The Future Of Games

COMPUTE! *Talks To Adventure International, Atari, Brøderbund, Commodore, On-Line Systems, Sirius Software, And Others...*

COMPUTE!

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1982
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The Journal For Progressive Computing™

Special Games Issue

Superchase, Mathman, Meteor Storm, Laser Barrage, And Much More

Writing Games For Computers With Limited Memory

Software Digital Speech Synthesis For Apple And PET/CBM

Character Set Editor For The VIC-20

Color Mixing On The Atari

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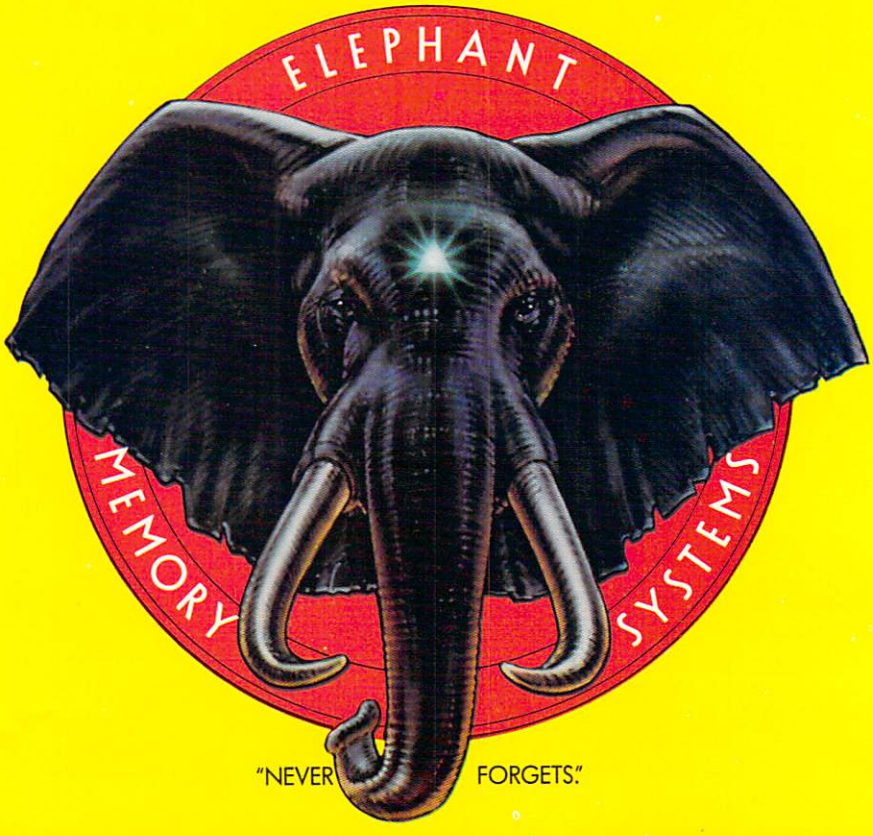

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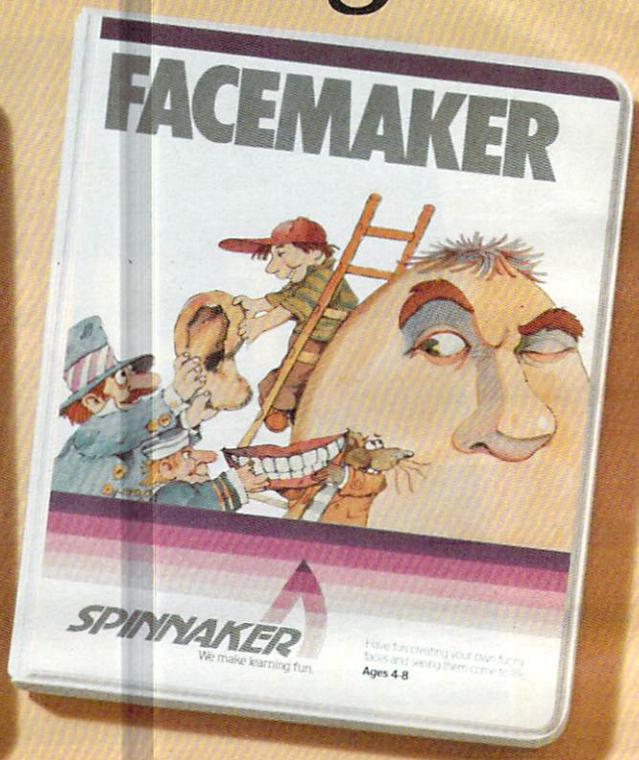

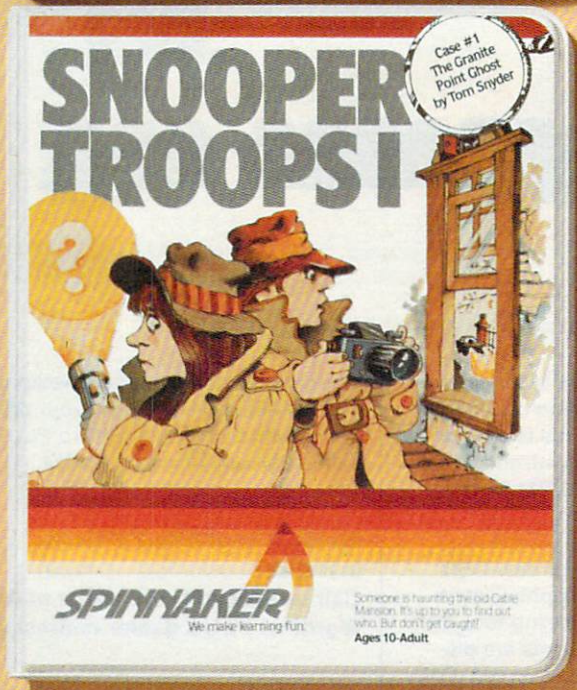

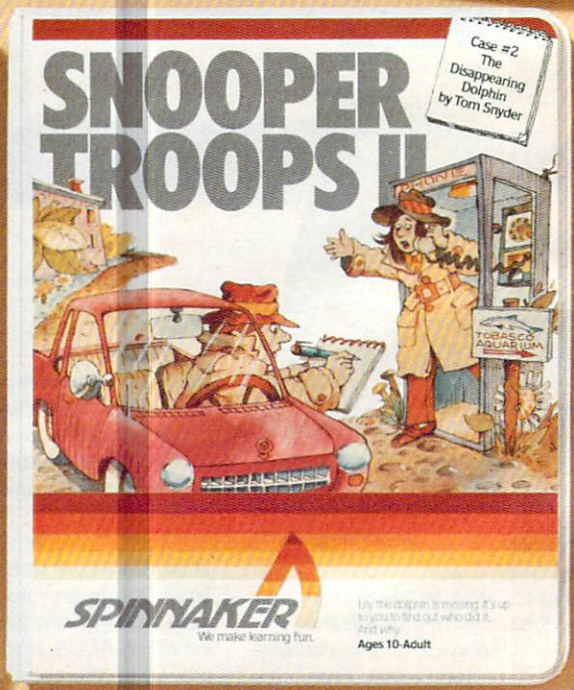

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And right now, we're introducing four new games that can be played on the most popular computers, Apple,® Atari,® and IBM.®

First, there's FACEMAKER. It's for young computer users, kids ages 4-8. FACEMAKER helps children improve memory and concentration and provides familiarity with the computer.

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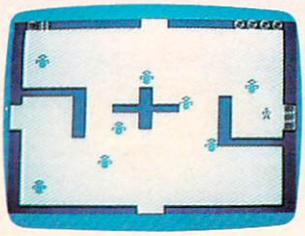

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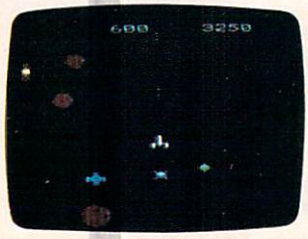

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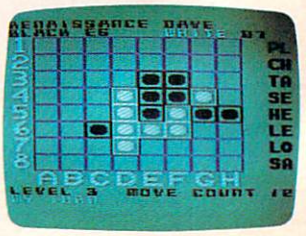

Renaissance — 1600

October 1982 Vol. 4, No. 10

FEATURES

EDUCATION AND RECREATION

REVIEWS

COLUMNS AND DEPARTMENTS

THE JOURNAL

GUIDE TO ARTICLES AND PROGRAMS

AP Apple, **AT** Atari, **P** PET/CBM, **V** VIC-20, **O** OSI, **C** Radio Shack Color Computer, **64** Commodore 64, **ZX** Sinclair ZX-81, * All or several of the above.

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The Editor's notes...

Robert Lock, Publisher/Editor-In-Chief

Will The Price Wars Continue?

Texas Instruments announced a $100 rebate program on the TI-99/4A, thereby bringing its price to $199. We must confess that we were never aware that TI had moved to $299, but this was apparently the case. The stock market welcomed all of this news enthusiastically, promptly lowering the price of stock in TI, Commodore, Warner Communications (Atari), and Tandy.

The recent market rally seems to have helped though, and the group is climbing back. Atari has announced a software coupon savings offer on the 400, and Commodore has moved to lower prices on the VIC-20. Predictably, Commodore has slowed down its introduction of the $179 Max machine, moving instead to dramatically increased VIC production. Their 40,000 units per month will be increased to 70,000 by late fall.

As an aside, we'd like to point out a few things. A personal computer is not, for example, a toaster. It's a sophisticated piece of computing power that, properly used, can teach, entice, amuse, and entertain. This is a rapidly maturing market. It will continue to grow on its strengths. We suspect that those who try to sell it on price alone will suffer in the long run.

West Coast Subscribers, Take Heart

Finally, with this issue, your copies will start arriving earlier. You are now officially in the "pool," meaning your copies are trucked by our printer to three west coast mailing centers, where your copies are mailed. The key is mailing you on the west coast rather than the midwest. We're expecting this will cause all of your magazines to arrive by no later than the first week of the month. Imagine – your subscriber copy arriving before retail store copies!

A Record Setting Issue

Not only did our press run break 100,000 with this issue, but we set other new **COMPUTE!** records as well: largest issue, most advertising, most four-color. Equally important, this special games issue is full of excellent articles, and, as always, programs ready to type right in and use. Enjoy it.

A New Atari President

Roger Badertscher, who resigned as president of the Atari, Inc. Home Computer Division in June, has been replaced. Ray Kassar, chairman and CEO of Atari, has announced the appointment of John Cavalier. Mr. Cavalier was previously vice-president and general manager of the Dixie-Dixie /Marathon unit of American Can Company.

Sinclair, Radio Shack Color Computer, and TI-99/4A Owners

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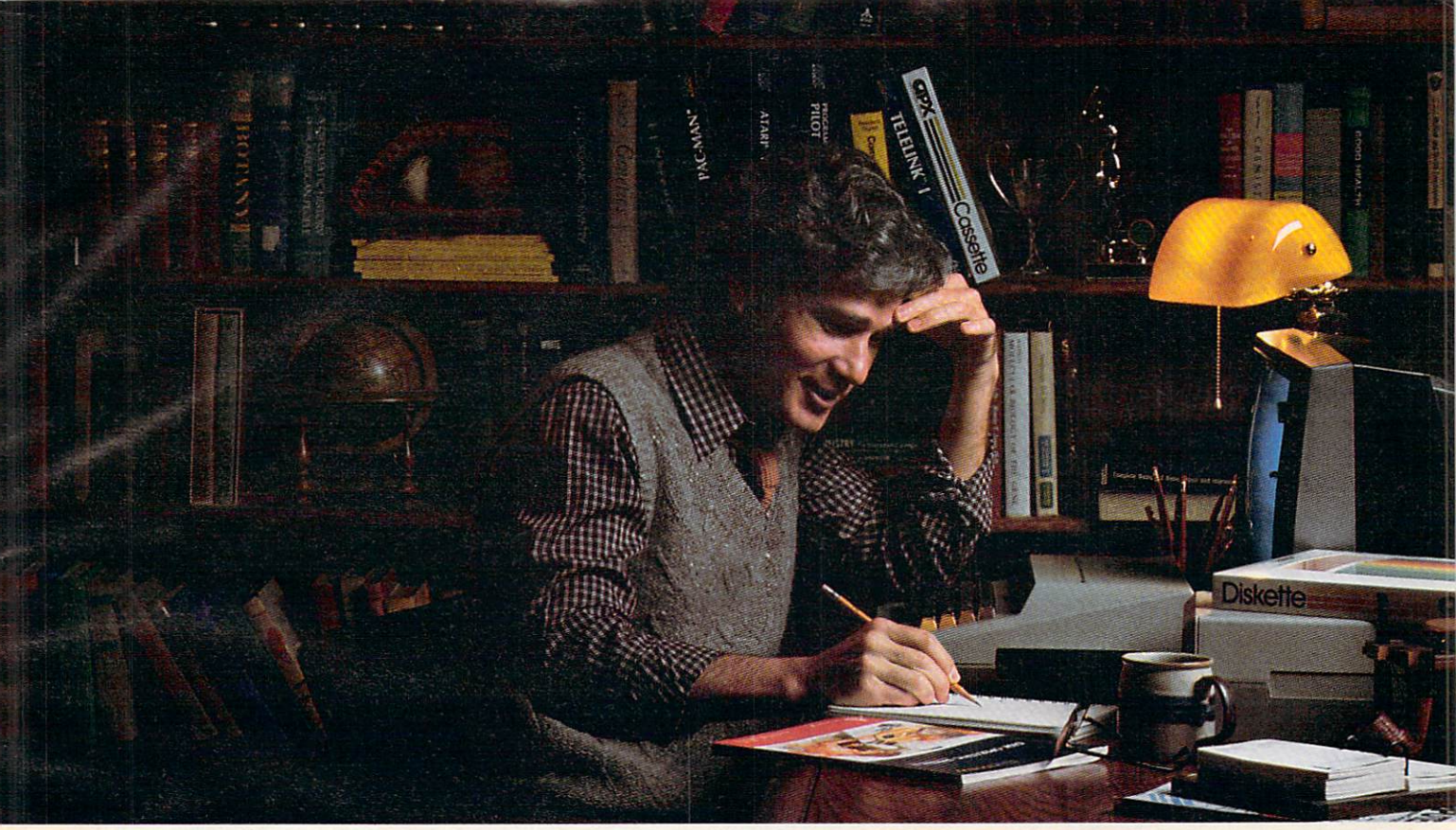

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Fig-FORTH*—For specialized programming needs, such as educational or game applications, ATARI Fig-FORTH is uniquely effective. Fig-FORTH combines power and simplicity in an efficient 10K size, with characteristics of an interpreter and the speed of machine language code.

ATARI BASIC—An affordable and easy to use BASIC that requires only 8K of memory. It allows you to take advantage of the spectacular ATARI graphics and sound capabilities. And its immediate mode error messages greatly simplify debugging.

ATARI Assembler Editor—An excellent tool to assist the assembler-programmer in creating, editing and debugging assembly programs.

PILOT—ATARI PILOT is an exceptional learning language, with built-in "turtle" graphics to let you create spectacular designs and pictures with very short programs. Simple one or two-letter commands allow you to create a dialogue with the computer. And a single "match" command can perform complex text evaluation and pattern-matching instantly.

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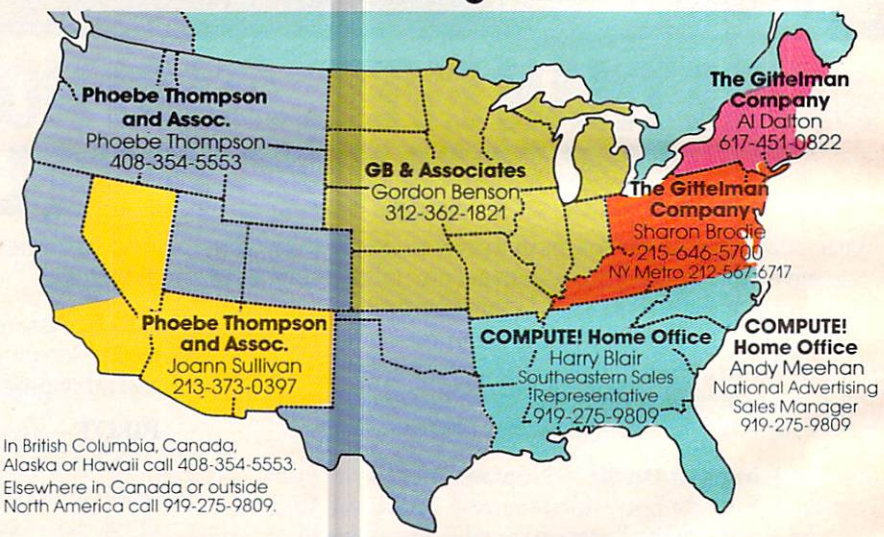

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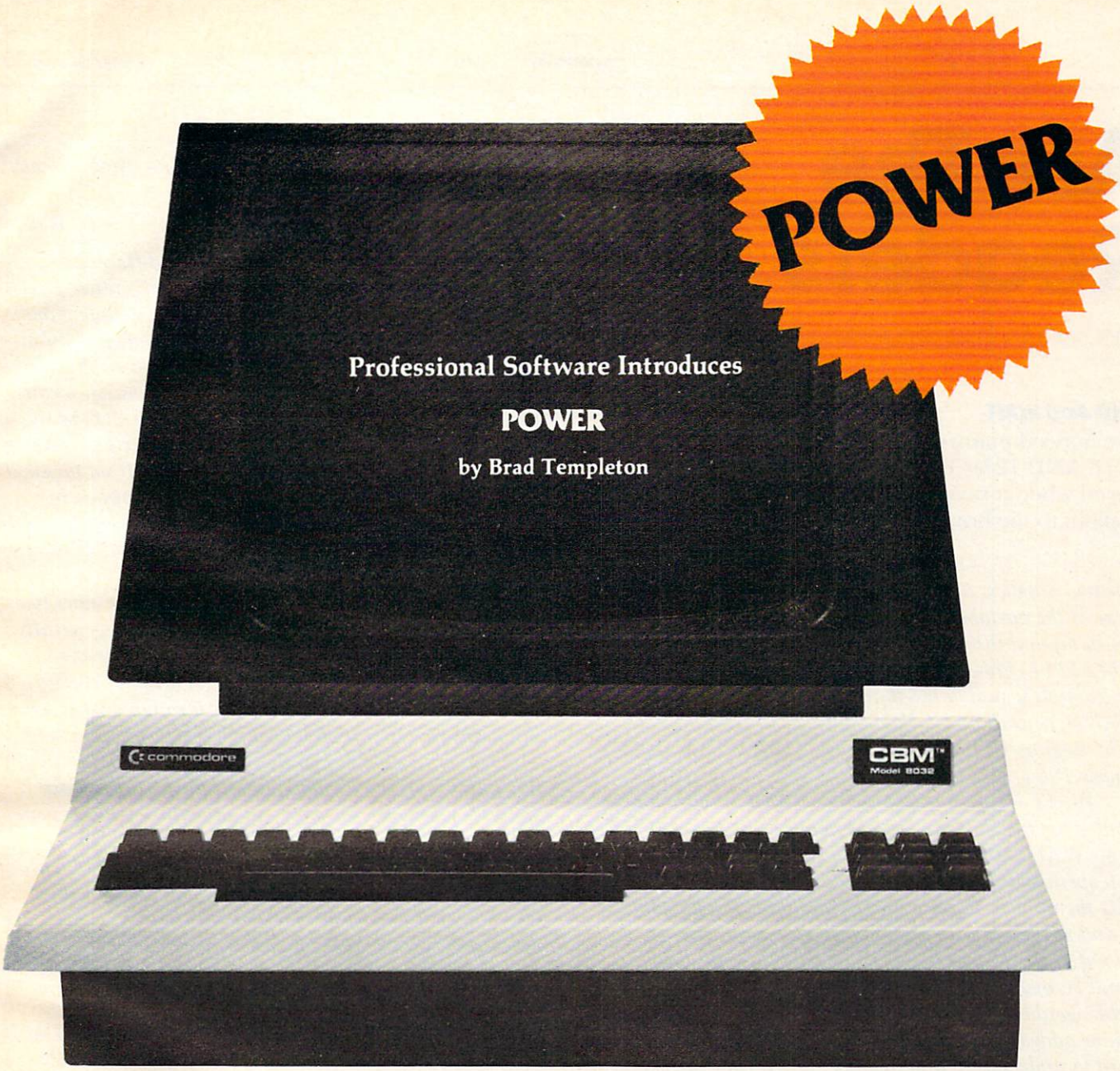

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POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

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Ask The Readers

The Editors And Readers of COMPUTE!

AND And WAIT

I've noticed many programs using "AND," such as: IF (Z AND 127)<32 THEN.... What's being compared when it says "Z AND 127"? Could you also explain to me how the WAIT statement works?

David Zacharuk

The two numbers are being compared in their binary form: if the variable Z is, say, 15 then it would look like this in binary: 00001111. ANDing it with 127 (01111111) gives 00001111 (15) so the IF THEN in the example would be less than 32. For further explanation of AND, consult any book on machine language or see "The Beginner's Page" last month, **COMPUTE!**, *September 1982, p. 24.*

WAIT is infrequently used in BASIC programming (and is not available in some versions of BASIC). If you wrote WAIT 5000,5,1 you would cause the computer to stop operations until it PEEKed address 5000, Exclusive-ORs the number it found there with the 1, ANDs with the 5, and the result is anything other than zero. If it gets a zero after these operations, it continues to wait until the result becomes something other than zero. WAIT's primary value would be for communicating with peripherals when you've added your own interface. It's hard to explain, hard to understand, and, luckily, hardly ever needed.

Reader Requests Assistance

In November 1981 I corresponded with a company named PROTRONICS for the purchase of a memory board for a PET computer. My check has been cashed. To date I have not received a product, nor have I been successful in getting my monies refunded. I have initiated action with the postal authorities and the Washington State Attorney General.

I am requesting that anyone who has had a similar experience with PROTRONICS to please correspond with me. Mail a short letter giving a few particulars of your case. I will then package the information and forward it to the proper authorities along with each person's name. Mail information to:

Arthur G. Walden
7505-78th Avenue SE
Mercer Island, WA 98040

Arcade Vs. Adventure

Could you define the difference between an arcade game and an adventure game?

A. Rabin

It's getting less and less easy to define the difference between these two computer game styles. Adventure games are including "arcade" features, and some arcade games now have several different "scenes" of action. Traditionally, an arcade game (named after the rooms in shopping malls where the machines offering these games are located) has one scene or "playfield" like the maze on Pac-Man. *There's fast action, color, sound, and you succeed in these games because you have good coordination. It's a physical experience – some say a sport – and things happen in* realtime *(the time between your moves and the opponent's moves is the same as it would be if you were really running through a maze being pursued by ghosts).*

An adventure game, on the other hand, is more like reading an adventure story in a book. There is generally no time limit to your "moves," and there are often many characters and many settings. An adventure game can take hours to play while you wander through a mansion with many rooms or search through forests and caves for a hidden treasure. Frequently your victory will depend on your skill at solving a riddle, or effectively using your available resources. In short, an adventure game is generally a mental rather than an athletic effort.

The trend, though, is toward a merging of adventure and arcade game qualities into what will likely be the supergames of tomorrow. To find out what the experts are forecasting, see "Future Games" on page 20.

Butterfield On RS-232 Interfacing

I have a RS-232 interface made by Quantum Data, Inc., connecting my Data Products DP-50 Daisy Wheel printer to my VIC-20. I am having a problem printing anything in my program. I keep getting out of memory. I am able to use my un-word processor I got from Microdata. It prints fine. However, it's in machine language and my programs are in BASIC. I can also list my programs by using:

```
10 open 128,2,0,chr$(4+2):cmd128:list
```

Here is the buffer Control Protocol for my printer (handshaking).

Data Terminal Ready, goes false (-V) when the interface buffer has less than 16 locations remaining and goes true (+V) when the buffer has more than 96 locations available. Remote/Software Provision: The terminal inspects the incoming data stream for the ASCII ETX control character (67 Coded Decimal Value) and automatically transmits an ACK control character (70 Coded Decimal Value) when the ETX is pulled from the interface buffer. By transmitting the data in blocks separated by ETX characters, the host system can synchronize the rate of block transmissions to the actual average

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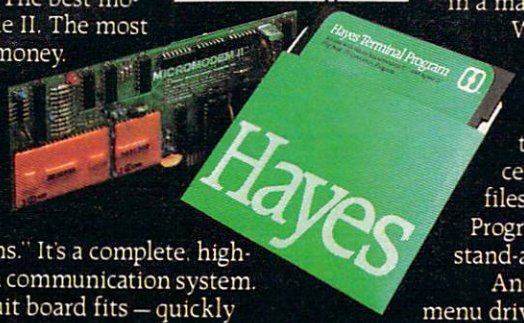
Microcoupler



Now there's Hayes Terminal Program, too! Developed by Hayes specifically for Micromodem II, this new Terminal Program allows you to access all the great features of your modem in a matter of seconds. With it, you can use your CP/M® DOS 3.3 or Pascal formatted diskettes to create, send, receive, list and delete files. Hayes Terminal Program is a complete, stand-alone disk.

And because it's menu driven, you can choose from a wide variety of options to set your communication parameters – as well as change hardware configuration – directly from the keyboard. It even allows you to generate ASCII characters that are normally not available from Apple keyboards, further extending your capabilities. Incoming data can be printed (on serial or parallel printers) as it's displayed on your screen.

Software sold with Micromodem II or separately. A Terminal Program disk and user manual now come with Micromodem II; or, if you already have one, you can buy the Terminal Program separately.

If you're ready to communicate with other computers, to access information utilities, timesharing systems, or use bulletin boards, then you're ready for Micromodem II. Come on. Compare. Consider.

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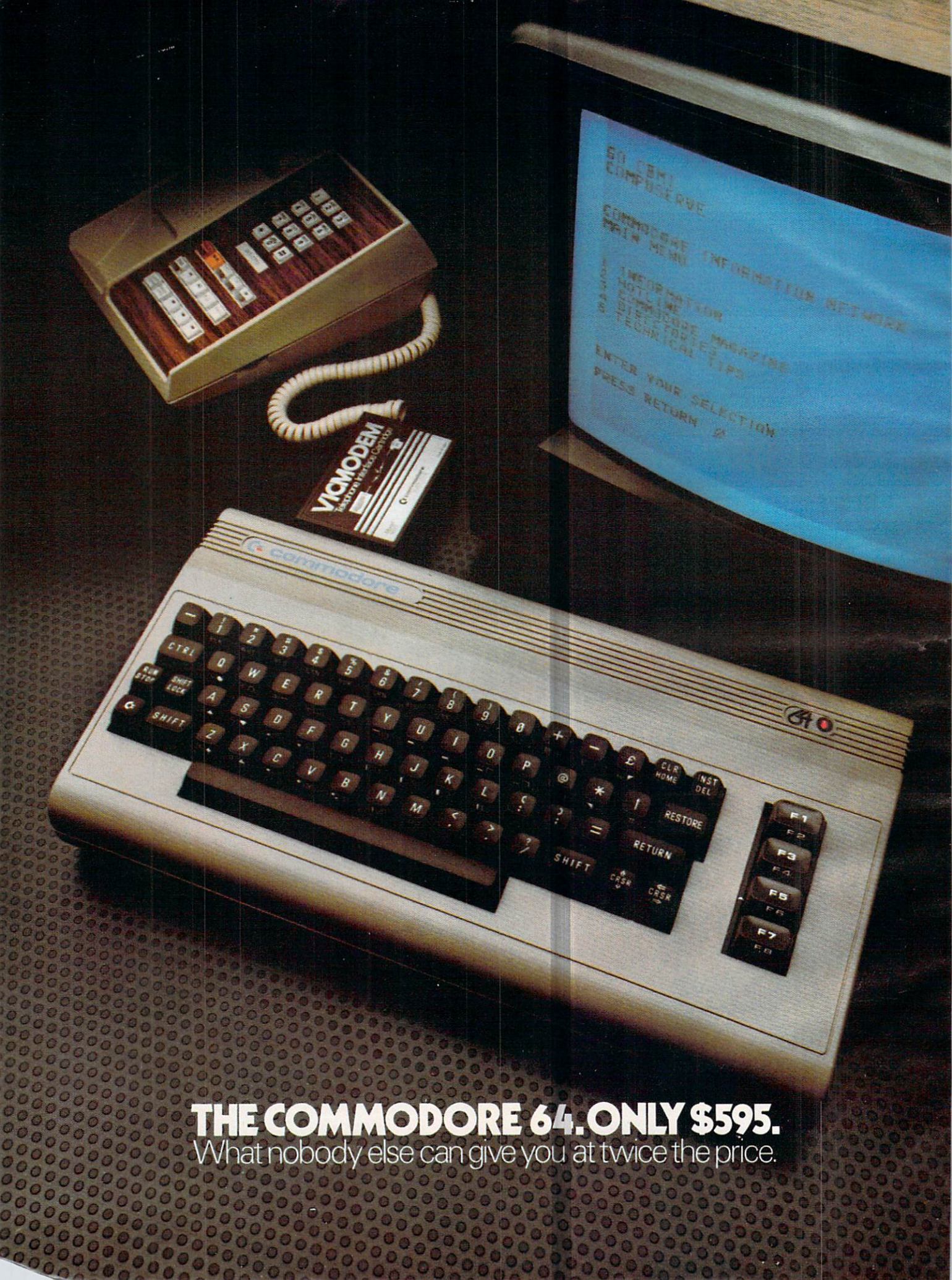

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So it looks like I have to set up a buffer for handshaking. I am lost; can you help me? I have one other problem in setting up this buffer. If I want to print lower case letters I will need some conversion in setting up my buffer. This is because my printer uses true ASCII characters, not Commodore. Are you still with me or have I lost you as I am lost?

Daryl E. Williams

The August issue of **COMPUTE!** *should have been some help on how VIC uses RS-232 (page 99, "VIC Communications: The RS-232 Interface").*

First, a little exercise in terminology. Usually, VIC is the "terminal" and is working a communications line through a modem. However, if we want VIC to talk to a printer, VIC can't be the terminal – we already have one of these – so VIC must become the "line," acting the part of the modem. No problem here except that connections change names as they pass between the two units. One device's Send is the other's Receive, of course. The DTR sent by the printer becomes the DSR (Data Set Ready) connection on the VIC, and vice versa. Similarly, the RTS (Ready to Send) output and CTS (Clear to Send) input must be flipped over between the two devices.

RS-232 is hard to pin down; it can be used in many ways. If we wish, we can simply send on the send line and receive on the receive line and not worry about the other wires. This is the basic "three-wire" operation (the third wire is ground); it has no handshake. Alternatively, we can use DSR to see if the other guy is willing to receive from us, and DTR to signal whether we are ready to take from him. This is one of the options on your printer.

Now, VIC reads the handshake lines from the printer (VIC sees them as DSR and CTS) and is capable of restraining traffic. Unfortunately, there's a bug in the present VIC software, and the handshake won't work. Your program can still check this information directly: DSR, the printer's DCD, can be seen with PEEK(37136) AND 128; and CTS, the printer's RTS, can be seen with PEEK(37136) AND 64. But you must do this in your BASIC program.

The alternative you mention is a remote/software handshake. Not hard to do for a printer that is so equipped. Just PRINT#n,CHR$(67); that sends the ETX. Now wait in a GET#n loop until you get a character back from the printer. The character will be CHR$(70), but that doesn't matter. When it arrives, you'll know that the printer is "caught up."

No need to set up a buffer: opening the RS-232 does that for you automatically.

Final problem: PETASCII is not the same as ASCII. The conversion rules – assuming your PET is in text mode (upper/lowercase) – are as follows: ASC values less than 65: no change. ASC values from 65 to 96: add 32. ASC values from 193 to 224: subtract 128. Any other characters are not really ASCII compatible (for example, graphics), and you can make arbitrary decisions on their translation.

This is all very nice as a set of rules, but starts to look clumsy when you want to translate "The quick brown fox..." for the printer. Each character will need to be extracted with MID$, changed to its ASC number, translated to the new ASCII numeric, and then sent on its way with PRINT#n,CHR$(..);. Slow and unsatisfying, but workable. The translation part can be speeded up somewhat by setting up an array of pre-translated values, so that a PETASCII value of 70 would translate immediately to T(70), in this case 102. We can now start boiling down translation of string S$ to something like:

```
FOR J = 1 TO LEN(S$):PRINT#n,CHR$(T(ASC(MID$
    (S$,J))));:NEXT J
```

(Whew!)

The whole thing becomes faster and easier with either of two other solutions: hardware or machine language. It turns out the manipulations above are really simple bit rearrangements. A few hardware gates on the interface will do the job easily. Similarly, a few machine language instructions can test for certain bits and then AND them away or OR extra bits into place. But we must deal with new questions here: how do we get into the information stream to make these changes? It can be done, but there's no space for a brief answer here. Perhaps your word processor can be easily modified for your printer; you might query the supplier.

The following machine language conversion code takes a PETASCII value in the A register and converts it to ASCII before output. The hardware conversion is very similar to this simple machine language process.

```
        CMP  #$40
        BCC  NOTALF
        CMP  #$60
        BCS  NOTALF
        ORA  #$20
NOTALF  AND  #$7F
```

The jargon of RS-232 can intimidate the beginner. It can be puzzling to find that most of the 25 connections are left unused in the average system; they are there for features that we don't need. And the VIC's non-working handshake doesn't help clarify things.

But the pieces are all there, and they can be made to work. The VIC gives you a lot of help on RS-232: a bit more effort might pay real dividends.

Jim Butterfield

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

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MAIL TODAY!

A Monthly Column

Computers And Society

David D. Thornburg
Associate Editor

The Game's The Thing

Those who draw a distinction between Education and Entertainment don't know the first thing about either.

(Marshall McLuhan)

I can think of no application of microprocessor technology that has aroused as much controversy as the electronic game. It matters not if the game is in the home or in an arcade; some people feel that such electronically enhanced entertainment is a greater threat to society than, for example, microprocessor controlled smart bombs.

Almost anyone with a sufficiently negative opinion of game arcades seems assured of television exposure on the evening news or front page treatment in the local paper. As an example of the level to which the hysteria has risen, I have only to thank those readers who sent me copies of the front page article from the June 1 issue of the tabloid *Weekly World News*. For those of you who haven't read it, the front page headline blared (in 1 3/8" type) TEEN KILLED BY VIDEO GAME. The article went on to say:

> Shocked players at the Calumet, Ill. video center were stunned as they watched the 18-year-old youth suddenly slump at the controls of 'Berserk' and slowly crumple to the ground. His lifeless body was a tragic symbol of the video game's conquest over its human foe.

Of course, the article went on to point out that the coroner found the boy had an undetected heart condition, and that it was the stress that killed him. Had this young man died as a result of overstress on the tennis court, I'm sure the story would not have been nearly as newsworthy.

It was thus with great relief that I received a package of articles in the mail from Peter Favaro – a Long Island psychologist who has spent years carefully studying the effect of video games on children.

You say that you haven't heard of Peter? Well, from what I can tell, he isn't the sort who is going to be gobbled up by *60 Minutes* or *The Today Show*. He is a scientist who believes in reporting without hysteria what he observes. His writing does *not* contain sentences like:

> He could see the beads of sweat reflected in the TV screen as his clammy hand reached for another quarter. Finally, after spending $85, he was within striking distance of his goal – a free game.

What Peter has done is quite interesting. He explored the skills acquisition potential of video games for his Master's thesis a few years ago. He explored the use of video games as a reinforcement tool for teaching learning disabled and emotionally disturbed children, and he studied the so-called "addictive" aspects of video games.

Coordination Test Findings

What did he find? First, some game proponents (myself among them) have speculated that, if nothing else, prolonged video game play would result in improved eye-hand coordination. Along with three colleagues, Peter devised a test involving 45 nursery school boys aged three to five years. The children were randomly divided into three groups. The experimental group received six, five-minute training sessions on a popular video game; another group received the same amount of personal attention, but did not play any games; and the third group was a control group that received no special treatment.

Prior to the experiment, each group was tested on two video games and one pencil and paper maze-solving task. The results showed that the experimental group did improve their skills in playing other video games, but that these skills did not transfer to the maze-following task. As Peter says,

> One might criticize these results by saying that they suggest that children who play video games only get better at playing video games. On the surface, this is certainly true; however, my colleagues and I feel that, if given longer training sessions, the children might have achieved transfer to the maze tasks since there was a trend in this direction and since transfer was shown on a task with different stimulus characteristics.

Note that he did *not* say:

> In the diffuse light of the damp basement laboratory, one could see that the children's eyes, once large with excitement and wonder, had hardened to steel as they fought for the right to get just one more quarter.

Peter's more recent work included the use of video games as a reinforcer for good behavior in a

25 of The Hundreds of Reasons You Ought To Be A **COMPUTE!** Magazine Subscriber:

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special education class of six boys who had previously "acted out." (Acting out, for those of you unfamiliar with the term, means doing things like breaking chairs over each other's heads.) Using this class as an opportunity for more research, he discovered that children responded much better when video games were used as the reinforcement tool than when the traditional "snack" reinforcers were used. An incidental benefit (beyond the low sugar content of video games) was that some of the more withdrawn and defensive children gained confidence and peer acceptance through the games.

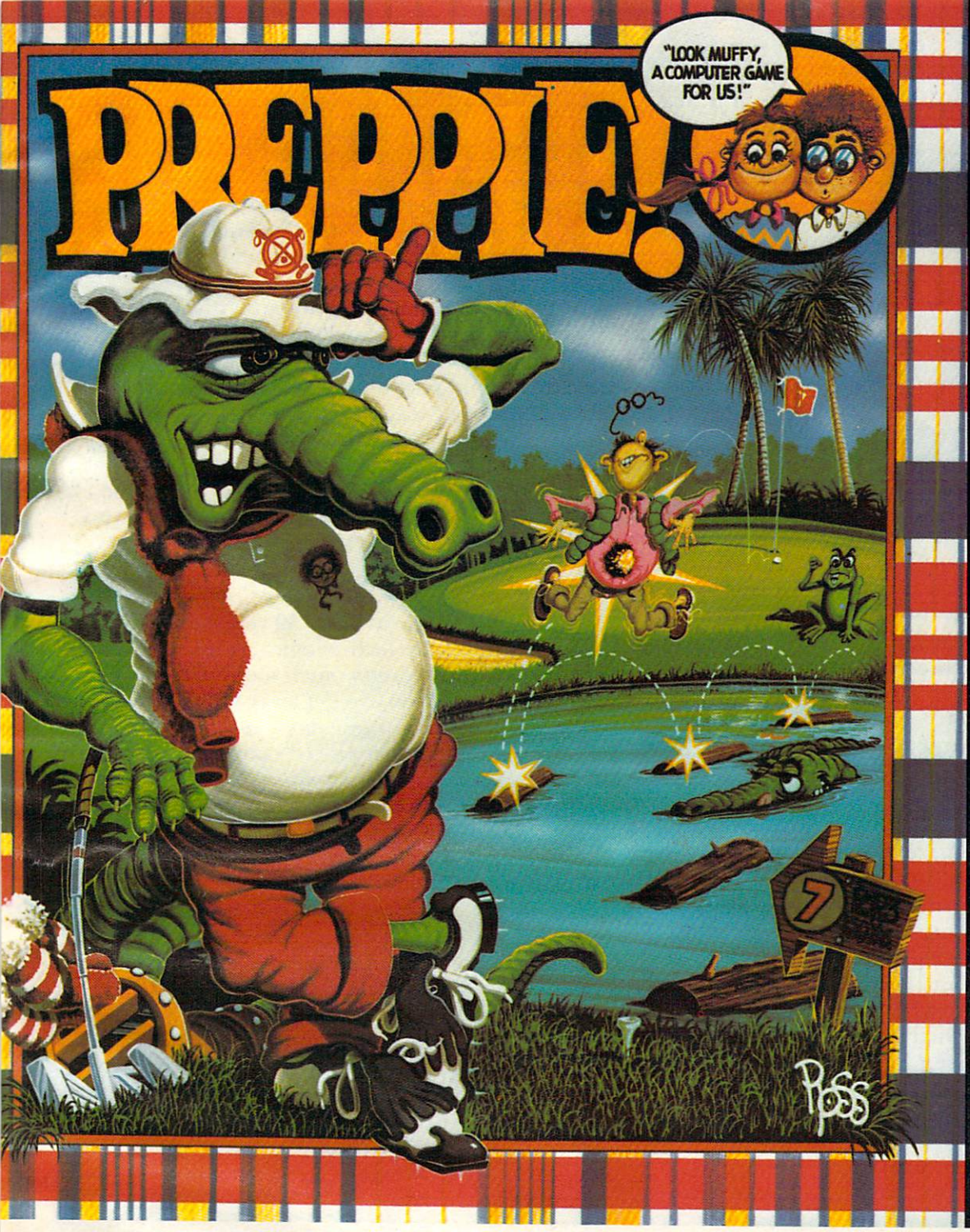
Of all the criticisms leveled against these games, the idea that children become addicted to them raises considerable concern with the greatest number of people. Accordingly, Peter devised a study to measure social responsibility, impulse control, and compliance among groups of children who played video games. Since these three areas are ones in which addicts display behavior quite different from that displayed by non-addicts (whether the addiction is alcohol, drugs, etc.), it seemed appropriate to measure these things for a group of "heavy game users" and to compare the results with those for a group of "light game users."

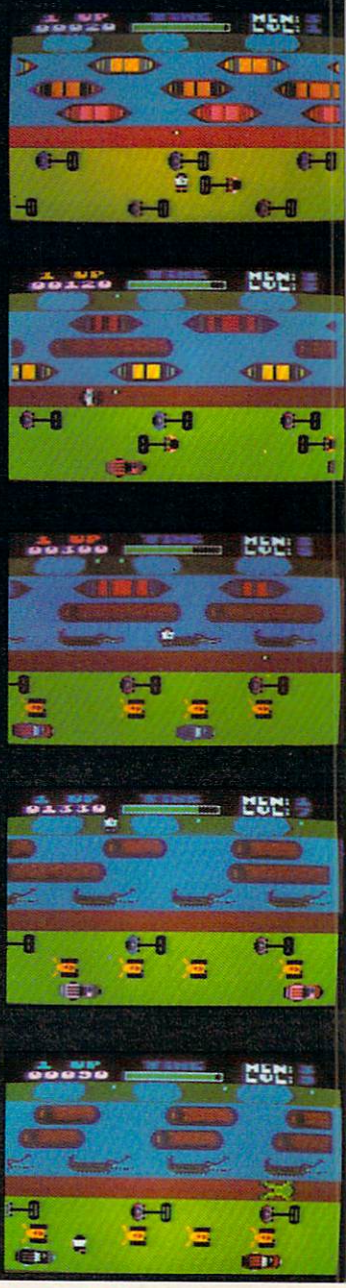
In one test, he gave every child 12 quarters and told them that they could use six quarters on a game, but must give the remaining six quarters to a person nearby who was collecting money for charity. While the heavy game users did play more games (7.6 quarters vs. 5.6 for light users), the heavy users showed more social responsibility in giving the balance to charity (5.5 quarters vs. 4.5). My, my – so much for differences in social responsibility.

While Favaro's study is by no means conclusive, it did encourage him to make an interesting observation:

> Obviously, anything that is done in an obsessive way can seriously disrupt anyone's life, but the point is: Why focus on video games? A child would be in serious trouble if he practices dribbling a basketball nine hours a day to the exclusion of everything else. Children as well as adults who have "addictive personalities" will always find a target for their addictions. It is unscientific to claim that a causal link exists between video games and maladaptive behavior, simply because a small population of children do both.

Well said, Peter, well said. ©





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—Holister Townsend Wolfe

"I had so much fun I almost blew my doughnuts."
—Theodore Boston III

"I haven't had this much fun since Buffy and I went to Princeton for the weekend."
—Martha Vineyard

Listen to what Scott Adams, Chris Crawford, and other experts have to say about computer games of the future. You're in for some surprises.

The Computer Games Of Tomorrow

Tom R. Halfhill
Features Editor

Harry Buttondown left the office promptly at 5:05 p.m., walked two blocks to the subway stop, dutifully deposited his token in the turnstile, and stepped onto the train.

It was already pretty crowded. Harry decided to squeeze himself next to a seat-hog who was inconsiderately sprawled across two spots, staring obliviously out the window with his back turned. Harry leaned toward the stranger. "Excuse me, sir," said Harry, with the assuming poise of a supervisory executive. "Please move aside."

Slowly the man turned his head. Harry froze in terror as he stared into the stranger's glowing red eyes – all five of them. Foam drooled from laser-sharp fangs and dribbled down a fur-covered chest. Growling like a timber wolf with acid indigestion, the thing reached toward Harry with a pair of six-inch claws.

Harry screamed. All poise forgotten, he hurled his Gucci briefcase at the horrible monster and stumbled over an obstacle course of ankles and feet in his mad scramble down the aisle for the exit.

Suddenly, Harry became aware that people were laughing at him. Were they insane? He turned around, panting, and saw that the creature had mysteriously disappeared. Then Harry noticed a huddle of snickering teen-agers in the back of the train. They were holding one of those newfangled portable holographic computer game machines. (Snicker, snicker.)

Harry sheepishly recovered his briefcase and found another seat. How he yearned for the good old days when kids used to board the subways with nothing more than boom boxes.

Forces Shaping The Future

Sounds pretty fantastic, doesn't it? But when you think about it, Harry Buttondown's encounter with the subway creature is a logical extension of two trends in game and entertainment technology: the trend toward games which more and more closely simulate reality (or unreality), and the trend of miniaturizing entertainment devices until they are portable enough to be carried around almost anywhere. Both of these trends are highly visible today.

On the one hand, technology is making possible increasingly vivid video games, and on the other, it is shrinking stereos and televisions – and computers and electronic games – down to personal size. Appliances that used to occupy immovable living room cabinets can now be carried while jogging. Would anybody have imagined 25 years ago that radio-tape stereos, the "boom boxes," would be toted by kids on subways? Or, even ten years ago, that video games could be worn on your wrist?

Still, it's too easy to get carried away with the possibilities of future technology. Sure, almost anything is possible in 20 or 30 years. The moon landings and other technological feats of the past two decades have pretty much silenced the doubters and nay-sayers. You can get away with predicting practically anything these days, and almost nobody is now willing to go on record saying, "Impossible!"

So what are the possibilities? What can we realistically expect in the near, and not-so-near, future? Three-dimensional, high-resolution computer graphics on home video game machines? NASA flight simulators in the arcades? Videodisc adventures? Wraparound screens and "smellavision"? Will the teen-agers of tomorrow really carry portable holographic computer game machines onto subways?

Even the experts – the programmers and software producers who will make the future happen – don't agree. What's more, some warn against a narrow vision of the future that considers only technological advances as a vehicle of change. Don't forget, they point out, that psychological factors, fads, styles, marketing considerations, and economics are equally important.

"Five years ago I could never have predicted where things are today," says Scott Adams of Adventure International. "I've been totally amazed. So there's no way I could anticipate what's going to happen five years from now."

Predicting the future – as many a crystal ball-gazer busted by the fraud squad has discovered – is a

Scott Adams, Adventure International.

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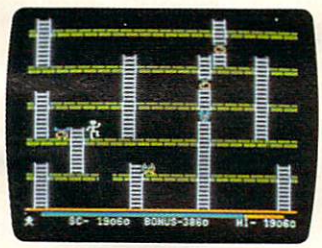

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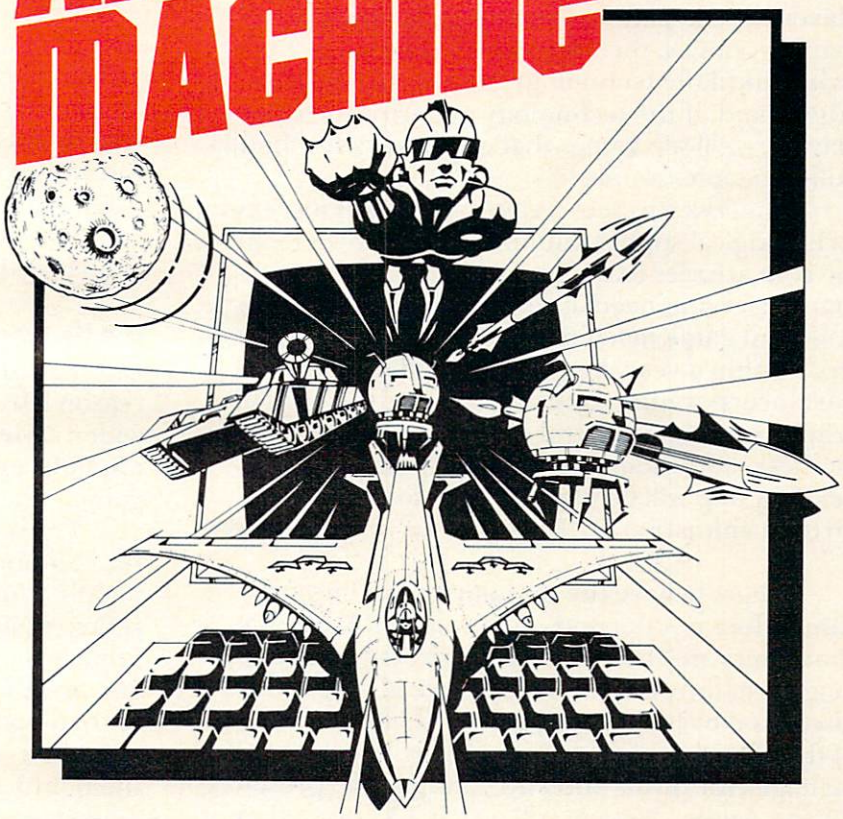

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Are Video Games A Fad?

One thing virtually everyone agrees on is that computer games are here to stay. Individual games will pass on after short lifespans, and certain general types of games may fade in and out of style, but we've only begun to exploit the possibilities of computerized gaming.

"If people today are becoming bored with electronic games, it's because they're becoming too sophisticated for the games," says Michael Tomczyk, product marketing manager for Commodore International. "The whole question is whether the game players will outstrip the technology, or whether the technology will outstrip the players. If the players grow more sophisticated than the games, then the games will fall off for awhile until the technology catches up. On the other hand, if the technology outstrips the game players, we'll see games that only a very few highly skilled people can play."

Tomczyk foresees a general trend of increasing technological sophistication filtering down from the coin arcades to the home. Right now, he says, there's a crying need at the home level for more powerful game machines and better game controllers. Within a year, he predicts, home games will start incorporating simulated three-dimensional graphics, remote-control joysticks, voice-actuated joysticks, and wider use of voice synthesis. "The next big step will be graphics that look just like cartoon animation on TV – I mean very much like it."

Others believe the popularity of computer games does not depend on new technology, that computers are flexible enough already to sustain long-term interest. "I think people always will be fascinated by [computer] games. They'll never tire of those fantasy worlds," says Ernie Brock, product manager for Sirius Software, a top game producer for the Apple. "People still watch TV, don't they? People have hi-fis and stereos and continue to buy new records and don't tire of them. I think the same thing is true of computers and game software.... If you tire of one world on the computer, you can stick in a new disk and create another one."

This principle of escapism has not been lost on software designers, any more than it has on today's Hollywood filmmakers. That's why space and fantasy themes are so prevalent in both entertainment fields. What better way to escape the day's troubles than to leave the planet altogether, or even the universe? But although escapism will endure, certain methods of achieving it may not. Some already think the "shoot-'em-up" space games have peaked.

"The key is that the computer can temporarily make you into something you are not," notes Ken Williams of On-Line Systems, a major game software producer. "But even being a spaceship commander gets boring if that's all you do. The games where he just shoots up screens of aliens, and which only give him more aliens when he's done, are going to die. They're OK for now, but they won't be soon."

Several top game designers predict more different types of simulations in the very near future. Chris Crawford, a programmer with Atari, Inc.'s Research and Development Group who has written such games as *Eastern Front,* refers to the "movement of computer games into larger realms of reality," and "broadening our base of fantasies instead of expanding our hardware." He says the current glut of space/fantasy games will be supplanted in part by computer simulations of soap operas, Westerns, detective mysteries, cops and robbers stories, and even gothic romances. In other words, all the escapist paths of pop culture in modern America.

Harlequin romances on disk? Heaven help us.

The Psychology Of Computer Games

But the fear of fading fads is certainly not the only reason why game producers are moving toward wider varieties of simulations. Another reason might be even more important: they want computer games to attract wider audiences.

Think about it. The audience (read: market) for computer games today is really quite narrow – mainly, children and young adults with excellent reflexes and an almost insatiable appetite for space/fantasy themes. Too many people (read: consumers) are left out. For example, millions are addicted to soap operas. What if they could be hooked on a computer-adventure simulation that transports them into *All My Children*? Or if the thousands of *True Detective* readers could be transformed into cops by an interactive adventure game, so they themselves could heroically rescue the innocent victim from the cult-killers? It takes no marketing genius to realize that software sales would skyrocket.

This possibility – the concept of redesigning the *psychology* of computer games to attract a wider audience – is now under close scrutiny by many game designers. If they weren't already thinking about it, something stupendous happened last year which opened their eyes:

Pac-Man.

You see, *Pac-Man* was more than just a hugely successful video game that managed to gobble more money in 1981 than the entire Hollywood

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film industry combined. *Pac-Man* also turned out to be an equal opportunity employer.

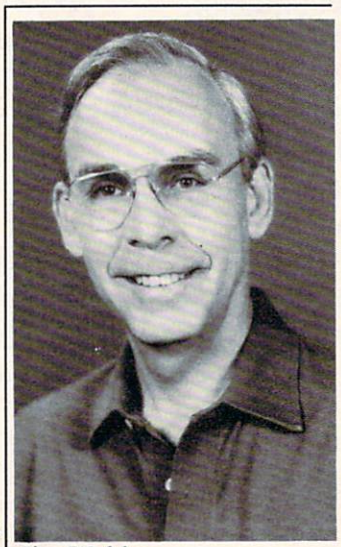
Before *Pac-Man,* you saw very few young women playing video games. When you did, they usually were with their boyfriends. But *Pac-Man* was different. Women liked *Pac-Man*. So much, in fact, that although no one has done a formal study, women are believed to have been a major factor in the immense *Pac-Man* phenomenon.

That's exactly why a new version of *Pac-Man* hit the arcades and cafes this summer: *Ms. Pac-Man,* complete with different graphics and colors. The lesson was not lost on other game designers, either. Computer games are no different than any other form of popular entertainment – specific audiences can be psychologically targeted.

"*Pac-Man* is classified as a 'cartoon' game," says Gary Carlston, marketing director and co-founder of Brøderbund Software, a leading game house. "If you're planning a game to appeal to women, you've got to be consistent in your concepts. For example, you couldn't put together *Pac-Man* and *Space Invaders* and expect a game about space warfare and killing aliens to attract women."

Commodore's Tomczyk says his company has gone so far as to informally study the matter. "Men tend to like games that have you destroying aliens and running away from robots and landing landers without crashing them. Women tend to like games which are, well, let's not say nonviolent, but not as grotesque, not involving destruction of animate objects or human life. Like, the ghosts in *Pac-Man* never really die, they just get recycled."

Jim Wylde, vice president-sales for United Microware, Inc., has also noticed these characteristics. "There doesn't seem to be much 'femaleness' in computer games today. They seem to be left out of computer games. I've talked to many, many young women in my own organization and elsewhere, and I always ask them, 'What would you like to see in a computer game?' And I always get a blank stare."



Jim Wylde,
United Microware, Inc.

Joanne Lee, a consultant for Tensor Technology Ltd. and a freelance game programmer for United Microware, explains why: "I don't like violence and I am not into science fiction, so I don't like space games. I don't like the little aliens running around on the screen. The only game I really liked was *Pac-Man*...."

The bottom line is that game designers no longer will ignore the female market, and will scramble to tap other new markets as well. Does this mean we'll see a sharp decline in space/fantasy shoot-'em-ups? No way. The young males still dominate the market. As Lee explains, "Sure, I would prefer to write a more nonviolent type of game, but I have to think about what is marketable."

The forecast: more diversified computer games, each catering to its own audience.

Re-creating Reality

So. Now that we have some idea where computer gaming is headed, what technological form will it take? This is the sort of pie-in-the-sky dreaming that everyone likes to indulge in, but there's a difference between imagination and extrapolation. We can imagine anything – well, quite a lot – but what seems likely to happen, based on current trends?

Practically all the experts agree that computer games will continue to grow increasingly sophisticated, and that sophistication will come in the form of better simulations of environments. That is, the games of tomorrow will seem incredibly real.

Videodiscs are most commonly mentioned. As consumer items, today they're pretty much limited to playing back movies, like videotapes. But videotapes, like computer tape drives, are only *sequential access* devices. Videodiscs, like minifloppy computer disks, allow *random access*. Under computer control, an image (or sequence of images) stored anywhere on a videodisc can be searched out and displayed within seconds. Consider the possibilities of a videodisc interactive adventure game. Instead of watching crude computer drawings of dungeons and caverns on the screen – or text descriptions – the player can see actual film footage of the scene unfold. In fact, filmed motion can be stored on the videodisc and recalled in response to joystick commands. Move the stick forward, and you walk deeper into the cavern. Move it left, and your "eyes" pan left.

Not only is all this possible: it's being done right now in highly advanced flight simulators and trainers. There are even projects underway in which film crews are filming all the streets of entire cities, making every possible turn at every intersection. When the images are stored on high-density videodiscs, they will be linked to computerized driving simulators to train truckers and cabbies.

The chief limitations are speed and cost. "We've fooled with that here," says Williams of On-Line Systems, "but the access time just isn't fast enough yet. No one wants to wait four or five seconds for a

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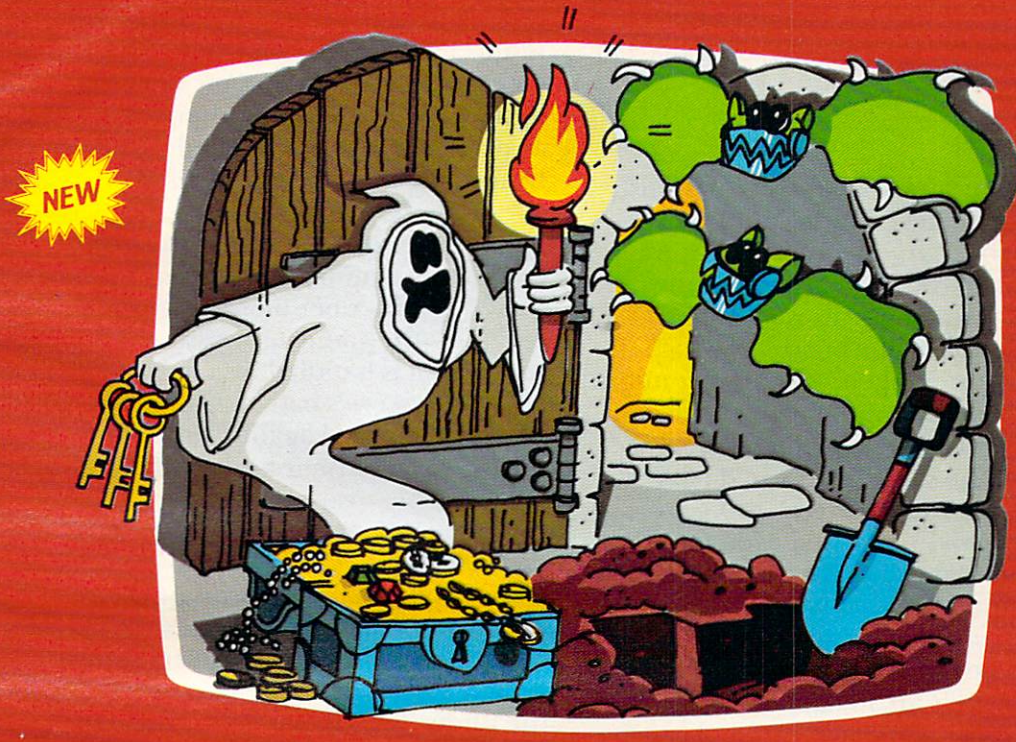

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videodisc to go search out an image. Also, there aren't enough of those [videodisc] units out there yet."

But he is excited over the possibilities of three-dimensional video games. "I've already seen some prototypes of arcade machines which use the same type of 3-D effects as the movies, the red-blue technique. We'll probably see this and also polaroid 3-D, at least in the arcades."

Total Immersion

Fred D'Ignazio, author and **COMPUTE!** columnist, thinks realism will be achieved by isolating the player from extraneous stimuli – of which there is plenty in most arcades – by "immersion" in the game environment. Arcade games would look something like those automatic booths in which people have their pictures taken, and players might even don helmets, headsets, and goggles. "All you would see visually would be your game screen, maybe wraparound," he says. "And you'd have a better environment for sound effects, too, and especially voice synthesis. You could even have voice-responsive commands, which even today's technology would support to a degree. And you'd need more controls, foot pedals and everything."

Nor would you be limited to playing a lifeless computer. D'Ignazio says arcade games could be hooked up to each other so people could play against other humans – maybe in another part of the city, or even another state – absolutely anonymously. "A lot of people play these games – at least, I know I do – because you don't have to compete with another human face-to-face. You can play the computer. But if you could play another person anonymously without having to confront them face-to-face, it would be a new challenge for a lot of gamers."

Fred D'Ignazio. *CREDIT: Karen Tam, Raleigh News And Observer*

What's more, the hook-ups could serve another function: "You could have news bulletins. 'Joe Smith just got a high score on *Galaxians* in Cincinnati.'"

This kind of telecomputing, or "telegaming," is already here in a simpler form. Although communications over phone lines between personal computers are still too slow to permit realtime, multi-player, arcade-style games, a few games are available which allow several players to compete head-to-head using phone modems. CompuServe, a leading information utility, offers two space warfare games, *Megawars* and *Decwars*. Up to ten people can simultaneously play either – a CompuServe subscriber merely signs onto the system and joins the game in progress. Although the game processing is handled by a large PDP-11 computer at CompuServe's base in Columbus, Ohio, the players are pitted against each other, communicating through their keyboards. Both games are text-only (no graphics).

Scott Adams's Adventure International sells a telecomputing game called *Commbat*. *Commbat* is a bit different than *Megawars* or *Decwars*; it allows only two players, but bypasses the need for a central computer. Instead, the players compete against each other using their own computers, linked over the phone lines by modems. Also, the game has graphics. The graphics are very simple, though, since *Commbat* allows Apple, Atari, and TRS-80 users to compete interchangeably, and those computers' graphics systems are normally incompatible.

Still, all of these games allow the sort of anonymous telegaming that D'Ignazio says could someday immerse the gamer in an elaborate environment of sight, sound, and sensation.

On the other hand, if you're the nervous type who would react to this "total immersion" by degrading into a screaming meemie, you might prefer computer games as a spectator sport. You know, Sunday afternoons on NBC. "I think there'd be a great audience for watching world-class video game players," says D'Ignazio. "You could have instant replays, slow-motion, and commentators going over their moves."

What's that, you say the video combat on TV got your adrenalin pumping? Anyone who wanted to work off a little "displacement aggression," as psychologists call it, could take up boxing at the local amusement park. "Instead of driving bump-'em cars or riding roller coasters or shooting at ducks in a shooting gallery," suggests D'Ignazio, "you'll be able to have robot wars by controlling your own little robots."

D'Ignazio also says video games will be found in unusual places, not just arcades. They'll be built

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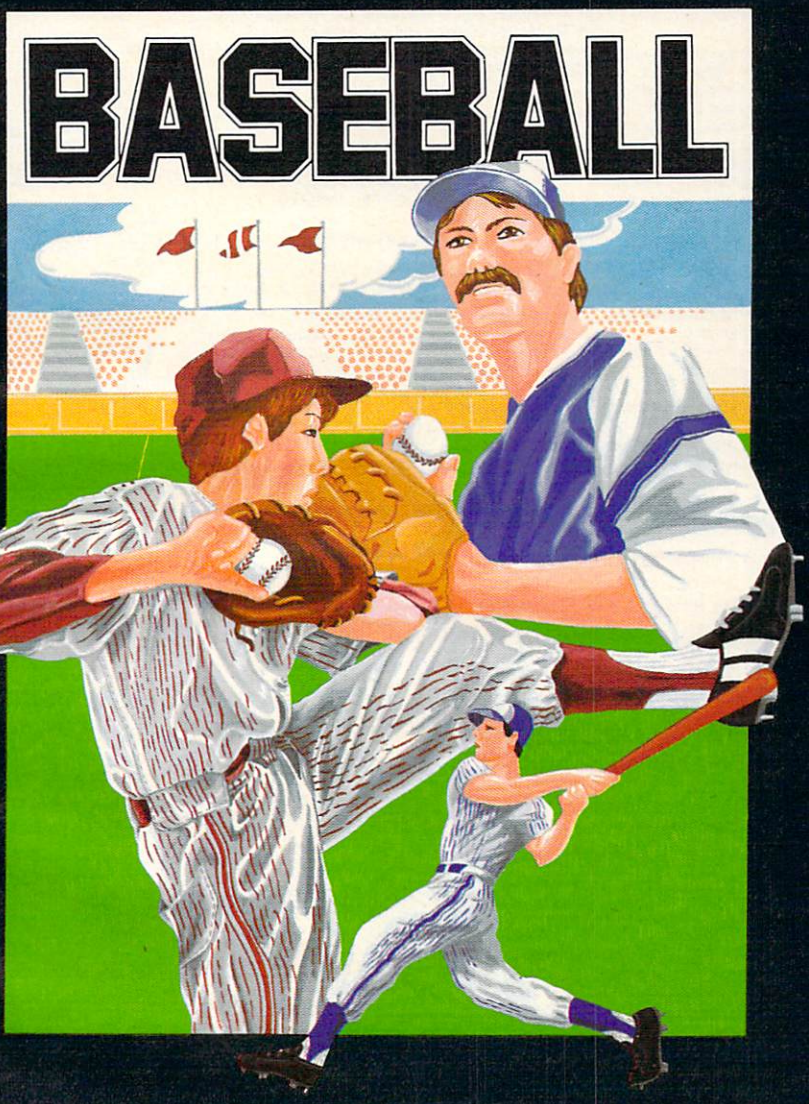

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into the backseats of cars to keep rowdy tots occupied; implanted in the ceilings of bedrooms; reduced to book-size and placed in dentist waiting rooms next to the *National Geographics*; installed in hospital rooms and nursing homes to entertain the bedridden; loaned by public libraries, and, of course, carried by teen-agers onto subways. He thinks they might even be built into eyeglasses, so the true addict can throw a switch and see video games on the inside of the lenses.

Commodore's Tomczyk carries it one step further: "The concept of *TRON*, when you are really the computer – and the computer is you – is definitely going to happen. That's the ultimate. The trends of the pricing and power and technology indicate that is really going to happen. The physics of the fantasy expressed in that movie are probably impossible, but we are moving in that direction. We are moving toward the ultimate *TRON*."

The Future Or Fantasy?

But not everyone agrees with this fantastic view of the future. Crawford, the respected Atari expert, says the role of technology in future computer games is constantly overblown. "All these people predict that in coming years we'll be able to plug into our computers, and be surrounded by colorful 3-D images, and wonderful sound, and we'll just be able to think and all these things will appear, and it'll be just a gas.... I reject all that. I don't think it's going to happen, and I don't think it has to happen.

"A lot of people mention new technologies as the engine of change in computer games," explains Crawford. "But I don't see technological developments as the driving force in computer games. I don't even see technology as the limiting constraint in creating computer games. I think the main constraint is lack of creativity and imagination."

Just as the technology of the automobile has not changed drastically over the past 50 years, neither must the technology of computer games, he argues. Technology remains fairly static if it is perceived as adequate, and Crawford believes most people are satisfied with the current state of computer games. "The development of cars since 1932 has been more in the way of polish than the way of new technology.... Although I believe the technology of new hardware will be forced upon us, I don't believe we'll need it to develop the computer games of the future."

Crawford's theory, though apparently the minority viewpoint, might come as welcome relief to those who are less than thrilled with the concepts of "total immersion" and "the ultimate *TRON*." Maybe you won't have to worry about running into a monster on the subway after all. ©

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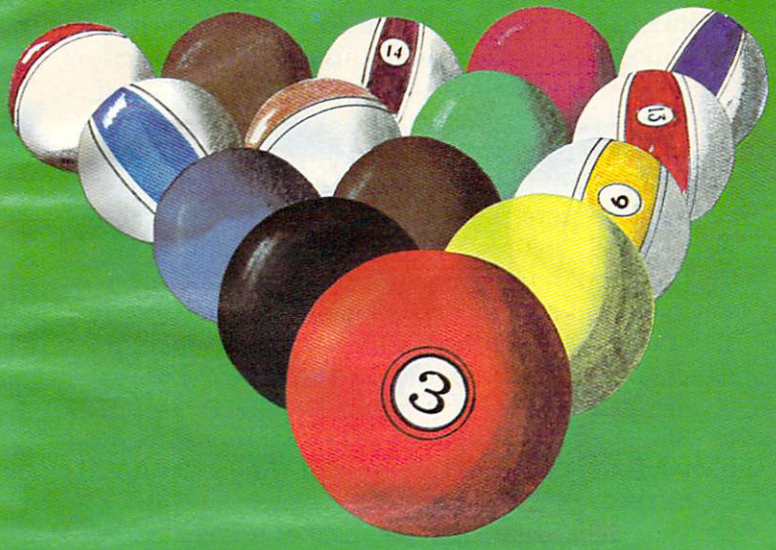

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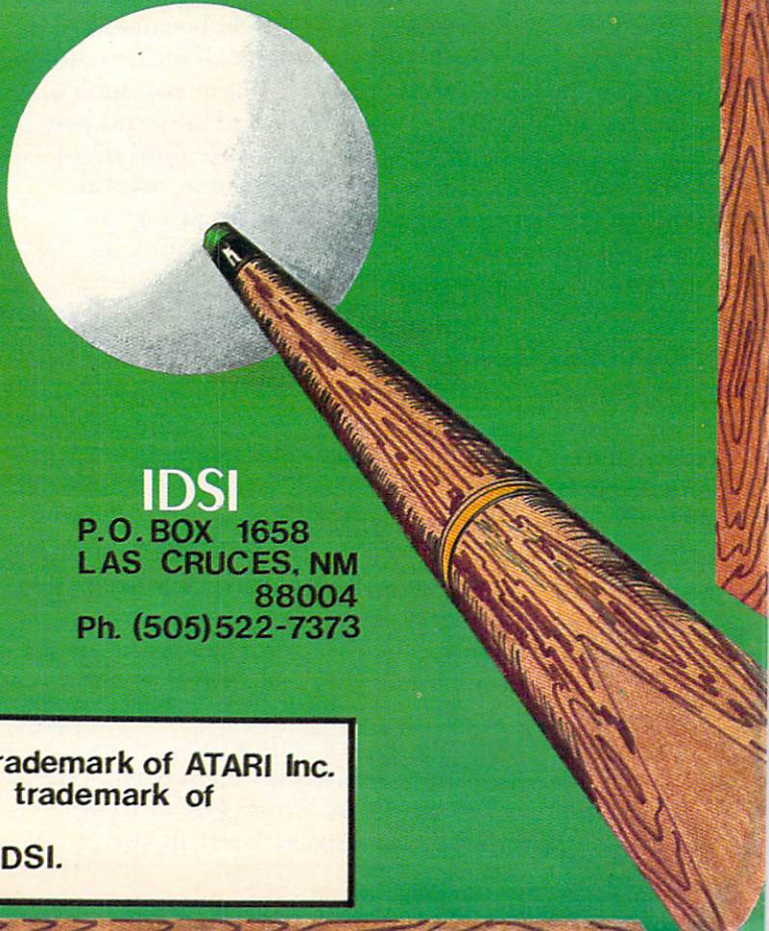

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A Monthly Column

The Beginner's Page

Writing Your First Game

Richard Mansfield
Senior Editor

If you are tempted to write your own games, go ahead. It's a good way to learn to program. Games are basically the same as any other kind of programming.

Computer games fall into two broad categories: 1. imitations of old standards (checkers, Othello) and 2. games (Space Invaders, PacMan) which could not be played without a computer. This second category is more difficult to program for several reasons. For one thing, you've got to think up a whole new, and entertaining, concept and then adjust the action until it is just hard enough to be challenging but not so difficult that people want to give up.

