COMPUTE!

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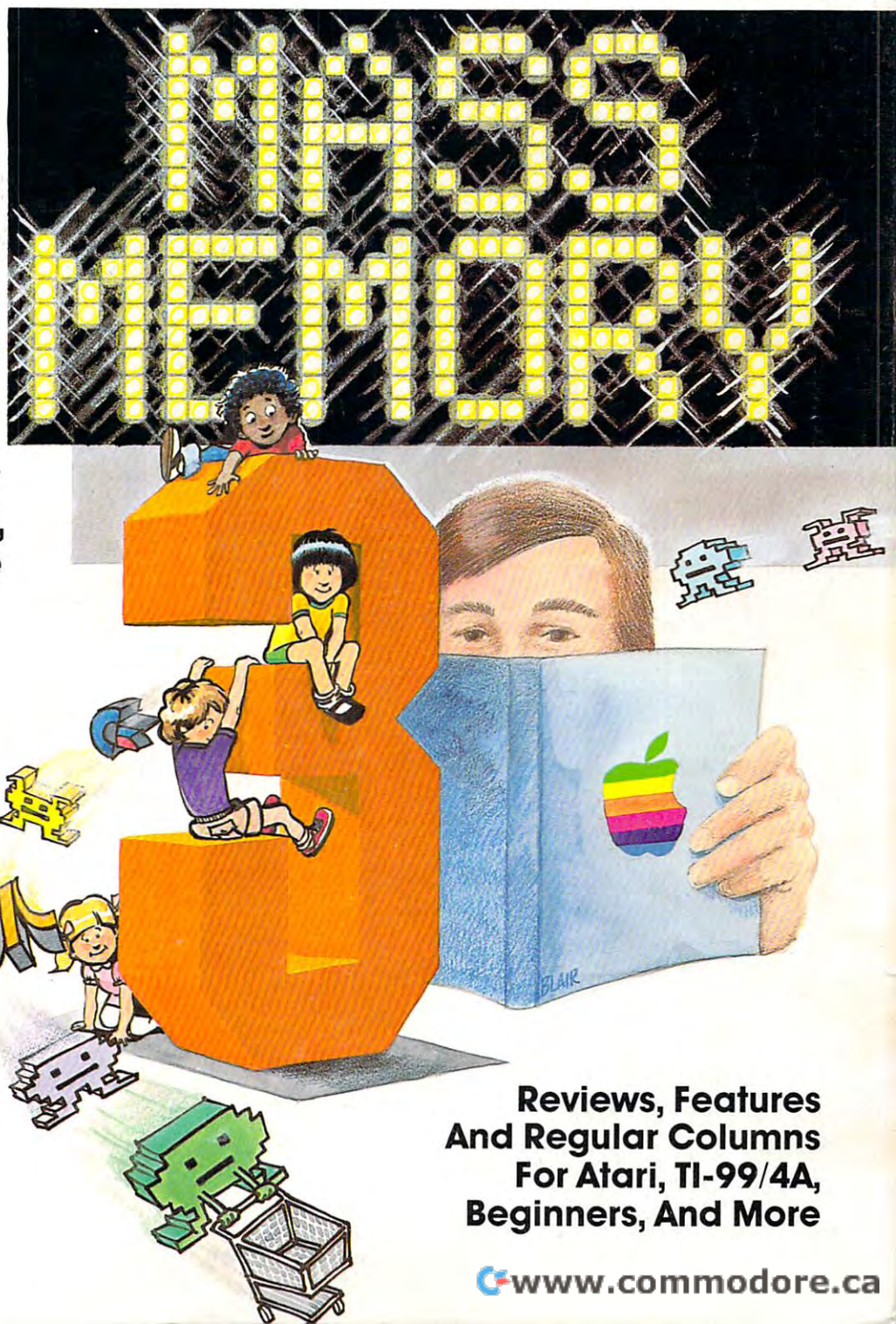
The Leading Magazine Of Home, Educational, And Recreational Computing

New Home Computers

At The Winter Consumer Electronics Show



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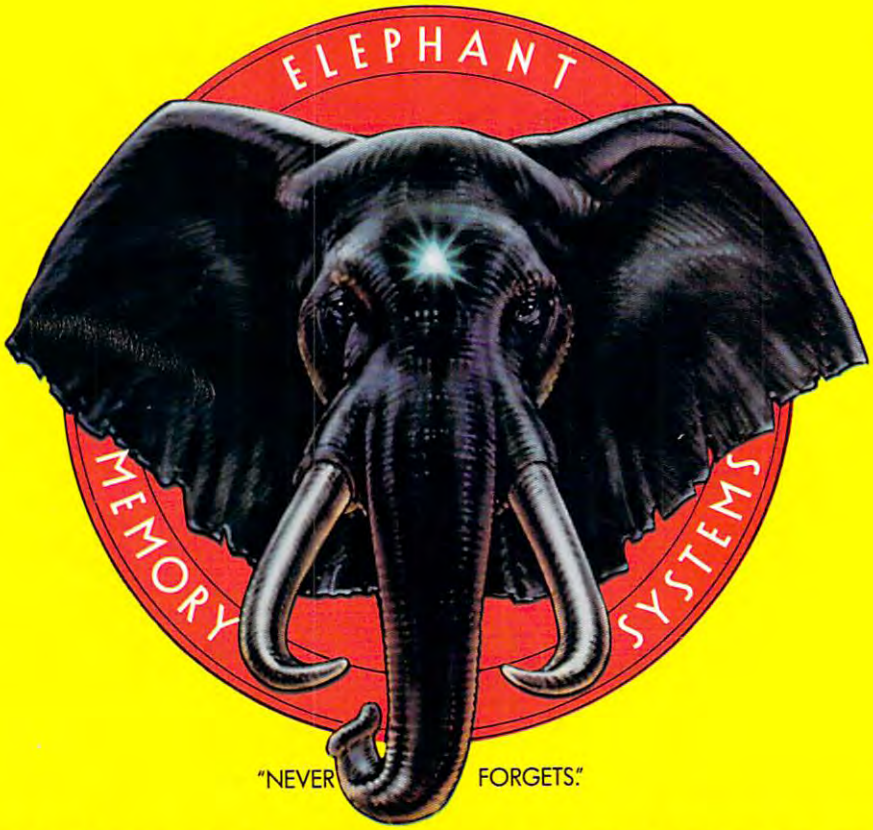

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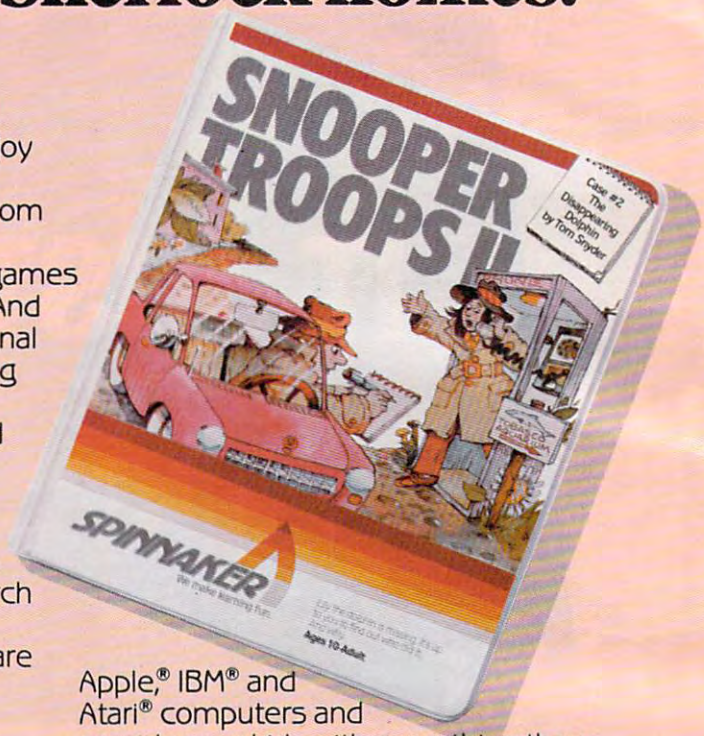

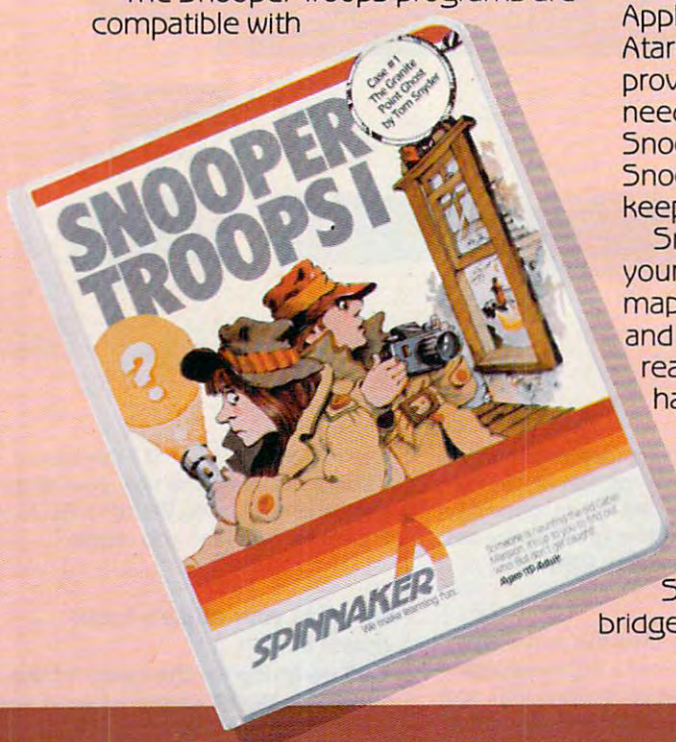

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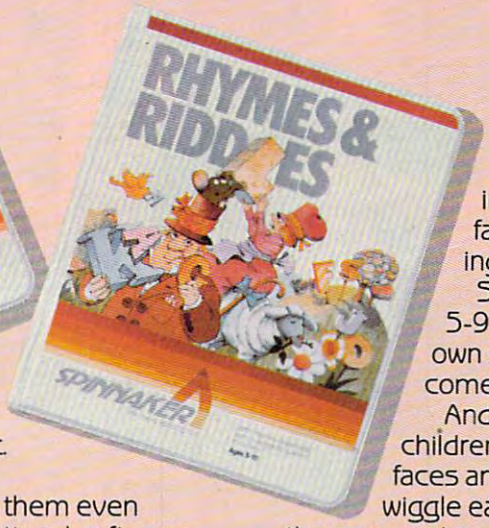

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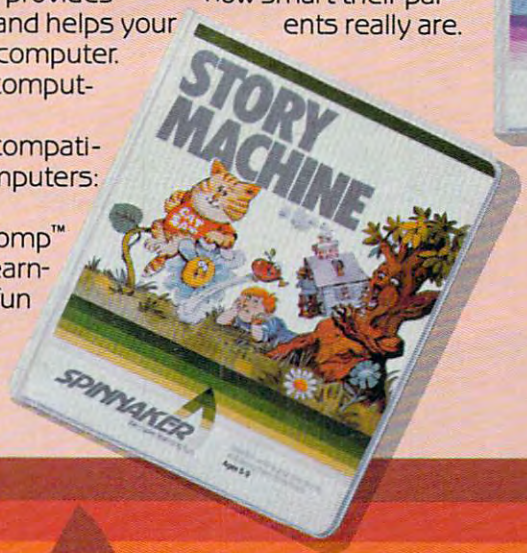

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EDITOR'S NOTES

The Winter Consumer Electronics Show was most impressive, and not solely because of the variety and magnitude of new product introductions for the personal computer marketplace. Tom Halfhill covers these new computers elsewhere in this issue. It may seem self-serving for industry editors to keep saying, "Well, *now* the personal computer revolution has *really* arrived...," but there is some historical precedent for these statements.

Let me provide some historical background. The Winter CES is a very old, established trade show. It displays consumer electronics, but isn't open to those consumers. It's a buyers show. It's a fascinating potpourri of gadgets for gadget lovers. The appearance of personal computers and their associated vendors has been recent and swift. My first Winter CES was January 1980. Commodore and Atari were there. I don't recall the presence of a single software vendor. Commodore had a relatively small booth, and three quarters of it was devoted to electronic watches. Crowded back into one corner was a display of Commodore computer equipment. Near the other end of a great hall was the much larger Atari booth... full of video games. One section of this booth too was devoted to the Atari 400 and 800.

Since the winter of 1980, our industry has grown tremendously, and its impact was quite clear this time around. For the first time, a whole section of the massive exhibit halls was devoted to consumer computers. All around were two story exhibits packed with not only the latest from TI, Commodore, Coleco, Atari, Mattel, etc., but also, and equally important, packed with interested, eager buyers.

Hardware itself isn't sufficient, and for the first time ever, this show sported an impressive selection of software vendors. In years past, a single software company (Automated Simulations, now EPYX) persisted in exhibiting.

This year two points were quite clear. The support companies are sharing in the growth and maturation, and are doing so as independents or as merging subsets of far larger companies. So we had numerous software exhibitors, from the independent companies like Brøderbund and UMI to CBS/K-Byte and Datamost (now merged with a venture firm on the East Coast).

1983 will be more than a shakeout year in the personal computer hardware market. It will be a finalizing year in many ways, a year in which substantial allocations of resources are committed by industry giants to tie down their stake in the personal computer marketplace. We hope that the spirit of entrepreneurial independence and innovation continues to flourish and energize our industry.

IBM did not make any of the not expected but widely hoped for announcements regarding their new home personal computer, but a recent *Wall Street Journal* article indicates the system, with 64K, will be available within the next nine months with a price in the $600-$700 range. We would expect the unit to be formally introduced at the Summer Consumer Electronics Show, with deliveries in volume by August or September. After all, even IBM wouldn't want to miss the spirit of Christmas future. **COMPUTE!** still plans to expand its coverage to include this new entry.

Some spoilsports have suggested that I restrain myself in constantly "going on" about **COMPUTE!**'s growth, so I'll simply mention in passing that the press run for this issue is getting awfully close to 200,000, and it wouldn't surprise me at all if we break the 200,000 mark with our April issue. We are rather proud of the continued quality of our growth.

Important reminder: We moved! Our new street address for advertising materials, etc., is 505 Edwardia Drive, Greensboro, North Carolina, 27409. Our Post Office Box and telephone numbers remain the same.

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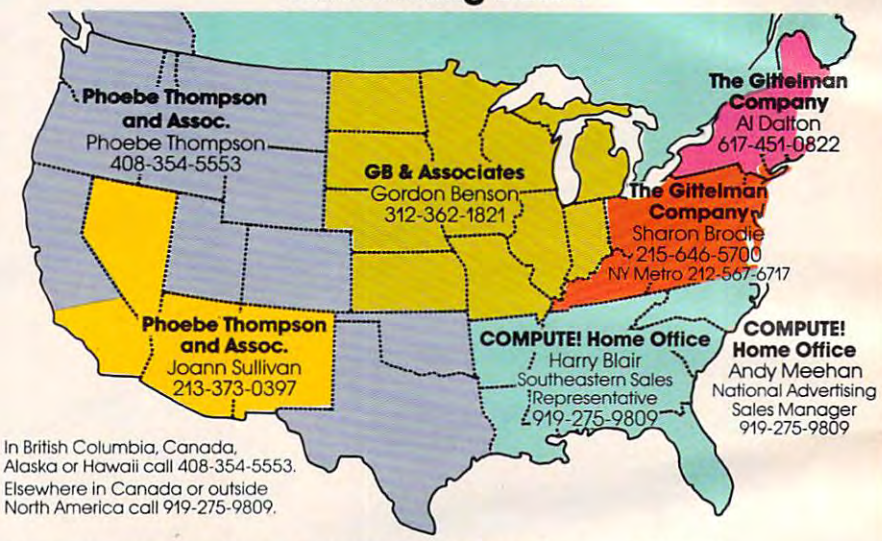

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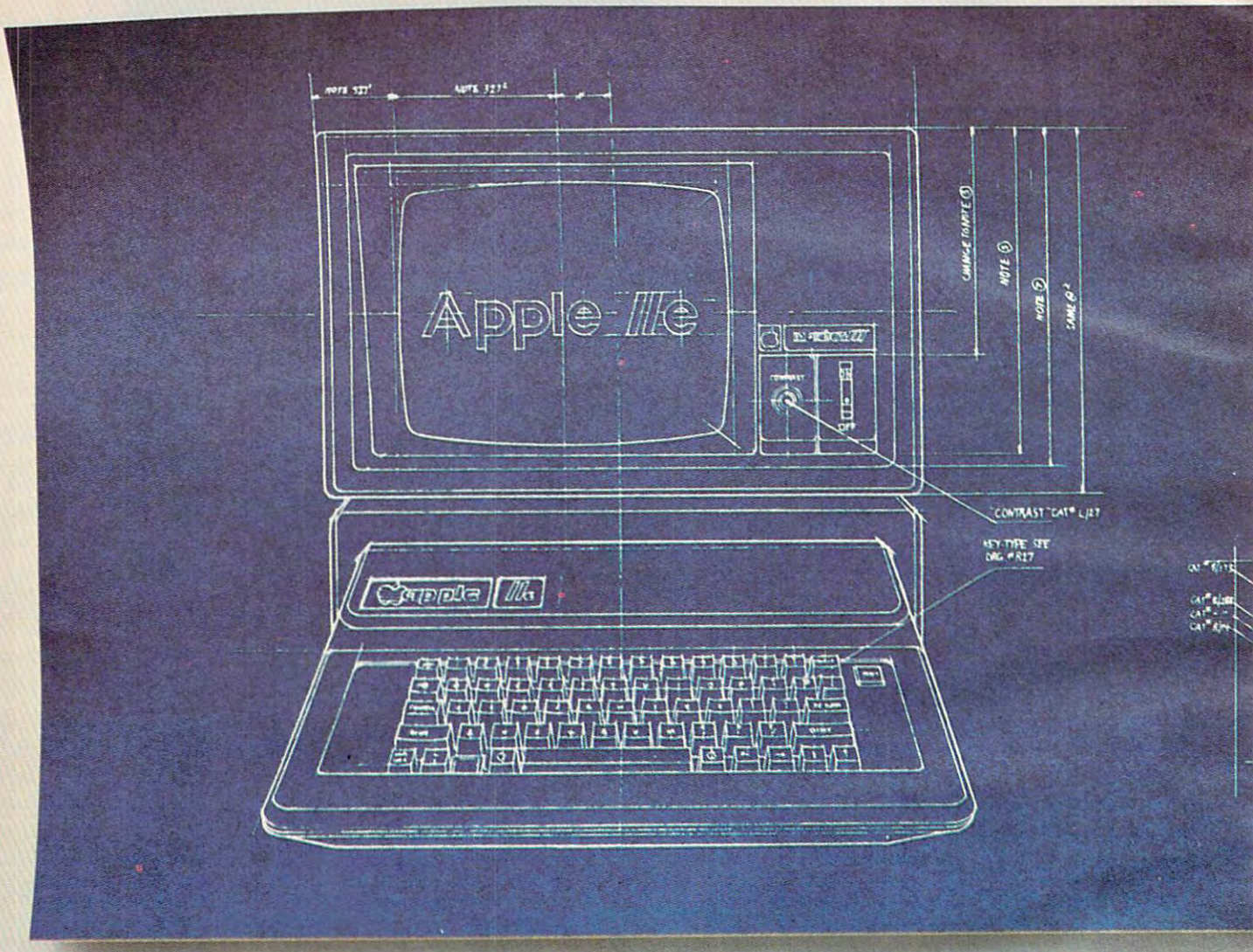

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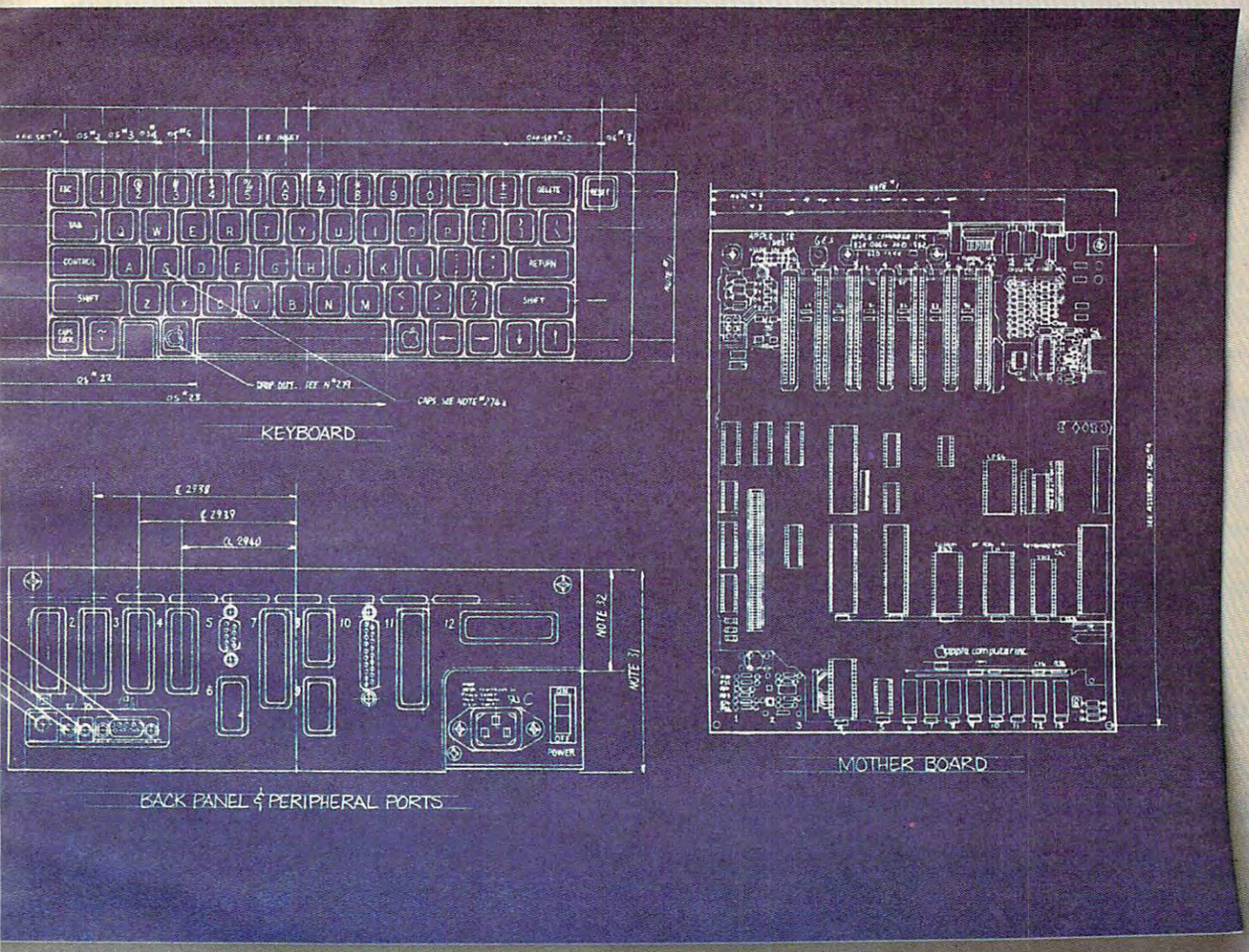
Except for the front, back and inside.



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READERS' FEEDBACK

The Editors and Readers of COMPUTE!

Improving VIC Graphics

I would like to know how I can get better graphics on the VIC-20 without using any add-on. Is there some small program that will work that you could send me or tell me where to get it? Can the VIC be made to do graphics the same as Atari?

Mike Johnson

The VIC-20 and the Atari do not have similar graphics systems. However, you can use VIC's custom characters to simulate some Atari games. See the VIC-20 version of "Hidden Maze" in the December 1982 issue of **COMPUTE!**.

Programmable Characters On An Expanded VIC

I have been designing my own programmable characters on the VIC-20 (unexpanded) and find this very useful. I am completely unable to figure out how to use programmable characters if 8K or more of memory is added to the VIC-20. Could you please explain how this can be done?

Neil Boyle

See "Understanding VIC High Resolution Graphics," **COMPUTE!**, *December 1982.*

Small Screen, Large Printer

What effect would a 22 line screen have on an 80 column printer? Example: VIC (22 lines screen text) VIC 1515 Printer (80 columns).

T. W. Logan

Lines, columns, characters – it takes a bit of getting used to. For example, line three is the entire third line of text down from the top of the TV screen. If you had two blank lines and then the words "This is a line." on your screen, that complete message would be called line three. *Columns are just the opposite: the character in the fourth column (of line three) would be the "s" in the word* this.

The printer is an independent peripheral. It won't be reading the text off the screen. Instead, it prints out what it finds in the computer's RAM memory (when a program tells it to), and it doesn't need to conform to any limitations of screen size. Printer columns depend on the maximum size allowed by the printer's manufacturer. Printer lines *can continue until you run out of paper. There is no limit.*

A Restless Atari ROM

The 10K OS ROM in my Atari 800 tends to work loose and then my machine crashes or fails to cold start. Reinserting or jiggling the cartridge seems to cure the problem temporarily, sometimes for weeks, sometimes minutes. I understand that this is a common Atari problem. Can any readers suggest a more permanent repair?

Joe Cocuzzo

This is a new one to us. If your machine is used on a level, stable surface, this wandering ROM problem should be easy for a technician to cure. Take it to an authorized service center and they can narrow the distance between the rows of pins to provide a better grip.

Atari Tape Loads

I own an Atari 400 computer. Recently I purchased a game program written in assembly language. It is stored on cassette tape. I was told to load the program by turning the computer on while depressing the START key (with no cartridge in the computer). After hearing the beep, I load the tape as normal. The problem is that sometimes the program loads fine and sometimes just before it finishes loading a BOOT ERROR message appears. This seems to happen with no consistency at all. I can't figure out what causes it to load properly once in a while. I have cleaned the tape player heads and I am sure I did not damage the tape. Can you suggest a way to get the program to load correctly more often and with fewer tries?

Phil Thomas

There are a variety of precautions to take to insure reliable loads. To isolate your difficulty, you might look into the following known trouble areas. Connect the 410 directly to the computer console, not through a peripheral. Follow the maintenance instructions listed in the 410 manual. Avoid using SYSTEM RESET before CSAVE. Before CSAVE or CLOAD, execute an LPRINT command. Be sure that commercial tapes are fully rewound before attempting a load. Use high-quality, ferrite audio tapes (and avoid chrome tapes). Keep some distance between the tape drive and a TV or

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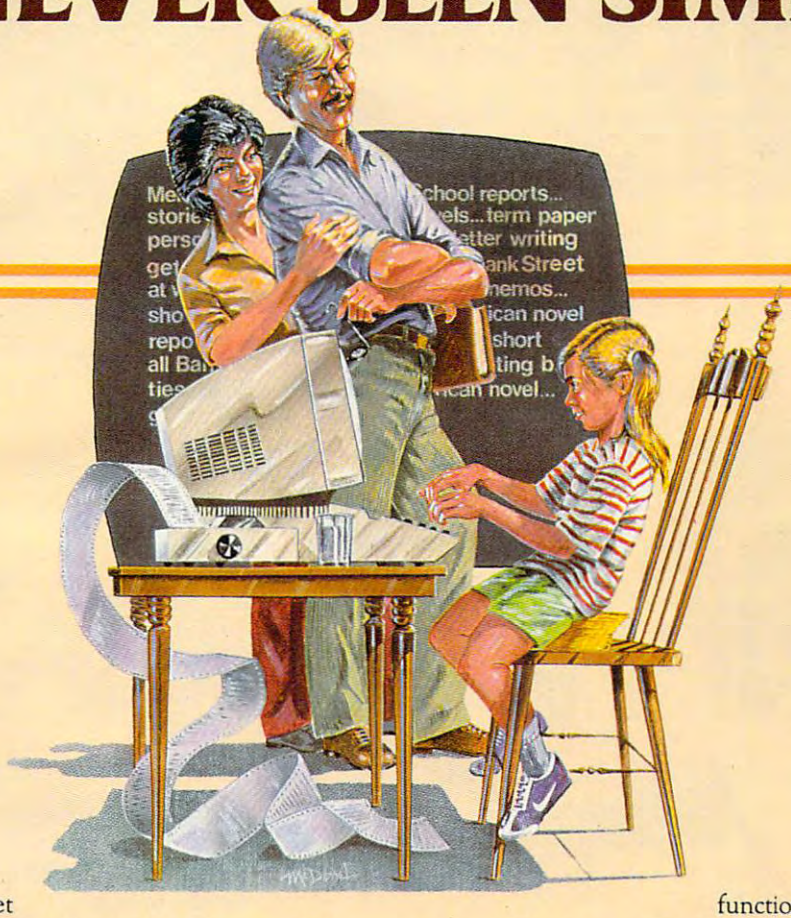

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power transformer. Don't leave any buttons on the 410 depressed when the player is not in use.

If you have tried all of these suggestions and still cannot get reliable performance, it would be worthwhile to have the unit checked over at an authorized service center.

VIC Expansion Memory

A problem has developed with my VIC-20 computer that I do not know how to solve.

I have found that the ads lead you to believe that the VIC is expandable, but one or more RAM cartridges installed will not run most of the programs I now have.

How does one overcome this problem? Can you put me in touch with someone who can help me? Thank you for your time.

Leon A. Weitzel

When you add RAM to a 5K machine, the VIC "adjusts" itself to the extra memory. The screen memory moves to a new location, the start of BASIC relocates, and a few other pointers move around.

You can determine where the screen memory (normally at 7680) resides on any size VIC:

```
SCR=4*(PEEK(36866)AND128)+
64*(PEEK(36869)AND120)
```

If you use the above formula within your programs, they will run on any VIC, regardless of memory size.

The VIC Custom Character Solution

In reference to the letter from Dick Gough in the January 1983 issue regarding custom characters on the VIC-20 with 8K or larger expansion, here is a solution.

