, we hope to develop computer programs and methods to enhance the special education program in our area, and to share some of these programs, results, and insights with our readers in this column. We would appreciate suggestions for program ideas and techniques, as well as feedback from those trying the programs we develop.

The communication series we just concluded in this column relied heavily on menus as an input method for the motor-impaired. Menus can also be used advantageously in special education. All options are shown on the screen. If they are self-explanatory, they should eliminate complicated or lengthy directions to be mastered before the program can be used.

Eliminating The Keyboard

Another technique that simplifies the use of the

computer for very young special education students is eliminating the keyboard as an input device. Using a joystick or light pen to select the options presented on the screen reduces the number of choices, and the student may feel less threatened or confused.

Part of the problem some students have with counting, for example, involves a loss of continuity when they can't remember the next counting number. When provided with the next number, some students can't continue counting from that point, but must start again from the beginning.

The program presented here is our first attempt at a computer aid for this learning difficulty. A target number is shown at the top of the screen, indicating how high the student must count. The student can enter a number by typing any of the digits from 0 through 9, followed by a RETURN key. We are using graphics mode 2, which gives the largest characters in any of four colors. The number being entered appears in blue at the right edge of the screen. If it is the next counting number, it moves to the left and changes to a gold color, joining the previously entered correct numbers in line. If it is wrong, the entered digits for the number disappear. When the student does enter the correct number, it will appear as red digits in the line, so both the teacher and the student can see the numbers with which the student has problems.

In this graphics mode, the screen width is only 20 characters wide. By using the joystick, the student can scroll the entered numbers left or right to view whatever part of the line is desired. By moving the joystick down, the student will instantly see the number line from the first entered number; and by moving it up, the number line can be viewed at the end of the numbers entered.

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version of a repetitive task, the student will have a more positive attitude which should improve the learning environment.

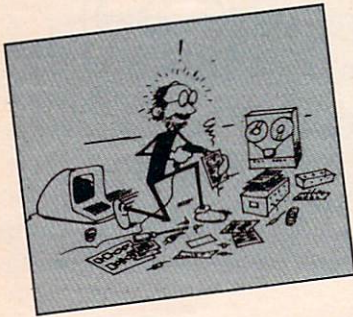
Menu Selection With A Joystick

```
5 DIM S$(300),T$(40)
10 W=20:S$(1)=" ":S$(W)=" ":S$(2)=S$(1)
20 T=30:P=W+1:FOR I=1 TO T:T$=STR$(I):L=LEN(T$):FOR J=1 TO L
30 IF T$(J,J)="0" THEN T$(J,J)="0"
40 NEXT J:T$(L+1)=" ":S$(P)=T$:P=P+L+1:NEXT I
45 GRAPHICS 2+16:POKE 752,1
46 T$=STR$(T):POSITION W/2-LEN(T$)/2,0:FOR I=1 TO LEN(T$):K=ASC(T$(I,I))
47 IF K=48 THEN K=79
48 ? #6;CHR$(K);:NEXT I
50 N=0:PS=1:PE=W:OPEN #1,4,0,"K:"
55 C=0
60 V=0:L=0:T$=""
70 IF N=T THEN CLOSE #1:? S$:END
80 POSITION 0,5:? #6;S$(PS,PE);
90 POKE 764,255
95 IF STICK(0)<>15 THEN 95
100 IF PEEK(764)=255 AND STICK(0)=15 THEN 100
110 IF STICK(0)<>15 THEN 250
120 GET #1,K
130 IF K=155 THEN 200
140 IF K<48 OR K>57 THEN 90
150 V=V*10+K-48
```

```
160 PS=PS+1:POSITION 0,5:? #6;S$(PS,PE);
170 IF K=48 THEN K=79
175 L=L+1:T$(L,L)=CHR$(K-32+64*(K=79)):POSITION W-L,5:? #6;T$
180 GOTO 90
200 IF V<>N+1 THEN PS=PS-L:C=C+1:GOTO 60
210 N=N+1:PS=PS+1:PE=PE+L+1:IF C=0 THEN 60
220 T$=STR$(N):L=LEN(T$):A=ADR(S$)-1:FOR I=PE-L TO PE-1:POKE A+I,PEEK(A+I)+96+64*(PEEK(A+I)=79):NEXT I:GOTO 55
250 IF V THEN 90
255 XS=PS:XE=PE
260 Z=STICK(0):IF Z=15 THEN 260
270 IF Z=13 THEN XS=3:XE=W+2:GOTO 400
280 IF Z=14 THEN 70
290 IF Z<>7 THEN 320
295 IF XE>=PE THEN 70
300 A=ADR(S$):P=PE:FOR I=XE+1 TO PE:IF PEEK(A+I)=32 THEN P=I:I=PE
310 NEXT I:A=P-XE:XS=XS+A:XE=XE+A:GOTO 400
320 IF Z<>11 THEN 260
325 IF XS<=3 THEN 260
330 A=ADR(S$):P=1:FOR I=XE-1 TO 1 STEP -1:IF PEEK(A+I-1)=32 THEN P=I:I=1
340 NEXT I:A=XE-P:XS=XS-A:XE=XE-A
400 POSITION 0,5:? #6;S$(XS,XE):GOTO 260
```

Computing To Read

Fred D'Ignazio, Associate Editor



When Catie was four years old, lots of children used to come to our house to play with our computers. Many of the children were older than Catie, and their favorite programs were the graphics-and-text adventure games.

Older children (8 to 14) used to spend hours at our house playing Epyx's *Crush, Crumble and Chomp! The Movie Monster Game*, Sirius Software's *Copts and Robbers*, and On-Line Systems' *Cranston Manor*.

The games are a lot like the "choose-your-own-adventure" books from Bantam, TSR Hobbies, Pocket Books/Archway, and other publishers. They are electronic "interactive novels," with the child playing the lead role—as hero, heroine, villain, or monster.

In the computer's story world, the child is important; what she does matters. When she makes a decision it changes the whole course of the story. She enters a world where she alone is at the center of the stage.

In addition, the child gets to choose the pace

of the story. When she boots up the disk (most of these story games appear on disk or cartridge, since they are based on very long programs), a picture appears on the screen. This is the first frame in the electronic picture book. Underneath the picture are a couple of brief sentences and a question. The statements might say something like "You are in a purple maze. All the doors are locked." The question might ask, "What do you do now?"

The child must decide what to do. But she isn't rushed. She can proceed through the story world inside the computer at her own pace. Or she can leave that world and walk into the kitchen for a glass of apple juice or a cookie. She can talk to a friend on the telephone. When she is ready to reenter the story world, she can come back to the computer and slide back into the story.

Power Words

Catie spent hours watching the older children play the story games. At first she was happy to stand nearby and watch them play. Then she got bored just watching. She began climbing up on the kids' laps and begging to push some of the buttons.

She wanted, at first, to push the buttons the other children had chosen. Later on, this was not enough; she wanted to choose the buttons herself. Eventually, she made herself such a nuisance that the others stopped playing with her. For a brief time my wife, Janet, and I had to ban her from the computer room because she was so disruptive.

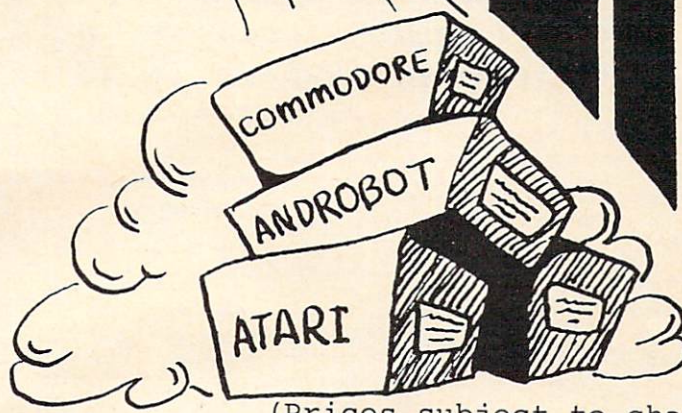
That's when Catie began to play the games on her own.

The older kids were so relieved that they helped Catie by writing down lots of the key words she would need to know to play the games. They wrote these *power words* down on little scraps of pink and blue paper, and Catie taped them to the

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer (Creative Computing), Chip Mitchell: The Case of the Stolen Computer Brains (Dutton/Lodestar), The Star Wars Question and Answer Book About Computers (Random House), and How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) (McGraw-Hill).

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in COMPUTE!.

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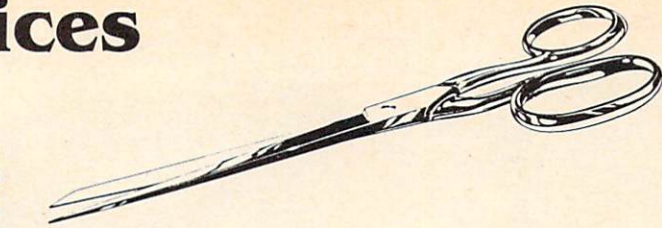
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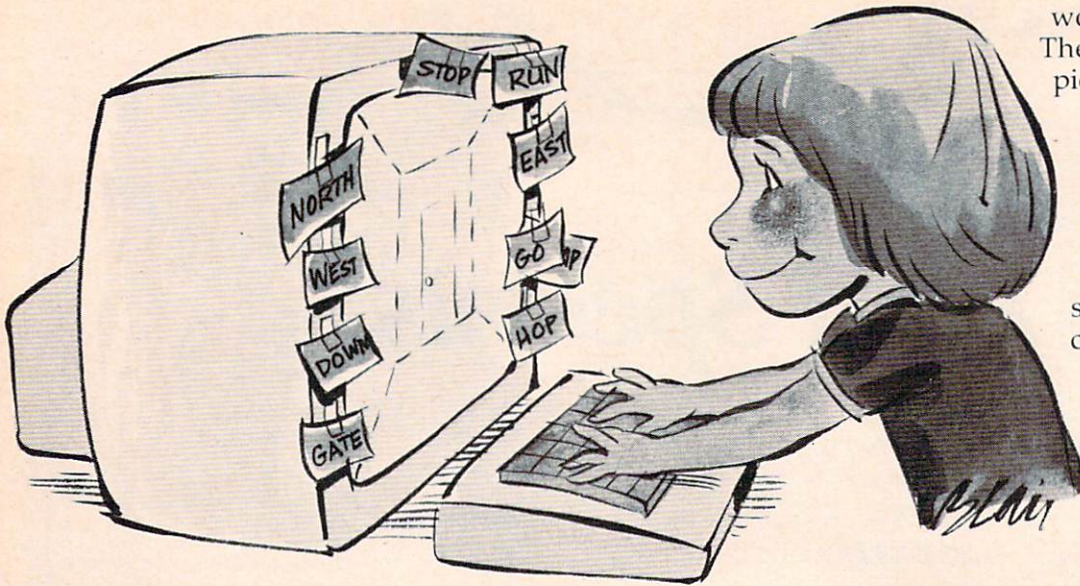
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words and half pictures. The words reinforced the pictures, and vice versa.

Since Catie saw the older children playing the adventure games, she didn't think of the pictures as being part of a picture book—something for younger children. Catie saw the adventure games as something only big kids could master, and she wanted to be like the big kids.

side of the monitor and across the top of the computer.

As Catie grew more adept at playing the games, the number of scraps of paper taped to the computer grew, until the front of the display screen began to look like a bulletin board. It got so hard to see the computer screen that the older kids had to squeeze the words onto fewer paper scraps.

The power words Catie learned enabled her to answer the computer's questions, avoid the monsters lurking in the computer's mazes, and survive longer inside the computer's game world. They included direction words like up, down, left, and right; and the points on the compass—North, South, East, and West. She learned simple verbs like go, stop, run, jump, hop, and climb. And she learned lots and lots of nouns, like candle, flashlight, food, box, treasure, window, gate, and house.

The words were important to Catie because using them gave her power. They let Catie make choices, go where she wanted to go, and do what she wanted to do.

And they had meaning within the context of her adventure inside the computer. But they were not words that appeared on a page, or even on the display screen. They were words on paper scraps outside the computer, in Catie's world. Catie had to type the words herself and enter them into the computer's world. They were keys on a key ring that Catie herself carried. At first, Catie wasn't sure which key opened which door, but she quickly learned to match the doors with the keys. When a key worked, its effects were immediate and dramatic.

Catie could control the microworld she entered by using the right power words. But the world was not made up entirely of words. It was really an electronic "picture book" world, half

Catie had the opportunity to act like the big kids because the challenge was not too great. She had to simultaneously develop her logical, puzzle-solving, and memory skills, along with her reading and writing skills, as she played the games. But Catie could follow the pathway to these skills by taking small, child-sized steps.

Catie could play the games at her own pace—with no one looking over her shoulder or telling her what to do. This meant that she had to live with the consequences of her actions. She got to experience a certain independence inside the computer without a watchful adult hovering over her.

When Catie turned on the computer, the world inside became Catie's world. She was the only human there.

A Closet Reader

One afternoon, after Catie had been playing the adventure games by herself for several weeks, I entered the computer room and noticed that all the paper scraps had disappeared from the picture screen of Catie's game computer. Catie was playing one of the games (*Mystery House* by On-Line Systems), but she was flying solo, without any help from the power words or older children.

I was going to say something, but Catie distracted me by telling me to watch her whiz through the multicolored *Copts and Robbers* mazes, capture four jewelled rings and a vase, and take them to the Vault room so she could win the game. I remember being amazed at her manual dexterity as she pushed the four arrow buttons on the computer keyboard, and I totally forgot to ask her about the paper scraps.

Catie entered kindergarten that fall and reports from her teacher about her reading began filtering home. One day my wife was talking to Catie's teacher and learned that Catie was, perhaps, the best reader in the class. She was

reading books intended for children in second, third, and fourth grade.

The teacher asked us how we had taught Catie to read. My wife said that we had never taught Catie to read. If Catie had learned, she must have taught herself.

That night my wife asked Catie how and when she had learned to read. Catie said that she had known how to read all during the previous summer but that she had been too shy to tell us.

My wife and I were shocked. We had been reading picture books to Catie all summer, while secretly Catie had been reading books written for much older children. We had a daughter who was a "closet" reader.

Once Catie came out of the closet about her reading, we couldn't hold her back. That fall and winter she had her nose in a book all the time. She began bringing home six or seven Nancy Drew books a week. She read her way through Beverly Cleary, Judy Blume, Paula Danziger, Mary Norton, C.S. Lewis, and Katherine Paterson. She read all of Donald Sobol's *Encyclopedia Brown* books and Bantam's Choose Your Own Adventure books. Then she returned to fairy tales and began reading her way through the Brothers Grimm.

Books And Computers

My wife and I are not certain how Catie learned to read, but we are sure that the computer played a big part.

Of course, the computer was not the only factor. Janet and I both love books, and we have read books to Catie from the time she was four months old. Before she learned how to read, Catie already had a library of dozens of picture books. I write books, and both Janet and I collect children's books. We are compulsive readers, and now Catie is, too.

But, as far as we know, Catie never did any reading on her own until after she had begun playing the computer adventure games. So I feel that those games were the key factor in turning her from an almost-reader into a reader. She was probably on the verge of reading, and the games gave her the boost she needed to get started.

Reading: Pain Before Pleasure

We book lovers sometimes think that reading has always been an effortless and pleasurable experience. This just isn't true. It wasn't true for us, and it's not true for our children. For beginning readers, the process of decoding thousands of strange-looking letters, punctuation symbols, and words on a printed page approaches pure agony. The decoding process is slow, painful, and can be extremely frustrating.

This is where computers can play a valuable role. They can break reading skills into small,

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manageable pieces. They can turn each small step a child takes into a mastery, an accomplishment, or a reward. And they can bring the whole process of learning to read more under the child's control and more personally meaningful to the child.

In an adventure game the child is in supreme control. Each time he types in the right power word and advances to a new screen, he feels a sense of accomplishment and mastery. And the stories have meaning because he himself is the central actor in the computer's story world.

Electronic Fairy Tales

When Catie learned to read, the only adventure games were for older children or adults. Now there are adventure games for younger children. These include *Gertrude's Puzzles* and *Gertrude's Secrets* from the Learning Company; *In Search of the Most Amazing Thing*, *Trains*, and *Snooper Troops* from Spinnaker; *Dragon's Keep* from Sierra On-Line; and the many voice-enhanced adventure games and stories from PDI (Program Design, Inc., in Greenwich, Connecticut).

In two months, in this column, I will take a look at some of the newer children's adventure games, and offer suggestions about other techniques that parents, teachers, and librarians can employ to help children develop reading and writing skills using computers.

Submarine Simulations For Commodore

Subwar 64 for the Commodore 64 provides a different sort of challenge. A black-and-white version of the program, titled *Submarine Warfare*, is available for the CBM 8032 and 4032.

Subwar 64 has the perfect balance of simplicity, realism, and complexity. However, it is by no means easy. You must master so many controls aboard your attack submarine that the package comes with three "training" programs.

Dale F. Brown

The Pressure Of The Sea

The first trainer program explains how to trim the ship (balance it horizontally and laterally for best performance), how to make it dive and surface, and how to control its speed. It is a simple text presentation with operating examples of how each command works.

The controls do not respond immediately to the touch of a button (the programs are all written in BASIC), so you must lead your commands in order to keep from overfilling a ballast tank or diving below your desired depth. This program is fast and informative, so you will move on to the next program rapidly after practicing this one a few times.

You next run an initialization program, and then you can try the Ship Control Trainer. You now apply what you learned in the first program to an actual running vessel. Your sub will start out of port badly out of trim.

You, the dive control officer, must trim the sub and then respond to the captain's orders to dive or submerge. You must pump water from trim tank to trim tank, ballast tank to sea, or take on water to correctly balance the weight.

In addition, a few malfunctions are introduced to kill your engines, flood a certain part of your ship, or prevent you from controlling pumps or maneuvering planes. Then, if you're slow to respond to your captain's

orders, you may be sunk by depth charges or crushed by the pressure of the sea.

Controls Take Practice

A little patience is required here. The controls are a bit tricky, and it does take a few seconds for your commands to take effect, so a little preparation and foresight will help. If you open a valve, for example, and you want to take on only a few thousand pounds of water for trim, be prepared to shut it off immediately or you may have to start all over again and rebalance the weight. Some of the emergencies or malfunctions that occur are very difficult to solve. A flooded compartment, for example, may make it nearly impossible to keep your sub level.

The third training program introduces you to the attack center, where, now as captain of the vessel, you pursue and attack surface ships. The Attack Center Trainer sets your depth and trim for you. You use sonar, hydrophones (underwater microphones), and a periscope to locate ships. Once you locate a target, you maneuver your sub to the proper firing course and fire your torpedoes. In the Attack Center Trainer, your targets will take little evasive action and will not counterattack, so you can shoot away until your 24 torpedoes are expended.

The 20-page manual is an excellent aid to learning how to use the various devices and controls, and it shows how to perfectly set up and execute a torpedo run.

Some Real Action

Okay. You've gone through the

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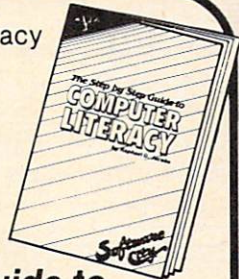
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may take you this long just to finish trimming the ship, let alone starting an attack. Level the sub off near the commanded depth, trim her the best you can, and switch over to "attack center." You will remain at the same depth when you go to "attack center" mode, but if your ship hasn't been trimmed properly, you will bob to the surface or sink rapidly when you switch back from "attack center" to

"full ship control" modes.

The vessel you're tracking will not simply sit there and wait to be sunk. If you get too close, or use your active sonar to prepare for your torpedo run, your target will turn and start dropping depth-charges, and you will automatically switch from "attack center" mode to "full ship control" mode to evade its attack.

Malfunctions can occur at any time, and even your torpedoes can go astray after firing and spoil a perfectly executed torpedo run. A good idea is to return to "full ship control" mode right after firing torpedoes, dive to a safer depth, then switch back to "attack center" mode to see if your torpedoes hit. Your target's retaliation can come quickly, and you can't fire a second salvo of torpedoes until the first torpedoes either hit or miss.

Your score is computed from the number of enemy vessels you sink, the number of enemy attacks you survive or evade, and the skill level (beginner, advanced, or expert) you selected at the beginning.

Subwar 64 is an excellent game simulation for all levels of computer players. It may tax the abilities of younger players, but a few practice shakedown cruises will be in order for almost everyone who gives this game a try. The sounds are excellent, and the graphics and the overall presentation are very good. It will take some careful reading of the manual to explain the sub's operation, but you will soon master the vessel and move up quickly in skill and proficiency. This excellent game simulation is highly recommended.

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D I S T R I B U T O R S

Computer War For Atari, VIC, And TI

Dan Gutman

The success of the movie *WarGames* has spawned several post-*Missile Command* "end of the world" games, most notably Probe 2000's *War Room* and Thorn E.M.I.'s *Computer War*. Coleco, which owns the rights to the title *WarGames*, has yet to be heard from. There will certainly be others.

Computer War is a game in three parts. In the first phase, you see a map of the United States with four American missile bases highlighted. Also highlighted is the computer at NORAD (North American Air Defense System). Suddenly, small white blips move into view, indicating that nuclear missiles are headed for American targets.

But wait! Upon closer examination (of the instructions, that is), you realize that the missiles aren't enemy missiles—somebody has tapped into NORAD to activate a nuclear war simulation program. Since the computer can't tell the difference between real missiles and fake ones, it's going to launch a volley of American missiles as soon as NORAD headquarters is in danger. You've got to knock out the missiles in the computer's memory banks and crack the code to shut down the bases.

Find The Missiles

This first section consists merely of zooming from the map of the United States to individual missiles. The joystick controls an onscreen cursor. When the cursor overlaps the missile blip and the fire button is pressed, that area of the map zooms into view. This exercise is fairly easy. In fact, I would prefer that the blips move a little faster to make this part of the game more challenging. As it is now, zooming in on the missiles is merely a formality.

The graphics on the map screen, however, are the most impressive of the game.

You will zoom to a close-up view of the missiles' target area. Aside from the mountains in the distance, the landscape is totally barren. In fact, you may wonder just what it is you are defending. There are no people or buildings around. Why not just let the missiles harmlessly explode and avoid all the complications?

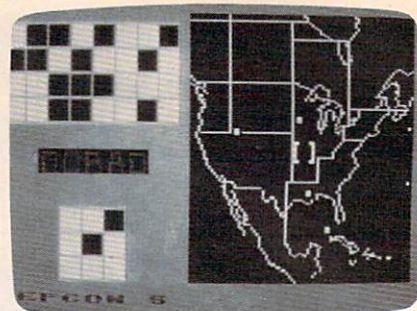
No, the security of the world is in your hands. The joystick can swivel your gunsight left and right and move it up and down also. A little box on one side of the screen indicates which direction to turn to see the missile, and rapid beeping tells you it is about to appear. The fire button launches your fire—two small rockets that arc across the sky and converge in the middle.

The missile will zip back and forth across the screen much faster than you can turn your gunsight. This means that to hit it, you have to fire before it appears onscreen. If you miss, you'll turn far past the target and have to wait for your slow-moving gunsight to change directions. The gunsight should probably move faster, or the missiles slower.

If you fail at this task, the missiles will reach U.S. bases and the DEFCON (Defense Condition) count will deteriorate. If it reaches DEFCON 1 (it starts at DEFCON 5), global war will begin.

Crack The Code

But if you succeed, you reach the third and most interesting part of the game. There are two banks of flashing squares on the left of the screen. Suddenly they freeze in random checkerboard patterns. With your joystick, you have to match the pattern of



Incoming missiles are shown at right in opening screen of Computer War (Atari version).

the smaller box with a section of the pattern of the larger box—kind of like fitting the peg in the correct hole. You have just a few seconds to do this, and you may have to rotate the box to complete the task.

If you match the two patterns (cracking the code), you have earned the right to shut down one of the U.S. missile bases. Of course, there are three more ready to launch everything they've got, so you've got to blow up more missiles, crack more codes, and so on.