This category (basically "arcade" games) is especially hard to program precisely because a good computer-only game exploits all of the computer's special attributes: speed, color, sound. To do this well, to make things look and respond just the way you imagine them, requires a good bit of programming experience. Usually, too, several things are happening *at once* in an arcade game. This often means that such a program must be written in machine language, which is far faster than BASIC.

High Card Slice

Old standards, on the other hand, can often be the best way to get started programming games. You already know the game concept, and cards or dice or game boards are fairly easily constructed and manipulated on your computer screen. To illustrate, let's take a look at a simple simulation of one of the oldest card games, "High Card." The rules are simple: you place a bet, and then you draw a card from the deck. The computer, your opponent, draws a card too, and the highest card wins the money.

One simplification here is that there is no attempt to represent the cards on the screen. The entire game relies simply on words ("Ace of Spades," for example) when cards are drawn.

Like most computer programs, the program can be visualized as having four distinct zones: initialization, main loop, subroutines, data tables. We can go through the steps in programming this game by looking at each zone separately.

Initialization

From lines 10 through 80 we are "teaching" the computer some basics about this game. Initialization is the activity which must take place before any of the action can begin. Computers are so fast that they will zip up through these lines and start things off in the main loop at line 100 in a flash. However, as programmers, we are aware that several preliminary events took place inside before anything else.

In line 20, the computer discovers that there is a variable called "dollars" which is to equal 500. It sets aside a section (like a small box) in its memory which it labels "dollars." When the game is running, it will add or subtract from this "box" (lines 230-240) to keep a running total of how much money you have left to bet. From time to time (line 110), it will check the box and report to the player how much he has. The box labelled "dollars" is called a *variable* because during the game the amount in it will vary.

Lines 30 through 60 are simple enough – they ask the player to give his or her name. The computer "memorizes" it in another "box" called "name$" and can now speak more personally to the player in lines 140 and 230. Also, the computer prints the rules of the game in line 60.

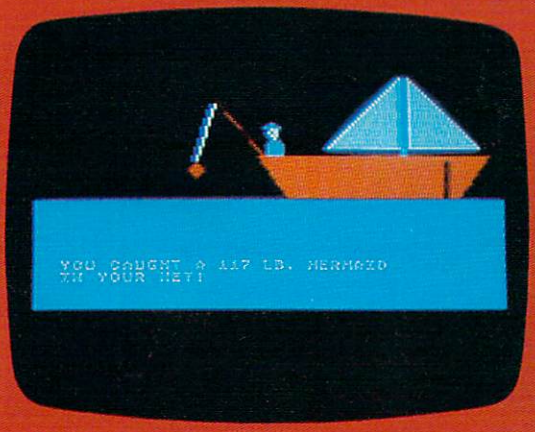
Line 70 "reads" four names (the face cards) from the data tables in lines 510 on. It also makes a "mental note" that it already READ four items. So, when it's asked to READ again (line 80), it will start with the next unread item of data which will be "clubs." By now, the computer has "memorized" a variety of important facts: the player's name, the amount of his or her betting purse, the names of the face cards, and the suits of a standard deck. In less than a second, the computer has grasped and filed away the necessary facts to go on to the main loop where all the action takes place.

The Main Loop

After checking that the player has money to bet, the computer asks for the bet, checks again that the bet is possible, and then runs through one cycle of the game starting in line 160. At this point, a programmer might find it worthwhile to visualize the steps involved in the game: 1. draw a card for the player; 2. draw for the computer; 3. decide who won; 4. adjust the player's purse.

Since both draws are essentially identical actions (the only difference will be that we say "Bob draws a..." instead of "The computer draws"), we don't need to program the draw twice. This is where subroutines come in handy.

Good News for Kids...



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The Subroutine

Twice in the main loop, we GOSUB 300. First the player, then the computer, draws. Line 310 randomly picks two numbers, the card and the suit. If line 320 finds that this selection matches the one drawn just before by the player, it goes back for another draw. Line 330 makes the *name* of the card be the number if it wasn't a number higher than 11 (a face card).

Then line 340 announces the draw using three variables. The first variable (player$) is set up in either line 160 or 190 as appropriate. Then the card$ and suit$ variables are selected from the lists that were "memorized" back in the initialization phase (lines 70-80). The subroutine then RETURNs to the main loop.

Lines 210-240 decide and announce the winner of this round. First, if the variable "card" (the computer's card) is greater than (>) "yourcard," the computer is declared the winner in line 240, the purse is adjusted, and the main loop is restarted (GOTO 100). If the cards are equal, nothing happens to the purse and the next round begins. Notice that we don't need to say "IF YOURCARD > CARD" at the start of line 230 to test if the player has won. It's the only possible thing if the computer has gotten this far.

Once you've solved a particular problem, you'll find you can use the solution in many future games. This subroutine which draws cards, for instance, would work just as well for Poker, or Blackjack, or dozens of other games. Subroutines are handy not only because they can be used repeatedly within a program, but because they can be saved and used repeatedly in future programs. So think up a simple, traditional game and teach it to your computer. There is probably no more pleasurable way to learn programming than to write a game.

Program 1: Apple, PET, VIC, OSI, Radio Shack

```
10 REM *** NECESSARY INITIAL INFORMATION ***
20 DOLLARS = 500
30 PRINT" WITH WHOM DO I HAVE THE PLEASURE"
40 PRINT" OF PLAYING HIGH CARD SLICE?"
50 INPUT NAME$
60 PRINT" HIGH CARD WINS IN THIS GAME!"
70 DIM CARD$(14):FORI=11 TO 14:READ CARD$(I):
   NEXTI
80 FORI=1TO4:READ SUIT$(I):NEXTI
90 REM
100 REM *** MAIN PROGRAM LOOP ***
110 PRINT:PRINT" YOU HAVE $" DOLLARS
120 IF DOLLARS <= 0 THEN PRINT" THE GAME IS OV
   ER.  YOU ARE OUT OF CASH.":END
130 PRINT"WHAT IS YOUR BET";:INPUT BET
140 IF DOLLARS < BET THEN PRINT" YOU ONLY HAVE
    $"DOLLARS" TO BET,"NAME$:GOTO130
150 YOURCARD=0:YURSUIT=0
160 PLAYER$=NAME$
170 GOSUB300
180 YOURCARD=CARD:YURSUIT=SUIT
190 PLAYER$=" THE COMPUTER"
200 GOSUB300
210 IF CARD > YOURCARD THEN GOTO 240
220 IF CARD = YOURCARD THEN PRINT" A TIE!":GOT
   O100
230 PRINT NAME$ " WINS": DOLLARS = DOLLARS + B
   ET:GOTO100
240 PRINT" THE COMPUTER WINS": DOLLARS = DOLLA
   RS - BET:GOTO100
290 REM
300 REM *** SUBROUTINE TO DRAW THE CARDS ***
310 CARD = INT(RND(5)*13)+2: SUIT = INT(RND(5)
   *4)+1
320 IF CARD = YOURCARD AND SUIT = YURSUIT THEN
    300: REM NO IDENTICAL DRAWS
330 IF CARD < 11 THEN CARD$(CARD) = STR$(CARD)

340 PRINTPLAYER$ " DRAWS THE " CARD$ (CARD) " ~
   OF " SUIT$ (SUIT)
350 RETURN
490 REM
500 REM *** DATA TABLE ***
510 DATA JACK,QUEEN,KING,ACE
520 DATA CLUBS,DIAMONDS,HEARTS,SPADES
```

Program 2: For Atari, make these substitutions to Program 1.

```
20 DOLLARS = 500:DIM NAME$(20),PLAYER$(20)
70 DIM CARD$(14*5),T$(10):FORI=11 TO 14:READT
   $:CARD$(I*5-4,I*5)=T$:NEXTI
80 DIM SUIT$(8*4):FORI=1TO4:READT$:SUIT$(I*8-
   7,I*8)=T$:NEXTI
330 IF CARD < 11 THEN T$=STR$(CARD):GOTO340
335 T$=CARD$(CARD*5-4,CARD*5)
340 PRINTPLAYER$ " DRAWS THE ";T$;" OF ";SUIT$
   (8*SUIT-7,SUIT*8)
510 DATA JACK ,QUEEN,KING ,  ACE
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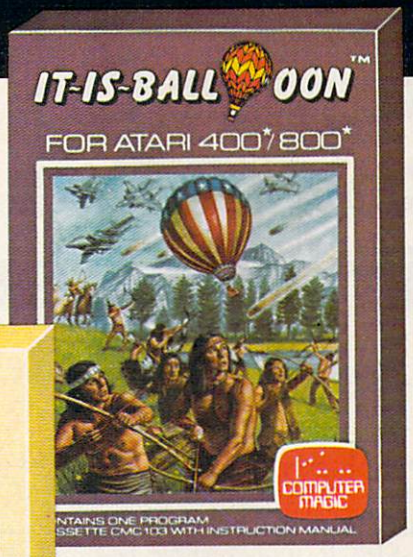

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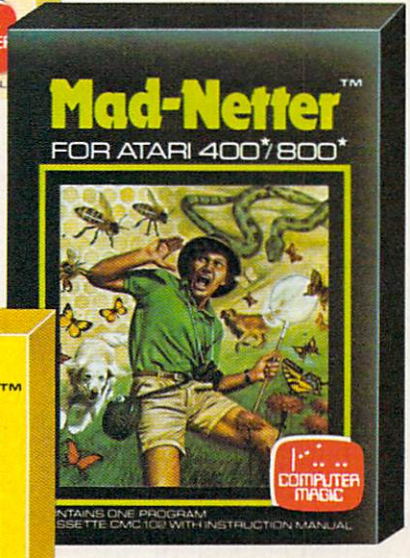

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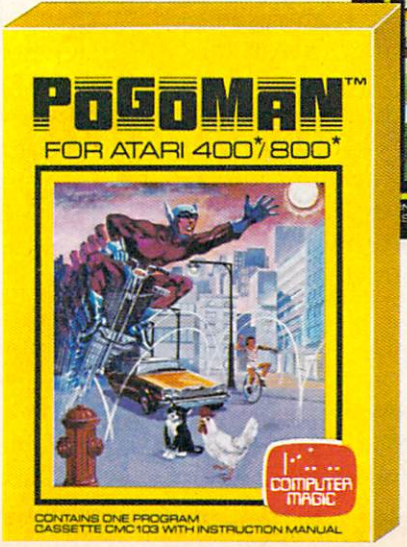

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It's sometimes a challenge, but very good games can be written for computers with small amounts of free memory. If you're programming on an unexpanded VIC, Atari, Sinclair, or pocket computer or any other system with few bytes of RAM, these suggestions are worth remembering.

Programming Games On Computers With Limited Memory

Charles Brannon, Editorial Assistant

One of the most valuable elements of a computer system is its volatile memory, RAM. This "workspace" holds the program you're working on, its variables, and even the screen display and "system software." Managing memory efficiently becomes vital when writing games of any complexity.

There are many programming tricks you can use to save memory. The following list contains some of my favorite techniques – and many more can be intuited:

• Emphasize color and change. Any kind of movement will generate excitement. And don't forget sound. Sound effects can add sparkle to your program very economically. Most computers use no extra memory for sound. Various combinations of FOR/NEXT loops usually suffice for simple, yet pleasing, sound effects.

• Use "keyboard" graphics, or low-resolution graphics, imaginatively, and you can save thousands of bytes more than when you use a high-resolution screen. Remember that color changes are as important as movement to stimulate the eye.

• Abbreviate text and prompts. Avoid using players' names. Use their initials if possible. Unless unfeasible, never put written instructions into a program. Don't overuse strings, especially when a little math will permit the use of numeric variables. Both of these statements will extract the rightmost character of a number:

```
A=VAL(RIGHT$(STR$(N),1))
A=10*(N/10-INT(N/10))
```

• Limited RAM does not permit the luxury of easy-to-follow programs. Use REM statements sparingly (or not at all), to document subroutines or obscure program segments. You can write in REM statements on a paper listing of your program. Use short variable names (not applicable to Atari). If you use a long constant more than once, such as 3.1415927 for pi, define it as a variable (PI = 3.1415927). This technique can save six bytes per use on the Atari, even for simple constants like 0.

• Compact program lines. Each use of a colon can save from three to five bytes, depending on the computer. Don't use spaces when entering a program, unless your computer automatically deletes spaces (e.g., Atari BASIC) or unless they are necessary for proper interpretation.

• Simplify coding. If a certain routine or formula is used more than once, generalize it into a subroutine or defined function (DEF FN if your computer's BASIC has this command). Don't have long sections of IF/THEN statements. For example: you can use "boolean arithmetic" to reduce the space-wasting IF/THEN statement. Try this line on computer: PRINT 1=2. Your system whould return with 0, indicating a "false" answer. Now try: PRINT 2*2=2+2. It should return either 1 or -1, meaning "true" (non-zero, 2*2=4=2+2). You can convert statements like:

```
IF A>0 THEN A=A-1
```

to:

```
A=A-(A>0), or A=A+(A>0)
   if your computer returns a -1.
```

• Program control can be simplified with statements like ON/GOTO. Break your task into blocks. Each block performs a discrete task, and a given block can "call," or use, another block. Not only is this structured programming technique easier to use, but it also saves memory by encouraging you to develop tight, fast "blocks." A bonus is that you can often use these programming building blocks in other programs.

• Don't overlook machine language. It's well worth learning, and the benefits you reap in high speed, programming techniques, and overall efficiency can repay your effort many times. "Hybrid" programs of both BASIC and machine language let you enjoy the best of both worlds.

If worst comes to worst, you can use a technique called "chaining," where one program loads and runs the next. This technique is prone to problems and is awkward to use. On tape, the programs must be contiguous, and the second program can not return to the first. Nevertheless, chaining is valuable for "initialization" code such as loading character sets or machine language, displaying the game's rules at the start, or reading or defining variables (if your BASIC permits chained programs to share variables). Chaining permits you to run programs of almost any size. ©

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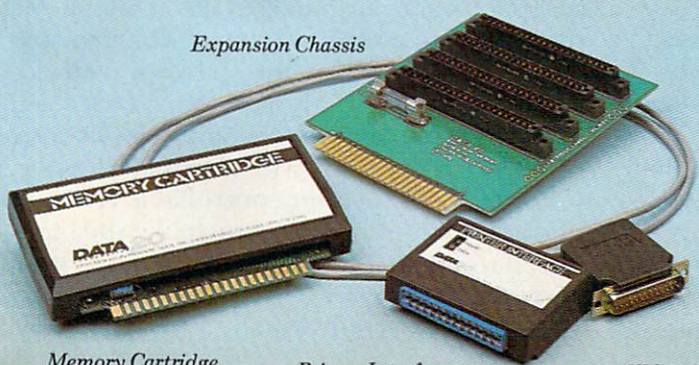

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Don't touch that dial! FM radio could do a lot more than provide background music while you're programming – when a new venture to broadcast software gets under way next year. "We're thinking about transmitting the Top Ten programs each month," says Stephen Wozniak, co-founder of Apple.

Tune In Software (On Your FM Radio)

Tom R. Halfhill
Features Editor

It's another late night and you're slaving over a hot computer, wearily wearing your fingers to the nubs typing in that huge program listing for "Space Marathon V. 98.6." Surely, in this age of computerization, there must be a better way, you think grumpily for the hundredth time. Meanwhile, you tune your FM radio to a favorite station for background music.

An idea strikes: what if you could download programs off the air, much like the way data is transmitted over phone lines between computers with modems?

Your brainstorm is too late. Somebody has already thought of it.

Starting in January – if plans go according to schedule – a pilot project will get under way in the Washington, D.C.-Baltimore area. Computer programs will be broadcast over the FM airwaves by National Public Radio stations into the homes and businesses of charter subscribers. The programs (and other digital information) will be decoded by special "radio modems" leased for a monthly fee, and fed directly into computers, terminals, or printers – maybe even while the subscribers sleep. Six months after this test project, plans call for the service to expand nationally, bouncing the signals off a satellite to all cities reached by NPR stations.

The operation will be run by INC Telecommunications, a newly formed partnership between the nonprofit NPR network and the National Information Utilities Corporation (NIU), a supplier of telecommunications services and information products. The joint venture brings together two vital components: NPR's satellite transmission network and NIU's telecomputer hardware.

NPR, known for its news ("All Things Considered"), educational programs, and classical and jazz music, broadcasts over a national network of 267 FM stations by leasing 12 channels on Westar IV, a Western Union communications satellite. The new service will take advantage of this same network. NIU is contributing the technology for encoding and decoding the data into radio signals, including the small "radio modems" which subscribers will lease.

For Business And Home

Although the system is designed to have wide business applications, in some cases replacing the use of phone lines for beaming computer information throughout the country, INC is playing up the home applications, too. Significantly, two backers of INC are Stephen Wozniak – co-founder of Apple Computer – and Jack R. Taub, founder of the Source Telecomputing Corporation, which owns The Source. The Source is one of the major information utilities for personal computerists with phone modems. Taub started NIU in 1981. Wozniak is helping on the software end, putting together the programming which will attract home subscribers.

Already they are talking about such things as the "Video Game of the Week." We might even see a new definition of radio's traditional "Top 40": tomorrow's "hit list" may well be the most popular computer programs instead of records. It could open up a huge new market for the cottage software industry, provide specialized information for certain groups of subscribers, and possibly even reduce software prices by drastically cutting distribution costs.

"Wozniak is really excited about this as a way of getting the prices of software down so people are less inclined to steal it," says Jack Ault, president of NIU. "He thinks we can get the software down to the point where it is so inexpensive that it will be actually cheaper and easier for the person to download it at home than to go out and pirate it. Plus you would get all the support inherent in that."

The Little Black Box

The key to the system is what Ault calls a "radio modem," a book-sized black box linking personal computers and terminals to the airwaves. Actually, the box is not a true "modem," which means "modulator-demodulator," a two-way device. The radio modem is strictly a one-way device, a demodulator. Crammed into the eight-inch by four-inch by two-inch deep box with the demodulator is an FM subcarrier receiver controllable from the point of transmission. It's very much like the black boxes leased to subscribers by certain pay-TV stations known as "super TV."

Each box is individually addressable by a com-

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puter at the transmission source. For example, if subscribers to these "super TV" services pay an extra fee to watch a championship boxing match, the station remotely activates their black boxes – and no one else's – for the duration of the fight. Everyone else gets a scrambled signal. The same thing can be done with the new computer service: highly specialized software and data can be broadcast to only those customers who are interested in receiving it (and in paying for it). Subscribers would receive only the programs or data they have subscribed to.

Because the radio modem is controllable from the transmission point, unattended reception is possible, too. As Ault envisions it, someday the radio modem will be left on 24 hours a day. Just before a transmission is sent to a certain group of subscribers, a signal is broadcast to their modems which switches on their computers or terminals. After the information is received and stored on disk or printed out, another signal is broadcast to turn off the devices. It could all happen while a subscriber sleeps.

The radio modems, now at the working prototype stage, have RS-232 interfaces to be compatible with practically any computer or terminal. Ault says an IEEE-488 interface is in the works, too. The modem includes a buffer memory to temporarily store incoming information, so it will work not only with computers and smart terminals, but also with dumb terminals and stand-alone printers. The modems will be leased, not sold, and will be serviced by INC Telecommunications at regional service centers.

If you're worried about losing your favorite NPR programs to an unintelligible stream of digitally encoded bleeps, don't be. The computer transmissions will be inaudible to regular FM radio listeners. The new service will broadcast on a "subcarrier," an unused portion of the frequency band assigned to each NPR station. Some NPR stations, for example, now use subcarriers to broadcast special programming for the blind. The new service uses a different subcarrier and will not displace this programming.

Tuning In To VisiCalc

What sorts of services can we expect from INC? Just about everything, it seems. Ault points out that the system can distribute data on a regional, as well as national, basis.

Businesses and the government can lease time to transmit data to remote offices throughout the country, bypassing costly phone lines. Businesses could also subscribe to receive specialized business news and stock reports. School systems could sign up to receive special educational software and information. Home computer users could subscribe to get the programs and information that interest them. It seems that INC is aiming to do for telecomputing what cable is doing for television: providing a selection of subscription services for specialized audiences.

Wozniak foresees a big future in the mass distribution of software directly to homes and businesses. People could sign up to buy word processing packages or *VisiCalc* over the air, and even games. He thinks this could slash software prices by reducing the packaging and distribution costs, and also by piling up massive sales in a very short time. Instead of selling a program the usual way for $200, it could be offered to INC subscribers for $50. If 10,000 subscribers signed up, the software producer would reap $500,000 – in one day, and without packaging or shipping a single disk.

As a bonus, revisions and patches for bugs could be transmitted at very little cost to everyone who bought the original program, says Wozniak. Demo versions of programs could even be transmitted as advertisements. Video game fanatics could subscribe to the "Game of the Week" and be assured that they're the first on the block to get every new release.

"We're thinking about transmitting the Top Ten programs each month, plus maybe another 100 of the lower-end, lesser-known programs," says Wozniak. "My concept of it is that perhaps all 100 programs that are transmitted every month are sent each day. So users who perhaps don't have much memory could save a few different programs each day of the month, try them out, and decide whether to keep them or not."

That ought to satisfy even the most brain-fried video game freaks.

How Much Will It Cost?

At this point, you're probably wondering how much it will cost to subscribe to this new service. The answer isn't clear yet. Wozniak speculates that the monthly subscription fee might be something like $20 to $50. INC's backers promise it will be cheaper than mass downloading of programs and information over phone lines from existing utilities such as The Source or CompuServe. Their argument is that a one-way system is inherently cheaper than a two-way system. Anyway, they say, INC is intended to complement, rather than compete with, the phone-linked information utilities. Each system has its own applications. The INC system, which is described as "point-to-multipoint" instead of "point-to-point," is better suited to mass distribution than the phone-line systems.

"There's no way 100,000 people could tie up 100,000 phone lines downloading something from

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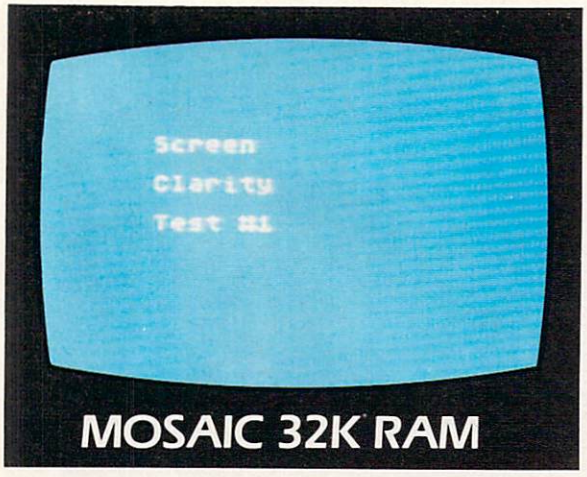

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The Source," explains Wozniak.

In other words, by its nature, the new service will share all the advantages that mass telecommunications media have over single-channel communications lines. It's more efficient for a radio station to broadcast the news at once to thousands of listeners than it is to individually call up those people on the telephone and tell them what's happening.

"It's such a simple and efficient system, and so obvious, in fact, that you wonder why it hasn't been done before," says Wozniak. "Maybe it just makes too much sense. Sometimes things that make good sense are so obvious that nobody sees them."

Care to doubt this reasoning? Just remember, Wozniak took another obvious idea in his garage a few years ago and put together the Apple I computer – which made him a millionaire. He thinks the INC service could prove equally popular. So popular, in fact, that he doesn't see the need for a big push to sell the new service to consumers.

"I don't think that'll be necessary, not once word gets around. It'll catch on, just like The Source caught on."

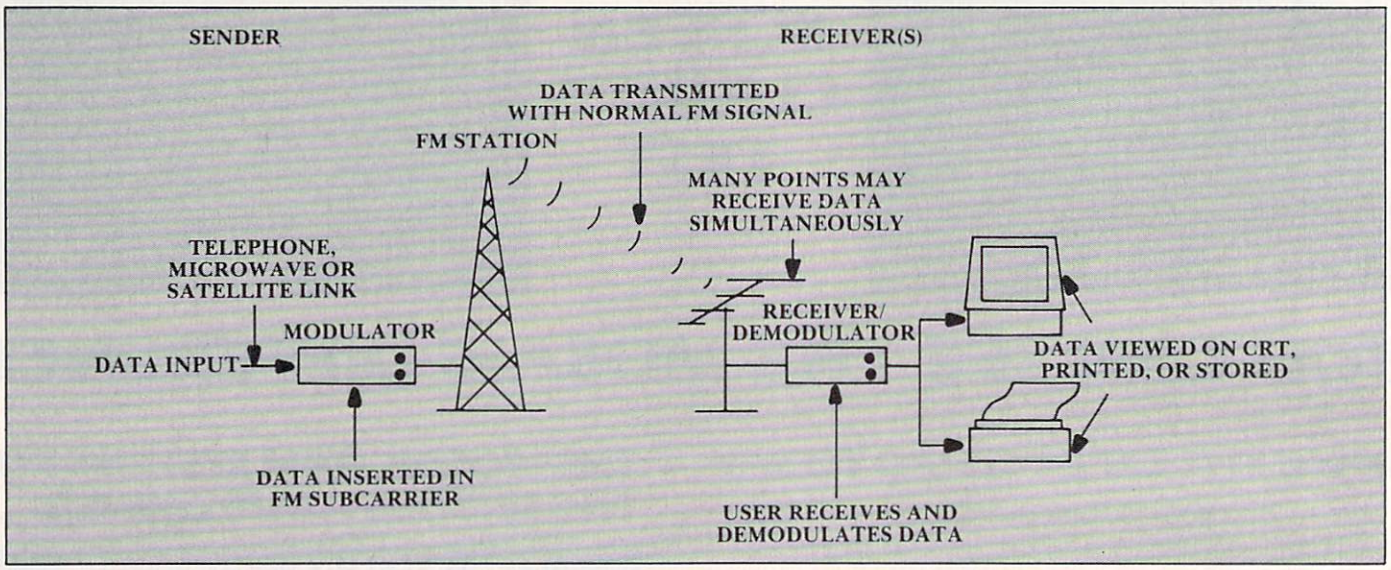

Figure 1. FM SCA Subcarrier Data Delivery – local FM stations are the final link in the transmission.

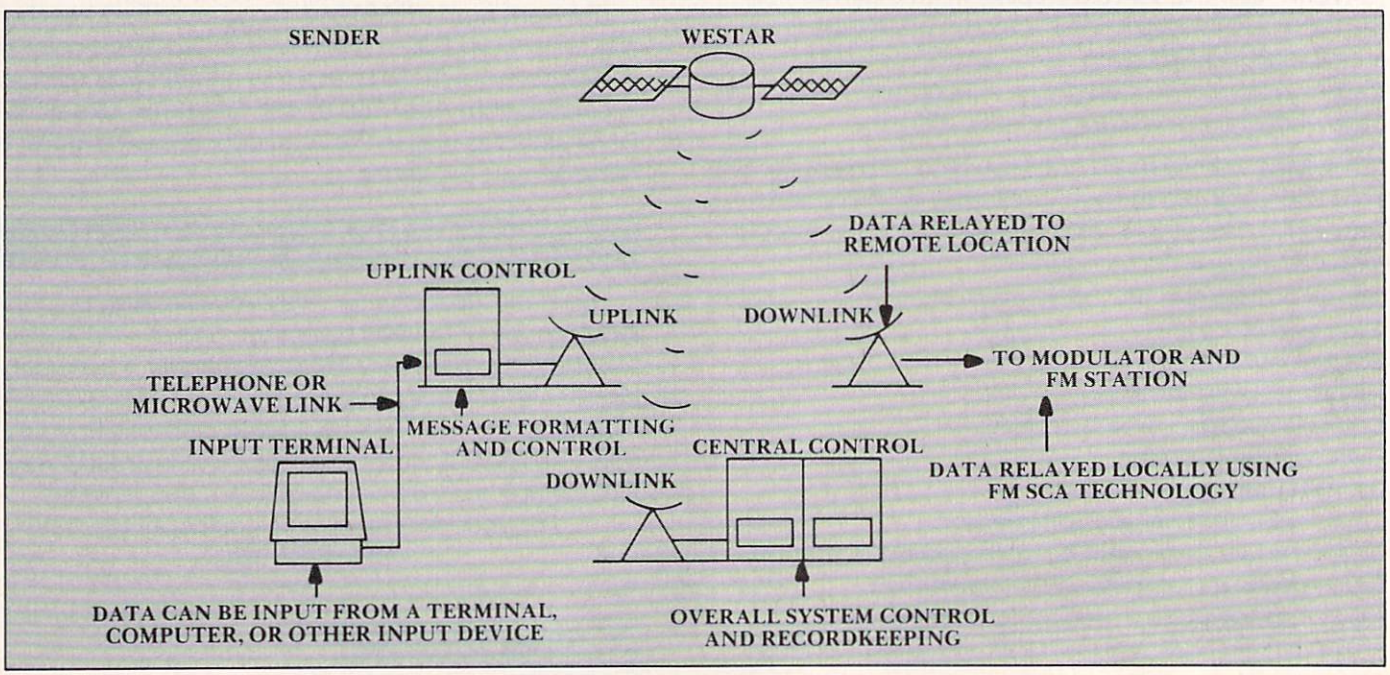

Figure 2. Using a satellite network with the FM SCA Subcarrier System brings a computer program through space to your computer.

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Meteor Storm

Emil Engels
Springfield, VA

In "Meteor Storm," the player must navigate his ship through a dense space disturbance. The player's ship, remaining at the top of the screen, is maneuvered left and right by pressing the (4) and (6) keys, respectively. The player's ship is equipped with a laser, fired by pressing the (F) key. The laser is capable of destroying meteors (10 points each). Hyperspace can be entered by hitting the SPACE bar and can be left by pressing any other key; while in hyperspace, the ship is invulnerable, but no points are awarded. The difficulty factor can be selected by the player, and the game's high score and high scorer are recorded by the computer.

One of the most interesting features of the program itself is the use of scrolling. A random line of meteors is PRINTed at the bottom of the screen at the beginning of each game cycle. This scrolls all the other lines of meteors up one line. (It also scrolls the ship off the screen. The ship is, however, immediately rePOKEd into position.) The effect of this scrolling is that the ship appears to move down through the meteor storm.

Program 1: PET/CBM Version

```
5 GOSUB78
6 PRINT"{DOWN}        GAME BEGINS IN 5 SECOND
    S{UP}"
7 FORSEC=300TO1STEP-1
8 IFSEC/60<>INT(SEC/60)THEN10
9 PRINT"        GAME BEGINS IN";SEC/60;"SECON
    DS{UP}"
10 NEXTSEC
11 B=32786:C=32787:D=32788
12 A$(0)="  Q     Q  Q Q  Q Q  Q   Q     Q  Q
    Q  "
13 A$(1)="Q   Q Q  Q      Q   Q  Q Q   Q
    Q  Q"
14 A$(2)="  Q    Q  Q   Q  Q  Q Q     Q  Q  Q
    Q  "
15 A$(3)=" Q Q Q     Q    Q   Q  Q     Q   Q
    Q  Q"
16 A$(4)=" Q Q   Q     Q  Q       Q  Q  Q Q
    Q  Q"
17 A$(5)="Q   Q Q     Q  Q  Q   Q      Q  Q Q
    Q  "
18 A$(6)=" Q Q  Q Q Q       Q      Q  Q Q Q
    Q  "
19 A$(7)="  Q   Q  Q  Q    Q  Q    Q  Q  Q  Q
    Q  "
20 A$(8)="Q     Q Q    Q   Q  Q Q    Q   Q
    Q  Q"
21 A$(9)=" Q   Q    Q    Q Q  Q   Q  Q    Q
    Q  Q"
22 PRINT"{CLEAR}{24 DOWN}";
23 A=INT(RND(1)*10)
24 PRINTA$(A)
25 IFHY=1THENPRINT:PRINT:RETURN
26 GOSUB33:REM*SHIP CONTROL*
27 PRINT
28 GOSUB33:REM*SHIP CONTROL*
29 IFPEEK(B+40)=81ORPEEK(C+40)=81ORPEEK(D+40)
    =81THENPRINT:GOTO58
30 PRINT
31 GOSUB33:REM*SHIP CONTROL*
32 GOTO23
33 POKEB,79:POKEC,22:POKED,80
```

Atari Notes

The Atari version of Meteor Storm, 4.5K in length with all REM statements removed, can barely squeeze into an 8K Atari 400. But it will not run without some code shortening and simplification, since only 5.3K of memory is free on an 8K Atari, and the program reserves additional space for strings and player/missile graphics.

After the game starts, you will see a flashing arrow at the bottom center of the screen. Move it with the joystick to select game difficulty. Moving it to the right makes the game harder; moving it left, easier. This provides about 40 skill levels. After you press the trigger button to select the difficulty, your player – a glowing, wedge-shaped, missile-firing spaceship – will appear at the bottom of the screen facing an onslaught of descending meteors which scroll from top to bottom. Your only defense is your laser cannon, which is fired with the trigger button. Move your ship left and right with the joystick, evading meteors, and fire on any meteors in your path. You get one point for each meteor hit. If all else fails, and destruction seems imminent, push the joystick forward to enter hyperspace. The meteor field will scroll at high speed, but your ship will be invisible, safe from the meteors. Pull back on the joystick to return from hyperspace. This is no small feat, since you must try to come out of hyperspace into an area free of meteors. Once you've tried hyperspace, you'll see why it's the move only of a desperado. Another feature allows high-scoring players to enter their initials. But you'd better be good – you have only one chance!

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```
34 IFT>1000ANDJ>11THENT=T-1000:J=J-1
35 FORE=1TO5
36 GETB$
37 FORF=1TOJ:NEXTF
38 IFB$<>""THEN40
39 NEXTE
40 IFB$="F"THEN46
41 IFB$=" "THEN55
42 IFB$="4"ANDB>32768THENB=B-1:C=C-1:D=D-1
43 IFB$="6"ANDD<32807THENB=B+1:C=C+1:D=D+1
44 POKEB,79:POKEC,22:POKED,80
45 T=T+5:SCO=SCO+5:RETURN
46 H=C+40
47 FORG=1TO24
48 IFPEEK(H)=81THENPOKEH,32:SCO=SCO+10:T=T+10
   :RETURN
49 POKEH,93
50 FORI=1TO10:NEXTI
51 POKEH,32
52 H=H+40
53 NEXTG
54 RETURN
55 HY=1:GOSUB23
56 GETB$:IFB$=""THEN55
57 HY=0:GOSUB23
58 POKEB,32:POKEC,32:POKED,32
59 POKEB+39,79:POKEC+40,22:POKED+41,80
60 FORI=1TO250:NEXTI
61 POKEB+39,32:POKEC+40,32:POKED+41,32
62 POKEB+78,79:POKEC+80,22:POKED+82,80
63 FORI=1TO250:NEXTI
64 POKEB+78,32:POKEC+80,32:POKED+82,32
65 POKEB+117,79:POKEC+120,22:POKED+123,80
66 PRINT"{HOME}{09 DOWN}{07 RIGHT}O##########
   ############P"
67 PRINT"{07 RIGHT}% YOUR SCORE:          '{1
   2 LEFT}";SCO
68 IFSCO>HSTHENINPUT"{07 RIGHT}% INITIALS    ~
          '{14 LEFT}";HSI$
69 HSI$=LEFT$(HSI$,3)
70 IFSCO>HSTHENHS=SCO
71 PRINT"{07 RIGHT}% HIGH SCORE:          '{1
   2 LEFT}";HS;HSI$
72 PRINT"{07 RIGHT}%                      '"
73 PRINT"{07 RIGHT}% ANOTHER GAME?(Y OR N)'"
74 PRINT"{07 RIGHT}L$$$$$$$$$$$$$$$$$$$$$:"
75 GETDE$:IFDE$=""THEN75
76 IFDE$="N"THENPRINT"{CLEAR}";:END
77 A=0:B=0:C=0:D=0:E=0:F=0:G=0:H=0:I=0:J=0:T=
   0:SCO=0:GOTO7
78 PRINT"{CLEAR}{04 DOWN}"
79 PRINT"          *** METEOR STORM ***{DOWN}
   "
80 PRINT"      YOUR MISSION IS TO NAVIGATE"
81 PRINT"      YOUR SHIP THROUGH A FIERCE"
82 PRINT"      METEOR STORM . MOVE LEFT BY"
83 PRINT"      PRESSING <4>,RIGHT BY PRESS-"
84 PRINT"      ING <6>,AND FIRE BY PRESSING"
85 PRINT"      <F> . SHOOTING A METEOR IS"
86 PRINT"      WORTH 10 PTS . YOU MAY ENTER"
87 PRINT"      HYPERSPACE BY PRESSING THE"
88 PRINT"      <SPACE> KEY . LEAVE HYPER-"
89 PRINT"      SPACE BY PRESSING ANY OTHER"
90 PRINT"      KEY."
91 PRINT"{DOWN}          DIFFICULTY FACTOR":I
   NPUT"          (1-40/HARD-EASY)";J
92 IFJ<1ORJ>40THENPRINT"{03 UP}";:GOTO91
93 RETURN
```

Program 2: Atari Version

```
110 HITCLR=53278:PPF=53252:REM P/M CO
    LLISION REGISTERS
120 DIM A$(20),B$(200),C$(4),I$(3):IN
    IT=0
130 C$="{0}{M}{Z}":REM Characters us
    ed for explosion
140 GOSUB 750:REM INITIALIZATION STUF
    F
150 SCR=0:POKE 53248,0:POKE HITCLR,25
    5:REM Reset collision register
160 POKE 752,1:POKE 82,0:REM Turn off
     cursor and set left margin to ze
    ro
170 SETCOLOR 1,1,12:REM COLOR 2 Gold
180 POKE 87,1:REM Set printing regist
    er to mode 1 (default)
190 R=INT(10*RND(0)):REM Pick a set o
    f dots
200 A$=B$(R*20+1,R*20+20)
210 POSITION 0,2:? #6;A$;:REM Display
     it
220 REM "POKE 87,0" fools OS into thi
    nking that mode 1 is mode 0.  All
    ows cursor control.
230 POKE 87,0:POSITION 0,1:? CHR$(157
    );:REM PUSH IT DOWN (INSERT LINE)
     TO PERFORM REVERSE SCROLL
240 IF STICK(0)=13*HYP THEN HYP=0:POK
    E 53248,ZP:POKE HITCLR,255:POSITI
    ON 4,0:? #6;"meteor storm":GOTO 1
    70
250 REM High-speed repeat if in hyper
    space mode
260 IF HYP THEN POKE 709,PEEK(53770):
    GOTO 180
270 REM GO INTO HYPERSPACE IF STICK I
    S UP (SOUND SUBR.)
280 IF STICK(0)=14 THEN POKE 53248,0:
    GOSUB 710:GOTO 180
290 REM Following formula will either
     add or subtract two from the
300 REM current horizontal position,
    ZP, unless such move will place c
    ursor out of range
310 REM (PTRIG is used to return 1 an
    d -1 for horizontal joystick moti
    on)
320 ZP=ZP-2*PTRIG(1)*(ZP>44)+PTRIG(0)
    *(ZP<200)*2
330 REM Update horizontal position
340 REM Location 53770 generates a ra
    ndom # from 0-255.  Used to rapid
    ly change Player 0 (704) color.
350 POKE 53248,ZP:POKE 704,PEEK(53770
    )
360 IF PEEK(PPF) THEN 550:REM CHECK F
    OR COLLISION
370 IF STRIG(0)=0 THEN POKE 704,68:GO
    SUB 400:REM Fire missile
380 IF PEEK(20)<DIF THEN 320:REM Chec
    k for time delay
390 POKE 20,0:GOTO 180:REM Scroll ano
    ther set of "meteors"
400 REM SHOOT MISSILE
410 MP=(ZP-44)/8:REM Calculate mode 1
     horizontal position (0-19) from
    P/M position (0-255)
420 PP=PEEK(88)+256*PEEK(89)+440+MP:R
    EM PP is location in screen RAM t
    o start missile from
430 REM Location 88/89 contains locat
    ion of upper left corner.
440 POKE 53761,47:REM SOUND 0,?,2,15
    used for high-speed sound POKEs
```

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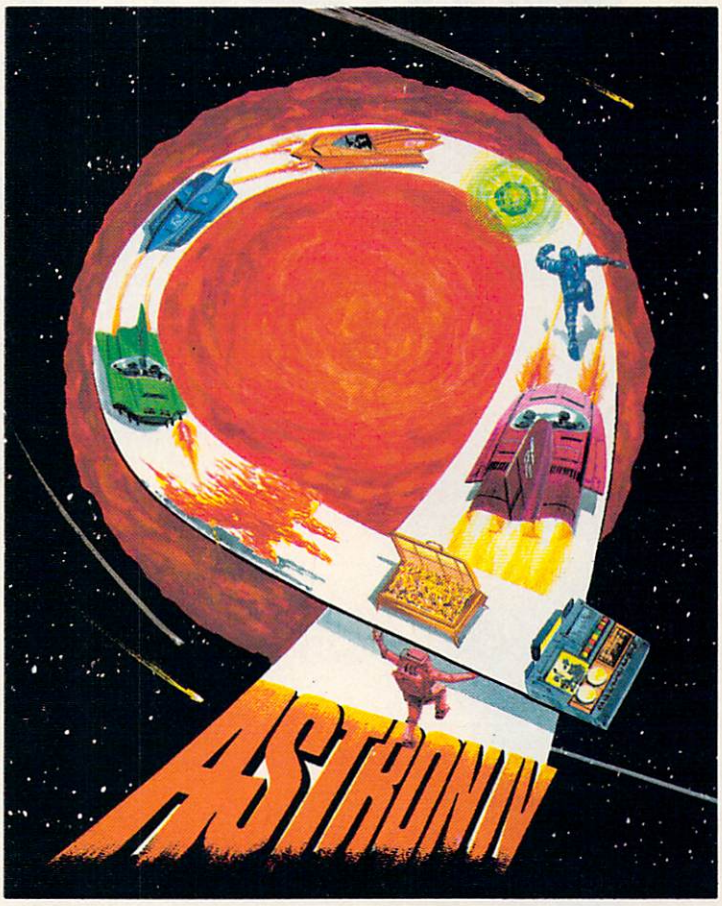

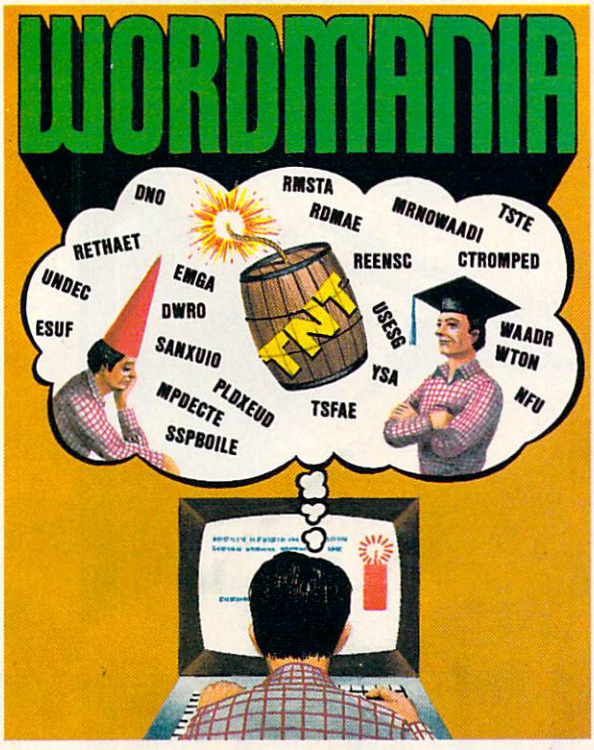

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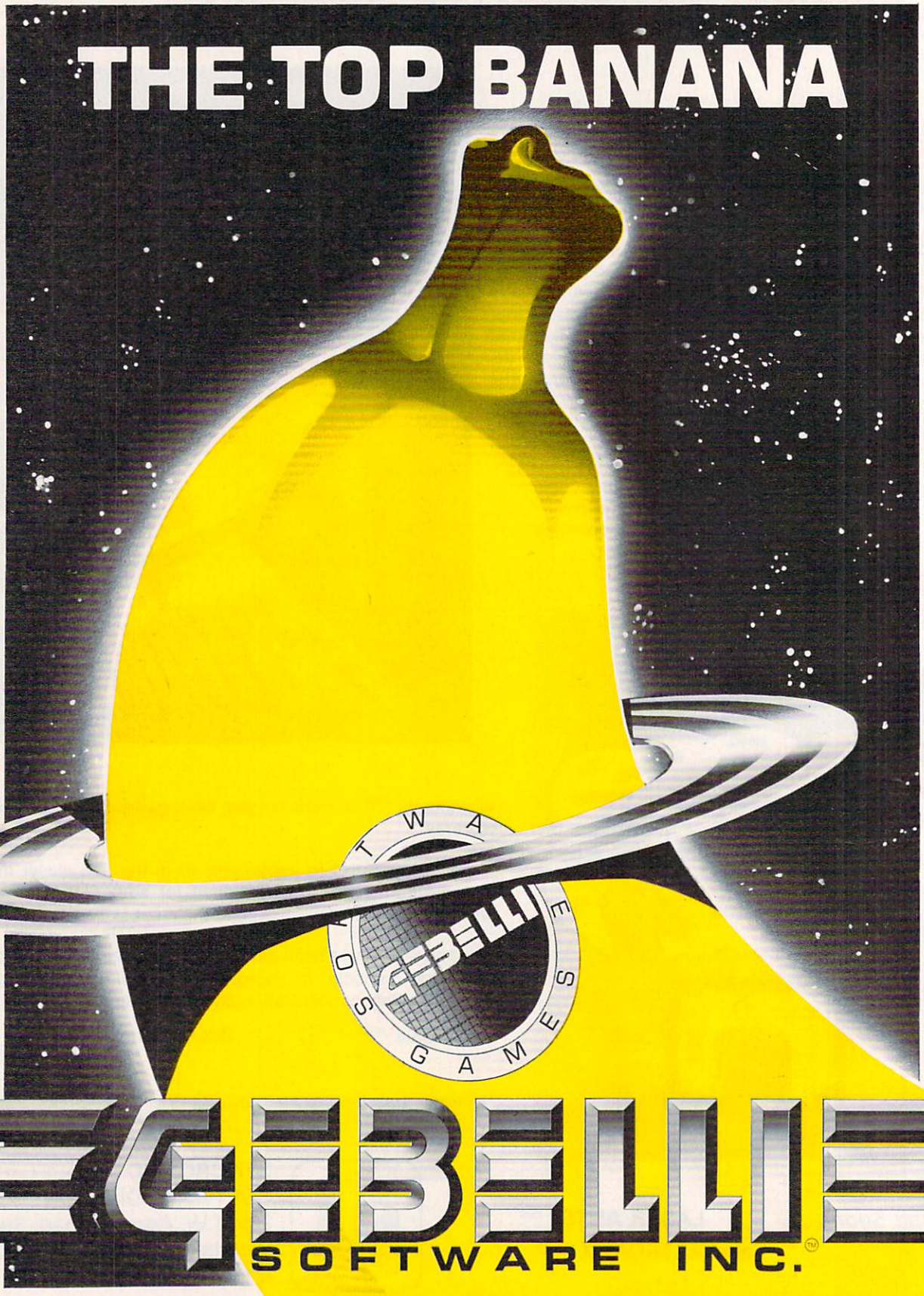

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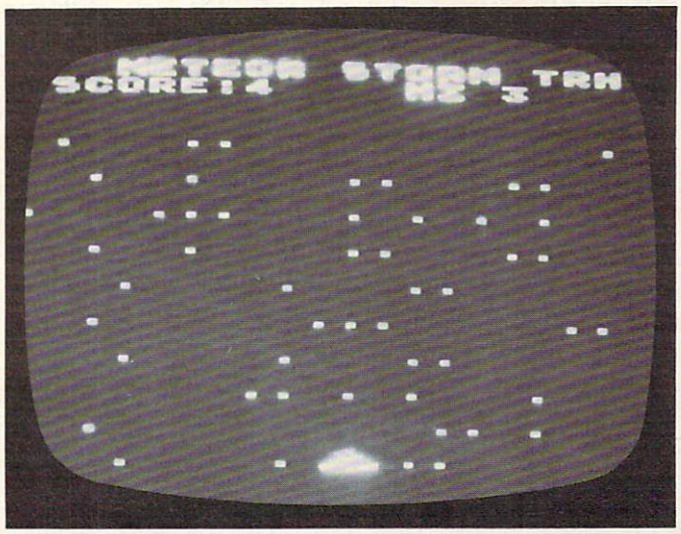
```
450 FOR I=2 TO 18 STEP 2:NP=PP-20*I:R
    EM Next Position
460 POKE 53760,I*10:REM Make sound
470 P=PEEK(NP):POKE NP,154:POKE NP-20
    ,90
480 REM If missile hit something (P<>
    0, SPACE) then do explosion
490 IF P<>0 THEN I=20:POKE NP-20,0:FO
    R W=1 TO 100 STEP 10:POKE 53760,W
    :K=K*(K<4)+1:POKE NP,ASC(C$(K)):N
    EXT W
500 REM If score divisible by ten, in
    crease difficulty
510 IF P<>0 THEN SCR=SCR+1:IF SCR/10=
    INT(SCR/10) THEN DIF=DIF-2:IF DIF
    <0 THEN DIF=0
520 NEXT I:OP=0:FOR I=PP TO NP-20 STE
    P -20:POKE I,OP:NEXT I:REM ERASE
    "MISSILE" CHARACTERS
530 SOUND 0,0,0,0:POKE 87,1:POSITION
    7,1:? #6;SCR:REM UPDATE SCORE
540 RETURN
550 REM COLLISION
560 REM Essentially reads in "shape"
    data to draw 10 "explosion" scene
    s
570 REM in place of player.
580 RESTORE 610:T=PMBASE+616
590 FOR I=1 TO 10:POKE 704,INT(16*RND
    (0))*16+14:SOUND 0,I*10,8,10-I
600 FOR J=0 TO 3:READ A:POKE T+J,A:NE
    XT J:NEXT I
610 DATA 0,0,24,60,0,0,60,126,0,24,52
    ,90,16,74,32,90,145,68,16,66,65,8
    ,129,0,69,8,0,0,0,129,4,0,0,0,129
    ,4,0,0,0,4
620 POKE 53248,0:POKE 53277,0
630 FOR I=100 TO 255 STEP 5:SOUND 0,I
    ,12,8:FOR W=1 TO 10:NEXT W:NEXT I
    :SOUND 0,0,0,0:REM Sad sound
640 IF SCR<HI THEN 690:REM Check for
    high score
650 GRAPHICS 2+16:SETCOLOR 4,9,4:SETC
    OLOR 2,1,10:SETCOLOR 0,3,12:POSIT
    ION 2,0:? #6;"congratulations!"
660 POSITION 0,2:? #6;"NEW HIGH SCORE
     ";SCR:HI=SCR
670 POSITION 0,6:? #6;"ENTER YOUR INI
    TIALS":POSITION 8,8
680 I$="":CLOSE #1:OPEN #1,4,0,"K:":F
    OR J=1 TO 3:GET #1,A:I$(J)=CHR$(A
    ):? #6;CHR$(A);:NEXT J
690 GOTO 130
700 REM HYPERSPACE
710 FOR I=255 TO 0 STEP -1:SOUND 0,I,
    12,8:POKE 711,PEEK(53770):NEXT I:
    POKE 711,70
720 SOUND 0,0,0,0:FOR I=1 TO 5:SETCOL
    OR 4,4,4:FOR W=1 TO 50:NEXT W:SET
    COLOR 4,0,0:FOR W=1 TO 50:NEXT W:
    NEXT I
730 POSITION 3,0:? #6;"  hyperspace "
    :HYP=1:RETURN
740 RETURN
750 GRAPHICS 17:PMBASE=256*(PEEK(106)
    -8):POKE 89,PEEK(89)-8:? #6;"
    {CLEAR}":POKE 89,PEEK(89)+4:GRAPH
    ICS 17
760 SETCOLOR 4,1,12:POSITION 4,2:? #6
    ;"METEOR STORM "
770 REM MOVE PLAYER OFF SCREEN (53248
     IS HORIZ. POSITION)
780 POKE 53248,0:FOR J=0 TO 9
790 POSITION 1,21:? #6;"easy <--":POS
    ITION 12,21:? #6;"--> hard":IF IN
    IT THEN 890
800 POSITION 5,11:? #6;"PATIENCE..."
810 REM Generate ten meteor patterns
820 FOR J=0 TO 9
830 A$="{20 SPACES}"
840 FOR I=1 TO 20:POKE 710,PEEK(53770
    )
850 IF RND(1)>0.7 THEN A$(I,I)=CHR$(1
    42):REM 0.7 is density of meteors
     from 0 (all meteors) to 1 (no me
    teors)
860 NEXT I
870 B$(J*20+1)=A$
880 NEXT J:INIT=1
890 REM SET UP P/M GRAPHICS
900 POKE 54279,PMBASE/256
910 POKE 559,46:POKE 53277,3:POKE 532
    56,1
920 RESTORE 930:FOR I=0 TO 3:READ A:P
    OKE PMBASE+616+I,A:NEXT I
930 DATA 8,28,62,28
940 ZP=124:POSITION 2,11:? #6;"SELECT
     DIFFICULTY":SETCOLOR 2,0,14
950 POKE 53248,ZP:POKE 704,PEEK(53770
    )
960 ZP=ZP-2*PTRIG(1)*(ZP>40)+PTRIG(0)
    *(ZP<200)*2
970 IF STRIG(0) THEN 950
980 DIF=(160-(ZP-40))/4:REM CALCUATE
    DIFFICULTY
990 ZP=124:? #6;CHR$(125)
1000 POSITION 3,0:? #6;"meteor storm"
     :POSITION 1,1:? #6;"SCORE:0":POS
     ITION 12,1:? #6;"HI ";HI:POSITIO
     N 16,0:? #6;I$
1010 REM POKE PMBASE+619,127 MAKES "A
     RROW" INTO "WEDGE"
1020 POKE 704,106:SETCOLOR 4,0,0:POKE
      PMBASE+619,127:RETURN
```



Meteor Storm – Atari version

Do you have a mixed-up Rubik's Cube sitting around? Your computer can tell you how to solve it step-by-step. There are versions of the solution here for PET/CBM and Atari – it requires 16K RAM memory. The author will make a tape copy (for Commodore machines only) for $3 if you don't want to type it in.

Rubik's Cube Solved

Dieter Kuespert
Glendale, AZ

Here is a general solution for the problem of the Rubik's Cube. It absolutely does not matter what the combination of colors is on your cube when the program is started. There are differently designed cubes on the market having a variety of color combinations on the various planes.

The only deviation from the generality is the requirement that you use the letter "W" for white. If this is not done, the program assumes a wrong input. There is this required initial condition under all circumstances:

White has to be in the middle of the upper plane! Throughout the whole procedure it is mandatory that only single slices are turned, never the cube as a whole.

The program has been written in BASIC only. It is for use with a PET/CBM computer. As, however, no unusual program techniques are used, it sould not cause any difficulties to adapt it to other Microsoft computers. Due to its generality, it was not possible to fit the program into 8K of memory. It takes about 14K instead, which permits use of a 16K computer.

At the start the program requests the color combination of the cube as it exists. A question mark appears in the respective field for which the first letter of the relevant color has to be keyed in. This has to be done carefully, as no correction is possible except to restart the program from the beginning. In practice it has proven unnecessary to provide a correction routine. The cube is displayed as if it were folded open. The letter "W" is also displayed as a reminder. It is easy to assign the fields to the cube accordingly.

After input of the last letter, the program starts to check for the fields of the white plane, which will appear on top of the cube after the appropriate instructions have been executed.

The cube will subsequently be solved in slices from top to bottom. The number of necessary moves is not optimized because this would require more than 16K of memory. Therefore, in order to find a field of a certain color, you are asked to turn slices until this color appears at a certain spot which is the only one checked every time. This will require some additional moves.

The subroutines necessary for keeping track of all fields are grouped at the end of the program. There is one for each kind of turn. The display of the required turn is connected to the exchange routine. After the display is on the CRT, the exchange is performed by the program. At the same time the plane of the actual cube is turned by the player. Thus the time is used in an optimal way. After the cube is solved, the computer so indicates.

As this is a rather long program, I am willing to save you the boring work of typing all those GOSUBs. Just send a tape or disk and $3 for a copy. (PET/CBM machines only.) Don't forget to include a self-addressed, stamped mailer.

Dieter Kuespert
4333 W. Sandra Circle
Glendale, AZ 85308

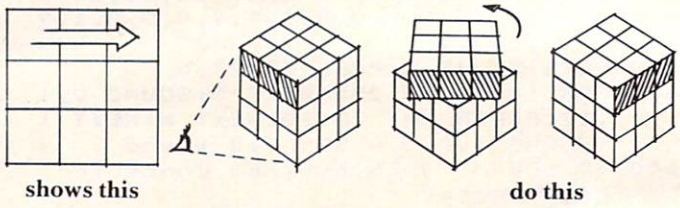


Figure 1: With the arrow pointing right on the top slice, rotate one turn as shown.

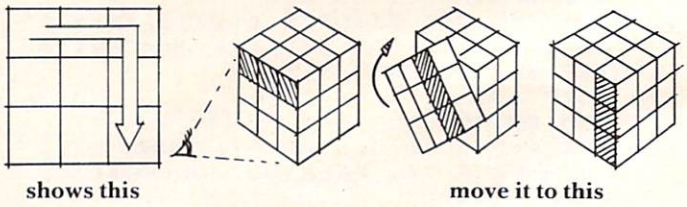


Figure 2: A curved arrow means rotate the front or rear face once in the direction of the arrow.

PET Version

```
150 CLR:DIMA$(9),B$(9),C$(9),D$(9),E$(9)
160 PRINT"{CLEAR}{Ø3 DOWN}THIS PROGRAM SOLVES ~
    ANY RUBIK'S
170 PRINT"{DOWN}CUBE. THE ONLY CONDITION IS :
180 PRINT"{DOWN}{REV}WHITE HAS TO BE IN THE MI
    DDLE OF THE
190 PRINT"{DOWN}{REV}UPPER PLANE.
200 PRINT"{Ø2 DOWN}ALWAYS KEEP IN MIND TO TURN
```

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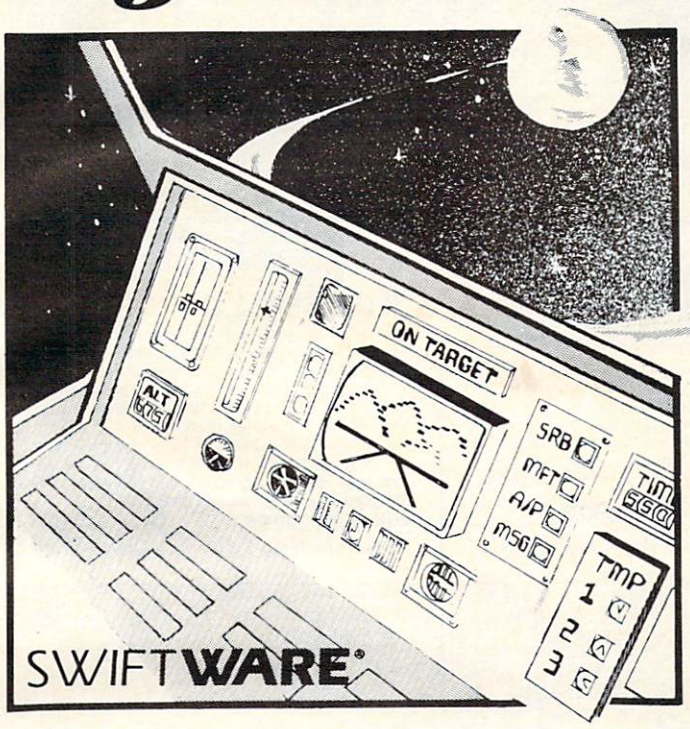

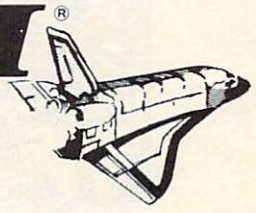

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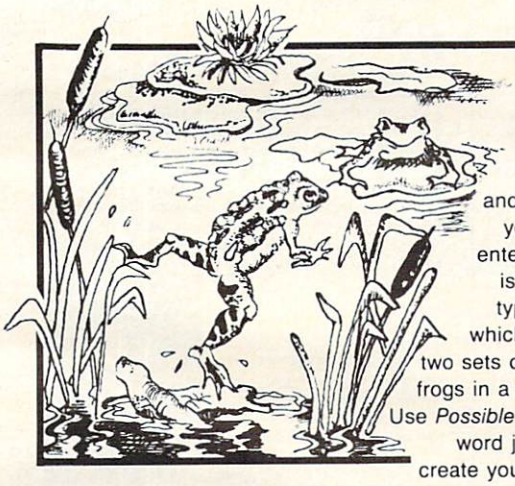

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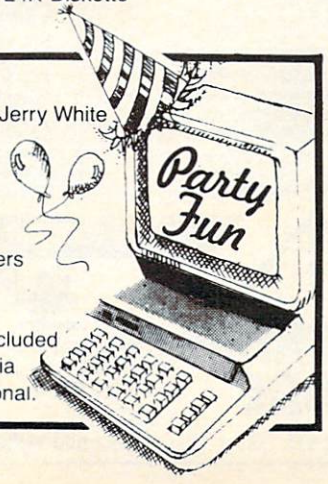

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By Warren Schwader & Ken Williams
You, alone, can save the Earth Federation from the lawless aliens who roam our galaxy. Not only have these invaders been attacking our home planet—they're also raiding our space colonies! Space travel has become increasingly dangerous, as has friendly trade. But supplies must go through. As the pilot of the Federation fighter THRESHOLD, it's all up to you! High resolution graphics and sound plus "save the game" feature. Requires joystick.

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CAPTIVITY

From Program Design, Inc.
The most advanced maze game for the Atari! You must guide your robot through the maze, with the aid of a 3-D view on the screen. 5-color, high-res graphics, sound effects, **20** game variations and an ***infinite*** variety of mazes. Requires joystick.

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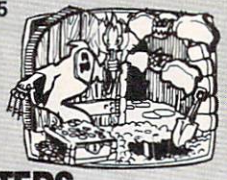

GHOST ENCOUNTERS

From JV Software
You're a ghost in this real-time adventure, trying to find the 20 treasures hidden a network of 30 rooms. You may have to transmutate into other forms in order to solve the puzzles and avoid the dangers. You'll have to be fast and clever to figure this one out! Requires joystick.

16K Tape or Disk, $29.95

Also available from JV Software:

ACTION QUEST
16K Tape or Disk, $29.95 *Requires joystick.*

INSTEDIT

By Sheldon Leemon from APX
This is the best character set editor we've seen. Using your joystick, you can modify characters; or ***create*** characters, script or multi-character objects easily! Your modified character is displayed in all six graphic modes simultaneously. And, you can save your character sets for use with BASIC or assembly source code. Comes with detailed user manual. Requires joystick.

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BATTLE OF SHILOH

From Strategic Simulations
The first wargame for the Atari! Now Civil War buffs can engage in a realistic simulation of a major battle. Marching through the war-torn countryside, strategically using the forests, creeks, hills for defense, you recreate every facit of the battle on a hex-grid map. If you had been in charge, would we still be whistling "Dixie"? 1 or 2 players.

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AIR TRAFFIC CONTROLLER

By David Mannering from Creative
Wonder if the air traffic controllers are really under stress? Want to see what all the fuss is about? This program will give you a taste of what goes on in those towers as you try to guide 26 aircraft safely through your airspace. This advanced version has five separate control areas from which to choose, as well as other enhancements.

16K Disk, $19.95

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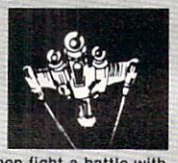
From Atari
Throw out your file boxes—use the Home Filing Manager instead! Now you can create, edit, print, store and retrieve your files with this one easy-to-use program. Great for organizing books, record albums, tools, antiques, stocks, addresses . . . and your computer programs.

16K Disk, $49.95

CLOWNS AND BALLOONS

From DataSoft by Frank Cohen
A huge bunch of balloons is stuck at the top of the circus tent. How do you get them down? By bouncing a clown on a trampoline, high enough to burst them, of course! You must break the balloons in order, one row at a time—if you miss any, the whole row fills up again. Aim your clowns where you want them by moving the trampoline to just the right position. 1 or 2 players; multi-skill levels; joystick or paddle required.

16K Tape or Disk, $29.95



THE COSMIC BALANCE

From Rapid Fire (SSI)
Design your own spaceship, then fight a battle with it to test your design on-the-spot. The goal is to create a ship that's powerful, fast, maneuverable—and armed with the most effective weapons—to tip the COSMIC BALANCE in your favor. 1 or 2 players; requires joystick.

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MASTER MEMORY MAP

From Santa Cruz Software
If you are serious about programming the Atari, this booklet could become one of your most important tools. A highly detailed map of the Atari's memory, it details thousands of locations and routines. Using this booklet makes easier the use of display list, player/missile, and interrupt graphics. The "Miscellaneous Notes" section contains a wealth of knowledge picked up by Santa Cruz in their explorations of the Atari. Also included are notes on the new GTIA graphics chip.

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KATIE AND THE COMPUTER

By D'Ignazio; Illustrated by Gilliam from Creative
Delightful, full-color picture book about Katie, who falls into the land of Cybernia, inside her father's home computer. She learns how a computer works during her adventures with Colonel Software, the Bytes and a ferocious Program Bug. Ages 4 to 10.

Hardcover, $6.95

6502 ASSEMBLY LANGUAGE SUBROUTINES

By Leventhal and Saville from Osborne/McGraw-Hill
If you're interested in using assembly language quickly, this book is ideal. It describes general 6502 programming methods, provides code for more than 40 subroutines to help you improve your programming skills, debug or revise an existing program; add instructions and addressing modes.

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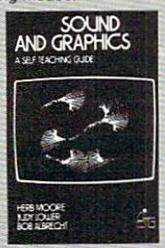
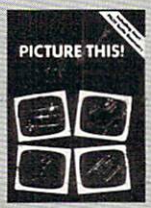
ATARI SOUND AND GRAPHICS



By Moore, Lower and Albrecht from John Wiley
This self-paced, self-teaching guide will have you seeing and hearing things on your Atari in no time—even if you're a complete beginner. You'll learn to compose and play melodies, draw cartoons, create sound effects and games. Each section teaches something new in BASIC, the most commonly used computer language.

Softcover, $9.95

PICTURE THIS!
An Introduction to Computer Graphics for Kids of All Ages



By David D. Thornburg from Addison-Wesley
This book promises to become the "modern replacement for coloring books and crayons". It's a learn-by-doing manual that uses PILOT, a simpler language than BASIC, and Turtle Geometry to teach kids to create pictures in full color from simple lines to complex angles and curves. Recommended for use in conjunction with PILOT Cartridge.

Spiral-bound, $14.95

ATARI ASSEMBLER

By Don & Kurt Inman from Reston
While the Atari Assembler Cartridge comes with an operating manual, it assumes that you already know assembly language. If you're new to the Atari or its 6502 processor, this book is a must. The Inmans guide you through the rudiments of this fascinating type of programming in clear, easy steps. Includes full listing and description of 6502 mnemonics and addressing modes. Recommended for use in conjunction with Assembler Cartridge.

Softcover, $12.95

INSIDE ATARI DOS

By Bill Wilkinson from Compute
The comprehensive manual on the disk File Manager System (FMS), commonly known as Atari DOS 2.0S. Contains the only complete and official listing for the system, plus a full description of: the external view, charts & tables, various interfaces and functions of individual subroutines.

Spiral-bound, $19.95

COMPUTERS FOR PEOPLE

By Willis and Miller from Dilithium
Do you need a computer for your business? Your home? Which one would be most useful? Which software should you consider? You don't have to be an electronics wizard to answer these questions. . . just read this book! It will guide the complete novice, step by step, to the selection of the best system for your needs.

Softcover, $7.95

DE RE ATARI

From APX
Translated from Latin, the title of this book is "All About Atari" and it means what it says! Used in combination with Atari's Technical Reference Manual, advanced programmers will be able to learn to exploit the many hardware and operating system features that make the Atari 400/800 so tremendously versatile. Includes a useful discussion of the new GTIA chip. Once you know Atari BASIC and assembler, this book is a must.

Loose leaf (binder not supplied), $19.95

COMPUTERS FOR KIDS

Atari Edition By Sally Larsen from Creative
The BASIC programming manual written for kids, from flowcharts to color graphics, including the sure-to-please program, "Scare Mom with an Elephant." Detailed instructions and sketches plus glossary of statements and commands. With lesson plans and tips for parents and teachers.

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STIMULATING SIMULATIONS,
Atari Version, 2nd Edition

By C.W. Engel from Hayden
A handbook of 12 simulation games including Art Auction, Starship Alpha, Monster Chase and Devil's Dungeon—each complete with listing, sample run, instructions and program documentation, including flowchart and ideas for variations.

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How To Follow The Computer's Instructions:

You must keep the same face of the cube towards you at all times. Start with white in the middle of the upper (facing the ceiling) face. As you make the moves, imagine that the cube is held firmly in a vice in *the same position* throughout. Rotate individual slices, but the whole cube stays in position from start to finish.

An "arrow" will appear on screen for each move, and you respond by turning the slice on which the arrow sits in the direction the arrow points. Turn one rotation only per move. (See Figure 1.) If the computer wants you to turn that slice three times, the arrow will reappear in the same place three times.

There are only two other possible moves: the front (the side closest to your body) and rear faces (the one furthest away from you). If a strange "curved" arrow appears, that means that you should rotate the entire front face *one move* in the direction the arrow curves. To perform the same move for the back side, the computer will announce that you should turn the rear side. The arrow will appear curved as it does for a front-side rotation. (See Figure 2.)