You must move BASIC RAM above page 30. This is done by POKEing locations 44 and 643 with the value 32. You must also POKE location 8192 with the value 0. If you don't POKE 8192 with the value 0 you will get a Syntax Error when you try to run your program. This is because the first location in RAM for BASIC must have the value 0. I use the following program for this:

```
10 POKE 8192,0:POKE 44, 32: POKE 643,32:
   POKE 198,1: POKE 631,131
```

When you run this program, it will move BASIC RAM to page 30, load, and run the next program on the tape.

If you are writing a program from scratch, and not loading from tape, you must type "NEW" before you start your program.

Tom Ayers

Our thanks to Tom and several other readers who supplied this information.

Specialized Graphics

I and many VIC users in my area feel that it is time to start offering many "draw" and other graphic routines in both BASIC and machine language for the VIC-20. We would also like to see some animation techniques such as moving stars in the background or rotating characters in place on the screen. These and other arcade-type animations are what I'm sure a large majority of your readers would like to see. I am asked by friends how to do some of these things, and I have no answers. Would you please ask the readers or would your magazine please do an article or articles on this badly neglected topic?

Thomas Stewart, Jr.

*We are always interested in articles which describe various graphics techniques. "Understanding VIC High Resolution Graphics" (**COMPUTE!**, December 1982) is one such article. A good source of graphics information is also to be found in the explanations which accompany the games we publish every month.*

Bringing Atari Up To Speed

I am quite confused and disappointed. I have written several games on my Atari 800 (purchased in October 1981) and given them to my brother to run on his 400 (purchased in May 1982). These programs (which include machine language subroutines and player/missile graphics) invariably run *much* faster on the newer machine. I suspect it is because of the "upgraded" operating system that supposedly came out in December 1981. But every attempt I have made (with repair centers and dealers) to get the new OS ROM for my machine has failed. What can *I* do to bring my system up to speed?

Edward Loniewski

The speed upgrade could be due to a lesser amount of memory. A machine with 16K runs a little faster than the same machine with 48K. This is due to the use of "dynamic" RAM memory. Dynamic RAM is less expensive than "static" RAM, but it must be periodically refreshed by an electronic signal. During refresh, the 6502 is not allowed to access memory. Since 48K of memory takes longer to refresh than 16K, there is some difference in speed, but it wouldn't be drastic. Another possibility is that your brother has an Atari 400 with the new, Revision B 10K ROM, which may be faster than Revision A since the interrupt routines were streamlined. Benchmarks anyone?

VIC Printer Improvement

I have purchased a VIC-1525 printer and have used it with good results. However, every once in a while the printer will make a noise as if it is going

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to print, and then stop. The final result is that the computer hangs up and nothing is printed. Can someone explain why this is happening and how I can stop it from happening again?

Chuck Lorigo

The first of the VIC-1525 printers had a bug in their internal ROMs which occasionally caused the printer and computer to hang up. If you take your printer to the nearest Commodore service center, they will replace the original ROMs which will correct this problem.

Every Possible Dip Switch

I own an Atari 800 with the works, 48K, disk-drive, 850 interface, 830 modem, and a NEC 8023A printer. All work well, but there is one glitch.

I discovered this when trying out the program to dump graphics to the printer. To wit, a two line program like this:

```
10 LPRINT "hello";
20 GOTO 10
Does not yield HELLOHELLOHELLOHELLO (etc.)
Instead, the printer does this...
HELLO          HELLO
HELLO          HELLO
HELLO          HELLO
```

See? It finds the ";" or even a "," to mean that it should go not to the next available space, but to a predetermined tab position. I have tried what seems to be every combination of dip switches and CHR$() commands, but to no avail. This glitch prevents me from using your program suggestions and from using other software like it.

Can you help?

Dave Kruh

LPRINT is a convenient command. Used in place of PRINT, it routes output to the printer. On the Atari, LPRINT is equivalent to an OPEN, a PRINT#, and a CLOSE. However, this prevents two LPRINTs from printing continuously (using the semicolon). You can bypass LPRINT and use PRINT# directly, by OPENing a file to the printer yourself. Using your sample program, this will give the desired output:

```
5 OPEN #1,8,0,"P:"
10 PRINT #1:"HELLO";
20 GOTO 10
```

You will need to CLOSE the file (CLOSE#1) if you want to re-use it for another file. END will automatically close all files.

Atari Graphics

I have run into problems concerning Atari graphics. I would like to mix more than two graphic modes onto one screen. I don't know how to instruct the computer to create multiple graphic modes nor how to write to a particular mode without affecting the others.

Another problem: how do you instruct the computer to create colors in each individual graphics mode?

Richard Kaplan

There is an article in COMPUTE!'s First Book Of Atari *which would be of help to you: "Designing Your Own Atari Graphics Modes." Also, you might want to look at* COMPUTE!'s First Book Of Atari Graphics, *which was just published (December 1982).*

VIC RUN/STOP Traps

How does one "trap" the RUN/STOP key on the VIC? I am presently working on a preschool program and have been using GET instead of INPUT when asking for a user response. Unfortunately, though, a child may inadvertently "break" into the program by hitting the RUN/STOP key.

Werner Meserth

This has been a problem for quite some time and numerous solutions have been proposed. Reader Don Kitching recently suggested POKE 808,127 to disable the VIC STOP key and thus prevent accidental falling out of a program RUN into immediate mode. An excellent solution can be found in the article "Perfect Commodore INPUTs," in the January 1982 issue.

Atari Lockup Escapes

I have discovered another Atari keyboard lockup. I followed the suggestions to save my programs often, but my lockup occurs immediately after reloading a program using CLOAD. I even saved it twice and neither copy would work. It was a long program. Is there any way I can recover it?

Roger Johnson

You don't mention whether your machine locked up totally (keyboard does not respond, System RESET doesn't work, etc.) or if you got just an error message. Always first try to escape from a crash by pressing System RESET. Remember also to use the proper cassette procedures. Enter LPRINT before CSAVE. You can try saving program modules with LIST "C:". When you re-ENTER such modules, it is often possible to salvage part of a damaged program.

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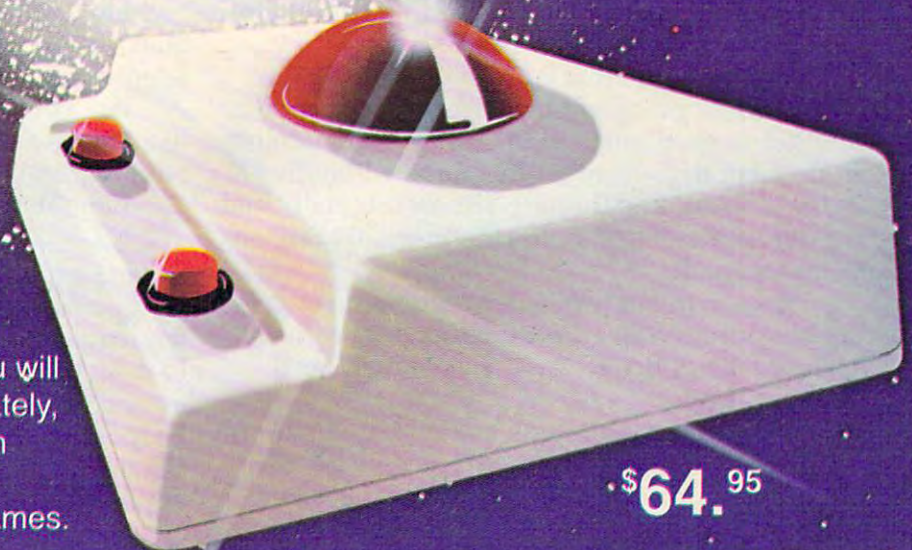

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Computers And Society

David D. Thornburg, Associate Editor

Language And Languages

Next to the question "Which computer should I buy?", I am most often asked "Which language should I learn?" This question is often asked by teachers, but is of relevance to so many people that I want to devote some space to it this month.

To start with, those of you who read these columns regularly may expect my answer to be Logo.

It isn't.

The reason for this has nothing to do with Logo's power – I use Logo more than any other language in my own work. The point is that *no* computer language is appropriate for all applications.

In 1978, when Radio Shack, Apple, and Commodore owned the personal computer market, the only high level language in common use was BASIC. Because BASIC was built into the hardware, it was easy to see the reason for its rapid adoption. Just as with the arrangement of keys on the keyboard, the user didn't have a choice – BASIC was just there.

As a language that launched an industry, BASIC was a pretty good choice. It was compact, and didn't need much of the computer's memory (remember that the first PETs came with only 8K bytes of RAM, and that the TRS-80 originally had only 4K bytes of RAM). Furthermore, BASIC was "good at math."

Since many of the 75,000 customers for personal computers in 1978 were tinkerers with a technical bent, BASIC gave them a high-level tinkering tool.

But then a funny thing started to happen. As more and more people started learning BASIC, there was a growing belief that BASIC was the *best* computer language, simply because everyone was using it. By that same argument, one would argue that *Combat* is the best video game cartridge, simply because it is packed with the Atari video game console.

BASIC's Weaknesses

So what is wrong with BASIC?

There are two main problems with this language. First, because BASIC is very good at arithmetic calculations, it tends to be of great use to those who are also math-oriented. In fact, BASIC uses numbers everywhere – even in front of each program line.

Why is this a problem?

Well, believe it or not, a great many people don't consider themselves "good at math," and have avoided using computers for just this reason. Limiting the computer to use by those who are math whizzes is unfair to both the prospective users and to the utility of the computer itself. The computer is not a math tool – it is more than that: it is a symbol manipulation tool. It is therefore essential that people have a choice in languages tailored to specific types of applications – but more on that topic later.

I said there was a second problem with using BASIC as a universal computer language. This problem is that BASIC is not extensible; the user cannot define new words in BASIC's vocabulary. Imagine how limiting English would be if we hadn't invented any new words since the time of Shakespeare. What would we call televisions, or telephones, or computers?

Are you willing to trust a language designer to anticipate all the words you might need to create your application program?

I'm not.

The main reason I'm so fond of Logo is that it lets me create my own words that extend the language in any direction I want. Non-extensible languages are like fine-cut crystal – very pretty to look at, but not very flexible. Languages such as Logo are more like lumps of clay that can be molded to fit your own applications. I find that moldability to be essential in most of my applications.

Is Logo a universal applications language?

No, it is not. In fact, there is no computer language that is appropriate for all applications, nor should we want there to be.

The reason for this is pretty simple to grasp. Let's say you are interested in writing a word processor program and that you decide to implement the program in BASIC. Many BASICs have some ability to manipulate strings of characters, so this may not seem to be a bad choice. But look

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at what else BASIC can do. BASIC contains many math-related functions such as SQRT, SIN, ATAN, SGN, etc.

What happens to your program when the language is cluttered with extraneous commands? First, the memory requirement for your application program plus language is larger than it needs to be. Second, your program will not run as fast as it should.

Multilingual Computers

No single language can (or should) serve all needs. Computer users who write programs in many application areas should be versed in several computer languages. The more languages you have available, the more versatile you will become, and the better your programs will be.

How hard is it to gain access to other computer languages?

Fortunately, computers such as the Atari 400 and 800 are completely flexible as far as language is concerned. To go from BASIC to PILOT, one merely switches cartridges. Many other popular computer systems (e.g., the Apple II, TI 99/4A, VIC-20, Commodore 64, Max, and Radio Shack Color Computer) also allow languages other than BASIC to be loaded, either from disk or, in many cases, from a plug-in cartridge.

So the question "Which language should I learn?" becomes "Which languages should I learn and what can I use them for?"

While any attempt to answer this question will be incomplete and will display some personal bias, the following table lists a few languages that are available on personal computers and some of their attributes and relevant application areas:

Language	Major Features	Appropriate Applications
BASIC	arithmetic calculations	computation intensive programs such as budget calculations
PILOT	word manipulation	text processing, computer-aided instruction using text
Logo	general symbol manipulation	mathematics (as opposed to arithmetic), logic, adaptive programs
FORTH	speed	realtime graphics, high speed programs such as games

Note especially that the applications are just typical areas where a given language might be of benefit. As we all know, video games *can* be written in BASIC, and one *can* do arithmetic in most versions of PILOT. The point is that other languages are better suited to these tasks.

What I hope is that an increasing number of personal computer users will unleash themselves from the restrictions of a single language and start to reap the benefits of becoming multilingual. ©

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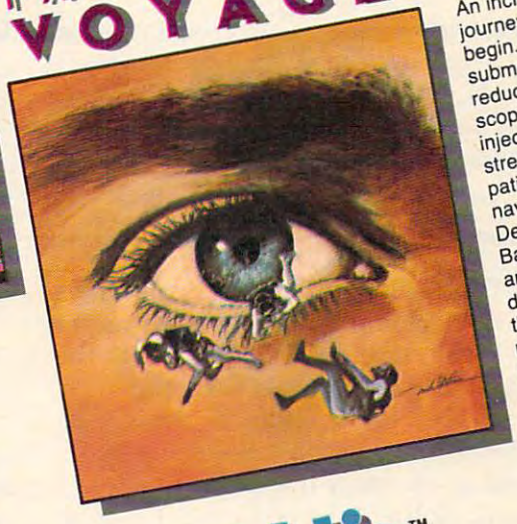

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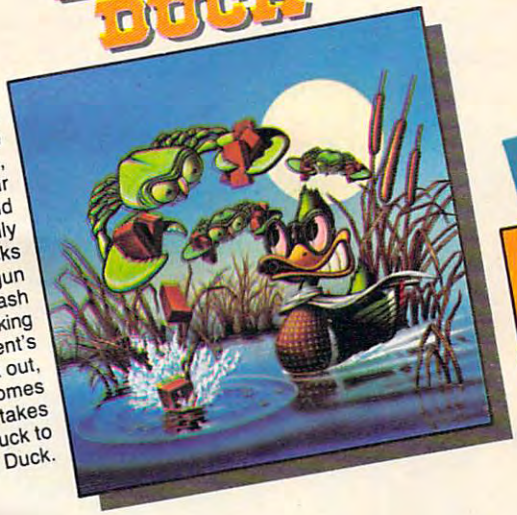

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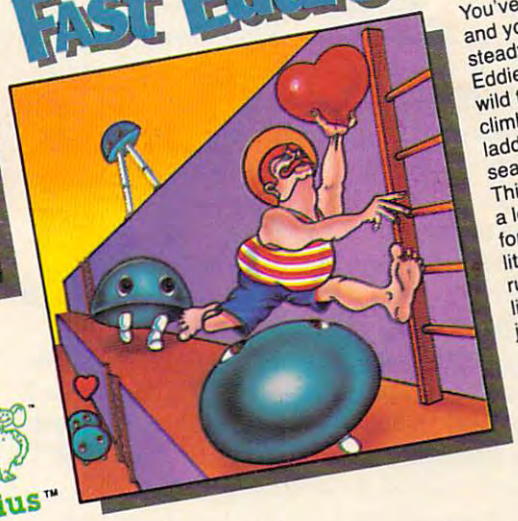

You've got to be cool and you've got to be steady to play Fast Eddie. Eddie is on a wild treasure hunt, climbing up and down ladders everywhere in search of prizes. Things would sure be a lot easier if it weren't for all of those pesky little Sneakers™ running around. They literally keep him jumping!

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New Home Computers
At The Winter Consumer Electronics Show

Tom R. Halfhill, Features Editor

More than a dozen new home/personal computers made their debuts at the recent Winter Consumer Electronics Show in Las Vegas. This four-day extravaganza seemed to fulfill many of the predictions of a home computer revolution we've been hearing for the past several years.

Last August **COMPUTE!** published an article about "The New Wave Of Home Computers," a growing collection of new models that would usher in the much talked-about age of home computing.

It's not a wave – it's a thundering flood. The home computer revolution that has been dismissed by some as a fantasy or a fad is finally surging forward. At least, the equipment is now here to fuel it.

The evidence was unavoidable during four days in January at the Winter Consumer Electronics Show in Las Vegas, a huge exhibition of the newest leisure electronics equipment that will be sold to Americans in the coming year. There – among the stereo systems, videotape recorders, video cameras, big-screen TVs, remote telephones, and myriad other gadgets – were the new home/personal computers. More than a dozen of them, in fact. By their glamor, at least, if not by the sheer numbers of people crowding their displays, they stole the attention of the show. One of the show's daily news bulletins predicted that this year's exhibition would be remembered as "the year the home computers came to town."

And come they did. An estimated 70,000 attendees witnessed the introductions of three new models under $100, including the first under-$100 color computer; the first 48K memory computer for under $200; the first portable computer with 64K, built-in disk drive, and TV screen for under $1000; the first 12-voice add-on synthesizer keyboard for under $100; the first accessory voice synthesizer for under $100; and the first computer-controlled "home robot" for under $1000.

The future is arriving even faster than we had thought. And here is what it will include:

Commodore

Commodore's announcements dominated last summer's shows; and, although competitors grabbed much of the spotlight at this one, the industry's fastest-rising company had even more bombshells to drop.

Topping the list was the SX-100, a portable version of the popular Commodore 64. Essentially, Commodore has taken the insides of a C64 – including the 64K of Random Access Memory (RAM), the 16-color graphics, and the extraordinary music synthesizer chip – and stuffed it all into a carrying case with a large handle. The top of the case unlatches and becomes a detachable keyboard you can rest on your lap. This then reveals a built-in five-inch TV screen – optional black and white or color – and either one or two built-in 170K disk drives.

The SX-100 is completely compatible with the C64 and shares all its specifications. In fact, the prototype was running a C64 demo program showing off the color graphics, sprites, and synthesized music. The preliminary word from Commodore is that the black-and-white TV version with one disk drive will retail for $995, and the

Commodore's prototype SX-100 with built-in color monitor and twin disk drives. Note the detachable lid/keyboard and carrying handle.

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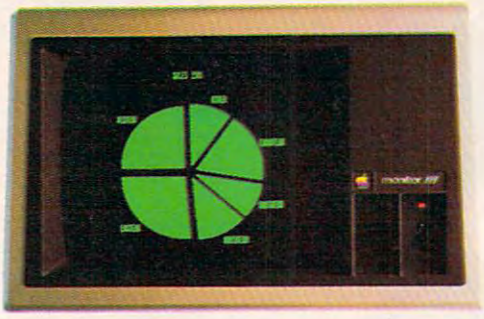
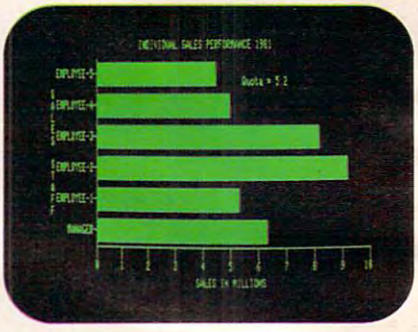
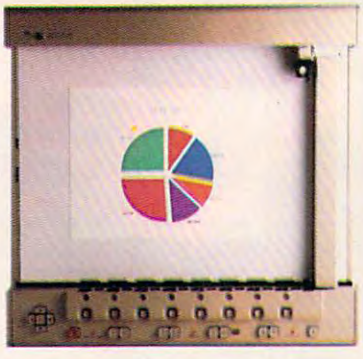
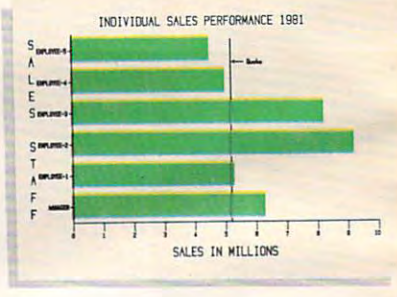


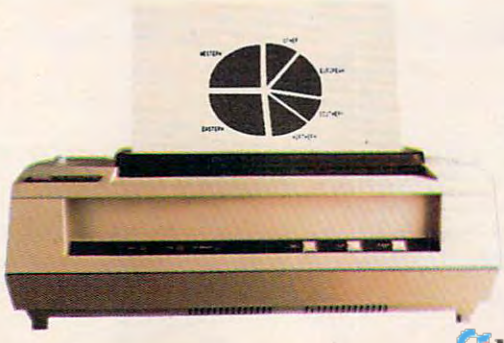


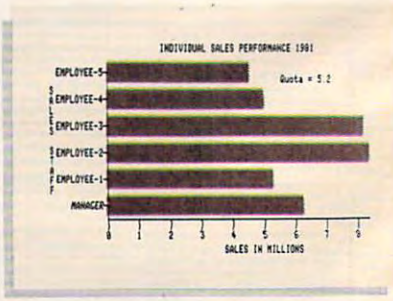
	Apple	VisiTrend/ VisiPlot	pfsGraph
Graph Types			
Line	Yes	Yes	Yes
Vertical Bar	Yes	Yes	Yes
Horizontal Bar	Yes	No	No
Side-by-side Bar	Up to 4	2	4
Pie	Yes	Yes	Yes
Partial Pie	Yes	No	No
Scattergram	Yes	Yes	No
Curve Fitting	5 Kinds	1	None
Data Points (Max.)	3500+	645	36
Plotter Compatible	Virtually Any	None	H-P7470A Only
Compatible File Types	Pascal BASIC VisiCalc	BASIC VisiCalc	pfs VisiCalc
Math Functions	Yes	Yes	No
Available Colors	6	4	4

Apple Business Graphics is available for both the Apple II and Apple III.









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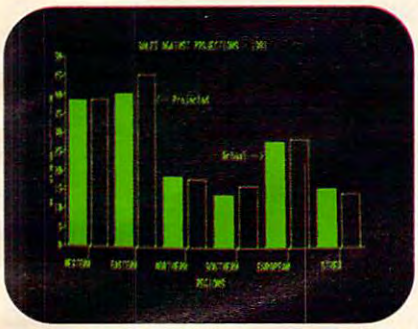

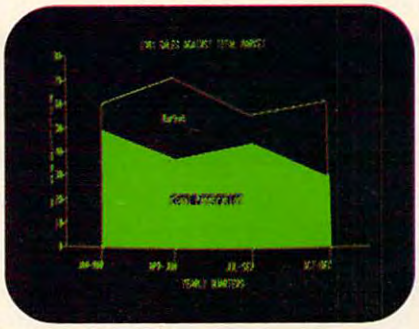

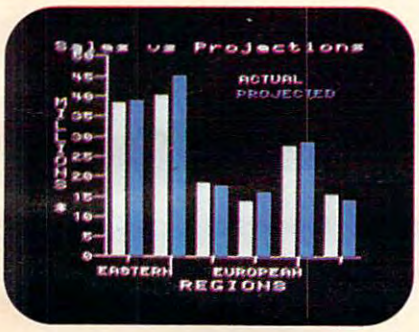

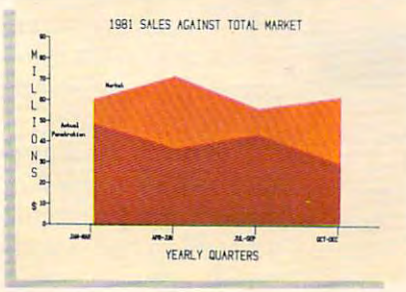

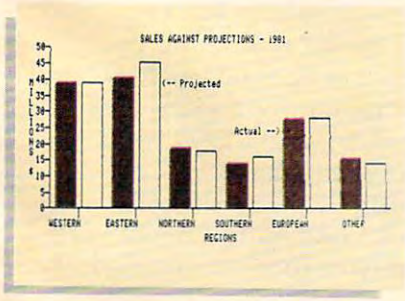

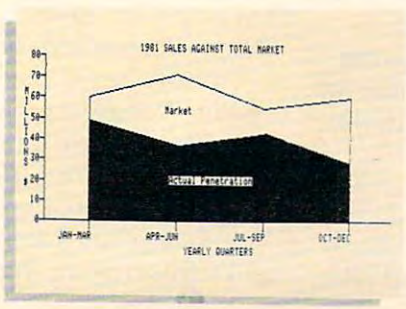

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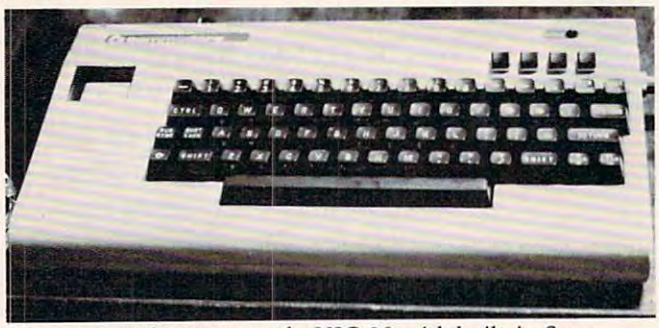
color TV version with two disk drives for $1295.

Both can be plugged into an external TV or monitor or any other C64-compatible peripherals. Commodore suggests it will be available by April 1. It is likely to send shockwaves throughout the portable computer market – remember that a coming plug-in cartridge will allow the C64 and SX-100 to use CP/M (Control Program for Microcomputers), the most popular operating system for business programs.

The other new computer from Commodore is also a portable – the HHC-4 (Hand-Held Computer). This calculator-sized machine has an alphabetic keyboard arranged in the standard "QWERTY" (typewriter) format; a separate numeric keypad; a single-line 24-character liquid-crystal display; 4K of RAM (3K user-available), expandable to 16K; and 20K of Read-Only Memory (ROM) including BASIC programming language.

Commodore's HHC-4 handheld computer, plugged into its peripheral interface and printer.



Experimental prototype of a VIC-20 with built-in Sony Watchman TV (upper left). Note that the keyboard has been shifted right to make room for the TV, and the four function keys have been displaced to the top. Commodore says this working prototype is only "an example of what could be done, not what will be done."

By adding an RS-232 peripheral interface module (which includes a small built-in dot-matrix printer), you can hook up the HHC-4 to full-size printers, cassette recorders, and even a VIC-20 or Commodore 64. This means the HHC-4 can directly exchange data with your home computer. Another module allows the HHC-4 to display on a standard TV or monitor. Commodore says the HHC-4 will sell for $199.

A Full Keyboard Synthesizer

One of the most exciting peripherals at the show was a plug-in synthesizer keyboard for the Commodore 64. Lots of computer music enthusiasts have been waiting for this, since the C64 has the most advanced sound capability of any home computer, thanks to its synthesizer-on-a-chip Sound Interface Device (SID). SID has three voices with programmable waveforms, filters, and envelopes (see "A First Look At The Commodore 64," Parts One and Two, **COMPUTE!**, August and September 1982).

The full-size, organ-style keyboard attaches to the C64 via a black box that contains no less than three additional SID chips, for 12 voices in all. And the software is equally advanced. From the C64's keyboard, you can change waveforms, octaves, and even save what you play in RAM memory for later playback – even playing duets with yourself.

No recording tape is involved; the notes are stored in the computer's memory (up to nine minutes' worth). This means you can modify the music after it's played by changing waveforms or octaves. (For a detailed explanation of this technique, which is revolutionary in itself, see the last section of "Sound Synthesis," **COMPUTE!**, January 1983.)

Even more amazing, this entire package – organ keyboard, additional SID chips, and sophisticated software – is scheduled to be available sometime this spring for under $100.

Another Commodore breakthrough, at less than $100, is a plug-in voice synthesizer for the C64. Making a BASIC program talk is as easy as adding the command:

```
10 SAY "Hello there!"
```

A built-in educational program, *A Bee C's*, uses clever graphics and speech to teach the alphabet to preschoolers. The graphics animation and speech are simultaneous. The voice module also works with other cartridges; Commodore is preparing a new series of talking educational programs and games.

Another music peripheral is the Digi-Drum for the C64 and VIC-20. This three-pad synthesized drum kit simulates a snare drum, bass drum, and "high hat" cymbals. Drawings of the instruments appear on the TV screen and flash as their pads are thumped. Drum routines can even be saved and played back later. Put the Digi-Drum together with the synthesizer keyboard, and you'd have a pretty effective one-man band. The Digi-Drum is promised for this spring at $59.95.

Other new Commodore peripherals include a $199.95 four-pen printer/plotter for the C64 and VIC-20 (available immediately), and a $299.95 13-inch color monitor (promised by March 1). Commodore also released the $19.95 *Commodore 64 Programmer's Reference Guide*, and more VIC-20 and C64 software than we have room to mention.

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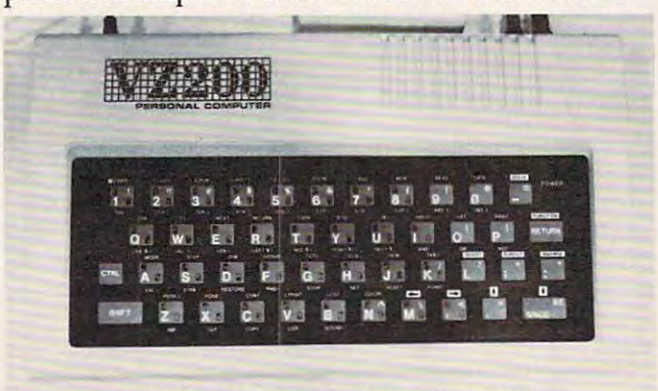
Commodore has also started marketing the C64 in the same way that it currently sells the VIC: through mass retailers. Although Commodore officials refused to discuss prices, this marketing move means discounters will begin slashing the C64's price – perhaps soon as low as $399. Since many full service computer dealers do not compete with this kind of discounting, Commodore is releasing the new P Series exclusively to dealers. The P Series comes with 128K of RAM, expandable to 896K, and has the same 40-column screen, color graphics, and sound as the C64 (for details, see "The New Wave Of Home Computers," **COMPUTE!**, August 1982, and "Editor's Notes," July 1982). When the P Series was announced last summer, the price was set at $995; but now Commodore says it will sell the machine for $795.

In the manufacturing area, Commodore announced yet another important move: it has signed an agreement with Zilog to co-produce the chip manufacturer's Z 8000 microprocessor, a 16-bit version of Zilog's extremely popular Z 80 microchip. Why? Commodore plans to build a new generation of 16-bit computers around the Z 8000. Expect the first models to be announced by the end of this year.

Under-$100 Computers

For the past year, the $99 Timex/Sinclair computer has had the under-$100 market all to itself – and it has been selling by the hundreds of thousands. But that is about to end. Three new computers retailing for $99 were shown at the show, including the first one with color.

