COMPUTE!

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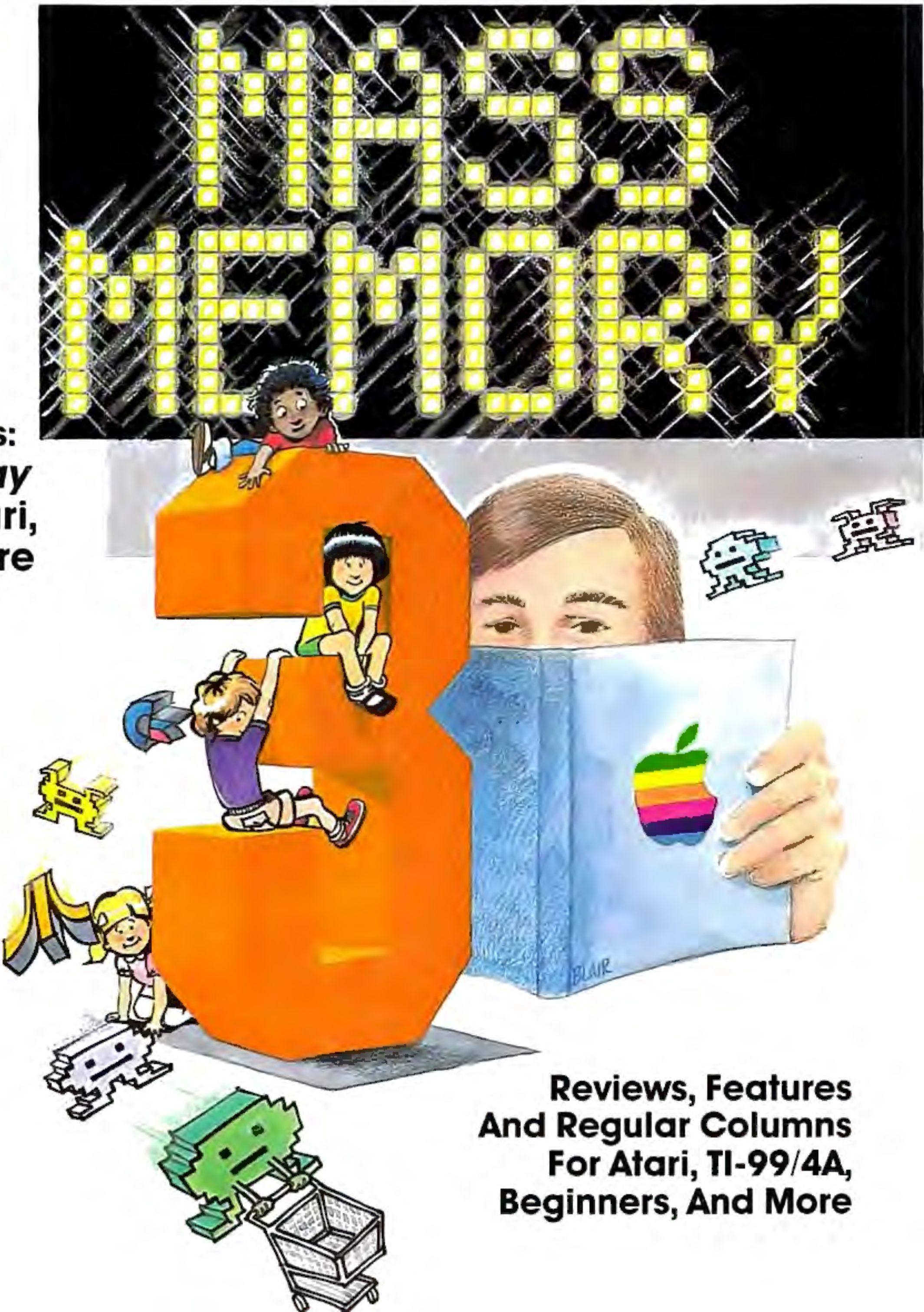
The Leading Magazine Of Home, Educational, And Recreational Computing

New Home Computers

At The Winter Consumer Electronics Show



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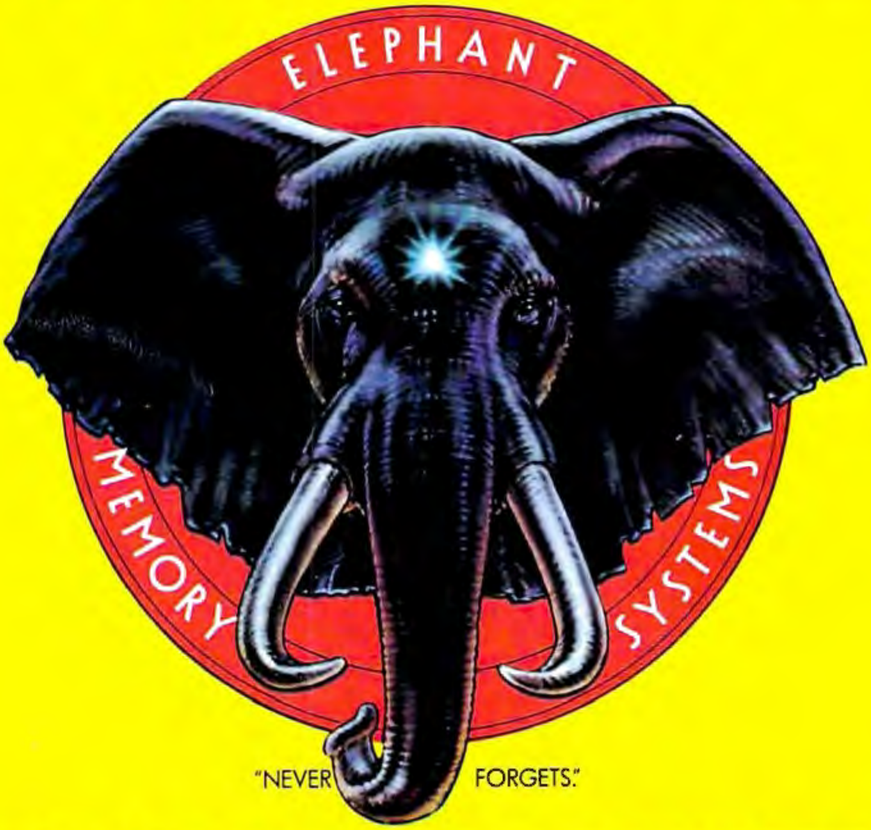

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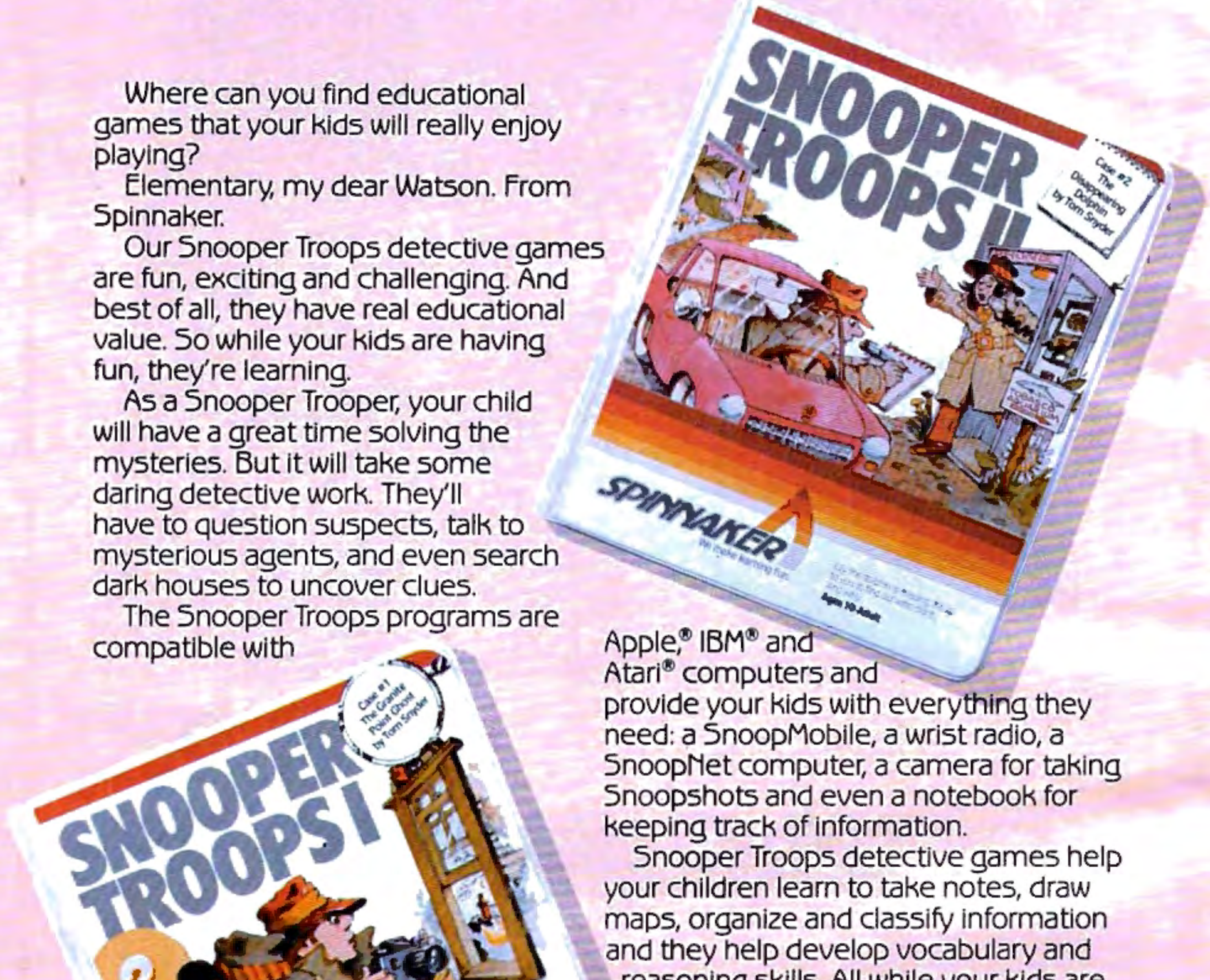
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COMPUTE

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
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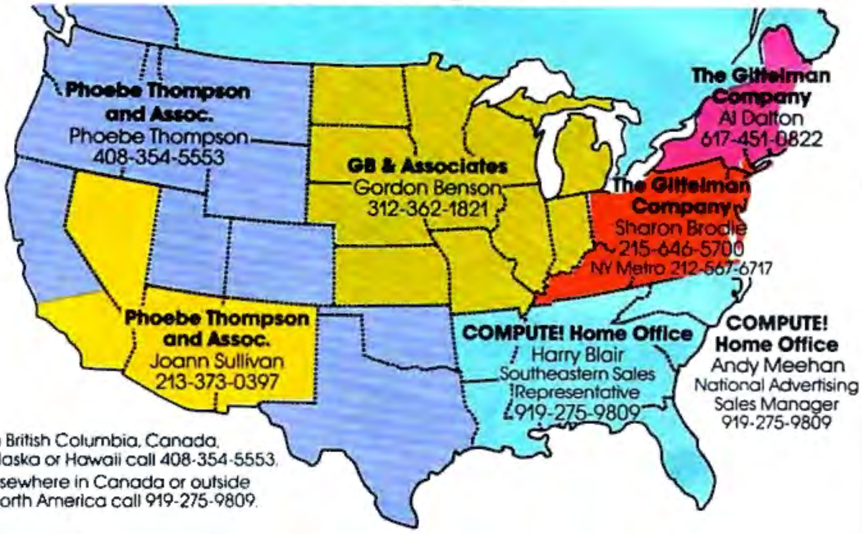

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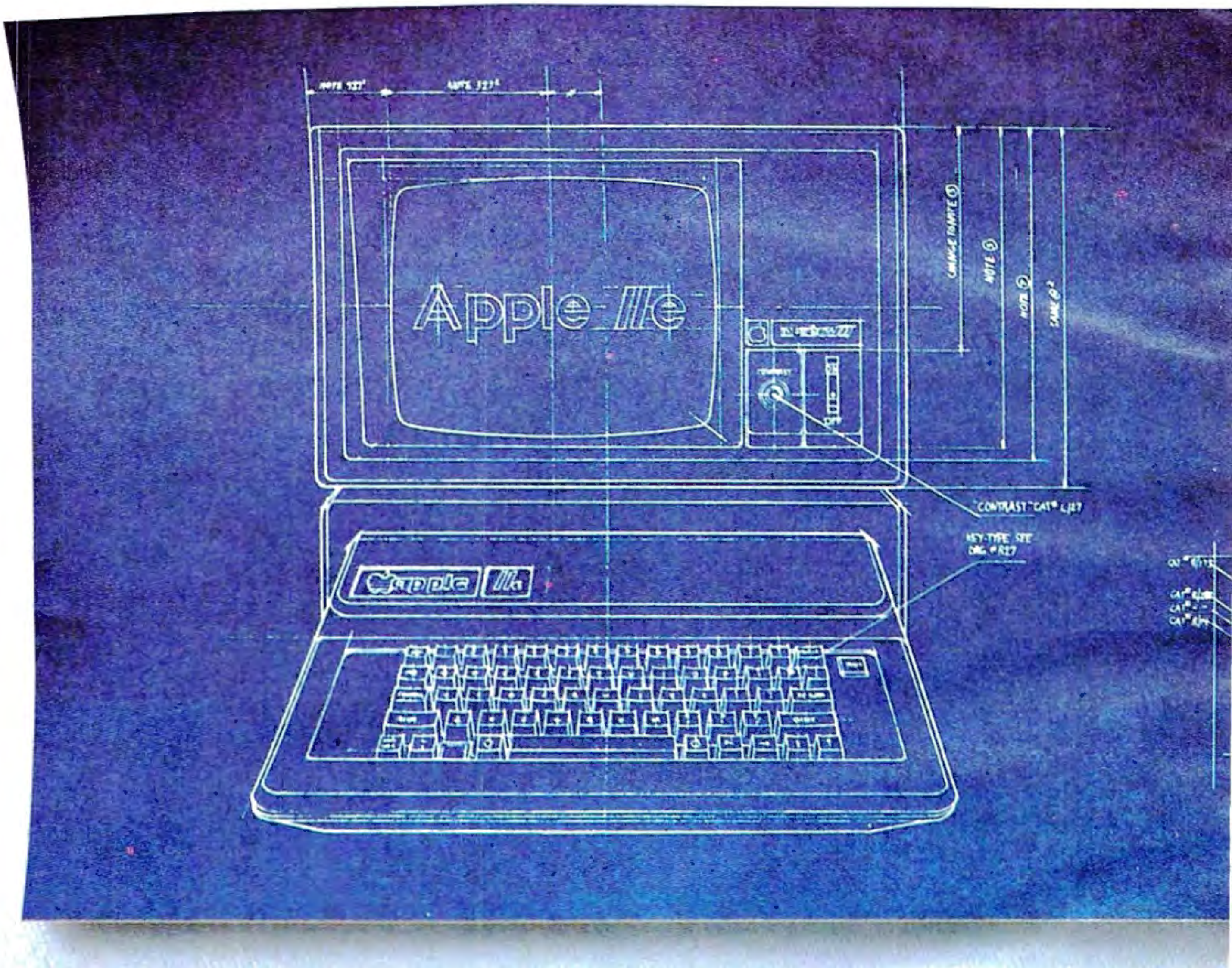
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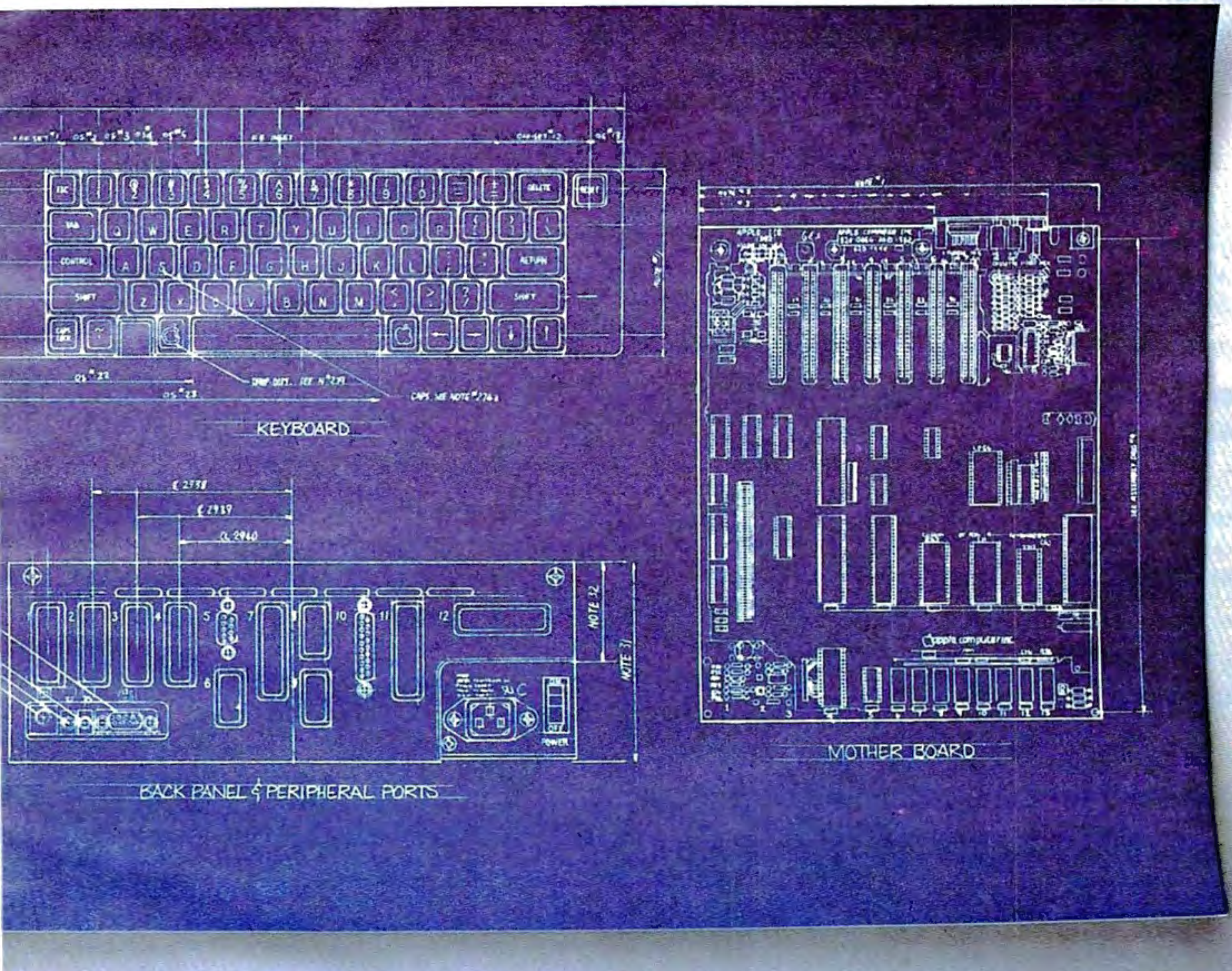

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READERS' FEEDBACK

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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Hardware requirements: Apple version requires Apple II or Apple II + with 48K and Applesoft in ROM of language card, DOS 3.3. Atari 400/800 version requires 48K and BASIC cartridge. Both versions require only one disk drive.

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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.

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

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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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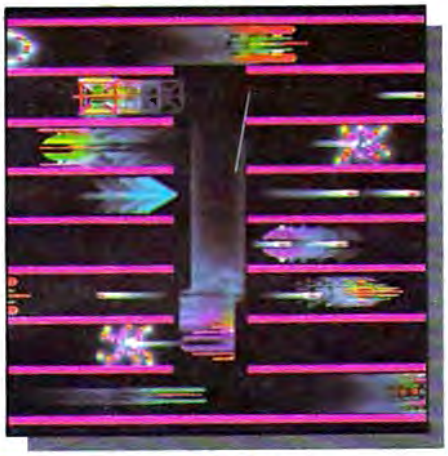

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New Home Computers At The Winter Consumer Electronics Show

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.

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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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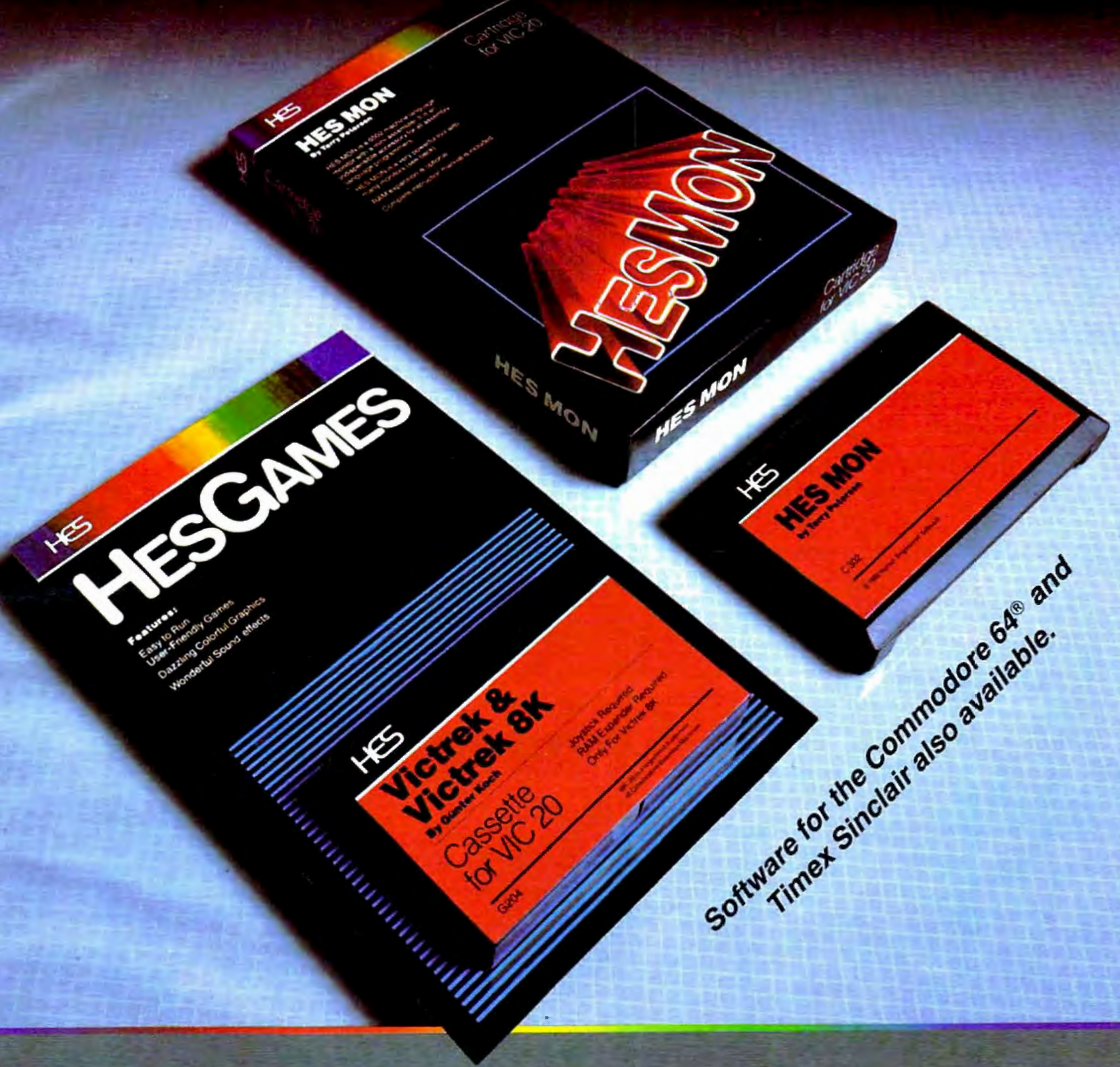

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Pie	Yes	Yes	Yes
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Curve Fitting	5 Kinds	1	None
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Plotter Compatible	Virtually Any	None	H-P7470A Only
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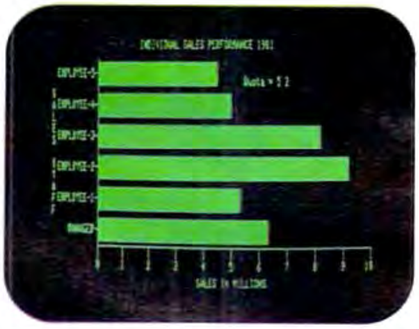

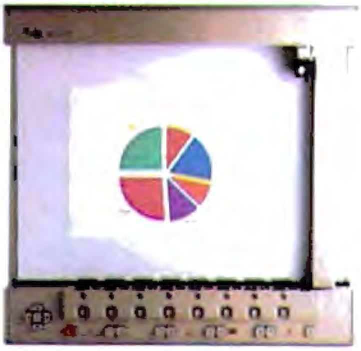

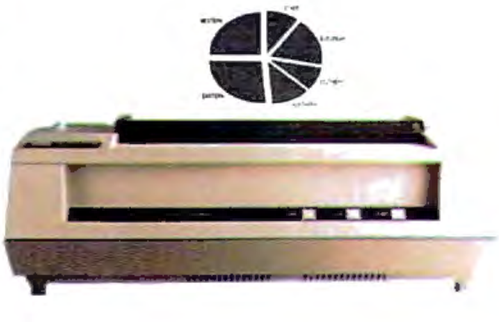

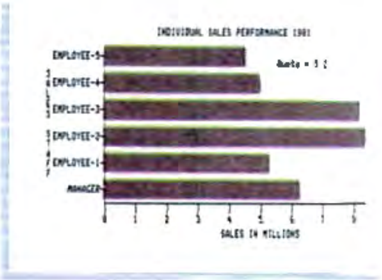

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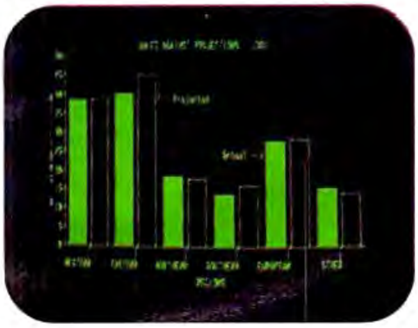

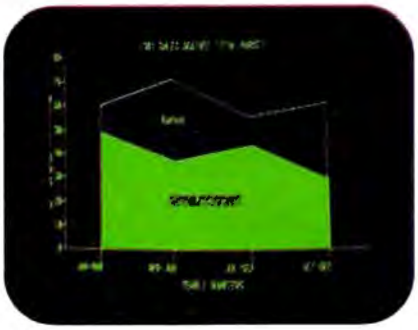

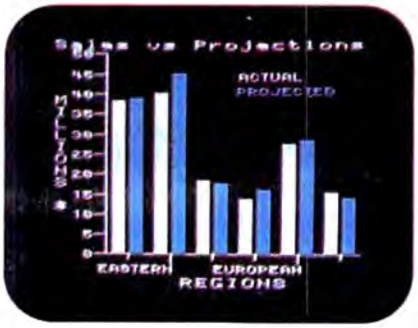

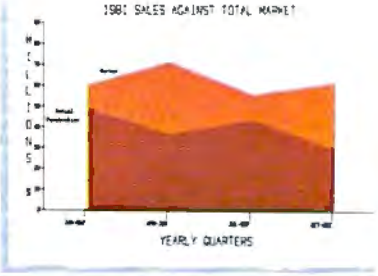

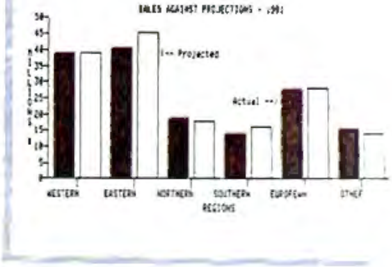

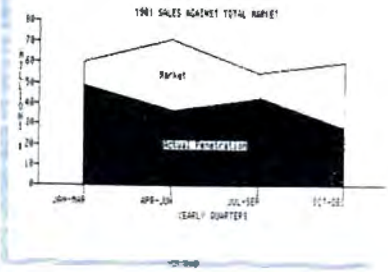

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color TV version with two disk drives for $1295.

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. 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.

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."

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.

The game that puts space games in perspective. Zaxxon™, one of the most popular arcade games of 1982, is now available for use with your home computer system.

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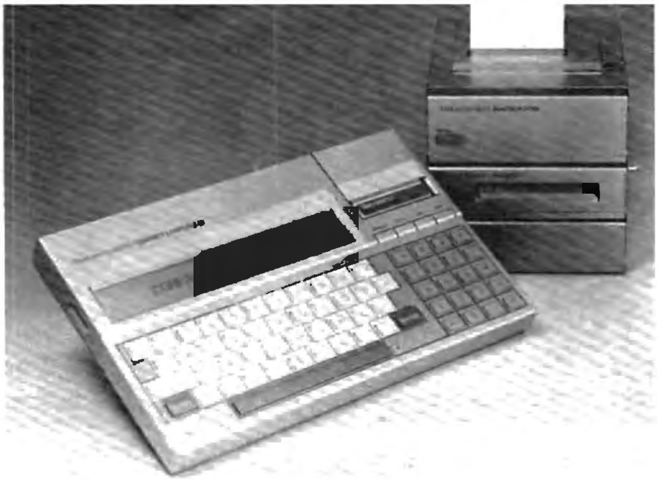
Texas Instruments TI-99/2, with 4K of memory for $99.

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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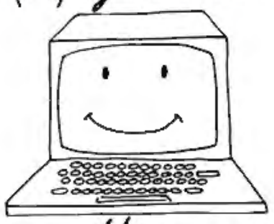

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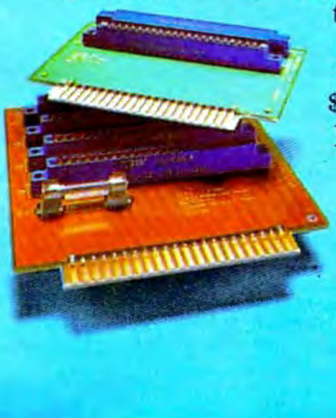

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The Timex Sinclair 2000 is the first computer with 48K memory for under $200. Production models will have a topside cartridge slot for plug-in software. At right is the new thermal printer, which works with both the T/S 2000 and T/S 1000.

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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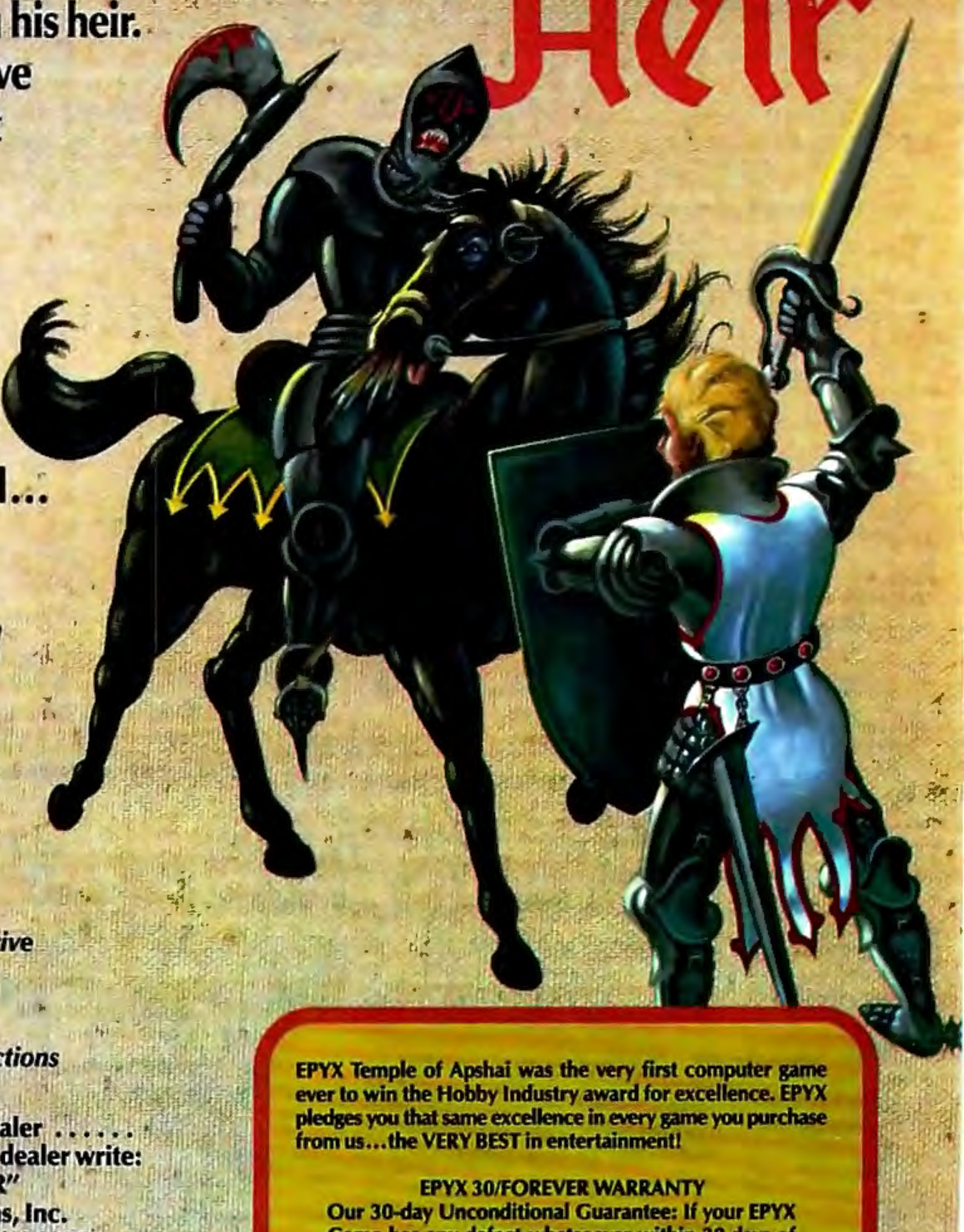

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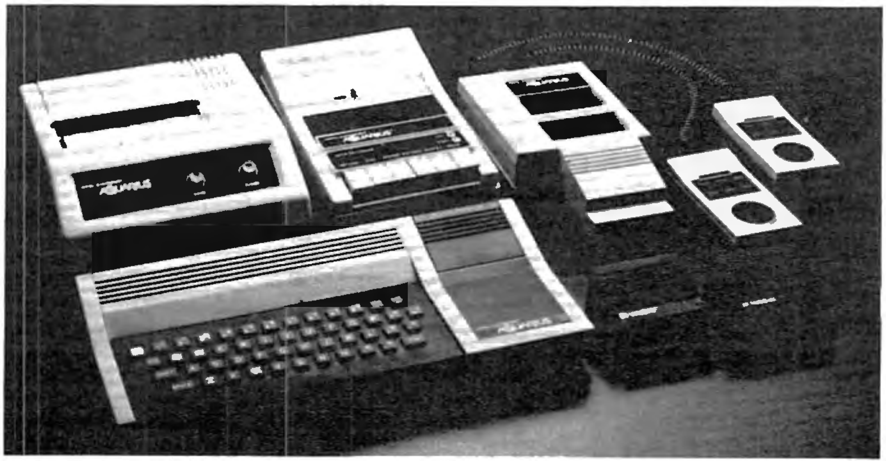


Mattel's new Aquarius and its family of peripherals.

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).

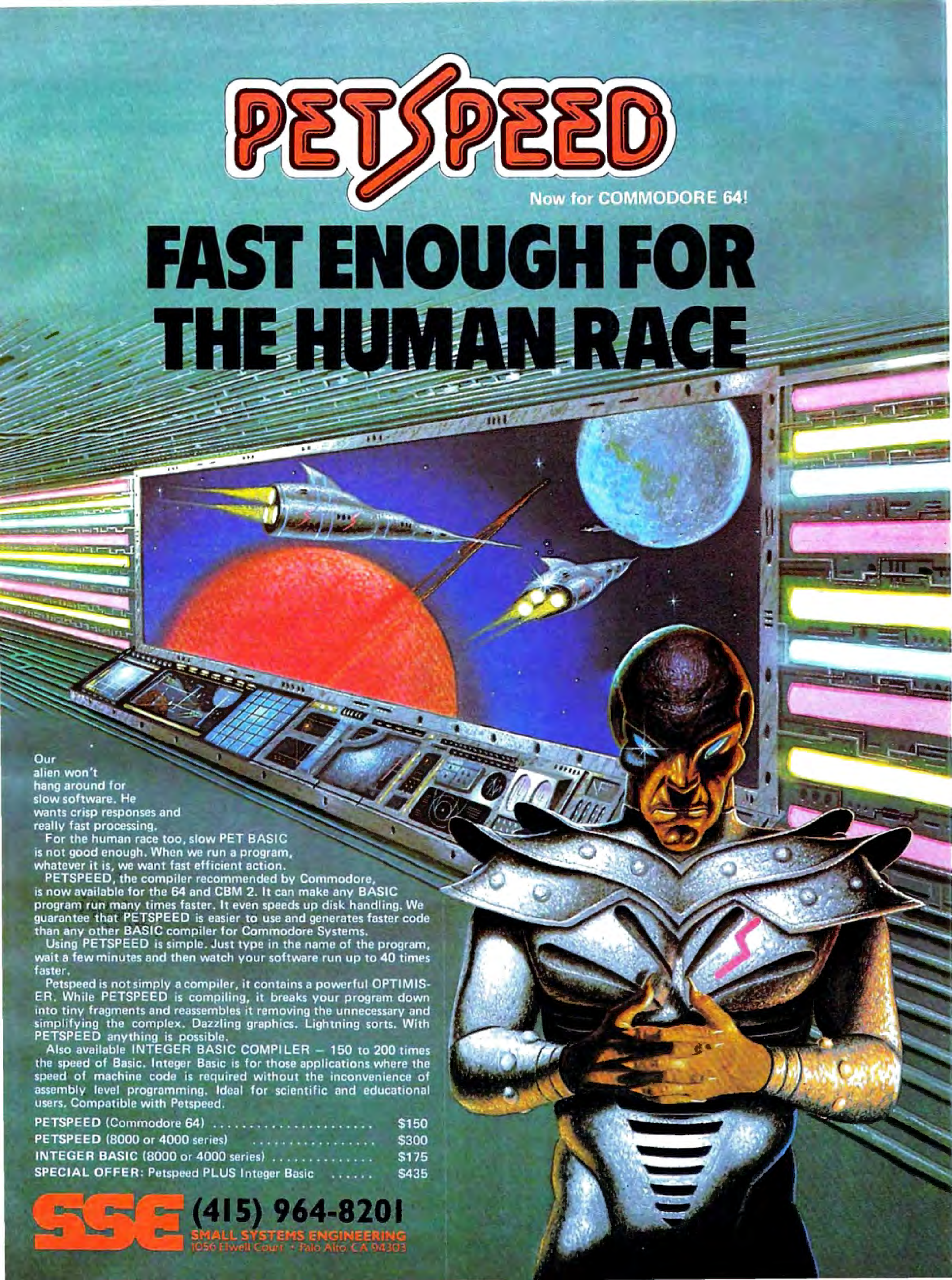
First, as expected, the price was set at $899. One Atari spokesman said that the 1200XL's 64K RAM chips accounted for 40 percent of its production costs, and since 64K chips should be dropping in price rather quickly, it's likely that the 1200XL's price also will drop in coming months. Another factor 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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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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PRICES SUBJECT TO CHANGE

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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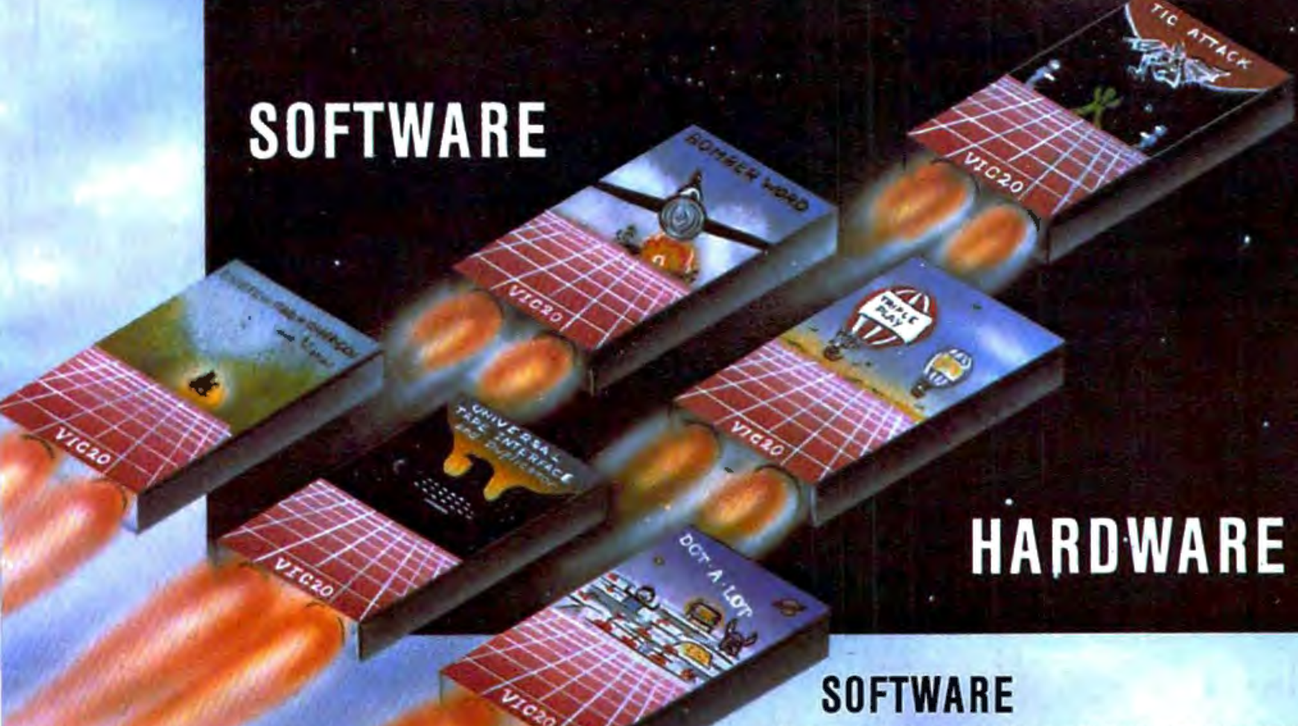

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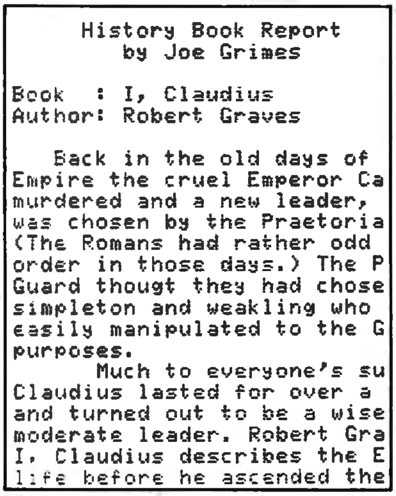

```
      History Book Report
        by Joe Grimes

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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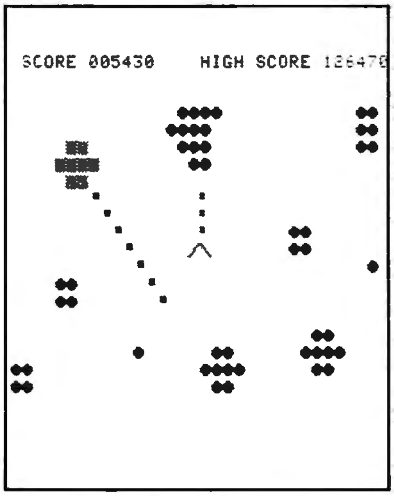
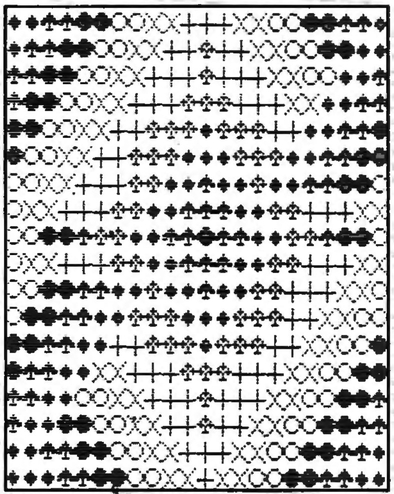


Create my own custom computer games. The printer kit includes the new *First Book of VIC:* it's full of great game ideas.



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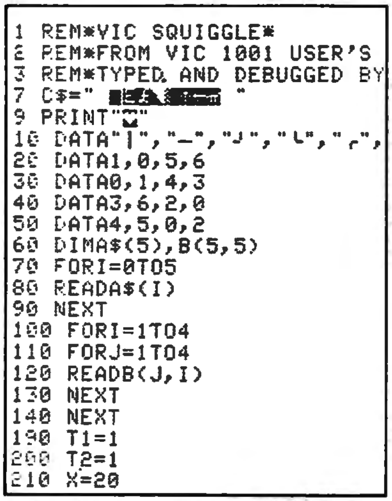

```
1 REM*VIC SQUIGGLE*
2 REM*FROM VIC 1001 USER'S
3 REM*TYPED AND DEBUGGED BY
7 C$=" [illegible] "
9 PRINT"[illegible]"
10 DATA"|","—","┘","└","┌",
20 DATA1,0,5,6
30 DATA0,1,4,3
40 DATA3,6,2,0
50 DATA4,5,0,2
60 DIMA$(5),B(5,5)
70 FORI=0TO5
80 READA$(I)
90 NEXT
100 FORI=1TO4
110 FORJ=1TO4
120 READB(J,I)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

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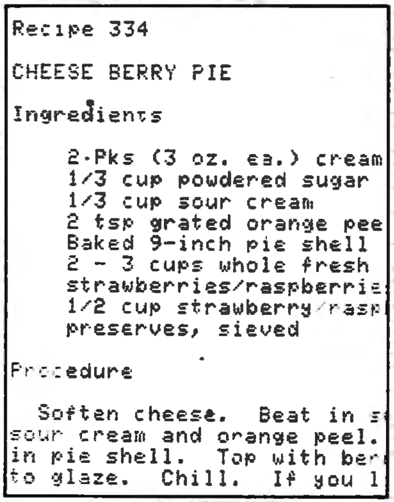

```
Recipe 334

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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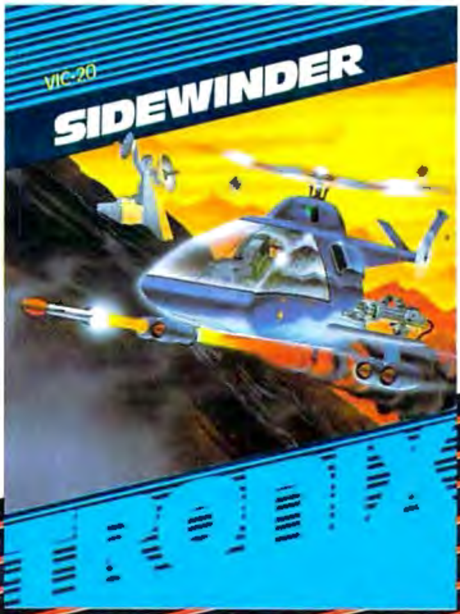
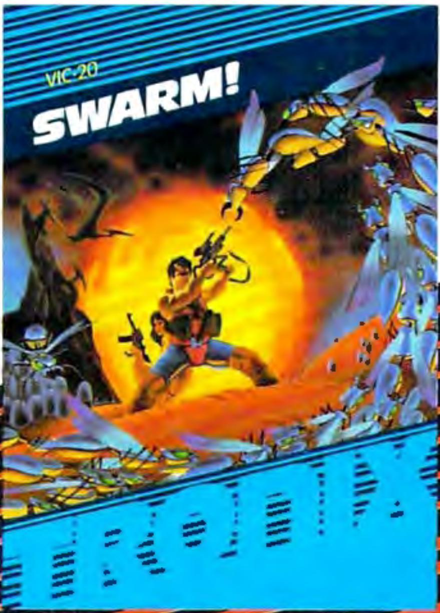
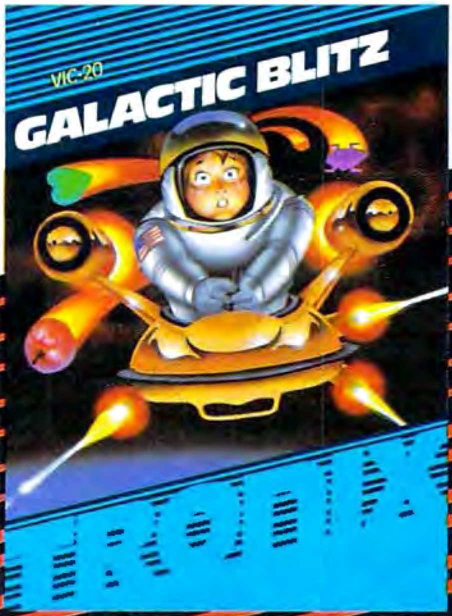






TRONIX

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$
```

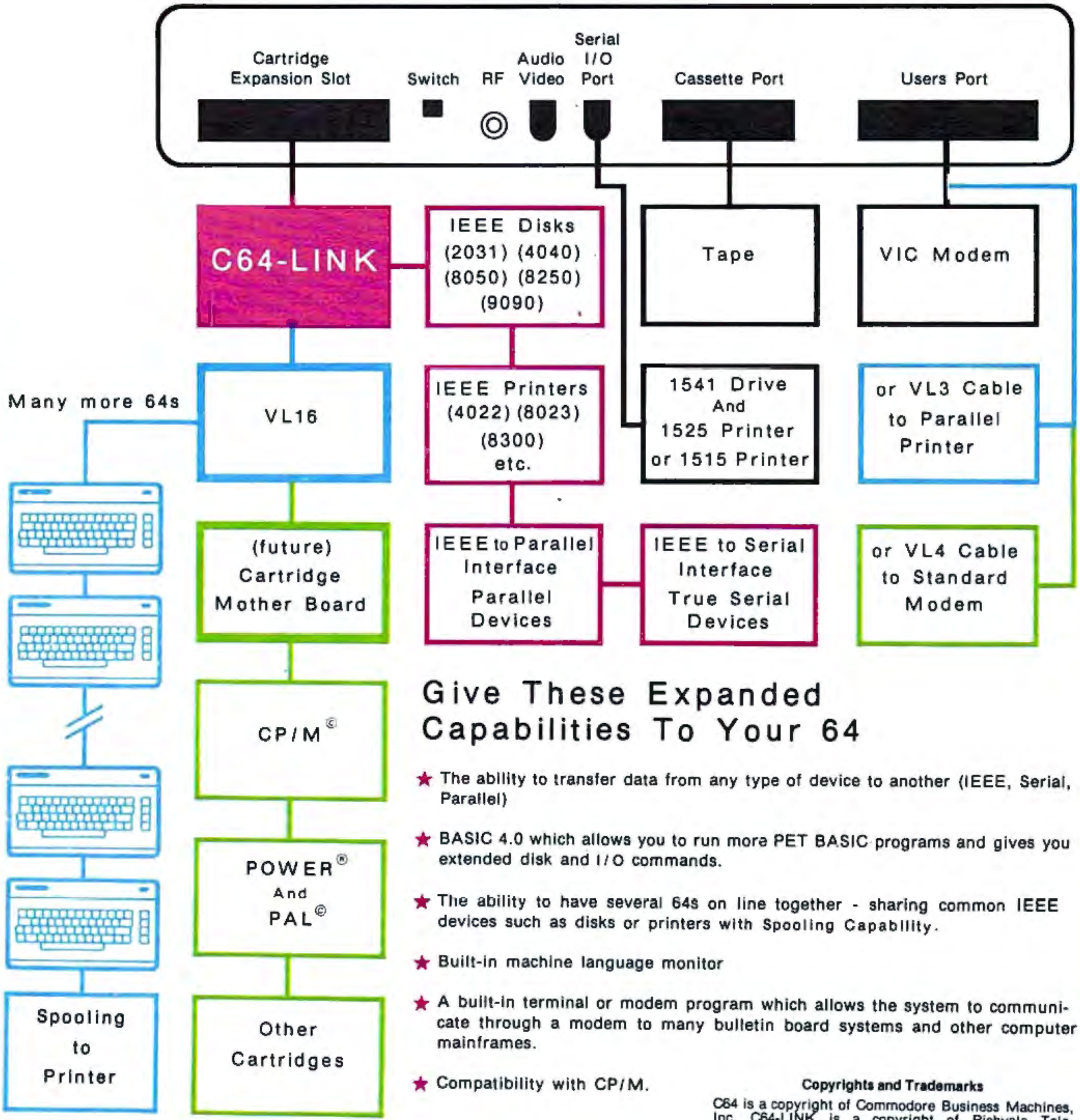
By the way, you may number your devices anything you want, from #1 to #255, inclusive. You may even use OPEN #X+5 if you have previously defined X.

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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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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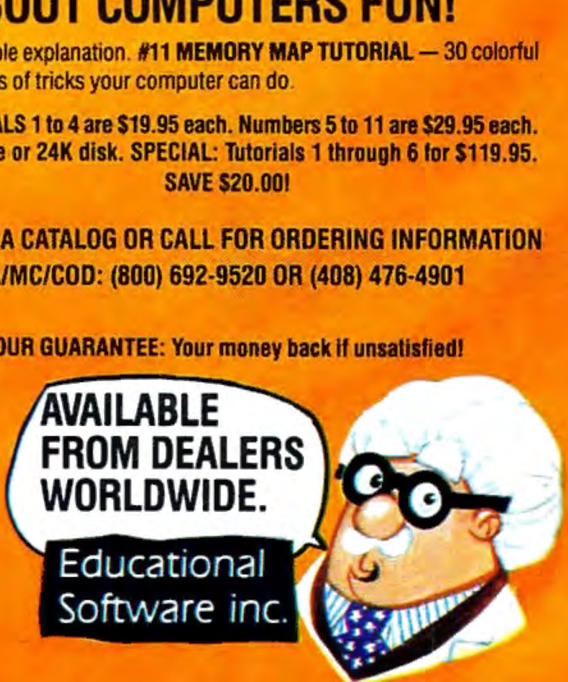

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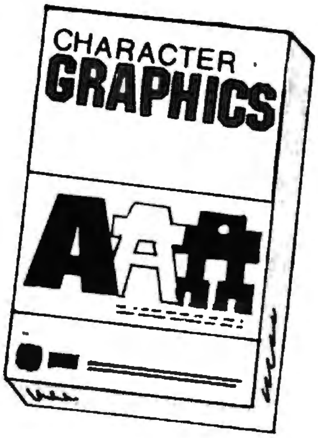

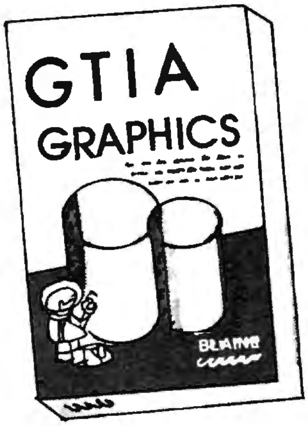

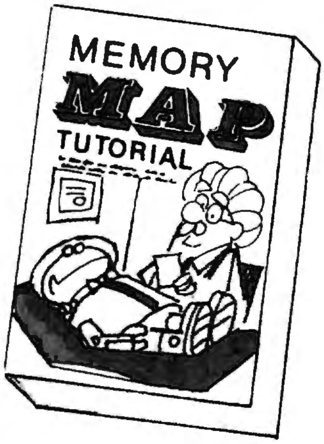

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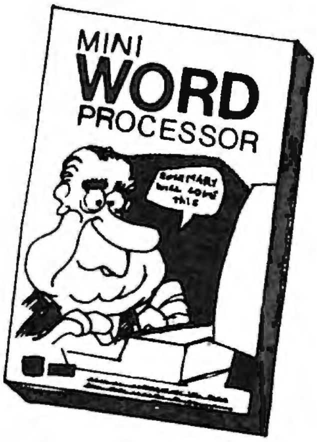

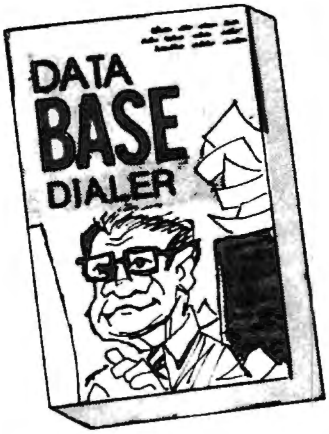

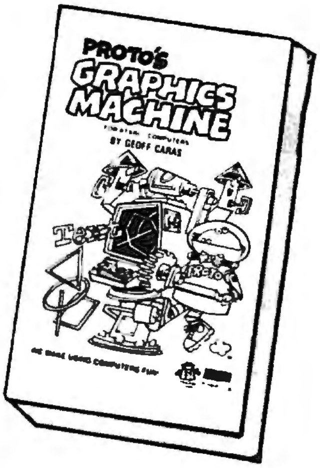

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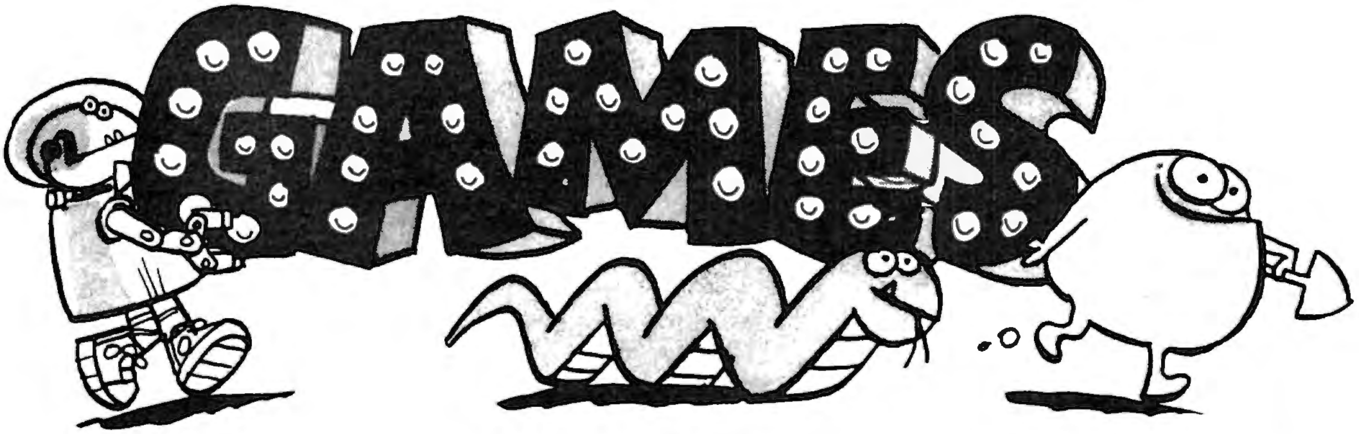
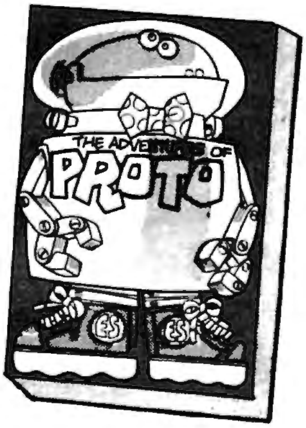


AN ADVANCED ARCADE GAME

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.

For those of you who always wanted a pet snake, this game is for you. What do you feed a guest like this? An ample supply of insects, of course, but be aware that snakes often wind up biting themselves or getting electrocuted on their cage walls if not properly trained. Difficulty levels for all ages. $24.95.



Prototype the Robot needs the help of your child, 4 or older. His busy day includes catching marshmallows being dropped by friendly Aliens, Coloring pictures, and Playing tunes on his piano. $24.95

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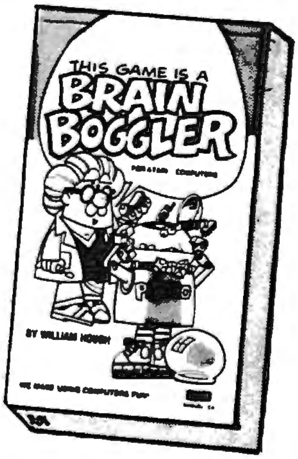
Diggerbonk! is the first arcade style game with a continuously scrolling maze that never repeats. You must guide your Digger upward before it goes off the bottom of your screen. There are, however, a few problems you must BONK! along the way (see ingredients). To add to the complication, you need to 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.

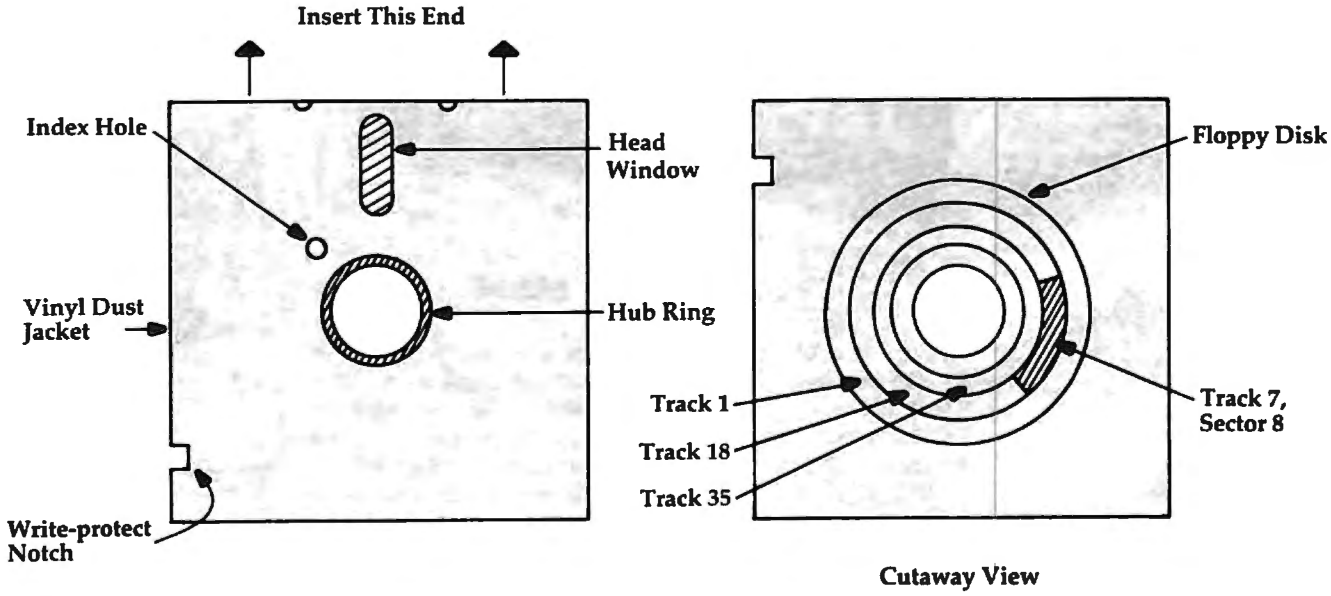
Both styles are similar, enclosing the disks in a vinyl dust jacket so that only a small section of the disk itself is exposed through a *head window*. When the disk drive is summoned by a command from the computer, the disk starts spinning at about 300 revolutions per minute, and a *read/write head* 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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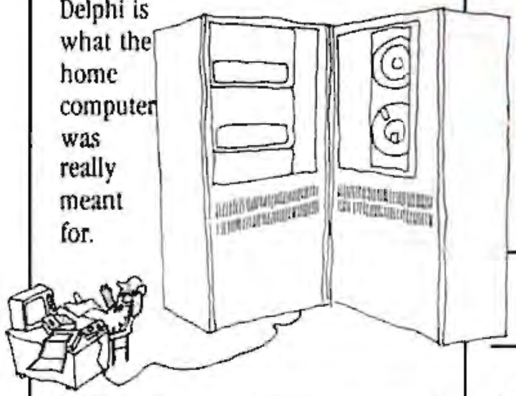

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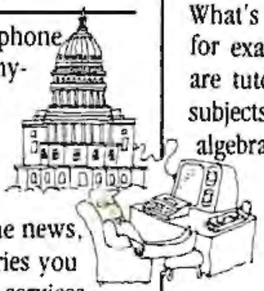

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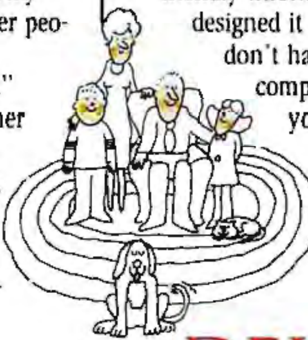

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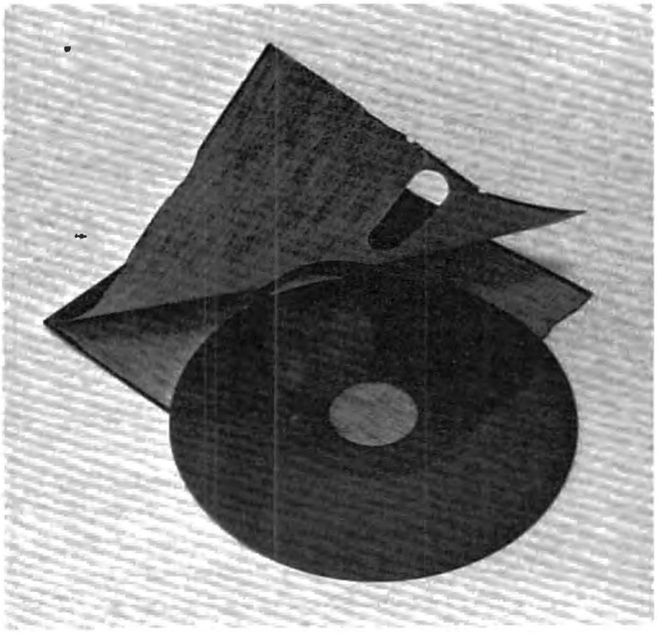
*Comp-U-Store is a registered trademark of Comp-U Card of America ter, as fast as 3600 rpm. (A floppy disk would quickly wear out under this kind of use, but the read/write head of a hard disk does not actually touch the surface.) Hard disks transfer their data much faster than floppies and can store 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."

You can see the fourbest for the trees.

In a time where everywhere you turn there's a forest of new video games, it's exciting to see a series of video games that obviously stand apart from the rest.

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Baseball $34.95 US funds available in 16K Tape and 24K Disc, Alien Swarm, Sentinel One and Guardians of the Gorn $29.95 US funds Tape and $34.95 Disc—obviously standing apart from the rest.

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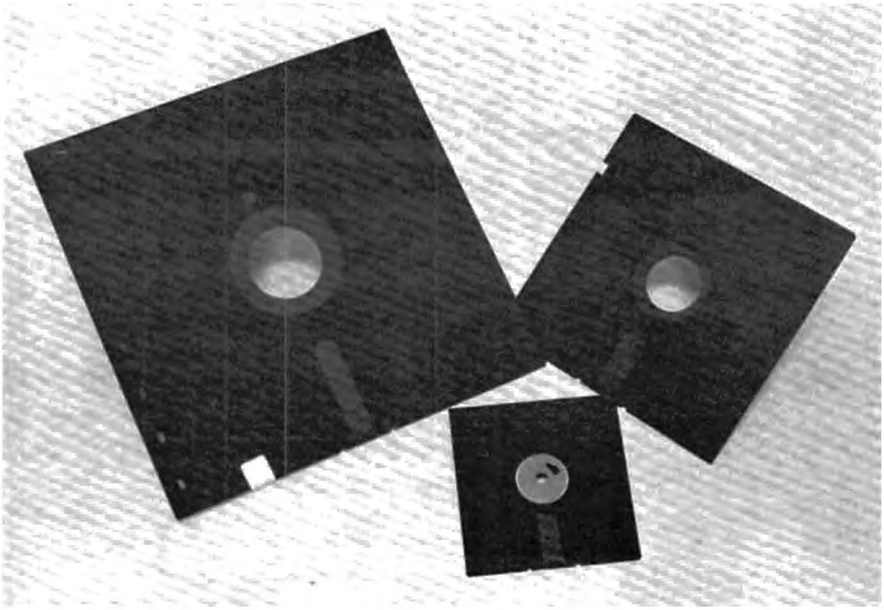

The Incredible Shrinking Disk. At left is an 8" floppy diskette; at right, a 5¼" minifloppy; and in the center, a 3¼" microfloppy. Are even smaller disks on the way?

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

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 multicolor 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 antimatter 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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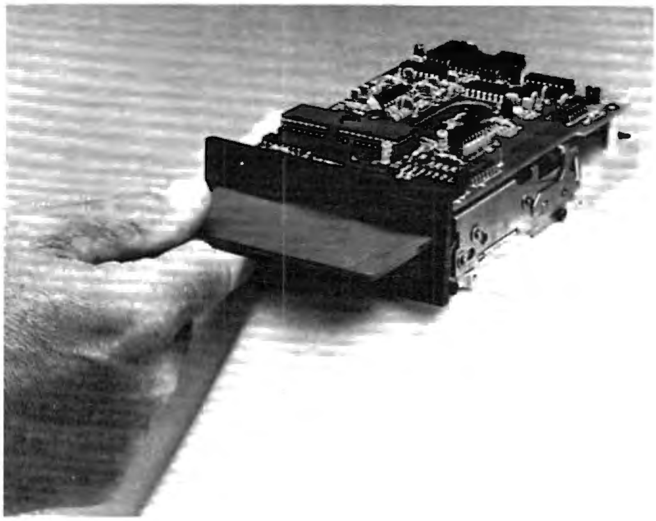

Tandon's 3½" microfloppy disk drive, the TM35, stores 875K per disk. It adheres to the Sony microfloppy standard.

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 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. **C**

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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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 fanfold 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.

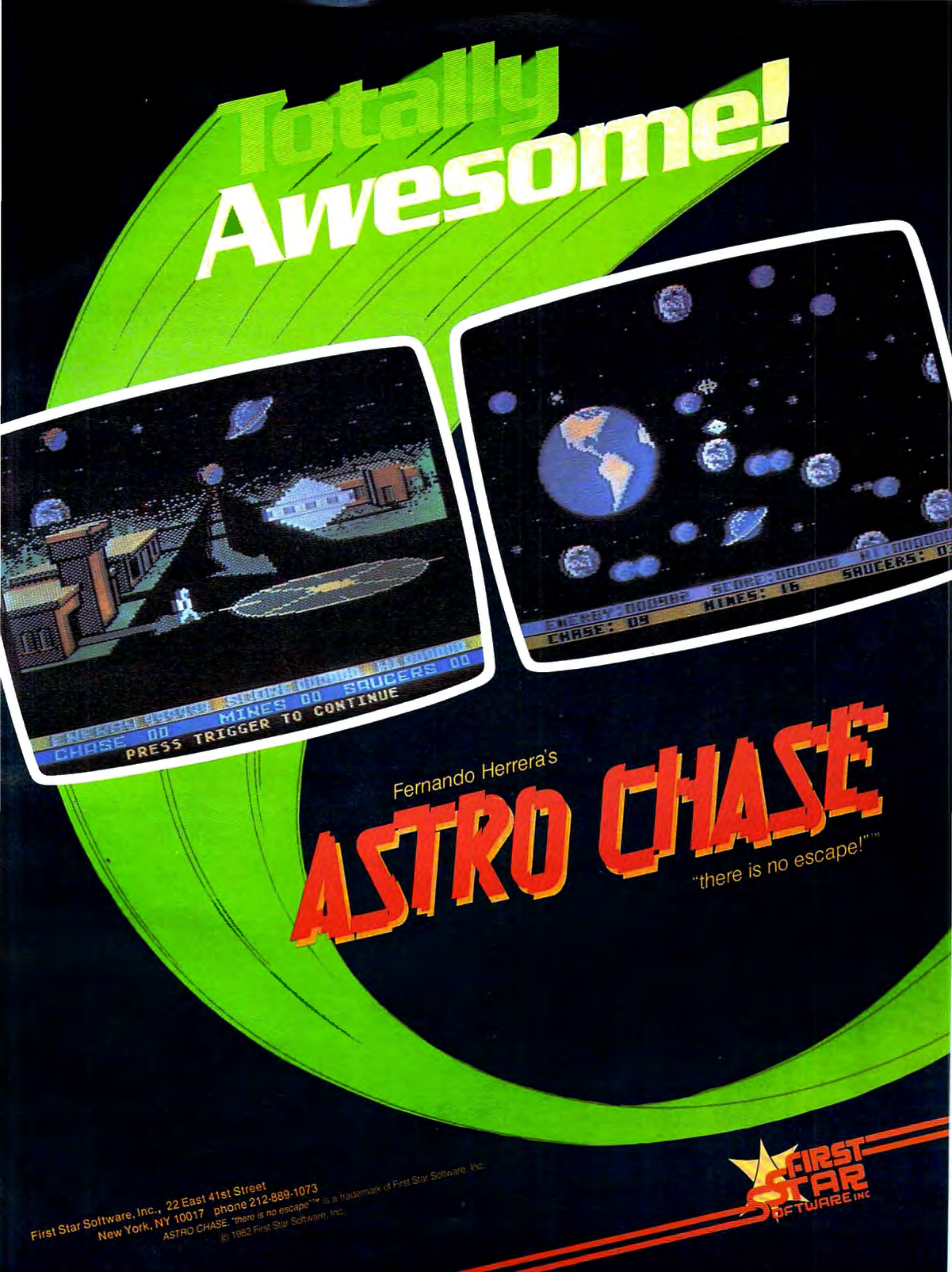
All the peripherals are promised for delivery in March and April. Atari also is hinting that a redesigned disk drive is on the way.