Even though I love shooting games, I found that the last part of *Computer War*—cracking the code—was the most intriguing. Since *Space Invaders*, we have shot down so many enemies that the whole ordeal has become a little routine. But when you have five seconds to find a way to fit one pattern into another pattern—that can get the adrenaline flowing again. Mental challenges like this can stand up as games by themselves, and they should—they're exciting and they provide the brain with a little exercise.

Computer War is a single-player, single-difficulty level game. It captures the overall feel of *WarGames* without attempting the complexity of *War Room*, in which you must not only stop the missiles, but also rebuild cities, control production of goods and services, and pick up enemy spies.

Computer War's graphics are sometimes good (locating the

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missiles) and sometimes poor (shooting the missiles). You get the feeling that the game was programmed by two designers with different styles. The music in the beginning is excellent—serious and ominous. The scoring is much too low—40-50 points for knocking out a nuclear missile flying over your hometown. The game is available for Atari computers, VIC-20, and TI-99/4A. Fans of the movie *WarGames* who want to relive it will surely enjoy this game.

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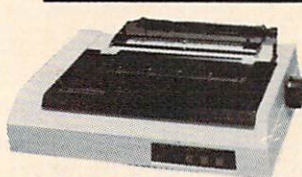
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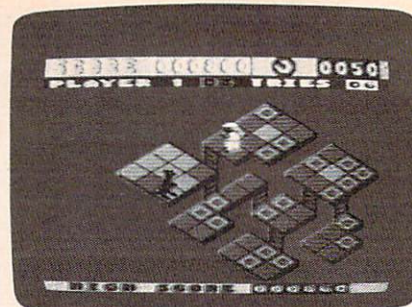
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Flip And Flop For Atari, Commodore 64

Stephen Levy, Editor, COMPUTE! Books



Flip the kangaroo tries to keep clear of the zookeeper in First Star Software's Flip and Flop.

Maze games have been popular for a very long time. Game books that include page after page of maze puzzles for the reader to solve are eagerly snatched up. And schoolchildren often spend many hours designing their own mazes for friends to solve. They enjoy including long paths that seem to go on and on and finally end in a dead end, forcing the player to backtrack to find the right path to the treasure at the end of the maze.

It's no surprise that maze games quickly became popular with videogame enthusiasts. The first games had simple mazes. Then creators of video mazes began to add new dimensions, impossible on paper. They took advantage of the fact that a video screen was more than just a reflection of the printed page. Players demanded action, color, sound—things computers can do so well.

Flip and Flop is a maze game, a chase game, and more. The author, Jim Nangano, has combined some of the concepts that make maze games fun to play with the thrill and fast action of a good chase game. But he didn't stop there. He added some new twists that should make this game a favorite.

Flip And Mitch

Flip is a kangaroo. Mitch is his friend, a monkey. It seems they have been taken away from their friends in the circus and put into a zoo. They're trying to escape. Your job is to help Flip and Mitch return to the circus.

The Atari version's playfield (there is also a Commodore 64 version available) consists of a series of maze-type platforms that Flip and Mitch must alternately solve. Each platform con-

tains squares which must be flipped. Once all the squares have been flipped, the player moves to the next level. Flip must complete the odd-numbered levels and Mitch the even. Like any healthy monkey, Mitch does his flipping while hanging by his hands.

Levels 1 and 2 are really for practice. This is where you learn how to maneuver up and down the ladders from one platform to another. If you try to go off the maze (a platform), you will fall off the platform and lose one of your tries. Each time you successfully complete a level, one more try will be added to your total.

Thirty-Six Levels

Flip and Flop is a game for one or two players with either one or two joysticks. If two players are playing, each takes a turn. They are not playing head to head, just competing to see who can score the highest number of points. Scores are based on the number of tiles flipped and the amount of time remaining when a player completes a level.

There are 36 levels. Levels 1 to 13 build the platforms, with level 1 having the fewest squares and the fewest platforms. The game becomes more difficult as you move from level to level. Above level 14, it's a real challenge.

In levels 1 and 2, you simply race against the clock. After level 2 the chase begins. Flip is being chased by the zookeeper and Mitch by his net. At the lower levels it is not too difficult to keep your distance and complete the level without being caught. But each level gets increasingly difficult as the playfield gets bigger and the chasers become

more intense. At the highest levels you must flip the indicated tiles twice to complete the level—no easy task.

A Game Of Strategy

On each level there are sticky squares. If either the animal or the chaser steps on a sticky square, he must stay there for a few seconds. These squares are to the player's advantage. They can be used to trick the chaser into getting stuck, so that Flip or Mitch can get away. The use of sticky squares must be planned, since each can be used only once on a level.

Playing this game takes practice. Maneuvering the joystick is really easy once you learn the relationship between the stick and the playfield. What is more difficult to learn is how to outwit the chasers. Since you are able to choose which level to begin (1 to 13), you can practice any level until you've mastered the techniques you need. You must complete each level from 13 on up in order to advance to the next. This is where the pause feature comes in very handy. If you manage to get to a high level and are getting tired (and this is likely), hit the space bar; the game will pause until you press the space bar again.

Some Of The Best Graphics You'll Ever See

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see. The two animals and the chasers move smoothly. The music and sound effects are well done, demonstrating that sound can be simple, yet add greatly to the enjoyment of a game.

Perhaps the best answer to the question "Was it fun?" is to say that I continued to play this game over and over. Once I had mastered the first five levels, I thought I had it figured out, but I was wrong: The challenge continued. I managed to get to level 14, and as soon as I can I'll go back to Mitch and Flip to see if I can return them to their friends.

Flip and Flop

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The Cosmic Balance II For Apple, Atari

Robert L. Hurt

After blasting away wave after wave of space invaders and wacka-wacking through endless *Pac-Man* imitations, you may find yourself looking for something different to while away the hours. If you've always had a yen for galactic domination, *The Cosmic Balance II* may be for you.

This game, published by Strategic Simulations for the Apple II+ and Atari 400/800, is a sequel to *The Cosmic Balance*. But while the first game involves detailed ship-to-ship combat, *The Cosmic Balance II* is a strategic game involving interstellar sagas of exploration, colonization, and conquest.

With this sequel, variety is the key word. The game may be played by one (with four skill levels) or by two players. The player may create his own

scenario or select from five existing ones. These trace the history of Humanity, from Earth's expansion into space, to the first contact with a hostile race, to the Final Conflict between Humanity and the Empire.

The game divides the near reaches of space into 16 sectors, each with a maximum of 40 habitable worlds. The sectors are displayed graphically as a multitude of irregular interlocking patterns—a nice touch, much more pleasing to behold than squares or hexagons, which would have been easier to implement. The play turns are broken up into several segments to make the complex sequences easier to manage.

Production Phase

During this phase, the player tallies his Industrial Output points, supplies his ships, and uses the remaining IOs to buy more supplies or construct more ships. There are 15 different ship classes to choose from, ranging from small escorts and merchants to battle cruisers and colony ships.

The IOs come from either active terran-type worlds or supply networks. Terran planets are those rare worlds with the proper blend of resources and climate to become self-sufficient. Less ideal farming, mining, and industrial worlds may also be linked together with cargo ships to form an interdependent commerce net.

First Movement Phase

Here is where most of the strategy is worked out. Sector by sector, each player gives orders to his ships. The available options are: Garrison, guarding friendly planetary systems; Commerce Mission, providing transport lines linking a commerce net (and thus generating IOs); Supply Mission, shipping goods to create or maintain colonies; Patrol, attempting to intercept enemy ships; Invasion, attempt-

ing to take over an enemy world; Commerce Raid, assaulting an enemy commerce mission; Planetary Raid, attempting to decimate an enemy planet; and Scout, exploring the sector for usable planets.

The computer maintains an updated listing of which ships have been assigned to which missions. This aids tremendously in assigning the proper orders to the right number of ships.

Execution Phase

Here the computer takes each sector and resolves the combat, battle by battle. It starts by displaying the mission and the ships on each side. Pressing a key will resolve the combat instantly, showing casualties for both sides and stating whether the mission was successful. Gamers owning *The Cosmic Balance I* have an interesting option of resolving each combat using that game. While much more satisfying, this would slow down the game considerably and is best reserved for critical combats.

Colony Supply Phase

Now each player has the option to start new colonies, supply existing ones, or aid devastated worlds in a state of "ecolapse." It is very important to have sent ships on supply missions so supplies will be available in this phase (untransported supplies are assumed to be stockpiled somewhere in the sector but unavailable at this point). There are few things more frustrating than having a successful attack on a minor farming world put the entire commerce net out of action simply because there are no supplies to bring it back to an active status.

Empires Fall More Slowly Than Starships

This phase allows a few types of ships outfitted with two warp generators to move once more, towing up to one more ship

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along. This is quite necessary when invading enemy territory. Until bases have been established there, ships must use hit-and-run tactics or be destroyed due to lack of supplies in the next production phase.

The Cosmic Balance II displays game information in a clear, usable manner. At the beginning of each phase the player is asked to enter his choice of sectors and is then given the option of viewing several displays before giving orders. The general display gives a summary of the numbers of each type of ship and world in the sector. There are also more detailed ship and planet displays available.

A reasonable effort is made to prevent the user from making mistakes. In the production and supply phases, for example, he is forced to give orders to each sector he controls. Unfortunately, this is not the case with the movement phase, so it is disturbingly easy to exit from it

before giving orders.

The computer is a worthy opponent and makes its moves very quickly. Execution is also very rapid; it really deserves its label "RapidFire." By far the most time-consuming aspect is entering orders (expect to spend a minimum of ten minutes per player per turn. For the more complex scenarios, it may take 20 minutes).

All in all, the game works quite well. It takes a concept usually found only in tactical wargames and adapts it fully to a computerized format, with the computer efficiently handling the drudgery of record-keeping and execution.

But there are drawbacks. This game lacks the fast-paced excitement of arcade games or even *The Cosmic Balance I* (after all, each turn represents a period of a year or so). And empires are much slower to fall than starships.

A complex scenario with

several sectors on each side could take many hours to play, and the Final Conflict literally could take months. If *The Cosmic Balance I* Combat Option is used, playing time would greatly increase. This system easily lends itself to extended campaigns. Fortunately, provisions have been made for saving a game in progress.

So if you're in the mood for building an empire and have time to spare, this might be the game for you. Just remember—the Federation wasn't built in a day.

The Cosmic Balance II
Strategic Simulations, Inc.
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Building A-200
Mountain View, CA 94043
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3-D

Drawing Master

Donald E. Smith

"Drawing Master" helps you create complex three-dimensional drawings by making use of your computer's high-resolution graphics mode. Originally written for VIC with 16K expander; versions also are included for 64 and Apple.

Drawing with a joystick is fun, but it lacks the precision and flexibility that artists and designers expect in a drawing instrument. With "Drawing Master," you can create complex drawings on the screen. Just provide the points on the screen where each line begins and ends, and Drawing Master fills in the lines for you.

You can define the starting points of two lines and the point where they meet (Figure 1a), or the places where a single line changes direction (Figure 1b), or you can define the points along a curved line (Figure 1c). Drawing Master also lets you define open and closed two-dimensional shapes (Figure 2) as well as complex drawings utilizing a combination of two- and three-dimensional shapes (Figure 3).

Cartesian Coordinates

Drawing Master makes use of your computer's high-resolution graphics mode, which allows you to draw by controlling the individual pixels (specks of light) on the screen. In high-resolution mode, you find a specific pixel's position by using the Cartesian Coordinate System, the common X-Y coordinate system widely used in plotting charts and graphs. The X coordinates represent points on a horizontal plane, and the Y coordinates represent points on a vertical plane. You can locate any point on the screen by its horizontal and vertical distances from a point of origin. It's like the way you can locate a particular street on a city map by looking for it in the square called F-5 or C-2.

X coordinate points begin at the left of the screen and increment to the right, and Y coordinate points begin at the top of the screen and increment down the screen. Position (0,0) is the HOME position, in the upper-left corner of the screen. So, Position (36,45) in Figure 3 is 36 X points to the right of, and 45 Y points down from, Position (0,0).

The VIC high-resolution screen has 175 X coordinates and 160 Y coordinates, for a total of 28,000 individual points on the screen. (The 64 has 320 X coordinates and 200 Y coordinates, for a total of 64,000; and the Apple has 280 X coordinates and 192 Y coordinates, for a total of 53,760.)

To illustrate how Drawing Master uses this plotting system, let's create the drawing in Figure 3 step by step, using a plotting routine from Paul F. Schatz's article, "High Resolution Plotting," in *COMPUTE!'s First Book of VIC*.

First, type in the program and SAVE it. Next, turn the VIC off and then back on. Before LOADING the program, you must move the start of BASIC to 8192 (to accommodate the 16K expander) by entering this line in the immediate mode:

```
POKE44,32:POKE8192,0:NEW
```

(This must be done each time you LOAD the program.)

(The 64 version includes Programs 2 and 3. Type in each program separately and SAVE each one to tape or disk. LOAD and RUN Program 2 before you RUN Program 3.)

Drawing Master In Action

Now LOAD the program and RUN it.

Drawing Master begins by displaying a menu with seven options:

- D—Define Object
- R—Read Object
- S—Save Object

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V-View Object
T-Translate Object
M-Main Menu
E-End Session

Select D to define the object that you wish to draw on the screen.

In this practice run, you will be defining the different shapes contained in Figure 3, a box with two windows in the front. If you break down the drawing into its components, you have one three-dimensional part, the box, and two two-dimensional parts, the windows.

Pressing D begins a series of prompts asking you to provide data for the object. The first prompt is for the number of 2-D (two-dimensional) parts, which you can think of as the number of flat surfaces which you want to represent on the screen. In Figure 3, the box is drawn to simulate three dimensions, but the two windows are drawn as flat rectangles, so you respond with 2 for the number of 2-D parts.

These two-dimensional parts are defined with the next series of prompts. You are asked for the number of points in part one. Window 1 has 4 points, so you enter 4. Drawing Master then prompts you for the X and Y coordinates of each point. (Remember our X,Y coordinate system.) For the sake of clarity and consistency, enter the coordinates in clockwise order. Be sure you have entered each set of coordinates correctly before you press RETURN. Drawing Master has no editor, and a mistake can cause you to have a lopsided figure. Each time you press RETURN, you will be prompted for the coordinates of the next point.

```
X,Y [ENTER] 84,80
X,Y [ENTER] 99,73
X,Y [ENTER] 99,116
X,Y [ENTER] 84,122
```

Since you have two windows (two 2-D parts), the next prompt asks for the data for the second window. Drawing Master allows you to make a second window from data already entered for the first. (If you wanted a third window, you would copy it from the completed second window.)

COPY LAST PART? (Y/N) Y

Respond with Y, because you want both windows to be alike, but in different positions on the screen. The next prompt asks for the translation of the figure in both X and Y directions. This prompt determines how far horizontally (X) or vertically (Y) from its original position you want to copy the first window to produce the second window.

Look at Figure 3 again. In relation to the HOME position (0,0), Window 2 is farther to the right and higher than Window 1. To make the example as painless as possible, the exact distances

have been computed for you: Window 2 is to be translated 35 X points to the right of, and 13 Y positions higher than, Window 1. Drawing Master prompts you with:

```
PART2/TRANSLATION:
RIGHT= +X LEFT= -X
DOWN= +Y UP= -Y
```

This tells you that your X translation is positive if you are translating the figure to the right, and negative if translating to the left. The Y translation is positive if you are translating down, and negative if you are translating up from the original position.

You will be prompted X TRANS? and you type 35. In answer to Y TRANS? you type -13. Since the windows are not three-dimensional, you respond with N to the prompt:

IS PART 3D? N

You have not yet created the box which surrounds the windows.

When the prompt asks:

OF 3D PARTS?

respond with 1, for the box.

You can now create the 3-D simulation by creating certain sides of the box and letting Drawing Master fill in the rest of the box for you. Look at Figure 4. This is a simulated three-dimensional drawing of a box similar to the one you are about to create. (The dotted lines would be hidden if the box were solid.) This box has six sides, or *faces*: front (Face 1), back (Face 2), top (Face 3), bottom (Face 4), and the left and right sides, which, to avoid clutter, are not labeled. Each face is a closed, four-sided shape. (See Figures 4b and 4c.)

First you are prompted for the number of points on each face:

```
# OF POINTS ON EACH FACE? 4
IS THE SIDE CLOSED? Y
```

Now enter the points for two opposite sides.

```
Face 1
X,Y 36,45
X,Y 70,70
X,Y 70,139
X,Y 36,111
```

```
Face 2
X,Y 114,17
X,Y 148,41
X,Y 148,111
X,Y 114,84
```

When you press RETURN after entering the fourth set of coordinates, you return to the main menu. From this menu, you may view your figure by pressing V. After you view it, press M to return to the main menu. You can save your drawings on disk or tape (disk only for Apple), and load them back into memory using the R option in the main menu.

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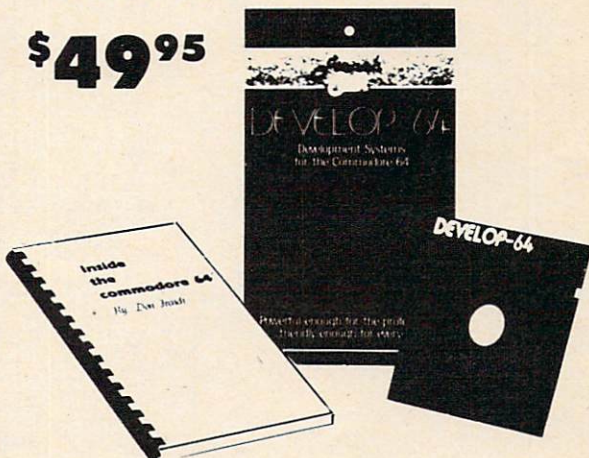
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Figure 1a

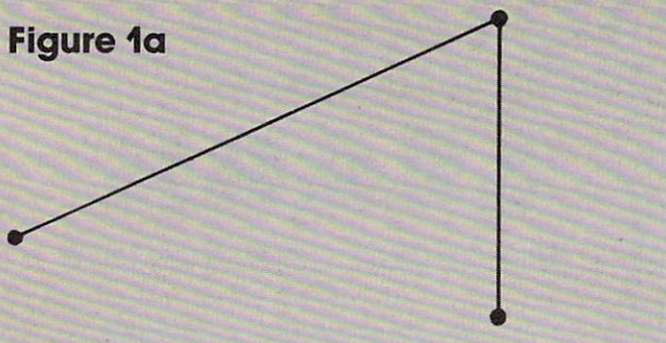


Figure 1b

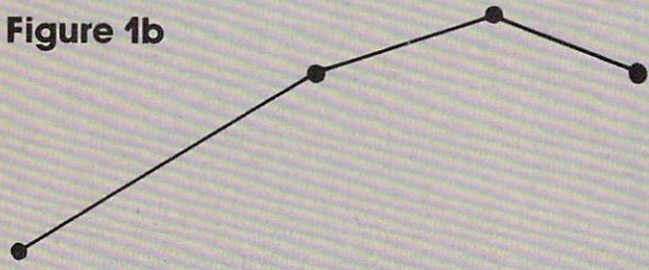


Figure 1c

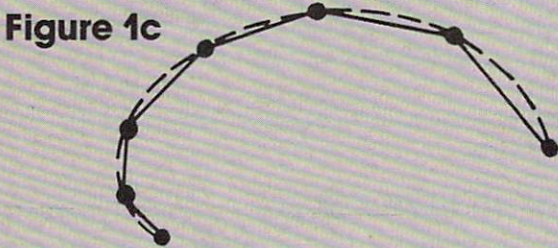
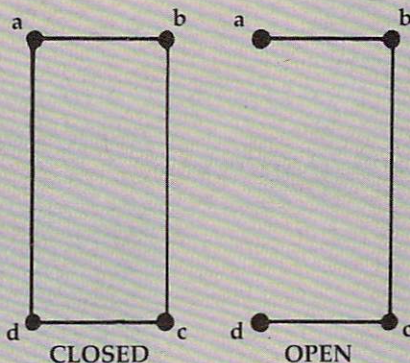


Figure 2



(0,0)

Figure 3

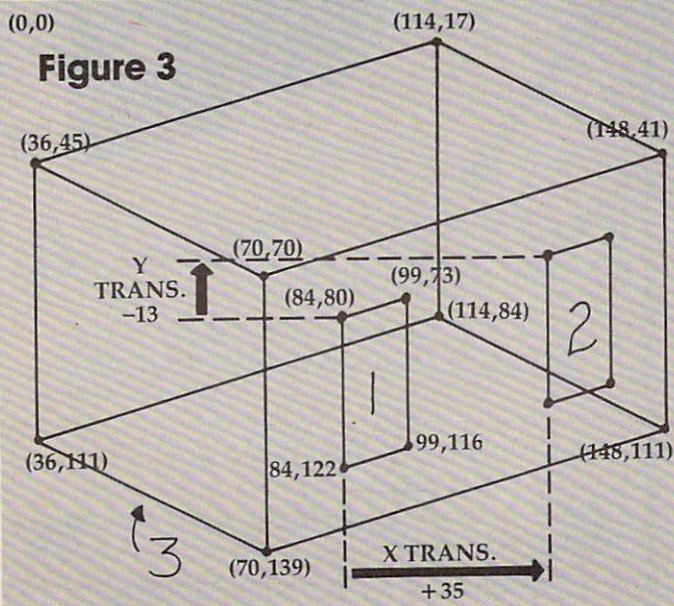


Figure 4a

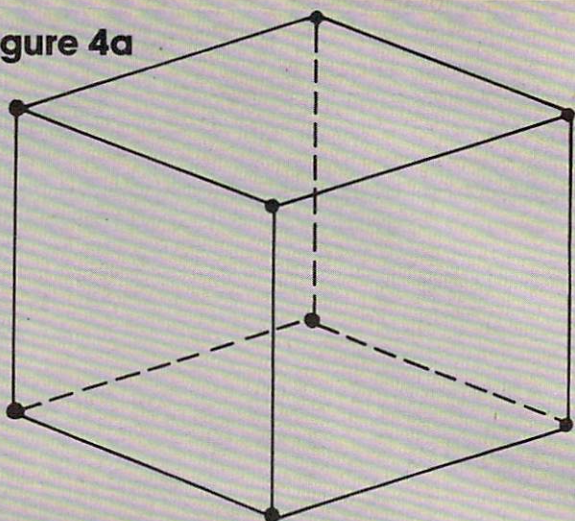


Figure 4b

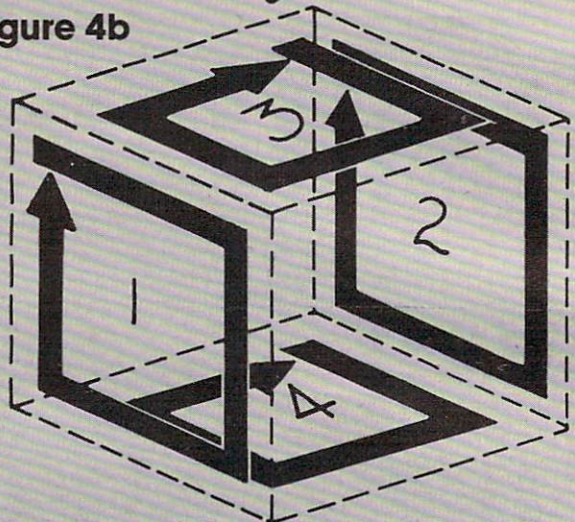
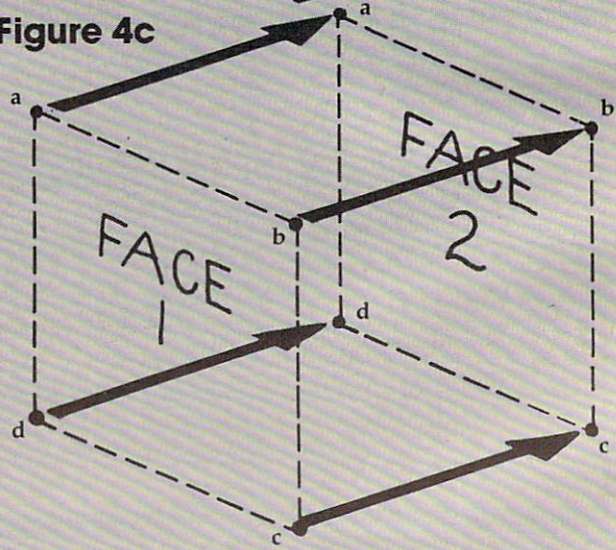


Figure 4c



Translation

An extra utility in Drawing Master is the ability to move the entire object around the screen. Translation works like Copy. It prompts you for the X and Y translation numbers. It can be used for centering the object or for other purposes. It physically alters the data base. If you don't wish to keep

Figure 5a

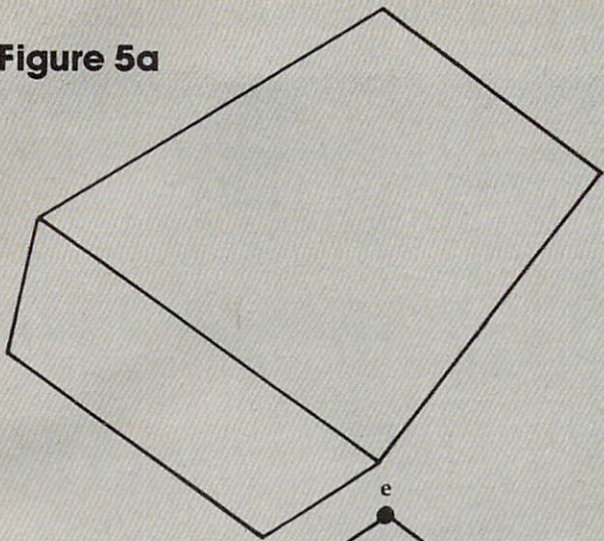
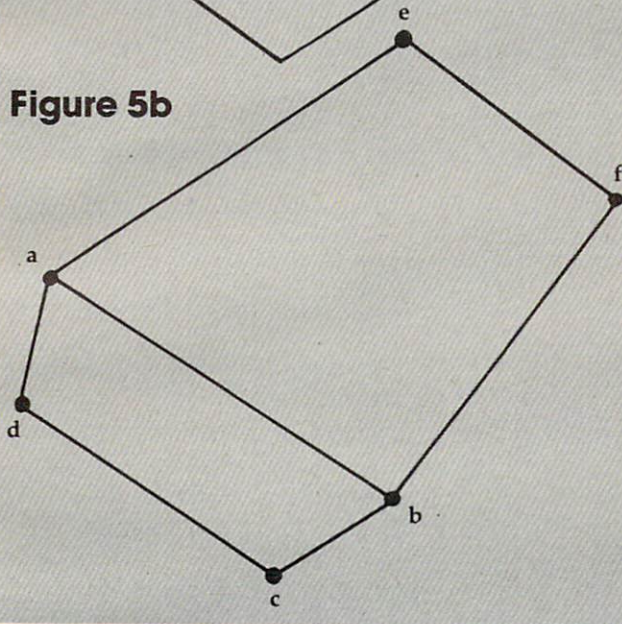


Figure 5b



the translation after VIEWing it, don't SAVE it.