The color model is the VZ200, the first home computer from Video Technology Ltd., a company with two factories in Hong Kong. Promised for delivery by April, the VZ200 comes with 4K of RAM, expandable to 16K ($45) or 64K (price not yet determined). Its 12K of ROM includes Microsoft BASIC, with one-touch entry of BASIC commands from the keyboard (similar to the Timex). The Central Processing Unit (CPU) – the microprocessor chip that is the "brain" of a microcomputer – is the widely used eight-bit Z80.



Video Technology's VZ200, the first under-$100 color computer.

Unlike the Timex, its established competition, the VZ200 has a real moving-key keyboard. Not quite a full-stroke typewriter keyboard, but partial-stroke, calculator-style keys made of rubber. No less than six of the new computers at the show sported rubber keyboards. The keys are soft and wiggly to the touch and feel sort of like pencil erasers.

The VZ200 has a text mode of 32 columns by 16 rows, a mixed graphics/text mode with a resolution of 64 by 32 pixels (screen dots) with nine colors, and a high resolution graphics mode of 128 by 64 pixels with eight colors. There's a single-channel sound output, also unique among under-$100 computers. Other VZ200 features: full-screen editing; 600 baud interface to any standard cassette recorder; RF output for TV sets and video output for monitors; auto-repeat keys; keypress "beep"; and keyboard character graphics.

Peripherals promised for later this year include a printer interface module, printer, joysticks, light pen, telephone modem, disk drive, bar code reader, and a monitor. Video Technology is preparing 29 software packages on cassette, and says about a third will be available when the computer hits the market. The programs range from educational and entertainment to home management and simple business. They will sell for $9.95 each.

Video Technology also is introducing to the U.S. market a video game machine convertible to a home computer which it has been selling in Europe and Australia for a year. Called the CreatiVision, the game machine will sell for $189 and includes a membrane keyboard on the joysticks. The addition of a $10 BASIC cartridge turns it into a 16K RAM computer, and a plug-in keyboard (with rubber keys) will be available for $30. The video game graphics looked excellent. However, the BASIC is not compatible with the VZ200.

Two From Texas Instruments

Another significant entry into the sub-$100 field is the $99.95 Texas Instruments TI-99/2, available in the second quarter of this year. It, too, has a moving-key, calculator-style, rubber keyboard. It comes with 4.2K of RAM, expandable to 36.2K. Although it lacks the color, sprite graphics, and sound of its elder cousin, the TI-99/4A, the BASIC programs are "upward-compatible" – meaning TI-99/2 programs will run on a TI-99/4A, but not necessarily vice versa.

It accepts software on cassettes or plug-in cartridges, though not the same cartridges as the TI-99/4A. Fourteen cartridges have been announced for entertainment, education, and home management. The computer's CPU is a Texas Instruments 16-bit chip – making it the first 16-bit

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8" DSDD Soft Sector (512 B/S, 15 Sectors)	F145	3.19
8" DSDD Soft Sector (1024 B/S, 8 Sectors)	F147	3.19
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25 of The Hundreds of Reasons You Ought To Be A **COMPUTE!** Magazine Subscriber:

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Texas Instruments TI-99/2, with 4K of memory for $99.

computer for under $100 – though it is not the same chip found in the TI-99/4A.

One of the most interesting things about the new TI is its line of peripherals. A connector on the back accepts a new family of add-ons, including an RS-232 interface ($99.95), a four-color printer/plotter ($199.95), and the Wafertape drive ($139.95). The Wafertape drive uses "wafers," small endless-loop tape cartridges familiar for years to TRS-80 users (and now other users) as "stringy floppies." Less expensive than a disk drive, a stringy floppy drive can store up to 48K on a wafer and is sometimes faster than a disk. (See "Mass Memory: Now And In The Future," on page 54.) The peripherals also will work on TI's new portable machine, the Compact Computer 40, and on the TI-99/4A (with a $59.95 "Hexbus interface"). This means someone starting out with a low-end TI-99/2 can move up to a TI-99/4A without discarding the peripherals.

TI's other new computer, the Compact Computer 40, is a hand-holdable battery unit. For $249.95, it comes with 4K of RAM (expandable to 16K); 34K of ROM containing an Enhanced BASIC compatible with TI's other home computers; a one-line, 31-character liquid crystal display that scrolls sideways to 80 characters; upper- and lowercase; QWERTY keyboard; memory retention when switched off; and a cartridge slot for plug-in software. TI says 75 cartridges will be available by the third quarter.

Texas Instruments Compact Computer 40, a battery-powered 4K portable for $249.95. At right is the new printer/plotter, Wafertape drive, and RS-232 interface.

The remaining $99 entry is one of three new Japanese computers introduced at the show, the Sanyo PHC 20. This compact model has a moving-key, rubber keyboard, 4K of RAM (unexpandable for now), 8K of ROM with a Tiny BASIC, 32-character by 16-line text display, 64- by 64-pixel graphics, full-screen editing, 1200 baud interface with any cassette recorder, and a monitor output that connects to a TV with an adaptor. The CPU is a Z80A. The PHC 20 is supposed to be available immediately through Sanyo dealers.

Two similar Sanyos are also on the way. The PHC 10 is a battery-powered hand-held model with built-in liquid crystal display, 2K of RAM expandable to 4K, and a buzzer for simple sound output. Otherwise, it is almost identical to the PHC 20. No price or delivery date is available. And on the higher end is the PHC 25, a souped-up PHC 20 with 16K of RAM (expandable to 32K); 24K of ROM with a larger BASIC; additional graphics modes of 128 by 192 pixels and 256 by 192 pixels; parallel printer interface; joystick port; and three-channel sound output. It should be available at the same time as the PHC 20 for $199.95.

A Second Generation Timex

Another exciting low-end introduction is the Timex Sinclair 2000, the first computer that offers 48K RAM for under $200. The T/S 2000 is basically the U.S. version of the Sinclair ZX Spectrum, until now available only in the United Kingdom.

The T/S 2000's main improvements over its popular cousin, the $99 T/S 1000, are more memory, color, sound, and a moving-key keyboard. There are 40 rubber keys with upper- and lowercase, auto-repeat, standard Timex Sinclair character graphics, one-touch BASIC keyword entry, and the same editing functions as the T/S 1000. Separate keys control the colors of the screen foreground, background, and borders, with variable brightness and a FLASH command for blinking characters. A one-channel sound generator beeps through an internal speaker over 10 octaves. Other T/S 2000 features include a 16K extended BASIC, 256- by 192-pixel high resolution graphics, high-speed cassette interface (16K in 100 seconds), and a 32-column by 24-line text display. Timex says the T/S 2000 will be available this spring for $149.95 (16K) or $199.95 (48K). With that much memory at those prices, the T/S 2000 should prove an interesting competitor.

Timex also introduced a 32-column thermal

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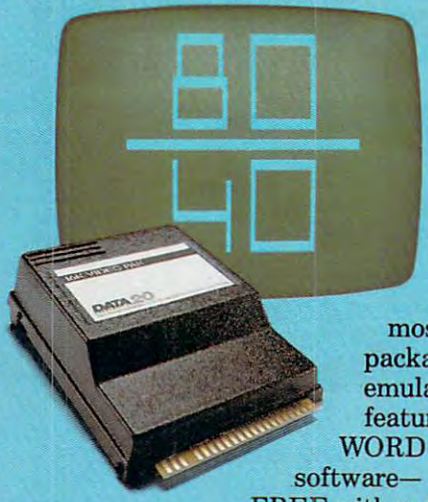

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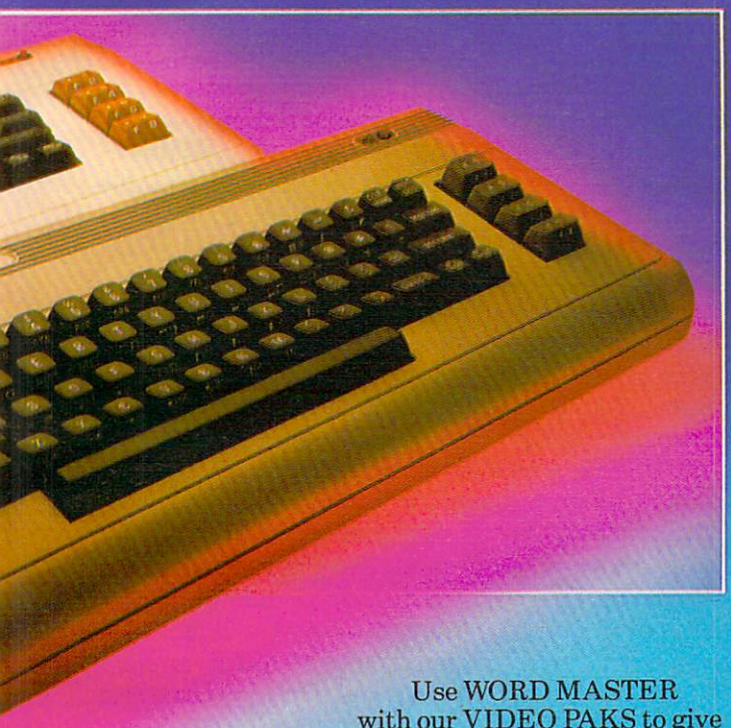

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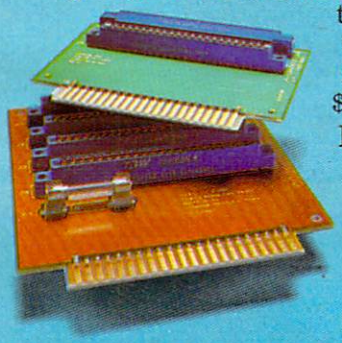

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The Timex Sinclair 2000 is the first computer with 48K memory for under $200. Production models will have a topside cartridge slot for plug-in software. At right is the new thermal printer, which works with both the T/S 2000 and T/S 1000.

printer that works with both of its computers. The T/S 2040 printer reproduces full-screen graphics or text at the touch of a single key. It should be available immediately for $99.95. Timex also announced a $15 rebate (expiring March 31) for buyers of the T/S 1000.

New From Japan

The Japanese, largely left out of the U.S. home computer bonanza, were at the Las Vegas show trying to make inroads with new models, too. Besides Sanyo, Panasonic and NEC also had wares to exhibit.

Panasonic's JR-200U comes with 32K RAM (unexpandable); 16K ROM with Panasonic's own BASIC; a 63-key partial-stroke rubber keyboard; 32-column by 24-line text display; eight colors; 64 graphics symbols labeled on the keyboard; 64 programmable characters; 64- by 48-pixel graphics; three-channel sound covering five octaves; two Atari-type joystick ports; Centronics-standard parallel printer interface; and outputs for TV, composite video monitors, or sophisticated color RGB (Red-Green-Blue) monitors.

The Panasonic works with any standard cassette recorder at 600 baud, but a special recorder will be available for $89.95 that saves and loads at 2400 baud. The sound comes from an internal speaker rather than the TV, but an external speaker jack allows hook-up to stereo systems. The CPU is an MN1800A chip, equivalent to a 6802. Panasonic says the JR-200U will be on sale by March for $349. About 30 home-oriented programs also will be available at that time, and 70 more are promised by the end of 1983. Some peripherals also are due later in the year, including a 320K disk drive, an 80-column dot matrix printer ($369.95), an RGB monitor ($44.95), and an RS-232 serial interface ($69.95).

Panasonic's JR-200 features a rubber keyboard and 32K RAM.

NEC showed its new PC-6001, due by the end of February, for $349. Early prototypes had a partial-stroke rubber keyboard, but production models were sporting a full-stroke typewriter-style keyboard with five programmable function keys. The PC-6001 comes with 16K RAM, expandable to 32K with a cartridge; 16K ROM, also expandable to 32K; 32-column by 16-line text display; three graphics modes, including 256- by 192-pixel black-and-white, 128 by 192 with "limited color," and 64 by 48 with nine colors; 600/1200 baud cassette interface; Centronics-standard parallel printer interface; two Atari-type joystick ports; TV and monitor outputs; three sound channels with an eight-octave range, plus a noise generator for sound effects; and a Z80A-compatible CPU.

A number of peripherals also will be introduced for the PC-6001. A $99.95 expansion unit adds three slots for memory cartridges, disk controllers, etc. There'll be a disk drive ($599.99), a touch panel graphics tablet ($149.95), a 20/40-character thermal printer, a color monitor, and a tape drive ($99.95), although any standard cassette recorder will work.

NEC also is lining up quite a bit of software from such well-known companies as Synapse, Datasoft, Datamost, Adventure International, and Courseware. There will also be an extended BASIC cartridge, a symbolic assembler for machine language programmers, and a $99 BASIC compiler on a cartridge. What's more, the memory expansion cartridges are RAM/ROM units with an extra empty chip socket, so they can be customized.

Spectra Video And Mattel

Mattel, Inc., was showing its new Aquarius, an under-$200, moving rubber-key, 4K RAM computer expandable to 52K. Some people seem to be confusing this with Mattel's Intellivision add-on keyboard, but the products are entirely different. Besides showing off some educational and entertainment software, Mattel had an interesting direct-connect modem (about the size of a cigarette pack) which plugs into the cartridge slot. This will sell for under $100, complete with terminal software and a free subscription to the CompuServe data base. Mattel also is planning to introduce a higher-end version of the Aquarius later this year.

Meanwhile, Spectra Video was exhibiting its new SV-318, a $299, moving rubber-key, 16K RAM

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Mattel's new Aquarius and its family of peripherals.

A non-working mock-up of Spectra Video's planned SV-328. This upgraded version of the SV-318 will have 64K RAM and sell for about $500.

computer expandable to 128K. The SV-318's were running some impressive graphics demos, and it turns out that the computer has the same graphics chip as the Texas Instruments TI-99/4A – 32 sprites and all.

In a back room, out of sight from the crowds, Spectra Video had a mock-up of a higher-end computer, the SV-328. All software and peripherals will be compatible with the SV-318, but Spectra Video has replaced the rubber keyboard with a full-stroke typewriter-style keyboard, including a numeric keypad, and upgraded the standard memory to 64K, expandable to 128K. Special editing keys on the SV-328 are labeled to match commands in a new word processor being introduced by Microsoft. All other specifications – including the color graphics, three sound channels, CP/M capability, and 80-column adaptability – are the same as the SV-318. The disk drives for both computers will use the Xerox 820 format. The SV-328 should be available later this year for around $500.

Atari's 1200XL

More details also surfaced on the new 64K Atari 1200XL (see "Atari's New Top-Line Home Computer," page 66).

First, as expected, the price was set at $899. One Atari spokesman said that the 1200XL's 64K RAM chips accounted for 40 percent of its production costs, and since 64K chips should be dropping in price rather quickly, it's likely that the 1200XL's price also will drop in coming months. Another factor is that the 1200XL may be less expensive to produce than the 800, or even than the 400, once production gears up. The 1200XL contains all its components on a single board. The 400 has four boards, and the 800 has six.

Although the 1200XL is compatible with the 400/800, it was revealed that the CPU is a custom version of the 6502 found in the earlier computers. The new CPU, code-named "Sally," has an extra line for the ANTIC chip. This means ANTIC and the CPU won't be fighting to access the same memory all the time, which means the 1200 XL should run faster than its predecessors.

The 1200XL also has a different Operating System than the 10K OS in the 400/800. The new 16K OS uses its extra 6K for the diagnostic tests and four programmable function keys. In addition, like the Commodore 64, the OS is overlaid upon the 64K of RAM. This means you can disable the OS with a POKE to access the RAM underneath. Of course, this also means you'd have to write your own OS – not a trivial task. But software developers will be able to incorporate their own custom OS in their programs, freeing more RAM for workspace – as in a word processor or spreadsheet, for example. A maximum 62K of RAM is available when the OS is disabled (2K is still needed by the computer).

Other new 1200XL features: an additional graphics mode, GRAPHICS E, to be supported by a new BASIC that's on its way; improved circuitry to sharpen the sound and colors; no more memo pad mode when the computer is powered up without a cartridge (a colorful Atari logo appears instead); and the transfer of all ports and plugs from the right side of the computer to the rear (except for the two joystick ports and cartridge slot, which appear on the left).

The four new function keys can act as 12 – they work alone, or in combination with the SHIFT and CTRL keys. If they are not reprogrammed by the user, the default function of the keys when pressed by themselves are the four cursor movements – up, down, right, and left. This circumvents the CTRL key which must be held down when the keyboard cursor controls are used. Atari also is preparing new software to take advantage of the 1200XL's HELP key. ©

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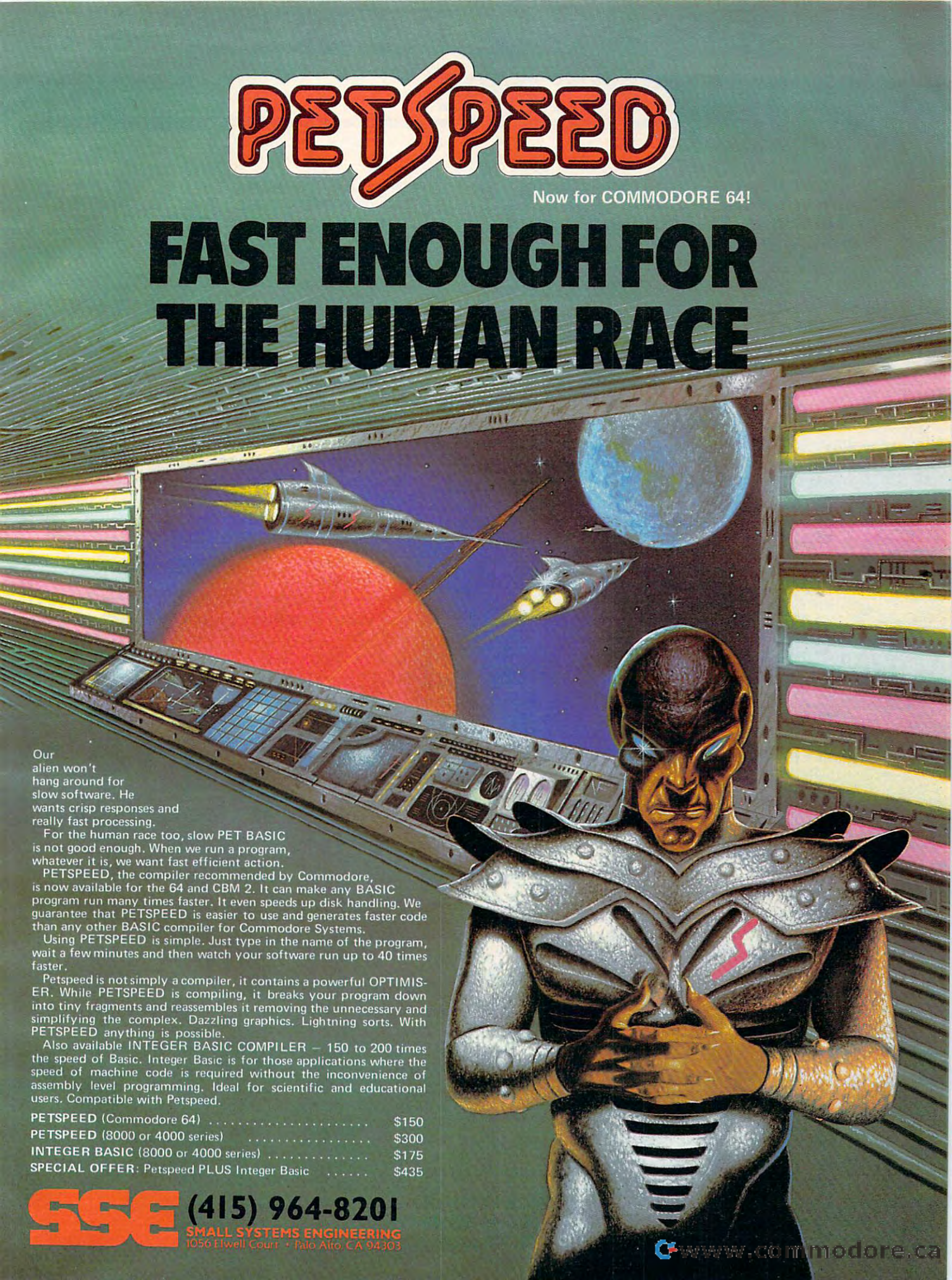

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THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

If you have a question that's been bothering you, send it in to the address below. Many of these columns have been written in response to an issue raised in one of your letters. This month, a question from Todd Oldham reminded me how I felt when I was using a tape drive and was trying to justify switching to a disk drive.

For the first year I owned a computer I never used a disk. In fact, there were few computer stores then and I had only seen disk drives in photos. I was happy enough with tapes. On the other hand, reading about disks made me think that they must be in some way fairly desirable if people were spending about as much money to buy a disk drive as they had spent on their computer itself. But just exactly what could a disk do for my system? It seemed to promise to transform it into a far more powerful machine. But in what ways?

Todd writes: *"Why don't you run an article on this device, including information on what it does, how it can benefit someone like me, and how well this product performs?"* Fair enough.

An Athletic Memory

A disk makes your computer's memory much larger and faster. It doesn't make the computer *smarter* by adding new commands to BASIC or anything, but it does make it easier, far easier, for the computer to access large amounts of information quickly. In a way, your RAM memory becomes bigger, stronger, and more agile.

Adding a disk does not give you more internal RAM in a literal sense. However, the great speed with which you can switch programs and data in and out of RAM from a disk makes it appear that you have limitless internal memory. It can seem as if a disk is an extension of RAM. Sometimes this effect is called *virtual memory* because a disk can be virtually as good as adding hundreds of thousands of RAM memory cells.

There are currently three places that a computer typically puts its programs and information (*data*, such as a list of addresses): RAM, tape, and disk. RAM memory is inside the computer and is limited in size. Usually RAM can only hold one program and some associated data at one time. What's more, RAM goes blank when the power is turned off. It is, however, the fastest way to make information available to the computer. It's inside the computer to start with.

Tape is inexpensive because cassette tape drives are common and relatively easy to manufacture. The manufacturing problems are fairly simple to solve for a machine which slowly pulls a ribbon of magnetic material past a "head" that picks patterns off, or puts them on, the tape. The head never moves, just the tape.

A floppy disk looks like a limp 45-rpm record enclosed within a protective black cardboard envelope. When inserted into the *disk drive*, the disk whirls around a spindle at about 300 revolutions per minute. Equally important, the head can quickly move to any of about 35 positions along a line from the spindle to the edge. In this way, any piece of information, anywhere on the disk, can be located and sent to the computer at lightning speed. It can be stored (sent from the computer to be memorized on the disk) just as fast.

To give you an idea of this speed, a 4,000 byte program takes about ninety seconds to come in from, or go out to, a tape. A disk loads or saves the same size program in seven seconds. You might not think that this represents a crucial difference, but in many ways it makes all the difference in the world.

Here's one example. A normal video screen will hold about 1000 bytes. Suppose that you wanted to have dozens of different screenfulls of instructions. You could have them each on screen in a second from a disk. They wouldn't all fit at once in RAM memory, but they could be brought in almost instantly from disk and flipped like the pages of a notebook. It's possible, but slow and awkward, to bring in such screens from tape. You can only load things off tape *in the order in which they were saved.*

This (plus the great increase in speed) is perhaps the main advantage that disk has over tape. Disk heads are able to leap to any position on the surface of a disk. Tape items are all lined up in order. That's fine if you want the first item on the tape. If you want the last item, you have to pull off all the others first. You can't just drop down instantly to any desired location on a tape.

Changes Of Behavior

As might be expected, switching to disk memory has an impact on the way that you program. Programmers are often cautioned to make a copy, called a *backup*, every 20 minutes or so to prevent losing everything if there is a power outage or something else causes RAM memory to fail and destroy your work. This backup task becomes a snap with disks: a matter of waiting a few seconds. You're more likely to make frequent backups when it's this easy to do.

There are also several new ways that you can program when you have a disk drive. You can

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bring programs into the computer quickly and "overlay" the program that's in memory. In this way, programs can be made quite large, and divided into segments which call each other in from disk at appropriate times. This technique is called *chaining*.

An additional advantage is the fact that a typical disk (Commodore) can hold 176,640 bytes on one side. If you have a double-drive (two drives in one housing), this means that you've got 345K of memory available to your computer.

Why Not Disks?

Asking "why not get a disk drive?" is like asking "why not trade in the car on a helicopter, it's faster and more efficient?" True, but more expensive. Prices are falling, however. A year ago, a disk drive cost roughly ten times the price of a tape drive. Now you can buy single-drive disk units for under $400. Rumor has it that the drive assemblies will soon cost OEM's (Original Equipment Manufacturers) about $50. This could well mean that the drives' retail price will be going down further before bottoming out.

The Beginner's Page
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An Introduction To Data Storage On The VIC, 64, PET/CBM, And TI-99/4A

Ron Gunn

Data storage can be the most perplexing aspect of programming for the novice. Here are some practical tips for VIC, 64, PET/CBM, and TI users which just might save you days of experimentation.

Types Of Data

Commodore Computers use three kinds of variables, and it is the values stored in variables that you will be dealing with when you save and recall data. The first of these is floating point, represented by a variable like A or A(X). The second is integer, represented by a variable like A% or A%(X).

The third is the string variable, represented by A$ or A$(X). Any of these varieties can be single: A; or may have subscripts: A(X); A(X,Y); or A(X,Y,Z). Part of your sense of power in computing comes when you realize just how much data you can pack and organize into those multiple-subscripted arrays.

When you are putting data out on tape or disk and expecting to read it back in, you must remember two things: 1. The three variable types are different and are not interchangeable. 2. They are put onto the recording medium in series without any identification and must therefore be read back in, in exactly the same sequence, to be recovered.

Only the data is recorded, not the variable names themselves. You can send it onto the tape as A, and can call it B when reading it back in. That is fair. But if you read data back as B% or B$, you will get an error message. Some error messages are really undeserved, as you know. This one is deserved. Don't mix your data types – integer to integer, string to string, and so on.

A Caution About String Variables

String variables, however, are a special case. Let's see why. In Commodore BASIC, unlike some other versions, there is a default value for variables. It is set when the machine is turned on, or when an array is dimensioned. The value is zero.

When you write string variables to tape, however, this default value of zero is not a legitimate representation of anything. A string "0" would be ASCII 48, but that is not what is there. What is there is a binary, octal, decimal, hex 0 – which, in the special language of strings, represents a null. Neither the cassette nor the disk will accept null strings. Result: input rejects it and the data isn't transferred.

The cure is logical, once it is pointed out: load all string variables, including string arrays, with a string variable that the tape or disk can recognize. Example: you have dimensioned a string array A$(20) that may not be filled from your program when you want to save it. Right after the DIMension statement, do the following:

```
11000 DIM A$(20)
11010 FOR I=0 TO 20:A$(I)="X":NEXT
```

The array has now been loaded with a recognizable string ("X") and can be saved. All unused parts of it will be saved as X and will not confuse things later.

Saving Simple Variables

When the sequence used in saving data is also followed in loading data, then the right variables get put back where they belong, and the transfer proceeds smoothly. You can safely use the following procedure, and it will work very well indeed on cassette:

```
12000 OPEN 2,1,1:REM WRITE
12010 PRINT#2,A;",";B%;",";C$
12020 REM WHAT'S THIS?
```

You should be surprised by line 12010. First, variables are mixed, but that *is* OK as long as they are brought back in in the same order. A floating-point, an integer, and a string can be safely handled on the same line. You can't just have your other program trying to bring in a string when a number is next in line to come off the tape.