It sounds a little complicated, but it isn't when you get started. There are really only two different types of moves to make. The computer will wait until you have moved; then you hit a key, and it announces the next move.

```
    ONLY THE
210 PRINT"{DOWN}DESIGNATED PLANES, NEVER THE W
    HOLE CUBE!
220 PRINT"NOW INPUT THE COLORS OF ALL PLANES."
    :PRINT:PRINT:PRINT:PRINT
230 GOSUB5440
240 PRINT"{CLEAR}":FORJ=1TO3:GOSUB5350:NEXT
250 PRINT"{HOME}{04 DOWN}{03 RIGHT}{REV}W{OFF}"
260 PRINT"{HOME}{02 DOWN}";:K=1:GOSUB4070
270 FORI=1TO2:GOSUB4070:NEXT
280 PRINT"{HOME}{04 DOWN}";:GOSUB4070
290 FORI=1TO2:GOSUB4070:NEXT
300 PRINT"{HOME}{06 DOWN}";:GOSUB4070
310 FORI=1TO2:GOSUB4070:NEXT
320 PRINT"{HOME}{09 DOWN}";:K=1:GOSUB4080
330 FORI=1TO2:GOSUB4080:NEXT
340 PRINT"{HOME}{11 DOWN}";:GOSUB4080
350 FORI=1TO2:GOSUB4080:NEXT
360 PRINT"{HOME}{13 DOWN}";:GOSUB4080:
370 FORI=1TO2:GOSUB4080:NEXT
380 PRINT"{HOME}{09 DOWN}{08 RIGHT}";:K=1:GOSU
    B4090
390 FORI=1TO2:GOSUB4090:NEXT
400 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4090
410 FORI=1TO2:GOSUB4090:NEXT
420 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4090
430 FORI=1TO2:GOSUB4090:NEXT
440 PRINT"{02 RIGHT}{04 UP}";:K=1:GOSUB4100
450 FORI=1TO2:GOSUB4100:NEXT
460 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4100
470 FORI=1TO2:GOSUB4100:NEXT
480 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4100
490 FORI=1TO2:GOSUB4100:NEXT
500 PRINT"{02 RIGHT}{04 UP}";:K=1:GOSUB4120
510 FORI=1TO2:GOSUB4120:NEXT
520 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4120
530 FORI=1TO2:GOSUB4120:NEXT
540 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4120
550 FORI=1TO2:GOSUB4120:NEXT
560 PRINT"{HOME}{16 DOWN}";:K=1:GOSUB4110
570 FORI=1TO2:GOSUB4110:NEXT
580 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4110:GOSUB
    4130
590 FORI=1TO2:GOSUB4110:NEXT
600 PRINT"{02 DOWN}{06 LEFT}";:GOSUB4110
610 FORI=1TO2:GOSUB4110:NEXT
620 IFA$(5)="W"THEN650
630 PRINT"{CLEAR}WRONG INPUT, {REV}W{OFF}HITE ~
    HAS TO BE IN CENTER
640 PRINT"OF UPPER PLANE!":FORI=1TO2000:NEXT:G
    OTO150
650 IFA$(2)<>"W"THEN720
660 IFD$(2)=D$(5)THEN720
670 IFD$(2)=C$(5)THEN710
680 IFD$(2)=F$(5)THEN700
690 GOSUB4520
700 GOSUB4520:GOTO720
710 GOSUB4600
720 IFA$(6)<>"W"THEN800
730 IFC$(2)=C$(5)THEN800
740 IFC$(2)=B$(5)THEN790
750 IFC$(2)=D$(5)THEN780
760 GOSUB4290:GOSUB4290:GOSUB4530:GOSUB4530
770 GOSUB4390:GOSUB4390:GOTO800
780 GOSUB4290:GOSUB4290:GOSUB4610:GOSUB4880:GO
    SUB4880:GOTO800
790 GOSUB4290:GOSUB4290:GOSUB4530:GOSUB4770:GO
    SUB4770
800 IFA$(4)<>"W"THEN880
810 IFF$(2)=F$(5)THEN880
820 IFF$(2)=B$(5)THEN870
830 IFF$(2)=D$(5)THEN860
840 GOSUB4270:GOSUB4270:GOSUB4610:GOSUB4610
850 GOSUB4410:GOSUB4410:GOTO880
860 GOSUB4270:GOSUB4270:GOSUB4530:GOSUB4970:GO
    SUB4970:GOTO880
870 GOSUB4270:GOSUB4270:GOSUB4610:GOSUB4670:GO
    SUB4670
880 IFA$(8)<>"W"THEN960
890 IFB$(2)=B$(5)THEN960
900 IFB$(2)=C$(5)THEN950
910 IFB$(2)=F$(5)THEN940
920 GOSUB4770:GOSUB4770:GOSUB4610:GOSUB4610:GO
    SUB4880:GOSUB4880
930 GOTO960
940 GOSUB4770:GOSUB4770:GOSUB4530:GOSUB4390:GO
    SUB4390:GOTO960
950 GOSUB4770:GOSUB4770:GOSUB4610:GOSUB4410:GO
    SUB4410
960 IFB$(2)<>"W"THEN1040
970 IFA$(8)=B$(5)THEN1030
980 IFA$(8)=C$(5)THEN1020
990 IFA$(8)=F$(5)THEN1010
1000 GOSUB4600:GOSUB4670:GOSUB4520:GOSUB4770:GO
    TO960
1010 GOSUB4670:GOSUB4390:GOTO960
1020 GOSUB4770:GOSUB4410:GOTO960
1030 GOSUB4770:GOSUB4520:GOSUB4770:GOSUB4600
1040 IFB$(4)<>"W"THEN1140
1050 IFF$(6)=F$(5)THEN1130
```

BORED?

Here's some great games to keep you entertained

DATASOFT
Sands of Egypt

It's a high-resolution adventure with a new twist—it's animated. You play the part of an English explorer who is lost in the desert. As you wander through the desert in search of your yet to be determined goal the SANDS of EGYPT reveal many secrets (if you know the right questions to ask). All screens are in high-resolution, full color graphics.

Cat No. 4285 Atari, 16K, disk $39.95

SYNAPSE SOFTWARE
Nautilus

Definitely a new type of game for the Atari computer. A one or two player game. NAUTILUS features split-screen play allowing simultaneous action and viewing by the player or players. One player's mission is to destroy the underground city from a submarine while avoiding destruction. The other player (or the computer) is, at the same time, racing to preserve the city by destroying you. Each screen features high-resolution graphics and INDEPENDENT scrolling game maps. Definitely a tough challenge to master.

Cat No. 4255 Atari, 32K, cass $29.95
Cat No. 4286 Atari, 32K, disk $29.95

SIRIUS SOFTWARE
Snake Byte

SNAKE BYTE starts out politely. You (the snake) may accept or decline the presence of the Perilous Purple Plums who haphazardly bounce around the screen. Next, simply concentrate on slithering around the screen, chomping down apples as you go. Every time you devour an apple, your snake grows longer. If your're not fast enough, penalyu apples appear. As you eat the apples, your snake grows longer, so beware. If you run into the walls, the Perilous Plums, or even your own tail you will break your fangs. If your're a good snake and eat all your apples, a door will appear at the top of the screen which leads to another of the 28 mazes in SNAKE BYTE. You only have three sets of fangs, so be careful.

Cat No. 4256 Atari, 48K, disk $29.95

AUTOMATED SIMULATIONS
Dragon's Eye

DRAGON'S EYE, an overland adventure, invites the player into a completely detailed world of fantasy involvement. Your mission is to rescue the Seven Provinces from the curse of the Dragon's Eye. It is a perilous task, but the rewards are great. Treasures of true potency will be found by those who seek out the Eye-Treasures that are guarded by foul dragons, golems, ghosts, and a variety of things that go bump in the night. Can you be the mighty One who can forever banish the Evil Necromancer? Only time will tell.

Cat No. 4270 Atari, 40K, disk $29.95

AVALON HILL
Voyager

A solitaire computer game that challenges the human player to explore the four levels of an alien spacecraft's maze-like corridors and rooms in 3-D simulated graphics, all the while avoiding robots programmed to blast any intruders. In order to win, the human must destroy all power generators and escape or hunt out and annihilate the killer robots. Includes color-animated graphics and sound effects.

Cat No. 4103 Atari, 24K, cass $29.95
Cat No. 4104 Atari, 32K, disk $34.95

SYNCRO
Astron IV

You are a space warrior of the galaxy and your assignment is to penetrate and destroy the pirate asteroids. Astron IV. As you enter the asteroid a Power Beam closes the only exit behind you. You are now locked inside and your only hope for escape is to destroy the power panels contained in a multi-level complex deep inside the planet. You battle several types of robots and the deadly ORBITRON with your space vehicle equipped with Z-bolts. One or two players may compete against the computer or against each other for control of ASTRON IV.

Cat No. 4238 Atari, 16K, cass $19.95
Cat No. 4239 Atari, 24K, disk $24.95

JV SOFTWARE
Ghost Encounters

GHOST ENCOUNTERS is a 16K assembly language real-time adventure game. You, as a ghost, travel through a network of 30 rooms in search of valuable prizes while, at the same time, try to survive the many perils encountered. Of course, a mere ghost cannot overcome all the evil powers striving to block his journey. Luckily, you are not a mere ghost, but are equipped with the power of transmutation, allowing you to take on the form of other, more useful, objects. Locating all 20 prizes scattered throughout requires a player with fast response and a keen wit.

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```
1060 IFF$(6)=B$(5)THEN1120
1070 IFF$(6)=D$(5)THEN1100
1080 GOSUB4270:GOSUB4610:GOSUB4610:GOSUB4410:GO
     SUB4410
1090 GOTO1110
1100 GOSUB4270:GOSUB4530:GOSUB4970:GOSUB4970
1110 GOSUB4390:GOTO960
1120 GOSUB4600:GOSUB4670:GOSUB4520
1130 GOSUB4390
1140 IFB$(6)<>"W"THEN1230
1150 IFC$(4)=C$(5)THEN1220
1160 IFC$(4)=B$(5)THEN1210
1170 IFC$(4)=D$(5)THEN1190
1180 GOSUB4290:GOSUB4530:GOSUB4530:GOSUB4390:GO
     TO1200
1190 GOSUB4290:GOSUB4610:GOSUB4880:GOSUB4880
1200 GOSUB4410:GOTO960
1210 GOSUB4520:GOSUB4770:GOSUB4600:GOTO960
1220 GOSUB4410
1230 IFB$(8)<>"W"THEN1310
1240 IFE$(2)=B$(5)THEN1300
1250 IFE$(2)=C$(5)THEN1290
1260 IFE$(2)=D$(5)THEN1280
1270 GOSUB4610:GOSUB4290:GOSUB4880:GOTO1200
1280 GOSUB4770:GOSUB4390:GOSUB4670:GOTO960
1290 GOSUB4670:GOSUB4410::GOSUB4770:GOTO960
1300 GOSUB4610:GOSUB4280:GOSUB4530
1310 IFC$(2)<>"W"THEN1380
1320 IFA$(6)=C$(5)THEN1370
1330 IFA$(6)=B$(5)THENGOSUB4290:GOTO1360
1340 IFA$(6)=D$(5)THENGOSUB4410:GOSUB4880:GOTO6
     20
1350 GOSUB4290:GOSUB4770:GOSUB4530:GOSUB4390:GO
     SUB4390
1360 GOSUB4670:GOTO620
1370 GOSUB4410:GOSUB4520:GOSUB4410:GOSUB4600
1380 IFC$(4)="W"THENGOSUB4410:GOTO1310
1390 IFC$(6)="W"THENGOSUB4290:GOTO1310
1400 IFC$(8)="W"THENGOSUB4410:GOTO1380
1410 IFD$(2)<>"W"THEN1490
1420 IFA$(2)=D$(5)THEN1470
1430 IFA$(2)=C$(5)THENGOSUB4970:GOSUB4290:GOTO6
     20
1440 IFA$(2)=F$(5)THENGOSUB4880:GOSUB4270:GOTO6
     20
1450 GOSUB4970:GOSUB4410:GOSUB4530:GOSUB4670:GO
     SUB4670
1460 GOSUB4410:GOTO620
1470 GOSUB4970:GOSUB4970:GOSUB4530:GOSUB4410:GO
     SUB4670
1480 GOSUB4290
1490 IFD$(4)="W"THENGOSUB4880:GOTO1410
1500 IFD$(6)="W"THENGOSUB4970:GOTO1410
1510 IFD$(8)="W"THENGOSUB4970:GOTO1500
1520 IFE$(2)<>"W"THEN1620
1530 IFB$(8)=B$(5)THEN1610
1540 IFB$(8)=C$(5)THEN1590
1550 IFB$(8)=F$(5)THEN1570
1560 GOSUB4610:GOSUB4610:GOTO1790
1570 GOSUB4530
1580 GOSUB4390:GOSUB4390:GOTO1520
1590 GOSUB4610
1600 GOSUB4410:GOSUB4410:GOTO1520
1610 GOSUB4670:GOSUB4670
1620 IFE$(4)<>"W"THEN1710
1630 IFF$(8)=F$(5)THEN1580
1640 IFF$(8)=B$(5)THEN1690
1650 IFF$(8)=D$(5)THEN1670
1660 GOSUB4610:GOSUB4610:GOTO1600
1670 GOSUB4530
1680 GOSUB4970:GOSUB4970:GOTO1520
1690 GOSUB4610
1700 GOSUB4770:GOSUB4770:GOTO1520
1710 IFE$(6)<>"W"THEN1800
1720 IFC$(8)=C$(5)THEN1600
1730 IFC$(8)=D$(5)THEN1780
1740 IFC$(8)=B$(5)THEN1760
1750 GOSUB4610:GOSUB4610:GOTO1580
1760 GOSUB4530
1770 GOSUB4770:GOSUB4770:GOTO1520
1780 GOSUB4610
1790 GOSUB4880:GOSUB4880:GOTO1520
1800 IFE$(8)<>"W"THEN1870
1810 IFD$(8)=D$(5)THEN1680
1820 IFD$(8)=C$(5)THEN1860
1830 IFD$(8)=F$(5)THEN1350
1840 GOSUB4610:GOSUB4610:GOTO1770
1850 GOSUB4610:GOTO1580
1860 GOSUB4530:GOTO1600
1870 IFF$(2)<>"W"THEN1940
1880 IFA$(4)=F$(5)THEN1930
1890 IFA$(4)=B$(5)THENGOSUB4270:GOSUB4770:GOTO6
     20
1900 IFA$(4)=D$(5)THENGOSUB4390:GOSUB4970:GOTO6
     20
1910 GOSUB4270:GOSUB4270:GOSUB4610:GOSUB4670:GO
     SUB4410
1920 GOSUB4770:GOTO620
1930 GOSUB4270:GOSUB4520:GOSUB4270:GOSUB4600:GO
     TO620
1940 IFF$(4)="W"THENGOSUB4270:GOTO1870
1950 IFF$(6)="W"THENGOSUB4390:GOTO1870
1960 IFF$(8)="W"THENGOSUB4390:GOSUB4390:GOTO187
     0
1970 IFA$(1)="W"THEN1990
1980 GOTO2010
1990 IFF$(1)=F$(5)THEN2010
2000 GOSUB4390:GOSUB4530:GOSUB4270:GOTO2660
2010 IFA$(3)="W"THEN2030
2020 GOTO2050
2030 IFD$(1)=D$(5)THEN2050
2040 GOSUB4410:GOSUB4530:GOSUB4290:GOTO2560
2050 IFA$(7)="W"THEN2070
2060 GOTO2090
2070 IFB$(1)=B$(5)THEN2090
2080 GOSUB4270:GOSUB4610:GOSUB4390:GOTO2640
2090 IFA$(9)="W"THEN2110
2100 GOTO2130
2110 IFB$(3)=B$(5)THEN2130
2120 GOSUB4290:GOSUB4530:GOSUB4410:GOTO2580
2130 IFE$(1)<>"W"THEN2250
2140 IFF$(9)=F$(5)THEN2190
2150 IFF$(9)=B$(5)THEN2210
2160 IFF$(9)=C$(5)THEN2230
2170 GOSUB4610:GOSUB4290:GOSUB4610:GOSUB4410:GO
     SUB4410
2180 GOSUB4530:GOSUB4290:GOTO2130
2190 GOSUB4530:GOSUB4530:GOSUB4970:GOSUB4610:GO
     SUB4880:GOSUB4880
2200 GOSUB4610:GOSUB4970:GOTO2130
2210 GOSUB4530:GOSUB4390:GOSUB4610:GOSUB4270:GO
     SUB4270
2220 GOSUB4530:GOSUB4390:GOTO2130
2230 GOSUB4670:GOSUB4610:GOSUB4770:GOSUB4770:GO
     SUB4530:GOSUB4670
2240 GOTO2130
2250 IFE$(3)<>"W"THEN2270
2260 GOSUB4530:GOTO2130
2270 IFE$(7)<>"W"THEN2290
2280 GOSUB4610:GOTO2130
2290 IFE$(9)<>"W"THEN2310
2300 GOSUB4610:GOTO2280
2310 IFB$(7)<>"W"THEN2390
2320 IFF$(9)=B$(5)THEN2380
2330 IFF$(9)=D$(5)THEN2370
2340 IFF$(9)=C$(5)THEN2360
2350 GOSUB4610:GOSUB4270:GOSUB4530:GOSUB4390:GO
     TO2130
2360 GOSUB4530:GOSUB4410:GOSUB4530:GOSUB4290:GO
     TO2130
2370 GOSUB4880:GOSUB4530:GOSUB4970:GOTO2130
2380 GOSUB4610:GOSUB4610:GOSUB4770:GOSUB4530:GO
```

The Adventures of PROFESSOR VON CHIP & ORBIE

TRICKY TUTORIALS (tm)

There are many things that the ATARI computers can do either better, or easier than other small computers. The following series of programs is designed for anyone who is at least familiar with BASIC programming. What each tutorial offers is similar to an extensive magazine article with all discussion in as simple language as possible, plus you get MANY examples already typed in and running. The instruction manuals range from 10 to 50 pages, and some tutorials fill up a complete tape or disk. There is little overlap in what is taught, so anyone wanting to know all they can should buy them all (my banker thanks you). ATARI buys these from us to use in training their own people! Rave reviews have been published in ANTIC, ANALOG, CREATIVE COMPUTING, and even INFOWORLD. You trust INFOWORLD, don't you?

TT #1: DISPLAY LISTS—This program teaches you how to alter the program in the ATARI that controls the format of the screen. Normally, when you say "Graphics 8", the machine responds with a large Graphics 8 area at the top of the screen and a small text area at the bottom. Now, you will be able to mix various Graphics modes on the screen at the same time. The program does all of the difficult things (like counting scan lines). You will quickly be able to use the subroutines included in your own programs.
16K Tape or 24K Disk. **$19.95**

TT #2: HORIZONTAL/VERTICAL SCROLLING—The information you put on the screen, either GRAPHICS or TEXT, can be moved up, down, sideways, or diagonally. We provide the basic methods and leave the rest up to your skill and imagination. Includes 18 examples to get you started, with several using a small machine language subroutine for smoothness.
16K Tape or 24K Disk. **$19.95**

TT #3: PAGE FLIPPING—Now you don't have to redraw the screen every time you change the picture or text. You will learn how to have the computer draw the next screen you want to see while you are still looking at the previous screen, then flip to it instantly. You won't see it being drawn, so a complicated picture can seem to just appear. Depending on your memory size and which graphics or text modes you are using, you can instantly look at up to 50 pages. The basic method takes only 9 lines and the usefulness is infinite.
16K Tape or 24K Disk. **$19.95**

TT #4: BASICS OF ANIMATION—This program shows you how to animate simple shapes (with some sound) using the PRINT and PLOT commands, and it also has a nice little PLAYER/MISSILE GRAPHICS game you can learn from. The P/M example is explained and will get you started on this complicated subject (more fully explained in TT #5). This would be an excellent way to start making your programs come alive on the screen with movement! Recommended for beginning users.
16K Tape or 24K Disk. **$19.95**

TT #5: PLAYER/MISSILE GRAPHICS—Learn to write your own games and other animated applications! The tutorial begins with many small examples that compliment the 50 page manual, then gradually builds up to a complete game where everything you need to know is fully explained. Also included are two machine language utilities that you can use to animate Players with from BASIC. Next we include two of the best editors currently available; one for editing playfield shapes (backgrounds); and one to edit your players, and all in glorious Technicolor!! Everything except the two editors run in 16K Tape or 32K Disk. **$29.95**

TT #6: SOUND AND MUSIC—Unless you have spent many years experimenting with the four voice channels, you will learn a lot from this one! Learn to play standard notes, chords, and whole songs using some simple "tricks". One of the nicest parts are the examples of special sound effects that you can refer to whenever you need a sound for a program or to impress a friend. This program will be of interest to all ages and levels of experience!
16K Tape or 24K Disk. **$19.95**

SPECIAL DISCOUNT

Order the first six tutorials in a 3-ring binder for $99.95, a $30.00 savings!

TT #7: DOS UTILITIES—We at Educational Software have been shocked by some of the prices others are charging to offer you small utilities to help in the use of your Disk Drive. We now offer you all of the following plus explanation as to how each was written, and how to use them: A UNIQUE MENU PROGRAM, AN AUTORUN.SYS BUILDER, DISK INSPECTOR (LOOK AT SECTORS), DISK JACKET PRINTER, AUTOMATIC FORMATTER, RECORD SAVE AND LOAD UTILITY.
32K Disk Only. **$29.95**

MASTER MEMORY MAP (tm)

This book is the most valuable source of information for your ATARI you can buy. It starts out by explaining how to PEEK and POKE values into memory, so that even new computer owners can use many of these "Tricks". Then you are given 32 pages of the memory locations that are the most useful, along with hints on how to use many of the locations. Finally, it includes hints on problems you may be having with the computer and discusses the new Graphics modes 9 to 11. Even ATARI buys this book from us! **$6.95**

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MINI-DATABASE/DIALER—stores and edits up to 8 lines of information such as names & addresses, phone numbers, messages, inventories, or anything you want. It has the usual sort, search, and print options, but it also has an unusual feature: If your file includes phone numbers and your phone company allows touch-tone phone signals, the program will DIAL THE PHONE NUMBER FOR YOU! 16K Tape or 24K Disk. **$24.95**

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OUR NEWEST PROGRAMS

*** OUR BEST GAME ***

SPACE GAMES—Our family is being attacked by ALIENS, and only you can save us. A comic book manual will guide you through three games that test your ability in space skills. Includes ALIENS, SURVIVE, and ROBOT ATTACK, and is for all ages. The first two games require 16K for Tape. The last game and all Disk users need 32K. **$24.95**

MATHS FOR FUN—Another ENGLISH import teaching basic math skills. Very colorful and enjoyable to use. For ages 5 to 16. 16K Tape or 24K Disk. **$19.95**

TT #10: SOUND EFFECTS—From laser blasts to ringing phones, this tutorial will show you how to make unique sound effects in all of your programs! 16K Tape or 24K Disk. **$19.95**

MARATHON—This is a unique math quiz for one or two players. You are in a race to move your runner across the screen first! There are four levels of play with five modes of operation for each. The game uses joysticks for all input, so play is easy for young children. This wonderful learning tool is imported from ENGLAND for your learning pleasure. Your kids will never even notice they are playing an EDUCATIONAL program. 16K Tape or 24K Disk. **$19.95**

TT #8: CHARACTER GRAPHICS—Character Graphics is the best way to animate your ATARI! Make letters look like space monsters, gunfighters, or a myriad of other shapes. Use our editor to create these multicolor shapes and then we'll show you how to move them around the screen. This tutorial even shows how our Space Games were written! 16K Tape or 24K Disk. **$19.95**

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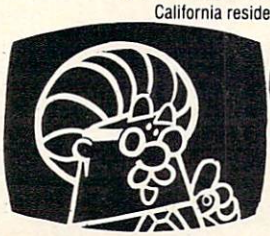

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Soquel, Ca. 95073
(408) 476-4901

```
    SUB4670:GOTO2130
2390 IFB$(9)<>"W"THEN2480
2400 IFC$(7)=D$(5)THEN2440
2410 IFC$(7)=C$(5)THEN2460
2420 IFC$(7)=F$(5)THEN2470
2430 GOSUB4530:GOSUB4530:GOSUB4670:GOSUB4610:GO
    SUB4770:GOTO2130
2440 GOSUB4290:GOSUB4530:GOSUB4530
2450 GOSUB4410:GOTO2130
2460 GOSUB4530:GOSUB4290:GOSUB4610:GOSUB4410:GO
    TO2130
2470 GOSUB4610:GOSUB4390:GOSUB4610:GOSUB4270:GO
    TO2130
2480 IFB$(3)<>"W"THEN2500
2490 GOSUB4290:GOSUB4530:GOTO2450
2500 IFB$(1)<>"W"THEN2520
2510 GOSUB4270:GOSUB4610:GOSUB4390:GOTO2260
2520 IFF$(1)<>"W"THEN2540
2530 GOSUB4880:GOSUB4610:GOSUB4970:GOTO2130
2540 IFF$(3)<>"W"THEN2560
2550 GOSUB4670:GOSUB4530:GOSUB4770:GOTO2270
2560 IFF$(7)<>"W"THEN2580
2570 GOSUB4610:GOTO2310
2580 IFF$(9)<>"W"THEN2600
2590 GOTO2570
2600 IFC$(1)<>"W"THEN2620
2610 GOSUB4770:GOSUB4610:GOSUB4670:GOTO2130
2620 IFC$(3)<>"W"THEN2640
2630 GOSUB4970:GOSUB4530:GOSUB4880:GOTO2130
2640 IFC$(7)<>"W"THEN2660
2650 GOSUB4530:GOTO2310
2660 IFC$(9)<>"W"THEN2680
2670 GOTO2650
2680 IFD$(1)<>"W"THEN2700
2690 GOSUB4410:GOSUB4610:GOSUB4290:GOTO2130
2700 IFD$(3)<>"W"THEN2720
2710 GOSUB4390:GOSUB4530:GOSUB4270:GOTO2130
2720 IFD$(7)<>"W"THEN2740
2730 GOTO2650
2740 IFD$(9)<>"W"THEN2760
2750 GOTO2650
2760 IFB$(8)<>B$(5)THEN2830
2770 IFE$(2)<>C$(5)THEN2800
2780 D=0:GOSUB4530:GOSUB4290:GOSUB4610:GOSUB441
    0:GOSUB4610:GOSUB4770
2790 GOSUB4530:GOSUB4670:GOTO2760
2800 IFE$(2)=E$(5)THEN2830
2810 D=0:GOSUB4610:GOSUB4270:GOSUB4530:GOSUB439
    0:GOSUB4530:GOSUB4670
2820 GOSUB4610:GOSUB4770:GOTO2760
2830 IFB$(8)<>C$(5)THEN2900
2840 IFE$(2)<>D$(5)THEN2870
2850 D=0:GOSUB4970:GOSUB4610:GOSUB4880:GOSUB461
    0:GOSUB4410:GOSUB4530
2860 GOSUB4290:GOTO2760
2870 IFE$(2)=E$(5)THEN2900
2880 D=0:GOSUB4610:GOSUB4610:GOSUB4770:GOSUB453
    0:GOSUB4670:GOSUB4530
2890 GOSUB4290:GOSUB4610:GOSUB4410:GOTO2760
2900 IFB$(8)<>F$(5)THEN2970
2910 IFE$(2)<>B$(5)THEN2940
2920 D=0:GOSUB4530:GOSUB4530:GOSUB4670:GOSUB461
    0:GOSUB4770:GOSUB4610
2930 GOSUB4270:GOSUB4530:GOSUB4390:GOTO2760
2940 IFE$(2)=E$(5)THEN2970
2950 D=0:GOSUB4880:GOSUB4530:GOSUB4970:GOSUB453
    0:GOSUB4390:GOSUB4610
2960 GOSUB4270:GOTO2760
2970 IFB$(8)<>D$(5)THEN3040
2980 IFE$(2)<>F$(5)THEN3010
2990 D=0:GOSUB4610:GOSUB4390:GOSUB4610:GOSUB427
    0:GOSUB4610:GOSUB4880
3000 GOSUB4530:GOSUB4970:GOTO2760
3010 IFE$(2)=E$(5)THEN3040
3020 D=0:GOSUB4530:GOSUB4410:GOSUB4530:GOSUB429
    0:GOSUB4530:GOSUB4970
3030 GOSUB4610:GOSUB4880:GOTO2760
3040 IFD<3THEND=D+1:GOSUB4530:GOTO2760
3050 IFB$(4)=B$(5)THEN3070
3060 GOTO2810
3070 IFB$(6)=B$(5)THEN3090
3080 GOTO2780
3090 IFD$(4)=D$(5)THEN3110
3100 GOTO2990
3110 IFD$(6)=D$(5)THEN3130
3120 GOTO2950
3130 IFB$(6)=B$(5)THEN3150
3140 GOTO2780
3150 IFB$(4)=B$(5)THEN3170
3160 GOTO2780
3170 IFD$(4)=D$(5)THEN3190
3180 GOTO2990
3190 IFD$(6)=D$(5)THEN3210
3200 GOTO2990
3210 D=0
3220 IFB$(8)=B$(5)ORE$(2)=B$(5)THEN3240
3230 IFD<3THEND=D+1:GOSUB4530:GOTO3220
3240 IFF$(8)=F$(5)ORE$(4)=F$(5)THEN3280
3250 IFD$(8)<>F$(5)ANDE$(8)<>F$(5)THEN3290
3260 GOSUB4610:GOSUB4880:GOSUB4410:GOSUB4610:GO
    SUB4290:GOSUB4530
3270 GOSUB4970:GOTO3220
3280 IFD$(8)=D$(5)ORE$(8)=D$(5)THEN3310
3290 GOSUB4610:GOSUB4410:GOSUB4770:GOSUB4610:GO
    SUB4670:GOSUB4530
3300 GOSUB4290:GOTO3220
3310 IFE$(2)=E$(5)THEN3330
3320 FORD=1TO4:GOSUB4770:GOSUB4520:NEXT:GOTO331
    0
3330 IFE$(4)=E$(5)THEN3350
3340 GOSUB4610:GOTO3320
3350 IFE$(6)=E$(5)THEN3370
3360 GOSUB4530:GOTO3320
3370 IFE$(8)=E$(5)THEN3390
3380 GOSUB4610:GOTO3340
3390 IFB$(8)=B$(5)THEN3420
3400 GOSUB4530:GOTO3390
3410 D=0
3420 IFB$(7)=B$(5)ORF$(9)=B$(5)ORE$(1)=B$(5)THE
    N3510
3430 IFB$(9)=B$(5)ORE$(3)=B$(5)ORC$(7)=B$(5)THE
    N3530
3440 IFC$(9)=C$(5)ORE$(9)=C$(5)ORD$(7)=C$(5)THE
    N3550
3450 IFF$(7)=F$(5)ORE$(7)=F$(5)ORD$(9)=F$(5)THE
    N3570
3460 IFD>0THEN3590
3470 GOSUB4770:GOSUB4510:GOSUB4770:GOSUB4770:GO
    SUB4510:GOSUB4510:GOSUB4770
3480 GOSUB4770:GOSUB4510:GOSUB4670
3490 IFD=1THENGOSUB4530:GOTO3410
3500 GOSUB4610:D=1:GOTO3470
3510 IFB$(7)=F$(5)ORF$(9)=F$(5)ORE$(1)=F$(5)THE
    ND=D+1
3520 GOTO3430
3530 IFB$(9)=C$(5)ORE$(3)=C$(5)ORC$(7)=C$(5)THE
    ND=D+2
3540 GOTO3440
3550 IFC$(9)=D$(5)ORE$(9)=D$(5)ORD$(7)=D$(5)THE
    ND=D+3
3560 GOTO3450
3570 IFF$(7)=D$(5)ORE$(7)=D$(5)ORD$(9)=D$(5)THE
    ND=D+4
3580 GOTO3460
3590 IFD>5THEN3780
3600 IFD>1THEN3660
3610 D=0
3620 GOSUB4880:GOSUB4510:GOSUB4880:GOSUB4880:GO
    SUB4510:GOSUB4510
3630 GOSUB4880:GOSUB4880:GOSUB4590:GOSUB4970
3640 IFD=1THEN3490
3650 D=1:GOSUB4610:GOTO3620
```

```
3660 IFD>2THEN3720
3670 D=0
3680 GOSUB4270:GOSUB4510:GOSUB4270:GOSUB4270:GO
    SUB4510:GOSUB4510
3690 GOSUB4270:GOSUB4270:GOSUB4590:GOSUB4390
3700 IFD=1THEN3490
3710 D=1:GOSUB4610:GOTO3680
3720 IFD=3THEND=0:GOTO3470
3730 D=0
3740 GOSUB4410:GOSUB4510:GOSUB4410:GOSUB4410:GO
    SUB4510:GOSUB4510
3750 GOSUB4410:GOSUB4410:GOSUB4590:GOSUB4290
3760 IFD=1THEN3490
3770 D=1:GOSUB4610:GOTO3740
3780 IFE$(1)=E$(5)THEN3800
3790 FORY=1TO2:GOSUB4270:GOSUB4670:GOSUB4390:GO
    SUB4770:NEXT:D=0:GOTO3780
3800 IFE$(3)=E$(5)THEN3830
3810 IFD=5THEN3790
3820 GOSUB4530:D=5:GOTO3790
3830 IFE$(7)=E$(5)THEN3860
3840 IFD=4THEN3790
3850 GOSUB4610:D=4:GOTO3790
3860 IFE$(9)=E$(5)THEN3890
3870 IFD=6THEN3790
3880 GOSUB4530:GOSUB4530:D=6:GOTO3790
3890 IFB$(8)=B$(5)THEN3910
3900 GOSUB4530:GOTO3890
3910 IFW<1THENW=1:GOTO620
3930 PRINT"{CLEAR}{13 DOWN}{07 RIGHT}***  WE FI
    NALLY DID IT  ***":PRINT:PRINT:PRINT:
    PRINT:PRINT:PRINT:PRINT:PRINT
3940 END
3950 GETA$(K):IFA$(K)=""THEN3950
3960 K=K+1:RETURN
3970 GETB$(K):IFB$(K)=""THEN3970
3980 K=K+1:RETURN
3990 GETC$(K):IFC$(K)=""THEN3990
4000 K=K+1:RETURN
4010 GETD$(K):IFD$(K)=""THEN4010
4020 K=K+1:RETURN
4030 GETE$(K):IFE$(K)=""THEN4030
4040 K=K+1:RETURN
4050 GETF$(K):IFF$(K)=""THEN4050
4060 K=K+1:RETURN
4070 PRINT"{RIGHT}?{LEFT}";:GOSUB3950:GOSUB4130
    :PRINTA$(K-1);:RETURN
4080 PRINT"{RIGHT}?{LEFT}";:GOSUB3970:GOSUB4130
    :PRINTB$(K-1);:RETURN
4090 PRINT"{RIGHT}?{LEFT}";:GOSUB3990:GOSUB4130
    :PRINTC$(K-1);:RETURN
4100 PRINT"{RIGHT}?{LEFT}";:GOSUB4010:GOSUB4130
    :PRINTD$(K-1);:RETURN
4110 PRINT"{RIGHT}?{LEFT}";:GOSUB4030:GOSUB4130
    :PRINTE$(K-1);:RETURN
4120 PRINT"{RIGHT}?{LEFT}";:GOSUB4050:GOSUB4130
    :PRINTF$(K-1);:RETURN
4130 IFA$(K-1)=CHR$(20)THENPRINT" {03 LEFT}?{02
     LEFT}";:K=K-2:RETURN
4140 RETURN
4150 PRINT"{CLEAR}{02 DOWN}
4160 PRINT"              @@@@2@@@2@@@@.
4170 PRINT"              ]   ]   ]   ]
4180 PRINT"              ] "B$(1)" ] "B$(2)" ] "
    B$(3)" ]
4190 PRINT"              +@@@[@@@[@@@3
4200 PRINT"              ]   ]   ]   ]
4210 PRINT"              ] "B$(4)" ] "B$(5)" ] "
    B$(6)" ]
4220 PRINT"              +@@@[@@@[@@@3
4230 PRINT"              ]   ]   ]   ]
4240 PRINT"              ] "B$(7)" ] "B$(8)" ] "
    B$(9)" ]
4250 PRINT"              -@@@1@@@1@@@=
4260 RETURN
4270 P=15:GOTO4300
4280 P=19:GOTO4300
4290 P=23
4300 GOSUB4150:PRINT"{HOME}":PRINT"{05 DOWN}"TA
    B(P)"65"
4310 PRINTTAB(P)"65"
4320 PRINTTAB(P)"65"
4330 PRINTTAB(P)"65"
4340 PRINTTAB(P)"  )"
4350 IFP=15THENGOSUB5170
4360 IFP=19THENGOSUB5190
4370 IFP=23THENGOSUB5200
4380 GOSUB5440:RETURN
4390 P=15:GOTO4420
4400 P=19:GOTO4420
4410 P=23
4420 GOSUB4150:PRINT"{HOME}":PRINT"{05 DOWN}"TA
    B(P)"{REV})_{OFF}"
4430 PRINTTAB(P)"65"
4440 PRINTTAB(P)"65"
4450 PRINTTAB(P)"65"
4460 PRINTTAB(P)"65"
4470 IFP=15THENGOSUB5110
4480 IFP=19THENGOSUB5130
4490 IFP=23THENGOSUB5140
4500 GOSUB5440:RETURN
4510 P=2:GOTO4540
4520 P=5:GOTO4540
4530 P=8
4540 GOSUB4150:PRINT"{HOME}":FORPP=0TOP:PRINT:N
    EXTPP:PRINTTAB(17)"{REV})_{OFF}////{DO
    DOWN}{05 LEFT}_7777"
4550 IFP=2THENGOSUB5290
4560 IFP=5THENGOSUB5310
4570 IFP=8THENGOSUB5320
4580 GOSUB5440:RETURN
4590 P=2:GOTO4620
4600 P=5:GOTO4620
4610 P=8
4620 GOSUB4150:PRINT"{HOME}":FORPP=0TOP:PRINT:N
    EXTPP:PRINTTAB(17)"////{REV}_{OFF}{DO
    DOWN}{05 LEFT}7777)"
4630 IFP=2THENGOSUB5230
4640 IFP=5THENGOSUB5250
4650 IFP=8THENGOSUB5260
4660 GOSUB5440:RETURN
4670 GOSUB4150:PRINT"{HOME}":PRINTTAB(16)"{05 D
    DOWN}!"
4680 PRINTTAB(16)"!"
4690 PRINTTAB(16)"!"
4700 PRINTTAB(16)"!{05 RIGHT}{REV}_{OFF}"
4710 PRINTTAB(16)"888888)"
4720 F$(0)=F$(3):F$(3)=A$(9):A$(9)=C$(7):C$(7)=
    E$(1):E$(1)=F$(0):F$(0)=A$(7)
4730 A$(7)=C$(1):C$(1)=E$(3):E$(3)=F$(9):F$(9)=
    F$(0):F$(0)=A$(8):A$(8)=C$(4)
4740 C$(4)=E$(2):E$(2)=F$(6):F$(6)=F$(0)
4750 FORI=1TO9:U$(I)=B$(I):NEXT:GOSUB5090:FORI=
    1TO9:B$(I)=U$(I):NEXT:GOSUB5440
4760 RETURN
4770 GOSUB4150:PRINT"{HOME}":PRINTTAB(15)"{05 D
    DOWN}{REV})_{OFF}"
4780 PRINTTAB(15)"65"
4790 PRINTTAB(15)"65"
4800 PRINTTAB(15)"65"
4810 PRINTTAB(15)"65"
4820 PRINTTAB(16)"8888888"
4830 A$(0)=A$(9):A$(9)=F$(3):F$(3)=E$(1):E$(1)=
    C$(7):C$(7)=A$(0):A$(0)=F$(9)
4840 F$(9)=E$(3):E$(3)=C$(1):C$(1)=A$(7):A$(7)=
    A$(0):A$(0)=F$(6):F$(6)=E$(2)
4850 E$(2)=C$(4):C$(4)=A$(8):A$(8)=A$(0)
4860 FORI=1TO9:U$(I)=B$(I):NEXT:GOSUB5070:FORI=
    1TO9:B$(I)=U$(I):NEXT:GOSUB5440
4870 RETURN
4880 GOSUB4150:PRINT"{HOME}{REV}REAR{OFF} SURFA
    CE!":PRINTTAB(16)"{05 DOWN}!"
```

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Atari Notes

Because of the extreme length of this program, a full converted program is not feasible. Instead, use the following suggestions to convert Rubik's Cube Solver to the Atari as you are typing it in. If you prefer, you can type in the program first, LIST it to tape or disk, and then use an Editor (such as the Atari Assembler/Editor Cartridge) with search and replace to make "global" changes to the text. You can then use ENTER to read the converted program with BASIC.

1. Change all occurrences of "NEXT" without a variable to "NEXT I".

2. Text preceded with "[RVS]" should be entered using the Atari Logo key.

3. PRINT statements with the [HOME] character should be rephrased:

```
from: PRINT"[HOME][06 RIGHT]"
to:   POSITION 0,0:PRINT"[06 RIGHT]"
```

4. All TAB statements should be converted as in:

```
from: PRINT TAB(TB);T$
to:   POKE 85,TB:PRINT T$
```

5. The PRINT statements to draw the arrows will have to be converted for use with Atari keyboard graphics. (See below.)

6. GET statements such as:

```
GET B$(K):IF B$(K)="" THEN
```

should be changed to:

```
GET#1,A:B$(K+1,K+1)=CHR$(A)  (see below)
```

7. Substitute line 150 below, and add line 100:

```
100 GRAPHICS 0:POKE 752,1:POKE 82,0:
    OPEN#1,4,0,"K:"
150 DIM A$(10),B$(10),C$(10),D$(10),E$(10),
    F$(10),T$(10),U$(10)
```

8. Strings (of course) will have to be changed. Generally, all references to variable xx$(n) will become xx$(n+1,n+1). For example,

```
1170 IF C$(4)=D$(5) THEN 1190
```

becomes

```
1170 IF C$(5,5)=D$(6,6) THEN 1190
```

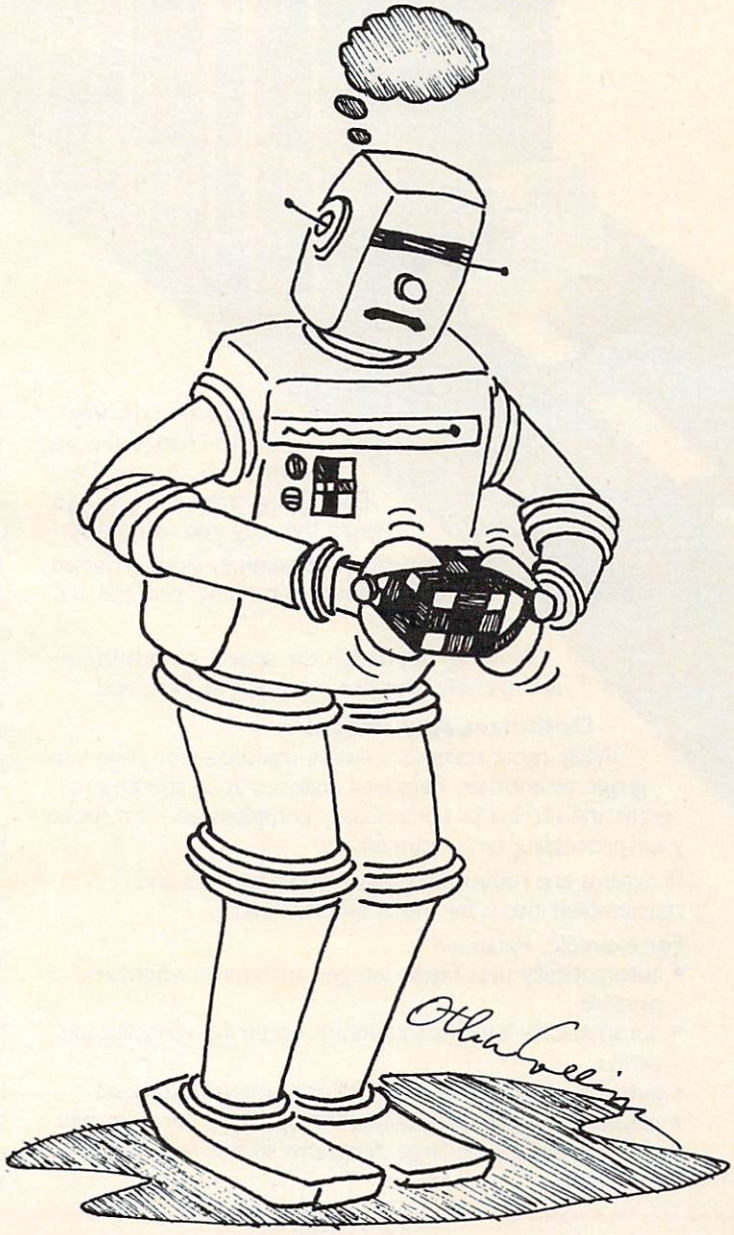
Here's where SEARCH and REPLACE come in handy. Just use ten patterns, such as:

```
REP/$(0)/$(1,1)/,A
```

Watch out for statements like A$(I), which should become A$(I+1,I+1), or A$(10-K), which should be A$(11-K,11-K).

```
4150 PRINT "{CLEAR}{2 DOWN}"
4160 PRINT "{13 SPACES}{Q}{3 R}{W}{3 R}
     {W}{3 R}{E}"
4170 PRINT "{13 SPACES}¦{3 SPACES}¦
     {3 SPACES}¦{3 SPACES}¦"
4180 PRINT "{13 SPACES}¦ ";B$(2,2);" ¦
     ";B$(3,3);" ¦ ";B$(4,4);" ¦"
4190 PRINT "{13 SPACES}{A}{3 R}{S}{3 R}
     {S}{3 R}{D}"
4200 PRINT "{13 SPACES}¦{3 SPACES}¦
     {3 SPACES}¦{3 SPACES}¦"
4210 PRINT "{13 SPACES}¦ ";B$(5,5);" ¦
     ";B$(6,6);" ¦ ";B$(7,7);" ¦"
4220 PRINT "{13 SPACES}{A}{3 R}{S}{3 R}
     {S}{3 R}{D}"
4230 PRINT "{13 SPACES}¦{3 SPACES}¦
     {3 SPACES}¦{3 SPACES}¦"
4240 PRINT "{13 SPACES}¦ ";B$(8,8);" ¦
     ";B$(9,9);" ¦ ";B$(10,10);" ¦"
4250 PRINT "{13 SPACES}{Z}{3 R}{X}{3 R}
     {X}{3 R}{C}"
4300 GOSUB 4150:POSITION 0,0:PRINT "
     {6 DOWN}";:POKE 85,P:? "{B}{V}"
4310 POKE 85,P:? "{B}{V}"
4320 POKE 85,P:? "{B}{V}"
4330 POKE 85,P:? "{B}{V}"
4340 POKE 85,P:? "{■}{F}"
4350 IF P=15 THEN GOSUB 5170
4420 GOSUB 4150:POSITION 0,0:? "":PRI
     NT "{5 DOWN}";:POKE 85,P:? "{H}
     {J}"
4430 POKE 85,P:? "{B}{V}"
4440 POKE 85,P:? "{B}{V}"
4450 POKE 85,P:? "{B}{V}"
4460 POKE 85,P:? "{B}{V}"
4540 GOSUB 4150:POSITION 0,1:FOR PP=0
     TO P:PRINT :NEXT PP:POKE 85,17:
     ? "{H}{4 N}{DOWN}{5 LEFT}{■}{4 M}
     "
4620 GOSUB 4150:POSITION 0,1:FOR PP=0
     TO P:PRINT :NEXT PP:POKE 85,17:
     ? "{4 N}{J}{DOWN}{5 LEFT}{4 M}
     {F}"
4670 GOSUB 4150:POSITION 0,2:POKE 85,
     16:? "{5 DOWN}■"
4680 POKE 85,16:? "■"
4690 POKE 85,16:? "■"
4700 POKE 85,16:? "■{5 U}{J}"
4710 POKE 85,16:? "{6 ■}{F}"
4770 GOSUB 4150:POSITION 0,0:POKE 85,
     15:? "{5 DOWN}{H}{J}"
4780 POKE 85,15:? "{■}{Y}"
4790 POKE 85,15:? "{■}{Y}"
4800 POKE 85,15:? "{■}{Y}"
4810 POKE 85,15:? "{■}{Y}"
4820 POKE 85,15:? "{■}{6 SPACES}"
4880 GOSUB 4150:POSITION 0,0:? "REAR
     SURFACE!":POKE 85,16:? "{6 DOWN}
     ■"
4890 POKE 85,16:? "■"
4900 POKE 85,16:? "■"
4910 POKE 85,16:? "■{5 U}{J}"
4920 POKE 85,16:? "{6 ■}{F}"
4970 GOSUB 4150:POSITION 0,0:? "REAR
     SURFACE!":POKE 85,15:? "{4 DOWN}
     {H}{J}"
4980 POKE 85,15:? "{■}{Y}"
4990 POKE 85,15:? "{■}{Y}"
5000 POKE 85,15:? "{■}{Y}"
5010 POKE 85,15:? "{■}{Y}"
5020 POKE 85,15:? "{■}{6 SPACES}"
5350 POKE 85,TB:? "{Q}{R}{W}{R}{W}
     {R}{E}"
5360 T$="¦ ¦ ¦ ¦":POKE 85,TB:? T$
5370 FOR I=1 TO 2:POKE 85,TB:? "{A}
     {R}{S}{R}{S}{R}{D}":POKE 85,TB:?
     T$:NEXT I
5380 POKE 85,TB:? "{Z}{R}{X}{R}{X}
     {R}{C}"
```

```
4890 PRINTTAB(16)"!"
4900 PRINTTAB(16)"!"
4910 PRINTTAB(16)"!{05 RIGHT}{REV}_{OFF}"
4920 PRINTTAB(16)"888888)"
4930 FORI=1TO9:U$(I)=D$(I):NEXT:GOSUB5070:FORI=
     1TO9:D$(I)=U$(I):NEXT
4940 F$(0)=F$(7):F$(7)=A$(1):A$(1)=C$(3):C$(3)=
     E$(9):E$(9)=F$(0):F$(0)=F$(4)
4950 F$(4)=A$(2):A$(2)=C$(6):C$(6)=E$(8):E$(8)=
     F$(0):F$(0)=F$(1):F$(1)=A$(3)
4960 A$(3)=C$(9):C$(9)=E$(7):E$(7)=F$(0):GOSUB5
     440:RETURN
4970 GOSUB4150:PRINT"{HOME}{REV}REAR{OFF} SURFA
     CE!":PRINTTAB(15)"{05 DOWN}{REV}) {OF
     OFF}"
4980 PRINTTAB(15)"65"
4990 PRINTTAB(15)"65"
5000 PRINTTAB(15)"65"
5010 PRINTTAB(15)"65"
5020 PRINTTAB(16)"8888888"
5030 FORI=1TO9:U$(I)=D$(I):NEXT:GOSUB5090:FORI=
     1TO9:D$(I)=U$(I):NEXT
5040 A$(0)=A$(3):A$(3)=F$(1):F$(1)=E$(7):E$(7)=
     C$(9):C$(9)=A$(0):A$(0)=A$(2)
5050 A$(2)=F$(4):F$(4)=E$(8):E$(8)=C$(6):C$(6)=
     A$(0):A$(0)=A$(1):A$(1)=F$(7)
5060 F$(7)=E$(9):E$(9)=C$(3):C$(3)=A$(0):GOSUB5
     440:RETURN
5070 U$(0)=U$(3):U$(3)=U$(1):U$(1)=U$(7):U$(7)=
     U$(9):U$(9)=U$(0):U$(0)=U$(6)
5080 U$(6)=U$(2):U$(2)=U$(4):U$(4)=U$(8):U$(8)=
     U$(0):RETURN
5090 U$(0)=U$(7):U$(7)=U$(1):U$(1)=U$(3):U$(3)=
     U$(9):U$(9)=U$(0):U$(0)=U$(4)
5100 U$(4)=U$(2):U$(2)=U$(6):U$(6)=U$(8):U$(8)=
     U$(0):RETURN
5110 FORI=1TO7STEP3:GOSUB5160:NEXTI:FORI=1TO9:U
     $(I)=F$(I):NEXT:GOSUB5090
5120 FORI=1TO9:F$(I)=U$(I):NEXT:RETURN
5130 FORI=2TO8STEP3:GOSUB5160:NEXTI:RETURN
5140 FORI=3TO9STEP3:GOSUB5160:NEXTI:FORI=1TO9:U
     $(I)=C$(I):NEXT:GOSUB5070
5150 FORI=1TO9:C$(I)=U$(I):NEXT:RETURN
5160 A$(0)=A$(I):A$(I)=B$(I):B$(I)=E$(I):E$(I)=
     D$(10-I):D$(10-I)=A$(0):RETURN
5170 FORI=1TO7STEP3:GOSUB5220:NEXTI:FORI=1TO9:U
     $(I)=F$(I):NEXT:GOSUB5070
5180 FORI=1TO9:F$(I)=U$(I):NEXT:RETURN
5190 FORI=2TO8STEP3:GOSUB5220:NEXTI:RETURN
5200 FORI=3TO9STEP3:GOSUB5220:NEXTI:FORI=1TO9:U
     $(I)=C$(I):NEXT:GOSUB5090
5210 FORI=1TO9:C$(I)=U$(I):NEXT:RETURN
5220 B$(0)=B$(I):B$(I)=A$(I):A$(I)=D$(10-I):D$(
     10-I)=E$(I):E$(I)=B$(0):RETURN
5230 FORI=1TO3:GOSUB5280:NEXT:FORI=1TO9:U$(I)=A
     $(I):NEXT:GOSUB5090:FORI=1TO9
5240 A$(I)=U$(I):NEXT:RETURN
5250 FORI=4TO6:GOSUB5280:NEXT:RETURN
5260 FORI=7TO9:GOSUB5280:NEXT:FORI=1TO9:U$(I)=E
     $(I):NEXT:GOSUB5070:FORI=1TO9
5270 E$(I)=U$(I):NEXT:RETURN
5280 B$(0)=B$(I):B$(I)=F$(I):F$(I)=D$(I):D$(I)=
     C$(I):C$(I)=B$(0):RETURN
5290 FORI=1TO3:GOSUB5340:NEXT:FORI=1TO9:U$(I)=A
     $(I):NEXT:GOSUB5070:FORI=1TO9
5300 A$(I)=U$(I):NEXT:RETURN
5310 FORI=4TO6:GOSUB5340:NEXT:RETURN
5320 FORI=7TO9:GOSUB5340:NEXT:FORI=1TO9:U$(I)=E
     $(I):NEXT:GOSUB5090:FORI=1TO9
5330 E$(I)=U$(I):NEXT:RETURN
5340 B$(0)=B$(I):B$(I)=C$(I):C$(I)=D$(I):D$(I)=
     F$(I):F$(I)=B$(0):RETURN
5350 PRINTTAB(TB);"@@2@2@."
5360 T$="] ] ] ]":PRINTTAB(TB);T$
5370 FORI=1TO2:PRINTTAB(TB);"+@[@[@3":PRINTTAB(
     TB);T$:NEXTI
5380 PRINTTAB(TB);"-@1@1@="
5390 IFJJ=4THENTB=0:RETURN
5400 IFJJ=2ANDJ=2THENTB=16:PRINT"{08 UP}":JJ=3:
     GOTO5350
5410 IFJJ=3ANDJ=2THENTB=24:PRINT"{08 UP}":JJ=4:
     GOTO5350
5420 IFJ=2THENTB=8:PRINT"{08 UP}":JJ=2:GOTO5350
5430 RETURN
5440 PRINT"{HOME}{20 DOWN}HIT {REV}SPACE{OFF} T
     O CONTINUE"
5450 GETR$:IFR$=""THEN5450
5460 IFR$=CHR$(32)THENRETURN
5470 GOTO5450
```



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This challenging and fast-paced game is for the VIC (5K) and Atari computers. Try to collect as much treasure as you can, but keep an eye on the monster!

Superchase

Anthony Godshall
Elkhart, IN

"Superchase" is an arcade-style game where you try to eat all the treasures before the monster of dungeons eats you! Sounds easy, doesn't it? Well, it isn't quite that simple. The faster you go, the faster he goes. What's the point in going fast? If you go fast, you get more points.

Here's how the game works. You get to choose your skill level. Hit a key between 1 and 9. After this, the maze is drawn. Following this, the treasures are put in, and you appear in the upper left-hand corner. Take off!

If you clear the maze of all the treasures, you will receive a bonus, depending on your skill level and score, and will start a new screen with a higher skill level. Don't be disappointed if you don't get a good score the first time. I find that most people learn quickly.

The monster will follow in your exact footsteps, so you can duck into a side passageway and let him go past if you know where you have been. If you are trapped, try to make him accelerate. When he is accelerating, you can run past him. Do this by moving back and forth as fast as you can.

If you don't want to spend the time to type the VIC version in, send me a cassette, a self-addressed, stamped mailer, and $3:

Anthony Godshall
137 Wagner
Elkhart, IN 46516

Program 1: VIC Version

```
10 REM"{07 DEL}@@@@@@@@@@@@@@@@@@@@. ]    SUP
   ERCHASE     ] ]BY ANTHONY GODSHALL]
22 REM"{07 DEL}-@@22@@@@@@@@@@@22@@@= 88888888
   88888888888888
40 GOSUB14000
42 POKE1,0:POKE2,0
45 GOSUB12000:CLR:SK=PEEK(0):P=PEEK(1)*256+PE
   EK(2)
100 GOTO10000
1000 M$=""
1110 POKEDD,127:P1=PEEK(D1)ANDAD:P2=PEEK(D2)
1120 IFP1=58THENM$="+{LEFT}{UP}":PRINTM$;:Y=Y-1
   :C$="{DOWN}":CX=0:CY=1:GOTO1160
1130 IFP2=119THENM$="+{LEFT}{RIGHT}":PRINTM$;:X
   =X+1:C$="{LEFT}":CX=-1:CY=0:GOTO1160
1140 IFP1=46THENM$="+{02 LEFT}":PRINTM$;:X=X-1:
   C$="{RIGHT}":CX=1:CY=0:GOTO1160
1150 IFP1=54THENM$="+{LEFT}{DOWN}":PRINTM$;:Y=Y
   +1:C$="{UP}":CY=-1:CX=0:GOTO1160
1155 GOTO1300
1160 IFFNCH(S)=WLTHENPRINTC$;:X=X+CX:Y=Y+CY:GOT
   O1300
1170 F$=F$+RIGHT$(M$,1)
1180 IFFNCH(S)=DITHENP=P+100*(EL-S):PC=PC+1
1190 IFFNCH(S)=SPTHENP=P+50*(EL-S):PC=PC+1
1200 IFFNCH(S)=CLTHENP=P+30*(EL-S):PC=PC+1
1210 IFFNCH(S)=HETHENP=P+20*(EL-S):PC=PC+1
1220 IFFNCH(S)=CITHENP=P+10*(EL-S):PC=PC+1
1250 J$=STR$(P*SK):FORJ=1TOLEN(J$):POKESC+J+489
   ,ASC(MID$(J$,J,1)):NEXT
1300 PRINT"Q{LEFT}";
1310 IFPC>=61THENPRINTDN$"NO MORE TREASURE.";:G
   OTO7000
1900 RETURN
2000 IFLEN(F$)>=30THENGOSUB3000
2005 FM=FM+1:IFFM/S<>INT(FM/S)THENRETURN
2006 FORH=1TOSKL:
2007 POKEFNPLOT(0),32
2010 J$=LEFT$(F$,1):F$=MID$(F$,2)
2030 POKEV,15:POKES1,254-LEN(F$):FORM=1TO10:NEX
   T:POKE36875,0
2100 IFJ$="{UP}"THENYF=YF-1:GOTO2200
2110 IFJ$="{RIGHT}"THENXF=XF+1:GOTO2200
2120 IFJ$="{DOWN}"THENYF=YF+1:GOTO2200
2130 IFJ$="{LEFT}"THENXF=XF-1:GOTO2200
2150 GOTO2200
2200 POKEFNPL(0),42
2205 NEXT
2210 RETURN
3000 POKEFNPL(0),32
3007 S=S-1:IFS<1THENS=1
3008 J$=STR$(EL-S):FORJ=1TOLEN(J$):POKESC+J+502
   ,ASC(MID$(J$,J,1)):NEXT
3010 FORC=1TO10:J$=MID$(F$,C,1):IFJ$="{UP}"THEN
   YF=YF-1:GOTO3100
3020 IFJ$="{DOWN}"THENYF=YF+1:GOTO3100
3030 IFJ$="{RIGHT}"THENXF=XF+1:GOTO3100
3040 IFJ$="{LEFT}"THENXF=XF-1:GOTO3100
3100 POKEFNPL(0),42
3150 IFC/SK=INT(C/SK)THENGOSUB1000
3310 FORM=CTOC+2:POKES2,M*3+130:FORN=1TO10:NEXT
   :NEXT:POKES2,0
3350 POKEFNPLOT(0),32
3400 NEXT
3500 F$=MID$(F$,EL):RETURN
4000 IFX=XFANDY=YFTHENPRINTDN$"A TASTY MORSEL I
   NDEED!";:GOSUB6000:GOTO11000
4500 RETURN
6000 POKE36877,220:FORL=15TO0STEP-1:POKE36878,L
   :FORM=1TO300:NEXT:NEXT:POKE36877,0:PO
   KE36878,15
6010 RETURN
7000 FORK=1TO30
7005 POKE36876,220:FORL=1TO5:NEXT:POKE36876,0:F
   ORL=1TO5:NEXT:POKE36876,200:FORL=1TO5
   :NEXT
7010 POKE36876,0:FORL=1TO5:NEXT:NEXT
7100 J=INT(P/256):POKE1,J:POKE2,P-J*256
7200 SK=PEEK(0)+1:POKE0,SK:GOTO45
7999 GOTO7000
8000 FORM=1TO500:GOSUB1000:IFLEN(F$)<20THENNEXT
8010 FORJ=8142TO8142+20:POKEJ,32:NEXT
8100 GOSUB1000:GOSUB2000:GOSUB4000:GOTO8100
10000 DN$="{HOME}{21 DOWN}{REV}{WHT}"
10030 S=10:PC=0:SC=7680:RO=22
10050 DEFFNPL(XX)=(YF*RO+XF)+SC
10060 DEFFNCH(XX)=PEEK((Y*RO+X)+SC)
10077 SO=10:POKE36878,15
10100 DD=37154:D1=37151:D2=37152:AD=63
10110 WL=102:DI=90:SP=65:CL=88:HE=83:CI=87:EL=11
10120 V=36878:S1=36875:S2=36876
10500 TI$="000000"
10600 PRINTDN$"       GO !!!!!!      "
10700 PRINTDN$"{OFF}{DOWN}{BLK}SCORE:{WHT}
   {BLK}SPEED:{WHT} 1{HOME}"
10800 PRINT"{HOME}{RIGHT}{DOWN}";:X=1:Y=1:XF=1:Y
```

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Talk is cheap

```
    F=1
10900 GOTO8000
11000 REM GAME OVER
11010 POKE37154,255
11105 PRINT:PRINT"{DOWN}TIME WAS ";MID$(TI$,3,2)
    ;" MINUTES, ";RIGHT$(TI$,2);" SECONDS
    "
11110 PRINT"PLAY AGAIN ? ${LEFT}";
11120 GETJ$:IFJ$=""THEN11120
11130 PRINTJ$:IFJ$="N"THENEND
11140 IFJ$="Y"THENRUN
11150 PRINT:PRINT"{UP}";:GOTO11110
12000 DIMA(3):A(0)=2:A(1)=-44:A(2)=-2:A(3)=44:WL
    =102:HL=32:SC=7680:A=SC+23:J=RND(-TI)

12010 POKE36879,110
12100 PRINT"{CLEAR}{YEL}{OFF}";CHR$(142):FORI=1T
    021:PRINT"&&&&&&&&&&&&&&&&&&&&&&":NEXT
    :POKEA,4
12200 J=INT(RND(1)*4):X=J
12205 B=A+A(J)
12210 IFPEEK(B)=WLTHENPOKEB,J:POKEA+A(J)/2,HL:A=
    B:GOTO12200
12240 J=(J+1)*-(J<3):IFJ<>XTHEN12205
12250 J=PEEK(A):POKEA,HL:IFJ<4THENA=A-A(J):GOTO1
    2200
12300 PRINT"{HOME}{DOWN}{RIGHT}V"
12305 READJ,K,C:IFJ<0THEN12500
12310 FORA=1TOJ
12320 B=INT(RND(1)*410):IF(B-21)/22=INT((B-21)/2
    2)THEN12320
12330 IF PEEK(B+7702)<>32THEN12320
12340 POKEB+7702,K:POKEB+38422,C
12350 NEXT:GOTO12305
12400 DATA2,90,1,4,65,0,7,88,5,9,83,2,39,87,3,-1
    ,0,0
12450 PRINT"12450:P="P
12500 RETURN
14000 POKE36879,46
14010 PRINTCHR$(14)"{CLEAR}{WHT}{04 DOWN}{02 RIG
    RIGHT}    $$$$$$$$$$              {REV}
    SUPERCHASE{OFF}"
14020 PRINT"{03 DOWN}{02 RIGHT} BY TONY GODSHALL
    "
14050 PRINT"{03 DOWN} SKILL LEVEL (1-9): {REV} {
    OFF}{02 LEFT}";
14060 GETJ$:IFJ$=""THEN14060
14070 SK=VAL(J$):IFSK<1ORSK>9THEN14060
14075 POKE0,SK
14080 PRINTSK:POKE0,SK:RETURN
```

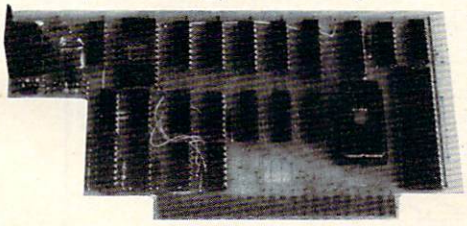
Program 2: Atari Version

```
40 GOTO 14000
42 POKE 1,0:POKE 2,0
45 TRAP 47:DIM F$(40):TRAP 40000
47 F$="":GOSUB 12000:SK=PEEK(0):P=PEE
   K(1)*256+PEEK(2):GOSUB 10000:GOTO
   8000
990 REM  READ JOY, MOVE
1000 REM
1010 PA=STICK(0)
1020 S3=(PA=7)
1030 S0=(PA=14):S1=(PA=13):S2=(PA=11)
1100 IF S0 THEN POKE X,7+128:C=20:GOT
     O 1160
1130 IF S3 THEN POKE X,6+128:C=-1:GOT
     O 1160
1140 IF S2 THEN POKE X,8+128:C=1:GOTO
      1160
1150 IF S1 THEN POKE X,9+128:C=-20:GO
     TO 1160
1155 FOR J=1 TO 50:NEXT J:GOTO 1300
1160 X=X-C:IF PEEK(X)=129 THEN X=X+C:
     GOTO 1300
1165 SOUND 0,100,10,8
1170 F$(LEN(F$)+1)=CHR$(-C+99)
1180 J=PEEK(X):POKE X,2+64:IF J=10 TH
     EN K=100:GOSUB 9000
1190 IF J=11 THEN K=50:GOSUB 9000
1200 IF J=12 THEN K=30:GOSUB 9000
1210 IF J=13 THEN K=20:GOSUB 9000
1220 IF J=14 THEN K=10:GOSUB 9000
1230 SOUND 0,0,0,0
1250 POSITION 6,22:? #6;P;" ";
1300 POKE X,3+64:RETURN
1990 REM " MOVE MONSTER
2000 IF LEN(F$)>=30 THEN GOSUB 3000
2005 O=O+1:IF O/S<>INT(O/S) THEN RETU
     RN
2010 FOR J=1 TO SK:GOSUB 4000:POKE F,
     0:F=F+(ASC(F$)-99):F$=F$(1+((LEN
     (F$)>1)))
2030 POKE F,5+192:SOUND 0,120,0,8:FOR
      M=1 TO 50:NEXT M:POKE F,4+192:S
     OUND 0,80,0,8:NEXT J:SOUND 0,0,0
     ,0:RETURN
2990 REM " SPEED UP MONSTER
3000 POKE F,0:S=S-1:IF S<1 THEN S=1
3005 POSITION 18,22:? #6;E-S;
3010 FOR N=1 TO 10:POKE F,0:F=F+(ASC(
     F$)-99):F$=F$(2):POKE F,5+192
3150 IF (N/SK=INT(N/SK)) AND PP THEN
     GOSUB 1000
3310 FOR M=N TO N+2:SOUND 0,M*3,0,8:N
     EXT M:NEXT N:SOUND 0,0,0,0

3500 RETURN
3990 REM " CHECK IF EATEN
4000 IF X<>F THEN RETURN
4005 POKE F,8:SOUND 0,0,0,0
4010 GOSUB 18000:POSITION 0,22:? #6;"
     A TASTY MORSEL{8 SPACES}INDEED_"
     ;
4015 FOR J=1 TO 2000
4025 NEXT J
4027 IF PP=0 THEN 16800
4060 GOTO 11000
6990 REM " GET PROMOTED
7000 J=INT(P/256):POKE 1,J:POKE 2,P-J
     *256
7100 SK=PEEK(0)+1:POKE 0,SK
7200 POSITION 0,23:? #6;"CONGRATULATI
     ONS !!"
7400 PRINT "{CLEAR}{3 DOWN}  ONE AS F
     LEET-FOOTED AS YOU DESERVES":? "
       MORE CHALLENGE.{2 DOWN}"
7405 FOR J=1 TO 1000:NEXT J
7410 PRINT "  YOU ARE THEREFORE PROMO
     TED TO":? "  SKILL LEVEL ";SK
7420 FOR J=1 TO 1000:NEXT J
7500 GOTO 45
7990 REM " MAIN LOOP!
8000 FOR M=1 TO 500:GOSUB 1000:IF LEN
     (F$)<20 THEN NEXT M
8100 GOSUB 1000:GOSUB 2000:GOSUB 4000
     :GOTO 8100
8990 REM " PICKED UP TREASURE
9000 FOR I=1 TO 10:SOUND 0,10*RND(0),
     10,8:NEXT I:SOUND 0,0,0,0
9010 P=P+K*(E-S):PC=PC+1:IF PC>=61 TH
     EN 7000
9100 RETURN
9990 REM " SET VARIABLES, ETC.
10000 REM
10030 S=10:PC=0:RO=22:PP=1
10110 W=5:E=11:GOSUB 18000
10600 POSITION 8,23:? #6;"■■{INSERT}"
10700 POSITION 0,22:? #6;"SCORE■
      {6 SPACES}speed:1"
```

We turn your VIC into a real computer for only $ 249

Computer World offers you its sensational videocartridge. Just plug it in, connect a video monitor with your VIC-20 and enter the world of professional computing. Discover word-processing, accounting etc.



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- No alternations needed to your VIC;
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- Fits in ARFON or Commodore expansion box;
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Looking for high resolution graphics? Buy Commodore's super expander. But... it doesn't work together with the programmers aid. The solution: buy our SUPER VICTOOL, the toolkit that works perfectly with the super expander. Our SUPER VICTOOL adds 18 commands to your VIC, i.e. AUTO, DELETE, DUMP, FIND, HELP, OFF, RENUMBER, STEP, TRACE, TEXT, GRAPHICS, LINE, CLEAR, DRAW, PUT, FILL, SET, POINT, CIRCLE.
ROM cartridge and manual

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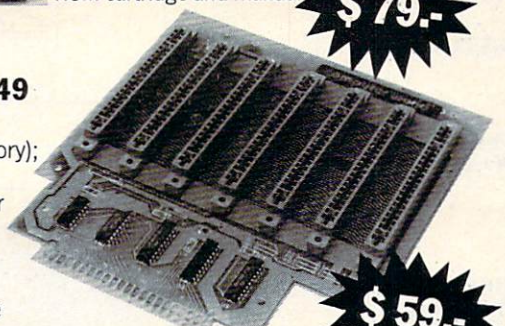


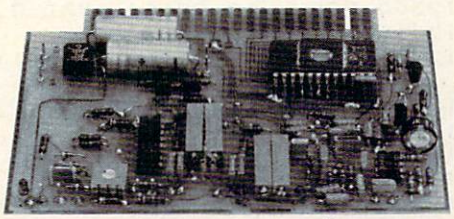
$ 59.-

Memory Expansion

If you want to expand your VIC with more memory you'll need this unique expander. Now you can have 7 more slots for programmers aid, RAM packs, etc. Computer World offers you this expander (with 1 slot completely tested) for $ 59.– (Add $ 9.– for each extra connector).

Great news for HAM's... Now you can see what you hear!

The TDK-20 'HAM interface' is a complete RTTY and MORSE code system fot the VIC-20 computer. It comes in a single cartridge which you can plug in either a standard VIC-20 or in an expansion box. The cartridge includes two converters, one for MORSE reception and the other for RTTY. Just plug it in and you can read what's in the air on your VIC-monitor!



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VICPHONE Leave the dialing to your VIC!

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VICPHONE is a mailinglist program and an interface between your VIC computer and your telephone. Type the name of the person you want to speak and your VIC looks in its memory and dials automatically the correct number. On your (TV)screen you'll see name and phonenumber.

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```
10800 X=SC+21:F=X
10900 RETURN
11000 REM " GAME OVER
11105 PRINT :? "SCORE:";P:?
11110 PRINT "PLAY AGAIN ? (Y/N): ";
11120 OPEN #1,4,0,"K:":GET #1,A:CLOSE
       #1
11130 IF A=ASC("N") THEN END
11140 RUN
11990 REM " MAKE MAZE  (ALGORITHM FRO
      M COMPUTE!)
12000 GRAPHICS 17:POKE 756,CHSET/256
12010 TRAP 12015:DIM A(3):A(0)=2:A(1)
      =-40:A(2)=-2:A(3)=40:WL=129:HL=
      0:TRAP 40000
12015 A=SC+21
12100 FOR I=1 TO 21:? #6;"■■■■■■■■■■■■
      ■■■■■■■■■":NEXT I:POKE A,5
12150 ? #6;"the dwarves mined":? #6;"
      here many years ago";
12200 J=INT(RND(1)*4):X=J
12205 B=A+A(J)
12210 IF PEEK(B)=WL THEN POKE B,J+1:P
      OKE A+A(J)/2,HL:A=B:GOTO 12200
12240 J=(J+1)*(J<3):IF J<>X THEN 1220
      5
12250 J=PEEK(A):POKE A,HL:IF J<5 THEN
       A=A-A(J-1):GOTO 12200
12255 GOSUB 18000
12260 POSITION 0,22:? #6;"■■■■■■■■■■■■
      ■■■■":? #6;"■■■■■■■■■■■■■■■■■■■■"
      ;
12270 RESTORE
12300 FOR K=10 TO 14:READ J,C
12310 FOR A=1 TO J
12320 B=SC+40+INT(20*RND(0))*20+INT(1
      9*RND(0))
12330 IF PEEK(B)<>0 THEN 12320
12340 POKE B,K
12350 NEXT A:NEXT K
12500 RESTORE :RETURN
12600 DATA 1,1,7,3,12,7,15,6,26,0
13990 REM " TITLE PAGE, ETC.
14000 GRAPHICS 17
14005 SC=PEEK(88)+256*PEEK(89):CHSET=
      PEEK(106)-8:CHSET=CHSET*256
14007 FOR I=0 TO 512:POKE CHSET+I,PEE
      K(57344+I):NEXT I
14010 ? #6;"{5 SPACES}■■■■■■■■■■■■■■■
      {INSERT}":? #6
14020 ? #6
14030 GOTO 16000
14050 ? #6:? #6;"■■■■■■■■■■■■■■ <1..9>"
14060 OPEN #1,4,0,"K:":GET #1,A:CLOSE
       #1
14070 SK=A-48:IF SK<1 OR SK>9 THEN 14
      060
14080 POKE 0,SK:GOTO 42
15990 REM " SHOW & DEFINE CHARACTERS
16000 FOR J=1 TO 7:POKE SC+J*40+80,J:
      NEXT J
16010 FOR J=8 TO 15:POKE SC+19+80+40*
      (J-7),J:NEXT J
16020 POKE 756,CHSET/256
16150 FOR J=0 TO 7:POKE CHSET+J,0:NEX
      T J
16160 FOR J=1 TO 10:READ K:NEXT J
16200 X=256:FOR J=0 TO 119:READ K
16250 X=X-0.81:SOUND 0,X,10,8
16300 POKE CHSET+8+J,K:NEXT J
16305 FOR I=0 TO 7:READ A:POKE CHSET+
      63*8+I,A:NEXT I
16310 SOUND 0,0,0,0:GOTO 14050
17111 REM " CHARACTER DATA
17112 DATA 85,42,85,42,85,42,85,0
17115 DATA 28,42,62,34,28,36,68,38
17120 DATA 28,42,62,34,28,21,18,24
17130 DATA 60,90,126,74,66,60,36,102
17140 DATA 60,90,126,74,126,66,66,195
17150 DATA 0,224,240,224,14,15,14,0
17160 DATA 4,14,14,14,32,112,112,112
17170 DATA 0,112,240,112,7,15,7,0
17180 DATA 14,14,14,4,112,112,112,32
17190 DATA 0,8,34,8,93,8,34,8
17200 DATA 1,76,18,34,68,72,50,128
17210 DATA 0,73,42,0,216,28,60,0
17220 DATA 0,2,24,36,36,24,64,0
17230 DATA 0,0,12,28,56,48,0,0
17235 DATA 0,126,126,126,122,126,126,
      0
17300 DATA 0,7,15,14,24,48,0,64
18000 COLOR 0:PLOT 0,21:DRAWTO 19,21:
      PLOT 0,22:DRAWTO 19,22:PLOT 0,2
      3:DRAWTO 19,23:RETURN
```

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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

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

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

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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

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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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Here is a game for VIC and Atari that teaches math while it entertains.