The program makes it possible to VIEW an object positioned half on and half off the screen. Drawing Master has a safety device that does not allow POKing locations outside the screen area. The plotter will continue to compute those points, but they will not be POKed.

Viewing Tips

You may have noticed that after you pressed V, there was a pause and perhaps you saw some random graphics as the screen locations were being cleared out. This is normal. Even when there is no garbage displayed, the "clearing" process is going on. Be patient, and soon your image will begin to form. When you pressed M to return to the menu, the image was "cleared" in the same way.

As your image appears, you will notice that vertical lines are wider than horizontal ones. This has to do with the way the screen plot works. A character space is normally eight bits wide and eight bits high. In order to increase the size of the

plotting area without heavy demands on memory size, the character cell size has changed to 8 bits wide by 16 bits high. For a further explanation, see Paul Schatz's article.

You may be puzzled by the way Drawing Master draws diagonal lines. Rather than drawing a straight line, it draws a very small staircase between two points. This is a product of the VIC's resolution. Any raster scan system, no matter how sharp the resolution, will give the same effect to some extent. The stairsteps are less noticeable if you draw as large as possible. Try to use the whole screen.

Hidden Lines In 3-D

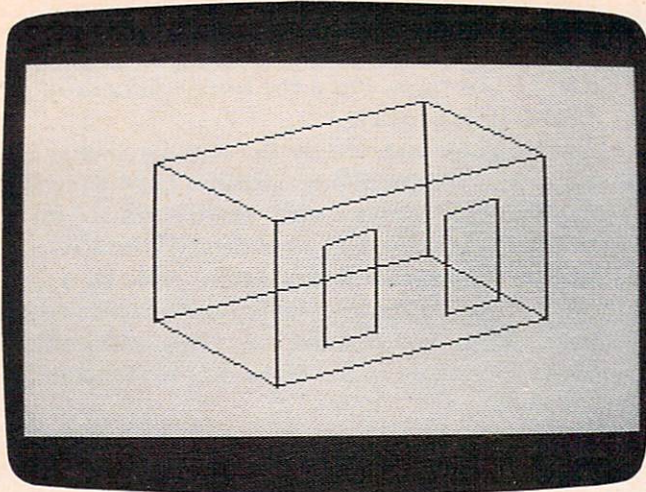
3-D mode normally draws a representation of the object as if it were transparent; you can see all edges at once. This is sometimes confusing. Drawing Master has no algorithms for removing hidden lines automatically, but under certain conditions you can fool the 3-D mode into drawing as if it did. Figure 5a shows a hidden line drawing for a rectangular solid in perspective. Only the visible edges are showing. You could draw it in 2-D as two parts (two rectangular shapes). Or we can make 3-D draw it as one part. Here's the secret. Nothing prohibits you from using the same point twice.

The first face is entered as usual: starting with point a, then b, c, and d. The second face is entered differently: point e, f, b, and a. If you follow the way the VIC plots, you'll see that it traces the same line more than once. But the result is the image you want (Figure 5b).

A Plotting Table

In order to define your object accurately in terms of its points, you will need to make a plotting table. All you need is a pencil, a ruler, and a piece of paper approximately 12 by 20 inches. Across the page from left to right, draw 18 vertical lines one inch apart. From top to bottom, draw 17 horizontal lines $\frac{3}{4}$ inch apart. Label the vertical lines from 0 to 170 by tens (0, 10, 20...) and the horizontal lines from 0 to 160, also by tens. Be as accurate as possible. Now divide every square into ten equal sections (with nine lines) horizontally and vertically. You will note that the vertical lines stop at 170. You must add six small sections out beyond the last line to 175: the maximum right position (X coordinate) on the screen.

You now have a plotting table for use with Drawing Master. The object or scene you want to reproduce on the screen should be drawn or traced onto tissue paper and laid over the plotting table. Then note on the drawing the X and Y coordinate for each important point. In standard notation, the X coordinate is given first, followed by the Y, with a comma separating them (ax, ay).



This VIC-20 display results after following the steps to create a three-dimensional box with two windows in one face using "3-D Drawing Master."

Program 1: Drawing Master, VIC Version

```

15 DIM A(20,2,26)
20 Q$=""
49 REM MENU
50 PRINT"{CLR}"
51 PRINTSPC(4)"DRAWING MASTER":PRINT:PRINT:PRINT
52 PRINTSPC(3)"D-DEFINE OBJECT":PRINT
53 PRINTSPC(3)"R-READ OBJECT":PRINT
54 PRINTSPC(3)"S-SAVE OBJECT":PRINT
55 PRINTSPC(3)"V-VIEW OBJECT":PRINT
57 PRINTSPC(3)"T-TRANSLATE OBJECT":PRINT
58 PRINTSPC(3)"M-MAIN MENU":PRINT
59 PRINTSPC(3)"E-END SESSION"
60 GOSUB 3700
65 ON-(Q$="D")-2*(Q$="R")-3*(Q$="S")-4*(Q$="V")-5*(Q$="T")GOTO100,1600,1800,300,1399
68 IF Q$="E"THEN3800
70 GOTO50
99 REM DEFINE
100 PRINT"{CLR}"
101 REM 2D MODE
102 PRINT"MAXIMUMS:":PRINT"20 PARTS":PRINT"12 PTS PER PART/FACE":PRINT
103 INPUT"# OF 2D PARTS";P1
104 PA=P1+2:Q$="":A(0,0,0)=P1
106 IF P1=0THEN200
107 FOR PT=2TO P1+1
108 PRINT:PRINT"PART";PT-1
109 IF PT=2 THEN 120
110 PRINT"COPY LAST PART?(Y/N)":GOSUB 3700
111 IF Q$="N"THEN120
115 GOSUB1000
117 GOTO140
120 INPUT"# OF POINTS";PO
125 PRINT"CLOSED?(Y/N)":GOSUB3700
127 IF Q$="Y" THEN A(PT,0,1)=1:GOTO 129
128 A(PT,0,1)=2
129 A(PT,0,0)=PO
130 TA=2
135 FOR T=2TO PO+1:INPUT"X,Y";A(PT,0,TA),A(PT,0,TA+1):TA=TA+2:NEXT
140 NEXT PT
199 REM 3D MODE
200 INPUT"# OF 3D PARTS";P2
202 IF P2=0 THEN A(1,0,0)=0:GOTO49
204 Q$="":A(1,0,0)=P2
205 FOR PT=PATO P2+PA-1
206 PRINT:PRINT"PART";PT-1
207 IF PT=PA THEN 212
208 PRINT "COPY LAST PART?(Y/N)":GOSUB3700
209 IF Q$="N" THEN212
210 GOSUB1000
211 GOTO 229
212 PRINT"# OF POINTS?"
213 INPUT"ON EACH FACE";PO
214 A(PT,0,0)=PO
216 PRINT"CLOSED?(Y/N)":GOSUB3700
217 IF Q$="Y" THEN A(PT,0,1)=1:GOTO220
218 A(PT,0,1)=2
220 TA=2
222 FOR TT=1 TO 2
223 PRINT "FACE";TT
225 FOR T=2 TO PO+1:INPUT "X,Y";A(PT,TT,T),A(PT,TT,TA+1):TA=TA+2:NEXT
226 TA=2
227 NEXT TT
229 NEXT PT
298 GOTO 50
299 REM VIEW MOVE RAM
300 POKE36866,150:POKE36869,240:POKE648,30
310 FORJ=217TO228:POKEJ,158:NEXT:FORJ=229TO250:POKEJ,159:NEXT
320 POKE36865,30:POKE36867,21:POKE36869,252:POKE36879,30
330 FORI=0TO219:POKE7680+I,I:NEXT
333 CO=0
335 FOR I=0 TO 219:POKE38400+I,CO:NEXT
340 FORI=4096TO7615:POKEI,0:NEXT
349 REM 2D READ
350 P1=A(0,0,0):PA=P1+2
351 IFP1=0THEN449
352 FOR PT=2 TO P1+1
353 PO=A(PT,0,0)
354 TA=2
355 FOR T=2 TO PO+1
360 X1=A(PT,0,TA):Y1=A(PT,0,TA+1)
399 REM VIEW 1ST COMPARE
405 IFT=PO+1ANDA(PT,0,1)=1 THENX2=A(PT,0,2):Y2=A(PT,0,3):GOSUB500
410 IF T=PO+1 THEN445
420 X2=A(PT,0,TA+2):Y2=A(PT,0,TA+3)
430 GOSUB500
435 TA=TA+2
440 NEXT T
445 NEXT PT
449 REM 3D READ
450 P2=A(1,0,0)
451 IFP2=0THEN800
452 FOR PT=PA TO P2+PA-1
454 PO=A(PT,0,0)
458 FOR TT=1 TO 2
459 TA=2
460 FOR T=2 TO PO+1
462 X1=A(PT,TT,TA):Y1=A(PT,TT,TA+1)
464 IF T=PO+1 AND A(PT,0,1)=1 THEN X2=A(PT,TT,2):Y2=A(PT,TT,3):GOSUB 500
466 IF T=PO+1 THEN 476
468 X2=A(PT,TT,TA+2):Y2=A(PT,TT,TA+3)
470 GOSUB500
472 TA=TA+2
474 NEXT T
476 NEXT TT
478 TA=2
480 FOR FA=1 TO PO
482 X1=A(PT,1,TA):Y1=A(PT,1,TA+1)
484 X2=A(PT,2,TA):Y2=A(PT,2,TA+1)

```

```

486 GOSUB500
488 TA=TA+2
490 NEXT FA
492 NEXT PT
498 GOTO800
499 REM VIEW 2ND COMPARE
500 X=0:Y=0:SI=1
510 IFX1>X2ANDY1>Y2THENSI=-1
520 IF(X2-X1)<(Y2-Y1)ANDY1<Y2 THEN525
522 GOTO530
525 IF(Y2-Y1)>(X1-X2)THEN640
527 SI=-1:GOTO540
530 IF(X2-X1)<(Y1-Y2)ANDY1>Y2THEN620
540 IFY1=Y2 AND X1=X2THENRETURN
550 IFY1=Y2THEN3500
599 REM VIEW PLOT LOOPS
600 FORYY=Y1TOY2 STEPSI*((Y2-Y1)/(X2-X1))
      :Y=INT(YY):X=X1:GOSUB3000:GOSUB3200:N
      EXTYY
610 GOTO660
620 IF(Y1-Y2)>(X1-X2)THENSI=-1:GOTO640
630 GOTO540
640 IF X1=X2THEN3600
650 FORXX=X1TOX2STEPSI*((X2-X1)/(Y2-Y1)):
      X=INT(XX): Y=Y1:GOSUB3000:GOSUB3300:N
      EXTXX
660 RETURN
799 REM VIEW GO MENU
800 A$=""
810 GETA$:IFA$=""THEN810
820 IF A$<>CHR$(77)THEN810
830 FORI=4096TO7615:POKEI,0:NEXT
840 POKE36865,25:POKE36867,46:POKE36869,2
      40:POKE36879,27
850 PRINTCHR$(147)
860 GOTO 50
898 END
999 REM COPY PART
1000 PRINT"{CLR}":PRINT"PART";PT-1;"/TRAN
      SLATION:"
1005 PRINT"RIGHT=+X LEFT=-X"
1010 PRINT"DOWN=+Y UP=-Y":PRINT
1015 INPUT"X TRANS.":TX
1020 INPUT"Y TRANS.":TY
1025 PRINT"IS PART 3D?(Y/N)":GOSUB3700
1030 IF Q$="Y" THEN 1100
1035 A(PT,0,0)=A(PT-1,0,0):A(PT,0,1)=A(PT
      -1,0,1)
1040 TA=2
1045 FOR T=2 TO A(PT,0,0)+1
1050 A(PT,0,TA)=A(PT-1,0,TA)+TX
1055 A(PT,0,TA+1)=A(PT-1,0,TA+1)+TY
1060 TA=TA+2
1065 NEXT T
1068 PRINT"{CLR}"
1070 RETURN
1100 A(PT,0,0)=A(PT-1,0,0):A(PT,0,1)=A(PT
      -1,0,1)
1105 FOR TT=1 TO 2
1110 TA=2
1115 FOR T=2 TO A(PT,0,0)+1
1120 A(PT,TT,TA)=A(PT-1,TT,TA)+TX
1125 A(PT,TT,TA+1)=A(PT-1,TT,TA+1)+TY
1130 TA=TA+2
1135 NEXT T
1140 NEXT TT
1142 PRINT"{CLR}"
1145 RETURN
1399 REM TRANS
1400 PRINT"{CLR}":PRINT"TRANSLATION:"
1405 PRINT"RIGHT=+X LEFT=-X"
1410 PRINT"DOWN=+Y UP=-Y":PRINT
1415 INPUT"X TRANS.":TX
1420 INPUT"Y TRANS.":TY
1430 P1=A(0,0,0):PA=P1+2
1435 FOR PT=2 TO P1+1
1440 PO=A(PT,0,0)
1445 TA=2
1450 FOR T=2 TO PO+1
1455 A(PT,0,TA)=A(PT,0,TA)+TX
1460 A(PT,0,TA+1)=A(PT,0,TA+1)+TY
1465 TA=TA+2
1470 NEXT T
1475 NEXT PT
1480 P2=A(1,0,0)
1485 FOR PT=PA TO P2+PA-1
1490 PO=A(PT,0,0)
1495 FOR TT=1 TO 2
1500 TA=2
1505 FOR T=2 TO PO+1
1510 A(PT,TT,TA)=A(PT,TT,TA)+TX
1515 A(PT,TT,TA+1)=A(PT,TT,TA+1)+TY
1520 TA=TA+2
1525 NEXT T
1530 NEXT TT
1535 NEXT PT
1540 GOTO 50
1599 REM READ
1600 PRINT"{CLR}":PRINT"TAPE OR DISK":INP
      UT OU$
1601 INPUT"NAME OF PICTURE FILE";F$
1602 IFLEFT$(OU$,1)="T"THENOU=1:GOTO1605
1603 OU=8
1605 OPEN1,OU,0,F$
1610 INPUT#1,A(0,0,0),A(1,0,0)
1615 FOR PT=2 TO A(0,0,0)+1
1620 TA=2
1625 INPUT#1,A(PT,0,0),A(PT,0,1)
1630 FOR T=1 TO A(PT,0,0)+1
1635 INPUT#1,A(PT,0,TA),A(PT,0,TA+1)
1640 TA=TA+2
1645 NEXT T
1650 NEXT PT
1655 FOR PT=A(0,0,0)+2 TO A(1,0,0)+A(0,0,
      0)+1
1657 INPUT#1,A(PT,0,0),A(PT,0,1)
1660 FOR TT=1 TO 2
1665 TA=2
1675 FOR T=2 TO A(PT,0,0)+1
1680 INPUT#1,A(PT,TT,TA),A(PT,TT,TA+1)
1685 TA=TA+2
1690 NEXT T
1700 NEXT TT
1710 NEXT PT
1715 CLOSE 1
1720 GOTO 50
1799 REM FILE
1800 PRINT"{CLR}":PRINT"TAPE OR DISK":INP
      UT IN$
1801 INPUT"NAME OF PICTURE FILE";F$
1803 IFLEFT$(IN$,1)="T"THENIN=1:GOTO1805
1804 IN=8
1805 OPEN1,IN,1,F$
1810 R$=CHR$(13)
1815 PRINT#1,A(0,0,0);R$;A(1,0,0)
1820 FOR PT=2 TO A(0,0,0)+1
1825 TA=0
1830 FOR T=0 TO A(PT,0,0)+1
1835 PRINT#1,A(PT,0,TA);R$;A(PT,0,TA+1)
1840 TA=TA+2
1845 NEXT T
1850 NEXT PT
1855 FOR PT=A(0,0,0)+2 TO A(1,0,0)+A(0,0,
      0)+1
1857 PRINT#1,A(PT,0,0);R$;A(PT,0,1)
1860 FOR TT=1 TO 2
1865 TA=2
1870 FOR T=2 TO A(PT,0,0)+1

```

```

1880 PRINT#1,A(PT,TT,TA);R$;A(PT,TT,TA+1)
1885 TA=TA+2
1890 NEXT T
1895 NEXT TT
1900 NEXT PT
1910 CLOSE 1
1915 GOTO 50
2999 REM PLOT SUB
3000 IF X>176 OR X<0 THEN RETURN
3010 IF Y>160 OR Y<0 THEN RETURN
3020 CH=INT(Y/16)*22+INT(X/8)
3030 RO=(Y/16-INT(Y/16))*16:BY=4096+16*CH
+RO
3040 BI=7-(X-INT(X/8)*8):POKEBY,PEEK(BY)O
R(2↑BI):RETURN
3199 REM Y LOOP SUB
3200 IFX1<X2THENX1=X1+1:RETURN
3210 X1=X1-1:RETURN
3299 REM X LOOP SUB
3300 IF Y1<Y2THENY1=Y1+1:RETURN
3310 Y1=Y1-1:RETURN
3499 REM Y1=Y2
3500 IFX1>X2THENSI=-1
3510 FORXX=X1TOX2STEPXI*1:X=INT(XX):Y=Y1:
GOSUB3000:NEXTXX
3520 RETURN
3599 REM X1=X2
3600 IFY1>Y2THENSI=-1
3610 FORYY=Y1TOY2STEPYI*1:Y=INT(YY):X=X1:
GOSUB3000:NEXTYY
3620 RETURN
3699 REM Q$
3700 Q$=""
3702 GET Q$:IF Q$=""THEN 3702
3710 RETURN
3799 REM END SESSION
3800 PRINT"{CLR}":END

```

Program 2: Drawing Master, 64 Loader

```

100 POKE16384,0:POKE16385,0
145 POKE641,0:POKE642,64
150 POKE43,1:POKE44,64:POKE55,0:POKE56,12
8:POKE646,1:PRINT"{CLR}"

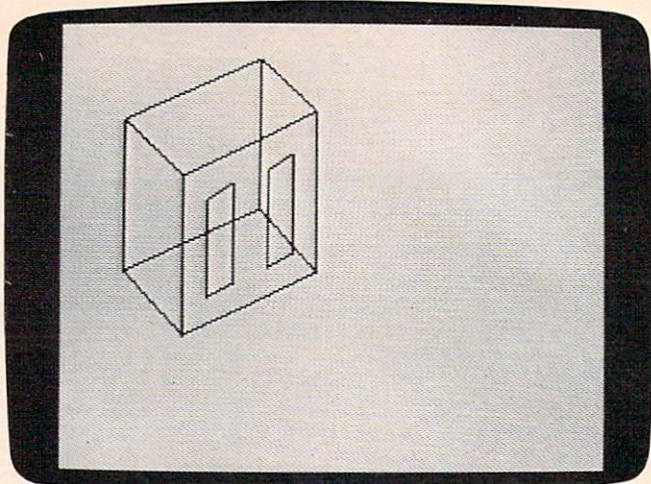
```

Program 3: Drawing Master, 64 Main Program

```

1020 DIM A(20,2,26)
1030 Q$=""
1040 REM MENU
1050 PRINT"{CLR}"
1060 PRINTSPC(12)"DRAWING MASTER":PRINT:P
RINT
1070 PRINTSPC(12)"D-DEFINE OBJECT":PRINT
1080 PRINTSPC(12)"R-READ OBJECT":PRINT
1090 PRINTSPC(12)"S-SAVE OBJECT":PRINT
1100 PRINTSPC(12)"V-VIEW OBJECT":PRINT
1110 PRINTSPC(12)"T-TRANSLATE OBJECT":PRI
NT
1120 PRINTSPC(12)"M-MAIN MENU":PRINT
1130 PRINTSPC(12)"E-END SESSION"
1140 GOSUB 3700
1150 GP=-(Q$="D")-2*(Q$="R")-3*(Q$="S")-4
*(Q$="V")-5*(Q$="T")
1155 ONGPGOTO1190,3000,3250,1670,2700
1160 IF Q$="E"THEN3740
1170 GOTO1050
1180 REM DEFINE
1190 PRINT"{CLR}"
1200 REM 2D MODE
1210 PRINT"MAXIMUMS:":PRINT"20 PARTS":PRI
NT"12 PTS PER PART/FACE":PRINT
1220 INPUT"# OF 2D PARTS":P1