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. ©



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.

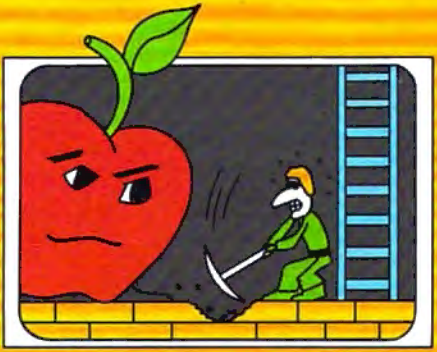
Your shopper is on the ground floor in the bottom left corner. Use the joystick to move left and right, or up and down stairs. You must be directly under the stairs to use them, and to exit onto a floor you must be standing exactly on it.

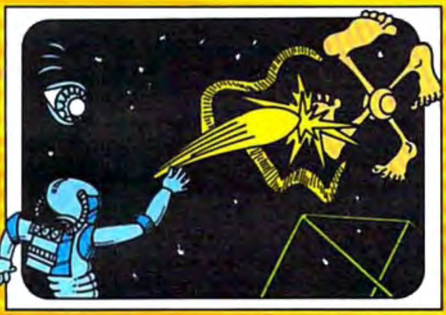
The program might run faster on U.S. Ataris than on my New Zealand model. The game for Atari is based on an idea in "P/M Graphics Made Easy" (**COMPUTE!**, February 1982) which animates the players with vertical blank interrupts (the split-second interval between the display of video frames). American 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.

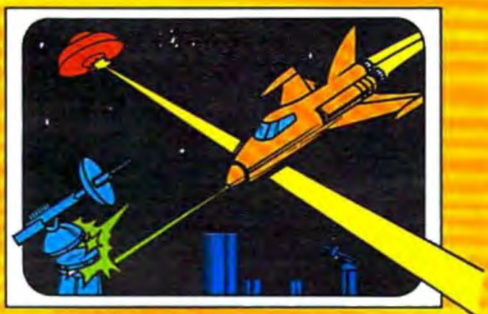
Good luck! I'd like to know who can better my score of 1200 points.

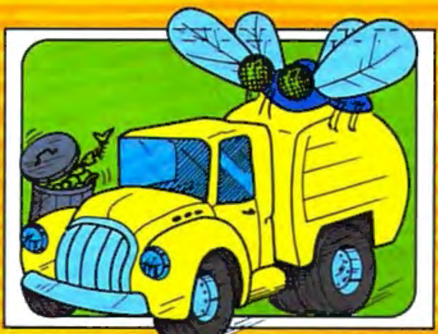
Since I omitted REM statements from the program to save space, here is a short explanation of the Atari version:

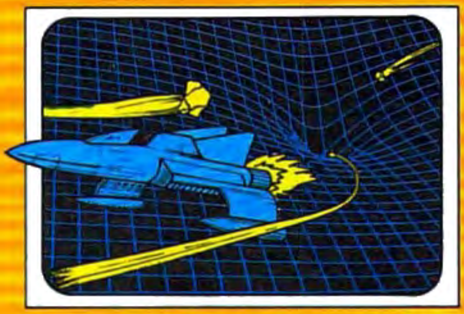
Line No.	**Comments**
10	Initializes. Jumps to line 209 to POKE in the P/M utility and player shapes, then to line 112 to wait for the trigger to be pressed to start the game. These jumps keep the lower numbered lines free for frequently accessed statements.
20-23	Check for your moves up the stairs.
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











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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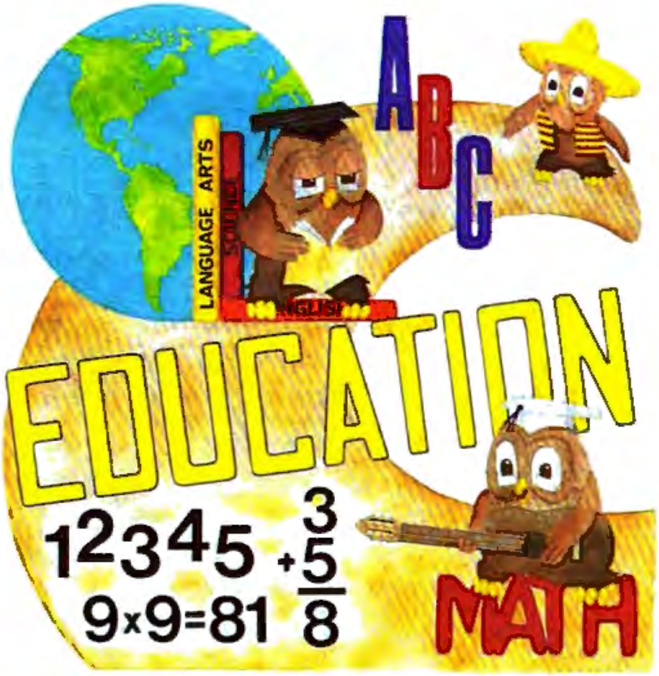

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Program 1: Atari Version

```
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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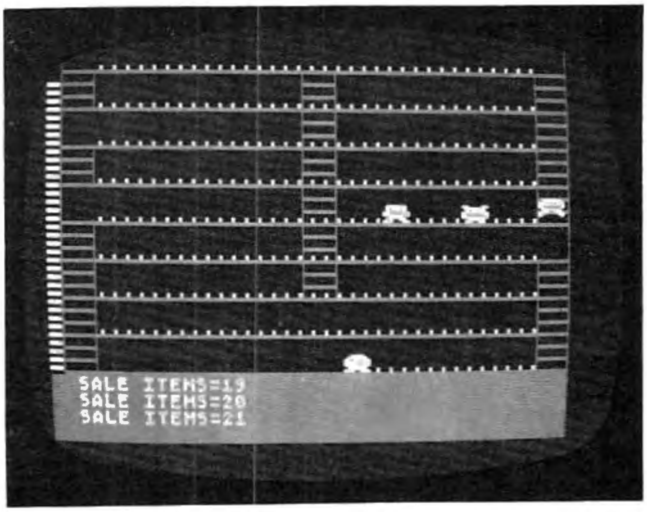
```
     TO PMBASE+1288:READ Z:POKE Y,Z:N
    EXT Y:FOR Y=PMBASE+1537 TO PMBASE
    +1544
213 READ Z:POKE Y,Z:NEXT Y:FOR Y=PMBA
    SE+1793 TO PMBASE+1800:READ Z:POK
    E Y,Z:NEXT Y:POKE P+2,76:POKE P+3
    ,204
214 POKE P,252:POKE P+1,140:POKE 559,
    62:POKE 623,1:POKE 1788,PM+4:POKE
     53277,3:POKE 54279,PM:X=USR(1696
    )
215 POKE O,8:POKE O+1,8:POKE O+2,8:PO
    KE O+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."

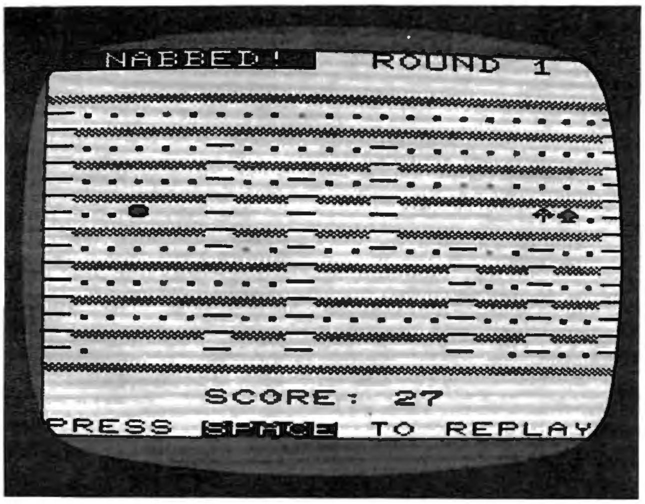
Program 2: VIC-20 Version

```
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=O
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(O)+2
250 NEXT:NEXT
260 FORI=66TO378STEPQ:POKETX+I,64:POKECO+I,O:P
    OKETX+21+I,64:POKECO+21+I,O:NEXT
270 FORI=1TO10
280 SX=INT(7*RND(O))*3+3:SY=5+INT(6*RND(O))*2
290 LN=2+INT(3*RND(O))*2:IF SY+LN>18 THEN 290
300 FORJ=SY*QTO(SY+LN)*QSTEPQ
310 POKETX+SX+J,64:POKECO+SX+J,O
320 NEXT:NEXT
330 EX%(O)=1:EX%(1)=2:EX%(2)=3:FORI=OTO2:EY%(I
    )=3:NEXT
340 EC%(O)=65:EC%(1)=88:EC%(2)=81
350 DX%(O)=1:DX%(1)=1:DX%(2)=-1
360 FORI=OTO2:EP%(I)=46:PC%(I)=INT(6*RND(O)+2)
    :NEXT
370 PX=2:PY=17:PC=94:DX=O:DY=O:PK=32
380 GETA$:IFA$<>""THENB$=A$
390 IFB$=" "THENGOSUB800
400 IFB$="I"THENDY=-1:DX=O
410 IFB$="M"THENDY=1:DX=O
420 IFB$="J"THENDX=-1:DY=O
430 IFB$="K"THENDX=1:DY=O
440 CP=TX+PX+Q*PY
450 IFPK<>64ORPEEK(CP+Q*DY)=104THENDY=O
460 IFPEEK(CP+DX)=104THENDX=O:B$=""
470 POKE CP,PK:POKECO+CP-TX,CC
480 PX=PX+DX:PY=PY+DY
490 IFPX<0THENPX=O:B$="":DX=O
500 IFPX>21THENPX=21:B$="":DX=O
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%(O)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=O:YY=SGN(PY-EY)
630 IFPEEK(CP+YY*Q)=104OR(EY=PYANDEY/2<>INT(EY
```

```
    /2))THENYY=O: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%(O)ANDEP<>EC%(1)ANDEP<>EC%(2)THEN
    700
680 FORI=OTO2: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%(O)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$,23);TAB(10)"SHOVE
    S ="SH;
910 RETURN
920 FORJ=OTO2:IFSV%(I)<>EC%(J)THENNEXT:STOP
930 SV%(I)=EP%(J):POKECO+CP+I-TX,PC%(J)
940 EX%(J)=INT(20*RND(O)+1):EY%(J)=3
950 DX%(J)=-1:IFRND(O)>.5THENDX%(J)=1
960 DY%(J)=O:EP%(J)=46
970 PTS=PTS+50:FORJ=0TO15:POKES3,128+J:POKEV,1
    5-J:NEXT:POKES3,0:POKEV,0
980 PRINTCHR$(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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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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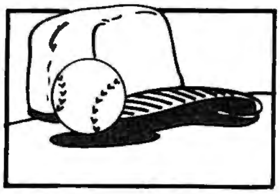

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This fantasy role-playing game is in real-time, so you only have 5 seconds to make decisions! Choose your character attributes and begin your descent into the *50-level* dungeon of TELENGARD. Some players defeat the monsters and return with great wealth. Others, however, may loose sleep, their jobs, and even their spouses. *Don't say we didn't warn you!*

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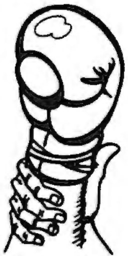

KNOCKOUT

From Avalon Hill

Can be played by two players simultaneously.

This computer boxing game has the exciting graphics you can expect from the whole Sports Illustrated Series from Avalon Hill. This one's a real KNOCKOUT, as you control the movements of your boxer with your joystick. For one or two players ... or try the computer against itself, as you watch and learn. Requires joystick.

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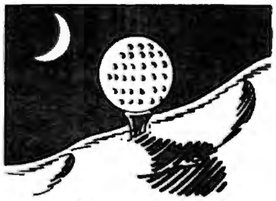

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Realistic, challenging golf game on courses open 24 hours a day, regardless of weather. Great sound and graphics; with running tally of each player's score. Select course, type of club, 1–4 players.

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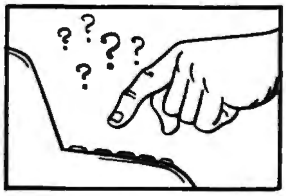

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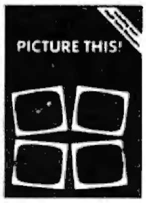

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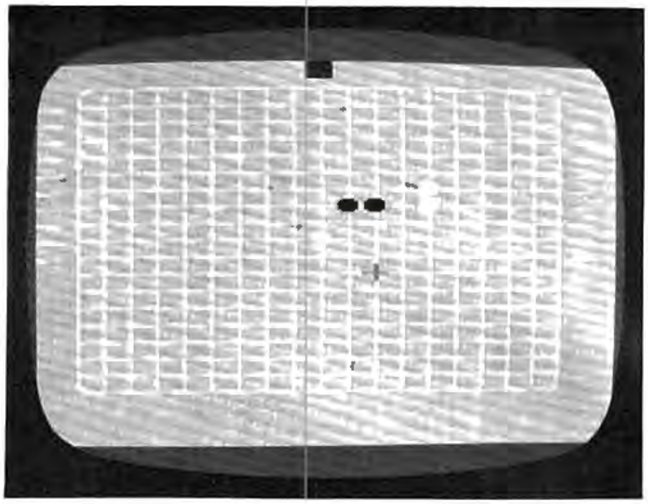
```
1840 IF PEEK(CR+O1%)<>81OR(PEEK(C+((CR+O1%)
     -A))AND15)<>OPTHEN 2200
1850 IF PEEK(CR+O2%)<>81OR(PEEK(C+((CR+O2%)
     -A))AND15)<>OPTHEN 2200
1860 IF PEEK(CR+O3%)<>81OR(PEEK(C+((CR+O3%)
     -A))AND15)<>CLTHEN 2200
2000 IFCL=1THEN2100
2001 BC=BC+22:POKEBC,81
2003 POKECR+O1%,91:POKE C+(CR+O1%-A),1
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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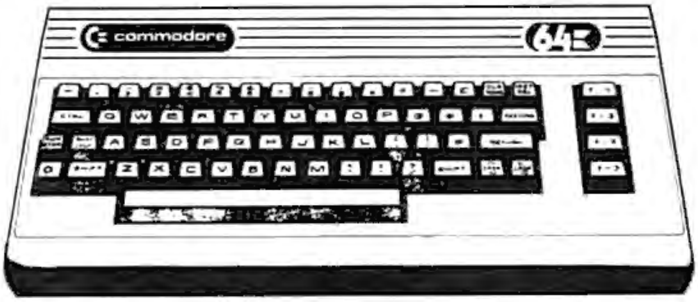

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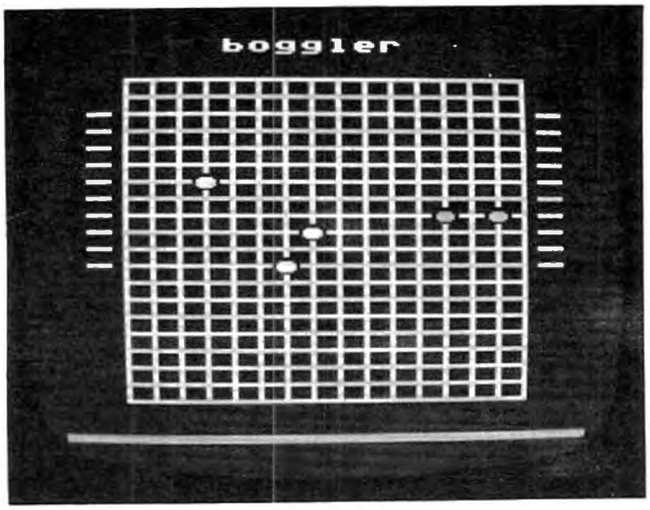
```
7910 IF FR=0 AND W=8 THEN 7900
7999 RETURN
8000 IF PEEK(T2)=107THEN T2=T2+17
8005 IF PEEK(T2)=115THEN T2=T2-17
8010 IF PEEK(T2)=113THEN T2=T2-374
8020 IF PEEK(T2)=114THEN T2=T2+374
8030 IF PEEK(T2)=85THEN T2=T2+391
8040 IF PEEK(T2)=75THEN T2=T2-391
8050 IF PEEK(T2)=73THEN T2=T2+357
8060 IF PEEK(T2)=74THEN 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
```



"Boggler," Atari version.

```
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"
```

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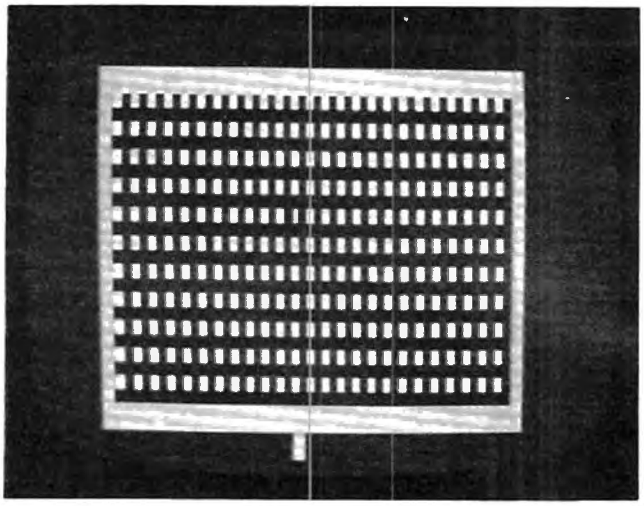
```
890 FOR I=4 TO 13:POKE SCR+I*20+1,82:
    POKE SCR+18+I*20,82:NEXT I
900 DIM PPOS(1),PIECE(1),COUNT(1)
910 PPOS(0)=SCR+229:PPOS(1)=SCR+209
920 PIECE(0)=148:PIECE(1)=212:COUNT(0
    )=0:COUNT(1)=0
930 POKE PPOS(0),PIECE(0)
940 RETURN
```

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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8" DSDD Soft Sector (1024 B/S, 8 Sectors)	743-0/1024	3.49
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5¼" SSDD 10 Hard Sector w/Hub Ring	744D-10RH	2.34
5¼" SSDD 16 Hard Sector w/Hub Ring	744D-16RH	2.34
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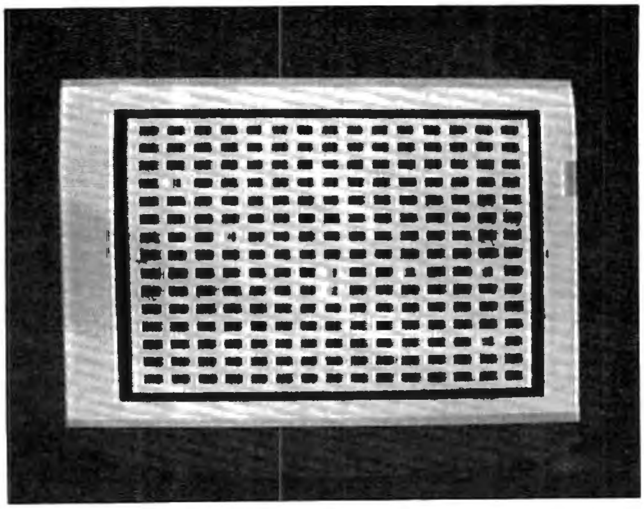
Program 4: Apple II Version

```
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
```

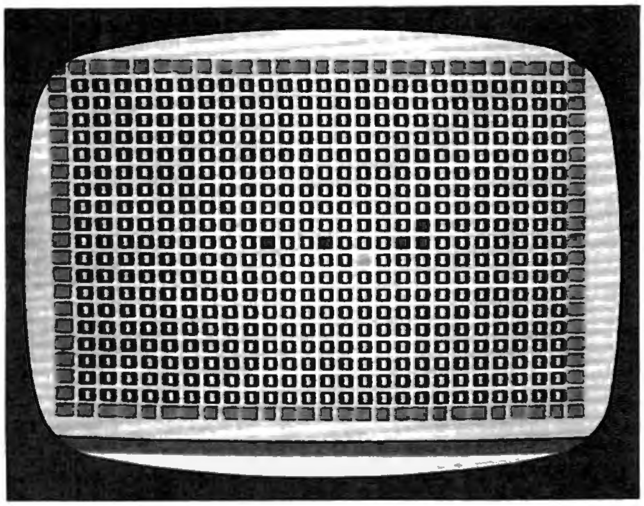


"Boggler," Apple version.

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)
```

```
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
```

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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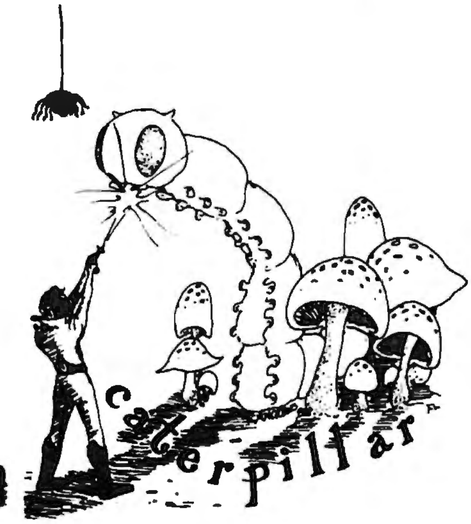

CATERPILLAR

O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. $19.95 for TRS 80 COLOR.

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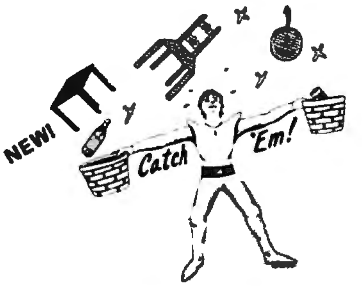

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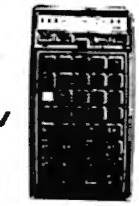

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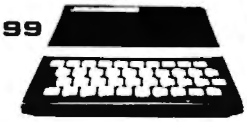

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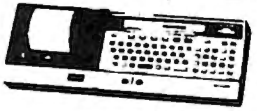

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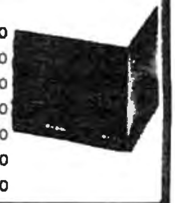

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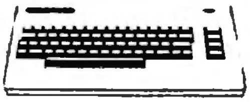

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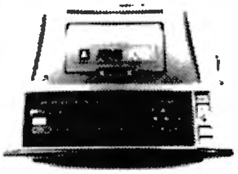

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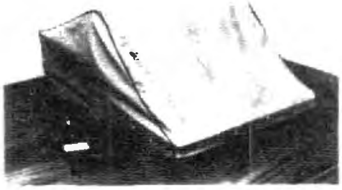

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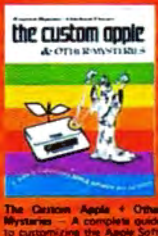

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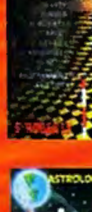

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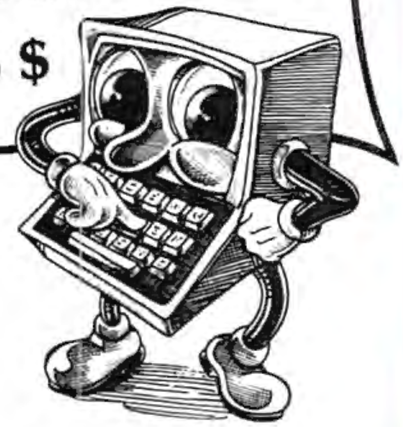

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Magic Spells For Apple

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 actually hear the words. A second way would be for each word to flash on the screen for a long enough time to be read, and then be erased before the child begins typing it in. A third possibility would be for the program to generate sentences with the target word omitted.

Some of the word lists on the diskette contain words that children misspell because they choose the wrong homonym. Words like "there" and "their" are in the lists, as are "to", "two", and "too". Avoiding these misspellings would be helped only with practice using them in sentences. Unscrambling their letters is of no value whatsoever.

A relatively minor problem with the program is the length of the game. Each game could take up to 40 minutes. This is longer than the amount of time children typically have on a computer at school. If a child needs to stop playing before the game is over, the ESC key will allow an escape from the game. However, when this option is exercised, no score summary is presented, and no reward is given.

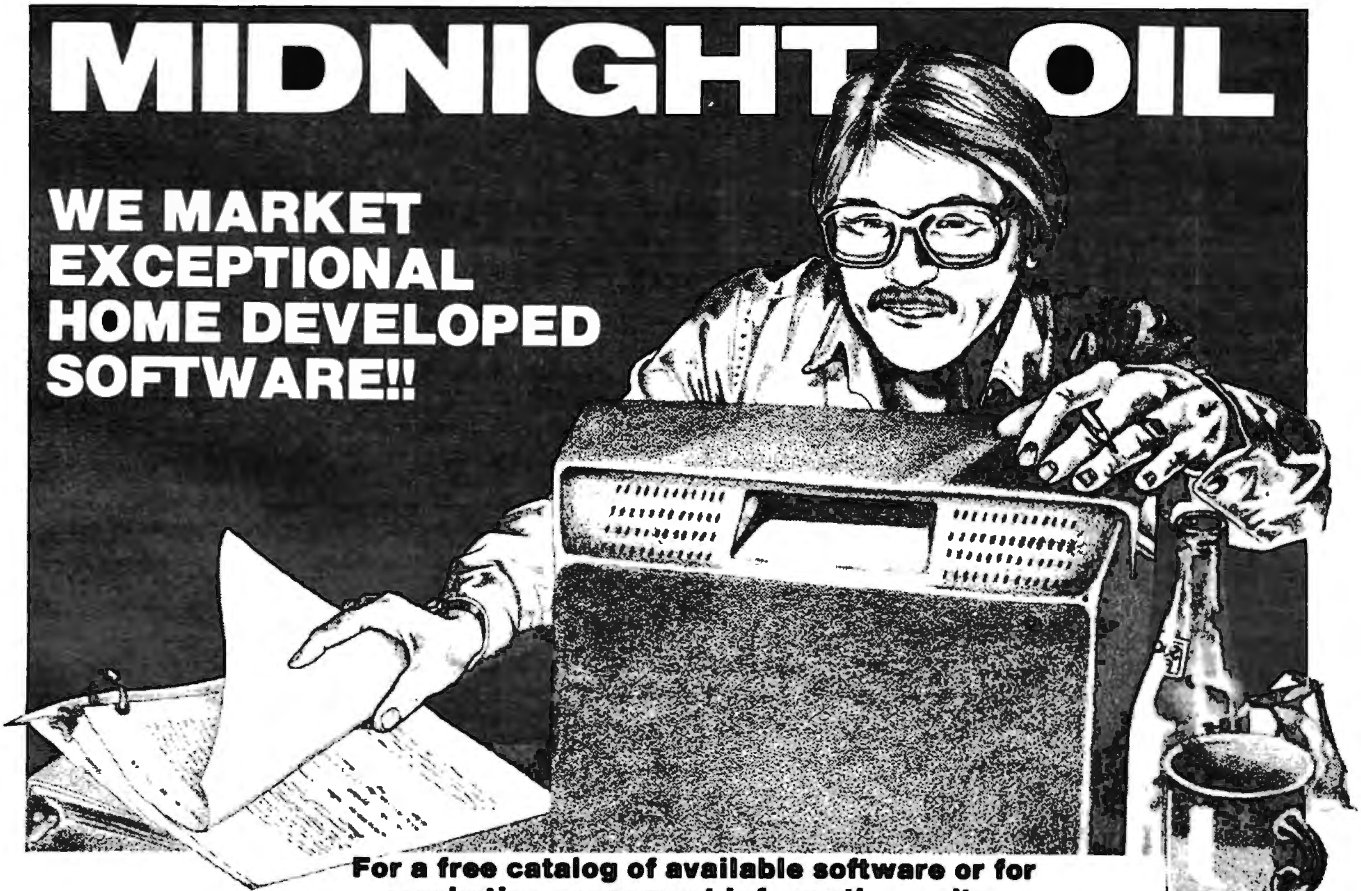
Unscrambling spelling words in Magic Spells.

The documentation for this diskette gives information about the game in an interesting, clear fashion. Screen photographs add a lot to its understandability. It gets a little confusing when it gives instructions for making backup copies of lists of words, however. The major confusion is whether the manual is referring to the *Magic Spells* backup diskette or another backup diskette. A teacher or parent new to the computer would probably need some help understanding to which disk the instructions are referring.

This program has potential, but I feel it should be revised. Although the kids love the game, the teacher utility works well, and the flow of the program is appealing and makes logical sense, it should be reworked to include an educationally sound way of giving practice in spelling words.

The program, written by Leslie Grimm, comes with a master and a backup and runs on an Apple II Plus with 48K.

Magic Spells
Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014
$45



Frogger For Atari

Larry Isaacs

A number of arcade games have been converted for home computers. *Frogger* has now joined these ranks. We Atari 400/800 owners are fortunate to receive another excellent conversion. This game is sold by Sierra On-Line, Inc., under license from Sega, the same folks who made the original arcade version. The Atari version is credited to John Harris. *Frogger* is available on disk (requires 32K) or cassette.

For those who do not frequent the arcade game rooms, a detailed description of the game follows. But first, there are a couple of options that may be set. Once the game has finished loading, you may choose between two speeds, FAST and SLOW, and whether you want the accompanying music on or off. The OPTION switch toggles the game speed between FAST and SLOW, with FAST being the initial setting. So far, the SLOW speed has been plenty hard enough for me.

The music option is controlled by the SELECT switch. By the way, this music is some of the best I've heard on any game so far. The music option is available only on the disk version. I also appreciate the fact that you are not required to listen to 10 to 20 seconds of music before you can start the game. You start or restart the game by pressing START. Even after the game has begun, you may still change speeds or toggle the music using the appropriate key.

Once the game gets underway, you face the challenge of *Frogger*. The primary task is to hop frogs, one at a time, across a highway and a river into one of the five "homes" on the far side. On the display, this journey starts at the bottom of the screen and ends at the top. You control the movement of each frog with the joystick. Each frog is able to hop forward, backward, left, and right, but not at any of the 45-degree angles. To make it hop, you push the joystick in the desired direction. To make it hop again, you must return the stick to the neutral position and push it again in the desired direction.

Rest On The River Bank

The first obstacle is the highway. This involves crossing four lanes of traffic. To make this phase less than simple, the direction of traffic alternates with each lane, and the speed of each lane is different. Once you have made it past the highway, you can rest on the river bank before tackling the river. The river contains five "lanes." The first and fourth lanes contain turtles swimming upstream (i.e., to the left as you face the screen). The second, third, and fifth lanes contain logs which are floating downstream (i.e., to the right).

Naturally, these lanes move at different speeds. You cross the river by hopping on top of the turtles and logs to go from lane to lane. On the far side of the river, there is a wall with five little arches which represent the frogs' homes. You must hop directly from the last lane of logs into the arch to reach home.

The object of the game is to accumulate as many points as possible until you lose five frogs. The frogs may be lost in a number of different ways. The two most common ways: they are struck by a vehicle on the highway, or they fall into the river (swept away by the current, I assume). One feature that makes the river slightly more difficult to cross is that some of the turtles will submerge, taking your frog into the water with them. You also lose the frog if it misses the arch and hits the wall instead.

Finally, there is a time limit within which the frog must reach home. Each frog gets 120 counts which amounts to about 32 seconds. The "clock" appears as an orange bar at the bottom of the screen, and it shortens as the time runs out. When a frog is lost, a skull and crossbones appears briefly at the frog's last position. In addition to the "bleep" when the frog hops, there are appropriate sound effects when a frog is lost.

Points are accumulated in a number of ways. First, you receive 10 points for each forward jump your frog makes and 50 points for each frog that arrives home. Second, when a frog reaches home, you get 5 points for each count remaining on the time clock. In addition, there are a couple of ways to earn bonus points. From time to time an insect will appear in one of the unoccupied homes. If your frog can pounce on this insect, you receive 200 bonus points.

Alligators, Snakes, And Otters

A typical game consists of a sequence of rounds, once you can get past the first. A round is completed by maneuvering a frog into each of the five homes. There is a 1000-point bonus for completing a round, and you get to move on to the next round. Naturally, the level of difficulty increases for each successive round.

First of all, the traffic pattern on the highway changes: the amount of traffic increases, and the pattern requires more maneuvering to get across. The pattern of turtles and logs in the river also changes. Fewer logs appear in the third lane, and some of the logs in the last lane are replaced by alligators. You may hop on the backs of the alligators, but if you come too close to an alligator's mouth, the frog is eaten. Occasionally, an alligator will appear in one of the unoccupied homes for a brief period. You can wait for the alligator to leave or choose a dif-

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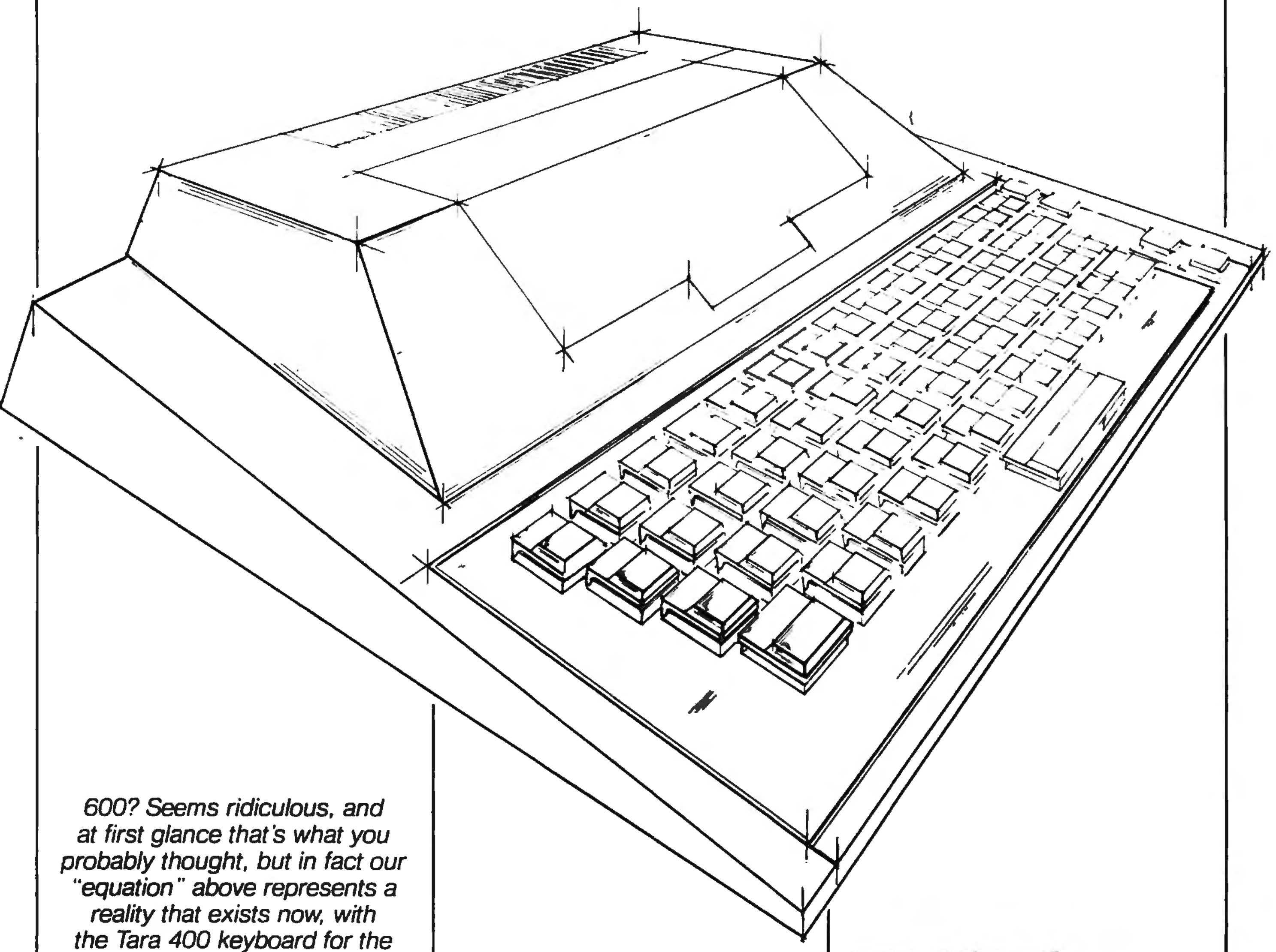

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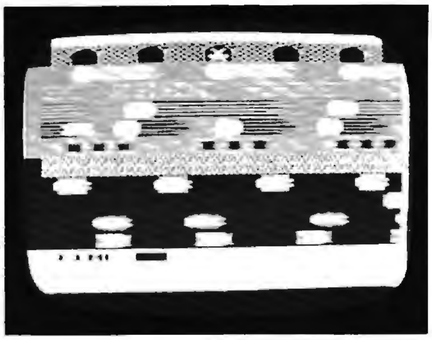
ferent home.

When you reach the third round, the difficulty is increased further by two additional predators: snakes and otters. The snakes will appear on the logs in the third lane of the river, and on the river bank between the river and the highway. If a snake appears, it will slither back and forth on the log. It is relatively safe to hop onto a log patrolled by a snake, since the snake will not chase the frog.

However, if you let the snake slither into the frog, the frog is eaten. On the river bank, the snake will make only one pass along the bank, but another may appear from either direction a short time later. An important point is that you can hop away from a snake, but you cannot hop over one.

The otters also are dangerously hungry, and can appear anywhere in the river, swimming between logs or between groups of turtles. The otters appear only on the disk version of the game.



Speeding cars, turtles, and logs whiz by in the official Atari version of Frogger.

After playing *Frogger* for quite a few hours, I would have to rate it as among the best games available for the Atari. It has very good graphics with lots of motion. In spite of all the motion, there is no noticeable jitter. Joystick response is very quick and quite sensitive. At first I found the joystick too sensitive. It was very easy to hop once too often or hop in the wrong direction. However, as your skill increases, this sensitivity becomes more and more valuable.

One of the best features of the game is the rate at which the level of difficulty increases with each round. The increased difficulty noticeably adds to the challenge, but is not so great as to cause undue frustration while trying to reach the higher levels. With the music thrown in for good measure, the game is a sure winner.

The Atari version of *Frogger* is very close to the real arcade game. There are only a few differences. First, there is twice the number of counts in the time limit to get the frog home. Along with this change, you receive only five bonus points for each count remaining on the clock. The only other significant difference is that the Atari version allows only one player.

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VIC Rabbit: A High-Speed Cassette Interface

Roger N. Trendowski

With a very unassuming name, the VIC Rabbit may be one of the most useful peripherals you can add to your VIC-20 cassette system. What is a VIC Rabbit? It's a Read Only Memory (ROM) cartridge, manufactured by Eastern House Software, that plugs into the VIC expansion port.

VIC Rabbit adds 12 new commands to VIC BASIC. Of these, the new SAVE, LOAD, and VERIFY commands are the most impressive. (More about these commands later.) The Rabbit consists of two ROM sockets mounted on a circuit board; a ROM is mounted in one socket and the other is empty. Eastern House has plans to develop additional ROMs; possibly other utility programs or a word processor.

Also mounted on the circuit board are some capacitors, a controller chip, and at the rear, a female 44-pin connector. This expansion connector allows you to add additional memory, another utility cartridge, or even an expander motherboard with multiple slots. In other words, the Rabbit won't take over your expansion port.

SAVE, LOAD, And VERIFY

To activate the Rabbit, type the following command: SYS 7*4096. The manufacturer's name will be displayed, followed by READY.

Two SAVE commands, a LOAD command, and a VERIFY command are the main capabilities of the Rabbit. One of the SAVE commands, *S, is for saving programs with a six-second tape leader. The other SAVE command, *SS, provides only a three-second leader. The general format of the SAVE commands:

```
*SS"name",1,xxxx,yyyy
*SS"name"
*S
```

The name and device number are optional arguments, as they are with the normal SAVE command. The optional xxxx and yyyy fields are hexadecimal addresses which allow you to designate where in Random Access Memory (RAM) you want the program when reloading it.

Loading is done with a similar format:

```
*L"name",1,xxxx
*L"name"
*L
```

Normally, a program is loaded into memory at the same location from where it was previously saved. If you load a program with *L"name",1,f00, for example, the program will be loaded at the starting address of $0f00 (3840 decimal). After the program is loaded, the program name, program length (hex), starting address, and ending address are displayed in reverse video.

The format for verifying a program is:

```
*V"name"
*V
```

This VERIFY command is a different technique than is normal for the VIC-20. To guarantee a good recording, the standard VIC VERIFY command reads a program from tape and compares it (byte-for-byte) with the program stored in RAM. With the VIC Rabbit, a checksum value is calculated as the program is read from the tape. (The checksum is the cumulative total of the value of each byte in the program.) Next, the computed checksum is compared with a checksum which was saved on tape at the end of the program. Because Rabbit never compares the tape version with a copy in RAM, you don't actually need the program in RAM to verify it.

Saves Five Times Faster

The Rabbit performs a short SAVE five times quicker than the normal VIC SAVE. For example, for a 3K byte program, the SAVE command process takes one minute and nine seconds; the Rabbit, 15 seconds. For a 16K program, SAVE takes five minutes; the Rabbit takes only one minute.

The *S commands takes three seconds longer than *SS; since a longer leader is put on the tape. The *S command can be used to move past the plastic leader found at the beginning of most cassette tapes. Both the LOAD and VERIFY Rabbit commands take the same length of time as the SAVE command.

I did not actually test for error-rates on the Rabbit; however, I did record the number of bytes and the number of SAVEs I performed over a four-hour period of testing. I experienced no loading errors with 75 SAVEs and LOADs (involving about 200K).

There are three limitations to the Rabbit. First, it obviously cannot load a program which was saved in regular VIC tape format. Second, multiple commands cannot be used, e.g., *S:*S. Third, the Rabbit does not transfer data files to cassette tape. The PRINT# command, which VIC Rabbit does not affect, normally does this in the VIC-20.

Other Features

***E,"name"** – This command loads a program and then automatically runs it.

***T,v,xxxx,yyyy** – This command performs RAM tests in the memory range xxxx to yyyy (hex). If v = 1 for Test 1, the Rabbit tests RAM chips for storage retention. If v = 2 for Test 2, the chips are tested for proper selection operation. If an error is found, the bad memory address is printed out, along with the test pattern and error pattern numbers.

***Hxxxx** and ***Dxxxx** – These commands convert a hex number to decimal and decimal to hex. They are especially useful when working with the hex starting address and number of program bytes which are printed out with the load and verify commands.

***Gxxxx** – Go to machine language program at hex address xxxx.

***** – This is one way to get back to the normal VIC screen. Pressing the RUN/STOP and RESTORE keys also works.

***Z** – This command switches the VIC to the graphics character set, or back to the alphanumeric character set. This command may be useful on other Commodore computers; however, on the VIC you need only to press the COMMODORE and SHIFT keys to accomplish the same thing.

***K** – Use this command to kill the Rabbit (disable the link). To reactivate the Rabbit link, you must type SYS 7*4096.

Configurations

VIC Rabbit can be used in a variety of configurations, with memory expansions, utility and graphics cartridges, and expansion motherboards. Rabbit uses address space in the third 8K RAM expansion block (from decimal 28672 to 32767). This leaves room for 27K of memory expansion. The Rabbit should be configured in series with an expansion motherboard if you intend to use one.

If you load the motherboard with both 8K + 16K, the Rabbit will isolate that portion of memory that overlaps into the address space that it uses. A block three memory expander should not be plugged in parallel with the Rabbit since that places two circuit controllers on the same VIC input lead. VIC will not know which device to take orders from.

According to Eastern House Software, block three RAM address space was used for the VIC Rabbit program so that the ROM area (decimal 32768 - 36869) could be reserved for other utility programs.

Documentation

An eight-page booklet is supplied with the VIC Rabbit. Except for the first page, it is easy to read. Page 1 is somewhat confusing because of its discussion of Rabbit interfaces with Commodore 64, PET Model 2001 and 4001, and CBM 8032. A separate VIC-20 instruction book will be available soon, according to the manufacturer.

The VIC Rabbit is an impressive product which should be extremely useful for BASIC and machine language programmers. It is built with expansion in mind and is both innovative and inexpensive.

VIC Rabbit
Eastern House Software
3239 Linda Drive
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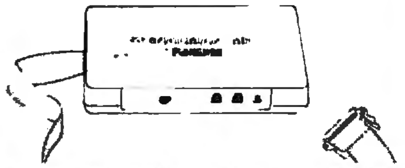

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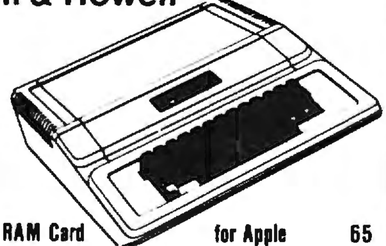

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by Michael Riley

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For writing text, Paper-Mate has a definable keyboard so you can use with either Business or Graphics machines. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

Paper-Mate text editing includes floating cursor, scroll up or down, page forward or back, and repeating insert and delete keys. Text block handling includes transfer, delete, append, save, load, and insert.

All formatting commands are imbedded in text for complete control. Commands include margin control and release, column adjust, 9 tab settings, variable line spacing, justify text, center text, and auto print form letter (variable block). Files can be linked so that one command prints an entire manuscript. Auto page, page headers, page numbers, pause at end of page, and hyphenation pauses are included.

Unlike most word processors, CBM graphics as well as text can be used. Paper-Mate can send any ASCII code over any secondary address to any printer.

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Mathematics Action Games For TI

C. Regena

Parents and teachers – can you imagine a situation where you do *not* have to nag your students to practice their math? In our high tech society what could be more motivating than computer games? Scott, Foresman and Company has developed three command modules for the Texas Instruments TI-99/4A computer that combine color, graphics, animation, and music with educational concepts for some fun *Mathematics Action Games*.

Each module consists of two major games, and each game has three levels of difficulty, so the modules are versatile enough for a wide range of students. You may choose a one-player or a two-player game. The series supplements any major basal mathematics program. Each module is packaged in a durable vinyl album with a *Teacher's Guide*. The *Teacher's Guide* includes reproducible worksheets and record sheets.

Hard, Harder, Hardest

The modules are an intriguing way to practice fundamental math skills. A student interacts with the game after a correct response. If the student answers incorrectly, the correct response is supplied. There is a time element, so the more quickly the student answers, the higher the score will be (or more jumps or more bowling pins, etc.). Scott, Foresman produces the Mathematics Courseware Series to teach and to give tutorial and remedial help. The *Mathematics Action Games* provide the practice.

Module A is for kindergarten through third grade and has difficulty levels of Hard, Harder, and Hardest. *Frog Jump* at the Hard level is a game involving identifying one greater than or one less than a given number. The Harder level employs the concept of the next number in a series counting by twos, fives, and tens. The Hardest level involves order multiples of 10, 100, and 1000. A sample problem is "Give 100 more than 8396." Depending on your answer, your frog jumps a certain number of lilly pads.

The second game in Module A is *Picture Parts*, which gives practice in the basic mathematical operations. For the Hard section, you give answers to basic addition and subtraction questions such as 9+3=?. In the Harder level, you give the missing number in basic addition and subtraction equations, such as 12 - ? = 5. The Hardest level requires answers to basic multiplication questions.

Module B is designed for grades three through six and provides practice with multiplication and division. *Pyramid Puzzler* is the game for multiplication. The Standard level involves giving missing multiplication factors. The Advanced level involves multiplying by multiples of 10 and 100. A sample problem is to multiply 7 x 400.

Ready to practice division? Try the game of *Star Maze*. All the problems are written in standard division form (long division). The Standard level requests answers to basic division problems. The problems for the Advanced level involve dividing by a one-digit divisor to get a one-digit quotient with a remainder. The Master level problems ask you to divide a three-digit dividend by a one-digit divisor.

From Amateur To Champion

Module C of the *Math Action Games*, one of my favorite modules, is for 6th, 7th, and 8th grades. The graphics for *Number Bowling* are really good. To get a strike, you must give the correct response almost immediately. The longer it takes to answer, the fewer pins you'll hit – and an incorrect answer is a gutter ball. *Number Bowling* has problems involving decimals and fractions. The Amateur level has two types of problems. One type asks you to compare and order decimals (Which is greater? 3.0254 3.3025). The second type of problem asks you to write decimals, such as "Give as a decimal: fifty-one ten-thousandths." The Pro level requires you to write a fraction given a mixed number or to write a mixed number given an improper fraction. The Champion level involves writing a decimal equivalent of a given fraction.

Space Journey gives practice with decimals and percents and at the same time satisfies anyone's urge for a space game. Using the arrow keys, you can land on asteroids or planets, answer a certain number of questions, and try to get to your destination as soon as possible. The Amateur level asks you to give decimal equivalents for percents greater than one and less than 100. The Pro level involves writing decimal equivalents for percents greater than 100 or less than one (Example: Give as a decimal .7%). The Champion level requires you to write percent equivalents for decimals, fractions, or whole numbers.

The *Math Action Games* are highly motivational, and, in the competitive formats, encourage quick thinking. Students will enjoy playing the games over and over to try to improve scores. It's practice at basic math concepts disguised as fun.

I highly recommend these modules for all classrooms up to 8th grade and for families with children under the age of 14.

Mathematics Action Games
Scott, Foresman and Company
1900 East Lake Avenue
Glenview, IL 60025
$75.95 per module

Facemaker And Story Machine For Apple, Atari And CBM

Sheila Cory

Spinnaker Software Corp. has developed two terrific ideas into programs for young children. *Facemaker*, designed for children aged four to eight, is a program that allows you to create and animate funny faces. *Story Machine*, for children aged five to nine, allows you to write a story at the keyboard and see it animated. One of these terrific ideas was developed into a terrific program, while the other one falls a bit short.

Facemaker

Have you ever had a secret desire to design and animate your own cartoon? Have you been looking for software that can be used to introduce computer programming to children as young as four? Do you like a good chuckle now and then? If you answered "yes" to at least one of these questions, *Facemaker* deserves your attention. Although designed for four- to eight-year-olds, *Facemaker* appeals to older children and adults as well.

Facemaker has three major options available. First, it allows you to design a face and, second, you can determine how the face should be animated. The third option is an entertaining and memory-building game.

To design a face, you choose from a series of menus of mouths, eyes, ears, noses, and types of hair. There are eight possible choices for each of these features; this permits a large number of possible different faces. As each feature is chosen, it is added to the face, so the face takes form right before your eyes. The choice of features is varied and creative, and the method of selecting them from the various menus is simple enough for even young children to learn.

When you want to make another face, you replace the features, one by one, on the old face. It's almost like a metamorphosis taking place before your eyes. Some of the children who looked at this program felt they would like to be able to build all of their faces from scratch. This can't be done once the first face is created, unless you turn the computer off, take the diskette out, and begin all over again.

Once a face is designed, you can animate it. In animating the faces, you are essentially writing a program, a list of instructions for the face to follow. Choices here include wink, cry, smile, frown, tongue out, and ear wiggle. To make it easier for young children to use this program, each of these options can be specified with just its first letter.

A typical program might be WTWFCW-EEW. This would cause your face to wink, stick its tongue out, wink again, frown, cry, wink a third time, delay a moment, ear wiggle twice, and end with a wink. All of this can be accompanied by appropriate sounds. I've yet to see anyone, adult or child, animate a face and not giggle when the program is run.

The third option, or memory game, is also based on a face you've designed. If you choose to play the game without having designed a face first, you'll get *very* strange results, so be sure to play the game after you've built your face. In this game, the face you've designed will animate, and the object is for you to specify exactly what steps were involved in the animation. If you get it right, one more step is added to the animation the next time.

For example, the first time the face may wink and frown. If you respond with the correct sequence, you're rewarded with a smile and a wink, and a third action is added to the animation. This continues until a mistake is made. One criticism I have of this program is the way it handles a mistake – the tongue is stuck out, and unfriendly sounds announce your error. I would be sure to alert children to this before letting them use the program.

The screen layouts for this program are very pleasing, and not too complicated or crowded for use by young children. Documentation for *Facemaker* is minimal, but that's all that's needed since the program is very user-friendly and clearly explained.

Facemaker might be the ideal program to accomplish several different objectives. Introducing young children to programming by writing programs for the created characters would be an excellent way of exposing them to an important programming concept. This program would also be an ideal invitation to try a computer – for people of any age that have some anxiety about sitting down at the keyboard. I suspect that few people would turn down an opportunity to design their own animated cartoon. *Facemaker* also lends itself well to presentation to a group of people. Various people can contribute suggestions to the building of the face, and the animation can be a group effort.

Story Machine

Children love to make up stories. They also love to watch cartoons judging by the number of Saturday morning cartoons on television. A recognition of these things that are enjoyable to children is behind the development of *Story Machine*.

Using the words allowed in the program, you can write stories at the keyboard. As the story is typed in, *Story Machine* uses the top portion of the screen to illustrate the story. When a sentence involves action (such as "The dog goes to the store."), the program will actually animate the sentence.

Story Machine provides a dictionary of 45 words, divided into seven categories: (1) articles, such as *the*, *a*, and *an*; (2) adjectives, such as *this*, *that*, and *those*; (3) pronouns, such as *he*, *she*, and *it*; (4) nouns, such as *apple(s)*, *dog(s)*, and *girl(s)*; (5) possessive pronouns, such as *his*, *her*, and *its*; (6) verbs, such as *are*, *eat(s)* and *run(s)*; and (7) prepositions, such as *at*, *by*, and *to*.

The documentation lists the following rules for generating sentences that are acceptable in the program:

1. Begin each sentence with an article, pronoun, or adjective.

2. Use present tense verbs (*run*, not *ran*).

3. A period or prepositional phrase must follow a verb (run *to a house*).

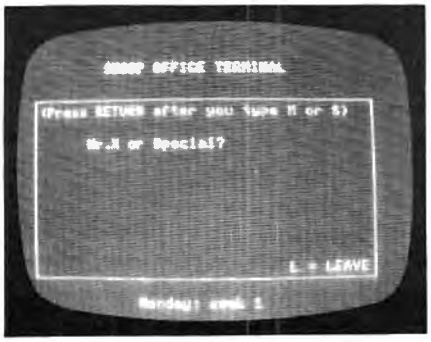
4. Pronouns can be used only for the last noun used as the subject of a sentence.

5. End each sentence with a period.

6. Only four actors (nouns) may appear on the screen at any one time.

Carefully following these rules, I designed a few simple stories to type in and animate. My first story was:

A BOY RUNS BY A BOX.
AN APPLE IS IN THE BOX.
THE BOY EATS THE APPLE.
THE BOY GOES IN THE BOX.



```
SNOOP OFFICE TERMINAL

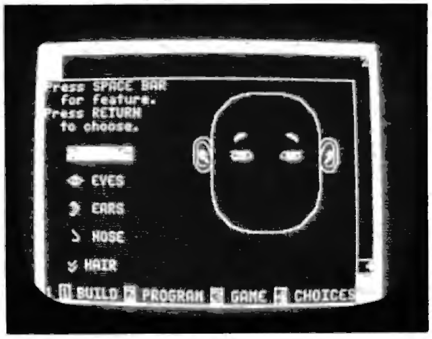
(Press RETURN after you type N or S)

     [illegible] or Special?

                          L = LEAVE

Monday: week 1
```

A typical screen common to both Snooper Troops #1 *and* Snooper Troops #2.



Building a face with Facemaker.

```
DICTIONARY:
The    Apple(s)    Are       To
This   Box(es)     Go(es)    For
That   Boy(s)      Dance(s)
A(n)   Bumpus(es)  Eat(s)    His
These  Cat(s)      Hop(s)    Her
Those  Dog(s)      Is        Its
Some   Fence(s)    Jump(s)   Their
He     Flower(s)   Run(s)
She    Girl(s))    Sing(s)   In
It     House(s)    Walk(s)   At
They   Rook(s)     Zot(s)    By
       Store(s)
       Tree(s)

End each sentence with a period.
1 STORY 2 DICTIONARY 3 DISK 4 CHOICES
```

Words are chosen from the dictionary to spin a yarn with Story Machine.

Eagerly anticipating seeing my story animated, I began to type in the first sentence. Here is a running commentary of my experience.

I typed "A BOY" (picture of a boy appeared on screen), then "RUNS BY" (BY got a slash through it and was then erased). I guessed I couldn't do that, so I typed in "TO A BOX" (picture of a box appeared on screen, and the boy ran to it!). Now, on to the second sentence. I typed "AN APPLE" (apple appeared on screen) "IS IN THE BOX" (message IT'S FULL appeared on screen, BOX got a slash through it, and my whole sentence was automatically erased).

Oh well. I decided I'd try a slight modification and continued typing. "AN APPLE" (apple appeared on screen) "IS BY THE BOX" (message NO SPACE appeared on the screen and, again, my whole sentence was erased, but the apple stayed on the screen although there was now no sentence mentioning it).

I decided to stop trying to relate the apple to the box, and went on to the next sentence. I typed "THE BOY EATS THE APPLE" (message MUST BE CLOSER appeared on screen, and again my sentence was erased). Assuming the boy needed to be closer to the apple in order to eat it, I typed in "THE BOY GOES TO THE APPLE" (boy on screen moved toward the apple).

Next I typed in "THE BOY EATS THE APPLE" (the apple slowly disappeared, and the boy moved to the spot where the apple had been – the boy did not appear to actually eat the apple). And finally I was at my last sentence, so I typed in "THE BOY GOES IN" (IN got a slash through it, then erased), so I gave up and typed "TO THE BOX". My finished story looked like this:

A BOY RUNS TO A BOX.
THE BOY GOES TO THE APPLE.

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THE BOY EATS THE APPLE.
THE BOY GOES TO THE BOX.

I felt quite frustrated. That's not at all what I had wanted my story to say.

Typing in my other two stories proved equally frustrating. The sentences that were acceptable to the program were very limited, with more being rejected than accepted.

Story Machine allows stories, once written, to be saved on a diskette. This option would allow children to go back and enjoy their old stories over and over. In a classroom situation, it would also allow them to be shared with others.

The idea for creating a program like *Story Machine* is excellent and educationally valid. Unfortunately, in its present form it could well be more frustrating than educational for children at the appropriate age to use it. To be useful, it would need to accept a much broader array of sentences – ideally any sentence that is correctly formed with the words available in the limited dictionary. Because the program is such a terrific idea, I hope the Spinnaker people put out another version that will accept any syntactically correct sentences.

Other Spinnaker Software

I also took a quick look at *Snooper Troops*, Case #1 and Case #2. These two adventure games, designed for people aged ten to adult, are based on two different who-done-it type mysteries. The adolescents in my neighborhood loved them, comparing them favorably to other adventure games they've spent time on. They can develop logical thinking skills to narrow in on the culprit.

Facemaker *($34.95)*
Story Machine *($34.95)*
Snooper Troops #1 and #2
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Spinnaker Software Corp.
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Graphics And Programming Utilities For Sinclair/Timex

Arthur B. Hunkins

Softsync, publishers of high-quality software for Sinclair/Timex, has recently released two useful utility packs for the 16K Sinclair line – *Programmers Toolkit* and *Graphics Kit*. The two "kits" are compatible; i.e., they are designed to be used together (though they need not be).

Both are in machine language, hidden away – protected – in high memory. *Programmers Toolkit* occupies the top 1K; *Graphics Kit* requires an additional 1K-plus. The packages are not user-relocatable, no doubt in part because allowing this option would have compromised security; these programs are *well* protected.

Graphics is a collection of 23 graphics routines; *Toolkit* includes eight utilities. The nature of the packages is evident from their titles. The individual routines are quite useful, provided one doesn't expect too much from them. They operate by calling USR, often after POKEing specific information into key memory locations. This procedure is somewhat unwieldy, requiring you to remember – or constantly refer to – many different memory locations (i.e., five-digit numbers). *Graphics Kit* has no ready reference guide to these locations; the documentation for *Toolkit* is better in this regard.

The Most Important Routine

The software is well-written throughout. Aside from its cumbersomeness, I find only one thing to criticize about *Toolkit*: it omits a repeat key routine. Perhaps a repeat function was not considered appropriate for the package, but it surely would have been useful. I can't think of any utility that would do more to facilitate programming on the Sinclair/Timex.

The most important routine in *Toolkit* is *Renumber*. This routine renumbers an entire program, with any starting line number and any increment (default values are 10). It handles GOSUB and GOTO; the only difficulty – and something of a nuisance – is that GOTOs and GOSUBs must be four-digit numbers. If they are not, the routine ignores them.

Perhaps next most useful are *Search And List* and *Search And Replace*. The former lists line numbers (not entire statements) where a designated character is found; the latter replaces all occurrences of one designated character with another. Equally handy is *Free*, which prints the number of bytes free at any given point.

Reverse and *Fill* affect a specified number of lines on the screen, starting with the topmost line. *Reverse* inverts the field of the area; *Fill* fills it with any specified character. There is no provision for reversing or filling partial lines, or implementing any other kind of screen partition.

Probably the most fascinating routine is *Hyper-Graphics Mode*, which changes the start address of the character table. A demo program illustrates the "exploded" characters that result; clearly *Hyper-Graphics* is an entry into the intriguing world of user-created character graphics. Unfortunately, no further software is offered; let us hope that Softsync soon releases additional tools.

Finally, *Wait* does a program "hold" until it senses input from the cassette player, whereupon the BASIC program is continued. *Toolkit*'s documentation includes a set of short programs that nicely demonstrates the various utilities.

A Wealth Of Useful Aids

It is difficult to select highlights from *Graphics Kit*. There are a wealth of useful routines here; most are well illustrated in the demo program included on tape. The demo is impressive, and would serve well as a repeating window display. Perhaps the best way to become familiar with *Graphics* is to study and work with this program. It is entirely in BASIC. Note at the outset that *Graphics Kit* has no high-resolution capability, nor does it permit you to create your own character set.

It does, however, allow you to define your own multi-character shapes, and to *Draw* or *Undraw* (erase) them anywhere on the screen, using PRINT AT. *Draw*, probably the classiest utility of the package, lets shapes be defined in REM statements, using the usual graphics characters and a system of "cursor controls" (directional arrows).

One useful feature that appears in the demo, but is not referred to elsewhere, is the quote character ("), which serves as a cursor blank (in place of the space). There is a difference; "background" shows through the cursor blank, while it does not for the space. The demo shows a worm marching ("crawling" would be stretching a point) along the screen, *behind* a cactus and *in front* of a background. Not spectacular, but not bad either.

A number of other routines also "do" and "undo" various features: *Foreground On, Foreground Off; Border, Unborder; Onscreen, Offscreen; Background On, Background Off. Foreground On* is especially interesting, as it "protects" everything currently displayed, causing graphics added later to "pass behind" the protected display. *Background On* works on a related principle; it creates a background of a specified character upon which everything *else* is projected – including *Foreground* and other characters.

Thus a simple three-dimensionality is created. *Background* can include one or both edit lines, if desired. In general, *Graphics* routines can use or exclude these lines at the user's option. Most routines optionally permit working with fewer than 20 lines.

Border places your choice of character around the outside of the screen. *Offscreen* blanks the screen to its normal background color (not black), while saving its contents. The documentation stresses that Fast is not used in this operation.

A multi-directional scroll capability is also most attractive. *Upscroll, Downscroll, Rightscroll,* and *Leftscroll* move the entire screen display (with wraparound) one position in the appropriate direction for each call. Edit lines are included in the scrolling. The documentation is correct when it states "characters ... will wraparound ... except when *Border* is on."

When a border is present, it normally does not scroll; in reprinting itself, it erases any scrolled material it encounters. What the documentation fails to mention – the demo illustrates it admirably – is that there is a location to POKE that permits any border to scroll appropriately along with everything else. The required statement is: POKE 31743,0. *Now* watch it go!

Editprint changes the current print position to the first of the two edit lines. This change is for a single PRINT only; the following PRINT reverts to the normal placement unless *Editprint* is called again. *Square* is a handy utility that draws squares and rectangles according to two sets of coordinates – one specified by PLOT, the other by a pair of POKEs. The width of the line is one-half character.

Other miscellany regarding *Graphics*: *Graphics* routines use Slow mode only; and substantial error code recovery is implemented. These codes are nicely summarized, in tabular form, in the documentation. Error recovery is not available in *Toolkit*, where it is not nearly as important.

I discovered no program bugs, and – with minor exceptions – found the documentation quite satisfactory. When instructions for LOADing are precisely followed, all goes well. I particularly recommend *Graphics Kit* and its well-done demo program as helpful tools for exploring the Sinclair/Timex graphics capabilities.

Programmers Toolkit
Graphics Kit
Softsync, Inc.
P.O. Box 480, Murray Hill Station
New York, NY 10156
$14.95/each $25/both

THE WORLD INSIDE THE COMPUTER

The Computer Friend: Getting To Know You

Fred D'Ignazio, Associate Editor

In my recent **COMPUTE!** columns (August through November 1982), I introduced the "computer friend." The friend is a little animated face that appears on the computer picture screen. A bell rings, and the friend "wakes up" and talks to the child. It asks the child's name. Then it asks the child to play some games. The friend program automatically calls up games (like the story-telling game in the November column). Each time the child is finished playing a game, the friend pops back on the screen.

Lots of computer *programs* are friendly. But few computer operating systems are friendly. The computer friend is my effort to make computers friendlier, warmer, and more human-like for little kids.

Children are going to be spending many, many hours in front of these machines. Often the child's interaction with the machine will replace his interaction with other people. If the child's interaction with the machine is cold and impersonal, the child will be losing valuable opportunities to develop social skills. The child's character may eventually begin to mirror the machine's.

Already many people are complaining about the effect of computers and video games on older kids. Computer "hackers" are stereotypically pictured as being antisocial loners who speak BASIC better than they speak English.

So what happens when little kids spend the same number of hours on their computers? Their values are still being formed. Their reservoir of social and emotional experiences is still relatively limited. Computers are certain to have a big effect on them. And it may be negative as well as positive. It is likely that the kids will become computer literate and enhance their mathematical, logical, and creative skills. But they may not experience enough of the interaction with adults and peers which is vital to their development.

Let's face it. Computers are great as mind expanders and sharpeners. But when it comes to charm and personality, computers are cold fish.

That's where the computer friend comes in. The friend is kin to the first computer languages developed in the 1950s. It is a very crude attempt to make computers friendlier and easier to use.

Before the early "high-level" languages appeared, people interacted with the computer on its own terms – in machine language. They spent hours, days, weeks translating complicated problems into endless strings of ones and zeros.

People got fed up dealing with the computer on *its* terms. After all, the machine was supposed to be the servant of human beings, not the other way around. People sought ways to get the computer to do its own translation. They developed the early compilers and interpreters that took English-like commands and translated them into the computer's binary language, and vice versa.

As a result, the computer became more human-like. It became easier to use and a lot more useful. As a machine that could almost speak English, it became a valuable sidekick for people who needed to solve problems.

A computer friend is a lot like the early computer languages. I think computer friends will be the next step in the computer's evolution. Lots of people will find a computer friend much more attractive than the "friendly" computers they're stuck with today. A human-like machine that

---

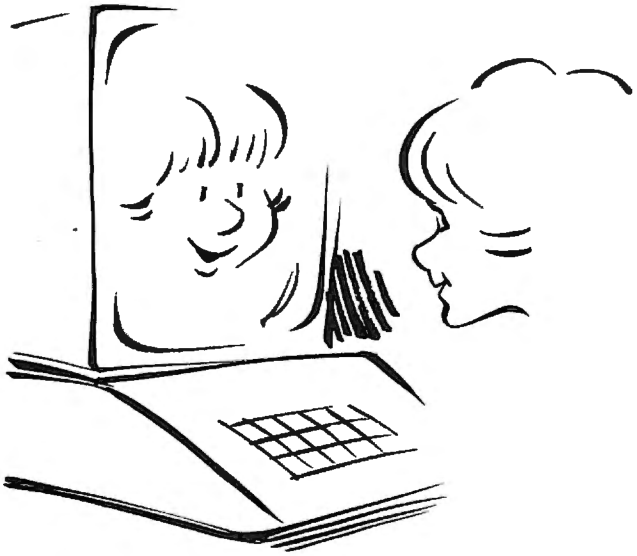
Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. He is presently working on two major projects: he is writing a series of books on how to create graphics-and-sound adventure games. He is also working on a computer mystery-and-adventure series for young people.

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

focuses on a person and his or her problems will be a confidant, a colleague, and a comrade – not just a tool.

The Interested Friend

Here is the latest version of my computer friend program. This friend doesn't play games. It does only one thing: it learns about your child.



The older versions of the friend used Atari Graphics 2 Mode to enlarge the friend's face and the computer letters. However, that left less room on the screen for the friend's messages and questions, and the child's answers. In this version, we use the Graphics 0 Mode. This gives us plenty of space – up to 20 characters per line, and up to nine lines of text.

In the old program, on line 550, the friend jumped to a subroutine that asked if the child wanted to play games. In this program, the "game" GOSUB on line 550 has been replaced by a GOSUB to a subroutine that asks the child questions.

What sorts of questions? All sorts! For example:

Basic questions about the child's name, address, phone number, age, school, teachers, brothers, sisters, and pets.

Important questions like what the child likes to wear, what the child likes to eat, what makes the child happy or sad.

Whimsical questions like the child's favorite superhero, the scariest monster, and the names of any imaginary friends.

The only limitations are that the child cannot have more than three brothers, three sisters, three pets, and three imaginary playmates. If your child has more, then you need to modify the subroutines on lines 5780 through 5971, and add new DATA statements to those found on lines 13421 through 13456.

The computer takes all of the child's answers and stores them in a long string (C$). Percent symbols (%) are used as delimiters between the answers.

When the child is finished answering the friend's questions, the friend thanks him or her and tells the child how impressive he or she is. "You are a neat person!" the friend exclaims.

If you have old versions of the friend on your computer, look first at the lines preceded by asterisks. These are the lines I added or modified to create the new version of the friend program.

This version of the friend is geared to a disk system. At the end of the program (line 5974), the friend saves the child's answers (C$) on a disk file called "CHILD."

With only a couple of changes, you can make the program store the file on a tape cassette. First, you should erase the old line 5975, then add a new 5975 and a 5978:

```
5975 GOSUB 2010:REM * FRIEND TELLS AB
     OUT TAPE
5978 OPEN #1,8,0,"C:"
```

Next, add four DATA statements on lines 10050 through 10053:

```
10500 DATA 3
10051 DATA GET,THE,TAPE,READY.,-1
10052 DATA (PRESS,PLAY,AND,RECORD,BUT
      TONS.),-1
10053 DATA AFTER,THE,BEEP,PRESS,RETUR
      N,-1
```

Now the friend will prompt the child when it is ready to save the child's file. The friend will tell the child to press the right buttons on the program recorder and press the RETURN button on the computer.

Next Month

Next month I hope to print some of the interesting letters I have been receiving in response to my December 1982 column on "Sexism and Children's software."

In an upcoming column we'll teach the friend how to converse with the child using some of the information stored in the CHILD "data base." We'll see how we can automatically create files for several children.

I welcome your letters. And I will make every attempt to write back. From now on, you can write to me directly:

Fred D'Ignazio
2117 Carter Road, SW
Roanoke, VA 24015

```
100 REM *** DIMENSION VARIABLES
110 DIM M$(20):REM * MESSAGE
115 DIM C$(1500):REM * CHILD INFO
117 FOR I=0 TO 1450 STEP 50:C$(I+1,I+
    50)="{50 SPACES}":NEXT I
118 C$=""
```

NEW MULTI-USER SOFTWARE LETS THE WHOLE FAMILY SHARE IN THE JOY OF LEARNING.

Is the personal computer doing all it can to help our children learn?

To some degree, no, although it's not fair to blame it entirely on the computer. After all, computers are only as good as their software.

How can we improve this situation?

A solution already exists. But first, some background.

Where personal computers fail.

For years, studies have shown that children learn more efficiently in group situations. Peer groups, for example, motivate slower learners to persevere. Groups of older and younger children encourage divergent thinking. Even the simple "group" of a parent and child promotes faster acceptance of new ideas by combining education with trust and confidence.

But personal computers and their programs are designed to be personal. One computer, one child. It's hard for anyone else to be part of the learning experience, even you.

At least not until today.

A simple solution.

When two educational researchers, Dr. Matilda Butler and Dr. William Paisley, observed this problem they proposed an interesting, yet simple, solution. Instead of writing programs that shut out brothers, sisters, friends, and parents, why not give everyone the opportunity to share learning simultaneously. This one idea sparked an entire line of unique educational programs and gave birth to a new company, Edupro.

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With Edupro's Microgroup™ computer programs, up to eight players work at solving math, language, social studies, or science problems which are presented as contests, races, and puzzles. The players work together, either competitively or cooperatively, as they race against time, each other, or both.

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______	MATH-HUNT: American Years: Multiplication and Division	______	______
	THE WORLD AROUND US: Ages 12–Adult		
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```
120 N=1:REM * MESSAGE POINTER
125 DATNUM=10000:REM * WHERE TO READ
    DATA STATEMENTS
130 DIM NAME$(20):REM * CHILD'S NAME
500 REM *** FRIEND MASTER
510 IF PEEK(1791)=1 THEN GOSUB 7010:G
    OTO 550
515 GOSUB 1010:REM * FRIEND WAKE-UP
520 GOSUB 2010:REM * FRIEND INTRODUCE
    S HIMSELF/HERSELF
530 ANSWER=2:GOSUB 3210:REM * FRIEND
    LEARNS CHILD'S NAME
540 GOSUB 2010:REM * FRIEND HAPPY TO
    SEE CHILD
550 GOSUB 5610:REM * ASK INTRO QUESTI
    ONS
600 PRINT "{CLEAR}":POKE 752,0:END
1000 REM *** FRIEND WAKE-UP
1010 GOSUB 5010:REM * DRAW FACE
1020 GOSUB 5410:REM * DRAW SLEEP EYES
1030 GOSUB 5210:REM * DRAW CLOSED MOU
     TH
1035 FOR P=1 TO 800:NEXT P
1040 GOSUB 4010:REM * WAKE-UP BELL
1050 GOSUB 5460:REM * DRAW OPEN EYES
1060 FOR P=1 TO 600:NEXT P
1070 GOSUB 5320:REM * WINK EYE
1080 FOR P=1 TO 50:NEXT P
1085 GOSUB 5460:REM * DRAW OPEN EYES
1090 M=0:GOSUB 4820:REM * WINK NOISE
1100 FOR P=1 TO 800:NEXT P
1120 RETURN
2000 REM *** FRIEND TALK
2010 RESTORE DATNUM+N*10:REM * SELECT
      MESSAGE
2011 N=N+1:REM * SET POINTER TO NEXT
     SET OF FRIEND MESSAGES
2012 READ SNUM:REM * SNUM = NUMBER OF
      SCREENS IN CURRENT SET OF FRIEN
     D MESSAGES
2015 FOR K=1 TO SNUM
2020 GOSUB 3010:REM * FRIEND TALK--1
     SCREEN
2033 FOR P=1 TO 200:NEXT P
2035 GOSUB 5510:REM * CLEAR MESSAGE W
     INDOW
2040 NEXT K
2050 RETURN
3000 REM *** FRIEND TALKING--1 SCREEN
3010 PY=6:REM * MESSAGE VERTICAL (Y)
     START LOCATION
3030 PX=30:REM * HORIZONTAL (X) CENTE
     R OF MESSAGE ON SCREEN
3040 READ M$
3050 IF M$="-1" THEN FOR P=1 TO 200:N
     EXT P:GOSUB 5510:RETURN
3051 IF M$="*" THEN M$=NAME$
3055 GOSUB 5260:REM * OPEN MOUTH
3060 POSITION INT(PX-(LEN(M$)/2)+0.5)
     ,PY:REM * CENTER LINE
3070 PRINT #6;M$
3075 GOSUB 4810:REM * FRIEND SOUND
3080 FOR P=1 TO 10:NEXT P:REM * KEEP
     MOUTH OPEN
3090 GOSUB 5210:REM * CLOSE MOUTH
3095 FOR P=1 TO 50:NEXT P:REM * KEEP
     MOUTH CLOSED
3100 PY=PY+2
3110 GOTO 3040
3200 REM *** FRIEND ASKS CHILD A QUES
     TION
3210 OPEN #1,4,0,"K:"
3212 M$=""
3215 POSITION 20,6
3217 FOR I=1 TO 20
3220 GET #1,A
3222 IF A=126 AND I=1 THEN 3220
3225 IF A=126 THEN GOSUB 3310
3230 IF A=155 THEN 3265
3240 PRINT #6;CHR$(A);
3250 M$(LEN(M$)+1)=CHR$(A)
3260 NEXT I
3265 FOR P=1 TO 75:NEXT P
3267 GOSUB 5510:REM * CLEAR MESSAGE W
     INDOW
3270 CLOSE #1
3280 GOSUB 3410:REM * EVALUATE ANSWER
3290 RETURN
3310 POSITION I+18,6:PRINT #6;" ";
3312 POSITION I+18,6
3315 M$(LEN(M$))=""
3317 I=I-1
3320 GET #1,A
3330 IF A<>126 THEN 3390
3350 IF I<2 THEN 3320
3360 GOTO 3310
3390 RETURN
3400 REM *** EVALUATE ANSWER
3410 ON ANSWER GOSUB 3510,3610
3420 RETURN
3500 REM *** NO NEED TO STORE ANSWER
3510 RETURN
3600 REM *** ANSWER=CHILD'S NAME
3610 NAME$=M$
3620 RETURN
4000 REM *** WAKE-UP BELL
4010 BEL=105:TIM=7.5:GOSUB 4040
4020 BEL=132:TIM=8.5:GOSUB 4040
4030 SOUND 0,0,0,0:RETURN
4040 VLM=15:INC=0.79+TIM/50
4050 SOUND 0,BEL,10,VLM
4060 VLM=VLM*INC
4070 IF VLM>1 THEN 4050
4080 RETURN
4800 REM *** FRIEND VOICE
4810 M=INT(RND(1)*51)+15
4820 FOR A=M+25 TO M STEP -8
4830 SOUND 0,A,10,10
4840 FOR T=1 TO 10
4850 NEXT T
4860 NEXT A
4875 SOUND 0,0,0,0
4880 RETURN
5000 REM *** FRIEND'S FACE
5010 GRAPHICS 0
5015 POKE 752,1
5020 PRINT "{CLEAR}"
5040 POSITION 9,7:PRINT #6;"
     {3 SPACES}*"
5050 POSITION 9,8:PRINT #6;"  / \"
5060 POSITION 9,9:PRINT #6;" ====="
5070 POSITION 9,10:PRINT #6;"/
     {5 SPACES}\"
5090 POSITION 8,11:PRINT #6;"<:  ^  :
     >"
5100 POSITION 9,14:PRINT #6;"\_____/"
5110 RETURN
5200 REM *** CLOSE MOUTH
5210 POSITION 9,12:PRINT #6;":
     {5 SPACES}:"
5220 POSITION 9,13:PRINT #6;": --- :"
5230 RETURN
5250 REM *** OPEN MOUTH
5260 POSITION 9,12:PRINT #6;": ___ :"
5270 POSITION 9,13:PRINT #6;": \_/ :"
5280 RETURN
5300 REM *** LEFT EYE WINK
5320 POSITION 9,10:PRINT #6;": O - :"
5330 FOR P=1 TO 150:NEXT P
5340 RETURN
```

```
5400 REM *** EYES ASLEEP
5410 POSITION 9,10:PRINT #6;": - - :"
5440 RETURN
5450 REM *** EYES AWAKE
5460 POSITION 9,10:PRINT #6;": O O :"
5470 RETURN
5500 REM *** CLEAR MESSAGE WINDOW
5510 FOR Y=6 TO 22 STEP 2
5520 POSITION 20,Y
5530 PRINT #6;"{19 SPACES}"
5540 NEXT Y
5550 RETURN
5600 REM *** ASK INTRO QUESTIONS
5610 ANSWER=1:REM * EVALUATE ANSWER A
     S PART OF THIS SUBROUTINE
5615 GOSUB 2010:REM * CAN FRIEND ASK
     CHILD QUESTIONS?
5620 GOSUB 3210:REM * GET CHILD'S ANS
     WER
5630 IF M$(1,1)<>"N" THEN 5640
5632 RESTORE 12526:SNUM=1:GOSUB 2015:
     REM * FRIEND SAYS GOOD-BYE!
5635 GOTO 5745
5640 IF M$(1,1)<>"Y" THEN N=N-1:GOTO
     5610
5650 RESTORE 13010
5660 READ SNUM:REM * READ # OF QUESTI
     ONS
5670 FOR I=1 TO SNUM
5680 GOSUB 3010:REM * FRIEND ASKS ONE
      QUESTION
5685 FOR P=1 TO 200:NEXT P
5688 GOSUB 5510:REM * CLEAR MESSAGE W
     INDOW
5690 GOSUB 3210:REM * GET CHILD'S ANS
     WER
5700 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5710 NEXT I
5715 GOSUB 5785:REM * BROTHERS?
5720 GOSUB 5845:REM * SISTERS?
5725 GOSUB 5895:REM * PETS?
5730 GOSUB 5945:REM * IMAGINARY FRIEN
     DS?
5740 N=4:GOSUB 2010:REM * NICE GETTIN
     G TO KNOW YOU!
5741 GOSUB 5975:REM * SAVE ANSWER
5742 RESTORE 12526:SNUM=1:GOSUB 2015:
     REM * FRIEND SAYS GOOD-BYE!
5745 RETURN
5750 REM *** ADD CHILD'S ANSWER TO ST
     RING
5755 IF LEN(C$)<>0 THEN C$(LEN(C$)+1)
     ="%"
5760 C$(LEN(C$)+1)=M$
5770 RETURN
5780 REM *** BROTHERS?
5785 RESTORE 13420
5790 GOSUB 3010:REM * ASK QUESTION
5795 GOSUB 3210:REM * GET ANSWER
5800 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5805 IF M$="0" OR M$="NONE" THEN RETU
     RN
5810 FOR I=1 TO VAL(M$)
5815 GOSUB 3010:REM * ASK QUESTION
5820 GOSUB 3210:REM * GET ANSWER
5825 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5827 GOSUB 3010:REM * ASK QUESTION
5829 GOSUB 3210:REM * GET ANSWER
5830 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5835 NEXT I
5837 RETURN
```

```
5840 REM *** SISTERS?
5845 RESTORE 13430
5849 GOSUB 3010:REM * ASK QUESTION
5851 GOSUB 3210:REM * GET ANSWER
5853 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5855 IF M$="0" OR M$="NONE" THEN RETU
     RN
5857 FOR I=1 TO VAL(M$)
5859 GOSUB 3010:REM * ASK QUESTION
5862 GOSUB 3210:REM * GET ANSWER
5864 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5866 GOSUB 3010:REM * ASK QUESTION
5868 GOSUB 3210:REM * GET ANSWER
5870 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5872 NEXT I
5875 RETURN
5890 REM *** PETS?
5895 RESTORE 13440
5900 GOSUB 3010:REM * ASK QUESTION
5902 GOSUB 3210:REM * GET ANSWER
5904 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5906 IF M$="0" OR M$="NONE" THEN RETU
     RN
5908 FOR I=1 TO VAL(M$)
5910 GOSUB 3010:REM * ASK QUESTION
5912 GOSUB 3210:REM * GET ANSWER
5914 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5916 GOSUB 3010:REM * ASK QUESTION
5918 GOSUB 3210:REM * GET ANSWER
5920 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5922 NEXT I
5924 RETURN
5940 REM *** IMAGINARY FRIENDS?
5945 RESTORE 13450
5947 GOSUB 3010:REM * ASK QUESTION
5949 GOSUB 3210:REM * GET ANSWER
5951 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5953 IF M$="0" OR M$="NONE" THEN RETU
     RN
5955 FOR I=1 TO VAL(M$)
5957 GOSUB 3010:REM * ASK QUESTION
5959 GOSUB 3210:REM * GET ANSWER
5961 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5963 GOSUB 3010:REM * ASK QUESTION
5965 GOSUB 3210:REM * GET ANSWER
5967 GOSUB 5755:REM * ADD ANSWER TO S
     TRING
5969 NEXT I
5971 RETURN
5974 REM *** SAVE ANSWER
5975 OPEN #1,8,0,"D:CHILD"
5980 PRINT #1;C$
5990 CLOSE #1
5995 RETURN
6000 REM *** FRIEND'S GAMES
6010 GOSUB 2010:REM * FRIEND ASKS CHI
     LD: PLAY A GAME?
6020 ANSWER=1:GOSUB 3210:REM * GET CH
     ILD'S ANSWER
6030 IF M$(1,1)="N" THEN 6090
6040 IF M$(1,1)<>"Y" THEN N=N-1:GOTO
     6010
6050 GOSUB 6110:REM * SELECT GAME
6090 RESTORE 12526:SNUM=1:GOSUB 2015:
     REM * FRIEND SAYS GOOD-BYE!
6095 RETURN
6100 REM *** SELECT GAME
```

```
6110 DATNUM=12000:N1=N:N=1:REM * RESE
     T DATA POINTERS
6120 GOSUB 2010:REM * GENIE BEGINS GA
     ME-SELECTION QUESTION
6130 READ GAMENUM
6140 N=N+1
6150 FOR Z=1 TO GAMENUM
6160 GOSUB 2010:REM * DISPLAY GAME NA
     ME
6170 GOSUB 3210:REM * GET CHILD'S ANS
     WER
6180 IF M$(1,1)="Y" THEN GOSUB 6310:G
     OTO 6410
6190 IF M$(1,1)<>"N" THEN N=N-1:GOTO
     6160
6200 NEXT Z
6210 N=52:GOSUB 2010:REM * NO GAMES S
     ELECTED--FRIEND'S SORRY MESSAGE
6220 RETURN
6300 REM *** PREPARE FRIEND'S MEMORY
     FOR EXIT FROM FRIEND PROGRAM
6301 REM *** STORE CHILD'S NAME
6302 REM *** IN LOCATIONS
6303 REM *** 1781-1789
6304 REM *** (LENGTH OF NAME IN 1790)
6305 REM *** AND SET LOCATION 1791
6306 REM *** AS FLAG THAT
6307 REM *** FRIEND HAS ALREADY
6308 REM *** BEEN CALLED SINCE
6309 REM *** TURNING ON COMPUTER
6310 REM
6315 FOR I=1 TO LEN(NAME$)
6320 POKE 1780+I,ASC(NAME$(I,I))
6330 NEXT I
6335 POKE 1790,LEN(NAME$)
6340 POKE 1791,1
6350 RETURN
6400 REM *** DISK VERSION OF FRIEND
6405 REM ***
6408 REM *** SELECT GAME PROGRAM/EXIT
      FRIEND
6410 GOTO 6410+Z*10
6420 RUN "D:TELLTALE"
7000 REM *** FRIEND CALLED ON BEFORE
7010 FOR I=1 TO PEEK(1790)
7020 NAME$(LEN(NAME$)+1)=CHR$(PEEK(17
     80+I))
7030 NEXT I
7040 GOSUB 5010:GOSUB 5210:GOSUB 5460
     :REM * DRAW FRIEND
7050 DATNUM=11000:GOSUB 2010:REM * NE
     W FRIEND MESSAGES
7060 DATNUM=10000:N=3
7070 RETURN
10000 REM *** WAKE-UP FRIEND
10005 REM *** MESSAGES
10010 DATA 3
10011 DATA HI, I'M, GED,-1
10012 DATA YOU,TURNED,ME,ON,-1
10013 DATA WHO'S,OUT,THERE?,-1
10020 DATA 2
10021 DATA I'M,SO,HAPPY,-1
10022 DATA TO,SEE,YOU,*,-1
10030 DATA 2
10031 DATA CAN,I,ASK,YOU,-1
10032 DATA SOME,QUESTIONS?,-1
10040 DATA 3
10041 DATA THANKS,*,-1
10042 DATA I'M GLAD,I LEARNED,ABOUT,Y
      OU.,-1
10043 DATA YOU,ARE,A,NEAT,PERSON!,-1
11000 REM *** FRIEND ALREADY AWAKE ME
      SSAGES
11010 DATA 5
11011 DATA HI,*,-1
11012 DATA I,HOPE,YOU,-1
11013 DATA HAD,FUN!!,-1
11014 DATA I,WONDER,WHAT,-1
11015 DATA WE,SHOULD,DO,NOW.,-1
12000 REM *** GAMES
12001 REM
12002 REM *** LIST GAMES ON
12003 REM *** EVERY 10TH LINE--
12004 REM *** LINES 12030-12490
12005 REM *** FOR A MAXIMUM OF
12006 REM *** 50 GAMES.
12007 REM
12010 DATA 2
12011 DATA DO,YOU,WANT,-1
12012 DATA TO,PLAY,-1
12020 DATA 1
12030 DATA 1
12031 DATA THE,STORY,GAME?,-1
12520 DATA 6
12521 DATA *,I,AM,SORRY,-1
12522 DATA NONE,OF,THE,GAMES,-1
12523 DATA LOOKED,FUN.,-1
12524 DATA MAYBE,WE,CAN,-1
12525 DATA PLAY,LATER.,-1
12526 DATA BYE!,BYE!,BYE!,-1
13000 REM *** QUESTIONS
13010 DATA 40
13015 DATA WHAT,IS,YOUR,FIRST,NAME?,-1
13020 DATA WHAT,IS,YOUR,MIDDLE,NAME?,
      -1
13030 DATA WHAT,IS,YOUR,LAST,NAME?,-1
13040 DATA WHAT,IS,YOUR,NICKNAME?,-1
13050 DATA WHAT,IS,YOUR,STREET,NAME?,
      -1
13060 DATA WHAT,IS,YOUR,STREET,NUMBER
      ?,-1
13070 DATA WHAT,IS,YOUR,APARTMENT,NUM
      BER?,-1
13080 DATA WHAT,IS,YOUR,APARTMENT,NAM
      E?,-1
13090 DATA WHAT,IS,THE,NAME,OF,YOUR,C
      ITY?,-1
13100 DATA WHAT,IS,THE,NAME,OF,YOUR,S
      TATE?,-1
13110 DATA WHAT,IS,YOUR,ZIP,CODE?,-1
13120 DATA WHAT,IS,YOUR,PHONE,NUMBER?
      ,-1
13130 DATA WHEN,IS,YOUR,BIRTHDAY?,-1
13140 DATA WHAT,YEAR,WERE,YOU,BORN?,-1
13150 DATA HOW, OLD,ARE,YOU?,-1
13160 DATA WHAT,IS,YOUR,FAVORITE,COLO
      R?,-1
13170 DATA WHAT,IS,YOUR,FAVORITE,TV,S
      HOW?,-1
13180 DATA WHAT,IS,YOUR,FAVORITE,MOVI
      E?,-1
13190 DATA WHAT,IS,YOUR,FAVORITE,BOOK
      ?,-1
13200 DATA WHAT,IS,YOUR,FAVORITE,VIDE
      OGAME?,-1
13210 DATA WHAT,IS,YOUR,FAVORITE,SPOR
      T?,-1
13220 DATA WHAT,IS,YOUR,FAVORITE,THIN
      G,TO,DO?,-1
13230 DATA WHAT,IS,THE,YUCKIEST,THING
      ,TO,DO?,-1
13240 DATA WHAT,IS,YOUR,FAVORITE,THIN
      G,TO,WEAR?,-1
13250 DATA WHAT,IS,YOUR,FAVORITE,HOLI
      DAY?,-1
13260 DATA WHAT,IS,THE,THING,YOU,LIKE
      ,MOST,ABOUT,YOURSELF?,-1
13270 DATA WHAT,TRICK,OR,SKILL,ARE,YO
      U,MOST,PROUD,OF?,-1
13280 DATA WHAT,IS,THE,SCARIEST,MONST
```

```
       ER,YOU,KNOW,OF?,-1
13290  DATA WHAT,IS,THE,NAME,OF,YOUR,B
       EST,FRIEND?,-1
13300  DATA WHO,IS,YOUR,FAVORITE,HERO?
       ,-1
13310  DATA WHO,IS,YOUR,FAVORITE,SUPER
       HERO?,-1
13320  DATA WHAT,MAKES,YOU,THE,HAPPIES
       T?,-1
13330  DATA WHAT,MAKES,YOU,THE,SADDEST
       ?,-1
13340  DATA WHAT DO,YOU WANT,TO BE,WHE
       N YOU,GROW UP?,-1
13350  DATA WHAT,IS,THE,NAME,OF,YOUR,S
       CHOOL?,-1
13360  DATA WHAT,IS,YOUR,TEACHER'S,NAM
       E?,-1
13370  DATA WHAT,GRADE OR CLASS,ARE,YO
       U,IN?,-1
13380  DATA WHAT,IS,THE NAME,OF,YOUR,F
       AVORITE, DOLL OR TOY?,-1
13390  DATA WHAT TYPE,OF,WORK,DOES,YOU
       R MOM,DO?,-1
13400  DATA WHAT TYPE,OF,WORK,DOES,YOU
       R DAD,DO?,-1
13420  DATA HOW,MANY,BROTHERS,DO YOU,H
       AVE?,-1
13421  DATA WHAT IS,BROTHER #1'S,NAME?
       ,-1
13422  DATA WHAT IS,BROTHER #1'S,AGE?,
       -1
13423  DATA WHAT IS,BROTHER #2'S,NAME?
       ,-1
13424  DATA WHAT IS,BROTHER #2'S,AGE?,
       -1
13425  DATA WHAT IS,BROTHER #3'S,NAME?
       ,-1
13426  DATA WHAT IS,BROTHER #3'S,AGE?,
       -1
13430  DATA HOW,MANY,SISTERS,DO YOU,HA
       VE?,-1
13431  DATA WHAT IS,SISTER #1'S,NAME?,
       -1
13432  DATA WHAT IS,SISTER #1'S,AGE?,-1
13433  DATA WHAT IS,SISTER #2'S,NAME?,
       -1
13434  DATA WHAT IS,SISTER #2'S,AGE?,-1
13435  DATA WHAT IS,SISTER #3'S,NAME?,
       -1
13436  DATA WHAT IS,SISTER #3'S,AGE?,-1
13440  DATA HOW,MANY,PETS,DO YOU,HAVE?
       ,-1
13441  DATA WHAT,KIND OF,ANIMAL,IS,PET
        #1?,-1
13442  DATA WHAT IS,PET #1'S,NAME?,-1
13443  DATA WHAT,KIND OF,ANIMAL,IS,PET
        #2?,-1
13444  DATA WHAT IS,PET #2'S,NAME?,-1
13445  DATA WHAT,KIND OF,ANIMAL,IS,PET
        #3?,-1
13446  DATA WHAT IS,PET #3'S,NAME?,-1
13450  DATA HOW MANY,IMAGINARY FRIENDS
       ,DO YOU,HAVE?,-1
13451  DATA WHAT,KIND OF,CREATURE,IS,F
       RIEND #1?,-1
13452  DATA WHAT IS,FRIEND #1'S,NAME?,
       -1
13453  DATA WHAT,KIND OF,CREATURE,IS,F
       RIEND #2?,-1
13454  DATA WHAT IS,FRIEND #2'S,NAME?,
       -1
13455  DATA WHAT,KIND OF,CREATURE,IS,F
       RIEND #3?,-1
13456  DATA WHAT IS,FRIEND #3'S,NAME?,
       -1
```

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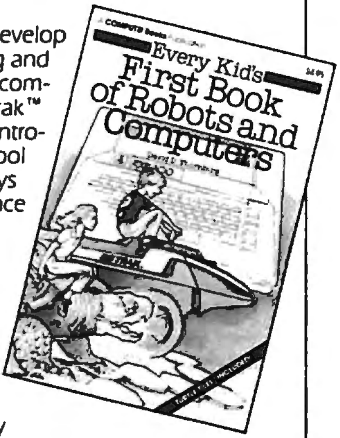

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LETTER AND NUMBER PLAY

Garold R Stone

This has given my two year old, Jesse, and me a good deal of fun together. It really isn't a game. It offers an opportunity to play with large letters and numbers on the screen.

When the program starts, it's in the Alphabet mode. A large letter "A" appears in the middle of the screen, and a small reverse video "A" appears near the bottom. Each time Jesse presses the space bar, the next letter in the alphabet replaces the previous one in the middle of the screen, and the new letter is added to a growing alphabetic sequence at the bottom.

I had originally planned to use a speech synthesizer with the program. But, while play testing it with Jesse, I discovered that I made an even better speech synthesizer. Although Jesse already can say his ABCD's, he is just now learning that the ABC song he has learned is really made up of things called letters.

He sits on my lap and presses the space bar to see the letters. I say the names of the letters, and he repeats after me (sometimes). Or I may ask him questions like "What is the first letter of the alphabet?" or "Can you find the *A*?" It's all quite relaxed, but he is being exposed to the names, shapes, and alphabetical order of the letters.

If he says the wrong name for a letter, I don't say, "That's not *B*." I simply say the correct name of the letter. He sometimes just sits and listens as I say the names, while he presses the space bar to advance the letters.

One day he asked to see the *Q* when we were only up to *D*. Later, I added code which lets him put any letter at the top of the screen by pressing its key on the keyboard. After pressing individual letter keys, he can continue the alphabet at the bottom of the screen from where we left off by pressing the space bar again.

At any time I can press the shift and space bar to start over with the letter *A*. If we ever get to the end of the alphabet, the string of letters at the bottom of the screen flashes ten times, and I make a big deal of it.

But there are lots of other things to do, too. He can guess the name of the next letter or try to find a letter on the keyboard. Sometimes he just wants to see some favorite letters and touch them on the screen.

Finally, I added the Numbers Game. To play with the numbers, press the SHIFT and the number one. Pressing the space bar displays the next higher number in large print in the middle of the screen. Numbers greater than 9999 will not fit on the screen. Pressing any of the digits, zero to nine, displays that digit in large print at the top of the screen. To start counting over with one again, press SHIFT and space. To get back to the alphabet, press SHIFT and *A*.

These sessions are not very long – three to five minutes, at most. Jesse is usually a little impatient as the program loads from tape. Just about the time it's ready, he's decided he wants to play another favorite game (another excuse for getting a disk drive).

Jesse has been playing at my computer since he was about 18 months old. By now he knows that you "press" the keys, not pound them, though exuberance can lead to banging. He has learned that the keyboard has letters, numbers, and symbols like "star" (*) and "arrow" (↑).

(I can provide a copy of the PET Version of the program to those sending a cassette with $3 and a SASE mailer to: Garold R. Stone, P.O. Box 153, Annapolis Junction, MD 20701.)

Program 1: PET/CBM Version

Some characters are inaccessible from the PET/CBM business style keyboard and adjustments will need to be made in order to run Letter and Number Play on this machine.

```
100 POKE59468,12:REM GRAPHICS MODE
110 PRINT CHR$(142)
120 PRINT"{CLEAR}";
130 PRINT"{03 DOWN}FOR THE SUPERVISING ADU
    LT:"
140 PRINT:PRINT"PRESS [SHIFT] AND [A] FOR ~
    THE ALPHABET:"
150 PRINT:PRINT"  PRESS LETTER KEYS OR [SP
    ACE] TO PLAY."
160 PRINT"  [SHIFT] & [A] RESETS ALPHABET ~
    TO 'A'."
```

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```
170 PRINT:PRINT:PRINT"PRESS [SHIFT] AND [1
    ] FOR THE NUMBERS:"
180 PRINT:PRINT"  PRESS NUMBER KEYS OR [SP
    ACE] TO PLAY."
190 PRINT"  [SHIFT] & [1] RESETS NUMBERS T
    O '1'."
200 PRINT:PRINT:PRINT"PRESS [SPACE] TO CON
    TINUE, '/' TO STOP"
210 REM STORE LETTERS IN A$()
220 DIM A$(26):DIM N$(9)
230 NL$="{DOWN}{08 LEFT}":REM 1 DOWN 8 BAC
    K
240 FOR I=1 TO 26
250 REM SET UP A LETTER
260 FOR J=1 TO 6
270 READ A$:A$(I) = A$(I) + A$
280 NEXT J
290 NEXT I
300 GOSUB2220:REM SET UP NUMBERS
310 GETA$:IFA$=""THEN310
320 GOSUB 3170
330 REM LETTERS
340 L$ = "":L=1:GOSUB 2040:GOSUB2070:GOSUB
     2120
350 GETA$:IF A$ = "" THEN 350
360 GOSUB 3170
370 IFA$=CHR$(177)ORA$=CHR$(33)THENGOSUB29
    20:GOTO340:REM NUMBERS
380 IFA$ = CHR$(193) THEN 340
390 IFA$=" "THEN L=L+1:IFL>26THEN340
400 IFA$=" "THEN IF L>26 THEN 340
410 IFA$=" "THEN GOSUB 2040:GOSUB2070:GOSU
    B 2120:GOTO350
420 A = ASC(A$):T = L:REM REMEMBER L
430 IF A >= 65 AND A <= 90 THEN L=A-64:PRI
    NT"{HOME}";:GOSUB 2070
440 L=T
450 GOTO350
460 PRINT"{CLEAR}";:END
470 REM LETTERS
480 DATA" N####M "
490 DATA"'     T "
500 DATA"T     T "
510 DATA"T#####P "
520 DATA"'     ' "
530 DATA"T     T "
540 DATA" O####M "
550 DATA" %    T "
560 DATA" %    N "
570 DATA" O####M "
580 DATA" %    T "
590 DATA" L$$$$N "
600 DATA" N###M  "
610 DATA" %      "
620 DATA" %      "
630 DATA" %      "
640 DATA" %      "
650 DATA" M$$$N  "
660 DATA" O##M   "
670 DATA" %   M  "
680 DATA" %   T  "
690 DATA" %   T  "
700 DATA" %   N  "
710 DATA" L$$N   "
720 DATA" O####  "
730 DATA" %      "
740 DATA" L$$    "
750 DATA" %      "
760 DATA" %      "
770 DATA" L$$$$  "
780 DATA" O####  "
790 DATA" %      "
800 DATA" L$$    "
810 DATA" %      "
820 DATA" %      "
830 DATA" %      "
840 DATA" N##M   "
850 DATA" %      "
860 DATA" %$$$   "
870 DATA" %   '  "
880 DATA" %   T  "
890 DATA" M$$N   "
900 DATA" %    ' "
910 DATA" %    T "
920 DATA" L$$$:  "
930 DATA" %    ' "
940 DATA" %    T "
950 DATA" %    T "
960 DATA" #P##   "
970 DATA"  '     "
980 DATA"  T     "
990 DATA"  T     "
1000 DATA"  '     "
1010 DATA" $:$$   "
1020 DATA"  #P##  "
1030 DATA"   '    "
1040 DATA"   T    "
1050 DATA"   T    "
1060 DATA" % T    "
1070 DATA" M$N    "
1080 DATA" '  N   "
1090 DATA" T N    "
1100 DATA" TN     "
1110 DATA" TM     "
1120 DATA" ' M    "
1130 DATA" T  M   "
1140 DATA" %      "
1150 DATA" %      "
1160 DATA" %      "
1170 DATA" %      "
1180 DATA" %      "
1190 DATA" L$$$$  "
1200 DATA"'M    N%"
1210 DATA"T M  N %"
1220 DATA"T  MN  %"
1230 DATA"T      %"
1240 DATA"T      %"
1250 DATA"T      %"
1260 DATA"TM     %"
1270 DATA"' M    %"
1280 DATA"T  M   %"
1290 DATA"T   M  %"
1300 DATA"T    M %"
1310 DATA"T     M%"
1320 DATA"  N###M "
1330 DATA" N     M"
1340 DATA" %     T"
1350 DATA" %     T"
1360 DATA" M     N"
1370 DATA"  M$$$N "
1380 DATA"'#####M "
1390 DATA"'     ' "
1400 DATA"T$$$$$N "
1410 DATA"'       "
1420 DATA"T       "
1430 DATA"T       "
1440 DATA"  N###M "
1450 DATA" N     M"
1460 DATA" %     T"
1470 DATA" %     T"
1480 DATA" M    MN"
1490 DATA"  M$$$NM"
1500 DATA"'#####M "
1510 DATA"'     ' "
1520 DATA"T$$$$$N "
1530 DATA"'   M   "
1540 DATA"T    M  "
1550 DATA"T     M "
```

...and so there were keys for the Atari 400.

In the beginning there was the membrane keyboard.

So it was to be done that Inhome Software would create a full-stroke keyboard for the Atari 400 Home Computer and it would be called the B Key 400, and would sell for $119.95 U.S. funds.

The new B Key 400 was made so easy to install that the owner could do it himself in a miraculous two minutes.

With the B Key 400 keyboard from Inhome Software, you will follow into the land of professional home computers that are powerful, easy to program and have a great capacity that can be made even greater with Inhome Software 48K and 32K memory boards. It was done and it was good.

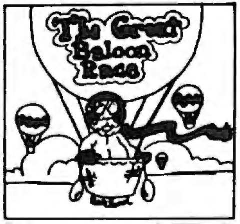
INHOME

ADVANCING THE PROGRESS

Inhome Software Incorporated, 2485 Dunwin Drive, Mississauga, Ontario, L5L 1T1 (416) 828-0775. Atari is a trade mark of Atari Inc. Made in Canada

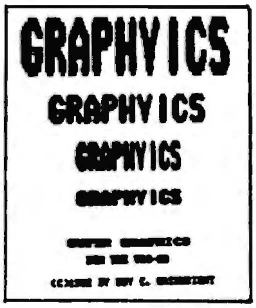
```
1560 DATA" N####M "
1570 DATA" %      "
1580 DATA" M$$$$  "
1590 DATA"      M "
1600 DATA"      T "
1610 DATA" M$$$$N "
1620 DATA" ##P### "
1630 DATA"   '    "
1640 DATA"   T    "
1650 DATA"   T    "
1660 DATA"   T    "
1670 DATA"   T    "
1680 DATA"        "
1690 DATA"'      %"
1700 DATA"T      %"
1710 DATA"T      %"
1720 DATA"T      %"
1730 DATA" M$$$$N "
1740 DATA"        "
1750 DATA"        "
1760 DATA"        "
1770 DATA" M    N "
1780 DATA"  M  N  "
1790 DATA"   MN   "
1800 DATA"        "
1810 DATA"'      %"
1820 DATA"T      %"
1830 DATA"T  NM  %"
1840 DATA"T N  M %"
1850 DATA"TN    M%"
1860 DATA" M    N "
1870 DATA"  M  N  "
1880 DATA"   MN   "
1890 DATA"   NM   "
1900 DATA"  N  M  "
1910 DATA" N    M "
1920 DATA" M    N "
1930 DATA"  M  N  "
1940 DATA"   MN   "
1950 DATA"   '    "
1960 DATA"   T    "
1970 DATA"   T    "
1980 DATA"  $$$$  "
1990 DATA"     N  "
2000 DATA"    N   "
2010 DATA"   N    "
2020 DATA"  N     "
2030 DATA"  ####  "
2040 REM PRINT LETTER
2050 PRINT"{CLEAR}";
2060 FOR I = 1 TO 9:PRINT:NEXT:RETURN
2070 PRINT"{15 RIGHT}";
2080 FOR I=0 TO 5
2090 PRINT MID$(A$(L),I*8+1,8);NL$;
2100 NEXT:RETURN
2110 REM PRINT ALPHABET
2120 L$ = L$ + CHR$(L+64)
2130 B$="{HOME}{21 DOWN}       {REV}":PRINT
     B$;L$
2140 FOR I=1 TO 250:NEXT
2150 IF L=26 THEN GOSUB2180
2160 FOR I=1 TO 10:GETA$:NEXT:RETURN
2170 REM FLASH ALPHABET
2180 FOR I=1 TO 10
2190 C$="{HOME}{21 DOWN}       ":PRINTC$;L$
    :FOR J=1 TO 100:NEXT
2200 PRINT B$;L$:FOR J=1 TO 100:NEXT
2210 NEXTI:RETURN
2220 REM STORE DIGITS IN N$()
2230 BL$="{DOWN}{03 LEFT}"
2240 FOR I=0 TO 9
2250 REM SET UP A DIGIT
2260 FOR J=0 TO 5
2270 READ N$
2280 N$(I)=N$(I)+N$
2290 NEXT J
2300 NEXT I:RETURN
2310 REM DIGITS
2320 DATA"N#M"
2330 DATA"% '"
2340 DATA"% T"
2350 DATA"% T"
2360 DATA"% T"
2370 DATA"M$N"
2380 DATA" N%"
2390 DATA"  %"
2400 DATA"  %"
2410 DATA"  %"
2420 DATA"  %"
2430 DATA" $L"
2440 DATA"N#M"
2450 DATA"  '"
2460 DATA" $N"
2470 DATA"N  "
2480 DATA"%  "
2490 DATA"L$$"
2500 DATA"N#M"
2510 DATA"  '"
2520 DATA" $N"
2530 DATA"  M"
2540 DATA"  T"
2550 DATA"M$N"
2560 DATA"% %"
2570 DATA"% %"
2580 DATA"% %"
2590 DATA"##O"
2600 DATA"  %"
2610 DATA"  %"
2620 DATA"O##"
2630 DATA"L$ "
2640 DATA"  M"
2650 DATA"  T"
2660 DATA"  T"
2670 DATA"M$N"
2680 DATA"N#M"
2690 DATA"%  "
2700 DATA"L$ "
2710 DATA"% M"
2720 DATA"% '"
2730 DATA"M$N"
2740 DATA"O#P"
2750 DATA"  N"
2760 DATA" N "
2770 DATA" % "
2780 DATA" % "
2790 DATA" % "
2800 DATA"N#M"
2810 DATA"% '"
2820 DATA"M$N"
2830 DATA"N M"
2840 DATA"% '"
2850 DATA"M$N"
2860 DATA"N#M"
2870 DATA"% '"
2880 DATA"M$:"
2890 DATA"  '"
2900 DATA"  T"
2910 DATA"M$N"
2920 N=1:GOSUB3160
2930 GETA$:IFA$=""THEN2930
2940 GOSUB 3170
2950 IFA$=" "THEN N=N+1:GOSUB3160:GOTO2930
2960 T=N:N=ASC(A$)-48
2970 IFN>=0ANDN<10THENGOSUB3020
2980 N=T
2990 IFA$=CHR$(177)OR A$=CHR$(33)THEN N=1:G
   OSUB3160
3000 IFA$=CHR$(193)THEN RETURN
```


Synthy-64!
©1982 By ROY WAINWRIGHT


The Great Baloon Race


Budgeteer!


SPRITE AID
FOR THE COMMODORE 64!
SPRITE AID


GRAPHVICS
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TINY PILOT


ABACUS
SOFTWARE


Joystick Painter

```
3010 GOTO2930
3020 REM
3030 P=1:F$=STR$(N)
3040 IF LEN(F$)>5 THEN 460
3050 X=VAL(MID$(F$,P+1,1))
3060 IFVAL(A$)=NTHENPRINT"{HOME}";:GOSUB311
     0:GOTO3080
3070 GOSUB3100
3080 P=P+1:IFP<=LEN(F$)-1THEN3050
3090 FORQ=1TO 250:NEXT:FORQ=1TO9:GETA$:NEXT
     :RETURN
3100 PRINT"{HOME}{10 DOWN}";
3110 PRINT"{20 RIGHT}";:FORQ=1TOLEN(F$):PRI
     NT"{05 LEFT}";:NEXT
3120 FORQ=1TO P:PRINT"{05 RIGHT}";:NEXT
3130 FOR I=0 TO 5
3140 PRINT MID$(N$(X),I*3+1,3);BL$;
3150 NEXT:RETURN
3160 PRINT"{CLEAR}";:GOSUB3020:RETURN
3170 IF A$="/" THEN 460
3180 RETURN
```

Program 2: VIC Version

```
100 PRINT"{CLEAR}{09 DOWN}{RIGHT}{REV}LETT
    ERS AND NUMBERS"
110 PRINT"{09 RIGHT}{REV}PLAY"
120 FOR I=1 TO2000
130 NEXT
140 PRINT"{CLEAR}";
150 PRINT:PRINT"PRESS [SHIFT] AND [A] FOR ~
    THE ALPHABET:"
160 PRINT:PRINT" *PRESS LETTER KEYS OR [SP
    ACE] TO PLAY."
170 PRINT"  [SHIFT] & [A] RESETS ALPHABET ~
    TO 'A'."
180 PRINT:PRINT:PRINT"PRESS [SHIFT] AND [1
    ] FOR THE NUMBERS:"
190 PRINT:PRINT" *PRESS NUMBER KEYS OR [SP
    ACE] TO PLAY."
200 PRINT"  [SHIFT] & [1] RESETS NUMBERS T
    O '1'."
210 PRINT"{02 DOWN}PRESS [SPACE] TO"
220 PRINT"CONTINUE, '/'TO STOP"
230 GETA$:IFA$=""THEN230
240 GOSUB 890
250 REM LETTERS
260 L$ = "":L=1:GOSUB 390:GOSUB420:GOSUB 5
    30
270 GETA$:IF A$ = "" THEN 270
280 GOSUB 890
290 IFA$=CHR$(33)THENGOSUB640:GOTO260:REM ~
    NUMBERS
300 IFA$ = CHR$(193) THEN 260
310 IFA$=" "THEN L=L+1:IFL>26THEN260
320 IFA$=" "THEN IF L>26 THEN 260
330 IFA$=" "THEN GOSUB 390:GOSUB420:GOSUB ~
    530:GOTO270
340 A = ASC(A$):T = L:REM REMEMBER L
350 IF A >= 65 AND A <= 90 THEN L=A-64:PRI
    NT"{HOME}";:GOSUB 420
360 L=T
370 GOTO270
380 PRINT"{CLEAR}";:END
390 REM PRINT LETTER
400 PRINT"{CLEAR}";
410 FOR I = 1TO 9:PRINT:NEXT:RETURN
420 T8=6
430 M=32768+8*L
440 PRINT"{02 DOWN}";
450 FOR J=M TO M+7
460 D=PEEK(J):FOR K=1 TO 8
470 Y=146:D=D*2:IF D>255 THEN D=D-256:Y=18
```

A wrong letter match in "Letter And Number Play," VIC-20 version.

```
480 PRINT TAB(T8);CHR$(Y);CHR$(32);
490 NEXT K
500 PRINTTAB(T8);CHR$(146)
510 NEXT J:RETURN
520 REM PRINT ALPHABET
530 L$ = L$ + CHR$(L+64)
540 B$="{HOME}{20 DOWN}{REV}":PRINT B$;L$
550 FOR I=1 TO 250:NEXT
560 IF L=26 THEN GOSUB590
570 FOR I=1 TO 10:GETA$:NEXT:RETURN
580 REM FLASH ALPHABET
590 FOR I=1 TO 10
600 C$="{HOME}{20 DOWN}":PRINTC$;L$:FOR J=
    1 TO 100:NEXT
610 PRINT B$;L$:FOR J=1 TO 100:NEXT
620 NEXTI:RETURN
630 REM DIGITS
640 N=1:GOSUB880
650 GETA$:IFA$=""THEN650
660 GOSUB 890
670 IFA$=" "THEN N=N+1:GOSUB880: GOTO650
680 T=N:N=ASC(A$)-48
690 IFN>=0ANDN<10THENGOSUB740
700 N=T
710 IFA$=CHR$(33) THEN N=1:GOSUB880
720 IFA$=CHR$(193)THEN RETURN
730 GOTO650
740 REM
750 P=1:F$=STR$(N)
760 X=VAL(MID$(F$,P+1,1))
770 IFVAL(A$)=NTHENPRINT"{HOME}";:L=X:GOSU
    B820:GOTO790
780 L=X:GOSUB810
790 P=P+1:IFP<=LEN(F$)-1THEN760
800 FORQ=1TO 250:NEXT:FORQ=1TO9:GETA$:     ~
      NEXT:RETURN
810 PRINT"{HOME}{10 DOWN}";
820 T8=17:FORQ=1TOLEN(F$):T8=T8-7:NEXT
830 FORQ=1TOP:T8=T8+7:NEXT
840 IF T8<0THEN 380
850 L=L+48
860 GOSUB 430
870 RETURN
880 PRINT"{CLEAR}";:GOSUB740:RETURN
890 IF A$="/" THEN 380
900 RETURN
```

Program 3: Apple Version

```
10  LOMEM: 16384
20  DIM L$(26)
```

AMERICAN PERIPHERALS

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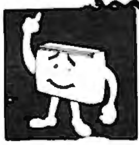
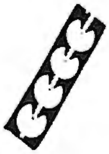
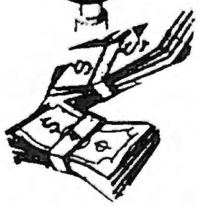
VIC=20

The friendly computer







V 6 FOUR ACROSS
Vertical game for two players; similar to tic-tac-toe. $9.95

V 10 SNAKE
Like the Arcade game SURROUND. One or two players. $9.95

V 12 BREAKOUT
Adaption of the classic Ping-Pong against the wall. All time favorite. $9.95

V 78 BRICK
The computer has a brick float across the screen and it disappears before it hits the window. You have to stop the brick before it breaks the glass. $7.95

V 79 SHOOT
You have to shoot a moving object. The game has five different skill levels. $7.95

V 80 REVERSE
This game is played with two sets of pegs. The board starts with a set of pegs at each end and you must reverse them. $7.95

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You have to capture the two beasts by containing them in the brick cage that you build. It has nine skill levels. $9.95

V 82 WORLD CAPITALS
An entertaining and educational variation of STATE CAPITALS. $9.95

V 83 JACKPOT
You must see this one armed bandit in action to believe it. Full color graphics and sound. $7.95

V 84 STATE CAPITALS
The computer displays a state or capital; the student types in the corresponding capital or state. Even corrects spelling mistakes. $9.95

V 85 HANGMAN
Unbelievable graphics and sound with a twist of humor. Kids of all ages will love this one. $9.95

V 86 TAC-TAC-TOE
The perennial favorite, a fast-paced colorful game. Try if you can to beat the VIC. $7.95

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The VIC challenges your memory to the ultimate degree. Just like the old T.V. show Concentration. $9.95

V 88 MATCH
Hand and eye coordination are a must in this game. Beat the clock and get the maximum number of points. $7.95

V 89 MONKS
A devilish game of logic. It will have you glued to the VIC for days. $7.95

V 428 INTRUDER-SCRAMBLE
Just as fine as the arcade game. Machine language. A must! $19.95

V 90 MOSAICS
A variation of Rubics cube for the VIC. This game has never been seen before for any computer. We wrote the program but could not solve the puzzle. $9.95

V 91 SENKU
If you like thinking logically, this one will challenge you all the way! Based on the popular game of Mastermind. $7.95

V 92 MAGIC PAD
A mini-version of Visi-Calc for the VIC. Allows storage and retrieval of data from cassette; invaluable for personal and business use. Turns VIC into the perfect record keeper. $20.00

V107 BINARY NUMBERS
This program is designed to introduce you to the binary number system and the conversion to binary from base 10 numbers and back. $9.95

V108 BOMBER
You must decide who you want to fly for. You then get to pick a target and your experience level. $9.95

V151 BIZZ-BUZZ
Math game that tests the student on division by 2&3. Good for elementary school students. With color and sound. $9.95

V152 MISSILE COMMAND
You have three bases and you must destroy as many space ships as you can before you run out of missiles. $9.95

V153 TANK VS. UFO
The tank is moving back and forth along the base and you must shoot the UFO before it shoots you. $9.95

V190 BIORHYTHM
Just like the biorhythm charts you find in books. $9.95

V191 BLACKJACK
Just like Blackjack in the casinos. $14.95

V192 BEST STRAIGHT LINE
This program finds the equation for the best straight line through the desired points on a graph. $9.95

V194 SNAKMAN
Pacman for the VIC. $24.95

V197 ASTROBASE-2001
Destroy the alien invaders from space as they attack your planet. Requires 3K memory expander. $9.95

V199 SUBROUTINES
The use of this standard programming technique allows you to save much room and effort. Typical uses are stressed. $14.95

V299 A CAT HAS NINE LIVES
You're an alley cat who is trying desparately to defend himself from unidentified deadly objects. Fast paced game. $7.95

V300 PSYCHIC MISSILES
The object of the game is to guess where the target will be, then fire the missile! This program will exercise your psychic ability. Requires $9.95
By Richard Leiman

V301 BEECHA GOTCHA
Play "Beecha Gotcha." If the harpoon hits the monster fish, I "beecha." If the monster eats the boat, I "gotcha." Requires 3K expander. $9.95
By Richard Leiman

V302 AIR ATTACK
You must shoot down enemy aircrafts with your limited supply of missiles. $7.95

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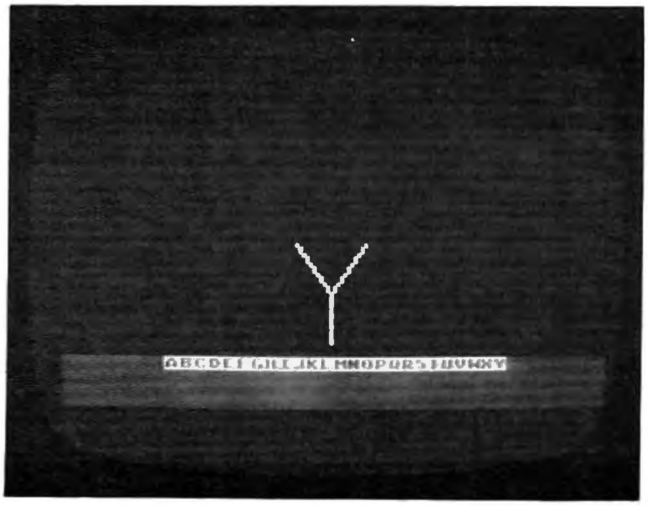
```
30  HOME
40  VTAB 3: PRINT "FOR THE SUPERVISING ADULT
     :"
50  PRINT : PRINT "PRESS <SHIFT> AND <A> FOR
      THE ALPHABET:"
60  PRINT : PRINT "  PRESS LETTER KEYS OR <S
     PACE> TO PLAY."
70  PRINT "  <SHIFT> & <A> RESETS ALPHABET T
     O 'A'."
80  PRINT : PRINT : PRINT "PRESS <SHIFT> AND
      <1> FOR THE NUMBERS:"
90  PRINT : PRINT "  PRESS NUMBER KEYS OR <S
     PACE> TO PLAY."
100  PRINT "  <SHIFT> & <1> RESETS NUMBERS T
     O '1'."
110  REM  STORE LETTER COORDINATES IN A
120  DIM A(26,20): DIM N(10,20)
130  REM  SET UP LETTERS
140  FOR I = 1 TO 26
150  FOR J = 1 TO 20
160  READ A(I,J)
170  NEXT J: NEXT I
180  GOSUB 1370: REM  SET UP NUMBERS
190  PRINT : PRINT : PRINT "PRESS <SPACE> TO
      CONTINUE, '/' TO STOP"
200  GET A$
210  GOSUB 2050
220  REM  LETTERS
230 L$ = "":L = 1: GOSUB 1170: GOSUB 1270
240  GET A$
250  GOSUB 2050
260  IF A$ =  CHR$ (33) THEN  GOSUB 1750:
     GOTO 230: REM  NUMBERS
270  IF A$ =  CHR$ (65) THEN 230
280  IF A$ = " " THEN L = L + 1:B = 0: IF L >
     26 THEN 230
290  IF A$ = " " THEN  IF L > 26 THEN 230
300  IF A$ = " " THEN  GOSUB 1170: GOSUB 127
     0: GOTO 240
310  IF B <  > 0 THEN T = L:L = B - 64: HCOL
    OR=0:Y7 = 30: GOSUB 1190:L = T: HCOLOR= 3
320 A =  ASC (A$):T = L: REM  REMEMBER L
330  IF A >  = 65 AND A <  = 90 THEN L = A -
     64:B = A:Y7 = 30: GOSUB 1190
340 L = T
350  GOTO 240
360  TEXT : HOME : END
370  REM  LETTERS
380  REM  ---A---
390  DATA  0,40,13,0,13,0,26,40,6,21
400  DATA  20,21,-1,-1,-1,-1,-1,-1,-1,-1
410  REM  ---B---
420  DATA  0,0,0,40,0,1,25,1,25,1
430  DATA  25,39,0,39,25,39,0,20,25,20
440  REM  ---C---
450  DATA  25,0,0,0,0,0,0,40,0,40
460  DATA  25,40,-1,-1,-1,-1,-1,-1,-1,-1
470  REM  ---D---
480  DATA  0,0,0,40,0,1,25,1,25,1
490  DATA  25,39,25,39,0,39,-1,-1,-1,-1
500  REM  ---E---
510  DATA  25,40,0,40,0,40,0,0,0,0
520  DATA  25,0,0,20,13,20,-1,-1,-1,-1
530  REM  ---F---
540  DATA  0,40,0,0,0,0,25,0,0,20
550  DATA  13,20,-1,-1,-1,-1,-1,-1,-1,-1
560  REM  ---G---
570  DATA  25,0,0,0,0,0,0,40,0,40
580  DATA  25,40,25,40,25,20,25,20,15,20
590  REM  ---H---
600  DATA  0,0,0,40,25,0,25,40,0,20
610  DATA  25,20,-1,-1,-1,-1,-1,-1,-1,-1
620  REM  ---I---
630  DATA  0,0,24,0,0,40,24,40,12,0
640  DATA  12,40,-1,-1,-1,-1,-1,-1,-1,-1
650  REM  ---J---
660  DATA  25,0,25,40,25,40,0,40,0,40
```

```
670  DATA  0,30,-1,-1,-1,-1,-1,-1,-1,-1
680  REM  ---K---
690  DATA  0,0,0,40,0,20,25,0,0,20
700  DATA  25,40,-1,-1,-1,-1,-1,-1,-1,-1
710  REM  ---L---
720  DATA  0,0,0,40,0,40,25,40,-1,-1
730  DATA  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1
740  REM  ---M---
750  DATA  0,0,0,40,0,0,13,20,13,20
760  DATA  26,0,26,0,26,40,-1,-1,-1,-1
770  REM  ---N---
780  DATA  0,40,0,0,0,0,25,40,25,40
790  DATA  25,0,-1,-1,-1,-1,-1,-1,-1,-1
800  REM  ---O---
810  DATA  0,0,25,0,25,0,25,40,25,40
820  DATA  0,40,0,40,0,0,-1,-1,-1,-1
830  REM  ---P---
840  DATA  0,40,0,0,0,0,25,0,25,0
850  DATA  25,20,25,20,0,20,-1,-1,-1,-1
860  REM  ---Q---
870  DATA  0,0,25,0,25,0,25,40,25,40
880  DATA  0,40,0,40,0,0,20,35,30,45
890  REM  ---R---
900  DATA  0,40,0,0,0,0,25,0,25,0
910  DATA  25,20,25,20,0,20,10,20,25,40
920  REM  ---S---
930  DATA  25,0,0,0,0,0,0,20,0,20
940  DATA  25,20,25,20,25,40,25,40,0,40
950  REM  ---T---
960  DATA  0,0,25,0,13,0,13,40,-1,-1
970  DATA  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1
980  REM  ---U---
990  DATA  0,0,0,40,0,40,25,40,25,40
1000  DATA  25,0,-1,-1,-1,-1,-1,-1,-1,-1
1010  REM  ---V---
1020  DATA  0,0,13,40,13,40,25,0,-1,-1
1030  DATA  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1
1040  REM  ---W---
1050  DATA  0,0,5,40,5,40,13,0,13,0
1060  DATA  21,40,21,40,26,0,-1,-1,-1,-1
1070  REM  ---X---
1080  DATA  0,0,25,40,0,40,25,0,-1,-1
1090  DATA  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1
1100  REM  ---Y---
1110  DATA  0,0,13,20,13,20,26,0,13,20
1120  DATA  13,40,-1,-1,-1,-1,-1,-1,-1,-1
1130  REM  ---Z---
1140  DATA  0,0,25,0,25,0,0,40,0,40
1150  DATA  25,40,-1,-1,-1,-1,-1,-1,-1,-1
1160  REM  PRINT LETTER
1170  HOME :Y7 = 90
1180  HGR : HCOLOR= 3
1190 X7 = 130
1200  FOR J = 1 TO 20 STEP 4
1210 X1 = A(L,J):Y1 = A(L,J + 1):X2 = A(L,J +
     2):Y2 = A(L,J + 3)
1220  IF X1 < 0 THEN 1240
1230  HPLOT X1 + X7,Y1 + Y7 TO X2 + X7,Y2 +
     Y7
1240  NEXT J
1250  RETURN
1260  REM  PRINT ALPHABET
1270 L$ = L$ +  CHR$ (L + 64)
1280  VTAB 22: HTAB 6: INVERSE : PRINT L$:
      NORMAL
1290  FOR I = 1 TO 250: NEXT
1300  IF L = 26 THEN  GOSUB 1330
1310  RETURN
1320  REM  FLASH ALPHABET
1330  VTAB 22: HTAB 6: FLASH : PRINT L$
1340  FOR I = 1 TO 3000: NEXT
1350  VTAB 22: HTAB 6: NORMAL : PRINT L$
1360  RETURN
1370  REM  STORE DIGIT COORDINATES IN N
1380  FOR I = 0 TO 9
1390  REM  SET UP A DIGIT
1400  FOR J = 0 TO 19
```

```
1410  READ N(I,J)
1420  NEXT J
1430  NEXT I: RETURN
1440  REM  DIGITS
1450  REM  ---0---
1460  DATA  0,0,20,0,20,0,20,40,20,40
1470  DATA  0,40,0,40,0,0,-1,-1,-1,-1
1480  REM  ---1---
1490  DATA  5,10,13,0,13,0,13,40,0,40
1500  DATA  26,40,-1,-1,-1,-1,-1,-1,-1,-1
1510  REM  ---2---
1520  DATA  0,10,12,0,12,0,24,10,24,10
1530  DATA  0,40,0,40,25,40,-1,-1,-1,-1
1540  REM  ---3---
1550  DATA  0,0,20,0,20,0,20,40,20,40
1560  DATA  0,40,0,20,20,20,-1,-1,-1,-1
1570  REM  ---4---
1580  DATA  20,0,0,35,0,35,25,35,20,0
1590  DATA  20,40,-1,-1,-1,-1,-1,-1,-1,-1
1600  REM  ---5---
1610  DATA  19,0,5,0,5,0,0,19,0,19
1620  DATA  20,19,20,19,20,40,20,40,0,40
1630  REM  ---6---
1640  DATA  2,0,0,20,0,20,22,20,22,20
1650  DATA  22,40,22,40,0,40,0,40,0,20
1660  REM  ---7---
1670  DATA  0,0,25,0,25,0,0,40,-1,-1
1680  DATA  -1,-1,-1,-1,-1,-1,-1,-1,-1,-1
1690  REM  ---8---
1700  DATA  0,0,0,40,0,40,20,40,20,40
1710  DATA  20,0,0,20,20,20,20,0,0,0
1720  REM  ---9---
1730  DATA  0,0,22,0,22,0,22,20,22,20
1740  DATA  0,20,0,20,0,0,22,20,20,40
1750 N1 = 1: GOSUB 2040
1760  GET A$: GOSUB 2050
1770  IF A$ = " " THEN N1 = N1 + 1:C2 = 0:
      GOSUB 2040: GOTO 1760
1780  IF C2 = 1 THEN X = N2: HCOLOR= 0:Y7 =
     30:X7 = 135: GOSUB 1980: HCOLOR= 3
1790 T = N1:N1 =  ASC (A$) - 48:N2 = N1:C2 =
     1: IF N1 < 0 OR N1 > 9 THEN N2 = 1
1800  IF N1 >  = 0 AND N1 < 10 THEN C5 = 1:
      GOSUB 1850
1810 N1 = T
1820  IF A$ =  CHR$ (33) THEN N1 = 1: GOSUB
     2040
1830  IF A$ =  CHR$ (65) THEN  RETURN
1840  GOTO 1760
1850  REM
1860 P = 1:F$ =  STR$ (N1)
1870 X =  VAL ( MID$ (F$,P,1))
1880  IF  VAL (A$) = N1 THEN Y7 = 30: GOSUB
     1930: GOTO 1900
1890  GOSUB 1920
1900 P = P + 1: IF P <  =  LEN (F$) THEN 187
     0
1910  RETURN
1920 Y7 = 90
1930 X7 = 135: FOR Q = 1 TO  LEN (F$):X7 = X
     7 - 33: NEXT
1940  FOR Q = 1 TO P:X7 = X7 + 33: NEXT
1950  IF P > 1 OR C5 = 1 THEN 1980
1970  HGR : HCOLOR= 3
1980  FOR J = 0 TO 19 STEP 4
1990 X1 = N(X,J):Y1 = N(X,J + 1):X2 = N(X,J +
     2):Y2 = N(X,J + 3)
2000  IF X1 < 0 THEN 2030
2010  HPLOT X1 + X7,Y1 + Y7 TO X2 + X7,Y2 +
     Y7
2020  NEXT
2030 C5 = 0: RETURN
2040  HOME : GOSUB 1850: RETURN
2050  IF A$ = "/" THEN 360
2060  RETURN
```

Program 4: Atari Version

```
50 OPEN #1,4,0,"K:"
60 DIM A$(1),L$(26),F$(4)
180 GRAPHICS 0:POKE 752,1
190 PRINT :PRINT :PRINT "FOR THE SUPE
    RVISING ADULT:"
200 PRINT :PRINT "PRESS [SHIFT] & [A]
     FOR THE ALPHABET:"
210 PRINT :PRINT "*PRESS LETTER KEYS
    OR [SPACE] TO PLAY."
211 PRINT " >[SHIFT]&[A] RESETS ALPHA
    BET TO 'A'."
220 PRINT :PRINT :PRINT "PRESS [SHIFT
    ] & [1] FOR THE NUMBERS:"
221 PRINT :PRINT "*PRESS NUMBER KEYS
    OR [SPACE] TO PLAY."
222 PRINT " >[SHIFT]&[1] RESETS NUMBE
    RS TO '1'."
250 PRINT :PRINT "{3 SPACES}WAIT FOR 
    ARRAYS TO BE READ"
280 REM STORE LETTER COORDINATES IN A
290 DIM A(26,20):DIM N(10,20)
305 REM SET UP LETTERS
310 FOR L=1 TO 26
320 FOR L1=1 TO 20
330 READ A:A(L,L1)=A
340 NEXT L1
350 NEXT L
370 GOSUB 2270:REM SET UP NUMBERS
375 PRINT :PRINT :PRINT "PRESS [SPACE
    ] TO CONTINUE, '/' TO STOP"
380 GET #1,A
385 A$=CHR$(A):GOSUB 3500
390 REM LETTERS
400 L$="":L=1:GOSUB 2100:GOSUB 2170
410 GET #1,A:A$=CHR$(A):GOSUB 3500
420 IF A$=CHR$(33) THEN GOSUB 2970:GO
    TO 400:REM NUMBERS
430 IF A$=CHR$(65) THEN 400
440 IF A$=" " THEN L=L+1:B=0:IF L>26
    THEN 400
450 IF A$=" " THEN IF L>26 THEN 400
460 IF A$=" " THEN GOSUB 2100:GOSUB 2
    170:GOTO 410
465 IF B<>0 THEN T=L:L=B-64:COLOR 0:Y
    7=3:GOSUB 2120:L=T:COLOR 1
470 A=ASC(A$):T=L:REM REMEMBER L
480 IF A>=65 AND A<=90 THEN L=A-64:B=
    A:Y7=3:GOSUB 2120
490 L=T
500 GOTO 410
510 GRAPHICS 0:END
520 REM LETTERS
```



The computer awaits a match in "Letter And Number Play," Atari version.

```
530 REM ---A---
540 DATA 0,30,10,0,10,0,20,30,5,15
550 DATA 15,15,-1,-1,-1,-1,-1,-1,-1,-1
560 REM ---B---
570 DATA 0,0,0,30,0,1,20,1,20,1
580 DATA 20,29,0,29,20,29,0,15,20,15
590 REM ---C---
600 DATA 17,0,0,0,0,0,0,30,0,30
610 DATA 17,30,-1,-1,-1,-1,-1,-1,-1,-1
620 REM ---D---
630 DATA 0,0,0,30,0,1,17,1,17,1
640 DATA 17,29,17,29,0,29,-1,-1,-1,-1
650 REM ---E---
660 DATA 18,30,0,30,0,30,0,0,0,0
670 DATA 17,0,0,15,12,15,-1,-1,-1,-1
680 REM ---F---
690 DATA 0,30,0,0,0,0,17,0,0,15
700 DATA 12,15,-1,-1,-1,-1,-1,-1,-1,-1
710 REM ---G---
720 DATA 17,0,0,0,0,0,0,30,0,30
730 DATA 17,30,17,30,17,17,17,17,11,1
    7
740 REM ---H---
750 DATA 0,0,0,30,20,0,20,30,0,15
760 DATA 20,15,-1,-1,-1,-1,-1,-1,-1,-1
770 REM ---I---
780 DATA 0,0,20,0,0,30,20,30,10,0
790 DATA 10,30,-1,-1,-1,-1,-1,-1,-1,-1
800 REM ---J---
810 DATA 20,0,20,30,20,30,0,30,0,30
820 DATA 0,23,-1,-1,-1,-1,-1,-1,-1,-1
830 REM ---K---
840 DATA 0,0,0,30,0,15,15,0,0,15
850 DATA 15,30,-1,-1,-1,-1,-1,-1,-1,-
    1
860 REM ---L---
870 DATA 0,0,0,30,0,30,17,30,-1,-1
880 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,-
    1
890 REM ---M---
900 DATA 0,30,0,0,0,0,10,10,10,10
910 DATA 20,0,20,0,20,30,-1,-1,-1,-1
920 REM ---N---
930 DATA 0,30,0,0,0,0,20,30,20,30
940 DATA 20,0,-1,-1,-1,-1,-1,-1,-1,-1
950 REM ---O---
960 DATA 0,0,19,0,19,0,19,30,19,30
970 DATA 0,30,0,30,0,0,-1,-1,-1,-1
980 REM ---P---
990 DATA 0,30,0,0,0,1,16,1,16,1
1000 DATA 16,15,16,15,0,15,-1,-1,-1,-1
1010 REM ---Q---
1020 DATA 0,0,19,0,19,0,19,30,19,30
1030 DATA 0,30,0,30,0,0,15,25,23,35
1040 REM ---R---
1050 DATA 0,30,0,0,0,1,16,1,16,1
1060 DATA 16,15,16,15,0,15,5,15,16,30
1070 REM ---S---
1080 DATA 16,0,0,0,0,0,0,15,0,15
1090 DATA 16,15,16,15,16,30,16,30,0,3
     0
1100 REM ---T---
1110 DATA 0,0,20,0,10,0,10,30,-1,-1
1120 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,
     -1
1130 REM ---U---
1140 DATA 0,0,0,30,0,30,20,30,20,30
1150 DATA 20,0,-1,-1,-1,-1,-1,-1,-1,-
     1
1160 REM ---V---
1170 DATA 0,0,10,30,10,30,20,0,-1,-1
1180 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,
     -1
1190 REM ---W---
1200 DATA 0,0,5,30,5,30,10,0,10,0
1210 DATA 15,30,15,30,20,0,-1,-1,-1,-1
1220 REM ---X---
1230 DATA 0,0,20,30,0,30,20,0,-1,-1
1240 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,
     -1
1250 REM ---Y---
1260 DATA 0,0,10,15,10,15,20,0,10,15
1270 DATA 10,30,-1,-1,-1,-1,-1,-1,-1,
     -1
1280 REM ---Z---
1290 DATA 0,0,20,0,20,0,0,30,0,30
1300 DATA 20,30,-1,-1,-1,-1,-1,-1,-1,
     -1
2090 REM PRINT LETTER
2100 GRAPHICS 0:POKE 752,1:Y7=45
2110 GRAPHICS 6:POKE 752,1:COLOR 1
2120 X7=65
2130 FOR J=1 TO 20 STEP 4
2135 X1=A(L,J):Y1=A(L,J+1):X2=A(L,J+2
     ):Y2=A(L,J+3)
2140 IF X1<0 THEN 2147
2145 PLOT X1+X7,Y1+Y7:DRAWTO X2+X7,Y2
     +Y7
2147 NEXT J
2150 RETURN
2160 REM PRINT ALPHABET
2170 L$(LEN(L$)+1)=CHR$(L+192)
2180 PRINT "{5 SPACES}";L$
2200 IF L=26 THEN GOSUB 2230
2210 RETURN
2220 REM FLASH ALPHABET
2230 FOR I=1 TO 20:POKE 755,0:FOR W=1
      TO 20:NEXT W:POKE 755,2:FOR W=1
      TO 20:NEXT W:NEXT I
2250 RETURN
2270 REM STORE DIGITS IN N
2290 FOR I=0 TO 9
2300 REM SET UP A DIGIT
2310 FOR J=0 TO 19
2320 READ N:N(I,J)=N
2330 NEXT J:NEXT I
2350 RETURN
2360 REM DIGITS
2370 REM ---0---
2380 DATA 0,0,16,0,16,0,16,30,16,30
2390 DATA 0,30,0,30,0,0,-1,-1,-1,-1
2400 REM ---1---
2410 DATA 4,6,10,0,10,0,10,30,0,30
2420 DATA 20,30,-1,-1,-1,-1,-1,-1,-1,
     -1
2430 REM ---2---
2440 DATA 0,7,10,0,10,0,20,7,20,7
2450 DATA 0,30,0,30,20,30,-1,-1,-1,-1
2460 REM ---3---
2470 DATA 0,0,16,0,16,0,16,30,16,30
2480 DATA 0,30,0,15,16,15,-1,-1,-1,-1
2490 REM ---4---
2500 DATA 18,30,18,0,18,0,0,27,0,27
2510 DATA 20,27,-1,-1,-1,-1,-1,-1,-1,
     -1
2520 REM ---5---
2530 DATA 16,0,3,0,3,0,0,15,0,15
2540 DATA 17,15,17,15,17,30,17,30,0,3
     0
2550 REM ---6---
2560 DATA 5,0,0,15,0,15,16,15,16,15
2570 DATA 16,30,16,30,0,30,0,30,0,15
2580 REM ---7---
2590 DATA 0,0,20,0,20,0,0,30,-1,-1
2600 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,
     -1
2610 REM ---8---
2620 DATA 0,0,0,30,0,30,16,30,16,30
2630 DATA 16,0,16,0,0,0,0,15,16,15
2640 REM ---9---
2650 DATA 0,0,16,0,16,0,16,15,16,15
2660 DATA 0,15,0,15,0,0,16,15,10,30
2970 N1=1:GOSUB 3190
2980 GET #1,A:A$=CHR$(A):GOSUB 3500
```

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3) Number of Disk Drives (Check 1)
   - ☐ None
   - ☐ 1
   - ☐ 2 or More

4) Cassette Interface (Check 1)
   - ☐ Yes
   - ☐ No

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   - ☐ Printer
   - ☐ Joysticks or Paddles

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```
2990 IF A$=" " THEN N1=N1+1:C2=0:GOSU
     B 3190:GOTO 2980
2995 IF C2=1 THEN X=N2:COLOR 0:Y7=3:X
     7=70:GOSUB 3155:COLOR 1
3000 T=N1:N1=ASC(A$)-48:N2=N1:C2=1:IF
      N1<0 OR N1>9 THEN N2=1
3010 IF N1>=0 AND N1<10 THEN C5=1:GOS
     UB 3060
3020 N1=T
3030 IF A$=CHR$(33) THEN N1=1:GOSUB 3
     190
3040 IF A$=CHR$(65) THEN RETURN
3050 GOTO 2980
3060 REM LETTER PRINTING
3070 P=1:F$=STR$(N1)
3080 X=VAL(F$(P,P))
3090 IF ASC(A$)-48=N1 THEN Y7=3:GOSUB
      3140:GOTO 3110
3100 GOSUB 3130
3110 P=P+1:IF P<=LEN(F$) THEN 3080
3120 RETURN
3130 Y7=45
3140 X7=70:FOR Q=1 TO LEN(F$):X7=X7-2
     3:NEXT Q
3145 FOR Q=1 TO P:X7=X7+23:NEXT Q
3146 IF P>1 OR C5=1 THEN 3155
3150 GRAPHICS 6:COLOR 1
3155 FOR J=0 TO 19 STEP 4
3160 X1=N(X,J):Y1=N(X,J+1):X2=N(X,J+2
     ):Y2=N(X,J+3)
3170 IF X1<0 THEN 3185
3175 PLOT X1+X7,Y1+Y7:DRAWTO X2+X7,Y2
     +Y7
3180 NEXT J
3185 C5=0:RETURN
3190 POSITION 1,1:GOSUB 3060:RETURN
3500 IF A$="/" THEN 510
3510 RETURN
```

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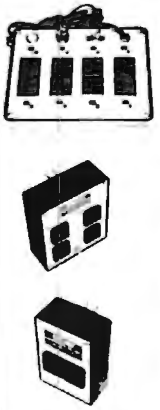

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Glenn M Kleiman

Computerized Drill And Practice

There is a very old joke which starts with the question: How does one get to Carnegie Hall from here? The answer is, of course: practice, practice, practice.