Second, what is all that between the variables? It is instructions to the computer about what to

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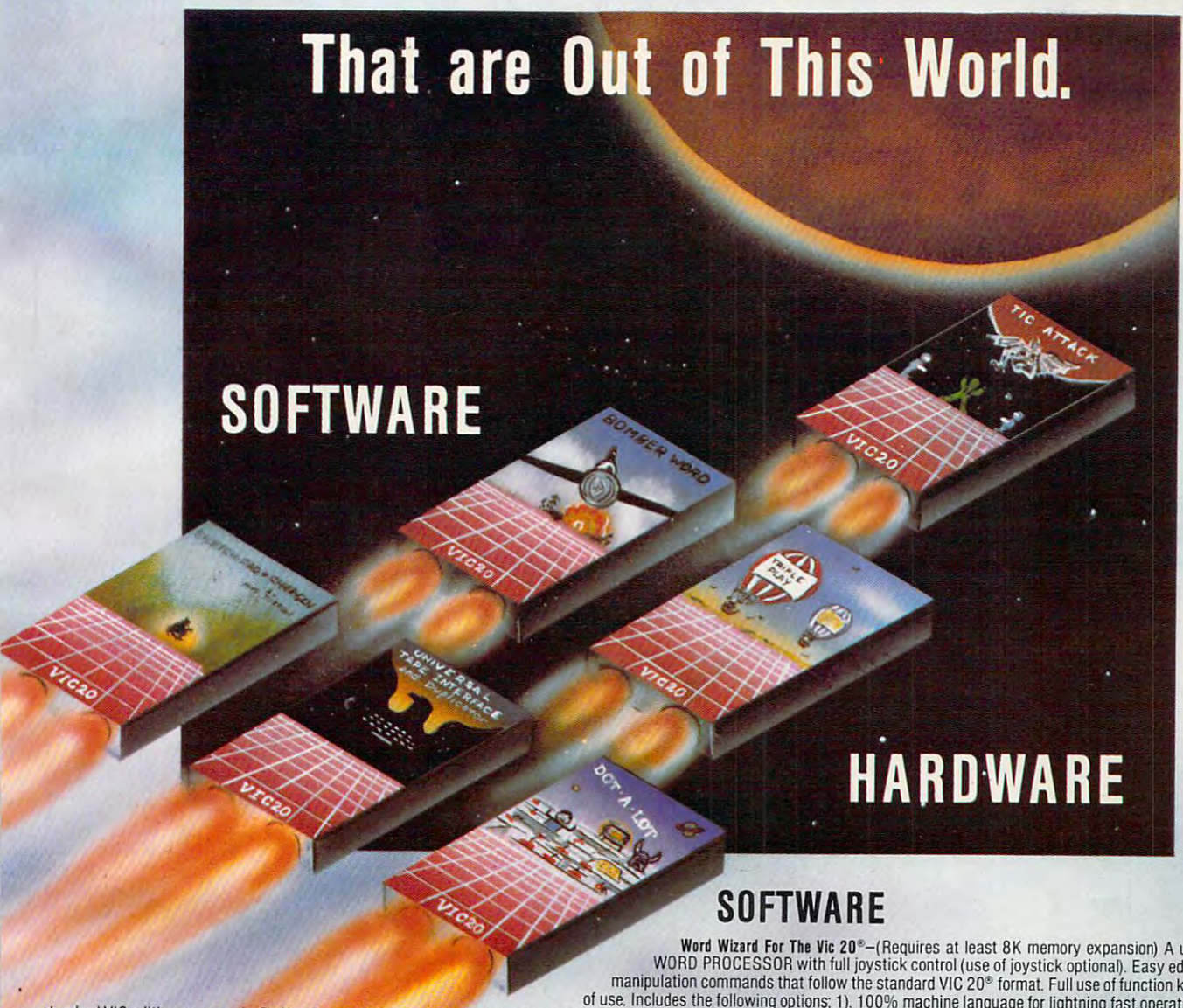

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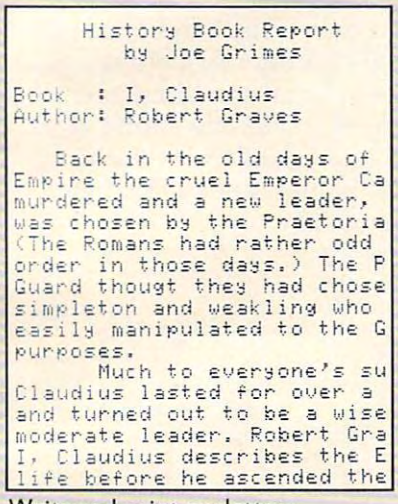

```
History Book Report
by Joe Grimes

Book   : I, Claudius
Author: Robert Graves

   Back in the old days of
Empire the cruel Emperor Ca
murdered and a new leader,
was chosen by the Praetoria
(The Romans had rather odd
order in those days.) The P
Guard thougt they had chose
simpleton and weakling who
easily manipulated to the G
purposes.
      Much to everyone's su
Claudius lasted for over a
and turned out to be a wise
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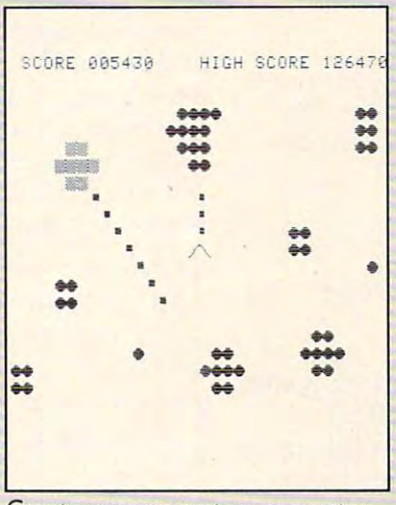

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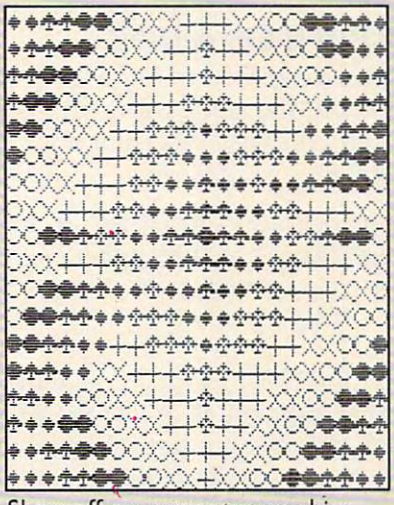

Show off my computer graphics creations. The kit includes *Kaleidoscope* and *Sketch Pad* graphics programs.

```
1 REM*VIC SQUIGGLE*
2 REM*FROM VIC 1001 USER'S
3 REM*TYPED AND DEBUGGED BY
7 C$="
9 PRINT"
10 DATA"|","—","J","└","┌",
20 DATA1,0,5,6
30 DATA0,1,4,3
40 DATA3,6,2,0
50 DATA4,5,0,2
60 DIMA$(5),B(5,5)
70 FORI=0TO5
80 READA$(I)
90 NEXT
100 FORI=1TO4
110 FORJ=1TO4
120 READB(J,I)
130 NEXT
140 NEXT
190 T1=1
200 T2=1
210 X=20
```

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```
Recipe 334

CHEESE BERRY PIE

Ingredients

     2 Pks (3 oz. ea.) cream
     1/3 cup powdered sugar
     1/3 cup sour cream
     2 tsp grated orange pee
     Baked 9-inch pie shell
     2 - 3 cups whole fresh
     strawberries/raspberrie
     1/2 cup strawberry/rasp
     preserves, sieved

Procedure

   Soften cheese.  Beat in s
sour cream and orange peel.
in pie shell.  Top with ber
to glaze.  Chill.  If you l
```

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put on the tape record. Semicolons suppress "carriage returns," but "," is put in to allow the beginning and end of each separate item of information to be established. These are *delimiters*. They are like walls to make sure that two items are separated. (A "carriage return" is like moving the paper up one line when you hit the RETURN key on a normal typewriter. Each time you use a PRINT statement in BASIC, it is followed by a carriage return unless you put a ";" after it.)

Let's Put It On A Disk

So far we've zeroed in on cassette data operations. What about the same thing on disk? (Skip this section if you are concerned now just about cassette data.)

```
12000 DO$="1:SCORES,S,W"
12010 OPEN 2,8,9,DO$
12020 PRINT#2,A;",";B%;",";C$;CHR$
      (13);
```

In line 12000, a record is defined as associated with disk unit 1: it is to be called SCORES and is identified as Sequential. This will be a Write operation. A later Read operation will be needed to bring it back in. In line 12010, file 2 is opened to unit 8 (the disk) with a secondary address of 9. Use 9 for a disk secondary address unless you specifically want something else. It works. The last part of the file opening statement is the DO$ that was defined in line 12000.

Line 12020 contains all of the variables and delimiters used in the cassette statement, with one addition: a carriage return CHR$(13) has been added to the disk statement. Note that it is surrounded by semicolons so no line feeds will be slipped in. You want a CHR$(13), not a CHR$(13) CHR$(10), there to keep the records straight. There are simpler ways to do this with the new 4040 disk, but this works for all disks, both new and old.

Saving Array Variables

While it is clear that mixing variable types on a single line is OK as long as they are recovered in that same order, this does not seem to be true if an array is involved. The following is not recommended:

```
13000 FOR I=0 TO 20
13010 PRINT#2,A(I)
13020 PRINT#2,B$(I)
13030 NEXT
```

For reliable records, just don't mix string and numerical variables in a FOR/NEXT loop when saving data. Use an entirely separate loop to handle the strings. Any potential savings by avoiding the use of another separate loop to handle the strings can be costly. This works reliably:

```
13000 FOR I=0 TO 20
13010 PRINT#2,A(I)
13020 NEXT
13030 FOR I=0 TO 20
13040 PRINT#2,B$(I)
13050 NEXT
```

(If this were a disk operation, each PRINT#2 statement would end with ;CHR$(13);).

A Practical Application

Now let's define and then write a minor cassette or disk data *tour-de-force* program. Let's say you need to input two arrays that contain names and scores for a tournament. NT$ is the name of the tournament, TP the number of tournament players, N$(TP) their names, and S(TP) their scores. We are reading data:

```
15000 OPEN 1,1
15010 INPUT#1,NT$,TP
15020 CLOSE 1
15030 DIM N$(TP),S(TP)
15040 OPEN 1,1
15050 FOR I=0 TO TP
15060 INPUT#1,N$(I)
15070 NEXT
15080 FOR I=0 TO TP
15090 INPUT#1,S(I)
15100 NEXT
```

At 15010 the name and size are brought in on the same line. That's OK. They were put on the record earlier using the necessary "delimiters." The file is then closed to bring all of the information in from the buffer.

At 15030, TP is used to dimension the necessary arrays to hold the data. Then, using loops, the data for names and then for scores is brought in separately. So, we have stuck to our principles. Single line data is mixed because it will mix. Array data is not mixed even though it seems compellingly simple to do so.

Note that we referred to both cassette and disk in this program. The only difference between input of cassette data and input of disk data is the opening statements. It is actually practical to have independent opening statements, but then GOSUB to the same input loop subroutine for both cassette and disk. When you are reading data back in, there are no forced delimiters and no fancy manipulation of the line feeds. You can easily make your program read either cassette or disk data with negligible extra programming or complexity.

The Commodore cassette and disk are amazingly reliable in handling data. I once tried saving and then reloading .5 megabytes (500,000 characters) in the same program, and no errors occurred.

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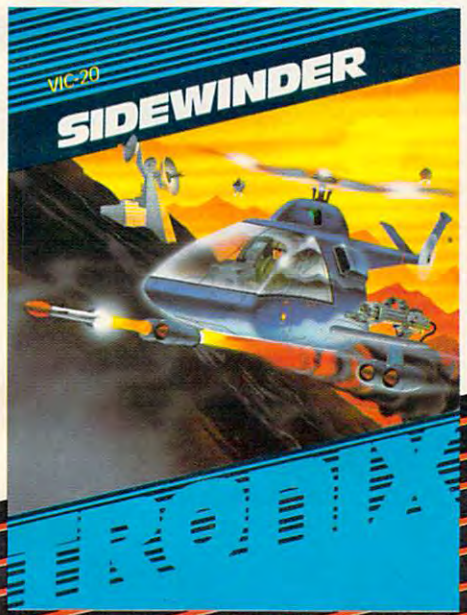

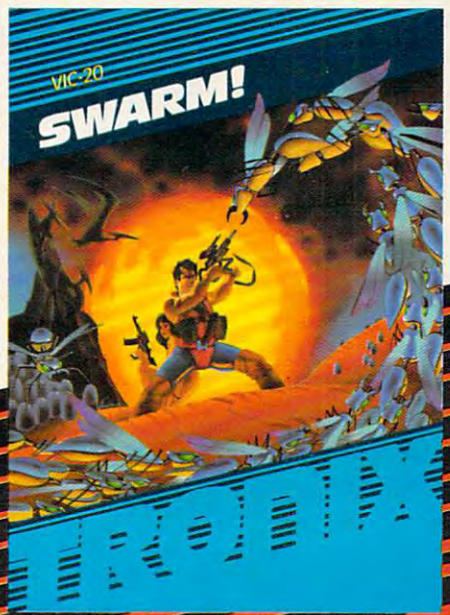

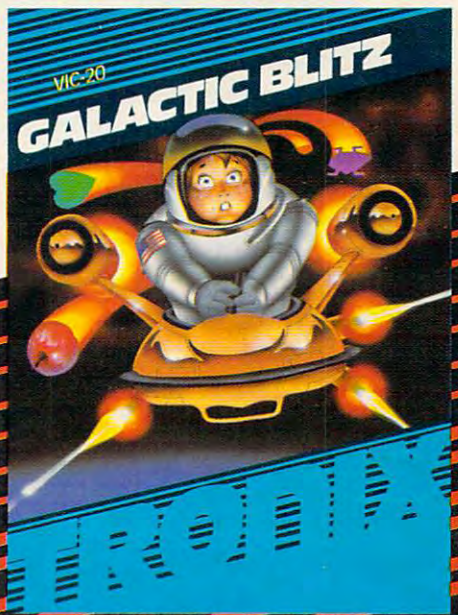

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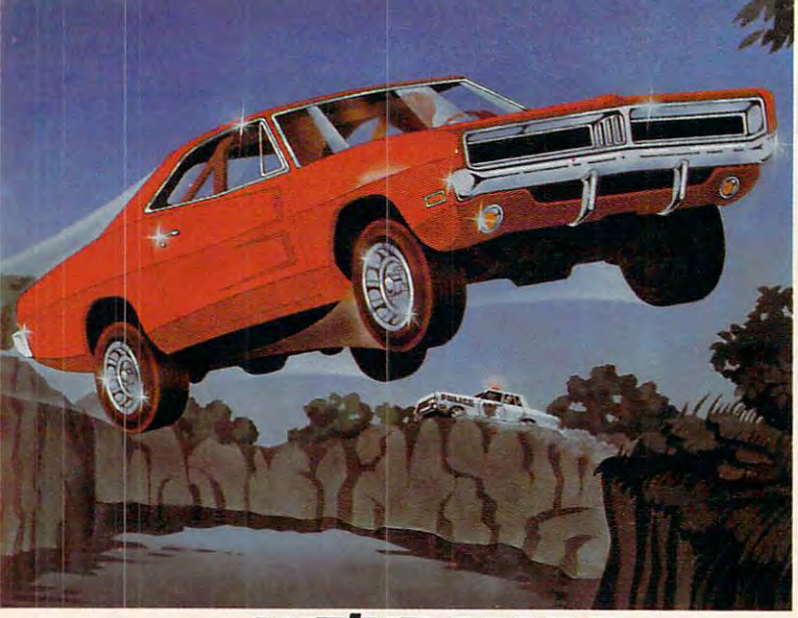

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TI Data Storage

C. Regena

Data handling is discussed in detail in the *User's Reference Guide* that is included with your TI computer. You may refer to the topic, "File Processing." In the TI-99/4 book, the pages are 144 to 162. In the TI-99/4A book, the pages are II-118 to II-136.

There are only two kinds of variables in TI BASIC, A or A(X) for numeric and A$ or A$(X) for string. You do not need to worry about integer or floating-point numbers.

Unlike the Commodore computers, the TI *will* accept null strings. You may specify a null string by setting the variable C$="" or reading in data:

```
200 DATA 3,4.5,,X
210 READ A,B,C$,D$
```

Saving Simple Variables

Only in DISPLAY mode do you need to specify delimiters in quotes. If you specify INTERNAL, it is easier to handle data. A sample program to save the variables A, B, and C$ is:

```
100 OPEN #2:"CS1",INTERNAL,
    OUTPUT,FIXED
110 PRINT #2:A,B,C$
```

When you are using the program later and want to read the variables, use this procedure:

```
200 OPEN #3:"CS1",INTERNAL,
    INPUT,FIXED
210 INPUT #3:A,B,C$
```

By the way, you may number your devices anything you want, from #1 to #255, inclusive. You may even use OPEN #X+5 if you have previously defined X.

On A Disk

The procedure is the same as with cassette except for the device name:

```
100 OPEN #2:"DSK1.TEST",
    INTERNAL,OUTPUT,FIXED
110 PRINT #2:A,B,C$
```

The *Disk Memory System* manual that comes with the Disk Controller describes "File Processing" on pages 29-41 and presents several sample programs.

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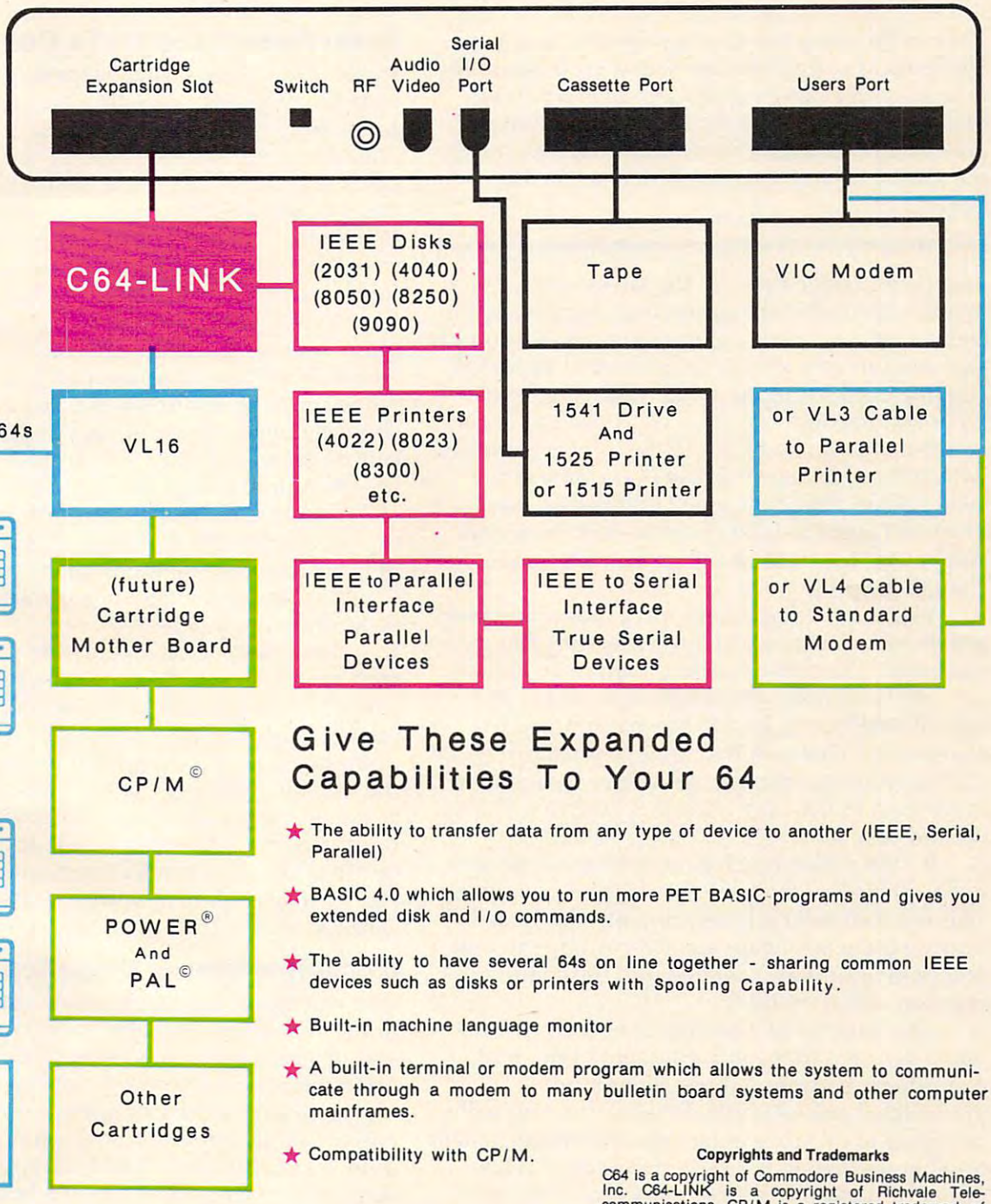

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Mass Memory Now And In The Future

Tom R. Halfhill, Features Editor

To be useful, every computer system must have some kind of mass storage *– a tape or disk drive, something to permanently store programs and data outside the computer's built-in memory. Here's a brief history of mass storage methods, a rundown of today's technology, and what developments we can expect in the near future.*

Eagerly you page through the latest issue of your favorite computer magazine. Searching for applications, you discover a game program that sounds fantastic, an educational program that looks fascinating, and a programming utility that is just what you needed.

What if you had no way to store programs or data and had to type them in every time you switched on your computer? Or even worse, imagine having to take apart the computer and completely rewire it each time you wanted to change the program.

Yet, that's what operators of the earliest computers were forced to do – and it wasn't that many years ago. The first electronic computer, ENIAC, a 30-ton behemoth which first came to life just after World War II, had to be programmed by *hard-wiring*. That is, it had to be physically rewired to alter its programming. And since it contained more than 18,000 vacuum tubes, rewiring ENIAC was no easy task.

It didn't take long for computer scientists to realize the advantage of a *stored program* computer. This is a computer whose programs are stored outside the machine on some recording medium, and then temporarily loaded into the computer's memory when needed.

This concept of *mass storage* or *mass memory* was a key step in the development of modern computers, because it made them more generalized and versatile. ENIAC was originally designed to calculate trajectories for artillery shells and bombs. When reprogramming was made easier by making it a "soft" process, computers could be applied to jobs that even the designers had not anticipated.

From French Looms To Computers

Ironically, although some experts predict that today's computer revolution eventually will result in a society that is almost paperless, computers once devoured whole forests of the stuff. Punch cards and paper tape were the earliest media for mass storage. Both work on the same principle – the presence or absence of a punched hole indicates a bit (binary digit) switched "on" or "off." Punch cards long pre-dated electronic computers; they were first used in the 19th century to "program" weaving patterns on mechanized French looms. They turned up later on adding machines when the Census Bureau realized its manual counting methods could not tabulate the 1890 census in time for the 1900 census.

Although punch cards and paper tape are still used in some places today, they were largely replaced in the 1960s by what has become the dominant storage method – magnetic media. Reels of audio tape and magnetic drums led to hard disks and floppy disks.

Disk drives were invented to solve a problem with tape drives: to find a certain piece of data on a tape, you must first wind through all the intervening tape (*sequential access*). Then someone hit upon the idea of coating a flat plastic disk with the same magnetic material found on tape, so that a movable recording head could skip to the right spot in a split-second, just as a tone arm can be lifted to a certain selection on a phonograph record. This system of *random access* made it much easier to retrieve information.

Cassettes Versus Diskettes

When personal microcomputers started appearing in the mid-1970s, the early hobbyists needed some sort of inexpensive mass storage device to hook up to their home-brewed or kit-built computers.

As you've no doubt noticed during a power failure, all the information in a computer's Random Access Memory (RAM) disappears the instant the power goes off. That's because RAM chips need a constant flow of electricity to maintain the molecular alignments that indicate if a given

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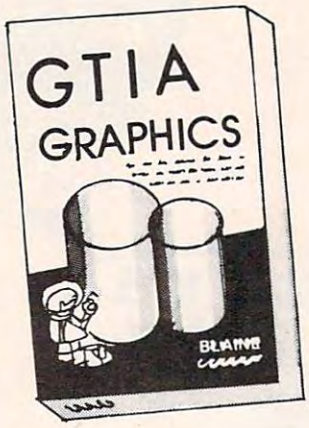

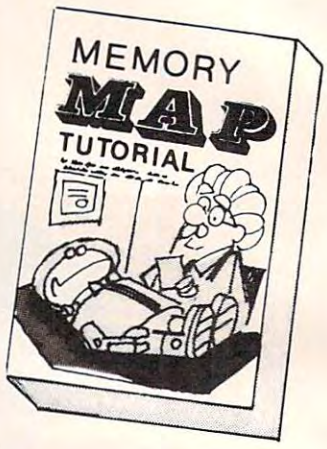

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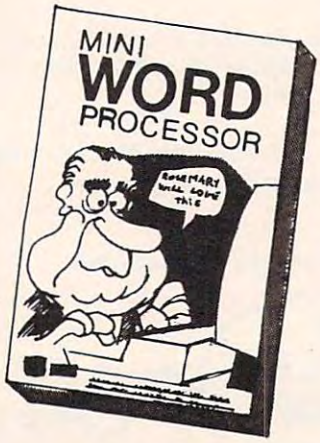

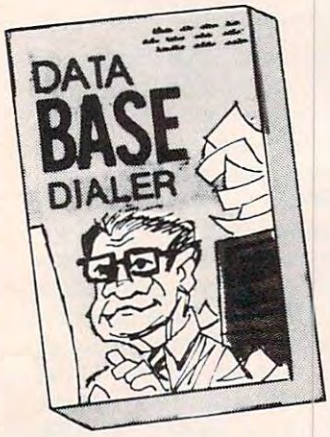

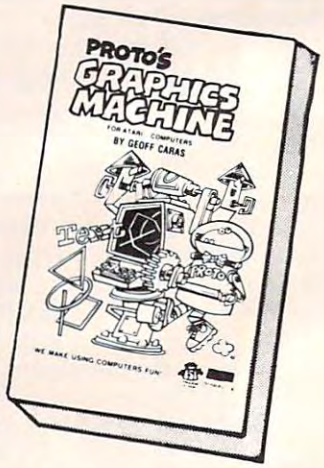

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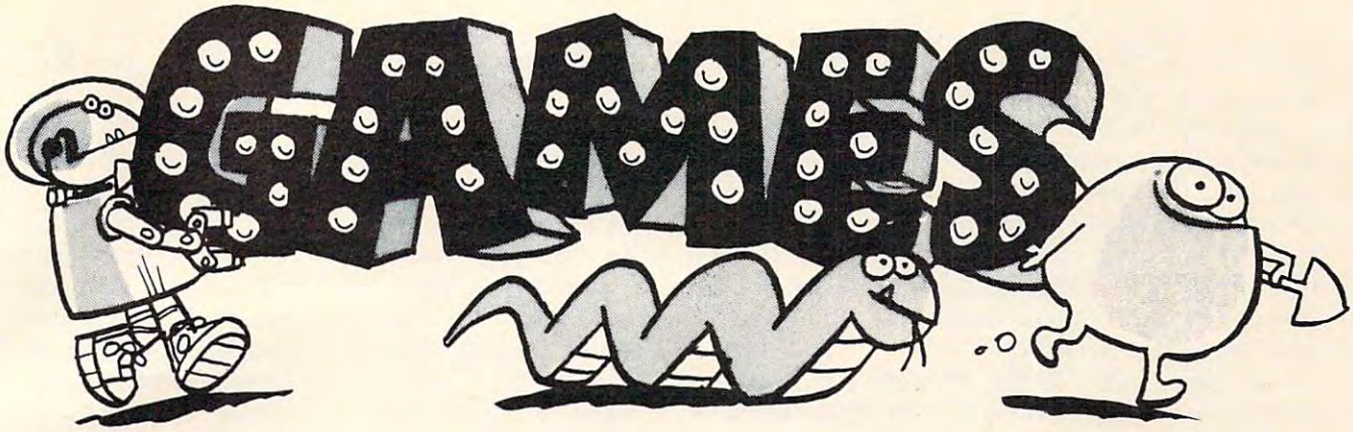

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Diggerbonk! contains the following ingredients: Orange Whirlers, Pulsing Greenies, Twinklers, Bombs, Fog, Purple Gurples, Yellow Blinkers, Aqua Chasers (watch out), and of course the PANIC BUTTON.

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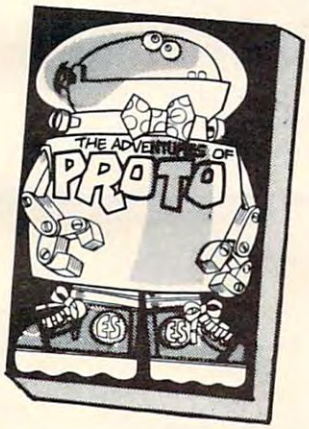

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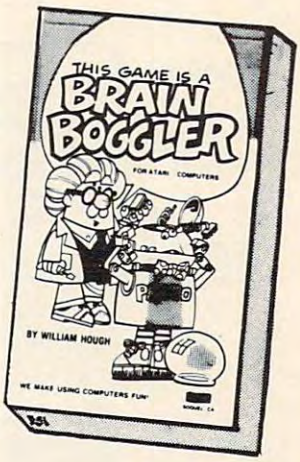

Diggerbonk! is the first arcade style game with a continuously scrolling maze that never repeats. You must guide your Digger upward before it goes off the bottom of your screen. There are, however, a few problems you must BONK! along the way (see ingredients). To add to the complication, you need to BONK! the creatures in a specific order. Playable by all ages, but be prepared to end up with a NEGATIVE SCORE.

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bit is "on" or "off." Even if memory chips were designed to retain their data in a powerless state – as magnetic "bubble" memory chips do – there would still be a need for mass storage outside the computer. A typical computer owner's software library might consist of dozens or hundreds of programs, and there's no way they could be held all at once in the computer's relatively small built-in memory. And even if they could, they would interfere with each other.

Arriving in the 1970s, personal computers pretty much skipped the paper methods of mass storage, although punch card and bar code readers are used on some microcomputers. Instead, the early computerists looked around and adapted audio cassette recorders as mass storage devices. Cheap and generally reliable, cassettes remain the most popular way to store programs and data on low-cost home computer systems.

Unfortunately, cassettes suffer from one major problem: they are usually abysmally slow. While this doesn't matter much for casual applications, business users, advanced programmers, and others who need to frequently transfer large volumes of data just cannot afford to tie up person-hours and computer time waiting for tapes to load. Having already borrowed the idea of tape storage from the world of large computers, microcomputer users next adapted disk drives to their small machines.

By this time, there were two sizes of *floppy disks* (so-called because the magnetic layer is coated onto a thin, flexible sheet of plastic): 8" floppies (pioneered by IBM), and 5¼" minifloppies (pioneered by Shugart). Partly because the smaller disks seemed more appropriate to small computers, and partly because of their smaller cost, the 5¼" size became the standard for personal computers.

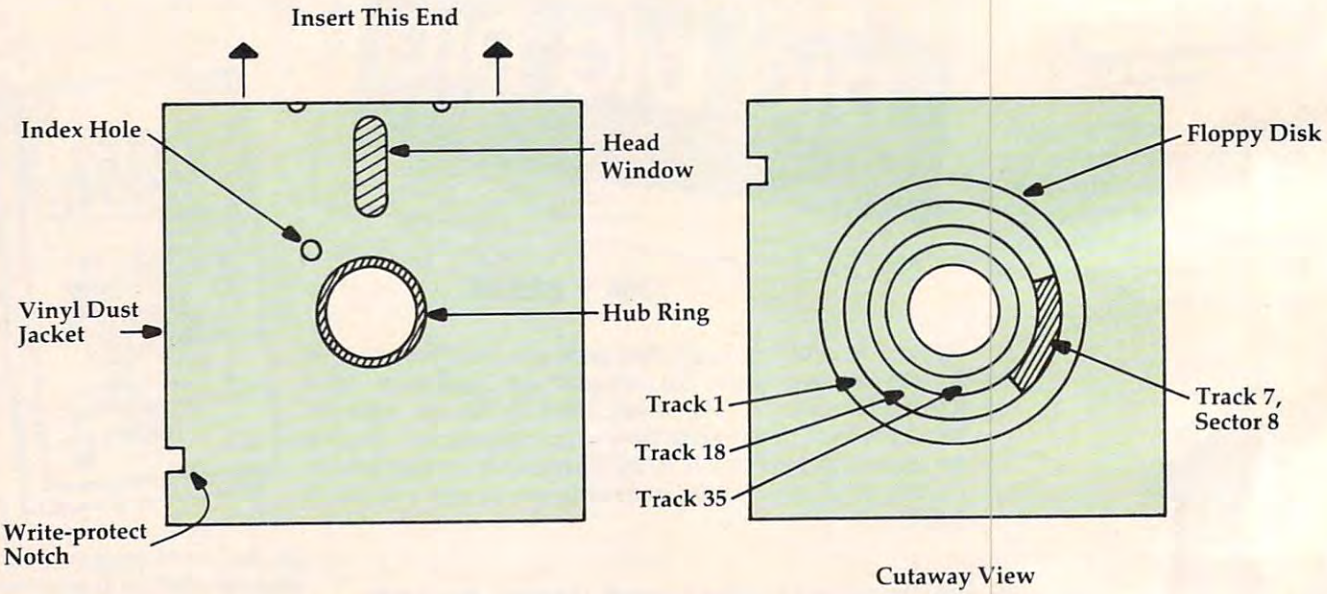
Both styles are similar, enclosing the disks in a vinyl dust jacket so that only a small section of the disk itself is exposed through a *head window*. When the disk drive is summoned by a command from the computer, the disk starts spinning at about 300 revolutions per minute, and a *read/write head* very similar to a tape recorder's playback/recording head is lowered into contact with the disk.