```



"3-D Drawing Master," 64 version.

```

1230 PA=P1+2:Q$="" :A(0,0,0)=P1
1240 IF P1=0THEN1410
1250 FOR PT=2TOPI+1
1260 PRINT:PRINT"PART":PT-1
1270 IF PT=2 THEN 1320
1280 PRINT"COPY LAST PART?(Y/N)":GOSUB 37
00
1290 IF Q$="N"THEN1320
1300 GOSUB2430
1310 GOTO1390
1320 INPUT"# OF POINTS":PO
1330 PRINT"CLOSED?(Y/N)":GOSUB3700
1340 IF Q$="Y" THEN A(PT,0,1)=1:GOTO 1360
1350 A(PT,0,1)=2
1360 A(PT,0,0)=PO
1370 TA=2
1380 FORT=2TOPO+1:INPUT"X,Y":A(PT,0,TA),A
(PT,0,TA+1):TA=TA+2:NEXT
1390 NEXT PT
1400 REM 3D MODE
1410 INPUT"# OF 3D PARTS":P2
1420 IF P2=0 THEN A(1,0,0)=0:GOTO1040
1430 Q$="" :A(1,0,0)=P2
1440 FOR PT=PATO P2+PA-1
1450 PRINT:PRINT"PART":PT-1
1460 IF PT=PA THEN 1510
1470 PRINT "COPY LAST PART?(Y/N)":GOSUB37
00
1480 IF Q$="N" THEN1510
1490 GOSUB2430
1500 GOTO 1630
1510 PRINT"# OF POINTS?"
1520 INPUT"ON EACH FACE":PO
1530 A(PT,0,0)=PO
1540 PRINT"CLOSED?(Y/N)":GOSUB3700
1550 IF Q$="Y" THEN A(PT,0,1)=1:GOTO1570
1560 A(PT,0,1)=2
1570 TA=2
1580 FOR TT=1 TO 2
1590 PRINT "FACE":TT
1600 FOR T=2 TO PO+1:INPUT "X,Y":A(PT,TT,
TA),A(PT,TT,TA+1):TA=TA+2:NEXT
1610 TA=2
1620 NEXT TT
1630 NEXT PT
1640 GOTO 1050
1650 REM VIEW MOVE RAM
1670 POKE53272,(PEEK(53272)OR8):POKE53265
,PEEK(53265)OR32
1700 FORI=0TO999:POKEI024+I,1:NEXT
1710 CO=0

```

```

1730 FORI=8192TO8192+7999:POKEI,0:NEXT
1740 REM 2D READ
1750 P1=A(0,0,0):PA=P1+2
1760 IFP1=0THEN1900
1770 FOR PT=2 TO P1+1
1780 PO=A(PT,0,0)
1790 TA=2
1800 FOR T=2 TO PO+1
1810 X1=A(PT,0,TA):Y1=A(PT,0,TA+1)
1820 REM VIEW 1ST COMPARE
1830 IFT=PO+1ANDA(PT,0,1)=1 THENX2=A(PT,0,2):Y2=A(PT,0,3):GOSUB2160
1840 IF T=PO+1 THEN1890
1850 X2=A(PT,0,TA+2):Y2=A(PT,0,TA+3)
1860 GOSUB2160
1870 TA=TA+2
1880 NEXT T
1890 NEXT PT
1900 REM 3D READ
1910 P2=A(1,0,0)
1920 IFP2=0THEN2340
1930 FOR PT=PA TO P2+PA-1
1940 PO=A(PT,0,0)
1950 FOR TT=1 TO 2
1960 TA=2
1970 FOR T=2 TO PO+1
1980 X1=A(PT,TT,TA):Y1=A(PT,TT,TA+1)
1990 IF T=PO+1 AND A(PT,0,1)=1 THEN X2=A(PT,TT,2):Y2=A(PT,TT,3):GOSUB 2160
2000 IF T=PO+1 THEN 2050
2010 X2=A(PT,TT,TA+2):Y2=A(PT,TT,TA+3)
2020 GOSUB2160
2030 TA=TA+2
2040 NEXT T
2050 NEXT TT
2060 TA=2
2070 FOR FA=1 TO PO
2080 X1=A(PT,1,TA):Y1=A(PT,1,TA+1)
2090 X2=A(PT,2,TA):Y2=A(PT,2,TA+1)
2100 GOSUB2160
2110 TA=TA+2
2120 NEXT FA
2130 NEXT PT
2140 GOTO2340
2150 REM VIEW 2ND COMPARE
2160 X=0:Y=0:SI=1
2170 IFX1>X2ANDY1>Y2THENSI=-1
2180 IF(X2-X1)<(Y2-Y1)ANDY1<Y2 THEN2200
2190 GOTO2220
2200 IF(Y2-Y1)>(X1-X2)THEN2300
2210 SI=-1:GOTO2230
2220 IF(X2-X1)<(Y1-Y2)ANDY1>Y2THEN2280
2230 IFY1=Y2 AND X1=X2THENRETURN
2240 IFY1=Y2THEN3620
2250 REM VIEW PLOT LOOPS
2260 FORYY=Y1TOY2 STEPSI*((Y2-Y1)/(X2-X1)):Y=INT(YY):X=X1
2265 GOSUB3500:GOSUB3560:NEXTYY
2270 GOTO2320
2280 IF(Y1-Y2)>(X1-X2)THENSI=-1:GOTO2300
2290 GOTO2230
2300 IF X1=X2THEN3660
2310 FORXX=X1TOX2STEPSI*((X2-X1)/(Y2-Y1)):X=INT(XX):Y=Y1
2315 GOSUB3500:GOSUB3590:NEXTXX
2320 RETURN
2330 REM VIEW GO MENU
2340 A$=""
2350 GETA$:IFA$=""THEN2350
2360 IF A$<>CHR$(77)THEN2350
2370 FORI=8192TO8192+7999:POKEI,0:NEXT
2380 POKE53272,21:POKE53265,27
2390 PRINTCHR$(147)
2400 GOTO 1050

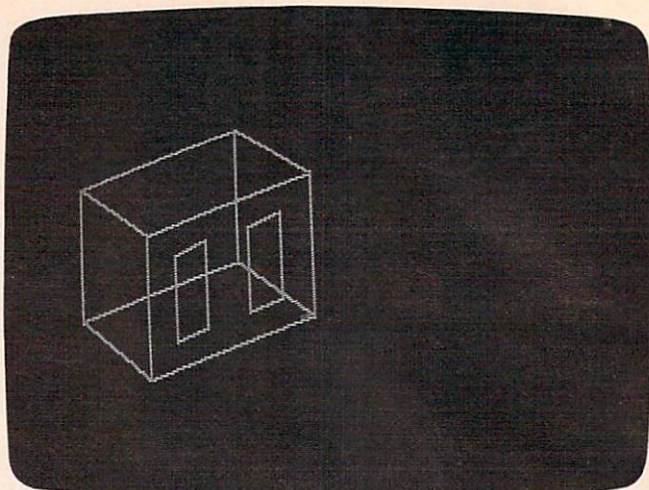
2410 END
2420 REM COPY PART
2430 PRINT"{CLR}":PRINT"PART";PT-1;"/TRANSLATION:"
2440 PRINT"RIGHT="+X LEFT="-X"
2450 PRINT"DOWN="+Y UP="-Y":PRINT
2460 INPUT"X TRANS. ";TX
2470 INPUT"Y TRANS. ";TY
2480 PRINT"IS PART 3D?(Y/N)":GOSUB3700
2490 IF Q$="Y" THEN 2590
2500 A(PT,0,0)=A(PT-1,0,0):A(PT,0,1)=A(PT-1,0,1)
2510 TA=2
2520 FOR T=2 TO A(PT,0,0)+1
2530 A(PT,0,TA)=A(PT-1,0,TA)+TX
2540 A(PT,0,TA+1)=A(PT-1,0,TA+1)+TY
2550 TA=TA+2
2560 NEXT T
2570 PRINT"{CLR}"
2580 RETURN
2590 A(PT,0,0)=A(PT-1,0,0):A(PT,0,1)=A(PT-1,0,1)
2600 FOR TT=1 TO 2
2610 TA=2
2620 FOR T=2 TO A(PT,0,0)+1
2630 A(PT,TT,TA)=A(PT-1,TT,TA)+TX
2640 A(PT,TT,TA+1)=A(PT-1,TT,TA+1)+TY
2650 TA=TA+2
2660 NEXT T
2670 NEXT TT
2680 PRINT"{CLR}"
2690 RETURN
2700 REM TRANS
2710 PRINT"{CLR}":PRINT"TRANSLATION:"
2720 PRINT"RIGHT="+X LEFT="-X"
2730 PRINT"DOWN="+Y UP="-Y":PRINT
2740 INPUT"X TRANS. ";TX
2750 INPUT"Y TRANS. ";TY
2760 P1=A(0,0,0):PA=P1+2
2770 FOR PT=2 TO P1+1
2780 PO=A(PT,0,0)
2790 TA=2
2800 FOR T=2 TO PO+1
2810 A(PT,0,TA)=A(PT,0,TA)+TX
2820 A(PT,0,TA+1)=A(PT,0,TA+1)+TY
2830 TA=TA+2
2840 NEXT T
2850 NEXT PT
2860 P2=A(1,0,0)
2870 FOR PT=PA TO P2+PA-1
2880 PO=A(PT,0,0)
2890 FOR TT=1 TO 2
2900 TA=2
2910 FOR T=2 TO PO+1
2920 A(PT,TT,TA)=A(PT,TT,TA)+TX
2930 A(PT,TT,TA+1)=A(PT,TT,TA+1)+TY
2940 TA=TA+2
2950 NEXT T
2960 NEXT TT
2970 NEXT PT
2980 GOTO 1050
2990 REM READ
3000 INPUT"{CLR}NAME OF PICTURE FILE";F$
3001 PRINT"{CLR}TAPE OR DISK":INPUTOU$
3003 IFOU$<>"T"ANDOU$<>"D"THEN3001
3005 IF OU$="T"THENOU=1:GOTO3020
3008 OU = 8
3020 OPEN1,OU,0,F$
3030 INPUT#1,A(0,0,0),A(1,0,0)
3040 FOR PT=2 TO A(0,0,0)+1
3050 TA=2
3060 INPUT#1,A(PT,0,0),A(PT,0,1)
3070 FOR T=1 TO A(PT,0,0)+1
3080 INPUT#1,A(PT,0,TA),A(PT,0,TA+1)

```

```

3090 TA=TA+2
3100 NEXT T
3110 NEXT PT
3120 FOR PT=A(0,0,0)+2 TO A(1,0,0)+A(0,0,0)+1
3130 INPUT#1,A(PT,0,0),A(PT,0,1)
3140 FOR TT=1 TO 2
3150 TA=2
3160 FOR T=2 TO A(PT,0,0)+1
3170 INPUT#1,A(PT,TT,TA),A(PT,TT,TA+1)
3180 TA=TA+2
3190 NEXT T
3200 NEXT TT
3210 NEXT PT
3220 CLOSE 1
3230 GOTO 1050
3240 REM FILE
3250 PRINT"{CLR}"
3260 INPUT"{CLR}NAME OF PICTURE FILE";F$
3261 PRINT"{CLR}TAPE OR DISK":INPUTIN$
3263 IFIN$<>"T"ANDIN$<>"D"THEN3261
3265 IF IN$="T"THENIN=1:GOTO3270
3268 IN = 8
3270 OPEN1,IN,1,F$
3280 R$=CHR$(13)
3290 PRINT#1,A(0,0,0);R$;A(1,0,0)
3300 FOR PT=2 TO A(0,0,0)+1
3310 TA=0
3320 FOR T=0 TO A(PT,0,0)+1
3330 PRINT#1,A(PT,0,TA);R$;A(PT,0,TA+1)
3340 TA=TA+2
3350 NEXT T
3360 NEXT PT
3370 FOR PT=A(0,0,0)+2 TO A(1,0,0)+A(0,0,0)+1
3380 PRINT#1,A(PT,0,0);R$;A(PT,0,1)
3390 FOR TT=1 TO 2
3400 TA=2
3410 FOR T=2 TO A(PT,0,0)+1
3420 PRINT#1,A(PT,TT,TA);R$;A(PT,TT,TA+1)
3430 TA=TA+2
3440 NEXT T
3450 NEXT TT
3460 NEXT PT
3470 CLOSE 1
3480 GOTO 1050
3490 REM PLOT SUB
3500 IF X>320 OR X<0 THEN RETURN
3510 IF Y>199 OR Y<0 THEN RETURN
3520 CH=INT(X/8):LN =YAND7
3530 RO=INT(Y/8):BY=8192+RO*320+8*CH+LN
3540 BI=7-(XAND7):POKEBY,PEEK(BY)OR(2↑BI):RETURN
3550 REM Y LOOP SUB
3560 IFX1<X2THENX1=X1+1:RETURN
3570 X1=X1-1:RETURN
3580 REM X LOOP SUB
3590 IF Y1<Y2THENY1=Y1+1:RETURN
3600 Y1=Y1-1:RETURN
3610 REM Y1=Y2
3620 IFX1>X2THENS1=-1
3630 FORXX=X1TOX2STEPS1*1:X=INT(XX):Y=Y1:GOSUB3500:NEXTXX
3640 RETURN
3650 REM X1=X2
3660 IFY1>Y2THENS1=-1
3670 FORYY=Y1TOY2STEPS1*1:Y=INT(YY):X=X1:GOSUB3500:NEXTYY
3680 RETURN
3690 REM Q$
3700 Q$=""
3710 GET Q$:IF Q$=""THEN 3710
3720 RETURN
3730 REM END SESSION
3740 PRINT"{CLR}":END

```



The Apple version of "3-D Drawing Master" produces its image in reverse.

Program 4: Drawing Master, Apple Version

```

1020 DIM A(20,2,26)
1030 Q$ = ""
1040 REM MENU
1050 HOME
1060 PRINT SPC(13)"DRAWING MASTER": PRINT
: PRINT : PRINT
1070 PRINT SPC(12)"D-DEFINE OBJECT":
PRINT
1080 PRINT SPC(12)"R-READ OBJECT": PRINT
1090 PRINT SPC(12)"S-SAVE OBJECT": PRINT
1100 PRINT SPC(12)"V-VIEW OBJECT": PRINT
1110 PRINT SPC(12)"T-TRANSLATE OBJEC
T": PRINT
1120 PRINT SPC(12)"M-MAIN MENU": PRINT
1130 PRINT SPC(12)"E-END SESSION"
1140 GOSUB 3700
1150 GP = (Q$ = "D") + 2 * (Q$ = "R") +
3 * (Q$ = "S") + 4 * (Q$ = "V") +
5 * (Q$ = "T")
1155 ON GP GOTO 1190,3000,3250,1670,27
00
1160 IF Q$ = "E" THEN 3740
1170 GOTO 1050
1180 REM DEFINE
1190 HOME
1200 REM 2D MODE
1210 PRINT "MAXIMUMS:": PRINT "20 PART
S": PRINT "12 PTS PER PART/FACE": PRINT
1220 INPUT "# OF 2D PARTS ? ";P1
1230 PA = P1 + 2:Q$ = "":A(0,0,0) = P1
1240 IF P1 = 0 THEN 1410
1250 FOR PT = 2 TO P1 + 1
1260 PRINT : PRINT "PART ";PT - 1
1270 IF PT = 2 THEN 1320
1280 PRINT "COPY LAST PART? (Y/N) ": GOSUB
3700
1290 IF Q$ = "N" THEN 1320
1300 GOSUB 2430
1310 GOTO 1390
1320 INPUT "# OF POINTS ? ";PO
1330 PRINT "CLOSED ? (Y/N)": GOSUB 3700
1340 IF Q$ = "Y" THEN A(PT,0,1) = 1: GOTO
1360
1350 A(PT,0,1) = 2
1360 A(PT,0,0) = PO
1370 TA = 2
1380 FOR T = 2 TO PO + 1: INPUT "X,Y ?
";A(PT,0,TA),A(PT,0,TA + 1):TA =
TA + 2: NEXT

```



```

1390 NEXT PT
1400 REM 3D MODE
1410 INPUT "# OF 3D PARTS ? ";P2
1420 IF P2 = 0 THEN A(1,0,0) = 0: GOTO
1040
1430 Q$ = "":A(1,0,0) = P2
1440 FOR PT = PA TO P2 + PA - 1
1450 PRINT : PRINT "PART";PT - 1
1460 IF (PT = PA) THEN 1510
1470 PRINT "COPY LAST PART ? (Y/N)": GOSUB
3700
1480 IF Q$ = "N" THEN 1510
1490 GOSUB 2430
1500 GOTO 1630
1510 PRINT "# OF POINTS?"
1520 INPUT "ON EACH FACE ? ";PO
1530 A(PT,0,0) = PO
1540 PRINT "CLOSED ? (Y/N) ": GOSUB 3700
1550 IF Q$ = "Y" THEN A(PT,0,1) = 1: GOTO
1570
1560 A(PT,0,1) = 2
1570 TA = 2
1580 FOR TT = 1 TO 2
1590 PRINT "FACE ";TT
1600 FOR T = 2 TO PO + 1: INPUT "X,Y ?
";A(PT,TT,TA),A(PT,TT,TA + 1):TA =
TA + 2: NEXT
1610 TA = 2
1620 NEXT TT
1630 NEXT PT
1640 GOTO 1050
1650 HGR2 : HCOLOR= 3
1670 HGR2 : HCOLOR= 3
1740 REM 2D READ
1750 P1 = A(0,0,0):PA = P1 + 2
1760 IF P1 = 0 THEN 1900
1770 FOR PT = 2 TO P1 + 1
1780 PO = A(PT,0,0)
1790 TA = 2
1800 FOR T = 2 TO PO + 1
1810 X1 = A(PT,0,TA):Y1 = A(PT,0,TA + 1
)
1820 REM VIEW 1ST COMPARE
1830 IF T = PO + 1 AND A(PT,0,1) = 1 THEN
X2 = A(PT,0,2):Y2 = A(PT,0,3): GOSUB
2160
1840 IF T = PO + 1 THEN 1890
1850 X2 = A(PT,0,TA + 2):Y2 = A(PT,0,TA
+ 3)
1860 GOSUB 2160
1870 TA = TA + 2
1880 NEXT T
1890 NEXT PT
1900 REM 3D READ
1910 P2 = A(1,0,0)
1920 IF P2 = 0 THEN 2340
1930 FOR PT = PA TO PPA - 1
1940 PA = A(PT,0,0)
1950 FOR TT = 1 TO 2
1960 TA = 2
1970 FOR T = 2 TO PO + 1
1980 X1 = A(PT,TT,TA):Y1 = A(PT,TT,TA +
1)
1990 IF T = PO + 1 AND A(PT,0,1) = 1 THEN
X2 = A(PT,TT,2):Y2 = A(PT,TT,3): GOSUB
2160
2000 IF T = PO + 1 THEN 2050
2010 X2 = A(PT,TT,TA + 2):Y2 = A(PT,TT,
TA + 3)
2020 GOSUB 2160
2030 TA = TA + 2
2040 NEXT T
2050 NEXT TT
2060 TA = 2
2070 FOR FA = 1 TO PO
2080 X1 = A(PT,1,TA):Y1 = A(PT,1,TA + 1
)
2090 X2 = A(PT,2,TA):Y2 = A(PT,2,TA + 1
)
2100 GOSUB 2160
2110 TA = TA + 2
2120 NEXT FA
2130 NEXT PT
2140 GOTO 2340
2150 REM VIEW 2ND COMPARE
2160 GOSUB 3500: RETURN
2330 REM VIEW GO MENU
2340 GOSUB 3700
2360 IF Q$ < > CHR$( 77) THEN 2340
2380 TEXT
2390 HOME
2400 GOTO 1050
2410 END
2420 REM COPY PART
2430 HOME : PRINT "PART";PT - 1;"/TRAN
SLATION:"
2440 PRINT "RIGHT=+X LEFT=-X
2450 PRINT "DOWN=+Y UP=-Y": PRINT
2460 INPUT "X TRANS. ";TX
2470 INPUT "Y TRANS. ";TY
2480 PRINT "IS PART 3D?(Y/N)": GOSUB 3
700
2490 IF Q$ = "Y" THEN 2590
2500 A(PT,0,0) = A(PT - 1,0,0):A(PT,0,1
) = A(PT - 1,0,1)
2510 TA = 2
2520 FOR T = 2 TO A(PT,0,0) + 1
2530 A(PT,0,TA) = A(PT - 1,0,TA) + TX
2540 A(PT,0,TA + 1) = A(PT - 1,0,TA + 1
) + TY
2550 TA = TA + 2
2560 NEXT T
2570 HOME
2580 RETURN
2590 A(PT,0,0) = A(PT - 1,0,0):A(PT,0,1
) = A(PT - 1,0,1)
2600 FOR TT = 1 TO 2
2610 TA = 2
2620 FOR T = 2 TO A(PT,0,0) + 1
2630 A(PT,TT,TA) = A(PT - 1,TT,TA) + TX
2640 A(PT,TT,TA + 1) = A(PT - 1,TT,TA +
1) + TY
2650 TA = TA + 2
2660 NEXT T
2670 NEXT TT
2680 HOME
2690 RETURN
2700 REM TRANS
2710 HOME : PRINT "TRANSLATION:"
2720 PRINT "RIGHT=+X LEFT=-X
2730 PRINT "DOWN=+Y UP=-Y": PRINT
2740 INPUT "X TRANS. ? ";TX
2750 INPUT "Y TRANS. ? ";TY
2760 P1 = A(0,0,0):PA = P1 + 2
2770 FOR PT = 2 TO P1 + 1
2780 PO = A(PT,0,0)
2790 TA = 2
2800 FOR T = 2 TO PO + 1
2810 A(PT,0,TA) = A(PT,0,TA) + TX
2820 A(PT,0,TA + 1) = A(PT,0,TA + 1) +
TY
2830 TA = TA + 2
2840 NEXT T
2850 NEXT PT
2860 P2 = A(1,0,0)
2870 FOR PT = P TO PP2 + PA - 1
2880 PO = A(PT,0,0)
2890 FOR TT = 1 TO 2
2900 TA = 2
2910 FOR T = 2 TO PO + 1
2920 A(PT,TT,TA) = A(PT,TT,TA) + TX
2930 A(PT,TT,TA + 1) = A(PT,TT,TA + 1) +
TY

```

```

2940 TA = TA + 2
2950 NEXT T
2960 NEXT TT
2970 NEXT PT
2980 GOTO 1050
2990 REM READ
3000 HOME : INPUT "NAME OF PICTURE FIL
E";F$
3008 OU = 8
3020 PRINT CHR$ (4);"OPEN";F$: PRINT
CHR$ (4);"READ";F$
3030 INPUT A(0,0,0),A(1,0,0)
3040 FOR PT = 2 TO A(0,0,0) + 1
3050 TA = 2
3060 INPUT A(PT,0,0),A(PT,0,1)
3070 FOR T = 1 TO A(PT,0,0) + 1
3080 INPUT A(PT,0,TA),A(PT,0,TA + 1)
3090 TA = TA + 2
3100 NEXT T
3110 NEXT PT
3120 FOR PT = A(0,0,0) + 2 TO A(1,0,0)
+ A(0,0,0) + 1
3130 INPUT A(PT,0,0),A(PT,0,1)
3140 FOR TT = 1 TO 2
3150 TA = 2
3160 FOR T = 2 TO A(PT,0,0) + 1
3170 INPUT A(PT,TT,TA),A(PT,TT,TA + 1)
3180 TA = TA + 2
3190 NEXT T
3200 NEXT TT
3210 NEXT PT
3220 PRINT CHR$ (4);"CLOSE";F$
3230 GOTO 1050
3240 REM FILE
3250 HOME
3260 HOME : INPUT "NAME OF PICTURE FIL
E";F$
3268 IN = 8

```

```

3270 PRINT CHR$ (4);"OPEN";F$: PRINT
CHR$ (4);"WRITE";F$
3280 R$ = ","
3290 PRINT A(0,0,0): PRINT A(1,0,0)
3300 FOR PT = 2 TO A(0,0,0) + 1
3310 TA = 0
3320 FOR T = 0 TO A(PT,0,0) + 1
3330 PRINT A(PT,0,TA): PRINT A(PT,0,TA
+ 1)
3340 TA = TA + 2
3350 NEXT T
3360 NEXT PT
3370 FOR PT = A(0,0,0) + 2 TO A(1,0,0)
+ A(0,0,0) + 1
3380 PRINT A(PT,0,0): PRINT A(PT,0,1)
3390 FOR TT = 1 TO 2
3400 TA = 2
3410 FOR T = 2 TO A(PT,0,0) + 1
3420 PRINT A(PT,TT,TA): PRINT A(PT,TT,
TA + 1)
3430 TA = TA + 2
3440 NEXT T
3450 NEXT TT
3460 NEXT PT
3470 PRINT CHR$ (4);"CLOSE";F$
3480 GOTO 1050
3490 REM PLOT SUB
3500 IF X1 > 279 OR X1 < 0 OR X2 < 0 OR
X2 > 279 THEN RETURN
3510 IF Y1 > 190 OR Y1 < 0 OR Y2 < 0 OR
Y2 > 190 THEN RETURN
3515 HPLLOT X1,Y1 TO X2,Y2: RETURN
3690 REM Q$
3700 IF PEEK ( - 16384) < 127 THEN 3700
3710 GET Q$
3720 RETURN
3730 REM END SESSION
3740 HOME : END

```

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Speedy BASIC For VIC And 64

Frank C. Gutowski

Though these valuable rules will make your Commodore programs run faster, they're also applicable to Color Computer and Apple BASIC.