Practice is necessary to become proficient at any skill, whether it is a musical skill such as playing the piano, a physical skill such as riding a bicycle, or the more cognitive skills of reading, writing and arithmetic. In each case, beginners must concentrate their effort and attention on basic components of the skill. Beginning pianists think about the location of each note, beginning bicyclists attend to balancing, steering and pedaling, and beginning readers concentrate on recognizing each word.

After extensive practice, the individual becomes agile and can perform the basics without much effort or attention. Proficient pianists move their fingers almost automatically, and can therefore concentrate on the music, not the physical actions of playing the notes. After practice, bicyclists can balance, steer and pedal without attending to their movements. Proficient readers recognize most words quickly and effortlessly, and therefore can focus their attention on the overall meaning of the text.

Rote Drills And Practice

Despite the obvious need and value of practice, there are controversies about the drill and practice work that occupy so much of students' and teachers' time. One controversy centers on the amount of time and effort which should be devoted to drill work, as opposed to more conceptual, exploratory, or creative endeavors. Another controversy centers on the nature of the practice exercises given to students.

Many educators believe that common approaches to reading, math, and other drills are not effective and, in some cases, may even be detrimental. Often, this debate is over the virtues of dividing skills into many subskills and having students practice each one in isolation, as opposed to practicing the entire skill at once. The most common example is in the teaching of reading, where the contrast is between emphasis on practicing phonics and word recognition subskills versus emphasis on practicing reading real books, magazines, and newspapers.

The introduction of computers into schools has involved these debates about drill and practice. Drill work was the first use of computers in many schools, and it continues to be a prevalent application. There is more software for math and other drills than for any other educational application of computers. However, many educators decry such use of computers. They strongly advocate that the limited number of computers in schools be used to encourage conceptual learning, not rote drills.

I concur, to a large extent, with those who criticize the drill and practice exercises so common in many schools. However, I do not agree that computers should never be used for drill and practice. Practice is, I think, a necessary evil, one which is essential for mastering any skill. Computers, with properly designed software, can make the practicing of certain skills both more effective and more enjoyable.

Many types of practice follow a similar format. Practice items, such as math problems or typing drills, are presented to the students. The students respond to each item, answering questions or performing actions such as typing sequences of letters. At some point, the students receive feedback on their work. In many skills, speed as well as correctness is important, so the feedback covers both. Students are then expected to direct further study and practice to those items with which they had difficulty.

Effective Computer Exercises

Several factors determine the effectiveness of practice drills. First, the selection of the practice items is critical. There is no value to practicing already mastered items, and items that are too difficult will lead to frustration rather than learning. Certain characteristics of feedback are also critical.

Immediate feedback is much more valuable than delayed feedback, since it enables students to catch their errors and learn the correct response while they are still actively involved in the drill. Immediate feedback also helps keep students' attention on their work.

Also important is whether the feedback helps students understand and correct their errors. Feedback that explains why responses are incorrect leads to much more effective learning than feedback which simply tells students whether their answers are correct or incorrect.

Computers can be programmed to present practice items, monitor students' performance, adjust the items to an appropriate level for each individual, and provide immediate and, in many cases, explanatory feedback. For skills in which speed is important, computers can accurately measure the time of every response and control how quickly practice items are presented.

Learning to type provides a good example of the possible benefits of using computers. Everyone agrees that typing is a valuable skill, one that is becoming even more valuable as computers are used more widely. The only way to become a proficient typist is through repetitive practice. Computers can make practice more effective, so less time need be devoted to it. Computers can also free teachers from the drudgery of correcting typing tests.

Several companies market programs to help people learn to type. When these programs are used, the computer presents sequences of letters and words on the screen, and the student types them. The drills follow established methods of teaching typing, so they begin with the "home" keys (ASDFJKL;) and then gradually add other letters. As the student types each sequence, the computer monitors both accuracy and speed. It can make students immediately aware of their errors, so that incorrect habits do not become ingrained.

In addition, the computer can identify keys and sequences on which the student needs to gain more speed. The programs automatically adjust later drills so that practice time is directed to those letters and sequences that are most in need of further work. This continuous dynamic adjustment of the drill items can be accomplished only with computers.

Practice With Games

Computers can also make drills more enjoyable by incorporating them into games. In one such program, called *MasterType* (from Lightning Software, P.O. Box 11725, Palo Alto, CA 94306), typing drills are placed into the context of a space invaders game. The scenario has the player defending his planet against attackers from the planet Lexicon. The attackers are represented by letters or words in each of the four corners of the screen. The attackers fire missiles at the planet. The player must destroy the attackers by quickly and accurately typing each of the words. The excellent arcade-like features have many people so caught up in the game they forget they are actually involved in the drudgery of typing practice. The same approach is used in a series of well-designed programs from Developmental Learning Materials, Inc. (1 DLM Park, Allen, TX 75002) which incorporate math drills into arcade-like games.

Music training is another area in which computerized drills can be beneficial. Several music drill programs are available. The following examples are based on programs developed by the Minnesota Educational Computing Consortium.

One drill helps train students to recognize and produce rhythms. The computer presents a sequence of notes on the screen. The student is asked to tap the rhythm by pressing the space bar on the computer keyboard. The computer immediately checks the answer. When the student makes an error, the computer plays the original rhythm and the one tapped out by the student, thereby aiding understanding. Another part of the drill plays rhythms and has the student specify the length of each note.

Another music drill helps students learn to recognize musical notes and musical notation. In this drill, the student sees written notes on the computer screen and then hears notes played. In each case, one of the notes played does not match the corresponding note in the written sequence. The student's job is to find the incorrect note. If the student makes a mistake, the computer repeats the original sequence and plays the notes as written, so that the student can hear the difference.

These are but a few examples of the potential benefits of computerized drill and practice. These benefits can, of course, also be applied to more academic skills, such as math and spelling drills. A great deal of drill and practice software is available. This software varies in how well it takes advantage of the potential value of computer-assisted practice. Careful evaluation is necessary before selecting any drill and practice program. ©

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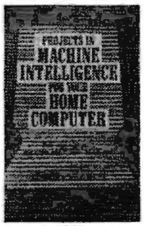

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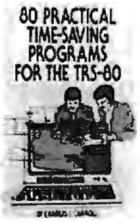

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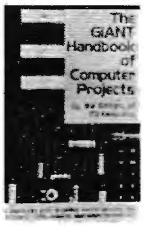

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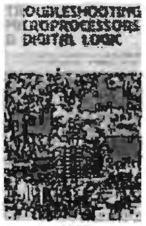

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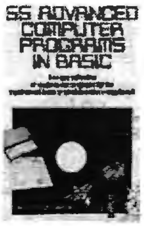

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FIGHTER ACES-
Add A Second VIC Joystick

John Parr

This game, Fighter Aces, is fun in its own right. But it also shows a simple way to add a second joystick to your VIC for two-player games.

I spend many hours behind the CRT on my VIC, attempting one program or another, but when the work is done, I am not ashamed to play a game or two for relaxation. Many of the games that I like, however, require two joysticks.

Other programmers have circumvented this problem through the use of keys, but I find the use of keys awkward. Besides, most games use the same keys over and over, which I am sure must be wearing on my precious investment. The only answer to my dilemma, therefore, was to find some way of connecting a second joystick.

Before I went to work, I decided that I'd better find out a little bit about how the joysticks worked. As it turns out, the VIC joystick is just a lever connected to four micro switches at its base. When the stick is pressed in one direction, the lever closes the appropriate switch, grounding one of the pins on the games port. For diagonals, two switches are closed simultaneously, grounding two pins in the games port. When a pin is grounded, one bit is turned off in either memory location 37137 or in location 37152. (For any who do not know what a "bit" is, I refer you to **COMPUTE!**, November and December 1981, #'s 18 and 19, "An Introduction to Binary Numbers.")

From this understanding, I decided that the best place to hook a second joystick on was through the parallel user port. (As it turns out, PET users have been doing this for years.) After a little checking of my memory map, I decided to connect my second joystick on pins D through J, grounding to pin A. These pins are easily read through memory location 37136.

My next chore was to determine the most logical order in which to make my connections. I finally decided on a system by which any formulas for the first joystick could be used by the second. The following hookup is the result of my research.

Looking at the plug on the joystick, you will see this (minus the numbers, of course):

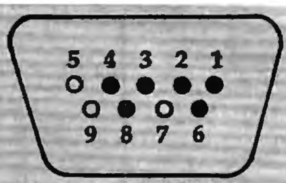


Figure 1: VIC Joystick Plug

The filled-in holes represent pins which are used. You will notice that this is a mirror image to the diagram which is in your VIC book.

The following chart tells what each pin does:

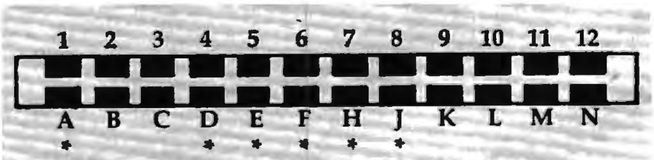
Table.

Pin number	Description	
1	Up	– Joy 0
2	Down	– Joy 1
3	Left	– Joy 2
4	Right	– Joy 3
6	Fire Button	
8	Ground	

Simply connect these pins to a 24-pin edge connector as follows:

Joystick		Edge Connector
1	to	E
2	to	F
3	to	H
4	to	D
6	to	J
8	to	A

The 24-pin edge connector then plugs into the User I/O Port on the back of the VIC, which has the configuration shown in Figure 2.



Pins to which connections are made are marked with an asterisk(*).

Figure 2: VIC User I/O Port

These connections can be made either by replacing the existing joystick plug with the edge

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connector or by using a "patch" cord. A "patch" cord is an extension cord with one type of plug on one end (such as our edge connector and with a different type of plug on the other end (such as a connector like the one which is mounted on the side of your computer for the games port). I personally prefer the "patch" cord method, because then the joysticks can be interchanged if one wears more than the other. Also, if a joystick breaks for some reason, there need be no changes made to the replacement.

From the arrangement I have chosen, all formulas used on one joystick can be used on the other with little modification. Personally, I find the new joystick easier to use because all switches can be read from the same memory location with one simple PEEK. I like it so much, in fact, that it has become my main joystick.

Fighter Aces

Now that I have shown you how to connect this joystick, I will show you how to use it with one of my favorite games, Fighter Aces. In this game, two players engage in a "dog-fight" across your VIC's screen. The game ends at fifteen points; may the best pilot win!

As it is written, this program will run on any memory configuration the VIC can attain.

Before continuing, I must explain the use of the decimal points. The decimal point is a constant for the number zero. The only difference between the use of the decimal point and the use of a zero is that decimal points will speed program execution. If you feel ambitious, try replacing the decimals with zeros to see what I mean.

At last, we have arrived at our program description. The code follows a fairly simple algorithm, so with the explanation, you should be able to understand its workings.

Lines	Description
10-50	Set the program to run with any memory by changing the locations of the screen and color. Also, these lines move the variable storage above the user-defined characters if your computer is expanded by 8K or more; if not, the program sets the end of memory below the special characters, thus protecting them for any memory configuration.
60-150	Set up the variables and the screen before the game begins.
160-170	Get values for each joystick.
180-220	Check for a fire button; see if a shot has already been fired. Each shot is checked here to see if it has gone to the end of its limited range. Note: By eliminating line 180 and the NEXT on line 290, the biplanes will be more responsive, but the shots will be slower. Conversely, if the value of the loop is upped, the shots will move faster, but the planes will be harder to control.
230-280	Move the shots checking for out of bounds, out of range, and a hit.
290-340	Set new direction on each biplane and determine which type of biplane is to be POKEd.
350-400	Move each biplane, checking for out of bounds and crashes.
410-440	Subroutine to determine what a shot hit. (Control tower, another shot, or a biplane.)
450-540	Subroutine for an explosion. Also checks for a mid air collision and updates the score. If either score equals fifteen, the ending flag(s) are set.
550-650	Game over routine.
660-790	Create the biplanes and print the title page.

Important Variables:

S	The first sound channel.
V%	The starting address of the video display.
C	The difference between the screen and color locations.
P%()	Position of each plane on the screen.
SP%()	Position on the screen of each shot.
SD%()	Direction of each shot.
SF%()	Flag to show whether a shot is on the screen and, if it is, how far it has to travel.
D%()	Direction of each plane.
A%()	The attitude of each plane.
SC%()	The score for each player.
E%()	Flag to show if someone has fifteen points.
G%()	The number of games that each player has won.
M%()	Value from each joystick.
L%	Flag for the biplane being out of screen limits.

```
10 IFFRE(0)>7000THENPOKE46,32:GOTO30
20 POKE56,29
30 CLR:S=36874:POKE4+S,5:POKE36879,25
40 V%=4*(PEEK(36866)AND128)+64*(PEEK(3686
   9)AND120):C=37888+4*(PEEK(36866)A
   ND128)-V%
50 GOTO660
60 DIMP%(1),SP%(1),SD%(1),SF%(1),D%(1),A%
   (1),SC%(1),E%(1),G%(1)
70 DEFFNM(X)=((XAND4)=.)*22+((XAND16)=.)-
   ((XAND2)=.)-((XAND8)=.)*22
80 GOTO120
90 P%(.)=V%+463:A%(.)=.:D%(.)=1:RETURN
100 P%(1)=V%+482:A%(1)=4:D%(1)=-1:RETURN
110 PRINT"{HOME}{CYN}{REV}SCORE:":PRINTTAB
    (5)"{REV}{BLK}"SC%(.)TAB(14)"{WHT
    WHT}"SC%(1):RETURN
120 PRINT"{CLEAR}{GRN}{02 DOWN}{REV}******
    ****************":FORX=1TO18:PRIN
    T:NEXT:PRINT"{REV}{CYN} #########
    #";
130 PRINT"{UP}B{UP}{LEFT}B{UP}{LEFT}B{UP}{
    LEFT}B{04 DOWN}{LEFT}##########{HOME}"
140 GOSUB90:GOSUB100:GOSUB110
150 POKES+3,200:POKES,200
160 POKE37154,127:X=PEEK(37152):POKE37154,
    255:M%(1)=2*(X=119)+PEEK(37137)
170 M%(.)=PEEK(37136)-129
180 FORY=1TO2
190 FORX=.TO1:IFM%(X)AND32THENNEXT:GOTO230

200 IFSF%(X)THENNEXT:GOTO230
210 SF%(X)=11:SP%(X)=P%(X)+D%(X):SD%(X)=D%
    (X)
220 IFSP%(X)>V%+483ORSP%(X)<V%+66ORPEEK(SP
```

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```
     %(X))=194THENSF%(X)=.:NEXT:GOTO23
     0
230  FORX=.TO1:IFSF%(X)=.THENNEXT:GOTO290
240  SF%(X)=SF%(X)-1:IFSF%(X)=.THENPOKESP%(
     X),32:NEXT:GOTO290
250  POKESP%(X),32:SP%(X)=SP%(X)+SD%(X)
260  IFSP%(X)<V%+66ORSP%(X)>V%+483THENSF%(X
     )=.:NEXT:GOTO290
270  IFPEEK(SP%(X))<>32THENSF%(X)=.:GOTO410
     :NEXT:GOTO290
280  POKESP%(X)+C,X:POKESP%(X),41:NEXT
290  NEXT:FORX=.TO1:IF(M%(X)AND30)=30THEN35
     0
300  D%=FNM(M%(X)):IFD%=D%(X)THEN350
310  D%(X)=D%:A=(D%/11):IFA>2THENA=A+1
320  IFA<-2THENA=A-1
330  IFA<.THENA=A-4
340  A%(X)=ABS(A)
350  IFP%(X)+D%(X)<V%+66ORP%(X)+D%(X)>V%+48
     3THENC%=X:L%=1:GOSUB450
360  IFPEEK(P%(X)+D%(X))<>32THENC%=X:GOSUB4
     50
370  IFE%(.)ORE%(1)THEN550
380  POKEP%(X),32:P%(X)=P%(X)+D%(X)
390  POKEP%(X)+C,X:POKEP%(X),A%(X)+33
400  NEXT:GOTO160
410  IFPEEK(SP%(X))=194THEN290
420  IFPEEK(SP%(X))=41THENPOKESP%(X),32:SF%
     (.)=.:SF%(1)=.:GOTO290
430  C%=1-X:GOSUB450:IFE%(X)THEN550
440  GOTO290
450  POKEP%(C%),42:POKES+4,15:FORI=1TO70:NE
     XT:POKES+4,5:POKEP%(C%),32
460  H%=PEEK(P%(C%)+D%(C%))
470  IFH%=41THENSF%(1-C%)=.:POKEP%(C%)+D%(C
     %),32:H%=32
480  IFH%<>32ANDH%<>194THENB%=1
490  SC%(1-C%)=SC%(1-C%)+1
500  IFSC%(1-C%)=15THENE%(1-C%)=1
510  ONC%+1GOSUB90,100
520  IFL%THENL%=.:B%=.:GOTO540
530  IFB%THENB%=.:C%=1-C%:GOTO450
540  GOSUB110:RETURN
550  POKES+4,0
560  IFE%(.)ANDE%(1)THENPRINT"{CLEAR}{REV}T
     IE GAME !!":GOTO600
570  W%=-(E%(.)=1)-2*(E%(1)=1)
580  PRINT"{CLEAR}{REV}PLAYER"W%" WINS."
590  G%(W%-1)=G%(W%-1)+1
600  PRINT"{02 DOWN}{CYN}{REV}* CURRENT  ST
     ANDINGS *":FORX=.TO1:PRINT"{DOWN}
     {YEL}{REV}PLAYER"X+1" -"G%(X):NEX
     T
610  PRINT:PRINT"{BLK}{REV}PLAY AGAIN?"
620  GETA$:IFA$=""THEN620
630  IFA$<>"N"THENSC%(.)=.:SC%(1)=.:E%(.)=.
     :E%(1)=.:POKES+4,5:GOTO120
640  PRINT"{CLEAR}{BLU}"
650  POKE36869,240+48*(V%=4096):FORX=.TO4:P
     OKES+X,0:NEXT:POKE36879,27:END
660  PRINT"{CLEAR}{BLU}{DOWN}* * FIGHTER  A
     CES! * *"
670  FORX=1TO5:PRINT:NEXT
680  PRINTTAB(7)"{BLK}ANOTHER":PRINT:PRINTT
     AB(9)"JHP":PRINTTAB(9)"VIC":PRINT

690  PRINTTAB(7)"PROGRAM"
700  FORX=.TO10:READY:FORZ=.TO7:READA:POKEZ
     +Y,A:NEXT:NEXT:
710  DATA7464,0,56,145,187,255,187,145,56,7
     440,4,22,39,88,58,180,72,32
720  DATA7448,60,24,0,90,126,90,0,60,7456,3
     2,104,228,26,92,45,18,4
730  DATA7432,0,28,137,221,255,221,137,28,7
     472,4,18,45,92,26,228,104,32
740  DATA7480,60,0,90,126,90,0,24,60,7488,3
     2,72,180,58,88,39,22,4,7496,0,0,0
     ,24,24,0,0,
750  DATA7504,153,90,60,255,255,60,90,153,7
     424,0,0,0,0,0,0,0,0
760  FORX=1TO6:PRINT:NEXT
770  PRINT"{GRN}PRESS RETURN TO BEGIN{HOME}
     "
780  GETA$:IFA$<>CHR$(13)THEN780
790  PRINT"{CLEAR}":POKE36869,255+48*(V%=40
     96):POKE36879,110:GOTO60
```

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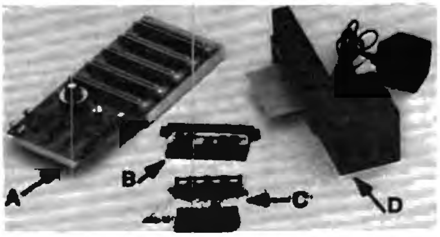

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TI Trapshoot

C. Regena

It's time to try your skill at the TI-99/4A trapshooting range. Each game consists of 50 clay pigeons sprung from the trap near the center of the screen. You aim the shotgun located at the bottom center of the screen by pressing the left or right arrow key. Fire when you are ready by pressing the ENTER key. You'll need to aim and fire quickly – you have only one chance per target.

At the lower right side of the screen is your scoring record. The number of successful hits, the number of clay pigeons, and the number of rounds fired are displayed.

Programming Techniques

Line 120 defines a function RRV for the random row velocity for the clay pigeon moving from 0 to 140 upward. You may change the number 14 in the equation to 15 or 16 to make the target move upward more quickly, but you will have less time to aim the shotgun, shoot, and hit the target.

Line 130 defines a function RCV for the random column velocity of -17 to +17 moving the target toward the left or right. The number 18 in the equation may be changed to decrease or increase the range of the target. Increasing the number will move the target more to the left or right, but the target may "wrap" to the other side of the screen before being deleted.

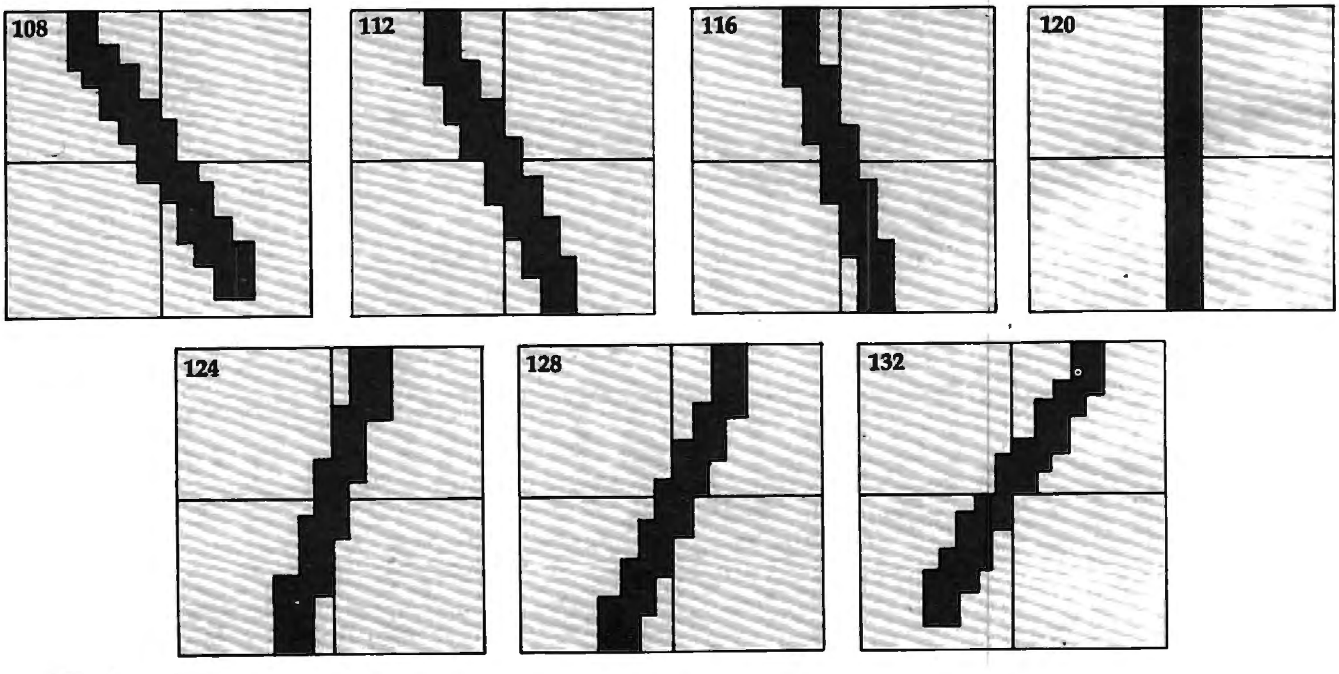
The shotgun is Sprite #3, defined in Line 190. There are seven shotgun positions drawn with characters 108 through 135. CALL MAGNIFY(4) is used so the shotgun may be drawn as large as possible by specifying only one character number for the sprite. If the left arrow key is pressed, the character number N is decreased by 4; if the right arrow key is pressed, N is increased by 4. N may vary from 108 to 132, where 120 is straight up. The shotgun position is changed after a key is pressed by using CALL PATTERN(#3,N).

Line 220 stops the game after 50 clay pigeons. You may change the limits of the game by changing the limit for T, or you may wish to test for the number of shots, SH (perhaps stopping after 50 rounds or 100 rounds instead of after 50 birds).

Line 230 springs the clay pigeon from the trap at the random row and column velocities. The target is Sprite #1.

If you press ENTER to fire, buckshot appears as Sprite #2 at the end of the shotgun and goes upward in the direction the shotgun is aimed. The value of N2 is N-120 and is used in calculating position and column velocity parameters for Sprite #2. The position of the end of the shotgun is dot column 116 plus some function of N2. Experimentation shows that the dot column position is 116+N2*1.2.

Following are the graphic representations of the seven positions of the shotgun:



By using trigonometry, the angle of the shotgun was determined dependent upon the character number. The ratio of the row velocity to the column velocity is equal to the ratio of the horizontal displacement to the vertical length of the shotgun. Whether the shotgun is pointing left or right is determined by SGN(N2). The upward (row) velocity of Sprite #2 was set at 100.

The theoretical factor to calculate column velocity is 12.5, but since the displacement per character number is not precisely linear, 12.7 works better. The resultant column velocity is (N2/4 + 2*SGN(N2))*12.7. I chose the row velocity of 100 so the buckshot moves faster than the clay pigeon, but slowly enough to report coincidence and to prevent wrapping on the screen.

Controlling Sprites

Lines 330-340 check to see if the buckshot hits the target. CALL COINC(ALL,C) is used so coincidence is reported if any dot of the buckshot coincides with any dot of the target. Using a statement such as CALL COINC(#1,#2, TOL,C) between two sprites tests coincidence of the upper left corners of each sprite within a certain tolerance; sometimes a hit would be scored when the buckshot appeared to miss the target.

The faster sprites move, the more difficult it is to control them in a program. Coincidence is reported only if the sprites are touching at the exact moment the CALL COINC statement is executed in the program. Once ENTER is pressed and the buckshot starts on its path, CALL COINC is executed in a FOR/NEXT loop 19 times. At the end of 19 loops without coincidence, the buckshot is near the top of the screen and is deleted.

If coincidence is reported, then the program branches to the appropriate section for a hit. If you change the speed of either the target or the buckshot, you may need to change the limit 19 in the FOR/NEXT loop. If you play many times, you may notice that once in a while the buckshot will pass through the target without recording a hit. This happens when the target is going straight upward slowly and you fire immediately. The sprites pass each other before the program has a chance to get to the CALL COINC statement. To avoid this problem, you could slow the buckshot down; however, I prefer the faster buckshot since the problem rarely occurs. This is an example of "programming trade-offs."

After the buckshot is deleted, the program keeps testing the position of the target until it is at the top of the screen; then Sprite #1, the target, is deleted (line 360). If ENTER is not pressed, then the position of Sprite #1 is tested in the CALL KEY loop.

If the target is hit, then the broken clay pigeon is shown by changing the pattern of the sprite. The buckshot disappears by changing the pattern of the buckshot to a blank character. The statement is CALL PATTERN(#1,100,#2,136). After sounding a hit using Noise -6, both sprites are deleted with CALL DELSPRITE(#1,#2).

99/4 Versus 99/4A

Note: Some of the consoles process at different rates. It makes a difference whether you have the TI-99/4, the earlier TI-99/4A, or the later TI-99/4A. It also makes a difference if you have the old Extended BASIC module or the new Extended BASIC. (You can tell which you have by holding a key down. If it will automatically repeat, you have a newer module.) Since this game is very critical on timing, you will have to experiment a little so that sprites won't wrap and cause bugs. You can adjust the game by changing the limit in line 330.

New XBASIC, TI-99/4A	330 FOR I=1 TO 19	(or 20)
Old XBASIC, TI-99/4A	330 FOR I=1 TO 9	
New XBASIC, TI-99/4	330 FOR I=1 TO 19	
Old XBASIC, TI-99/4	330 FOR I=1 TO 12	

If you prefer to save your typing time and effort, I will send you a copy of this program if you send me $3 plus a stamped, self-addressed mailer, and a blank tape or disk.

C. Regena
P.O. Box 1502
Cedar City, Utah 84720

```
100 REM TRAPSHOOT
110 REM TI EXTENDED BASIC
120 DEF RRV=-INT(RND*10+14)
130 DEF RCV=(-1)^(INT(RND*4+1))*(INT(
    RND*18))
140 GOTO 460
150 RANDOMIZE :: CALL CLEAR :: N=120
    :: H,T,SH=0
160 CALL COLOR(8,3,1):: CALL HCHAR(24
    ,1,92,32)
170 CALL HCHAR(15,14,140):: CALL HCHA
    R(15,15,141,3):: CALL HCHAR(15,18
    ,142)
180 CALL HCHAR(16,14,141,5):: CALL HC
    HAR(17,14,141,5)
190 CALL SPRITE(#3,N,5,160,108)
200 DISPLAY AT(21,19):"HITS:" :: DISP
    LAY AT(22,19):"BIRDS:" :: DISPLAY
    AT(23,19):"ROUNDS:"
210 DISPLAY AT(21,26):USING "###":H :
    : DISPLAY AT(22,26):USING "###":T
    :: DISPLAY AT(23,26):USING "###":SH
220 IF T=50 THEN 410
230 T=T+1 :: CALL SPRITE(#1,96,7,112,
    117,RRV,RCV):: CALL SOUND(150,-5,
    0)
240 CALL KEY(0,KEY,S)
250 IF KEY=13 THEN 310
260 IF KEY<>83 THEN 280 ELSE N=N-4 ::
     IF N<108 THEN N=108
270 CALL PATTERN(#3,N):: GOTO 300
280 IF KEY<>68 THEN 300 ELSE N=N+4 ::
     IF N>132 THEN N=132
290 CALL PATTERN(#3,N)
300 CALL POSITION(#1,R,C):: IF R>10 A
    ND R<112 THEN 240 ELSE CALL DELSP
    RITE(#1)::GOTO 210
```

```
310 CALL SOUND(1000,-4,0):: N2=N-120
320 CALL SPRITE(#2,104,2,154,116+N2*1
    .2,-100,(N2/4+2*SGN(N2))*12.7)
330 FOR I=1 TO 19 :: CALL COINC(ALL,C
    ):: IF C=-1 THEN 370
340 NEXT I
350 CALL DELSPRITE(#2)
360 CALL POSITION(#1,R,C):: IF R>5 AN
    D R<112 THEN 360 ELSE CALL DELSPR
    ITE(#1)::SH=SH+1 :: GOTO 210
370 CALL PATTERN(#1,100,#2,136):: CAL
    L SOUND(1000,-6,0)
380 CALL DELSPRITE(#1,#2)
390 SH=SH+1 :: H=H+1
400 CALL SOUND(1,-6,30):: GOTO 210
410 CALL DELSPRITE(ALL):: CALL HCHAR(
    24,1,32,32):: CALL COLOR(8,2,1)
420 PRINT : :TAB(4);"SCORE =";INT(H*1
    00/T+.5);"PERCENT": :TAB(4);"TRY
    AGAIN? (Y/N)"
430 CALL KEY(0,KEY,S)
440 IF KEY=89 THEN 150
450 IF KEY=78 THEN STOP ELSE 430
460 CALL CLEAR :: CALL MAGNIFY(4)
470 CALL CHAR(96,"3C7EFFFFFFFF7E3C000
    000000000000000000000000000000000
    000000000000")::CALL COLOR(2,7,16)
480 CALL HCHAR(9,6,42,21):: CALL HCHA
    R(13,6,42,21)
490 CALL VCHAR(10,6,42,3):: CALL VCHA
    R(10,26,42,3)
500 DISPLAY AT(11,6)SIZE(17):"T R A P
     S H O O T"
510 CALL CHAR(64,"3C4299A1A199423C")
530 CALL CHAR(104,"1038100000000000000
    000000000000000000000000000000000"
    ):: CALL COLOR(2,16,7)
540 CALL CHAR(108,"18181C0E0607030101
    00000000000000000000000008080C0E
    06070381818"):: CALL COLOR(2,7,16)
550 CALL CHAR(112,"000C0C0E0607030301
    0100000000000000000000000008080C
    0C0E060703030"))::CALL COLOR(2,16,7)
560 CALL CHAR(116,"060606070303030101
    0100000000000000000000000808080C
    0C0C0E0606060")::CALL COLOR(2,7,16)
570 CALL CHAR(120,RPT$("01",16)&RPT$(
    "80",16)):: CALL COLOR(2,16,7)
580 CALL CHAR(124,"000000000000010101
    03030307060606606060E0C0C0C080808
    "):: CALL COLOR(2,7,16)
590 CALL CHAR(128,"000000000000000101
    030307060E0C0C0030307060E0C0C0808
    "):: CALL COLOR(2,16,7)
600 CALL CHAR(132,"000000000000010103
    07060E1C1818001818387060E0C08080"
    ):: CALL COLOR(2,7,16)
610 CALL COLOR(9,11,1):: CALL COLOR(2
    ,16,7)
620 CALL CHAR(140,"0103070F1F3F7FFFFF
    FFFFFFFFFFFFFF80C0E0F0F8FCFEFFF0")
    :: CALL COLOR(2,7,16)
630 CALL CHAR(100,"DCDD590244D29B1900
    00000000000000000000000000000000
    "):: CALL COLOR(2,16,7)
640 CALL COLOR(14,11,1):: CALL COLOR(
    2,7,16)
650 CALL CHAR(136,"0"):: CALL COLOR(2
    ,16,7)
660 CALL CHAR(92,"82A6B7F7FFFFFFFF"):
    : CALL COLOR(2,7,16)
670 CALL COLOR(2,2,1):: CALL CLEAR
680 DISPLAY AT(3,1):"A CLAY PIGEON WI
    LL SPRING{5 SPACES}":"FROM THE TR
    AP."
690 DISPLAY AT(8,1):"USE THE ARROW KE
    YS TO AIM{4 SPACES}":"YOUR RIFLE
    LEFT OR RIGHT."
700 DISPLAY AT(13,1):"PRESS <ENTER> T
    O SHOOT."
710 DISPLAY AT(17,1):"YOU WILL HAVE A
     CHANCE{7 SPACES}":"TO SHOOT 50 C
    LAY BIRDS."
720 DISPLAY AT(24,1):"PRESS ANY KEY T
    O START."
730 CALL KEY(0,KEY,S):: IF S=1 THEN 1
    50 ELSE 730
740 END
```

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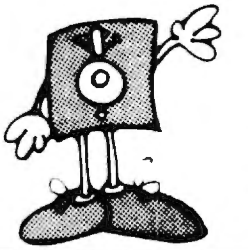

Musical Scales On The VIC

Brian H Lawler

"Scales" is a short, 2K RAM educational program which exploits the sound generating capabilities of the VIC-20 microcomputer. The program allows you to choose one of nine musical scales in the key of your choice. The computer then plays the scale up and down and assigns eight notes of the scale, in ascending order, to keys 1 through 8 on the VIC keyboard. You may then play any note on the scale by pressing one of these keys.

You will soon be able to play simple tunes on the scales "by ear," even if you can't read a note of music. Besides being fun, this exercise will give you some understanding of the scales used in different types of music. You will be able to recognize which scale is commonly used in jazz and which scale has an oriental sound. Get together with three of your computer friends and start a VIC quartet, or be the first composer on your block to write a symphony for cello and VIC.

Program Notes

Line Nos.	
10	Initializes variables S1-S4 as the four VIC "voice" locations and variable VO as volume.
20	Reads data into variable N(x). These are all the notes that the VIC can play. The values are from page 135 of the *User's Guide*.
30-38	These are strings containing the data used in making the scales. A 1 raises the next note 1/2 step, a 2 raises the next note a whole step, etc.
155-160	Get the scale number.
175-240	Input the key and set variable S as the pointer to the first note of the scale.
250-290	Put the notes of the scale into Q(1) to Q(8) by using the data strings in lines 30-38.
300-390	Play the selected scale up and down once.
420-450	Get your note and POKE it into S2.
460	Waits for you to release the key.
470	Turns off the sound and goes back to line 420 to wait for another note.

```
5 DIMN(37)
10 VO=36878:S1=36874:S2=S1+1:S3=S2+1:S4=S
   3+1
20 FORI=1TO37:READN(I):NEXT
30 D$(1)="2212221"
31 D$(2)="2122122"
32 D$(3)="2122131"
33 D$(4)="2322323"
34 D$(5)="2222222"
35 D$(6)="2122212"
36 D$(7)="1222122"
37 D$(8)="2221221"
38 D$(9)="2212212"
100 PRINT"{CLEAR}           SCALES"
110 PRINT"{02 DOWN}"
112 PRINT"THIS PROGRAM ALLOWS   YOU TO SEL
    ECT A MUSI-";
114 PRINT"AL SCALE IN ANY KEY."
115 PRINT"THE COMPUTER THEN AS- SIGNS THE ~
    NOTE VALUES"
116 PRINT"TO KEYS 1 TO 8 ON THE VIC KEYBOA
    RD."
117 PRINT"{03 DOWN}HIT ANY KEY-"
118 GOSUB890
120 PRINT"{CLEAR}{02 DOWN}{REV}1{OFF} MAJOR"
122 PRINT"{DOWN}{REV}2{OFF} MINOR"
124 PRINT"{DOWN}{REV}3{OFF} HARMONIC MINOR"
126 PRINT"{DOWN}{REV}4{OFF} PENTATONIC"
128 PRINT"{DOWN}{REV}5{OFF} WHOLE TONE"
130 PRINT"{DOWN}{REV}6{OFF} DORIAN"
132 PRINT"{DOWN}{REV}7{OFF} PHRYGIAN"
134 PRINT"{DOWN}{REV}8{OFF} LYDIAN"
136 PRINT"{DOWN}{REV}9{OFF} MIXOLYDIAN"
150 PRINT"{02 DOWN}WHICH SCALE?"
155 GOSUB890:IFA$<"1"ORA$>"9"THEN155
160 SC=VAL(A$)
170 PRINT"{CLEAR}WHAT KEY?"
171 PRINT"{DOWN}          {REV}ABCDEFG{OFF}"
172 PRINT"{DOWN}    {REV}#{OFF} SHARP  {
    REV}-{OFF} FLAT"
173 PRINT
175 INPUT KY$
180 K$=LEFT$(KY$,1)
190 IFK$<"A"ORK$>"G"THENGOTO170
200 IFK$="C"THENS=13
202 IFK$="D"THENS=15
204 IFK$="E"THENS=17
206 IFK$="F"THENS=18
208 IFK$="G"THENS=8
210 IFK$="A"THENS=10
212 IFK$="B"THENS=12
220 IFLEN(KY$)=1THEN250
225 K$=RIGHT$(KY$,1)
230 IFK$="#"THENS=S+1:GOTO250
235 IFK$="-"THENS=S-1:GOTO250
240 GOTO170
250 Q(1)=N(S)
260 FORI=2TO8
270 S=S+VAL(MID$(D$(SC),I-1,1))
280 Q(I)=N(S)
290 NEXTI
300 REM-PLAY IT
305 POKEVO,15
310 FORI=1TO8
320 POKES2,Q(I)
330 FORK=1TO100:NEXT
340 NEXTI
350 FORI=7TO1STEP-1
360 POKES2,Q(I)
370 FORK=1TO100:NEXT
380 NEXTI
390 POKES2,0:POKEVO,0
400 PRINT"{CLEAR}YOU MAY NOW PLAY THE  SCA
    LE ON YOUR KEY-    BOARD."
410 PRINT"{02 DOWN}  --HIT {REV}↑{OFF} TO ~
    QUIT--"
420 GOSUB890:IFA$="↑"THENPOKES2,0:POKEVO,0
    :GOTO120
430 IFA$<"1"ORA$>"8"THEN420
440 A=VAL(A$)
450 POKEVO,15:POKES2,Q(A)
460 IFPEEK(203)<>64THEN460
470 POKES2,0:GOTO420
890 A$="":GETA$:IFA$=""THEN890
895 RETURN
900 DATA 135,143,147,151,159,163,167,175,1
    79,183,187,191
910 DATA 195,199,201,203,207,209,212,215,2
    17,219,221,223
920 DATA 225,227,228,229,231,232,233,235,2
    36,237,238,239,240
```

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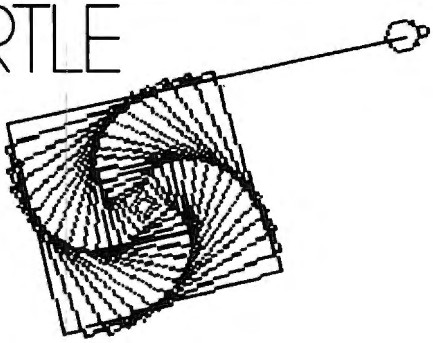
FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

On Logo And Turtles

Last December I attended the California Math Council meeting at the Asilomar conference center. Although the conference was directed primarily towards educators from Northern California, attendees came from all over the country.

One evening I was giving an informal presentation in a hospitality suite. While the computer was running a graphics demonstration, one teacher came up to me and said, "I didn't know that Logo ran on the Atari 800."

"That's not Logo," I replied. "That's Atari PILOT."

"Oh," said the teacher, "I thought these pictures were made with turtle graphics."

"They *were* made with turtle graphics," I said. "Turtle graphics doesn't have any specific relationship to any one computer language."

As we talked some more, it became clear that Logo is becoming more and more identified with the turtle. Worse, the turtle is becoming more and more identified with Logo. While the teacher who approached me seemed startled to find that there were turtles outside of Logo, and that Logo could do far more than turtle graphics, I'm sure that this confusion is commonplace among new computer users.

The real tragedy comes when the association of Logo as simply a turtle graphics language becomes a self-fulfilling prophecy. I am content to believe that many Logo users may not want to use the other features of Logo for the first few months. But any language that has *just* turtle graphics, no matter how sophisticated, user-friendly, or Logo-like it is, is not Logo.

Radio Shack Color Logo

Unfortunately, the superb turtle graphics package developed for the Radio Shack Color Computer (Radio Shack Color Logo) is one example of such a language. Radio Shack Color Logo supports much of what we expect from Logo – extensibility, local variables, recursion, and turtle graphics. However, the only variables that can be used with this language are numbers. There is none of the list processing capability that gives Logo its tremendous power as a symbol manipulation language.

The sad part is that this symbol manipulation capability is often of value in advanced turtle graphics programs! If you doubt this, you can see some striking examples in Abelson and diSessa's *Turtle Geometry*, or in my new Logo book.

Even with these detractions, I find Radio Shack Color Logo to be a tremendous turtle graphics language. It supports multiple turtles (created with the word HATCH). It has a built-in procedure editor that allows the user to format multi-line statements so they look nice. (Most other Logos require that you just keep typing a line until you are done. For a line of a few hundred characters in length, this can look messy.)

Radio Shack Color Logo runs in a 32K system (using the disk-based version I had last year), and a cartridge version (as of this writing) is expected to run in a 16K computer. This makes Radio Shack Color Logo one of the less expensive Logo-like turtle graphics packages on the market.

Realtime Animation

The language provides the user with several modes. When the computer is turned on, it is in the BREAK mode. To gain access to the turtle immediately, you simply press R to enter the RUN mode. From this mode the turtle can draw pictures using single commands such as FD 50, RT 37, etc. Unfortunately, you cannot enter repeated commands in this mode. For example, you cannot enter REPEAT 4 (FD 30 RT 90) to draw a square. You must use this command inside a procedure instead.

A very nice feature of the RUN mode that has great appeal to young turtle users is the DOODLE mode. To enter this mode from the RUN mode, the user just types the character @. The computer then waits for the user to enter a word that becomes a procedure name. Once this has been entered, the user can draw pictures by pressing the number keys on the keyboard. Each key corresponds to a different command, e.g., CLEAR, HOME, PENUP, PENDOWN, RIGHT 45, LEFT 45, FORWARD 1, FORWARD 10, RIGHT 15, and LEFT 15. Once a picture is completed, the user can redraw it by simply entering the procedure name from the RUN mode.

The EDIT mode allows the user to create his or her own extensions to the language. These can be saved on disk or tape (for the disk-based version), or on tape (for the cartridge version).

This language also supports user-defined turtle shapes and multiple turtles. Unlike TI's Logo, the user-defined multiple turtles can each draw lines and actually rotate as their orientation is changed. The high speed of these turtles makes this language useful for some realtime animation applications.

Overall, I am quite impressed by this language. As a turtle graphics environment, it should be of great use to all owners of the Radio Shack Color Computer. My only criticism is that Radio Shack is calling the language Logo, when it is not Logo at all.

The task of educating the public *and* the manufacturers is an important one. After all, you wouldn't think you had purchased a car if it didn't have an engine in it. To call a language Logo, one must be able to perform list processing. It would have been much better if Radio Shack had called the language TurtleTalk, or some other catchy name.

But, until the customers come to understand that Logo is far, far more than just a turtle language, we can't be overly critical when a manufacturer makes the same mistake. ©

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Direct Atari Disk Access

Andrew Lieberman

Here are three programs that make disk access easier, display the contents of any sector on disk, and allow you to save screen displays to disk. Caution: these techniques write directly to disk. Be certain that you fully understand how to use these methods or you risk damaging existing disk files. The program opens the door to many interesting and valuable applications. And it's only 67 bytes long.

Even with a fast-formatted disk, the Atari disk drive is slow for many applications if BASIC commands like INPUT, PRINT, PUT, and GET are used. With the machine language subroutine in this article, you can transfer the contents of a specified area of memory to disk, and vice versa, quickly and easily, eliminating the need for the slower BASIC commands.

Program 1 is the source code for the program. Type in the program on your Assembler/Editor, assemble it, and save it with "SAVE#D:SECRAM.OBJ<601,643". If you do not have the Assembler/Editor, use Program 2. Type in the program, save it, run it, go to DOS, and use option K, binary save, by typing: D:SECRAM.OBJ<601,643". It may be a good idea to lock the file.

To use this subroutine in a BASIC program, just add Program 2 to the BASIC program. Be sure the DATA has been put into memory before the routine is used; otherwise, you will crash the system. To call the routine, simply type: I = USR (1537,RAM,SECTOR,NUMSEC,DCOMD).

"I" can be any variable; RAM is the starting memory location; SECTOR is the first sector to be read from or written to. Each disk has 720 sectors, numbered from 1 to 720. The computer fills these sectors starting with 1 and works up, so you should plan to use sectors from 650 to 720 depending upon how many you need.

These sectors are not protected; if the disk starts getting full, your information may be overwritten. Program 3, which is described later, will be a help in preserving your data. NUMSEC is the number of sectors to be copied. There are 128 bytes to a sector and eight sectors to a kilobyte. DCOMD refers to read or write. An 82 here means read from disk to RAM, and 87 means copy memory to disk.

Let's look at an example of all this. Suppose you wanted to copy a modified character set to disk. Suppose further that your character set is located in memory locations 30720 through 31743 and you wanted it stored starting at sector 700. You would first have to calculate that you need eight sectors for the 1024 bytes of character set. Then simply type I = USR(1537,30720,700,8,87). If you did not understand this example, go back and look at what each number means; it should then be clear.

Saving Data And Graphics Displays

There are many applications for this program. Program 3 will display the contents of any sector on a disk. Another application that you are sure to find useful is saving screen displays to disk for quick recovery from within a program. Suppose you wanted to save your current Graphics 0 screen to disk. Simply type: I = USR(1537,PEEK(88) + PEEK(89)*256,680,8,87). Clear the screen and then type: I = USR(1537,PEEK(88) + PEEK(89)*256,680,8,82).

Voilà! After eight beeps you recover your old screen. If you have a customized display list, you may want to save it also by using: PEEK(560) + PEEK(561)*256 instead of PEEK(88) + PEEK(89)*256.

You should also find that this program works well when saving and loading character sets and player/missile data. The program should be used in any situation in which the contents of any area of memory should be the same every time, like a character set or a graphics display.

Program 3 is a simple program that copies the contents of a disk sector into a string and then prints the string on the screen. RETURNs are printed as "(RET)", and other editing characters are printed as their graphics symbols, i.e., with an ESCape printed first. This is very useful for finding free space on a disk for saving DATA. If, for example, you wanted to check sectors 700 to 710 to make sure they are empty, just RUN the program, start with 700, then use the right arrow to see what is on 701, etc.

A whole string of hearts (CHR$(0)) indicates an empty sector. Anything else means there is DATA on that sector. This program may also be used to modify DOS and other programs that

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cannot normally be modified. Look at sector 43 of any DOS II disk. It should be the top of the menu. If it isn't, find the correct sector. Now, BREAK the program and type "PRINT A$". It will be the same as what appeared on the screen except RETURNs and CLEAR SCREENs will be printed.

Try making some changes in the middle of the string. For example, type: A$(71,87)="A. DISK MENU ". Then save this modified string back to the disk by typing: *I*=USR(1537,ADR(A$), 43,1,87). Now go to DOS, and if all went correctly your change has been made.

Now that you know how to use this program, you probably want to know how it works. Lines 1 through 40 should be fairly obvious. Line 50 clears the keyboard of any key pressed earlier. Line 60 reads the keyboard. A 7 means the right arrow was hit, so the variable SEC is incremented. Line 70 checks for a left arrow in the same way. If no key has been pressed, the program jumps back to line 60 to wait for a key to be pressed. If a key other than left or right arrow was pressed, line 90 accepts the input.

Lines 100 and 110 check to make sure the sector is within the legal limit. Line 130 loads the requested sector into the RAM area of string A$. Instead of just printing the string to the screen, each character is printed one at a time. Before the character is printed, it is checked for being a RETURN (CHR$(155)); if it is a RETURN, "(RET)" is printed instead. Furthermore, an ESCape is printed before each character. If these precautions were not taken, many sectors would clear the screen and do other strange, undesirable things when printed. The extra spaces are printed at the end of the sector to clear away any loose ends left over from the last sector.

Easy Programming

Now for the good stuff: how does this program work in only 67 bytes? The real key to this program is the Operating System subroutine at $E453. Each time it is JSRed to, it takes the information in the lower page three memory locations and processes it, and it does that very quickly. There are many handy subroutines in the Operating System for things like print to the screen, plot, drawto, set up VBLANK, change graphics modes, etc. For more information on how to use the graphics subroutines, get the February 1982 issue of **COMPUTE!** and look at "Insight: Atari," page 77. These subroutines can make life very easy on a programmer.

You should be able to interpret how the assembly language program works by looking at the comments in the source code. The only part that is likely to be unfamiliar to you is the first part. The first number in the USR command is the starting memory location. The other numbers are all placed on the stack as shown in the table. Lines 260 to 390 pull the values off the stack and put them into the memory locations in which they belong.

There is one other memory location that you may find useful: $303 (decimal 771) shows the status after the most recent operation. A 1 means everything is all right. Any other number is an error code. Errors are usually the result of trying to read a bad, or nonexistent, sector.

Top Of Stack

Number of variables passed		**xx**	**We ignore this**
First number passed	**hi byte**	**xx**	**RAM pointer**
First number passed	**lo byte**	**yy**	**RAM pointer**
Second number passed	**hi byte**	**xx**	**Sector pointer**
Second number passed	**lo byte**	**yy**	**Sector pointer**
Third number passed	**hi byte**	**xx**	**Number of sectors – we ignore**
Third number passed	**lo byte**	**yy**	**the hi byte because the program is set up to do a maximum of 255 sectors**
Fourth number passed	**hi byte**	**xx**	**Disk command – since this**
Fourth number passed	**lo byte**	**yy**	**value should only be $52 or $57 we can ignore the hi byte**

Bottom Of Stack

Program 1.

```
0100 ;*********************************
    **
0110 ;**A routine for storing RAM on
    **
0120 ;**a disk or for reading it back
    **
0130 ;**by ANDREW LIEBERMAN  7/10/82
    **
0140 ;*********************************
    **
0150 NUMSEC=$600 ;Number of sectors s
    till to be done
0160 DUNIT=$301 ;Which drive?(1-4)
0170 DCOMD=$302 ;$52=Read, $57=Write
0180 DBUFLO=$304 ;Pointer for Lo byte
     of RAM
0190 DBUFHI=$305 ;Pointer for Hi byte
     of RAM
0200 DAUXLO=$30A ;Pointer for Lo byte
     of sector
0210 DAUXHI=$30B ;Pointer for Hi byte
     of sector
0220  *=$601
0230 ;The USR command places data on
    the stack
0240 ;This part of the program pulls
    the data off and puts it in the
0250 ;proper memory locations
0260  PLA ;We don't care about this
0270  PLA
0280  STA DBUFHI
0290  PLA
0300  STA DBUFLO
0310  PLA
0320  STA DAUXHI
0330  PLA
0340  STA DAUXLO
0350  PLA ;This is assumed to be 0
0360  PLA
```

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```
0370   STA NUMSEC
0380   PLA ;This is assumed to be 0
0390   PLA
0400   STA DCOMD
0410   LDA #$01 ;Assume drive 1
0420   STA DUNIT
0430 LOOP DEC NUMSEC ;One less sector
     to be done
0440   BMI END  ;If minus result, last
     sector was 0, so branch to END
0450   JSR $E453 ;This is the O.S. sub
    routine that does all the work
0460   CLC
0470   INC DAUXLO ;Increment sector po
    inter
0480   BCC SKIP1 ;Check for carry
0490   INC DAUXHI ;There was a carry s
    o hi byte is incremented
0500 SKIP1 LDA DBUFLO ;Since each sec
    tor is $80 bytes long, the
0510   CLC ;RAM pointer, DBUF, must be
     incremented by $80
0520   ADC #$80 ;Add $80 to lo byte
0530   BVC SKIP2 ;If it didn't overflo
    w everything's O.K.
0540   INC DBUFHI ;Lo byte overflowed,
     so increment hi byte
0550 SKIP2 STA DBUFLO ;Don't forget t
    o store the lo byte
0560   CLC ;A jump done this way makes
     the program relocatable in RAM
0570   BCC LOOP
0580 END RTS ;All done
```

Program 2.

```
1 GOSUB 31000
30999 END
31000 RESTORE 31010:FOR I=1537 TO 160
      3:READ J:POKE I,J:NEXT I:RETURN

31010 DATA 104,104,141,5,3,104,141,4,
      3,104,141,11,3,104,141,10,3,104
      ,104,141,0,6,104,104,141,2,3,16
      9,1,141,1,3,206
31020 DATA 0,6,48,29,32,83,228,24,238
      ,10,3,144,3,238,11,3,173,4,3,24
      ,105,128,80,3,238,5,3,141,4,3,2
      4,144,222,96
```

Program 3.

```
1 REM A program to examine disk secto
  rs
5 GOSUB 31000
10 DIM A$(128):A$(128)=" "
20 GRAPHICS 0:? "Type sector number,
   or use right arrowfor next sector,
    left arrow for last  sector."
30 POSITION 2,5:? "{11 M{CLEAR}"
40 POSITION 2,12:? "{4 DEL-LINE
   {CLEAR}WHAT SECTOR?";
50 POKE 764,255
60 I=PEEK(764):IF I=7 THEN SEC=SEC+1:
   GOTO 100
70 IF I=6 THEN SEC=SEC-1:GOTO 100
80 IF I=255 THEN 60
90 TRAP 40:INPUT SEC
100 IF SEC<1 THEN SEC=1
110 IF SEC>720 THEN SEC=720
120 POSITION 2,4:? "SECTOR #";SEC;"
    "
130 I=USR(1537,ADR(A$),SEC,1,82):POSI
    TION 2,6:FOR I=1 TO 128:J=ASC(A$(
    I,I))
140 IF J=155 THEN ? "(RET)";:GOTO 160
150 ? CHR$(27);CHR$(J);
160 NEXT I:? "(28 SPACES}":GOTO 40:REM
     about 30 spaces
30999 END
31000 RESTORE 31010:FOR I=1537 TO 160
      3:READ J:POKE I,J:NEXT I:RETURN

31010 DATA 104,104,141,5,3,104,141,4,
      3,104,141,11,3,104,141,10,3,104
      ,104,141,0,6,104,104,141,2,3,16
      9,1,141,1,3,206
31020 DATA 0,6,48,29,32,83,228,24,238
      ,10,3,144,3,238,11,3,173,4,3,24
      ,105,128,80,3,238,5,3,141,4,3,2
      4,144,222,96
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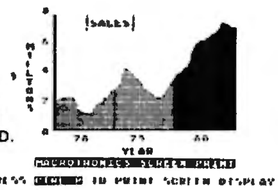

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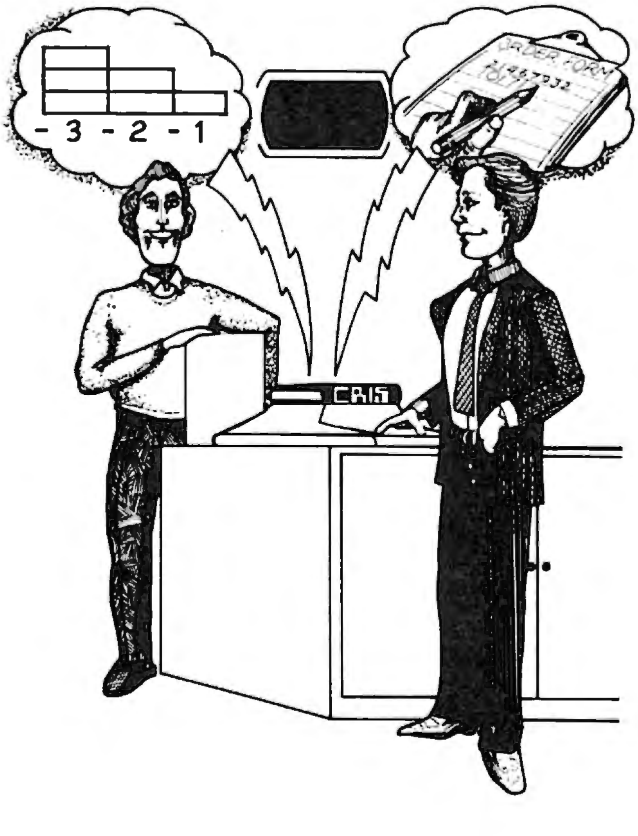

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Automatic Commodore Program Selector

Steven A Smith

Here are several ways to make disks easier to use with the VIC, Commodore 64, or PET/CBM. Are you setting up a business application and want to save users the trouble of working with LOAD and RUN? Are you planning a party and want to avoid spending all your time just showing friends how to run the games? Do you want to save yourself time and trouble in your everyday computing? Try out these various menu programs and see if they wouldn't be useful in many ways.

If you want to be able to choose from among a number of options within a program, one of the best methods available is a menu. The computer displays a list of items with numbers or letters assigned to each, and you press the number or letter corresponding to the option you want. This way, you don't have to worry about which responses are allowed or about how to spell a particular response, and it's much faster.

All this applies to disk drives, as well. Also, someone who is not familiar with the operating system of the computer can call up any of a number of programs without having to know about diskette directories or about LOADing or RUNning programs.

You can choose between two ways of automating program selection from a disk. The first one we'll describe uses specific, pre-defined menus for each diskette or function. The second can be used with any diskettes, determining at runtime which programs are available on the disk.

Pre-defined Menus

A pre-defined menu is written right into the BASIC menu program. Because of this, a new program must be written for each diskette for which you want a menu. However, there are several advantages to using a pre-defined menu. First, it's fast. As soon as you RUN it, the menu program knows what programs should be on the diskette and can go about the business of displaying the menu. Also, you can add program descriptions to the menu screens to show more information about the programs than just their names.

Another, less obvious advantage to pre-defined menus is that you can set up a menu for just a few of the programs on a diskette, have another menu for some others, and have other programs that are not accessed by any menus. This way, you can let someone have access to only the programs that a particular application requires.

Program 1 is a sample of a pre-defined menu for an inventory file maintenance system. Although it is short, it is surprising how impressive it can be in operation, especially to someone who is used to having to load and run individual programs via the traditional directory method.

Lines 120-130 set up an array of program names, one per array element.

Lines 140-230 display the actual menu. The numbers "1" through "8" are displayed in reverse, with a description of the associated programs next to them. The number of items on the menu is not significant – eight just happened to fit well on this menu. Just remember to change your array dimensioning and the error-checking in lines 250-260.

In this menu, the programs are grouped by type of operation to make things clearer for the user. Inventory file operations, transaction file operations, and setup operations are each grouped together and separated from the others by a line. Of course, you can display and group items on your menus any way you wish, remembering to have your item numbers and array elements correspond properly.

Lines 240-260 accept your menu item choice, making sure it is between one and the maximum item number on the menu. On this menu, choice number "8" simply ends the program.

Lines 270-300 are the heart of the menu program. Using the "dynamic keyboard" technique (where the computer *enters its own instructions*) the computer types the LOAD and RUN instructions on the screen, and then forces RETURNs into the keyboard buffer to make it execute them. For Original ROM BASIC, change line 300 to:

```
300 POKE 527,13:POKE 528,13:POKE 525,2
```

To accomplish this "dynamic" effect, you need to POKE a value of 13 into the first two "Keyboard Buffer" bytes, and a value of two into "Number of Characters in Keyboard Buffer." These locations vary on different Commodore machines. For the VIC and the 64, change line 300 to:

```
300 POKE 631,13:POKE 632,13:POKE 198,2:END
```

Line 300 in the printed program works as is on Upgrade and 4.0 BASIC PET/CBMs.

This menu program will expect to find a "Li-

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brary Inventory System" diskette in Drive 1. If you want to use Drive 0, just change the "1:" in line 280 to "0:".

Increasing Menu Items

Nine items can be placed on this menu before it begins to look crowded. There are two ways to improve on this number: the first is simply to use several menus and let each menu chain (call in) the next. You can let one menu item be the next menu program, or add a line:

```
245 IF A$=CHR$(13) THEN C$(1)="MENU2":A$="
     1":GOTO 270
```

This line will call the next menu program (here named MENU2) if RETURN, rather than one of the options shown, is pressed.

While this works quite well, you do have to wait for the new menu to be loaded each time you chain from one to the next. A faster way is shown in Program 2. Several menus can be stored in the same program. By pressing RETURN, you can go from one menu to the next without waiting to load a new menu program. A message is added to the bottom of the screen indicating that you can press RETURN to go on to the next menu. After the last menu is shown, pressing RETURN again will bring you back to the first menu. Of course, going to the next menu could itself be made a menu option, instead of being automatic.

To make menus especially useful to people unfamiliar with computers, you can make the programs called by the menu, themselves call the menu back when they finish. To do this, find where your program ends, whether by an END statement or by reaching the last of the line numbers. Change your END statements to GOTO 62000 and add the following lines:

```
62000 PRINT"{CLEAR}{04 DOWN}"
62010 PRINT"LOAD"CHR$(34)"0:MENU"CHR$(34)",
     8{04 DOWN}"
62020 PRINT"RUN":PRINT"{09 UP}"
62030 POKE 623,13:POKE 624,13:POKE 158,2:END
```

This assumes that your menu program is named "Menu" and is in Drive 0. As before, change line 62030 for your computer exactly as you modified line 300, to perform the "dynamic keyboard" on your model.

Once you load the menu program, you don't need to worry about loading any more programs. Each time you finish one program, the machine will take you back to your menu. This is why menus are especially helpful for inexperienced operators. A menu also works well at parties – you set it up with games which call back the menu, and you don't have to worry about being around to show people how to load and run their choices.

Fully Automatic Menus

Program 3 is a different method of generating menus, a fully automatic diskette menu. When you run this program, you can put any disk in Drives 0 and/or 1, and it will find out what programs are on the disk and build a menu around them. Although you can't add descriptions to the program names, with diskette files you do have 16-character names to work with, and you can make *them* quite descriptive.

This method is slower than using pre-defined menus because, before the program can generate the menus, it must read the diskette directory and fill its own array of program names. However, you don't have to write a new menu program for each diskette or change a menu program when you change the contents of a diskette.

The following is a description of the variables used in Program 3:

AE$: Filename Array
AN : Array Entry Number
A0 : Files From Drive 0
C$: Character Read In
DE : Directory Entry
DR$: Drive Number
ER : Disk Error Number
F$: Filename Found
FL : Filename Length
I : Iteration Variable
J : Iteration Maximum
MM : Maximum # On Menu
MN : Menu Number

Lines 190-210 set up the variables and the program name array used by the program. Line 220 initializes the diskette in the drive currently being checked. Although the 4040 and 8050 diskette drives do not need to be initialized, this sets things up for line 230, which checks to see if a diskette was found in the drive. If not, the program goes over to the other drive.

Lines 240-250 are in the program mostly to let you know something is happening. While the program is reading the diskette directory, it lets you know how many programs it has found on that drive.

In lines 260-390, the diskette directory is opened and read as a sequential file. After skipping over the directory header, each directory block of eight file entries is checked for programs until the last entry is reached.

Line 310 skips entries which have their first byte equal to anything other than 130. That would indicate that the file was not a program file. You could use this line to create menus which displayed only USR or SEQ files if you wished. Line 330 puts the program name into string F$. Line 340 keeps the "Universal Wedge" DOS Support program from showing up on the menus. This line can be deleted if you wish. Line 350 updates

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your screen to tell you how many program entries have been found, and line 360 puts this program name and drive number into the array of filenames found. Lines 370-380 then read past the proper number of bytes to be ready to read in the next file entry.

Lines 410-420 finish up the work with one drive and switch to the other, if necessary. If no programs are found on either drive, the program ends here. Otherwise, the first menu is ready to be displayed.

Entering Your Choices

Line 440 prints the menu heading. The heading will include a menu number starting with "1" and going as high as necessary to show all of the program names found, in groups of nine. Line 450 checks to see if there are enough program names left in the array to display nine menu items. If not, the menu is shortened. Line 460 displays the menu item itself, and lines 470-480 display the messages at the bottom of the screen.

Lines 490-530 check for your choice of menu item. It must be between "1" and the maximum number on the menu, or it can be RETURN, in which case the program will display the next menu. If there are no more items in the program name array, the first menu is redisplayed.

If the key you pressed was one of the menu items shown, the program continues to line 540. Variable AE$ is now the drive number, a colon, and the 16-character name of the program you have chosen. Any blanks in the name are stored in the directory as *shifted* spaces, with an ASCII value of 160.

Lines 560-580 check to see how long the program name is by looking backwards from the end for the first character that is not a shifted space. When one is found, variable FL contains the length of the name plus the drive number. Then, the LOAD and RUN instructions are displayed, and the keyboard buffer is POKEd with RETURNs to load the chosen program, just as in the pre-defined menu programs. Line 600 of Program 3 should be modified as before for the "dynamic keyboard" appropriate to your model.

Using these programs with the 2020 disk drive requires no changes. Using them with the 8050 drive requires only one change in Program 3. Change line 230 to:

```
230 IF DS=21 THEN 400
```

Program 1.

```
100 REM ** LIBRARY INVENTORY SYSTEM DRIVER
     MENU **
110 POKE59468,14:DIMC$(6)
120 C$(0)="SLIB":C$(1)="SLIBPRINT":C$(2)="
    SLIBINQ":C$(3)="STRANPRINT"
130 C$(4)="STRANPURGE":C$(5)="SLIBSETUP":C
    $(6)="FORMAT"
140 PRINT"{CLEAR}{02 DOWN}          {REV} ~
    PROGRAM CHOICE MENU {OFF}{02 DOWN
    DOWN}"
150 PRINT"       {REV}1{OFF} INVENTORY FIL
    E MAINTENANCE{DOWN}"
160 PRINT"       {REV}2{OFF} INVENTORY FIL
    E LISTING{DOWN}"
170 PRINT"       {REV}3{OFF} INVENTORY FIL
    E INQUIRY{02 DOWN}"
180 PRINT"       {REV}4{OFF} TRANSACTION F
    ILE LISTING{DOWN}"
190 PRINT"       {REV}5{OFF} TRANSACTION F
    ILE PURGE{02 DOWN}"
200 PRINT"       {REV}6{OFF} FIRST-TIME FI
    LE SETUP{DOWN}"
210 PRINT"       {REV}7{OFF} FORMAT A DISK
    ETTE{02 DOWN}"
220 PRINT"       {REV}8{OFF} END OF LIBRAR
    Y WORK{DOWN}"
230 PRINT"        {REV} CHOOSE ONE OF THE ~
    ABOVE {OFF}";
240 GETA$:IFA$=""THEN240
250 IFA$<"1"ORA$>"8"THEN240
260 IFA$="8"THENEND
270 PRINT"{CLEAR}{06 DOWN}"
280 PRINT"LOAD"CHR$(34)"1:"C$(VAL(A$)-1)CH
    R$(34)",8"
290 PRINT"{04 DOWN}RUN":PRINT"{09 UP}"
300 POKE623,13:POKE624,13:POKE158,2:END
```

Program 2.