The data is stored on the disk in concentric circular *tracks* divided into arc-shaped *sectors*. The amount of data a disk can store is determined by the number of tracks and sectors, and the density of the recorded information (*single-*, *double-*, or *quad-density*). Some disk drives have two read/write heads, one for each side of the disk, thus doubling a disk's capacity. The highest-density double-sided minifloppies can now store about one megabyte (one million bytes, or characters).

Hard Disks And Stringy Floppies

Now that their prices are dropping, *hard disks* are becoming increasingly common on microcomputers. Unlike floppies, hard disks consist of a magnetic coating on a rigid aluminum platter which spins constantly, not just when the disk drive is called by the computer. They also spin much fas-

Typical Floppy Diskette Architecture



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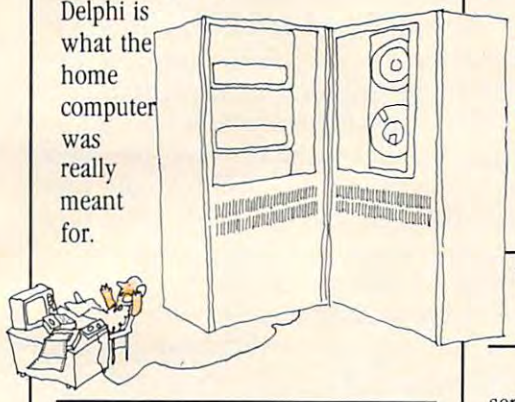

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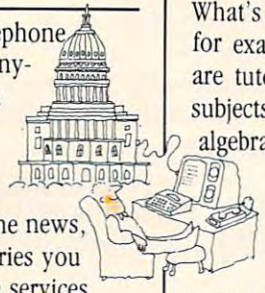

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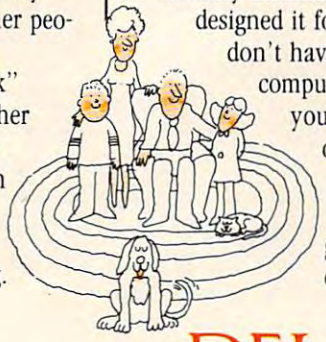

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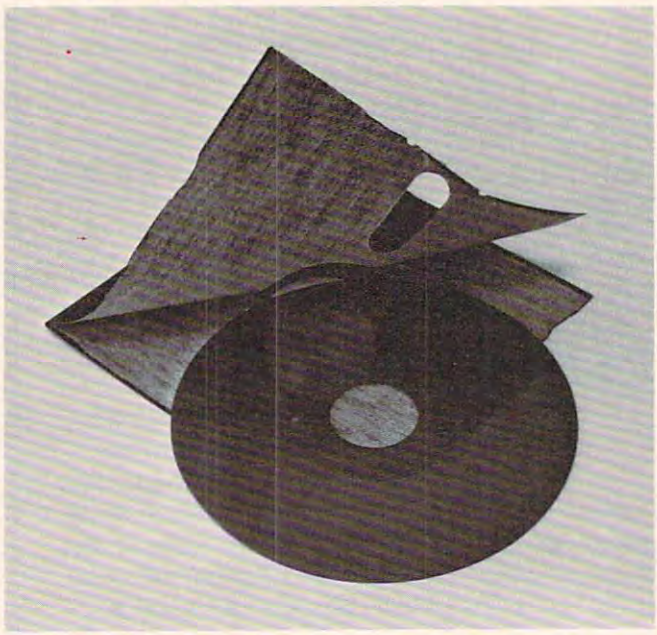
ter, as fast as 3600 rpm. (A floppy disk would quickly wear out under this kind of use, but the read/write head of a hard disk does not actually touch the surface.) Hard disks transfer their data much faster than floppies and can store much more information, up to 100 megabytes. Like floppies, hard disks come in 8" and 5¼" sizes.

But besides their expense, hard disks have other drawbacks. The gap between the read/write head and the disk surface must be critically adjusted, and the disk itself must be centered exactly on its spindle. Also, hard disks are much more sensitive to dust or defects. That's why most hard disks are permanently sealed in their drives, unlike floppies. Since the disks are non-removable, they must be backed up on another hard disk, on floppies, or on tape. Still, hard disks are showing up in greater numbers on microcomputers used for business.



Exposed – a 5¼" minifloppy diskette removed from its protective sleeve.

One of the less common mass storage devices found on personal computers is the *stringy floppy*. This is something of a cross between cassette tape and floppy disk. The medium is a small cartridge called a *wafer*, which is about the size of a business card and 3/16" thick. Inside the wafer is a special tape designed for storing digital data. But instead of being wound end-to-end on a pair of spools, like cassette tape, wafer tape is wound in an endless loop, much like an eight-track audio cartridge. Tape lengths vary from five feet to 75 feet, and can hold up to 64 kilobytes (64,000 bytes). Wafers snap into a special stringy floppy drive which resembles an eight-track player. On some systems, stringy floppies can load and store programs as fast as or even faster than disk drives, and they usually cost less than a disk drive.

Stringy floppies are most commonly used with Radio Shack TRS-80 computers. However, they may have found a new market in portable microcomputers, where their small size, high speed, and ruggedness make them viable alternatives to microcassettes and floppy disks. A newly announced portable aimed at business people, the Rover I, will use stringy floppies for mass storage.

The Incredible Shrinking Floppy

As technology advances, storage media seem always to shrink. For example, consider what's happened over the past 50 years to photographic film (which, after all, is just another method of storing information – *visual* information). In the 1930s and 1940s, most professional photographers worked almost exclusively with cameras that used 4x5" sheet film. Smaller-sized film was avoided because the enlarged prints would turn out too grainy (that is, the film was incapable of storing visual information at a high enough density).

But as film technology advanced, photographers were able to trade in their bulky 4x5" cameras for lighter models using smaller film. In the 1950s, 2¼" square film was very popular. This was superseded in the 1960s by 35-millimeter (1x1½"). In the 1970s Kodak introduced the 110 format, and in the 1980s, the new disc film – in each case, roughly half as large as the previous format. The ability to record information at greater densities (more tightly pack the film's grain particles) has allowed smaller film and cameras with little, if any, loss of quality.

Now we're witnessing the same progression in computer mass storage technology. Floppies begat minifloppies which have now spawned *microfloppies*.

The main problem with microfloppies right now is that everyone cannot agree on a standard format. There seem to be three major microfloppies emerging – 3½", led by Sony; 3¼", led by Dysan; and 3", led by Hitachi. Some people believe more than one format can coexist, while others maintain that one will eventually rule supreme.

Which disk really has the inside track?

Sony is off to a good start, largely on the strength of a $30 million contract to supply microfloppy drives to Hewlett Packard for a new line of business/technical computers. Also, a group of U.S. manufacturers has decided to follow the Sony standard.

"What's going to establish the standard is the marketplace," points out Myles Tintle, general manager of Sony Data Products. "It probably will be the one that emerges as the dominant technology."

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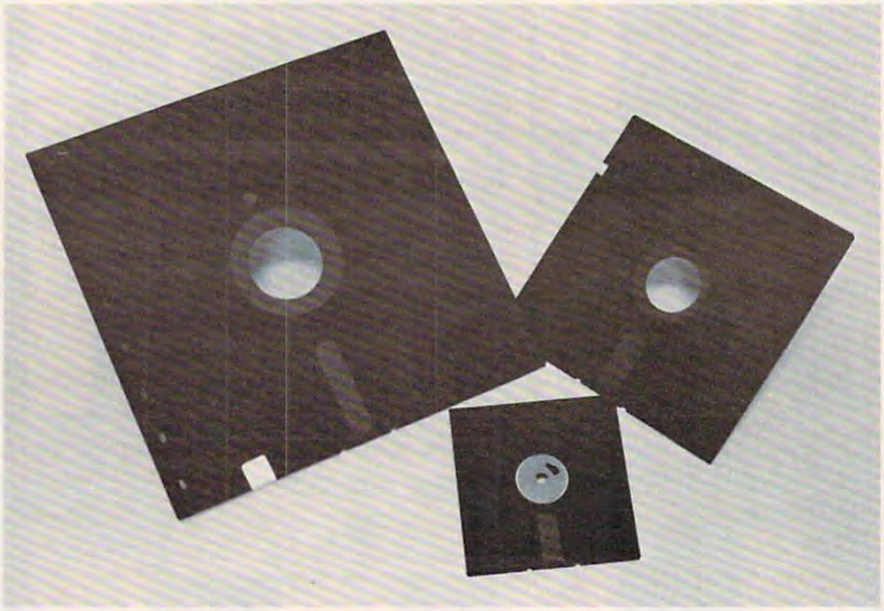

The Incredible Shrinking Disk. At left is an 8" floppy diskette; at right, a 5¼" minifloppy; and in the center, a 3¼" microfloppy. Are even smaller disks on the way?

On the other hand, the competing formats also have factors in their favor – mainly, greater compatibility with existing computers. Even though all three types of miniature diskettes are known collectively as "microfloppies," there are significant differences which reflect various design philosophies.

Microfloppy Wars

The most noticeable difference is in the nature of the media themselves. Both the Sony-standard 3½" and the Hitachi-standard 3" disks are encased in hard plastic-and-metal housings much more impervious to abuse than the vinyl sleeves found on 8" and 5¼" disks. They look and handle more like cartridges than "floppies."

"You can actually stand on these disks without damaging the media," boasts a spokesman for Amdek Corp., whose microfloppies adhere to the Hitachi standard. Both the Sony- and Hitachi-standard cases include movable shields which protect the head window when not in use. The shield retracts automatically when the Hitachi disk is inserted in a drive; the Sony shield works manually.

The Dysan 3¼" microfloppy is unlike the Sony or Hitachi disks. The Dysan appears more like a shrunken 5¼" or 8" floppy.

All three microfloppies, however, have metal hub rings, an improvement over their larger ancestors. Since the disk drive spindle does not directly grip the media, the holes are virtually immune to wear. And what is perhaps more important, the metal hubs have special holes or nubs which securely anchor the disk to the drive spindle and center it more accurately and consistently. This is vital because recording densities are much greater, so there is less tolerance for mistracking.

Thanks to the denser recording, all the new microfloppies can store about as much information as most 5¼" or even 8" disks. Sony's microfloppy crams 437.5K (unformatted) on a single side of a double density disk, which means a double-sided version would approach a megabyte. It also revolves at 600 rpm, twice as fast as larger disks, which yields faster data transfer (*throughput*) and shorter access times. But these characteristics also make the Sony microfloppy less compatible with existing computers.

On the other hand, Hitachi decided to go with less capacity and greater compatibility. Amdek's Hitachi-standard microfloppy stores 250K (unformatted) on one side of its smaller 3" disk, or 500K (half a megabyte) per double-sided disk. It also spins at 300 rpm and is easier to interface to existing machines since it adheres to the 5¼" Shugart standard. In other words, the microfloppy appears to the computer as an ordinary minifloppy drive.

Amdek is selling a dual microfloppy drive, the Amdisk 3, which attaches to an IBM Personal Computer or TRS-80, at only $749 retail. The Amdisk 3 also works with Atari and Apple computers with an extra controller. Amdek also is introducing a single microfloppy drive for the Apple, with a built-in controller, that will sell for only $299. A similar unit is on the way for the Commodore 64.

At those prices, microfloppies already are more than competitive with minifloppies. The media price is a bit higher – $55 for a box of ten Amdek disks – but that should drop with greater production. Amdek's assistant sales manager, Jerry S. Benson, Jr., says his firm is being flooded with inquiries.

"You wouldn't believe the kind of questions we're getting over here," says Benson. "We get calls from people who want to know if they can hook up our $750 dual microdrives to their $99 Sinclairs.

"We've also got a lot of interest from people who are designing portable computers, because they really have to go with the microfloppy technology," he adds. "It also greatly simplifies their design considerations, because we just tell them the microdrive works with a standard Shugart

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Exterminator **By Ken Grant**
Just about as action-packed and complex as is nufisically possible in your standard 5K VIC 20. This extremely well-written, machine code game is invariably praised by customers and has been called the second best tape game made for the VIC of 1982 (oh, no, not by us, we don't agree with that opinion). Rapidfire from the bottom of the screen at moving insects and creatures . . . anything that moves, and even anything that doesn't. Just don't be overrun by any or all. It's as much fun the hundredth time you play it as it was the first. This game plays stick or key and runs in standard 5K VIC 20.

3-D Man Not just another eat-the-dots-in-a-maze game, this! Though you find yourself in an edible dot-littered floor plan that may seem vaguely familiar, we guarantee you have never looked at it from this perspective (eye level) before. The dots diminish into the distance as you race down a hallway eating them one after the other. The dot-remaining counter on the right clicks downward. Race through a 4-way intersection and whoops! Head to head with one of the ghosts that haunt these halls! Back quickly on the stick puts you facing the dotless hall you just cleaned out when . . . another ghost! A quick left turn into that junction saves you, but in the confusion you've lost direction momentarily and must check the miniature radar plotting screen to set things straight. . . . Definitely, an ordinary maze game this one is *not*. 3-D Man requires a joystick and at least 3K extra memory.

Racefun Extensive use of multi-color character graphic capabilities of the VIC make this game very appealing to the eye. Fast all-machine language action, quick response to the stick or keyboard-controlled throttle, combine with the challenge of driving in ever-faster traffic to make it appeal to the rest of the body. Plays joystick or keyboard.

Antimatter Splatter! A more dastardly alien could scarcely be found than one who would wipe out an entire civilization by dropping anti-matter anti-canisters, right? If your opinion of this alien troublemaker is the same as ours, probably your first thought was, get some matter! We say calm down! All is not lost. A mobile rapid splatter cannon capable of both breaking through his standard alien moving force fields and laying waste to the ever-increasing number of anti-canisters is even now hovering above us. If only our cannoneer hadn't called in sick...say, what are you doing today? *Anti-Matter Splatter* is 100% machine language and runs in standard 5K VIC.

Defender on Tri As pilot of the experimental Defender-style ship "Skyes Limited," you are the only hope for an advance party of scientists trapped in ancient alien sphere which suddenly (heat from collision course with sun presumably—G.E.) came to life. Four screens worth of unique defenses, on-off shields, fuel deposits, alien treasures, running timer, energy, score and very nice graphics display make this one that does not quickly wax old. *Defender on TRI* requires at least 3K memory expander, but will run with any memory add-on (8K, 16K, 24K, etc.) we have come across.

Alien Panic Standard 5K VIC 20/combination stick & keyboard. This arcade-type game pits you against time and an alien on a six level construction sight with ladders and pitfalls, but *not to worry!* You have a shovel.

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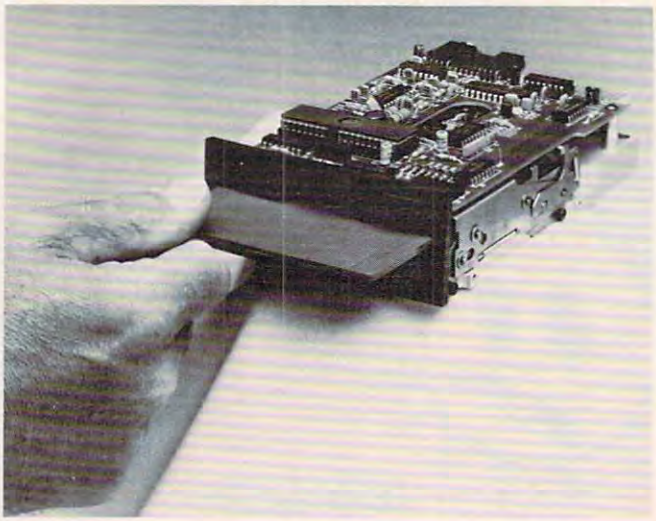

Tandon's 3½" microfloppy disk drive, the TM35, stores 875K per disk. It adheres to the Sony microfloppy standard.

strip and they automatically know what we're talking about."

A $100 ZX Microdrive

Like the Hitachi/Amdek, Dysan's 3¼" microfloppy also spins at 300 rpm, but manages to pack even more data than the Sony – 500K per side, or one megabyte per disk. And an even more exciting development is on its way from Great Britain: Sinclair's ZX Microdrive, which does not conform to any of the aforementioned systems. Although this still-unseen palm-sized disk drive stores only 100K per disk, Sinclair claims it will transfer data at 16K per second and sell for about $100. How could it be so inexpensive? One rumor has it that the ZX Microdrive is a sequential access device, like a tape drive. Whatever its secret, the ZX Microdrive should appear, at least overseas, sometime this year.

Obviously, there is no storage penalty for switching from mini- to microfloppy. In fact, most people will gain capacity. And if the drives cost about the same (Tandon Magnetics is selling both size drives at a manufacturer's cost of $200-$225), then what's left to stop the microfloppy revolution?

Software, for one thing. If commercial software is hard to get on microfloppies, it will seriously affect their popularity. Amdek's Benson points out that programs such as *VisiCalc* will have to be readily available before microfloppies really take off. The smart companies are already courting the major software producers.

And, of course, the ever-present standards battle will slow things for awhile. Many software producers and computer manufacturers may decide to wait until a clear winner emerges. Still, it seems likely that microfloppies will be the dominant mass storage device on personal microcomputers within a couple of years.

Making Magnets Stand At Attention

Meanwhile, even greater developments in recording are on the way which will advance mass storage technology by quantum leaps.

The one which is most promising, or at least the most impending, is known as *vertical* or *perpendicular* recording. This is a method of magnetic recording which will dramatically increase the amount of information that can be stored on a small disk. How does a five-megabyte *micro*floppy grab you?

The secret is in the way the microscopic particles are aligned on the magnetic surface of the disk. Conventional recording stores information by aligning the particles horizontally, end-to-end. Vertical recording aligns them – well, vertically. It's sort of like the difference between a line of people lying on the ground head-to-toe, or standing upright. Naturally, you can get a lot more people into a room if they're standing up.

That five-meg microfloppy is a bit down the road, but preliminary results are already impressive enough. Clark Johnson, president of Vertimag Systems, a small company in Minneapolis, Minnesota, says he has a working prototype of a five-meg 5¼" minifloppy. Actually, Johnson says, a microfloppy would work even better, because the smaller disks are less affected by temperature and humidity changes and are thus more reliable for vertical recording.

"A minifloppy is a sub-optimal application for this technology because it's limited to 96 tracks per inch for mechanical reasons," says Johnson. "The plastic shrinks and expands too much, and all the tolerances are too sloppy."

Vertical recording requires a special magnetic coating on the disk, one that tends to magnetize vertically. Johnson is using a two-layer coating. The first is a half-micron-thick layer of nickel-iron permalloy, and the second is a cobalt-chromium alloy. The disks are actually easier to make than conventional disks, he says, because the coating is much thicker and therefore easier to apply. Although the coating is more expensive to make, he contends that vertical recording disk drives will be more than competitive with conventional drives – especially if measured in terms of dollars per megabyte.

"It really doesn't cost that much more. In fact, the machine doesn't cost *any* more. The media costs more – maybe two to three times more – but it also stores more, and the price will come down.

Johnson expects to have vertical recording drives in production by mid-1984. Oddly, he doesn't have much competition, at least in the U.S. "Almost none," he marvels. "Only the Japanese. And they're no threat to us because the

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market is so huge and we're just about the only U.S. company working on this thing. Very few people know about us at all. We're kind of just at the end of a line of a string out here, just doing our thing."

Dennis Speliotis, whose Massachusetts consulting firm, Advanced Development Corp., is very active in vertical recording, says that only three or four small companies in the U.S. are exclusively working on the new technique despite "tremendous" interest. A few large firms, such as Control Data, 3-M, IBM, and Univac, also are reportedly interested, but none are as active as the Japanese. Toshiba has announced a vertical-recording floppy system, but it probably won't reach the market until late 1983 or 1984. Speliotis expects the first systems will use 5¼" minifloppies, shifting later to microfloppies. The more stable smaller disks can easily hold 200 tracks per inch, he says, more than twice what Johnson says is possible with the larger minifloppies.

A Laser In Your Disk Drive

Another new technology that has a devoted following is *optical recording*. This system dispenses with magnetics altogether and uses lasers to write information on disks and read it back. Proponents maintain that optical recording is more reliable than extremely dense magnetic recording, and is more *archival* (better able to store information safely for long periods).

Research is taking several paths, but the essence of optical recording is coating a disk with a heat- or light-sensitive material, burning in the "bits" of data with a laser, and then reading it back by scanning with another laser. This is similar to home videodisc systems that use lasers. A big advantage is that since the read/write head does not rub the media – as floppy disk drives do – the disks can last much longer.

Right now one of the problems holding back optical recording is the formulation of a coating that can withstand repeated writing and erasures. Magnetic media can be written to, erased, and rewritten hundreds of times. Since optical recording uses a laser's heat to "evaporate" tiny bits of material, the process is hard to reverse over and over again.

Some proponents of magnetic recording contend that, barring a breakthrough, optical recording cannot achieve the densities of magnetic recording. Currently, optical recording is pushing against a diffraction limit which is approximately the wavelength of the laser's light – .75 to one micron. This means a limit of about 25,000 bits per inch. This is large when compared to current magnetic densities; the Sony double-density microfloppy records 7610 bpi.

But Vertimag's prototype vertical minifloppy already packs 36,000 bpi, and Johnson expects 100,000 bpi in five years. And reportedly, some U.S. researchers who toured Japanese laboratories saw vertical recording under carefully controlled conditions which approached 440,000 bpi. Of course, the chances of errors or defects at these high densities are also much greater.

Although the magnetic versus optical question is being fiercely debated, the prevailing opinion seems to be that magnetics will dominate reusable recording for the foreseeable future, and that optical recording will be used where archival storage is more important than frequent writing, erasing, and rewriting.

Superminimicrofloppy?

Even more advanced technologies are being played with in the laboratories. Speliotis, the vertical recording consultant, says the Japanese are experimenting with something called *magneto-optics*. This seems to be an attempt to wed magnetic and optical technologies. A laser is used to affect a magnetic coating with heat; somehow, the intense heat alters the magnetic properties. Since the read/write head would be a laser, disk wear could be dramatically reduced. But Speliotis says the system is still stuck with the same diffraction limits as optical recording.

Getting back to magnetics: now that we've seen full-sized floppies reduced to minifloppies reduced to microfloppies, will we see something even smaller? Tintle, the general manager of Sony Data Products, responds to this question by pointing out that Sony is preparing to market an electronic camera, the Mavica, that dispenses with film and records photographic images on a tiny, two inch magnetic disk. The disk and disk drive is so small that it fits in the back of the camera – which is about the size of a 35-millimeter single-lens reflex. Could we someday be using a superminimicrofloppy for computer mass storage?

"There's always that possibility," he says. ©

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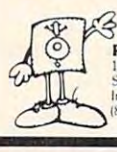

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Atari's New Top-Line Home Computer

Tom R. Halfhill, Features Editor

Atari, Inc., enters the new-computer sweepstakes with a high-end home model that improves on the Atari 800 while retaining full compatibility. A new series of peripherals rounds out the Atari line.

Let's get the catch-phrases out of the way first: "1200XL," "64K," "software/hardware compatible," "under $1000."

There. With that off our chests, we can sit back and take a closer look at Atari's new entry into the high-end home market.

Mindful of the growing competition, Atari took pains not to share too much of the spotlight. Knowing that competitors were unveiling several other new home computers at January's Consumer Electronics Show in Las Vegas (see coverage elsewhere in this issue), Atari beat them to the publicity punch. The Atari 1200XL was announced at an early December press conference in New York.

What's the 1200XL like? Very much like an Atari 800. Basically, the new machine is an upgraded version of Atari's former top-line model, the 800 (which is not being dropped, according to the latest word from Atari).

Inside, the Atari 1200XL comes with 64K of memory, unexpandable, just like the machine it most likely will be compared to, the Commodore 64. Like the 64, the 1200XL actually has much less Random Access Memory (RAM) available for BASIC language programming, after overhead for the Operating System, BASIC, and screen memory is subtracted. Both computers are "64K" machines in the sense that they can address a total of 64K memory. The 1200XL's Central Processing Unit is a 6502 microprocessor chip – the same as in the 400/800, and functionally identical to the 6510 chip in the 64.

A Friendlier Keyboard

As you can see from the photo, the most obvious changes are cosmetic. The 1200XL's sleek, low-profile case is remarkably similar to an Apple II's, right down to the mock vent slots in the sides. The 1200XL, though, has a polished metal frontpiece around the keyboard. Atari devotees also will notice some interesting changes in the keyboard.

First, the four console keys found to the right of the keyboard on the Atari 400/800 – START, SELECT, OPTION, and SYSTEM RESET – have been moved above the keyboard and recessed into the case. They have been joined by four new programmable function keys – F1 through F4 – a HELP key, the inverse video key, and the BREAK key formerly found in the upper right corner of the keyboard.

The HELP key serves two purposes. With certain programs, it will call up instructions for baffled users. It also runs diagnostic tests on the computer's memory, audio/video and keyboard systems, and verifies that all external wiring connections are intact.

The new function keys also add some features. The keyboard can be shifted into a European character set (from the regular graphics set) with special symbols for currency and grammar. Another key disables the entire keyboard so that programs which are running cannot be interrupted by accidental keystrokes. Still another key shuts off the screen to prevent permanently "burning in" the image on the TV when the computer is left unattended for long periods. This is like the 400/800's automatic "attract mode" which constantly changes the screen colors if no keys have been pressed for a few minutes.

Two additional lights, labeled L1 and L2, located near the new power indicator, show if the keyboard-disabling function or European character set have been selected.

The main keyboard layout has also been improved. Both SHIFT keys are now extra-wide, and the inverse video key (also known as the "Atari logo key") has been moved away from its bothersome position next to the right SHIFT key – no more accidental inverse video when reaching for SHIFT. The CONTROL, TAB, ESCape, CAPS, and DELETE BACK SPACE keys have been

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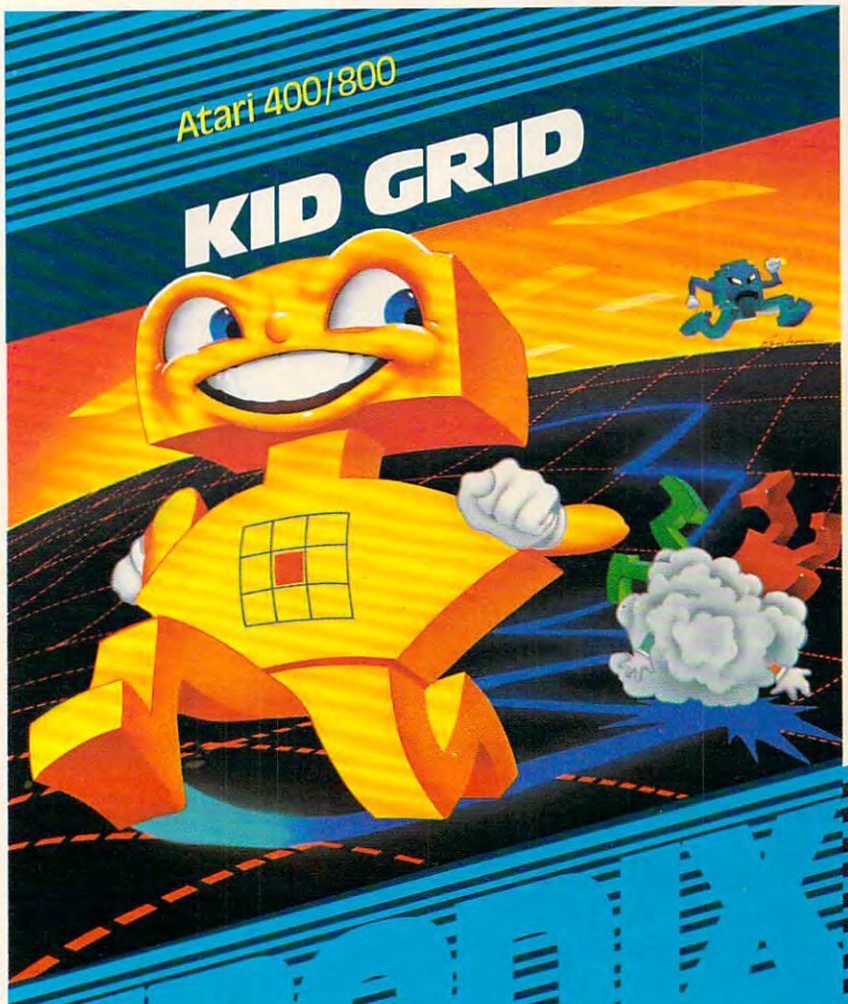

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widened, the last one extending over the spot vacated by the old BREAK key. The cursor-control keys now work without pressing CONTROL, although this isn't apparent by looking at the keyboard.