In order to understand what makes BASIC fast or slow, we must look at how Commodore BASIC handles numbers.

Rule 1

In Rule 1, we look at integers. Machine language integer arithmetic is fast, while BASIC's simulation of integer operations is slow. The reason: An integer is converted to a floating point number (a number with a decimal point), the operation is done in floating point, and then the result is re-converted to integer. There are valid reasons for this conversion, but program execution speed suffers.

An example of a slow integer statement would be:

```
100 A% = B% + C%/D%
```

In this example, at least five conversions are performed. Unless you need the eight bytes this statement saves, do not use one like it. The faster equivalent to this form would be:

```
100 A = B + C/D
```

Rule 2

Rule 2 may surprise you. If converting integers takes time, converting ASCII numbers takes even more. You might say, "I never use ASCII numbers," but you do, every time you make a statement like:

```
100 POKE 7680,1
```

The numbers in this statement are stored in memory as ASCII characters. The BASIC interpreter converts these ASCII numbers to integers, then

into floating point in case they are to be operated on, and then back into integers for use as addresses and bytes of data to be POKEd into them. We can help the system out by converting ASCII-to-integer and integer-to-floating point ahead of time, with a line at the start of the program like, B=7680:A=1. In the case of numbers which will be used many times, as in POKEs within a FOR/NEXT loop to fill screen memory, this simple action can *double* the speed of the POKE.

This same rule applies to statements other than POKEs and PEEKs which involve certain fixed constants, as in the following FOR/NEXT loop:

```
100 FOR I=1TO100  
110 A(I)=A(I)+22  
120 NEXT
```

This loop would run faster if written:

```
100 B=22  
120 FOR I=1TO100  
130 A(I)=A(I)+B  
140 NEXT
```

In the second example, the conversion of 22 from ASCII to integer to floating point is done only once. Replacing the 1 or 100 in the FOR statement with predefined variables will not increase execution speed, since these are converted once, at the beginning of the looping process.

Rule 3

Rule 3 involves the use of a period in place of zero. When the BASIC Interpreter finds a period by itself in a line, it interprets it as a floating point zero, directly. The time variation involved is demonstrated in the benchmark program. This information is most useful in speeding up a statement like:

```
100 IF X=0 THEN 200
```

A faster version is:

```
100 IF X = . THEN 200
```

Just think of how many times you have written a line like the first example.

Rule 4

IF statements help us decide which of two paths to take. The "fall-through" path, the one taken when the IF statement is false, is the least time-consuming path. Construct your IF statements to take advantage of this. That is, the statement you will be executing most often should be the one to be executed when the IF comparison is false.

Rule 5

This one involves string variables when used in a PRINT statement. In addition to execution time spent on ASCII conversion, BASIC must look up the value of a variable before it can be printed. Thus the statement PRINT A\$, when A\$ has been defined as A\$ = "A", is slower than PRINT "A". PRINT CHR\$(65) is slower yet. Because we use PRINT statements so often, the use of literal strings can make a real difference in the speed of program execution.

The benchmark program is written in two sections. The first, from lines 100 to 290, uses fast and slow methods of statement construction. This is done with a mixture that may be present in the average BASIC program. There is a 1 to 1.37 ratio in speed between the fast and slow sections. The speed differential is also observed in the animation that is produced. If the difference in animation is all that you desire to see, remove some of the arithmetic and PRINT and IF statements.

The second section of the benchmark is the most interesting and shows dramatic timing variations. Some speed differences are only 10 percent, while others are better than 100 percent.

Time lost in the FOR/NEXT loop, which is used in each of the subsections, is measured and subtracted from all timing loops. This will keep measurements accurate. The time is measured in *jiffies* ($1/60$ second).

Program 1 is the benchmark for the VIC-20. Program 2 shows the necessary changes to Program 1 for a 64 benchmark. The table gives sample results of the VIC and 64 benchmarks.

The benchmark times for the 64 are between 6 and 7 percent slower than the VIC-20 on the average. This is due to the way the 6566 VIC-II video chip in the Commodore 64 shares the system bus.

The line POKE53265,PEEK(53265)AND239 will cause the screen to blank. The 6510 microprocessor will then have full use of the system bus and the times will be equal for the 64 and VIC-20. POKE53265,PEEK(53265)OR16 will re-

Run Times From Benchmark For 64 And VIC-20

All times given in jiffies for 500 line executions.

Time for standard FOR loop	
64—32	VIC—30
Time for variable FOR loop	
64—32	VIC—30
Time for number in statement	
64—91	VIC—85
Time for variable in statement	
64—73	VIC—67
Time for IF, no compare	
64—81	VIC—74
Time for IF, compare	
64—100	VIC—92
Time for PEEK, address in statement	
64—203	VIC—181
Time for PEEK, address as variable	
64—92	VIC—81
Time for POKE, address and data in statement	
64—208	VIC—187
Time for POKE, variable as address and data	
64—89	VIC—79
Time for PRINT, data in statement	
64—45	VIC—46
Time for variable in PRINT statement	
64—70	VIC—67
Time for CHR\$ in PRINT statement	
64—258	VIC—244
Time for 0 in statement	
64—64	VIC—58
Time for variable 0 in statement	
64—51	VIC—46
Time for period in place of 0 in line	
64—46	VIC—41
Time for integer add	
64—170	VIC—162
Time for floating add	
64—77	VIC—72
Time for ASCII add	
64—96	VIC—90
Times for combination loop	
Slow	Fast
Loop	Loop
64—801	64—578
VIC—743	VIC—542

store the screen display and return the processor to normal speed. This slight difference in speed is a small price to pay for the enhanced capabilities of the 64.

Written in Commodore BASIC, sections of the program may be adapted to any computer that has a clock accessible from BASIC. If you happen to run this on another machine, I think you will be delighted with how the VIC and 64 compare to some of their big brothers, although if a true benchmark were to be run between systems, you would want to include more detailed arithmetic sections.

Let's review the rules we have established.

Rule 1: Never use integer variables unless the memory saved is a higher priority than speed.

Rule 2: Predefine numbers as variables, rather than using a number in a statement. This cuts

down the number of conversions BASIC will have to make.

Rule 3: Wherever a zero must be used, use a period instead. This is the only known variance to rule 2.

Rule 4: In an IF statement, the fall-through path is the fastest. Make this the path most often used.

Rule 5: When using strings, include them in the statement, in quotes, rather than predefining them. If you must use the CHR\$ function, use it to predefine a string variable for later use.

Rule 6: Although I have not discussed it, you should follow the standard rules for program reduction. Combine statements in one line when possible. Eliminate all spaces that are not in quotes. Put frequently used subroutines and loops at the lowest line numbers possible.

These rules are by no means restricted to the VIC-20 and Commodore 64. They can be applied to TRS-80, Apple, and others with little revision. Follow them and I am sure that you will be pleased with the results. You also can use the timing methods set down in the benchmark to test your own loops to see if they can be improved, and you may make some interesting discoveries about how BASIC works.

Program 1: VIC Benchmark

```
10 REM*****
11 REM BASIC BENCHMARK
12 REM*****
13 REM*****
14 REM*NOTE:*
15 REM REMOVE REM STATEMENTS WHEN RUN
16 REM THEY MAY ALTER TIMES
17 REM*****
100 POKE36879,88
110 PRINT"{CLR}":C=7680:D=1:E=10:F=21:A=1
    3:B=12:G=90:H=88
120 C$=CHR$(147):H$=CHR$(19):T=TI
121 REM*****
122 REM START OF COMBINATION LOOP
123 REM*****
130 FORI=DTOE:PRINTH$"[21 +]":FORJ=DTOF
    :X=PEEK(C+J):IFX=GTHEN150
140 POKEC+J,H
150 POKEC+J,G
160 K=A+B:K=D:PRINTH$A,B:NEXT:NEXT:TY=TI-
    T:PRINT"{CLR}":T=TI
170 FORI=1TO10:PRINTCHR$(19)"[21 +]"
180 FORJ=1TO21
190 X%=PEEK(7680+J)
200 IFX%<>90THEN220
210 POKE7680+J,90
220 POKE7680+J,88
230 A%=5+8:B%=10+2
240 PRINTCHR$(19) 13,12
250 NEXTJ
260 NEXTI
270 TX=TI-T
280 PRINT"SLOW","FAST",TX,TY
290 FORI=1TO2000:NEXT
291 REM*****
292 REM END OF COMBINATION LOOP
```

```
293 REM START OF STATEMENT TIMING SECTION
294 REM*****
300 PRINTC$:GOSUB890
310 T=TI
320 FORI=1TO500:NEXT
330 T1=TI-T
340 T=TI
350 FORI=ATOB:NEXT
360 T2=TI-T
370 T=TI
380 FORI=ATOB:D=2+3:NEXT
390 T3=(TI-T)-T2
400 T=TI
410 FORI=ATOB:D=E+F:NEXT
420 T4=(TI-T)-T2
430 T=TI
440 FORI=ATOB:IFI=CTHEN450
450 NEXT:T5=(TI-T)-T2
460 T=TI
470 FORI=ATOB:IFI>CTHEN480
480 NEXT:T6=(TI-T)-T2
490 T=TI
500 FORI=ATOB:X=PEEK(7680):NEXT
510 T7=(TI-T)-T2
520 T=TI
530 FORI=ATOB:X=PEEK(G):NEXT
540 T8=(TI-T)-T2
550 T=TI
560 FORI=ATOB:POKE7680,1:NEXT
570 T9=(TI-T)-T2
580 T=TI
590 FORI=ATOB:POKEG,A:NEXT
600 T0=(TI-T)-T2
610 T=TI
620 FORI=ATOB:PRINT"A{LEFT}";:NEXT
630 TA=(TI-T)-T2
640 T=TI
650 FORI=ATOB:PRINTA$;:NEXT
660 TB=(TI-T)-T2
670 T=TI
680 FORI=ATOB:PRINTCHR$(65)CHR$(157);:NEX
    T
690 TC=(TI-T)-T2
700 T=TI
710 FORI=ATOB
720 X=0:NEXT:TD=(TI-T)-T2
730 T=TI
740 FORI=ATOB
750 X=C:NEXT:TE=(TI-T)-T2
760 T=TI
770 FORI=ATOB
780 X=. :NEXT:TF=(TI-T)-T2
790 T=TI:A%=1:B%=2:C%=3
800 FORI=ATOB
810 A%=B%+C%:NEXT:TG=(TI-T)-T2
820 T=TI
830 FORI=ATOB
840 F=E+A:NEXT:TH=(TI-T)-T2
850 T=TI
860 FORI=ATOB
870 F=2+1:NEXT:TJ=(TI-T)-T2
880 GOTO900
881 REM*****
882 REM END OF STATEMENT TIMING SECTION
883 REM*****
890 A=1:B=500:C=0:E=2:F=3:G=7680:A$="A"+C
    HR$(157):RETURN
891 REM*****
892 REM LINE 900 FOR
893 REM PRINTER LIST
894 REM ONLY. CHANGE
895 REM IT AND LINE 1100
```

```

896 REM FOR SCREEN LIST
897 REM*****
900 OPEN3,4:CMD3
902 PRINT"ALL TIMES GIVEN IN JIFFIES FOR
{SPACE}500"
903 PRINT"LINE EXECUTIONS."
904 PRINT:PRINT
910 PRINT"{RVS}TIME FOR STANDARD FOR LOOP
":PRINTT1
920 PRINT"{RVS}TIME FOR VARIABLE FOR LOOP
":PRINTT2
921 PRINT
930 PRINT"{RVS}TIME FOR NUMBER IN STATEME
NT":PRINTT3
940 PRINT"{RVS}TIME FOR VARIABLE IN STATE
MENT":PRINTT4
941 PRINT
950 PRINT"{RVS}TIME FOR IF, NO COMPARE":P
RINTT5
960 PRINT"{RVS}TIME FOR IF, COMPARE":PRIN
TT6
961 PRINT
970 PRINT"{RVS}TIME FOR PEEK, ADDRESS IN
{SPACE}STATEMENT":PRINTT7
980 PRINT"{RVS}TIME FOR PEEK, ADDRESS AS
{SPACE}VARIABLE":PRINTT8
981 PRINT
990 PRINT"{RVS}TIME FOR POKE, ADDRESS & D
ATA IN STATEMENT":PRINTT9
1000 PRINT"{RVS}TIME FOR POKE, VARIABLE A
S ADDRESS & DATA":PRINTT0
1001 PRINT
1010 PRINT"{RVS}TIME FOR PRINT, DATA IN S
TATEMENT":PRINTT1A
1020 PRINT"{RVS}TIME FOR VARIABLE IN PRIN
T STATEMENT":PRINTT1B

```

```

1030 PRINT"{RVS}TIME FOR CHR$ IN PRINT ST
ATEMENT":PRINTTTC
1031 PRINT
1040 PRINT"{RVS}TIME FOR 0 IN STATEMENT":
PRINTTD
1050 PRINT"{RVS}TIME FOR VARIABLE 0 IN ST
ATEMENT":PRINTTE
1060 PRINT"{RVS}TIME FOR PERIOD IN PLACE
{SPACE}OF 0 IN LINE":PRINTTF
1061 PRINT
1070 PRINT"{RVS}TIME FOR INTEGER ADD":PRI
NTTG
1080 PRINT"{RVS}TIME FOR FLOATING ADD":PR
INTTH
1090 PRINT"{RVS}TIME FOR ASCII ADD":PRINT
TJ:PRINT
1091 PRINT:PRINT"TIMES FOR COMBINATION LO
OP":PRINT"SLOW","FAST":PRINT"LOOP","
LOOP"
1100 CLOSE3:END

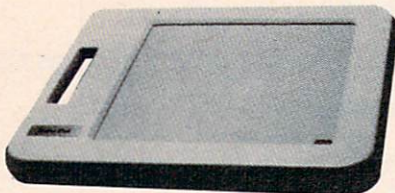
```

Program 2: 64 Benchmark

```

100 POKE53280,1:POKE53281,0:PRINT"{WHT}"
110 PRINT"{CLR}":C=1024:D=1:E=10:F=21:A=1
3:B=12:G=90:H=88
190 X%=PEEK(1024+J)
210 POKE1024+J,90
220 POKE1024+J,88
280 PRINT"SLOW","FAST",,,TX,TY
500 FORI=ATOB:X=PEEK(1024):NEXT
560 FORI=ATOB:POKE1024,1:NEXT
890 A=1:B=500:C=0:E=2:F=3:G=1024:A$="A"+C
HR$(157):RETURN
901 PRINT"RUN TIMES FROM BENCHMARK FOR C-
64"

```



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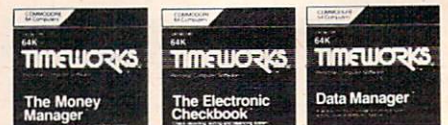
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MACHINE LANGUAGE

Jim Butterfield, Associate Editor

ML Factors Part 2

Last month we presented a machine language program which would find the prime factors of very large numbers—up to 19 digits. This month we'll pick apart the ML to see how it works. Here's the commented machine language for the PET/CBM version. The VIC/64 version is identical except for the address references.

Note that in both the PET/CBM and VIC/64 versions the actual machine language was preceded by a number of lines of BASIC which provided instructions and called the ML. These are not discussed here.

First, a few variables. BCOUNT counts bits during division. EXP is the exponent value which appears in the output. CHAR is the equals character or the plus character, depending on where we are working on the output line. ZSUP is a flag for zero suppression. INDEX counts through a table of divisor offsets.

```
BCOUNT = $0348
EXP     = BCOUNT + 1
CHAR    = EXP + 1
ZSUP    = CHAR + 1
INDEX   = ZSUP + 1
```

Next, arrays. NUMBER holds the number we have input; it reduces as factors are found. VALUE holds the original number. BASE holds a multiple of 30; we'll add the index number to it to get divisors of 31, 37, 41, etc. DVSR is the actual number we're dividing by. REMDR is the remainder after division; it is partially combined with QUOT, which holds the quotient. DECIML holds a decimal number being built for output. ZZY is not used, but shows the end of DECIML.

```
NUMBER = $0350
VALUE  = NUMBER + 8
BASE   = VALUE + 8
DVSR   = BASE + 8
REMDR  = DVSR + 4
QUOT   = REMDR + 4
```

```
DECIML = REMDR + 12
ZZY    = DECIML + 10
```

Here we go. Let's print a RETURN to start a new line, followed by a prompt character, and reset a few values.

```
0500 A9 0D      START LDA #$0D      ;RETURN
0502 20 D2 FF      JSR $FFD2      ;.. PRINT
0505 20 BA 05      JSR PRPT      ;PROMPT
0508 A9 3D          LDA #$3D          ;EQUALS'
050A 8D 4A 03      STA CHAR
050D A2 0F          LDX #15
050F A9 00          LDA #0          ;CLEANHOUSE
0511 9D 50 03 SLP  STA NUMBER,X
0514 9D 58 03      STA VALUE,X
0517 9D 60 03      STA BASE,X
051A CA            DEX
051B 10 F4          BPL SLP
```

It's time to get digits. We scan the keyboard, and ignore everything that's not a legitimate numeric key or RETURN. Subroutine DODIG will work the digit into the total we are building. An error (usually number too big) will cause a question mark to be printed.

```
051D 20 E1 FF GDIG JSR $FFE1      ;TEST RUN/STOP
0520 F0 17          BEQ QUIT      ;NEEDED FOR
                                VIC/64
0522 20 E4 FF      JSR $FFE4      ;GET CHARACTER
0525 C9 0D          CMP #$0D      ;RETURN?
0527 F0 11          BEQ CALC      ;YUP,CALCULATE
0529 20 C4 05      JSR DODIG     ;NOPE,DO DIGIT
052C B0 03          BCS ERR
052E 4C 1D 05      JMP GDIG     ;.. AND LOOP.
0531 A9 3F          LDA #$3F      ;?'
0533 20 D2 FF      JSR $FFD2     ;.. PRINT
0536 4C 00 05      JMP START
0539 60            QUIT  RTS
```

We now have a number. We wipe out the prompt character and then get to the main calculation; but first we check to make sure that the number is nonzero.

```
053A A9 20          CALC LDA #$20      ;SPACE
053C 20 D2 FF      JSR $FFD2     ;..PRINT
053F A9 14          LDA #$14      ;DELETE
0541 20 D2 FF      JSR $FFD2     ;..PRINT
0544 A2 07          LDX #7        ;FOR EACH DIGIT
```

```

0546 BD 50 03 CAP0 LDA NUMBER,X
0549 D0 05 BNE CAP1 ;...NOT A ZERO?
054B CA DEX
054C D0 F8 BNE CAP0
054E F0 E1 BEQ ERR ;OOPS, ALL ZERO

```

```

05AD D0 05 BNE DWRAP
05AF CA DEX
05B0 10 F8 BPL WLP
05B2 30 03 BMI DEND ;IT'S 1, SKIP
05B4 20 B9 06 DWRAP JSR SRAP ;ELSE PRINT IT
05B7 4C 00 05 DEND JMP START

```

Division Attempts

Here we go. We try dividing by two, three, and five; in each case, we check to see if it's time to quit. The subroutine FLOOK will print factors if it finds them; all we do here is name the divisors.

```

0550 A9 02 CAP1 LDA #2 ;TRY TWO
0552 20 7A 06 JSR FLOOK
0555 90 4B BCC WRAP
0557 A9 03 LDA #3 ;TRY THREE
0559 20 7A 06 JSR FLOOK
055C 90 44 BCC WRAP
055E A9 05 LDA #5 ;TRY FIVE
0560 20 7A 06 JSR FLOOK
0563 90 3D BCC WRAP

```

Once we go above a divisor of five, we change to a different system. We pick offset numbers out of a table, and add them to a "base" number (which starts at zero). This gives us 7, 11, 13, 17, etc. When the offset number reaches 29, we increase the base by 30 and start over: This will give us 31, 37, 41, 47, etc. Note that we are working in four-byte numbers, so additions take more code.

```

0565 A2 00 LDX #0 ;START INDEX
0567 8E 4C 03 STX INDEX ;... AT SEVEN.
056A 20 E1 FF MLP1 JSR $FFE1 ;RUN/STOP?
056D F0 CA BEQ QUIT ;YES, QUIT
056F AC 4C 03 LDY INDEX
0572 C8 INY ;NEXT INCREMENT
0573 C0 08 CPY #8 ;TOO FAR?
0575 90 12 BCC MOK1 ;NO, KEEP GOING
0577 A0 00 LDY #0 ;YES, RESET
0579 18 CLC
057A A9 1E LDA #30 ;AND ADD 30
057C A2 03 LDX #3 ;...TO 3-BYTE
057E 7D 60 03 MLP2 ADC BASE,X ;...BASE
0581 9D 60 03 STA BASE,X
0584 A9 00 LDA #0
0586 CA DEX
0587 10 F5 BPL MLP2
0589 8C 4C 03 MOK1 STY INDEX ;STORE INDEX
058C B9 65 07 LDA TABLE,Y ;GET VALUE
058F 18 CLC ;...ADD
0590 A2 03 LDX #3 ;...3-BYTE
0592 7D 60 03 MLP3 ADC BASE,X ;...BASE
0595 9D 68 03 STA DVSR,X ;...SUM TO DIVISOR

0598 A9 00 LDA #0
059A CA DEX
059B 10 F5 BPL MLP3
059D 20 7D 06 JSR FLOOP ;TRY THIS FACTOR
05A0 B0 C8 BCS MLP1

```

When we reach WRAP, our quotient is greater than our divisor, which means that we're not going to find any more factors. We wind it up, printing the remaining number unless it's equal to one.

```

05A2 AE 57 03 WRAP LDX NUMBER+7;IS IT ONE?
05A5 CA DEX
05A6 D0 0C BNE DWRAP ;NOPE, PRINT
05A8 A2 06 LDX #6 ;6 HIGH BYTES
05AA BD 50 03 WLP LDA NUMBER,X

```

This part prints the prompt. I've picked the numbers symbol (call it the pounds symbol if you wish); after we print it we backspace so that the next input will type over it.

```

05BA A9 23 PRPT LDA #$23 ;'#
05BC 20 D2 FF JSR $FFD2 ;PRINT IT
05BF A9 9D LDA #$9D ;BACKSPACE
05C1 4C D2 FF JMP $FFD2 ;PRINT & RETURN

```

Number Input

Here's where we do most of the work inputting a number. We reject nonnumeric keys; the numerics we echo and convert to binary with an AND. Now we multiply the previous value by ten; we use subroutine GROT to multiply the eight-byte value by two. Our method is: times two, times two, add the original value, times two. Then we can add in the new digit.

```

05C4 C9 30 DODIG CMP #$30 ;LESS THAN 0?
05C6 90 42 BCC DOEX ;YUP, IGNORE IT
05C8 C9 3A CMP #$3A ;MORE THAN 9?
05CA B0 3D BCS DOEX1 ;YUP, IGNORE IT
05CC 20 D2 FF JSR $FFD2 ;ELSE PRINT
05CF 29 0F AND #$0F ;CHANGE TO BINARY

05D1 A8 TAY
05D2 20 BA 05 JSR PRPT ;DO PROMPT
05D5 20 0B 06 JSR GROT ;TIMES 2
05D8 B0 30 BCS DOEX
05DA 20 0B 06 JSR GROT ;TIMES 2
05DD B0 2B BCS DOEX
05DF A2 07 LDX #7 ;EIGHT BYTE
05E1 18 CLC ;ADD
05E2 BD 50 03 GLP3 LDA NUMBER,X ;ORIGINAL NUMBER

05E5 7D 58 03 ADC VALUE,X
05E8 9D 50 03 STA NUMBER,X
05EB CA DEX
05EC 10 F4 BPL GLP3
05EE B0 1A BCS DOEX
05F0 20 0B 06 JSR GROT ;TIMES 2
05F3 B0 15 BCS DOEX
05F5 A2 07 LDX #7 ;EIGHT BYTE
05F7 98 TYA ;NEW DIGIT
05F8 18 CLC ;ADD
05F9 7D 50 03 GLP5 ADC NUMBER,X
05FC 9D 50 03 STA NUMBER,X
05FF 9D 58 03 STA VALUE,X
0602 A9 00 LDA #0
0604 CA DEX
0605 10 F2 BPL GLP5
0607 B0 01 BCS DOEX
0609 18 CLC
060A 60 DOEX1 RTS
060B A2 07 GROT LDX #7 ;EIGHT BYTE
060D 18 CLC ;LEFT SHIFT
060E 3E 50 03 GLP1 ROL NUMBER,X
0611 CA DEX
0612 10 FA BPL GLP1
0614 60 RTS

```

Next month we'll conclude our commented listing by taking a look at the division and print routines.