```
100 REM ** INVENTORY SYSTEM DISKETTE DRIVE
    R MENU #1 **
110 POKE59468,14:DIMC$(9)
120 C$(1)="SLIB":C$(2)="SLIBPRINT":C$(3)="
    SLIBINQ":C$(4)="STRANPRINT"
130 C$(5)="STRANPURGE":C$(6)="SLIBSETUP":C
    $(7)="FORMAT":C$(8)="DIRECT"
140 PRINT"{CLEAR}{DOWN}       {REV} LIBRAR
    Y INVENTORY MENU 1 {OFF}{02 DOWN}
    "
150 PRINT"       {REV}1{OFF} LIBRARY FILE ~
    MAINTENANCE{DOWN}"
160 PRINT"       {REV}2{OFF} LIBRARY FILE ~
    LISTING{DOWN}"
170 PRINT"       {REV}3{OFF} LIBRARY FILE ~
    INQUIRY{02 DOWN}"
180 PRINT"       {REV}4{OFF} TRANSACTION F
    ILE LISTING{DOWN}"
190 PRINT"       {REV}5{OFF} TRANSACTION F
    ILE PURGE{02 DOWN}"
200 PRINT"       {REV}6{OFF} SETUP INVENTO
    RY FILES{DOWN}"
210 PRINT"       {REV}7{OFF} FORMAT A DISK
    ETTE{DOWN}"
220 PRINT"       {REV}8{OFF} PRINT A DISKE
    TTE DIRECTORY{02 DOWN}"
230 PRINT"     {REV}    CHOOSE ONE OF THE ~
    ABOVE    {OFF}"
240 PRINT"     {REV} OR PRESS RETURN FOR N
    EXT MENU {OFF}";
250 GETA$:IFA$=""THEN250
260 IFA$=CHR$(13)THEN290
270 IFA$<"1"ORA$>"8"THEN250
280 GOTO450
290 C$(1)="SLIBPRT1":C$(2)="SLIBPRT2":C$(3
    )="SLIBPRT3":C$(4)="SLIBPRT4"
300 C$(5)="SLIBPRT5":C$(6)="SLIBPRT6":C$(7
    )="SLIBPRT7":C$(8)="SLIBPRT8"
310 PRINT"{CLEAR}{DOWN}       {REV} LIBRAR
```

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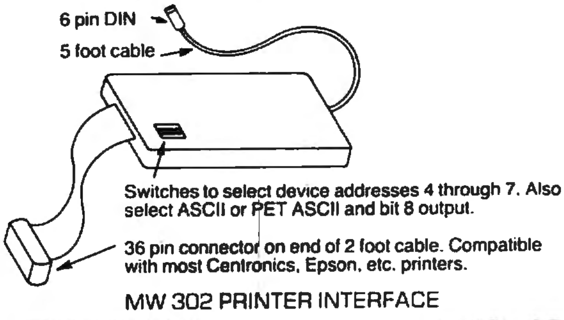
```
    Y INVENTORY MENU 2 {OFF}{02 DOWN}
    "
320 PRINT"          {REV}1{OFF} PRINT SALES R
    EPORT{DOWN}"
330 PRINT"          {REV}2{OFF} PRINT BACKORD
    ER REPORT{DOWN}"
340 PRINT"          {REV}3{OFF} PRINT DELINQU
    ENT ACCOUNTS{DOWN}"
350 PRINT"          {REV}4{OFF} PRINT HISTORI
    CAL REPORT{DOWN}"
360 PRINT"          {REV}5{OFF} PRINT HISTORI
    CAL SUMMARY{DOWN}"
370 PRINT"          {REV}6{OFF} PRINT SALES T
    AX REPORT{DOWN}"
380 PRINT"          {REV}7{OFF} PRINT MONTHLY
     REPORTS{DOWN}"
390 PRINT"          {REV}8{OFF} PRINT YEARLY ~
    REPORTS{DOWN}"
400 PRINT"       {REV}    CHOOSE ONE OF THE ~
    ABOVE    {OFF}"
410 PRINT"       {REV} OR PRESS RETURN FOR N
    EXT MENU {OFF}";
420 GETA$:IFA$=""THEN420
430 IFA$=CHR$(13)THEN120
440 IFA$<"1"ORA$>"9"THEN420
450 PRINT"{CLEAR}{06 DOWN}"
460 PRINT"LOAD"CHR$(34)"0:"C$(VAL(A$))CHR$
    (34)",8"
470 PRINT"{04 DOWN}RUN":PRINT"{09 UP}"
480 POKE623,13:POKE624,13:POKE158,2:END
```

Program 3.

```
190 AE$="":AN=0:A0=0:C$="":DE=0:DR$="0"
200 ER=0:F$="":FL=0:I=0:J=0:MM=0:MN=0
210 POKE59468,14:DIMAE$(300)
220 OPEN15,8,15:PRINT#15,"I"+DR$
230 INPUT#15,ER:IFER=21THEN400
240 PRINT:PRINT"{DOWN}READING DIRECTORY OF
     DRIVE "DR$
250 PRINT"{DOWN}  PROGRAMS FOUND:  0"
260 OPEN8,8,8,"$"+DR$+",SEQ"
270 FORI=1TO254:GET#8,C$:NEXT
280 FORDE=1TO8:F$="":GET#8,C$
290 IFC$=CHR$(13)THEN410
300 IFC$=""THENJ=29:GOTO370
310 IFASC(C$)<>130THENJ=29:GOTO370
320 AN=AN+1:J=11:GET#8,C$:GET#8,C$
330 FORI=1TO16:GET#8,C$:F$=F$+C$:NEXT
340 IFLEFT$(F$,9)="UNIVERSAL"ANDMID$(F$,11
    ,5)="WEDGE"THENAN=AN-1:GOTO370
350 PRINT"{UP}"TAB(18)AN-A0
360 AE$(AN)=DR$+":"+F$
370 FORI=1TOJ:GET#8,C$:NEXT
380 IFDE<>8THENGET#8,C$:GET#8,C$
390 NEXT:GOTO280
400 PRINT"{DOWN}NO DISKETTE FOUND IN DRIVE
     "DR$"{DOWN}":FORI=1TO2000:NEXT
410 CLOSE8:CLOSE15
420 IFDR$="0"THENDR$="1":F$="I1":A0=AN:GOT
    O220
430 IFAN=0THENPRINT"{02 DOWN}{REV} NO PROG
    RAMS FOUND {OFF}{02 DOWN}":END
440 MM=9:PRINT"{CLEAR}{DOWN}          {REV} ~
    PROGRAM CHOICE MENU #"STR$(MN+1)"
     {OFF}{DOWN}"
450 FORI=1TO9:IFAE$(MN*9+I)=""THENMM=I-1:I
    =9:GOTO470
460 PRINTTAB(12)"{REV}"RIGHT$(STR$(I),1)"{
    OFF} "MID$(AE$(MN*9+I),3,16)"{DOWN}"
470 NEXT:PRINT"     {REV}    CHOOSE ONE OF ~
    THE ABOVE OR    {OFF}"
480 PRINT"     {REV} PRESS RETURN TO GO TO ~
    NEXT MENU {OFF}";
490 GETC$:IFC$=""THEN490
500 IFC$<>CHR$(13)THEN530
510 MN=MN+1:IFMN*9+1>ANTHENMN=0
520 GOTO440
530 IFC$<"1"ORVAL(C$)>MMTHEN490
540 AE$=AE$(MN*9+VAL(C$))
550 PRINT:PRINT"{CLEAR}{04 DOWN}MENU ITEM ~
    CHOSEN: #"C$" - "MID$(AE$,3,16)
560 FORI=18TO1STEP-1:FL=I
570 IFASC(MID$(AE$,I,1))<>160THENI=1
580 NEXT:PRINT"{04 DOWN}LOAD"CHR$(34)LEFT$
    (AE$,FL)CHR$(34)",8{04 DOWN}"
590 PRINT"RUN":PRINT"{09 UP}"
600 POKE623,13:POKE624,13:POKE158,2:END
```



Input Into Apple's EXEC

Wally Hubbard

This simulation of the INPUT command, written in Applesoft BASIC, can be used to make EXEC files take input from the Apple keyboard.

Normally, the command INPUT A$ in an EXEC file ignores the keyboard and uses the next line in the EXEC file as its input. As an example, the file

```
INPUT A$
INPUT B$
PRINT A$, B$
```

would set A$ = "INPUT B$".

Program 1 shows a text file, EXPUT, which issues a prompt and then puts the response from the keyboard into XX$. The second line then RUNs the file named by XX$. Program 2 shows an Applesoft BASIC program which can be used to make EXEC files. It could be used to enter Program 1, but because EXPUT is so long, Program 2 contains a subroutine that automatically enters EXPUT whenever you type CTRL-I.

Let me explain how EXPUT works. It uses two FOR/NEXT loops as WHILE-WENDs, which are not explicitly available in Applesoft. The FOR/NEXT loop using B keeps cycling until B = 1. B does not equal 1 until a key has been pressed. The statement B = (X>127) sets B = 1 if the statement in parentheses is true, otherwise B = 0. And X, the value at the keyboard port, is always less than 128 until a key is pressed. The B loop gets each character, and the A loop, which is around it, puts each character into XX$ until RETURN is pressed. The sequence from FLASH to NORMAL puts the flashing cursor on the screen. The segment

```
XX$ = LEFT$(XX$,LEN(XX$)-(X = 13)-2*(X = 8))
```

subtracts one character from the end of XX$ if that last character is a carriage return [CHR$(13)], two characters if it is a backspace [CHR$(8)].

If a one-character response is all that is needed, you can simulate a GET command by eliminating the segments that affect XX$ and the statements that refer to A, including the last NEXT. This will put the character in X$.

EXPUT allows use of the left-arrow (BACKSPACE) key but does not allow use of the right-arrow or ESCape functions. A RUN, LOAD, CLEAR, or NEW command will erase the contents of XX$ and the other variables.

Using Make Exec

"Make Exec" (Program 2) is a simple, general-purpose text-entry program. The familiar Apple editing features (right-arrow, left-arrow, and pure cursor moves via the ESCape key) are available. Tap the space bar twice instead of once to get out of the ESCape functions. To back up to a previous line, type CTRL-B. To go forward one line, without changing the contents of the current line, enter a RETURN as the first character on the line. When you have finished entering all of the text, enter a ! as the first character on a new line; you will be prompted for the name the file is to be saved under. If you want to resume editing, don't enter a file name, just press RETURN. If you want to exit the program, type CTRL-C.

Most of EXPUT is automatically entered on the current line when you type CTRL-I. You must designate the contents of PR$, which is used as the prompt, and if desired, use HOME and VTAB before typing CTRL-I. Keep in mind that EXPUT is long, and lines cannot exceed 255 characters. To eliminate a chance of syntax errors, EXPUT begins with a colon.

Program 1.

```
  THE FILE 'EXPUT' CONSISTS OF TWO
LINES.  THEY ARE BROKEN INTO SEGMENTS
IN THIS LISTING FOR CLARITY.
  THE FIRST LINE GIVES THE PROMPT AND
TAKES THE INPUT.  THE SECOND EXECUTES
A COMMAND USING THE INPUT AS A
PARAMETER.  (IF THE FOR-NEXT
LOOPS ARE NOT ON THE SAME LINE THEY
WILL NOT BE EXECUTED.)

XX$="":
HOME:
VTAB 15:
?"ENTER FILE TO BE RUN: ";:
   FOR A = 0 TO 1:
   FLASH:
   ?" ";CHR$(8);:
   NORMAL:
   POKE-16368,0:
      FOR B = 0 TO 1:
      X=PEEK(-16384):
      B=(X>127):
      NEXT:
   X=X-128:
   X$=CHR$(X):
```

```
    ?X$;:
    XX$=XX$+X$:
    A=(X=13):
    XX$=LEFT$(XX$,LEN(XX$)-(X=13)-2*(X=8)):
     NEXT
PRINT CHR$(4);"RUN ";XX$
```

Program 2.

```
110  VTAB 1: INVERSE : INPUT "CLEAR SCREEN?
     (Y/N) ";A$: NORMAL : IF  LEFT$ (A$,1) =
     "Y" THEN  HOME
120  VTAB 5
130  DIM C$(100)
140  GOTO 320
150  REM   GET EACH LETTER
160  GET A$: PRINT A$;
170  IF A$ =  CHR$ (13) AND  LEN (B$) = 0 THEN
     A = A + 1: CALL  - 958: PRINT : PRINT A
     ;" ";C$(A);: FOR B = 0 TO  LEN (C$(A)):
      PRINT  CHR$ (8);: NEXT : PRINT " ";:
     GOTO 160: REM  GO FORWARD ONE LINE
180  IF A$ =  CHR$ (13) THEN  CALL  - 958:
     GOTO 300: REM  RETURN
190  IF A$ =  CHR$ (8) AND  LEN (B$) < 2 THEN
     B$ = "": GOTO 160: REM BACKSPACE IF LEN
     (B$) <= 1
200  IF A$ =  CHR$ (8) THEN B$ =  LEFT$ (B$,
      LEN (B$) - 1): GOTO 160: REM  BACKSPAC
     E IF LEN(B$)<>1
210  IF A$ =  CHR$ (21) THEN A$ =  CHR$ ( PEEK
     ( PEEK (40) + 256 *  PEEK (41) +  PEEK
     (36))): PRINT A$;: REM  RIGHT-ARROW
220  IF A$ =  CHR$ (27) THEN  CALL  - 721:
     GOTO 160: REM ESCAPE
230  IF A$ =  CHR$ (2) THEN A = A - 1:B$ = C
     $(A): CALL  - 958: PRINT : PRINT A;" ";
     B$;: FOR B = 0 TO  LEN (B$): PRINT  CHR$
     (8);: NEXT : PRINT " ";:B$ = "": GOTO 1
     60: REM   BACK UP  ONE LINE
240  IF A$ =  CHR$ (3) THEN  STOP : GOTO 160
     : REM  CTRL-C
250  IF A$ = "!" THEN 340
260  IF A$ =  CHR$ (9) THEN 500: REM  CTRL-I
270  B$ = B$ + A$
280  GOTO 160
290  REM   STORE A LINE
300 C$(A) = B$
310 B$ = ""
320 A = A + 1: PRINT : PRINT A;" ";
330  GOTO 160
340  REM   SAVE IT ALL
350 D$ =  CHR$ (4)
360  PRINT : PRINT
370  INPUT "WHAT IS THE FILE'S NAME? ";FL$
380  IF FL$ = "" THEN 160: REM   NULL
390  PRINT : PRINT "SAVING ";FL$
400  PRINT D$;"OPEN";FL$
410  PRINT D$;"DELETE";FL$
420  PRINT D$;"OPEN";FL$
430  PRINT D$;"WRITE";FL$
440  FOR B = 1 TO A
450  PRINT C$(B)
460  NEXT
470  PRINT D$;"CLOSE";FL$
480  END
490  REM   CTRL-I CALLS EXPUT
500 A$ = ":XX$=" +  CHR$ (34) +  CHR$ (34) +
     ":?PR$;:FOR A=0 TO 1:FLASH:?CHR$(32);CH
     R$(8);:NORMAL:POKE-16368,0:FOR B=0 TO 1
     :X=PEEK(-16384):"
510 A$ = A$ + "B=(X>127):NEXT:X=X-128:X$=CHR
     $(X):?X$;:XX$=XX$+X$:A=(X=13):XX$=LEFT$
     (XX$,LEN(XX$)-(X=13)-2*(X=8)):NEXT"
520  PRINT A$;
530 B$ = B$ + A$
540  GOTO 160
```

Atari Menu Printer

Dana Noonan

Alphabetize and then automatically print a listing of programs on an Atari disk. It also provides an easy way to quickly update file listings.

Ever wondered just what was on a particular disk? Tried using a disk library program, but gave up because of the time involved in updating your library listing? Do you want a simple way to know what is on all your Atari disks?

For the last six months most of my disks have included some sort of menu program I saw in a computer magazine. These menu programs list all the files on the disk as they appear in the DOS disk directory. Most allow you to call DOS or to run programs by typing a number. While useful, I have never been completely satisfied with any of them.

What annoyed me most was that the programs were listed in a disorganized manner. Since I use word processing and spread-sheet programs extensively, I usually back up each file, using the same title but a different extender. I may have files called CHAPTER2.S12, CHAPTER2.S15, and CHAPTER2.BAC on the same disk. The DOS directory is organized by the order in which disk space is used, and similar file names can be overlooked easily.

Lines 100 to 860 are a simple alphabetized menu program. If your disk contains more than 32 programs, the menu program gives you a choice of viewing either the first or the last 32 programs on a disk. You can call DOS or run any BASIC program which has been previously SAVEd from the menu.

Although I was pleased with the improved appearance of the menu listing, I was still not satisfied with it. What was really needed was a program that would automatically create a printed listing of the programs on a disk (lines 900-1130). I wanted a program that could print either a 4" x 1½" pressure-sensitive label or a slip of paper that I could insert in the disk jacket.

The label could be applied to closed disks – those that were full of programs that I intended to keep indefinitely. I use the simplified Menu (lines 100 to 860) on these disks. For disks that are only partially full or are still being changed, I use a 4⅝" x 5⅛" paper label which slips into the disk jacket.

This is ideal for using with a word processor or spread-sheet. After each session in which you add to, or delete anything from, a disk, simply run the Menu Printer and insert the new listing into the jacket. The list as programmed here is to be printed on an Epson MX-80 printer with Graphtrax, but could be adapted to any printer with a condensed font.

Unless a disk already boots another program automatically, you could use the program in the article, "Automate Your Atari," in the January 1983 **COMPUTE!**.

After formatting a disk, use a pattern disk to duplicate (DOS option J) DOS.SYS, DUP.SYS, MENU and the AUTORUN.SYS.

You could even keep a copy of Menu Printer and DOS.SYS (but not DUP.SYS) on word processor and spread-sheet data disks. Although these programs take about ten percent of the disk space, the ease of generating a hard copy listing of working files is worth it. One possible disadvantage of auto-booting this program: it takes about 18 seconds to bring up the menu, while booting DOS takes only about nine seconds.

The program has significantly improved my ability to find the programs I need quickly and easily. The alphabetized printed list of disk files is particularly useful for finding data files for commercial word processing, data base, and spread-sheet programs.

Menu Printer Listing

Lines	Function
100-150	Dimension the strings. Line 150 names the disk.
200-290	Read the disk directory and set up the string to be sorted.
300-370	The actual string sort.
400-630	Display the program names and enable you to run a program, call DOS, or print a menu.
620-630	Let you switch back and forth between the first and last 32 programs.
700-860	Run the program, if it is a SAVEd BASIC file.
900-1050	Print an alphabetized list of the programs on the disk. Line 920 provides blank fields if they are needed. If you want to add more information, such as a date or your name, to the title line, delete the final ? #4;CHR$(13) from line 980 and add line 985 ? #4;"My Name";: ? #4;CHR$(13). If a pressure-sensitive label is needed, change line

1030 to IF PG<7 THEN GOTO 1020. This works best if the disk contains fewer than 24 programs.

1100-1130 Trap any disk or printer errors. After you check the disk or printer, the program continues.

```
100 REM SET-UP
110 REM SAVE"D:MENU
120 OPEN #2,4,0,"K:":GRAPHICS 0:POKE
    752,1:POKE 559,0
130 DIM A$(900),P$(15),S$(13),B$(15),
    BL$(40),F$(15),L$(13),N$(30),Z$(1
    6):Z$="AND PRESS RETURN"
140 A$(1)=" ":A$(900)=" ":A$(2)=A$:P$
    ="":S$="":B$="":BL$=" ":BL$(40)=B
    L$:BL$(2)=BL$:F$=""
150 N$="JOURNAL AND WORKING FILES"
200 REM READ DIRECTORY
210 TRAP 1130:OPEN #1,6,0,"D:*.*":TRA
    P 40000
220 FOR I=0 TO 14:B$=" ":NEXT I
230 INPUT #1,P$
240 IF P$(5,8)="FREE" THEN GOTO 290
250 P$=P$(3,13)
260 REC=REC+1:CC=LEN(P$)
270 IF CC=0 THEN T=REC:CLOSE #1:GOTO
    300
280 A$(REC*13-12,REC*13-12+CC)=P$:GOT
    O 230
290 F$=P$:CC=0:GOTO 270
300 REM SORT
310 T=INT(T/3)+1:FOR L1=1 TO REC-T:FO
    R L2=L1 TO 1 STEP -T
320 IF A$(L2*13-12,L2*13)<=A$((L2+T)*
    13-12,(L2+T)*13) THEN 360
330 S$=A$(L2*13-12,L2*13):A$(L2*13-12
    ,L2*13)=A$((L2+T)*13-12,(L2+T)*13
    )
340 A$((L2+T)*13-12,(L2+T)*13)=S$
350 NEXT L2
360 NEXT L1
370 IF T>1 THEN 310
400 REM PREVIEW DATA
420 P=1:X=1:TEC=REC-32:IF TEC<=0 THEN
     440
430 IF TEC>0 THEN N=16:REC=32
440 N=INT(REC/2)
450 POKE 559,34:GRAPHICS 0:POKE 752,1
    :POKE 82,2
460 L=LEN(N$):LL=(38-L)/2:POSITION LL
    ,0:? N$
470 POSITION 12,2:? F$;"S  "
480 POSITION 2,4:FOR MX=X TO N:S$=""
490 IF MX<=9 THEN S$=CHR$(32)
500 ? S$;MX;") ";:? A$(MX*13-12,MX*13
    ):NEXT MX
510 POKE 84,4:FOR MX=N+1 TO REC:S$=""
520 POKE 85,20:IF MX<=9 THEN S$=CHR$(
    32)
530 ? S$;MX;") ";:? A$(MX*13-12,MX*13
    ):NEXT MX
540 POSITION 2,21:? "1) RUN
    {7 SPACES}2) DOS{7 SPACES}3) PRIN
    T"
550 IF TEC>0 THEN POSITION 13,22:? "4
    ) NEXT PAGE"
560 POSITION 13,23:? "CHOOSE OPTION";
570 GET #2,R:IF R<49 OR R>52 THEN 560
580 A=VAL(CHR$(R))
590 IF A=1 THEN 700
600 IF A=2 THEN DOS
610 IF A=3 THEN 900
620 IF A=4 AND P=1 THEN ? CHR$(125):R
    EC=REC+TEC:X=33:N=INT(TEC/2)+32:P
    =2:GOTO 460
630 IF A=4 AND P=2 THEN P=1:GOTO 460
700 REM RUN PROGRAM
710 TRAP 710:POSITION 2,21:? "
    {6 SPACES}INPUT PROGRAM YOU WANT
    {6 SPACES}":POSITION 11,22:? Z$;:
    INPUT X:TRAP 40000
720 IF X<>INT(X) THEN 710
730 IF X=0 THEN 710
740 L$=A$(X*13-12,X*13)
750 IF L$(9,9)=" " THEN L$=L$(1,8):GO
    TO 770
760 FOR X=12 TO 10 STEP -1:L$(X,X)=L$
    (X-1,X-1):NEXT X:L$(9,9)="."
770 S$="D:":FOR I=1 TO LEN(L$):IF L$(
    I,I)=" " THEN 790
780 S$(LEN(S$)+1)=L$(I,I)
790 NEXT I
800 POKE 752,1:POSITION 6,22:? "
    {4 SPACES}LOADING ";L$
810 TRAP 820:RUN S$:TRAP 40000
820 POSITION 6,22:? "{3 SPACES}CANNOT
     RUN ";S$:TRAP 40000:FOR WAIT=1 T
    O 900:NEXT WAIT
830 POSITION 2,19:FOR J=20 TO 23
840 ? BL$(1,38);
850 NEXT J
860 POSITION 2,19:GOTO 540
900 REM PRINT
910 GOTO 940
920 REC=REC+1:P$="{11 SPACES}"
930 CC=LEN(P$):A$(REC*13-12,REC*13-12
    +CC)=P$
940 IF REC/4<>INT(REC/4) THEN 920
950 TRAP 1110:OPEN #4,0,8,"P:":TRAP 4
    0000
960 ? #4;CHR$(27);CHR$(68);CHR$(3);CH
    R$(23);CHR$(43);CHR$(63);CHR$(0);
970 ? #4;CHR$(15);"-------------------
    ----------------------------------
    ----------------------------"
980 ? #4;CHR$(13);CHR$(9);N$;CHR$(9);
    F$;"S";:? #4;CHR$(13)
990 PG=1
1000 N=INT(REC/4):FOR Q=1 TO N:FOR MX
     =Q TO REC STEP N
1010 ? #4;CHR$(9);A$(MX*13-12,MX*13);
     :NEXT MX:? #4;CHR$(9):PG=PG+1:NE
     XT Q
1020 ? #4:PG=PG+1
1030 IF PG<=27 THEN GOTO 1020
1040 ? #4;"----------------------------
     ---------------------------------
     --------------------"
1050 CLOSE #4:GOTO 540
1100 REM ERROR TRAPS
1110 CLOSE #4:? "{CLEAR}":POKE 82,11:
     POKE 752,1:POSITION 13,10:? "CHE
     CK PRINTER":? "{2 DOWN}";Z$:GET
     #2,R
1120 POKE 82,2:GOTO 400
1130 ? CHR$(125):POKE 82,11:POKE 752,
     1:POSITION 14,10:? "CHECK DISK":
     ? "{2 DOWN}";Z$:GET #2,R:GOTO 20
     0
```

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Part I:

COLOR COMPUTER GENERAL PURPOSE DATA BASE

Jeffrey S Yohay

For TRS-80 Color Computer, this tutorial can serve as a model for creating a data base manager. Among the most useful of computer applications, data bases can manipulate and process lists, catalogs, and thousands of other kinds of information. This article concludes next month with a discussion of screen displays, program structure, and the data base program itself.

As a personal information manager, the TRS-80 Color Computer is often overlooked in favor of its more expensive counterparts. This may be because of the machine's somewhat cramped screen format or its calculator-like keyboard.

Whatever the reason, it is a serious mistake to relegate the Color Computer to a back seat in information handling. This is because the Color Computer offers as standard equipment a fast and reliable cassette tape storage system with many disk-like features for data storage. This allows even the lowest priced Color Computer to store and retrieve personal data quickly and efficiently – an important consideration in a machine that is likely to be purchased by computer novices who won't be starting right away with a disk drive.

Using the TRS-80 Color Computer's powerful cassette system, this program is a model for a personal information management system. It is called the "Videotape Movie Data Base Program" (VMDP), because it was designed to catalog and manage a collection of movies on videotape. While the VMDP is designed around the Color Computer's powerful cassette storage format, it also makes good use of the limited 16 line x 32 character text screen to display a great deal of information about the cataloged movies. The program is written in Extended Color BASIC and requires at least 16K of RAM.

As more and more video enthusiasts are discovering, the TRS-80 Color Computer is a good microcomputer to include as part of a home video system. It is easily connected to any television or videorecorder, and it combines all the features of a ROM-based video game system and a powerful microcomputer system. The high-resolution color graphics can be used to produce spectacular video displays for games and simulations. Those same graphics, combined with the Color Computer's innovative cassette-to-television audio channel, can be used for numerous educational applications. And the CPU itself, the Motorola 6809, is a powerful one that can support many applications.

How The VMDP Can Help

Let's take a look at a typical video enthusiast's collection of movies on videotape. Chances are that the joy of possessing a recording of some rare old movie will quickly fade the first time the intrepid video buff goes to find the recording and can't! Scribbled labels, out-of-order index cards, and frazzled nerves are typical of a videotape cataloging system. Yet those video hobbyists who are organized enough to develop an accurate and useful catalog of their videotapes can find themselves spending as much time on the record-keeping as on the collecting.

The VMDP offers a cure to these ills. For each movie in your collection, the VMDP will allow you to store:

1. The title.
2. The year of release.
3. The type of movie (comedy, mystery, etc.).
4. The name of the director.
5. The names of up to three actors/actresses.
6. The videotape you recorded it on.
7. The location on videotape by VCR counter number.
8. The recording speed.
9. The approximate viewing time.
10. The time remaining on the videotape.
11. The date you recorded it.
12. The channel you recorded it from.
13. Whether the movie is in color or black-and-white.
14. Whether you recorded it with or without commercials.

Once you've cataloged your movies, the VMDP will let you:

1. Display all data for any movie or movies.
2. Display all movies by title and type.
3. Search for and display data for a particular movie.
4. Print all movie data or only title and type.
5. Enter data for a new movie.
6. Delete data for an existing movie.
7. Sort the movie data by title, type, or videotape number.

Using the VMDP, your Color Computer can organize even the most haphazard collection of videotape movies and let you choose the movie you're in the mood to see, when you're in the mood to see it. Feel a little low? Just have the VMDP sort your movie collection by type, and pick out a good comedy. Or let the VMDP search through your collection for that particular movie you haven't seen in months. Finding entertainment to suit your mood couldn't be easier.

Data Storage Concepts

The most important consideration in the design of the VMDP was the Color Computer's cassette tape storage system. Before I tell you how I decided on the VMDP's tape data storage format, let's take a look at how this cassette system works.

For those of you who are new to data storage concepts, let me first define a few terms. Data is stored on a magnetic device (cassette tape or floppy disk) in groups of related information called "files." Files themselves are collections of related data items called "records," which are usually the smallest units of data read or written to a cassette tape or disk at one time. Within each record, the data is further organized into "fields." This is done so that once you read the record from the tape or disk into the computer, you'll know where to find any particular subset of data that you're looking for.

If all you want from the record is the title of the movie being described, knowing the location of the field containing the title makes it easy to find. Remember, too, that though the computer handles the storage of records and files, the storage of the data within the records is completely up to you. So it's a good idea to do what the computer does, and organize your data fields so you'll always know how to get your data back quickly and easily.

Files can be stored by the computer in two different ways: sequential-access or random-access files. For tape storage, however, we can use only sequential-access files. These have to be read or saved one record after another; thus, you can reach a record in the middle of a file only by reading in all the records that come before it. Random-access files have records that can be read or saved no matter where they are in the file, but that can only be done if you have a disk.

The biggest advantage of random-access is that you don't have to read an entire file into memory before you start extracting the information you want from it. Just read in the records that you want and get the data out of the fields in those records. Of course, you could do that with sequential-access files, but you'd have to go through the entire file every time you wanted a particular group of records. For cassette files, that would be too slow to be practical.

The Color Computer Cassette

The Color Computer's cassette tape system has many improvements over those of earlier TRS-80 models. The most important of these improvements is the speed at which programs and data are saved on tape: 1500 baud (bits per second), or about 11,000 characters per minute. There are also many disk-like features; one of these is the use of a file structure for all data stored on cassette. Instead of simply PRINTing data to cassette directly from a variable as in the Model I/III, the Color Computer opens a file on tape, stores the data, then closes the file when you're done. This is the same way sequential-access data files are stored on disk.

Central to this data file storage method is the use of "buffers." A file buffer is an area of RAM memory reserved for data that is to be read from, or written to, cassette. When you want to read or write cassette data, you use the Color Computer's OPEN command to initialize a file buffer in memory. This buffer is used to hold cassette data during cassette I/O operations.

When you have data to save on tape, the buffer is filled before the data is written to tape, keeping data transfer time to a minimum since the tape doesn't have to be moved for every variable value that your program tells the computer to save. This also enables data to be stored on tape very efficiently, since the computer "saves it up" until it can write one buffer's worth of data to tape. Similar use is made of the file buffer when loading data (i.e., assigning tape data to a variable) to minimize tape movement and data transfer time.

Using the OPEN command when saving data also causes BASIC to write a block of data onto tape called the "NAMEFILE" block. (These block names and descriptions are all from the Radio Shack *TRS-80 Color Computer Technical Reference Manual.*) The NAMEFILE block consists of 15 bytes of BASIC-generated data that describe your data file in several ways, including the name of the file and how it is recorded.

OPENing a data file to load data tells BASIC to read this NAMEFILE block to see if this is the data file you wanted; if not, the cassette will be searched until the file you wanted is found. This lets you store several independent data files (perhaps collections of movies by certain directors or with certain actors/actresses) on the same tape.

Similarly, use of the CLOSE command tells BASIC to delete the file buffer and write an "END-OF-FILE" block to tape. When reading in the data file, BASIC can then use the END-OF-FILE block to tell when it has reached the end of your data file. The EOF(-1) function will be "true" (equal to -1) if the END-OF-FILE block has been reached; use it when loading a data file to check whether all of the data you wanted has been read in from tape.

In between the NAMEFILE and END-OF-FILE blocks are your actual data. These are stored in "DATA" blocks that both describe the data and contain up to 255 bytes of the data itself.

Building Your Data Base

Using my knowledge of the Color Computer cassette system, I decided to store the data for each movie in 127-byte records. This would allow my movie data to make the best use of the 255-byte tape data blocks, and would make it simple for BASIC to read and write data to and from the tape buffer and the tape itself. And, since Color Disk BASIC stores data on disk in multiples of 256 bytes, I would get the added benefit of movie data that could be easily adapted to a random-access disk system in the future.

Once I had chosen the 127-byte length for the movie records, I decided that this would be the record size no matter how few bytes were actually required to describe a particular movie. This "fixed length" record format has a big advantage over "variable length" records (where each record is only as long as required to describe each movie adequately).

Though it takes more tape to store a file with records that may be filled with a lot of blanks, a fixed record length insures that the locations of all movie data within a record (the fields) are the same in every record. This makes it easy to get the data for displaying, printing, and sorting. And no matter what the future brings (e.g., a disk drive!), my videotape data would be consistent and easily accessed by any program on cassette or disk.

I then had to decide how to place the movie data within the record. From experience with a pencil-and-paper system, I knew what information I wanted to have for each movie, and I could see that I would need 17 individual fields within each record to store this information. So, after deciding on the size of each field and its location within the record, I came up with the record format illustrated in Table 1 next month.

I chose the size of each field so that each was just large enough for the data it was to contain, but not so large that it would be filled with blanks most of the time (because of the fixed record length). This was particularly important for the director and actor/actress fields, where the names could vary widely in length. Since my favorite director's name (Alfred Hitchcock) is 16 characters long, I thought that would be a good length to start with. As it turned out, that length was ideal, and left more than enough bytes for the rest of the data, with two bytes left over for future use (they're filled with a slash "/ " for now). Note that some fields had to be only long enough for a one-byte or two-byte code that the VMDP can recognize and expand into usable information.

There was a method to my madness in the ordering of the fields within the record, too. If you BREAK the program after loading data and then PRINT some values from the movie record array R$, each 127-byte record will fit neatly on four of the Color Computer's 32-character screen lines. The title and year will be on the first line, the director and actors/actresses will be on the second and third lines, and the remaining information will be on the fourth line, separated for easier readability by the slashes I placed in the "future use" fields. This bit of clever record formatting makes it easy to check the contents of any movie record in the R$ array.

However, my real purpose in organizing the records to fit neatly onto the Color Computer screen was to make it easier to enter data into the R$ array directly. This can be a real boon to those who already have large videotape movie collections who want a fast way to enter numerous movie records into the VMDP without repeatedly running the "add record" routine.

For example, if N is the number of movie records, then just set R$(N + 1) equal to the four lines of movie data to enter a new record into the movie array directly (a good screen editor, such as Datasoft's *S.E.C.S.*, makes this a lot easier). Do this in "command mode" (i.e., without a line number), and then restart the program with "GOTO 50" to avoid the CLEAR statement in line 40. (Note that because a RUN statement contains its own CLEAR, you must use a GOTO when you want to restart the program with your data intact.) ©

Apple Subroutine Capture

R W W Taylor and Max Hailperin

Do you include certain favorite BASIC subroutines in program after program? The easiest way to incorporate a standard subroutine into a new program is to EXEC the code from an existing text file, as explained on page 76 of the *Apple II DOS Manual*. A short program is given on that page for "capturing" specified lines from a program already in memory and writing the lines as text to a sequential file for later retrieval by an EXEC command.

The main inconvenience of this particular approach is that the capture subroutine must be typed in new each time it is to be used, with details specific to the situation at hand.

This nuisance can be avoided. In fact, it is possible to create and store a master file Capture so that a user who simply types EXEC CAPTURE will be interrogated about the desired file name and line-number range, and the desired capture will then be performed without any further action by the user.

The text of Capture appears in Program 1. This text can be entered into a file by a program such as File Builder (Program 2). Note the subroutine at line 8000. The purpose of this subroutine is to allow input of arbitrary text strings, including commas, colons, and hyphens. It is a good example of the sort of subroutine that is handy to capture and maintain for re-use in other programs.

Saving To Memory

Once Capture has been stored on disk, and a program containing lines to be captured has been loaded or created, the command EXEC CAPTURE is issued. The first effect is to overlay lines 1-18 of the program in memory – lines in this range cannot be captured. These lines are then run by the RUN at the end of Capture. The user is asked to specify a name for the file to be created and two line numbers indicating the range of code to be captured. The line numbers must be entered separated by a *comma*.

The program then proceeds to build a file called Tempcapture, incorporating the information supplied by the user. Before ending, the program issues a command to EXEC TEMPCAPTURE. Once again, lines in the range 1-18 are overlaid, and the new lines are run. This time, the desired capture is performed, Tempcapture is deleted, and the completion of the task is announced.

Note that if the user's disk already happens to contain a text file named Tempcapture, this file will be overwritten and then deleted. An already existing text file will also be overwritten if its name is specified as the file to be created. However, if the name specified represents an existing binary, Applesoft, or integer file, a "FILE TYPE MISMATCH" message will be generated, and the process will halt without any damage to the file.

Program 1: Text For Capture File

```
1  REM  - CAPTURE SUBROUTINE
2 CD$ =  CHR$ (4): REM   CONTROL D
3 Q$ =  CHR$ (162): REM   QUOTE CHARACTER
4  HOME : INPUT "FILE NAME TO BE CREATED? ";F$
5  VTAB 4: INPUT "LINES TO BE CAPTURED? ";LO
    %,L1%
6  PRINT CD$;"OPEN TEMPCAPTURE"
7  PRINT CD$;"WRITE TEMPCAPTURE"
8  PRINT "4 PRINT CD$;";Q$;"OPEN ";F$ + Q$
9  PRINT "5 PRINT CD$;";Q$;"WRITE ";F$ + Q$
10  PRINT "6 LIST ";LO%;"-";L1%
11  PRINT "7 PRINT CD$;";Q$;"CLOSE ";F$ + Q$
12  PRINT "8 PRINT CD$;";Q$;"DELETE TEMPCAPT
     URE";Q$
13  PRINT "9 HOME: PRINT ";Q$;"FILE ";F$;" H
     AS BEEN CREATED.";Q$
14  PRINT "10 END"
15  PRINT "RUN"
16  PRINT CD$;"CLOSE TEMPCAPTURE"
17  PRINT CD$;"EXEC TEMP CAPTURE"
18  END
```

Program 2: EXEC File Builder

```
10  REM  ** FILE BUILDER **
20 CD$ =  CHR$ (4): REM  CONTROL D
30  HOME : PRINT "ENTER NAME OF FILE TO BE B
     UILT:"
40  PRINT : HTAB 10: INPUT F$: HTAB 10: VTAB
      PEEK (37): PRINT " "
50  PRINT : PRINT "INPUT LINES ONE BY ONE."
60  PRINT "TO END, JUST PRESS RETURN."
70  VTAB 9: POKE 34,8: REM   SET TOP OF TEXT
      WINDOW
80  PRINT CD$;"OPEN ";F$: PRINT CD$;"DELETE
     ";F$: PRINT CD$;"OPEN ";F$
90  FOR I = 0 TO 1
100  PRINT "* ";: GOSUB 8000
110  IF 0 <  LEN (IN$) THEN I = 0: PRINT CD$
     ;"WRITE ";F$: PRINT IN$: PRINT CD$
120  NEXT I
130  PRINT CD$;"CLOSE";F$
140  HOME : POKE 34,0: REM   RESET TEXT WINDOW
150  PRINT "* FILE ";F$;" HAS BEEN BUILT."
160  END
8000  CALL 54572: REM  INPUT SUBROUTINE
8010  FOR B = 512 TO 751
8020  IF  PEEK (B) <  > 0 THEN  NEXT
8030 IN$ = ""
8040  POKE  PEEK (131) + 256 *  PEEK (132) +
     1,0
8050  POKE  PEEK (131) + 256 *  PEEK (132) +
     2,2
8060  POKE  PEEK (131) + 256 *  PEEK (132),B
      - 512
8070 IN$ =  MID$ (IN$,1)
8080  RETURN
```

Part II

Commodore 64 Video – A Guided Tour

Jim Butterfield, Associate Editor

We now continue our guided tour of the video capabilities of the Commodore 64 computer. Along the way we'll stop for lots of experiments, things for you to type in and watch the effects of manipulating this remarkably versatile computer.

The story so far: we're touring the 6566 chip, which gives the Commodore 64 its video. We noted last month that the chip goes to memory for its video information, but can only reach 16K; the computer controls which 16K bank via control lines in 56576 (hex DD00). Then we picked out the functions of the video control word at 53265 (hex D011).

We've seen the variety of important controls that we can reach in location 53625: vertical screen positioning, screen blank, bit mapping, and extended color. There's a second control location, at 53270 (hexadecimal D016); let's look at it.

The first thing we should note about this location is that the two high bits are not used. That means that we can usefully POKE only values from 0 to 63 in there. It happens that if we PEEK 53270, we'll probably see a number that is 192 too big; if you want to see the working value, use PEEK(53270) AND 63, which will throw away the unused part of the number.

We saw a vertical fine scroll in location 53265. Location 53270 has a horizontal fine scroll that works exactly the same way. Type:

```
FOR J=8 TO 15:POKE 53270,J:NEXT J
```

You'll see the screen characters slide over horizontally. As with the vertical fine scroll, we also have facilities for trimming the size of the screen. Restore the screen to its original form with POKE 53270,8. Then shrink the screen by typing POKE 53270,0. You'll see a character disappear from each end. In other words, you now have a 38-character screen instead of 40 characters. Don't forget that fine scroll and shrink can be used effectively together.

If you add 16 to the contents of 53270, you'll switch to multicolor mode. This is not the same as extended color which we discussed previously. Multicolor allows *selected* characters to be shown on the screen in a combination of colors. Extended color, you may remember, allows screen background and foreground to be set individually for each character.

If you're familiar with the VIC-20, you'll find that setting the multicolor mode makes the Commodore 64 behave in the same way. Here's the trick: we invoke multicolor on an individual character by giving that character a color value greater than 7. This way, the regular colors (red, blue, black) behave normally, but the new pastels (grey, puce) switch to multicolor mode.

You'll need to create a new character base to exploit the advantages of multicolor, since the old characters weren't drawn with color in mind. However, we can get a quick idea of the feature by invoking it: POKE 53270,24 sets up multicolor; the screen characters may turn a little muddy, but don't worry about them. Set a primary color such as cyan and type a line. Normal, right?

Next, set up one of the alternate colors (hold down the "Commodore" key and press a key from 1 to 8). Type some more; you'll get multicolor characters. They won't make much sense, since the character generator isn't building the colors suitably; but you can see that something new is going on.

Adding 32 to the contents of 53270 gives chip reset. You won't want to do this very often – it's done on your behalf when you turn the power on. If you do use chip reset, remember that to make it work, you must turn reset on and then off again. POKE 53270,32:POKE 53270,8 will clear you out of multicolor mode.

Setting Screen And Characters

Location 53272 sets the location of screen RAM (the video matrix) and the character generator (the character base). Don't forget that they must be in the same 16K block, as determined by the

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low bits of address 56576.

You can get the BASIC address of screen RAM in this way: take the contents of 53272 and divide by 16; then throw away the remainder and multiply by 1024, and you have the screen address. You can get the BASIC address of the character base in this way: take the contents of 53272 and divide by 16. Then take the remainder, subtracting one if it's odd, and multiply by 1024; that's the character base address. Both addresses will need to be adjusted to allow for the 16K quadrant we have selected.

Now: if we are in bit map mode, we get the character base address in a slightly different way: divide the contents of 53272 by 16; take the remainder and divide by 8, discarding the remainder; finally, multiply by 8192. That's the bit image; it should be either 0 or 8192.

How does this work out in the standard Commodore 64? We may PEEK 53272 and see a value of 21. That means the screen is at INT(21/16)* 1024, or address 1024. Right on target. The character matrix works out: the remainder of 21/16 is 5, so drop one for the odd number, giving 4; multiply by 1024 to get address 4096. You may remember that our discussion last month indicated that RAM was replaced by the character generator ROM at this video chip address. And when we flipped to bit mapping in the last episode, we still got remainder 5; divide by 8 giving 0, then multiply by 8192 – you still get 01 high resolution screen from address 0.

If you'd like to try your hand at the arithmetic, flip to upper-/lowercase mode (hold down SHIFT and press the Commodore key) and see what addresses have changed. Or if you'd rather, try typing in FOR J=1 TO 100:POKE 53272,21:POKE 53272,23:NEXT J and watch the action.

The Raster Register

Location 53266 (hex D012) and the high bit of the previous location are not of much use to the BASIC programmer, but can be very valuable to the machine language tyro. Here's the idea: by looking at these locations, you can tell exactly where the screen is being scanned at that moment. This allows you to change the screen as it's being scanned: halfway down, you could switch from characters to bit map, or change to multicolor, or move a sprite that has already been displayed.

If you're really interested in machine language, you may want to take an extra step: instead of watching where the screen is, you can leave the message "Wake me when you get to scan line 100." ML tyros will recognize this as an interrupt request. How do you set the identity of the desired scan line? By placing it into the same locations, that's how. We have a dual function here: when we read, we recall the scan location; when we write, we store an interrupt value.

Light Pen

Locations 53267 and 53268 (hex D013 and D014) are the light pen registers. An Atari-style light pen can be plugged into joystick port number one; if it sees a suitable signal from the screen, the X and Y values will be latched into these registers. The light pen can be used on an interrupt basis: we can "stop the music" and get immediate action if we choose to set things up that way.

This is the second time we've mentioned interrupts; perhaps we'd better discuss them a little more closely.

Interrupts

Interrupts are for machine language experts – things happen too fast for BASIC to cope in this area. There are four types of interrupts: raster, light pen, and two kinds of sprite collision. (We'll talk about sprites in Part III next month.) We may use all of them or none; and even when these signals are not used for interrupt, we can check them.

Location 53273 (hex D019) tells us which of the four events has occurred. We don't need to make the interrupts "live"; they will signal us any time the particular event happens. The weights are as follows:

1 (bit 0) – the raster has matched the preset line value;

2 (bit 1) – a sprite has collided with the screen background;

4 (bit 2) – a sprite has collided with another sprite;

8 (bit 3) – the light pen has sensed a signal;
128 (bit 7) – one of the above has triggered a live interrupt.

Once any of the above takes place, the bit will remain stuck on until you turn it off. How do you turn it off? This may sound goofy, but you turn an interrupt signal off by trying to turn it on. Hmmm, let me try that again. Suppose that we have both a raster and a light pen signal; we'll see a value of 9 (8+1) in the interrupt register. Now suppose further that we are ready to handle the light pen, so we want to turn its signal off. We do this by storing 8 into location 53273. Huh? wouldn't that turn it on? Nope, it turns it off, and leaves the other bit alone. So after storing 8, we look at the register again, and (you guessed it) we see a value of 1 there. Honest.

Location 53274 (hex D01A) is the interrupt enable register: it sets the above signals for "live interrupt." Select bits 0 to 3 corresponding to the interrupts you want. Whatever live interrupt you select will now trigger a processor interrupt and also light up that high bit of 53273. Don't forget to

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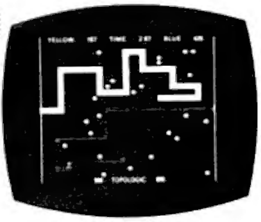

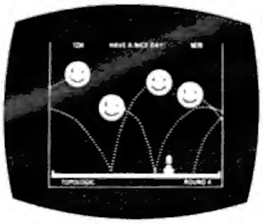

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Table 1:

6566 Video Chip
C64 Control and Miscellaneous Registers

D011		Extended Color Mode	Bit Map	Display Enable	Row Select	Y-Scroll			53265
D012	Raster Register								53266
D013	Light Pen Input X								53267
D014	Light Pen Input Y								53268
D016	X	X	Reset	Multi Color	Col Select	X-Scroll			53270
	Screen				Character Base				
D018	VM13	VM12	VM11	VM10	CB13	CB12	CB11	X	53272
D019	IRQ	Interrupt ←Sense→			LP	SSC	SBC	RST	53273
D01A	Interrupt Enable →				Light Pen	Sprite Collision with Sprite	Back	Raster	53274

Color Registers

D020	X	Exterior	53280
D021	X	Background #0	53281
D022	X	Background #1	53282
D023	X	Background #2	53283
D024	X	Background #3	53284
D025	X	Sprite Multicolor #0	53285
D026	X	Sprite Multicolor #1	53286

Table 2:

6566 Video Chip
C64 Sprite Registers

Sprite 0	Sprite 7			Sprite 0	Sprite 7
D000	D00E	Position	X	53248	53262
D001	D00F	Position	Y	53249	53263
D027	D02E	X	Color	53287	53294

	Sprite 7	Sprite 6	Sprite 5	Sprite 4	Sprite 3	Sprite 2	Sprite 1	Sprite 0	
D010	X-Position High								53264
D015	Sprite Enable								53269
D017	Y-Expand								53271
D01B	Background Priority								53275
D01C	Multicolor								53276
D01D	X-Expand								53277
D01E	Interrupt: Sprite Collision								53278
D01F	Interrupt: Background Collision								53279

shut the interrupt flag off when you service the interrupt, using the method indicated in the previous paragraph. Otherwise, when you finish the job and return from the interrupt (with RTI), it will re-interrupt you all over again.

A Little Color

Some of the colors we have mentioned and some we have yet to discuss are neatly stored in addresses 53280 to 53286 (hex D020 to D026). We may store only values 0 to 15 here, for the 16 Commodore 64 colors.

The chart shows it all: the exterior (border) color; then four background colors (they may be selected as part of multicolor characters or bits); and finally, two colors reserved especially for sprites.

Sorry, but we had to be a little more technical this time around. Many of the locations are of value to machine language users; we can't show their features with simple PEEKs and POKEs.

But these locations are powerful, and they are not hard to use once you get a feeling for them.

Next time, we'll take a look at sprites and, literally, fit them into the picture. They are great fun.

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A Commodore Gotcha

M G Ryschkewitsch and M V Barnhill

For all Commodore computers, a short hint on how to prevent a hidden error when writing or reading data files to tape or disk.

From the time you first began to learn algebra, you were taught that if X = Y and Y = Z then X = Y. This may seem trivial to you, but the problem is that your PET, VIC, or 64 doesn't always see things this way. However, this state of computer confusion doesn't happen often and is easily taken care of if you know to look for it.

Try typing in and running this disk program (tape users, see below):

```
10 CLOSE 1:OPEN 1,8,15,"S0:TEST":CLOSE 1
20 OPEN 8,8,8,"0:TEST,S,W"
30 X=1/3:Y=.333333333
40 PRINT"{CLEAR}";X;Y;X-Y
50 PRINT#8,X;",";Y;CHR$(13);
60 CLOSE 8:OPEN 8,8,8,"0:TEST,S,R"
70 INPUT#8,X,Y:CLOSE 8
80 PRINT X;Y;X-Y
```

If you hadn't thought carefully about what your Commodore computer does with numbers, you were probably surprised that you didn't get the same result both times. What happened? Well, when the computer writes a number to the disk, it sends character by character exactly what it would write to the screen if you asked it to print that number (all of these comments also apply to tape files).

Since the internal operations are carried out with more significant figures than those displayed on the screen or printed to the data file, you can get a truncation error when doing operations with data from a disk file. In cases where the display uses less than the full number of digits because of trailing zeros, there will be no problem (try replacing the 1/3 with 1/2 and .333333333 with .500000000).

You should watch out for this problem if you are comparing numbers written to a data file to numbers kept in memory (for example, if you store temporary results from calculations or try to verify that data has been written properly to a data file). These situations can be handled by comparing STR$(number in memory) to STR$ (number from the disk). This comparison will not give an error if the numbers were the same to start with, but of course there is no guarantee that the numbers were not slightly different. At least your program will not crash unnecessarily.

Tape Version

```
10 OPEN1,1,1,"TEST"
20 X=1/3:Y=.333333333
40 PRINT"{CLEAR}";X;Y;X-Y
50 PRINT#1,X;",";Y;CHR$(13);
60 CLOSE 1
70 PRINT"REWIND TAPE,THEN TYPE:CONT"
80 STOP
90 OPEN 1,1,0,"TEST"
100 INPUT#1,X,Y:CLOSE1
110 PRINTX;Y;X-Y
```

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General-purpose Speedups For Atari BASIC

D K Titchenell

Do you ever need to quickly move character sets around, to achieve fast vertical P/M motion, to instantly clear out players or missiles? These and many other speed-critical problems can be solved with these short, simple subroutines. You need not understand or write machine language to take advantage of its great speed. (Since BASIC itself is written in machine language (ML), you use it all the time without having to be able to explain exactly how PRINT prints.) Here are some efficient solutions to those programming problems where BASIC is just too slow. The example (Program 1) illustrates how to use these subroutines from BASIC.

BASIC is a comfortable language, very friendly, helpful and delightfully forgiving. Eventually, however, the user discovers that there are a few things that can't really be done in BASIC. Then the only solution seems to be to walk over into the rather less certain world of machine language.

There are no two ways about it – BASIC is slow – and you occasionally need to make several things happen with apparent simultaneity.

The Atari provides a very convenient channel for BASIC to communicate with machine language (ML), the USR statement. USR, allowing as it does the passage of any number of values from BASIC to ML, permits a great deal of flexibility. Not only is the number of parameters unlimited, but this number is a known quantity once in the routine and therefore it may be treated as a variable. In taking advantage of this feature, I have found that a relatively small selection of ML routines may be used to solve a large percent of these problems requiring machine language solutions.

MultiPOKE

Under certain circumstances it can be necessary to change the contents of a few addresses without the noticeable lag time between the operations that you encounter using BASIC. One instance of this is in playing music. When BASIC plays a piece with multiple voices, a sharp *attack* (the start of a sound) cannot be achieved because the attack of the different voices is slightly staggered due to the sluggishness of the language.

This point is brought out in *De Re Atari*, and a short machine language routine is presented as a remedy. Another problem of this kind occurs whenever a two-byte register must be changed in realtime – scrolling, for example. Inevitably, that perceptible interval between changing the low byte and the high byte of a register will cause embarrassment. As ANTIC goes zipping through the load memory scan 60 times a second, it can easily display several screens of material during that interval. You could, of course, write little ML routines to solve these individual problems as they arise; or better yet, if you are a little lazy or simply not overly enamored of machine language, you could write a program to solve that type of problem in general.

This was the intention behind MultiPOKE. The MultiPOKE routine acts just like several POKE statements together, performed at machine language speed. Since the number of parameters passed in the USR function is a known quantity, any number of addresses and data to be POKEd into them may be contained in the parameter list. They follow the same order as the POKE statement. The general format is:

D=USR(ADR(POK$),ADDRESS, DATA,
[ADDRESS, DATA ...])

A special feature of the routine was added specifically to address the high-byte, low-byte problem. If a data element passed is a one-byte quantity (less than 256), then the routine acts just like one or more POKE statements. If, however, a larger quantity is passed, the low byte is POKEd in in the normal fashion, and the high byte is POKEd into the next higher register in standard low-byte, high-byte form. This eliminates the bother of calculating the carry. Consider the following solution to the scrolling problem:

```
DLIST=PEEK(560)+256*PEEK(561): FOR I=
300 TO 20000 STEP 40: D=USR(ADR(POK$)
,DLIST+4,I): NEXT I
```

This is a very simple way to scroll the screen RAM through most of memory; DLIST+4 and DLIST+5 (the LMS operand) are adjusted without BASIC.

Moving RAM With MOV$ And MOVU$

The MOV$ and MOVU$ routines solve a different type of problem: moving large, contiguous areas of RAM. When used in various ways, these utilities can perform the following functions: rapid player/missile vertical motion; initializing areas of memory to a single value or a repeating set of values; or moving around blocks of RAM, such as character sets, with no wasted time. The general form of the call to these routines is: D=USR (ADR(MOV$),FROM,TO,HOWMUCH) where FROM and TO are addresses of origin and destination and HOWMUCH is the number of bytes to move.

The routines are used in exactly the same way, but for complete versatility both are needed. Bytes are moved from the origin to the destination areas one at a time. MOV$ starts at the bottom and goes up. MOVU$ starts at the top and goes down. If the locations of origin and destination do not intersect, both perform identically; if there is overlap, though, the right routine must be chosen for the data to remain intact.

Here's why: suppose you wanted to move five bytes starting at location 500 to the five bytes starting at location 499. MOV$, whose execution proceeds up, would perform correctly – moving the byte at 500 to 499, then the byte at 501 to 500, etc., leaving the data intact. If, on the other hand, you were to use MOVU$, which proceeds down, the following would be the case: the byte at location 504 would be moved to 503, then the byte at 503 would be moved to 502 and so on, filling all five bytes with the original contents of location 504. Both effects can be very useful, but make sure to choose the right one. Let's see some examples.

Speeding Up P/M Graphics With MOV$

Vertical player/missile motion in BASIC tends to resemble an inchworm crawling up the screen. Some alternative methods I have seen have used string manipulation or dedicated machine language programs which erase the former image and position the new one rapidly. Using MOV$ is far simpler than either. You need only to put your player data into a string or other safe place with a zero or two before and after it and "MOV$" that data to the appropriate position in player/missile RAM. No erasing of the former player data is necessary because the incoming data (with help from the zeroes before and after) will obliterate it.

The simple example (Program 1) just puts a player, movable by joystick 1, on the screen, while playing a three-voice melody. It demonstrates the use of POK$ in playing multiple voice music and uses MOV$ for vertical player motion and RAM initialization. The three subroutines at lines 2000, 2100 and 2200 read the machine language code for POK$, MOV$ and MOVU$ into their respective strings.

This is, of course, a terribly inefficient use of time and space, but it is the only method possible when readable, printable characters are required. After entering these routines, you may then convert them into character strings using the following method: call the reading subroutine for POK$, for example, then enter the following line in direct mode:

```
FOR W=1 TO LEN(POK$):?CHR$(27);POK$(W,W);
  :NEXT W
```

This will print out the character string, which then may be made into an assignment statement by putting double quotes at either end and putting "POK$=" in front of it. Each of the three routines fits easily on a single BASIC line.

The short reading routine at line 1000 sets up the two arrays DIRH(15) and DIRV(15) with direction indicators which are selected during execution by using the value returned by the STICK function as a subscript. This is a useful and very time-efficient device.

Clearing P/M RAM With MOV$

The virtual simultaneity afforded by POK$ is not required in the P/M setup procedure at all, but it is used here in line 230 where it serves well to show the format of the routine call. It's also nice to be able to get all of that picky P/M stuff out of the way in one chunk. Line 240 then shows off one of the applications of MOV$, clearing P/M RAM in a split second.

MOV$ executes a data transfer from the bottom up and can thus be used to move blocks down in memory, leaving them intact. Here, however, it is used in the opposite direction, for a purpose. A zero is POKEd into location PMBASE+512. Then 128 bytes are moved up a distance of one byte, starting at that point. Thus the zero value is passed up from each register to the following one, thereby clearing the entire player area.

The actual program loop is a bare skeleton. In line 310 the player data is moved into P/M RAM with MOV$ passing, as parameters, the address of PLAYER$ (FROM), the P/M position (TO) and the number of bytes, ((HOWMUCH) 10 in this case) as the player is eight bytes high and a zero is added at either end.

Since this move does not involve overlapping, either MOV$ or MOVU$ could have been used with identical results; the choice was arbitrary. Lines 320 and 330 read the STICK value and adjust the X and Y coordinates accordingly. Lines 340 and 350 read the tune data and RESTORE when the end is reached. Line 360 uses POK$ to set the player X position and insert the frequency bytes into AUDF1, AUDF2 and AUDF3, the AUDC registers having been initialized by the SOUND statement in line 250. The piece chosen plays here at an appropriately frenetic pace in the absence of a delay loop. The tempo is sufficiently restrained by the snail's pace data reading speed of BASIC. Were we to retard the loop further with added processing, it would probably be advisable to read the tune data into a string first; this would more than double the tempo.

Notes On Structure

A note on the structure of the ML routines themselves: free memory locations that are safe from the meanderings of BASIC or graphics mode changes are often in high demand. In order not to consume the few safe memory areas at the programmer's disposal, each of these routines is relocatable and is placed in a character string.

Most of the space in the routines is used to handle the stack contents properly; the actual loop in each case requires very little space. Were we to POKE all of the parameters into the correct locations beforehand, the size of the routines would be considerably diminished, but the beauty and generality of the parameter list would be lost. Care must be taken in all the routines to pass the correct number of parameters.

Because the address to which execution will return upon completion of the routine is kept in the stack (just below the passed parameters), exactly the right number of bytes must be pulled off the stack or the computer will never find its way home again. In the case of POK$, the number is a variable and the routine keeps track of how many have been pulled; however, there must be an even number, pairs of [address, data]. MOV$ and MOVU$ each must receive exactly the three parameters: FROM, TO and HOWMUCH.

Whenever starting a new project I have taken to entering a listing of these routines into the program at the outset, confident that I will eventually have a need for them. In most cases I do. Possible applications for these ML BASIC helpers are certainly not limited to the ones presented here. New uses suggest themselves often.

Program 1.

```
50 GRAPHICS 0:SETCOLOR 2,3,3
100 GOSUB 2000:REM POK$
110 GOSUB 2100:REM MOV$
120 GOSUB 2200:REM MOVU$
130 GOSUB 2300:REM PLAYER DATA
140 GOSUB 1000:REM DIRECTION ARRAYS
200 TEMP=PEEK(106)-8
210 PMBASE=256*TEMP
220 X=100:Y=50
230 D=USR(ADR(POK$),54279,TEMP,559,46
    ,53277,3,53248,X,704,216):REM ALL
     THOSE PM THINGS
240 POKE PMBASE+512,0:D=USR(ADR(MOV$)
    ,PMBASE+512,PMBASE+513,128):REM C
    LEAR PM RAM QUICKLY
250 SOUND 0,0,10,6:SOUND 1,0,10,6:SOU
    ND 2,0,10,6
260 RESTORE 3100
290 REM ********* LOOP **********
310 D=USR(ADR(MOV$),ADR(PLAYER$),PMBA
    SE+512+Y,10):REM MOVE IN PLAYER
320 TEMP=STICK(0)
330 Y=Y+DIRV(TEMP):X=X+DIRH(TEMP)
340 READ A:READ B:READ C
350 IF C=-1 THEN RESTORE 3101:GOTO 34
    0
360 D=USR(ADR(POK$),53248,X,53760.A,5
    3762,B,53764,C)
400 GOTO 310:REM ****** END LOOP ***
999 REM READ DIRECTION ARRAY
1000 DIM DIRV(15):DIM DIRH(15)
1005 RESTORE 1100
1010 FOR W=5 TO 15
1020 READ Q
1030 DIRH(W)=Q
1040 READ Q
1050 DIRV(W)=Q
1060 NEXT W
1070 RETURN
1100 DATA 1,1,1,-1,1,0,0,0,-1,1,-1.-1
     ,-1,0,0,0,0,1,0,-1,0,0
1999 REM SET UP POK$ ROUTINE
2000 DIM POK$(25):RESTORE 2005
2002 FOR W=1 TO 25:READ P:POK$(W,W)=C
     HR$(P):NEXT W
2003 RETURN
2005 DATA 104,74,170,160,0,104,133,25
     5
2006 DATA 104,133,254,104,240,4,200,1
     45
2007 DATA 254,136,104,143.254,202,208
     ,237
2008 DATA 96
2099 REM SET UP MOV$ ROUTINE
2100 DIM MOV$(39):RESTORE 2105
2102 FOR W=1 TO 39:READ P:MOV$(W,W)=C
     HR$(P):NEXT W
2103 RETURN
2105 DATA 104,104,133,215,104,133,214
     ,104
2106 DATA 133,217,104,133,216,104,133
     ,218
2107 DATA 104,170,160,0,177,214,145,2
     16
2108 DATA 200,208,4,230,215,230,217,2
     02
2109 DATA 208,242,198,218,16,238,96
2199 REM SET UP MOVU$ ROUTINE
2200 DIM MOVU$(47):RESTORE 2205
2202 FOR W=1 TO 47:READ P:MOVU$(W,W)=
     CHR$(P):NEXT W
2203 RETURN
2205 DATA 104,104,133,255,104,133,254
     ,104
2206 DATA 133,253,104,133,252,104,170
     ,24
2207 DATA 101,255,133,255,138,24,101,
     253
2208 DATA 133,253,104,168,177,254,145
     ,252
2209 DATA 136,192,255,208,247,198,253
     ,198
2210 DATA 255,202,224,255,208,238,96
2300 REM SET UP PLAYER DATA
2310 DIM PLAYER$(10):RESTORE 2350
2320 FOR W=1 TO 10
2330 READ P:PLAYER$(W,W)=CHR$(P)
2340 NEXT W:RETURN
2350 DATA 0,255,129,129,129,129,129,1
     29,255,0
```

```
3100 REM MUSIC DATA
3101 DATA 121,0,0,121,0,0,96,128
3102 DATA 0,91,128,0,81,144,0,81
3103 DATA 144,0,121,162,0,121,162,0
3104 DATA 144,182,0,144,182,0,108,182
3105 DATA 0,121,182,0,128,162,0,144
3106 DATA 162,0,128,162,0,162,162,0
3107 DATA 121,243,0,0,243,0,121,243
3108 DATA 0,108,243,0,96,243,0,108
3109 DATA 243,0,96,243,0,121,243,0
3110 DATA 108,162,0,96,162,0,108,144
3111 DATA 0,121,144,0,128,217,0,144
3112 DATA 217,0,128,162,0,162,162,0
3113 DATA 121,121,0,121,121,0,96,128
3114 DATA 0,91,128,0,81,144,0,81
3115 DATA 144,0,121,162,0,121,162,0
3116 DATA 144,182,0,144,182,0,108,182
3117 DATA 0,121,182,0,128,162,0,144
3118 DATA 162,0,128,162,0,162,162,81
3119 DATA 121,243,40,108,243,40,96,24
     3
3120 DATA 45,121,243,47,108,162,53,96
3121 DATA 162,60,108,162,64,121,162,7
     2
3122 DATA 128,217,81,144,217,91.128.1
     62
3123 DATA 96,162,162,108,121.243,121,
     121
3124 DATA 243,121,121,243,121,121,243
     ,121
3126 DATA 0,0,0.0.0.0.0.0.0.-1.-1.-1
```

Program 2.

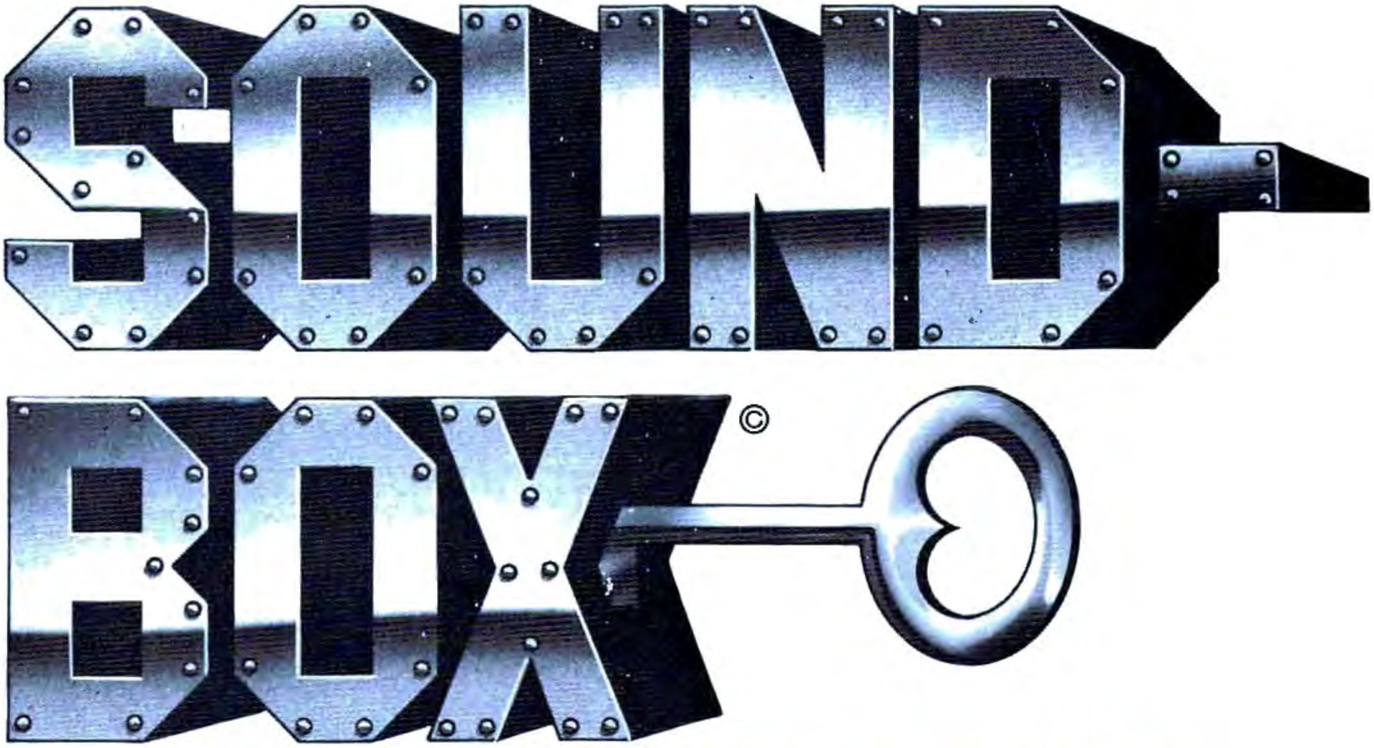
```
10 ; POK$ SUBROUTINE
20 ; BY D. K. TITCHENELL
30 ; PARAMETERS PASSED:
40 ; ANY NUMBER OF PAIRS OF [ADDRESS,
   DATA]
50 ;
60 ;
70 ;
80   *=$0600          ARBITRARY STARTING
   POINT
90 ADDR=$FE           A FREE ZERO PAGE S
  POT
0100   PLA              NUMBER OF PARAME
   TERS PASSED
0110   LSR A            DIVIDED BY 2
0120   TAX              KEEP IN X
0130   LDY #$00         Y INDEX ZERO
0140 ;                  LOOP FOR EACH PO
   KE
0150 LOOP
0160   PLA              HIGH BYTE OF ADD
   RESS
0170   STA ADDR+1
0180   PLA             LOW BYTE OF ADDRES
   S
0190   STA ADDR
0200   PLA             HIGH BYTE OF NUMBE
   R TO BE POKED
0210   BEQ SKIP        IGNORE IF ZERO
0220   INY             IF NOT ZERO,
0230   STA (ADDR),Y    STORE IN NEXT REG.
0240   DEY             ZERO Y
0250 SKIP PLA          LOW BYTE
0260   STA (ADDR),Y    STORE IN REG.
0270   DEX             COUNT DOWN
0280   BNE LOOP        LOOP IF NOT ZERO
0290   RTS             RETURN TO BASIC
```

Program 3.

```
01 ; MOV$ SUBROUTINE
02 ; BY D. K. TITCHENELL
03 ; PARAMETERS PASSED: FROM, TO, HOW
  MUCH
04 ;
05 ;
10   *=$0600              ARBITRARY STA
  RTING POINT
20 FROM=$D6               ZERO PAGE SPO
  TS FOR STORING ADDRESSES
30 TO=$D8
40 LENGTH=$DA             AND LENGTH
50   PLA                  PULL PERAMETE
  RS OFF OF STACK FIRST IS NOT USED
60   PLA
70   STA FROM+1           HIGH BYTE OF
  ORIGIN RAM
80   PLA
90   STA FROM             LOW BYTE
0100   PLA
0110   STA TO+1           HIGH BYTE OF
   DESTINATION RAM
0120   PLA
0130   STA TO             LOW BYTE
0140   PLA
0150   STA LENGTH         HIGH BYTE OF
   LENGTH
0160   PLA
0170   TAX                LOW BYTE IN X
0180   LDY #$00           ZERO Y
0190 LOOP LDA(FROM),Y     LOAD A BYTE F
   ROM FROM
0200   STA (TO),Y         STORE IN TO
0210   INY                INCREMENT Y
0220   BNE SKIP           IF <>0 SKIP
0230   INC FROM+1         INCREMENTING
0240   INC TO+1           HIGH BYTES
0250 SKIP DEX             DECREMENT LOW
   BYTE COUNTER
0260   BNE LOOP           LOOP IF<>0
0270   DEC LENGTH         IF ZERO DECRE
   MENT HIGH BYTE
0280   BPL LOOP           RELOOP IF POS
   ITIVE
0290   RTS                RETURN TO BAS
   IC
```

Program 4.