Another interesting keyboard change that will be immediately noticed by Atari veterans is the absence of the usual "beep" when a key is pressed. But the controversial little beep is not entirely gone. Instead, it now emanates from the TV speaker, so at least it can be turned down, or off altogether.

One Cartridge, Two Joysticks

The cartridge slot – notice the singular – has been moved from beneath the top hatch of the 400/800 to the left side of the 1200XL. It is no longer necessary to open a door to plug in ROM cartridges. Atari apparently elected for just one ROM slot on the 1200XL because only one cartridge has ever been marketed for the 800's extra right slot – and that cartridge is not made by Atari.

Atari also moved the controller ports from the front to the left side, and reduced their number from four to two. This means you can plug in only two joysticks instead of four, and four paddles instead of eight. Atari is silent on its rationale for this move. Some of Atari's own games (e.g., *Asteroids*) are designed for up to four joysticks.

Like the Atari 800, the 1200XL works with either a TV or video monitor. Like the GTIA-equipped 400/800, the 1200XL displays up to 256 colors. On the audio side, there are still four sound channels as found on the older models.

Atari is promising delivery of the 1200XL late in the first quarter of 1983.

Color Printing And Plotting

Atari also has introduced a new line of peripherals designed to match the new computer. They will also work with the 400/800. In addition, the peripherals have built-in interfaces for the 1200XL, so the new computer does not need the 850 Interface Module.

There's the Model 1010 Program Recorder, a repackaged 410 Recorder that will retail for $99.95; the Model 1025 80-column dot-matrix printer, a 40-character per second device that accepts fan-fold tractor paper, single sheets, or rolls, $549; and the Model 1020 40-column color printer/plotter.

This interesting peripheral prints four-color text and graphics on 4½" wide paper. Under program control, it can draw to any set of X and Y coordinates, and change the size and typeface of text. The rotary print head accepts four snap-in pens available in 16 colors. The printer/plotter will retail for $299.

All the peripherals are promised for delivery in March and April. Atari also is hinting that a redesigned disk drive is on the way.

E. T. Phone Home!

Besides all the new hardware, Atari has also introduced some new software with the 1200XL. The Programmer, Communicator, and Entertainer Kits have been updated and joined by a new package, the Home Manager Kit. This includes two disk-based programs, *Family Finances* and *The Home Filing Manager*. (Prices not yet available.)

New games include *E.T. Phone Home!*, adapted from the film (no price yet); and *Dig Dug*, *Galaxian*, *Defender*, and *Qix*, all home versions of the arcade games ($44.95 each). *Juggle's Rainbow* and *Juggle's House* are the first two programs in a new Early Learning Series ($29.95 each). Additions to Atari's line of home management/personal development software are *Family Finances*, a two-disk package ($49.95); *Timewise*, an electronic calendar ($29.95); *Atari Writer*, a cartridge word processor that can save text to disk or cassette ($79.95); and *Atari Music 1*, a music-theory teacher aimed at third-graders to adults, the first in a new series of Music Learning Software (no price yet).

All the software is promised for delivery throughout the first quarter of 1983. ©

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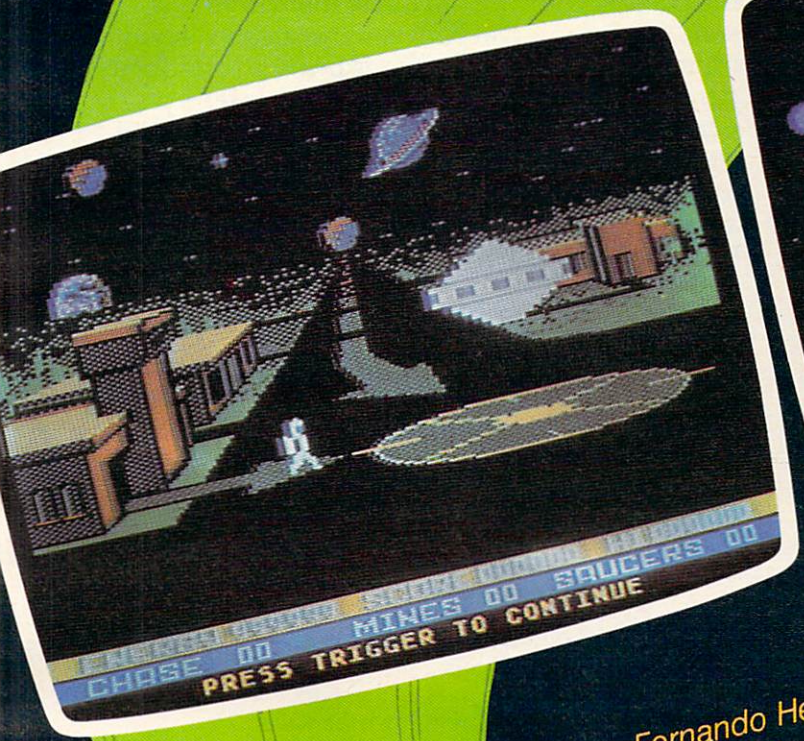

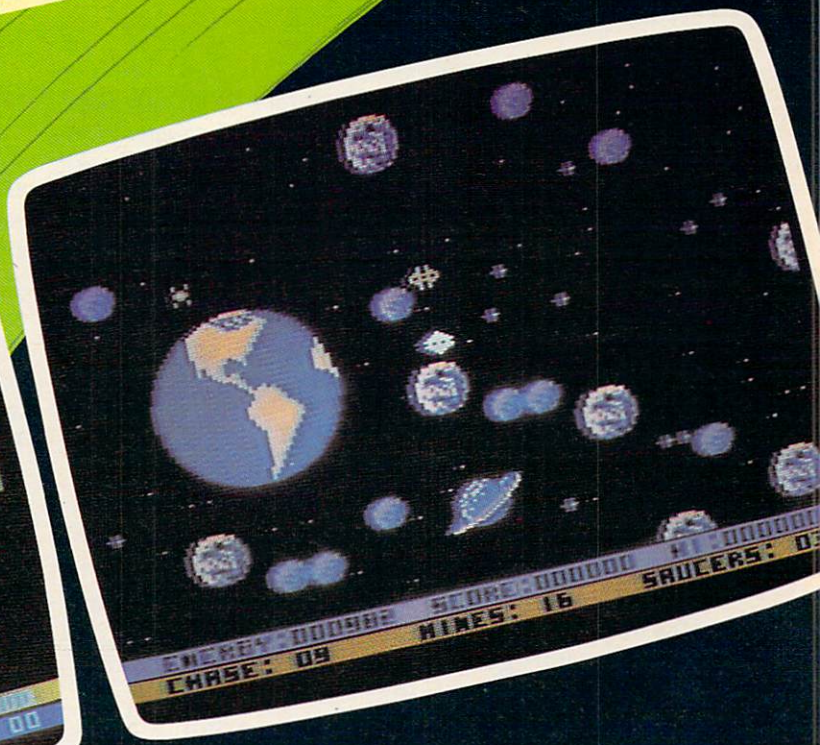

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Closeout

L L Beh

"Closeout" has been tested by 30 people, aged 5 to 55, for over four months. Many claim that they enjoy this game even more than popular commercial games. Written originally for Atari computers with 16K of memory, it has been translated to also work on a VIC with any amount of memory.

This program just fits into a 16K Atari. Almost all lines contain multiple statements, so make no alterations unless you have a bigger machine.

Scrambling For Bargains

Here's how you play the Atari version (VIC-20 owners should refer to the "VIC Notes"):

There's a huge sale going on at a local department store. You arrive at the multi-story building hungry for bargains. Boldly, you enter the store and look around – and see bargains galore. A real sale! You start gathering up sale items, but then become aware of a strange group of shoppers. Wherever you go, they follow you around. Soon you learn their true intentions – they are out to stop you at all costs, so they can have the store to themselves. What's worse, they're armed with ray guns from the Toy Department and modified to work!

The object of "Closeout" is to snatch up as many sale items as possible while evading the hostile bargain hunters. Don't let them get too close, because they'll either capture you or shoot you. Some of them can shoot farther than others. You can shoot back with the slingshot you bought in the Sporting Goods Department (50 percent off), but since slingshots require two hands to shoot, you must drop 25 sale items each time you use it.

You have only one chance and about three minutes of play. Extra time is awarded for higher scores. The remaining time is indicated on the left, and colors change as time runs out (there can be up to nine different colors on the screen at a time). When your score surpasses 25 points, you can shoot your slingshot, but remember, it costs you 25 points. You can only shoot horizontally, by aiming the joystick and pressing the fire button. The best strategy is to shoot only when cornered.

After you have typed in the program, save it twice on disk or tape, then type RUN. There will be a short initialization pause, and the screen will clear to GRAPHICS 7. The four players will appear, and the floors and stairways will be drawn. Short instructions will appear. Plug your joystick into port one. Press the fire button to start.

Your shopper is on the ground floor in the bottom left corner. Use the joystick to move left and right, or up and down stairs. You must be directly under the stairs to use them, and to exit onto a floor you must be standing exactly on it.

The program might run faster on U.S. Ataris than on my New Zealand model. The game for Atari is based on an idea in "P/M Graphics Made Easy" (**COMPUTE!**, February 1982) which animates the players with vertical blank interrupts (the split-second interval between the display of video frames). American televisions use the NTSC standard, which allows 60 vertical blank interrupts per second, while New Zealand's PAL standard allows only 50. On the other hand, the 6502 Central Processing Unit chip in our Ataris is clocked at three megahertz, as opposed to 1.8 MHz in U.S. Ataris, so the two factors might cancel each other out.

Good luck! I'd like to know who can better my score of 1200 points.

Since I omitted REM statements from the program to save space, here is a short explanation of the Atari version:

Line No.	Comments
10	Initializes. Jumps to line 209 to POKE in the P/M utility and player shapes, then to line 112 to wait for the trigger to be pressed to start the game. These jumps keep the lower numbered lines free for frequently accessed statements.
20-23	Check for your moves up the stairs.
30-33	Check for your moves down the stairs.
37-44	Check for enemy movement on the left stairs.
55-59	Check for enemy movement on the right stairs and also give the enemy some brainpower.
60-65	Check for enemy movement on the middle stairs.
73-76	Reading of joystick one (second slot from left) to determine your moves. Change this reading here and at two other locations if you want to use any other slot for the game.
78	Uses BASIC LOCATE statement to determine points scored.
79	If the sale items run low, draw some more.
80-82	Determine movement of Player 2 – Enemy No. 1.
84-86	Determine movement of Player 3 – Enemy No. 2.
87-89	Determine movement of Player 4 – Enemy No. 3.
90	Checks if you can shoot.
93-95	Check to see if you are in the enemy shooting range. Note: some enemies can shoot farther than others.
96	Game timekeeper.
97	Go back to start of loop.
100-101	Draw dots – sale items.
105-108	Draw time bar graph and erase the portion of time that has run out; also award extra time for high scores.
109-114	You got shot! So these lines get you off the visible side of the screen, and you wait for the trigger to be pressed to start a new game.
209	Only simple constants and variables are used in the program. These constants and variables are used all

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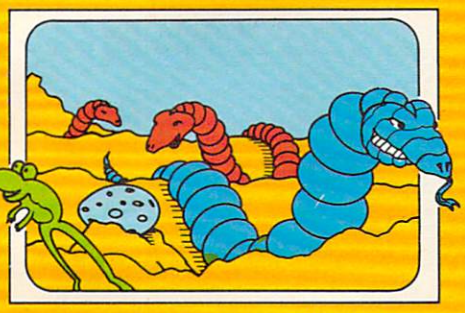
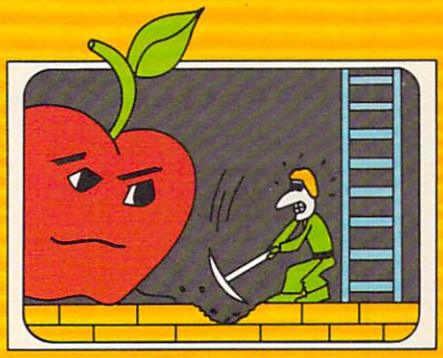
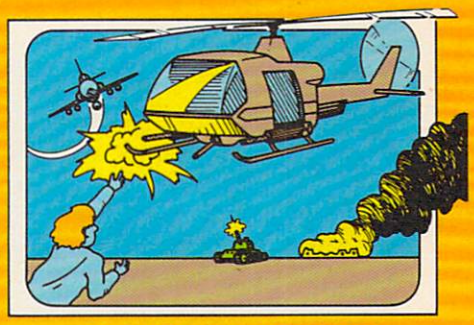
VIC-20 ?



SERPENTINE



APPLE PANIC



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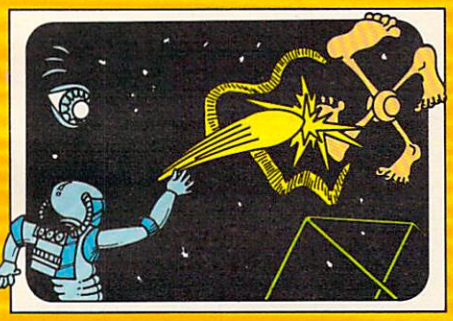

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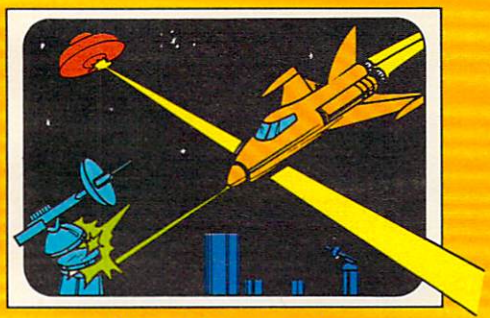
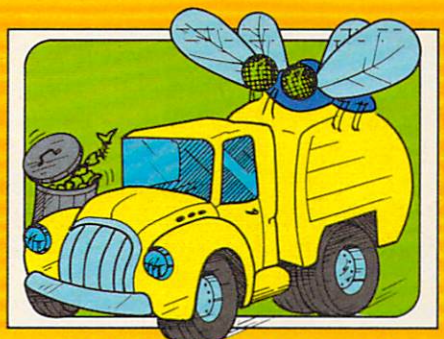
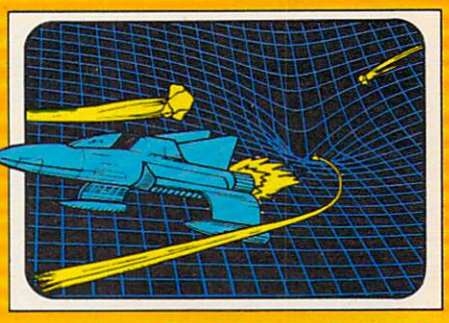


ASTROBLITZ



TRASHMAN



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over the place to conserve RAM; they are also used for the line numbers. These make the program look very untidy, but this is the only way I can get this program to run on my 16K Atari.

210-215 POKE the P/M utility and players' shapes and colors into RAM.

216-225 Constants and variables for the stairs and building levels; draw it out in Graphics 7.

230 Data for P/M graphics utility as presented in **COMPUTE!** (February 1982).

236-237 Last eight DATAs in line 236 and all of line 237 are for the P/M shapes. Change these if you like different shapes.

VIC-20 Notes

Charles Brannon, Editorial Assistant

The VIC-20 version of Closeout, like the Atari version, uses almost all the memory that the unexpanded 5K VIC can offer. Don't enter any extra spaces or semicolons. It will run on any size VIC. "Floating" memory is handled in lines 180 and 190. Instead of using TX=7680, the start of text memory on a 5K VIC, the formula in line 180 will return the proper address for any VIC. For more information on POKEing the screen, see "The Window" (*Home and Educational Computing!*, Fall 1981, or *COMPUTE!'s First Book Of VIC*).

Playing VIC-20 Closeout

Using the I,J,K,M keys (I=up, M=down, J=left, K=right) move yourself (represented by the "pi" symbol) around the department store, avoiding the rapacious bargain hunters who mercilessly pursue you. Pick up the various sale items by moving your character over the colored dots. You can ascend and descend escalators to move from floor to floor. If a fellow shopper gets too aggressive, you can deliver a shove that will send him reeling back to the top floor. You start out with three shoves, and you get two more every time you acquire 120 sale items (at which point you move on to a whole new store). Press SPACE to deliver a shove, but be careful not to run out of them. You cannot use your shoves while you're on an escalator. Unlike the Atari version, you have no time limit to worry about.

Special Techniques

In an attempt to get the most speed from a BASIC program while using the least amount of memory, there are several tricks here that may be useful to VIC programmers. First, variables replace much-used constants. For example, the number 22 (number of characters per line) is used extensively in the screen POKE statements. Initially setting Q=22 at the start of the program lets me substitute Q for the constant 22. Aside from the convenience of this, using variables is much faster. Instead of converting the characters "22" to the floating point equivalent, the computer only has to look up the value of Q. It seems trivial, but judicious use of variables can significantly speed up your programs. Also note that the letter "O" is used instead of zero in some places for the same reason.

Artificial Intelligence?

A game like this is the perfect opportunity to fiddle with artificial intelligence. When you write a routine that makes a character chase another, you've simulated a simple animal's "instincts," or predetermined behavior.

The crazed shoppers in Closeout must know how to home in on you. Their behavior must include the ability to get on and off the escalators. One thing you should watch out for when writing games like this is predictability. If your "intelligence" subroutine is too good, your creatures will accurately home in on the victim, but they will act in predictable ways. Sometimes it helps to stir a little randomness in with the RND function (we humans call such "careful" randomness *creativity*).

Since all three pursuers use the same "intelligence" algorithm, we've just created "mini-arrays" that hold important variables for each character: the X and Y position, the character used, the current direction, and the character "underneath" the pursuer. To move a character non-destructively, you have to save and restore the background characters. The routine can move any of the three chasers according to E, the "Enemy index." To create the illusion of simultaneous motion without slowing down the player too much, only one chaser can move for every move the player makes.

Enhancements

If you have more than the normal 5K RAM memory in your VIC, you might want to make some enhancements to the game. You could add: custom characters, improved sound effects, and more pursuers.

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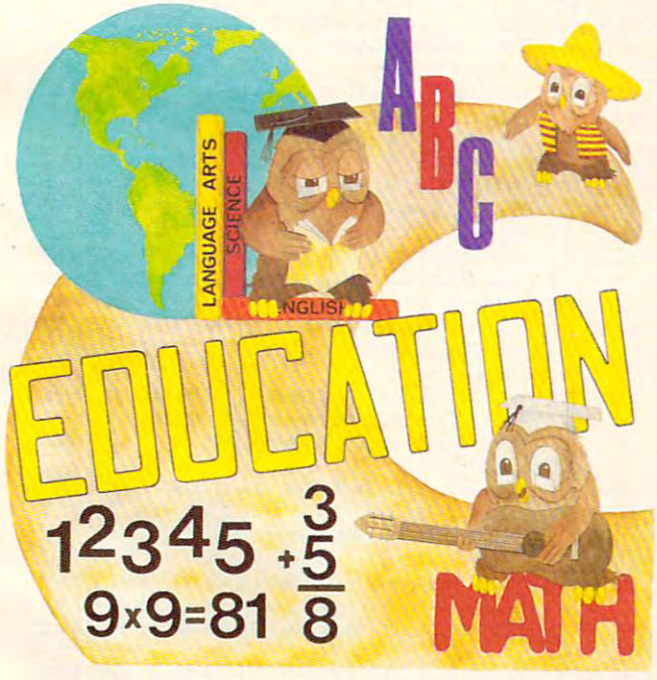

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Program 1: Atari Version

```
10 GRAPHICS 7:SETCOLOR 2,0,0:POKE 752
   ,1:? "CLOSEOUT!":GOSUB 209:GOSUB 1
   12:Y1=181:GOTO C
20 IF X1=J THEN IF Y1>A AND Y1<=B OR
   Y1>C AND Y1<=D OR Y1>E AND Y1<=I T
   HEN Y1=Y1-3:RETURN
21 IF X1=L THEN IF Y1>A AND Y1<=E OR
   Y1>F AND Y1<=I THEN Y1=Y1-3:RETURN

22 IF X1=K THEN IF Y1>A AND Y1<=G THE
   N Y1=Y1-3:RETURN
23 RETURN
30 IF X1=J THEN IF Y1>=A AND Y1<B OR
   Y1>=C AND Y1<D OR Y1>=E AND Y1<I T
   HEN Y1=Y1+3:RETURN
31 IF X1=K THEN IF Y1>=A AND Y1<G THE
   N Y1=Y1+3:RETURN
32 IF X1=L THEN IF Y1>=A AND Y1<E OR
   Y1>=F AND Y1<I THEN Y1=Y1+3
33 RETURN
37 IF Y5=I OR Y5=H OR Y5=G OR Y5=F OR
    Y5=E OR Y5=D OR Y5=C OR Y5=B OR Y
   5=A THEN GOSUB 42:RETURN
41 RETURN
42 Z=INT(RND(0)*3):IF Z=0 THEN IF Y5=
   I OR Y5=H OR Y5=G OR Y5=F OR Y5=D
   OR Y5=B THEN X9=0:Y9=-3:RETURN
43 IF Z=1 THEN IF Y5=A OR Y5=C OR Y5=
   E OR Y5=F OR Y5=G OR Y5=H THEN X9=
   0:Y9=3:RETURN
44 X9=4:Y9=0:RETURN
55 IF Y5=I OR Y5=H OR Y5=G OR Y5=F OR
    Y5=E OR Y5=D OR Y5=C OR Y5=B OR Y
   5=A THEN GOSUB 57
56 RETURN
57 IF Y5>Y1 THEN IF Y5=B OR Y5=C OR Y
   5=D OR Y5=E OR Y5=G OR Y5=H OR Y5=
   I THEN X9=0:Y9=-3:RETURN
58 IF Y5<Y1 THEN IF Y5=A OR Y5=B OR Y
   5=C OR Y5=D OR Y5=F OR Y5=G OR Y5=
   H THEN X9=0:Y9=3:RETURN
59 X9=-4:Y9=0:RETURN
60 IF Y5=G OR Y5=F OR Y5=E OR Y5=D OR
    Y5=C OR Y5=B OR Y5=A THEN GOSUB 6
   2
61 RETURN
62 Z=INT(RND(0)*4):IF Z=0 THEN IF Y5=
   E OR Y5=F OR Y5=D OR Y5=C OR Y5=B
   OR Y5=A THEN X9=0:Y9=3:RETURN
63 IF Z=1 THEN IF Y5=B OR Y5=C OR Y5=
   D OR Y5=E OR Y5=G OR Y5=F THEN X9=
   0:Y9=-3:RETURN
64 IF Z=2 THEN X9=-4:Y9=0:RETURN
65 X9=4:Y9=0:RETURN
73 S=STICK(0):IF S=14 OR S=10 OR S=6
   THEN GOSUB 20
74 IF S=13 OR S=9 OR S=5 THEN GOSUB 3
   0
75 IF S=7 AND X1<L THEN IF Y1=A OR Y1
   =B OR Y1=C OR Y1=D OR Y1=E OR Y1=F
    OR Y1=G OR Y1=H OR Y1=I THEN X1=X
   1+4
76 IF S=11 AND X1>J THEN IF Y1=A OR Y
   1=B OR Y1=C OR Y1=D OR Y1=E OR Y1=
   F OR Y1=G OR Y1=H OR Y1=I THEN X1=
   X1-4
78 Q=X1-42:R=(Y1-25)/2:LOCATE Q,R,Z:I
   F Z=1 THEN COLOR 4:PLOT Q,R:T=T+1:
   T1=T1+1:? "SALE ITEMS=";:? T
79 IF T1>T2 THEN GOSUB 100
80 POKE 77,0:POKE M,X1:POKE N,Y1:SOUN
   D 0,Y1,10,7:IF X2=J THEN Y5=Y2:X9=
   X7:Y9=Y7:GOSUB A:X7=X9:Y7=Y9
81 IF X2=K THEN Y5=Y2:X9=X7:Y9=Y7:GOS
   UB 60:X7=X9:Y7=Y9
82 IF X2=L THEN Y5=Y2:X9=X7:Y9=Y7:GOS
   UB B:X7=X9:Y7=Y9
84 X2=X2+X7:Y2=Y2+Y7:POKE M+1,X2:POKE
    N+1,Y2:IF X3=J THEN Y5=Y3:X9=X8:Y
   9=Y8:GOSUB A:X8=X9:Y8=Y9
85 IF X3=K THEN Y5=Y3:X9=X8:Y9=Y8:GOS
   UB 60:X8=X9:Y8=Y9
86 IF X3=L THEN Y5=Y3:X9=X8:Y9=Y8:GOS
   UB B:X8=X9:Y8=Y9
87 X3=X3+X8:Y3=Y3+Y8:POKE M+2,X3:POKE
    N+2,Y3:IF X4=J THEN Y5=Y4:X9=X6:Y
   9=Y6:GOSUB A:X6=X9:Y6=Y9
88 SOUND 0,0,0,0:IF X4=K THEN Y5=Y4:X
   9=X6:Y9=Y6:GOSUB 60:X6=X9:Y6=Y9
89 IF X4=L THEN Y5=Y4:X9=X6:Y9=Y6:GOS
   UB B:X6=X9:Y6=Y9
90 X4=X4+X6:Y4=Y4+Y6:POKE M+3,X4:POKE
    N+3,Y4:IF STRIG(0)=0 AND T>25 THE
   N IF Y1=Y2 OR Y1=Y3 OR Y1=Y4 THEN
   GOSUB H
93 IF Y1=Y2 AND 70>ABS(X1-X2) THEN U=
   X2-44:V=(Y2-31)/2:GOSUB E
94 IF Y1=Y3 AND 60>ABS(X1-X3) THEN U=
   X3-44:V=(Y3-31)/2:GOSUB E
95 IF Y1=Y4 AND 55>ABS(X1-X4) THEN U=
   X4-44:V=(Y4-31)/2:GOSUB E
96 IF PEEK(19)>A1 THEN GOSUB 105
97 GOTO C
100 SOUND 0,0,0,0:COLOR 1:SETCOLOR 0,
    C1,9
101 FOR Y=6 TO 79 STEP 9:FOR W=16 TO
    148 STEP 4:PLOT W,Y:NEXT W:NEXT Y
    :T1=0:RETURN
105 C1=INT(RND(0)*15):SETCOLOR 1,C1,8
    :COLOR 4:PLOT 0,V1:DRAWTO 3,V1:A1
    =A1+1:V1=V1+2:IF A1<>41 THEN RETU
    RN
106 IF T<T3 THEN GOSUB 112:RETURN
107 ? "EXTRA 3.5 MIN":T3=T3+T4:? "NEX
    T BONUS AT ";:? T3:T4=T4+100
108 COLOR 2:FOR Y=0 TO 78 STEP 2:PLOT
     0,Y:DRAWTO 3,Y:NEXT Y:A1=1:V1=0:
    POKE 19,0:POKE 20,0:RETURN
109 SOUND 0,2,6,15:COLOR 2:PLOT U,V:D
    RAWTO Q,R:POKE M,1:POKE N,247:COL
    OR 4:PLOT U,V:DRAWTO Q,R
112 SOUND 0,0,0,0:GOSUB 216:GOSUB 100
    :? :? "GAME OVER, SALES FOUND=";:
    ? T:T=0:? "To play-Press FIRE"
113 IF STRIG(0)<>0 THEN 113
114 ? "Extra TIME at 200":GOSUB 108:T
    =0:T3=200:T4=300:RETURN
163 W=0:T=T-25:? "SALE ITEMS=";:? T:I
    F Y1=Y2 THEN U=X2-44:V=(Y2-31)/2:
    I1=M+1:J1=N+1:GOSUB I:Y2=Z:X2=L:R
    ETURN
164 IF Y1=Y3 THEN U=X3-44:V=(Y3-31)/2
    :I1=M+2:J1=N+2:GOSUB I:Y3=Z:X3=L:
    RETURN
165 IF Y1=Y4 THEN U=X4-44:V=(Y4-31)/2
    :I1=M+3:J1=N+3:GOSUB I:Y4=Z:X4=L:
    RETURN
181 SOUND 0,1,6,15:COLOR 1:PLOT Q,R:D
    RAWTO U,V:COLOR 4:PLOT Q,R:DRAWTO
     U,V:SOUND 0,0,0,0:POKE I1,1:POKE
     J1,247
189 Z=V*2+67:IF Z=A OR Z=B OR Z=C OR
    Z=D OR Z=E OR Z=F OR Z=I OR Z=G T
    HEN GOSUB T2:RETURN
190 V=3:GOTO 189
209 A=37:B=55:C=73:D=91:E=109:F=127:G
    =145:H=163:I=181:J=54:K=126:L=198
    :M=53248:N=1780:O=1784:P=704:T2=2
    20
210 ? "Please wait":FOR Y=1536 TO 170
    6:READ Z:POKE Y,Z:NEXT Y:FOR Y=17
    74 TO 1787:POKE Y,0:NEXT Y:PM=PEE
    K(106)-32
211 PMBASE=256*PM:FOR Y=PMBASE+1023 T
    O PMBASE+2047:POKE Y,0:NEXT Y:FOR
     Y=PMBASE+1025 TO PMBASE+1032:REA
    D Z
212 POKE Y,Z:NEXT Y:FOR Y=PMBASE+1281
```


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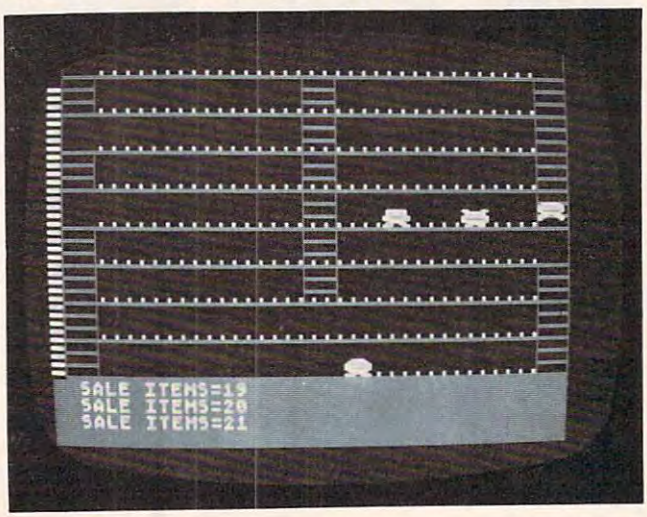
```
 TO PMBASE+1288:READ Z:POKE Y,Z:N
EXT Y:FOR Y=PMBASE+1537 TO PMBASE
+1544
213 READ Z:POKE Y,Z:NEXT Y:FOR Y=PMBA
SE+1793 TO PMBASE+1800:READ Z:POK
E Y,Z:NEXT Y:POKE P+2,76:POKE P+3
,204
214 POKE P,252:POKE P+1,140:POKE 559,
62:POKE 623,1:POKE 1788,PM+4:POKE
 53277,3:POKE 54279,PM:X=USR(1696
)
215 POKE 0,8:POKE 0+1,8:POKE 0+2,8:PO
KE 0+3,8:RETURN
216 X1=J:Y1=I:Y2=B:X2=62:Y3=E:X3=154:
Y4=6:X4=122:X6=4:Y6=0:X7=-4:Y7=0:
X8=-4:Y8=0
220 COLOR 3:SETCOLOR 2,15-C1,5:FOR Y=
7 TO 79 STEP 9:PLOT 4,Y:DRAWTO 15
9,Y:NEXT Y
221 PLOT 4,0:DRAWTO 4,79:PLOT 159,0:D
RAWTO 159,79:PLOT 149,79:DRAWTO 1
49,52:FOR Y=52 TO 79 STEP 3:PLOT
149,Y
222 DRAWTO 159,Y:NEXT Y:PLOT 14,79:DR
AWTO 14,43:FOR Y=43 TO 79 STEP 3:
PLOT 4,Y:DRAWTO 14,Y:NEXT Y:PLOT
149,43
223 DRAWTO 149,7:FOR Y=7 TO 43 STEP 3
:PLOT 149,Y:DRAWTO 159,Y:NEXT Y:P
LOT 14,7:DRAWTO 14,16:FOR Y=7 TO
16 STEP 3
224 PLOT 4,Y:DRAWTO 14,Y:NEXT Y:PLOT
77,7:DRAWTO 77,61:PLOT 87,7:DRAWT
O 87,61:FOR Y=7 TO 61 STEP 3
225 PLOT 77,Y:DRAWTO 87,Y:NEXT Y:PLOT
 14,25:DRAWTO 14,34:FOR Y=25 TO 3
4 STEP 3:PLOT 4,Y:DRAWTO 14,Y:NEX
T Y:RETURN
230 DATA 162,3,189,244,6,240,89,56,22
1,240,6,240,83,141,254,6,106,141,
255,6,142,253,6,24,169,0,109,253,
6,24,109
231 DATA 252,6,133,204,133,206,189,24
0,6,133,203,173,254,6,133,205,189
,248,6,170,232,46,255,6,144,16,16
8,177,203
232 DATA 145,205,169,0,145,203,136,20
2,208,244,76,87,6,160,0,177,203,1
45,205,169,0,145,203,200,202,208,
244,174
234 DATA 253,6,173,254,6,157,240,6,18
9,236,6,240,48,133,203,24,138,141
,253,6,109,235,6,133,204,24,173,2
53,6,109
235 DATA 252,6,133,206,189,240,6,133,
205,189,248,6,170,160,0,177,203,1
45,205,200,202,208,248,174,253,6,
169,0,157
236 DATA 236,6,202,48,3,76,2,6,76,98,
228,0,0,104,169,7,162,6,160,0,32,
92,228,96,60,126,219,255,195,126,
60,231
237 DATA 126,219,255,129,126,102,195,
129,195,126,90,255,129,255,60,102
,126,90,126,195,255,60,102,195
```



Snatching up sale items on the bottom floor while evading enemy shoppers in the Atari version of "Closeout."