MathMan

Andy Hayes
San Jose, CA

Here's a program which proves that computer-aided math practice need not be boring. In the guise of a game, MathMan teaches multiplication facts by presenting random problems. The player (or student) types in the answer and presses RETURN. If he is correct, his friends gathered below cheer, but if the player fails to guess correctly, one of his friends will run away in shame. If all six friends flee, the game is over.

A good player can advance to the next level by successfully completing ten problems. The problems get successively more difficult, so this single program will provide challenge for almost any elementary school child. (Adults may also enjoy the animation!)

Program 1: VIC Version

```
0 A=6
1 LV=1
10 PRINT"{WHT}{CLEAR}"
20 POKE36879,110
30 CS$="{HOME}{21 DOWN}"
200 PRINTLEFT$(CS$,16)"{REV}  {OFF} N"
220 PRINTLEFT$(CS$,17)"{REV}   {OFF}"
230 PRINTLEFT$(CS$,18)"{REV}    {OFF}"
240 PRINTLEFT$(CS$,19)"{REV}     {OFF}"
250 PRINTLEFT$(CS$,20)"{REV}      {OFF}"
260 PRINTLEFT$(CS$,21)"{REV}       {OFF}"
270 IFA=6THENPRINT"{HOME}{17 DOWN}{07 RIGHT}UI
    UIUIUIUIUI"
271 IFA=6THENPRINT"{07 RIGHT}JKJKJKJKJKJK"
272 IFA=6THENPRINT"{07 RIGHT}POPOPOPOPOPO"
273 IFA=6THENPRINT"{07 RIGHT}NMNMNMNMNMNM"
274 IFA=5THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
    UIUIUIUIUI"
275 IFA=5THENPRINT"{07 RIGHT}  JKJKJKJKJK"
276 IFA=5THENPRINT"{07 RIGHT}  POPOPOPOPO"
277 IFA=5THENPRINT"{07 RIGHT}  NMNMNMNMNM"
278 IFA=4THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
      UIUIUIUI"
279 IFA=4THENPRINT"{07 RIGHT}    JKJKJKJK"
280 IFA=4THENPRINT"{07 RIGHT}    POPOPOPO"
281 IFA=4THENPRINT"{07 RIGHT}    NMNMNMNM"
282 IFA=3THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
       UIUIUI"
283 IFA=3THENPRINT"{07 RIGHT}      JKJKJK"
284 IFA=3THENPRINT"{07 RIGHT}      POPOPO"
285 IFA=3THENPRINT"{07 RIGHT}      NMNMNM"
286 IFA=2THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
         UIUI"
287 IFA=2THENPRINT"{07 RIGHT}        JKJK"
288 IFA=2THENPRINT"{07 RIGHT}        POPO"
289 IFA=2THENPRINT"{07 RIGHT}        NMNM"
290 IFA=1THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
          UI"
291 IFA=1THENPRINT"{07 RIGHT}          JK"
292 IFA=1THENPRINT"{07 RIGHT}          PO"
293 IFA=1THENPRINT"{07 RIGHT}          NM"
294 IFA=0THENPRINT"{HOME}{17 DOWN}{07 RIGHT}  ~
           "
295 IFA=0THENPRINT"{07 RIGHT}            "
296 IFA=0THENPRINT"{07 RIGHT}      "
297 IFA=0THENPRINT"{07 RIGHT}            ":GOT
    O3000
298 IFA=6THENML=7688:MM=7710
299 PRINT"{HOME}LEV.{REV}"LV
300 IFA=5THENML=7690:MM=7712
302 IFA=4THENML=7692:MM=7714
304 IFA=3THENML=7694:MM=7716
306 IFA=2THENML=7696:MM=7718
308 IFA=1THENML=7698:MM=7720
322 IFO=10THENLV=LV+1:GOTO2000
350 LETS=LV*2
355 O=O+1
360 B=INT(RND(1)*S)+1
370 C=INT(RND(1)*9)+1
375 PRINTLEFT$(CS$,23)"{REV}{PUR}SCORE-"SC"{WH
    WHT}"
380 PRINTLEFT$(CS$,5)"{09 RIGHT}"B"{LEFT}  "
390 IFB<10THENPRINTLEFT$(CS$,7)"{08 RIGHT}X"C"
    {LEFT}  ":GOTO400
393 IFB<100THENPRINTLEFT$(CS$,7)"{08 RIGHT}X "
    C"{LEFT}  ":GOTO400
395 IFB<1000THENPRINTLEFT$(CS$,7)"{08 RIGHT}X ~
     "C"{LEFT}  ":GOTO400
400 PRINTLEFT$(CS$,8)"{08 RIGHT}@@@@@@"
410 PRINT"{HOME}{08 DOWN}{07 RIGHT}          "
415 INPUT"{HOME}{08 DOWN}{08 RIGHT}";AS
430 IFAS=B*CTHEN700
440 IFAS<>B*CTHEN1000
700 SC=SC+5*LV
711 PRINTLEFT$(CS$,16)"{07 RIGHT}{REV}THANK YO
    U!!!{OFF}"
715 X=X+1
720 POKE36878,15
730 E=INT(RND(1)*30)+210
740 POKE36875,E
742 FORT=1TO100:NEXT:POKE36878,0
744 IFX=10THENX=0:GOTO760
750 GOTO715
760 FORT=1TO500
770 PRINTLEFT$(CS$,23)"{12 RIGHT}         "
772 PRINTLEFT$(CS$,10)"                   "
775 PRINTLEFT$(CS$,16)"{07 RIGHT}             "
776 IFO=10THEN790
780 F=0:GOTO355
790 LV=LV+1:GOTO2000
1000 Q=7992
1005 POKEQ,32:Q=Q-21:POKEQ,78
1010 IFQ=7866THEN1030
1020 GOTO1005
1030 POKEQ,160:POKEQ+1,160:POKEQ-1,160:POKEQ+22
    ,160:POKEQ-22,160
1040 POKE36877,220
1041 Z=15
1042 Z=Z-1
1044 POKE36875,0:POKE36878,Z
1046 FORM=1TO100:NEXT
1048 IFZ=0THENZ=15:GOTO1060
1050 GOTO1042
1060 POKE36877,0:POKE36878,0:POKEQ+22,32:POKEQ-
    22,64:POKEQ,32:POKEQ-1,32:POKEQ+1,32
1070 Q=7992
1075 POKEQ,32:Q=Q-21:POKEQ,78
1080 IFQ=7866THEN1200
1085 GOTO1075
1199 END
1200 Y=Y+1
1205 PRINT"{HOME}{08 DOWN}{09 RIGHT}{REV}"B*C"{
    LEFT}{REV} "
1210 FORT=1TO150:NEXTT
1220 PRINT"{HOME}{08 DOWN}{09 RIGHT}       "
1230 FORT=1TO150:NEXTT
1235 IFY=8THENY=0:GOTO1300
1240 GOTO1200
```

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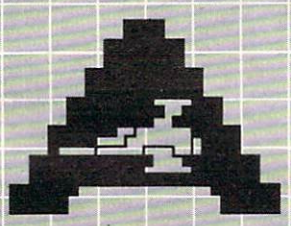

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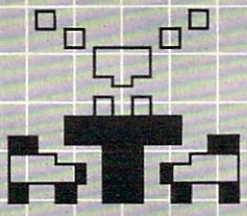

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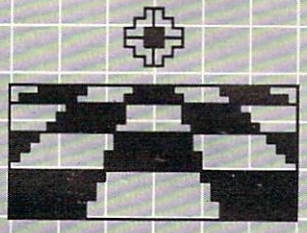

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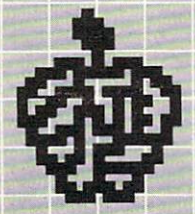

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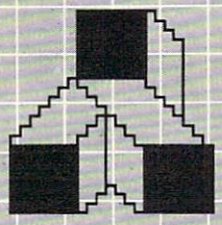

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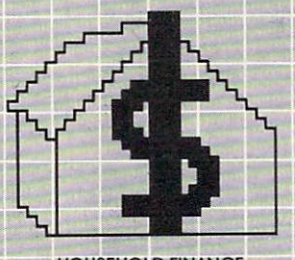

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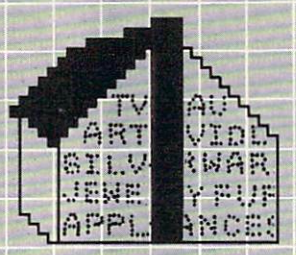

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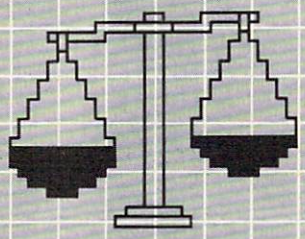

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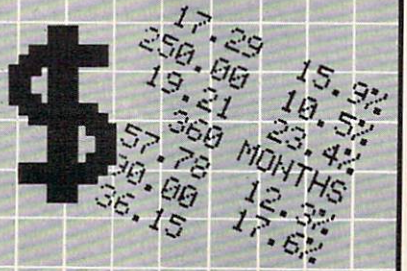

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```
1300 PRINTLEFT$(CS$,5)"                    "
1310 IFB<10THENPRINTLEFT$(CS$,7)"          ~
       "
1320 IFB<100THENPRINTLEFT$(CS$,7)"         ~
       "
1330 IFB<1000THENPRINTLEFT$(CS$,7)"        ~
       "
1340 PRINTLEFT$(CS$,8)"                    "
1345 PRINTLEFT$(CS$,9)"                   "
1400 W=MM+22:A=A-1
1430 IFO=10THEN2000
1500 POKEW,32:GOTO10
2000 FORT=1TO2000:NEXT
2001 PRINT"{CLEAR}{HOME}{06 DOWN} YOU MADE IT T
    HROUGH"
2005 PRINT"       LEVEL"LV-1
2010 PRINT"{02 DOWN}  YOU NOW ADVANCE TO"
2015 PRINT"       LEVEL"LV:O=0:FORT=1TO4000:NEXT
    :GOTO10
3000 FORT=1TO2000:NEXT
3010 PRINT"{CLEAR}{HOME}{04 DOWN}SORRY BUT YOU ~
    LOST ALL";
3020 PRINT"{02 DOWN}        YOUR MEN"
3030 PRINT"{04 DOWN}     {REV}YOUR SCORE WAS{OFF
    OFF}"
3040 PRINT"{02 DOWN}        "SC
```

Program 2: Atari Version

```
0 A=6
1 LV=1
10 GRAPHICS 0:POKE 82,0:POKE 752,1:?
   "{CLEAR}"
20 POSITION 0,16
200 ? "■■{F}"
220 ? "{3 SPACES}"
230 ? "{4 SPACES}"
240 ? "{5 SPACES}"
250 ? "{6 SPACES}"
260 ? "{7 SPACES}"
270 IF A=0 THEN 3000
275 FOR I=1 TO A
280 POSITION I*3+6,17
290 ? "{RIGHT}{Q}{E}{DOWN}{2 LEFT}
    {Z}{C}{DOWN}{2 LEFT}{E}{Q}{DOWN}
    {2 LEFT}{F}{G}"
295 NEXT I
298 SC=PEEK(88)+256*PEEK(89)
299 POSITION 0,0:? "LEVEL ";LV
322 IF O=10 THEN LV=LV+1:GOTO 2000
350 S=LV*2
355 O=O+1
360 B=INT(RND(1)*S)+1
370 C=INT(RND(1)*9)+1
375 POSITION 0,22:? "SCORE-";SCO
380 POSITION 10,5:? B;"  "
390 POSITION 8,7:? "X ";C
400 POSITION 8,8:? "{6 R}"
410 POSITION 8,9:? "{6 SPACES}"
415 TRAP 415:POSITION 8,11:INPUT A$:T
    RAP 40000
430 IF A$=B*C THEN 700
440 IF A$<>B*C THEN 1000
700 SCO=SCO+5*LV
711 POSITION 10,14:? "THANK■YOU!!!!"
715 X=X+1
730 E=INT(RND(1)*30)+210
742 FOR T=1 TO 10:POKE 710,PEEK(53770
    ):SOUND 0,T,10,8:NEXT T
743 SETCOLOR 2,9,4:SOUND 0,0,0,0
744 IF X=10 THEN X=0:GOTO 760
750 GOTO 715
760 FOR T=1 TO 500
770 COLOR 32:PLOT 0,23:DRAWTO 39,23
772 PLOT 0,10:DRAWTO 39,10
775 PLOT 0,16:DRAWTO 39,16
776 IF O=10 THEN 790
780 F=0:GOTO 10
790 LV=LV+1:GOTO 2000
1000 Q=SC+604
1005 POKE Q,0:Q=Q-39:POKE Q,10
1010 IF Q-SC<=409 THEN 1030
1020 GOTO 1005
1030 FOR I=1 TO 10:SOUND 0,I,0,10-I:S
     OUND 1,I*10+50,2,8
1040 POKE Q,128:POKE Q+1,128:POKE Q-1
     ,128:POKE Q+40,128:POKE Q-40,128
1050 POKE Q+40,0:POKE Q-40,0:POKE Q,0
     :POKE Q-1,0:POKE Q+1,0
1060 NEXT I:SOUND 1,0,0,0
1080 REM MAN RUNS AWAY
1090 REM
1100 FOR I=A*3+6 TO 35
1110 POSITION I,17:? " {Q}{E}{DOWN}
     {3 LEFT} {A}{C}{DOWN}{3 LEFT} :
     {F}{DOWN}{3 LEFT} {F}{G}"
1115 SOUND 0,100,0,8
1120 FOR W=1 TO 5:NEXT W
1125 SOUND 0,10,0,8
1130 POSITION I,17:? " {Q}{E}{DOWN}
     {3 LEFT} {A}{C}{DOWN}{3 LEFT} :
     {R}{DOWN}{3 LEFT} :{G}"
1140 FOR W=1 TO 5:NEXT W
1145 SOUND 0,0,0,0
1150 NEXT I
1160 A=A-1:GOTO 10
1199 END
1413 NEXT K
2000 PRINT "{CLEAR}{6 DOWN} YOU MADE
     IT THROUGH"
2005 PRINT "{6 SPACES}LEVEL ";LV-1
2010 PRINT "{2 DOWN}  YOU NOW ADVANCE
      TO"
2015 PRINT "{6 SPACES}LEVEL ";LV:O=0:
     FOR T=1 TO 500:NEXT T:GOTO 10
3000 REM
3010 PRINT "{CLEAR}{4 DOWN}SORRY BUT
     YOU LOST ALL";
3020 PRINT "{2 DOWN}{7 SPACES}YOUR ME
     N"
3030 PRINT "{4 DOWN}{4 SPACES}YOUR SC
     ORE WAS"
3040 PRINT "{2 DOWN}{7 SPACES}";SCO ©
```

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There are versions of this exciting adaptation of Tag for the Atari (16K required) and PET/CBM with Upgrade or 4.0 BASIC. Each game involves a special extra feature which makes the action all the more challenging: the pursuer can become the pursued without warning and without tagging the other player!

TAG

Ed Davis
Rumford, ME

When playing real-life tag with only two players, nobody really wins because the number of tags per player remains constant. But in computer Tag, the clock decides who will be the champion. Every 15 seconds, if the person who is *It* cannot tag the other, the computer will reverse the It player. This feature allows a real fight for points. If you are not skilled in attacking, you can become skilled in evasive tactics and win the game.

Before the game starts, the players must input their names. Then, the computer will ask for the "color" of the playing arena. "Color" simply describes which keyboard character will appear as the border of the arena.

Then, you set a point limit by inputting a number from one to infinity. Game length is determined by the amount of time it takes for any one player to amass the predefined number of points.

The computer then draws a large square area the length and width of the screen and fills this area with 180 obstacles that players must dodge in their quest for victory.

The Controls

The PET number pad serves as the control for the right-side player. The "QWE", "ASD", and "ZXC" keys serve as the controls for the left-side player. These are movement controls, and the "5" or the "s" keys will stop the player from going further than he wishes. To quit a game in progress, typing "%" will cease all function, and no points will be given to either player. This feature exists because the computer will sometimes surround a player with obstacles before battle, causing a shutdown of the afflicted player's actions.

Sound Effects

The sound effects in Tag are mostly simple loops. The sound output is for CB2 sound users. If you are not using sound, or just want to make the game movements a little faster by eliminating the sound loops, just remove the sound GOSUBs (lines 10-81) and install RETURNs. There are six different sound effects.

Machine Language

The machine language program built into Tag will work on all 40-column Commodore PETs. Even though the starting address is 826, and starting here on 4.0 ROMs sometimes messes things up, the program always works on the Fat-Forty that I use, and it works on the 4016, 2001, and 8032 models as well. The machine language program simply reverses all the characters on the screen by SYS826. (Typing SYS826 again will restore the screen to normal.)

Program 1: PET Version

```
0 POKE59467,16:POKE59466,15
1 POKE59464,0:POKE59468,12:GOTO100
10 FORT=0TO127STEP5
20 FORX=T*2TOTSTEP-3:POKES1,X:NEXT
21 NEXT
30 POKES1,0:RETURN
32 FORT=255TO100STEP-1:POKES1,T:NEXT
33 POKES1,100:FORX=1TO100:NEXT
34 FORT=100TO255STEP2:POKES1,T
35 POKES2,T:NEXT:POKES1,0:RETURN
50 FORT=255TO0STEP5:POKES1,T:NEXT
55 POKES1,142:FORT=1TO100:POKES2,T:NEXT
56 FORT=1TO18:FORX=3TO30STEP3:POKES1,X
57 NEXT:NEXT:POKES1,0:RETURN
60 POKES1,30:POKES1,0:RETURN:REM AAA
70 POKES1,170:POKES1,0:RETURN:REM ZZZ
75 FORY=1TO13:REM GALAXIAN WIPETHEOUT
80 FORT=200TO100STEP-20:POKES1,T:NEXT
81 NEXT:POKES1,0:RETURN
100 A=32809:Z=33726:AA=81:ZZ=87:TT=900
101 S1=59464:S2=59466
110 DATA39,40,41,-1,0,1,-41,-40,-39
120 FORT=1TO9
130 READX
140 AM(T)=X:ZM(T)=X:NEXT
150 PRINT"{CLEAR}";
160 IFG=1THEN600
200 READAB,BM
201 FORT=ABTOBM:READX:POKET,X:NEXT
210 PRINT"{CLEAR}{10 RIGHT}TAG!"
220 PRINT"{DOWN}RACE FOR POINTS!!"
230 PRINT"{DOWN}ASSUMING YOU KNOW THE ";
231 PRINT"KEYBOARD GAME     CONTROLS..."
250 PRINT
260 PRINT"Q WILL BE NUMBER CONTROL'S MAN"
270 PRINT"W WILL BE LETTER CONTROL'S MAN"
280 PRINT"{DOWN}IF EITHER MAN IS {REV}RVS{OFF}
    'D,HE IS IT!!"
290 PRINT"'IT' TAGS OTHER MAN FOR 1 POINT AND
    WHO IS 'IT' CHANGES.  "
300 PRINT"IN 15 SECONDS DURING GAME, IF NO TAG
    S   ARISE, THEY CHANGE ANYWAY!"
310 PRINT"{DOWN}YOU'LL BOTH GO BACK TO START A
    FTER EACH TAG."
315 PRINT:PRINT"WINNER OF EACH ROUND IS INDICA
    TED "
316 PRINT"BY A {REV}B{OFF} AFTER A WINNING HIT
    !"
320 PRINT"{DOWN}{REV}RETURN{OFF} TO CONTINUE..
    ."
350 GETT$:IFT$=CHR$(13)THEN390
355 PRINT"{HOME}";TAB(21);"{REV}WITH SOUND{OFF
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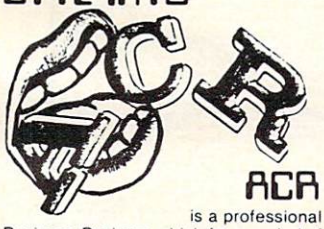

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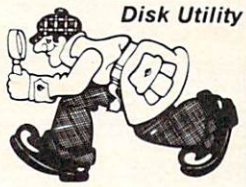

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NEW

BRIDGE MASTER (Available for all computers) Price: $21.95 Diskette
If you liked DYNACOMP'S BRIDGE 2.0, you will absolutely love BRIDGE MASTER. BRIDGE MASTER is a comprehensive bridge program designed to provide hours of challenging competition. Bidding features include the Blackwood convention, Stayman convention, pre-emptive openings, and recognition of demand bids and jump-shift responses. After playing a specific hand, you may replay the same hand, with the option of switching cards with your computer opponents. This feature allows you to compare your bidding and playing skills to BRIDGE MASTER. Bonuses for game contracts and slams are awarded as in duplicate bridge. Doubled contracts are scored based upon a computer assigned vulnerability. A score card is displayed at the conclusion of each hand. The score card displays a summary of total hands played, total points scored, number of contracts made and set, and % bids made. BRIDGE MASTER is clearly the best computer bridge program available.
DYNACOMP'S previous BRIDGE 2.0 customers may upgrade to BRIDGEMASTER for a nominal charge of $5.00 plus postage and handling (see ordering information box). Original cassette/diskette must be returned.

BACCARAT (Atari only) Price: $18.95 Cassette/$22.95 Diskette
This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.

GIN RUMMY (Apple diskette only) Price: $22.95 Diskette
This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

POKER PARTY (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32K (or larger) Apple II.

GO FISH (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GO FISH is a classic children's card game. The opponent is a friendly computer with user inputs that are simple enough for small children to easily master. The Apple and Atari versions employ high resolution graphics for the display of hands. A must for children! Runs in 16K.

NEW

BLACKJACK COACH (32K TRS-80 only) Price: $29.95 Cassette/$33.95 Diskette
BLACKJACK COACH teaches and evaluates professional playing methods. This program will coach you using the Basic and the Complete Card Counting Methods. The BLACKJACK COACH can be used in automatic, unattended play to test the playing and betting strategies you select. Extensive summary reports pinpoint the strengths and weaknesses of various methods of play. All the standard player choices are included: Insurance, splitting pairs, double downs and surrender (optional). A line printer may be used to collect data. If you risk money at the tables, increase your skills with the BLACKJACK COACH!

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Available for all computers) Price: $25.95 Cassette/$29.95 Diskette
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company, which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) Price: $19.95/Cassette/$23.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) Price: $17.95 Cassette/$21.95 Diskette
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique, Personal Computing and Creative Computing.

BACKGAMMON 2.0 (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

NEW

FROG MASTER (Atari only) Price: $17.95 Cassette/$21.95 Diskette
The Atari APEX first prize winner. FROG MASTER contains exciting arcade features in addition to being a highly educational program. It is a fast-moving high-concentration game for 1-4 players. You score by making touchdowns on the opponents' goal line - if his goalie doesn't get there first. But your players (tadpoles and frogs) must be trained. This is accomplished by giving them a reward at just the right moment when they do something right. This takes precise timing and judgement. Your critters must penetrate barriers and avoid evil line backs if they are to score. Many will fall by the wayside, but some will get through. As they learn you can look inside their heads to see how they think. As you reward them, they reward you (the "thought processes" simulated demonstrate the basic type of animal learning - operant conditioning - widely studied in high school and college courses). As you teach them they teach you how learning takes place! Great graphics! Runs in 16K. Requires two joysticks.

FOREST FIRE! (Atari only) Price: $14.95 Cassette/$18.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalities. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

CRANSTON MANOR ADVENTURE (North Star, SuperBrain and CP/M only) Price: $19.95 Diskette
At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette.

SPACE EVACUATION! (Available for all computers) Price: $15.95 Cassette/$19.95 Diskette
Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE.

MONARCH (Atari only) Price: $14.95 Cassette/$18.95 Diskette
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K Atari.

NEW

RUBIK'S CUBE SOLVER (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette/$21.45 Disk
Solving the Rubik's cube puzzle is an exercise in algorithmic logic, and is a "natural" for computer calculation. The RUBIK'S CUBE SOLVER permits you to input the starting state of the 24 facing elements of the cube. It then solves the problem one step at a time, with each step shown as a unfolded view of the cube. Can you solve the cube in fewer steps. In any case, it sure beats disassembling the cube or peeling off and replacing the colors! Requires 16K.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II), NEC and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820, Heath/Zenith and many others). 5¼" CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

*ATARI, PET, CBM, NORTH STAR, CP/M, IBM, OSBORNE, SUPERBRAIN, NEC PC-8000 and XEROX are registered trademarks and/or trademarks.
**Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.
***For most North Star disk-based systems.
****For Altair systems having Microsoft BASIC.
*****For SUBERBRAIN systems running under MBASIC or CBASIC (state which).

DYNACOMP OFFERS THE FOLLOWING

- Widest variety
- Guaranteed quality
- Fastest delivery
- Friendly service
- Free catalog*
- Toll free order phone

*$2.00 U.S. funds for foreign mailing.

AND MORE...

NEW

STARBASE 3.2 (Available for all computers) Price: $13.95 Cassette/$17.95 Diskette
This is the classic space simulation, but with several new features. For example, the Croylins now shoot at the Invincible without warning while also attacking starbases in other quadrants. The Croylins also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Invincible is besieged by three heavy cruisers and a starbase S.O.S. is received! The Croylins get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

LIL' MEN FROM MARS (Atari only) Price: $19.95 Cassette/$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.

ALVIN (Atari only) Price: $17.95 Cassette/$21.95 Diskette
ALVIN is a great arcade game. You are commanding a highly maneuverable ship seeking to destroy several enemy cities. You are attempting to bomb these cities while at the same time trying to avoid their defensive fire (MISSILE COMMAND ' in reverse?). Also, your radar has been damaged so that you can only see downwards. This would normally not be much of a problem except that you also have to contend with high-flying enemy aircraft. As long as you are above these aircraft you have the advantage and are safe. However, high level bombing takes considerable skill. Therefore to achieve your goal the best strategy is to swoop down for a bombing run while the enemy craft is out of range, and quickly retreat to the skies. A fun game. Requires 16K.

ESCAPE FROM VOLANTIUM (Atari only) Price: $15.95 Cassette/$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! To escape you must maneuver your space ship around obstacles and laser blast the guardian (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by repeatedly chopping away at it. Other times it is impervious. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) Price: $13.95 Cassette/$17.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) Price: $14.95 Cassette/$18.95 Diskette
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) Price: $15.95 Cassette/$19.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

MIDWAY (Atari 32K only) Price: $14.95 Cassette/$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.

NEW

GOLF PRO (Atari only) Price: $17.95 Cassette/$21.95 Diskette
Both realism and beautiful graphics are joined together in GOLF PRO to produce the best golf simulation available. To really appreciate this game, you should have a color TV so that you can see the green of the fairway, the blue of the water hazards, and the white sand of the traps. You tee off with a wood, use your wedge in the sand trap, and putt on the green just as would be done on the course. Show off the Atari to your friends with GOLF PRO. Requires 16K and one joystick.

GAMES PACK I (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.
Why pay $9.95 or more per program when you can buy a DYNACOMP collection for just $14.95?

MOON PROBE (Available for all computers) Price: $12.95 Cassette/$16.95 Diskette
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) Price: $14.95 Cassette/$18.95 Diskette
This galactic "shoot 'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

SUPER SUB CHASE (Atari only) Price: $19.95 Cassette/$23.95 Diskette
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

TWO PLAYER GAMES

NEW

TWO PLAYER GAMES (Available for all computers; 32K disk/diskette only)
DYNACOMP has acquired the distribution rights to the best eight of Xitron's war games. These two-player games were originally written for the North Star computer, but have since been converted to play on all of the computers currently supported by DYNACOMP. Because our licensing and development costs were so low, DYNACOMP offers these programs two to a disk(ette) for only $19.95/diskette, $23.95/disk. If you like war games, then this is a bargain you can not pass up.

Set #1: PANZER and BLITZKRIEG
PANZER
Date: 23 Nov. 1943 Place: Several miles west of Kiev, Russia. The Russians have just liberated Kiev and are moving quickly to reach the German forces which are preparing for a last desperate attempt to halt the Russian advance.
BLITZKRIEG
Date: Spring 1940 Place: Northern France. The German blitzkrieg in the east was complete. Germany had turned its attention to the west: France. The German forces has penetrated the Ardennes and Meuse. The heroism of Dunkirk, the defense of the Aisne-Somme position, and the final collapse of the French armies in the south has all passed. And, now, the drive on Paris . . .

Set #2: STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE
STARSHIP TROOPERS
Date: Fortieth Century. Place: Arachnid planet of Sheol. The first all-out battle on the planet Sheol which will match equal forces of Terran and alien units. The outcome will set the course of the conflict, for the planet of Sheol is a key position in the solar war.
INVASION OF THE MUD PEOPLE
A Peruvian army battalion has been dispatched to a remote village area to investigate the destruction of many local dwellings and the disappearance of most of the villagers. Eye-witnesses have reported strange creatures appearing from scores of slimy mud holes which have oddly begun forming across the terrain.

Set #3: FALL OF THE THIRD REICH and ARMORCAR
FALL OF THE THIRD REICH
Date: March, 1945. Place: Remagen, Germany. The allies under General Eisenhower had reached the Rhine. The Germans had failed in destroying the Ludendorff railroad bridge, allowing several allied divisions to cross before it finally collapsed on March 17 .... and so, the allies began their drive on Berlin.
ARMORCAR
Date: 2 Feb. 1944 Place: Minsk, Russia. A German front-line unit is hard pressed for radio equipment and medical supplies. A relief convoy of armored cars must reach them through partisan-infested territory.

Set #4: MOUNT SURIBACHI and MIDDLE EARTH
MOUNT SURIBACHI
Date: 16 Feb. 1945 Place: Iwo Jima. The Japanese opened fire from Mount Suribachi as the marines landed on the porkchop-shaped island. Gunfire from the hill could cover the entire island, thus it was a critical objective if the Americans were to capture and utilize the all-important air field. Mount Suribachi proved to be one of the most strongly defended positions in the Japanese theatre of war.
MIDDLE EARTH
Date: 1997 Place: MIDDLE EARTH. Through a maze of tunnels, crevices, and rocky passageways discovered leading from an inactive volcano in South America, a team of United Nations' researchers have undertaken a mission to an uncharted frontier: the center of the Earth. After a perilous journey spanning a period of several months, the mission has arrived at the Earth's core, a land of flames, steam, oceans, and unforeseen vegetation. And then the creatures of MIDDLE EARTH appeared . . . unmatched by the most frightening horror stories created by man . . .

MISCELLANEOUS

CRYSTALS (Atari only) Price: $14.95 Cassette/$18.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.
Price: $9.95 each/$8.95 each (4 or more)
The complete collection may be purchased for $159.95.

NEW

5¼" DISKETTES (soft sectored/ten sectored) Price: $39.95/20 Diskettes
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

BUSINESS and UTILITIES

NEW

PORTFOLIO MANAGEMENT (Apple only) Price: $69.95 two Diskettes

The PORTFOLIO MANAGEMENT package was written by a stock broker to help manage portfolios for individual customers. With this program data files can be easily created and kept up to date. A variety of reports can be generated for clients which are attractively and professionally laid out. The user may define his/her own investment catagories. PORTFOLIO MANAGEMENT is a top quality, professional tool which will not only provide you with new conveniences but will also serve to enhance your appearance as an efficient and up to date advisor to your clients. Comes complete on two diskettes along with a 30 page instruction manual.

NEW

PERSONAL FINANCE SYSTEM (Available for all computers) Price: $39.95 Diskette

PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort. PFS has been demonstrated on network (CBS) TV!

NEW

FAMILY BUDGET (Apple and Atari only) Price: $34.95 Diskette

FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

NEW

TEXT MASTER (Apple 32K, diskette only) Price: $49.95 Diskette

TEXT MASTER is a general purpose text editor for the Apple II computer. It features powerful, English-oriented commands which permit the complete manipulation of textural information. The information treated may be correspondence, computer programs, data to be used by other programs, and more. TEXT MASTER also interfaces with any printer connected to your Apple. The minimum system requirements are 32K of RAM, Applesoft on ROM, at least one disk, and a lower case adapter. TEXT MASTER can process any length file segment by segment. Thus it is possible to process files as large as a diskette. Comes complete with an efficient 16 page manual. TEXT MASTER is equivalent in capability to many word processing systems costing 3 x or more in price. The commands available in TEXT MASTER are: COLLECT, USE, EXECUTE, NONUM, INSERT, MERGE, STOP, RENUM, DELETE, SAVE, COPY, FREE, REPLACE, WAIT, MOVE, LENGTH, LIST, RESAVE, CLEAR, AUTO, RETRY, APPEND, SET, MANUAL, CHANGE, SCRATCH, SHOW, CATALOG, MODIFY, COMPARE, NUM, DISPLAY, HELP.

INTELINK (Atari only) Price: $49.95 Diskette

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a very smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

NEW

PAYFIVE (Apple II plus diskette, two drives required) Price: $149.95

This is an enormously flexible employee payroll system with extraordinarily good human engineering features. PAYFIVE prints checks and compiles the required federal, state and local forms for up to 148 employees. The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and they also can be used in any combination. PAYFIVE includes many other features and comes extremely well documented with a 200 page manual. The manual may be purchased separately for $30, and that payment later applied to the software purchase.

SHOPPING LIST (Atari only) Price: $12.95 Cassette/$16.95 Diskette

SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

NEW

TAX OPTIMIZER (Available for all computers) Price: $59.95 Diskette

The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

STOCK MASTER/STOCK PLOT (Apple 48K) Price: $59.95 Diskette

This is a full-featured stock portfolio management and analysis system. Ten years of records on up to thirty stocks may be maintained. You may record prices, revenue, earnings/share, ROE, quarterly earnings and dividends, transactions, long/short term gains, P.E. indexes (DJ, S & P, NASDAQ) and MORE! You may plot (HIRES) the price history of any stock against any other, time, or the indexes. Portfolio value may be evaluated at any time. Comes complete with superbly written instructions and sample files on a second diskette.

TURNKEY AND MENU (Atari only) Price: $17.95 Diskette

TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) Price: $29.95 Diskette

STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days x 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

NEW

NYINDEX (Atari only) Price: $29.95 Diskette

NYINDEX is a comprehensive software package for storing, retrieving and plotting New York Stock Exchange information. The daily data treated includes the composite index, advances, declines, new highs and new lows. Graphical displays include the above plus the index oscillator, cumulative advances/declines and moving averages. Data entry and editing is easy. The diskette includes more than two years of daily data. NYINDEX is an excellent companion to STOCKAID.

PLAYER-MISSILE GRAPHICS TABLET (Atari only) Price: $19.95 Diskette

The PLAYER-MISSILE GRAPHICS TABLET was designed to take the drudgery out of developing four color displays in GRAPHICS MODE 7. No longer will you have to read the locations of those tiny blocks on your graph paper and calculate PLOTs and DRAWTOs. With PMG you will be able to easily design colorful graphic displays with your joystick and save them on diskette for later recall.

LIFE CYCLE ANALYSIS AND DEPRECIATION (Apple diskette only) Price: $39.95 Diskette

This software package creates a data file of business expenses for equipment which can later be used to calculate and display a variety of reports. You may project annual costs, find the present worth, create depreciation schedules and justify tax deductions. The evaluation techniques conform to standards set by federal agencies. This is an invaluable package for any businessman who has invested in equipment. LIFE CYCLE ANALYSIS features an easy to use data file creation section and provides formatted hardcopy reports for use in presentations or for tax record keeping purposes. When used for generating tax information, this package is tax deductible! Requires 48K. Comes on two diskettes.

NEW

MICROMAGIC (Apple diskette only) Price: $39.95 Diskette

The emphasis of this program is clearly the MAGIC! MICROMAGIC offers outstanding versatility in its ability to function as a stand alone entertainment package or as a utility program to create stunning *animated* graphics for use in other programs. The secret lies in MICROMAGIC's special on screen graphics editor. You control a graphics cursor directly from the keyboard, creating high resolution images using all 16 available colors. When you are done with a picture, it can be saved on disk with a single key command. Up to 24 images can be saved as "frames" of a movie, and then played back at high speed to creat short animated sequences. The effects are truly stunning.

This package comes complete with demonstration programs so that even novice users can get immediate results. No programming skills are necessary to use MICROMAGIC. If you have been frustrated by the effort required to create graphics images with your computer, MICROMAGIC will delight you.

SHAPE MAGICIAN (Apple II, 48K, diskette only) Price: $29.95

At last! An utility for painlessly creating graphics shapes for the Apple. Create, edit and save up to 30 shapes which can then be used to develop arcade games or to simply enhance your programs. Add that professional touch!

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card. Purchase orders accepted.

Shipping and Handling Charges
Within North America: Add $2.00
Outside North America: Add 15% (Air Mail)

Delivery
All orders (excluding books) are sent First Class.

Quantity Discounts
Deduct 10% when ordering 3 or more programs; 20% when ordering 5 or more. Dealer discount schedules available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star, Osborne, Superbrain and NEC format.

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This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

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HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage; retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $51.95 (three cassettes) and $63.95 (three diskettes).

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NEW

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FILTER ANALYSIS is the ideal program for determining the frequency response of passive filters. Any number of RLC components may be included, and any number of poles treated. FILTER ANALYSIS features its own mini-language which makes circuit description simple. Results may be printed in tabular form or plotted in HIRES graphics (decibels versus log-frequency).

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NEW

BEAM DEFLECTION (Available for all computers) (disk/diskette only) Price: $29.95 Diskette $32.45 Disk

BEAM DEFLECTION is the first in DYNACOMP's new series of structural analysis software packages. It consists of two programs. The first program permits the development of data files which describe the problem. For example, the ends of the beam may be pinned, clamped or free. The beam may be uniformly supported by an elastic bed, or held up by springs variously located and having differing spring constants. The elasticity and cross section of the beam may vary along its length. The load may be uniformly distributed or it may include discrete forces. The beam may be joined at various points along its length. And so on. All this information may be easily entered and edited using the data input program.

Following this the analysis program is called. The calculated results are the stress and deflections of the beam, both in numerical and graphical form, since the input data is saved, cases may be easily re-run with modification, thereby permitting iterative design.

The documentation which comes with BEAM DEFLECTION clearly shows how to use the software. In addition, three text problems are described and demonstrated to ensure that you understand how to use the program. Also, helpful theoretical information is supplied in the appendix.

STATTEST (Not available on Atari cassette or for PET/CBM) Price: $19.95 Cassette $23.95 Diskette

This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

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```
    OFF}":FORT=1TO200:NEXT:GOSUB60
356 PRINT"{HOME}";TAB(21);"WITH SOUND":FORT=1T
    O200:NEXT:GOSUB70:GOTO350
390 SYS(826):GOSUB10:SYS(826)
500 GETT$:IFT$<>""THEN500
600 INPUT"{CLEAR}PLAYER WITH LETTER CONTROLS  ~
      LETTER{10 LEFT}  ";LL$
601 INPUT"{CLEAR}PLAYER WITH NUMBER CONTROLS  ~
      NUMBER{10 LEFT}  ";NU$
602 PRINT"{CLEAR}"
1000 PRINT"{CLEAR}NOW, PUSH A KEY FOR THE PLAYI
    NG
1010 PRINT"FIELD. THE KEY YOU PUSH WILL BE
1020 PRINT"THE OUTLINE OF THE FIELD. YOU MAY US
    E   THE {REV}RVS{OFF} KEY."
1030 GETT$:IFT$=""THEN1030
1040 IFT$=CHR$(13)THEN1030
1050 IFT$="{REV}"THENKK=128:GOTO1030
1060 IFT$="{OFF}"THENKK=0:GOTO1030
1070 PRINT"{HOME}";T$:FF=PEEK(32768)+KK
1071 GOSUB55
1072 IFFF=32THENFF=96
1100 X=INT(RND(1)*2)+1:IFX<2THENAA=AA+128:GOTO1
    300
1200 ZZ=ZZ+128
1300 PRINT"{CLEAR}SET POINT LIMIT 1-THRU:  5{03
    LEFT}";:INPUTPL:IFPL<1THEN1300
1400 GOSUB32:M=32768
1410 FORT=1TO39:POKEM,FF:M=M+1:NEXT:GOSUB60:FOR
    T=1TO24:POKEM,FF:M=M+40:NEXT
1420 FORT=1TO39:POKEM,FF:M=M-1:NEXT:GOSUB60:FOR
    T=1TO24:POKEM,FF:M=M-40:NEXT
1430 C=0:FORT=1TO180
1440 M=INT(RND(1)*1000)+1
1450 IFPEEK(32767+M)<>32THENGOSUB60:GOTO1440
1460 GOSUB70:POKE32767+M,FF:NEXT
1500 TI$="000000":POKEA,32:POKEZ,32
2000 GETT$:IFT$<>""THEN4000
2010 L=PEEK(A+B):IFL=FFTHEN2050
2020 IFL=ZZTHEN5000
2030 GOSUB60:POKEA,32:A=A+B:POKEA,AA
2050 Y=PEEK(Z+W):IFY=FFTHEN2000
2060 IFY=AATHEN5000
2070 GOSUB70:POKEZ,32:Z=Z+W:POKEZ,ZZ
2080 IFTI>TTTHENTI$="000000":SYS(826):GOSUB55:S
    YS(826):GOTO3000
2090 GOTO2000
3000 IFAA>128THENAA=AA-128:ZZ=ZZ+128:GOTO2050
3010 ZZ=ZZ-128:AA=AA+128:GOTO2010
4000 IFVAL(T$)THENV=VAL(T$):W=ZM(V):GOTO2050
4005 IFT$="%"THENPRINT"{CLEAR}":GOTO8000
4010 IFT$="Z"THENC=1
4020 IFT$="X"THENC=2
4030 IFT$="C"THENC=3
4040 IFT$="A"THENC=4
4050 IFT$="S"THENC=5
4060 IFT$="D"THENC=6
4070 IFT$="Q"THENC=7
4080 IFT$="W"THENC=8
4090 IFT$="E"THENC=9
4100 B=AM(C):GOTO2010
5000 SYS(826):GOSUB10
5100 IFAA>128THENPA=PA+1:GOTO5200
5150 PZ=PZ+1:GOTO5210
5200 IFPA=PLTHENGOSUB20001:GOTO6010
5210 IFPZ=PLTHENGOSUB20010:GOTO6020
5300 SYS(826):POKEA,32:POKEZ,32:A=32809:Z=33726

5310 B=0:W=0:TI$="000000":SYS(826):SYS(826)
5320 IFAA>128THENAA=AA-128:ZZ=ZZ+128:GOTO2000
5330 AA=AA+128:ZZ=ZZ-128:GOTO2000
6010 GOSUB50:GOSUB32:GOSUB75:GOSUB10:PRINT"{CLE
    CLEAR}"LL$;"  WON!!! BY ";PA-PZ;
6011 IFPA-PZ<>1THENPRINT"POINTS!!":GOTO6033
6012 PRINT"POINT!!!":GOTO6033
6020 GOSUB75:GOSUB50:GOSUB32:GOSUB10:PRINT"{CLE
    CLEAR}";NU$;" WON!!! BY ";PZ-PA;
6021 IFPZ-PA<>1THENPRINT"POINTS!!":GOTO6033
6022 PRINT" POINT!!!"
6033 GETT$:IFT$<>""THEN6033
8000 PRINT:PRINT:PRINT:PRINT"PLAY AGAIN  Y OR N
    ?";
8010 GETT$:IFT$="Y"THENSYS(826):PRINT"{CLEAR}":
    GOSUB10:CLR:G=1:GOTO0
8011 PRINT"{REV} {OFF}{LEFT}";:FORN=1TO50:NEXT:
    IFT$=""THENGOSUB20000:GOTO8010
8012 PRINT"{CLEAR}"
8020 A$="{REV}THANKS{OFF} FOR {REV}PLAYING{OFF}
    "
8022 O=LEN(A$):PRINT"{05 DOWN}{11 RIGHT}";
8033 FORZ=1TOO:FORY=1TOINT(RND(1)*30)+70:NEXT
8040 PRINTMID$(A$,Z,1);:GOSUB70:NEXT
9000 POKE59468,14
9010 PRINT"{HOME}{07 DOWN}{18 RIGHT}TAG":SYS(82
    6)
9020 GOSUB32:GOSUB50
9050 DATA826,849,162,128,160,0,132,33,134,34,17
    7,33,73,128,145,33
9051 DATA200,208,247,232,224,132,208,240,96,0
10000 POKE59467,0:POKE59466,255:POKE59464,60:POK
    E59468,12:SYS(826)
10001 END
20000 PRINT"Q{LEFT}";:FORN=1TO50:NEXT:RETURN
20001 FORT=100TO130:POKEA,T
20002 POKE59468,14:POKE59468,12:NEXT
20003 RETURN
20010 FORT=100TO130:POKEZ,T
20011 POKE59468,14:POKE59468,12:NEXT
20012 RETURN
```

Program 2: Atari Version

```
100 REM ■TAG■=■ATARI■VERSION
110 GOSUB 1170:REM INITIALIZE
120 PLR=1-PLR:IF PEEK(53279)=6 THEN R
    UN :REM ALLOW RESTART
130 IF PEEK(20)+256*PEEK(19)>900 THEN
     IT=1-IT:POKE 20,0:POKE 19,0:FOR
    W=15 TO 0 STEP -0.1:SOUND 0,10,12
    ,W:NEXT W
140 BLINK=BLINK-(BLINK>0):GOSUB 530
150 S=STICK(PLR):T=STRIG(PLR):POKE PO
    KEHERE+1,VV+IT
160 IF S=15 AND T=1 THEN S=S(PLR)
170 S(PLR)=S
180 SOUND PLR,S*5+100,10,4
190 TEST=POS(PLR)
200 TEST=TEST-20*(S=10 OR S=14 OR S=6
    )+20*(S=5 OR S=9 OR S=13)-(S>8 AN
    D S<12)+(S>4 AND S<8)
210 IF TEST<SCR+20 OR TEST>SCR+439 TH
    EN SOUND PLR,0,0,0:GOTO 120
220 CHR=(S>4 AND S<8)+3*(S>8 AND S<12
    )+2*(S=14 OR S=13)
230 SOUND PLR,0,0,0
240 P=PEEK(TEST):IF P=0 THEN POKE POS
    (PLR),0:POKE TEST,CHR+PLR*64:POS(
    PLR)=TEST:GOTO 120
250 Z=P-(PLR=0)*64:IF Z<1 OR Z>3 THEN
     280
260 IF PLR=IT THEN 310:REM GOTCHA
270 PLR=1-PLR:GOTO 310:REM WHOOPS!
280 IF P=196 THEN PLR=1-PLR:GOTO 310:
    REM "MONSTER" GOT PLAYER
290 GOTO 120
300 REM PLAYER CAUGHT ROUTINE
310 RESTORE 340:SOUND 3,0,0,0
320 POSITION 0,1:? #6;"  PLAYER ";(1-
    PLR)+1;" TAGGED! "
330 POKE POS(0),0:POKE POS(1),0
340 DATA 100,1,100,1,115,1,90,1,100,2
    ,120,3
```

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Atari Notes For Tag

Charles Brannon
Editorial Assistant

Plug a joystick into jacks one and two, and get ready for some furious chasing and desperate dodging. After the game initializes, each player can type in his initials (three letters). You then select the final score (what you play to) from 1-10. Press OPTION to increase the final score, and SELECT when the desired number appears. The game will begin with player one in the upper left-hand corner, and player two in the opposite corner. Player one will be flashing, which indicates that he is *It*.

Whoever is It has to chase down and catch the other player in order to claim a point. If It fails to score within 15 seconds, the players "switch roles," and player two is It and has his chance to catch player one. The "switcheroo" is signaled by a loud bell, so when you hear it, change direction fast!

Play consists of It trying to catch the "victim" as fast as possible, while the "victim" tries to evade It for at least 15 seconds. Both players must maneuver about the screen, turning and twisting among a maze of pink rocks. But if you dally too long, the rocks will wake up, open their eyes, and further confound the conflict. Don't let one of the Living Rocks touch you.

Tag With A Twist

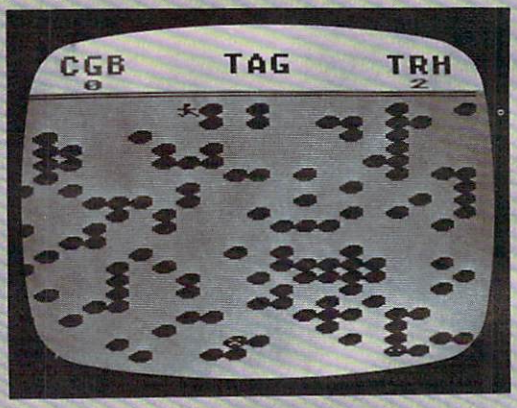
Tag for the Atari uses character graphics in graphics mode one, but with a twist. Usually, if you want a redefined character set along with letters and numbers, you are limited to redefining punctuation and other special symbols and have to wait 10 to 15 seconds for a POKE loop that downloads the ROM character set to RAM.

Tag, however, uses a Display List Interrupt (DLI) to "flip" the character set midway down the screen. This lets you use the upper portion of the display for normal text (using the entire character set), and the lower portion for as few or as many custom characters as desired. The DLI used in Tag also changes the screen colors, so you get five colors in each portion, for a total of ten simultaneous colors.

Flipping Out

Another interrupt-driven machine language routine in Tag uses Count-Down Timer #2 to "flip" the character set pointer every 16/60ths of a second. In Tag, there are two character sets. The first character set, for example, displays one view of a running person. The other character set, at an offset of 512 bytes, displays another view.

When the CHBASE pointer is switched between the two views, the character appears to be running. Character set flipping can also be used to represent blinking, flashing, spinning, bouncing, or any other simple motion. And, since the flipping is controlled by machine language, the motion is fast and regular. It also simplifies the BASIC program.



Tag – Atari version

```
350 FOR I=1 TO 6:READ A,B
360 FOR W=15 TO 0 STEP -0.5/B:SOUND 0
    ,A,10,W:NEXT W
370 SOUND 0,0,0,0:NEXT I
380 COLOR 32:PLOT 0,1:DRAWTO 19,1
390 SCR(PLR)=SCR(PLR)+1
400 POSITION 3,1:? #6;SCR(0):POSITION
     17,1:? #6;SCR(1)
410 IF MONSTERS THEN FOR I=1 TO MONST
    ERS:POKE MPOS(I),5+128:NEXT I
420 IF SCR(PLR)<ESCORE THEN IT=1-IT:G
    OSUB 1510:GOTO 120
430 REM GAME OVER
440 FOR I=255 TO 0 STEP -5:POKE COLTA
    B+4,PEEK(53770):SOUND 0,I,12,4:SO
    UND 1,I,10,4:NEXT I:SOUND 0,0,0,0
450 POSITION 0,1:? #6;"{3 SPACES}PLAY
    ER ";PLR+1;" WINS!{3 SPACES}"
460 FOR I=1 TO 5:FOR W=0 TO 15:SOUND
    0,10,0,W:NEXT W:FOR W=0 TO 15:SOU
    ND 0,12,0,15-W:NEXT W:NEXT I
470 POKE COLTAB+4,28:S=0:GOTO 490
480 IF PEEK(20)<25 THEN 510
490 POKE 20,0:POSITION 7,0:S=1-S:IF S
     THEN ? #6;"PRESS":GOTO 510
500 ? #6;"START":POKE 53279,0
```

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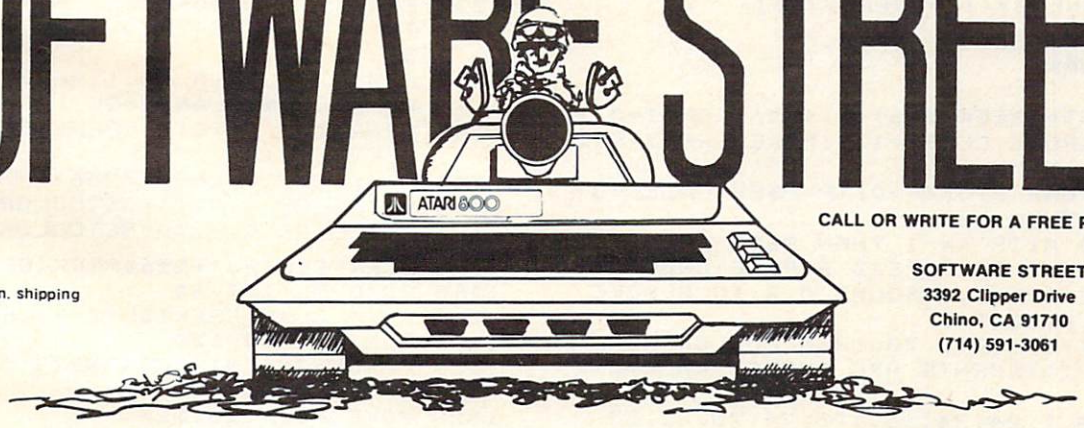

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```
510 IF PEEK(53279)<>6 THEN 480
520 RUN
530 REM ...AND THE MONSTERS COME OUT
    TO PLAY
540 DURATION=DURATION-1:IF DURATION T
    HEN 590:REM MAKE IT RARE
550 MONSTERS=MONSTERS+1:IF MONSTERS>8
     THEN MONSTERS=8:GOTO 590
560 MPOS=SCR+20+INT(420*RND(0)):IF PE
    EK(MPOS)<>5+128 THEN 560
570 MPOS(MONSTERS)=MPOS:MCUR(MONSTERS
    )=DIR(INT(8*RND(0))):MNERGY(MONST
    ERS)=20-MONSTERS
580 BLINK=10:POKE MPOS,6+128:DURATION
    =45:RETURN
590 IF MONSTERS=0 OR BLINK THEN RETUR
    N
600 INDEX=INDEX+1:IF INDEX>MONSTERS T
    HEN INDEX=1
610 SOUND 3,INDEX*10+20,0,15
620 MPOS=MPOS(INDEX)+MCUR(INDEX):IF M
    POS<SCR+20 OR MPOS>SCR+419 THEN 6
    50
630 P=PEEK(MPOS):IF P=0 THEN POKE MPO
    S(INDEX),0:POKE MPOS,196:MPOS(IND
    EX)=MPOS:GOTO 670
640 IF P<4 OR P>64 AND P<68 THEN PLR=
    1-(P>64):GOTO 310:REM MONSTER BUM
    P PLAYER
650 MCUR(INDEX)=DIR(INT(8*RND(0)))
660 MNERGY(INDEX)=MNERGY(INDEX)-1
670 IF MNERGY(INDEX)>0 THEN SOUND 3,0
    ,0,0:RETURN
680 REM TURN TO STONE
690 FOR I=1 TO 10:SOUND 3,I*2+50,0,8:
    NEXT I:SOUND 3,0,0,0
700 MONSTERS=MONSTERS-1:POKE MPOS(IND
    EX),5+128:INDEX=INDEX-1
710 FOR I=INDEX+1 TO MONSTERS
720 MPOS(I)=MPOS(I+1):MCUR(I)=MCUR(I+
    1):MNERGY(I)=MNERGY(I+1)
730 NEXT I:SOUND 3,0,0,0
740 RETURN
750 END
760 CHSET=(PEEK(106)-8)*256:FOR I=0 T
    O 7:POKE CHSET+I,0:POKE CHSET+512
    +I,0:NEXT I
770 RESTORE 810:TP=0:IF PEEK(CHSET+8)
    =24 THEN 960
780 READ A:IF A=-1 THEN 960
790 FOR J=0 TO 7:READ B:POKE CHSET+TP
    *512+A*8+J,B:SOUND 0,B,10,8:POKE
    712,B:NEXT J
800 TP=1-TP:GOTO 780:REM FOLLOWING DA
    TA STATEMENTS ARE CUSTOM CHARACTE
    RS
810 DATA 1,24,24,16,126,24,28,82,33
820 DATA 1,24,24,18,124,16,24,36,72
830 DATA 2,28,28,72,62,9,28,22,48
840 DATA 2,28,28,9,62,72,28,52,6
850 DATA 3,24,24,8,126,24,56,74,132
860 DATA 3,24,24,72,62,8,24,36,18
870 DATA 4,30,63,91,255,231,219,126,6
    0
880 DATA 4,30,63,91,255,231,195,126,6
    0
890 DATA 5,30,63,127,255,255,255,126,
    60
900 DATA 5,30,63,127,255,255,255,126,
    60
910 DATA 6,30,63,127,219,255,255,126,
    60
920 DATA 6,30,63,127,255,255,255,126,
    60
930 DATA 7,0,255,0,255,0,0,0,0
940 DATA 7,0,255,0,255,0,0,0,0
950 DATA -1
960 IF PEEK(1600)=173 THEN 980
970 FOR I=1536 TO 1629:READ A:POKE I,
    A:POKE 712,A:SOUND 0,A,10,8:NEXT
    I
980 SOUND 0,0,0,0:LET POKEHERE=1605:V
    V=22:COLTAB=1624
990 RETURN
1000 REM FOLLOWING IS MACHINE LANGUAG
     E CODE.  TYPE CAREFULLY.
1010 DATA 104,104,104,133,203,169
1020 DATA 36,141,0,2,169,6
1030 DATA 141,1,2,169,192,141
1040 DATA 14,212,169,76,141,40
1050 DATA 2,169,6,141,41,2
1060 DATA 169,16,141,26,2,96
1070 DATA 72,138,72,166,203,173
1080 DATA 92,6,141,10,212,141
1090 DATA 26,208,142,9,212,1
1100 DATA 4,189,87,6,157,21
1110 DATA 208,202,208,247,173,10
1120 DATA 210,9,6,141,22,208
1130 DATA 104,170,104,64,165,203
1140 DATA 73,2,133,203,169,16
1150 DATA 141,26,2,96,102,118
1160 DATA 72,216,28,0,0,0
1170 REM ■INITIALIZATION■CODE■
1180 OPEN #1,4,0,"K:"
1190 GRAPHICS 2+16:POKE 538,0:POKE 54
     286,64
1200 POSITION 2,2:? #6;"THE":POSITION
      4,4:? #6;"GAME":POSITION 6,6:?
     #6;"OF":POSITION 7,8:? #6;"t a g
     "
1210 FOR I=0 TO 3:SETCOLOR I,I,14-I*2
     :NEXT I
1220 FOR I=1 TO 50:POKE 53274,PEEK(53
     770):POKE 53279,0:POKE 712,PEEK(
     53770):NEXT I
1230 GOSUB 760:REM INITIALIZE CHSET A
     ND MACHINE LANGUAGE
1240 GRAPHICS 1+16:DL=PEEK(560)+256*P
     EEK(561)+4
1250 A=USR(1536,CHSET/256)
1260 SETCOLOR 4,0,14:SETCOLOR 3,15,8:
     SETCOLOR 0,2,10:SETCOLOR 2,9,6
1270 SCR=PEEK(DL)+256*PEEK(DL+1)+40
1280 POKE DL-1,7+64
1290 POKE DL+2,PEEK(DL+2)+128
1300 FOR I=1 TO 120
1310 P=SCR+30+INT(388*RND(0)):IF PEEK
     (P) THEN 1310
1320 POKE P,5+128:NEXT I
1330 FOR PLR=0 TO 1
1340 POSITION 6,0:? #6;"PLAYER ";PLR+
     1
1350 POSITION 1,1:? #6;"ENTER■YOUR■IN
     ITIALS":FOR I=1 TO 3
1360 GET #1,A:IF A<32 OR A>90 THEN 13
     60
1370 COLOR A+32*(A>64)+PLR*128:PLOT P
     LR*14+1+I,0:NEXT I
1380 COLOR 32:PLOT 5,0:DRAWTO 15,0:PL
     OT 0,1:DRAWTO 19,1:NEXT PLR:COLO
     R 48:PLOT 3,1:PLOT 17,1
1390 POSITION 7,0:? #6;"PRESS■TO":ESCO
     RE=5
1400 IF PEEK(53279)=5 THEN 1460
```

```
1410 POSITION 8,1:? #6;"■ ";ESCORE;"
     ";
1420 IF PEEK(53279)<>3 THEN 1400
1430 IF PEEK(53279)=3 THEN 1430
1440 ESCORE=ESCORE+1:IF ESCORE>10 THE
     N ESCORE=1
1450 GOTO 1400
1460 COLOR 32:PLOT 5,0:DRAWTO 15,0:PL
     OT 5,1:DRAWTO 15,1
1470 POSITION 9,0:? #6;"■■■":IT=0:PLR
     =IT
1480 POSITION 0,2:? #6;"{20 ■}"
1490 DIM POS(1),S(1),SCR(1),MPOS(8),D
     IR(7),MCUR(8),MNERGY(8):SCR(0)=0
     :SCR(1)=0
1500 DIR(0)=20:DIR(1)=20:DIR(2)=19:DI
     R(3)=-19:DIR(4)=21:DIR(5)=-21:DI
     R(6)=1:DIR(7)=-1
1510 POKE 20,0:POKE 19,0:MONSTERS=0:D
     URATION=70
1520 POS(0)=SCR+20:POS(1)=SCR+419:S(0
     )=7:S(1)=11:Z=0
1530 RETURN                          ©
```

Defend your energy pods against the fifteen amok robots. For Atari and PET/CBM.

Laser Barrage

Sean Igo
Ogden, Utah

Here is a one-player game for 40-column PETs. It is packed with action and fun. [To run it on the 80-column machines, use the program on pg. 130 of **COMPUTE!** #12 — Ed.]

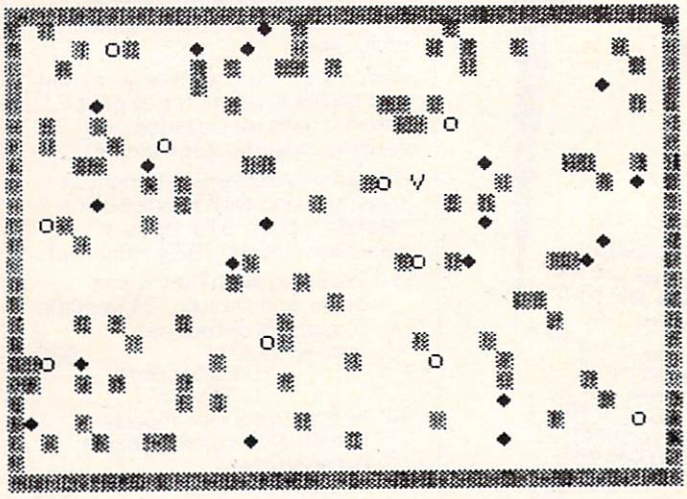
The Idea

In this game, 15 enemy robots are after some fuel pods of yours. You must defend the ten pods. The robots must touch a pod to eat it, but you may zap robots with a laser.

All the robots pick a pod to pursue. They will flatten anything in their way (except each other) to get it. This includes the barriers that are scattered about (which you will bounce off).

When a robot destroys a pod, whether or not it was his objective pod, he will pick a new one to go after.

Figure 1



A sample playfield. Robots are Diamonds, Barriers are Grids, Fuel Pods are Circles, and the Player is the V.

Laser Barrage has eight main routines, and all are noted in the program by a REM statement.

Set Up Playfield – draws playfield, initializes variables, places pods, robots, barriers, and player, defines functions.

Move Player – increments the position of the player and scans the upcoming space in the event that the player is moving.

Fire Player – shoots the player's laser. The laser spans five spaces and will destroy pods as well as robots. Watch where you shoot! The ray will not destroy barriers.

Move Robots – moves one robot one space toward its target pod. The player and robots alternate moving, so the game goes a lot faster than if the player waited for all the robots to move.

Rotate Player – rotates player clockwise, counterclockwise, or 180°.

You Win You Lose – deliver a message of appropriate nature.

Instructions – instructions preceded by a small graphic laser effect.

Tips For Playing

When the game starts, it is OK to patrol around and blast robots at your leisure. But when the game winds down to the last few robots or pods, it is wise to guard a single pod or a small group of them and attack robots approaching. If you can keep your laser between them and their target pods, you will do better. Even if you save only one pod from destruction, that is better than losing.