```
10 ; MOVU$ SUBROUTINE
20 ; BY D. K. TITCHENELL
30 ; PARAMETERS PASSED:
40 ; FROM, TO, HOWMUCH
50 ;
60 ;
70 ;
80   *=$0600            ARBITRARY START
  ING POINT
90 FROM=$FE             ZERO PAGE LOCAT
  IONS
0100 TO=$FC
0110   PLA              FIRST BYTE NOT
   USED
0120   PLA              HIGH BYTE OF FR
   OM
0130   STA FROM+1       STORE IT
0140   PLA              LOW BYTE
0150   STA FROM
0160   PLA              HIGH BYTE OF TO
0170   STA TO+1         STORE IT
0180   PLA              LOW BYTE
0190   STA TO
0200   PLA              HIGH BYTE OF HO
   W MUCH
0210   TAX               IS STORED IN X.
0220   CLC
```



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```
0230  ADC FROM+1        HIGH BYTE OF
0240  STA FROM+1        HOWMUCH IS ADDE
    D
0250  TXA               TO FROM AND TO
0260  CLC               AS EXECUTION WI
    LL
0270  ADC TO+1          START AT THE TO
    P
0280  STA TO+1
0290  PLA               LOW BYTE OF HOW
    MUCH
0300  TAY               IS KEPT IN Y
0310 ;
0320 LOOP
0330  LDA (FROM),Y      WHICH IS THEN U
    SED
0340  STA (TO),Y        AS THE INDEX FO
    R THE TRANSFER
0350  DEY               AND DECREMENTED
    .
0360  CPY #$FF          WHEN IT REACHES
0370  BNE LOOP          <0 THEN
0380  DEC TO+1          THE HIGH BYTES
0390  DEC FROM+1        ARE DECREMENTED
    .
0400  DEX               THE HIGH BYTE C
    OUNT
0410  CPX #$FF          IS DECREMENTED
0420  BNE LOOP          AND CHECKED
0430  RTS               RETURNING TO BA
    SIC WHEN THROUGH
```

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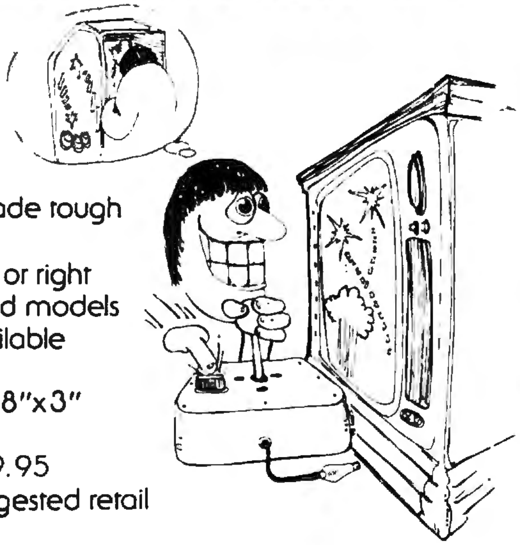

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BASIC Trace For The VIC

Jim Wilcox

A trace *program is very helpful as a tool for finding errors, for* debugging. *It will let the operator see at which line number the program is,* while it is running. *The programmer can see errors in program flow as well as find the areas where problems are located.*

This "Trace" program will adjust to any size memory in the VIC. It uses fewer than 200 bytes of memory. The program will be protected in the uppermost memory positions.

Type in the BASIC program below and double check the DATA statements. Once you're sure the program is right, SAVE it. RUN the program, and in a couple of seconds the screen should show you the SYS values to turn the TRACE on and off. On an unexpanded VIC the following will be printed:

```
TRACE ON  SYS( 7501 )
TRACE OFF SYS( 7488 )
```

If, when you type SYS (7501) on an unexpanded VIC, the machine "crashes," or does something unexpected, something was typed in wrong. The solution is to LOAD the program and correct any mistakes, then try again.

After you've got a working tracer, the program that you would like TRACEd may now be LOADed or typed in. Type in the SYS and hit RETURN to turn the TRACE on and RUN the program. The line numbers will be printed in reverse field.

Trace will help you find bugs faster and correct them. It will also show exactly where a program is operating at any given time during execution.

```
5 F=0:C=PEEK(55)-192:IFC<0THENC=C+256:F=
   -1
10 D=PEEK(56)+F:POKE55,C:POKE56,D:CLR
15 N=PEEK(55)+256*PEEK(56)
20 F=0:FORD=NTON+191:READA$:IFASC(A$)<58T
   HENA=VAL(A$):GOTO35
25 IFASC(A$)=76THENA=VAL(RIGHT$(A$,LEN(A$
   )-1))+PEEK(55):IFA>255THENA=A-256
   :F=1
30 IFASC(A$)=72THENA=VAL(RIGHT$(A$,LEN(A$
   )-1))+PEEK(56)+F:F=0
35 POKED,A:NEXT
40 PRINT"TRACE ON  SYS("N+13")"
45 PRINT"TRACE OFF SYS("N")":NEW
50 DATA169,230,133,115,169,122,133,116,16
   9,208,133,117,96,169,255,141,61,3
   ,169,76
55 DATA133,115,169,L31,133,116,169,H0,133
   ,117,96,72,138,72,152,72,165,58,2
   01,250
60 DATA176,12,205,61,3,208,10,165,57,205,
   60,3,208,3,76,L134,H0,165,57,141
65 DATA60,3,141,62,3,165,58,141,61,3,141,
   63,3,169,18,32,210,255,169,32
70 DATA32,210,255,169,0,141,64,3,162,0,32
   ,L148,H0,173,65,3,240,3,238,64
75 DATA3,173,64,3,240,8,173,65,3,9,48,32,
   210,255,232,224,5,208,227,173
80 DATA64,3,208,5,169,48,32,210,255,169,1
   46,32,210,255,104,168,104,170,104
   ,230
85 DATA122,208,2,230,123,76,121,0,169,0,1
   41,65,3,56,173,62,3,253,L182,H0
90 DATA168,173,63,3,253,L187,H0,144,12,23
   8,65,3,141,63,3,140,62,3,76,L153
95 DATAH0,96,16,232,100,10,1,39,3,0,0,0,3
   2,56,53,32,4,1,20,1
```

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Atari Mass Line Delete

Aaron M Contorer

Probably just about everyone who has tried to write a lengthy BASIC program on the Atari has encountered the most serious bug in Atari BASIC: system lockup. When changes are made in a program so that a major portion of the program must be moved either up or down in memory, BASIC can cause the computer to completely stop working, or to "lock up." In such cases, there is usually no recourse but to turn the computer off and back on, completely erasing the memory. One good solution is this program, "Mass Line Delete."

If changes in a BASIC program are made by the program itself (through the use of the "dynamic keyboard"), system lockup will not occur. "Mass Line Delete" will erase a specified area of a target program – for example, lines 100 through 200 – without causing the computer to crash. Use of Mass Line Delete also saves a considerable amount of typing, since the only line numbers the user must type are the start and end of the area to be erased, as opposed to typing in the number of every line in the area.

The program itself is as brief as possible so that it will leave most of the computer's memory for the main program. To use Mass Line Delete, first type it in, then list it to cassette by typing LIST "C" or to disk by typing LIST "D:DELETE. LST". Then, at any point during work on another program that you wish to use Mass Line Delete, retrieve it using the ENTER command and type GOTO 32600. In response to the utility's prompt, type the starting and ending line numbers of the program area to be deleted. Mass Line Delete will delete the appropriate lines and automatically end. You may then continue work on your program.

Remember that the safest way to make sure that your program is not lost forever is to SAVE it at least every half-hour that you work on it.

```
32600 GRAPHICS 0:? :? "Mass Line Dele
      te"
32605 TRAP 32605:POKE 84,11:? "Start,
       end";:INPUT S,E
32610 IF INT(S)<>ABS(S) OR S>32099 OR
       INT(E)<>ABS(E) OR E>32099 OR E
      <S THEN ? CHR$(253):GOTO 32605
32615 GRAPHICS 0:? :?
32620 ? S:S=S+1
32625 ? "CONT":POSITION 0,0:POKE 842,
      13:STOP
32630 POKE 842,12:IF S<=E THEN 32615
32635 GRAPHICS 0:END
```

The Confusing Catalog

Jim Butterfield Associate Editor

Have you ever wanted to have a program gain control of the disk catalog? There are a number of ways to use directory information, but getting hold of it is not as simple as it might seem at first glance.

On 4.0 Commodore machines, you just type CATALOG or DIRECTORY. On earlier machines, you must LOAD "$",8 and then LIST. Either way, you get a directory with your disk header, information on the programs, and the number of bytes free. Very handy indeed.

Here's the problem: you would like your program to be able to read a directory. It seems simple: just OPEN it as a file and bring in the items. Unfortunately, it doesn't work that way.

Two Types

When you command LOAD "$",8 you are bringing in a directory with a LOAD command; it arrives in a certain format. If you OPEN 1,8,2,"$" within your program, you'll get an entirely different format. Why?

When you say LOAD, the disk manufactures a directory that imitates a BASIC program. After all, the next thing you'll say is LIST, and the only thing that can be listed is BASIC. If you say OPEN, however, the disk will give you its directory, in binary, just as it is stored on the disk surface. That seems to be a little better – until you realize that BASIC has a devil of a time understanding binary.

You can do an OPEN and get the "imitation program." The trick is to use secondary address 0 – usually reserved for LOADing.

Another Problem

Either way, you get binary. You'll need to translate it and interpret it; and you'll need to cope with that annoying BASIC glitch, inputting a CHR$(0). Whenever BASIC GETs a CHR$(0), it changes it to a null string (" "), and you'll need to detect this and change it back.

The coding for this is fairly easy. After we get a character with GET A$, we may take its binary value with A=ASC(A$) – except that the null string won't work right. So, we say, A=ASC (A$+CHR$(0)) and everything works out.

Imitation BASIC

This is the easiest and most standard way of obtaining directory information; it works the same way with all Commodore disks. To understand it, we must see how a BASIC line is constructed:

First two bytes:	forward chain or zero (dummy on directory)
Next two bytes:	binary number
Then:	text of line
Ending with:	binary zero

So let's write it:

```
100 OPEN 1,8,0,"$0"
     Let's get the directory for drive 0.
110 N$=CHR$(0)
     Here's our null string replacement.
190 GET#1,A$,A$
     Skip the "Load Address" at file start.
200 GET#1,A$,A$
     Skip the forward chain, except:
210 IF A$=" " GOTO 400
     Zero chain means the end.
220 GET#1,A$,B$
     Get the binary number.
230 PRINT ASC(A$+N$)+ASC(B$+N$)*256;
     Print "number of blocks."
300 GET#1,A$
     Let's get text.
310 IF A$=" " THEN PRINT:GOTO 200
     End of this line: go back;
320 PRINT A$;
     Print one character;
330 GOTO 300
     Get some more.
```

This program prints the directory. Big deal: you could do that anyway. But since it's a program, you can change it to do whatever functions you need. For example, you could dig into the text part in more detail, extracting the program name and type; that way, your program would know if a given data file were on the disk.

It's handy to be able to check how many blocks are free on the disk. Our program already does this: the last number that line 230 calculates will be the blocks-free value. You can abbreviate this procedure by making the program skip all the file names. Change the OPEN statement to read:

```
100 OPEN 1,8,0,"$0:S%Q"
```

Now, the program will catalog only those programs whose name happens to be exactly S%Q. Chances are you won't have many of these. Your directory is now shortened down to the header line and the BLOCKS FREE line. Let's telescope our program into a simple block-free checker:

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```
100 OPEN 1,8,0,"$0:E7!N"
      Another unlikely name
110 N$=CHR$(0)
200 GET#1,A$,A$,A$,A$,A$,A$
      Throw away load address, link, number.
210 GET#1,A$:IF A$<>" "GOTO 210
      Throw away the header line
220 GET#1,A$,A$,A$,B$
      Throw away the link, get the number.
230 F=ASC(A$+N$)+ASC(B$+N$)*256
      Here's our block-free count.
400 CLOSE 1
410 PRINT F
```

We've only scratched the surface. Try your hand at programming some directory search function of your choice.

Bit-Image Directories

You can get more information from a bit-image directory than from a BASIC-imitator. For example, you can read the length parameter of relative files, see deleted files, and view file track and sector values.

But this comes with considerable difficulty. You might get any one of several different formats, depending on the disk. We won't do the whole job here: you can chase after some of the details for yourself.

```
100 OPEN 1,8,15,"I0":CLOSE 1
      We must initialize for this one.
110 OPEN 1,8,2,"$0"
      Here comes the bit directory.
120 N$=CHR$(0)
130 GET#1,A$
      The disk will identify itself.
140 A=ASC(A$+N$)
      Here's the identity.
150 IF A=67 THEN PRINT "†8050 ▌"
160 IF A=65 THEN PRINT "†4040 ▌"
170 IF A=1 THEN PRINT "†2040 ▌"
      Just to prove we identified it.
      8250's will give trouble here.
200 FOR J=1 TO 253
210 GET #1,A$
220 NEXT J
      Skip the (bit) BAM.
230 IF A<>67 GOTO 300
240 FOR J=1 to 254*2
250 GET#1,A$
260 NEXT J
      The 8050 has a big BAM to skip.
300 FOR J=1 TO 8
      Eight files per block.
310 GET#1,F$,T$,S$
      File type, Track, Sector.
320 F=ASC(F$+N$)
330 P$="":FOR K=1 TO 16
      Get 16-character name.
340 GET#1,X$:P$=P$+X$
350 NEXT K
360 FOR K=1 TO 9
370 GET#1,X$
380 NEXT K
      There's useful stuff here; we'll skip it.
390 GET#1,L1$,L2$
      File length
400 IF J<8 THEN GET #1,X$,X$
      Weird; 254 bytes/8 leaves us two bytes short.
410 SW=ST
      To allow us to test end-of-directory.
420 IF F<129 OR F>132 GOTO 480
      Not a real file.
430 PRINT P$;ASC(L1$+N$)+ASC(L2$+N$)*256
      Name and length.
480 NEXT J
500 IF SW=0 GOTO 300
900 CLOSE 1
```

This isn't a program – it's a research outline. Yes, you can go in there and drag out the BAM. Yes, you can dig useful data out of the stuff we skipped in lines 360-380. Check your disk manual for details.

It's not easy either way. The "imitation BASIC" is the shortest and works on all disks: use it when you can. But if you need the extra power of the bit map, don't hesitate to go for it. ©

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INSIGHT: Atari

Bill Wilkinson

Almost BASIC

This month we'll start a major project: a pseudo-BASIC interpreter written in Atari BASIC. Will this be a useful product? No. First, since it is written in and interpreted by Atari BASIC, it will of necessity be much slower than even Atari BASIC. Second, it will be an extremely limited language (as we'll shortly see) and, in fact, a nonstandard language.

But suppose we could overcome the first objection (speed) and ignore the second (so what if it is nonstandard, as long as it is ours). Would it be useful then? Sure. In fact, we could even speculate on rewriting the interpreter in C/65 or assembly language and ending up with an extremely fast, presumably integer-only interpreter. Still, the language is limited, and it would have to have some major extensions added before it would be really usable.

Enough speculation. Let's proceed to the language's definition.

1. The program editing scheme used will be essentially identical to that of Atari BASIC. Line numbers from 1 to some maximum will automatically be sorted and executed in order. Entering just a line number will erase any line with that number.

2. Single letter variables *only* will be allowed. This is a major point of departure from Atari BASIC, but it makes the interpreter significantly simpler. And no string variables.

3. Only the first letter of each statement name (command name) will be significant. Another big departure, and one which limits us to 26 different statements. Also note that this implies that if we use "Print," we can't use "Plot," "POKE," or "Position," etc. This also implies that you can keep programs small (and unreadable) by using single letter commands.

4. No functions. Sorry, but there will be no "RND(0)", no "SIN(30)", etc. This is necessary if we are to keep the expression analyzer down to manageable proportions when it is written in Atari BASIC.

5. No precedence of operators. Same excuse as number 4. This means that "3+4*5" will evaluate as "(3+4)*5" or 35. Most BASICs would see that as "3+(4*5)" or 60. Similarly, no parentheses will be allowed.

6. No provision for loading or saving programs. It would be easy to add this, and we might do so later. However, I see little point in doing so as long as the interpreter is running under Atari BASIC.

Whew! Feel restricted? Well, if you are adventuresome, you can try adding to and modifying the interpreter. It is a good exercise in logic, and you might even get good enough at it to give us a scare.

And one more thing before we get started with the heavy stuff. What do we call this thing? I haven't come up with anything better than BAIT, which is my acronym for BASIC (Almost) InTerpreter. (And which is also meant to imply that it *is* bait: I am fishing for innovation and interest from you, my gentle readers.)

BAIT Statements

Remember: only the first character of each statement/command name is significant, so what I am really presenting here is a list of which letters of the alphabet we are going to use. The table below lists the first letter, the mnemoic I am using, the syntax of the statement, and (in parentheses) the Atari BASIC equivalent, if indeed that BAIT statement is not the same.

A	**Accept <variable>**	**(INPUT)**
B	**Begin**	**(RUN)**
C	**Call <line-number>**	**(GOSUB)**
D	**Display**	**(LIST)**
E	**End**	
F	**Fetch <address>, <variable>**	**(pseudo-PEEK)**
G	**Goto <line-number>**	
I	**If <expression>, <statement>**	
L	**Let <variable> = <expression>**	
N	**New**	
P	**Print <string-literal>** **Print <variable>** **Print**	
R	**Return**	
S	**Store <address>, <expression>**	**(POKE)**

A few of the statements need explanation, which is given below. Also, note that line-numbers and addresses, as used in the above syntax, may

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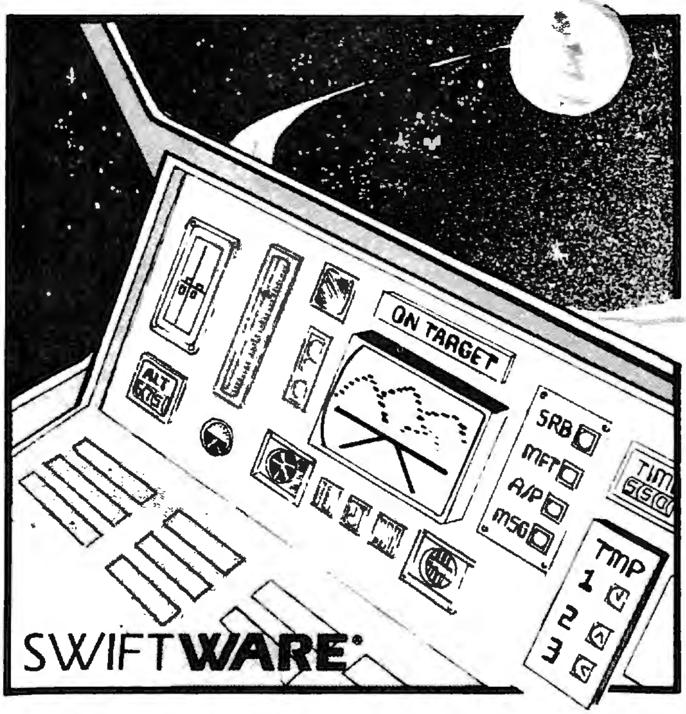

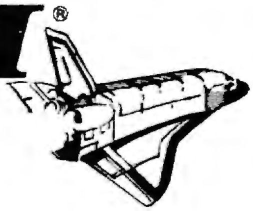

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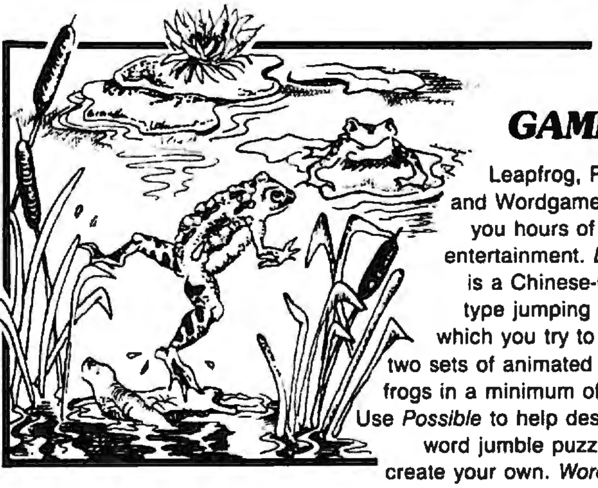

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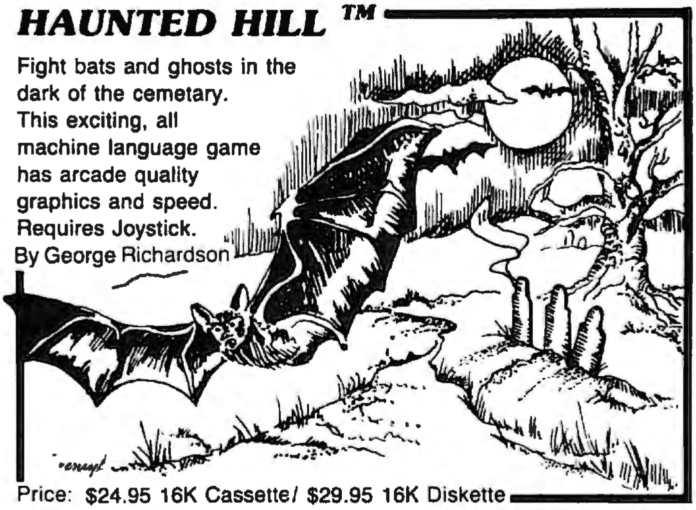

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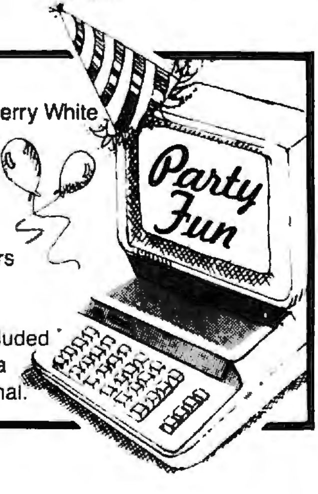

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always be general expressions.

"Accept" allows only a single variable per use, unlike "INPUT" which allows several variables separated by commas.

"Fetch" and "Store" are complementary statements, both with the form of Atari BASIC's "POKE." The only difference is that "Fetch" obviously needs a variable (instead of an expression) to place the fetched (PEEKed) byte into.

"If" does *not* use a "THEN" keyword. Instead, any BAIT statement may follow the comma.

"Let" is a *required* keyword in BAIT. Actually, you may have already presumed this, since otherwise there is no way to distinguish a statement letter from a variable letter in such an assignment statement.

"Print" allows only one item to be printed per statement. Not shown in the above syntax, but allowed by BAIT, are the trailing semicolons or trailing commas, which have the same meaning as under Atari BASIC.

A discussion of what constitutes a valid expression, as well as several other more esoteric points, will have to wait for following month(s).

General Concepts

Since the code for BAIT will be presented in pieces over the course of several months, we must start with a coherent scheme. Also, since we will *not* reprint this month's code next month (for example), the listings must merge properly and neatly.

To this end, I have designated several line number ranges for specific purposes, as listed below.

1000-1999	Initialization of variables used as constants; dimension of strings and arrays; etc.
2000-2999	The "ready" prompt. Get a line of program/command. Parse line for line number.
3000-3999	Program editing. Delete and insert lines.
4000-4999	Control execution of running program. Execute next line, execute command line, etc.
5000-5999	Major subroutine which evaluates arbitrary arithmetic expressions by executing them.
8000-9999	Various miscellaneous subroutines, used by one or more statements.
10000 up	Execution of the actual statements and commands of BAIT. Line numbers of execution routine for each statement are defined in initialization segment, above.

Sidelight: What are the major differences between this scheme and that actually used by the authors of Atari BASIC? (1) There is no provision for generalized I/O routines. (2) Atari BASIC checks the syntax of each line as it is entered and tokenizes it into internal form right then and there. BAIT simply stores exactly what you type in. (3) BAIT is missing many, many of BASIC's capabilities, as noted above.

This Month's Listing

This program is my offering for this month. It consists primarily of the program editor, including the initialization need thereby.

One note about some temporary code: In the finished BAIT, lines 4000 through 4999 will control which statement/command will be executed next. In the case of a command (direct statement, in Atari parlance), these lines will pass control back to the ready prompt when the particular command executor returns. For program editing, we really only need one command, "Display" (LIST), so we have provided a very simple execute control which assumes that *all* direct statements are a request for "Display."

And now for some commentary on the code. Each section of comment is preceded by the line number (or range of numbers) that it refers to.

1010. I chose a practical number here. The larger MAXLINE is, the slower the line deletion process, and the larger the memory you will need. But feel free to change it.

1020. BUFFER$ is used to hold the program you type in and can be almost any size, but be careful: I have not put any provisions in the current BAIT code for detecting when you run out of space.

1030. This is a departure from Atari BASIC (and an effective, though memory-consuming one). Rather than scanning through the program space (BUFFER$) for a line, we "know" where it is via a table kept in LINES.

2360. Since I can't suppress the question mark which the INPUT on line 2300 produces, it is possible that using the Atari cursor keys will sometimes cause the "?" prompt to appear at the beginning of an input line. This gets rid of it by moving the right hand part of the string to the left. (It really works! Try it. And it's also used in line 2720.)

2520 and 2630. Remember, a completed FOR/NEXT loop exits with the loop variable already changed to the first failing value (thus LL+1 in this example).

2710. If we don't do this, and if LP is greater than LL (i.e., if there is nothing following the line number), then the reference to LINE$(LP) in line 2720 gives us a string length error.

3020. Necessary, if we stripped off the line number.

3040. Shame on you. You typed in a line number with a decimal point, trying to fool me. Gotcha.

3060. The only error message in this month's code.

3110. If the line doesn't yet exist, we can't delete it.

3120, 3130. The number stored in the "LINES"

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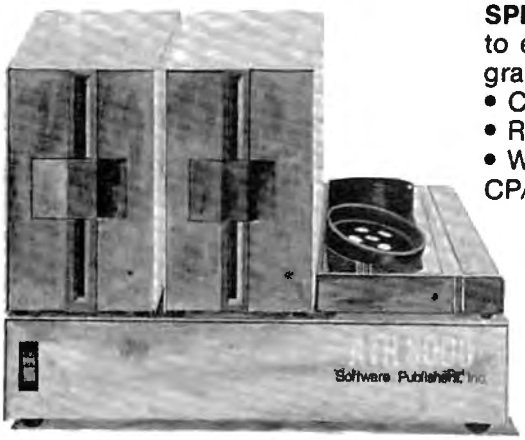

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table is the length of the line as stored in "BUFFER$" added to 1000 times its starting position in "BUFFER$". We could have used two arrays (one for starting position and one for length) to make it neater, but it would have used a lot more memory.

3140. This line might not work, thanks to a bug in Atari BASIC. Perhaps next month we will have a fix to work around the bug. In the meantime, small programs in BAIT will always work. (Same as the my-system-went-away-when-I-deleted-a-line problem in Atari BASIC.)

3160-3180. This is tricky. After you remove a line via 3140, the starting position of all lines above it in the buffer must be adjusted downward by the size of the line deleted. Can you follow line 3170? Remember, "START" and "LENGTH" refer to the former start and length of the deleted line.

3210. In case we typed in just a line number.

3220-3240. Notice that each new line overlays the "*" which we tack onto the end of the buffer. We then have to put the "*" back on the end. This insures that line 3140 will always work properly, even when we delete the last line in the buffer.

3250. See the comments about lines 3120 and 3130.

3310. If it wasn't a direct line, assume it was added to the program and go after another line.

10100-10150. We check all possible line numbers to see if they need to be listed. Note the similarity between this code and the code needed to delete a line (lines 3110 through 3130): in both cases we need the starting position and length of the line.

10190. Note how each statement will simply RETURN to the execute control code.

Still with me? Go try it. Type it in *very* carefully, backing yourself up every 20 lines or so. If it doesn't work, go back and examine what you typed in, because I guarantee that it worked just seconds before I made this listing for **COMPUTE!**.

Next month, we will try our hand at adding Execute Expression (the most complicated part of what is left) and Print (so we can verify that expressions are executing).

```
1000 REM ..INITIALIZATION..
1001 REM ..................
1010 MAXLINE=99
1020 DIM BUFFER$(5000),LINE$(128)
1030 DIM LINES(MAXLINE)
1040 FOR LP=0 TO MAXLINE:LINES(LP)=0:NEXT LP
1050 BUFFER$="*"
1500 REM LINE NUMBERS OF EXECUTION ROUTINES
1510 PROMPT=2100:INNEXT=2300
1550 DODISPLAY=10100
2000 REM ..INTERACTION..
2001 REM ...............
2100 PRINT "READY"
2300 INPUT LINE$
2350 IF LEN(LINE$)=0 THEN GOTO INNEXT
2360 IF LINE$(1,1)="?" THEN LINE$=LINE$(1):
     GOTO 2350
2370 LL=LEN(LINE$)
2500 REM CHECK FOR LINE NUMBER
2510 FOR LP=1 TO LL
2520 IF LINE$(LP,LP)<="9" AND LINE$(LP,LP)>
     ="0" THEN NEXT LP
2550 REM LP HAS POSITION OF FIRST NON-NUMER
     IC CHARACTER
2560 CURLINE=0
2570 IF LP>1 THEN CURLINE=VAL(LINE$(1,LP-1))
2600 REM NOW SKIP LEADING SPACES, IF ANY
2610 IF LP>LL THEN 2700
2620 FOR LP=LP TO LL
2630 IF LINE$(LP,LP)=" " THEN NEXT LP
2699 REM
2700 REM REMOVE LINE NUMBER AND LEADING SPA
     CES
2710 IF LP>LL THEN LINE$="":GOTO 3000
2720 LINE$=LINE$(LP)
3000 REM ..EDITING..
3001 REM ...........
3010 REM IF HERE, LINE NUMBER IS IN CURLINE
3020 LL=LEN(LINE$):REM AND LL IS LENGTH THE
     REOF
3030 IF CURLINE=0 AND LL=0 THEN GOTO PROMPT
3040 IF CURLINE<>INT(CURLINE) THEN 3060
3050 IF CURLINE<=MAXLINE THEN 3100
3060 PRINT "***BAD LINE NUMBER***"
3070 GOTO PROMPT
3100 REM FIRST, DELETE CURLINE IF IT ALREAD
     Y EXISTS
3110 LENGTH=LINES(CURLINE):IF LENGTH=0 THEN
      3200
3120 START=INT(LENGTH/1000)
3130 LENGTH=LENGTH-1000*START
3140 BUFFER$(START)=BUFFER$(START+LENGTH)
3150 LINES(CURLINE)=0
3160 FOR LP=1 TO MAXLINE:TEMP=LINES(LP)
3170 IF TEMP>=START*1000 THEN LINES(LP)=TEM
     P-LENGTH*1000
3180 NEXT LP
3200 REM NOW ADD LINE TO END OF BUFFER
3210 IF LL=0 THEN GOTO INNEXT
3220 START=LEN(BUFFER$)
3230 BUFFER$(START)=LINE$
3240 BUFFER$(LEN(BUFFER$)+1)="*"
3250 LINES(CURLINE)=START*1000+LL
3300 REM NOW LINE IS IN BUFFER...WHAT DO WE
      DO
3310 IF CURLINE THEN GOTO INNEXT
3320 REM **** TEMPORARY: JUST FALL THROUGH ~
     TO 4000 ****
4000 REM ..EXECUTE CONTROL..
4001 REM ...................
4010 GOSUB DODISPLAY
4020 BUFFER$(INT(LINES(0)/1000))="*"
4030 LINES(0)=0
4040 GOTO PROMPT
4050 REM **** 4010 THRU 4050 ARE TEMPORARY ~
     ****
5000 REM ..EXECUTE EXPRESSION..
5001 REM ......................
8000 REM ..MISCELLANEOUS SUBROUTINES..
8001 REM .............................
10000 REM ..EXECUTE THE VARIOUS STATEMENTS..
10001 REM ..................................
10100 REM ==EXECUTE DISPLAY==
10110 FOR LP=1 TO MAXLINE
10120 LENGTH=LINES(LP):IF LENGTH=0 THEN 1015
      0
10130 START=INT(LENGTH/1000):LENGTH=LENGTH-1
      000*START
10140 PRINT LP;" ";BUFFER$(START,START+LENGT
      H-1)
10150 NEXT LP
10190 RETURN
```

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MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Part I

Numeric Input

It's relatively easy to input strings in machine language. You must receive the characters and put them away neatly. But numbers are a different problem: the ASCII characters must be changed to binary and gathered into a single number.

It's usually best to gather the digits into a buffer rather than to try to process them as they arrive; in this way, you can cope with special characters such as delete and backspace. When the user signals that the input is complete (usually by pressing RETURN), your program can go to the buffer and work out the whole number.

Single Digits

One-digit numbers are fairly easy. If we understand that values coming in from keyboard or file are in ASCII, we're well on the way to doing the job.

ASCII represents the character zero as hexadecimal 30, decimal 48. To print the character zero in BASIC, you'd need to say PRINT CHR$(48). This may seem confusing to beginners (PRINT CHR$(0) doesn't print anything), but it works out well when you get used to it. So hex 30 represents zero; and, if we wish to do arithmetic on it, we must change it to binary zero. The easiest way to do this is with an AND command: AND #$0F will knock out the unwanted high bits.

This works on all the decimal digits: zero, hex 30, up to nine, hex 39. We should check each input character to insure that it is indeed a legitimate digit – otherwise, we may be converting a nonsense character, such as a comma.

Before we output, we must convert our binary value back to ASCII. If its value may be printed as a single digit (0 to 9), the job is once again easy. We simply use the ORA function to insert the missing bits back in: ORA #$30 changes binary to an ASCII digit.

Let's write a simple program to accept a single numeric digit. We'll use $FFE4 for GET, and $FFD2 for PRINT – this will work on all PET/CBM machines, VIC, and Commodore 64. Our coding goes:

```
TOP  JSR   $FFE4   (get a character)
     CMP   #$30    (less than zero ASCII?)
     BCC   TOP     (it's less, go back)
     CMP   #$3A    (greater than nine ASCII?)
     BCS   TOP     (it's greater, go back)
     JSR   $FFD2   (echo to screen)
     RTS           (return to BASIC)
```

We have not converted our number to binary – just checked it to insure that it's in the right range. If our program were to continue, it might perform AND #$0F to convert to binary, and then store the value in A.

As a matter of amusement, let's convert the above program to BASIC POKEs and run it. Our BASIC equivalent goes:

```
100 DATA 32,228,255, 201,48, 144,249
110 DATA 201, 58, 176,245, 32,210,255,
120 DATA 96
200 FOR J=848 TO 862:READ X: POKE J,X:NEXT J
300 FOR J=1 TO 10:SYS 848:NEXT J
```

The first three lines give the machine language program in decimal. The individual instructions have been separated by spaces to make them more visible. Line 200 POKEs the program into the cassette area. Finally, line 300 invokes the machine language program ten times; you will be required to type ten numeric digits. If you try to type other keys, alphabetic or punctuation, the computer will ignore you.

Hexadecimal Input

Hex input is fairly easy. Since each digit is weighted at 16 times the following one, we need to multiply by 16, and that's easy to do, since 16 is a power of two. For example: to convert hex 1234, we must start with the one, multiply by 16, add the two, multiply by 16, add the three, multiply by 16, and finally add the four. If we did this on a calculator, we'd get 4660 as the result. Even though we're working in binary, we must do the same kind of calculation. Let's input four digits and convert them to a binary value. First, a subroutine to get a hex digit in ASCII and convert to binary 0-15:

```
HEXIN JSR   $FFE4   (get a digit)
      TAX           (save a copy)
      CMP   #$3A    (less than 9?)
      BCS   BIG     (no, skip next)
      SBC   #$2F    (convert 0-9)
  BIG CMP   #$41    (A or more?)
      BCC   SMALL   (no, skip next)
```

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```
        SBC  #$37    (convert A-F)
SMALL   CMP  #$10    (result too big?)
        BCS  HEXIN   (yes, try again)
        TAY          (copy value to Y)
        TXA          (restore ASCII)
        JSR  $FFD2   (print digit)
        RTS
```

There are some "tricks" to the above coding. The first subtraction seems to be taking off 47 ($2F), but it really subtracts the correct value of 48 since the carry is clear, which is a "borrow" in subtraction. The carry is set for the second subtraction, so the stated value of $37 (55) is used. All illegal characters are excluded, although it may take a little hand calculation to work out why.

That's the hard part. Now let's do the easy part – the actual hex input of four digits:

```
FOUR JSR  HEXIN   get character
     TYA          move value to A
     ASL  A       mult. by 2..
     ROL  A            ..by 4..
     ROL  A            ..by 8..
     ROL  A            ..by 16
     STA  VALUE   put result somewhere
     JSR  HEXIN   another character
     TYA
     ORA  VALUE   combine with previous
     STA  VALHI   store in high byte
     JSR  HEXIN   get third character
     TYA          move value to A
     ASL  A       mult. by 2..
     ROL  A            ..by 4..
     ROL  A            ..by 8..
     ROL  A            ..by 16
     STA  VALUE   put result somewhere
     JSR  HEXIN   fourth character
     TYA
     ORA  VALUE   combine with previous
     STA  VALLO   store in low byte
```

Not too hard? Multiplying by 16 is performed by four short instructions: a shift and three rotates. The rest involves combining the digits and putting them away.

Next time, we'll discuss decimal number input, which requires a somewhat more difficult multiplication by ten. ©

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PROGRAMMING THE TI

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Easy Editing

If you use these editing keys and built-in programmers' commands, you'll soon discover how fun and easy-to-use the TI-99/4A can be.

You are typing along writing a program or "keying-in" one from **COMPUTE!** Magazine when – oops! – you make an error. Hold it! Don't type the whole line over! Take advantage of the easy-to-use editing capabilities built in to the TI-99/4A.

Take a look first at the arrow keys (found on letters E,S,D,X). You thought they were just for games? They will probably be the most used editing keys once you get used to them. Suppose you have typed lines 100-150 and look up at the screen and notice you want to change the number in line 130:

```
130 CALL SCREEN(14)
```

Type in 130 then hold the function key (FCTN) down while you press the down arrow ↓. (It might be best to follow through this article as you sit at your TI-99/4A.) You'll notice line 130 comes up at the bottom of the screen with the cursor at the first position. Now press FCTN and the right arrow. The cursor will go toward the right. You may go one space at a time, or hold the key and it will repeat. Go over to the 4 in 14. Stop right over the 4 and type 6. Press ENTER, and the line will now be

```
130 CALL SCREEN (16)
```

Any characters you don't want to change you can just pass over with the arrow key. Change the character you want, then press ENTER – you don't need to go to the end of the line either.

Now suppose you don't like color 16 (white) and decide you want color 6. Type 130 then FCTN ↓. Use FCTN→to get over to the 1 in 16. Stop right on top of the 1. Now press FCTN and 1, which is DEL, for DELete. Now press ENTER and you should have

```
130 CALL SCREEN(6)
```

Try another function key. Type 130 then FCTN↓. Use FCTN→to go on top of the 6 and type 2. Just a second, though. You don't want screen 2; you want 12. Use FCTN← to back up one spot (cursor on 2). Press FCTN 2 for INSert. You won't notice anything right away, but now type 1 – you have color 12. Press ENTER and your line has been changed.

Automatic Repeats

The left arrow, right arrow, and DELete keys have the automatic repeat feature by just holding the key down. The INSert key needs to be pressed just once and characters will keep being inserted as you type until you press ENTER, DELete, or one of the arrow keys. To delete or get rid of a whole line, type the line number and then press ENTER.

Two more handy editing keys are the up arrow and down arrow. Let's assume you have the following lines:

```
200 CALL HCHAR(3,5,42)
210 CALL HCHAR(3,8,42)
220 CALL HCHAR(3,20,33)
```

You RUN your program and discover the graphics needs to be a line lower – the row value needs to be changed from 3 to 4.

Type 200, press FCTN ↓, and use the right arrow to change the 3. Instead of pressing the ENTER key, press FCTN ↓. After line 200 has been edited, the very next line, line 210 in this case, will appear for editing. Likewise, the up arrow will give you the line just before the one on which you were working.

Two other editing keys you should be aware of are ERASE (FCTN 3) and CLEAR (FCTN 4). You may already be familiar with CLEAR. If you are running a program and want to stop, FCTN 4 will interrupt the program. (QUIT, FCTN =, will stop the program, erase it from memory, and return to the TI title screen; CLEAR stops the program but it is still in the computer and you may either CONtinue or RUN.)

CLEAR has another function while you are programming. If you start typing a line and decide you don't want that line after all, press CLEAR.

The cursor will go to the next line and the line you were working on is ignored. ERASE will erase the line that you are working on.

The other function keys you see along the top row of your keyboard are used in some of the command modules and are described in the manuals accompanying the modules.

Some helpful commands for programmers are LIST, NUM, and RES. As you are writing a program, each command needs a line number. When the program is RUN, the computer executes each line in numerical order. The command LIST will list your complete program in order. As your program lists, if it is too long for one screen, the lines scroll off the top. If you want to stop the listing, press CLEAR. If you want to list only part of your program, just list the lines you wish:

Command	Lists:
LIST	Whole program
LIST -200	All lines up to and including line 200
LIST 200-300	Lines 200 to 300 inclusive
LIST 300-	Lines 300 to the end

When you're typing in a program, it will save time and reduce the chance for error if you let the computer type the line numbers. Type in the command NUM (for NUMBER). The computer will automatically start with line 100. Now type in CALL CLEAR and press ENTER. The computer enters line 100 and starts you on line 110. The NUM command automatically increments the line numbers by 10.

You may start anywhere – for example, type NUM 3220 and press ENTER. Your program starts with line 3220 and increments by 10.

Yes, you can change the increments also. Type NUM 200,5 and you'll start with line 200 and increment by 5 (line 200, 205, 210, etc.). The general form is: NUM initial line, increment.

If you want the program to start with line 100 but the increments to be 7 instead of 10, you may use NUM ,7.

To get out of the automatic numbering, just press ENTER after the line number or CLEAR. You'll also notice that if you have a program in the computer and type NUM the computer will show you what is on that line. If you want to keep the line as is, just press ENTER.

Complete Renumber

RES is a command that stands for RESEQUENCE. You've been programming and adding lines here and there and want it to look nice again, all numbered by tens. Type RES and press ENTER. As soon as the cursor reappears, your program is resequenced or renumbered, including all line numbers referenced in other lines. Try this sample:

```
10 CALL CLEAR
12 CALL SCREEN(14)
20 FOR I=1 TO 8
30 CALL SOUND(500,-I,2)
35 GOTO 20
```

Now type RES and press ENTER, then LIST. The lines are resequenced, starting with 100 and incrementing by 10. Like the NUM command, you may specify the starting line number and the increment: RES initial line, increment.

Try RES 10 then LIST.

Try RES 1,1 or RES ,5 and experiment with your own numbers.

Quite often I like to start writing programs with line numbers incrementing by 10. Type in NUM and start programming. If the program has several branches, I may start one branch at 1000 (NUM 1000), another at 2000, etc. Leaving gaps in the line numbers makes it easier to add lines later.

For example, if I have a line 200 and the next line is line 210, I may easily add lines in between by numbering them 202, 204, etc. But what if I have to add 15 lines between lines that are only ten apart? RES ,50 will spread the lines apart and allow more numbers in between. Of course, when I'm through with the program, I RES so the program starts at 100 and increments by 10, and you can't tell where I have planned poorly and had to add lines. ©

PET Quickplot

Matt Ganis

This machine language subroutine, when added to any BASIC program, will perform fast, high-resolution drawing or plotting on PET/CBM's of any memory size, any version of BASIC (see Programs 2 and 3 for the variations). Program 1 checks your memory size and places itself in the correct location at the top of RAM and reports to you the SYS address to use from BASIC programs.

Program 1, the BASIC loader for "Quickplot," can be RUN and then, to get an idea of its graphics capabilities, try Programs 4 and 5 for demonstrations. When you give a value for X and Y, that point on the PET screen is illuminated with the appropriate character from the table. This series of characters effectively creates an 80 x 40 resolution for the screen. In order to plot a point, say (20,10), just execute SYS (address given by loader), 20,10 and there it appears.

The program is set up to avoid any negative values. The lower left-hand corner of the screen is 0,0 (line zero, column zero). The way the value of X and Y is given to the machine language plotting routine is the most interesting feature of Quickplot. There is a short subroutine, three machine language JSR's long, which is contained in line 500 of Program 1. It jumps to three PET ROM routines in a row.

The first jump is to a ROM routine called "checkcom," which looks through the line in BASIC for a comma. Then we jump to "evaexp" which evaluates expressions. It can handle both numbers and variables. Finally, "fltfix" gives a numerical value expressed as an integer, anything to the right of the decimal point is dropped, and the number can be found divided between its high byte in the accumulator and low byte in the Y register.

After the program thus recovers the coordinates, it decides which of the characters (see the table) is appropriate and then figures out the screen address.

The method used here to pass values from a SYS to a machine language subroutine could easily be adapted to other machine language work. Just disassemble the three JSR's in line 500 which apply to your computer. Jot them down if you ever need to send numbers conveniently from BASIC to machine language.

The plot characters

Character	Index	Binary Representation
□	0	0000
▗	1	0001
▝	2	0010
▐	3	0011
▖	4	0100
▄	5	0101
▞	6	0110
▟	7	0111
▘	8	1000
▚	9	1001
▀	10	1010
▜	11	1011
▌	12	1100
▙	13	1101
▛	14	1110
█	15	1111

Program 1: BASIC Loader

```
100 TP=PEEK(53)-1
110 FOR T=0 TO 220
120 READ A$
130 IF A$="*" THEN A=TP:GOTO 150
140 A=VAL(A$)
150 POKE T+TP*256,A
160 NEXT T
170 POKE 53,TP:PRINT"{CLEAR}USE   SYS"TP*256:N
    EW
180 DATA 32,185,*,140,211,*,141,212,*,32
190 DATA 185,*,140,213,*,141,214,*,173,212
200 DATA *,208,11,173,214,*,208,6,32,35
210 DATA *,32,60,*,96,24,78,211,*,144
220 DATA 4,169,1,208,2,169,4,141,215,*
230 DATA 24,78,213,*,144,3,14,215,*,96
240 DATA 56,169,24,237,213,*,141,216,*,169
250 DATA 40,141,218,*,169,0,141,217,*,32
260 DATA 133,*,173,219,*,24,109,211,*,144
270 DATA 3,238,220,*,133,1,173,220,*,24
280 DATA 105,128,133,2,160,0,162,0,177,1
```

```
290 DATA 221,195,*,240,7,232,224,16,208,244
300 DATA 162,0,138,13,215,*,170,189,195,*
310 DATA 145,1,96,169,0,141,219,*,141,220
320 DATA *,24,78,216,*,144,25,24,173,219
330 DATA *,109,218,*,141,219,*,144,3,238
340 DATA 220,*,24,173,220,*,109,217,*,141
350 DATA 220,*,24,14,218,*,46,217,*,173
360 DATA 216,*,208,213,96
500 DATA 32,245,190,32,152,189,32,45,201,96
510 DATA 32,108,124,225,123,98,255,254,126,127
520 DATA 226,251,97,252,236,160,0,0,0,0
530 DATA 0,0,0,0,0,0
```

Program 2: Use this line for Upgrade BASIC.

```
500 DATA 32,248,205,32,159,204,32,210,214,96
```

Program 3: Use this line for Original BASIC.

```
500 DATA 32,17,206,32,184,204,32,208,214,96
```

Program 4: Example Sine Wave

```
10 FORX=0TO79
20 Y%=24*SIN(6.28*X/80)+24
30 SYS32512,X,Y%
40 NEXTX
```

Program 5: Example plot of a circle centered at (40,24) and radius 10

```
10 X=40:Y=24:R=10
20 FORT=1TO360
30 X%=X+R*COS(T*3.14/180)
40 Y%=Y+R*SIN(T*3.14/180)
50 SYS 32512,X%,Y%
60 NEXTT
```

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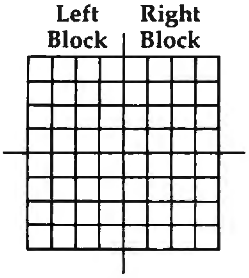
TI Graphics Made Easy

Lyle O Haga

There is a better way of figuring out pattern-identifier code than that presented in the TI manual.

The TI screen is divided up into a giant grid of 24 rows and 32 columns for graphics. This grid, shown in your TI manual in the CALL CHAR section, makes 768 positions or spaces for you to put your graphics in. Each square of the grid is divided up into an 8x8 grid consisting of 64 dots to be turned on or off. Each 8x8 grid is divided up into a "left block" and a "right block."

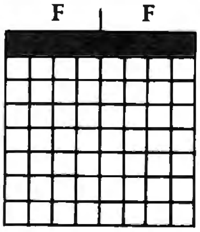


Each time you define a pattern-identifier, you use all 64 dots whether or not you so stipulate. Thus, the statement CALL CHAR(100,"FF") covers all 64 dots even though you stipulated only the top row of eight dots to be turned off; the remaining dots stay turned on. This can be seen by a simple little exercise. Make a box outline, 4x4.

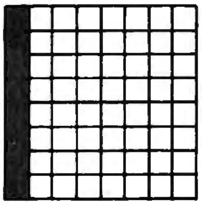
On the surface this sounds like a pretty simple exercise, and it is. The problem is that many people probably won't think it through, and will come up with the following:

```
10 CALL CLEAR
20 CALL CHAR(100,"FF")
30 CALL CHAR(101,"8080808080808080")
40 CALL HCHAR(12,8,100,4)
50 CALL HCHAR(16,8,100,4)
60 CALL HCHAR(12,8,101,4)
70 CALL HCHAR(12,12,101,4)
80 GOTO 80
```

No matter what you do, this won't work; there will always be a gap somewhere. Remember that even though you didn't stipulate all 64 dots in CHAR 100, you still have them to deal with.



On top of this you put the following:



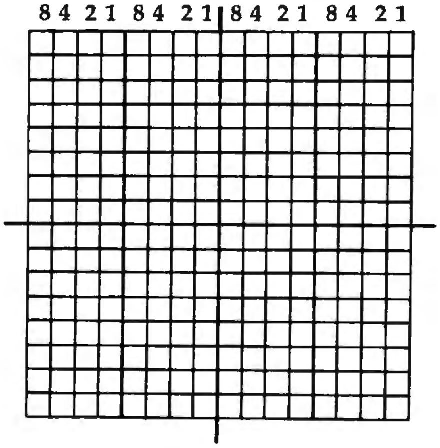
You should be able to see where the gap comes in now. When you put CHAR 101 on top of CHAR 100, the dots you left turned on cover the dots you turned off, thus the gap.

Here's one solution to the problem:

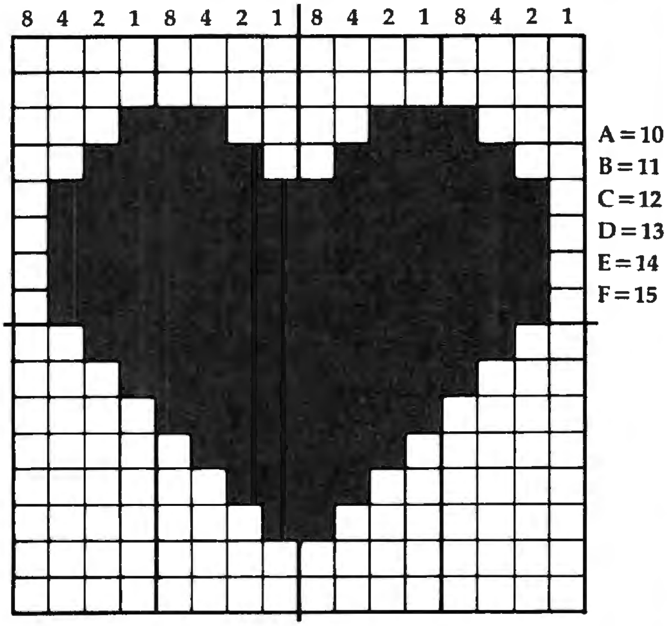
```
10 CALL CLEAR
20 CALL CHAR(100,"00000000000000FF")
30 CALL CHAR(101,"FF")
40 CALL CHAR(102,"8080808080808080")
50 CALL CHAR(103,"0101010101010101")
60 CALL VCHAR(12,8,102,4)
70 CALL VCHAR(12,11,103,4)
80 CALL HCHAR(11,8,100,4)
90 CALL HCHAR(16,8,101,4)
100 GOTO 100
```

What's the easier way of defining graphics? The new method is one your kids learned in school, called base 16. Using base 16, you write the numbers 8,4,2,1,8,4,2,1 across the top of each 8x8 grid. Let's see how this works in defining the heart; we will make it two positions high and two wide.

If you are planning to do many graphics, you should get some graph paper – this will make it easier. Let each square on the graph paper represent one dot; this gives you 16 squares wide and 16 squares high. Make the outline with a heavy line. Count horizontally from the left 4, 8, and 12 lines; make these heavier than the other lines, and make the eighth line even heavier and have it extend beyond the outline. This will mark off your left and right blocks and one position from another. Now, counting vertically, go down eight and darken this line, going beyond the outline. Across the top, put your base 16 numbers 8, 4, 2, 1, 8, 4, 2, 1, and your paper should look like this:



With this, let's make our heart. First, color in all the squares marking your heart. Then, starting at the top row, add up the numbers over the squares you darkened. If the total is under ten, your pattern code will be that number, and if it is over nine, you use the letters A-F. You do the one complete grid and then move to the right; when you are through, move down to the next line. You should come up with the following results:



Row one has no darkened squares, so the code is zero for both left and right blocks. You get the same results with row two. In row three, a square under the number one is darkened in the left block of grid one, so the code is one. In the right block, squares under the 8 and 4 are darkened, so the code is C. In row four, the squares under the 2 and 1 are darkened; the code is 3. Row four of the right block has darkened squares under 8, 4, and 2, so the code is E. Just keep this up, and you will come up with the following:

```
CALL CHAR(100,"00001C3E7F7F7F7F")
CALL CHAR(101,"0000387CFEFEFEFE")
CALL CHAR(102,"3F1F0F0703010000")
CALL CHAR(103,"FCF8F0E0C0800000")
```

Using base 16 is easier. ©

A SuperPET Monitor You Can Bank On

Gary L Ratliff

How to add and easily relocate Micromon to the SuperPET. When this powerful monitor is paired with that powerful computer – you can explore the languages, the operating system, and maybe construct a 6809 disassembler.

Have you acquired the SuperPET computer and found that resident monitors lack several features found in extended monitors such as Supermon and Micromon? (Both of these monitors were made available to **COMPUTE!** readers: Supermon, December 1981 and Micromon, January 1982.) Have you considered adding additional memory or buying one of the newer Commodore units with the 6508 or 6509 chips? Since both these devices can use bank switching to extend the address range to several megabytes, it's likely that you will soon need a monitor which adds bank switching to an already powerful set of commands.

Or, have you wished to add a user feature to one of these monitors and wondered how it was done? If so, then the methods which I've used to add a Bank command to Micromon Plus will be of interest to you. We will examine more closely the structure of the command and jump tables so that any code which you may wish to add to the monitor will also be easy to relocate with the T and N commands of Micromon.

The first step necessary for the addition of a command to Micromon Plus which will allow bank switching is that you have correct versions of Micromon and Plus which have not been run. When Micromon Plus is executed, several changes are made to the Micromon portion of the code which make relocating the code difficult. [*After the code first appeared in the January 1982 issue of* **COMPUTE!**, *several readers found relocating the code difficult. Consequently, several comments and suggestions appeared in the "CAPUTE!" section of later issues (April 1982 and June 1982).*] If you are entering this on a SuperPET, be certain to make the changes for converting the code for the 8032 screen format to your correct version of Micromon. The assumed starting point is Micromon located at $6000-$6FFF and the Plus code at $5B00-$5FFF.

The first features of the Plus code which we shall examine are the commands and jump vectors. This segment of code is found at $5F15-$5F39. Note that the jump vectors for the @ command and the > command are both to $5CD8. The first change is to add a shifted B command by locating the $3E in the line starting at $5F15 and changing it to $C2. Now you can test this by issuing a shifted B command.

If you don't get the disk status, you have made an error and should correct it before entering further code. Next, change the second occurrence of the pattern D8 5C to 4A 5F. The code of the bank command will be assembled starting at $5F4A. If you wish to enter your own command into this monitor, you would follow a similar procedure.

The commands are obtained by the command search and dispatch routine found at $5B69 to $5B86. The commands start at $5F15; the jump vectors start at $5F22. If the value of the X register becomes negative, it signals that the command was not found and an error message is printed.

The design of the command is the next step. My idea of the B command was to print out the present bank setting on B <return>. Change the bank setting on entering any hex value from 0 to F, then print out the altered status. Any character other than spaces between the B and the parameter would be an error; the error message (?) should be printed to show this fact.

Note: if after the break a simple G command is issued, Micromon Plus with a BANK command added will perform a cold start. The code for adding the bank command is found in Program 1. You may enter it directly with the command: A 5F4A JSR $6006 etc. Just enter the listed code until you reach the end of the bank code at $5F8D. (If you make any entry errors, use the D command to correct the assembled code.)

Easy Relocation

A text message is easily printed by loading the Y and A registers with the address of the string followed by JSR STROUT. This was the first approach; however, the two-byte immediate instructions will not relocate properly when the finished code is moved. A careful study of the Micromon Plus code reveals that if the address is contained in a pointer, it will change automatically with the N command word option and make it easy for the user to relocate the code to any desired address. If your own routine is to use ROM-based routines which require setting up certain registers, then a similar analysis will reveal whether you need to reserve some memory as pointers to your code.

Micromon is designed to work for both Upgrade and 4.0 operating systems so look up both routines and code accordingly. SuperPET is available only for 4.0 operating systems, yet the code will operate on Upgrade BASIC which has a bank-switched RAM board (the hidden RAM feature of the 8032 excepted).

Next, the text message and the hexadecimal data need to be moved to safe ("hidden") memory. This is the purpose of the initialization code presented in Program 2. Again, just use the A command of Micromon Plus to assemble the code starting at $5AD7.

The final step is to enter the text and data. Using the M command, change the contents of locations $5F15-$5F45 and $5F90-$5FF0 to read exactly like those presented in the text of the article. This change will also enter your pointers, which will allow easy relocation of the code. Before saving the code, load the correct version of Micromon. As I mentioned, running the Plus portion will alter the Micromon code and make relocation difficult. When all these changes have been made correctly, you are ready to save the finished product. Now save the finished product by entering: S "0FILENAME",08,5AD7,7000.

You are now ready to test the operation of the bank command. Since this was written to overcome some of the shortcomings of the resident monitors present in the SuperPET, flip your machine to the 6809 setting and load in the development system. This step will fill your 64K bank switched RAM and give you something to explore. Now flip back to the 6502 side and load in Bankplus or whatever you called it when you saved the program.

Enter a SYS(1024) to get the monitor and then a command of: G 5AD7. Since this is an assembler, linker, and editor, let's try to find the instruction set text for 6809 opcodes. Enter the command: B0 followed by M 9000 9FFF to examine bank zero.

Examine Both 6502 And 6809

What? Something passed by which you wanted to see! You now have the power of Micromon Plus to examine not only the 6502 side, but also the 6809 side of your SuperPET. Before working with the 6809 monitor, you would have had to reissue the command and hope to narrow down on the target. Now, to catch that segment you missed, just hit the cursor keys and scroll up or down through memory.

Did you want to hunt through memory for the 6809 equivalent of the JSR and RTS statements to more closely zero in on the code to be translated later by the 6809 translate instruction? (While you're at it, if you turn on the printer you'll have the results of your search as hardcopy.) Want a printed hex dump of the APL in the SuperPET? Since this is larger than the 64K, you now know why the code for BANK switching must be easy to relocate. For those who are becoming impatient, the opcode data table will be found in bank six at locations $9660-$9A70.

The next step is instructions to move the code. I am certain that SuperPET owners will want to explore not only the languages, but also the operating system itself. To do this we will want to relocate Micromon to start at $7000 and the Bankplus addition to run from $0AD7-0FFF. This will allow us to move a copy of the 6809 operating system from $A000-FFFF to the freed space from $1000-6FFF. The goal is achieved by writing a simple 6809 move routine. The trick is to power-up with the switch in program mode, and then, once the code has been moved, change the registers to automatically switch to the 6502 mode. Be certain that you know how to control the diagnostic sense pin, or you will completely wipe out your freshly moved code. You'll notice that the stack pointer is messed up. Don't try to correct it: just get the code to the disk as a file.

Step-by-step

The following instructions will achieve this relocation of the code:

1. **T 6000 6FFF 7000**
   (first move Micromon)
2. **N 7000 7FFF 1000 6000 6FFF**
   (relocate the code)
3. **N 7FB0 7FFF 1000 6000 6FFFW**
   (relocate the words)
4. **T 5AD7 5FFF 0AD7**
   (move Plus and additions)
5. **N 0AD7 0FFF B000 5000 5FFF**
   (relocate Plus)
6. **N 0F4A 0F8F B000 5000 5FFF**
   (relocate Bank)
7. **N 0AD7 0FFF 1000 6000 6FFF**
   (correct any Micromon calls from Plus)
8. **N 0D4A 0F8F 1000 6000 6FFF**
   (correct any Micromon calls from Bank)

```
5F15 50 C4 49 CD 40 C2 DA 4A CB CC 5E 55 59 BE 5B 89PDIM@BZJKL^UY>[,
5F25 5B 6B 5C 16 5C D8 5C 4A 5F 27 5E 3A 5E 62 5E 69[k\.\X\J_'^:^b^i
5F35 5E 77 5E 82 5E D2 5E 69 5B 00 5B B0 5F D7 5A 31^w^.^R^i[.[0_WZ1
5F45 30 32 31 38 31 20 06 60 C9 20 D0 03 20 17 6C C902181 .`I P. .lI
```

Figure 1: Command/Jump Vectors

```
5F90 0D 2E 20 42 41 4E 4B 20 3D 20 30 2E 0D 2E 00 00.. BANK = 0.....
5FA0 30 31 32 33 34 35 36 37 38 39 41 42 43 44 45 460123456789ABCDEF
5FB0 93 4D 49 43 52 4F 4D 4F 4E 20 50 4C 55 53 0D 42.MICROMON PLUS.B
5FC0 59 3A 20 42 2E 20 53 45 49 4C 45 52 0D 11 42 41Y: B. SEILER..BA
5FD0 4E 4B 20 43 4F 44 45 20 41 44 44 45 44 0D 42 59NK CODE ADDED.BY
5FE0 3A 20 47 2E 20 52 41 54 4C 49 46 46 0D 0D 00 00: G. RATLIFF....
5FF0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00................
```

Figure 2: Text String Area

9. **N 0F22 0F47 B000 5000 5FFFW**
 (correct the word tables)

At this point you can run the code and issue a load command to recall the file of the 6809 operating system. Save the whole thing, and with one very powerful monitor you can examine the 6502 ROM, the relocated code of the 6809 side of the SuperPET, and any of the languages which load into the bank-switched RAM space. Furthermore, you can also load and save segments of 6809 code. (A feature omitted from the 6809 monitor.) Not only this, but you can also determine where the 6809 programs load with the J "1:FILENAME" command of Plus and alter this location with the Y command to load the short program "loader" into the bank-switched RAM space.

Program 1:
Add the Bank Command

```
5F4A 20 06 60 JSR $6006
5F4D C9 20    CMP #$20
5F4F D0 03    BNE $5F54
5F51 20 17 6C JSR $6C17
5F54 C9 0D    CMP #$0D
5F56 F0 14    BEQ $5F6C
5F58 A2 0F    LDX #$0F
5F5A DD E0 87 CMP $87E0,X
5F5D F0 06    BEQ $5F65
5F5F CA       DEX
5F60 10 F8    BPL $5F5A
5F62 4C 8E 60 JMP $608E
5F65 8A       TXA
5F66 8D DF 87 STA $87DF
5F69 8D FC EF STA $EFFC
5F6C AE DF 87 LDX $87DF
5F6F BD E0 87 LDA $87E0,X
5F72 8D DA 87 STA $87DA
5F75 A0 87    LDY #$87
5F77 A9 D0    LDA #$D0
5F79 AE 00 C0 LDX $C000
5F7C E0 40    CPX #$40
5F7E F0 06    BEQ $5F86
5F80 20 1D BB JSR $BB1D
5F83 4C 89 5F JMP $5F89
5F86 20 1C CA JSR $CA1C
5F89 00       BRK
5F8A 20 60 6C JSR $6C60
5F8D 6C 3E 5F JMP ($5F3E)
```

I would like to learn how the disassembler works. The biggest headache in writing a disassembler in BASIC is getting the data statements correct. Since these are easily copied in from the source code used in the development system, I think the disassembler from Micromon could be converted to translate the 6809 opcodes and also print them in a correct format. How about it? Is anyone game for writing a 6809 disassembler routine in 6502? Would such a product be called a cross disassembler? You can now bank switch; let's translate too.

Program 2:
Initialization of Bank Command

```
5AD7 AC 41 5F LDY $5F41
5ADA AD 40 5F LDA $5F40
5ADD AE 00 C0 LDX $C000
5AE0 E0 40    CPX #$40
5AE2 F0 06    BEQ $5AEA
5AE4 20 1D BB JSR $BB1D
5AE7 4C ED 5A JMP $5AED
5AEA 20 1C CA JSR $CA1C
5AED A2 1F    LDX #$1F
5AEF BD 90 5F LDA $5F90,X
5AF2 9D D0 87 STA $87D0,X
5AF5 CA       DEX
5AF6 10 F7    BPL $5AEF
5AF8 A9 00    LDA #$00
5AFA 8D DF 87 STA $87DF
5AFD 8D FC EF STA $EFFC
```

Automatic VIC Appending

Mark Niggemann

It's quite simple to add two programs together to make a single, larger program. This brief tutorial shows how and explains how the VIC automatically relocates programs in memory.

One of the nice features of the VIC is the autorelocation of BASIC programs during a LOAD. The VIC puts a program into the correct place in RAM memory automatically because programs can be located at three different places in VIC, depending on the memory size that it has. If you saved a program on a 3.5K VIC and later on you bought a 3K expander, it would be next to impossible to RUN that program if the locator didn't make an adjustment.

BASIC on a 3.5K machine expects the starting memory address to be 4097. All programs are saved with this memory address as their starting point. On an expanded-by-3K VIC, the starting memory address is 1025. Since the starting point of BASIC can thus vary, it's left up to the relocator to set things right.

How The Relocator Works

The relocator first checks to see where the start of BASIC is. This is an address POKEd by the computer into locations 43 and 44 when the VIC is switched on. This "start of BASIC" address is where the relocator will begin to store any program that the VIC is LOADing. *Note:* This does not include programs that are saved using absolute save mode, as in Jim Butterfield's "Tinymon" (**COMPUTE!**, January 1982, #20).

Since the relocator depends on the "start-of-BASIC" memory locations (called "pointers") to know where to start storing a program during a LOAD, it is possible to join two separate programs by using a method that I will describe later on. Note that the two programs to be joined must not have overlapping line numbers and that the program in memory at the time must have lower line numbers than the program you are "appending" onto it from tape.

Type in this example program:

```
50 REM PART 2 OF TEST PRG.
60 PRINT "THIS A TEST"
70 PRINT "TO SEE A VIC"
80 PRINT "APPENDING!"
```

Now save this example on tape and clear the memory using NEW to make way for the next program:

```
SAVE"PART 2"
PRESS PLAY & RECORD ON TAPE
OK
SAVING PART 2
READY.
NEW
```

Now type in this example program:

```
10 REM PART 1 OF TEST PRG.
20 PRINT "WILL THIS WORK?"
30 PRINT "I HOPE IT DOES."
40 PRINT "I KNOW IT WILL!"
```

I had you type in the second part first so that part one, the program we are appending, is in memory, and part two is on tape.

Clear the screen and type the following in direct mode:

```
PRINT PEEK(43),PEEK(44)
```

On a 3.5K machine you should get 1 and 16, respectively. Write down these printed values because you're going to need them again later on.

Now type in the following in direct mode:

```
POKE 43,PEEK(45)-2:POKE 44,PEEK(46)
LOAD"PART 2"
PRESS PLAY ON TAPE
OK
SEARCHING FOR PART 2
LOADING PART 2
READY.
```

The above lines typed in direct mode set the start of BASIC to the end of the current program already in memory. Then you load part two as you would any other program. The key to the whole thing is that the relocator will use as its starting location the start of BASIC which is directed by locations 43 and 44.

There is one final step before the two programs are finally appended. You must reset the start of BASIC to what it was before you loaded in part two. To do this, you simply POKE the two values that you previously PEEKed into their respective memory locations. For a 3.5K machine it would look like the following:

```
POKE 43,1:POKE 44,16
```

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If you made no error in the procedure outlined above, you should be able to list the whole program with both parts together. Appending can be a very powerful programming aid, since it allows you to develop several sets of subroutines and then later on lets you patch them into a main program at will.

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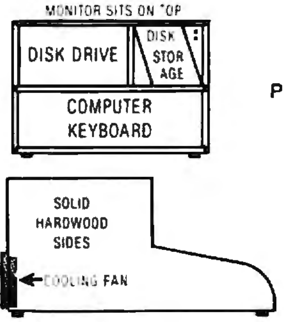

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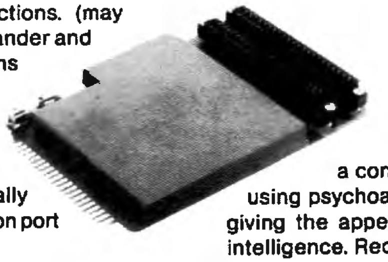

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16-Bit Atari Music

Fred Tedsen

Did you know that you can improve the tuning of your Atari's notes and extend its range dramatically? Normally you can only choose between 256 notes with the ordinary SOUND command. These subroutines let you have more than 65,000 frequencies to make music that's more precise and more pleasant to hear.

As I listened to my Atari play a new song that I had entered from a magazine listing, I could hear that some of the notes were not quite right. The music extended into the third octave above middle C, and though the tune was recognizable, some of the notes were off pitch enough to make listening to the tune unpleasant. I decided that it was time for me to investigate 16-bit music. What I discovered was not only that the accuracy of the notes could be improved dramatically, but also that the effective range could be more than doubled.

How SOUND Works

Before we discuss 16-bit music, let's take a look at what is happening when we use the SOUND statement or in other words, eight-bit sound, in Atari BASIC. The following registers in the POKEY chip are used for sound generation:

AUDF1 (53760) - Audio Frequency Register 1
AUDC1 (53761) - Audio Control Register 1
AUDF2 (53762) - Audio Frequency Register 2
AUDC2 (53763) - Audio Control Register 2
AUDF3 (53764) - Audio Frequency Register 3
AUDC3 (53765) - Audio Control Register 3
AUDF4 (53766) - Audio Frequency Register 4
AUDC4 (53767) - Audio Control Register 4
AUDCTL (53768) - Audio Mode Control Register

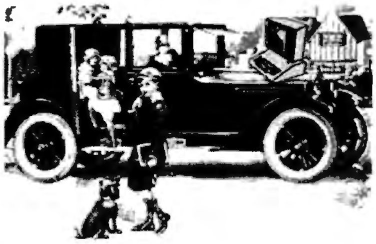
The audio control registers are used to set volume (low order four bits) and sound content (high order bits). Thus there are 16 different volume settings and a variety of sounds available. For this discussion we are concerned only with pure tones, corresponding to SOUND x,x,10,x.

The audio frequency registers are used to control the divide by "N" circuits. These circuits use the contents of the frequency registers to divide a "clock" frequency to produce different output frequencies. Since they are one-byte registers, they are referred to as eight-bit dividers. The output frequency is determined by the formula F0=F/(2x(AUDF+1)), where F is the clock frequency and AUDF the value in the audio frequency register. With a normal clock rate of 64KHz(or more exactly 63,921 cycles per second), the frequency range is about 125Hz to 32KHz.