Program 2: VIC-20 Version

```
100 REM VIC-20 CLOSEOUT
110 DIM EX%(2),EY%(2),EC%(2),EP%(2),PC%(2),DX%
    (2),DY%(2),SV%(21)
120 S1=36874:S3=S1+3:V=36878:POKES1,0:POKEV,0:
    S2=S1+1
130 R=0:PTS=0:SH=1:O=0:CD$=CHR$(19):FORI=1TO23
    :CD$=CD$+CHR$(17):NEXT
140 PRINTCHR$(147)CHR$(18)CHR$(156)"  CLOSEOUT
    "
150 R=R+1:PRINTCHR$(19)TAB(12)CHR$(30)"ROUND"R

160 SH=SH+2:GOSUB900
170 SC=36879:Q=22:M=0
180 TX=4*(PEEK(36866)AND128)+64*(PEEK(36869)AN
    D120)
190 COLOUR=37888+4*(PEEK(36866)AND128)
200 FORI=44TO65:POKETX+I,104:POKECO+I,6:NEXT
210 FORI=88TO400STEP44
220 FORJ=ITOI+21
230 POKETX+J,104:POKECO+J,6
240 POKETX+J-Q,46:POKECO+J-Q,6*RND(0)+2
250 NEXT:NEXT
260 FORI=66TO378STEPQ:POKETX+I,64:POKECO+I,0:P
    OKETX+21+I,64:POKECO+21+I,0:NEXT
270 FORI=1TO10
280 SX=INT(7*RND(0))*3+3:SY=5+INT(6*RND(0))*2
290 LN=2+INT(3*RND(0))*2:IF SY+LN>18 THEN 290
300 FORJ=SY*QTO(SY+LN)*QSTEPQ
310 POKETX+SX+J,64:POKECO+SX+J,0
320 NEXT:NEXT
330 EX%(0)=1:EX%(1)=2:EX%(2)=3:FORI=0TO2:EY%(I
    )=3:NEXT
340 EC%(0)=65:EC%(1)=88:EC%(2)=81
350 DX%(0)=1:DX%(1)=1:DX%(2)=-1
360 FORI=0TO2:EP%(I)=46:PC%(I)=INT(6*RND(0)+2)
    :NEXT
370 PX=2:PY=17:PC=94:DX=0:DY=0:PK=32
380 GETA$:IFA$<>""THENB$=A$
390 IFB$=" "THENGOSUB800
400 IFB$="I"THENDY=-1:DX=0
410 IFB$="M"THENDY=1:DX=0
420 IFB$="J"THENDX=-1:DY=0
430 IFB$="K"THENDX=1:DY=0
440 CP=TX+PX+Q*PY
450 IFPK<>64ORPEEK(CP+Q*DY)=104THENDY=0
460 IFPEEK(CP+DX)=104THENDX=0:B$=""
470 POKE CP,PK:POKECO+CP-TX,CC
480 PX=PX+DX:PY=PY+DY
490 IFPX<0THENPX=0:B$="":DX=0
500 IFPX>21THENPX=21:B$="":DX=0
510 NP=TX+PX+Q*PY:CC=PEEK(CO+NP-TX)
520 PK=PEEK(NP):IFPK<>46ANDPK<>42THEN560
530 PTS=PTS+1:IFPK=42THENPTS=PTS+49
540 GOSUB980:PK=32:FORI=15TO0STEP-5:POKES3,255
    -I:POKEV,I:NEXT:POKES3,0
550 M=M+1:IFM=120THEN140
560 IFPK=EC%(0)ORPC=EC%(1)ORPK=EC%(2)THEN730
570 POKENP,PC:POKECO+PX+Q*PY,2
580 E=-(E+1)*(E<2)
590 EX=EX%(E):EY=EY%(E):EC=EC%(E):XX=DX%(E):YY
    =DY%(E):EP=EP%(E):C=PC%(E)
600 POKETX+EX+Q*EY,EP:POKECO+EX+Q*EY,C
610 CP=TX+EX+Q*EY
620 IF(PEEK(CP-Q)=64ORPEEK(CP+Q)=64)ANDRND(1)>
    .1THENXX=0:YY=SGN(PY-EY)
630 IFPEEK(CP+YY*Q)=104OR(EY=PYANDEY/2<>INT(EY
```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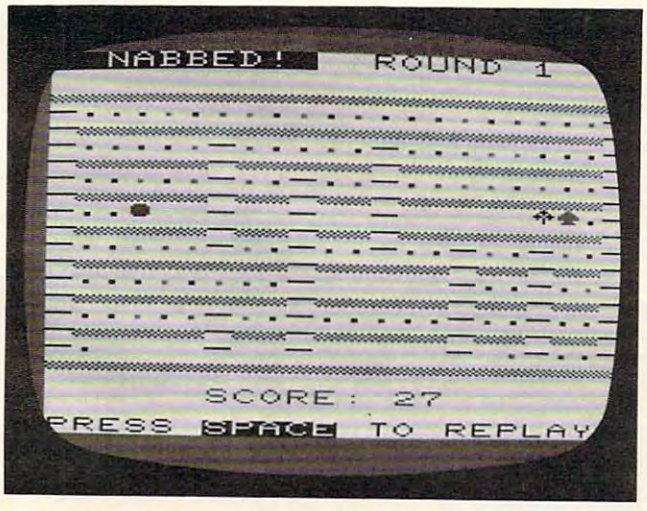
```
    /2))THENYY=0:XX=SGN(PX-EX)
 640 EX=EX+XX:EY=EY+YY
 650 IFEX=OOREX=21THENXX=-XX
 660 NP=TX+EX+Q*EY:EP=PEEK(NP):C=PEEK(CO+NP-TX)

 670 IFEP=PCTHENPOKENP,161:GOTO730
 675 IFEP<>EC%(0)ANDEP<>EC%(1)ANDEP<>EC%(2)THEN
     700
 680 FORI=0TO2:IFEP<>EC%(I)THENNEXT:STOP
 690 EP=EP%(I):C=PC%(I)
 700 POKENP,EC:POKECO+NP-TX,3+E
 710 EX%(E)=EX:EY%(E)=EY:EP%(E)=EP:PC%(E)=C:DX%
     (E)=XX:DY%(E)=YY
 720 GOTO380
 730 FORI=128TO255STEP2:POKESC,I:POKES3,I:POKEV
     ,(I-128)/8:NEXT
 740 POKESC,27:PRINTCHR$(19)CHR$(18)CHR$(156)" ~
      NABBED! "
 750 PRINTLEFT$(CD$,23);CHR$(31);"PRESS "CHR$(1
     8);
 760 PRINTCHR$(156)"SPACE"CHR$(146)CHR$(31)" TO
      REPLAY";
 770 FORI=1TO10:GETA$:NEXT
 780 GETA$:IFA$<>" "THEN780
 790 RUN
 800 REM SHOVE!
 810 IFDX=0THENPOKESC,31:POKES2,200:POKEV,10:FO
     RW=1TO100:NEXT:POKESC,27:POKES2,0:RET
     URN
 820 IFSH=0THENPOKESC,28:POKES2,255:POKEV,10:FO
     RW=1TO100:NEXT:POKESC,27:POKES2,0:RET
     URN
 830 CP=TX+Q*PY:LC=64:B$=""
 840 FORI=PXTO-21*(DX>0)STEPDX
 850 SV%(I)=PEEK(CP+I):POKECP+I,LC:LC=131-LC:PO
     KES1,LC:POKEV,(IAND15)
 860 IFSV%(I)=EC%(0)ORSV%(I)=EC%(1)ORSV%(I)=EC%
     (2)THENGOSUB920
 870 NEXTI:POKES1,0:POKEV,0
 880 FORI=PXTO-21*(DX>0)STEPDX
 890 POKECP+I,SV%(I):NEXT:SH=SH-1
 900 PRINTCHR$(156);LEFT$(CD$,23);TAB(10)"SHOVE
     S ="SH;
 910 RETURN
 920 FORJ=0TO2:IFSV%(I)<>EC%(J)THENNEXT:STOP
 930 SV%(I)=EP%(J):POKECO+CP+I-TX,PC%(J)
 940 EX%(J)=INT(20*RND(0)+1):EY%(J)=3
 950 DX%(J)=-1:IFRND(0)>.5THENDX%(J)=1
 960 DY%(J)=0:EP%(J)=46
 970 PTS=PTS+50:FORJ=0TO15:POKES3,128+J:POKEV,1
     5-J:NEXT:POKES3,0:POKEV,0
 980 PRINTCHR$(159)LEFT$(CD$,21)"        SCORE:"P
     TS;
 990 RETURN
```



Enemy shoppers have captured the player in this game of "Closeout," VIC-20 version. ©

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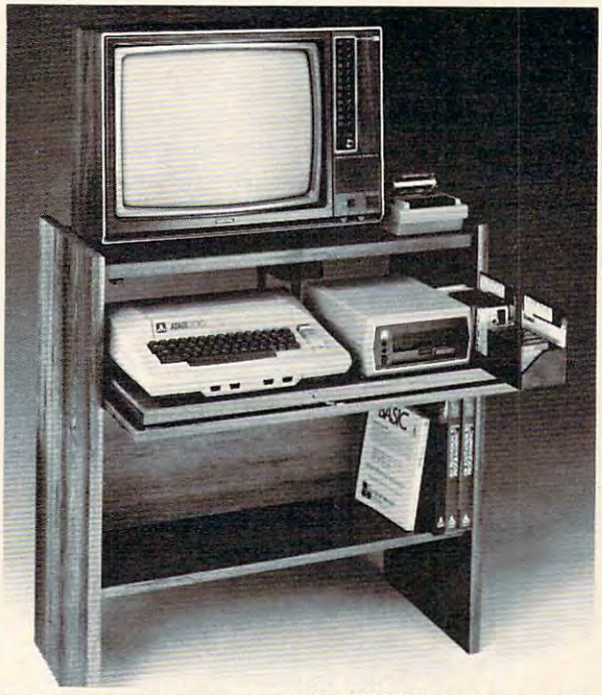

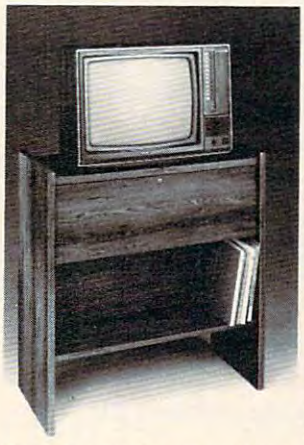

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BOGGLER

Gary Braun

In the tradition of popular board games like checkers, Boggler should offer hours of intriguing strategic planning as you try to capture your opponent's pieces and avoid capture yourself.

This is a simple, yet challenging, game of skill. The object of the game is to capture five pairs of your opponent's pebbles or to get five consecutive pebbles in a row, either vertically, horizontally, or diagonally. In this version, the computer acts as the playing board, checking all moves for validity and keeping score for the two opposing players, who alternate turns.

At the top center of the screen is a box indicating, by turning either black or white, whose turn it is. White always goes first in the center of the board. A joystick is used to position the player's pebble in the desired location, and the fire button is used to drop the pebble.

The program then checks to see if the player has either captured a pair of his opponent's pebbles by placing one of his on either side or has five pebbles in a row. If he has captured two pebbles, it places them on his side of the board. To begin play after the instructions are printed, touch any control on the joystick.

Two final notes on the program: If you should try to go off the board, you will be brought back to the opposite side from where you left. As you take a new turn, the program will always return you back to where you made *your* last play.

Program 1: VIC Version

```
1 DIM JS(2,2):POKE37139,0:DD=37154:PA=37
    137:PB=37152
2 FORI=0TO2:FORJ=0TO2:READJS(J,I):NEXTJ,
    I
3 DATA7,0,1,6,8,2,5,4,3:GOSUB7000
6 PRINT"{CLEAR}":POKE 36879,221
7 C=37888+4*(PEEK(36866)AND128)
8 A=4*(PEEK(36866)AND128)+64*(PEEK(36869
    )AND112)
9 CL=0:RS=1:POKEC+230,1
10 POKE A+23,85:BC=A+22:WC=A+42
20 FORI=1TO17:POKEA+23+I,114:NEXT
25 FORI=1TO 17:POKEA+419+I,113:NEXT
30 POKEA+41,73
40 FORI=0 TO352STEP22:POKE A+45+I,107:NEX
    T
45 FOR I=0TO 352 STEP 22:POKE A+63+I,115:
    NEXT
47 POKE A+419,74:POKEA+437,75
50 X=A+45:FORI=1TO17
60 FORQ=1TO17:POKEX+Q,91:NEXTQ:X=X+22:NEX
    TI
110 FOR I=0TO 352 STEP 22:POKE A+63+I,115:
    NEXT
115 POKE A+10,160:CR=A+230:POKEC+10,CL
121 BL=CR:WH=CR
122 POKE CR,81
123 FOR WE=22TO220STEP22:POKEWC+WE,70:NEXT
124 FOR WE=22TO220STEP22:POKEBC+WE,70:NEXT
200 GOSUB 9000
202 POKE C+10,CL
205 IFFR=1THEN500
210 IFW=8THEN200
220 IFW=0THENT2=CR-22
230 IFW=1THENT2=CR-21
240 IFW=2THENT2=CR+1
250 IFW=3THENT2=CR+23
260 IFW=4THENT2=CR+22
270 IFW=5THENT2=CR+21
280 IFW=6THENT2=CR-1
290 IFW=7THENT2=CR-23
305 GOTO8000
306 IFPEEK(CR)=91THENRS=1
310 POKEC+(CR-A),RS
315 RS=PEEK(C+T2-A)
320 POKEC+(T2-A),3
330 CR=T2
340 GOTO200
500 IF PEEK(CR)=91THEN510
502 GOSUB6000
504 GOTO200
510 IF CL=1THEN530
511 POKEC+(CR-A),0:POKECR,81
523 GOSUB 1000
524 BL=CR:T2=WH:RS=1:CL=1
529 GOTO 320
530 POKE C+(CR-A),1
550 POKE CR,81
555 WH=CR:RS=0:T2=BL
557 GOSUB 1000:CL=0
560 GOTO 320
1000 IFCL=0THENOP=1
1001 IFCL=1THENOP=0
1010 O1%=-22:O2%=-44:O3%=-66:GOSUB1800
1012 O1%=-21:O2%=-42:O3%=-63:GOSUB1800
1014 O1%=+1:O2%=+2:O3%=+3:GOSUB1800
1020 O1%=+23:O2%=+46:O3%=+69:GOSUB1800
1034 O1%=22:O2%=44:O3%=66:GOSUB1800
1036 O1%=21:O2%=42:O3%=63:GOSUB1800
1040 O1%=-1:O2%=-2:O3%=-3:GOSUB1800
1044 O1%=-23:O2%=-46:O3%=-69:GOSUB1800
1060 O1%=-88:O2%=22:GOSUB 3000
1070 O1%=-84:O2%=21:GOSUB 3000
1080 O1%=-4:O2%=1 :GOSUB 3000
1090 O1%=-92:O2%=23:GOSUB 3000
1780 RETURN
1800 IF PEEK(CR+O1%)<>81OR(PEEK(C+((CR+O1%)
    -A))AND15)<>OPTHEN 2200
```


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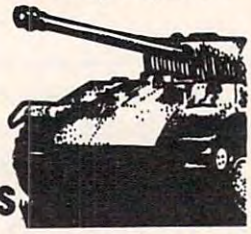

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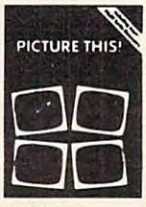

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By Don & Kurt Inman from Reston
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By Bill Wilkinson from Compute
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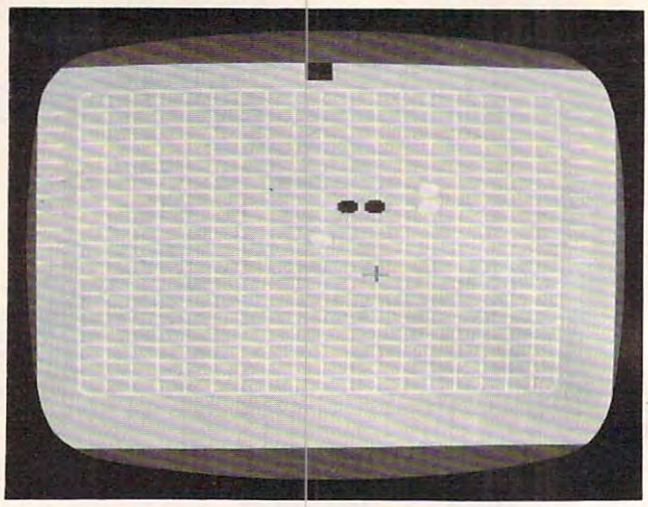
```
1840 IF PEEK(CR+O1%)<>81OR(PEEK(C+((CR+O1%)
   -A))AND15)<>OPTHEN 2200
1850 IF PEEK(CR+O2%)<>81OR(PEEK(C+((CR+O2%)
   -A))AND15)<>OPTHEN 2200
1860 IF PEEK(CR+O3%)<>81OR(PEEK(C+((CR+O3%)
   -A))AND15)<>CLTHEN 2200
2000 IFCL=1THEN2100
2001 BC=BC+22:POKEBC,81
2003 POKECR+O1%,91:POKE C+(CR+O1%-A),1
2006 BC=BC+22:POKEBC,81
2009 POKE CR+O2%,91:POKE C+(CR+O2%-A),1
2010 IF BC>A+220THEN 4500
2020 GOTO 2200
2100 WC=WC+22
2102 POKE WC,81:POKE C+(WC-A),0
2103 POKE CR+O1%,91:POKE C+(CR+O1%-A),1
2106 WC=WC+22
2108 POKE WC,81:POKE C+(WC-A),0
2109 POKE CR+O2%,91:POKE C+(CR+O2%-A),1
2110 IF WC>A+240THEN 4500
2200 RETURN
3000 CN%=0
3010 FOR N=1TO 10
3030 IF PEEK(CR+O1%)=81AND(PEEK(C+((CR+O1%)
   -A))AND15)=CLTHEN 3500
3040 CN%=0
3050 GOTO 3600
3500 CN%=CN%+1
3600 IF CN%=5THEN 4500
3700 O1%=O1%+O2%
3750 NEXT N
4000 RETURN
4500 PRINT"{HOME}{20 DOWN} ";
4505 IF CL=1THEN PRINT"  {REV}WHITE WINS !!
   {OFF}"
4510 IF CL=0THEN PRINT"  {REV}BLACK WINS!!{
   OFF}"
4515 PRINT" PRESS FIRE BUTTON TO"
4516 PRINT"   PLAY AGAIN";
4520 GOSUB 9000
4530 IF FR=0 THEN 4520
4540 GOTO 6
6000 POKE 36878,15
6010 POKE 36876,200
```



Setting up a trap in "Boggler," VIC-20 version.

```
6020 FOR WF=1TO 200:NEXT
6030 POKE 36878,0
6040 RETURN
7000 PRINT"{CLEAR} * OBJECT OF GAME *"
7003 PRINT
7005 PRINT" 1 CAPTURE FIVE PAIRS"
7010 PRINT"   OF THE OPPONENT'S"
7020 PRINT"   STONES BY PLACING"
7022 PRINT"   ONE OF YOURS ON  "
7024 PRINT"   EACH SIDE OF HIS."
7060 PRINT
7070 PRINT"      @@@@OR@@@"
7075 PRINT
7080 PRINT" 2 GET 5 CONSECUTIVE"
7085 PRINT"   STONES IN A ROW."
7090 PRINT
7180 PRINT" STONES CAN BE PLACED"
7200 PRINT"  VERTICALLY,"
7205 PRINT"   HORIZONTALLY,"
7210 PRINT" OR DIAGONALLY."
7900 GOSUB 9000
```

Notes For Atari, Apple, TI, And TRS-80 Color Computer

In these adaptations of the VIC-20 version of "Boggler," two players take turns moving their playing pieces. Player two goes first, since player one's piece is placed in the center automatically. Use joysticks plugged into the first two ports to move the pieces in the Atari version. The arrow keys (E,S,D,X for the TI; I,J,K,M for the Apple) are used in the other versions. Position the piece, and press RETURN (or ENTER) to place the piece. You cannot place a piece on top of another piece.

Translating Programs

The various versions of Boggler illustrate how you can translate programs from one machine to another. The Atari version was written first (not following the VIC version). The TI version was written following the Atari version. The TRS-80 Color Computer version was next, and finally the Apple II version, based on the Color Computer version.

Overall, the programs are similar, but none are written in "general" BASIC. Each attempts to use the computer's special graphics and/or sound capabilities. This avoids the boring "teletype" style of gaming you get with games written in totally transportable BASIC, but does require familiarity with each computer.

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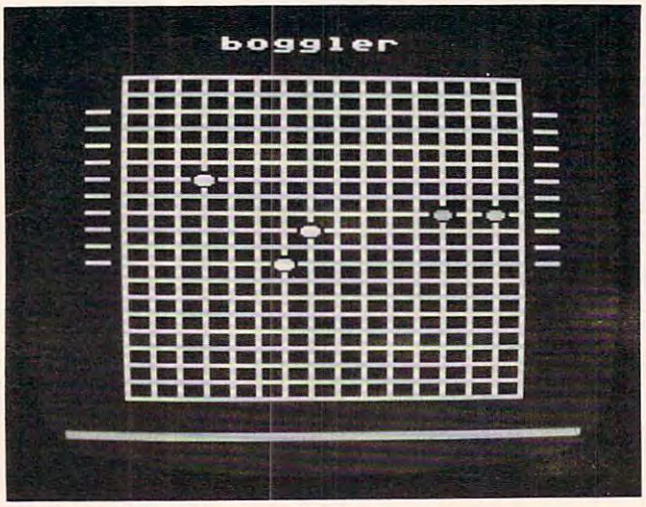
```
7910 IF FR=0 AND W=8 THEN 7900
7999 RETURN
8000 IF PEEK(T2)=107THEN T2=T2+17
8005 IF PEEK(T2)=115THEN T2=T2-17
8010 IF PEEK(T2)=113THEN T2=T2-374
8020 IF PEEK(T2)=114THEN T2=T2+374
8030 IF PEEK(T2)=85THEN T2=T2+391
8040 IF PEEK(T2)=75THEN T2=T2-391
8050 IF PEEK(T2)=73THEN T2=T2+357
8060 IF PEEK(T2)=74THEN T2=T2-357
8900 GOTO306
9000 POKEDD,127:S3=-((PEEK(PB)AND128)=0):PO
    KEDD,255
9010 P=PEEK(PA):S1=-((PAND8)=0):S2=((PAND16
    )=0):S0=((PAND4)=0)
9020 FR=-((PAND32)=0):X=S2+S3::Y=S0+S1
9030 W=JS(X+1,Y+1)
9040 RETURN
```

Program 2: Atari Version

```
100 REM ATARI 400/800 BOGGLER
110 REM
120 GOSUB 760:REM INITIALIZATION
130 REM MAIN LOOP
140 PLR=1-PLR
150 COLOR 181-32*PLR:PLOT 0,23:DRAWTO
     19,23:REM Plot bar
160 PK=PEEK(PPOS(PLR)):REM Current po
    sition
170 POKE PPOS(PLR),PIECE(PLR):REM Pl
    ace piece
180 FOR W=1 TO 20:NEXT W:REM Delay l
    oop makes flash visible
190 ST=STICK(PLR):IF STRIG(PLR)=0 AND
     PK=83 THEN 270
200 POKE PPOS(PLR),PK-128*(PK>128)
210 IF ST=15 THEN 170
220 POKE PPOS(PLR),PK
230 PPOS(PLR)=PPOS(PLR)+DIR(ST)
240 PK=PEEK(PPOS(PLR))
250 IF PK<>83 AND PK<>PIECE(0) AND PK
    <>PIECE(1) THEN PPOS(PLR)=PPOS(PL
    R)-DIR(ST)
260 GOTO 160
270 POKE PPOS(PLR),PIECE(PLR)
280 REM Check for five-in-a-row
290 REM
300 REM Step 1. Find bottom
310 REM Use joystick values
320 FOR I=5 TO 14
330 TEMP=PPOS(PLR):DIR=DIR(I):N=0
340 IF DIR=0 THEN 410
350 TEMP=TEMP+DIR
360 IF PEEK(TEMP)=PIECE(PLR) THEN N=N
    +1:GOTO 350
370 N=0:REM Do count from bottom
380 TEMP=TEMP-DIR
390 IF PEEK(TEMP)=PIECE(PLR) THEN N=N
    +1:GOTO 380
400 IF N=5 THEN 570
410 NEXT I
420 REM No five-in-a-row
430 REM Check for capture
440 FOR I=5 TO 14
450 TEMP=PPOS(PLR):DIR=DIR(I)
460 IF DIR=0 THEN 540
470 IF PEEK(TEMP+DIR)<>PIECE(1-PLR) O
    R PEEK(TEMP+DIR*2)<>PIECE(1-PLR)
    OR PEEK(TEMP+DIR*3)<>PIECE(PLR) T
    HEN 540
480 COUNT(PLR)=COUNT(PLR)+2:IF COUNT(
    PLR)>10 THEN COUNT(PLR)=10
490 FOR J=1 TO COUNT(PLR)
500 POKE SCR+(3+J)*20+1+17*PLR,PIECE(
    1-PLR)
510 NEXT J
520 POKE TEMP+DIR,83:POKE TEMP+DIR*2,
    83
530 IF COUNT(PLR)=10 THEN 570
540 NEXT I
550 GOTO 140
560 REM SOMEBODY WON !
570 FOR I=1 TO 100:POKE 712,PEEK(5377
    0):NEXT I:POKE 712,0
580 P=PEEK(710+PLR):C=INT(P/16)
590 FOR I=1 TO 10:POKE 710+PLR,0:SOUN
    D 0,200,10,8:FOR W=1 TO 20:NEXT W
    :POKE 710+PLR,P:SOUND 0,100,10,8
600 FOR W=1 TO 20:NEXT W:NEXT I
610 P=PEEK(711-PLR):C=INT(P/16)
620 FOR I=14 TO 0 STEP -0.2:SOUND 0,I
    *2,12,I:POKE 711-PLR,C*16+I:NEXT
    I
630 POKE 711-PLR,0
640 FOR I=1 TO 10:POKE 53274,PEEK(537
    70):NEXT I
650 POSITION 2,0:? #6;"player ";:IF P
    LR THEN ? #6;"two";:GOTO 670
660 ? #6;"one";
670 ? #6;" wins"
680 FOR W=1 TO 500:NEXT W
690 POSITION 1,0:? #6;"press fire'new
     game"
700 IF STRIG(0)=0 THEN 700
710 IF STRIG(0) THEN 710
720 RUN
730 GOTO 730
740 REM Initialization
750 REM
760 DIM DIR(15)
770 FOR I=5 TO 15
780 READ A:DIR(I)=A
790 NEXT I
800 DATA 21,-19,1,0,19,-21,-1,0,20,-2
    0,0
810 GRAPHICS 17:SETCOLOR 0,0,0
820 POKE 756,226:REM GRAPHICS SET
830 SCR=PEEK(88)+256*PEEK(89)
840 FOR I=2 TO 20:FOR J=2 TO 17:POKE
    SCR+I*20+J,83:NEXT J:NEXT I
850 FOR I=2 TO 17:POKE SCR+40+I,87:PO
    KE SCR+420+I,88:NEXT I
860 FOR I=2 TO 20:POKE SCR+20*I+2,65:
    POKE SCR+20*I+17,68:NEXT I
870 POKE SCR+42,81:POKE SCR+57,69:P
    E SCR+422,90:POKE SCR+437,67
880 POSITION 6,0:? #6;"BOGGLER"
```



"Boggler," Atari version.