When patrolling around, you must remember these guidelines. When in doubt, STOP. Don't run into a robot because that causes instant destruction. Running into pods is alright because that only stops you. Barriers are treacherous, for you will bounce off them, possibly into a robot.

```
10 REM *** LASER BARRAGE ***
20 REM
30 REM      BY SEAN IGO
40 REM
50 POKE 59468,12
60 PRINT"{CLEAR}NEED INSTRUCTIONS ~
    (Y/N)  ";CHR$(160);"{03 LE
    LEFT}";:INPUT A$
70 IF LEFT$(A$,1)="Y" THEN 1110
80 IF LEFT$(A$,1)<>"N" THEN 60
90 REM ---SET UP PLAYFIELD---
100 PRINT"{CLEAR}":RN=0
110 DIM P(10),P1(10),R(15),R1(15),D
    I(8),DX(8),LB(8),DP(15)
120 DEF FNY(X)=INT((X-32768)/40):DE
    F FNX(X)=40*((X-32768)/40-
    INT((X-32768)/40))
130 DI(1)=-39:DI(2)=1:DI(3)=41:DI(4
    )=40:DI(5)=39:DI(6)=-1:DI(
    7)=-41:DI(8)=-40
140 DX(1)=80:DX(2)=62:DX(3)=122:DX(
```

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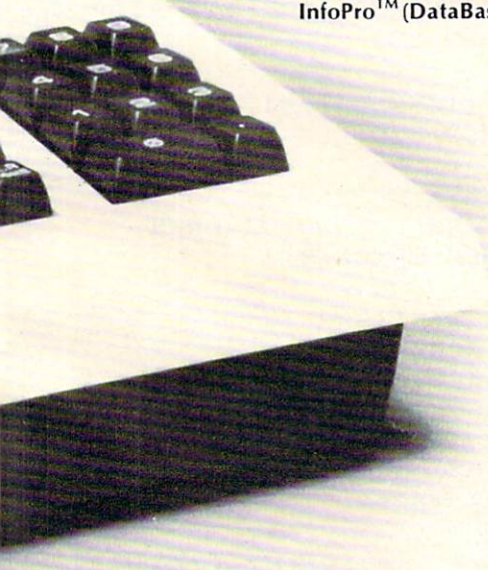

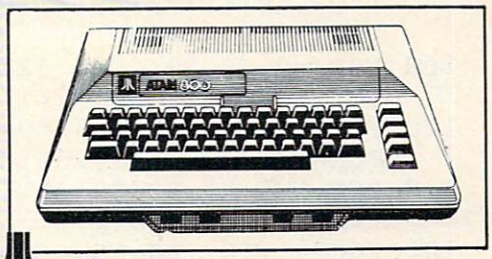

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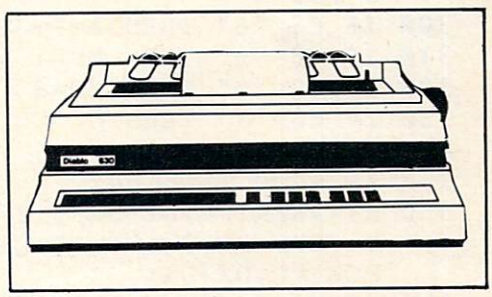

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```
    4)=22:DX(5)=76:DX(6)=60:DX
    (7)=79:DX(8)=1
150 LB(1)=78:LB(2)=64:LB(3)=77:LB(4
    )=93:LB(5)=78:LB(6)=64:LB(
    7)=77:LB(8)=93
160 FORJ=0 TO 39:POKE 32768+J,230:P
    OKE 33767-J,230:NEXT
170 FORJ=0TO24:POKE 32807+40*J,230:
    POKE 33728-40*J,230:NEXT
180 DEF FNF(X)=32809+INT(38*RND(1))
    +40*INT(22*RND(1))
190 FORJ=1 TO 100:POKE FNF(1),102:N
    EXT
200 FORJ=1 TO 10:P(J)=1
210 P1(J)=FNF(1):IF PEEK(P1(J))<>32
     THEN 210
220 POKE P1(J),87:NEXT
230 FORJ=1 TO 15:R(J)=1
240 R1(J)=FNF(1):IF PEEK(R1(J))<>32
     THEN 240
250 POKE R1(J),90:DP(J)=INT(10*RND(
    1)+1):NEXT
260 PP=FNF(1):IF PEEK(PP)<>32 THEN ~
    260
270 DR=INT(8*RND(1)+1):POKE PP,DX(D
    R)
280 REM ---MOVE PLAYER---
290 GET C$:IF C$="4" THEN A=-1:GOSU
    B 900
300 IF C$="6" THEN A=1:GOSUB 900
310 IF C$="5" THEN MS=1
320 IF C$="0" THEN MS=0
330 IF C$="8" THEN GOSUB 420
340 POKE PP,DX(DR)
350 IF MS=0 THEN 640
360 X1=PEEK(PP+DI(DR)):IF X1=32 THE
    N POKE PP,32:PP=PP+DI(DR):
    POKEPP,DX(DR)
370 IF X1=90 THEN 1770
380 IF X1=87 THEN MS=0
390 IF X1=102 OR X1=230 THEN A=4:GO
    SUB 900
400 GOTO 640
410 REM ---FIRE PLAYER---
420 X2=0:MS=0
430 X2=X2+1:IF X2>5 THEN 480
440 X3=PEEK(PP+X2*DI(DR)):IF X3=102
     OR X3=230 THEN 480
450 IF X3=87 THEN 530
460 IF X3=90 THEN 580
470 POKE PP+X2*DI(DR),LB(DR):GOTO 4
    30
480 IF X2=1 THEN 500
490 FORJ=1 TO X2-1:POKE PP+J*DI(DR)
    ,32:NEXT
500 IF PG=10 THEN 1040
510 IF RG=15 THEN 940
520 RETURN
530 POKE PP+X2*DI(DR),42
540 FORJ=1 TO 10:IF PEEK(P1(J))=42 ~
    THEN P(J)=0
550 NEXT:POKE PP+X2*DI(DR),32
560 PG=PG+1
570 GOTO 480
580 POKE PP+X2*DI(DR),42
590 FORJ=1 TO 15:IF PEEK(R1(J))=42 ~
    THEN R(J)=0
600 NEXT:POKE PP+X2*DI(DR),32
610 RG=RG+1
620 GOTO 480
630 REM ---MOVE ROBOTS---
640 RN=RN+1:IF RN>15 THEN RN=RN-15
650 IF P(DP(RN))=0 THEN 870
660 IF R(RN)=0 THEN 640
670 Z8=P1(DP(RN))
680 X=INT(FNX(Z8)+.5):Y=FNY(Z8)
690 X0=INT(FNX(R1(RN))+.5):Y0=FNY(R
    1(RN))
700 IF X0<X THEN X9=1:GOTO 730
710 IF X0>X THEN X9=-1:GOTO 730
720 X9=0
730 IF Y0<Y THEN Y9=1:GOTO 760
740 IF Y0>Y THEN Y9=-1:GOTO 760
750 Y9=0
760 Z9=X9+40*Y9:Z0=PEEK(R1(RN)+Z9)
770 IF Z0=90 THEN 290
780 IF Z0=DX(DR) THEN 1770
790 IF Z0=87 THEN 820
800 POKE R1(RN),32:R1(RN)=R1(RN)+Z9
    :POKE R1(RN),90
810 GOTO 290
820 POKE R1(RN)+Z9,42:FORJ=1 TO 10
830 IF PEEK(P1(J))=42 THEN P(J)=0:P
    OKE P1(J),32
840 NEXT:PG=PG+1:IF PG=10 THEN 1040

850 DP(RN)=INT(10*RND(1)+1):IF P(DP
    (RN))=0 THEN 850
860 GOTO 800
870 DP(RN)=INT(10*RND(1)+1):IF P(DP
    (RN))=0 THEN 870
880 GOTO 660
890 REM ---ROTATE PLAYER---
900 DR=DR+A:IF DR>8 THEN DR=DR-8
910 IF DR<1 THEN DR=DR+8
920 RETURN
930 REM ---YOU WIN!!---
940 FORJ=1 TO 2000:NEXT
950 PRINT"{CLEAR}YOU HAVE DEFEATED ~
    THE 15 ROBOTS!!!"
960 PRINT:PRINT"GOOD FOR YOU."
970 PRINT:PRINT"YOU MANAGED TO SAVE
    ";10-PG;"OF THE"
980 PRINT"PODS."
990 PRINT:PRINT"PLAY AGAIN? (Y/N)"
1000 GET YN$:IF YN$="Y" THEN CLR:GOT
    O 100
1010 IF YN$<>"N" THEN 1000
```

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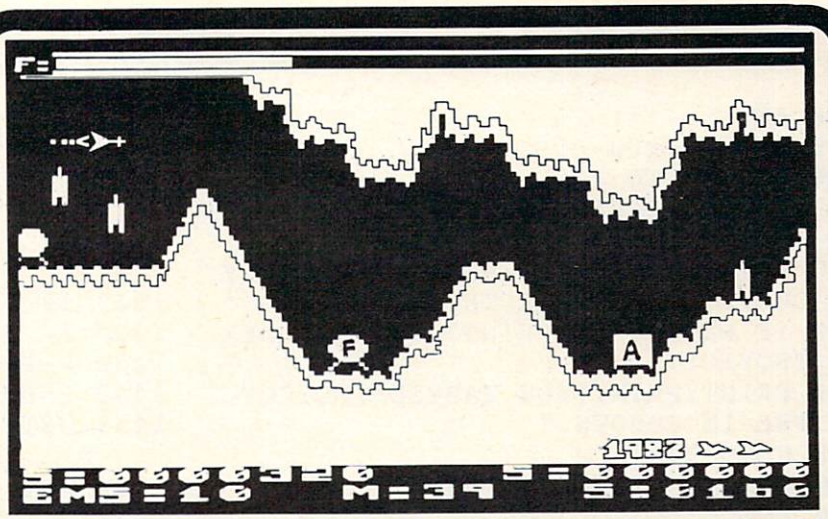

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```
1020 END
1030 REM ---YOU LOSE.---
1040 FORJ=1 TO 2000:NEXT
1050 PRINT"{CLEAR}YOU HAVE BEEN DEFE
     ATED!!!"
1060 PRINT:IF PG=10 THEN PRINT"ALL Y
     OUR PODS WERE DESTROYED!"
1070 IF PD=1 THEN PRINT"YOU WERE DES
     TROYED!!"
1080 PRINT:PRINT"YOU ZAPPED";RG;"OF ~
     THE 15 ROBOTS."
1090 GOTO 990
1100 REM ---INSTRUCTIONS---
1110 X$=""
1120 GOSUB 1750:GOSUB 1760
1130 FORJ=1 TO 13:READ Q:X$=X$+CHR$(
     Q):NEXT:GOSUB 1760:GOSUB 1
     750:GOSUB 1760
1140 DATA 76,65,83,69,82,32,66,65,82
     ,82,65,71,69
1150 FORJ=1 TO 13:READ Q:X$=X$+CHR$(
     Q):NEXT:GOSUB 1760:GOSUB 1
     750:GOSUB 1760
1160 DATA 192,66,89,32,83,69,65,78,3
     2,73,71,79,192
1170 FORJ=1 TO 13:X$=X$+CHR$(32):NEX
     T
1180 PRINT"{CLEAR}0(((@";:POKE 32787
     ,90
1190 FORJ=1 TO 2000:NEXT:PRINT"*";
1200 FORJ=1 TO 143:PRINTMID$(X$,J,1)
     ;:FORK=1 TO 25:NEXT:NEXT
1210 POKE 32773,32:POKE 32787,42:FOR
     J=1 TO 250:NEXT:POKE 32787
     ,32
1220 PRINT:PRINT:PRINT"  THE OBJECT ~
     OF THIS GAME IS"
1230 PRINT"TO DEFEND 10 FUEL PODS FR
     OM 15"
1240 PRINT"ROBOTS. PRESS THE RETURN ~
     KEY TO"
1250 PRINT"GO ON."
1260 GET R$:IF R$<>CHR$(13) THEN 126
     0
1270 PRINT"{CLEAR}YOUR FUEL PODS LOO
     K LIKE THIS: W"
1280 PRINT"THE ROBOTS LOOK LIKE THIS
     : Z"
1290 PRINT
1300 PRINT"THERE ARE BARRIERS HERE A
     ND THERE       WHICH LOOK ~
     LIKE THIS: &"
1310 PRINT
1320 PRINT"YOU LOOK LIKE:"
1330 X$="AV><L:PO"
1340 FORJ=1 TO 8:PRINTMID$(X$,J,1);C
     HR$(32);"IF YOU ARE FACING
     ";CHR$(32);
1350 IF J=1 THEN PRINT"UP"
1360 IF J=2 THEN PRINT"DOWN"
1370 IF J=3 THEN PRINT"RIGHT"
1380 IF J=4 THEN PRINT"LEFT"
1390 IF J=5 THEN PRINT"LEFT & DOWN"
1400 IF J=6 THEN PRINT"RIGHT & DOWN"
1410 IF J=7 THEN PRINT"RIGHT & UP"
1420 IF J=8 THEN PRINT"LEFT & UP"
1430 PRINT:NEXT
1440 PRINT"PRESS RETURN TO GO ON."
1450 GET R$:IF R$<>CHR$(13) THEN 145
     0
1460 PRINT"{CLEAR}YOUR CONTROLS:"
1470 PRINT:PRINT"{REV}4{OFF} - ROTAT
     E COUNTERCLOCKWISE"
1480 PRINT"{REV}6{OFF} - ROTATE CLOC
     KWISE"
1490 PRINT"{REV}5{OFF} - MOVE FORWAR
     D"
1500 PRINT"{REV}0{OFF} - STOP MOVING
     "
1510 PRINT"{REV}8{OFF} - {REV}FIRE L
     ASER"
1520 PRINT:PRINT"WHEN YOU ENTER A 5,
      YOU WILL"
1530 PRINT"MOVE FORWARD UNTIL YOU EI
     THER"
1540 PRINT"STOP OR FIRE YOUR LASER."
1550 PRINT"IF YOU RUN INTO A BARRIER
     , YOU WILL"
1560 PRINT"BOUNCE OFF AND BEGIN TRAV
     ELING"
1570 PRINT"THE OPPOSITE DIRECTION."
1580 PRINT"YOU CANNOT DESTROY BARRIE
     RS OR WALL"
1590 PRINT"SECTIONS. IF YOU HIT A WA
     LL, YOU WILL   BOUNCE OFF.
     "
1600 PRINT"ROBOTS WILL MOVE TOWARD A
      TARGET POD."
1610 PRINT"THEY WILL SMASH ANYTHING ~
     IN THEIR"
1620 PRINT"PATH (INCLUDING BARRIERS ~
     AND YOU!)"
1630 PRINT"TO GET THERE. THEY DESTRO
     Y THINGS BY"
1640 PRINT"TOUCHING THEM, SO IF YOU ~
     TOUCH ONE-"
1650 PRINT"BYE BYE!!"
1660 PRINT"PRESS RETURN TO GO ON."
1670 GET R$:IF R$<>CHR$(13) THEN 167
     0
1680 PRINT"{CLEAR}GOOD LUCK!!"
1690 PRINT:PRINT"YOU WILL LOSE IF AL
     L YOUR PODS"
1700 PRINT"ARE EATEN OR IF YOU ARE!!
     "
1710 PRINT:PRINT"YOU MUST BLAST ALL ~
```

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```
    THE ROBOTS TO WIN!"
1720 PRINT:PRINT"PRESS THE SPACE BAR
    TO PLAY."
1730 GET R$:IF R$<>CHR$(32) THEN 173
    0
1740 GOTO 100
1750 FORJ=1 TO 13:X$=X$+CHR$(192):NE
    XT:RETURN
1760 FORJ=1 TO 13:X$=X$+CHR$(157):NE
    XT:RETURN
1770 FORX=-2 TO 2:POKE PP+40*X,93:NE
    XT
1780 FORX=-2 TO 2:POKE PP+X,64:NEXT
1790 POKE PP-81,85:POKE PP-41,85:POK
    E PP-42,85
1800 POKE PP-79,73:POKE PP-39,73:POK
    E PP-38,73
1810 POKE PP+42,75:POKE PP+41,75:POK
    E PP+81,75
1820 POKE PP+38,74:POKE PP+39,74:POK
    E PP+79,74:POKE PP,42
1830 PD=1:GOTO 1040
```

Atari Version

```
100 GOSUB 1070:REM INITIALIZE CHARACT
    ER SET
110 GOSUB 1460:REM MORE INITIALIZATIO
    N
120 R=0:FOR I=1 TO 200:POKE PPOS,0:PO
    KE PPOS,DIR+64:NEXT I
130 IF ROBOTS<5 THEN FOR W=1 TO 50:NE
```

Atari Notes

Charles Brannon
Editorial Assistant

The Atari version of Laser Barrage requires 16K and a joystick. When you RUN the program for the first time, you'll see the message "PLEASE WAIT", and if you turn up your TV volume control, you'll hear a series of random tones as the custom character set for the game is initialized.

Subsequent RUNs will not require the initialization, thanks to line 1080, which checks if the character set is already POKEd in. This technique is very useful if a program will be RUN many times at one sitting. It can be used with machine language programs to PEEK a certain location to see if a particular opcode is present. If not, a READ/POKE loop can be called to put the machine language code into memory.

Go After The Amok Robots With Z-Beams

You start the game with three ships. The screen is filled with "energy pods," blue robots, and brick-like obstacles. Each robot picks a pod to attack, and then moves towards it with deadly deliberation. If a robot contacts a pod, the pod bursts and collapses, and the robot instantly picks another target to destroy.

Your ship, which can be controlled in eight directions with the joystick, can fire a powerful "Z-beam" in whatever direction it is currently facing. Your mission is to clear the screen of robots by destroying each one with your Z-beam. You get one point for each robot you eliminate, and when you clear the screen, five points for each surviving pod.

You then face a new screen of pods and robots, but each new level challenges you with two additional robots. You know you're really good (but in big trouble) when you have 15 or more robots to deal with. The game can handle up to 64 robots, but it is inconceivable that anyone could withstand the "Laser Barrage" that long. (But if you're superhuman and manage to, you can change lines 1640 and 1650, memory permitting.)

A Speedy Technique

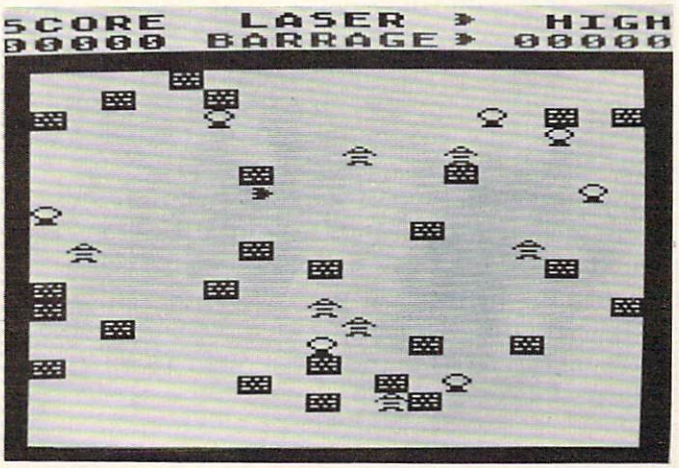
One interesting thing about this game is its fast execution speed, a feat normally impossible in BASIC. Character graphics (with a custom character set) allows you to create detailed, colorful games, but you are limited (without using special techniques, such as fine scrolling) to a single character of resolution. This makes motion seem rather coarse compared to player/missile graphics.

Nevertheless, character graphics in modes one and two provides a great deal of flexibility. Unlike player/missile graphics, a single POKE to "screen RAM" determines the X,Y position of a character. PEEK can be used like LOCATE to check for collisions. This simplicity allows you to program games in BASIC that will run pretty fast.

One last note on the importance of positioning BASIC subroutines to maximize speed. Laser Barrage has a large section of "initialization" code, which is run only once at the beginning of the program. When all this code was moved to the end of the program, the game ran twice as fast!

```
    XT W
140 GOSUB 200:REM MOVE PLAYER
150 R=R+1:IF R>ROBOTS THEN R=0
160 GOSUB 410:GOSUB 200:REM MOVE A RO
    BOT, THEN GIVE PLAYER ANOTHER TUR
    N
170 IF MPOS THEN GOSUB 710:GOSUB 710:
    REM UPDATE "MISSILE" IF IN FLIGHT
180 GOTO 130
200 REM ■PLAYER■MOVEMENT■
210 IF STRIG(0)=0 AND MPOS=0 THEN 370
220 GOTO 220+STICK(0)
225 DIR=4:GOTO 320
226 DIR=2:GOTO 320
227 DIR=3:GOTO 320
229 DIR=6:GOTO 320
230 DIR=8:GOTO 320
231 DIR=7:GOTO 320
233 DIR=5:GOTO 320
234 DIR=1:GOTO 320
235 RETURN
320 NPOS=PPOS+DIR(DIR-1):POKE 77,0
330 PK=PEEK(NPOS):IF PK=31 OR PK=158
    OR PK=PC THEN RETURN
340 IF PK=63+192 THEN 590
350 POKE PPOS,0:POKE NPOS,DIR+64
360 PPOS=NPOS:RETURN
370 REM ■***■FIRE■MISSILE■***■
380 SIGN=-1
390 MPOS=PPOS:MDIR=DIR-1:IF MDIR>3 TH
    EN MDIR=DIR-5:SIGN=1
400 RETURN
410 REM ***ROBOT■MOVEMENT***
420 REM Given R, Robot Index
430 IF ROBOT(R)=0 THEN RETURN
440 IF POD(TARGET(R))=0 THEN TARGET(R
    )=INT(8*RND(0)):GOTO 440
450 RX=RX(R):RY=RY(R):TX=PX(TARGET(R)
    ):TY=PY(TARGET(R))
460 RX=RX+SGN(TX-RX):RY=RY+SGN(TY-RY)
470 NPOS=CRT+RX+20*RY:P=PEEK(NPOS)
480 IF P=158 OR P=31 THEN RX=RX+1-INT
    (3*RND(0)):RY=RY+1-INT(3*RND(0)):
    GOTO 470
490 IF P<>PC THEN 560
500 PK=CRT+RX+20*RY
510 FOR I=59 TO 62:POKE PK,I:SOUND 0,
    I*2,0,8:FOR W=1 TO 20:NEXT W:NEXT
     I:SOUND 0,0,0,0
520 FOR I=0 TO 7:IF RX=PX(I) AND RY=P
    Y(I) THEN KP=I:GOTO 540
530 NEXT I:STOP
540 POKE PK,0:POD(KP)=0
550 PODS=PODS-1:IF PODS=0 THEN 590
560 IF P>64 AND P<73 THEN 590
570 POKE ROBOT(R),0:POKE NPOS,63+192:
    ROBOT(R)=NPOS:RX(R)=RX:RY(R)=RY
580 RETURN
590 REM PLAYER KILLED ROUTINE
600 FOR I=1 TO 8
610 FOR J=0 TO 3:POKE PPOS,I+COLMSK(J
    ):NEXT J
620 SOUND 0,I*8+K*64,12,16-I*2:SOUND
    1,I*4,8,16-I*2:NEXT I
630 FOR I=1 TO 4 STEP 0.5:FOR J=0 TO
    3:POKE PPOS,15+COLMSK(J):POKE PPO
    S,32+COLMSK(J):POKE PPOS,0
640 SOUND 0,I*4+J,8,15-4*3+J:NEXT J:N
    EXT I
650 SOUND 0,0,0,0:LIFE=LIFE-1:IF LIFE
     THEN 110
660 POSITION 5,10:? #6;"{11 SPACES}":P
    OSITION 5,11:? #6;" GAmE OVeR ":P
    OSITION 5,12:? #6;"{11 SPACES}"
670 POSITION 7,0:? #6;"PRESS ":POSITIO
    N 6,1:? #6;" START ":F=0
680 IF PEEK(20)>15 THEN POKE 20,0:F=1
    -F:POSITION 0,1:? #6;"{5 SPACES}"
    :IF F THEN POSITION 0,1:? #6;SCR$
690 IF PEEK(53279)<>6 THEN 680
700 ROBOTS=3:SCR=0:SCR$="000000":LIFE=
    3:GOTO 110
710 REM ■***■UPDATE■MISSILE■***■
720 IF MPOS=0 THEN RETURN
730 NPOS=MPOS+LDIR(MDIR)*SIGN
740 KK=PEEK(MPOS):IF KK<65 OR KK>72 T
    HEN KK=0
750 PK=PEEK(NPOS):ALT=1-ALT
760 IF PK=255 THEN GOSUB 820
770 IF PK>0 THEN POKE MPOS,0:MPOS=0:R
    ETURN
780 POKE MPOS,KK:POKE NPOS,LC(MDIR*2+
    ALT)
790 MPOS=NPOS
800 GOTO 730
810 RETURN
820 REM KILLED ROBOT
830 POKE MPOS,0
840 POKE NPOS,0
850 FOR I=0 TO ROBOTS:IF ROBOT(I)=NPO
    S THEN KR=I:I=ROBOTS:NEXT I:GOTO
    870
860 NEXT I:STOP
870 FOR I=0 TO 7:POKE NPOS,LC(I)+128:
    SOUND 0,I*10,8,14-I*2:NEXT I:POKE
     NPOS,0
880 SCR=SCR+1:ROBOT(KR)=0
890 SCR$="00000":SCR$(6-LEN(STR$(SCR)
    ))=STR$(SCR)
900 FOR Z=1 TO 5:SCR$(Z,Z)=CHR$(ASC(S
    CR$(Z))+128):NEXT Z:POSITION 0,1:
    ? #6;SCR$
910 IF SCR<HIGH THEN 940
920 HIGH=SCR:HI$="00000":HI$(6-LEN(ST
    R$(HIGH)))=STR$(HIGH)
930 FOR Z=1 TO 5:HI$(Z,Z)=CHR$(ASC(HI
    $(Z))-32):NEXT Z:POSITION 15,1:?
    #6;HI$
940 KILLED=KILLED+1:IF KILLED=ROBOTS+
    1 THEN 960
950 RETURN
960 REM ■ALL■ROBOTS■KILLED■HURRAY!
970 FOR J=1 TO 20:FOR I=0 TO 4:POKE 7
    08+I,PEEK(53770):NEXT I:NEXT J
980 FOR I=0 TO 7
990 IF POD(I)=0 THEN 1020
1000 FOR J=0 TO 3:SCR=SCR+5:POKE POD(
     I),PC+1+COLMSK(J):GOSUB 1050:GOS
     UB 890
1010 POKE POD(I),PC:GOSUB 1060:NEXT J
1020 FOR J=0 TO 4:POKE 708+J,PEEK(537
     70):NEXT J
1030 NEXT I
1040 ROBOTS=ROBOTS+2:GOTO 110
1050 FOR W=14 TO 0 STEP -2:SOUND 0,W*
     10,12,W:NEXT W:RETURN
1060 FOR W=14 TO 0 STEP -2:SOUND 0,15
     0-W*10,12,W:NEXT W:RETURN
1070 GRAPHICS 2+16:SETCOLOR 4,9,6:POK
     E 53770,27
1080 CHSET=(PEEK(106)-8)*256:IF PEEK(
     CHSET+11)=56 THEN RETURN
1090 POSITION 3,4:? #6;"LASER BARRAGE"
1100 POSITION 4,6:? #6;"please wait"
```

```
1110 FOR I=0 TO 512:POKE CHSET+I,PEEK
     (57344+I):POKE 708,PEEK(53770)
1120 SOUND 0,PEEK(53770),10,8:NEXT I
1130 RESTORE 1180
1140 READ A:IF A=-1 THEN RETURN
1150 FOR J=0 TO 7:READ B:POKE CHSET+A
     *8+J,B:POKE 708,PEEK(53770):SOUN
     D 0,B,10,8:NEXT J
1160 GOTO 1140
1170 SOUND 0,A,10,INT(I/34):NEXT I
1180 DATA 1,16,16,56,56,124,124,84,0
1190 DATA 2,3,31,62,14,22,4,0,0
1200 DATA 3,0,28,14,31,14,28,0,0
1210 DATA 4,0,0,4,22,14,62,31,3
1220 DATA 5,84,124,124,56,56,16,16,0
1230 DATA 6,0,0,32,104,112,124,248,19
     2
1240 DATA 7,0,56,112,248,112,56,0,0
1250 DATA 8,192,248,124,112,104,32,0,
     0
1260 DATA 9,56,68,130,130,68,56,56,12
     4
1270 DATA 10,56,68,186,186,68,56,56,1
     24
1280 DATA 11,192,64,112,16,28,4,7,1
1290 DATA 12,1,7,4,28,16,112,64,192
1300 DATA 13,128,224,32,56,8,14,2,3
1310 DATA 14,3,2,14,8,56,32,224,128
1320 DATA 15,0,64,1,48,56,80,0,4
1330 DATA 26,16,8,16,8,16,8,16,8
1340 DATA 27,8,16,8,16,8,16,8,16
1350 DATA 28,0,0,0,170,85,0,0,0
1360 DATA 29,0,0,0,85,170,0,0,0
1370 DATA 30,255,149,255,169,255,149,
     255,255
1380 DATA 31,255,255,255,255,255,255,
     255,255
1390 DATA 32,0,36,2,160,0,2,136,34
1400 DATA 59,60,66,129,129,129,66,60,
     0
1410 DATA 60,0,60,66,66,66,60,0,0
1420 DATA 61,0,0,24,36,24,0,0,0
1430 DATA 62,0,0,0,24,0,0,0,0
1440 DATA 63,24,36,126,129,60,0,60,10
     2
1450 DATA -1
1460 GRAPHICS 17:POKE 756,CHSET/256:P
     OKE 559,0
1470 RESTORE 1460:FOR I=0 TO 4:READ A
     ,B:POKE 708+I,A*16+B:NEXT I
1480 DATA 6,8,1,10,4,6,7,10,0,14
1490 KILLED=0
1500 FOR I=0 TO 3:SOUND I,0,0,0:NEXT
     I
1510 CRT=PEEK(88)+256*PEEK(89)
1520 FOR I=0 TO 21:POKE CRT+40+I*20,3
     1:POKE CRT+479-I*20,31
1530 IF I<20 THEN POKE CRT+40+I,31:PO
     KE CRT+479-I,31
1540 NEXT I
1550 IF  NOT DIMMED THEN DIM SCR$(5),
     HI$(5):HI$="{5 P}":HIGH=0:SCR$="
     [5 0]":SCR=0:LIFE=3
1560 POSITION 7,0:? #6;"[LASER]":POSITI
     ON 6,1:? #6;"[8 BLANKS]"
1570 IF LIFE>1 THEN POSITION 13,0:PUT
      #6,131:IF LIFE>2 THEN POSITION
     13,1:PUT #6,131
1580 POSITION 0,0:? #6;"SCORE":POSITI
     ON 16,0:? #6;"HIGH"
1590 POSITION 0,1:? #6;SCR$:POSITION
     15,1:? #6;HI$
1600 FOR I=1 TO 25:A=INT(18*RND(1)+1)
     :B=INT(19*RND(1)+3)
1610 POKE CRT+B*20+A,30+128:NEXT I
1620 IF DIMMED THEN 1760
1630 DIM POD(7),PX(7),PY(7):REM 8 POD
     S
1640 DIM ROBOT(64),RX(64),RY(64):REM
     UP TO 64 ROBOTS
1650 DIM TARGET(64):REM CHANGE 64 TO
     ANY OTHER UPPER LIMIT DESIRED
1660 DIM LC(7)
1670 DIM LDIR(3):REM LASER DIRECTION
1680 DIM DIR(7):REM 8 DIRECTIONS
1690 DIM COLMSK(3)
1700 COLMSK(0)=0:COLMSK(1)=64:COLMSK(
     2)=128:COLMSK(3)=192
1710 LI=0:REM LASER INDEX
1720 LC=0:REM LASER CHARACTER
1730 PC=9:REM POD CHARACTER
1740 PPOS=0:REM PLAYER POSITION
1750 ROBOTS=3:LET DIMMED=1
1760 FOR I=0 TO 7
1770 PX(I)=INT(18*RND(0)+1):PY(I)=INT
     (19*RND(0)+3)
1780 POD(I)=CRT+PX(I)+PY(I)*20:IF PEE
     K(POD(I))>0 THEN 1770
1790 POKE POD(I),PC
1800 NEXT I:PODS=8
1810 FOR I=0 TO ROBOTS
1820 RX(I)=INT(18*RND(0)+1):RY(I)=INT
     (19*RND(0)+3)
1830 ROBOT(I)=CRT+RX(I)+RY(I)*20:IF P
     EEK(ROBOT(I))>0 THEN 1820
1840 POKE ROBOT(I),63+192
1850 TARGET(I)=INT(8*RND(0))
1860 NEXT I
1870 FOR I=0 TO 7:READ A:DIR(I)=A:NEX
     T I
1880 DATA -20,-19,1,21,20,19,-1,-21
1910 FOR I=0 TO 7:READ A:LC(I)=A:NEXT
      I
1920 DATA 26,27,12,14,28,29,11,13
1930 FOR I=0 TO 3:READ A:LDIR(I)=A:NE
     XT I
1940 DATA 20,19,-1,-21
1950 PPOS=CRT+INT(18*RND(0)+1)+INT(19
     *RND(0)+3)*20:IF PEEK(PPOS)>0 TH
     EN 1950
1960 DIR=1:REM DIRECTION OF PLAYER, 0
     -7
1970 POKE PPOS,DIR+64:MPOS=0:POKE 559
     ,34
1980 RETURN
```



Laser Barrage – Atari Version

Teaching With Games

Harvey B. Herman
Associate Editor

Sometime ago I took part in a "District Day" for gifted and talented elementary school students. The program was hosted by the University of North Carolina at Greensboro. Workshops were organized by 32 university faculty members on topics ranging from computer technology to Appalachian folk music. I collaborated with a colleague from the Physics Department in a presentation, to a group of very bright kids, of small computers. Our objective was to give the students, in the short time available, some appreciation of the laboratory uses of computers in the physical sciences. I thought it might be useful to others to describe the rationale behind my part in the program.

Realtime Clocks

The computers used in the workshop were various model Commodore PET/CBMs. One of the features of these computers, as I am sure regular **COMPUTE!** readers are aware, is their built-in, realtime clocks. One of the variables in BASIC, TI$, is set aside (reserved) to keep track of hours, minutes, and seconds. Typically, the clock is set by equating this variable to the current time; e.g., at 9:30 a.m. type TI$="093000". If the value of TI$ reads 094502 after using the computer for a short time, the user would know that 15 minutes and two seconds have elapsed since the clock was last set.

Another reserved variable, TI, keeps track of 1/60th second intervals (jiffies) since the PET was turned on, or TI$ was set. Either variable can be used in a program in which the computer interacts with the environment at specified time intervals. Let us take as an example a program written to make measurements every ten minutes. Ten minutes translates to 36,000 jiffies. When the jiffy counter (TI) has increased by this amount, or the minutes segment of the string variable TI$ has increased by ten, the program should then take whatever action is required to make the measurement.

Attract Them With Games

Elementary students love to play games; *Pac-man* alone is a billion dollar industry. I decided to write an original game for the workshop in which time is an integral part. The students would play this game, the time guessing game, first. Later, when we had their attention, a discussion could begin on the laboratory uses of small computers where keeping track of time is essential. A scientific computer program used in a laboratory setting will undoubtedly have similar algorithms. We tried to focus on these aspects of the program without attempting in any way to make sophisticated programmers of the students – virtually impossible in the limited time for the workshop. I believe that it was indeed possible, however, to impart some understanding of scientific applications of computers to bright kids, many of whom already have home computers.

Time Guessing

A listing of the program accompanies this article. Readers should feel free to use it just as a game, or as a point of departure for a discussion on measurements with computers, as we did.

The program is relatively short and should be easy to follow. It begins with optional instructions. The object is to start and stop a clock, with a key press, coming as close to ten seconds as possible without going over. A player enters his or her name, and then presses any key. When players feel ten seconds is up, they press any key again. It takes some practice before one can reliably reach 9.90 seconds or greater, while still staying below ten. The last and best player's score for that session is displayed after each turn. At the conclusion of the game, all the students' names and their times are displayed in summary fashion.

There are two features of this program which perhaps should be incorporated in most applications at this level:

1. A return without data in response to an input statement will not stop the program. In my experience, this is the single most confusing part of PET BASIC to non-computerists. (It has been corrected in the VIC.)

2. The time values are not displayed to nine significant figures, but are rounded to a more realistic 1/100 of a second. It always bothers me to see unnecessary digits reported for an experimental measurement. Of course, rounding has an additional benefit; it makes for neater and easier to read tables at the conclusion of the program.

The time guessing program was developed on

a 40-column PET, but will work on 80-column CBMs and 22-column VICs, with minor editing of the output statements. If you do use this program, I hope your students will enjoy it as much as these workshop participants said they did.

```
150 N=0:N$="NOBODY":T=0
160 DIM N$(100),T(100)
170 PRINT "{CLEAR}         {REV}TIME GUESSING P
    ROGRAM{03 DOWN}"
180 PRINT "DO YOU WANT INSTRUCTIONS('Y' OR 'N'
    )?";
190 GET Q$:IF Q$="" THEN 190
200 IF LEFT$(Q$,1)="N" THEN 330
210 IF LEFT$(Q$,1)<>"Y" THEN 170
220 PRINT "{HOME}{04 DOWN}THE OBJECT OF THE GA
    ME IS TO SEE WHO CAN"
230 PRINT "{REV}BEST{OFF} GUESS A 10 SECOND IN
    TERVAL WITHOUT"
240 PRINT "GOING OVER THE 10 SECOND LIMIT."
250 PRINT"{DOWN}YOU WILL BE ASKED YOUR NAME FI
    RST."
260 PRINT "THEN PRESS ANY KEY TO START THE TIM
    ER."
270 PRINT "{DOWN}WHEN YOU THINK 10 SECONDS IS
    UP PRESS A"
280 PRINT "KEY AND YOUR TIME WILL BE SHOWN ON
    THE"
290 PRINT "LEFT. THE BEST TIME OF THIS SESSION
     IS"
300 PRINT "SHOWN ON THE RIGHT."
310 PRINT "{DOWN}WHEN YOU FINISH READING THESE
              INSTRUCTIONS PRESS ANY KEY
    ."
320 GET Q$:IF Q$="" THEN 320
330 PRINT "{CLEAR}         {REV}TIME GUESSING P
    ROGRAM"
340 N=N+1
350 PRINT "{03 DOWN}TYPE PLAYER'S FIRST NAME A
    ND RETURN     "
360 INPUT "  ?{03 LEFT}";N$(N):IF N$(N)="?"THE
    NPRINT:PRINT"NAME PLEASE":GOTO360
370 N$(N)=LEFT$(N$(N),9)
380 PRINT "WHEN READY START THE TIMER BY PRESS
    ING  ANY KEY."
390 GET Q$:IF Q$="" THEN 390
400 TI$="000000"
410 PRINT "PRESS ANY KEY WHEN 10 SECONDS IS UP
    ."
420 GET Q$:IF Q$="" THEN 420
430 T(N)=INT(TI/60*100)/100
440 IF T(N)>10 THEN 460
450 IF T(N)>T THEN T=T(N):N$=N$(N)
460 PRINT "{CLEAR}         {REV}TIME GUESSING P
    ROGRAM"
470 PRINT "{DOWN}LAST PLAYER","BEST PLAYER"
480 PRINT "{02 DOWN}";N$(N),T(N),N$,T
490 PRINT "{DOWN}AGAIN('Y' OR 'N')?"
500 GET Q$:IF Q$="" THEN 500
510 IF LEFT$(Q$,1)="Y" THEN 340
520 IF LEFT$(Q$,1)<>"N" THEN 500
530 PRINT"{DOWN}HOPE THIS WAS FUN. THANKS FOR
    PLAYING.  HERE IS A LIST OF THE PLAYE
    RS ";
540 PRINT "AND THEIR SCORES.":PRINT
550 IF N=1 THEN PRINT N$(1),T(1):END
560 FOR I=1 TO N-1 STEP 2
570 PRINT N$(I),T(I),N$(I+1),T(I+1)
580 NEXT I
590 IF I=N THEN PRINT N$(N),T(N)
```

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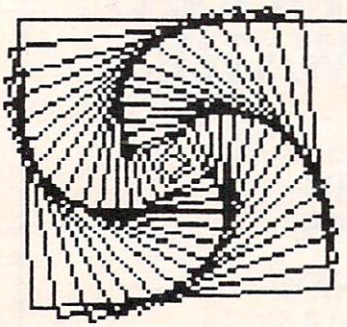


A Monthly Column

Friends Of The Turtle

David D. Thornburg
Associate Editor

LOGO Is Not Just Child's Play

Revolutionary periods are more than a time of change – they are often a time of great confusion as well. Those of us who are excited about the emergence of computer languages tailored to people's needs may be less sensitive than we should be to the way our message is being received.

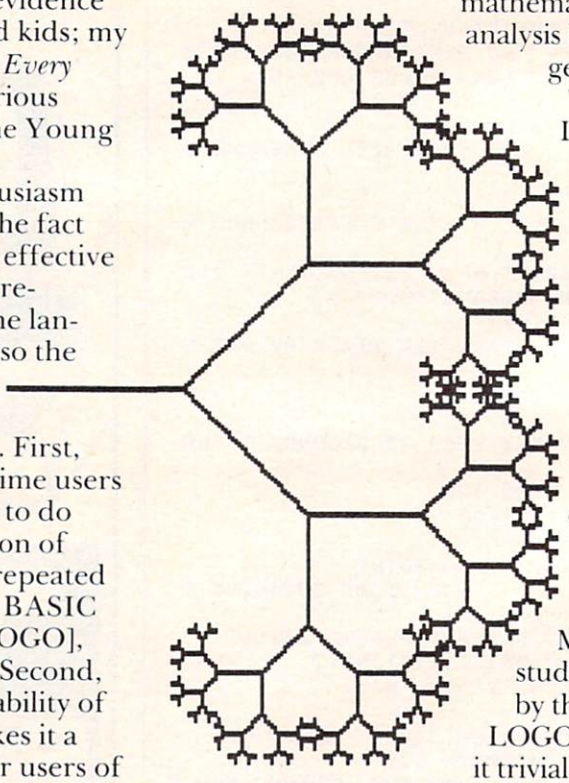
In the case of LOGO and Atari PILOT, this has had unfortunate consequences. Several readers have written to suggest that LOGO and Atari PILOT are "kid's" languages and are thus not worthy of serious attention. They cite as evidence Papert's *Mindstorms*, a book on LOGO and kids; my books, *Picture This!*, *Picture This Too!*, and *Every Kid's First Book of Robots and Computers;* various magazine articles; the very existence of the Young People's LOGO Association, etc.

Admittedly, much of the public enthusiasm for these languages has been devoted to the fact that, like English, PILOT and LOGO are effective communication tools for children. Let us remember, however, that while English is the language for "Baa, Baa, Black Sheep," it is also the language for James Joyce's *Ulysses* – the latter is definitely not for children.

The key to LOGO's power is twofold. First, much of it is very easy to learn, and first-time users find that within a short time they are able to do "interesting" things. (To me, the generation of logarithmic spirals is interesting, but the repeated printing of my name on the screen is not. BASIC has an easy time with the latter [as does LOGO], and has a horrible time with the former.) Second, LOGO is extensible by the user. This capability of LOGO, while of utility to youngsters, makes it a tremendous problem-solving language for users of any age. LOGO users readily develop skills in top-down programming and in the creation of building-block procedures that not only impart a logical order to programs, but also make them much easier to debug. When one adds to this such features as recursion, local variables, and list manipulation, it is obvious that LOGO is far more than just a kid's language. In fact, it is a far more useful language for many applications than many of the popular computer languages in use today.

Keep in mind that LOGO was a product of the artificial intelligence community. I assure you that something that is just a kid's language does not hold the interest of the MIT computer science department for over a decade.

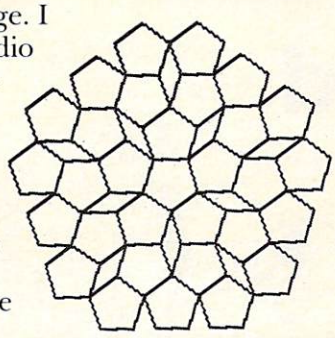
Is turtle geometry easy to use? Of course it is. But, do LOGO's detractors know that finite differential geometry (turtle geometry's formal name) is a major tool for exploring some aspects of pure mathematics that have evaded analysis by traditional analytic geometry?



Those who think that LOGO is only for kids should read *Turtle Geometry* by Abelson and diSessa. If their treatment of relativity theory is too tame for your kids, try reading Buckminster Fuller's *Synergetics* (Fuller independently developed finite differential geometry and used it to make some very interesting discoveries). My Stanford graduate students get slowed down by that book, but perhaps LOGO's detractors will find it trivial reading. Fractal geometry – the subject of this column a few months back – lay virtually unexplored for more than 50 years because mathematicians lacked the tools to do the job.

This July it was my pleasure to give a lecture on the consequences of dimensionality on the conservation rules of geometry. Apple LOGO was my principal tool.

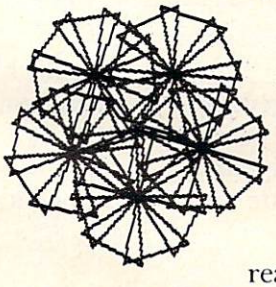
The reason I even care about this argument is that it has the promise of becoming a self-fulfilling prophecy. I have heard Apple dealers tell customers that LOGO is a kid's language. I have seen languages like Radio Shack Color LOGO that are excellent turtle graphics environments, but lack the list manipulation and other features that characterize a full LOGO implementation. In short, I have seen much confusion in the marketplace regarding LOGO and Atari PILOT.



So, please, know that languages like LOGO are marvelous tools for children – and that they are marvelous tools for almost everyone else as well. The power of a good tool is restricted only by the capabilities of its user. LOGO is a good tool.

Those Logophobes who feel like giving the language a second chance should read Harold Abelson's new book from Byte/McGraw Hill. The book is published in two editions, *Apple Logo* (for the LCSI LOGO sold by Apple), and *Logo for the Apple II* (for the MIT LOGO sold by Terrapin and Krell).

This book is excellent for all LOGO users simply because it is far more than a reference work. Abelson has managed to combine descriptions of LOGO primitives with projects that deepen the user's familiarity with the language. The first 60 pages are devoted to turtle graphics, and the remaining 150 concentrate on the other aspects of LOGO that make it a complete computer language. Thus, in addition to turtle graphics, readers become well versed in list manipulation, recursion, hierarchical structures, etc. While it is fair to say that no prior experience in programming is required to read this book, those of you who are learning LOGO as a replacement of or supplement to another language will not find Abelson's book excessively wordy. The text follows several presentation styles: reference material, sample procedures, and projects for the user to solve on his or her own. Except for elementary grade school children, I can't think of any LOGO users who would not benefit from this book.



How To Grapple With A Turtle

In my last column I showed Apple LOGO users how to print screen images on the Silentype printer. The Silentype has many features (low cost, quiet operation, etc.), but it doesn't produce pictures with very high contrast. For high contrast one must consider using a dot matrix impact printer.

Because I need high quality screen images for various reasons, I invested in the Grappler printer interface card (from Orange Micro) for use with my Epson MX-100 printer. I have not done an exhaustive search of the printer interfaces for the Apple II, but I can't think of much I would want to do that can't be done with the Grappler.

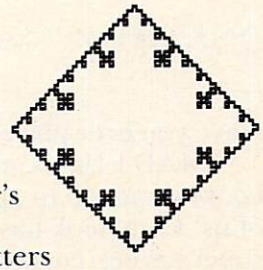
For example, this printer interface allows you to print a screen image at double size (rotated by 90 degrees) so it fits perfectly on an 8.5 by 11 sheet of paper. I enjoy the results of this print mode so much that I haven't explored any of the others.

To generate such prints for the Epson printer (there are Grapplers for other graphics printers as well), you should enter

```
SETSCRUNCH 0.84
```

before drawing any pictures. This compensates for the dot aspect ratio of the Epson printer. If you are using another printer (or another printing mode), you may have to experiment by drawing squares with various settings of SETSCRUNCH (or .ASPECT for those of you with MIT LOGO) until you get a picture that is perfectly square. The following procedure is all that is needed to generate a full-page image of your graphics screen. This procedure is written in Apple LOGO and assumes that the Grappler card is plugged in slot 1 of the Apple:

```
TO PRINTPICT
MAKE "CTRI CHAR 9
.PRINTER 1
PRINT WORD :CRI "GDR
PRINT CHAR 12
.PRINTER 0
END
```

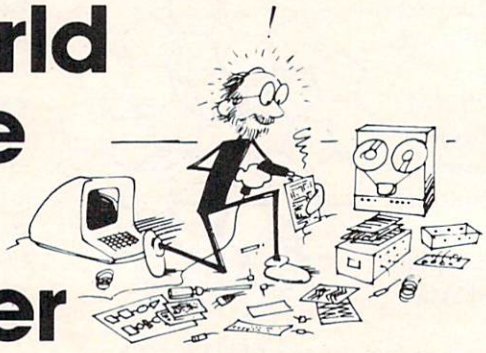


This procedure gets the printer's attention with the character ctrl-I (CHAR 9), followed by letters that set the various options. G indicates that we want a graphics image, D means it should be double size, and R means it should be rotated by 90 degrees. If you want to use the enhanced print mode of the Epson printer, add an E to the list, and you will get a much denser print (with a longer print time, of course).

That's all there is to it! The accompanying figures are taken from my next book, tentatively titled *Discoveries of Beauty*. (This book should appear from Addison-Wesley about January 1983.) Most of the illustrations for this book were generated with the procedure shown above. As you can see, the Grappler lets your Epson printer do a fine job printing pictures generated with LOGO on your Apple computer. ©

A Monthly Column

The World Inside The Computer



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!**

This game will appeal to children of all ages. And it can teach both programming and subjects like English or history while it entertains.

The Story Game

Fred D'Ignazio, Associate Editor

Have you ever played MAD LIBS?®

MAD LIBS is an assortment of wacky party books designed to appeal to the six-year-old in all of us. Each book has a theme – monsters, movies, super heroes, current events, geography, mysteries, or whatever. A MAD LIBS book is a collection of stories, songs, and rhymes with key words left out. You select the words needed to complete the stories. But you must do it blind.

You play MAD LIBS by first picking a *reader*. The reader selects a MAD LIB from the book. Then he (or she) asks people for words to help fill the blanks in the MAD LIB. "Give me a plural noun," the reader might say. Or, "I want the name of a person in this room." The reader fills in the blanks, taking care to hide the story from everyone else in the room.

When all the blanks are filled, the reader stops asking questions and reads the completed story. Depending on people's moods and personalities, the completed MAD LIB might sound philosophical, ridiculous, funny, or shockingly raunchy. For example, an exchange between Mickey Mouse and Minnie Mouse might go as follows:

MINNIE: Mickey! Will you stop doing those _____ exercises.

MICKEY: Aw, shucks, Minnie. I have to keep my _____ in shape.

MINNIE: Well, watch out for the _____. Just look at the way your _____ hangs down over your _____.

To fill in the above blanks, the reader would ask people to volunteer an adjective, a plural noun, an adjective, and two singular nouns. Depending on people's answers, the above passage could end up anywhere from banal to cute, or from innocent to X-rated.

Computer MAD LIBS For Kids

Japanese author Mitsumasa Anno has a book out called *Topsy-Turvies* (Weatherhill, 1970). Anno likes to play games with your vision and sense of perspective. The book is filled with colorful pictures of topsy-turvy buildings and people capable of walking up walls and strolling on ceilings. The book stretches the visual imagination in the same way as the bizarre paintings and drawings by M.C. Escher.

MAD LIBS games can do the same thing for kids' *verbal* and *literary* imaginations. And the "reader" who chooses the stories and asks for words can be a computer.

As a parent or teacher you can choose a MAD

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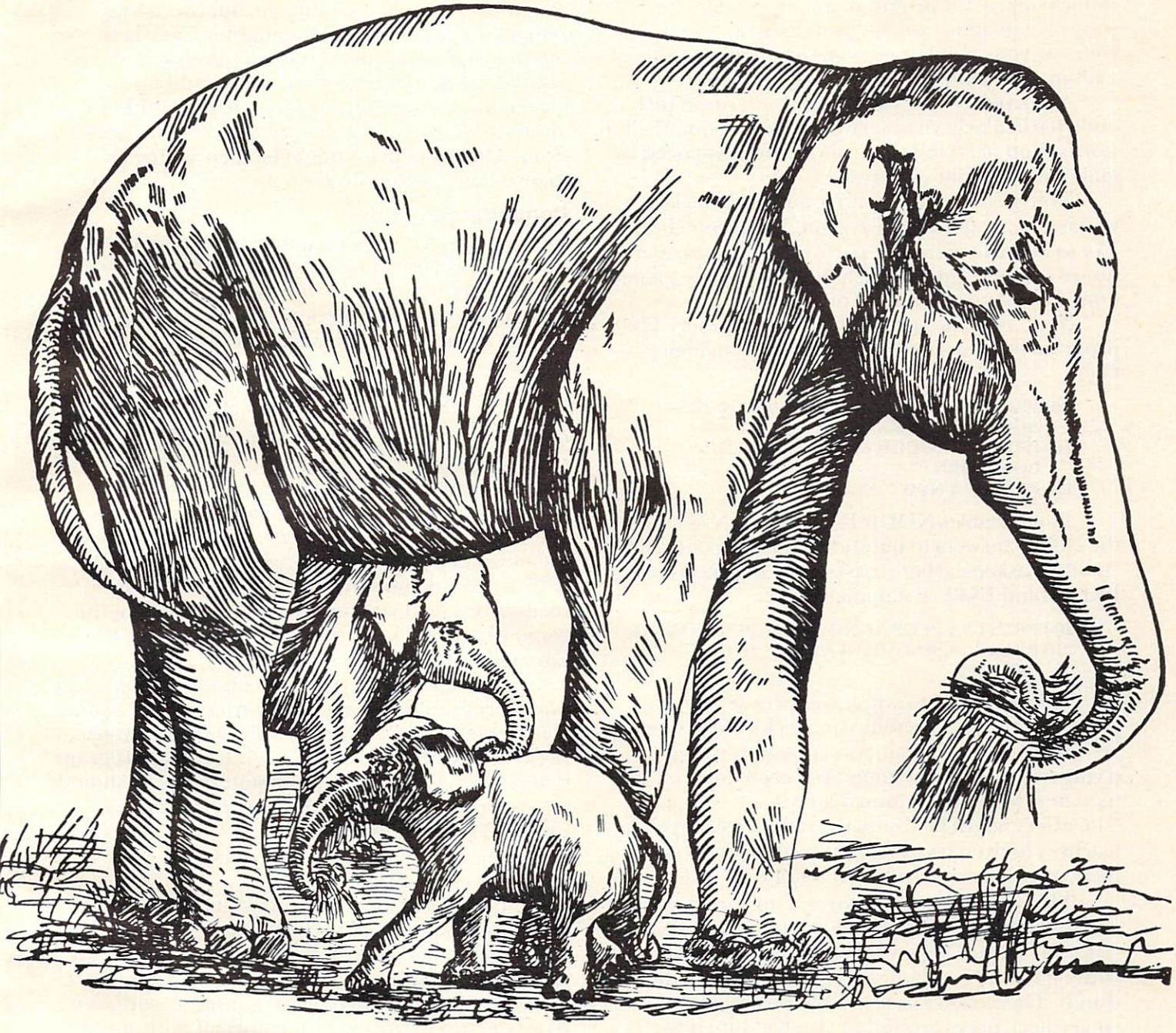

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LIBS-type "skeleton" story from just about anywhere: a picture book, the Bible, a fairy tale, a comic book, a TV program, a song, a poem, or your own imagination. Or you can draw from yours or your child's personal experiences – sort of a fill-in-the-blank autobiography.

After you choose the source for a story, pick out a particularly vivid section of only about 25-300 words. You need to keep it short and fast-paced to maintain the child's interest.

Now go through the story and pick the key words you are going to leave out. Vary your choices. Try to take out different parts of speech: proper nouns (names), adjectives, adverbs, verbs, exclamations, plural nouns, and so on.

Next, type the story into your computer. The program will consist mostly of PRINT statements, like:

```
500 PRINT "FOUR SCORE AND SEVEN YEARS
    AGO OUR ";NOUN1$
510 PRINT "BROUGHT FORTH ON THIS
    CONTINENT"
520 PRINT "A NEW ";NOUN2$;"."
```

The variables NOUN1$ and NOUN2$ contain the child's answers to questions that the computer "reader" asked earlier. It asked the questions using PRINT and INPUT statements like:

```
200 PRINT "A PLURAL NOUN";INPUT NOUN1$
210 PRINT "A SINGULAR NOUN";INPUT
    NOUN2$
```

No matter what subject you choose, the computer stories are sure to fascinate children. They are likely to play the same story over and over, trying new words each time. And each time children try a new word, they immediately see its effect. The effect might be dramatic, zany, or silly. But it teaches children the different parts of speech and their roles in a sentence or in a story.

This also stretches children's imaginations and increases their confidence in using new words. After all, it's just a game, They can experiment with new words without being afraid of looking dumb. There won't be any all-knowing adults or smart aleck peers around to laugh at him if the words make the story crazy or absurd. Instead, it will be fun. And they can change the words on the program's next go around.

Dark Stories

We have a family tradition. Each night, my three-year-old and six-year-old take a bath and get into their pajamas. Then they tumble into bed, climb under the covers, and I turn out the lights. Then I tell them a "dark story." (It might be happy or sad, frightening or funny. It's a *dark* story because it can be told only in the dark.)

I make up a new dark story each night. A dark story is usually a heroic fantasy with lots of evil monsters, princes, princesses, spaceships, and adventures. The stories change, but two things remain the same. First, my daughter Catie is always the story's heroine, my son Eric is always the hero. Second, no matter where the stories end up – in a dismal dungeon or on a faraway planet – they always start someplace that is familiar to my children. That someplace might be their bedroom, their school, or their backyard.

Computer Fairy Tales

I tell a new dark story each night. I don't tell a new story just because I love to be creative. I do it because my memory is so bad. By the time bedtime arrives each night, even the previous night's dark story is usually nothing more than a faint smudge in my memory.

You and your family can create a new dark story each night, too, regardless of the state of your memories and imaginations. The storyteller can be your computer.

You can write programs that combine dark stories with our fill-in-the-blank program. What you get are fractured *fairy tales*. The kids can invent the new words to add to the fairy tales each night. If they are old enough, they can type them in themselves. And you can turn off the lights in the room where you keep the computer to make the fairy tales into true-blue dark stories.

At the end of this month's column I have a sample computer "story game" program for you to try. It takes up 4024 bytes and is written in Atari BASIC. It is a very simple, straightforward program that consists mostly of PRINT statements. It should be easy to modify to run on other popular computers. The only fanciness in the program is that it makes the stories appear in the enlarged Atari (graphics mode 2) character set.

Once you see how to create your own computer fairy tale, you can add to the program or change it completely. Right now, for example, the program asks only for nouns (proper names, places, things). You can add adjectives, verbs, nonsense words, etc. Also, the story is in a fairy tale format appropriate for short bedtime dark stories. But it needn't be. You can rewrite the story to be about anything. Whatever appeals to you and your kids.

And if you are a teacher, not a parent, you can use the story idea in your classroom. You can make up a story-writing assignment that combines programming, language arts, and history or social studies. The subject of the story is up to you.

The Story Game Unraveled

Lines 50-120: Program documentation (REM statements) and a data section. The child's answers are stored in variables ten characters long to

accommodate normal-sized words. The words could be longer, but you have to keep the size of your screen in mind, or you get word wraparound (the tail end of the word gets printed on the next line).

Lines 500-940: On line 535, the program clears the screen. On lines 540-560, the program prints the *game title.* There is a delay loop on 560 and in many other places throughout the story to slow the story down to the reading level of the child. You need to adjust these loops up or down to fit your kid's reading level.

On lines 800-940, the program asks the child for words to complete the story. My kids almost always put themselves in as the story's heroes. Their other answers are usually a surprise. Sometimes they are a shock! (Watching the child fill in story parts can be a real learning experience for the alert parent or teacher.)

Lines 950-1390: Lines 950 to 1008 print out the story title (taken from the child's answers). The title is partly centered and displayed in a special color (blue).

On lines 1009 to 1350 the computer tells the story. The lines are double-spaced and designed to accommodate the child's answers so they fit on the screen. The story stretches across several screens. Each screen is fairly full without being crowded with words. You can think of each screen as a "page" in a storybook.

Lines 1365 to 1390 print "THE END" (a key story ingredient) in a special color (blue, again).

Lines 1395-1480: Lines 1395 to 1430 enable the child to see the same story again (over and over and over!). Or the child can go back to the beginning of the program and invent a whole new story.

When the child is tired of making up stories, he reaches lines 1435 to 1480. The program says good-bye to the child, then clears the screen one last time and closes up shop. The POKE command on line 1445 makes the Atari screen cursor turn invisible for the computer's "good-bye" message. The POKE command on line 1475 makes the cursor reappear.

Next Month

Next month I'll show you how to teach the computer friend introduced in this column last month how to play games. The sample game will be the "Story Game" program you see below. You will be able to add up to 50 games to the friend's repertoire.

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Story Game Program

```
50 REM ***************
55 REM THE STORY GAME
60 REM ***************
65 REM ***
70 REM *** PROGRAM HELPS
75 REM *** CHILD AND PARENT
80 REM *** INVENT THEIR OWN
85 REM *** FAIRY TALE.
90 REM ***
95 REM *** DATA SECTION
96 REM ***
110 DIM N1$(10),N2$(10),N3$(10),N4$(1
    0),N5$(10),N6$(10)
120 DIM ANSWER$(1)
500 REM ***
510 REM *** PROGRAM INTRODUCES
520 REM *** ITSELF
530 REM ***
535 PRINT "{CLEAR}"
540 SETCOLOR 0,14,10
550 POSITION 8,4:PRINT "*** THE STORY
     GAME ***":PRINT :PRINT
560 FOR I=1 TO 500:NEXT I
800 REM ***
810 REM *** PROGRAM ASKS FOR
812 REM *** KEY INGREDIENTS
814 REM *** OF STORY
815 REM ***
840 POSITION 8,7:PRINT "NAME
    ";:INPUT N1$
870 POSITION 8,9:PRINT "ENCHANTED PLA
    CE";:INPUT N2$
890 POSITION 8,11:PRINT "VILLAIN";:IN
    PUT N3$
910 POSITION 8,13:PRINT "BAD PLACE";:
    INPUT N4$
930 POSITION 8,15:PRINT "MAGIC THING"
    ;:INPUT N5$
940 POSITION 8,17:PRINT "SILLY CREATU
    RE";:INPUT N6$
950 REM ***
960 REM *** PROGRAM TELLS STORY
970 REM ***
1000 GRAPHICS 2+16
1001 SETCOLOR 0,6,10
1003 POSITION 6,3:PRINT #6;N1$;" AND"
1004 POSITION 6,5:PRINT #6;"THE MAGIC
     "
1005 POSITION 6,7:PRINT #6;N5$
1008 FOR I=1 TO 1500:NEXT I
1009 GRAPHICS 2+16
1010 PRINT #6;" ONCE UPON A TIME,"
1015 PRINT #6;" "
1020 PRINT #6;" A BRAVE CHILD"
1025 PRINT #6;" "
1030 PRINT #6;" NAMED ";N1$
1035 PRINT #6;" "
1040 PRINT #6;" WENT EXPLORING"
1045 PRINT #6;" "
1050 PRINT #6;" IN AN ENCHANTED"
1052 PRINT #6;" "
1055 PRINT #6;" ";N2$;"."
1060 FOR I=1 TO 1500:NEXT I
1070 GRAPHICS 2+16
1080 PRINT #6;" IN THE ";N2$
1085 PRINT #6;" "
1090 PRINT #6;" LIVED A HUGE,"
1095 PRINT #6;" "
```

```
1100 PRINT #6;" EVIL ";N3$
1105 PRINT #6;" "
1106 PRINT #6;" WHO LOVED"
1107 PRINT #6;" "
1110 PRINT #6;" TO EAT CHILDREN."
1115 FOR I=1 TO 1500:NEXT I
1116 GRAPHICS 2+16
1120 PRINT #6;" THE ";N3$
1125 PRINT #6;" "
1126 PRINT #6;" TRAPPED ";N1$
1127 PRINT #6;" "
1130 PRINT #6;" AND PUT"
1135 PRINT #6;" "
1140 PRINT #6;" ";N1$;" IN A DARK,"
1145 PRINT #6;" "
1150 PRINT #6;" STINKY ";N4$;"."
1155 FOR I=1 TO 1500:NEXT I
1156 GRAPHICS 2+16
1160 PRINT #6;" ";N1$;" SNEAKED"
1165 PRINT #6;" "
1170 PRINT #6;" OUT OF THE"
1175 PRINT #6;" "
1180 PRINT #6;" ";N4$;" AND"
1185 PRINT #6;" "
1190 PRINT #6;" GRABBED"
1195 PRINT #6;" "
1200 PRINT #6;" THE ";N3$;"'S"
1201 PRINT #6;" "
1202 PRINT #6;" MAGIC ";N5$;"."
1210 FOR I=1 TO 1500:NEXT I
1220 GRAPHICS 2+16
1230 PRINT #6;" ";N1$;" WAVED THE"
1235 PRINT #6;" "
1240 PRINT #6;" ";N5$;" AND"
1245 PRINT #6;" "
1246 PRINT #6;" TURNED THE"
1247 PRINT #6;" "
1250 PRINT #6;" ";N3$;" INTO "
1255 PRINT #6;" "
1260 PRINT #6;" A FAT, LAZY"
1265 PRINT #6;" "
1266 PRINT #6;" ";N6$;"."
1270 FOR I=1 TO 1500:NEXT I
1280 GRAPHICS 2+16
1290 PRINT #6;" ";N1$;" CHASED THE"
1295 PRINT #6;" "
1300 PRINT #6;" ";N6$;" THROUGH"
1301 PRINT #6;" "
1302 PRINT #6;" THE ";N2$;"."
1310 PRINT #6;" "
1311 PRINT #6;" THEN ";N1$;" RAN"
1315 PRINT #6;" "
1320 PRINT #6;" ALL THE WAY"
1325 PRINT #6;" "
1330 PRINT #6;" BACK HOME."
1350 FOR I=1 TO 1500:NEXT I
1360 GRAPHICS 2+16
1365 SETCOLOR 0,6,10
1370 POSITION 2,5:PRINT #6;"**  THE E
     ND  **"
1390 FOR I=1 TO 1500:NEXT I
1395 REM ***
1396 REM *** WOULD CHILD LIKE THE
1397 REM *** SAME STORY AGAIN?
1398 REM ***
1400 GRAPHICS 0
1402 PRINT "WOULD YOU LIKE TO SEE"
1403 PRINT "THE SAME STORY AGAIN";:IN
     PUT ANSWER$
1404 IF ANSWER$="Y" THEN 1000
1405 IF ANSWER$<>"N" THEN 1400
1406 REM ***
1407 REM *** WOULD CHILD LIKE TO
1408 REM *** INVENT A NEW STORY?
1409 REM ***
1410 GRAPHICS 0
1411 PRINT "WOULD YOU LIKE TO"
1415 PRINT "INVENT A NEW STORY";:INPU
     T ANSWER$
1420 IF ANSWER$="Y" THEN 535
1430 IF ANSWER$<>"N" THEN 1410
1435 GRAPHICS 0
1440 POSITION 6,8
1445 POKE 752,1
1450 PRINT "***  BYE!  BYE!  BYE!  **
     *"
1460 FOR I=1 TO 600:NEXT I
1470 GRAPHICS 0
1475 POKE 752,0
1480 END
```

A Monthly Column
Learning With Computers

A good simulation is a game so real, so responsive, that it seems to imitate a real situation. Here are two reviews of excellent educational simulations and some ideas on how to create a simulation of your own.

Computer Simulations: Learning Through Exploration, Discovery, And Play

Glenn Kleiman
Teaching Tools: Microcomputer Services
Palo Alto, CA

I hear and I forget;
I see and I remember;
I do and I understand.

Many educators have extolled the virtues of learning through exploration, discovery, and play. These modes of learning are active – guided by the learner's own curiosity and interests. They provide opportunities to acquire new information, discover general principles, test ideas, and develop thinking and problem-solving skills. Active learning is both more enjoyable and more effective than learning that is imposed upon students. In *Democracy and Education,* the American philosopher John Dewey, one of the most influential advocates of active, experiential learning, wrote:

> The fundamental fallacy in methods of instruction ... consists in supposing that we can begin with ready-made subject matter of arithmetic, or geography, or whatever, irrespective of some direct personal experience.... The first stage of contact with any new material must inevitably be of the trial and error sort. An individual must actually try, in play or work, to do something with material ... and then note the interaction of his energy and that of the material employed. This is what happens when a child at first begins to build with blocks, and it is equally what happens when a scientific man in his laboratory begins to experiment with unfamiliar objects.... [Effective methods of education] give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results.

Active learning has traditionally been limited by the number of objects, places, and experiences available for students to explore. But suppose we could make almost any type of experience available to students. They could learn about zero gravity environments by spending an hour in one. They could learn about city government by becoming the mayor and members of the city council. They could perform genetic engineering experiments with DNA, no matter how dangerous and unfeasible such experiments would be in actuality. They could experience being businessmen, air traffic controllers, architects, real estate brokers, generals, explorers, archeologists, or astronauts. Computer simulations make it possible for students to experience some aspects of all these roles and situations.

A computer simulation is a dynamic representation of a real object, situation, or environment. A representation reflects the main properties of an actual object or event as, for example, a map represents a city. A map, however, is static – it does not change in response to any type of actions. A simulation is called a *dynamic* representation because it responds and changes in a manner analogous to the real object, situation, or environment. Simulations can be actively explored, and students can

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learn from experiencing how the simulation responds to their actions.

Some simulations, such as the board game Monopoly, are familiar to almost everyone. Monopoly is a simulation of a real estate market. Each player assumes the role of an investor who buys, sells, and trades properties, trying to gain good locations to build houses and hotels, thereby amassing a fortune.

Children can learn a great deal from playing Monopoly. The game involves rents, taxes, utility bills, and banking, as well as financial successes and failures. Players must decide how to spend a limited amount of money wisely, and they learn about making investments for future returns. They practice and develop skills at negotiating, skills that can be developed only through experience. Money is constantly exchanged, so math skills are developed. I first learned about percentages as a result of landing on the dreaded income tax square and having to pay 10% of my assets. Some reading is required – I also learned the meaning of *assets*.

Simulations are never complete and precise representations. The aim of a simulation is to capture the main characteristics of what is being represented. The precision and completeness required depend upon the purposes for which the simulation will be used. For example, a fairly simple simulation of an airplane is sufficient for children, but a precise, detailed simulation is required to train pilots.

Computer simulations can be more complex, precise, and complete than any other type of simulations. Many things, such as zero-gravity environments and genetic engineering experiments, can be reasonably simulated only with a computer. Computer simulations can capture more aspects of reality and give people more flexibility in how they explore and experience the simulated environment.

A Roadtrip Simulation

A program called *Roadtrip* is a good example of a simulation which is both enjoyable and educational for children. Like many simulations, *Roadtrip* takes the form of a game. The aim of the game is to complete a 900-mile car trip from Dullsville to Greenstone Park. The player has a maximum of two days and $200 to spend. Along the way, he has to make many decisions like those in an actual trip.

The *Roadtrip* program is for Apple II computers and makes excellent use of high resolution, color graphics. The screen displays show a car dashboard and the views through the windshield and rear view mirror (see Figure 1). The dashboard has a speedometer, odometer, gas gauge, clock, alternator, and oil warning lights. The views

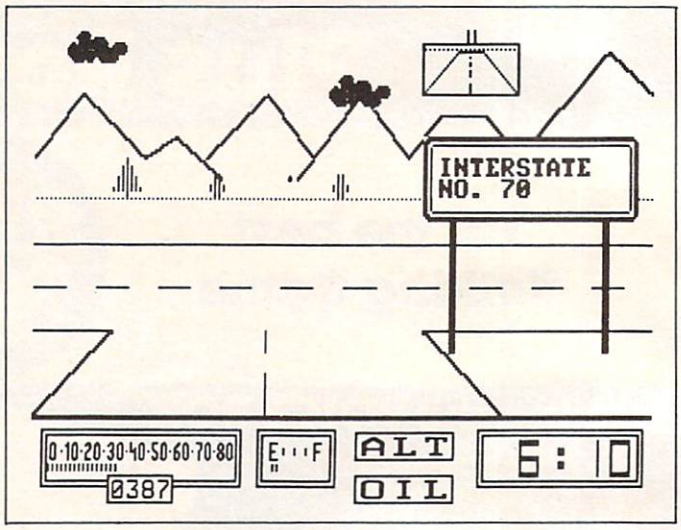

Figure 1.

through the windshield and rear view mirror change each time the car moves. The programmers of *Roadtrip* paid careful attention to every detail. For example, the sun comes up in the morning, and the stars appear at night.

While in the car, players have seven commands available. Pressing *F* moves the car forward; *R*, *L* and *T* turn the car to the right, left or completely around; *S* lets the player change the speed; *$* displays how much money is left; and *M* displays a map. The map is important: there are many crossroads and it is easy to get lost. Many a *Roadtrip* traveler has ended up in the swamp or Slipdisk City.

Along the way, players pass through towns where they can purchase gas, go to a restaurant, and check into a hotel. If you run out of gas, the game is lost. Failing to get sufficient food and rest increases the likelihood of an accident. If you get to a town late at night, the gas station and restaurant may be closed.

This simulation contains a number of events which may occur along the way. The computer's randomization capability is used, so it is impossible to predict if and when each event will occur. You may get a flat tire or have other car problems, have to wait for trains, pass hitchhikers, run into roads closed for construction, and so on. If you exceed the speed limit, you are likely to be stopped by a police car, be delayed, and have to pay a fine. Excessive speed, like lack of food and rest, makes accidents more likely.

Roadtrip provides an opportunity for children to explore and learn about car travel. Map reading is critical to success, as is careful attention to the amount of money being spent, getting enough food and sleep, and obeying speed signs. This program lets children experience in play many of

the situations people encounter while traveling.

Roadtrip was created as a class project by students of Jay Dean at the University of Minnesota. For Apple II computers with Applesoft, it is a public domain program, available (with two other class project simulations) for $10 from Softswap, San Mateo County Office of Education, 333 Main Street, Redwood City, CA 94063. For a catalog and order forms, send $1.00. *Roadtrip* uses a utility program called *Higher Text* to create type fonts. You do, however, have to obtain *Higher Text* and transfer the files to the *Roadtrip* disk. *Higher Text* is available for $40 from Synergistic Software, 5221 120th Avenue, S.E. Bellevue, WA 98006. (*Higher Text* is a very useful utility program if you do any programming yourself. It lets you create all kinds and sizes of type fonts on the Apple high resolution screen.)

A Logic Machine's Simulation

I have just received a review copy of an innovative new program which includes computerized simulations, tutorials, and demonstrations, combined into an educational game. The program, called *Rocky's Boots*, teaches about the building blocks of computer systems, such as AND, OR and NOT logic gates, flip-flops, clocks, delays, sensors and actuators. The operation of each device is explained and demonstrated. The simulation game has players use simple logical devices to build and test machines.

There are six levels in the program. Within each level is a set of rooms, each of which contains an explanation, demonstration, exercise, or other information. The player controls a cursor, moving it among the rooms by using either a joystick or the keyboard.

The first level of the program teaches how to move and pick up objects. The second level begins the lessons on building machines. The cursor contains electricity, so when it is placed on a socket of a device, electricity flows through the device. The flow of electricity is shown by the color orange.

Several *actuators* (devices which perform actions when connected to electricity) are introduced. These include a clacker which makes noise, a thruster which moves, and a boot which kicks. The player must discover what each one does by activating it with electricity from the cursor.

The concepts of *input* and *output* are then illustrated, and *sensors* are introduced. Each sensor detects a certain class of objects. One sensor detects green objects, another detects square objects, and so on. When a sensor detects an object, it sends electricity out. Players can, for example, connect a green sensor to a boot actuator, so that whenever a green object is detected, the sensor will send electricity to the boot actuator, which will then kick the green object. The program provides several practice rooms in which players can build and test all sorts of machines.

After some of the fundamentals are mastered, players are introduced to NOT, AND and OR logical gates. A NOT gate has one input line. When there is no electricity at the input line, the NOT gate sends electricity through its output line. When there is electricity at the input line, none is sent out. AND and OR gates each require two inputs. AND gates send electricity out only when there is electricity at both inputs. OR gates send electricity out when there is electricity at either one (or both) of the inputs.

Once these devices are understood, players are ready to try various games. Each game involves building a machine which will kick certain objects. For example, in one game the machine is to kick circles and squares, but not to kick triangles or crosses. Players receive points when their machine kicks an appropriate object and lose points if their machine kicks an inappropriate object. Once the machine is built, the player can throw a switch which causes various objects to flow into the room. The machine can be slowed or stopped at any point so its operation can be watched carefully.

Figure 2 shows a device which will kick squares and circles. The two boxes on the right are sensors. The top one detects circles, the bottom one detects squares. They are connected by wires to the input lines of an OR gate. The output line of the OR gate is connected to a boot actuator. When a square or circle comes into the room, the appropriate sensor will detect it and send electricity to the OR gate. Since electricity at either input causes electricity at the output of the OR gate, power is sent to the

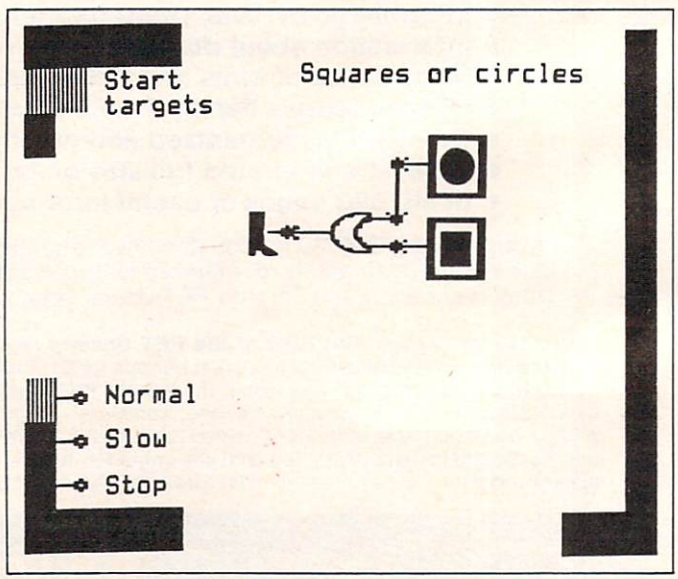

Figure 2.

boot, which kicks the object.

The other levels of the program add more devices, such as flip-flops, clocks, and delays. It then presents a series of games requiring the building of progressively more complex machines. Players can explore all sorts of combinations of simple logical devices.

Students can learn a great deal by actively exploring and playing with *Rocky's Boots*. It presents a carefully structured environment so that new knowledge and understanding are built step-by-step. Children can explore this environment at their own speed and follow wherever their interests lead. *Rocky's Boots* is an exciting and innovative program, one which makes the often proclaimed educational potential of personal computers a reality.

Rocky's Boots is available for $75 from The Learning Company, 4370 Alpine Road, Portola Valley, CA 94025.

Creating A Simulation Program

Many other simulations are available. Some examples are: *Lemonade*, a simulation of a very small business; *Oregon Trail*, a simulation of traveling across the U.S. in the 1800s; *Three-Mile Island*, a simulation of controlling a nuclear reactor; *Windfall*, a simulation of the oil market; and *Air Traffic Controller*.

Since simulations are widely touted as having great educational potential, it may seem surprising that few good simulations are available. The reason is that good simulations are very difficult to create.

In order to create a simulation, you must first create a model of what is being simulated. You then translate the model into a computer program, designed for students to learn by exploring and playing. Often it is necessary to simplify the model, so students can manipulate certain factors and come to understand their effects.

Consider, for example, what we would have to do to create a simulation game which would allow students to role-play running a city government. Perhaps we could have one student take the part of the mayor and others the police chief, chairman of the board of education, city council members, and so on.

Students would have to control raising and spending money in their simulated city. We could arrange the program so students can set sales tax and property tax rates. But of course simply raising taxes does not always bring in more money. Raising sales taxes in a city often leads to more people shopping outside the city, so fewer tax dollars are collected. Raising property taxes may lead to businesses leaving the city, thereby lowering the tax base. The simulation program would have to include equations which reflect the effects of these factors. We might also include other ways cities raise money, such as from the state or federal government, tourism, or municipal bonds.

The students should be able to allocate how the available funds would be spent. In a realistic simulation, the city would not have sufficient income for everything the city council would like, so the various departments would have to compete for funding. The simulation should reflect some of the complexity of real cities. For example, departments which pay their employees well might function most efficiently, but overpaying some employees can cause problems. For example, raising police department salaries might result in reduced crime, but it might also cause the firemen to strike for equal wages.

Random events might be built into the simulation. A snowstorm, hurricane, or epidemic could cause difficulties which require funds to be reallocated. A gas shortage would put an excess strain on public transportation, while a visit by a foreign dignitary would require many policemen to work overtime, straining the department's budget.

We would also have to consider evaluating how well the students run the city. Do we require a balanced budget, good schools, public transportation, sanitation and parks, and minimal crime? Should we count whether more people and businesses move into the city than leave it? What about the amount of tourism?

I have described just a few of the initial considerations in creating this simulation. Many other factors could be included, and the program should reflect some of the complex interactions of a real city. Creating a good simulation program requires an expert's knowledge of what is being simulated, combined with skill in designing and implementing programs.

Computer simulations provide new ways of teaching and learning. They certainly have great potential in education. However, creating programs which fulfill this potential is a difficult task, one which requires a great deal of effort by talented and knowledgeable people. ©

In Part I last month you were introduced to two Applesoft programs that create a powerful new language for the Apple. This language, called Turtle PILOT, combines PILOT, turtle graphics, and all of Applesoft's commands and functions. Turtle PILOT resembles Atari PILOT, allowing you to translate PILOT programs for the Atari to the Apple. The features of Turtle PILOT described last month were just the beginning. This month, along with the PILOT language for Atari, we will deal with the most interesting features of Turtle PILOT: the turtle graphics. Turtle graphics will add new commands to your computer which make high resolution graphics easier. At the end of this article you will find listings of three example programs in Turtle PILOT. These programs can be typed using the Editor and then translated to Applesoft or Atari BASIC with the Translator, as described in Part I.

Part 2

Turtle PILOT:

Including PILOT For Atari

Alan Poole
Loomis, CA

Introduction To Turtle Graphics

Turtle graphics gives you control over an imaginary and invisible turtle that lives on the screen. This turtle has a set of colored pens. When you instruct the turtle to move, it will leave a trail with its pens. All turtle commands must be preceded by a G: instruction. If there are no commands in the object of a G: instruction, page one of Apple high resolution graphics will be turned on without clearing. (This would result in Graphics 7 on the Atari.) Below is a description of each of the 11 turtle commands. Each description is followed by several examples using the command.

CLEAR

The CLEAR command sets Apple's high resolution graphics page one and clears the screen. (Atari goes to full-screen Graphics 7 and clears the screen.) This is identical to Applesoft's HGR command.