The effective range for music is limited to about four octaves. This is because the tuning accuracy of notes being reproduced becomes progressively worse as the frequency gets higher. Figure 1 illustrates this very clearly. It shows how far out of tune, measured in "cents," each note in the four octave range is. (A cent is 1/100th of a half-step. A sound which is 50 cents sharp or flat is exactly half-way between two notes.) Notes which are less than ten cents out of tune are usually acceptable, though two notes played together could sound bad if their combined inaccuracy is too large. For example, if you play a note which is eight cents flat followed by a higher note which is eight cents sharp, the second note will probably sound out of tune.

Tuning inaccuracy results from having a limited number of values to use as dividers. With an eight-bit divider, only 256 unique frequencies can be reproduced. The A note in the fourth octave should be 440 cycles per second. To reproduce this note on the Atari, the number 72 is used as a divider. The resulting frequency is 437.8Hz, which is 8.6 cents flat. If instead we use 71 as a divider, the output frequency is 443.9Hz. This note is 15.3 cents sharp and is obviously a poorer choice than the note using 72. The choices become more restricted as the notes get higher. For the A note in the sixth octave, for example, 17 produces a note which is 15.3 cents sharp, while 18 produces a note 78.4 cents flat (closer to G# than A).


• AP103

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Fine-tuning: 16-Bit Dividers

Luckily, the Atari provides a solution to this problem: 16-bit dividers. With a 16-bit divider 65,536 different output frequencies are possible. For example, to reproduce the A in octave 6, we could use either 502 (1.8 cents flat) or 501 (1.6 cents sharp) and not be able to hear any difference. Figure 2 shows how dramatically the range and accuracy are improved.

More accurate tuning does not come without a price. Sixteen-bit dividers are obtained by combining frequency registers: AUDF1 with AUDF2, or AUDF3 with AUDF4. This gives us a choice of one 16-bit and two eight-bit voices, or two 16-bit voices. We also cannot use the SOUND statement, even for the eight-bit voices, as it will confuse our settings for 16-bit sound. As it turns out, this is not much of a problem since machine language routines to play the music are simple and have the added advantage of being faster than separate SOUND statements.

Now let's look at how 16-bit sound is set up. The audio mode control register has four bits for this purpose:

Bit 6 – Clock channel 1 with 1.79MHz instead of 64KHz

Bit 5 – Clock channel 3 with 1.79MHz

Bit 4 – Combine channels 1 and 2

Bit 3 – Combine channels 3 and 4

The other bits in AUDCTL have no bearing on this discussion, so we will ignore them. If you are curious, see chapters 2 and 3 in the *Hardware Manual*.

The 1.79MHz (1.78979 MHz, to be exact) clock rate is required to obtain the full range of output frequencies. The formula for determining output frequency is a little different: $F0 = F/(2x(AUDF + 7))$. In this case, AUDF is the two-byte frequency register value. The second register of

Note Table.

NOTE	16-BIT	8-BIT		NOTE	16-BIT	8-BIT		NOTE	16-BIT	8-BIT	
C	27357		OCTAVE 1	C	3414	121	OCTAVE 4	C	421	14	OCTAVE 7
C#	25821			C#	3222	114		C#	397		
D	24372			D	3040	108		D	374		
D#	23003			D#	2869	102		D#	353		
E	21712			E	2708	96		E	332		
F	20493			F	2555	91		F	313		
F#	19342			F#	2412	85		F#	295		
G	18256			G	2276	81		G	278		
G#	17231			G#	2148	76		G#	262		
A	16264			A	2027	72		A	247		
A#	15351			A#	1913	68		A#	233		
B	14489			B	1805	64		B	219		
C	13675		OCTAVE 2	C	1703	60	OCTAVE 5	C	207		OCTAVE 8
C#	12907			C#	1607	57		C#	195		
D	12182			D	1517	53		D	183		
D#	11498			D#	1431	50		D#	173		
E	10852			E	1350	47		E	163		
F	10243			F	1274	45		F	153		
F#	9668			F#	1202	42		F#	144		
G	9125			G	1134	40		G	136		
G#	8612			G#	1070	37		G#	128		
A	8128			A	1010	35		A	120		
A#	7672			A#	953	33		A#	113		
B	7241			B	899	31		B	106		
C	6834	243	OCTAVE 3	C	848	30	OCTAVE 6	C	100		OCTAVE 9
C#	6450	230		C#	800	28		C#	94		
D	6088	217		D	755	26		D	88		
D#	5746	204		D#	712	25		D#	83		
E	5423	193		E	672	23		E	78		
F	5118	182		F	634	22		F	73		
F#	4830	172		F#	598	21		F#	69		
G	4559	162		G	564	19		G	64		
G#	4303	153		G#	532	18		G#	60		
A	4061	144		A	501	17		A	57		
A#	3832	136		A#	473	16		A#	53		
B	3617	128		B	446	15		B	50		
								C	46		OCTAVE 10

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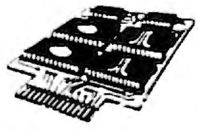

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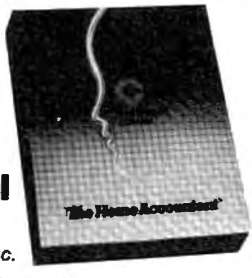

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the pair is the low order byte, either AUDF2 or AUDF4. For example, to use 1049 as a divider with registers 1 and 2, we would POKE 4 in AUDF2 and 25 in AUDF1.

The audio control register of the low order frequency register is not used and should be set to zero. Volume is controlled with the second control register only (AUDC2 or AUDC4).

16-Bit Subroutines

Now take a look at the BASIC 16-bit sound subroutines. The first plays one 16-bit and two eight-bit voices, and the second plays two 16-bit voices. Notice the SOUND 0,0,0,0 at the beginning of each routine. This statement must be included to initialize POKEY for sound. The POKE 53768,X initializes AUDCTL for 16-bit sound, either one or two voices. Remember that any SOUND statement executed later will reset this register to zero.

To use these subroutines, simply copy one or the other into your program and do a GOSUB 20100 once at the beginning of the program. Then, to play music, do the appropriate machine language call, X=USR(ADR(HF1$),N1,V1,N2,V2, N3,V3) or X=USR(ADR(HF2$),N1,V1,N2,V2). Nx is the note to be played and Vx is the volume. N1 is the 16-bit voice in the three-voice routine. You don't need to pass parameters for unused voices. For example, if you want only the 16-bit voice in the three-voice routine, you can use X=USR(ADR(HF1$),N1,V1), but to use only an eight-bit voice you would have to use X=USR (ADR(HF1$),0,0,N2,V2).

The note tables give you the most accurate values for four octaves of eight-bit and nine octaves of 16-bit notes. In a practical sense, the first octave of 16-bit notes is not usable because there are some loud harmonics which tend to mask the actual note being played. You can get some good sounds if you hook up to a stereo amplifier, however. Notice that the eight-bit value for F# in the third octave is 172 rather than 173 as shown in the *BASIC Reference Manual*. 173 produces a note which is more than 12 cents flat, while the note from 172 is only 2.4 cents flat.

Finally, some thoughts on when to use 16-bit music. If you have a piece of music which sounds fine using SOUND in BASIC, don't bother changing it – you probably won't be able to hear much improvement. I think you'll find that just about any music which extends into the fifth octave will be worth converting, however, especially if it is very complex. For three-part music, use the 16-bit voice for the highest notes. Some chord combinations may still sound slightly out of tune, in which case you might want to tune the 16-bit voice a little sharp or flat to match the eight-bit voices. The large number of divider values available gives you plenty of possibilities.

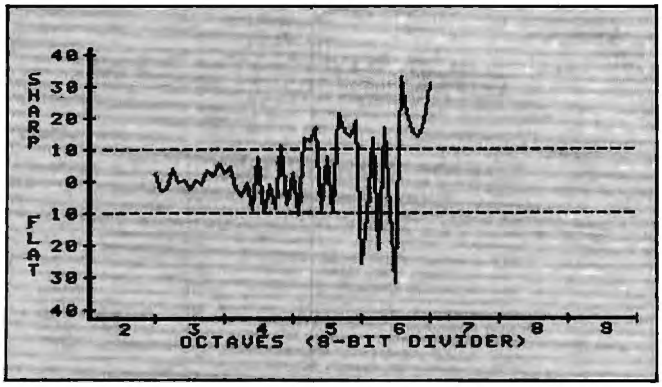

Figure 1: Tuning inaccuracy of musical notes in cents using 8-bit dividers

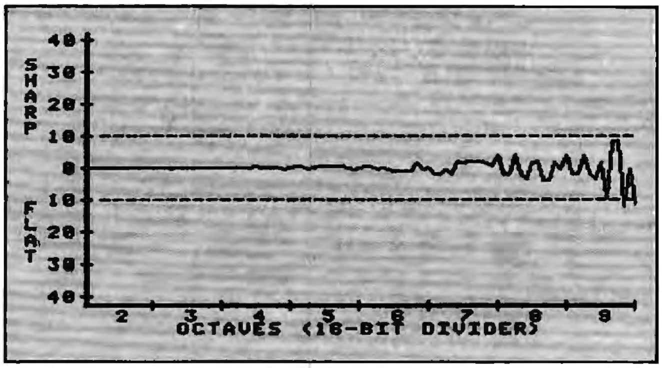

Figure 2: Tuning inaccuracy of musical notes in cents using 16-bit dividers

Program 1.

```
20000 REM 16-BIT SOUND ROUTINE 1
20010 REM
20020 REM 1 16-BIT & 2 8-BIT VOICES
20030 REM
20040 REM X=USR(ADR(HF1$),N1,V1,N2,V2
      ,N3,V3)
20050 REM
20100 SOUND 0,0,0,0:X=64+16:POKE 5376
      8,X
20110 DIM HF1$(56):RESTORE 20140
20120 FOR I=1 TO 56:READ X:HF1$(I,I)=
      CHR$(X):NEXT I
20130 RETURN
20140 DATA 104,170,104,141,2,210,104,
      141,0,210,104,104,41,15,9,160,1
      41,3,210
20150 DATA 224,2,240,32,104,104,141,4
      ,210,104,104,41,15,9,160,141,5,
      210
20160 DATA 224,4,240,14,104,104,141,6
      ,210,104,104,41,15,9,160,141,7,
      210,96
```

Program 2.

```
20000 REM 16-BIT SOUND ROUTINE 2
20010 REM
20020 REM 2 16-BIT VOICES
20030 REM
20040 REM X=USR(ADR(HF2$),N1,V1,N2,V2
      )
```

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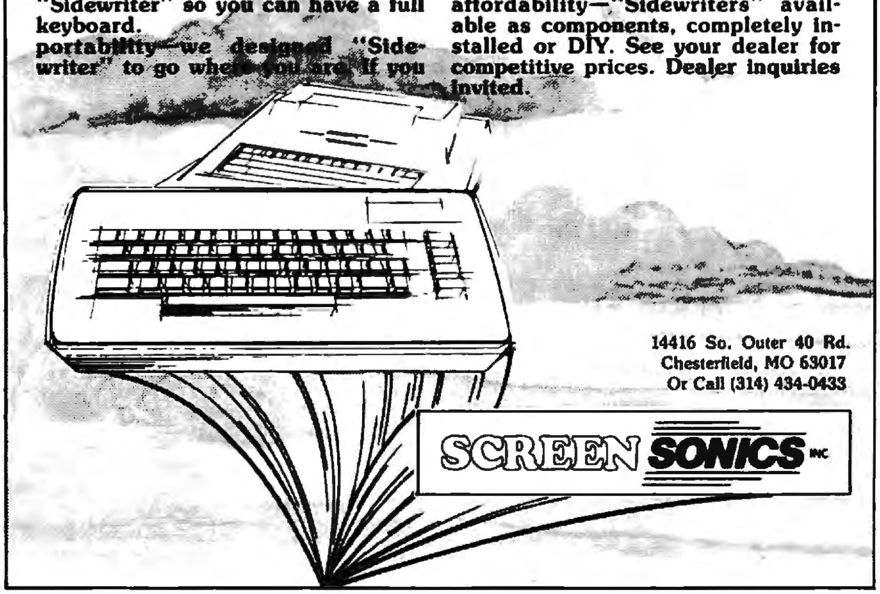

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```
20050 REM
20100 SOUND 0,0,0,0:X=(64+16)+(32+8):
      POKE 53768,X
20110 DIM HF2$(41):RESTORE 20140
20120 FOR I=1 TO 41:READ X:HF2$(I,I)=
      CHR$(X):NEXT I
20130 RETURN
20140 DATA 104,170,104,141,2,210,104,
      141,0,210,104,104,41,15,9,160,1
      41,3,210
20150 DATA 224,2,240,17
20160 DATA 104,141,6,210,104,141,4,21
      0,104,104,41,15,9,160,141,7,210
      ,96
```

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Custom Catalog

G J Vullings

For Apples with DOS 3.2.1 or 3.3, all memory sizes, this program lets you create customized directory headers, with inverse or normal input.

Have you ever wished to personalize your disks, identify the theme of a series of programs on a disk, or just improve the appearance of the directory as it appears on the screen after a CATALOG command? "Custom Catalog" will allow you these prerogatives and more by creating seven "bogus" files at the top of the directory. These bogus files will serve as a header to the disk's directory, displaying contents, ownership, DOS version, or whatever you wish.

The program is designed to run in either a DOS 3.2.1 or 3.3 environment. It will, additionally, permit either inverse or normal input and will allow toggling between the two input states. These features make possible directories with content and artistry.

Your Choice Of Input Types

The program should be used only with newly-initialized diskettes since it will occupy the first seven entries in the directory. Thus, if the program is used with established diskettes, the first seven programs will become inaccessible. To implement Custom Catalog, initialize a diskette the normal way and then delete the "HELLO" program. Run Custom Catalog and, when prompted, insert the diskette to be customized.

You have an initial choice of input states (normal or inverse) and may then design seven lines of 23 characters each (any except for control characters) to represent your identifying remarks or messages. The program sets aside a buffer of 256 bytes in high memory, using the input/output block at decimal location 896. There it stores the last sector of the directory track, which is normally track 17, sector 12 or sector 15, depending on the DOS version.

Each directory entry occupies 35 bytes. The first two represent the track and sector of the track/sector list (header). These we will direct towards an empty sector, namely track 17 (in most cases), sector one. The third byte represents the file type. Here we will use "00" to indicate an unlocked text file. The next 30 bytes represent the file name. We will make the first seven bytes backspaces to eliminate the "t" (for text) and the sector count from the display. The remaining 23 bytes may be anything of your choosing (normal or inverse). The 34th byte is the file length. This we set to "00" and the last byte is the end marker, which is also normally "00".

We now alter the entries in the buffer, but one problem remains. The output for the directory listing is via the COUT routine at $FDED using screen ASCII values, but keyboard ASCII values which we entered are in a different range. We can translate these values listing logical variables (one of the least used, yet very powerful, variable types). See page 15 of the *Apple Reference Manual* for screen ASCII values for both normal and inverse display. After altering the buffer, the revised version is written back to the disk.

Using a similar technique, track 2, sector 2 is then read into the buffer and the DISK VOLUME message which occupies the 176th to 186th bytes, inclusive, may be optionally changed.

A typical directory header might look like the following example:

```
&&&&&&&&&&&&&&&&&&&&&&&
& APPLE II - DOS 3.3  &
&   DISK UTILITIES    &
&    JANUARY 1983     &
&PROP. OF G.J.VULLINGS&
&&&&&&&&&&&&&&&&&&&&&&&
```

The above looks especially attractive in inverse mode. A hint: if the seventh line is left blank, a natural break is formed to separate the header from the rest of the directory.

Both backspace and forwardspace editing are implemented and work normally, with a few enhancements (because of the two modes of input). The only exception to normal implementation is that you cannot backspace beyond the first column (column numbers are provided to make centering easier). Therefore, pressing "RETURN" or typing past column 23 is final.

After the seventh line is entered, you are given the choice of accepting or rejecting the header that you have constructed. If you reject it, the procedure will begin again. Rejecting headers will give practice in obtaining a result which is aesthetically pleasing. If, on the other hand, you accept the header, it will be permanently written to the disk. The choice will then be offered to change the DISK VOLUME message to any 11 (or fewer) characters of your choice.

You can create additional custom entries using the method in this program, or you might want flashing entries, which you can get by translating to the required ASCII values. Have fun experimenting, and happy customizing.

How It Works

LINES

30-220 – the input routine, which allows input in two modes as well as forwardspace and backspace editing.

250-260 – translate keyboard ASCII into screen ASCII and store into disk buffer.

280-290 – toggle input status.

310-330 – backspace edit routine.

350-390 – forwardspace edit routine. Translate screen ASCII to keyboard ASCII.

410-450 – point each of the "bogus" header files to empty track 17, sector 1; declare each file to be of type "text-unlocked" of length zero; and set the end marker.

470 – inputs a series of seven backspaces into the filenames so that the lock indicator, file type, and sector count do not appear on screen.

480 – checks the memory size of your Apple and sets up a disk buffer, making the program virtually memory-size independent.

500-570 – organize screen display.

590-620 – set HIMEM: to protect the buffer and also initialize the variables.

640-670 – use track 17, sector 0, to find the directory, thus making it possible to use the program with either DOS 3.2.1 or 3.3, or even with disks having directories on tracks other than track 17.

680-800 – main routine.

820-840 – write the catalog header to the disk.

860-920 – change DISK VOLUME message.

940-990 – finishing touches.

1020-1040 – set up the input/output block for the Read Write Track Sector routine.

```
5  TEXT : HOME : ONERR  GOTO 1000
10  GOTO 480
20  REM   ***.INPUT ROUTINE.***
30  FOR I = 0 TO 6
40  VTAB VTB + I: HTAB HTB
50 CN = 1
60  INVERSE
70  IF  NOT INV THEN  NORMAL
80  GET CH$: IF CH$ <  >  CHR$ (13) THEN 110

90  IF CN > 23 THEN 200
100  FOR Z = CN TO 23:CH$ = " ": PRINT CH$;:
      GOSUB 250:CN = CN + 1: NEXT : GOTO 200

110  IF CH$ =  CHR$ (27) THEN  GOSUB 270: GOTO
     60
120  IF CH$ =  CHR$ (8) THEN  GOSUB 300: GOTO
     60
130  IF CN > 23 THEN 200
140  IF CH$ =  CHR$ (21) THEN  GOSUB 340: GOTO
     160
150  IF  ASC (CH$) < 32 THEN 60
160  PRINT CH$;
170  GOSUB 250
180 CN = CN + 1
190  GOTO 60
200  GOSUB 460
210  GOSUB 400
220  NEXT
230  RETURN
240  REM   ***.SCRN ASC INTO BUFFER.***
250  IF  ASC (CH$) >  = 32 AND  ASC (CH$) <
     64 THEN  POKE BFR + I * 35 + 10 + CN, ASC
     (CH$) + ( NOT INV > 0) * 128: RETURN
260  POKE BFR + I * 35 + 10 + CN, ASC (CH$) -
     (INV > 0) * 64 + ( NOT INV > 0) * 128: RETURN
270  REM   ***.CHANGE INPUT STATE.***
280  IF INV THEN INV = 0: RETURN
290 INV = 1: RETURN
300  REM   ***.BACKSPACE ROUTINE.***
310 CN = CN - 1: IF CN = 0 THEN  POP : GOTO
     50
320  PRINT CH$;
330  RETURN
340  REM   ***.FORWARD SPACE ROUTINE.***
350 ASKII =  PEEK ( PEEK (40) + 256 *  PEEK
     (41) +  PEEK (36))
360  IF ASKII < 32 THEN CH$ =  CHR$ (ASKII +
     64): RETURN
370  IF ASKII < 64 THEN CH$ =  CHR$ (ASKII):
      RETURN
390 CH$ =  CHR$ (ASKII - 128): RETURN
400  REM   ***.PLACE COMMON POINTERS.***

410  POKE BFR + I * 35 + 1,TRK
420  POKE BFR + I * 35 + 2,1
430  POKE BFR + I * 35 + 3,0
440  POKE BFR + I * 35 + 34,0
450  POKE BFR + I * 35 + 35,0: RETURN
460  REM   ***.PUT BKSPACES IN DIRECTORY.***

470  FOR M = 4 TO 10: POKE BFR + I * 35 + M,
     136: NEXT : RETURN
475  REM   ***.SET DISK BUFFER.***
480 BL =  PEEK (115):BH =  PEEK (116) - 1:BU
     FR = BL + BH * 256
490  REM    ***.INITIALIZE SCREEN.***
500  TEXT : HOME : VTAB 2: INVERSE : FOR I =
     1 TO 40: PRINT "=";: NEXT
510  PRINT "=       APPLE II CATALOG CUSTOMIZ
     ER      =";
520  PRINT "=";
530  FOR I = 1 TO 38: PRINT " ";: NEXT
540  PRINT "=";
550  PRINT "=                "; NORMAL : PRINT
     "BY G.J. VULLINGS";: INVERSE : PRINT "
            =";
560  FOR I = 1 TO 40: PRINT "=";: NEXT : NORMAL

570  POKE 34,6
580  REM   ***.INITIALIZE VARIABLES.***
590  HIMEM: BUFR:IOB = 904:ITRK = IOB + 4:IS
     ECT = IOB + 5:IBUFP = IOB + 8:ICMD = IO
     B + 12:ST = IOB + 13:RWTS = 896:D$ =  CHR$
     (13) +  CHR$ (4):RD = 1:WRT = 2:BFR = B
     UFR + 10
600  GOSUB 1020: POKE IBUFP,BL: POKE IBUFP +
     1,BH
610  HOME : VTAB 20: PRINT "INSERT DISK TO B
     E CUSTOMIZED"
620  VTAB 22: PRINT "THEN PRESS ";: INVERSE
     : PRINT " RETURN ";: NORMAL : GET Z$: PRINT
     Z$
630  REM   ***.READ CATALOG INTO BUFFER.***

640 TRK = 17:SECTR = 0
650  POKE ITRK,TRK: POKE ISECT,SECTR: POKE I
     CMD,RD: CALL RWTS
660 TRK =  PEEK (BUFR + 1):SECTR =  PEEK (BU
     FR + 2)
670  POKE ITRK,TRK: POKE ISECT,SECTR: CALL R
     WTS
```

```
675  REM   ***.MAIN ROUTINE.***
680  HOME : VTAB 20: PRINT "(I)NVERSE OR (N)
     ORMAL ";: GET A$: PRINT A$:VTB = 12:HTB
      = 8
690 INV = 0
700  IF A$ = "I" THEN INV = 1
710 Z1$ = "00000000011111111112222"
720 Z2$ = "12345678901234567890123"
730  VTAB 10: HTAB HTB: PRINT Z1$: HTAB HTB:
      PRINT Z2$
740 TB = 12: FOR Z = 0 TO 6
750  VTAB TB + Z: HTAB 7: PRINT "+";: IF INV
      THEN  INVERSE
760  FOR J = 1 TO 23: PRINT " ";: NEXT : NORMAL
     : PRINT "+"
770  NEXT
780  VTAB 20: CALL  - 958: HTAB 5: PRINT "IN
     PUT LINES OF CUSTOM CATALOG"
790  VTAB 22: PRINT " PRESS ";: INVERSE : PRINT
     " ESC ";: NORMAL : PRINT " TO CHANGE DI
     SPLAY STATUS"
800  GOSUB 30: NORMAL
810  REM   ***.WRITE SECTOR TO DISK.***
820  PRINT : VTAB 20: CALL  - 958: PRINT "IS
      THIS WHAT YOU WANT? (Y/N) ";: GET ZZ$:
      PRINT ZZ$
830  IF ZZ$ = "N" THEN 680
840  POKE ICMD,WR: CALL RWTS
850  REM   ***.CHANGE DISK VOLUME.***
860  PRINT : PRINT "IS ";: INVERSE : PRINT "
      DISK VOLUME ";:: NORMAL : PRINT " TO B
     E REPLACED? (Y/N) ";: GET Z$: PRINT Z$
870  IF Z$ <  > "Y" THEN 930
880 TRK = 2:SECTR = 2: POKE ITRK,TRK: POKE I
     SECT,SECTR: POKE ICMD,RD: CALL RWTS
890  INPUT "INPUT 11 CHARACTER HEADER: ";MS$
     :LN =  LEN (MS$): IF LN >  = 11 THEN MS
     $ =  LEFT$ (MS$,11): GOTO 910
900  FOR I = LN + 1 TO 11:MS$ = MS$ + " ": NEXT
910 J = 0: FOR I = BUFR + 176 TO BUFR + 186:
      POKE I, ASC ( MID$ (MS$,11 - J,1)) + 1
     28:J = J + 1: NEXT
920  POKE ICMD,WR: CALL RWTS
930  REM   ***.DISPLAY CATALOG AND FINISH.**
     *
940  HOME : PRINT D$"CATALOGD1"
950  PRINT : PRINT "MORE CUSTOMIZING? (Y/N)
     ";: GET ZZ$: PRINT ZZ$
960  IF ZZ$ = "Y" THEN 610
970  TEXT : HOME : VTAB 10: HTAB 11: FLASH :
      PRINT " SEE YA' LATER!! ": NORMAL
980  VTAB 23: END
990  RETURN
1000  HOME : PRINT "***.ERROR.***": END
1010  REM   ***.SET-UP IOB.***
1020  FOR I = 1 TO 25: READ I%: POKE 896 + I
      - 1,I%: NEXT I: RETURN
1030  DATA  160,136,169,3,32,181,183,96,1,96
     ,1,0,17,15,251,183,0,128,0,0
1040  DATA  2,2,254,96,1,59,236,236,59,59,23
     6,236,59,27,236,28,29,30,236,236
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VIC Tracing Disassembler

Peter Busby

Here's a handy tool to let you look at machine language programs – those in your VIC BASIC ROM chips, programs you've typed in from **COMPUTE!**, *or some you've written yourself. If you don't know machine language, seeing it and watching how fast it executes might tempt you to learn more about it.*

This article also describes how to adapt a special cassette technique to the VIC.

What is a disassembler? It is a program which looks at the machine code in memory, RAM or ROM, and prints the hexadecimal and decimal values or, more importantly, translates the hex code into 6502 mnemonics. These abbreviated words describe what the microprocessor is doing at that point in the machine language program being disassembled.

Why use a disassembler? Suppose you have Louis Sander's article on PET tape header machine language programs (**COMPUTE!**, July 1981, #14), which you wish to utilize with your computer. You would use the disassembler to discover how your computer handles tape headers and SAVEs. Hardly a week passes that I do not spend some time exploring the operating system.

The addressing modes are:

\# – Immediate
Z – Zero Page
-A – Accumulator
(X) – Indexed Indirect
(Y) – Indirect Indexed
Z,X
Z,Y – Zero Page Indexed
,X
,Y – Absolute Indexed
(I) – Indirect

No mode indicated represents either Absolute Addressing or an implied or relative operation. The addresses are shown first in hexadecimal, then in decimal, notation.

When disassembling, it is often convenient to jot down the mnemonics and assign descriptive labels to the branch targets and subroutine locations. At first these will be no more than "A", "B", etc.; but, as the purpose of each part becomes clear, the names evolve to "CHRGET", "SCNKEY", etc. Those of you with printers may wish to add a subroutine to print to hard copy.

As you work through a program, you may occasionally find "ILLEGAL" opcodes or perhaps misleading ones, particularly between subroutines. You have to follow the logic of the routines so that these traps do not prevent easy decoding. There may also be bytes of data interspersed with the program.

No one minds if you look at and disassemble a routine in order to decipher its workings and access points. If you discover that the routine you need is at $E165, by all means have your program go SYS 57701 and use the routine. On the other hand, you may not distribute any portion of copyrighted material, even with the (variable) names changed, without written permission. This program is intended only to explore the workings of your computer or to verify the assembly of your own programs.

Here's how to adapt the tape header machine language program ("MLP") routine to the VIC-20. Develop your MLP according to the precepts in Louis Sander's article. Prepare to load the program whose header you are using; place its title somewhere in RAM above the program (I use $333F on), and follow it immediately with the MLP. Generally, the title would be 16 characters and blanks and the MLP up to 171 bytes. With your monitor, display the six registers starting at $00B7 and place these values:

$ 00B7 – length of MLP + 16 for the title
00B8 – 0
00B9 – 0
00BA – 1
00BB
00BC – address of first byte of title, low byte first (e.g., 00BB - 3F;00BC - 33)

Now enter .G E156. Presto! Your program title and MLP, when LOADed, will start at $033F.

The VIC Disassembler will handle more than 10 subroutine levels with two adjustments that, however, do use extra memory: at the end of Line 520 may be added:

:DIM RE(99)

or however many you desire; also place this figure inside the parentheses in Line 280:

(SR<99)

or whatever.

```
10 PRINT"{CLEAR}  6502 DISASSEMBLER"
20 GOSUB520
30 PRINT:PRINTSE$"ELP   "RIGHT$(STR$(SR),2
   );:GOSUB70
40 GOSUB80:FORI=1TO12:IFA$<>MID$(SE$,I,1)
   THENNEXT:GOTO40
50 PRINT"                           ";:GOSUB70
60 MODE$="   ":LI=PA:ONIGOSUB220,220,200,
   630,210,180,580,999,170,190,220,6
   00:GOTO30
70 FORJ=0TO18:PRINTCHR$(157);:NEXT:RETURN
   :REM CURSOR LEFT'S - APPLE USE CH
   R$(8)
80 POKE198,0:WAIT198,1:GETA$:RETURN:REM A
```

```
     PPLE USE GETA$:ON-(A$="")GOTO80:R
     ETURN
90 J=3+2*(A<LI):K=16
100 A%=A+HI*(A>H):AD$="":FORI=0TOJ:AD$=AD$
     +MID$(H$,(A%/K↑(J-I)AND(K-1))+1,1
     ):NEXT:RETURN
110 AD=0:FORL=1TOR:GOSUB260:A=PEEK(X):AD=A
     D+A*PA↑(L-1):GOSUB90:MN$=AD$+LEFT
     $(MN$,2):NEXT
120 RETURN
130 J=10:A=0:K=A:L=5
140 GOSUB80:IFK=0THENIFA$="$"ORA$="%"THENP
     RINTA$;:K=1:J=16:IFA$="%"THENJ=2:
     L=9
150 ON-(A$=CHR$(13))GOTO120:FORI=1TOJ:IFA$
     <>MID$(H$,I,1)THENNEXT:GOTO140
160 PRINTA$;:A=A*J+I-1:K=K+1:ON-(K<L)GOTO1
     40:RETURN
170 GOSUB290:X=Y-3:GOTO220
180 R=-1:X=Z:GOTO220
190 Y=BR:FL=0:IFR=-1THENX=X+2*(X>1):GOTO22
     0
200 IFFLAG<4THENONFLGOSUB270,280,290:Z=Y
210 X=Z:R=0
220 Z=X:A=X:LIMIT=0:GOSUB90:LI=PA:PRINTAD$
     "  ";:A=PEEK(X):IFR>-1THENGOSUB300
230 IFR=-1THENGOSUB90:PRINTAD$;A;IL$;:GOTO
     260
240 PRINTMN$;MO$" ";IL$;:MN$="    "
245 IF FL=1 THEN GOSUB 110:LI=0:A=Y:GOSUB ~
     90:LI=PA:PRINT MN$" "AD$;:GOTO 26
     0
250 IFRTHENGOSUB110:PRINTBS$(R);MN$;AD;BS$
     (R);
260 IL$="":X=X-(X<HI-1):RETURN
270 BRANCH=X-2:RETURN
280 SRTN=SR-(SR<10):RETURN
290 SR=SR+(SR>0):Y=RE(SR):RETURN
300 R=0:FL=4:ONAAND3GOTO430,450,460:ONFNA(
     4)GOTO370:MN$=MID$(ZE$,(AAND248)/
     8*3+1,3)
310 IF(AAND31)=16THENR=1:Y=PEEK(X+1):Y=X+2
     +Y-2*(YAND128):FL=1
320 ON-((AAND31)>0)GOTO120:ONFNA(128)GOTO3
     40:ONFNA(32)GOTO350
330 IL$="                END OF ROUTINE":RETUR
     N
340 ON-(A=128)GOTO460:R=1:MO$=" # ":RETURN
350 ONFNA(64)GOTO360:R=2:Y=FNX(0):RE(SR)=X
     +3:FL=2:RETURN
360 FL=3:ON-(SR=0)GOTO330:RETURN
370 ONFNA(128)GOTO410:IF(AAND247)=36THENMN
     $="BIT":GOTO420
380 ON-((AAND223)<>76)GOTO460:R=2:FL=0:MN$
     ="JMP":Y=FNX(0)
390 IFA=108THENMO$="(I)":Y=PEEK(Y)+PEEK(Y+
     1)*PA
400 RETURN
410 MN$=MID$(ZE$,(AAND224)/8*3+1,3):IF(AAN
     D80)=80ORA=156THEN460
420 MO$=MID$(MD$,(AAND28)/4*3+1,3):R=1-((A
     AND31)=25)-((AAND15)>11):RETURN
430 GOSUB420
440 MN$=MID$(OP$(AAND3),(AAND224)/32*3+1,3
     ):ON-(A=137)GOTO460:RETURN
450 ONFNA(4)GOTO500:ONFNA(8)GOTO470:MO$=" ~
     # ":R=1:IFA=162THEN440
460 R=-1:IL$="ILLEGAL":RETURN
470 ONFNA(16)GOTO490:ONFNA(128)GOTO480:MO$
     ="-A ":GOTO440
480 MN$=MID$(TW$,(AAND96)/32*3+1,3):RETURN
490 ON-((AAND208)<>144)GOTO460:MN$="TSX":O
     NFNA(32)GOTO120:MN$="TXS":RETURN
500 GOSUB430:ON-((AAND208)<>144)GOTO120:ON
     FNA(8)GOTO510:MO$="Z,Y":RETURN
510 ON-(A=158)GOTO460:MO$=",Y ":RETURN
520 H$="0123456789ABCDEF":SELECT$=" ABCDEN
     QRU H"
530 ZERO$="BRKPHPBPLCLCJSRPLPBMISECRTIPHAB
     VCCLIRTSPLABVSSEI"
540 ZE$=ZE$+"STYDEYBCCTYALDYTAYBCSCLVCPYIN
     YBNECLDCPXINXBEQSED"
550 OP$(1)="ORAANDEORADCSTALDACMPSBC":OP$(
     2)="ASLROLLSRRORSTXLDXDECINC"
560 MD$="(X) Z  #    (Y)Z,X,Y ,X ":TWO$="T
     XATAXDEXNOP":BS$(2)=CHR$(157):REM
      CURSOR LEFT
570 HI=65536:H=32767:PAGE=256:DEFFNX(A)=PE
     EK(X+1)+PEEK(X+2)*PA:DEFFNA(B)=(A
     ANDB)/B
580 PRINT"ENTER STARTING ADDRESS (PREFIX '
     $' FOR HEX)":GOSUB130
590 X=A*-(A<HI):Z=X:BR=X:RE(0)=X+3
600 PRINT:PRINT" A-DVANCE ONE STEP     B-R
     ANCH/GO SUBROUTINE C-ONVERT BASES
610 PRINT" D-ISASSEMBLE CODES    E-XAMINE ~
     ADDRESSES    N-EW START ADDRESS  ~
       Q-UIT
620 PRINT" R-ETURN SUBROUTINE    U-NBRANCH
     /BACKSTEP UP  (SUBROUTINE LEVEL)"
     :RETURN
630 PRINT"ENTER NUMBER (PREFIX  '$'=HEX, '
     %'=BINARY)":GOSUB130
640 PRINT:IFA>HI-1THENPRINT"OUT OF RANGE";
     :RETURN
650 GOSUB90:IFA>255THENPRINT"$"AD$;A;:RETU
     RN
660 PRINT"$"AD$" %";:K=2:J=7:GOSUB100:PRIN
     TAD$;A;:RETURN
999 END
```

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ZX-81/TS-1000 Data Management

George W Miller

The user of the Timex-Sinclair computer can *store and work with data files, even though some commands for handling data are missing. This program can be easily adapted for other kinds of data management too.*

There are no commands for DATA, READ, RESTORE, RIGHT$, LEFT$, and MID$ in Sinclair BASIC. However, there are ways of getting around this lack of data management commands.

The easiest way to store data is in string arrays, using a FOR/NEXT loop to load the array, and using substrings to retrieve the information.

The program here is a file of addresses, but you could use the same method to keep track of membership rosters, records for an amateur radio station, a reference index for keeping track of interesting magazine articles or recipes. I do all these things with it.

The data is saved on tape by the SAVE command and is loaded into the computer for use. However, you don't start the program with RUN.

The RUN command clears all variables, so all that's left is a program with no data. If you do forget and hit RUN, you'll have to stop and reload your program from the tape.

Handy Address File

The "Addfile" program is set up to store 100 names, addresses, and phone numbers, and to search for information by either name or city.

If you have a printer, just add another function, LPRINT, and the appropriate subroutine, and you can have a printout of any addresses you desire.

Type the program into RAM. Try using inverse video on some of the headings to dress up your program a bit.

Notice lines 10-17, the dimension statements. Line 13 sets up an array named N$ which is a two-dimensional array with 100 subscripts for N$, each 30 characters in length. Or you may find it easier to visualize as a block 100 lines long and 30 characters wide in which information can be stored.

In lines 40-46, I'm just being fancy. The Timex-Sinclair Computer can look for headings to execute commands as well as looking the more common way, by checking line numbers.

CHANGE=500 is setting up a change for later; the correction sub-program begins at line 500. Likewise for ENTER=1000, LIST=1500, and SEARCH=2000.

In typing in my program menu, I used inverse letters for my commands. Note that for the stop in line 63, the shifted A is not spelled out.

In the SEARCH routine, we are using substrings to compare the characters stored in the file to the information supplied from the keyboard.

If you don't enter the FAST command, the program will run very slowly as the computer searches sequentially through its memory for the information.

After typing in the program, you're ready to RUN it; this is the *only* time you'll use the command RUN, unless you want to clear the variables to start a new file.

After entering RUN, the computer sets aside space in RAM for the variables, and will initialize the FOR/NEXT loops.

The screen will display the title block, then go to the menu. Enter "E" to go into the Entry Mode.

The program will display the last number used; this number is stored in memory for use in the change mode.

Caution: Narrow String Arrays

Follow the program prompts to enter data into the string arrays. Note that the strings for name and address are only 30 characters wide, so some abbreviation may be necessary. Any extra characters entered will be ignored.

The array for the phone number is 12 characters wide, so an area code can be included.

Zip code, Z$, is only five characters wide. If the postal service goes to the expanded zip code, you'll have to re-dimension this array to store the extra digits.

In line 1115, the computer will ask if you want to make another entry. By answering "N", you will exit the loop, but the number is stored in line 47 by allowing N=L.

Whenever you return to the Entry Mode, the program will pick up at the number where you stopped and then continue to number 100, when the "memory full" message will be displayed.

After entering "Y", you will drop to line 1140, and go back to the start of the loop.

If you notice an error in your data, complete the entry of information called for in the prompts by entering anything; then, when asked for another entry, enter "N". The screen will clear, and the program menu will be displayed.

Enter "C" and go into the Change Mode, which begins with line 500.

The display will ask for the number to change and, after receiving the number, will display the data on file at the top of the screen. Follow the instructions from the computer to reenter your data. Note that you will have to enter all the information for that entry.

After you complete the corrections, the screen will clear, and the menu will be displayed.

Choose Any Function

Now, you can enter "E" and continue making entries to your file, or enter any other function displayed on the menu.

If you'd like to scan your file, enter "L" for list. Be careful – this is the letter "L", not the function list. If you're like me, you'll want to keep entering the function "LIST", which will print as a "K"; the computer will ignore this error and ask for another command.

The screen will now begin to scroll up, displaying the contents of your file. After printing the last data in the file, the display will pause several seconds, and then the display will begin to scroll off, one line at a time. This is annoying, but I couldn't find any way around it after scrolling a long list.

After the screen is cleared, the display will go blank for several seconds, then return to the program menu.

Here's the most interesting feature of the program. Enter "S" to start the Search Mode.

The computer will ask if you'd like to search for a name or for all the names in a given city.

If you're looking for an address, enter the appropriate command from the prompts.

Make sure the spelling is correct. It may be necessary to try several variations if you're not sure of the spelling because the computer will only give you the information stored in the memory if there is a perfect match. For instance, if the name you're looking for is "John Smith" and the computer has "Mr. and Mrs. John R. Smith" stored in memory, the display will indicate "Name Not Found".

City-Wide Search

If you want a listing of all the names and addresses in your file from a given area, enter the CITY SEARCH command, and the computer will print a list of all names in memory in that city.

Again, the list must be exact for the computer to print it, so be consistent with your entries. Don't list Penna. one time and Pa. the next.

If there are more names and addresses than can be displayed on the screen, the program will fill the screen and return the error code 55/2041. After using the displayed information, enter CONT to clear the screen and continue with the listing of data from the memory.

By using subscripts in the arrays, the computer is comparing each character in the key arrays to find the matches. This is why you must be very careful with the data you input to get anything useful in output. If the program fails to run properly, check your input.

In the search mode, the command PAUSE 30000 is used. This holds the display for about nine minutes to give you a chance to use the displayed data. Since you will seldom need nine minutes, just press ENTER when you're finished, and the program menu will be displayed.

After working on your file, return to the program menu, and enter the function STOP (shifted A). The cursor will disappear and an error message will be displayed to indicate a break in the program.

All the data you entered is now stored in the string arrays. Enter LIST, get a display of the program listing, and SAVE in the usual manner; enter SAVE "ADDFILE".

This program takes about seven minutes to LOAD or SAVE, so don't be concerned about the time the screen is flickering.

It is probably worthwhile to save the program twice, for insurance against missing bytes. If the first program fails to load, the second follows immediately; the computer will pick it up.

Then use your file, LOADing in the normal way. However, after getting the 0/0 report, enter LIST, or just GOTO 35. This keeps all your data stored in the variables. If you pressed RUN and ENTER, you'll have to reload the tape to retrieve your data. From the program listing, enter GOTO 35 as shown in line 8.

If you'd like to make changes in the program for other uses, just change the title in the title subroutine to one more appropriate, and change the PRINT statements in the program prompts.

If your file is filled and you need to start a second file, just load the program into RAM, enter RUN to clear the variables, and start a new file, holding your old file on the cassette tape. Change the title blocks to indicate that two files exist, and remember that the information you don't have in one file may exist in the other.

Note: All underlined characters should be entered in *inverse video.*

```
1 REM "ADDFILE"
5 REM  START PROGRAM BY ENTERING GOTO 35
10 DIM L(1)
11 DIM S$(1,30)
12 DIM T$(1,30)
13 DIM N$(100,30)
14 DIM A$(100,30)
15 DIM C$(100,25)
16 DIM P$(100,12)
17 DIM Z$(100,5)
25 LET L=0
30 LET N=0
35 GOTO 5000
40 LET CHANGE=500
42 LET ENTER=1000
44 LET LIST=1500
46 LET SEARCH=2000
```

```
47 LET N=L
49 CLS
50 PRINT AT 0,10;":FUNCTION:"
52 PRINT
54 PRINT TAB 5;"ENTER C FOR CHANGE MODE"
55 PRINT
56 PRINT TAB 5;"ENTER E FOR ENTRY MODE"
57 PRINT
59 PRINT TAB 5;"ENTER L FOR LIST MODE"
60 PRINT
61 PRINT TAB 5;"ENTER S FOR SEARCH MODE"
62 PRINT
63 PRINT TAB 5;"ENTER STOP...TO STOP"
65 INPUT B$
67 IF B$="C" THEN GOTO CHANGE
68 IF B$="E" THEN GOTO ENTER
69 IF B$="L" THEN GOTO LIST
70 IF B$="S" THEN GOTO SEARCH
71 IF B$=" STOP " THEN STOP
75 GOTO 49
113 PRINT
500 CLS
510 PRINT AT 0,12;"CHANGE MODE"
512 PRINT
513 PRINT TAB 5;"ENTER NUMBER TO CHANGE
514 INPUT C
515 CLS
516 PRINT N$(C,1 TO 30)
517 PRINT A$(C,1 TO 30)
518 PRINT C$(C,1 TO 30)
519 PRINT Z$(C,1 TO 5)
520 PRINT P$(C,1 TO 12)
524 PRINT AT 10,5;"ENTER CORRECT NAME"
525 INPUT Y$
530 LET N$(C,1 TO 30)=Y$
535 PRINT AT 10,5;"ENTER CORRECT ADDRESS"
540 INPUT H$
545 LET A$(C,1 TO 30)=H$
550 PRINT AT 10,5;"ENTER CORRECT CITY"
555 INPUT G$
560 LET C$(C,1 TO 25)=G$
562 PRINT AT 10,5;"ENTER CORRECT ZIP CODE"
563 INPUT Z$(C)
564 PRINT AT 10,5;"ENTER CORRECT PHONE NUMBER"
565 INPUT P$(C)
570 GOTO 49
1000 CLS
1010 FOR X=N+1 TO 100
1015 IF X=100 THEN GOTO 1142
1020 LET L=X
1030 CLS
1040 PRINT AT 0,10;"    ENTRY MODE "
1050 PRINT AT 2,10;"LAST ENTRY WAS : ";X-1
1052 PRINT
1055 PRINT "ENTER NAME"
1060 INPUT N$(X)
1070 PRINT
1075 PRINT "ENTER ADDRESS"
1080 INPUT A$(X)
1090 PRINT
1095 PRINT "ENTER CITY"
1100 INPUT C$(X)
1105 PRINT
1107 PRINT "ENTER ZIP CODE"
1108 INPUT Z$(X)
1109 PRINT
1110 PRINT "ENTER PHONE NUMBER"
1111 INPUT P$(X)
1112 PRINT
1115 PRINT "ANOTHER ENTRY?? (Y/N)"
1130 INPUT F$
1138 IF F$<>"Y" THEN GOTO 47
1140 NEXT X
1142 PRINT
1145 PRINT "          LIST FILLED"
1147 PAUSE 200
1150 GOTO 47
1500 CLS
1505 PRINT AT 20,12;"LIST MODE"
1510 FOR V=1 TO L
1515 SCROLL
```

```
1520 PRINT N$(V);V
1521 SCROLL
1522 PRINT A$(V)
1523 SCROLL
1524 PRINT C$(V)
1525 SCROLL
1526 PRINT Z$(V)
1527 SCROLL
1528 PRINT P$(V)
1529 SCROLL
1530 PRINT
1532 NEXT V
1540 PAUSE 200
1550 GOTO 49
2000 CLS
2020 PRINT AT 0,12;"SEARCH MODE"
2021 PRINT
2022 PRINT "SEARCH NAME(N) OR CITY(C)??"
2023 INPUT V$
2033 FAST
2034 IF V$="N" THEN GOTO 2050
2036 PRINT "ENTER CITY AND STATE"
2037 PRINT "NOTE: SPELLING MUST BE EXACT"
2038 INPUT T$(1,1 TO 25)
2039 FOR S=1 TO L
2040 IF C$(S, 1 TO 25)=T$(1,1 TO 25) THEN GOTO
     2160
2041 NEXT S
2042 SLOW
2043 PRINT TAB 5;"     END OF LIST"
2044 PAUSE 30000
2045 GOTO 47
2047 PRINT
2050 PRINT "ENTER NAME FOR SEARCH"
2055 PRINT
2060 INPUT S$(1,1TO 30)
2062 FAST
2063 FOR S=1 TO L
2065 IF N$(S,1 TO 30)=S$(1,1 TO 30 THEN GOTO 21
2070 NEXT S
2100 PRINT
2110 PRINT     ; "NAME NOT FOUND"
2115 PAUSE 30000
2117 SLOW
2120 GOTO 47
2140 PRINT N$(S)
2141 PRINT A$(S)
2142 PRINT C$(S)
2143 PRINT Z$(S)
2144 PRINT P$(S)
2145 SLOW
2146 PAUSE 30000
2150 GOTO 47
2160 PRINT N$(S)
2161 PRINT A$(S)
2162 PRINT C$(S)
2163 PRINT Z$(S)
2164 PRINT P$(S)
2165 GOTO 2041
5000 PRINT "*********************************"
5005 PRINT "*                               *"
5006 PRINT "*                               *"
5007 PRINT "*                               *"
5008 PRINT "*                               *"
5009 PRINT "*                               *"
5010 PRINT "*                               *"
5011 PRINT "*                               *"
5012 PRINT "*********************************"
5013 REM FILE NAME
5015 PRINT AT 4,5;"    ADDRESS FILE"
5020 PAUSE 300
5021 CLS
5022 PRINT "THIS PROGRAM WILL STORE UP TO"
5023 PRINT
5024 PRINT "100 NAMES, ADDRESSES AND PHONE"
5025 PRINT
5026 PRINT "NUMBERS, AND WILL SEARCH BY NAME"
5027 PRINT
5028 PRINT "OR CITY"
5029 PAUSE 500
5030 GOTO 38
```

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Managing Memory: VIC And Atari

Charles Brannon, Editorial Assistant

Properly handling and allocating memory can be quite a challenge. This article, for the VIC and Atari, reveals some of the tricks used to successfully manage your computer's memory.

Programmers often wrangle with limitations and possibilities involving their computer's memory. For one thing, there never seems to be enough of it. If you have a 48K machine, you may never come close to filling it with a BASIC program. But when you start allocating RAM for graphics, or use your 48K for VisiCalc or a word processor, you need all you can get, and then some.

Where Did It Go?

A confusing problem is the discrepancy between memory installed and what you get from PRINT FRE(0). The 5K VIC has 3583 bytes free; the 48K Atari has less than 38K available for BASIC (this varies if you use DOS, or if the RS-232 handler is installed). Where did the missing memory go?

You've probably heard of the *operating system* (OS). It is a series of machine language programs in your computer's ROM that handle such mundane but vital functions as keyboard input, screen display, cassette and disk input/output, and interpreting BASIC code. The OS resides in permanent ROM memory, so it's not included in your RAM memory size. But since it is a program like any other, it needs some RAM for variables and buffers. The OS uses about 1K of low memory (starting from zero) and varying amounts of high memory for screen display.

Going...Going...

For example, the Atari GRAPHICS 0 text screen uses 960 bytes, the VIC's combination text/color map screen uses 1012 bytes. So, on the VIC-20, 5K less 2K gives about 3K. 48K - 2K = 46K on the Atari. Using the BASIC cartridge disables another 8K on the Atari (if you have 48K, since a cartridge "maps" into the same memory range as upper RAM), so we get the approximate figure of 38K. Extensions to the OS, such as the DOS (Disk Operating System), gobble up from 4-9K of memory. And adding software-based languages, such as Atari Microsoft BASIC or BASIC A+, can use from 16-26K more! Whatever's left is yours to use for BASIC programming, variables, arrays, strings, and graphics.

Graphics

Using graphics consumes even more memory. A full character set on the Atari uses 1024 bytes; a full set on the VIC uses 2048 bytes of memory. A full set is required for a VIC-20 hi-res screen. Atari's super hi-resolution screen (and the 16-color GTIA modes) uses almost 8K of RAM. Player/missile graphics uses at least 2K.

Picky Computers

And if that weren't enough, the computer can make life even harder for programmers. The VIC and Atari won't use just any block of RAM you've generously set aside – they're too choosy for that. The graphics chips in the Atari frequently require that the memory be on a 1K, 2K, or 4K boundary (explained later). VIC's requirements are similar.

In addition, the memory we reserve must be protected. Unless we say otherwise, BASIC will probably encroach upon our block of memory. We'll have to lower the "top-of-memory" pointer that tells BASIC or the OS how much memory it has. In effect, we'll fool the computer and reserve some "high memory" for our own purposes. Even this can cause problems, however, and we'll try to document them. Sometimes it's safer to use low memory (discussed later).

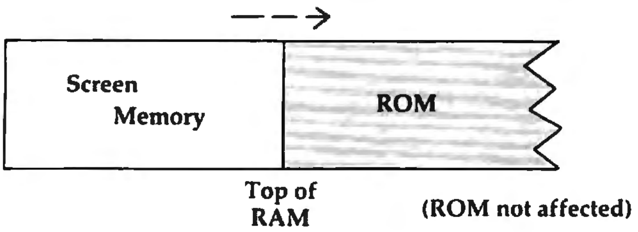
Getting Specific

Let's start with screen memory. This is the area where the text you see on the screen is stored. It can also hold the information required for a high-resolution, multicolor display. Many programmers use POKE, rather than PRINT, to place information directly on the screen. For example, if you enter POKE 7680,1 on a 5K VIC, or POKE 40000,33 on a 48K Atari, an A will appear at the upper left-hand corner of the screen. Using these same POKEs on an expanded VIC or 16K Atari won't work. This is because the screen memory "moves around," depending on the amount of memory installed.

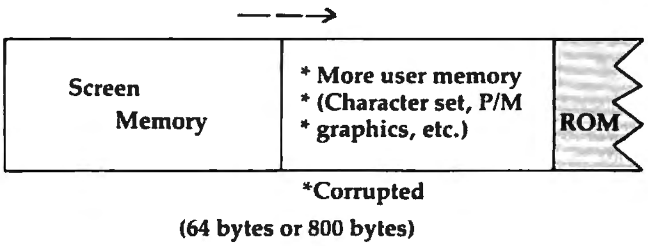
Screen Memory: Atari

The Atari likes to keep its screen at the very top of memory, so that it's side by side with ROM. That way, the screen can be erased with a massive series of zeros. Because of the way the screen clear code is written, it overshoots the end of screen memory. With the screen tucked up next to ROM, it won't matter. ROM is safe from these extra POKEs. But if you have relocated the Atari screen, memory just past the end of screen memory won't be safe. Clearing the screen can erase 64 bytes past the top of screen memory. Scrolling the text window can clear up to 800 bytes.

Screen clears too much:



Screen clears too much:



One solution is to reserve more memory than you need, and position your character set or P/M graphics higher up. You might be able to prevent the screen from scrolling or clearing. To reserve memory, just POKE a new value into RAMTOP (location 106) and re-execute a GRAPHICS statement. For example:

```
POKE 106, PEEK(106)-4:GRAPHICS 0
```

reserves four pages (1K) of high memory. The GRAPHICS command moves the screen and display list below RAMTOP. Everything above RAMTOP is yours. It will not be altered except as noted above. RAMTOP will be restored only by system reset.

You can find out the new address of screen memory with:

```
SCREEN=PEEK(88)+256*PEEK(89)
```

SCREEN will contain the proper address for any memory size. So instead of POKEing directly to locations 40000-40959 on a 48K Atari, use the above code and POKE SCREEN instead. This permits your program to run on any Atari, and the code is even more readable.

Screen Memory: VIC

Text screen memory is at location 7680 on a 5K VIC. This changes when you add memory. To obtain the correct text screen address on any VIC, use:

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

Color memory (normally at 38400) is determined with:

```
COLOUR=37888+4*(PEEK(36866)AND128)
```

Now if you want to manually move the screen, things get more complicated. One use of multiple screens is *page flipping*, where you use two or more views of an object and show them in sequence to provide animation. See Jim Butterfield's "Alternate Screens," in *COMPUTE!'s First Book of VIC*. We've reprinted his dual screen program at the end of this article. Press the F1 key to switch screens.

More Moving Memory

Other areas of memory also change with various memory sizes. Most Atari programs are stored at the same location in low memory, but if you boot DOS, the LOMEMory pointer is bumped up, and BASIC starts higher up (at about $2000). You can determine the start of BASIC on any Atari with:

```
STARTP=PEEK(136)+256*PEEK(137)
```

The VIC is notorious for moving BASIC. On a PET/CBM, BASIC always starts at $0401 (decimal 1025). 5K VICs start at $1001 (decimal 4097). Add 3K of memory (8K total), and it's just like the PET – decimal 1025. But add 8K to a 5K VIC (13K total), and the start of BASIC moves again, this time to 4609 decimal. You can eliminate all the guesswork with:

```
BASIC=PEEK(43)+256*PEEK(44)
```

This information is useful if you're trying to load a VIC program into a PET.

Character Sets: Atari

A character set must be located on a 512 byte boundary. You can even use pages four to six, subject to interference by floating point routines. (*Pages* are blocks of 256 bytes, starting at location zero. Thus, *page* zero would be the addresses from 0-255.) The easiest way is to simply "step back" from the top of RAM, without altering RAMTOP. If you place it behind the display list, but well above BASIC, it will be safe. Large BASIC programs, however, can encroach upon your reserved area. And if you change graphics modes, you must step back past the largest mode used.

The step size has to be a multiple of four for a full 1024-byte character set. You need to step back four pages to get past the screen in modes 0,1,2,3,4 and 5, and then four more to hold your character set, for a total of eight. GRAPHICS 6 would require

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12, GRAPHICS 7 would require 20, and you would need to step back a whopping 36 pages to fit your character set beneath a GRAPHICS 8 display.

A statement like:

```
CHSET=(PEEK(106)-8)*256
```

is most often used. CHSET will hold the starting address where you should POKE your character set, or copy from ROM character set at 57344.

Character Sets: VIC

You have to lower high memory on the VIC to protect a custom character set from BASIC's string storage. The high memory pointer is at location 56. For a small character set, you need to protect two 256-byte *pages* at the top of memory. POKE 56,PEEK(56)-2 protects the RAM. You also have to change BASIC's string pointer. Use these lines:

```
X=PEEK(56)-2:POKE52,X:POKE56,X:
POKE51,PEEK(55):CLR CS=256*PEEK
(52)+PEEK(51)
```

You have to execute CLR to reset BASIC's pointers after you lower high memory. Find the character set area as CS. (Use POKE 36868,255 to tell VIC where the new character set is.) This technique doesn't work on expanded VICs. Instead, you can store a full character set at locations 4096 to 7615 on an expanded VIC if you execute the following series of POKEs:

```
POKE 52,22:POKE 56,22:CLR:POKE
36869,240
```

To use these POKEs with an 8K expander, you'll have to relocate the start of BASIC as well:

```
POKE 44,32:POKE 8192,0:NEW
```

Naturally, the latter code cannot be within a main program. You'll also have to relocate the screen:

```
POKE 36866,150:POKE 648,30:PRINT
CHR$(147);
```

This will set the screen memory to location 7680, just like an unexpanded VIC.

Player/Missile Graphics On Atari

There are two types of P/M graphics: single and double line resolution. Single line resolution requires 2K of RAM: 256 bytes for each player (4 x 256 = 1K), 256 bytes for the missiles, and 768 unused bytes. Single line resolution, which has the vertical "fineness" of GRAPHICS 8 pixels, must start its memory on a 2K boundary (divisible by eight pages).

Double-line resolution, where two bytes are displayed for every byte in the shorter 128-byte player area, uses only 1K. 128 bytes are used for each player, 128 for the missiles, and 384 bytes are wasted. We've reprinted at the end of this article the memory table that pictorially represents this layout. You can easily store a small character set, machine language, or player shapes in the unused area.

If you lower RAMTOP, you have to subtract eight for single-line resolution, and four for double line. If you must fit large GRAPHICS screens (greater than seven) below RAMTOP, you must be sure to lower RAMTOP in 4K blocks. You can also just step back past the existing screen display (without touching RAMTOP). You must step back a multiple of four pages for double line resolution, and a multiple of eight pages for single-line.

To be safe, step back eight pages (or 16 for single-line) from modes 0-6. Go back 16 pages for double / 24 pages for single resolution in GRAPHICS 7, and 36/40 pages for GRAPHICS 8. The same problems apply as with character sets: lowering RAMTOP can cause up to 800 bytes of your protected area to be erased.

An Alternative: Use LOMEM

Let's take a look at another technique for reserving memory on an Atari. Various utilities and extensions (such as large machine language programs) frequently load in at low memory. For example, DOS loads in at $0700. To protect itself, DOS bumps up the low memory pointer to the end of DOS, where BASIC programs will then be stored. You can do the same trick to protect your own area of memory. Pick any point after about $1F00 to store your machine language, character sets, or P/M graphics. Address $2000 is perfect – it's on a 1K, 2K, and 4K boundary.

Before using the low RAM, it must be protected by changing LOMEM, $02E7. After you change LOMEM, you have to re-initialize the machine, so any program in memory will be lost. The best solution is to use a two-part program. Let the first part protect low memory, and then run the second part. For example, let's say you want to protect 2K of memory from $2000. The last byte in the 2K range will be $27FF. To place $2800, the new low memory value into LOMEM, use:

```
POKE 743,0:POKE 744,40:POKE 8,0:A=
USR(40960)
```

POKEing 0 into WARMST ($08) tells the OS to re-initialize, and jumping to address 40960 ($A000) re-executes the cartridge (BASIC). The memory below $2800 is safe from any interference.

Cheer Up

Someday, computers will have unlimited RAM. We already see low-cost 64K and high-end 896K *microcomputers*. Even languages will likely grow larger, becoming faster and easier to use. There

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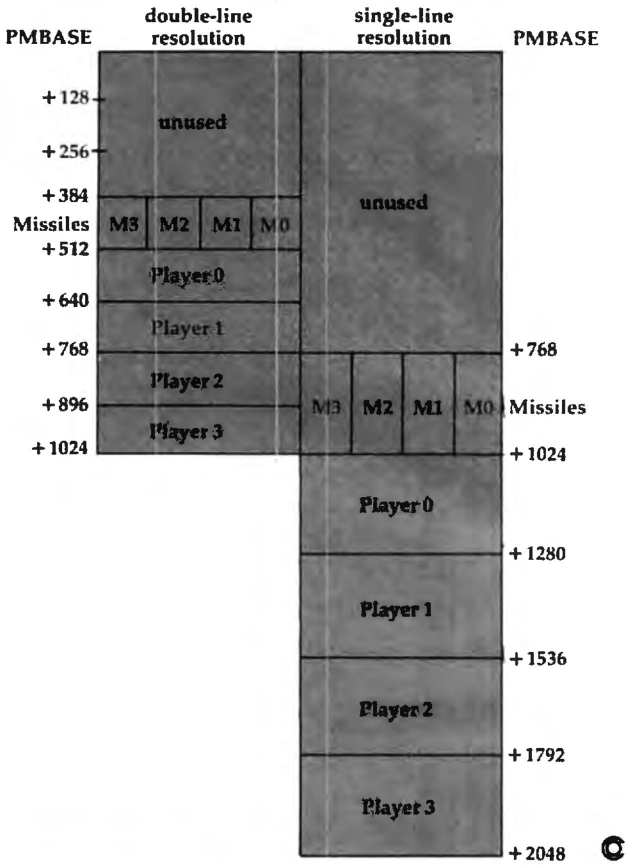
are already languages available for the VIC and Atari that ease the hassle of memory allocation, such as BASIC A+ for Atari, with its built-in P/M graphics commands, and the Super Expander for the VIC, which adds easy high-resolution commands such as CIRCLE and PAINT (adding 3K of RAM as a bonus!). But if you're interested in doing it yourself (and you have to in machine language), I hope these suggestions help.

Page Flipping for VIC

```
100 REMDUAL SCREEN JIM BUTTERFIELD
110 POKE56,28:CLR
120 DIML%(23)
130 GOSUB400:PRINTCHR$(147);GOSUB400
140 Z$=CHR$(133)
200 GETX$:IFX$=Z$THENGOSUB400
210 PRINTX$;:GOTO200
400 REM SWITCH
410 S=PEEK(648)
420 IFS=28THENS=30:T=150:GOTO500
430 IFS=30THENS=28:T=22:GOTO500
440 STOP: REMARK: ERROR
500 POKE648,S:POKE36866,T
510 FORJ=0TO23
520 V=PEEK(J+217):POKEJ+217,L%(J):
530 L%(J)=V
540 NEXTJ
550 PRINT:RETURN
```

Memory Allocation for P/M Graphics

PMBASE must be on 1K boundary for double-line resolution, 2K boundary for single-line resolution.



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Friendly VIC Inputs

Bill Pfeifer

Edit, Scan, and Input are special aids to help you painlessly enter lists or large amounts of information into your VIC. Errors won't result in hours of re-typing if you add Friendly VIC Inputs to your programs.

If you've ever run a lengthy program which required inputting a lot of string variables (such as an inventory sort, phone listing, etc.), you've probably had these experiences: 1. You discovered, halfway through the long list, that you entered one item twice. 2. You accidentally hit the return key twice, thereby entering a null string. 3. You misspelled something. 4. All of the above. Trying to correct these errors before sending the information to a tape or disk file can be tricky. The thought of having to re-do all that typing is most unpleasant. Here are some subroutines that will help take the drudgery out of entering, correcting, and re-entering your data.

Take a few minutes to enter the demo program into your computer. You can eliminate the REM statements to save keystrokes, but don't change the line numbers. Note that lines 310, 450, and 470 have two (2) spaces between the empty quotes, and line 90 has *no* space in the empty quotes. After you have entered the program and checked for errors, type RUN and hit RETURN. Now, let's walk through the program and see what's happening.

Easy Editing

The computer first asks for the number of entries (for our test, let's enter 10) and DIMensions A$ to this figure. We then enter a loop to input our data, using subroutine 310-350 as the INPUT routine (let's enter "THIS IS A TEST TO SEE HOW THE PROGRAM WORKS" – one word for each input prompt). Subroutine 310 looks rather involved for a simple input statement, but we'll see how this routine really shines, later on. After making each entry, we go back to line 90, and the computer checks to see if that entry was the letter E (for EDIT). For input prompt number 4, let's enter TYST and hit RETURN. For entry number 5, enter E and hit RETURN. Now the last entry is an E, and the program will jump to line 210, the EDIT routine.

If we know which entry number we want to correct, we simply enter that number. However, if we forget the number, or if it has scrolled off the screen, we enter 0. In the latter case, the program goes to yet another subroutine, the SCAN routine at line 370. This allows the user to scan up and down the list of data simply by holding down the f7 or f5 FUNCTION keys until the desired entry (along with its associated number) comes on screen. We note the number, hit the f1 key, and enter this number in response to the prompt at line 210.

Armed with this information, the computer counts the number of characters in our selected entry, and tells us to make our changes and hit the RETURN key. Now the power of the INPUT subroutine comes into play. First, the routine prints the entry number, then the entry itself – TYST. Then the cursor is moved BACK to the LEFT of the entry, the input prompt is displayed, and the cursor is left flashing on the first letter of the entry, which is all neatly printed out for us. We need only move the cursor to the trouble spot (the letter Y), make our correction (E), and hit RETURN. The computer's screen editor then accepts the change and replaces the old entry with the new one – and we had to type only one letter! Obviously, this is a great help when dealing with long, complicated strings, and will eliminate the chance of making further errors, since we don't have to re-type the whole entry. Inserts and deletions are perfectly acceptable too, of course.

The computer then asks if we have any more changes to make – if we do, the EDIT routine repeats. If we have no more changes, the E we entered in input number 5 is wiped out, and we are asked for a new entry number 5. The whole input loop continues until all the entries are made, at which point the program goes on with its other chores (sorting, number crunching, filing, etc.). You can check to see if our correction was accepted by entering the following line in direct mode:

```
FOR I=1 TO N: PRINT A$(I);: PRINT " ";: NEXT I
```

Changing Input Prompts

These subroutines can be called from any place in the program, but keep in mind that the cursor positioning in the INPUT routine works from the character count of the specified (or last used) entry. To get "new" input prompts, you must initialize


+90
180
0
-90
SCANNERS
COMMAND?
K EGY DMG
YEARS
KLINGONS
TORPEDOS

A$(I) and CH, as shown in line 90, or you may get funny-looking prompts. E is given the value of I because the INPUT subroutine uses both the original loop (line 90) and the EDIT routine (line 210) as sources for printing the input prompt.

A sample application: you might want to use the sample program pretty much as is when initially entering your data. You then might re-scan all the entries to check for omissions and typos, then sort the data and scan once again. Now any duplications will be readily apparent (right next to each other), and you can make further corrections (using the INPUT routine) as required, and re-sort, if desired. You then may file or print out the results – one time, with all your corrections made, thanks to the help of the powerful screen editor of the computer.

One final note – on my VIC, the SCAN routine sometimes works only partially (the scan continues only when the f7 or f5 key is re-pressed). This happens only when I've entered a large number of strings and I don't have one of the RAM cartridges inserted. Apparently, the VIC needs lots of elbow room to juggle the strings around during the SCAN routine. Don't worry, though; if this happens, simply press and hold the function key again, and another batch of strings will come up on the screen.

```
10 REM INPUT WITH SCREEN EDIT DEMO
50 PRINT"{CLEAR}HOW MANY ENTRIES":INPUT"W
   ILL YOU BE MAKING";N:DIMA$(N):PRINT
70 FORI=1TON
90 A$(I)="":E=I:CH=O:GOSUB310:IFA$(I)="E"
   THENGOSUB210
110 PRINT:NEXTI:GOSUB130:END:REM CONTINUE
    W/MAIN PROGRAM
130 PRINT:PRINT"MORE CHANGES (Y/N)?":Y$=""
150 GETY$:IFY$=""THEN150
170 IFY$="Y"THEN210
190 IFY$="N"THENI=I-1:RETURN
210 PRINT:PRINT"TITLE# (IF UNKNOWN,":INPUT
    "ENTER 0)";E
230 IFE=0THENGOSUB370:GOTO210
250 PRINT:PRINT"CHANGE ENTRY & {REV}RETURN
    {OFF}":CH=LEN(A$(E))
270 PRINT:GOSUB310
290 PRINT:PRINT:S=0:E=0:GOSUB130:RETURN
310 PRINT"ENTRY#"E;:PRINT"  ";:PRINTA$(E);

330 FORK=1TO(CH+2):PRINT"{LEFT}";:NEXTK
350 INPUTA$(E):RETURN
370 PRINT:PRINT"HIT F7 KEY TO SCAN UP.":PR
    INT"HIT F5 KEY TO REVERSE."
390 PRINT"HIT F1 KEY TO STOP.":S=1:POKE650
    ,128
410 E$="":PRINT
430 GETE$:IFE$=""THEN430
450 IFPEEK(197)=63THENPRINTS"  ";:PRINTA$(
    S):S=S+1:IFS=N+1THENS=1
470 IFPEEK(197)=55THENPRINTS"  ";:PRINTA$(
    S):S=S-1:IFS<1THENS=N
490 IFPEEK(197)=39THENPOKE650,0:RETURN
510 GOTO410
```

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The Commodore™ Gazette

The Monthly User's Guide for VIC-20™ and 64™ Personal Computers

The Commodore™ Gazette, a monthly publication of **COMPUTE!** Publications, is a layman's guide to consumer computing. Written for beginning and intermediate level owners and users of the Commodore VIC-20 and 64 computers. Regular features include best seller lists for recreational and educational software, reviews, new products, tutorials on home and educational applications, and much more. Written for entertainment as well as teaching, *The Commodore™ Gazette*, while appealing to users wishing to learn more about programming and computers, has continuing appeal for those who simply want to obtain maximum use from their computers in a non-technical way.

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PETterns

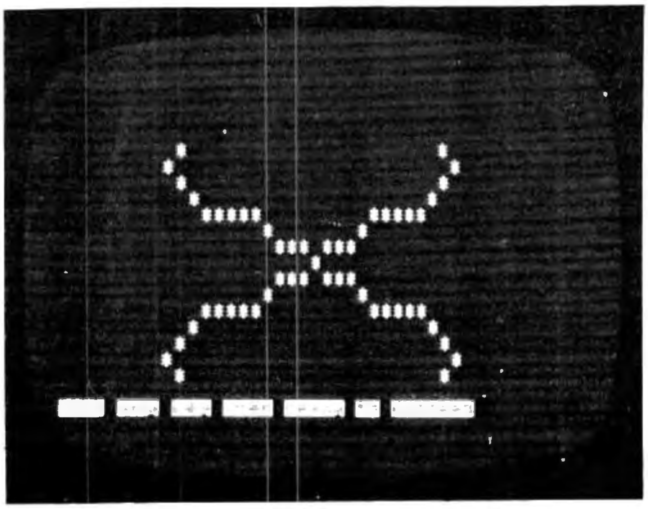
Bruce Shawyer

For PET/CBM's with 40-column screens, "PETterns" creates patterns, rotates and reflects them, and can be used to introduce mathematical concepts to students. Although the program can use the Commodore 2022 printer for hardcopy, it will also work with most other printers.