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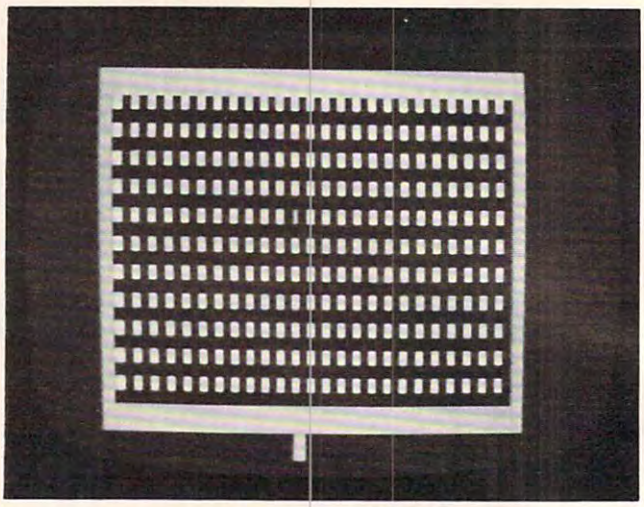
```
890 FOR I=4 TO 13:POKE SCR+I*20+1,82:
    POKE SCR+18+I*20,82:NEXT I
900 DIM PPOS(1),PIECE(1),COUNT(1)
910 PPOS(0)=SCR+229:PPOS(1)=SCR+209
920 PIECE(0)=148:PIECE(1)=212:COUNT(0
    )=0:COUNT(1)=0
930 POKE PPOS(0),PIECE(0)
940 RETURN
```

Program 3: TRS-80 Color Computer Version

```
100 ' TRS-80 COLOR COMPUTER
110 ' BOGGLER
120 DIM DX(8),DY(8),ROW(1),COL(1),CNT
    (1)
130 GOSUB 980
140 ' MAIN LOOP
150 PLR=1-PLR
160 PRINT@495,CHR$(16*(4+3*PLR)+143);
170 PK=POINT(COL(PLR),ROW(PLR))
180 SET(COL(PLR),ROW(PLR),PIECE(PLR))
190 '
200 WHICH=ASC(INKEY$+CHR$(0))
210 IF WHICH=13 AND PK=2 THEN 340
220 RESET(COL(PLR),ROW(PLR))
230 IF WHICH=0 THEN 180
240 SET(COL(PLR),ROW(PLR),PK)
250 TR=ROW(PLR)
260 TC=COL(PLR)
270 ROW(PLR)=ROW(PLR)-2*(WHICH=10)+2*
    (WHICH=94)
280 COL(PLR)=COL(PLR)-2*(WHICH=9)+2*(
    WHICH=8)
290 PK=POINT(COL(PLR),ROW(PLR))
300 IF PK<>7 THEN 170
310 ROW(PLR)=TR
320 COL(PLR)=TC
330 GOTO 170
340 SET(COL(PLR),ROW(PLR),PIECE(PLR))
350 ' CHECK FOR FIVE-IN-A-ROW
360 '
370 ' STEP 1. FIND BOTTOM
380 FOR I=1 TO 8
390 TR=ROW(PLR)
400 TC=COL(PLR)
410 DX=DX(I)
420 DY=DY(I)
430 N=0
440 TC=TC+DX
450 TR=TR+DY
460 PK=POINT(TC,TR)
470 IF PK<>PIECE(PLR) THEN 500
480 N=N+1
490 GOTO 440
500 N=0
510 TC=TC-DX
520 TR=TR-DY
530 PK=POINT(TC,TR)
540 IF PK<>PIECE(PLR) THEN 570
550 N=N+1
560 GOTO 510
570 IF N=5 THEN 800
580 NEXT I
590 ' NO FIVE-IN-A-ROW
600 ' CHECK FOR CAPTURE
610 FOR I=1 TO 8
620 DX=DX(I):DY=DY(I)
630 TC=COL(PLR)+DX
640 TR=ROW(PLR)+DY
660 C1=POINT(TC,TR)
670 C2=POINT(TC+DX,TR+DY)
680 C3=POINT(TC+DX*2,TR+DY*2)
690 IF C1<>PIECE(1-PLR) OR C2<>PIECE(
    1-PLR) OR C3<>PIECE(PLR) THEN 770
700 CNT(PLR)=CNT(PLR)+2
```



The TRS-80 Color Computer version of "Boggler."

```
710 IF CNT(PLR)>10 THEN CNT(PLR)=10
720 REM
730 FOR J=1 TO CNT(PLR)
735 SET(56*PLR+5,10+J*2,PIECE(1-PLR))
737 NEXT J
740 SET(TC+DX,TR+DY,2)
750 SET(TC,TR,2)
760 IF CNT(PLR)=10 THEN 800
770 NEXT I
780 GOTO 150
790 REM SOMEBODY WON!
800 FOR I=0 TO 7
810 CLS I
815 SOUND I*10+10,1
820 NEXT I
830 CLS
840 PRINT "PLAYER ";PLR+1;" WON!!"
850 PRINT
860 PRINT"PRESS SPACE TO PLAY AGAIN:"
    ;
870 IF INKEY$<>" " THEN 870
880 RUN
950 END
960 ' INITIALIZATION
970 '
980 CLS 0
990 FOR I=1 TO 8
1000 READ DX(I),DY(I)
1010 NEXT I
1040 DATA 0,2,2,0,2,2,-2,-2,-2,0,0,-2
     ,-2,2,2,-2
1050 '
1160 FOR I=3 TO 29
1170 PRINT@64+I,CHR$(239);
1180 PRINT@448+I,CHR$(239);
1190 NEXT I
1191 FOR I=3 TO 13
1193 PRINT@I*32+3,CHR$(239);
1194 PRINT@I*32+29,CHR$(239);
1195 FOR J=4 TO 28
1200 PRINT@I*32+J,CHR$(152);
1210 NEXT J
1220 NEXT I
1230 PIECE(0)=5
1240 PIECE(1)=8
1250 CNT(0)=0:CNT(1)=0
1270 ROW(0)=16
1280 COL(0)=32
1290 ROW(1)=14
1300 COL(1)=30
1310 SET(COL(0),ROW(0),PIECE(0))
1320 RETURN
```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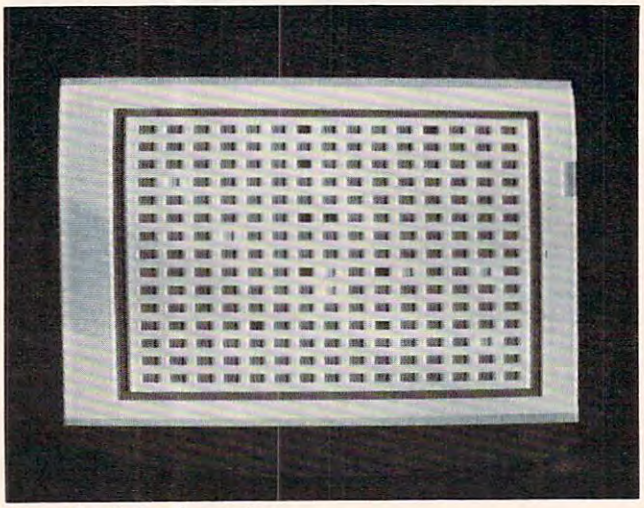
Program 4: Apple II Version

```
100  REM  APPLE II BOGGLER
110  REM
120  DIM DX(8),DY(8),ROW(1),COL(1),CNT(1)
130  GOSUB 980
140  REM  MAIN LOOP
150 PLR = 1 - PLR
160  COLOR= PIECE(PLR): HLIN 0,39 AT 0: HLIN
     0,39 AT 39
170 PK =  SCRN( COL(PLR),ROW(PLR))
180  COLOR= PIECE(PLR): PLOT COL(PLR),ROW(PL
     R)
190  REM
200 WHICH =  PEEK ( - 16384) - 128
210  IF WHICH = 13 AND PK = 13 THEN  POKE  -
     16368,0: GOTO 340
220  COLOR= 0: PLOT COL(PLR),ROW(PLR)
230  IF WHICH <  > 0 THEN 180
235  POKE  - 16368,0
240  COLOR= PK: PLOT COL(PLR),ROW(PLR)
250 TR = ROW(PLR):TC = COL(PLR)
270 ROW(PLR) = ROW(PLR) - 2 * (WHICH = 73) +
     2 * (WHICH = 77)
280 COL(PLR) = COL(PLR) - 2 * (WHICH = 74) +
     2 * (WHICH = 75)
290 PK =  SCRN( COL(PLR),ROW(PLR))
300  IF PK <  > 3 THEN 170
310 ROW(PLR) = TR
320 COL(PLR) = TC
330  GOTO 170
340  COLOR= PIECE(PLR): PLOT COL(PLR),ROW(PL
     R)
350  REM  CHECK FOR FIVE-IN-A-ROW
360  REM
370  REM  STEP 1. FIND BOTTOM
380  FOR I = 1 TO 8
390 TR = ROW(PLR)
400 TC = COL(PLR)
410 DX = DX(I):DY = DY(I):N = 0
440 TC = TC + DX:TR = TR + DY
460  IF  SCRN( TC,TR) = PIECE(PLR) THEN 440
510 TC = TC - DX:TR = TR - DY
530  IF  SCRN( TC,TR) = PIECE(PLR) THEN N =
     N + 1: GOTO 510
570  IF N = 5 THEN 800
580  NEXT I
590  REM  NO FIVE-IN-A-ROW
600  REM  CHECK FOR CAPTURE
610  FOR I = 1 TO 8
620 DX = DX(I):DY = DY(I)
630 TC = COL(PLR) + DX
640 TR = ROW(PLR) + DY
660 C1 =  SCRN( TC,TR)
670 C2 =  SCRN( TC + DX,TR + DY)
680 C3 =  SCRN( TC + DX * 2,TR + DY * 2)
690  IF C1 <  > PIECE(1 - PLR) OR C2 <  > PI
     ECE(1 - PLR) OR C3 <  > PIECE(PLR) THEN
     770
700 CNT(PLR) = CNT(PLR) + 2: IF CNT(PLR) > 1
     0 THEN CNT(PLR) = 10
710  COLOR= PIECE(1 - PLR)
730  VLIN 10,10 + CNT(PLR) AT 39 * PLR
740  COLOR= 13: PLOT TC,TR: PLOT TC + DX,TR +
     DY
760  IF CNT(PLR) = 10 THEN 800
770  NEXT I
780  GOTO 150
790  REM  SOMEBODY WON!
800  FOR I = 0 TO 15
810  COLOR= 16 *  RND (1): HLIN 0,39 AT 20 -
     I: HLIN 0,39 AT 19 - I
820  HLIN 0,39 AT 20 + I: HLIN 0,39 AT 21 +
     I
830  NEXT I
840  HOME : PRINT "PLAYER ";PLR + 1;" WON!!"

850  PRINT : PRINT "PRESS ";: FLASH : PRINT
     "SPACE";: NORMAL : PRINT " TO PLAY AGAI
     N:";
860  IF  PEEK ( - 16384) < 128 THEN 800
870  GET A$: RUN
960  REM  INITIALIZATION
970  REM
980  GR : COLOR= 15: FOR I = 0 TO 39: HLIN 0
     ,39 AT I: NEXT
985  HOME
990  FOR I = 1 TO 8
1000  READ DX(I),DY(I)
1010  NEXT
1040  DATA  0,2,2,0,2,2,-2,-2,-2,0,0,-2,-2,2
     ,2,-2
1050  COLOR= 3
1060  FOR I = 3 TO 39
1160  HLIN 4,36 AT 4
1170  HLIN 4,36 AT 36
1180  VLIN 4,36 AT 4
1190  VLIN 4,36 AT 36
1200  COLOR= 13
1210  FOR I = 6 TO 34 STEP 2
1220  HLIN 6,34 AT I
1230  NEXT I
1235  COLOR= 15
1240  FOR I = 7 TO 33 STEP 2
1250  VLIN 6,34 AT I
1260  NEXT I
1270 PIECE(0) = 7:PIECE(1) = 9
1280 CNT(0) = 0:CNT(1) = 1
1290 COL(1) = 20:ROW(1) = 18
1300 COL(0) = 18:ROW(0) = 20
1310  COLOR= PIECE(0): PLOT COL(0),ROW(0)
1320  RETURN
```



"Boggler," Apple version.

Program 5: TI Version

```
100 REM  TI-99/4A BOGGLER
110 REM
120 DIM DELTAX(8),DELTAY(8),ROW(1),CO
    L(1),PIECE(1),COUNT(1)
130 GOSUB 980
140 REM  MAIN LOOP
150 PLR=1-PLR
160 CALL HCHAR(24,1,128+PLR*8,32)
170 CALL GCHAR(ROW(PLR),COL(PLR),PK)
180 CALL HCHAR(ROW(PLR),COL(PLR),PIEC
    E(PLR))
190 REM
200 CALL KEY(3,WHICH,STATUS)
210 IF (WHICH=13)*(PK=144)THEN 340
220 CALL HCHAR(ROW(PLR),COL(PLR),32)
```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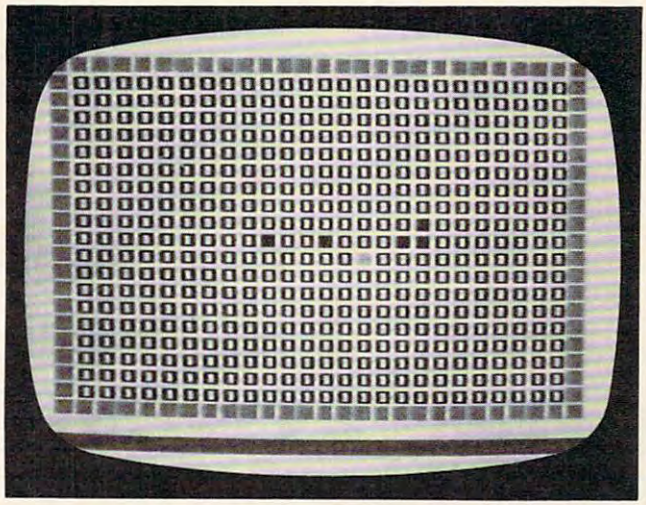
```
230 IF STATUS=0 THEN 180
240 CALL HCHAR(ROW(PLR),COL(PLR),PK)
250 TEMPROW=ROW(PLR)
260 TEMPCOL=COL(PLR)
270 ROW(PLR)=ROW(PLR)+(WHICH=69)-(WHI
    CH=88)
280 COL(PLR)=COL(PLR)+(WHICH=83)-(WHI
    CH=68)
290 CALL GCHAR(ROW(PLR),COL(PLR),PK)
300 IF PK<>152 THEN 170
310 ROW(PLR)=TEMPROW
320 COL(PLR)=TEMPCOL
330 GOTO 170
340 CALL HCHAR(ROW(PLR),COL(PLR),PIEC
    E(PLR))
350 REM  CHECK FOR FIVE-IN-A-ROW
360 REM
370 REM  STEP 1. FIND BOTTOM
380 FOR I=1 TO 8
390 TEMPROW=ROW(PLR)
400 TEMPCOL=COL(PLR)
410 DX=DELTAX(I)
420 DY=DELTAY(I)
430 N=0
440 TEMPCOL=TEMPCOL+DX
450 TEMPROW=TEMPROW+DY
460 CALL GCHAR(TEMPROW,TEMPCOL,PK)
470 IF PK<>PIECE(PLR)THEN 500
480 N=N+1
490 GOTO 440
500 N=0
510 TEMPCOL=TEMPCOL-DX
520 TEMPROW=TEMPROW-DY
530 CALL GCHAR(TEMPROW,TEMPCOL,PK)
540 IF PK<>PIECE(PLR)THEN 570
550 N=N+1
560 GOTO 510
570 IF N=5 THEN 800
580 NEXT I
590 REM  NO FIVE-IN-A-ROW
600 REM  CHECK FOR CAPTURE
610 FOR I=1 TO 8
620 TEMPROW=ROW(PLR)
630 TEMPCOL=COL(PLR)
640 DX=DELTAX(I)
650 DY=DELTAY(I)
660 CALL GCHAR(TEMPROW+DY,TEMPCOL+DX,
    CK1)
670 CALL GCHAR(TEMPROW+DY*2,TEMPCOL+D
    X*2,CK2)
680 CALL GCHAR(TEMPROW+DY*3,TEMPCOL+D
    X*3,CK3)
690 IF (CK1<>PIECE(1-PLR))+(CK2<>PIEC
    E(1-PLR))+(CK3<>PIECE(PLR))THEN 7
    70
700 COUNT(PLR)=COUNT(PLR)+2
710 IF COUNT(PLR)>10 THEN 720 ELSE 73
    0
720 COUNT(PLR)=10
730 CALL VCHAR(5,28*PLR+2,PIECE(1-PLR
    ),COUNT(PLR))
740 CALL HCHAR(TEMPROW+DY,TEMPCOL+DX,
    144)
750 CALL HCHAR(TEMPROW+DY*2,TEMPCOL+D
    X*2,144)
760 IF COUNT(PLR)=10 THEN 800
770 NEXT I
780 GOTO 150
790 REM  SOMEBODY WON!
800 FOR I=1 TO 20
810 CALL SCREEN(RND*15+1)
820 NEXT I
830 FOR I=1 TO 10
840 CALL COLOR(14-PLR,RND*15+1,RND*15
    +1)
```



Outmaneuvering an opponent in the TI-99/4A version of "Boggler."

```
850 CALL SOUND(-1,I*100+100,I*3)
860 NEXT I
870 CALL COLOR(14-PLR,1,1)
880 CALL CLEAR
890 PRINT "PLAYER ";
900 IF PLR THEN 930
910 PRINT "TWO";
920 GOTO 940
930 PRINT "ONE";
940 PRINT " WINS!"
950 END
960 REM  INITIALIZATION
970 REM
980 CALL SCREEN(16)
990 FOR I=1 TO 8
1000 READ A,B
1010 DELTAX(I)=A
1020 DELTAY(I)=B
1030 NEXT I
1040 DATA 0,1,1,0,1,1,-1,-1,-1,0,0,-1
     ,-1,1,1,-1
1050 CALL CLEAR
1060 CALL COLOR(13,9,1)
1070 CALL COLOR(14,6,1)
1080 CALL COLOR(15,14,1)
1090 CALL COLOR(16,12,1)
1100 CALL CHAR(152,"FEFEFEFEFEFEFE00")
1110 CALL CHAR(144,"007E666666667E00")
1120 CALL CHAR(129,"007E7E7E7E7E7E00")
1130 CALL CHAR(137,"007E7E7E7E7E7E00")
1140 CALL CHAR(128,"FFFFFFFFFFFFFFFF")
1150 CALL CHAR(136,"FFFFFFFFFFFFFFFF")
1160 CALL HCHAR(2,3,152,26)
1170 CALL HCHAR(22,3,152,26)
1180 CALL VCHAR(2,3,152,20)
1190 CALL VCHAR(2,29,152,21)
1200 FOR I=3 TO 21
1210 CALL HCHAR(I,4,144,25)
1220 NEXT I
1230 PIECE(0)=129
1240 PIECE(1)=137
1250 COUNT(0)=0
1260 COUNT(1)=0
1270 ROW(0)=12
1280 COL(0)=16
1290 ROW(1)=11
1300 COL(1)=16
1310 CALL HCHAR(ROW(0),COL(0),PIECE(0
     ))
1320 RETURN
```

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Questions Beginners Ask

Tom R. Halfhill, Features Editor

Are you thinking about buying a computer for the first time, but don't know anything about computers? Or maybe you just purchased a computer and are still baffled by what personal computing is all about. Each month, **COMPUTE!** *will tackle the types of questions we receive from beginners.*

Q Do I really need to learn how to program in order to use a home computer?

A No, you don't – not really. You could simply stick to buying *commercial software*, programs which are pre-written and pre-packaged for you by professional programmers. Your local computer dealers, and mail-order dealers which advertise in magazines such as **COMPUTE!**, carry hundreds of programs for all types of computers. You only have to make sure that the programs you buy will work on your computer and do what you want. (Read reviews; test the programs at the dealer's showroom.)

If you have a standard VIC-20 computer with a Datasette tape recorder, for example, make sure the programs you buy come on cassette tape (not diskette) and use no more memory than the standard VIC's 5K of RAM. Some computers, such as the VIC, also accept programs stored on plug-in cartridges. In any case, make sure you know what you're buying. The software should be clearly labeled as to its requirements: type of computer, amount of memory, peripherals required, and special equipment, if any (such as joysticks). Test the program if possible to be certain it does what you want.

Building a software library in this manner is like buying records or tapes for a stereo system – you don't have to be a professional musician to enjoy the equipment.

Computers, however, give you a choice that stereos do not. You can learn to write your own programs. This has several advantages. For one thing, you can tailor your own programs to do exactly what you want. For example, you could buy a pre-packaged personal budget program, but it might not be designed for a household with two checking accounts. It might also lack other features you find desirable. If you write programs yourself, you can fit them to your needs – *exactly*.

Also, writing your own programs is less expensive than buying commercial ones. Although it's quite challenging to write commercial-quality arcade games, something as relatively simple as a checkbook-balancer could be written in an evening. You might save $20 or $30.

And finally, do not immediately dismiss the idea that programming can be fun. Too many people assume that programming would be too hard or too boring for them. Yet, thousands of children have learned how to program computers, and their attention is often riveted for hours.

Q I'm interested in buying a home computer, but it seems that the prices are constantly dropping, and that new and better models are coming out all the time. Why should I buy a computer now? Shouldn't I wait?

A This seems to bother lots of people shopping for home computers. *If you want to wait, you should define for yourself exactly what you're waiting for.* A computer with 65K of memory selling for under $500? Any computer selling for under $75? An under-$1000 computer with at least 128K? A computer with eight synthesized voices and 500 colors?

If you don't decide exactly what you're waiting for, you might be waiting forever. For the past two decades, computer technology has been moving faster than any other technology, and it is not slowing down. In the foreseeable future, computers will *always* be getting cheaper and more powerful. This is likely to continue throughout our lifetimes. So if you wait, there's no doubt you'll get a better deal in terms of computing power per dollar.

But in the meantime, you won't have a computer. It's sort of like deciding whether to join some friends who are swimming in a lake on a chilly summer morning. You are hesitating because the water feels cold. You can see that your friends are enjoying themselves, and you know that if you jump in, you'll get used to the water and have fun yourself. But you also know that if you wait awhile, the day will grow warmer and make your dive easier. When do you take the plunge?

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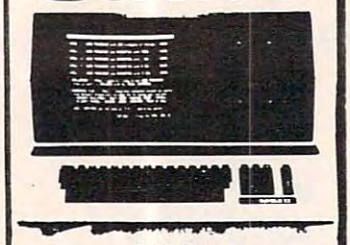

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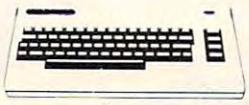

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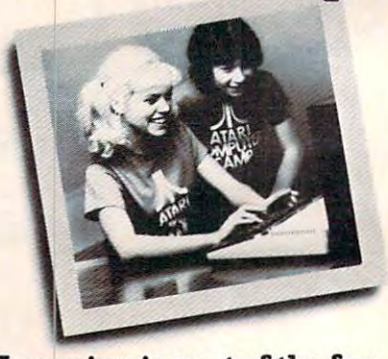

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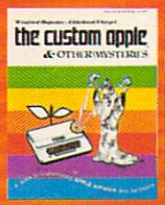

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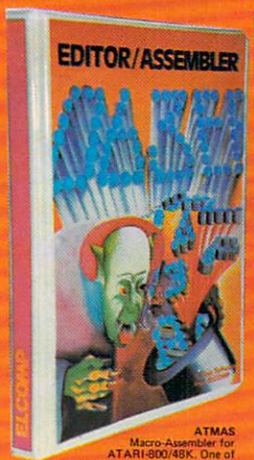

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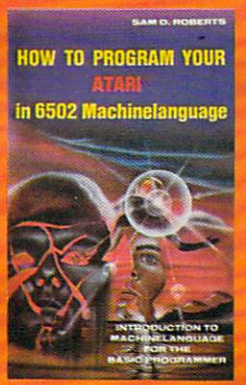

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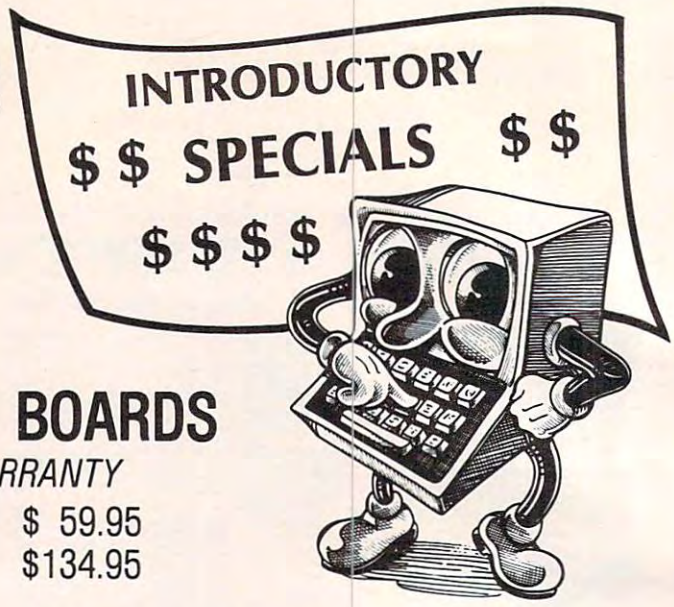

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Magic Spells For Apple

Sheila Cory

Magic Spells, by Apple Computer, is designed to give drill and practice in spelling. The program is divided into two parts: (1) a word-unscrambling game, and (2) a teacher's utility which allows the creation of word lists.

The game is set in the Castle of Spells. Merlapple, the Wizard of Spells, guides the player into the castle, where there are treasures which the player has a chance to win. Unfortunately, though, a demon also lurks in the castle, and he has his eyes on the gold. To play the game, the child first selects the word list he or she wants to be drilled on. The words are listed out, and the child is instructed either to copy the words or to just pay close attention as they're listed. The 12 word lists included on the diskette each contain 16 words.

When the player is finished looking at the words, they disappear, and one closed treasure chest appears on the screen for each word on the list. Then one of the spelling words appears on the screen, with the letters scrambled. The child is supposed to unscramble the letters to spell out one of the words that was on the list. If the word is typed in correctly, the treasure chest pops open and the gold is revealed.

The scorekeeping part of the screen displays the player's and the demon's points. Two points are accrued for each letter in the word. If the child takes more than one try to spell the word correctly, points are split with the demon. In this case, a demon holding a money bag takes the place of the closed treasure chest. If the child has to consult the demon for help (by typing an asterisk), the demon gets all points, and an empty treasure chest appears on the screen.

This procedure continues for each of the words on the list. The order of the words is random, as is the scrambling of the letters. At the end of the game, the child receives a reward based on his or her score. A typical reward is getting to make a wish on a beautiful unicorn.

Create Word Lists

The second part of this program, the teacher utility, allows the creation of word lists that are appropriate for each class setting. A menu for the teacher utility specifies the options, which include entering a list of words, deleting a list of words, viewing a list of words, seeing a list of file names, and copying a list on the printer.

Up to 20 words can be entered in each list. This will accommodate most weekly spelling lists found in elementary school spelling books. The lists will be automatically saved on diskette, unless the disk drive contains the *Magic Spells* master disk, which comes write-protected. The correct diskette to have in the drive is the *Magic Spells* backup, which is not write-protected.

My "kid consultants" for this program truly enjoyed the game. They found unscrambling the words a lot of fun. Lisa, seven years old, struggled to unscramble each word, and then never looked at the scrambled letters as she typed in the letters to spell the word correctly. It took her about a half-hour to get through one word list, but she wanted to try another when she was through. She conscientiously wrote down the words in the list when they appeared at the start of the game.

Chrissa, eight years old, did not want to ask the demon for help, preferring to wangle the help out of other people in the room. She felt that the game was hard, but enjoyed it enough to want to borrow the diskette. Cara, ten years old, played the game for about 45 minutes, and said she didn't really think she'd like to use it again.

Suggested Revisions

The program seemed to pass the kid test. However, I feel that it fails to do what it is designed to do – give drill and practice in spelling. Spelling is a recall rather than a recognition task. When we try to spell a word, it is rare indeed for us to have the letters there in front of us in scrambled form. We need to pull the letters from memory. This program does not give such practice.

One way recall can be practiced would be through a tape recorder link-up with the computer so that a child would actu-

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