```
G:CLEAR
GY:CLEAR
```

TURN

The TURN command is followed by an expression. The value of the expression is the number of degrees added to the angle the turtle is presently headed. A positive number turns the turtle clockwise, and a negative number turns it counterclockwise.

```
G:TURN 90
G:TURN A
G(V<10):TURN N+INT(X*RND(1))
```

TURNTO

This command will change the angle of the turtle. The turtle's angle will be set equal to the value of the expression following the TURNTO command. Zero degrees is north, 90 degrees is east, 180 degrees is south, and 270 degrees is west.

```
G:TURNTO 20
GN:TURNTO ABS(K)+8
```

DRAW

The DRAW command will move the turtle at the angle it is presently heading, leaving a trail on the screen as it moves. The value of the expression following the DRAW command is the distance the turtle will move. If the turtle hits the edge of the screen, it will stay at the edge.

```
G:DRAW 25
G:DRAW D-6
GY(L<>1):DRAW RND(1)*50
```

GO

The GO command is similar to the DRAW command, except the turtle will not leave a trail.

```
G:GO 50
GY:GO S1+ABS(S2)
```

GOTO

This command moves the turtle to new coordinates on the screen without leaving a trail. The GOTO command is followed by the x and y coordinates separated by a comma. The coordinates the turtle uses are more like a normal graph than Applesoft's high resolution coordinates. The origin is in the middle of the screen instead of the upper left-hand corner. As you move up the graph, the y coordinate increases. As you move to the right, the x coordinate increases. The range of x coordinates is from -139 to 140, and the range of y coordinates is from -111 to 80.

```
G:GOTO 0,10
GN:GOTO -50,-5
GY(W>5):GOTO X,Y*N+2
```

PEN

The PEN command changes the color of the pen which the turtle uses to draw. It may be followed by the color names BLACK, GREEN, VIOLET, WHITE, BLACK2, RED, BLUE, or WHITE2. If the colors on your monitor are different, the color names can be changed in lines 5410-5445 of the Translator program. The PEN command may also be followed by UP or DOWN. Setting the pen to UP will cause all DRAW commands to move the

turtle without leaving a trail. DOWN will return the pen to normal. A final option with the PEN command is to use the color ERASE. This will set the pen to the background color, which is normally black unless changed with a SCREEN command.

```
G:PEN RED
G:PEN ERASE
G(C=1):PEN UP
```

SCREEN

This command will clear the entire screen to the color that follows the SCREEN command. The color names are listed above under the PEN command.

```
G:SCREEN BLUE
GN:SCREEN WHITE2
```

FULL

Sets full screen graphics mode with no text at the bottom of the screen.

```
G:FULL
```

MIX

Sets the mixed text and graphics mode with four lines of text at the bottom of the screen.

```
G:MIX
```

QUIT

The QUIT command turns off the high resolution graphics and returns to the text mode. It is identical to Applesoft's TEXT command.

```
G:QUIT
```

Multiple Turtle Commands On A Line

The object of a G: instruction can hold up to six turtle commands. The commands are separated by semicolons. Below are some samples of multiple turtle commands on the same line.

```
G:DRAW 20; TURN 90
G:CLEAR; SCREEN BLUE; PEN RED; TURNTO 10
```

Turtle Loops

Suppose you want to draw a square. You could use the following series of commands.

```
G:DRAW 50
G:TURN 90
G:DRAW 50
G:TURN 90
G:DRAW 50
G:TURN 90
G:DRAW 50
G:TURN 90
```

This seems like a lot of work to draw a simple square. Wouldn't it be easier if there were a simple way to loop turtle commands? This is one of the features included in Turtle PILOT. You can place up to six turtle commands between parentheses and put an integer in front of them for the number of times to loop them. For example, the following instruction would draw the same square as the eight instructions above.

```
G:4(DRAW 50; TURN 90)
```

There are limitations with these loops. A loop cannot be placed inside another loop. Also, a command cannot be outside a loop on the same line. The following instructions would *not* be legal in Turtle PILOT.

```
G:4(DRAW 30; 3(TURN 120; DRAW 10))
G:PEN WHITE; 6(DRAW 75; TURN 60)
G:10(DRAW L; TURN 36); QUIT
```

Using High Resolution Page Two

If you write a long Turtle PILOT program that uses turtle graphics, you may find that there isn't enough memory. An extra 8K in the Apple's memory can be used by drawing on page two of high resolution graphics instead of page one. To do this, use a B:HGR2 instruction instead of G:CLEAR. All other turtle commands will work normally on page two.

PILOT Variables

Last month I mentioned that variables beginning with Q cannot be used in a Turtle PILOT program. This is not exactly true, but you must know how to use them correctly. Q variables are used in the translated program to execute some of the PILOT instructions. Below is a description of each of the variables and some possible uses for them in programs.

QM: This variable holds the number of the item that successfully Matched last. If more than one item Matched, QM will equal the number of the first item. This variable can be very useful, especially with programs containing a question with multiple choice answers. Program 3 with this article illustrates this.

QC: Conditioner flag, 0 = N, 1 = Y.

QR: Right margin, normally set to 40.

QI$: User's last response with an Accept instruction. The Match instruction normally uses the last response, but a string can be used instead by setting QI$ equal to the string immediately before the Match instruction. For instance, the following instructions would search for the word "TO" in R$.

```
C:QI$=R$
M:TO
```

QX,QY: Coordinates of the turtle.

QA: Angle of turtle.

QL: Length of line drawn by turtle.

QP: Pen position, 1 = UP, 0 = DOWN.

QB: Number of background color. Changes after a SCREEN command.

Q$(25): List of items to be Matched.

Q(31): List of values for pitches of notes.
QT$: String to be Typed.
Q1, Q2, QT, QI, QK$: Temporary variables.

Next month will be the third and last article on Turtle PILOT. We'll translate an Atari PILOT program to Turtle PILOT, provide some documentation on the Editor and Translator programs, and include PILOT for Commodore machines. If you want more information on turtle graphics and PILOT, read the "Friends Of The Turtle" column in **COMPUTE!**.

Program 1.

```
1 *EXAMPLE 1
2 R:DRAWS INTERESTING PATTERNS
3 B:TEXT:HOME
4 T:TYPE AN ANGLE (BETWEEN 70 AND 150 IS BES
    T).
5 A:A
6 G:CLEAR;GOTO 0,-17; TURNTO 0; PEN WHITE; F
    ULL
7 C:L=1
8 *DRAW
9 G:DRAW L; TURN A
10 C:L=L+2
11 J(L<125):*DRAW
12 E:
```

Program 2.

```
1 *EXAMPLE 2
2 R:DRAWS STARS OF RANDOM SIZE
3 G:CLEAR; FULL; PEN WHITE
4 *START
5 C:X=RND(1)*220-139+30
6 C:Y=RND(1)*132-111+30
7 G:GOTO X,Y
8 U:*STAR
9 C:STARS=STARS+1
10 J(STARS<10):*START
11 E:
12 *STAR
13 C:SIZE=INT(RND(1)*25+5)
14 S:SIZE,75
15 G:5(DRAW SIZE; TURN 144)
16 E:
```

Program 3.

```
1 *EXAMPLE 3
2 R:EXAMPLE OF USING QM
3 T:WHAT IS THE NAME OF THE LARGEST OCEAN
4 T:          ATLANTIC OCEAN
5 T:          PACIFIC OCEAN
6 T:          INDIAN OCEAN
7 *ANSWER
8 A:
9 M:ATLANTIC,PACIFIC,INDIAN
10 J(QM=1):*ATLANTIC
11 J(QM=2):*PACIFIC
12 J(QM=3):*INDIAN
13 T:PLEASE TYPE ONE OF THE THREE ANSWERS.
14 J:*ANSWER
15 *ATLANTIC
16 T:NO, THE ATLANTIC OCEAN IS THE SECOND LAR
    GEST OCEAN. TRY AGAIN.
17 J:*ANSWER
18 *PACIFIC
19 T:YES, THE PACIFIC OCEAN IS THE LARGEST OC
    EAN.
20 E:
21 *INDIAN
22 T:NO, THE INDIAN OCEAN IS THE THIRD LARGES
    T OCEAN. TRY AGAIN.
23 J:*ANSWER
```

Turtle PILOT For The Atari

Charles Brannon
Editorial Assistant

Use Program 1, the Turtle PILOT Editor, to enter and edit PILOT programs. Program 2, the Translator, converts your PILOT program into a BASIC program that is ready to RUN. Program 1 requires 32K with a disk, or 24K with a cassette. Program 2 requires 40K with a disk, or 32K with a cassette. By adjusting the MAX variable (line 1410 in Program 1, line 240 in Program 2), you may be able to adapt PILOT to systems with less RAM.

Using Atari Turtle PILOT

Using the Turtle PILOT Editor is like typing in a BASIC program, but there are some important differences. The Editor has 13 commands to help you type in, edit, save, and load PILOT programs (see the Quick Reference Chart). Each command is acknowledged with an "OK" prompt. If you see the "READY" prompt, you've somehow returned to BASIC.

The ADD command is used to enter programs sequentially. Just type "ADD," and you will be prompted with a line number. You can then type in a PILOT line, which will be added to the end of your program. For example,

```
1>T:What is your name?
2>A:NAME$
3>
```

Press RETURN> alone on a line to exit the ADD command. While in the ADD mode, you can't cursor up to change previous lines, so be careful. You must use ADD to add lines to the bottom of your program, but you can use cursor-based editing to change any line already typed. Simple syntax

checking is performed. The line must start with a valid PILOT command and must contain a colon.

List, Insert, Delete

LIST is used, as in BASIC, to display the program you are working on. Just type "LIST," and you will be asked for the starting and ending lines to list. "Default" answers are automatically provided, so if you want to list the whole program, just press RETURN twice. Otherwise, type over the default answers. While the program is listing, you can press "ESC" (for Escape) to abort the listing (used like the BREAK key, which is disabled in this program).

LMOD will find and list a specified module. For example, if you have a module named "*TURTLE," just type LMOD, and answer the prompt with "TURTLE" (the asterisk is supplied for you).

If you want to insert a line between two lines, enter "INS" (for INSert), and answer the prompt with the line number at which you wish to insert. The given line and all following lines will be "pushed down," and the given line will show as "BLANK." You can then LIST the program and cursor up to the blank line and make your addition.

To delete a line from a program, just type in its line number and press RETURN. The program will be automatically renumbered. To delete a range of lines, just type "DEL" and enter the start and end lines of the block of lines you want to delete. Use the NEW command to erase the entire program.

When using LOAD and SAVE, supply the complete filename (either C: or D:name), but don't use the optional three-character extender, as this is supplied automatically by the program. If you have a PILOT program in memory and type LOAD, the Editor will assume you want to append a program to the end of the one in memory. If you don't wish to do this, hit RETURN to exit the LOAD command, enter "NEW," and then type LOAD again.

Disk users will find the "DIR" command very helpful. It displays the directory of drive 1. Used in conjunction with PON, you can have a hardcopy listing of the directory. The PON command "turns on" the hardcopy option. After a PON command, all output will be sent to the printer (assuming you have one attached and turned on). You can use this feature to print listings of your PILOT programs. Use POFF to "de-select" the printer.

You can exit the Editor with either "BYE" or "RUN." The former will simply restore the break key, clear the screen, and return you to BASIC. "RUN" will run the Translator on disk-based systems. Make sure you save the program you're working on before you use "RUN" or "BYE."

Operation of the Translator is very simple. Just answer the filename prompt with the name of your PILOT program (you don't have to type D:). If you are using a cassette, position the tape to read the PILOT program, press PLAY, and answer with "C:". Press RETURN when you hear the beep. The Translator will then read in the PILOT

Quick Reference Chart

Editor Commands

ADD	Adds lines to program from keyboard.
LIST	Displays program.
LMOD	Lists module.
INS	Inserts line.
DEL	Deletes range of lines.
NEW	Erases program.
LOAD	Enters or appends program from tape or disk.
SAVE	Saves program to tape or disk.
DIR	Lists disk directory.
PON	Sets hardcopy feature.
POFF	Clears hardcopy feature.
RUN	RUNs Translator (disk only).
BYE	Exits to BASIC.

Turtle PILOT Commands:

T: Type line. Use $ and # to include variables.
A: Accept (ask for) input.
M: Match last accept with list of items separated by commas. Sets Y/N flag.
J:*LABEL Jump to indicated label.
U:*MODULE Use (call, GOSUB) indicated module (subroutine).
E:END Used to stop program or end a module.
C:Compute. Used to calculate variables. Similar to B:
R:Remark. Used to comment your program, like REM in BASIC.
S:Sound x,y x = tone, y = duration. Uses only voice 0. Use B: and SOUND for other effects.
B:line Compile a BASIC line.
* (No colon) Indicates a label.
G:Graphics (see below)

Graphics Subcommands

CLEAR	Clears screen; enters Graphics 7.
TURNTO A	Points turtle to angle A.
TURN A	Rotates turtle A degrees.
DRAW N	Moves turtle N units, leaving a trail.
GO N	Moves N units without leaving a trail.
PEN RED	
PEN GREEN	
PEN BLUE	
PEN ERASE	Selects drawing color.
PEN UP	
PEN DOWN	Permits or prevents drawing.
SCREEN ATARI	
SCREEN APPLE	Sets scale of drawing. (See text.)
GOTO X,Y	Go to absolute coordinate (-79,79; -47,47).
FULL	Removes text window.
MIX	Enables text window.
QUIT	Goes to Graphics 0.

program and start to work on the translation. If you have a cassette, insert a blank tape, rewind it, and press RETURN when you hear two beeps.

When the Translator is finished, you can use ENTER to read the completed BASIC program into memory. (Use ENTER"C" for cassette or ENTER"D:name.ENT" for disk, where "name" is the name of the program.) The Translator automatically NEWs itself out on completion, so you don't have to worry about the program-merging effect of ENTER. You may want to change the "NEW" on line 390 to "END" while you are typing in and correcting the program. For safety's sake, SAVE a copy of the Translator before you RUN it.

The "BASIC" program which results from your efforts will run as is and will mimic the action of the PILOT program, albeit slower.

A Note On Graphics

This PILOT system was converted from the Apple version published last issue. Since Apple graphics differ from Atari graphics, a few things need to be mentioned. The Apple used high-resolution page one, which permits eight simultaneous colors, while the Atari version uses Graphics 7, a four-color mode with less resolution than the Apple screen. To allow Atari users to enter Apple programs without changes, the SCREEN command can be used in your PILOT program to select the "scale" of points plotted. SCREEN ATARI is the default mode, but if your program includes SCREEN APPLE, all coordinates are "scaled" from Apple coordinates (0-279) to Atari coordinates (0-159). All unimplemented Apple colors are plotted in COLOR 1.

Program 1.

```
100 REM TURTLE PILOT EDITOR
110 REM
120 GOSUB 1300:POKE 752,0
130 FOR W=15 TO 0 STEP -1:SOUND 0,10,
    10,W:NEXT W
140 SETCOLOR 4,6-5*PON,2+4*PON:? :? "
    OK."
150 INPUT #1;IN$:IF IN$="" THEN 150
160 IF IN$(1,1)=" " THEN IN$=IN$(2):G
    OTO 160
170 TRAP 190:V=VAL(IN$):IF V>0 AND LE
    N(IN$)>=LEN(STR$(V))+2 THEN IN$=I
    N$(LEN(STR$(V))+2):TRAP 40000:GOT
    O 580
180 IF V>0 AND V<=EL THEN A=V:B=V:GOT
    O 1030
190 IF IN$<>"DIR" THEN 230
200 TRAP 1190:CLOSE #2:OPEN #2,6,0,"D
    :*.*":TRAP 220
210 INPUT #2;IN$:? #6;IN$:GOTO 210
220 CLOSE #2:TRAP 40000:GOTO 130
230 IF IN$<>"PON" THEN 260
240 PON=0:TRAP 250:CLOSE #6:OPEN #6,8
    ,0,"P:":TRAP 40000:PON=1:GOTO 130
250 CLOSE #6:OPEN #6,8,0,"E:":SETCOLO
    R 2,6,2:? "Printer not ready.":?
    :GOTO 130
260 IF IN$="POFF" THEN CLOSE #6:OPEN
    #6,8,0,"E:":SETCOLOR 2,6,2:PON=0:
    GOTO 130
265 IF IN$="BYE" THEN GRAPHICS 0:POKE
     16,192:POKE 53774,192:END
270 IF IN$<>"RUN" THEN 320
280 ? "Press RETURN to RUN translator
    ,":? "Press ESC to abort...";
290 IF PEEK(764)=255 THEN 290
300 ? :IF PEEK(764)=12 THEN POKE 764,
    255:POKE 16,192:POKE 53774,192:RU
    N "D:PILOT.XLT":REM RUN TRANSLATO
    R
310 POKE 764,255:GOTO 130
320 IL=LEN(IN$)
330 F=0:FOR I=1 TO 8:IF IN$=CMD$(I*4-
    3,I*4-(IL<4)) THEN F=I:I=9
340 NEXT I:IF F THEN 370
350 GOSUB 390:REM ERROR SOUND
360 ? :? IN$;"? -- WHAT'S THAT?":GOTO
     140
370 ON F GOTO 420,610,750,880,1000,11
    00,1120,1210
380 STOP
390 FREQ=ASC(IN$)
400 FOR W=0 TO 15:SOUND 0,FREQ,12,W:N
    EXT W:FOR W=15 TO 0 STEP -0.2:SOU
    ND 0,FREQ,12,W:NEXT W:RETURN
410 REM ADD
420 ? :? EL+1;">";:INPUT #1;IN$
430 IF IN$="" THEN 140
440 ZL=EL:GOSUB 470
450 EL=EL+1:GOTO 420
460 REM * ENTER LINE *
470 IF IN$(1,1)=" " THEN IN$=IN$(2):G
    OTO 470
480 K=ASC(IN$):REM * SYNTAX CHECK *
490 F=0:FOR I=1 TO 12:IF K=ASC(PILOT$
    (I)) THEN F=I
500 NEXT I:IF F>0 AND F<12 THEN 530
510 IF F=12 THEN 560
520 GOSUB 390:? "{ESC}";CHR$(K);":  i
    s not a PILOT command":? :POP :GO
    TO 150
530 F=0:FOR I=1 TO LEN(IN$):IF IN$(I,
    I)=":" THEN F=1:I=LEN(IN$)
540 NEXT I:IF F THEN 560
550 GOSUB 390:? IN$;"? No colon":? :G
    OTO 150
560 LL(ZL)=LEN(IN$):L$(ZL*80+1,ZL*80+
    LL(ZL))=IN$
570 RETURN
580 IF V>EL THEN GOSUB 390:? "Use ADD
     to add to end.":GOTO 140
590 ZL=V-1:GOSUB 470:GOTO 150
600 REM LIST
610 IF EL=0 THEN GOSUB 390:? :? "No l
    ines to list!":GOTO 140
620 TRAP 620:? "Starting from line?1
    {2 LEFT}";:INPUT A:TRAP 40000
630 IF A<1 OR A>EL THEN 730
640 TRAP 640:? "To Line?";EL;:POKE 85
    ,9:INPUT B:TRAP 40000
650 IF B<1 OR B>EL THEN 730
```

```
660 POKE 766,1:? :REM SHOW CTRLS
670 FOR I=A-1 TO B-1
680 IF LL(I)=0 THEN ? #6;I+1;" {BLANK
    ":GOTO 720
690 T$="{3 SPACES}":T$(4-LEN(STR$(I+1
    )))=STR$(I+1):IF L$(I*80+1,I*80+1
    )<>"*" THEN T$(LEN(T$)+1)=" "
700 ? #6;T$;" ";L$(I*80+1,I*80+LL(I))
710 IF PEEK(764)=28 THEN I=EL:POKE 76
    4,255
720 NEXT I:POKE 766,0:GOTO 130
730 GOSUB 390:? "Can't do that.":GOTO
     150
740 REM * LMOD - LIST MODULE *
750 IF EL=0 THEN GOSUB 390:? :? "No l
    ines.":GOTO 140
760 ? "Module Name";:POKE 764,7:INPUT
     IN$
770 F=0:FOR I=0 TO EL-1
780 IF IN$=L$(I*80+1,I*80+LEN(IN$)) T
    HEN F=I+1:I=EL-1
790 NEXT I:IF F=0 THEN GOSUB 390:? "M
    odule ";IN$;" not found.":GOTO 14
    0
800 POKE 766,1
810 FOR I=F-1 TO EL-1
820 IF LL(I)=0 THEN ? #6;I+1;" * BLAN
    K *":GOTO 860
830 IF ASC(L$(I*80+1))=69 THEN POKE 7
    64,28:REM "PRESS" ESC KEY
840 ? #6;I+1;" ";L$(I*80+1,I*80+LL(I)
    )
850 IF PEEK(764)=28 THEN I=EL:POKE 76
    4,255
860 NEXT I:POKE 766,0:GOTO 130
870 REM INSERT
880 IF EL=0 THEN 750
890 ? "Insert at which line";:TRAP 89
    0:INPUT A:TRAP 40000
900 A=INT(A):IF A<1 OR A>EL THEN 730
910 EL=EL+1:A=A-1
920 FOR I=EL-2 TO A STEP -1
930 IF LL(I)=0 THEN LL(I+1)=LL(I):GOT
    O 960
940 T$=L$(I*80+1,I*80+LL(I))
950 L$((I+1)*80+1,(I+1)*80+LL(I))=T$:
    LL(I+1)=LL(I)
960 NEXT I
970 L$(A*80+1,A*80+9)=" {BLANK ":LL(A)
    =7
980 GOTO 130
990 REM DELETE
1000 IF EL=0 THEN 750
1010 ? "Delete From";:TRAP 1020:INPUT
      A:TRAP 40000
1020 A=INT(A):IF A<1 OR A>EL THEN 730
1022 ? "From ";A;" to";:TRAP 1022:INP
     UT B:TRAP 40000
1023 B=INT(B):IF B<1 OR B<A OR B>EL T
     HEN 730
1030 OFF=(B-A)+1:EL=EL-OFF:A=A-1:B=B-
     1
1040 FOR I=A TO EL-1
1050 T$=L$((I+OFF)*80+1,(I+OFF)*80+LL
     (I+OFF))
1060 L$(I*80+1,I*80+LL(I+OFF))=T$:LL(
     I)=LL(I+OFF)
1070 NEXT I
1080 GOTO 130
1090 REM NEW
1100 EL=0:GOTO 140
1110 REM LOAD
1120 IF EL THEN ? "Append at line ";E
     L
1130 ? :? "Do not use extension{2 UP}
     "
1140 ? "Filename";:INPUT T$:? :FN$=T$
     :FN$(LEN(FN$)+1)=".PIL"
1150 IF T$="" THEN 130
1160 Z=EL:TRAP 1180:OPEN #2,4,0,FN$
1170 INPUT #2;T$:L$(Z*80+1,Z*80+LEN(T
     $))=T$:LL(Z)=LEN(T$):Z=Z+1:GOTO
     1170
1180 EL=Z:CLOSE #2:IF PEEK(195)=136 T
     HEN ? "Load OK":GOTO 130
1190 GOSUB 390:? "I/O Error #";PEEK(1
     95):CLOSE #2:GOTO 140
1200 REM SAVE
1210 IF EL=0 THEN GOSUB 390:? "Nothin
     g to save!":GOTO 140
1220 ? :? "Do not use extension{2 UP}
     "
1230 ? "Filename";:INPUT T$:? :FN$=T$
     :FN$(LEN(FN$)+1)=".PIL"
1240 TRAP 1270:OPEN #2,8,0,FN$
1250 FOR I=0 TO EL-1:PRINT #2;L$(I*80
     +1,I*80+LL(I)):NEXT I:TRAP 40000
1260 CLOSE #2:? "Save OK":GOTO 130
1270 CLOSE #2:GOTO 1190
1280 END
1290 REM INITIALIZATION
1300 GRAPHICS 0:OPEN #1,12,0,"E:"
1310 CLOSE #6:OPEN #6,8,0,"E:":SETCOL
     OR 2,6,2:POKE 752,1
1320 ? "{CTRL R}{35 CTRL R}{CTRL E}"
1330 ? "{CTRL B}{35 SPACES}{CTRL B}"
1340 ? "{CTRL Z}{35 CTRL R}{CTRL C}"
1350 DIM T$(80),FN$(20)
1360 T$="■TURTLE■PILOT■EDITOR■"
1370 LM=INT(LEN(T$)/2)
1380 FOR I=1 TO LM
1390 POSITION 19-I,1:? "■";T$(LM-I+1,
     LM+I);"■■":FOR W=1 TO 10:NEXT W
1400 NEXT I
1410 MAX=100:REM MAXIMUM # OF LINES
1420 DIM LL(MAX),L$(MAX*80):REM 80 CH
     ARACTER LINES
1430 L$=" ":L$(MAX*80)=" ":L$(2)=L$:R
     EM CLEAR L$ TO BLANKS
1450 DIM IN$(80):REM INPUT
1460 ? :? :?
1470 ? "{8 SPACES}Editor Commands:"
1480 DIM CMD$(40),PILOT$(12)
1490 CMD$="ADD LISTLMODINS DEL NEW LO
     ADSAVE"
1500 POKE 85,10:PILOT$="TAMJUECRSGB*"
1510 FOR I=1 TO 8:? CMD$(I*4-3,I*4);"
      ";:IF I=4 THEN ? :POKE 85,10
1520 NEXT I:?
1530 POKE 85,10:? "DIR  PON  POFF RUN
     "
1535 POKE 85,15:? "BYE"
1540 ? :? "Acceptable Turtle PILOT co
     mmands:":?
1550 FOR I=1 TO 11:? PILOT$(I,I);": "
     ;:NEXT I:? "*":?
1560 REM FOLLOWING LINE DISABLES BREA
     K KEY.  OPTIONAL FEATURE
1570 POKE 16,64:POKE 53774,64
1580 RETURN
```

Program 2.

```
100 REM TURTLE PILOT TRANSLATOR
110 REM FILENAME "D:PILOT.XLT"
120 REM
130 GOSUB 2250
140 REM
150 REM *** OPEN ENTER FILE ***
160 N$(LEN(N$)-2)="ENT":LIST N$,20000
    ,32767
170 OPEN #2,9,0,N$:? #2;"5 GOSUB 2000
    0"
180 REM *** MAIN LOOP ***
190 REM
200 LINE=9:FOR NUM=0 TO NL-1
210 P$=PP$(NUM*80+1,NUM*80+PL(NUM))
220 ? "--":? NUM+1;" ";P$:?
230 LINE=LINE+1:LN$=STR$(LINE*10)
240 I=0:FOR L=1 TO 12:IF P$(1,1)=I$(L
    ,L) THEN I=L:L=12
250 NEXT L:IF I=0 THEN 2520
260 GOSUB 420:GOSUB 520:GOSUB 590
270 ON I GOSUB 660,860,940,1160,1280,
    1350,1440,1480,1510,1580,2170,221
    0
280 PRINT #2;LN$:? LN$
290 NEXT NUM:IF NSTRINGS=0 THEN 350
300 ZZ=4:LN=1:FOR I=0 TO NSTRINGS-1
310 ZZ=ZZ+1:IF ZZ=5 THEN ? :? #2:? #2
    ;LN*10;" DIM ";:? :? LN*10;" DIM
    ";:LN=LN+1:ZZ=0
320 ZZ$=SNAME$(I*10+1,I*10+NAMELEN(I)
    ):? #2;ZZ$;"(20)";:? ZZ$;"(20)";
330 IF ZZ<5 AND I<NSTRINGS-1 THEN ? #
    2;",";:? ",";
340 NEXT I
350 LINE=LINE+1:? #2:? :? :? LINE*10;
    "END"
360 ? #2;LINE*10;"END":? #2;"?";CHR$(
    34);"Your translated program is i
    n memory";CHR$(34)
370 CLOSE #1:CLOSE #2
380 ? :? "To load your translated pro
    gram into":? "memory, type ENTER"
    ;CHR$(34);N$
390 NEW :REM USE "END" HERE UNTIL YOU
    'RE SURE PROGRAM WORKS, AND A COP
    Y IS SAVED
400 REM
410 REM *** SPLIT PILOT LINE AT COLON
     ***
420 FOR L=1 TO LEN(P$):IF P$(L,L)=":"
     THEN T=L:L=80
430 NEXT L
440 IF P$(1,1)="*" THEN L$="*":R$=P$:
    RETURN
450 L$=P$(1,T-1):IF T=LEN(P$) THEN R$
    ="":RETURN
460 R$=P$(T+1)
470 T$=L$:GOSUB 2470:L$=T$
480 IF L$(1,1)="G" THEN T$=R$:GOSUB 2
    470:R$=T$
490 RETURN
500 REM *** FIND CONDITIONER
510 REM
520 C=0:IF LEN(L$)<2 THEN RETURN
530 IF L$(2,2)="Y" THEN LN$(LEN(LN$)+
    1)="IF QC=1 THEN ":C=1
540 IF L$(2,2)="N" THEN LN$(LEN(LN$)+
    1)="IF QC=0 THEN ":C=2
550 RETURN
560 REM
570 REM *** FIND EXPRESSION
580 REM
590 EX$="":IF L$(LEN(L$))<>")" THEN R
    ETURN
600 T=0:FOR L=1 TO LEN(L$)-1:IF L$(L,
    L)="(" THEN T=L:L=80
610 NEXT L:EX$=L$(T+1,LEN(L$)-1):LN$(
    LEN(LN$)+1)="IF":LN$(LEN(LN$)+1)=
    EX$:LN$(LEN(LN$)+1)=" THEN"
620 RETURN
630 REM
640 REM *** T: INSTRUCTION ***
650 REM
660 LL=LEN(LN$):LN$(LL+1)="QT$=":LN$(
    LL+5)=CHR$(34)
670 IF R$="" THEN LN$(LL+6)=CHR$(34):
    LN$(LL+7)=":GOS.20040":RETURN
680 FOR L=1 TO LEN(R$):T$=R$(L,L)
690 IF T$="$" THEN 730
700 IF T$="#" THEN 790
710 LN$(LEN(LN$)+1)=T$
720 NEXT L:LN$(LEN(LN$)+1)=CHR$(34):L
    N$(LEN(LN$)+1)=":GOS.20040":RETUR
    N
730 IF L>LEN(R$)-2 THEN 710
740 T=0:FOR L1=L+2 TO LEN(R$):IF R$(L
    1,L1)="$" THEN T=L1:L1=80
750 NEXT L1:IF T=0 THEN 710
760 LL=LEN(LN$):LN$(LL+1)=CHR$(34):LN
    $(LL+2)=":QT$(LEN(QT$)+1)="
770 ZZ$=R$(L+1,T):GOSUB 2540
780 LN$(LEN(LN$)+1)=R$(L+1,T):LN$(LEN
    (LN$)+1)=":QT$(LEN(QT$)+1)=":LN$(
    LEN(LN$)+1)=CHR$(34):L=T:GOTO 720
790 IF L>LEN(R$)-2 THEN 710
800 T=0:FOR L1=L+2 TO LEN(R$):IF R$(L
    1,L1)="#" THEN T=L1:L1=80
810 NEXT L1:IF T=0 THEN 710
820 LN=LEN(LN$):LN$(LN+1)=CHR$(34):LN
    $(LN+2)=":QT$(LEN(QT$)+1)=STR$("
830 LN$(LEN(LN$)+1)=R$(L+1,T-1):LN$(L
    EN(LN$)+1)="):QT$(LEN(QT$)+1)=":L
    N$(LEN(LN$)+1)=CHR$(34):L=T:GOTO
    720
840 REM
850 REM ** A: INSTRUCTION **
860 LN$(LEN(LN$)+1)="GOSUB 20130"
870 IF R$="" THEN RETURN
880 IF R$(LEN(R$))="$" THEN ZZ$=R$:GO
    SUB 2540
890 IF R$(LEN(R$))="$" THEN LL=LEN(LN
    $):LN$(LL+1)=":":LN$(LL+2)=R$:LN$
    (LEN(LN$)+1)="=QI$":RETURN
900 LN$(LEN(LN$)+1)=":":LN$(LEN(LN$)+
    1)=R$:LN$(LEN(LN$)+1)="=VAL(QI$)"
    :RETURN
910 REM
920 REM *** M: INSTRUCTION ***
930 REM
940 FOR L=0 TO 25:ML(L)=0:NEXT L:IF R
    $="" THEN 2520
950 T=0:FOR L=1 TO LEN(R$):IF R$(L,L)
    <>"," THEN ML(T)=ML(T)+1:M$(T*20+
    ML(T))=R$(L,L):GOTO 970
960 T=T+1
970 NEXT L
990 FOR L=1 TO T+1:LN$="":? #2;LINE*1
```

```
    0+L-1;:? LINE*10+L-1;
1000 IF C=1 THEN ? #2;"IF QC=1 THEN "
     ;:? "IF QC=1 THEN ";
1010 IF C=2 THEN ? #2;"IF QC=0 THEN "
     ;:? "IF QC=0 THEN ";
1020 IF EX$<>"" THEN ? #2;"IF ";EX$;"
      THEN ";:? "IF ";EX$;" THEN ";
1030 LN$(LEN(LN$)+1)="Q$(":LN$(LEN(LN
     $)+1)=STR$((L-1)*20+1)
1040 LN$(LEN(LN$)+1)=")=":ZZ$=" ":ZZ$
     (2)=M$((L-1)*20+1,(L-1)*20+ML(L-
     1))
1050 IF ZZ$(LEN(ZZ$))="$" THEN ZZ$=ZZ
     $(2):GOSUB 2540:GOTO 1070
1060 ZZ$(1,1)=CHR$(34):ZZ$(LEN(ZZ$)+1
     )=CHR$(34)
1070 LN$(LEN(LN$)+1)=ZZ$:LN$(LEN(LN$)
     +1)=":"
1080 LN$(LEN(LN$)+1)="QL(":LN$(LEN(LN
     $)+1)=STR$(L-1):LN$(LEN(LN$)+1)=
     ")="
1090 IF ZZ$(LEN(ZZ$))=CHR$(34) THEN L
     N$(LEN(LN$)+1)=STR$(LEN(ZZ$)-2):
     GOTO 1110
1100 LN$(LEN(LN$)+1)="LEN(":LN$(LEN(L
     N$)+1)=ZZ$:LN$(LEN(LN$)+1)=")"
1110 ? #2;LN$;:? LN$;:IF L<T+1 THEN ?
      #2:?
1120 NEXT L:? #2;":GOSUB 20140":? ":G
     OSUB 20140":POP :GOTO 290
1130 REM
1140 REM *** J: INSTRUCTION ***
1150 REM
1160 IF R$="" THEN 1210
1170 IF R$(1,1)<>"*" THEN ZZ$=R$:R$="
     *":R$(2)=ZZ$
1180 T=0:FOR L=0 TO NL-1:IF PP$(L*80+
     1,L*80+PL(L))=R$ THEN T=L+1:L=25
     00
1190 NEXT L:IF T=0 THEN 2520
1200 LN$(LEN(LN$)+1)="GOTO":LN$(LEN(L
     N$)+1)=STR$(T*10+100):RETURN
1210 T=0:FOR L=NL TO 0 STEP -1:ZZ$=PP
     $((L-1)*80+1,(L-1)*80+1)
1220 IF ZZ$="A" THEN T=L:L=0
1230 NEXT L:IF T=0 THEN 2520
1240 GOTO 1200
1250 REM
1260 REM *** U: INSTRUCTION ***
1270 REM
1280 LN$(LEN(LN$)+1)="QU=QU+1":IF R$(
     1,1)<>"*" THEN ZZ$=R$:R$="*":R$(
     2)=ZZ$
1290 T=0:FOR L=0 TO NL-1:IF PP$(L*80+
     1,L*80+PL(L))=R$ THEN T=L:L=2500
1300 NEXT L:IF T=0 THEN 2520
1310 LN$(LEN(LN$)+1)=":GOS.":LN$(LEN(
     LN$)+1)=STR$(T*10+100):RETURN
1320 REM
1330 REM *** E: INSTRUCTION ***
1340 REM
1350 LN$(LEN(LN$)+1)="IF QU=0 THEN EN
     D"
1360 PRINT #2;LINE*10+5;:? LINE*10+5;
1370 IF C=1 THEN ? #2;"IF QC=1 THEN "
     ;:? "IF QC=1 THEN ";
1380 IF C=2 THEN ? #2;"IF QC=0 THEN "
     ;:? "IF QC=0 THEN ";
1390 IF EX$<>"" THEN ? #2;"IF ";EX$;"
      THEN ";:? "IF ";EX$;" THEN ";
1400 ? #2;"QU=QU-1:RET.":? "QU=QU-1:R
     ET.":RETURN
1410 REM
1420 REM *** C: INSTRUCTION ***
1430 REM
1440 LN$(LEN(LN$)+1)=R$:RETURN
1450 REM
1460 REM *** R: INSTRUCTION ***
1470 REM
1480 RETURN
1490 REM
1500 REM *** S: INSTRUCTION ***
1510 LN$(LEN(LN$)+1)="SO.0,"
1520 FOR L=1 TO LEN(R$):IF R$(L,L)=",
     " THEN T=L:L=LEN(R$)
1530 NEXT L:LN$(LEN(LN$)+1)=R$(1,T-1)
     :LN$(LEN(LN$)+1)=",10,8:FOR QW=1
      TO "
1540 LN$(LEN(LN$)+1)=R$(T+1):LN$(LEN(
     LN$)+1)=":NEXT QW:SO.0,0,0,0"
1550 RETURN
1560 REM *** G: INSTRUCTION ***
1570 REM
1580 IF R$="" THEN LN$(LEN(LN$)+1)="G
     R.7+32":RETURN
1590 F=0:IF ASC(R$)<48 OR ASC(R$)>57
     THEN 1620
1600 LN$(LEN(LN$)+1)="FOR Q1=1 TO ":L
     N$(LEN(LN$)+1)=STR$(VAL(R$))
1610 LN$(LEN(LN$)+1)=":":F=1:R$=R$(1,
     LEN(R$)-1):R$=R$(LEN(STR$(VAL(R$
     )))+2)
1620 REM FIND INDIVIDUAL COMMANDS
1630 FOR L=0 TO 6:GL(L)=0:NEXT L
1640 T=1:Z=1:FOR L=1 TO LEN(R$)
1650 IF R$(L,L)<>";" THEN GL$((T-1)*8
     0+Z)=R$(L,L):GL(T-1)=Z:Z=Z+1:GOT
     O 1670
1660 T=T+1:Z=1
1670 NEXT L:NN=T
1680 REM TRANSLATE EACH COMMAND
1690 FOR L=1 TO T
1700 GC=0:FOR L1=1 TO 11:IF G(L1-1)>G
     L(L-1) THEN 1740
1710 IF GL$((L-1)*80+1,(L-1)*80+G(L1-
     1))<>G$(L1*6-5,(L1-1)*6+G(L1-1))
      THEN 1740
1720 GC=L1:L1=11:IF GL(L-1)=G(GC-1)+1
      THEN GL(L-1)=0:GOTO 1740
1730 GL$(L*80-79,L*80)=GL$(L*80-79+G(
     GC-1)+1):GL(L-1)=GL(L-1)-G(GC-1)
     -1
1740 NEXT L1
1750 IF GC=0 THEN 2520
1755 ZZ$="":IF GL(L-1) THEN ZZ$=GL$(L
     *80-79,(L-1)*80+GL(L-1))
1760 ON GC GOSUB 1810,1830,1850,1870,
     1890,1980,2010,2060,2080,2100,21
     20
1770 IF L<NN THEN LN$(LEN(LN$)+1)=":"
1780 NEXT L:IF F=1 THEN LN$(LEN(LN$)+
     1)=":NEXT Q1"
1790 RETURN
1800 REM CLEAR COMMAND
1810 LN$(LEN(LN$)+1)="GR.7":RETURN
1820 REM TURNTO COMMAND
1830 LN$(LEN(LN$)+1)="QA=90-":LN$(LEN
     (LN$)+1)=ZZ$:RETURN
1840 REM TURN COMMAND
1850 LN$(LEN(LN$)+1)="QT=":LN$(LEN(LN
```

```
$)+1)=ZZ$:LN$(LEN(LN$)+1)=":GOS.
20190":RETURN
1860 REM DRAW COMMAND
1870 LN$(LEN(LN$)+1)="QL=":LN$(LEN(LN
$)+1)=ZZ$:LN$(LEN(LN$)+1)=":GOS.
20220":RETURN
1880 REM PEN COMMAND
1890 IF ZZ$="UP" THEN LN$(LEN(LN$)+1)
="QP=1":RETURN
1900 IF ZZ$="DOWN" THEN LN$(LEN(LN$)+
1)="QP=0":RETURN
1910 TT=1:LN$(LEN(LN$)+1)="COLOR "
1920 IF ZZ$="ERASE" THEN TT=0
1930 IF ZZ$="RED" THEN TT=1
1940 IF ZZ$="GREEN" THEN TT=2
1950 IF ZZ$="BLUE" THEN TT=3
1960 LN$(LEN(LN$)+1)=STR$(TT):RETURN
1970 REM SCREEN COMMAND
1980 TT=0:IF ZZ$="APPLE" THEN TT=1
1985 LN$(LEN(LN$)+1)="QSCR=":LN$(LEN(
LN$)+1)=STR$(TT)
1990 RETURN
2000 REM GOTO COMMAND
2010 FOR L1=1 TO GL(L-1)
2020 IF ZZ$(L1,L1)="," THEN T=L1:L1=2
55
2030 NEXT L1:LN$(LEN(LN$)+1)="QX=":LN
$(LEN(LN$)+1)=ZZ$(1,T-1)
2040 LN$(LEN(LN$)+1)=":QY=":LN$(LEN(L
N$)+1)=ZZ$(T+1):RETURN
2050 REM FULL COMMAND
2060 LN$(LEN(LN$)+1)="GR.7+16+32":RET
URN
2070 REM MIX COMMAND
2080 LN$(LEN(LN$)+1)="GR.7+32":RETURN

2090 REM QUIT COMMAND
2100 LN$(LEN(LN$)+1)="GR.0":RETURN
2110 REM GO COMMAND
2120 LN$(LEN(LN$)+1)="QP=1:QL=":LN$(L
EN(LN$)+1)=ZZ$
2130 LN$(LEN(LN$)+1)=":GOS.20220:QP=0
":RETURN
2140 REM
2150 REM *** B: COMMAND ***
2160 REM
2170 LN$(LEN(LN$)+1)=R$:RETURN
2180 REM
2190 REM *** LABEL
2200 REM
2210 LN$(LEN(LN$)+1)="REM ":LN$(LEN(L
N$)+1)=R$:RETURN
2220 REM
2230 REM *** INITIALIZE
2240 REM
2250 GRAPHICS 0:DETRAP=40000
2260 ? "{Q}{6 K}{23 R}{6 K}{E}"
2270 ? "{F}{5 S}{D}TURTLE PILOT
TRANSLATOR{A}{5 S}{D}"
2280 ? "{Z}{6 X}{23 R}{6 X}{C}"
2290 ? :?
2300 DIM N$(14),T$(80),LN$(255),P$(80
),SNAME$(10*50),NAMELEN(50):REM
UP TO 50 STRINGS IN PROGRAM
2310 ? "What is the name of the PILOT
":? "program? (Do not use extens
ion)"
2320 INPUT N$:IF N$="" THEN ? "{UP}
{DEL LINE}";:GOTO 2320
2330 IF LEN(N$)>1 THEN IF N$(2,2)<>":
" THEN T$="D:":T$(3)=N$:N$=T$
2340 TRAP 2530:N$(LEN(N$)+1)=".PIL"
2350 OPEN #1,4,0,N$:TRAP DETRAP
2360 DIM I$(12):I$="TAMJUECRSGB*"
2370 DIM G$(6*11),G(11),ZZ$(80),GL$(1
0*80),GL(10)
2380 FOR I=0 TO 10:READ ZZ$:G$(I*6+1,
I*6+LEN(ZZ$))=ZZ$:G(I)=LEN(ZZ$)-
1:NEXT I
2390 DATA CLEAR,TURNTO,TURN,DRAW,PEN,
SCREEN,GOTO,FULL,MIX,QUIT,GO
2400 DIM R$(80),EX$(20),L$(80),M$(25*
20),ML(25)
2410 ? "Now reading PILOT program..."
:?
2420 MAX=100:DIM PP$(MAX*80),PL(MAX)
2430 TRAP 2450:INPUT #1;P$:TRAP DETRA
P
2440 PP$(NL*80+1)=P$:? P$:PL(NL)=LEN(
P$):NL=NL+1:GOTO 2430
2450 IF PEEK(195)<>136 THEN 2530
2460 ? :CLOSE #1:RETURN
2470 IF T$="" THEN RETURN
2480 ZZ$="":FOR L=1 TO LEN(T$)
2490 IF T$(L,L)<>" " THEN ZZ$(LEN(ZZ$
)+1)=T$(L,L)
2500 NEXT L:T$=ZZ$:RETURN
2510 RETURN
2520 CLOSE #1:CLOSE #2:? "ERROR IN PI
LOT LINE #";NL;CHR$(253):END
2530 CLOSE #1:PRINT "UNABLE TO LOAD "
;N$;CHR$(253):END
2540 REM SEARCH "STRING NAME TABLE" F
OR ZZ$, ADD IT IF NOT PRESENT
2550 IF NSTRINGS=0 THEN 2600
2560 ZZ=0:FOR I=0 TO NSTRINGS-1
2570 IF ZZ$=SNAME$(I*10+1,I*10+NAMELE
N(I)) THEN ZZ=I+1:I=NSTRINGS
2580 NEXT I:IF ZZ THEN RETURN
2600 SNAME$(NSTRINGS*10+1,NSTRINGS*10
+LEN(ZZ$))=ZZ$:NAMELEN(NSTRINGS)
=LEN(ZZ$)
2610 NSTRINGS=NSTRINGS+1
2620 RETURN
2630 REM THE FOLLOWING LINES ARE NOT
PART OF THE TRANSLATOR, BUT ARE
2640 REM INCLUDED IN EVERY TRANSLATED
PROGRAM
20000 DIM Q$(25*20),QL(25),QS(31),QI$
(80),QT$(80):OPEN #4,12,0,"E:"
20010 COLOR 1:QX=0:QY=0:QC=-1:QR=40:Q
A=90:QQ=3.1415927/180
20020 FOR Q1=0 TO 25:QL(Q1)=0:NEXT Q1
20030 RETURN
20040 IF QT$="" THEN PRINT :RETURN
20045 QTAB=85+572*(PEEK(87)<>0)
20050 QT=0:IF QT$(LEN(QT$))="&" THEN
QT$=QT$(1,LEN(QT$)-1):QT=1
20060 FOR Q1=1 TO LEN(QT$):IF QT$(Q1,
Q1)=" " AND PEEK(QTAB)>QR-9 THE
N GOSUB 20090
20070 PRINT QT$(Q1,Q1);:NEXT Q1:IF QT
=0 THEN PRINT
20080 RETURN
20090 QF=0:FOR Q2=Q1+1 TO Q1+QR-PEEK(
QTAB)-1:IF Q2>=LEN(QT$) THEN Q2
=1000:QF=1:GOTO 20110
20100 IF QT$(Q2,Q2)=" " THEN Q2=1000:
QF=1
20110 NEXT Q2:IF QF=0 THEN PRINT :Q1=
```

```
      Q1+1
20120 RETURN
20130 INPUT #4;QI$:RETURN
20140 QM=0:QC=0:FOR Q1=1 TO 25:IF LEN
      (QI$)<QL(Q1-1) OR QL(Q1-1)=0 TH
      EN 20180
20150 FOR Q2=1 TO LEN(QI$)-QL(Q1-1)
20160 IF Q$((Q1-1)*20+1,(Q1-1)*20+QL(
      Q1-1))=QI$(Q2,Q2+QL(Q1-1)-1) TH
      EN QC=1:QM=Q1:Q1=25:Q2=300
20170 NEXT Q2
20180 NEXT Q1:FOR Q1=0 TO 25:QL(Q1)=0
      :NEXT Q1:RETURN
20190 QA=QA-QT:IF QA>360 THEN QA=QA-3
      60
20200 IF QA<0 THEN QA=QA+360
20210 RETURN
20220 IF PEEK(87)<>7 THEN GRAPHICS 7
20221 QS=1:IF QSCR THEN QS=0.576:REM
      SCALE FOR APPLE
20225 IF QP=1 THEN 20250
20230 TRAP 20250
20240 PLOT QX*QS+79,48-QY*QS:TRAP 400
      00
20250 QX=QX+QL*COS(QA*QQ):QY=QY+QL*SI
      N(QA*QQ)
20260 IF QP=1 THEN RETURN
20270 TRAP 20290
20280 DRAWTO QX*QS+79,48-QY*QS:TRAP 4
      0000
20290 RETURN                          ©
```

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This VIC game demonstrates how the motor-impaired can communicate in several ways with a computer – using only the button on a joystick. There are also suggestions on adapting the game for the blind, to other computers, and for use with other kinds of input devices.

A Bi-monthly Column

Micros With The Handicapped

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Many kinds of computer entertainment require keyboard interaction or other motor coordination that can be difficult and even impossible for motor-impaired individuals. This month we'll digress from our series on developing a daily communications program to explore how a game program can be modified to accept alternative input devices in order to allow the motor-impaired to interact with it.

In this "Color Master" game, the computer randomly fills a four-block pattern, choosing from seven colors, with repeats possible. The user tries to duplicate the hidden color pattern within ten guesses. The user's guesses are usually given by typing a letter or number for each color in the guess. To make this game more accessible to the motor-impaired, a menu of choices the user can make will be presented on the computer's screen, with a moving vertical arrow indicating the current menu choice which will be made if an input device is activated.

Figure 1 shows a typical layout for this game on the VIC computer's screen. The blocks for the user's ten possible guesses appear in the middle of the screen and are initially set to all white. A horizontal arrow will point to the current guess on which the user is working. The menu of choices appears at the bottom of the screen and includes blocks in each of the seven possible colors, movement left or right within the four blocks of the current guess, speeding up (+) or slowing down (-) of the menu's arrow, and requesting the computer to score the user's current guess. An advantage of a menu-driven game is that no written directions are needed to see what options are available during the game, since the choices are always visible in the menu.

The computer will score a guess in two ways, which are described at the top of the screen. Under the P-score, the computer will tell how many of the colors in the user's guess are correct colors in the right positions. The C-score will tell how many other colors are correct, but in the wrong positions. When the two scores add up to four, the user will have identified all of the colors in the hidden pattern. If the P-score is exactly four, then their positions are correct as well, and the game ends. Each time a P-score occurs, a whistle sound will be heard as an audible reward.

When the game is over, at the top of the screen will appear a score, which is inversely related to the number of guesses used to successfully duplicate the hidden pattern. The score ranges from a low score of zero, if not guessed within ten tries, to a top score of ten, if guessed in one try. The user's best score is also recorded at the top of the screen.

When the program is run, a horizontal arrow will point to the first row of white blocks which the user will be filling with his/her first guess. The first block of this row will be flashing to indicate that the user's response will be with respect to this block. A moving vertical arrow will point in turn to each of the possible responses the user can make from the menu. Program 1 assumes a joystick is attached to the VIC, and that the user will push the joystick button to indicate a response.

The program can be changed to permit the use of other means of input that may be more suitable to the needs of a particular handicap. Even sounds could be used in place of the colors so that a blind person could also participate, though fewer choices and a review option might be needed in this case as well. Lines 1040, 1080, and 241 need to be changed so that any activity on the joystick will indicate a user's response. (However, joystick movement to the right will *not* be picked up by this routine. Change the =158 in lines 1040 and 1080 to <>190, and change line 241 to =190 instead of <>158.) To change it so that any activity on a device attached to the user port will indicate a user's response, change the 37139 in line 9 to 37138. Also change the =158 in lines 1040 and 1080 to <>255, and the <>158 in line 241 becomes =255. Table 1 contains a description of the program's variables so that the program's logic will be easier to follow.

Try converting some of your favorite games to a menu-driven approach for alternative input. In future columns, the rest or our series on developing a communications program will provide additional techniques in this area.

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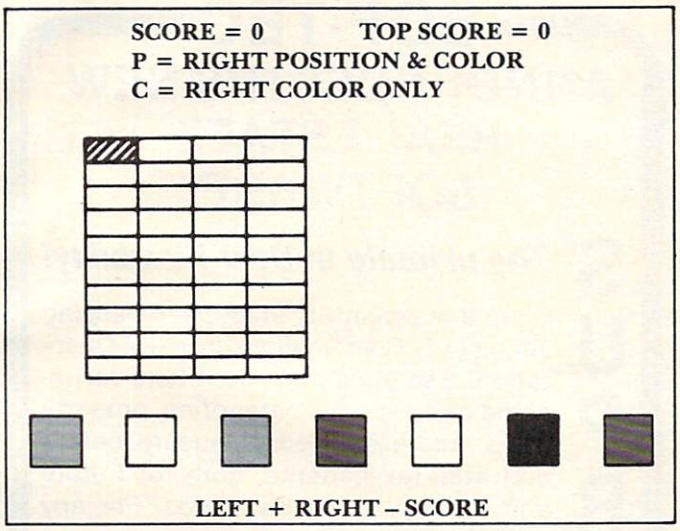


Figure 1.

Table 1.

Line 4 DE controls the time delay for the arrow moving through the menu. Note: After a selection is made, the arrow pauses again at that selection, thereby allowing immediate multiple selections of a menu item.

Line 5 C() contains the color codes for the menu blocks.

Lines 9, 10 V1, V2, and PL control spacing and positioning within the menu for the vertical arrow.
37139 sets the data direction register for the joystick.
36879 sets the screen to a cyan border with a black background.
36878 sets the volume for sound.

Line 20 Draws ten rows, each with four white blocks.

Line 22 H() contains the computer's hidden color pattern.

Lines 24,26 Print the menu.

Line 30 At the start of the game, a horizontal arrow points at the first row of white blocks. L contains the screen line for the current guess row of blocks.

Line 40 P indicates which block in the current guess row will flash. G() contains the user's guess, which is preset to all white.

Line 50 B contains the color map location for the screen location of the flashing block; S is the screen location of the flashing block.

Line 75 Looks for a SCORE response.

Line 80 On a LEFT response, moves the flashing to the next block on the left in the current guess row, as long as it isn't already the leftmost block.

Line 90 On a RIGHT response, moves the flashing to the next block on the right in the current guess row, as long as it isn't already the rightmost one.

Lines 100-110 Set the flashing block in the current guess row to the selected color.

Line 120 Indicates the next block to the right will be the next block to flash, if not already at the rightmost block in the current guess row.

Line 140 K() is a copy of the hidden pattern and will be used for scoring.

Line 150-170 Y counts the P-score, which is the number of matches in both position and color.

Lines 171-175 Whistle sound for each P-score.

Lines 180-190 B counts the C-score, which is the number of matches only in color.

Line 195 Checks for end of game by a correct guess.

Line 200 Checks for end of game by running out of guesses.

Line 210 Points to the next guess row.

Lines 220-230 Reveal the hidden pattern.

Lines 222-229 Update the score and top score.

Lines 240-242 Wait for the user to respond before starting a new game.

Line 1000 V contains the current menu item number. VL contains the screen location of the current menu item.

Line 1020 Positions the vertical menu arrow.

Line 1030-1060 Flash the current block in the guess row and delay the arrow at the current menu item.

Line 1040 Looks for a user's response on the joystick button.

Line 1080 Waits for the user to release the joystick button in order to eliminate a "keyboard-bounce" type problem.

Lines 1089-1110 Code menu item's function with respect to the arrow's position.

Color Master

```
4 DE=17
5 X=RND(-TI):C(2)=5:C(3)=28:C(4)=159:C(5)=15
    6:C(6)=30:C(7)=31:C(8)=158
9 POKE37139,0:V1=8100:V2=8166:VL=V1:PL=3
10 POKE36879,11:POKE36878,15:PRINT"{CLEAR}{GR
    GRN}SCORE=";D;"{YEL}TOP{RIGHT}SCORE="
    ;E;
15 PRINT"{CYN}P{WHT}=RIGHT POSITION &      CO
    LOR"
16 PRINT"{BLU}C{WHT}=RIGHT COLOR ONLY"
18 PRINT"{REV}{CYN}                          ";
20 PRINT"{WHT}";:FORL=1TO10:PRINT"{RIGHT}";:F
    ORC=1TO4:PRINT"{REV}L:";:NEXTC:PRINT:
    NEXTL:PRINT"{03 DOWN}  ";
22 FORI=1TO4:H(I)=INT(7*RND(1)+2):NEXTI
24 FORI=2TO8:PRINT"{REV}";CHR$(C(I));" ";"{02
     RIGHT}";:NEXTI
26 PRINT:PRINT:PRINT" LEFT {GRN}+ {CYN}RIGHT ~
    {GRN}- {PUR}SCORE{WHT}"
30 PRINT"{HOME}{05 DOWN}{10 RIGHT}_ ";:L=5
40 P=1:FORI=1TO4:G(I)=2:NEXTI
50 B=38400+L*22+1
```