"PETterns" will create patterns on the screen, rotate them, and reflect them. For any created pattern, the user can print it as it was created, print its rotation through 90°, 180°, or 270°, print its reflection in the positive diagonal line (its inverse), or print the rotations of the inverse. Certain combinations of these can be obtained directly in order to create pretty patterns.

The program is useful in introducing students to group theory, for the basis of the program is the group of symmetries of the reflections and rotations of the square (the dihedral group). This group has two generators, but they are, of course, not unique. For the first, I chose the rotation through 90° in the positive (counterclockwise) sense. For the other, I chose the reflection in the positive diagonal line (the line Y = X).

The other group operations are done within the program by calling the appropriate combinations of the generators. Thus they are slightly slower. I chose the second generator because it gives the inverse relation to the relation created, and so is useful in illustrating, for example, that the inverse of a function is not necessarily a function.



A crystalline shape begins to form in "PETterns."

The program given here is designed for a 40-column screen PET and uses the alternate character set. For reasons of symmetry, patterns of 39-columns by 25-rows are allowed. This permits the right-hand column to be reserved for a set of prompts to the set of input codes.

Patterns start at the center of the screen. This point is the origin for the X- and Y-axes. A symbol, initially a "*", will appear at this point. To print the next point, use the numeric key-pad in the conventional way. "5" is the center. The other non-zero digits are used to enter the direction for the next point to be printed. For example, entering "9" results in the next point printed being in a *north-east* direction from the previous point.

7	8	9
4	*	6
1	2	3

There are also five codes which allow combinations of the above to be printed. These codes are "a", "b", "c", "d" and "e".

Code "a" prints the original pattern together with reflections as if the X- and Y-axes were mirrors. That is, we have p, S, t and F.

Code "b" prints the inverse of the pattern together with reflections as if the X- and Y-axes were mirrors. That is, we have P, s, T and f.

Code "c" prints the original pattern together with its rotations. That is, we have p, s, t and f.

Code "d" prints the inverse of the pattern together with its rotations. That is, we have P, S, T and F.

Code "e" prints everything, that is, all eight possible positions.

There are two codes not appearing in the prompt column. The first is "h". This stands for "cHange the symbol". When you hit "h", the right-hand column is replaced by a list of symbols. Each has a number beneath it. By hitting the number that appears below a symbol, you cause that symbol to be the next printed in the patterns. This new symbol will continue until another symbol is selected. Note that "1" is below the blank symbol.

The second code is "v". This stands for "change Vector length". When you hit "v", the right-hand column is replaced by the words "CHANGE VECTOR LENGTH"; beneath them is the length of the present vector. When you hit a non-zero number, a new vector length is entered. When a new point is next entered, it will be repeated the number of times of the length of the vector.

Here is a list of other codes appearing in the prompt column, with an explanation of their effects:

CODE	EFFECT	
q	QUIT	- terminates the program.
r	RUN	- restarts the program for a new pattern.
n	NOTHING	- clears the screen.
o	OUTPUT	- prints the pattern on the printer. This program is written for a CBM 2022 printer.
p	PRINT	- prints your pattern on the screen.
s	SECOND	- rotates the pattern through 90°.
t	THIRD	- rotates through 180°.
f	FOURTH	- rotates through 270°.
P	(Shift)p	- reflects the pattern in the positive diagonal.
S	(Shift)s	- reflects, then rotates 90°.
T	(Shift)t	- reflects, then rotates 180°.
F	(Shift)f	- reflects, then rotates 270°.

```
10 REM     PETTERNS
11 REM
12 REM
13 REM    *******************************
14 CS=59468:CG=PEEK(CS):POKECS,14:PRINT"{CLEA
   CLEAR}":VL=1:B$=CHR$(1):GOTO77
15 REM    *******************************
16 REM
17 REM     THE ROTATIONS AND INVERSES
18 REM
19 REM    *******************************
20 T=X:X=Y:Y=T:RETURN:INVERSE "P"
21 RETURN: NO CHANGE P
22 T=X:X=-Y:Y=T:RETURN:ROTATE 90' S
23 GOSUB22:GOSUB22:RETURN:ROTATE 180' T
24 GOSUB23:GOSUB22:RETURN:ROTATE 270' F
25 GOSUB20:GOSUB22:RETURN: "S = PS"
26 GOSUB20:GOSUB23:RETURN: "T = PT"
27 GOSUB20:GOSUB24:RETURN: "F = PF"
28 FORC=2TO8STEP2:GOSUB46:NEXT:RETURN:COMB.A
29 FORC=1TO7STEP2:GOSUB46:NEXT:RETURN:COMB.B
30 FORC=2TO5:GOSUB46:NEXT:RETURN:COMB.C
31 C=1:GOSUB46:FORC=6TO8:GOSUB46:NEXT:RETURN:
   COMB.D
32 FORC=1TO8:GOSUB46:NEXT:RETURN:COMB.E
33 REM    *******************************
34 REM
35 REM    PLACING THE POINT ON SCREEN
36 REM
37 REM    *******************************
38 IFABS(X)>19THENX=19*SGN(X)
39 IFABS(Y)>12THENY=12*SGN(Y)
40 POKEOG+X-40*Y,SY:RETURN:PLACE POINT
41 REM    *******************************
42 REM
43 REM     WHICH OPERATION TO BE DONE
44 REM
45 REM    *******************************
46 X=0:Y=0:FORI=0TON:GOSUB55:XX=X:YY=Y
47 ONCGOSUB20,21,22,23,24,25,26,27,28,29,30,3
   1,32
48 IFC>0ANDC<9THENGOSUB38
49 X=XX:Y=YY:NEXT:RETURN
50 REM    *******************************
51 REM
52 REM         VECTOR FOR NEXT POINT
53 REM
54 REM    *******************************
55 IFI=0THENX=0:Y=0:GOSUB38:RETURN
56 V=V(I):IFV<4THENY=Y-1
57 IFV>6THENY=Y+1
58 IFV=2ORV=8THENRETURN
59 IFINT(V/3)*3=VTHENX=X+1:RETURN
60 X=X-1:RETURN
61 REM    *******************************
62 REM
63 REM         OUTPUT TO THE PRINTER
64 REM
65 REM    *******************************
66 OPEN6,4,6:PRINT#6,CHR$(32):OPEN1,4,1:CMD1:
   SC=2^15:FORVY=0TO24:PRINTB$;:FORVX=0T
   O38
67 VZ=SC+VX+40*VY:V=PEEK(VZ):A$=" ":IFV=32THE
   N70
68 FORVZ=2TO26STEP3:IFSY(VZ)<>VTHENNEXT
69 A$=SY$(INT(VZ/3))
70 PRINTA$;:NEXT:PRINT:NEXT
71 PRINT#1:CLOSE1:CLOSE6:RETURN:SCREEN DUMP T
   O PRINTER
72 REM    *******************************
73 REM
74 REM         MAIN PROGRAM - SET UP
75 REM
76 REM    *******************************
77 DIMSY(27),VL(27):FORVX=0TO26:SY(VX)=32:NEX
   T:FORVX=1TO26STEP3
78 SY(VX+2)=50+INT(VX/3):NEXT:SY(23)=160
79 SY(2)=42:SY(5)=43:SY(8)=35:SY(11)=15:SY(14
   )=170:SY(17)=171:SY(20)=91
80 SY$(0)="*":SY$(1)="+":SY$(2)="#":SY$(3)="O
   ":SY$(4)="{REV}*{OFF}":SY$(5)="{REV}+
   {OFF}"
81 SY$(6)="[":SY$(7)="{REV} {OFF}":C$=""
82 VL(0)=32:VL(1)=67:VL(2)=8:VL(3)=1:VL(4)=14
   :VL(5)=7:VL(6)=5:VL(7)=32
83 VL(8)=86:VL(9)=5:VL(10)=3:VL(11)=20:VL(12)
   =15:VL(13)=18:VL(14)=32
84 VL(15)=76:VL(16)=5:VL(17)=14:VL(18)=7:VL(1
   9)=20:VL(20)=8
85 DIMSZ(25):SZ(0)=17:SZ(1)=18:FORSX=2TO4:SZ(
   SX)=12+SX:NEXT:SZ(5)=19:SZ(6)=20
86 SZ(7)=6:SZ(8)=80:SZ(9)=83:SZ(10)=84:SZ(11)
   =70:FORSX=1TO5:SZ(SX+11)=SX:NEXT
87 FORSX=49TO56:SZ(SX-32)=SX:NEXT:FORSX=21TO2
   5:SZ(SX)=SZ(SX)+1:NEXT
88 O=2^15+39:DIMV(500):SY=42:OG=O+460:GOSUB15
   9:GOSUB124
89 X=0:Y=X:I=X:N=X:GOSUB38
90 REM    *******************************
91 REM
92 REM              MAIN PROGRAM
93 REM
94 REM    *******************************
95 GOSUB308:FORII=1TOVL:GOSUB131:C=0:IFV$="5"
   ORV$="0"THEN95
96 V=VAL(V$):IFV=0THEN98
97 N=N+1:I=N:V(I)=V:GOSUB55:GOSUB38:GOSUB124:
   NEXTII:GOTO95
98 IFV$="Q"THENPRINT"{CLEAR}":POKECS,CG:END
99 IFV$="R"THENC$="  AGAIN ?":GOSUB168:GOSUB1
   24:GOTO89
100 IFV$="N"THENPRINT"{CLEAR}":GOSUB124:GOTO95

101 IFV$="H"THENGOSUB141:GOSUB124:GOTO95
102 IFV$="V"THENGOSUB150:GOSUB124:GOTO95
103 IFV$="O"THENGOSUB66:GOSUB124:GOTO95
104 IFV$="P"THENC=2:GOTO117
105 IFV$="P"THENC=1:GOTO117
106 IFV$="S"THENC=3:GOTO117
107 IFV$="T"THENC=4:GOTO117
108 IFV$="F"THENC=5:GOTO117
```

```
109 IFV$="S"THENC=6:GOTO117
110 IFV$="T"THENC=7:GOTO117
111 IFV$="F"THENC=8:GOTO117
112 IFV$="A"THENC=9:GOTO117
113 IFV$="B"THENC=10:GOTO117
114 IFV$="C"THENC=11:GOTO117
115 IFV$="D"THENC=12:GOTO117
116 IFV$="E"THENC=13
117 IFC>0THENGOSUB46
118 GOSUB124:GOTO95
119 REM    ********************************
120 REM
121 REM          R H COLUMN OF CODES
122 REM
123 REM    ********************************
124 FORVX=0TO999STEP40
125 POKEO+VX,SZ(INT(VX/40)):NEXT:RETURN
126 REM    ********************************
127 REM
128 REM           HIGHLIGHTING CODE
129 REM
130 REM    ********************************
131 T=ASC(V$):IFT<58THEN133
132 T=T-64:IFT>64THENT=T-64
133 FORVX=OTOO+1000STEP40
134 VY=PEEK(VX):IFVY=TTHENPOKEVX,VY+128:RETURN

135 NEXT:RETURN
136 REM    ********************************
137 REM
138 REM           CHANGE THE SYMBOL
139 REM
140 REM    ********************************
141 FORVX=OTOO+990STEP40:POKEVX,SY(INT((VX-O)/
    40)):NEXT:POKEO,49
142 GOSUB308:IFVAL(V$)<1THEN142
143 IFV$="1"THENSY=32:RETURN
144 SY=SY(3*VAL(V$)-4):RETURN
145 REM    ********************************
146 REM
147 REM        CHANGE VECTOR LENGTH
148 REM
149 REM    ********************************
150 FORVX=21TO26:VL(VX)=32:NEXT:VL(22)=48+VL
151 FORVX=OTOO+990STEP40:POKEVX,VL(INT((VX-O)/
    40)):NEXT
152 GOSUB308:IFVAL(V$)=0THEN152
153 VL=VAL(V$):RETURN
154 REM    ********************************
155 REM
156 REM             INSTRUCTIONS
157 REM
158 REM    ********************************
159 PRINT"{CLEAR}{06 DOWN}{15 RIGHT}{REV}PETTE
    RNS{OFF}"
160 PRINT"{02 DOWN}{05 RIGHT}A PROGRAM TO CREA
    TE PATTERNS."
161 PRINT
162 FORN=1TO3000:NEXT
163 REM    ********************************
164 REM
165 REM   INSTRUCTIONS - YES OR NO?
166 REM
167 REM    ********************************
168 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}DO YOU WIS
    H TO READ THE INSTRUCTIONS";:IFC$=""T
    HENPRINT" ?"
169 PRINTC$"{DOWN}":PRINT"{DOWN}IF SO, {REV}HI
    T{OFF} {REV}RETURN{OFF}"
170 PRINT"{03 DOWN}IF YOU ARE READY TO MAKE PA
    TTERNS,"
171 PRINT"{DOWN}{REV}HIT{OFF} {REV}ANY{OFF} {R
    REV}OTHER{OFF} {REV}KEY{OFF}":GOSUB30
    8
172 IFV$=CHR$(13)THEN179
173 PRINT"{CLEAR}":RETURN
174 REM    ********************************
175 REM
176 REM   INSTRUCTIONS - GENERAL
177 REM
178 REM   ********************************
179 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THIS PROGR
    AMS ENABLES YOU TO CREATE"
180 PRINT"PATTERNS ON THE SCREEN, AND TO PRINT
    "
181 PRINT"THEIR ROTATIONS AND INVERSES.  VARIO
    US"
182 PRINT"COMBINATIONS ARE ALSO POSSIBLE."
183 PRINT"{DOWN}{02 RIGHT}YOU CAN PRINT THE NE
    XT POINT ON YOUR"
184 PRINT"DIAGRAM USING THE NUMERIC KEYS AS SH
    OWN"
185 PRINT"BELOW."
186 PRINT"{02 DOWN}{05 RIGHT}7 8 9":PRINT"{05
    RIGHT}4 * 6":PRINT"{05 RIGHT}1 2 3"
187 PRINT"{DOWN}{02 RIGHT}TO MOVE FROM THE POI
    NT  '*'  TO THE"
188 PRINT"NEXT POINT, HIT THE NUMBER THAT IS I
    N"
189 PRINT"THE DESIRED DIRECTION.":GOSUB309
190 PRINT"{REV}OF{OFF} {REV}INSTRUCTIONS.{OFF}
    "

191 PRINT"{CLEAR}{05 DOWN}THE WHOLE SCREEN CAN
     BE USED EXCEPT"
192 PRINT"FOR THE RIGHT HAND COLUMN.  IT WILL"

193 PRINT"DISPLAY A SET OF CODES TO REMIND"
194 PRINT"YOU OF WHAT YOU CAN DO."
195 PRINT"{DOWN}WHEN AN OPERATIONS IS BEING"
196 PRINT"PERFORMED, THAT CODE WILL BE"
197 PRINT"HIGHLIGHTED IN REVERSE MODE."
198 PRINT"{DOWN}THE LIST WILL NOW BE DISPLAYED
    "
199 PRINT"IN ITS POSITION.":FORI=1TO7000:NEXT:
    GOSUB124
200 PRINT"{DOWN}THESE INSTRUCTIONS WILL BE EXP
    LAINED"
201 PRINT"IN WHAT FOLLOWS.":GOSUB309
202 REM   ********************************
203 REM
204 REM   INSTRUCTIONS - Q R N O
205 REM
206 REM   ********************************
207 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THE FIRST
    FOUR CODES ARE"
208 PRINT"{02 DOWN}      Q      R      N      O"
209 PRINT"{02 DOWN} Q  MEANS QUIT AND ENDS THE
     PROGRAM."
210 PRINT"{DOWN} R  MEANS RUN AND RESTARTS THE
     PROGRAM."
211 PRINT"{DOWN} N  MEANS NOTHING ON THE SCREE
    N."
212 PRINT"{DOWN} O  MEANS OUTPUT AND PRINTS WH
    AT IS ON"
213 PRINT"{DOWN}               THE SCREEN ON THE
     PRINTER.":GOSUB309
214 REM   ********************************
215 REM
216 REM   INSTRUCTIONS - P S T F
217 REM
218 REM   ********************************
219 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THE SECOND
     FOUR CODES ARE"
220 PRINT"{02 DOWN}      P      S      T      F"
221 PRINT"{02 DOWN} P  MEANS PRINT AND PRINTS
    THE PATTERN"
222 PRINT"{DOWN}                ON THE SCREEN."
223 PRINT"{DOWN} S  MEANS SECOND AND ROTATES T
    HRU' 90'"
224 PRINT"{DOWN} T  MEANS THIRD AND ROTATES TH
    RU' 180'"
225 PRINT"{DOWN} F  MEANS FOURTH AND ROTATES T
    HRU' 270'":GOSUB309
226 REM   ********************************
227 REM
228 REM   INSTRUCTIONS - "P S T F"
```

```
229 REM
230 REM   ********************************
231 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THE THIRD
    FOUR CODES ARE"
232 PRINT"{02 DOWN}      P     S     T     F"
233 PRINT"{02 DOWN} P  MEANS PRINT THE INVERSE
     PATTERN."
234 PRINT"{DOWN}                 THAT IS, THE REFL
    ECTION"
235 PRINT"{DOWN}                 IN THE LINE  Y =
    X."
236 PRINT"{DOWN} S  MEANS  P  FOLLOWED BY  90'
     ROTATION ";
237 PRINT"{DOWN} T  MEANS  P  FOLLOWED BY  180
    ' ROTATION";
238 PRINT"{DOWN} F  MEANS  P  FOLLOWED BY  270
    ' ROTATION":GOSUB309
239 REM   ********************************
240 REM
241 REM   INSTRUCTIONS - A B C D E
242 REM
243 REM   ********************************
244 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THE NEXT F
    IVES CODES ARE"
245 PRINT"{02 DOWN}       A    B    C    D    E"
246 PRINT"{DOWN}THESE GIVE COMBINATIONS OF THE
     CODES"
247 PRINT"{DOWN}EXPLAINED ABOVE."
248 PRINT"{02 DOWN}HERE IS A DEMONSTRATION OF
    CODE  'A'."
249 PRINT"{DOWN}{02 RIGHT}THE ORIGINAL PATTERN
     WILL FIRST BE":PRINT"DISPLAYED."
250 FORT=1TO5:V(T)=9:V(T+4)=6:V(T+8)=9:NEXT:N=
    13:V(2)=6:V(3)=6:V(13)=7
251 GOSUB315:C=2:PRINT"{CLEAR}":GOSUB46:FORT=1
    TO9:PRINT"{DOWN}":NEXT: GOSUB315
252 C=9:PRINT"{CLEAR}":GOSUB46:FORT=1TO9:PRINT
    "{DOWN}":NEXT:GOSUB315
253 PRINT"{CLEAR}{06 DOWN}HERE IS A DEMONSTRAT
    ION OF CODE  'B'."
254 PRINT"{DOWN}{02 RIGHT}THE ORIGINAL PATTERN
     WILL FIRST BE":PRINT"DISPLAYED."
255 GOSUB315:C=2:PRINT"{CLEAR}":GOSUB46:FORT=1
    TO9:PRINT"{DOWN}":NEXT: GOSUB315
256 C=10:PRINT"{CLEAR}":GOSUB46:FORT=1TO9:PRIN
    T"{DOWN}":NEXT:GOSUB315
257 PRINT"{CLEAR}{06 DOWN}HERE IS A DEMONSTRAT
    ION OF CODE  'C'."
258 PRINT"{DOWN}{02 RIGHT}THE ORIGINAL PATTERN
     WILL FIRST BE":PRINT"DISPLAYED."
259 GOSUB315:C=2:PRINT"{CLEAR}":GOSUB46:FORT=1
    TO9:PRINT"{DOWN}":NEXT: GOSUB315
260 C=11:PRINT"{CLEAR}":GOSUB46:FORT=1TO9:PRIN
    T"{DOWN}":NEXT:GOSUB315
261 PRINT"{CLEAR}{06 DOWN}HERE IS A DEMONSTRAT
    ION OF CODE  'D'."
262 PRINT"{DOWN}{02 RIGHT}THE ORIGINAL PATTERN
     WILL FIRST BE":PRINT"DISPLAYED."
263 GOSUB315:C=2:PRINT"{CLEAR}":GOSUB46:FORT=1
    TO9:PRINT"{DOWN}":NEXT: GOSUB315
264 C=12:PRINT"{CLEAR}":GOSUB46:FORT=1TO9:PRIN
    T"{DOWN}":NEXT:GOSUB315
265 PRINT"{CLEAR}{06 DOWN}HERE IS A DEMONSTRAT
    ION OF CODE  'E'."
266 PRINT"{DOWN}{02 RIGHT}THE ORIGINAL PATTERN
     WILL FIRST BE":PRINT"DISPLAYED."
267 GOSUB315:C=2:PRINT"{CLEAR}":GOSUB46:FORT=1
    TO9:PRINT"{DOWN}":NEXT: GOSUB315
268 C=13:PRINT"{CLEAR}":GOSUB46:FORT=1TO9:PRIN
    T"{DOWN}":NEXT:GOSUB309
269 REM   ********************************
270 REM
271 REM   INSTRUCTIONS - NUMBERS
272 REM
273 REM   ********************************
274 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THE LAST S
    ET OF CODES IS"
275 PRINT"{02 DOWN}  9  8  7  6  4  3  2  1"
276 PRINT"{02 DOWN}THEY ARE TO REMIND YOU OF T
    HE DIRECTION"
277 PRINT"KEYS.":GOSUB309
278 REM   ********************************
279 REM
280 REM   INSTRUCTIONS - H  AND  V
281 REM
282 REM   ********************************
283 PRINT"{CLEAR}{02 DOWN}{02 RIGHT}THERE ARE
    TWO CODES NOT"
284 PRINT"DISPLAYED IN THIS WAY.   THEY ARE":P
    RINT"{DOWN}{09 RIGHT}H     AND      V"
285 PRINT"{DOWN}{RIGHT}H  MEANS C{REV}H{OFF}AN
    GE THE SYMBOL"
286 PRINT"{DOWN}BEING PRINTED ON THE SCREEN BY
    "
287 PRINT"ENTERING THE NUMBER BELOW THE SYMBOL
    "
288 PRINT"AS DISPLAYED IN THE RIGHT HAND "
289 PRINT"COLUMN AS NOW SHOWN.":GOSUB313:GOSUB
    141
290 PRINT"{DOWN}{RIGHT}V  MEANS CHANGE {REV}V{
    OFF}ECTOR LENGTH"
291 PRINT"BY ENTERING THE NUMBER REQUIRED.":GO
    SUB313:GOSUB150
292 REM   ********************************
293 REM
294 REM   INSTRUCTIONS - REPEAT ?
295 REM
296 REM   ********************************
297 PRINT"{CLEAR}{03 DOWN}IF YOU WISH TO SEE T
    HE INSTRUCTIONS"
298 PRINT"{DOWN}ONCE MORE, {REV}HIT{OFF} {REV}
    RETURN{OFF}"
299 PRINT"{03 DOWN}IF YOU ARE READY TO MAKE PA
    TTERNS,"
300 PRINT"{DOWN}{REV}HIT{OFF} {REV}ANY{OFF} {R
    REV}OTHER{OFF} {REV}KEY{OFF}":GOSUB30
    8
301 IFV$=CHR$(13)THEN179
302 VL=1:SY=42:PRINT"{CLEAR}":RETURN
303 REM   ********************************
304 REM
305 REM         PROCEEDING ROUTINES
306 REM
307 REM   ********************************
308 FORT=1TO10:GETVV$:NEXT:GOTO311
309 PRINT"{02 DOWN}{REV}HIT{OFF} {REV}ANY{OFF}
     {REV}KEY{OFF} {REV}WHEN{OFF} {REV}RE
    ADY{OFF} {REV}FOR{OFF} {REV}THE{OFF}"
310 PRINT"{REV}NEXT{OFF} {REV}SET{OFF} {REV}OF
    {OFF} {REV}INSTRUCTIONS.{OFF}":GOTO30
    8
311 GETV$:IFV$=""THEN311
312 RETURN
313 PRINT"{DOWN}{REV}HIT{OFF} {REV}ANY{OFF} {R
    REV}NUMBER{REV} {REV}KEY{OFF} {REV}AB
    OVE{OFF} {REV}0{OFF}"
314 PRINT"{REV}TO{OFF} {REV}PROCEED{OFF}.":RET
    URN
315 PRINT"{02 DOWN}{REV}HIT{OFF} {REV}ANY{OFF}
     {REV}KEY{OFF} {REV}WHEN{OFF} {REV}RE
    ADY{OFF} {REV}TO{OFF} {REV}PROCEED{OF
    OFF}":GOTO308
316 PRINT"{DOWN}THESE INSTRUCTIONS WILL BE EXP
    LAINED"
317 PRINT"IN WHAT FOLLOWS.":RETURN
```

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COMPUTE!'s
First Book Of Atari Graphics

Authors: **COMPUTE!** Magazine editors and contributors
Price: $12.95
On Sale: Now

COMPUTE!, the leading magazine of home, educational, and recreational computing, has led the way for Atari owners since the computers were first introduced in 1979. **COMPUTE!** has published scores of articles on Atari graphics, and was the first to divulge many important details on such techniques as redefined characters, custom graphics modes, and player/missile graphics. But those articles are scattered across dozens of issues, many of which are scarce or out of print.

That's why the editors of **COMPUTE!** decided to gather the very best Atari graphics articles published over the past three years into *COMPUTE!'s First Book Of Atari Graphics*. From the fundamentals to advanced techniques, here are some of the most instructive articles ever published for the Atari.

But that's not all. *COMPUTE!'s First Book Of Atari Graphics* also presents articles never before published anywhere, and additional sections written especially for this book. These include "The Basics Of Atari Graphics," an introductory tutorial which prepares beginners for the rest of the book; "How To Design Custom Graphics Modes," which covers the fundamentals of mixing modes on a single screen; and "Introduction To Player/Missile Graphics," a guide to understanding one of the Atari's most advanced features, written by Bill Wilkinson, a **COMPUTE!** columnist and a creator of Atari BASIC and the Atari Disk Operating System.

Numerous other articles include "Designing Your Own Character Sets," a new and improved "SuperFont," "High Speed Animation With Character Graphics," "Animation And Player/Missile Graphics," "The Collision Registers," and "GRAPHICS 8 In Four Colors Using Artifacts." There's even a brand new article by Wilkinson, "The Priority Registers," which for the first time shows how to use player/missile graphics to create a *fifth* player.

In the **COMPUTE!** tradition, *Atari Graphics* is crisply written and edited to be useful to beginners and experts alike. And it's spiral-bound for easy access to its dozens of ready-to-type program listings.

V. Introduction . . . . Robert C. Lock

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16 Using Strings For Graphics Storage . . . . Michael Boom
20 Using The COLOR And LOCATE Instructions To Program Pong-Type Games . . . . Michael A. Greenspan

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COMPUTE!'s Mapping The Atari

Author: Ian Chadwick
(Introduction by Bill Wilkinson)
Price: $14.95
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The inner workings of today's advanced personal computers unfortunately remain a mystery to many users. From beginners to machine language programmers, people are hungry for vital information about the insides of their machines. For example, there are tens of thousands of memory locations...which are safe to use? How can changing one number in a certain memory cell dramatically speed up output to the disk drive? Which memory address reveals what Operating System is in the computer? How can changing certain numbers in various memory locations improve a program's sound and graphics?

The key to finding one's way around the inside of a computer is a memory map. But often this important information is unavailable from the manufacturer. Or it can be obtained only in piecemeal fashion from scattered sources.

Now, for the first time, there is a comprehensive guidebook available for the Atari 400/800 computers which answers all of these questions, and hundreds more. *Mapping The Atari*, by Ian Chadwick, is a complete reference guide and memory map for one of the most popular of personal computers. From memory location zero to 65,535, *Mapping The Atari* is the most exhaustive memory sourcebook ever offered to Atari users.

Chadwick started by diligently assembling all the information he could find. Then he went a step further by testing this information, to verify its accuracy. And finally, he added months of his own research, delving deep into little-known areas of the Atari's memory to explore every secret. The result, *Mapping The Atari*, is an indispensable reference work for Atari programmers.

But *Mapping The Atari* is more than just a comprehensive reference book. It is also a tutorial for *all* inquisitive Atari enthusiasts – not just advanced programmers. *Mapping The Atari* explains each memory location in depth for beginning and intermediate programmers. Some descriptions of important locations fill several pages. And the book is packed with ready-to-type example programs and routines which show exactly how to put the information to work.

There's more. A special introduction by Bill Wilkinson, an author of Atari BASIC and the Atari Disk Operating System, explains how to access the Atari's memory in every available programming language. And there are *ten* appendices, covering such topics as "VBLANK Processes," "Atari Timing Values," "Color," "Sound And Music," "Player/Missile Graphics Memory Map," "Display Lists," and others. And to make the book still more useful, there are *two* indices – an Index By Label, and an Index By Subject.

Best of all, *Mapping The Atari* is from **COMPUTE! Books**, associated with **COMPUTE!** Magazine, the leading consumer publication of home, educational, and recreational computing. **COMPUTE!** has led the way for Atari owners since the computers were first introduced in 1979. In the **COMPUTE!** tradition, *Mapping The Atari* is carefully written and edited to be useful to beginners and experts alike. And it is spiral-bound to lie flat while typing programs.

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Authors: **COMPUTE!** Magazine contributors
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COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

February 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever- expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, The Voracious Butterfly on OSI.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: a VIC Monitor, Vic Color Tips, VIC Memory Map, ZAP: A VIC Game.

February 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Atari P/M Graphics Made Easy, Atari PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April 1982: Track Down Those Memory Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple's Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

June 1982: Outpost Game (multiple computers), Apple Pascal Lister, Income Property (multiple computers), VIC Intelligent Videodisc System, Atari Disk Operating Systems, PET/Apple Search, A Self-modifying Atari P/M Utility, Use Atari Joysticks with VIC, VIC/PET Program Transfers.

July 1982: Gold Miner Game (Atari and VIC), IRA Planner (multiple computers), Atari Video Graphics, Apple DOS Changer, Super QuadraPET, VIC Overview, Maze Race (multiple computers), Direct Access File Editor (PET and Atari), VIC Super Expander Memory Map, Using The 6560 Video Interface Chip, PET Compactor, Headless FORTH Metacompilation, Test RAM Nondestructively (multiple computers).

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, Intelligent Apple Filing Cabinet, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of *TRON*, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Color Computer Graphics, The Apple Pilot Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Editing Atari BASIC With the Assembler Cartridge, Process Any Apple Disk File.

Home and Educational COMPUTING! (Fall 1981 and Summer 1981 – count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters, Alternate Screens, Automatic Line Numbers, Using The Joystick (Spacewar Game), Fast Tape Locater, Window, VIC Memory Map.

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NEWS&PRODUCTS

Commodore 64 And VIC-20 Products

Human Engineered Software (HES) has introduced new software products and a sound-enhancing peripheral for Commodore 64 computers.

Soundbox improves the VIC-20's sound output for arcade games. In addition to the VIC-20, it can be used with Atari, Texas Instruments and other Commodore systems. Soundbox features include audio out, video out and audio in (for Commodore 64). Its suggested retail price is $14.95.

HES's 6502 Professional Development System is a cassette-based assembler package that offers a one-or two-pass 6502 assembler using standard MOS mnemonics and operand formats. It is available for the VIC-20 as well as for the Commodore 64 and has a suggested retail price of $29.95.

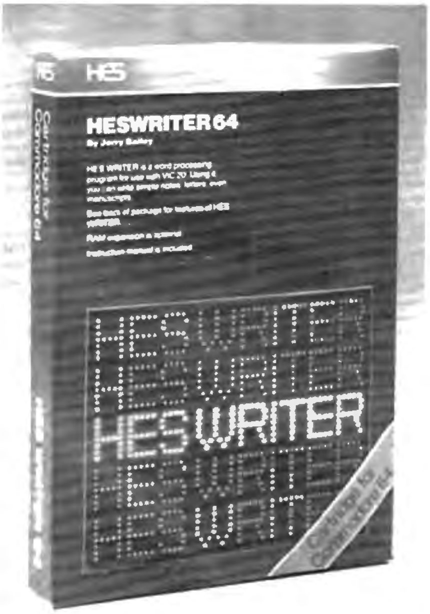
HESMON 64 is an adaptation of the HESMON cartridge for the VIC-20. It gives 64 owners the same machine language monitor with mini-assembler. The suggested retail price is $39.95.

HESCARD is an expansion board that includes four switchable slots and a reset button. The board has high-quality connectors and gold-plated edge fingers. Its suggested retail price is $29.95.

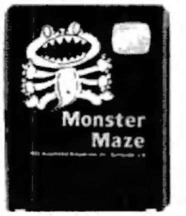
Turtle Graphics II is an advanced version of David Malmberg's Turtle Graphics that uses the full graphics features of the Commodore 64. Suggested retail is $59.95.

HESWRITER 64 is a sophisticated word processing package for the Commodore 64, based on HESWRITER for the VIC-20. Its features include full-screen editing; the package has a suggested retail price of $44.95.

Human Engineered Software
71 Park Lane
Brisbane, CA 94005
(415)468-4900



HESWRITER 64 is one of several new releases from Human Engineered Software.



Pressure Sensitive Keyboard For The Physically Handicapped

Cacti Computer Services is marketing a large (11" x 21"), pressure sensitive keyboard with widely spaced key contacts to enable users with limited finger and hand control to operate a microcomputer.

The system consists of large keyboard, interface to plug into the computer, connecting cables, plastic mask, and a driver routine to permit the large keyboard to function as a regular keyboard. Once the driver routine has been loaded, both the regular keyboard and the large keyboard function to run commercially available software without modification. The system can be installed and operated with no technical knowledge required.

Several keyboard layouts are available, and custom arrangements will be made at no extra charge.

Cacti Computer Services keyboard.

The system is presently available for immediate delivery for use with the Commodore PET/CBM at a cost of $525 (U.S.), and is being developed for the Apple. Interfaces may be developed for other systems, depending upon demand.

Cacti Computer Services
130 9th St. S.W.
Portage la Prairie
Manitoba, Canada, R1N 2N4

Guide To Applesoft BASIC

Hayden Book Company has published *Basic Apple BASIC*, a complete guide to Applesoft BASIC from beginning concepts to advanced topics. It provides alternative techniques for programming in Apple Integer BASIC and can be used as a textbook or read by anyone interested in BASIC programming on an Apple. The book is written by James Coan, also the author of *Basic BASIC*.

Applesoft BASIC is explained with short, complete programs that are slowly built to larger ones. More than 80 sample programs are presented; all can be quickly located with the book's program index. Programs are divided into small segments, most of which will fit on an Apple screen. Longer programs consist of a control routine at the beginning that handles all program management using subroutines.

Chapter One explains how to enter data and get results, and the programmer's corner covers immediate-mode execution. Chapter Two offers ideas on planning a program; the programmer's corner explains the Apple's special screen editing. Low-resolution graphics are presented in Chapter Three, and the programmer's corner tells how to obtain full-screen graphics.

Chapter Four contains a potpourri of BASIC features and programming techniques, with a programmer's corner that shows how to read the keyboard without using an INPUT statement. Chapter Five presents strings, and the programmer's corner reveals the character sets used by both BASICs. Chapter Six covers

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Commodore Products for the VIC-20

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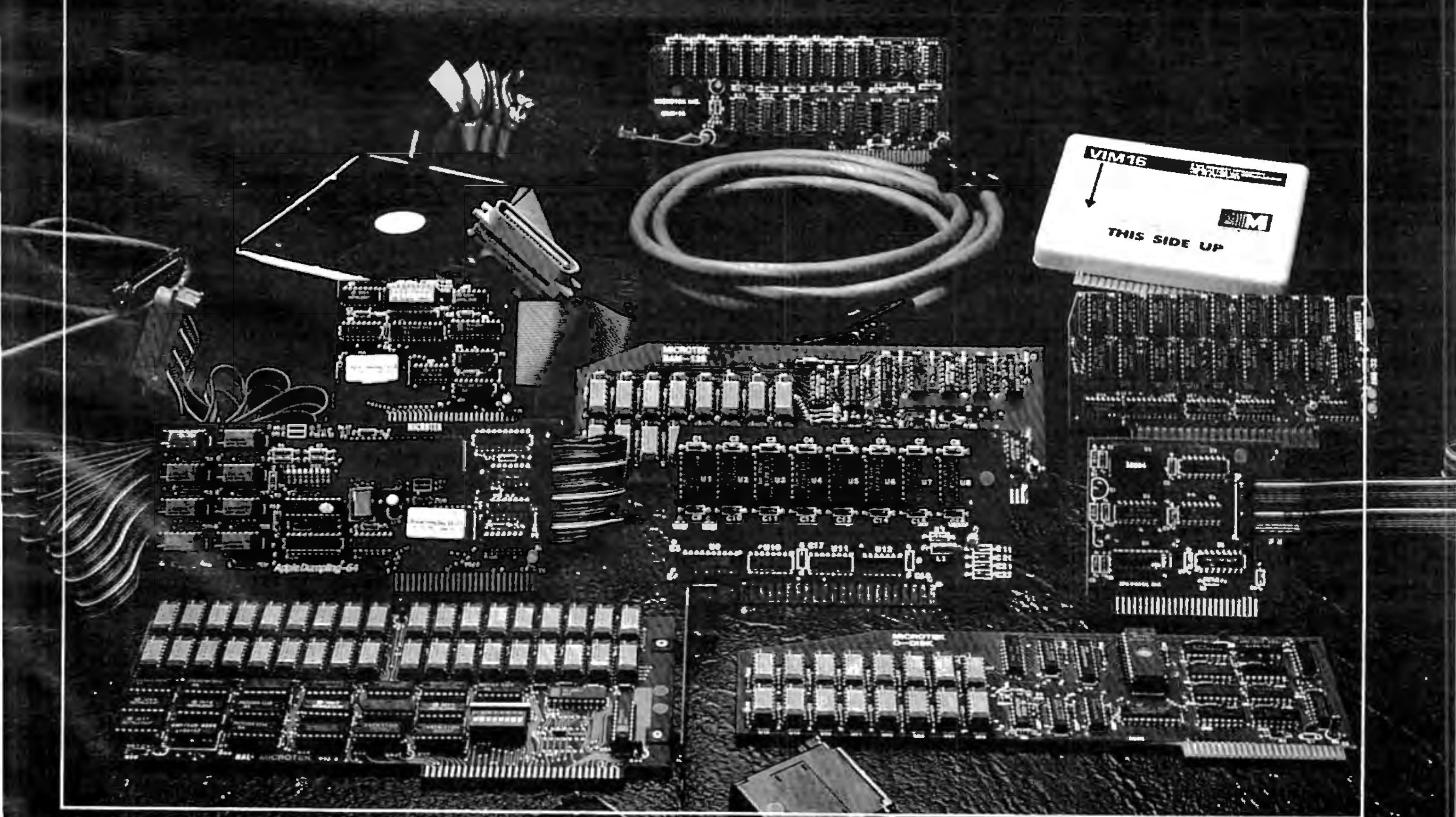

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numeric and string arrays, with a programmer's corner presenting integer variables in Applesoft.

Chapter Seven is a collection of miscellaneous applications; the programmer's corner concerns a menu program. Sequential and random access files are the topic of Chapter Eight, and some advanced features of file handling are in the programmer's corner. Chapter Nine presents high-resolution graphics using Applesoft, and the programmer's corner offers an example of a shape table.

Basic Apple BASIC by James Coan, 237 pp., 7 x 9, paper, ISBN-0-8104-5626-5, $12.95.

Hayden Book Company, Inc.
50 Essex Street
Rochelle Park, NJ 07662
(201)843-0550

Keyboard For The Atari 400

Microtronics has released the Joytyper 400, a standard full-travel keyboard for the Atari 400. The keyboard layout is the same as on the Atari 400/800, except that the right-hand SHIFT key is in the more usual location. The game keys are beside the space bar.

The Joytyper 400 has standard gray two-shot molded keycaps. The RESET key has an extra stiff spring, low profile, out-of-the-way keycap. The aluminum case (14" x 5" x 1") is color-matched with the Atari 400.

Electronic connection is simple: unplug the membrane keyboard, then plug in the Joytyper 400. Physical attachment: by industrial adhesive strips or by drill and bolt. The Joytyper 400 comes with a 90-day warranty on materials and workmanship. The cost is $129.95 plus $5 postage and handling.


Microtronics' Joytyper 400.

Microtronics, Inc.
P.O. Box 8894
Fort Collins, CO 80525
(303)226-0108

Preschool Library For The Atari

Program Design has announced the publication of its *Preshool Library*, a package that includes four popular PDI titles:

Sammy the Sea Serpent – An interactive story with a voice narration: the child uses a joystick to guide poor lost Sammy back to the sea. There are also games that the child can play with Sammy.

The Adventures of Oswald – As a narrator tells a story about a young boy named Oswald, children use the joystick to help Oswald walk, climb, jump, and escape from a deep, deep tunnel. There's also a game entitled "Oswald and the Golden Key."

Preschool IQ Builder 1 – Part 1: Decide whether pairs of figures are the same or different. Part 2: Match the letter at the top of the screen with the same letter at the bottom of the screen.

Preschool IQ Builder 2 – Six lessons of increasing difficulty ask the child to match the letter, number, shape or word at the top of the screen with the same object at the bottom of the screen.

PDI's Preschool Library is designed to help three- to six-year-olds develop certain critical skills that will be needed when they start school. The programs have five important objectives:

1. To teach shape, letter, and number recognition
2. To present the concept of *same* and *different*
3. To reinforce directional concepts
4. To develop listening skills
5. To improve hand-eye coordination

The package includes a detailed *User's Guide*. In addition to describing each program and explaining how to use it, the guide presents supplementary activities that reinforce and expand the material covered in the programs.

PDI's Preschool Library is designed for use on Atari 400/800 computers. It consists of four cassettes and the *User's Guide*, packaged in a convenient storage container. It requires a minimum memory of 16K and retails for $59.95.

Each of the four titles in the package is also available individually, on either cassette or disk. The cassette versions of each title require 16K of memory and retail for $16.95. The disk versions require 24K and retail for $23.95.

Program Design, Inc.
11 Idar Court
Greenwich, CT 06830
(203)661-8799

New Products For Commodore Computers

Computer Marketing has released several new products for Commodore computers. *Calc Result* is a three-dimensional spread-sheet program for the CBM 8032/8096 and Commodore 64. It provides a minimum of 32 pages of 63 x 254 cells, graphics (histograms) on screen and printer, the capability to view as many as three spread-sheets at one time through a window and split screen, and help functions on-line.

VIC/64 Switch connects up to eight VICs or 64's to share disks and printers. VIC-Relay Cartridge simplifies control of

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Computer Marketing Services, Inc.
300 W. Marlton Pike
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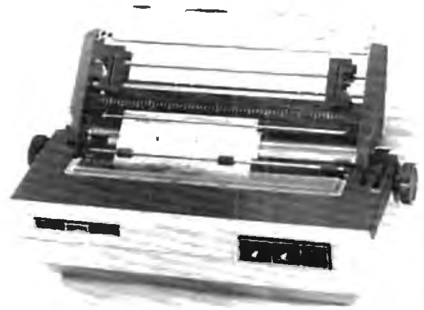
(609)795-9480

Daisy Wheel Printer For TRS-80

Radio Shack has added a second full-featured daisy wheel printer to its TRS-80 computer product line. The new DWP-410 (26-1250) is available for $1495 at Radio Shack Computer Centers and participating Radio Shack stores and dealers.



Radio Shack's daisy wheel printer.

The DWP-410 prints executive-quality correspondence and reports at over 300 words per minute. It features selectable pitch – either 10 or 12 characters per inch – or proportional spacing. Interchangeable 124-character print wheels provide easy type-face selection. External Program Mode allows the use of print wheels with different pitch or special characters.

The DWP-410 also features forward and reverse full and half line paper feed, underline, and programmable backspace, plus 1/120-inch minimum space and 1/48-inch line feed. Automatic Paper Set makes paper insertion easy and precise.

The DWP-410 Daisy Wheel Printer is U.L. listed, includes a standard parallel interface, and comes complete with print wheel and carbon ribbon cartridge.

Tandy Corporation / Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

Recorder Interface For Sinclair/Timex

Bytesize Computer Products has introduced the Z-DUBBER, an interface between the Sinclair computer and its cassette recorder which allows even the most difficult cassette program to load more easily. Additionally, the Z-DUBBER allows you to connect two cassette recorders to create perfect backup copies of your Sinclair programs. The Z-DUBBER operates on two AAA cells. It is available for $29.95 plus 3% shipping.

Bytesize Computer Products
P.O. Box 21123
Seattle, WA 98111

Z-DUBBER interface for Sinclair/Timex.

Printer Interface For The Commodore VIC And 64

Cardco, Inc., has introduced a microprocessor controlled printer interface for the Commodore VIC-20 and 64 computers. The "Card/?" (pronounced card-print) features an eight-bit, eight-megahertz Intel microprocessor with 1K of onboard ROM software. This advanced design allows the user to plug any standard parallel printer into the VIC printer port.

Using the VIC's own printer commands, in conjunction with seven additional commands added by the interface, allows currently available programs to be run without any modifications to the hardware or software. All of the CBM ASCII irregularities are compensated for by the interface.

Features such as upper/lowercase selection and auto line feed after carriage return can be controlled from the keyboard or from program control. Additionally, the unit offers a graphics mode that will pass all character string numbers without modification, and a special program listing mode that automatically substitutes bracketed letters in place of VIC graphic characters in program listings, making them far easier to read.

The "Card/?" includes all necessary cords and cables. Simply plug it in and print, no switches to switch, and no modifications required.

The "Card/?" is available from computer stores nationwide for only $79.95 suggested retail.

Cardco, Inc.
3135 Bayberry
Wichita, KS 67226
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Drawing Program For Children

Spinnaker Software has released *Delta Drawing Computer Graphics,* an introduction to programming for children 4 to 14.

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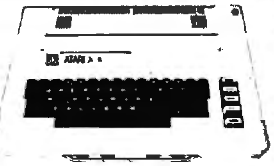

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Eric Martin's
5485 Warrensville Center Road
Cleveland, Ohio 44137
216/663-2032
Call Toll Free
1-800-482-7254
outside Ohio
Mon.-Sat. 10-6 EST

With *Delta Drawing*, children create colorful drawings on the computer screen using single keystroke commands to control the Delta Cursor. Complex pictures, patterns, and designs can be built from simple drawings because drawings are stored as programs and can be used to create extremely complex and sophisticated graphics. Drawings also can be saved on a disk and printed, if a graphics printer is available.

Spinnaker Software's graphics package for children.

In the new program, developed by Computer Access Corporation, editing pictures has been made as simple as pushing E for erase. There are no syntax errors to frustrate the young learner.

The program has been extensively play-tested in Boston-area schools since March 1982. Teachers have recommended using *Delta Drawing* prior to introducing children to Logo's Turtle Graphics. *Delta Drawing* has been commended for its simplicity and the ease by which children can produce a stunning variety of computer graphics. No prerequisites are required. A user does not have to be able to read, write, or even know English to use *Delta Drawing*.

The program is compatible with Apple, Atari, and IBM systems. The cost is $59.95.

Spinnaker Software
215 First Street
Cambridge, MA 02142
(617)868-4700

Darkroom Process Timer For The Atari

Darkroom Software has introduced *Computer Clockwork*, a flexible, programmable darkroom process timer.

– May be used to time most photographic processes.

– Counts down each step of a processing program second by second, and displays remaining time in both digital and bar graph format.

– Permits varying times for each step in a process, from one second to 36 hours.

– Allows between 25 and 300 single option steps, depending on available memory.

– Temporarily suspends the timing of a step, then will continue, skip over, or restart the step without restarting the whole process.

– Uses the Atari's sound capabilities to help the user maintain consistent film agitation.

– Requires no special timing modules or interface cards.

– Comes with 24-page user's guide.

The program requires an Atari 400/800, 16K (cassette) or 32K (diskette), Atari BASIC cartridge, and extra cassettes or diskettes to save process programs. Optional accessories: one joystick controller, and a red or amber plastic screen cover. The cost is $24.95 for cassette or diskette, plus $2 for shipping and handling.

Darkroom Software
1925-D Pacific Beach Drive
San Diego, CA 92109
(619)274-3495

Games From Children's Television Workshop For Apple

The playful approach to learning used in *Sesame Street* television programs is incorporated into 16 new computer games now available from Apple Computer, Inc.

Discovery Games were developed by Children's Television Workshop (CTW), the creators of *Sesame Street*, for use in the home by children aged 4 to 13. Colorful, animated characters, including the familiar Muppets, and lively sound effects encourage children to practice reading, problem-solving and motor skills, and to use their creative abilities.

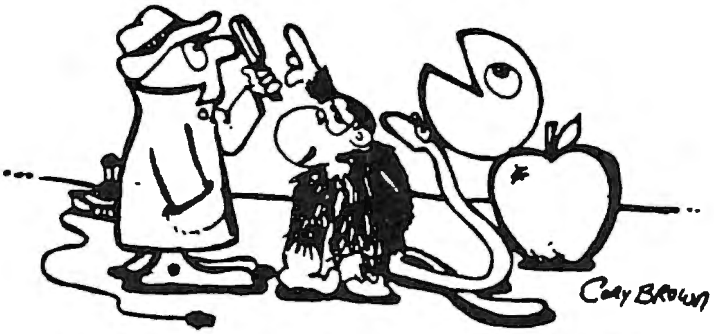
As they play with *Discovery Games*, children practice number skills and work with words and sentences. The programs also exercise recall ability, stimulate creativity, and acquaint children with computers.

Four *Discovery Games* packages are available, each containing four games.

* *Ernie's Quiz*, for ages 4 to 7, includes Muppet and number guessing games and a program that lets the child create a face, using game paddles to select

New computer programs from Apple Computer and the Children's Television Workshop.

THE USERS GROUP



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from a variety of eyes, noses, and other facial features.

* *Instant Zoo,* for ages 7 to 10, is a set of fast-moving games that encourage quick reactions as the child unscrambles words, spots shooting stars, names animals, and matches pairs of words. A word editor lets the child or parent add word lists to the easy, medium, and hard lists provided in the program.

* *Spotlight,* for ages 9 to 13, includes games that present advanced ideas, such as the way light will angle when reflected off a mirror, and how to guess a three-digit number using clues.

* *Mix and Match* is for all ages, allowing families to play *Discovery Games* together. The package includes easy games for younger children as well as more advanced programs for other members of the family.

Each of the four packages is sold separately at a suggested retail price of $50. The packages include activity booklets of ideas for using the games to exercise the child's imagination and creativity.

The programs run on 48K Apple II or Apple II Plus systems with one disk drive. A color monitor or television is recommended. *Mix and Match* requires Applesoft BASIC, and the other packages require Integer BASIC. *Ernie's Quiz* and *Spotlight* also require hand controllers. The games which do not require paddles will run in emulation mode on an Apple III.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014
(408)973-3019

Video Games For The VIC-20

Tronix Publishing has introduced three fast action video games for use with the Commodore VIC-20 home computer.

The new games are *SWARM!*, *Sidwinder*, and *Galactic Blitz*.

Created by designer Jimmy Huey, the three games feature frenetic action, colorful graphics and sound effects, and all are written in VIC-20 machine code. All the games are responsive to joysticks, and *SWARM!* works with a trackball as well.

SWARM! players must contend with deadly android wasps that are aided by various alien creatures. The wasps and aliens jump, fly, crawl, and hurl themselves at players, and any contact insures instant destruction. *SWARM!* offers 40 levels of play. Suggested list price is $29.95.

Sidewinder *for the VIC from Tronix Publishing.*

In *Sidewinder,* players lead their squadron of skilled helicopter commandos into deadly battle with killer pods in outer space. The Sidewinder forces go head to head with alien oblitojets while also dodging stalker bombs at high speed. Complete with a firing button and warning buzzers which sound when the enemy presses in, *Sidewinder* offers ten battle levels. It is priced at $29.95.

Galactic Blitz pits the player against a squadron of killer aliens who attack en masse. The aliens include Heartattacks, Pearons, Energridders, Beheadhinds and Towelships. *Galactic Blitz* offers 15 play patterns, the price is $24.95.

Accompanying each game is a four-color, self-displaying package for the games which holds 12 products.

Tronix Publishing, Inc.
701 West Manchester Blvd.
Inglewood, CA 90301
(213)761-8440

Talking Game Contest

The Alien Group, manufacturers of the Voice Box speech synthesizer for Atari and Apple II computers, has announced the Voice Box-ing Match Contest for the best talking or singing game program. This contest is for educational, adventure, arcade-style games, or something completely new in amusement or educational programming.

A panel of 13- to 18-year-old computer game players will judge entries on the basis of originality, playability, and quality of Voice Box use.

$6,800 in prizes plus royalties will be awarded, as follows:

First Prize	$5,000
Second Prize	$1,000
Third Prize	$500
Fourth Prize	$200
Fifth Prize	$100

Contest rules and further information can be obtained by writing:

The Alien Group
27 W. 23rd St.
New York, NY 10010

Games For Atari

Brøderbund Software has introduced two new games for the Atari:

David's Midnight Magic, by David Snider, is a pinball game for the Atari 400/800, 48K diskette. The game has dual flipper controls, bumper action, rollovers, multiple ball play, and all the sounds and lights of a classic

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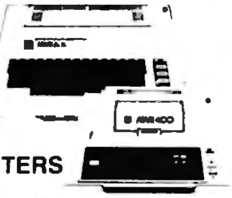

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commodore

Commodore "64" (special)	$499.95
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Broderbund

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Battle of Shiloh (D) (C)	39 95	26 50

AND MUCH MORE

arcade pinball machine. Requires paddles; suggested retail is $34.95.

Stellar Shuttle, by Matt Rutter, is an arcade-style game with four levels of play. You are assigned a dangerous rescue mission to the planet Ttam. You must maneuver your space shuttle among streaking asteroids, using retro rackets to control your rate of descent to the planet's surface. The rockets are also your only defense against the dragons that try to prevent you from rescuing the hostages and transporting them safely to the mother ship. Available only for Atari 400/800 (32K disk, 16K cassette); joystick controlled. Suggested retail is $24.95.

Brøderbund Software, Inc.
1938 Fourth Street
San Rafael, CA 94901
(415)456-6424

Commodore Donates Educational Programs

This fall Commodore announced the donation of 656 educational computer programs to the public domain. The programs may be copied by public and private educational institutions and by private computerists.

The first 656 programs in the series, drawn from educators around the world, have been standardized, categorized, and recorded on 50 disks.

The programs are compatible with any Commodore computer, including the PET 2001 and 4000 series, the CBM, and the new Commodore 64.

CALENDAR

March 10-12, 1983, Great Falls, Montana. The Second Annual Rocky Mountain Computer Conference, conducted by the Montana Council of Teachers of Mathematics (MCTM) and the Montana Office of Public Instruction. Seventy sections and workshops will be available in all areas of interest. Also available: minicourses with three or four sessions in a single area of interest, and many workshops providing hands-on experience. Areas to be presented in workshops include reading, special education, music, vocational education, computer networks, English, and many others. Registration for members of Math, Reading and Science Councils is $15; registration for non-members is $43. For more information, contact Dan Dolan, Math and Computer Education Specialist, Office of Public Instruction, Helena, MT 59620. 1-800-332-3402. For preregistration information, contact Gary Bauer, Conference Chairman, 125 Rieverview 2E, Great Falls, MT 59404.

April 26-28, New York; June 14-16, Washington; July 5-7, London; July 11-15, Los Angeles. Technology Opportunity Conferences, focusing on the convergence of optical storage, videodisk, and computer technology. Conference series (five more scheduled for 1983) launched by Edward S. Rothchild, publisher of *Optical Memory Newsletter Including Interactive Videodisks*, San Francisco, California, and Roy R. Goodman, Managing Director of Office of the Future Limited, of Richmond, England. One of several aims of the conferences is to provide an ongoing dialogue between executives in both vendor and end user organizations to plan future products, applications, and markets. In the U.S., contact Ed Rothchild, (415)626-1133; in the U.K., Roy Goodman 01-948-2203.

April 28-30, Washington, DC. Ed-Com/Spring '83, a national computer conference and exposition for educators of all levels. More than 300 session hours featuring demonstrations, seminars, hands-on sessions, panels, and MicroCourses. For further information, contact Carol Houts, Judco Computer Expos, Inc., 2629 North Scottsdale Road, Suite 201, Scottsdale, AZ 85257, toll free outside Arizona (800)528-2355; in Arizona (602)990-1715.

May 21, University of Oklahoma, Norman. The sixth annual spring microComputer Show & Tell Conference to permit sharing of hardware, software, and state-of-the-art ideas. Two major 45-minute talks are planned, as well as 30 five-minute talks. Each set of six five-minute talks will be followed by a 30-minute question/answer/demonstration period. An on-the-spot programming contest (with prizes) will also be held. Computer buffs not actually attending the conference may participate by submitting *original* programs for possible publication in *Conference Proceedings* and for a prize competition. Additional information, application forms, or directions for submitting programs may be obtained by sending an SASE to: Show & Tell, Dr. Richard V. Andree, 601 Elm, Room 423, Norman, OK 73019.

COMPUTE! *welcomes notices of upcoming events and requests that the sponsors send a short description, their name and phone number, and an address to which interested readers may write for further information. Please send notices at least three months before the date of the event, to: Calendar, P.O. Box 5406, Greensboro, NC 27403.*

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication. ©

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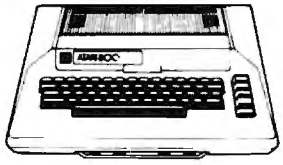

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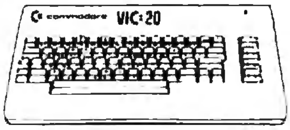

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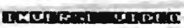
How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: 
Enter these characters with the Atari logo key, {⅄}.

When you see	Type	See	
(CLEAR)	ESC SHIFT <	↖	Clear Screen
(UP)	ESC CTRL -	↑	Cursor Up
(DOWN)	ESC CTRL =	↓	Cursor Down
(LEFT)	ESC CTRL +	←	Cursor Left
(RIGHT)	ESC CTRL *	→	Cursor Right
(BACK S)	ESC DELETE	◀	Backspace
(DELETE)	ESC CTRL DELETE	◧	Delete character
(INSERT)	ESC CTRL INSERT	◨	Insert character
(DEL LINE)	ESC SHIFT DELETE	⬒	Delete line
(INS LINE)	ESC SHIFT INSERT	⬓	Insert line
(TAB)	ESC TAB	▶	TAB key
(CLR TAB)	ESC CTRL TAB	◧	Clear tab
(SET TAB)	ESC SHIFT TAB	◨	Set tab stop
(BELL)	ESC CTRL 2	◪	Ring buzzer
(ESC)	ESC ESC	↰	ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T .

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {♥} means to enter a reverse-field heart with CTRL-comma, {5▥} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC

Generally, any PET/CBM/VIC program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor-down key; {3DOWN} would mean to press the cursor-down key three times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S̲ would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen. Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

Sometimes in a program listing, especially within quoted text when a line runs over into the next line, it is difficult to tell where the first line ends. How many times should you type the SPACE bar? In our convention, when a line breaks in this way, the ~ symbol shows exactly where it broke. For example:

```
100 PRINT "TO START THE GAME  ~
    YOU MAY HIT ANY OF THE KEYS
    ON YOUR KEYBOARD."
```

shows that the program's author intended for you to type two spaces after the word *GAME*.

All Commodore Machines

Clear Screen	{CLEAR}	Cursor Left	{LEFT}
Home Cursor	{HOME}	Insert Character	{INST}
Cursor Up	{UP}	Delete Character	{DEL}
Cursor Down	{DOWN}	Reverse Field On	{RVS}
Cursor Right	{RIGHT}	Reverse Field Off	{OFF}

VIC/CBM 64 Conventions

Set Color To Black	{BLK}	Function Two	{F2}
Set Color To White	{WHT}	Function Three	{F3}
Set Color To Red	{RED}	Function Four	{F4}
Set Color To Cyan	{CYN}	Function Five	{F5}
Set Color To Purple	{PUR}	Function Six	{F6}
Set Color To Green	{GRN}	Function Seven	{F7}
Set Color To Blue	{BLU}	Function Eight	{F8}
Set Color To Yellow	{YEL}	Any Non-implemented Function	{NIM}
Function One	{F1}		

To enter any color code, hold down CTRL and press the appropriate color key. Use CTRL-9 for RVS on and CTRL-0 for RVS off.

8032/Fat 40 Conventions

Set Window Top	{SET TOP}	Erase To Beginning	{ERASE BEG}
Set Window Bottom	{SET BOT}	Erase To End	{ERASE END}
Scroll Up	{SCR UP}	Toggle Tab	{TGL TAB}
Scroll Down	{SCR DOWN}	Tab	{TAB}
Insert Line	{INST LINE}	Escape Key	{ESC}
Delete Line	{DEL LINE}		

When you see an underlined character in a PET/CBM/VIC program listing, you need to hold down SHIFT as you enter it. Since the VIC-20 and Commodore 64 have fewer keys than the PET/CBM, some graphics are grouped with other keys and have to be entered by holding down the Commodore key. If you see any of the symbols in the left column underlined in a listing, hold down the Commodore key and enter the symbol in the right column. Just use SHIFT to enter all other underlined characters.

!	K	←	*	1	E
"	I	↑	PI	2	R
#	T	.	S	3	W
$	@	–	Z	4	H
%	G	=	X	5	J
'	M	<	C	6	L
&	#	>	V	7	Y
\	–	,	D	8	U
;	F	/	P	9	I
?	B	*	N	@	SHIFT*
(	£	+	Q	[	SHIFT+
)	SHIFT-£	0	A	]	SHIFT–

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

TRS-80 Color Computer

No special characters are used, other than lowercase. When you see letters printed in inverse video (white on black), press SHIFT-0 to enter the characters, and then press SHIFT-0 again to return to normal uppercase typing.

Texas Instruments 99/4

No special control characters are used. Enter all programs with the ALPHA lock on (in the down position). Release the ALPHA lock to enter lowercase text.

Timex TS-1000, Sinclair ZX-81

Study your computer manual carefully to see how to enter programs. Do not type in the letters for each command, since your machine features single-keystroke entry of BASIC commands. You may want to switch to the FAST mode (where the screen blanks) while entering programs, since there will be less delay between lines. (If the blanking screen bothers you, switch to the SLOW mode.)

A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in **COMPUTE!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type COMPUTE!'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type COMPUTE!'s Programs" elsewhere in the magazine.)

We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** *due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on this page, usually within eight weeks. If you have specific questions about items or programs which you've seen in* **COMPUTE!***, please send them to Ask The Readers, P.O. Box 5406, Greensboro, NC 27403.*

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CAPUTE!

Modifications Or Corrections To Previous Articles

Supermon 64

To get Jim Butterfield's machine language monitor for the Commodore 64 in the January 1983 issue to run properly, it is necessary to change the direct mode command listed on page 164 as POKE 45,232 to POKE 45,235.

Thunderbird

Some additional initialization is required in the Color Computer version of this game, which appeared in the January issue (p. 71). In order to get 1000 points on each new board and 10000 points with a new reset after the second board, you should add these two lines:

```
2011 TY=0
3035 HIT=0
```

Apple Memory Aid

In the article "Apple Machine Language Memory Aid" in the January issue (p. 160), lines 31, 29, 35, 33, and 51 mentioned in the text should be 310, 290, 350, 330, and 510. In the program listing, line 68 should be deleted.

WAITing On The VIC-20

In the notes in the January 1983 issue (p. 156) on testing VIC-20 joysticks with the WAIT statement, the following changes should be made:

```
LEFT   WAIT 37137,16,16
DOWN   WAIT 37137,8,8
```

Atari Simulator

The following changes will allow proper operation of the +, -, *, and / functions in the Atari version of the electronic spreadsheet program Tiny Plan, page 80 of the December 1982 issue.

```
2310 IF T$="+ " THEN DA(R3,C3)=DA(R1,
     C1)+DA(R2,C2)
2320 IF T$="- " THEN DA(R3,C3)=DA(R1,
     C1)-DA(R2,C2)
2330 IF T$="* " THEN DA(R3,C3)=DA(R1,
     C1)*DA(R2,C2)
2340 IF T$="/ " AND DA(R2,C2)<>0 THEN
      DA(R3,C3)=DA(R1,C1)/DA(R2,C2)
2350 IF T$="% " THEN DA(R3,C3)=DA(R1,
     C1)*DA(R2,C2)/100
```

VIC Hi-Res Graphics

The following correction will clear up some confusion concerning the article "Understanding VIC High Resolution Graphics" which appeared in the December issue. To make the 8K example

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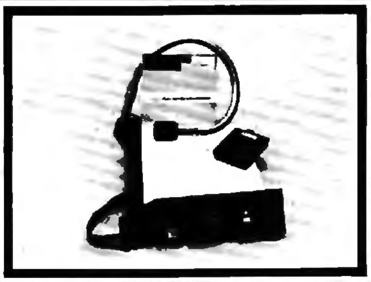

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(CAPUTE! (continued)

(Program 2) load correctly, replace the sentence on page 167 which now reads:

> Before typing in or loading this program, type in the following:

with these corrected instructions:

> Type in Program 2 and then SAVE it. Next, type in the following three POKE commands and then LOAD your hi-res program.

CalCalc

For those in the age bracket 40-50 who felt left out when attempting to use this program from the December 1982 issue (p. 84), the line below should be added to both the Microsoft and Atari versions.

```
785 IFAGE>=40ANDAGE<=50THEN CPD=3008:IF SX
     THEN CPD=2162
```

Atari Lister

In the program on page 191 of the January 1983 issue, the GOTO 32710 in lines 32715 and 32725 should be changed to GOTO 32705.

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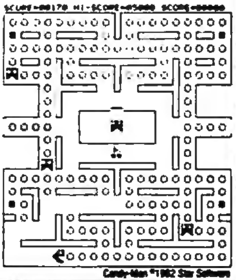

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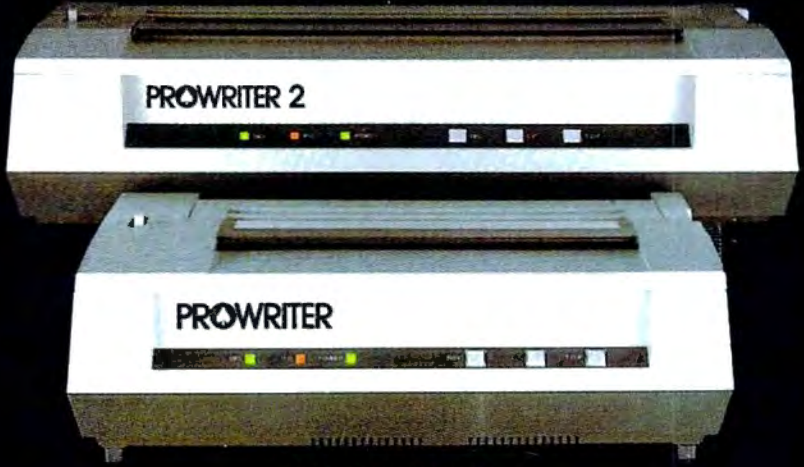

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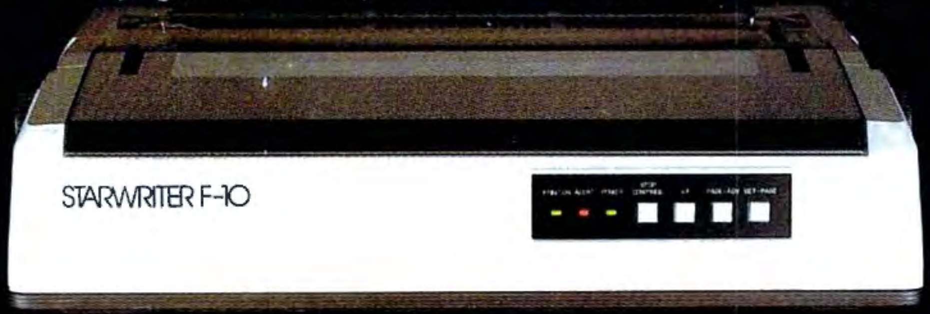

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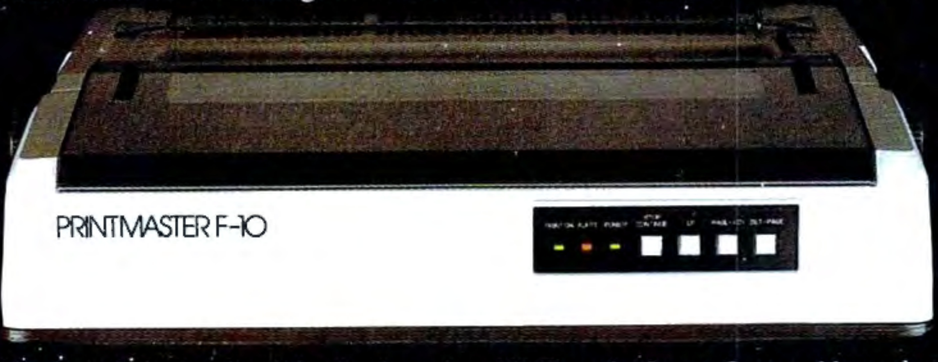

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Typewriter Keys	Yes	Yes	No
Typewriter Feel	Yes	No	No
Color Control Keys	Yes	No	No
Graphics on Keys	Yes	No	No
Reverse Letters	Yes	No	Yes
Programmable Function Keys	Yes	No	No
Works with TV or Monitor	Yes	Yes	No
True Lower Case Letters	Yes	No	Yes
DISK FEATURES			
Capacity	170K	90K	88K

If these two senses don't convince you that the VIC 20 offers more for the money than any other home computer, simply rely on common sense.

NOW THAT YOU KNOW HOW EASY A COMMODORE HOME COMPUTER IS TO OWN, FIND OUT HOW EASY IT IS TO EXPAND.

One thing about home computers that you're bound to discover at home is that, once you learn what they can do, you'll want them to do more and more. To do this, you may need accessories called peripherals. These let you get more out of a home computer by letting you put more into it.

They include items like cassette recorders and disk drives to input data, modems for telecomputing and printers. And all VIC 20 peripherals are fully compatible with the powerful Commodore 64™ personal computer.

PLAN AHEAD.

When you start looking at your first home computer, you may think it's too early to start planning to add peripherals. If that's what you think, you're once again playing right into the hands of our competitors.

Because once they've gotten you to buy their home computer, for what seems to be a reasonable price, they have you hooked on their system.

The costs of which, if you'll examine the chart below, can really start getting unreasonable. For example, while these computers may seem to be close to the same price to start, an expanded system can cost you twice as much with TI or Atari as with the Commodore VIC 20 or Commodore 64.

EXPANSION COSTS	VIC 20™ or COMMODORE 64™	TI99/4A®	ATARI 400®
BASIC	Included	Included	$59.95
Peripheral Expansion System	Not Necessary	$249.95	Not Necessary
Disk Drive	$399.00	399.95	599.95
Disk Controller Card	Included	249.95	Included
Modem	109.95	224.95	199.95
Modem Interface	Included	174.95	219.95
TOTAL	$508.95	$1299.75	$1079.80

Manufacturer's suggested list prices. Prices per TI June-December 1982 U.S. Consumer Products Suggested Price List.
Atari prices effective July 1, 1982 Suggested Retail Price List.

THINK OF IT AS BUYING A TOASTER.

It's easy to fill up a computer ad with RAM's and ROM's, numbers and technical jargon. But when it comes right down to it, buying a home computer is just like buying anything else. It's important to know just what you're getting for your hard-earned money.

And we hope we've accomplished that here by telling you about the cost of expanding your Commodore VIC 20 or Commodore 64 computer.

commodore
COMPUTER

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