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64Key And VICKey

Daniel Bingamon

This might be the last program you type in the traditional way. 64Key and VICKey allow you to print a BASIC instruction just by pressing one shifted key. VICKey will work on an unexpanded or 3K expanded VIC. Any additional memory must be removed or disabled to use this utility.

"64Key" (Program 1) is a Commodore 64 version of Thomas Henry's "VICKey" (Program 2), originally published in the August 1982 issue of COMPUTE!. It allows you to print a BASIC keyword just by pressing one shifted key. For example, pressing SHIFT-A prints ASC, SHIFT-B prints STEP, SHIFT-C gives CHR\$, and so on. It makes typing in long programs faster and easier.

To use 64Key, type in the program, SAVE it, and type RUN. If you have mistyped a DATA statement, the program will tell you so. The program POKES 64Key into the \$C000 block of free RAM. Type SYS52557 to activate 64Key. You will get the READY message back as though nothing has happened. But try typing a SHIFTEd letter. Presto! A keyword appears.

Now instead of typing out a keyword, you can simply hit the appropriate key as shown in the table. Of course, you can always type the keyword normally (you must if the keyword is not in the table). Be sure to type NEW before typing in your program.

Like VICKey, 64Key checks location \$D4 (212) to see if the editor is in quote mode. If you hit a SHIFTEd letter within quotes, you will get the normal graphics character or capital letter instead of a keyword. Typing SYS52557 turns 64Key on or off. So, if you want to deactivate it, type SYS52557 a second time. You can also deactivate it by pressing the RUN/STOP and RESTORE keys together. 64Key will remain in memory until you turn the computer off.

BASIC Keywords

A	ASC	N	NEXT
B	STEP	O	OPEN
C	CHR\$	P	POKE
D	DIM	Q	PEEK
E	END	R	RIGHT\$
F	FOR	S	STR\$
G	GET	T	TAB(
H	STOP	U	USR
I	INPUT	V	VAL
J	GOTO	W	DATA
K	GOSUB	X	READ
L	LEFT\$	Y	RESTORE
M	MID\$	Z	SYS

Program 1: 64Key

```
10 PRINT"{CLR} 64-KEY"
20 FORI=52557TO52739
30 READA:X=X+A:POKEI,A
40 NEXTI
50 IFX<>24016THENPRINT"THERE IS AN ERROR
{SPACE}IN YOUR DATA STATEMENTS":STOP
60 PRINT"SYS52557 TO ACTIVATE":END
80 DATA 120 , 173 , 20 , 3 , 72
90 DATA 173 , 21 , 3 , 72 , 173
100 DATA 116 , 205 , 208 , 2 , 169
110 DATA 118 , 141 , 20 , 3 , 173
120 DATA 117 , 205 , 208 , 2 , 169
130 DATA 205 , 141 , 21 , 3 , 104
140 DATA 141 , 117 , 205 , 104 , 141
150 DATA 116 , 205 , 88 , 96 , 0
160 DATA 0 , 72 , 138 , 72 , 152
170 DATA 72 , 165 , 215 , 72 , 165
180 DATA 212 , 240 , 4 , 104 , 76
190 DATA 221 , 205 , 104 , 201 , 193
200 DATA 144 , 82 , 201 , 219 , 176
210 DATA 78 , 56 , 233 , 193 , 170
220 DATA 189 , 229 , 205 , 162 , 0
230 DATA 134 , 198 , 170 , 160 , 158
240 DATA 132 , 34 , 160 , 160 , 132
250 DATA 35 , 160 , 0 , 10 , 240
260 DATA 16 , 202 , 16 , 12 , 230
```

```

270 DATA 34 , 208 , 2 , 230 , 35
280 DATA 177 , 34 , 16 , 246 , 48
290 DATA 241 , 200 , 177 , 34 , 48
300 DATA 17 , 8 , 142 , 255 , 205
310 DATA 230 , 198 , 166 , 198 , 157
320 DATA 119 , 2 , 174 , 255 , 205
330 DATA 40 , 208 , 234 , 230 , 198
340 DATA 166 , 198 , 41 , 127 , 157
350 DATA 119 , 2 , 169 , 20 , 141
360 DATA 119 , 2 , 230 , 198 , 104
370 DATA 168 , 104 , 170 , 104 , 76
380 DATA 49 , 234 , 198 , 169 , 199
390 DATA 134 , 128 , 129 , 161 , 144
400 DATA 133 , 137 , 141 , 200 , 202
410 DATA 130 , 159 , 151 , 194 , 201
420 DATA 196 , 163 , 183 , 197 , 131
430 DATA 135 , 140 , 158 , 127 , 0
440 DATA 0 , 0 , 255 , 255 , 255

```

```

240 DATA 72,165,212,240,4,104,76,221
250 DATA 29,104,201,193,144,82,201,219
260 DATA 176,78,56,233,193,170,189,229
270 DATA 29,162,0,134,198,170,160,158
280 DATA 132,34,160,192,132,35,160,0
290 DATA 10,240,16,202,16,12,230,34
300 DATA 208,2,230,35,177,34,16,246
310 DATA 48,241,200,177,34,48,17,8
320 DATA 142,255,29,230,198,166,198,157
330 DATA 119,2,174,255,29,40,208,234
340 DATA 230,198,166,198,41,127,157,119
350 DATA 2,169,20,141,119,2,230,198
360 DATA 104,168,104,170,104,76,191,234
370 DATA 198,169,199,134,128,129,161,144
380 DATA 133,137,141,200,202,130,159,151
390 DATA 194,201,196,163,183,197,131,135
400 DATA 140,158,127

```

Program 2: vicKey

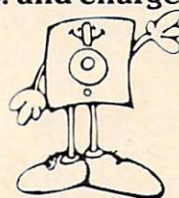
```

100 POKE55,77:POKE56,29
110 PRINT "{CLR}VIC-KEY":PRINT:PRINT"WAIT
... "
120 FORI=7501TO7679
130 READA:X=X+A:POKEI,A
140 NEXT
150 IF X<>22351 THEN PRINT"THERE IS AN ER
ROR ON YOUR DATA STATEMENTS":STOP
160 PRINT"SYS7501 TO ACTIVATE."
170 NEW
180 DATA 120,173,20,3,72,173,21,3
190 DATA 72,173,116,29,208,2,169,118
200 DATA 141,20,3,173,117,29,208,2
210 DATA 169,29,141,21,3,104,141,117
220 DATA 29,104,141,116,29,88,96,0
230 DATA 0,72,138,72,152,72,165,215

```

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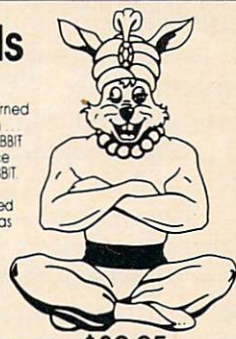


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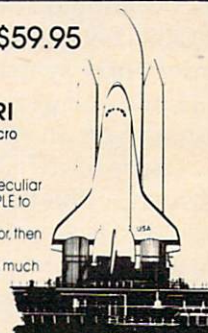
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INSIGHT: Atari

Bill Wilkinson

This month we'll begin to explore some of the techniques involved in creating a general-purpose formatted screen I/O routine in BASIC. "And just what is a general-purpose formatted screen I/O routine?" you quite rightfully ask.

A "New" Kind Of Screen Editor

Briefly, what I am trying to do is produce a method whereby the programmer may specify certain areas of the screen as "label" or "title" areas, which may not be modified by the user. Other parts of the screen then become the Input/Output (I/O) areas. The user will not be able to change any part of the screen except the designated I/O areas, but he or she will be able to "randomly" access any area and change it. When the screen is filled in properly, the user pushes a single key (I intend to use ESCape) and the screen is automatically read into data variables in memory, where the program may process them or write them to disk.

The concept is certainly nothing new. Main-frame installations such as airline reservation systems have been doing exactly this for years. And I am sure that programs already exist for the Atari computers which work in a like fashion. So why am I writing these routines? For practical use here at OSS. Believe it or not, we intend to have a sales order entry system, complete with accounts receivable and general ledger interface, up and running on an Atari computer.

Surprised? Didn't think the Atari was capable of such sophisticated work? Truthfully, as the machine is shipped from Atari, it is not. The big missing link is large amounts of disk storage. We intend to use at least two double-density, double-sided drives (or equivalents), and may find that we need three or four.

And why are we doing this on an Atari computer, instead of a CP/M or MS DOS machine? Quite frankly, because we have the equipment already paid for and because we have yet to see an adequate order entry system even for such

"bigger" machines.

Anyway, so far I have written three of the workhorse subroutines of my formatted screen routines: (1) Display fixed information at fixed locations on the screen, (2) Display variable information (presumably obtained from a disk file) on the screen, (3) Edit the variable information (or enter new information).

Routine number three is both too big and too complicated to put in this month's column. Also, it runs fine in BASIC XL; but when I tried to translate it to Atari BASIC, it got bigger and slower and may not be too usable. If there is enough interest, I might be persuaded to write about it in a future column. Routines 1 and 2, though, are so surprisingly small, simple, and elegant when written in Atari BASIC that I felt you would enjoy seeing them. So let's look at them before explaining how they work.

Routine 1: Fixed Setup

```
30000 REM set up fixed screen areas
30010 TRAP 30020 : DIM DATA$(50)
30020 TRAP 40000 : RESTORE PTRDATA
30030 READ DATA$ : IF DATA$="*" THEN
    RETURN
30040 POSITION VAL(DATA$(1,2)),VAL(D
ATA$(3,4))
30050 PRINT DATA$(5); : GOTO 30030
```

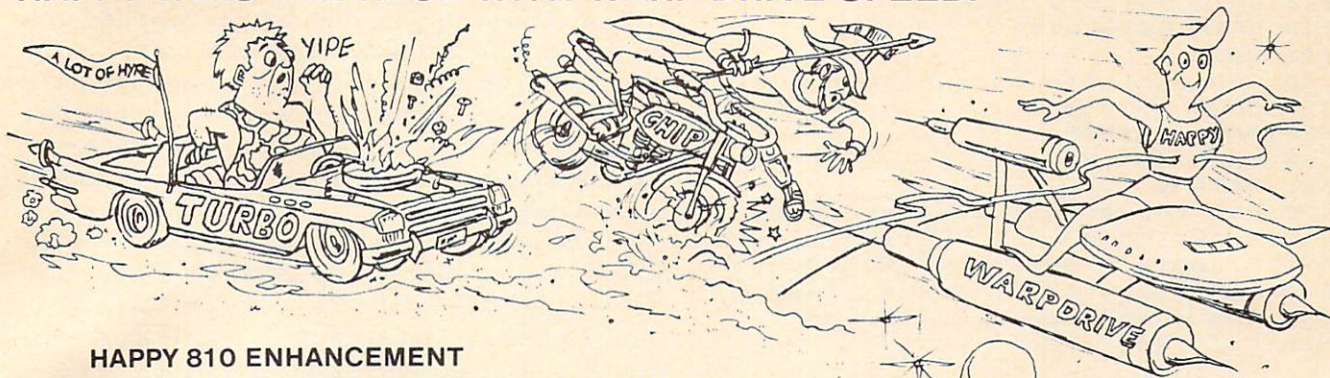
Routine 2: Variable Display

```
31000 REM display variable data area
31010 TRAP 31020 : DIM DATA$(50)
31020 TRAP 40000 : RESTORE PTRDATA :
    QPTR=1
31030 READ DATA$ : IF DATA$="*" THEN
    RETURN
31040 POSITION VAL(DATA$(1,2)),VAL(D
ATA$(3,4))
31050 PRINT SCREEN$(QPTR,QPTR-1+VAL(
DATA$(5,6)));
31060 QPTR=QPTR+VAL(DATA$(5,6)) : GO
TO 31030
```

Listing 3: A Tester For The Routines

```
100 DIM SCREEN$(200)
110 SCREEN$="ZUCKERMAN 95099C"
```

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```

200 REM fixed data
210 DATA 0810Name:
220 DATA 0412Zip Code:
230 DATA 0816Code:
240 DATA *
300 REM variable data parameters
310 DATA 151010
320 DATA 151205
330 DATA 151601
340 DATA *
400 REM the actual test program
410 GRAPHICS 0
420 PTRDATA = 200 : GOSUB 30000
430 PTRDATA = 300 : GOSUB 31000
440 REM just loop here for now
450 GOTO 440

```

Even though I have presented this example as three separate listings, if you would like to see its effects, you should type all the lines into a single program.

Addressable DATA

So, what's the secret of this simple yet (according to me) elegant program? Surprisingly enough, I find myself returning to the concept I explored in my very first COMPUTE! column (September 1981, for you "regulars"): addressable DATA statements. Very few BASICs have addressable DATA statements, yet when I look at this program I cannot understand why they don't.

The lines to look at carefully are 30020 and 31020, where the program says "RESTORE PTRDATA". When either of these routines is called, it expects that the variable PTRDATA will contain the line number of the beginning of some DATA statements which it must begin processing. So let's look at those DATA statements first.

In lines 210 through 230, we define the fixed fields on the screen as starting at a particular horizontal (X) position (the first two digits) and a particular vertical (Y) position (the next two digits). Notice how line 30040 reflects this usage with the VAL functions it uses in conjunction with the POSITION statement.

Similarly, in lines 310 through 330, the definitions of the variable fields are expressed as horizontal position (first two digits), vertical position (next two digits), and field length (last two digits). Again, lines 31040 through 31060 reflect these usages via VAL functions.

If you are wondering why I am making such a fuss over these two little routines, especially when it takes so much programming to prepare to use them, you probably haven't typed in the program to see what it does. Or, to be fair, you haven't seen the best part of all, the onscreen editor that's too big for this month's column.

INPUT Weaknesses


And why am I going to this much trouble, when I could use PRINTs and INPUTs to do the same

thing? Two reasons: (1) If I use PRINT and INPUT, I have to write the entire code each time in a form which makes my programs hard to read and understand. (2) The INPUT statement as implemented on most BASICs is a disaster, and Atari BASIC is no exception. There is no way, when using INPUT, to keep the user from hitting screen-editing keys or from entering too much or too little data.

Did I mention that the screen editing routine I have written allows the programmer to specify, via simple DATA statements, not only where and how big the variable data fields are on the screen but also what attributes they may have (for example, numeric, alphabetic, dollars and cents, etc.)? I didn't? Are you more interested now? Next month we'll continue our examination of screen I/O by making test runs of the example programs. ©

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Commodore Files For Beginners

Part 4

Jim Butterfield, Associate Editor

In this concluding article of the series, we'll clean up a few small details on sequential files; then I'd like to open up the big picture on the use of sequential files.

Linefeed

With every PRINT#, we have scrupulously ended with the sequence ;CHR\$(13); including the semicolon at the end. Is it overkill? Might we just say PRINT#1,X\$ without harm?

On all machines produced since 1981, the answer is yes. The 4.0 BASIC that was introduced for PET/CBM at that time solved the problem, and when the VIC and Commodore 64 were produced, the solution stayed.

The problem was this: When we said PRINT #1,"X" the computer would send the X to the file, followed by a carriage return—so far, we're OK—followed by a linefeed character. The linefeed got mixed into our data and caused confusion. On Commodore products before the 4.0 was announced, we needed to eliminate that automatic linefeed by sending our own carriage return, which is CHR\$(13).

From the 4.0 system onward (including VIC and 64), the linefeed won't go out unless you use a logical file number of 128 or greater. So on these machines, you can just say PRINT#1,"X" and have no problems.

Even if you have a newer machine, there's a question you should consider. Suppose you write a useful filing program. Is there a chance that someone might like to use your program on their computer—which might be an old PET/CBM? If so, use the CHR\$(13). It won't hurt your system, and will save other users a lot of potential headaches.

GET#

Sometimes a file doesn't seem to behave. The information that comes in when you INPUT# is not what you expect. To look at the file in detail, you should switch to GET#, which will look at each individual character.

For a simple ASCII file, we can write a quick program to display everything:

```
100 OPEN 1,8,3,"FILENAME" (or tape equivalent)
110 GET#1,X$
120 PRINT X$;
130 IF ST=0 GOTO 110
140 CLOSE 1
```

Chances are, you'll be able to see the problem right away; it's often an unwanted character such as a comma or colon, or a line that is too long.

Sometimes a bug in your program will put into your file "strange" characters that won't print. In this case, you can usually investigate the problem by changing to the numeric ASCII representation: 120 PRINT ASC(X\$); and if there's any chance that the file contains a binary zero character, you can catch it by coding 120 PRINT ASC(X\$+CHR\$(0)); to allow for the "null string" that results from reading this character.

A Longer Look

We've talked about the principles of writing and reading sequential files. I'd like to leave the mechanics to take a broader view of sequential files usage. We'll need to look at one extra touch: putting a file into some kind of order.

Unless we make a deliberate effort, a sequential file will end up with records in the order that they were created, or entered. But if we choose, we can set up the files with a distinctive sequence of records.

The Key Field(s)

We choose a certain field—say, student number or customer name—and decide that our file will be “sequenced” according to this field.

We may choose more than one field for our ordering. In this case, one of the fields is considered “major” and the other “minor.” For example, suppose we choose to sort by two fields: surname and first name. This would work out as follows: If the surnames are different, put the records in order of surname; if they are the same, put them in order of first name. Thus Fred Jones would come before Pete Jones, but William Jolson would come before both of them.

It turns out that the terms “major key” and “minor key” apply not just to music. You can go even further, and have an intermediate key. But the key fields always have a distinct precedence.

No Sort

Beginners often think that files must be sorted in order to be in a given sequence. Not so. If the files are created in sequence, they will stay that way; there will be no need for a distinct sort operation. So long as new items are inserted into the proper spot, the records never get out of order.

If you change keys, however, you’ll definitely need a sort; the new order will replace the old. And as we’ll see later, sorting does play a role in the handling of sequenced files.

Why Ordered?

It’s not obvious why a file will benefit from being placed in an ordered sequence. It’s extra work, and with small files it may not seem to pay off.

Let’s take a file of 100 records, and try some of the more common excuses.

- *It makes it easier to find a given record.* True, but often not important. We can usually search for a match in an array of 100 items in about a second; few users would find this an unworkable delay. With an ordered file, we could perform a binary search in one-tenth the time; but this may not matter.
- *It makes it easier to spot duplicates.* At the time that a new record is entered, finding a duplicate is the same job as finding a given record. Again, for 100 records or less, the difference may not be significant.
- *It makes it easier to add records.* Untrue: Adding to a keyed file may require “moving over” records so that the new one will fit. Adding to an unsequenced file involves tacking the new record onto the end of the file.
- *The file can be summarized faster.* Not usually true: 100 records take the same time to process regardless of their order.

As the number of records increases above

100, the first two reasons given above become more important; eventually, a sequenced file becomes quite desirable. But there’s another major reason why a keyed file is useful.

The Major Reason

Here’s the big one for commercial applications: In an ordered file, it’s easy to group similar items together for processing. They are already together.

Suppose we have a file of credit sales. This might include customer number, date, and amount. Now, if the file is sorted by customer number, each customer’s purchases are clustered together. We can summarize a customer’s activity very simply.

Suppose we have the following sales:

Customer Number	Amount
123	40.20
123	6.15
241	50.00
244	5.75
244	6.00

It’s obvious that these records are ordered by customer number. So here’s how we handle calculating each customer’s totals:

- Read the first record.
- Set Customer = the customer number, Total = the amount involved.
- Read the next record. If the customer number is still the same, add the amount into the Total, and repeat.
- If the customer number has changed, or when we reach end-of-file, print Customer, the previous customer number, and Total, the total customer purchases. If we’re not at the end-of-file, go back to step B.

If you’ve followed the above logic, you can see that when the customer number in the record changes, say from 123 to 241, we must stop and summarize. This point is called a “control break.”

More: Merging

If we have a file of customer transactions, and a file of customer names and addresses, and both files are sequenced by customer number, we can do something very powerful indeed. We can draw from both files simultaneously, and “mingle” the information together to produce a customer bill. We must be very careful to make sure that the customer numbers are synchronized.

This process—the streaming together of two ordered files—is called a “merge.” It can happen only if both files are sequenced in the same way. And to be able to handle two files at the same time, we must have a disk system.

The merge is vital to most commercial data processing systems. It’s worth describing how a typical commercial “merge/update” billing program works.

The Merge Update

The computer has a "Master Customer File" on disk. It contains the customer's name, address, previous balance, and the key field: customer number.

Over the past month, the computer has been gathering a "Transaction File." It contains a date, an amount, perhaps a transaction type and details, and the key field: customer number.

The program starts. Both the Master File and the Transaction File are opened and made ready for reading. A new file, the New Master File, is prepared for writing.

The computer grabs the first transaction, and then goes searching through the Master File for a matching customer number. Anything it finds on the Master File that doesn't match must be an inactive customer number (and a smaller number at that); and this is carefully copied over to the New Master File.

When we find a matching customer number on the Master File, we start to print out the customer bill. The name and address from the Master File are neatly printed. We move to the right place on the form and print the customer's previous balance. Now we print the first transaction.

We grab another transaction. If it's the same customer number, we print the transaction and keep going. But if it's a different customer number, we have a "control break." The previous customer's bill must be totaled, and a new statement moved into the right place on the printer. The New Master File will be written with the usual things: Name, Address ..., and a brand new balance.

This continues, the bills keep chugging out, and by the time we're finished we have created a brand new Master File that we'll use as an input next month.

Of course, there will be more things on the transaction file than purchases. Customer payments will also be shown there, and we might even include extra types of transactions such as corrections or changes of address.

And we'll produce extra output, usually directed to an "exception file." This includes transactions that have no matching customer number on the Master File, indications of customers with no activity but an outstanding balance, information on balances that exceed a certain amount, and whatever.

It's not my plan to give you a total outline of a billing system here. But I'd like you to get an appreciation of the mighty potential of the humble sequential file.

The Sort

We've previously deemphasized the role of sorting in the keyed sequential file. Perhaps we'd better

bring it back into perspective.

In the Merge operation we described above, it's likely that the Master File will always be in sequence. No need for sorting there. But the transactions are probably logged in as they arrive. They will be sorted into customer number order just before the mighty merge. But there's more.

The control break—the method whereby we group related records together and then summarize them—is so important that it's given rise to a whole class of programs: the "report generator." These are program systems prewritten to pick up control breaks and do the desired totaling. To use the power of a report generator program, we must sort our records according to the keys involved.

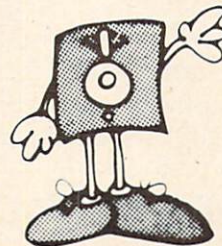
An example: Suppose we have sales records listing customer, salesman, sales office, date, amount, and product. Now, if you wish to analyze sales by product, here's what to do. Sort by product, and then use a report generator to summarize the file based on control breaks in the product number. Or if you want a report on each salesman's achievements, sort the records by salesman. Or by office, or by date, or by whatever you want to analyze. Once you know how to handle sequential file processing, you can pick over the data any way you want.

We leapt from simple file handling to the extraordinary power of control breaks and report generators. And yet it's all handled by the humble sequential file. Just a few simple coding rules will get you going. But the sky's the limit. ©

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PROGRAMMING THE TI

C. Regena

Foreign Languages

As you may already know, Texas Instruments has disbanded its home computer division. It's unfortunate that the TI-99/4A will no longer be manufactured and sold, because it's such a good computer.

However, there are still a lot of people out there who own TIs. I will keep writing and programming for the TI as long as there is a demand for it. Also, several third-party software companies have announced that they will continue to publish software as long as there is a market for it. If you are looking for further support, I suggest that you get involved with a local user group. If you are not aware of any in your area, or would like to start one, you may contact:

*Charles LaFara
International 99/4A User Group
P.O. Box 67
Bethany, OK 73008*

I have had several requests for programs for teaching or translating foreign languages. Letters have come from Southern California specifically requesting help in using Spanish accents and the tilde plus the opening exclamation and interrogation symbols.

In my high school days, we used headphones with an audio system that taught us a dialogue as we repeated phrases. With the TI computer and the Speech Synthesizer, you can imitate this. However, the computer adds branching capabilities to learning processes. The computer can determine when you are ready to continue to the next learning unit—or you can repeat one unit as long as you wish.

To use the Speech Synthesizer, you will need a command module that has speech capabilities. The Terminal Emulator II command module allows "unlimited" speech—there is no set vocabulary of words—so it is an ideal module for foreign speech. With the command module in place, press 1 for TI BASIC as usual (not 2 for the particular module). Any words that you want spoken you can spell phonetically in your program. Warning: Allow plenty of time to experiment with different sounds and spellings. The Spanish program included here presents the option to use speech.

To The Screen

Now to print the language on the screen. You probably noticed that the TI-99/4A keyboard has a tilde on one of the keys (FCTN W). It's the little curvy mark that belongs above the N in many Spanish words. The tilde is important enough in the language to change the pronunciation and the meaning of words. In Spanish writing you cannot just ignore the tilde or you may convey the wrong meaning. For example, Segundo P. I. Acuña writes, "A MONO is a MONKEY whereas a MOÑO is variously a bun, a crest, a chignon, a tuft.... You would wear a bun in your hair, but never a monkey!"

The problem with the tilde alone on a key is that it really should be above an N. To print an N with the tilde on the screen you need to print the tilde on one line, then the N directly below it. The solution is to design our own characters with the N and the tilde together and the accents with the appropriate vowels.

For this example program, I am leaving all the lowercase letters as is. (They really are small capital letters, not true lowercase letters, but it would take too much memory to redefine all of them to look like the normal lowercase letters.) To be able to print the N with the tilde and the vowels with the accent marks, I have redefined several characters.

In your own programming, choose regular characters between 33 and 127 that you would not otherwise be printing in the program. I chose to use Characters 91, 92, 93, and 94 for a, e, i, and o. I redefined the underline, Character 95, to be the ñ. I also redefined Character 35 to be the upside-down exclamation point and Character 36 to be the upside-down question mark. Later when you PRINT "\$" you won't see the dollar sign, but the upside-down question mark.

If you have the TI Extended BASIC command module, you can find out how the computer defines the characters by using the CHARPAT function. Rather than draw my own little letters, I used Extended BASIC and my printer to print a list of the definitions. If you have a printer and Extended BASIC, you can try the following

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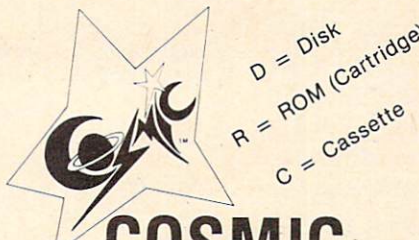
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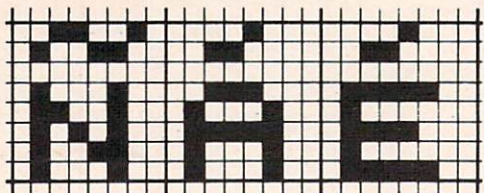
program. Change line 100 for your own printer configuration.