```
53 T=128
55 C=B+(P-1)*2:T=-T:S=C-30720
58 GOSUB1000:V=V-1
75 IFASC(A$)=13THEN140
80 IFA$="{LEFT}"ANDP>1THENPOKES,204:POKES+1,2
   50:S=S-2:P=P-1:GOTO50
90 IFA$="{RIGHT}"ANDP<4THENPOKES,204:POKES+1,
   250:S=S+2:P=P+1:GOTO50
95 IFA$<"2"ORA$>"8"THEN55
100 A=ASC(A$)-48
105 POKES,204:POKES+1,250
110 G(P)=A:POKEC,A-1:POKEC+1,A-1
120 P=P+1:IFP>4THENP=P-1
130 GOTO53
140 FORI=1TO4:K(I)=H(I):NEXTI:POKES,204:POKES+
   1,250
150 PRINT"{CYN}P{WHT}=";:Y=0
160 FORI=1TO4:IFG(I)=K(I)THENY=Y+1:K(I)=0:G(I)
   =9
170 NEXTI:PRINTY;"{BLU}C{WHT}=";:B=0
171 IFY=0THEN180
172 FORJJ=1TOY
173 POKE36878,15:FORLL=148TO220STEP2:POKE36876
   ,LL:NEXTLL
174 FORLL=128TO200STEP2:POKE36876,LL:NEXTLL:FO
   RLL=200TO128STEP-2:POKE36876,LL:NEXTL
   L
175 POKE36876,0:POKE36876,0:FORLL=1TO50:NEXTLL
   :NEXTJJ
180 FORI=1TO4:FORJ=1TO4:IFG(I)=K(J)THENB=B+1:G
   (I)=9:K(J)=0
190 NEXTJ,I:PRINTB;
195 IFY=4THENFORI=14TOL+1STEP-1:PRINT:NEXTI:PR
   INT"CORRECT. THE ANSWER IS";:GOTO222
200 L=L+1:IFL=15THEN220
210 PRINT"{10 RIGHT}_ ";:GOTO40
220 PRINT"THE ANSWER IS"
222 D=15-L
224 F=(D=10):POKE7686,32:IFFTHENPOKE7686,49:PO
   KE7687,48:GOTO227
225 POKE7687,48+D
227 IFD<=ETHEN230
228 E=D:G=(E=10):POKE7699,32:IFGTHENPOKE7699,4
   9:POKE7700,48:GOTO230
229 POKE7700,48+E
230 PRINT" {REV}";:FORI=1TO4:PRINTCHR$(C(H(I))
   );"L:";:NEXTI:PRINT"{WHT}"
240 PRINT"RESPOND TO CONTINUE.";
241 IFPEEK(37137)<>158THEN241
242 GOTO5
1000 V=V+1:IFV=8THENVL=V2:PL=4
1010 IFV>12THENVL=V1:V=1:PL=3
1020 POKEVL,30:POKEVL+30720,1
1030 J=1
1032 K=PEEK(S):M=PEEK(S+1)
1034 POKES,K+T:POKES+1,M+T
1040 IFPEEK(37137)=158THENPOKEVL+30720,0:GOTO10
   80
1042 T=-T
1050 J=J+1
1060 IFJ<DETHEN1032
1070 POKEVL+30720,0:VL=VL+PL:GOTO1000
1080 IFPEEK(37137)=158THEN1080
1089 IFV<8THENA$=MID$(STR$(V+1),2):RETURN
1090 IFV=8THENA$="{LEFT}":RETURN
1095 IFV=9THENDE=DE-.25*DE:A$="A":RETURN
1100 IFV=10THENA$="{RIGHT}":RETURN
1105 IFV=11THENDE=DE+.25*DE:A$="A":RETURN
1110 IFV=12THENA$=CHR$(13):RETURN
1120 END
```

Review:

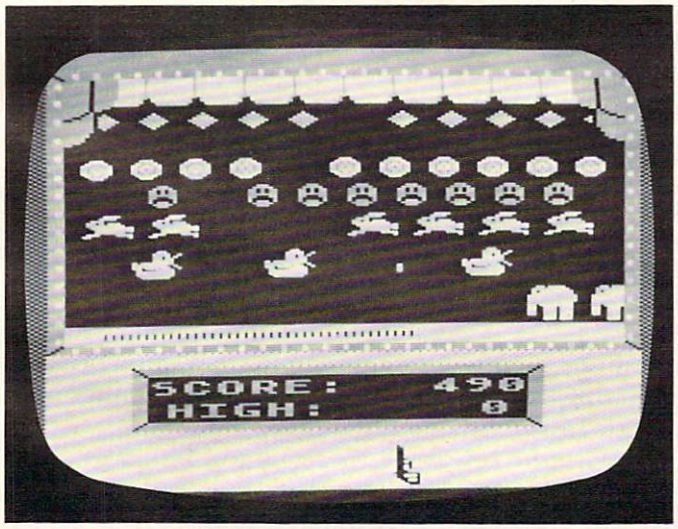
Four Atari Games

Charles Brannon
Editorial Assistant

As software developers discover and exploit more and more of the Atari's features, the games become more colorful, dazzling, and exciting.

DataSoft's four new games, *Canyon Climber, Pacific Coast Highway, Clowns And Balloons,* and *Shooting Arcade,* are of this type. All these games show off the graphics and animation capabilities of the Atari. New graphics techniques are used to allow fine scrolling of multicolor playfield objects at varying speeds (a feat normally impossible, but it looks like it's done here with DLI's and the four-color character modes 4 and 5).

Shooting Arcade is a most attractive game, with a display just like the carnival game. Bouncing, quacking, twisting, and flashing targets invite you to shoot, but you had better be accurate – you have a limited supply of bullets. Run out of ammunition and the game is over. If you clear the screen, you can shoot a cagey bear for bonus points, and play again against a faster set of targets.



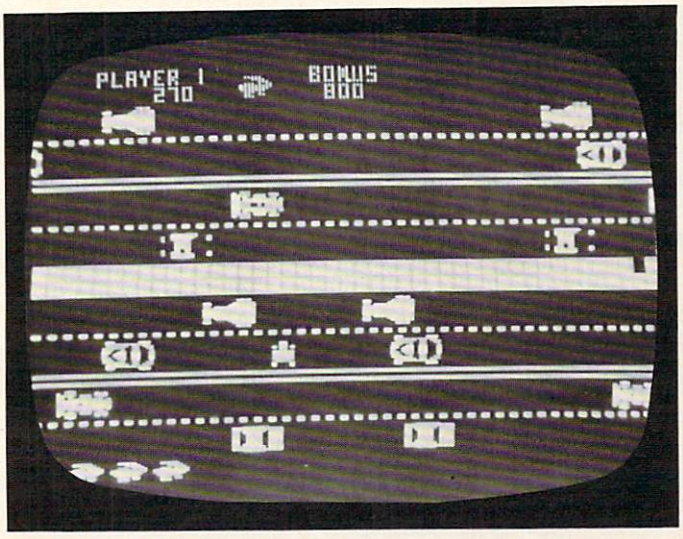
Shooting Arcade

There is a row of faces that alternate between happy and sad. Hit a sad face and you get another bunny to shoot. The music, color, and smoothness are sure to make the game popular.

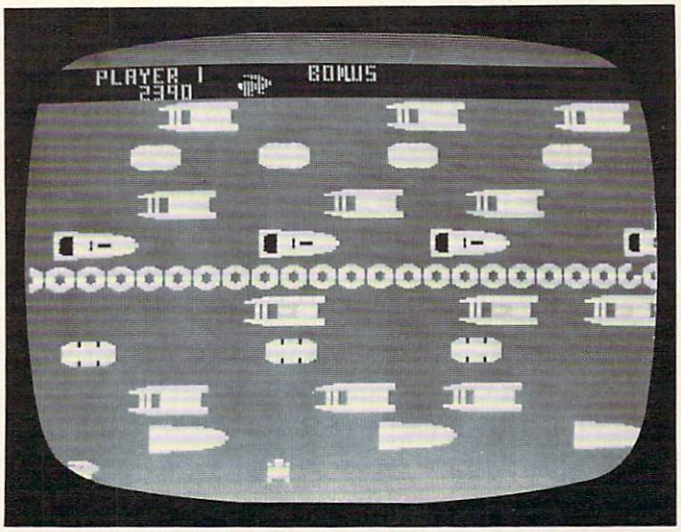
Rush Hour At 1.79 MHz

DataSoft is sure to score a hit with its *Pacific Coast Highway.* As either a turtle or a rabbit, you must try to cross a busy California freeway as you try to make it to the beach. Once there, you must hop (yes, the turtle can hop!) from surfboard to surfboard in search of the ultimate goal, bonus points.

The game is divided into two screens, a highway and a water scene. Each successful crossing makes the game more difficult. In the two-player game, the classic contest of turtle vs. rabbit is re-enacted.

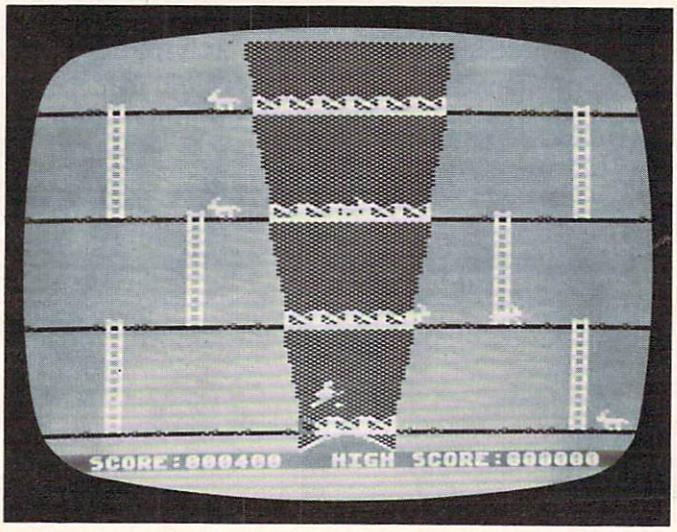


Pacific Coast Highway

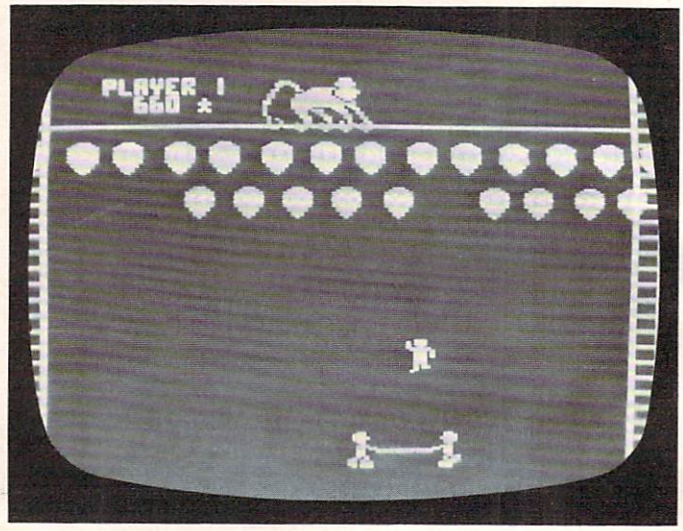


Pacific Coast Highway

A frustrating aspect of the game is that if one player gets hit (or takes a plunge), both players have to start over.



Canyon Climber



Clowns and Balloons

The animation is in "strips" of screen (a by-product of the graphics technique), but it suits this game very well. If you didn't know better, you'd think the Atari could control dozens of multicolor "sprites," as cars whiz and hum, and boats drift lazily along. The police car even flashes its lights!

Canyon Climber is similar to *Donkey Kong,* in the way that *Pac-Man* is like *Head-On,* or *Galaxians* is like *Space Invaders. Canyon Climber* is a "theme" game, where a little man you control with a joystick can run, jump, climb, wield a shield, blow up bridges, leap over obstacles in a single bound, or even fly! It's not an adventure game. These possibilities are just integrated into the game, as hitting barrels with a hammer is part of *Donkey Kong.*

Canyon Climber is really several games in one. The first level involves setting charges on various bridges, and then detonating them. You must evade malevolent goats that are determined to butt you to the bottom of the Grand Canyon. Assuming success, you advance to the second screen, where you dodge Indian arrows (or grab a shield that temporarily deflects them) as you wend your way to the top.

If you make it this far (don't count on it), you soar into the air as you progress to the third screen. Here you leap from rock to rock as you attempt to scale the canyon walls. Meanwhile, pesky (and surprisingly intelligent) birds overhead rain down rocks upon your weary head. If you can withstand this final barrage, you find yourself standing triumphant at the top of the Grand Canyon. The attainment of your goal is rewarded by a charging goat who knocks you all the way back to the first screen.

To fit a large-scale screen onto a standard TV set is quite a challenge. DataSoft uses small playing characters, but detailed settings. The graphics are less elaborate (and the colors are mostly Arizona dun and orange) than the other DataSoft games reviewed, but the overall animation and execution are perhaps the best of the four.

Shenanigans At The Circus

A seemingly simple game, *Clowns and Balloons* involves maneuvering a clown-driven trampoline across the bottom of the screen with either a joystick or paddle controller. A third clown climbs a ladder and leaps out to seeming doom. Ah, but that's your job, to save the clown, and what's more, bounce him to the top of the big top! Rolling along across the top three rows of the screen is an array of colorful circus balloons.

What this boils down to is an unusual janitorial duty. You try to clear the screen of balloons. Clear out a row at a time to reap bonus points. Meanwhile, a mischievous monkey keeps blowing up more balloons. More balloons will appear if you clear an upper row before a lower one, but the monkey does not stir from his high-wire perch, unless you clear the screen when he tips his hat at you.

The animation remains fairly simple, though smooth. The sound and music are some of the best I've heard. Despite the simple theme, *Clowns and Balloons* turned out to be great fun, and inspired hours of frenzied joystick twisting. Perhaps its appeal can be compared to that of *Breakout,* a similar game where you bounce a ball to clear out a brick wall. *Breakout* is one of the most popular games in arcade history (that's B.P. – Before *Pac-Man*).

With the release of these games, DataSoft has issued an implicit challenge to game producers: use the Atari's features to the utmost.

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Review:

High Orbit For Apple

Erann Gat
Oak Ridge, TN

I opened the package with anticipation. *High Orbit* seemed pretty ordinary for a computer game: a disk, some P.R. from Gebelli Software, the company that sells *High Orbit*, and a sheet of rather cryptic instructions.

I booted the disk in the usual way, and *High Orbit* immediately became very unordinary. My mouth fell open as I listened to the fastest disk boot I had ever heard. I later timed the furious "clickclickclick" of the head stepper motor: it was reading seven tracks per second! Apple DOS generally reads a track and a half per second.

The program then went into a nice demo mode which included some animated three-dimensional graphics, but nothing to give a clue as to what the game was all about. I tried for five minutes to start the game. I tried every key, but nothing worked. Oh well, when all else fails, read the directions. Aha! Control-R starts the game.

High Orbit starts with three dots that zoom onto the screen from the depths of space, which is gratifyingly free of stars. The object of the game is to "construct a space station" by moving a little fuzz ball (which represents a piece of the station) onto each of the dots using a tractor beam. To make it a bit more challenging, the dots spin around each other in a circle, and you can use the tractor beam for only a limited amount of time before it has to recharge. On top of that, there are the ubiquitous enemy spaceships that zip onto the screen and destroy your fuzz balls, so you have to start all over again. (You can destroy enemy spaceships, *if* you are fast enough, and that is a big "if.")

When (and if) you manage to maneuver a fuzz ball onto each of the dots at the same time, the space station is suddenly transformed into an abstract, three-dimensional shape which undergoes some breathtaking gyrations, splits in two, and starts spinning again.

The next phase is to "energize" the space station by moving yet another fuzz ball into the center (and I do mean the *exact* center) of the station and zapping it with your laser. Enemy spaceships will again try to destroy your supply of fuzz balls before you can get one fuzz ball into the center and destroy it.

If you are successful, the station stops spinning, becomes rainbow colored, and turns itself inside out, depositing the "crew" in deep space. The crew of the space station is just three little humanoid figures which pop onto the screen and do not move. The space station drops back into the depths of space, giving the impression that the crew is being launched into high orbit (hence the name of the program).

The last and final phase consists mainly of watching a shuttle pick up the crew. According to the instructions, you have to move the crew in front of the shuttle with your tractor beam, but I never had to. The shuttle seems to know where to go, and it will even destroy enemy spaceships that stray too close.

So how do you lose? Enemy spaceships cannot destroy you; in fact, you cannot be destroyed at all. Aye, but here's the rub: the space station must be constructed and energized before time expires. You get about two minutes to finish. If you do not, the game stops, and "mission incomplete" flashes on the screen.

If you do manage to complete a station within the time limit, you get a new station to build, but this one has four points instead of three. This goes on until you complete a six-point station. Then you go back to three points, but enemy spaceships get more aggressive. Every time you complete a station, a little colored square appears in a long hollow bar at the bottom of the screen. The bar is very long; I managed to fill up only about one-fifth of it with colored squares. You can always restart the game at the point where you last ran out of time.

High Orbit is a unique and challenging game. The graphics are well done and use the Apple's color capabilities to their fullest. It is a joy to play, provided you use a joystick. Paddles can be frustrating, and keyboard control was a frightening experience. (One nice feature of the keyboard control, though, is that you can redefine which key controls which function.) There seem to be enough levels of difficulty to keep even the best player occupied for a long, long time (although I was not able to get past the first few levels!).

All in all, *High Orbit* is an excellent game for all ages. It is challenging but not frustrating, simple but not boring. It requires a 48K Apple II with a disk drive. A joystick is not necessary, but it is *very* desirable.

High Orbit
Gebelli Software
1787 Tribute Road
Suite G
Sacramento, CA 95815
Requires 48K, disk
$29.95

Review:

Raster Blaster

G. L. Kopp, Indianapolis, IN

After Atari introduced video games to America, old-fashioned, flipper-smashing, steel-ball-rebounding, mechanical pinball faced a notable decline in popularity until manufacturers moved into the computer age and introduced some incredibly sophisticated pinball. Now the game is back, this time in video format.

Raster Blaster, first produced for the Apple, is now available in an Atari version. The game boasts the standard fare of point-counting obstacles in its display: channels along the top which are lighted when the ball passes through them; four round bumper posts; targets in the center and on one side; a spinner and "ball saving shields" at the bottom which are always functioning during "easy" play, but must be turned on by hitting targets in the "hard" version (the only difference between the two). In addition, "Raster Blaster claws" can be enabled, which catch up to three of five balls allotted during play (a new ball replaces the one caught each time) and then releases them for multiple-ball play once all three claws have been activated.

Although the game is a masterfully written program, it is not without a glitch (I hesitate to call it a "bug.") Most of the time, the player will be able to give the ball the old one-two flip – slightly deflecting it off the tip of one flipper and catching it a split second later with the other. Often, however, if one flipper is up (they stay in that position until the fire buttons are released) and the ball passes just beyond it toward the bottom of the screen, the second flipper will not function, even though the ball is in its range. There are other occasions when the player must endure the non-functioning flipper phenomenon as well, though infrequently.

Another adjustment a pinball wizard must make is in holding the globe on the flipper to apply more than blind luck to direct it where he wants it. In mechanical pinball, the ball slides along the flipper on release until it reaches the *kill* point you know so well from playing a machine until your fingerprints are gone. Sorry, not so in the video version. Once in motion, always in motion, is the computer game style. The ball bounces lightly on the flippers, which puts the player into partnership with luck.

On the other hand, there are occasions in which the ball can be observed to pass *through* a flipper which is actually in the way of the other flipper's return shot. This rarity does make you smile and glance about to see if anyone noticed that a law of physics was broken in your favor. This same break has been observed to go the other way, however, allowing the ball to pass right through the bottom side channel railing and slip out-of-play behind the flippers.

In spite of its shortcomings, though, *Raster Blaster* is addictive, which speaks well of any arcade game. About the only feature true pinball fanatics will find missing is being able to flip the ball so hard it slaps the inside of the TV screen. Requirements for play are a disk drive, 24K of memory, *two* joysticks (accommodating one to four players), and a good deal of patience.

Raster Blaster, *$30*
BudgeCo, 428 Pala Avenue
Piedmont, CA 94611

Review:

Four New Cartridges For VIC-20

Harvey B. Herman
Associate Editor

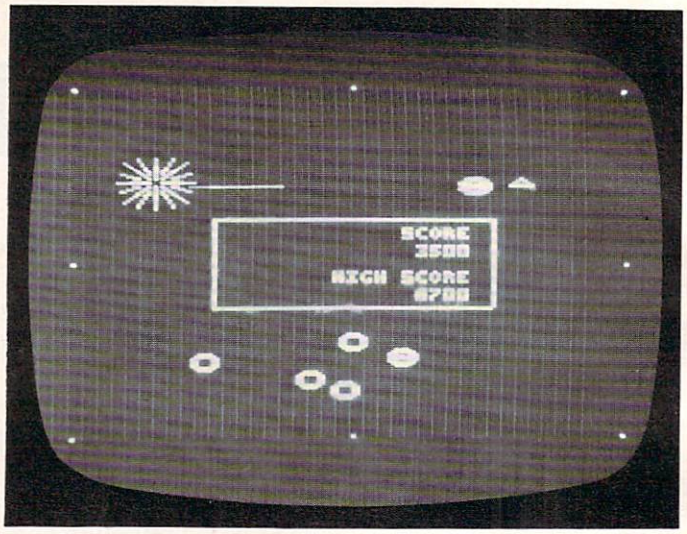
It seemed like Christmas in July when I received these cartridges to review. They turned out to be excellent examples of the full capabilities of the VIC. Some may have received more play than others, but all were challenging and fun to use. I think most adults will be very pleased with their purchase, and the kids who are arcade game freaks will especially like two of them (*Omega Race* and *Gorf*). *Sargon II Chess* is more a thinking person's game, and *Visible Solar System* is an interesting educational tool.

I am truly amazed at the ingenuity of machine language programmers. In the video games particularly, they use all the VIC's features. That is, color, sound, and graphics are integrated into a tour de force of gamesmanship – my word for their art. The programmers seem to be improving with each new release, so I hesitate to give numerical ratings as I am not sure what the future will hold.

Omega Race

An alien race, the Omegans, run a contest to improve their fighting skills. You are an Omegan fighter, and the command ship which you control must evade and destroy three types of enemy ships and two kinds of mines. Points are awarded for each ship and mine destroyed. The contest is played between two concentric rectangles. The central rectangle is impenetrable and displays the current score, the previous high, and the number of your remaining ships (turns). Force field boundaries, which resemble rubber bands, keep the players inside the outer rectangle.

The game is very fast-moving and difficult to master. Enemy droid ships start out with limited fire power, but improve with time. They occasionally become enemy command ships which are more deadly and become even more so when they metamorphize into widely spinning death ships. Watch out for newly laid mines!



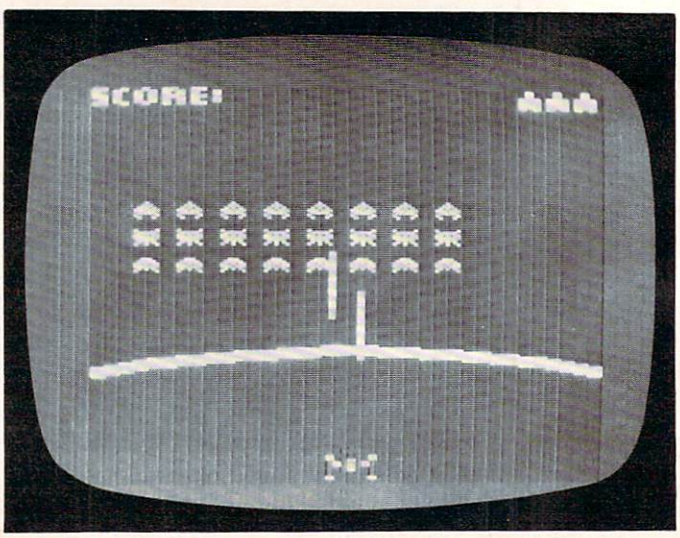
Omega Race

At the start of the game, you are given a choice of screen and character colors, three or five ships (turns), and either joystick or paddle control of your ship. I found paddle control easier to use, and my tiny testers agreed. I never scored very high, but one of the testers easily scored over 135,000 points starting with five men. Many of the testers preferred this game over any of the others reviewed here. A real winner for the VIC.

Gòrf

The Gorfian Empire poses a major threat to the Earth. Narrative translation: Get them before they get you, or you "bite the dust."

Gorf really is four games in one. You are in control of a fighter under attack. The Gorfian attacks come in waves. Wave 1 is called "Astro Battles" and is reminiscent of *Space Invaders*. Three rows of Droids, controlled by a Gorf, keep coming



Gorf: Defeat the Invaders

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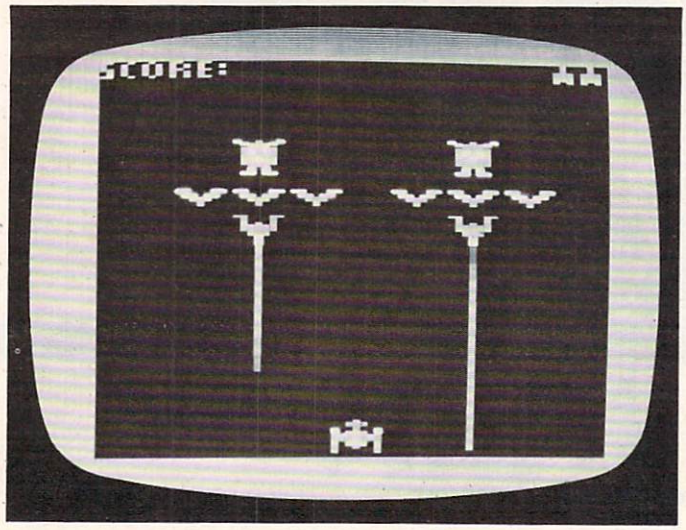
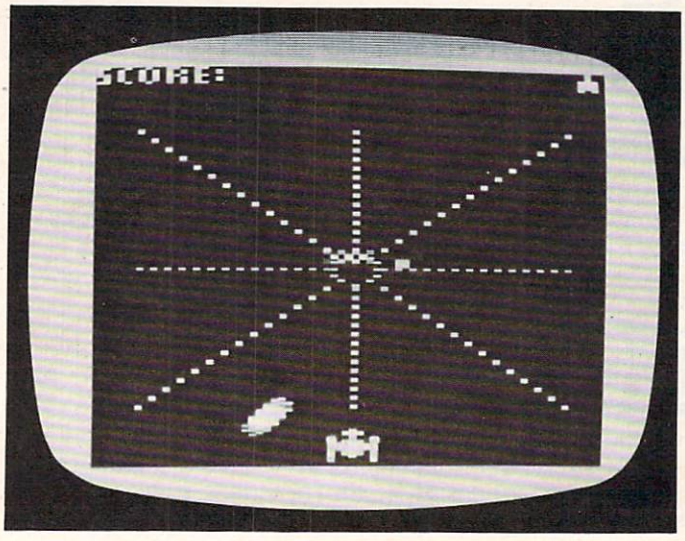
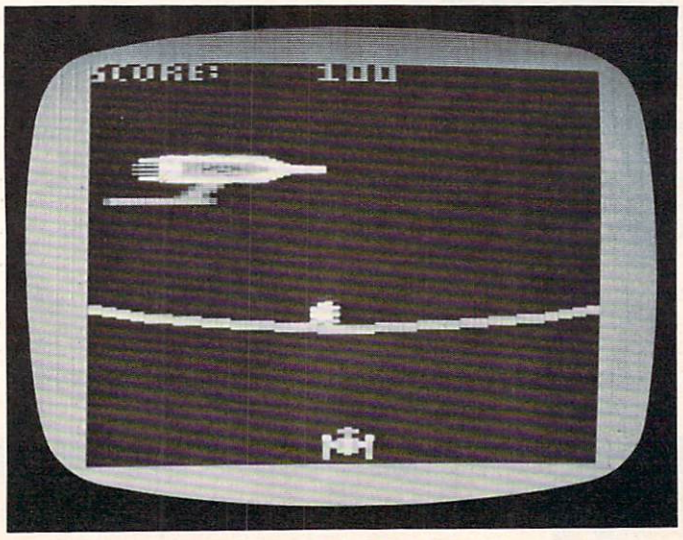


Gorf: Vanquish the Laser Armada



Gorf: Evade and Eliminate in 3-D



Gorf: The Final Challenge – The Mother Ship

at you. You have some protection by a force field, but that doesn't last long. Kill or be killed is your motto throughout all the waves. Wave two, assuming you survive wave one, is called "Laser Attack." Two groups – a Gorf, three attack ships and a laser ship – have a serious grudge against you. Keep out of the way of the laser power ray, or you'll be sorry. The third wave, called "Space Warp," is the most difficult. The attacks come in a spiral formation and could make you dizzy if you watch too long. Avoid the smart torpedoes which seem to zero in on you. The flagship wave is the only remaining hurdle. You must destroy the flagship's power reactor while dodging fireballs and chips from the damaged vessel. The reward for completion of all four missions is a promotion and the right to oppose an even more powerful Gorfian force.

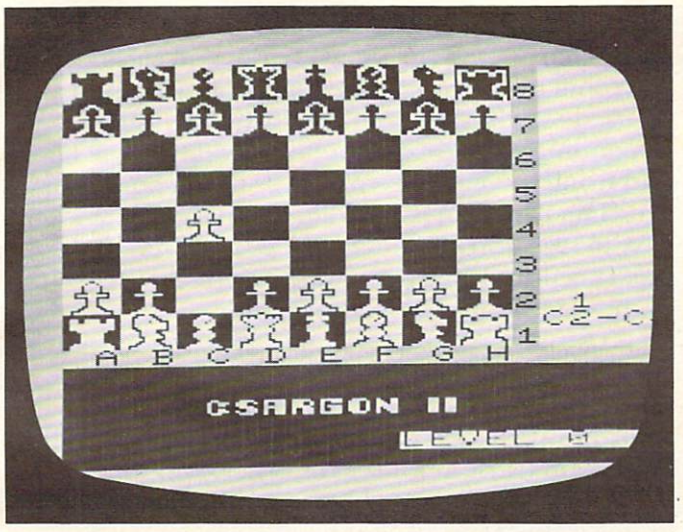
I find this game fascinating to watch while an "expert" plays. You are in a different world. I can't seem to get past the first or second waves, but experts can evade the enemy for mission after mission. How do they do it? I have no explanation except to say that I have the same feeling of awe when I watch professional sports on television. Why can't I do that – it looks so easy?

Sargon II Chess

Chess is considered a more "serious" game. Parents who would object to their child playing a video game would probably not object to chess. Chess certainly requires more thinking than most games, although the video games do have their own best strategies. Many people feel that the thinking associated with chess is good for us, and could carry over into other areas. Whatever the case, *Sargon II* is both fun and thought-provoking at the same time, and cannot help but make more people interested in one of the world's oldest games.

Sargon II probably has the best reputation of all the microcomputer chess programs. You are playing against the computer. At the start, you are given a choice of white or black pieces and the level of play. Beginners should choose level 1 or 0. Twenty seconds is given as the average response time for level 1. If you are a masochist, you can choose level 6, where the average response time is four hours! Of course, the play is much better at the highest levels as the computer is "thinking" further ahead.

The chess board is displayed with stylized pieces, which take a little getting used to at first. After awhile there is no problem. The last five moves are shown in a box next to the board. The notation used to show moves is algebraic (E2-E4) as opposed to descriptive (P-K4). However, the capture of a piece and castling is shown by X and O-.



Sargon II Chess

This program has several nice touches:

1. Moves can be made either by typing the from-to locations with the keyboard or with a joystick. In the latter case, the cursor is placed over the piece, which is then "picked up" and "set down" at the new location.

2. It is possible to correct errors or try a chess problem with the set-up mode. I tried a few simple chess problems, with which *Sargon II* had no trouble. This mode could be used to correct the only deviation from normal chess rules that I could find – pawn promotion was always to a queen.

3. At the higher levels, *Sargon II* will, at your request, tell you what it thinks is your best move. You are free to accept or reject this suggestion. It is usually a good suggestion!

I would guess that this is the most sophisticated program available for the VIC.

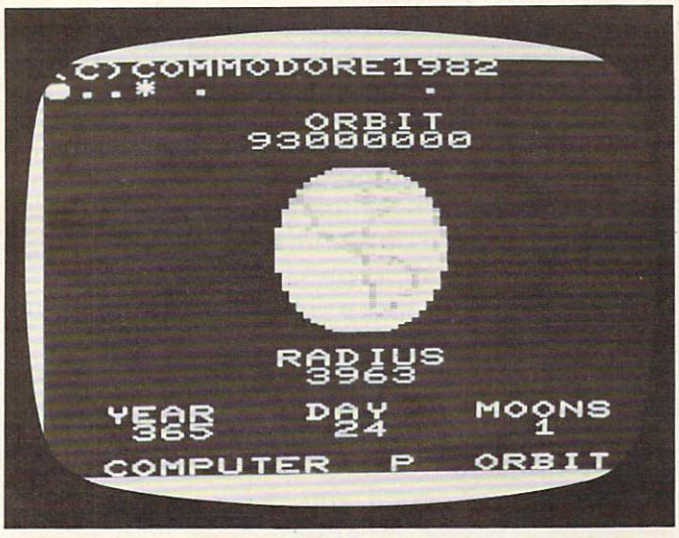
Visible Solar System

This program can hardly be called a game – it begins with a computer simulation of the solar system. You are in command of a spaceship which is on a tour of a scaled model of the planets in orbit around the sun. Additional features include a section displaying descriptive models of each of four planets and an "astrocalc," which gives detailed facts about the first six planets. Do not expect any unfriendly extra-terrestrials to appear when you use this program. If they do, turn off the VIC.

I would expect this simulation to get more classroom than home use. Flying through space shows in realtime perspective what can only be read about in textbooks. You have complete control of the position of the spaceship in three dimensions. The screen shows what one would see from an operator-controlled television camera. It can be positioned to view at any angle in an arc of 180 degrees relative to the ship. It does take some practice to get a feel for the program, and the preliminary text that comes with the cartridge is quite helpful. However, I believe an experienced teacher would be even more so.

In spite of my minor objections, *Visible Solar System* is the kind of program I would like to see more of. We have plenty of good games – I like to play them myself – but what we really need is more programs which can be used in teaching. They probably are more difficult to write effectively, and they may not sell as well, but they have a unique value.

Omega Race, Gorf, Sargon II Chess, Visible Solar System
Commodore International
487 Devon Park Drive
Wayne, PA 19087
$39.95 Each Cartridge



Visible Solar System: 3-D Planetary Display

Visible Solar System: A Star's Eye View

The Code Works is no longer publishing its cassette magazine for PET, CURSOR, *but the back issues reviewed below are still available. ($5.95 each or $4.95 for orders of 12 or more.)*

Review:

CURSOR:
Issues 23 Through 28

Marlene R. Pratto
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If your school is fortunate enough to own and use PET/CBM microcomputers, you can build your software library with programs from *CURSOR*. *CURSOR*, a cassette magazine, is published by Ron Jeffries of Code Works in Goleta, California.

Programs on *CURSOR* cost less than one dollar each, but are worth much more. I have classified *CURSOR* programs from issues 23-28 for children from kindergarten to eighth grade. In addition to five general classifications, I have added a sixth classification, TL, for Tools. Tools are those *CURSOR* programs which enable a user to program more effectively and with less effort (for example, *X-REF*) or to do other work more efficiently than without a program (*Repair*).

These tool programs may be used in a school setting. *X-REF* provides a cross-reference of variables used in a program, and *RE-NUM* renumbers the lines in a BASIC program.

One kind of "tool" program can also be used in schools to aid teachers, media specialists, and administrators in their work. In addition, students may use these tools to learn more about current and potential uses of computers. These programs enable the students to "do work" rather than to gain skills to be used later or to learn a body of knowledge. The children will learn skills and gain knowledge, but in a context different from the drill and simulation programs frequently used with children.

The *Repair* program mentioned previously can be used as a library checkout system. The program forms a file of items to be repaired. A record for a customer consists of a tag, name, amount, and location. A school media center could use the program to keep track of the books checked out to various rooms or units within the school. The tag would be the call number of the book; the name, the title of the book; the amount, the due date, such as 12.3 for December 3; and the location, the room number or unit. The program could also be used for checking out books to individuals, depending on the call number to identify the book and using the name as the name of the borrower.

The program is flexible, menu driven, and easy to use, and could be used by children in the media center. What a nice way to introduce children to the variety of uses of a computer.

The *Mail* program from *CURSOR* 25 is quite valuable. *Mail* creates and maintains a file of names for generating mailing labels. Letting children think of other ways to use the *Mail* program will help them learn new uses for other computer programs. One great advantage of *CURSOR* programs is that they are not protected; we can list them, change them, or make them into new programs when we or the children want to or are able to.

Several of these programs are usable by two persons at the same time. Among these is *"Mwhiz!"*. A mathematical statement is printed on the screen. Each person tries to determine if the statement is true or false and then to press the appropriate button before the other person. This certainly makes learning mathematics enjoyable.

Maxit is a clever and challenging game which can be played against the PET to learn some skills and strategy (hence the DT classification below) before playing with another person. Other two-person programs are *Ambush!* and *Tank!*.

One program, *Safe!*, can be played by sight-handicapped children. The program simulates cracking a safe – the child listens to the clicks as he turns the knob by pressing the number pad. The game does use graphics, but the player does not have to look at what is on the screen to "crack the safe."

Enigma should send many children on a search for information about coding and decoding in World War II. Using and learning about *Enigma* is fascinating.

Strictly speaking, *Printsit* requires a printer so that children may print the pictures they have made on the screen. However, the program can be enjoyed whether or not the pictures can be saved.

Some of the *CURSOR* games can be played at several levels. Younger children can start playing at the lowest level, and as they build up playing skills they can move to higher levels. Older children can start at higher levels. Frequently, the highest level in a game is a real challenge to even the best computer users. Multiple levels allow many children in a school to use the same programs. This provides for discussion among the different age levels and for a pleasant learning atmosphere.

One of the most congenial programs from these *CURSOR* issues is *Miser,* an adventure game. *Miser* was played continuously for two months at Erwin Open School, where it was the topic of both intense and casual conversations. Children exchanged information about what was hidden where. They used a thesaurus to look up alternative words when they could not make the computer take action. Some people think that personal computers will lead to fewer human conversations, but this program resulted in much conversation and cooperation.

Classification Of CURSOR Programs Issues 23 To 28

LEVEL	PROGRAM	ISSUE	CLASSIFICATION				
K-2	LAWN!	26	HE			PS	FF
	PRINTSIT	24	HE			PS	FF
	RESCUE!	25	HE			PS	
3-4	All of the above						
	BLASTO!	28				PS	FF
	DEFEND!	24	HE			PS	
	EMAZE!	27	HE			PS	
	FLAGS!	28		DT			FF
	MISER	27				PS	
	MWHIZ!	23		DT		PS	
	RACER!	24	HE			PS	
	SAFE!	26	HE			PS	FF
	TANK!	26				PS	
	VOZ	28			LS		
5-6	All of the above						
	AMBUSH!	23			LS	PS	
	ENIGMA	23		DT	LS	PS	
	MAXIT	25		DT	LS	PS	
	PROCHAR	27				PS	TL
	RE-NUM	24				PS	TL
	RECIPE	23				PS	TL
	SKEET!	28	HE			PS	FF
7-8	All of the above						
	ATTACK!	27				PS	
	DUEL!	27			LS	PS	
	G-WORD	24			LS	PS	
	MAIL	25					TL
	ORRERY	23		DT			
	RAM	26			LS		
	REPAIR	25				PS	TL
	STOP!	28			LS	PS	
	X-REF	25		DT		PS	TL
Teachers and aids							
	TEST	26					TL

Codes For Classifications

HE hand and eye coordination
LS logical skills
FF fun and familiarity with the PET
DT drill and tutor
PS problem solving
TL tool

Perhaps adventure style games have benefits beyond the social involvement and program solving. Because *Miser* and other adventure games have a restricted set of words that they understand, the player may know what to do, but not how to make the computer do it. This is similar to learning a programming language. The potential programmer may know what he/she wants the computer to do, but he/she must learn the words of the programming language used. Each computer language is a small subset of the language that humans know.

One of the programs, *Test,* will help teachers in grading. This program is nicely designed and even has its own example data to demonstrate what it does.

Our school here continues to find *CURSOR* an excellent resource for its PET microcomputers. The children have maintained their interest in computing over the past two and one-half years, and the newer children are quick to make friends with the PETs.

CURSOR
The Code Works
Box 550
Goleta, CA 93116

Review:

Meteorites And Red Alert For Sinclair/Timex

Tom R. Halfhill
Features Editor

As popular as the Sinclair ZX-81 computer has been in the U.S. (reportedly 300,000 sold), it has been an even bigger hit in the country of its birth, Great Britain. There, the ZX-81 (and its predecessor, the ZX-80) is the microcomputer most often found in thousands of households and hundreds of schools. For one thing, it has been available there longer than in the U.S.

It's no surprise, then, that some of the best software written for the Sinclair has come out of Britain. The large number of Sinclair users there has created both the market and the labor pool for quality software development.

A New York firm, Softsync, Inc., recently arranged to import some of that British software. Softsync's first two releases are arcade-style space games. They are being sold in Britain by a company called Quicksilva under the names *Asteroids* and *Scramble*. However, Softsync is repackaging and selling the games here as *Meteorites* and *Red Alert*.

The games are as playable, and the action as fast, as games available for machines costing many times the Sinclair's $99.95 price.

Both are one-player games compatible with the new Timex TS-1000, a version of the ZX-81 that Sinclair has licensed the watch company to market in the U.S. Both games come on cassette tape and require the 16K RAM memory expansion module.

Meteorites

Meteorites (neé *Asteroids*) is patterned after the popular coin-op arcade game. Basically, you have to defend your spaceship against oncoming hailstorms of space rocks. The game starts with your ship centered on the screen while meteorites drift randomly by. To aim, you press the "6" key to rotate the ship counterclockwise, and the "7" key to rotate clockwise. Pressing the "0" key fires a stream of torpedoes. Hitting the "9" key fires the engines and moves the ship in whatever direction it is pointed.

Because of the Sinclair's low graphics resolution, it was not possible to represent the ship with a graphics shape. Instead, the game uses a numeric character from "1" to "8" to represent the ship and its orientation. That is, the character "1" means the ship is pointed "north" (the 12 o'clock position); a "2" means the ship is pointed northeast; a "3", east; and so on. Although this might sound awkward, I had no trouble adapting to the system.

The meteorites start off as graphics shapes, and split into five "0" characters when hit by your torps. These smaller pieces are then blasted out of existence by further hits. Screen wraparound is supported, which means objects can leave one side of the screen and emerge on the other.

Although the graphics effects in *Meteorites* are sparse (there are no fancy explosions), it is a tribute to the 3K machine language program that so many objects can be moving on the screen at once without noticeably slowing down the action.

According to the instructions, a bonus spaceship is awarded at 10,000 points, although my coordination deficiencies foiled persistent attempts to verify this feature.

Interestingly, the game's skill level can be varied by POKEing numbers into certain memory locations. For example, you can increase the number of points at which bonus ships are awarded, or vary the number of ships you start off with, or change the firing pitch of torps. These features should keep the game challenging for advanced players.

Red Alert

Red Alert resembles the popular arcade game *Defender*. A random landscape of mountains and valleys scrolls horizontally at the bottom of the screen, lending illusory motion to your spacecraft. This ship can be moved up or down with the cursor-up and cursor-down keys (the "7" and "6" keys, respectively). The control is surprisingly responsive, and it takes some flying practice to keep from clipping tall peaks or bumping into the top screen border – especially since either mishap blows the ship to pieces.

There's not much opportunity to dally around practicing, though. For one thing, flocks of alien ships keep zooming across the screen head-on into your path. The aliens try to destroy you in three ways: by firing missiles, by kamikaze charges, and

by tricking you into dodging so fast that you hit either a mountain or the top of the screen. The last tactic is often the most annoying; just when you're congratulating yourself for evading the latest wave, you suddenly notice that your ship is rocketing headlong into a cliff. Unfortunately, there's no ejection seat.

You can do more than just dodge around, of course. Pressing another key fires your own missiles at the aliens, and they're even worse at evasive actions than you are. Knocking off a couple of them at the outset makes it easier to dodge the rest.

Red Alert would be good enough if this were all you had to worry about, but the programmer tossed in two more wrinkles. First, there are alien bases on the ground which present additional scoring opportunities. Daring (and presumably skillful) pilots can skim the surface, blasting the alien bases with missiles. This is a risky maneuver, however, since the slightest descent (accidental or provoked by the aliens above) reduces your ship to flying fragments.

Anyway, some of the bases are in valleys, protected from your missiles by flanking slopes. This forces you to resort to another method – your bombs. Pressing the "9" key drops one or a few bombs at once, destroying anything on contact. Like flying the ship, however, it takes some practice to learn how to properly "lead" the targets.

As a final twist, there are also some alien ships based on the surface. If you don't destroy them before they take off, they launch into a kamikaze path straight for your spacecraft.

The most amazing thing about *Red Alert* – and *Meteorites* – is that so much complex action happens simultaneously at relatively high speeds. Many Sinclair owners have been frustrated because so much software for their machines is written in BASIC. Both of these games are written in machine language, and it shows. In both cases the programmers have made the most of the Sinclair's capabilities. Of the two, *Red Alert* has the better graphics and arcade-style play, but both are top-shelf games that Sinclair users deserve.

Meteorites
Red Alert
Softsync, Inc.
P.O. Box 480
Murray Hill Station
New York, NY 10156
$14.95 each
plus $1.50 shipping/handling

In addition to Jim's review here, see Marlene Pratto's review of CURSOR, issues 23 through 28, on p. 136, along with complete ordering information.

Book Review:

PET Fun And Games

Jim Butterfield
Associate Editor

CURSOR magazine has been notable for several reasons. It's not a paper publication; the magazine is issued on cassette tape containing a "cover program" and five other PET/CBM programs. The programs are entertaining and of very high quality. And the price is surprisingly low.

CURSOR's programs haven't been exclusively games; a number of serious applications and utilities have been included over the years. But it's the games we remember best, and many of the *CURSOR* games have been memorable.

While *CURSOR* magazine ceased production with issue 30, back issues can still be obtained, and *CURSOR* may be making the transition from magazine to software house. Your dealer may stock the back issues or you may write *CURSOR* magazine at the address given in the book's Introduction.

Tape To Paper

If you can get the programs on tape, why bother with the book? After all, you can list the programs yourself. Well, the book is quite inexpensive. It is a collection of many "favorite" programs all in one place. And the program listings are useful for study. It's handy to have the game and its instructions in an easy-to-find location.

Since the book is limited to BASIC programs, some of *CURSOR*'s excellent machine language programs are not included. No worry: there's quite enough good material here to keep the reader busy and entertained. I must confess that I miss some of the classics that are too big to fit into the book: Ken Morley's "Phuzzy" and "Wuzzy" stories, for example.

Users who have both tape and book versions of a program may notice slight differences. These are usually small, cosmetic, and of no great importance.

The Games

If the book were called "PET Exercises, Simulations, and Challenges," it might enjoy more appeal in the

educational community. The word "games" seems to be taboo in some quarters. Yet games are what they are, and they're great fun.

The back cover of the book claims that 30 games and puzzles are included. I count 31. Thirteen of them are written by Glen Fisher, one of the book's editors. The remaining 18 are by various contributors. I wish that the authors' names had been included in the table of contents. There's no easy way to find a given author's programs. I would also have liked to see a cross-reference to the particular *CURSOR* issue which carried the game.

The games are divided into six sections: Action Games, Puzzles, Games of Risk, Games of Strategy, Games of Chance, and Games for Fun. These sections are somewhat arbitrary. Many games could be listed in any of several divisions.

Some are old standbys. *Reversi* and *Master Mind*, for example, are well known in many versions: ancient, computer, and commercial. Others are new, witty, and well suited to computers. *RATRUN* and *FIRE*, for example, are nicely animated and play well.

There are many styles of games. Some are action, some thoughtful. Some have the computer as an active player; in others, the computer just enforces the rules. Some are involved with handling words and numbers, others with graphic objects. You'll get a good cross section with this book.

PET Fun and Games: Selected CURSOR Programs.
by Ron Jeffries and Glen Fisher
Osborne/McGraw-Hill, 171 pages
$11.95 ©

"Pixelator" is an easier way to design custom characters for the VIC. Three accompanying programs let you save and load the character data from cassette and convert it into DATA statements – ready to use in a program. If you don't want to type everything in, the author has offered to make tape copies (see information at the end of the article).

PIXELATOR

James Calloway
Morrisville, NC

The first time you design your own characters on the Commodore VIC-20, the process can be downright thrilling. Marking off graph paper in eight by eight squares and drawing in a figure. Converting each line into a number as if the dark squares were binary one and the light squares were binary zero. Storing the numbers in memory.

Then you POKE the magic address, 36869. The screen fills with gobbledygook. But wait! Isn't that a space ship there where the "A" of READY is supposed to be? And that three-legged alien must be the "D."

Once the thrill wears off, the work can turn to drudgery. Converting your design into numbers is bad enough, but the job of typing all those numbers into DATA statements is not only boring but also subject to typographical error. A slip of the finger and your beautiful rocket cruiser looks as if it had been shot full of laser holes.

Designing Characters With Pixelator

A program called "Pixelator" restores some of the thrill of designing screen characters. Pixelator gives you four large eight by eight work areas on the screen for creating, editing, and comparing characters. Pixelator then stores those characters in RAM. On standard VICs with 3.5K memory, Pixelator will store up to 64 characters. With additional memory, the program will store up to 128 characters; it also can retrieve from memory any character you have already stored. You can even copy from the VIC's own ROM character set and change those characters to suit your needs.

Like most small computers, the VIC stores mosaics or maps of its characters in ROM (addresses 32768 to 36863). Unlike some other computers, whose characters may be five pixels wide by seven pixels tall, the VIC's characters are eight by eight. (A pixel is simply the smallest portion of the video image that a particular computer can control.) That makes the VIC's characters look a bit squat, but it's a tidy use of memory. Eight bytes are needed to describe a single character, with each byte corresponding to a horizontal line of the character. The vertical information comes from breaking the bytes into binary ones and zeros, corresponding to dark and light areas.

Just Enough Memory

By POKEing different numbers into address 36869, you can change where the Video Interface Chip looks for its character maps. You do this automatically when you change the keyboard from graphics to text mode. Graphics is a value of 240 at 36869, and text is 242. The value in between, 241, represents reversed graphics characters, but using the reversed characters doesn't normally change the value at 36869.

A value of 252 moves the map location to 4096, the start of standard 3.5K memory. Above 252 the corresponding address increases by increments of 1024, up to 7168 for a value of 255. Because of the length of the Pixelator program, it uses the highest value. (For a fuller explanation of what happens at address 36869, consult Jim Butterfield's "Browsing the VIC Chip" in the April 1982 issue of **COMPUTE!**.)

The Pixelator program, once it is up and running, consumes almost 3K of memory. On VICs that haven't been expanded, that leaves just room enough to store 64 characters. That limit coincides with the fact that the second half of the map memory starting at 7168 corresponds to screen memory in most machines. We'll discuss a way of getting around this 64-character limit later.

Of course, with expanded memory, all you have to do is select a memory location that doesn't interfere with screen memory. Sometimes the problem is solved automatically because the screen memory moves (as do the screen color addresses). The three variables in line 20 allow you to change the program to compensate. XX is map memory and should always be a multiple of 1024. SC is screen memory. CL is color memory.

When you run Pixelator, you first are offered a choice of creating a new character or retrieving an old one from memory. The choices are color-coded green and cyan, respectively. If you select "new character" by pressing the programmable key F1, the border changes from white to green, and you are asked to select one of the four work frames by keying F1, F3, F5, or F7. Next you are asked to select the character at the address where you intend to design a new shape.

Four Options Following Design

Once you've selected a character, you'll see a half-height dot screen figure pop up in the top left corner of the frame. That's your cursor, and you

can move it anywhere within the frame by using the cursor controls. To design a character, use the space bar. SHIFT/SPACE leaves a trail of red spaces in its wake. Without shifting, the SPACE bar returns the spaces to white. You can clear a cluttered frame simply by holding the SPACE bar down until all the red is gone.

After you have worked on the character to your satisfaction, you have four options. F1 stores your creation in the appropriate eight bytes of memory and then returns you to the opening format. F3 aborts the frame, returning you to the opening format without storing the character. F5 renames the character, enabling you to reassign it to a memory location different from the one for which it originally was named. This is of more use when retrieving characters from memory than when creating new ones, but it works in both modes. F7 allows you to work on a series of characters without having to go through the "select frame – select character" process every time. The command stores the current character, jumps to the next frame, and increments the character name. You can keep doing this until you have stored the question mark, at which point you are returned to the opening format.

If at the opening format you opt to retrieve a character from memory, the border changes to cyan, and you are given five choices. F1 retrieves from RAM; i.e., it accesses either characters you have already stored or whatever garbage happens to be in memory at the time. F2 accesses the VIC's ROM characters from the graphics mode, and F4 calls up the reverse of those characters. F6 and F8 are for text mode, the latter key again applying to reversed characters. You can freely mix characters from all modes and modify them to suit your needs. (If you need a full alphabet to go along with your custom characters, there is a short cut, provided you store your characters at 7168. After POKEing 255 into 36869, you can use RVS ON to get any normal character from "@" to "?". RVS OFF gives you your custom characters. This works only at 255.)

From there you are asked to select frame and select character again, but if you call up a graphics character (or, in text mode, an uppercase character) from ROM, you will be asked to rename it to something with a screen value less than 64. You now have the same options as before: to store, to abort, to rename, or to store and increment. If you have renamed a character, both the original character and its new name will be incremented.

Saving Your Custom Characters

More than likely, you will want to use Pixelator to create characters for use in some other program, such as a video game. Three shorter programs allow you to save the information the Pixelator has created. To save the characters directly on cassette as a data file, interrupt the Pixelator with the STOP key and type NEW to get rid of the program. Then load "Pixaver" into the VIC. Pixaver allows you to save a block of characters of any size, up to 64, on tape as a single data file. The first number in the file represents the screen value of the first character; the second number is the last character. This allows you to record as many different blocks as you like. Each file will contain the information necessary to store the data in the right place. Also, for convenience, each file will be tagged with the name of its first character. Now you can turn your VIC off.

The "Pixeloader" program will read the data off the cassette and enter it back into memory. Notice line 10, which sets the value of XX, the start of map memory. By changing that value, you can load character data into many different memory locations, thus bypassing the 64-character limit. Be sure that XX is a multiple of 1024, or else the characters won't properly correspond to the keyboard.

A third accessory program, called "Pixdata," will convert a block of RAM character memory into DATA statements, one for each character. The line numbers of the DATA statements will correspond to the screen value of the characters, plus 5000. DATA statements are highly inefficient, memory-wise, for storing that information, but they are much more convenient than cassette data files because they can be included within a program, which saves you the trouble of loading the characters separately.

Pixdata is not as user-oriented as the other programs because it has been stripped down to bare essentials. You probably will have to modify some lines of Pixdata each time you run it. The values SR and LS initialized in line 30, for example, represent the first and last characters, respectively. If you have only 3.5K of free RAM, don't do more than 30 characters at a time, because you'll run out of memory.

What makes Pixdata interesting is that it self-destructs, saving you the chore of deleting it line by line to make room for your own program. (If you type Pixdata in by hand, be sure to save it on tape or disk before trying it.)

The secret of Pixdata lies in the way the VIC-20 stores BASIC lines. The first two bytes of a line represent the address of the *next* line. The third and fourth bytes are the line number. After that, the line consists of numbers that represent either tokens for BASIC commands (the token for DATA is 131) or the ASCII values of string characters. All numerals are treated as strings, so a DATA state-

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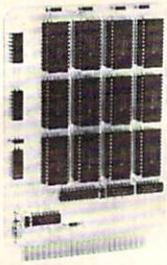

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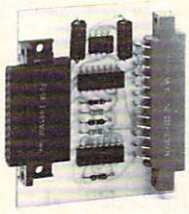

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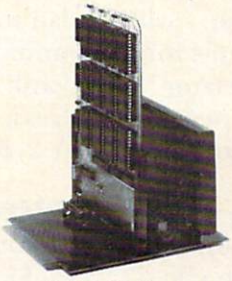

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ment may need as many as three bytes to represent a single numerical value. The number 128, for example, becomes 49, 50, and 56. Throw in a 44 for each comma, and you see why a DATA statement can use up more than four times the memory needed to store the numbers it represents.

Pixdata starts creating DATA statements at 5120, which is represented by the variable ZZ in line 40. Line 10 also sets 5120 as the end of BASIC memory, thereby protecting the DATA statements from the program itself. When Pixdata finishes creating DATA statements, it POKEs the low-high values of ZZ into the first and second bytes of line 1, the line that says "REM DELETE THIS LINE AFTER RUNNING." This causes BASIC to skip from line 1 to the first DATA statement, ignoring the rest of Pixdata in between. When you delete line 1 (simply type a "1" on a blank line and hit RETURN), the line editor compacts the DATA statements to the beginning of memory, destroying Pixdata in the process. If by adding RAM you have changed the start of BASIC memory, be sure to adjust the two addresses in line 170 accordingly before running Pixdata.

To use the DATA statements in a program, you will need a line like the following:

```
FORL=SR TO LS:FORM=0TO7:READ C:POKE
  XX+L*8+M,C:NEXTM:NEXTL
```

The values of XX (map memory), SR (first character screen value), and LS (last character) should be the same as they were in Pixdata.

Pixeloader and its companion programs should take some drudgery out of designing characters, but the programs themselves aren't much fun to type in from scratch. I will be glad to make cassette dubs of the programs for the standard fee of $3 a copy. Write "Pixelator" on a blank cassette and send it with a stamped, self-addressed mailer to James Calloway, Route 2, Box A-2, Morrisville, NC 27560.

The following articles in **COMPUTE!** provided valuable information and inspiration for the Pixelator: Jim Butterfield's "VIC Memory Map Above Page Zero" (January 1982); Doug Ferguson's "Large Alphabet for the VIC" and Butterfield's "More VIC Maps" (March 1982); Butterfield's "Browsing the VIC Chip" and Charles H. Gould's "Renumber VIC-20 BASIC Lines the Easy Way" (April 1982).

Program 1: Pixelator

```
20 XX=7168:SC=7680:CL=38400
30 POKE51,240:POKE52,XX/256-1:POKE55,240:POKE
   56,XX/256-1
40 FORLX=16TO1STEP-1:READXZ:POKEXX-LX,XZ:NEXT
   LX
50 POKEXX-10,SC/256:POKEXX-1,XX/256-1
60 PRINT"{CLEAR}{02 DOWN}";
70 FORY=1TO2:PRINT"{DOWN}{BLU}{02 RIGHT}/////
   ///{02 RIGHT}////////"
80 FORZ=1TO8:PRINT"{RIGHT}'{RED}        {BLU}
   &'{RED}        {BLU}&":NEXTZ
90 PRINT"{02 RIGHT}77777777{02 RIGHT}77777777
   {UP}":NEXTY
100 POKE36879,25:F=0:J=0:SYSXX-16:PRINT"{HOME}
   {GRN}{REV}F1{OFF}{BLU}-CREATE NEW CHA
   R."
110 PRINT"{CYN}{REV}F3{OFF}{BLU}-RETRIEVE MEMO
   RY"
120 GETS1$:IFS1$=""THEN120
130 IFS1$="{F1}"THENK=0:POKE36879,29:GOTO160
140 IFS1$="{F2}"THENPOKE36879,27:GOTO3500
150 GOTO120
160 IFJ=1THEN190
170 SYSXX-16:PRINT"{HOME}SELECT"SPC(4)"F1 F3":
   PRINT"FRAME:"SPC(4)"F5 F7";
180 GETS$:IFS$=""THEN180
190 IFASC(S$)>132THENONASC(S$)-132GOTO210,220,
   230,240
200 GOTO180
210 VV=3:HH=1:F=88:GOTO250
220 VV=3:HH=11:F=109:GOTO250
230 VV=13:HH=1:F=462:GOTO250
240 VV=13:HH=11:F=483
250 POKEF+SC,160:IFK>0THENPOKEF+CL,3:GOTO270
260 IFJ=0THENPOKEF+CL,5:GOTO280
270 IFJ>0THENC=CJ:C0=CG:GOTO320
280 SYSXX-16:PRINT"{HOME}SELECT CHARACTER";
290 GETC$:IFC$=""THEN290
300 GOSUB5000
310 IFCE=2ANDS2$="{F1}"THEN290
320 IFK=1ANDI=0ANDCE<>1THEN4000
330 IFCE>0THEN290
340 POKEF+SC,C:POKEF+CL,0:V=1:H=1:P=SC+23+VV*2
   2+HH:PA=P:PQ=PEEK(P)+72:PP=PQ
350 I=0:J=0:SYSXX-16:PRINT"{HOME}F1-STORE IN M
   EMORY"
360 PRINT"F3-ABORT"SPC(4)"F5-RENAME F7-STORE/I
   NCREMENT";
370 GETG$:POKEP,PQ:POKEPA,PP:IFG$=""THEN370
380 IFASC(G$)=32ORASC(G$)=160THENPOKEP,ASC(G$)
   :H=H+1:GOTO440
390 IFG$="{DOWN}"THENV=V+1:GOTO440
400 IFG$="{UP}"THENV=V-1:GOTO440
410 IFG$="{RIGHT}"THENH=H+1:GOTO440
420 IFG$="{LEFT}"THENH=H-1:GOTO440
430 IFASC(G$)<133ORASC(G$)>136THEN370
440 IFH>8THENH=1:V=V+1
450 IFH<1THENH=8:V=V-1
460 IFV>8THENV=1
470 IFV<1THENV=8
480 PP=PEEK(P):PA=P:IFPP=104ORPP=232THENPP=PP-
   72
490 IFG$="{F1}"THENK=0:POKEPA,PP:GOTO1000
500 IFG$="{F2}"THENK=0:POKEPA,PP:GOTO100
510 IFG$="{F3}"THENI=1:POKEPA,PP:POKEF+CL,PEEK
   (36879)-24:POKEF+SC,160:GOTO4120
520 IFG$="{F4}"THENJ=1:POKEPA,PP:GOTO1000
530 P=SC+(VV+V)*22+HH+H:PQ=PEEK(P)+72
540 GOTO370
1000 SYSXX-16:PRINT"{HOME}STORING ";:POKESC+8,C
1010 FORVE=1TO8:ZZ=0
1020 FORHY=1TO8:PO=SC+(VV+VE)*22+HH+HY
1030 IFPEEK(PO)=160THENZZ=ZZ+2^(8-HY)
1040 NEXTHY
1050 POKEXX+C*8+VE-1,ZZ:NEXTVE:IFJ=0THEN100
1060 GOTO2000
2000 CJ=C+1:CG=C0+1:S$=CHR$(ASC(S$)+1):IFASC(S$
   )>136THENS$="{F1}"
2010 IFCJ=64ANDXX=7168ANDSC=7680THENCE=2
2020 IFK=2THENK=1
2030 IFCG>127THENCG=0
2040 IFS2$="{F1}"ANDCE=2THENJ=0:GOTO100
```

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```
2050 IFK=0ANDCE=2THEN100
2060 GOTO190
3500 K=1:IFJ=1THEN3540
3510 SYSXX-16:PRINT"{HOME}F1-RETRIEVE FROM RAM"
3520 PRINT"F2-ROM GFX {REV}F4-REVERSE {OFF}F6-R
    OM TEXT {REV}F8-REVERSE{OFF}";
3530 GETS2$:IFS2$=""THEN3530
3540 IFS2$="{F1}"THENXR=XX:GOTO3580
3550 S2=ASC(S2$)-137:IFS2>-1ANDS2<4THENXR=32768
    +1024*S2:GOTO3570
3560 GOTO3530
3570 IFS2>1THENPOKE36869,242:GOTO160
3580 POKE36869,240:GOTO160
4000 IFJ=0THENC0=C
4010 SYSXX-16:PRINT"{HOME}":PRINT"LOOKING AT  "
    ;S5$:POKE7713,C0
4020 FORD=1TO8:DA=PEEK(XR+C0*8+D-1):DI=0
4030 FORDD=1TO8:DI=INT(DA/2^(8-DD)):DA=DA-DI*2^
    (8-DD)
4040 IFDI>0THENDO=160:GOTO4060
4050 DO=32
4060 IFDD=8ANDD<8THENZD=15:GOTO4090
4070 IFD=8ANDDD=8THENZD=-184:GOTO4090
4080 ZD=1
4090 ZF=SC+(VV+D)*22+HH+DD:POKEZF,DO:POKEZF+ZD,
    PEEK(ZF+ZD)+72:NEXTDD:NEXTD
4100 IFCE>0THENK=2:GOTO4120
4110 GOTO340
4120 SYSXX-16:PRINT"{HOME}RENAME":GOTO290
5000 C=ASC(C$):CE=0
5010 ONINT(C/32)GOTO5060,5040,5050,5020,5040,50
    30
5020 CE=1:RETURN
5030 C=C-64
5040 C=C-32
5050 C=C-32
5060 IFJ=1THENC0=CG
5070 IFXX=7168ANDC>63ANDSC=7680THENCE=2:RETURN
5080 RETURN
6000 DATA162,0,169,32,157,0,30,232,224,68,208,1
    ,96,76,244,27
```

Program 2: Pixaver

```
10 XX=(PEEK(56)+1)*256
3000 SYSXX-16:PRINT"{CLEAR}FIRST CHARACTER?";
3010 GETSR$:IFSR$=""THEN3010
3020 C$=SR$:GOSUB5000:SR=C:IFCE>0THEN3010
3030 PRINT"{HOME}"SPC(15)" "SR$;SPC(5)"LAST CHA
    RACTER? ";
3040 GETLS$:IFLS$=""THEN3040
3050 C$=LS$:GOSUB5000:LS=C:IFCE=1THEN3040
3060 IFSR>LSTHENSS=SR:SR=LS:LS=SS:SS$=SR$:SR$=L
    S$:LS$=SS$
3070 SYSXX-16:PRINT"{HOME}SAVING "SR$" TO "LS$;
3080 PRINT"{HOME}";:OPEN1,1,1,SR$
3090 SYSXX-16:PRINT"{HOME}SAVING "SR$" TO "LS$
3100 PRINT#1,SR
3110 PRINT#1,LS
3120 FORCZ=SRTOLS
3130 FORLL=0TO7
3140 PRINT#1,PEEK(XX+CZ*8+LL)
3150 NEXTLL
3160 NEXTCZ
3170 CLOSE1
3180 END
5000 C=ASC(C$):CE=0
5010 ONINT(C/32)GOTO5060,5030,5040,5020,5030,50
    50
5020 CE=1:RETURN
5030 C=C-64:GOTO5060
5040 C=C-32:GOTO5060
5050 C=C-128:GOTO5060
5060 IFXX=7168ANDPEEK(648)*256=7680ANDC>63THENC
    E=2:RETURN
5070 RETURN
```

Program 3: Pixeloader

```
10 XX=7168
20 OPEN1,1,0
30 INPUT#1,SR
40 INPUT#1,LS
50 FORS=SRTOLS
60 FORR=0TO7
70 INPUT#1,C:POKEXX+S*8+R,C:NEXTR:NEXTS
```

Program 4: Pixdata

```
1 REM DELETE THIS LINE AFTER RUNNING
10 POKE51,0:POKE52,20:POKE55,0:POKE56,20:REM ~
    MUST MATCH ZZ
20 XX=7168
30 SR=0:LS=26:REM FIRST AND LAST CHARACTERS
40 ZZ=5120:AA=ZZ
50 POKEZZ-1,0
60 FORL=SRTOLS
70 L2=INT((L*10+5000)/256):L1=(L*10+5000)-L2*
    256:POKEZZ+2,L1:POKEZZ+3,L2
80 POKEZZ+4,131:X=4
90 FORLL=0TO7
100 S$=STR$(PEEK(XX+L*8+LL)):S=LEN(S$)
110 FORLZ=2TOS:X=X+1:POKEZZ+X,ASC(MID$(S$,LZ,1
    )):NEXTLZ
120 IFLL=7THEN140
130 X=X+1:POKEZZ+X,44:NEXTLL
140 X=X+1:POKEZZ+X,0
150 X=X+1:Z2=INT((ZZ+X)/256):Z1=ZZ+X-Z2*256:PO
    KEZZ,Z1:POKEZZ+1,Z2:ZZ=ZZ+X:NEXTL
160 POKEZZ,0:POKEZZ+1,0
170 A2=INT(AA/256):A1=AA-A2*256:POKE4097,A1:PO
    KE4098,A2:POKE56,30
```

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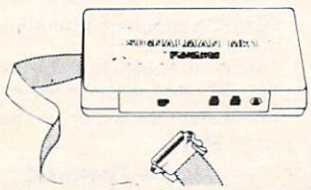

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BY L. C. Cargile and Michael Riley **$50**

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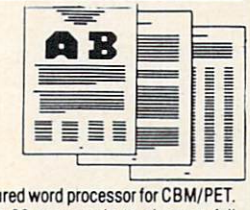
PaperMate
60 COMMAND WORD PROCESSOR

by Michael Riley



Paper-Mate is a full-featured word processor for CBM/PET. Paper-Mate incorporates 60 commands to give you full screen editing with graphics for all 16K or 32K machines (including 8032), all printers, and disk or tape drives.

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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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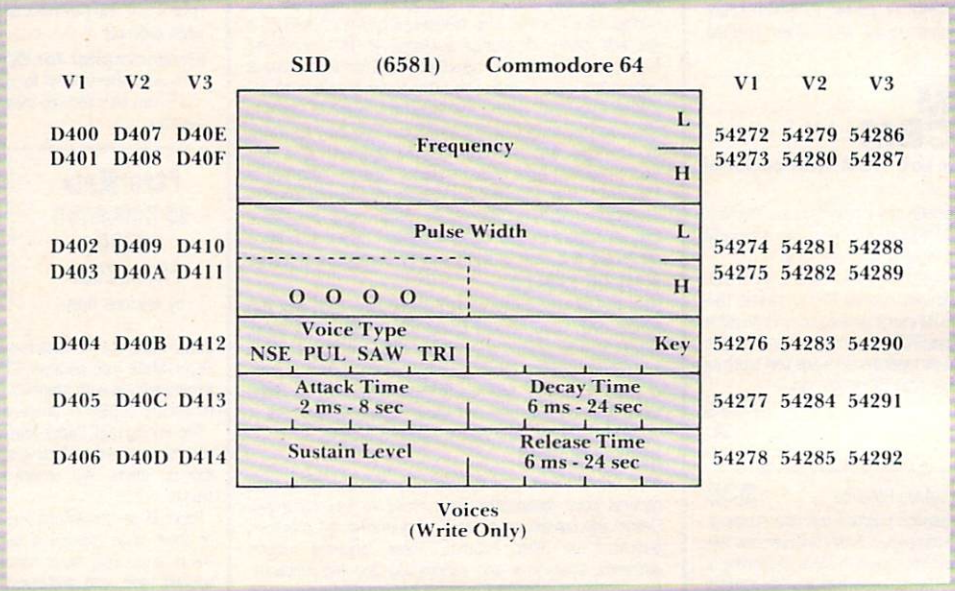
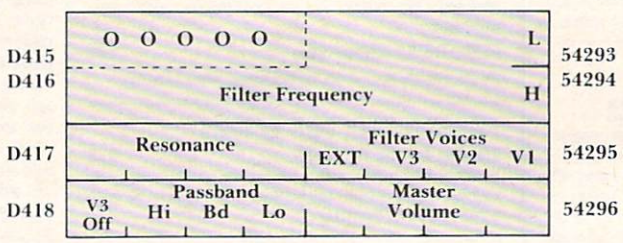
COMMODORE 64 MEMORY MAP

Compiled by Jim Butterfield, Associate Editor





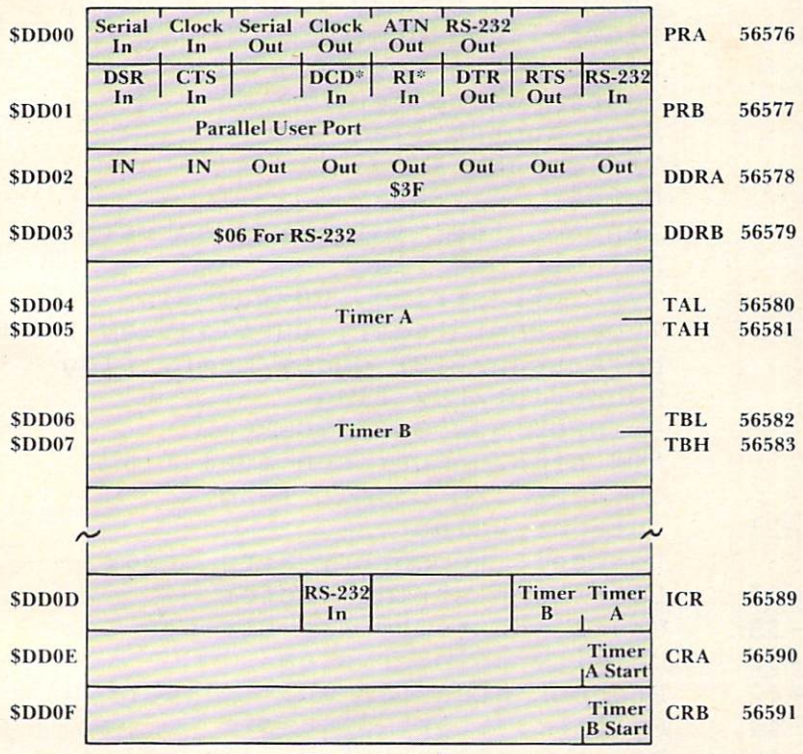
D419	Paddle X	54297
D41A	Paddle Y	54298
D41B	Noise 3 (Random)	54299
D41C	Envelope 3	54300

Sense

(Read Only)

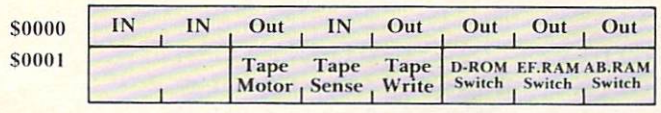
Special voice features (TEST, RING MOD, SYNC) are omitted from the above diagram.

CIA 2 (NMI) (6526) Commodore 64

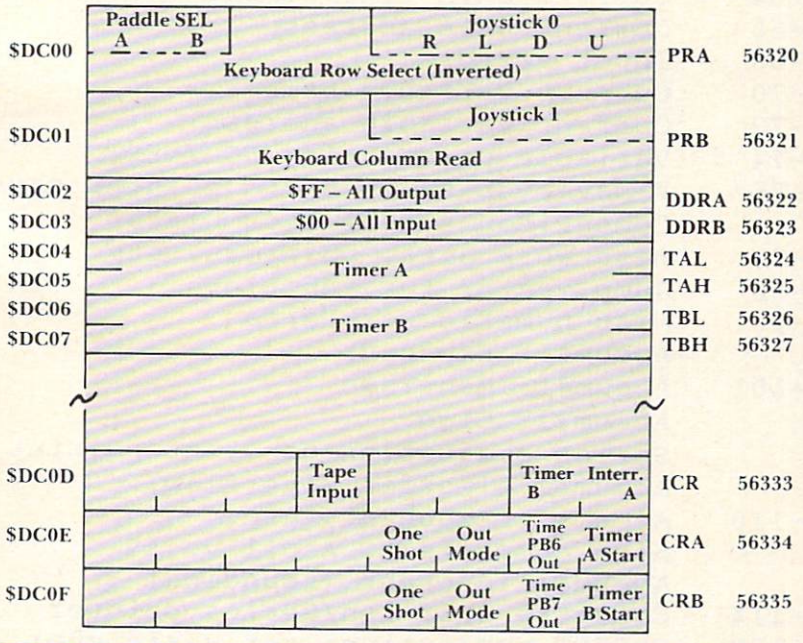


*Connected but not used by system.