```

100 OPEN #2: "RS232.BA=600"
110 PRINT #2: "CHARACTER", "PATTERN CO
    DE": :
120 FOR N=33 TO 126
130 CALL CHARPAT(N,C$)
140 PRINT #2: :N;"    ";CHR$(N),C$
150 NEXT N
160 CLOSE #2
170 END

```

This program showed me that for the lowercase n, the character definition is 0000004464544C44. The next step was to get out the graph paper and draw a tilde above the given n:



The new character definition is 324C004464544C44. Similarly, you can draw the accents above the lowercase a, e, i, and o.

The redefined Spanish characters all have the accents going the same way. In French you will need the regular e plus é and è. In German you will need to define vowels with the umlaut marks above. (Sure, use the same idea for Chinese or Japanese characters—but I'll leave that up to you!)

The Special Characters

After you have redefined the characters in your program, you can print them on the screen—just remember which symbols correspond to which regular characters. For example, in the Spanish program, to print the word "niño", remember that the ñ is the underline (FCTN U) and use the command PRINT "ni_l". As you are programming, you will see the underline, but when the program is RUN, the underline will be redefined and you will see the ñ.

The main purpose of this Spanish program is to illustrate how to print the special characters. All of the Spanish is written with the lowercase letters—release the ALPHA LOCK key to type the lowercase letters. To type any symbols on the face of the keys, use FCTN and the key. Any phrase in a PRINT #1 statement is spoken with the Speech Synthesizer. You may want to experiment and change these pronunciations. If you do not have the Terminal Emulator II module or the Speech Synthesizer, make choice number 2 at the beginning of the program for no speech. The variable SP will then equal 2 and all commands involving speech will be by-passed.

The first part of the program draws pictures and shows the Spanish word or phrase. If you have speech, the computer will say the word or

phrase and you may repeat it. If you want to hear the phrase again, press the space bar. To continue after each presentation, press the ENTER key. The last section of the program presents Spanish phrases with the English translation.

If you prefer to avoid the typing, you can receive a copy of "Spanish" by sending \$3, a blank cassette or diskette, and a stamped, self-addressed mailer to:

C. Regena
P.O. Box 1502
Cedar City, Utah 84720

Program Explanation

- 110-200 Print title screen; define special Spanish characters.
- 210-250 Print option for speech and receive a 1 or 2. If "no speech" is chosen, SP will equal 2.
- 260-290 Print instructions.
- 300-310 If speech option is chosen, OPEN the device to allow speech. You must have the TI Speech Synthesizer and Terminal Emulator II to use speech.
- 320-370 Define graphics characters for characters numbered 128 to 137. Be sure to type all the commas as shown. If you RUN the program and get an error message for line 330 or 340, there is probably a typing error in lines 360-370.
- 380-390 Define colors for graphics.
- 400-420 Wait for user to press any key to begin.
- 430-570 Draw a boy on the screen and present the Spanish phrase for "I am a boy."
- 580-690 Draw a girl and say the phrase for a girl.
- 700-1470 Clear screen; draw face. CALL CHAR statements define graphics, and CALL HCHAR and CALL VCHAR statements draw on the screen. W\$ contains the Spanish word to be printed. PRINT #1 statements use the speech synthesizer to say the word.
- 1480-1890 Present Spanish phrases with English translations.
- 1900-1950 Subroutine used for each word or phrase. If the space bar is pressed, R=2 and the phrase is repeated. If ENTER is pressed, the program continues.
- 1960-1990 Subroutine to print the word on the screen without scrolling. W\$ is the Spanish word, and X is the row for printing.
- 2000-2030 Clear screen; close speech device; end program.

Learning Spanish

```

100 REM SPANISH
110 CALL CLEAR
120 PRINT TAB(10); "SPANISH"
130 CALL CHAR(95, "324C004464544C44"
)
140 PRINT :TAB(10); "espa_ol":::::
150 CALL CHAR(91, "08300038447C4444"
)
160 CALL CHAR(92, "0830007C4078407C"
)
170 CALL CHAR(93, "0830003810101038"
)
180 CALL CHAR(94, "0830007C4444447C"
)
190 CALL CHAR(35, "0010001010101010"
)
200 CALL CHAR(36, "000800081020221C"
)

```

```

210 PRINT "DO YOU HAVE THE SPEECH
      (6 SPACES)SYNTHESIZER AND": "TER
      MINAL EMULATOR II?"
220 PRINT : " 1 YES, INCLUDE SPEECH
      ": " 2 NO SPEECH"
230 CALL KEY(0,K,S)
240 IF (K<49)+(K>50) THEN 230
250 SP=K-48
260 CALL CLEAR
270 IF SP=2 THEN 290
280 PRINT "PRESS THE SPACE BAR TO H
      EAR THE WORD OR PHRASE AGAIN.":
      ::
290 PRINT "PRESS <ENTER> TO CONTINU
      E": "AFTER EACH WORD OR PHRASE."
      :::
300 IF SP=2 THEN 320
310 OPEN #1: "SPEECH", OUTPUT
320 FOR C=128 TO 137
330 READ C#
340 CALL CHAR(C,C#)
350 NEXT C
360 DATA 307EC30C303037E3C,000000FFF
      F,181818FFFF181818,181818181818
      3030,00000000001010302
370 DATA 6642C38181,000000008080C04
      ,06040C183870E0C,602030181C0E07
      03,FFFFFFFFFFFFFFFF
380 CALL COLOR(13,5,1)
390 CALL COLOR(14,5,1)
400 PRINT "PRESS ANY KEY TO BEGIN."
410 CALL KEY(0,K,S)
420 IF S<1 THEN 410
430 CALL CLEAR
440 CALL HCHAR(17,16,128)
450 CALL HCHAR(18,15,129,3)
460 CALL HCHAR(18,16,130)
470 CALL HCHAR(19,16,131)
480 CALL HCHAR(20,15,132)
490 CALL HCHAR(20,16,133)
500 CALL HCHAR(20,17,134)
510 CALL HCHAR(21,15,135)
520 CALL HCHAR(21,17,136)
530 PRINT TAB(9); "Soy un ni_o."
540 IF SP=2 THEN 560
550 PRINT #1: "SOY UN ^NEEN YO."
560 GOSUB 1900
570 IF R=2 THEN 540
580 CALL COLOR(13,7,1)
590 CALL COLOR(14,7,1)
600 CALL CHAR(133, "7E7EFFFFFFFFFFFF
      ")
610 CALL CHAR(135, "07070F1F3F7FFFFF
      ")
620 CALL HCHAR(20,16,137)
630 CALL CHAR(136, "E0E0F0F8FCFEFFFF
      ")
640 CALL HCHAR(23,11,32,12)
650 PRINT TAB(8); "Soy una ni_a."
660 IF SP=2 THEN 680
670 PRINT #1: "SOY OONA ^NEEN YUH."
680 GOSUB 1900
690 IF R=2 THEN 660
700 CALL CLEAR
710 CALL CHAR(144, "EFDFFAA7FFEDFE7F
      ")
720 CALL CHAR(145, "8040201008040201
      ")
730 CALL CHAR(146, "010204081020408"
      )
740 CALL CHAR(147, "FF")
750 CALL HCHAR(8,19,144,7)
760 CALL HCHAR(9,18,144)
770 CALL HCHAR(9,26,144)
780 CALL VCHAR(10,17,144,8)
790 CALL VCHAR(10,27,144,8)
800 CALL HCHAR(18,18,145)
810 CALL HCHAR(18,26,146)
820 CALL HCHAR(19,19,145)
830 CALL HCHAR(19,25,146)
840 CALL HCHAR(20,20,147,5)
850 PRINT TAB(17); "cabeza"
860 IF SP=2 THEN 880
870 PRINT #1: "^CA BAY TSA."
880 GOSUB 1900
890 IF R=2 THEN 860
900 CALL CHAR(152, "0F1020408083878F
      ")
910 CALL CHAR(153, "F008040201C1E0F1
      ")
920 CALL CHAR(154, "4F4F4F2F2F2F708"
      )
930 CALL CHAR(155, "F2F2F2F4F4F40701
      ")
940 CALL COLOR(16,5,1)
950 FOR I=20 TO 23 STEP 3
960 CALL HCHAR(11,I,152)
970 CALL HCHAR(11,I+1,153)
980 CALL HCHAR(12,I,154)
990 CALL HCHAR(12,I+1,155)
1000 NEXT I
1010 W$="ojos"
1020 X=12
1030 GOSUB 1960
1040 IF SP=2 THEN 1060
1050 PRINT #1: "^O HOES."
1060 GOSUB 1900
1070 IF R=2 THEN 1040
1080 CALL CHAR(136, "000404080810102
      ")
1090 CALL CHAR(137, "20404080808C936
      ")
1100 CALL COLOR(14,10,1)
1110 CALL HCHAR(13,22,136)
1120 CALL HCHAR(14,22,137)
1130 W$="nariz"
1140 X=14
1150 GOSUB 1960
1160 IF SP=2 THEN 1200
1170 PRINT #1: " NAR ^DHIZ."
1180 GOSUB 1900
1190 IF R=2 THEN 1160
1200 CALL CHAR(128, "2040A010080601"
      )
1210 CALL CHAR(129, "000000000000817
      E")
1220 CALL CHAR(130, "0402050810608")
1230 CALL HCHAR(16,21,128)
1240 CALL HCHAR(16,22,129)
1250 CALL HCHAR(16,23,130)
1260 W$="boca"
1270 X=16
1280 GOSUB 1960
1290 IF SP=2 THEN 1310
1300 PRINT #1: "^BO CA."
1310 GOSUB 1900
1320 IF R=2 THEN 1290
1330 CALL CHAR(148, "0000000C4222222
      2")
1340 CALL CHAR(149, "000000601010102
      ")

```

```

1350 CALL CHAR(150,"000000060808080
4")
1360 CALL CHAR(151,"000000304244444
4")
1370 CALL HCHAR(10,20,148)
1380 CALL HCHAR(10,21,149)
1390 CALL HCHAR(10,23,150)
1400 CALL HCHAR(10,24,151)
1410 W$="pestu_a"
1420 X=10
1430 GOSUB 1960
1440 IF SP=2 THEN 1460
1450 PRINT #1:"PES ^TUNE YA."
1460 GOSUB 1900
1470 IF R=2 THEN 1440
1480 CALL CLEAR
1490 PRINT "Buenos dias, se_or.":":
Good day, Sir."
1500 IF SP=2 THEN 1520
1510 PRINT #1:"^BWAY NOSE THEE AS,
_SEEN YOR."
1520 GOSUB 1900
1530 IF R=2 THEN 1500
1540 PRINT :::"Buenas tardes, se_ora
.":": "Good afternoon, Madam."
1550 IF SP=2 THEN 1570
1560 PRINT #1:"^BWAY NAS. TAR DES,
^SEEN_YO RA."
1570 GOSUB 1900
1580 IF R=2 THEN 1550
1590 PRINT :::"Buenas noches, se_ori
ta.":": "Good evening, Miss."
1600 IF SP=2 THEN 1620
1610 PRINT #1:"^BWAY NAS NO CHES,
_SEEN YO _REE TA."
1620 GOSUB 1900
1630 IF R=2 THEN 1600
1640 PRINT :::"$Habla usted espa_ol
?":": "Do you speak Spanish?"
1650 IF SP=2 THEN 1670
1660 PRINT #1:"^ABLA OO _STED _S PA
N YOLE?"
1670 GOSUB 1900
1680 IF R=2 THEN 1650
1690 PRINT :::"#Yo hablo espa_ol!":
:" I speak Spanish!"
1700 IF SP=2 THEN 1720
1710 PRINT #1:"^YO ABLO _S PAN YOLE
!"
1720 GOSUB 1900
1730 IF R=2 THEN 1700
1740 PRINT :::"$C^mo estI usted?":
:" How are you?"
1750 IF SP=2 THEN 1770
1760 PRINT #1:"^COE MOE _S TAW _U
_STED?"
1770 GOSUB 1900
1780 IF R=2 THEN 1750
1790 PRINT :::"No s\."":": "I do not k
now."
1800 IF SP=2 THEN 1820
1810 PRINT #1:"^NO SAY."
1820 GOSUB 1900
1830 IF R=2 THEN 1800
1840 PRINT :::"#Adi^s!":": "Good bye
!":":
1850 IF SP=2 THEN 1870
1860 PRINT #1:"^AWDHEE OSE!"
1870 GOSUB 1900
1880 IF R=2 THEN 1850
1890 GOTO 2000
1900 R=1
1910 CALL KEY(0,K,S)
1920 IF K=13 THEN 1950
1930 IF K<>32 THEN 1910
1940 R=2
1950 RETURN
1960 FOR I=1 TO LEN(W$)
1970 CALL HCHAR(X,4+I,ASC(SEG$(W$,I
,1)))
1980 NEXT I
1990 RETURN
2000 CALL CLEAR
2010 IF SP=2 THEN 2030
2020 CLOSE #1
2030 END

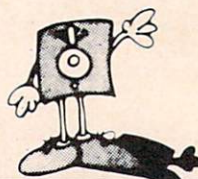
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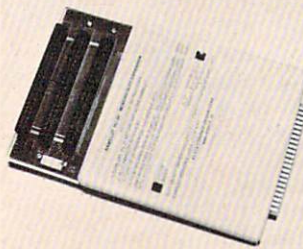
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64 EXPLORER

Larry Isaacs

First let's finish up the topic of last month's column: how to take advantage of the graphics features found in most dot-matrix printers. We offered a BASIC program which output a graphics image copy of the 64's character generator ROM to my NEC-8023, but that output was quite slow. As promised, here's a faster version which makes use of machine language.

Subroutine Changes

There are a few changes in operation. First, the subroutine beginning at line 200 now copies the entire character ROM contents to a buffer at 36608 (\$8F00). The old version copied only eight bytes and stored them in an array called SA.

Another change is that the subroutine beginning at line 300 now uses the USR function to call a machine language graphics output routine. It accepts a pointer to an eight-byte character cell and outputs the appropriate graphics bytes over logical channel 4. Last month's version output the bytes contained in the SA array.

The machine language routine rearranges the bits in the same way as the old version, but much faster, however. Errors that occur within the machine language routine are handled by returning the error code as the value of the USR function. A value of zero is returned if the eight-byte cell is output successfully. With some simple changes, the routine could be modified to rearrange the bits appropriately for other printers. This would be a good exercise for someone just learning machine language.

The program now takes approximately one minute to run, with half the time spent copying the character generator ROM to memory, and the other half printing it.

Checksum Routine

When entering the program, use the following procedure to insure the DATA statements are correct. Type in lines 10-90, except for line 40. Next, enter the DATA statements at the end of the program (lines 10000-10100). Now add the following lines and save a copy of the test program to play it safe:

```
100 TL=0:FOR I=0 TO 81
110 TL=TL+PEEK(40704+I)
120 T=INT((I+1)/8)*8-1
130 IF T=I THEN PRINT TL, :TL=0
140 NEXT I:PRINT TL
```

When you RUN the test program, the following numbers should be printed:

468	962	1117	1086
699	1041	1270	1241
905	165	0	

These are checksums of the numbers in each DATA statement, printed left to right. If one of your printed checksum numbers is different from those above, check the associated DATA statement for incorrectly entered numbers. Once these numbers check out, you can type the rest of the program.

Creating Useful Graphics

In my example program, I print out the character ROM for demonstration purposes. This is because creating a useful graphics screen image in BASIC is a complex task that would warrant a separate article (or two) and I want to keep the example programs simple.

However, being able to create your own graphics is prerequisite to putting the graphics features of your printer to best use. This means you need routines to set up and draw onto a graphics screen. BASIC is inefficient for this task, especially in terms of speed. Using machine language routines is better. An even better alternative would be to use one of the BASIC enhancement programs which adds a set of graphics commands. This allows you to access machine language drawing routines without resorting to SYS and USR. Instead, you use commands like MOVE and DRAW, making the programs much more readable.

The following is a review of one such BASIC enhancement program. There are others, so be sure to shop around to see what is available.

Ultrabasic-64

Written by Roy Wainwright, *Ultrabasic-64* is available from Abacus Software. It comes on tape for \$39.95, or on disk for \$42.95. *Ultrabasic-64* offers enhanced BASIC commands for controlling sound as well as graphics.

The program supports both the standard and multicolor bitmapped graphics modes provided by the 64 video chip. To set up a graphics display, you first initialize the graphics screen with either a HIRES or a MULTI command. The HIRES command sets up a standard bitmapped screen, and MULTI sets up a multicolor bitmapped screen.

Once you set up a graphics screen, you can switch between the graphics screen and normal program text display with the GRAPH and NORM commands. If you are in the direct command mode, you can switch to the graphics screen with the f5 function key, and back to the normal screen with the f7 function key.

Drawing Commands

To manipulate the graphics screen, you have three sets of commands at your disposal. There is a set of commands which performs normal line and dot plotting. This set includes DOT, DRAW, BOX, CIRCLE, CHAR, BLOCK, FILL, TIC, MODE, and PIXEL. Another set of commands provides for doing turtle graphics. These commands include TURTLE, TCOLOR, TUP, TDOWN, TURN, TURNT, MOVE, BYE, and TPOS. The third set of commands performs sprite manipulation. The commands are COPY, SPRITE, OFF, PLACE, and ROTATE. Associated with the sprite commands are some special commands like DATA statements which provide a choice of methods to specify the sprite data. These special commands are BIT, HEX, SDATA, and COLORS.

Sounds And Games

In addition to the graphics commands, there is a set of commands for controlling the SID sound chip on the 64. These commands include SOUND, GET, VOL, SET, and TUNE. The GEN and VOL commands are used to set up the hardware, with SOUND and TUNE making the sounds. The SOUND command plays a single note or sound of a specified pitch and duration. The TUNE command plays a tune selected by the SET command. The tune itself is specified by the data string in a TDATA statement.

Ultrabasic-64 also has commands to help with game applications. These include JOY, PADDLE, and PEN to access the joystick, paddle, and light pen. (Note: The PEN command simply reads the light pen registers. It makes no assumption or mention of what hardware is required to make it functional.) There are two commands, SCOLL and BCOLL, for detecting collisions between sprites and other sprites or with the background. Also implemented are ten countdown timers. These are initially set with an SCTR command. The current count of the timer can be read with a CTR() function. The first four of these timers count in jiffies ($1/60$ second); the others count in seconds.

There are a few other miscellaneous utility commands provided to fill out the set. The [N...] command implements a repeat loop, and the EXIT command provides forced exit from the loop. Essentially, all commands (including normal BASIC commands) found between the [N and the] will be executed N times, provided an EXIT isn't

encountered at some earlier point. The N may be any expression specifying how many times to repeat the loop. These two commands are primarily intended to enhance the turtle graphics commands.

There are DUMP and GREAD commands for writing and reading back the graphics screen. There is also a HARD command which prints the graphics image to your graphics printer. My review copy supports only the Commodore 1515 or 1525 and the Epson MX-80 or FX-80 printers. I would imagine that by the time you read this, others will be supported as well.

Documentation And Examples

Accompanying *Ultrabasic-64* on the disk or tape are a demo program and a tutorial program in two parts. These programs are intended to supply you with plenty of examples. The reference manual is fairly complete. I had no trouble understanding how to use the various commands.

Ultrabasic-64 adds quite a lot to BASIC. This, of course, does not come without penalty. With *Ultrabasic-64* running, you are left with a maximum of 21245 bytes free. This is a rather substantial reduction from the usual 38909 bytes free. About half of the memory taken is used by machine language added to the BASIC interpreter. The other half is taken up by various RAM storage areas for sprites, screen memory, etc. With only 21245 bytes available, *Ultrabasic-64* is not appropriate for applications which require a large program or a large amount of data storage.

Compatibility Questions

While on the topic of enhancement programs, I might as well say a few words about compatibility. There are essentially two ways for an enhancement program to attach its machine language onto the BASIC interpreter. One way is for the enhancement to actually make its machine language a part of the interpreter. This is what *Ultrabasic-64* does. Once operational, the new commands are as much a part of BASIC as the standard commands.

The second way for an enhancement program to attach to BASIC is to modify the CHRGET routine which BASIC uses to fetch the bytes of the program. By linking into the CHRGET routine, the enhancement can preexamine what BASIC is trying to execute, and steal any of the enhancement commands. These enhancement commands are executed and the command characters in the program are skipped over, so that BASIC never realizes they were in the program. The DOS Wedge uses this method.

As you might expect, *Ultrabasic-64* and the DOS Wedge will work together without a hitch. However, with other combinations of enhance-

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ment programs you may not be that lucky. Essentially, only one enhancement program will be able to use the first method at one time. More than one program can use the second method at a time, provided they don't make the modification at the same place, or can handle the situation in which a modification is already present in a desired location.

In addition to conflicts in attaching to BASIC, there may be conflicts in RAM usage as well. If documentation permits, you should try to determine if there is any memory usage conflict. Of course, the best way to determine if two enhancements are compatible is to try them out together.

Next Month

Sales figures show that a high percentage of you with 64s have also purchased at least one disk drive. In light of this, and the requests I've received for more information about the 1541 disk drive, I will try to cover this topic in the next column.

Graphics Demonstration Program

```

10 REM PROGRAM TO PRINT CHAR ROM IMAGE
20 REM RESERVE SOME MEMORY
30 POKE 55,0:POKE 56,143:CLR
40 OPEN 4,4,5
50 REM INSTALL MACHINE CODE
60 FOR I=0 TO 81
70 READ BY:POKE 40704+I,BY:NEXT
80 REM SET USR VECTOR
90 POKE 785,0:POKE 786,159:GOTO 1000
100 REM ENABLE GR. MODE FOR N CHARS
110 N$=STR$(N):N$=RIGHT$(N$,LEN(N$)-1)
120 N$=LEFT$("0000",4-LEN(N$))+N$
130 PRINT#4,CHR$(27);"S";N$;
140 RETURN
200 REM COPY CHAR. ROM TO MEMORY AT BF
210 PRINT "COPYING CHAR. ROM TO MEMORY"
220 POKE 56334,PEEK(56334) AND 254
230 POKE 1,PEEK(1) AND 251
240 FOR I=0 TO 4095
250 POKE BF+I,PEEK(CP+I):NEXT
260 POKE 1,PEEK(1) OR 4
270 POKE 56334,PEEK(56334) OR 1
280 RETURN
300 REM PRINT 8 BYTE CELL AT CP
310 T=CP+(CP>=32768)*65536
320 IF USR(T)=0 THEN RETURN
330 PRINT "ERROR OUTPUTTING TO PRINTER"
340 CLOSE 4:STOP
1000 REM THE MAIN ROUTINE
1010 PRINT#4,CHR$(27);"T16";
1020 N=16*8:CP=53248
1030 BF=36608:GOSUB 200:REM COPY ROM
1040 CP=BF:REM SET CP
1050 PRINT "PRINTING THE ROM CONTENTS"
1060 FOR L=1 TO 32:REM PRINT 32 LINES
1070 GOSUB 100
1080 FOR G=1 TO 16:REM 16 GROUPS/LINE
1090 GOSUB 300:CP=CP+8:NEXT G
1100 PRINT#4:NEXT L
1110 PRINT#4,CHR$(27);"A";
1120 CLOSE 4
1130 END

```

```

10000 DATA 76,9,159,108,3,0,108,5
10010 DATA 0,32,3,159,132,251,133,252
10020 DATA 160,7,177,251,153,74,159,136
10030 DATA 16,248,162,4,32,201,255,168
10040 DATA 176,32,169,0,160,0,162,0
10050 DATA 30,74,159,106,232,224,8,208
10060 DATA 247,32,210,255,165,144,208,9
10070 DATA 200,192,8,208,233,160,0,240
10080 DATA 1,168,32,204,255,169,0,76
10090 DATA 6,159,0,0,0,0,0,0
10100 DATA 0,0

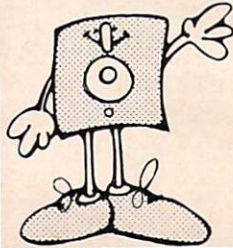
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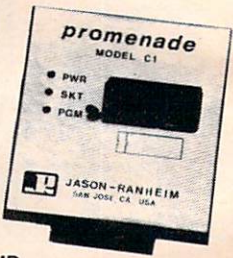
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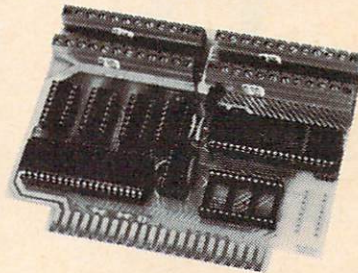
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Dr. Video 64

David W. Martin

The cursor control keys on your 64 already give you some of the most powerful screen editing capabilities of any home computer, but this utility adds even more: clear screen below the cursor, clear screen above the cursor, and "home" the cursor to the bottom left of the screen, all at machine language speed.

While revising long programs or doing repeated numerical calculations in immediate mode, it is often useful to be able to clear a portion of the screen display while leaving the rest intact. It is also useful at times to be able to "home" the cursor to the lower left of the screen instead of the usual upper-left position.

Although Commodore built excellent screen editing features into the 64, "Dr. Video 64" adds even more flexibility by giving you three additional cursor control keys. A special technique allows Dr. Video to function even while you are typing or running another program. Since the program is written entirely in machine language, it doesn't take up any of the memory normally used for BASIC programming.

The new cursor control features are assigned to three of the 64's special function keys. The assignments are as follows:

- f1 Clear display to the top of the screen starting with the line containing the cursor.
- f3 Clear display to the bottom of the screen starting with the line containing the cursor.
- f5 Move the cursor to the lower-left corner of the screen.

How The Doctor Operates

Every 1/60 second your 64 stops whatever it is doing and takes some time out to read the keyboard and perform other housekeeping tasks. These breaks are called *interrupts*, and the machine language program which runs during this interrupt period is called the interrupt service routine. When the microprocessor receives the interrupt request (IRQ) signal, it looks at a pair of memory locations to find the starting address (called the IRQ vector)

of the interrupt service routine to be executed. On the 64, the IRQ vector is contained in locations 788 and 789, which normally point to address 59953, the beginning of the standard IRQ SERVICE ROUTINE IN ROM (unchanging memory). However, since the IRQ vector is stored in RAM, changeable memory, we can substitute the address of our own machine language subroutine and add it to the normal interrupt service routine.

Like all interrupt-driven routines, Dr. Video 64 continues to run until you reset the computer (by hitting the RUN/STOP and RESTORE combination, for example). It is not disabled by hitting just the STOP key. After a reset, you can reactivate the new screen editing keys by typing SYS 49152.

Typing In The Program

Dr. Video is a machine language program which uses a BASIC loader to POKE the data into memory and issue the SYS to start it running. A checksum is calculated to assist in detecting typing errors in the DATA statements, but since the loader program NEWs itself out of the BASIC memory area, you should be careful to SAVE a copy before RUNNING for the first time.

Dr. Video 64

```
200 FORI=0TO148
210 READJ:POKE49152+I,J:X=X+J:NEXTI
230 IFX<>17524THENPRINT"ERROR IN DATA":STOP
240 SYS49152:NEW
300 DATA120,169,13,141,20,3,169,192,141,21,3,88,96,165,197,41
310 DATA127,201,4,208,27,169,0,133,25,169,4,133,26,216,24,165
320 DATA209,105,40,133,27,165,210,133,28,144,2,230,28,24,144,46
330 DATA165,197,41,127,201,5,208,19,165,209,133,25,165,210,133,26
340 DATA169,231,133,27,169,7,133,28,24,144,19,201,6,208,67,169
350 DATA192,133,209,169,7,133,210,169,24,133,214,24,144,44,216,56
360 DATA165,27,229,25,133,29,165,28,229,26,133,30,169,32,166,30
370 DATA240,12,160,0,145,25,200,208,251,230,26,202,208,246,166,29
380 DATA240,8,160,0,145,25,200,202,208,250,169,0,133,211,169,32
390 DATA133,197,76,49,234
```

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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!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one 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.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type **COMPUTE!**'s 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, break key, and RESET (or STOP) keys may all 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 or ENTER 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 brackets as the appropriate control key (see "How To Type **COMPUTE!**'s Programs" elsewhere in the magazine.)

*We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on the **CAPUTE!** page, usually within eight weeks. If you have specific questions about items or programs which you've seen in **COMPUTE!**, please send them to Readers Feedback, P.O. Box 5406, Greensboro, NC 27403.*

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How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: **INVERSE VIDEO**. Enter these characters with the Atari logo key, {A}.

When you see	Type	See
{CLEAR}	ESC SHIFT <	↵ Clear Screen
{UP}	ESC CTRL -	↑ Cursor Up
{DOWN}	ESC CTRL =	↓ Cursor Down
{LEFT}	ESC CTRL +	← Cursor Left
{RIGHT}	ESC CTRL *	→ Cursor Right
{BACK S}	ESC DELETE	⌫ Backspace
{DELETE}	ESC CTRL DELETE	⌫ Delete character
{INSERT}	ESC CTRL INSERT	⌫ Insert character
{DEL LINE}	ESC SHIFT DELETE	⌫ Delete line
{INS LINE}	ESC SHIFT INSERT	⌫ Insert line
{TAB}	ESC TAB	→ TAB key
{CLR TAB}	ESC CTRL TAB	⌫ Clear tab
{SET TAB}	ESC SHIFT TAB	⌫ Set tab stop
{BELL}	ESC CTRL 2	⌫ Ring buzzer
{ESC}	ESC ESC	⌫ ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T}.

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {A} means to enter a reverse-field heart with CTRL-comma, {5⌫} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC/64

Generally, any PET/CBM/VIC/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. 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). Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

For the VIC and 64, 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 indicated.

Rarely, you'll see in a Commodore 64 program a solitary letter of the alphabet enclosed in braces. These characters can be entered by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A.

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 tables when entering special characters:

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLEAR}	SHIFT CLR/HOME	⌫	{GRN}	CTRL 6	⌫
{HOME}	CLR/HOME	⌫	{BLU}	CTRL 7	⌫
{UP}	SHIFT ↑ CRSR ↓	⌫	{YEL}	CTRL 8	⌫
{DOWN}	↑ CRSR ↓	⌫	{F1}	f1	⌫
{LEFT}	SHIFT ← CRSR →	⌫	{F2}	f2	⌫
{RIGHT}	← CRSR →	⌫	{F3}	f3	⌫
{RVS}	CTRL 9	⌫	{F4}	f4	⌫
{OFF}	CTRL 0	⌫	{F5}	f5	⌫
{BLK}	CTRL 1	⌫	{F6}	f6	⌫
{WHT}	CTRL 2	⌫	{F7}	f7	⌫
{RED}	CTRL 3	⌫	{F8}	f8	⌫
{CYN}	CTRL 4	⌫	←	←	⌫
{PUR}	CTRL 5	⌫	↑	SHIFT ↑	⌫

All Commodore Machines

Clear Screen {CLR}	Cursor Left {LEFT}
Home Cursor {HOME}	Insert Character {INST}
Cursor Up {UP}	Delete Character {DEL}
Cursor Down {DOWN}	Reverse Field On {RVS}
Cursor Right {RIGHT}	Reverse Field Off {OFF}

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

Texas Instruments 99/4

The only special characters used are in PRINT statements to indicate where two or more spaces should be left between words. For example, ENERGY {10 SPACES} MANAGEMENT means that ten spaces should be left between the words ENERGY and MANAGEMENT. Do not type in the braces or the words 10 SPACES. Enter all programs with the ALPHA LOCK on (in the down position). Release the ALPHA LOCK to enter lowercase text.

CAPUTE!

Modifications Or Corrections To Previous Articles

Chopperoids

Here's how to produce a working version of the "Chopperoids" game described in the December 1983 issue (p. 122):

1. Load the MLX program shown on p. 216 of the December issue.
2. Add or change the following lines in the MLX program. (Note: These changes are for fixing Chopperoids only; they do *not* alter the MLX program. Be sure not to make any permanent changes to MLX.)

For tape users:

```
940 CLOSE #2:TRAP 32767:? "Finished.":?  
950 IF NOT READ THEN END  
955 BUFFER$(FIN-BEG+24)=CHR$(0):BUFFER$(  
25)=BUFFER$(55):LET READ=0:GOTO 360
```

For disk users:

```
1185 BUFFER$(31)=BUFFER$(61)
```

3. RUN MLX using the starting, ending, and run/init addresses specified in the Chopperoids article. Disk users should again choose to make a boot disk. Use the MLX Load function (CTRL-L) to load the Chopperoids data from the December issue. If you use the Display command (CTRL-D), you will see that all the data has been moved up five lines. That is, the data in lines 3584-3608 has been eliminated, so the data formerly at line 3614 is now at line 3584, and so forth.
4. Use the MLX New Address command (CTRL-N) to begin typing at line 6092. Add the following lines:

```
6092:197,020,208,252,169,000,026  
6098:133,148,076,146,023,160,128  
6104:005,166,142,169,000,157,087  
6110:130,025,232,136,208,249,178  
6116:141,005,208,141,006,208,169  
6122:096,000,000,000,000,000,074
```

5. After you type the last line, MLX should create a boot tape or disk which is a working version of Chopperoids.

Atari Gas Mileage

In the Atari version of this utility from the December 1983 issue (p. 86), delete lines 280, 290, and 450 and change the following lines:

```
270 ? "{CLEAR}"  
440 A=130-MG*2
```

TI Get The Gold

To load Program 2 of this two-part game from the December issue (p. 132), type in NEW, then OLD CS1. Reader Mark Leair suggests these improvements, which allow Program 1 to load Program 2:

For console BASIC:

```
790 PRINT "loading":"After load type RUN  
then Enter"  
800 OPEN #1:"CS1",INTERNAL,OUTPUT,FIXED  
810 CLOSE #1
```

For Extended BASIC:

```
790 PRINT "Loading"  
800 RUN "CS1"  
810 REM
```

Goodbye Charlie For 64 And VIC

In both these versions of this game from the November 1983 issue (p. 68), change the $S = CS + 10$ in line 515 to $SC = SC + 10$.

64 Crazy Climber

The logical AND in line 1440 of this game from the November 1983 issue (p. 80) should be replaced with an OR.

64 Sound Tester

The final Release stage of the ADSR envelopes generated in this program (November 1983, p. 187) is not realized because the program ends each note by POKEing the frequency to zero rather than by turning off the gate bit. To correct this, change the POKE W, in lines 250-280 to $X =$ and change the following lines:

```
310 FORI=1TO15STEP2: POKEW,X: POKEHF,SO((  
I,A(2)): POKELF,SO(I+1,A(2))  
311 O=O+1: FORN=1TOD(0): NEXT: POKEW,X-1:  
NEXT: FORI=1TO10000: NEXT
```

Then eliminate the NEXT in line 315. The new FOR-NEXT loop in 311 allows time for the Release to be heard at the end of the tune. Our thanks to Arthur Hunkins for this correction.

Stock Market Analyzer For VIC/64 And Atari

In both versions of this utility from the November 1983 issue (p. 54), the following line must be changed to plot stock prices higher than \$10 per share:

```
620 FORT=1TOINT(15/HI*TP(X)):PRINT"{UP}";  
:NEXTT
```

In line 652 of the VIC/64 version, insert a colon after the first semicolon.

Timex/Sinclair Making Change

A typographical error in the machine language loader (Program 1) for this article from the September 1983 issue (p. 252) causes the program to crash. The twentieth character in A\$ in line 20 should be 8 rather than 6.

COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of COMPUTE!. Each issue contains much, much more than there's space here to list, but here are some highlights:

Home and Educational COMPUTING! (Fall 1981 and Summer 1981 — count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters On The VIC, Alternative Screens, Automatic VIC Line Numbers, Using The Joystick (Spacewar Game), Fast VIC Tape Locater, Window, VIC Memory Map.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032, A Fast Visible Memory Dump, Cassette Filing System, Getting To A Machine Language Program, Epidemic Simulation.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever Expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, Quadra PET: Multitasking?, Mapping Unknown Machine Language, RAM/ROM Memory, Keeping TABs on a Printer.

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The

Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, Using TAB, SPC, And LEN.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying, Adding A Programmable Sound Generator, Converting PET BASIC Programs To ASCII Files.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, and VIC; Budgeting on the Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train Your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel \$\$ (multiple computers), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Atari Word Processor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game, Replacing The INPUT# Command, Foreign Language Text on The Commodore Printer, File Recovery.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, VIC Color Tips, VIC Memory Map, ZAP: A VIC Game.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacts, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, A VIC Light Pen For Under \$10, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of TRON, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Commodore Disk Fixes, The Apple Pilot Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers),

COMPUTE! Back Issues

Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Commodore User-defined Functions Defined, A VIC Bug.

January 1983: Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon 64, Perfect Commodore INPUTs, VIC Sound Generator, Copy VIC Disk Files, Commodore 64 Architecture.

March 1983: An Introduction To Data Storage (multiple computers), Mass Memory Now And In The Future, Games: Closeout, Boggler, Fighter Aces, Letter And Number Play (all for multiple computers), VIC Music, Direct Atari Disk Access, Automatic Commodore Program Selector, PET Quickplot, A Commodore Gotcha, VIC and Atari Memory Management, Friendly VIC INPUTs.

April 1983: Selecting The Right Word Processor, Air Defense (multiple computers), Commodore Structure BASIC, Retirement Planner (multiple computers), Dr. Video For Commodore, Atari Filefixer, Video 80:80 Columns For The Atari, VIC-word, Magic Commodore BASIC, A BASIC Hex Editor For VIC, VIC Music Theory.

May 1983: The New Low Cost Printer/Plotters, Jumping Jack (multiple computers), Deflector (multiple computers), VIC Kaleidoscope, Graphics on the Sinclair/Timex, Bootmaker For

VIC, PET and 64, VICSTATION: A "Paperless Office," The Atari Musician, Puzzle Generator (multiple computers), Instant 64 Art, 64 Odds And Ends, Versatile VIC Data Acquisition, POP For Commodore.

June 1983: How To Buy The Right Printer, The New, Low-cost Printers, Astrostorm (multiple computers), The Hawkmen Of Dindrin (multiple computers), MusicMaster For The Commodore 64, Commodore Data Searcher, Atari Player/Missile Graphics Simplified, VIC Power Spirals, Un NEW For The VIC and 64, Atari Fast Shuffle, VIC Contractor, Commodore Supermon Q & A.

July 1983: Constructing The Ideal Computer Game, Techniques For Writing Your Own Adventure Game, SpeedSki And Time Bomb (VIC), Castle Quest And Roadblock (Atari), RATS! And Goblin (64), How To Create A Data Filing System (multiple computers), How To Back Up Disks For VIC And 64, Atari Artifacts, All About The Commodore USR Command, TI Mailing List.

August 1983: Weather Forecaster (multiple computers), First Math And Clues (multiple computers), Converting VIC And 64 Programs To PET, Atari Verify, Apple Bytechanger, VIC And 64 Escape Key, Banish Atari INPUT Statements, Mixing Graphics Modes On The 64, VICplot, VIC/64 Translations: Reading The Keyboard, Musical Atari Keyboard, VIC Display Messages.

September 1983: Games That Teach, Caves Of Ice, Diamond Drop, Mystery Spell, and Dots

(multiple computers), VIC Pilot, Ultrasort (VIC, 64, PET), Easy Atari Page Flipping, Computer Aided Design On The TI, Relative Files On the VIC/64, Atari Fontbyter, TI Sprite Editor, All About Interrupts (multiple computers), Cracking The 64 Kernal, Making Change On The Timex/Sinclair, Build Your Own Random File Manager (multiple computers).

October 1983: Computer Games By Phone, Coupon File (multiple computers), Dragon Master And Moving Maze (multiple computers), Merging Programs From Commodore Disks, Atari Master Disk Directory, Sprites In TI Extended BASIC, Commodore EXEC, Multicolor Atari Character Editor, High Speed Commodore Mazer, Apple Sounds, Extra Instructions (multiple computers), Commodore DOS Wedges, Invisible Disk Directory For VIC And 64.

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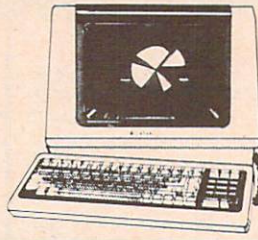
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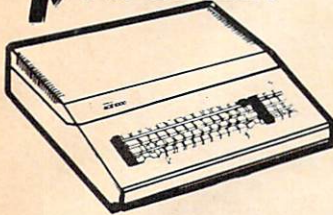
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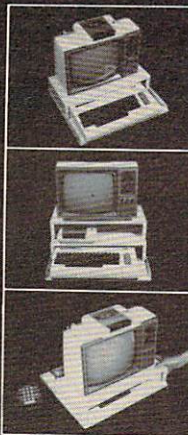
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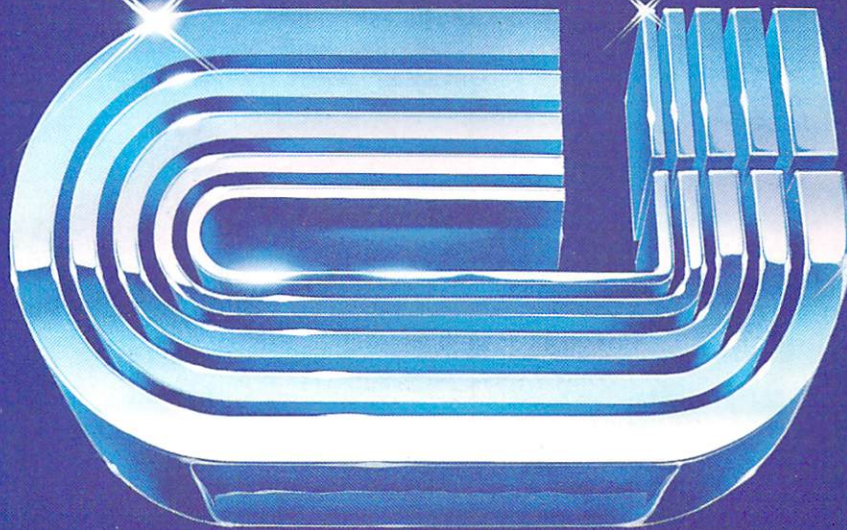
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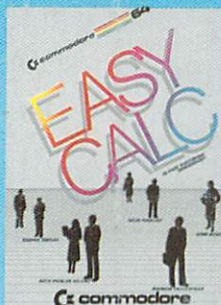
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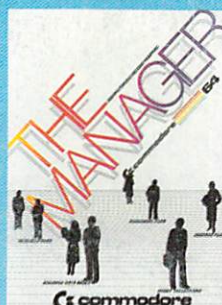
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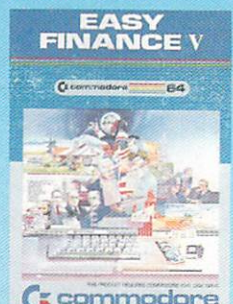
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