Processor I/O Port (6510) Commodore 64



CIA 1 (IRQ) (6526) Commodore 64



Hex	Decimal	Description
0000	0	Chip directional register
0001	1	Chip I/O; memory & tape control
0003-0004	3-4	Float-Fixed vector
0005-0006	5-6	Fixed-Float vector
0007	7	Search character
0008	8	Scan-quotes flag
0009	9	TAB column save
000A	10	0=LOAD, 1=VERIFY
000B	11	Input buffer pointer/# subscrpt
000C	12	Default DIM flag
000D	13	Type: FF=string, 00=numeric
000E	14	Type: 80=integer, 00=floating point
000F	15	DATA scan/LIST quote/memry flag
0010	16	Subscript/FNx flag
0011	17	0=INPUT;$40=GET;$98=READ
0012	18	ATN sign/Comparison eval flag
0013	19	Current I/O prompt flag
0014-0015	20-21	Integer value
0016	22	Pointer: temporary strg stack
0017-0018	23-24	Last temp string vector
0019-0021	25-33	Stack for temporary strings
0022-0025	34-37	Utility pointer area
0026-002A	38-42	Product area for multiplication
002B-002C	43-44	Pointer: Start-of-Basic
002D-002E	45-46	Pointer: Start-of-Variables
002F-0030	47-48	Pointer: Start-of-Arrays
0031-0032	49-50	Pointer: End-of-Arrays
0033-0034	51-52	Pointer: String-storage(moving down)
0035-0036	53-54	Utility string pointer
0037-0038	55-56	Pointer: Limit-of-memory
0039-003A	57-58	Current Basic line number
003B-003C	59-60	Previous Basic line number
003D-003E	61-62	Pointer: Basic statement for CONT
003F-0040	63-64	Current DATA line number
0041-0042	65-66	Current DATA address
0043-0044	67-68	Input vector
0045-0046	69-70	Current variable name
0047-0048	71-72	Current variable address
0049-004A	73-74	Variable pointer for FOR/NEXT
004B-004C	75-76	Y-save; op-save; Basic pointer save
004D	77	Comparison symbol accumulator
004E-0053	78-83	Misc work area, pointers, etc
0054-0056	84-86	Jump vector for functions
0057-0060	87-96	Misc numeric work area
0061	97	Accum#1: Exponent
0062-0065	98-101	Accum#1: Mantissa
0066	102	Accum#1: Sign
0067	103	Series evaluation constant pointer
0068	104	Accum#1 hi-order (overflow)
0069-006E	105-110	Accum#2: Exponent, etc.
006F	111	Sign comparison, Acc#1 vs #2
0070	112	Accum#1 lo-order (rounding)
0071-0072	113-114	Cassette buff len/Series pointer
0073-008A	115-138	CHRGET subroutine; get Basic char

007A-007B	122-123	Basic pointer (within subrtn)
008B-008F	139-143	RND seed value
0090	144	Status word ST
0091	145	Keyswitch PIA: STOP and RVS flags
0092	146	Timing constant for tape
0093	147	Load=0, Verify=1
0094	148	Serial output: deferred char flag
0095	149	Serial deferred character
0096	150	Tape EOT received
0097	151	Register save
0098	152	How many open files
0099	153	Input device, normally 0
009A	154	Output CMD device, normally 3
009B	155	Tape character parity
009C	156	Byte-received flag
009D	157	Direct=$80/RUN=0 output control
009E	158	Tp Pass 1 error log/char buffer
009F	159	Tp Pass 2 err log corrected
00A0-00A2	160-162	Jiffy Clock HML
00A3	163	Serial bit count/EOI flag
00A4	164	Cycle count
00A5	165	Countdown,tape write/bit count
00A6	166	Tape buffer pointer
00A7	167	Tp Wrt ldr count/Rd pass/inbit
00A8	168	Tp Wrt new byte/Rd error/inbit cnt
00A9	169	Wrt start bit/Rd bit err/stbit
00AA	170	Tp Scan;Cnt;Ld;End/byte assy
00AB	171	Wr lead length/Rd checksum/parity
00AC-00AD	172-173	Pointer: tape bufr, scrolling
00AE-00AF	174-175	Tape end adds/End of program
00B0-00B1	176-177	Tape timing constants
00B2-00B3	178-179	Pntr: start of tape buffer
00B4	180	1=Tp timer enabled; bit count
00B5	181	Tp EOT/RS232 next bit to send
00B6	182	Read character error/outbyte buf
00B7	183	# characters in file name
00B8	184	Current logical file
00B9	185	Current secndy address
00BA	186	Current device
00BB-00BC	187-188	Pointer to file name
00BD	189	Wr shift word/Rd input char
00BE	190	# blocks remaining to Wr/Rd
00BF	191	Serial word buffer
00C0	192	Tape motor interlock
00C1-00C2	193-194	I/O start address
00C3-00C4	195-196	Kernel setup pointer
00C5	197	Last key pressed
00C6	198	# chars in keybd buffer
00C7	199	Screen reverse flag
00C8	200	End-of-line for input pointer
00C9-00CA	201-202	Input cursor log (row, column)
00CB	203	Which key: 64 if no key
00CC	204	0=flash cursor
00CD	205	Cursor timing countdown

00CE	206	Character under cursor
00CF	207	Cursor in blink phase
00D0	208	Input from screen/from keyboard
00D1-00D2	209-210	Pointer to screen line
00D3	211	Position of cursor on above line
00D4	212	0=direct cursor, else programmed
00D5	213	Current screen line length
00D6	214	Row where curosr lives
00D7	215	Last inkey/checksum/buffer
00D8	216	# of INSERTs outstanding
00D9-00F2	217-242	Screen line link table
00F3-00F4	243-244	Screen color pointer
00F5-00F6	245-246	Keyboard pointer
00F7-00F8	247-248	RS-232 Rcv pntr
00F9-00FA	249-250	RS-232 Tx pntr
00FF-010A	256-266	Floating to ASCII work area
0100-103E	256-318	Tape error log
0100-01FF	256-511	Processor stack area
0200-0258	512-600	Basic input buffer
0259-0262	601-610	Logical file table
0263-026C	611-620	Device # table
026D-0276	621-630	Sec Adds table
0277-0280	631-640	Keybd buffer
0281-0282	641-642	Start of Basic Memory
0283-0284	643-644	Top of Basic Memory
0285	645	Serial bus timeout flag
0286	646	Current color code
0287	647	Color under cursor
0288	648	Screen memory page
0289	649	Max size of keybd buffer
028A	650	Repeat all keys
028B	651	Repeat speed counter
028C	652	Repeat delay counter
028D	653	Keyboard Shift/Control flag
028E	654	Last shift pattern
028F-0290	655-656	Keyboard table setup pointer
0291	657	Keyboard shift mode
0292	658	0=scroll enable
0293	659	RS-232 control reg
0294	660	RS-232 command reg
0295-0296	661-662	Bit timing
0297	663	RS-232 status
0298	664	# bits to send
0299-029A	665	RS-232 speed/code
029B	667	RS232 receive pointer
029C	668	RS232 input pointer
029D	669	RS232 transmit pointer
029E	670	RS232 output pointer
029F-02A0	671-672	IRQ save during tape I/O
02A1	673	CIA 2 (NMI) Interrupt Control
02A2	674	CIA 1 Timer A control log
02A3	675	CIA 1 Interrupt Log
02A4	676	CIA 1 Timer A enabled flag
02A5	677	Screen row marker
02C0-02FE	704-766	(Sprite 11)

```
0300-0301   768-769   Error message link
0302-0303   770-771   Basic warm start link
0304-0305   772-773   Crunch Basic tokens link
0306-0307   774-775   Print tokens link
0308-0309   776-777   Start new Basic code link
030A-030B   778-779   Get arithmetic element link
030C        780       SYS A-reg save
030D        781       SYS X-reg save
030E        782       SYS Y-reg save
030F        783       SYS status reg save
0310-0312   784-785   USR function jump            (B248)
0314-0315   788-789   Hardware interrupt vector    (EA31)
0316-0317   790-791   Break interrupt vector       (FE66)
0318-0319   792-793   NMI interrupt vector         (FE47)
031A-031B   794-795   OPEN vector                  (F34A)
031C-031D   796-797   CLOSE vector                 (F291)
031E-031F   798-799   Set-input vector             (F20E)
0320-0321   800-801   Set-output vector            (F250)
0322-0323   802-803   Restore I/O vector           (F333)
0324-0325   804-805   INPUT vector                 (F157)
0326-0327   806-807   Output vector                (F1CA)
0328-0329   808-809   Test-STOP vector             (F6ED)
032A-032B   810-811   GET vector                   (F13E)
032C-032D   812-813   Abort I/O vector             (F32F)
032E-032F   814-815   Warm start vector            (FE66)
0330-0331   816-817   LOAD link                    (F4A5)
0332-0333   818-819   SAVE link                    (F5ED)
033C-03FB   828-1019  Cassette buffer
0340-037E   832-894   (Sprite 13)
0380-03BE   896-958   (Sprite 14)
03C0-03FE   960-1022  (Sprite 15)
0400-07FF  1024-2047  Screen memory
0800-9FFF  2048-40959 Basic ROM memory
8000-9FFF 32768-40959 Alternate:  ROM plug-in area
A000-BFFF 40960-49151 ROM:  Basic
A000-BFFF 49060-59151 Alternate:  RAM
C000-CFFF 49152-53247 RAM memory, including alternate
D000-D02E 53248-53294 Video Chip (6566)
D400-D41C 54272-54300 Sound Chip (6581 SID)
D800-DBFF 55296-56319 Color nybble memory
DC00-DC0F 56320-56335 Interface chip 1, IRQ (6526 CIA)
DD00-DD0F 56576-56591 Interface chip 2, NMI (6526 CIA)
D000-DFFF 53248-53294 Alternate:  Character set
E000-FFFF 57344-65535 ROM:  Operating System
E000-FFFF 57344-65535 Alternate:  RAM
FF81-FFF5 65409-65525 Jump Table, Including:
  FFC6 - Set Input channel
  FFC9 - Set Output channel
  FFCC - Restore default I/O channels
  FFCF - INPUT
  FFD2 - PRINT
  FFE1 - Test Stop key
  FFE4 - GET
```

With this short program for the 5K VIC, you can make any key on the keyboard represent any other key. This gives you the freedom to make an alphabetic keyboard, a numeric keypad, or any keyboard plan you need.

The VIC Keyboard Redefined

Amihai Glazer
Assistant Professor of Economics
University of California
Irvine, CA

You might need to use a numeric keyboard on your VIC. As it is, all numerals are situated on the top row of the keyboard instead of being conveniently arranged in a square pattern which makes data entry easy. This program creates just such a keypad in the center of the keyboard, as shown in Figure 1. Thus, for example, hitting the space bar will be equivalent to hitting "0," and hitting the "R" key will have the same effect as hitting the "7" key.

Not only will the screen show numerals each time the appropriate keys are pressed, but the computer will actually interpret these alphabetic keys as the corresponding numerals. The program also allows the user to redefine *any* key as any other key. You can, for example, rearrange your keys in alphabetical order, or create any keyboard you like.

Type in the program and RUN it. To enable the new interpretation of the keys, type SYS 7424 and hit RETURN. You now have a numeric keypad. To return to a normal keyboard, just hit the RUN and RESTORE keys simultaneously (alternatively, you can execute the statement POKE 655,220: POKE 656, 235). Executing a SYS 7424 will bring back the numeric keypad.

You can also redefine keys of your own choosing. Type GOTO 220 and hit RETURN. Now enter pairs of keys: the key you want changed, and then its new meaning. To stop the program, hit the F1 key. Thus, if you want the key labelled "=" to mean "*", hit the "=" key, then the "*" key, and then the "F1" key. To turn on these new definitions, type SYS 7424 and hit RETURN.

What's Happening

The program works as follows. Normally, during interrupt processing every sixtieth of a second, the VIC calls the decode logic machine language program, whose address ($EBDC) is in the jump vector in locations $028F-$0290. Our machine language program in locations $1D00-$1D14, however, sends the VIC to another machine language program we've put in locations $1D15-$1D24.

This program picks up the code for the key just pressed, given in location $CB. It then indexes into a recode table (beginning in location $1D27, decimal 7463), and puts the new code back into location $CB. Processing continues by jumping into the normal decode logic program in ROM, which is at location $EBDC.

The program's Lines 10-110 insert these two machine language programs into memory. Lines 120-140 initialize the recoding table, and lines 150-200 recode the keys in the form shown in Figure 1. Custom recoding by the user is provided for in lines 220-330. The recoding table is initialized in lines 230-250. CO$ and CN$ get the key that is being redefined, and its new definition. The codes the VIC uses for these keys are obtained from location 203 ($CB); CO and CN are assigned these values. A code of 39 (representing the "F1" key) stops the program. The appropriate changes in the recoding table, which will be used by the machine language program, are performed in lines 310-320.

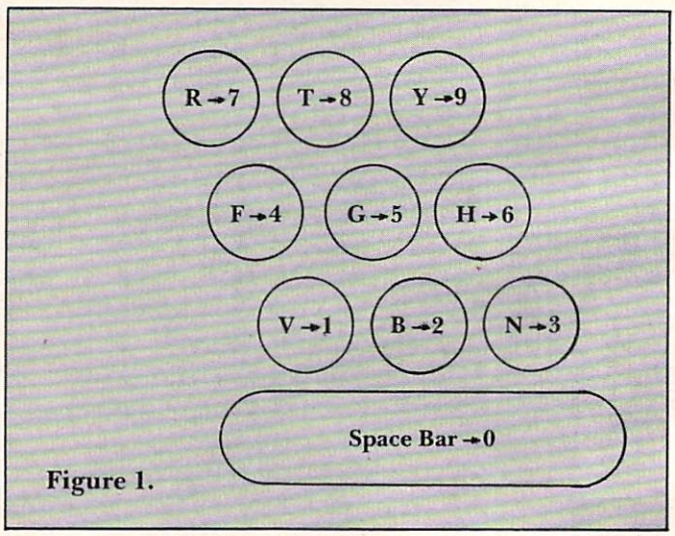


Figure 1.

```
10 REM CHANGE KEYBOARD
20 POKE 52,29: POKE 56,29:CLR
30 FOR I=7424 TO 7462
```

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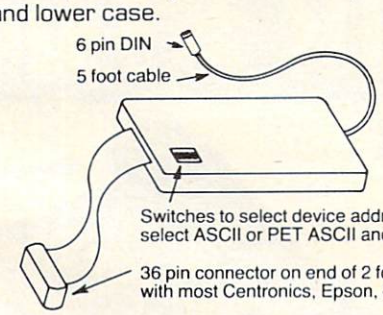

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William Robbins, Box 3745, San Rafael, CA 94912

. . . when you're through playing games.

```
40 READ D
50 POKE I,D
60 NEXT I
70 REM MACHINE LANG.
80 REM PROGRAM
90 DATA 120,8,72,138, 72,169,21,141,143,2,169
   ,29,141,144,2,104,170,104
100 DATA 40,88,96,8,72,138,72,166,203,189,39,2
   9,133,203,104,170,104,40
110 DATA 76,220,235
120 FOR I=0 TO 64
130 POKE 7463+I,I
140 NEXT I
150 FOR I=1 TO 10
160 READ CO,CN
170 POKE 7463+CO,CN
180 NEXT I
190 REM RECODED KEYS
200 DATA 32,60,27,0,35,56,28,1, 42,57,19,2,43,
   58, 10,3,50,59,11,4
210 END
220 REM CUSTOM RECODE
230 FOR I=0 TO 64
240 POKE 7463+I,I
250 NEXT I
260 PRINT "INPUT OLD, NEW"
270 GET CO$:IF CO$="" THEN 270
280 CO=PEEK(203):IF CO=39 THEN STOP
285 PRINT CO$;" ";
290 GET CN$: IF CN$="" THEN 290
300 CN=PEEK(203)
310 PRINT CN$
320 POKE 7463+CO,CN
330 GOTO 270
```

©

Atari Rainbow: Colors By Page Flipping

Robert W. Myers
Charlotte, NC

Have you ever wanted more colors than are provided on your Atari? Here's how you can mix colors to produce new colors. The demonstration program uses four colors in Graphics mode 2, which are mixed two at a time to produce a total of ten different colors.

Blending Colors

All this color, like most everything on the TV screen, is really an illusion. The blending of colors takes place because the displays are changed back and forth so fast that our eyes cannot keep up with the changes. Therefore, we see only one color, which is a mixture of the colors in all the different displays. You can mix more than two colors at a time, but as the number of displays increases, the amount of flicker on the screen increases too. The practical limit is four displays mixing at once. But the ten colors that my program produces seem like a rainbow compared to the four colors normally allowed by the CTIA chip.

This mixing is done by using multiple screen RAM areas and changing the Load Memory Scan (LMS) bytes in the display list during the Vertical Blank Interrupt. I realize that this sounds like a very complicated thing to do, but it's not.

Understanding The Display List

The Display List is a program for the ANTIC chip, which is a microprocessor that controls the TV screen so that the 6502 can be free to spend more of its time doing computational chores. The Display List is in RAM, and the first byte of the Display List can be found at PEEK(560)+256*PEEK(561).

Usually you will find that the first three bytes are the code that causes the black area at the top of the screen (to insure that nothing is lost due to overscan of the TV). The next byte is the LMS byte which sets the D6 bit (64 decimal). Added to this 64 is the ANTIC Graphics mode number, which is given in Table 1.

The LMS is a three-byte instruction. The 64+mode# is the first byte; the second and third bytes are the address of the beginning of screen RAM.

This address is what we are interested in here. Rapidly changing it allows us to switch from one picture to another and back. We cannot do this address swapping from BASIC; it is far too slow. The LMS bytes are changed by a short machine language routine that is run 60 times a second while the picture is blanked out as it returns to the top of the screen to begin the next frame. This is *Vertical Blank Interrupt.*

The routine loads the LMS bytes with the address of the first (normal) screen RAM, then it does an exclusive-or with one of the memory locations. This causes the memory location to toggle between 0 and 1. This 0 or 1 is used to determine whether a branch will be taken or not. If the branch is taken, the next instruction is JMP $E462, which puts the interrupt back in normal operation. If the branch is not taken, then the LMS bytes are changed to the address of the other (alternate) screen RAM. Then comes the JMP $E462.

Using VBI

The VBI is amazingly easy to use. All you do is write your routine that is to run during the interrupt. Then write a machine language program that puts the high byte of your routine's address into the X-register, the low byte into the Y-register, and the number seven into the accumulator. Finally you JSR $E45C. This second machine language program is at lines 160, 170, and 180 of my program.

After setting up your VBI to change the LMS, you print or plot and move one set of your screen RAM to the other (alternate) location that you have specified to the LMS. This technique should be usable with any multicolor display mode or any combination of display modes not only to mix colors, but also to mix text and graphics, to display mixed resolutions, etc.

ANTIC Graphics Mode Numbers

BASIC mode#	0	1	2	3	4	5	6	7	8
ANTIC mode#	2	6	7	8	9	10	11	13	15

```
1 REM ****************************
2 REM *{25 SPACES}*
3 REM *  MIXING COLORS TO MAKE  *
4 REM *{4 SPACES}AN ATARI RAINBOW
  {5 SPACES}*
5 REM *{10 SPACES}by{13 SPACES}*
6 REM *{4 SPACES}ROBERT W. MYERS
```

```
   {6 SPACES}*
 7 REM *{25 SPACES}*
 8 REM ****************************
 9 REM
 10 GRAPHICS 2+16:BREAK=1000
 15 REM MACHINE LANGUAGE TO BE RUN DURING
    VERTICAL BLANK{9 SPACES}INTERRUPT
 20 FOR I=0 TO 36:READ A:POKE 1536+I,A:NE
    XT I
 30 DATA 173,39,6,141,49,6,173,40,6,141,5
    0,6,173,51,6,73,1,141,51
 40 DATA 6,240,12,173,41,6,141,49,6,173,4
    2,6,141,50,6,76,98,228
 45 REM FIND DISPLAY LIST IN RAM
 50 DLIST=PEEK(560)+256*PEEK(561)
 55 REM MODIFY MACHINE LANGUAGE PROGRAM B
    Y POKEING IN ADDRESSES  FROM DISPLAY
    LIST
 60 BYTE=DLIST+4:GOSUB BREAK:REM LOAD MEM
    ORY SCAN LOW BYTE
 70 POKE 1540,LOW:POKE 1562,LOW
 80 POKE 1541,HIGH:POKE 1563,HIGH
 90 BYTE=DLIST+5:GOSUB BREAK:REM LOAD MEM
    ORY SCAN HIGH BYTE
100 POKE 1546,LOW:POKE 1568,LOW
110 POKE 1547,HIGH:POKE 1569,HIGH
120 BYTE=DLIST+20:GOSUB BREAK:REM NORMAL
     SCREEN RAM
130 POKE 1576,HIGH:POKE 1575,LOW
140 BYTE=DLIST-250:GOSUB BREAK:REM ALTER
    NATE SCREEN RAM
150 POKE 1578,HIGH:POKE 1577,LOW
155 REM MACHINE LANGUAGE PROGRAM TO INIT
    IALIZE VERTICAL BANK{4 SPACES}INTERR
    UPT
160 FOR I=0 TO 10:READ A:POKE 1600+I,A:N
    EXT I
170 DATA 104,162,6,160,0,169,7,32,92,228
    ,96
180 X=USR(1600)
220 REM DRAW FIRST SCREEN
240 POSITION 0,4
250 PRINT #6;"ATARi coMPUTER Club"
260 PRINT #6
270 PRINT #6;"{4 SPACES}OF CHARLottE"
275 REM MOVE FIRST SCREEN TO ALTERNATE S
    CREEN RAM
280 FOR I=0 TO 240
290 POKE DLIST-250+I,PEEK(DLIST+20+I)
300 NEXT I
305 REM SETCOLORS AND DRAW SECOND SCREEN
312 SETCOLOR 0,12,6
313 SETCOLOR 1,4,6
314 SETCOLOR 2,15,8
315 SETCOLOR 3,8,6
320 POSITION 0,4
330 PRINT #6;"AtARi COMPUTer CLUB"
340 PRINT #6
350 PRINT #6;"{4 SPACES}OF CHArlotte"
359 REM HOLD IMAGE ON SCREEN
360 GOTO 360
999 REM SUBROUTINE TO BREAK DOWN NUMBER
    INTO HIGH AND LOW BYTES
1000 HIGH=INT(BYTE/256)
1010 LOW=BYTE-HIGH*256
1020 RETURN
```

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There's nothing wrong with the way the CBM/PET/VIC writes data to sequential files. But sometimes it can be useful to pack the data in order to save space or aid certain types of processing.

PACK UP YOUR DATA

Jim Butterfield
Associate Editor

If your program contains a statement like PRINT#1,V and if you execute that statement when V contains a value of, say, 159, five characters will be placed on the file: Space, 1, 5, 9, and RETURN. Caution: if you don't have a 4.0 BASIC, one more character will be put to the file – a Line Feed – and it may give you problems. In this case, your program should say PRINT#1, V;CHR$(13); and be sure to include both semicolons. This applies to the VIC as well as to earlier PET/CBM units.

This is ideal for many purposes. An INPUT#.. statement executed at a later time will receive the characters just as if you had typed them on the keyboard, and the value of 159 will be input. All neat and orderly. What's more, the file is made up of conventional ASCII characters: it may be manipulated by text editors, sent to a communications line, or handled in a number of conventional ways.

But occasionally – rarely! – we might find a need to change the rules. We might have a utility program (notably a sort routine) that wants to handle the data in "columns" as if it were on a punched card. In this case, we would want to organize our data more formally. On the opposite side of the coin, we might need to crunch our data – it's very large and the file size is becoming a problem.

Formatted Data

Normally we would write the various fields of a computer record as individual items. To write name, initials, address, and balance, we might write:

```
PRINT#1,N$
PRINT#1,I$
PRINT#1,A$
PRINT#1,B
```

and it's written. Corresponding INPUT# statements would bring it back when needed. It's fairly compact and not hard to handle.

If we wanted to go into "fixed column" format, we'd need to make decisions. The name might be fitted into columns 1 to 15; the initials into columns 16 to 18; the address into columns 19 to 40; and the balance into columns 41 to 46. Now that we've made the decisions, we must pack the data that way.

Each field of data must be fitted to the fixed size. If the name were too long, we would need to trim it back with LEFT$(N$,15); if it were too short, we'd need to extend it with spaces by coding N$+" ". We can do both together by writing LEFT$(N$+" ",15). We must be sure to allow enough spaces to fill needed space; it's most convenient to define a lot of spaces as S$, which will make our coding more compact.

Names must align on the left, so that the *B* of BUTTERFIELD will fall into the same column as the *P* of PUNTER; in this way, a column sort will place the two names in correct alphabetic order. Numeric values must go the other way: 123 and 45 must be placed so that the *3* and the *5* digits are lined up. This is called "right justification" and is done with the RIGHT$ function: RIGHT$(" "+STR$(B),6). One caution on numerics: be careful with fractions; it's usually better to change everything to integer values, such as cents rather than dollars-and-cents.

The whole record then becomes:

```
S$="                " (spaces)
R$=LEFT$(N$+S$,15)+LEFT$(I$+S$,3)+LEFT$
   (A$+S$,22)+RIGHT$(S$+STR$(B),6)
```

Note that, in this case, every record will be exactly 46 characters long.

When we read this record (one INPUT# statement will do the job), we must extract the various fields. This is quite easy if we use the MID$ statement:

```
N$=MID$(R$,1,15)
I$=MID$(R$,16,3)
A$=MID$(R$,19,22)
B=VAL(MID$(R$,41,6)
```

The strings will be their original values, except that they will be padded out with extra spaces to make up the specified length.

Packing Them In

In contrast to the previous formatting, binary packing saves space. It makes the information almost indecipherable, however, unless you have the key. Also, as we crunch the information together, we lose the capability to manipulate the data with other programs, since what we are writing is not readable ASCII.

The principle is this: why store a value like 169 in five bytes of storage when the binary value of 169 will fit into one byte? It's a dangerous road. We must be sure to leave enough space for the size of the number we plan to hold. Two bytes, for example, will hold an integer value from zero

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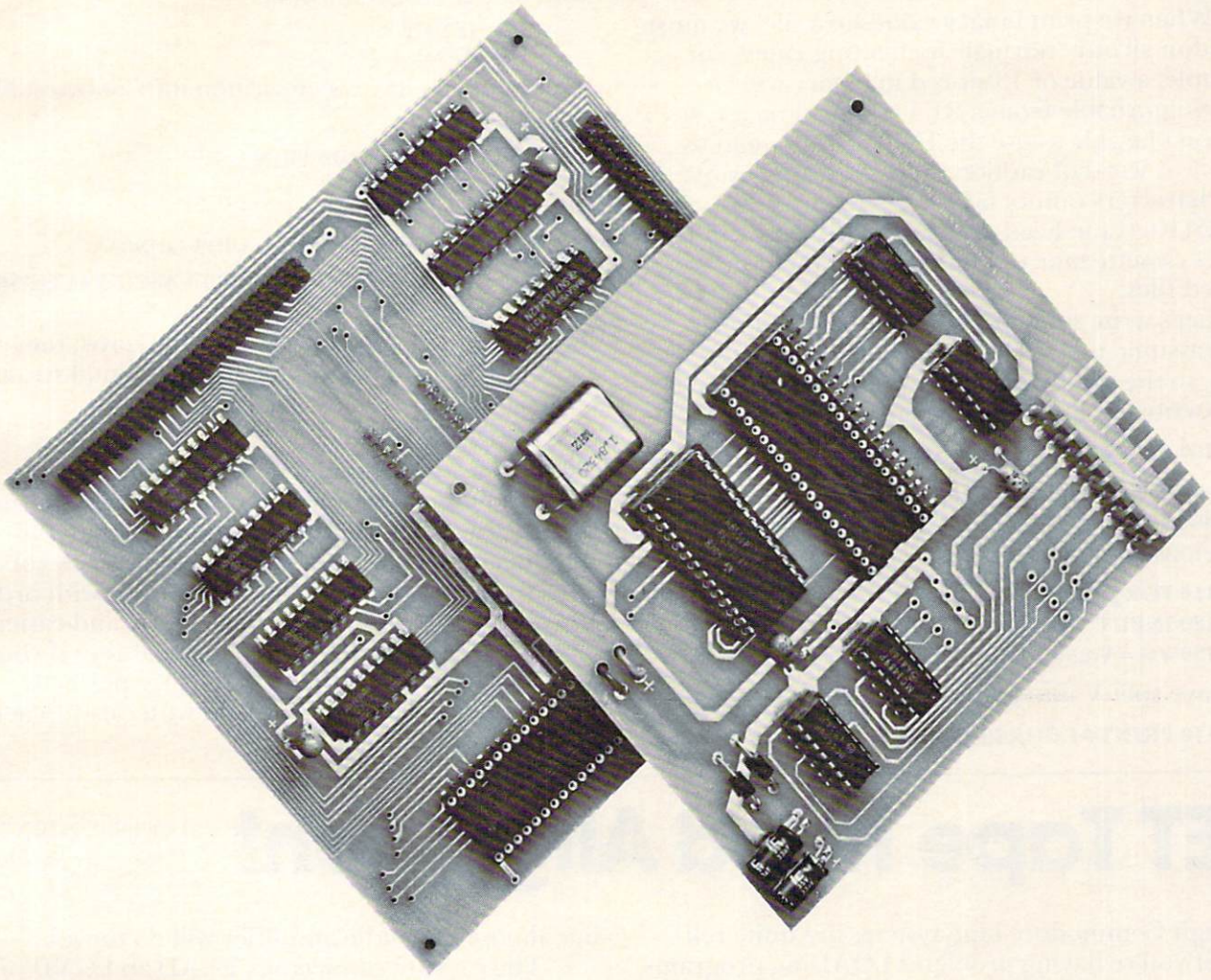

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to 65535.

When we print binary values to a file, we must abandon all our "normal" formatting rules. For example, a value of 13 stored in binary will be indistinguishable from a RETURN character, so we won't be able to use the INPUT statement to read it. A word of caution to cassette tape users: two characters cannot be written to tape files: CHR$(10) (Line Feed) and CHR$(0) (Null). This makes cassette tape of limited use in building packed files.

Let's write some packed numbers to a file. We'll assume that the numbers will fit into two bytes, so the values will range from zero to 65535. We'll write ten numbers to a binary file:

```
100 OPEN 1,8,2,"0:DATBIN,U,W"
```

Note that we designate the file as type USR (User). This is the same as Sequential. We just want to mark it as being in unusual format.

```
110 FOR J=1 TO 10
120 INPUT V:IF V<0 OR V>65536 GOTO 120
130 V%=V/256:L=V%*256
```

We have split V into low and high bytes.

```
140 PRINT#1,CHR$(L);CHR$(V%);
```

Don't forget the semicolons.

```
150 NEXT J
160 CLOSE 1
```

Ten numbers have been written into 20 bytes. Now let's read them.

```
100 OPEN 1,8,2,"DATBIN,U,R"
110 FOR J=1 TO 10
120 GET#1,A$,B$
```

We must use GET; INPUT can't cope.

```
130 PRINT ASC(A$+CHR$(0))+ASC(B$+CHR$(0))*
    256
```

The CHR$(0) is needed to allow for zeros; they will be received by the GET statement as a null string.

```
140 NEXT J
150 CLOSE 1
```

We've just coded numbers very compactly. One hundred numbers would fit into 200 bytes or one disk sector. Similar numbers in conventional sequential files would take up three or four sectors.

Most of the time, you'll want to stay with ordinary data files. They are more orderly and easier.

But you can build special types of files if you wish. Formatting and compacting are perfectly logical manipulations. Use them with care – when you need them. ©

PET Tape Head Alignment

Louis F. Sander
Pittsburgh, PA

Though Commodore tape systems are quite reliable, if you're having problems LOADing programs which were *not SAVEd on your cassette drive,* the culprit is probably head alignment. Here's a simple technique to eliminate most of the trial and error from the process of PET head alignment.

Connect an audio amplifier between the READ and GND pins on your tape player. (See Figure 1.) This will allow you to listen to your tapes as they are loaded, or even when the tape is running under manual control.

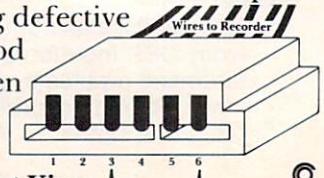
Then do your head alignment *while the tape is running.* As you turn the adjustment screw, the sound quality will make a definite transition from mushiness to crispness and back to mushiness. At the center of the crisp area, the tape and the head are in excellent alignment, and LOADing should be easy. I have used this method for several months and have found it to be useful for aligning my head to *any* foreign tape; then by using one of my own previously recorded tapes, I can easily return my head to its original state.

If you are using an amplifier to produce sound with your PET, that amplifier will work perfectly for head alignment. I use a Radio Shack #277-1008 cigarette-pack-size unit that I bought for $11.95, but almost any audio amplifier will do the job.

The cassette connector's READ and GND pins are identified in Figure 1. They are also plainly labeled on most PET printed circuit boards, right at the place where the recorder connector plugs in. You can make your connections to these pins by temporarily inserting wires or straightened paper clips into the back of the connector, where they will be able to touch the metal pins, or by contacting the appropriate points on the printed circuit board itself. Connect the shielded or grounded amplifier input wire to GND, and the other one to READ.

The voltages on these pins are very low, so there is no electrical shock hazard, but for PET's sake you should be very careful not to touch READ and GND together, or to apply any external voltages to these points.

An extra benefit of connecting the audio amplifier to the tape deck is that it lets *you* hear whatever PET hears. I've found this to be exceptionally useful for detecting defective tapes, for guaranteeing good LOADs, and for telling when PET is searching a blank area on the cassette.



PET Cassette Connector, Front View ©

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< (type "B" keyboard)
! (original keyboard)
> (for 'wedge' users)

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Command	Function
@	Display disk status / send command
@N	Format (header) a new diskette
@I	Force initialize diskette
@V	Validate diskette (collect)
@D	Duplicate diskette
@C	Copy or concatenate disk file(s)*
@R	Rename file
@S	Scratch file(s)*
@$	List directory*
@U:	Reset disk drive
@L	List disk file or BASIC program*

* Added/enhanced disk command.

EXTENDED EDITOR

Command	Function
/	Quick load from disk
↑	Quick load from disk with auto run
APPEND	Append from disk to end of current program
AUTO	Auto line number (allows header)
BLOAD	Load machine language (binary) file
BRUN	Load and execute machine language program
CHANGE	Change pattern to another pattern
CLOSE	Close one or all files
CMD	Set output to file (does not send "READY.")
DELETE	Delete a range of lines from program
DUMP	Dump all scalar variables to screen or file
EXEC	Execute a file as keyboard commands
FIND	Find occurances of a pattern
GET	Read a sequential file into editor
KEY	Define a key as a special function
KEYS	Turn key functions on
KILL	Disable SYSRES™
KILL*	Disable SYSRES™ and unreserve memory
LIST	Improved BASIC LIST command
LOAD	Defaults to disk drive
MERGE	Merge from disk into current program
MON	Break to current machine language monitor
OLD	Restore program after "NEW"
PUT	Send program to disk as text file
RENUMBER	Renumber all or part of program
RUN	Run current program, ignores screen garbage
SAVE	Defaults to disk drive, allows replace
SETD	Set disk device #, allows multiple drives
SETP	Set printer channel, format mode, paging
TRACE	Select 1 of 3 trace/step modes and speed
VERIFY	Compare current program against disk/tape
WHY	Print position of last error
WHY?	List line of break or error
*	Send output to printer
#	Display current version of SYSRES™

COMPARE SPECIFICATIONS!	SYSRES™	POWER™
Number of ADDED commands	33	13
Number of IMPROVED BASIC commands	7	none
Number of DOS SUPPORT commands	11	none
Approximate added syntax options	1200	60
Instruction manual length	86 pages	75 pages
Instruction manual style	structured	conversational
Re-loactable?	yes	no
Use on more than one (any) PET/CBM™	yes	no
Upgradable	yes	no

COMPARE FEATURES!	SYSRES™	POWER™
Automatic printer output?	yes	no
Selectable ASCII conversion?	yes	no
List programs without loading them?	yes	no
Formatted program listings?	yes	no
Dump SEQuential/RELative files?	yes	no
Edit data files?	yes	no
True program merge?	yes	no
Auto number with **AUTO TEXT**?	yes	no
Load machine language programs?	yes	no
Auto-execute machine language programs?	yes	no
Directory (menu) file commands?	yes	no

COMPARE "EQUIVALENT" FUNCTIONS!

Function: Change occurances of one pattern to another.

Feature	CHANGE	@
Command word		
'Wild cards' in search string?	yes	yes
'Wild cards' in replace string?	yes	no
Selectable range?	yes	yes
Match in entire text?	yes	yes
Match in commands only?	yes	no
Match exact variable names?	yes	no

Function: Define special one-key functions.

Feature	KEY	REM"
Command word		
Requires BASIC program changes?	no	yes
Destroys variables?	no	yes
Re-define any key?	yes	no
Maximum string length	255	73
Quotes and carriage-return allowed	yes	no
Re-define any token key?	yes	no
Retain user keys from program to program?	yes	no

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The two programs offered here use only the three Atari console keys to input answers. These programs should be useful for children as well as for programmers interested in learning more ways to use their machines. Requires at least 16K of memory.

Adding By Counting: Atari And Pre-schoolers

Stephen Levy
Bowie, MD

Using computers to teach young children can be fun and challenging. The Atari's design makes it extremely easy for young children to use. The Atari offers numerous ways other than the keyboard for a child to input answers.

Program 1, called "Add," simply teaches a very young child to add by presenting a simple addition problem and an equivalent number of symbols for each number in the problem. By counting the symbols, the child can decide on the answer. The child then presses the SELECT key until his/her answer (with the appropriate number of symbols) appears on the screen. In addition, the word for each number in the problem appears.

```
  5 ***** FIVE
+ 2 ##  TWO
  7 ^^^^^^^
```

To find out if an answer is correct, the child holds down the OPTION key. Program 3, which must be added to Program 1, contains the subroutines for the computer's response for correct and incorrect answers, as well as some music and sound. If the child gives an incorrect response, he/she is given another try. If the answer is correct, the child hears a song and then is given the option of another problem.

"Match," Program 2 (which also must be merged with Program 3), is designed similarly to Add, except in this case the child must match the word for a number with the correct number.

The Merge Timesaver

Neither Program 1 (Add) nor Program 2 (Match) will RUN alone. Each needs to be merged with Program 3. This was done in order to avoid having to type program lines unnecessarily. Program 3 should be typed and LISTed to disk (LIST"D1:‹filename›") or to tape (LIST"C:") first. Then type Program 1 and ENTER Program 3 to merge Programs 1 and 3 (Disk: ENTER"D1:‹filename›"; Tape: ENTER"C:"). You can repeat this operation to use Program 2. This avoids your having to type Program 3 twice. Also, all three programs can be merged into one by adding a menu option for the user at line 35 and changing lines 40 and 50 to IF-THEN statements based on the selection from the menu:

```
35 POSITION 3,2: PRINT "Press |SELECT| for
   ADD": POSITION 3,5: PRINT "Press |OPTION|
   for MATCH"
40 IF PEEK(53279)=5 THEN GOTO 300
50 IF PEEK(53279)=3 THEN GOTO 1400
60 GOTO 40
```

These two programs (Add and Match) have been written so that they can be merged easily.

Line 30 contains a long string which is used to print the word for the number chosen at random. Lines 105 and 115 in Add and line 230 in Match are used to select the appropriate characters from the string NUMBER$(line 30); this is more easily studied in line 230.

Here is a summary of the major sections of the program.

100-115	print the proper number of symbols and the word for the numbers.
120-130	select numbers for problems.
200-220	position answer and symbols on screen.
230	selects proper characters from NUMBER$.
240-260	select symbols to be used.
300	begins main program for Add.
318-360	print problem and go to subroutine to print symbols.
380-430	are routine to select answer.
450-460	check for correct answer.
520(5000-5520)	correct response.
600-695	incorrect response.
1400	begins program for Match (select a number).
1430-1445	print the word for the number.
1450	prints number.
1460-1520	select answer.
1610-1620	check for correct answer.

Program 1.

```
1 REM ADD
2 REM BY STEPHEN LEVY
3 REM BOWIE, MARYLAND
20 DIM CLEAR$(1),NUMBER$(51),C$(1),NU
   M$(6)
30 NUMBER$="ZERO ONE  TWO  THREEFOUR
   FIVE SIX  SEVENEIGHTNINE ":CLEAR$=
   CHR$(125):C$=CHR$(94)
40 GOTO 300
100 FOR AA=1 TO NUM1:POSITION AA+5,4:
    PRINT #6;C$:NEXT AA
105 POSITION AA+6,4:PRINT #6;NUMBER$(
    NUM1+1+(NUM1*4),NUM1+5+(NUM1*4)):
    RETURN
```

The New Standard

The following is from a review by Analog 400/800 magazine comparing programs for personal finance for Atari* computers...

"The programs we will discuss are *Personal Financial Management System* from Atari, *A Financial Wizard* from Computari, and *Budgetmaster* from Sunrise Software.

All three programs begin with the basic premise of setting up a budget, helping you follow it, and giving you an idea of where you are spending your hard earned dollars.

A Financial Wizard from Computari is by far the best of these programs, and will be *the standard of comparison* for the others. There are 26 expense categories available that are easily adapted to your personal requirements; 21 are regular expense accounts, one is reserved for salary and four are usage categories for record keeping, such as gas and electric usage. You then input your budgeted amounts.

The check entry mode is very simple to use. After asking you what month you are entering, the program prompts you to enter the check information including whether or not it is tax deductible. Come tax time, you will *really* appreciate this function and the Check Search mode which will search by Name, Category, Check # or tax deductible checks.

The way *A Financial Wizard* displays and handles your tabulations is excellent. You can chart your actual expenses vs. your budget by month, by category or Year to Date. Tabulations by month give you a list of all categories, how much you spent, how much you budgeted, the dollar amount plus or minus your budget and the percentage of your total income you are spending on each category. The tabulation by category also gives you actual expense vs. budget, the difference, and the average amount you are spending. Besides the charts, you can also look at your expenses vs. budget in bar graph form, again by month or by category. There it is in black & white (and blue and gold). The amount you budgeted vs. the amount you spent.

Everything about this program is excellent, but where it *really* outshines the rest is in the Check Reconciliation. In effect, it gives you your bank statement on the screen, a complete list by month of all your checks and deposits.

Graphics, while really not a factor in the quality of programs of this type, do make your budgeting chores a little more pleasant. Again *A Financial Wizard* comes out on top.

The version of *A Financial Wizard* that was reviewed is version 1.3. We have been told that a version 1.5 is coming out. This newest version will be enhanced in a few ways. There will be a check writer option. You enter your checks as if they have already been written, the program will perform all of the previously mentioned functions and if you have a printer, will print out your checks, you just sign and mail. Bank compatible checks will be available from Computari; ordering information will be in the package. There will also be an audit feature. User compatibility is excellent, and is set up with most of the instructions on the screen so you are not constantly referring to the instruction manual.

We strongly recommend this program."

A Financial Wizard 1.5 — **The Ultimate System**

- Budget–forecast 26 expense categories
- Check Entry–easy data entry–scan & correct 26 major & 36 sub-categories–information block
- Check Search–single or multiple parameters–(up to seven) to search entries
- Tabulations–detailed expense vs. budget by month, year-to-date, category
- Bar Graphs–screen displays in graph form expenses vs. budget–by month or category–printing with graphic capable printers
- Check Reconciliation–fast clearing of resident checks & deposits, complete summary report
- Checkwriter–print your custom checks
- Printouts–most popular printers • Audit Report
- Multi-Colored Graphics • Audio Enhancements
- 7 Utility Programs • User-Friendly Operation
- Easy To Use Instruction Manual
- Tinted Plastic Storage Case

The system is designed for Atari computers having a minimum of 24K and operating from a disk drive. The price is only $59.95 plus $3 for handling/postage. If your dealer does not have **A Financial Wizard**... Telephone orders are accepted on Mastercharge or Visa credit cards. Mail order must be accompanied by check or money-order or credit card #. Dealer Inquiries invited. (405)751-2783.

*trademark of Atari Inc. OK residents ad 4% Tax.

A Financial Wizard Exclusively thru ON LINE COMPUTER CENTERS of OKC™

10944 North May
Oklahoma City, OK 73120
(405) 751-2781

☐ CHECK ENCLOSED ☐ VISA ☐ MASTERCHARGE

NAME (Print) _____

Address _____

City _____ State _____ Zip _____

Card # _____ Exp. _____ Sig. _____

```
110 FOR AA=1 TO NUM2:POSITION AA+5,6:
    PRINT #6;C$:NEXT AA
115 POSITION AA+6,6:PRINT #6;NUMBER$(
    NUM2+1+(NUM2*4),NUM2+5+(NUM2*4)):
    RETURN
120 NUM1=INT(RND(0)*10):RETURN
130 NUM2=INT(RND(0)*10):RETURN
140 FOR WAIT=1 TO 500:NEXT WAIT:RETURN
200 IF AA=19 THEN 315
205 IF AA<11 THEN POSITION 5+AA,8:PRI
    NT #6;C$:POSITION 3,8:PRINT #6;AA
206 SOUND 0,75,10,8
207 IF AA=10 THEN POSITION 2,8:PRINT
    #6;"10 "
210 IF AA>10 THEN POSITION 5+(AA-10),
    9:PRINT #6;C$:POSITION 2,8:PRINT
    #6;AA
215 SOUND 0,0,0,0
220 RETURN
240 CHAR=INT(RND(0)*8)+36:GOTO 260
250 CHAR=INT(RND(0)*5)+60
260 C$=CHR$(CHAR):RETURN
300 REM ADDING
310 GOSUB 120:GOSUB 130
315 GRAPHICS 18:SETCOLOR 4,14,12:SETC
    OLOR 0,8,18
318 POSITION 3,4:PRINT #6;NUM1
320 IF NUM1=0 THEN POSITION 5,4:PRINT
     #6;"ZERO":GOTO 340
330 GOSUB 240:GOSUB 100
340 POSITION 3,6:PRINT #6;NUM2
345 IF NUM2=0 THEN POSITION 5,6:PRINT
     #6;"ZERO":GOTO 360
350 GOSUB 250:GOSUB 110
360 POSITION 2,7:PRINT #6;"■■■":POSIT
    ION 1,5:PRINT #6;"+"
370 AA=0:POSITION 3,8:PRINT #6;"0"
375 GOSUB 240
380 POSITION 0,0:PRINT #6;"press sele
    ct to{12 SPACES}change answer":GOS
    UB 140
385 IF PEEK(53279)=5 THEN AA=AA+1:GOS
    UB 200
390 POSITION 0,0:PRINT #6;"PRESS■OPTI
    ON■WHEN ■YOU■LIKE■YOUR■ANSWER "
    :GOSUB 140
400 IF PEEK(53279)=5 THEN AA=AA+1:GOS
    UB 200
420 IF PEEK(53279)=3 THEN 450
430 GOTO 380
450 IF AA=NUM1+NUM2 THEN GOSUB 520
460 IF AA<>NUM1+NUM2 THEN GOSUB 600:G
    OTO 315
470 SETCOLOR 4,14,12:SETCOLOR 0,8,18
480 POSITION 0,0:PRINT #6;"PRESS■SELE
    CT■FOR{4 SPACES}■ANOTHER PROBLEM
    {8 SPACES}":GOSUB 140:GOSUB 140
485 IF PEEK(53279)=5 THEN 300
490 IF PEEK(53279)=3 THEN END
500 POSITION 0,0:PRINT #6;"press OPTI
    ON to end{18 SPACES}":GOSUB 140
510 GOSUB 140:GOTO 480
```

Program 2.

```
1 REM MATCH
2 REM BY
3 REM STEPHEN LEVY
4 REM BOWIE, MARYLAND
20 DIM CLEAR$(1),NUMBER$(51),C$(1),NU
   M$(6)
30 NUMBER$="ZERO ONE  TWO  THREEFOUR
   FIVE SIX  SEVENEIGHTNINE ":CLEAR$=
   CHR$(125):C$=CHR$(94)
50 GOTO 1400
140 FOR WAIT=1 TO 500:NEXT WAIT:RETURN
230 NUM$=NUMBER$(COUNT+1+(COUNT*4),CO
    UNT+5+(COUNT*4)):RETURN
1400 REM SELECT A NUMBER
1403 COUNT=INT(RND(0)*9):GOSUB 230
1405 GRAPHICS 18:SETCOLOR 4,5,9:SETCO
     LOR 0,7,5
1410 POSITION 1,0:PRINT #6;"MATCH■UP■
     THE word":POSITION 2,1:PRINT #6;
     "WITH■THE number"
1412 POSITION 0,8:PRINT #6;"PRESS sta
     rt TO BEGIN"
1415 AA=1
1416 GOSUB 140
1417 IF PEEK(53279)<>6 THEN 1417
1420 GRAPHICS 18:SETCOLOR 0,1,13:SETC
     OLOR 4,5,9
1430 POSITION 8,7:PRINT #6;NUM$
1440 POSITION 2,3:PRINT #6;"SELECT■TO
     ■CHANGE":POSITION 1,4:PRINT #6;"
     OPTION■IF YOU■LIKE"
1445 POSITION 4,5:PRINT #6;"YOUR■ANSW
     ER"
1447 GOSUB 140
1450 POSITION 1,10:PRINT #6;"0■1■2■3■
     4■5■6■7■8■9"
1460 IF PEEK(53279)=5 THEN AA=AA+2:SO
     UND 0,75,10,8:FOR W=1 TO 10:NEXT
      W:SOUND 0,0,0,0
1470 IF PEEK(53279)=3 THEN 1600
1480 IF AA>19 THEN AA=1:POSITION 19,9
     :PRINT #6;" "
1490 IF AA=1 THEN 1510
1500 POSITION AA-2,9:PRINT #6;" "
1510 POSITION AA,9:PRINT #6;C$
1515 GOSUB 140
1520 GOTO 1460
1600 ANS=((AA+1)/2)-1
1610 IF ANS=COUNT THEN GOSUB 520
1620 IF ANS<>COUNT THEN GOSUB 600:GOT
     O 1420
1630 GOSUB 140
1635 GRAPHICS 18:SETCOLOR 4,8,12:SETC
     OLOR 0,8,2
1637 POSITION 1,3:PRINT #6;"VERY GOOD
     ":POSITION 2,5:PRINT #6;NUM$;" I
     S ";COUNT
1639 GOSUB 140:GOSUB 140
1640 POSITION 2,5:PRINT #6;" OPTION T
     O END"
1645 POSITION 0,3:PRINT #6;"
     {13 SPACES}"
1650 POSITION 1,1:PRINT #6;"SELECT FO
     R ANOTHER{6 SPACES}PROBLEM
     {7 SPACES}"
1660 IF PEEK(53279)=3 THEN END
1670 IF PEEK(53279)=5 THEN 1403
1680 GOTO 1660
```

Program 3.

```
520 POSITION 2,11:PRINT #6;"correct":
    GOSUB 5000:RETURN
600 REM WRONG ANSWER
610 POSITION 2,11:PRINT #6;"sorry"
615 FOR S=1 TO 2
620 SOUND 0,120,2,8
625 GOSUB 695
635 SOUND 0,29,10,12
636 FOR WAIT=1 TO 40:NEXT WAIT
640 GOSUB 690:NEXT S
650 FOR S=1 TO 3
660 SOUND 0,180,2,8
670 GOSUB 695:GOSUB 690
672 NEXT S
673 FOR S1=1 TO 2
```

```
674 SOUND 0,29,10,11
676 FOR WAIT=1 TO 40:NEXT WAIT
677 GOSUB 690:NEXT S1
680 RETURN
690 SOUND 0,0,0,0:FOR WAIT=1 TO 40:NE
    XT WAIT:RETURN
695 FOR WAIT=1 TO 80:NEXT WAIT:RETURN
5000 REM INTRO MUSIC
5005 S3=2
5010 MUSIC=INT(RND(0)*2)+1
5020 RESTORE 5300+(MUSIC*100)
5030 READ S1,TIME
5040 IF S1=-1 THEN SETCOLOR 4,8,3:RETURN
5050 SOUND 0,S1+3,10,7:SOUND 1,S1,10,11
5055 SETCOLOR 4,S3,8
5060 FOR WAIT=1 TO TIME*20:NEXT WAIT
5070 SOUND 0,0,0,0:SOUND 1,0,0,0:FOR
     WAIT=1 TO 5:NEXT WAIT
5075 S3=S3+1:IF S3>15 THEN S3=1
5080 GOTO 5030
5400 DATA 122,2,122,2,82,2,82,2,73,2,
     73,2,82,4,92,2
5410 DATA 92,2,97,2,97,2,109,2,109,2,
     122,4
5420 DATA 82,2,82,2,92,2,92,2,97,2,97
     ,2,109,4
5430 DATA 82,2,82,2,92,2,92,2,97,2,97
     ,2,109,4
5440 DATA 122,2,122,2,82,2,82,2,73,2,
     73,2,82,4
5450 DATA 92,2,92,2,97,2,97,2,109,2,1
     09,2,122,4,-1,-1
5500 DATA 122,2,109,2,97,2,122,2,122,
     2,109,2,97,2,122,2,97,2,92,2,82,
     4,97,2,92,2,82,4
5510 DATA 82,1,73,1,82,1,92,1,97,2,12
     2,2,82,1,73,1,82,1,92,1
5520 DATA 97,2,122,2,122,2,82,2,122,4
     ,122,2,82,2,122,4,-1,-1
```

For PET/CBM, Upgrade or 4.0 BASICs, with disk, this program will make the changes necessary so that any program will start itself RUNning. It need not be the first program on the disk – the program itself, when LOADed, will take control of the computer.

PET Self-starting Programs

Richard Mansfield
Senior Editor

There are some programs which are used so often that it is convenient to put them first on a disk if you use BASIC 4.0. Located on the disk as the first program, it will then automatically LOAD and RUN if you hit the RUN key. (Upgrade BASIC's RUN key tries to load from the tape drive.) "Bootfixer," however, will make *any* program self-starting.

If you have a disk of frequently used utilities, it might be worthwhile making every one of them self-starting. With 4.0 BASIC, you could have any one of them up and running with a simple dL"name. Also, people who have never used a computer would find this method of RUNning simpler to learn. All they would need to do is turn on the machine, insert a disk, and type in the name of the program they wanted: then the computer takes over. Built-in disaster prevention, such as a program with a disabled STOP key, should eliminate many of the start-up crashes experienced by novices.

Making The Mock Stack

Before Bootfixer can change another, target program, you must first prepare a special, slightly longer version of the target. It will include page one (memory from 256 to 511), which is the secret of automatic RUNs. It's easy. If your target program is called "HEXDUP," LOAD it normally and then type SYS 4 to get into the monitor. Type: .M 00C9 00C9 (RETURN) (this shows you the program's highest location in memory), and you will see something like:

```
.M 00C9 00C9
00C9  C5 04 00 00 00 00 00 00
```

We only care about those first two hex numbers. To reSAVE the program with a different name (HEXDUP1), switch the two hex numbers and add one. In this case, HEXDUP ended in memory at 04C5, so we make it 04C6 during the monitor SAVE. Normally, a BASIC program starts at 0401 hex, but we are going to SAVE this special version from 0100, the bottom of the stack. So, type in the following fashion (substituting your program's new name and the correct end address plus one found at 00C9):

```
.S "HEXDUP1",08,0100,04C6
```

That's it. We now have a version of HEXDUP which contains a false page one, a mock stack, which will be loaded in whenever HEXDUP1 is loaded. The computer puts all of its machine language RTS addresses (the same as BASIC's RETURN) on the stack. Bootfixer will now do two things to HEXDUP1. It will replace part of the false stack (on HEXDUP1 while it sits on the disk) with 60 03 60 03, etc. This has the effect of sending control of the computer to address 0361 when HEXDUP1 is loaded into the machine. Second, a little machine language routine is inserted into HEXDUP1 at 0361 to make it start a BASIC RUN when control is sent via the false stack to 0361.

To transform HEXDUP1, just LOAD and RUN Bootfixer. It will ask you for the name of the program you want fixed and then move into the disk and make the necessary changes. If you accidentally give it the name of a program not yet prepared to be fixed, it will report that to you and close all files without doing any damage. Replace lines 480 and 490 with 481 and 491 if you use Upgrade BASIC.

Machine language programs can be made self-starting too. Find out the starting address of the machine language program, and replace the CHR$(96) in line 420 with the least significant byte *plus one* and the CHR$(3) in line 440 with the most significant byte. This will send control directly to the machine language program following a LOAD.

```
100 PRINT"{CLEAR} BOOTFIXER ":T=18:S=1:D$="0":
    OPEN15,8,15,"I"+D$
110 OPEN2,8,2,"#"+"0":REM     OPEN CHANNEL 2
120 REM **** LOCATE TARGET
130 INPUT"FILENAME";NA$:LN=LEN(NA$)
140 GOSUB210:GOSUB300
150 IFT=0THENPRINTNA$" NOT FOUND":GOTO540
160 GOTO140
170 GOTO540
180 REM ***POINT TO BYTE AND GET IT INTO X.
190 PRINT#15,"B-P:"2,L:GET#2,A$:IFA$=""THENA$=
    CHR$(0)
200 X=ASC(A$):RETURN
210 PRINT"TRACK"T" SECTOR"S:REM *** CHANGE TRA
    CK/SECTOR
220 PRINT#15,"U1:2,"D$;T;S:REM    PUT T/S INTO
     DISK BUFFER
230 L=0:GOSUB180:T=X:L=1:GOSUB180:S=X:RETURN
240 REM *** CHECK FOR FULL MATCH
250 FORJ=ITOI+LN:L=J:GOSUB180:IFX=0ORX=160 THE
    N270
260 X$=X$+CHR$(X):NEXTJ
270 IFX$<>NA$THENX$="":RETURN
280 L=I-2:GOSUB180:TT=X:L=I-1:GOSUB180:SS=X:PR
    INT
```

```
290 GOTO340
300 REM *** CHECK THROUGH ONE BLOCK FOR NAME M
    ATCH
310 FORI=5TO230STEP32
320 L=I:GOSUB180:IFCHR$(X)=LEFT$(NA$,1)THENGOS
    UB240
330 NEXTI:RETURN
340 REM *** ACCESS 1ST SECTOR OF TARGET PROGRAM
350 T=TT:S=SS:GOSUB210
360 L=2:GOSUB180:AL=X:L=3:GOSUB180:AH=X:SA=AL+
    AH*256
370 IFSA<>256THENPRINT:PRINTNA$" IS NOT PREPAR
    ED FOR BOOTFIX":GOTO540
380 REM *** ESTABLISH FALSE STACK
400 PRINT#15,"U1:2";DR;TT;SS:PRINT
410 FORPB=173TO254STEP2:PRINT#15,"B-P:2";PB
420 PRINT#2,CHR$(96);
430 PRINT#15,"B-P:2";PB+1
440 PRINT#2,CHR$(3);:PRINT"*";:NEXT:PRINT
450 PRINT#15,"U2:2";DR;TT;SS
460 GOSUB210:PRINT
470 REM ***PUT AUTOBOOT CODE ONTO PAGE THREE
480 DATA 165, 202, 133, 43, 165, 201, 133, 42,
     32, 233, 181, 32
481 REM FOR UPGRADE DATA 165, 202, 133, 43, 16
    5, 201, 133, 42, 32, 114, 197, 32
490 DATA 182, 180, 76, 74, 183
491 REM FOR UPGRADE DATA 66, 196, 76, 196, 198
500 PRINT#15,"U1:2";DR;T;S
510 FORPB=105TO121:READBY:PRINT#15,"B-P:2";PB
520 PRINT#2,CHR$(BY);:PRINT". ";:NEXT:PRINT:PR
    INTNA$" CAN NOW BOOT ITSELF"
530 PRINT#15,"U2:2";DR;T;S
540 CLOSE2:CLOSE15
```

©

For VICs without memory expansion, these gaming routines will help speed up BASIC considerably.

VIC Joystick And Keyboard Routine

Michael Kleinert
Nanuet, NY

In the Fall 1982 issue of *Home and Educational COMPUTING!* was an article by David Malmberg entitled "Using the VIC Joystick," which demonstrated a short BASIC routine for reading from the joystick. After adding that routine to one of my game programs, I discovered that BASIC can just be too slow for some games. My attempts to speed up that routine were unsuccessful, so I decided to write one in machine language for reading from the joystick. I designed the routine to be most suitable for game purposes, especially those in which you must guide an object around the screen by using the joystick.

Entering The Machine Coding

Type in the BASIC loader provided in Program 1. For those who may not have a joystick or might like to use the keyboard, I have included an identical routine for the keyboard in Program 2.

Using The Routines

Both routines are very similar. Each checks for up, down, left, and right. Accounting for diagonal directions would require longer and more complex programming. The keyboard version will look for the depressing of four keys, which I have defined as I (up), M (down), J (left), and K (right).

I designed the routines for controlling the movement of an object on the screen, and I suggest the following format:

```
10 POKE A,B: SYS 7168: POKE A,32: A=A+PEEK(1)
-PEEK(2): GOTO 10
```

In the above line, A is the memory location of a character's position on the screen, and B is the character code of the desired character. First the character is POKEd onto the screen, and then the subroutine is called with SYS 7168. The subroutine checks for any movement of the joystick (or for keys being pressed). If it detects the joystick being pushed in any direction, it places an appropriate numerical value into location 1 or 2. These values will be used to update the position of the character being moved. First, the old character must be erased. This is accomplished by the command POKE A,32. The character is erased by POKEing a space onto the same screen position (A). After it has been erased, its position can be updated by adding the contents of memory location 1 and subtracting the contents of memory location 2. Do this as shown above, with the command A = A + PEEK(1)-PEEK(2).

If the routine does not detect the joystick or keyboard being depressed, the values in these two memory locations will be set to zero, and the variable A (character's position) will remain the same.

Avoiding Leaving The Screen

If the joystick is pushed up (or the "I" key is pressed on the keyboard), the routine will place a value of 22 into memory location 2. This causes the number 22 to be subtracted from the current screen address contained in variable A, and is the basis for accomplishing upward movement of a character on the screen. Similarly, a character is moved right, left, and down in this fashion.

In order to keep the character from going off the top or the bottom of the screen, more complex programming is required. An appropriate method is illustrated in Program 3. The program is not a game, but simply a demonstration for the use of the routines. It will scatter several boxes, as obstacles, on the screen and will enable you only to move your "player" around the screen with the joystick or keyboard. It is the basic structure for a game.

If you are going to use the joystick, enter in lines 10 to 40 from Program 1. If you are using the keyboard, copy the lines from Program 2.

When you are ready to use one of the routines in your own BASIC program, do the following. Place lines 10 to 40 from Program 1 or lines 10 to 30 from Program 2 at the beginning of your program. Then, wherever you wish to utilize the routine in your program, give the command SYS 7168. To update the character's position, use the method which I described above.

Other Applications

There are many other uses for these routines. You may use them in simple delay loops to temporarily stop the program and wait until something is pressed.

To check for a desired direction on the joystick or a key on the keyboard, use the values from Figures 1 and 2. For example, if you are using the

keyboard subroutine and want the program to wait until the letter "I" is pressed on the keyboard, you PEEK location 2 as follows:

```
100 SYS 7168: IF PEEK (2)<>22 THEN 100
```

This will call the subroutine, and the program will not proceed until the value in location 2 is equal to 22.

If you are using the joystick and want to wait until it is pushed to the right, you follow the same basic format: PEEK memory location 1 for a value of one. For example:

```
100 SYS 7168: IF PEEK(1)<>1 THEN 100
```

The Firing Button

A "firing" button is not accounted for in either of the two routines, since it would require a line of BASIC. If you would like to check for the firing button, you would place the following step into your program:

```
200 IF PEEK(37137)>69 THEN GOSUB (Line number)
```

After the GOSUB, you would place the line number to which you wish to send the program if it finds the firing button depressed.

If you wish to check for a "firing" button on the keyboard, you may use the following line, which checks for any depressing of the SPACE BAR (the one I usually use).

```
200 IF PEEK(197)=32 THEN GOSUB (LINE #)
```

The Demo Program

Briefly, here's a description of the function of each line in the demonstration, Program 3.

5 Limits the end of BASIC to protect the machine language routine, clears variables, and sets "A" equal to 7800 (the character's memory location on the screen).

10 READs the machine code from the DATA statements and POKEs the values into memory, starting at 7168.

20-40 Contain the machine code for the routine in DATA statements.

50 Clears the screen and then POKEs the color red onto each screen location.

60 Puts obstacles on the screen in 30 random screen locations.

70 POKEs the character onto the screen, calls the subroutine, and then sets "B" equal to the updated address.

80 If the new address is found to be off the screen, or if it is occupied by a box, the character remains stationary and the program goes back to line 70.

90 The new screen position has been accepted, so the old character is erased. The program goes back to line 70 to go through the same process.

Both routines can be used on a VIC with any amount of memory and can be placed anywhere in the user's RAM. In order to keep things relatively simple, I wrote the demonstration program for a 3.5K VIC; it will not work on a VIC with any memory expansion. These routines help speed up programs a great deal.

Program 1: Joystick Reader

```
10 FORM=0TO65:READN:POKE7168+M,N:NEXT
20 DATA169,128,141,19,145,169,0,133,1,133,2,1
    69,127,141,34,145,162,119,236,32,145
30 DATA208,4,169,1,133,1,169,255,141,34,145,1
    62,118,236,17,145,208,4,169,22,133,1
40 DATA162,110,236,17,145,208,4,169,1,133,2,1
    62,122,236,17,145,208,4,169,22,133,2,96
```

Program 2: Keyboard Reader

```
10 FORA=0TO40:READB:POKE7168+A,B:NEXT
20 DATA169,0,133,1,133,2,165,197,201,12,208,4
    ,162,22,134,2,201,36,208,4,162,22,134
    ,1
30 DATA201,44,208,4,162,1,134,1,201,20,208,4,
    162,1,134,2,96
```

Program 3: Demonstration

```
5 POKE56,28:POKE52,28:CLR:A=7800
10 FORM=0TO65:READN:POKE7168+M,N:NEXT
20 DATA169,128,141,19,145,169,0,133,1,133,2,1
    69,127,141,34,145,162,119,236,32,145
30 DATA208,4,169,1,133,1,169,255,141,34,145,1
    62,118,236,17,145,208,4,169,22,133,1
40 DATA162,110,236,17,145,208,4,169,1,133,2,1
    62,122,236,17,145,208,4,169,22,133,2,
    96
50 PRINT"{CLEAR}":FORX=38400TO38905:POKEX,2:N
    EXT
60 FORX=1TO25:Y=INT(RND(1)*500)+1:POKEY+7680,
    160:NEXT
70 POKEA,42:SYS7168:B=A+PEEK(1)-PEEK(2)
80 IFB>8185ORB<7680ORPEEK(B)=160THEN70
90 POKEA,32:A=B:GOTO70
```

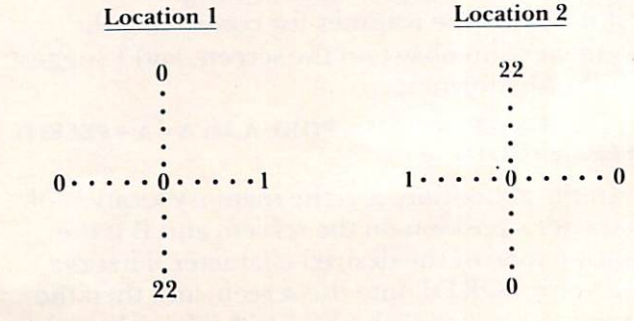

Figure 1: Joystick

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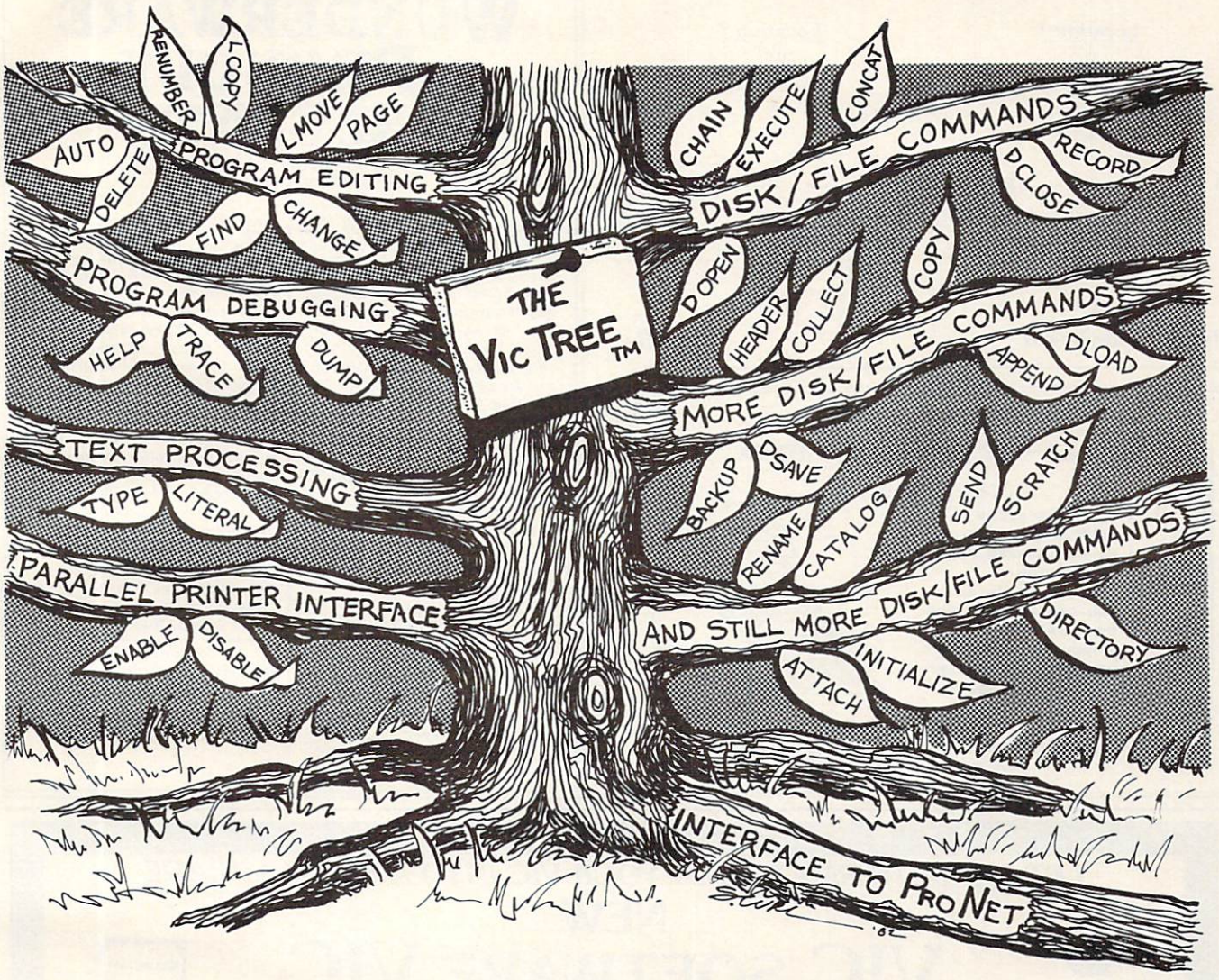

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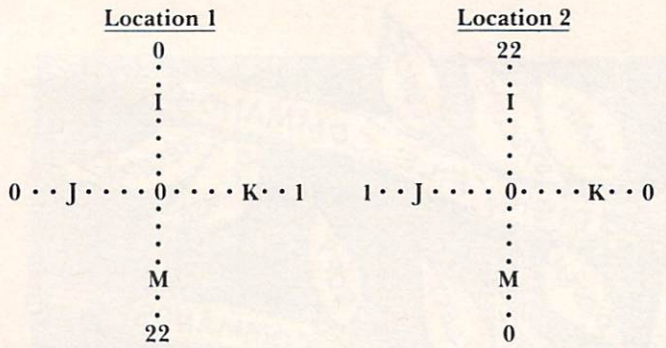

Figure 2: Keyboard

A BASIC game is translated into machine language. The comments in the program will teach you how to PLOT, DRAWTO, COLOR, etc., in your own machine language games.

Insight: Atari

Bill Wilkinson
Optimized Systems Software
Cupertino, CA

Last month marked the first anniversary of this column in **COMPUTE!**, and I didn't even notice it. Which tells you how busy I am. We, like almost everyone in the software industry, are beginning to realize that survival comes only to those who diversify. So we are busily introducing new products and concepts. We think the net effect is beneficial to everyone: for us it means a chance to grow and try new approaches; for the user it means newer and better products with a wider choice than ever.

Of course, with the wider choice comes the obvious problem: which one of several competing packages should the user buy? I think I am asked that question only slightly less often than its predecessor: which computer should I buy? I usually sidestep the issue by saying something like this: "Find a software package that seems to do exactly what you want it to do. Ask for references from satisfied customers. When you are convinced that the software will suit your needs, buy the computer that is needed to run the particular software."

The most common problem I see is people buying too little computer for the problem they want to tackle. And, while the problem is sometimes related to the speed of the chosen machine (let's face it, you shouldn't be doing realtime voiceprint analysis with an Atari), the more common problem is simply lack of memory – both kinds of memory, RAM and disk.

This month, I have several topics of interest to Atari aficionados. And, of course, the monster listing of the assembly language version of the "Boing" game (the BASIC version was published last month). Please – hear my disclaimer: I am not nor do I claim to be a game programmer. I am quite aware that Boing is not the epitome of the gamer's art. Rather, I am here attempting to show the fundamentals of writing graphics games in assembly language. So don't type this game in expecting a miracle program; use it for instructional purposes only. Add to it, experiment with it, and chalk it up to experience.

A Boo-Boo

Well, so far we've encountered only one substantial mistake in our book, *Inside Atari DOS* (published by **COMPUTE!**). The error occurs in the text on page 11 and in the diagram (Figure 2-3) on page 14. Both correctly indicate the contents of the last three bytes of a data sector (the "link" information), but both assign the wrong order to these bytes. The byte containing the "number of bytes used in sector" is the *last* byte of the sector (byte 127 in single density sectors), *not* byte 125 as shown. Then the bytes shown as 126 and 127 move up to become 125 and 126, respectively.

Our apologies for the misinformation; we hope it didn't affect too many of you adversely. I think the mistake came about because of the comment in the listing at line 4312 on page 87, where the file number and sector link bytes are called "bytes 126, 127." Well, they are, if you are numbering from 1 to 128. The tables, etc., in the book are all numbered from 0 to 127; but recall that sectors on the disk are numbered from 1 to 720 (instead of 0 to 719). I don't know why we humans have such a hard time counting from zero, but we do. And computers have a hard time counting from any other number. Oh well.

Incidentally, the only other error in the diagrams that I have found occurs on page 21, where the labels "SABUFH" and "SABUFL" at the heads of the two columns are reversed.

CP/M For Atari?

I often get asked whether OS/A+ will run CP/M programs on the Atari (since externally OS/A+ looks very, very similar to CP/M — not an accident). But, you simply can't run CP/M on a 6502 (the heart of any Atari or Commodore or Apple). So how do Apple II owners run CP/M? Simple. They plug a card into their machine that essentially disables the 6502 and runs a Z-80 CPU instead. Why not do the same with an Atari?

First, let me say that I don't think that, as a practical matter, it is possible to *replace* the 6502 in the Atari 400/800 with another CPU (e.g., a Z-80). The reasons are many, but the primary one is the fact that the Atari peripheral chips (particularly Antic) seem somewhat permanently married to the 6502. However, there is no real reason that one could not put a co-processor board in the third slot of an 800 (the co-processor would probably have to have its own memory, though, to avoid interfering with the Atari's DMA and interrupt processing). This is essentially how some manufacturers have added 8086 capability to Apple II's. But it is expensive, since we now must pay not only for a CPU but also for 65K bytes of RAM and some sort of I/O to talk to the "main" 6502 CPU.

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But doing this leaves you stuck with using the Atari serial bus to get data on and off a disk. And, aside from the slow speed, in my opinion an Atari 810 is really too small for practical CP/M work. So, what's the solution, if any? Actually, I've heard of a couple and know of one that is now working.

The first CP/M solution is to simply treat the Atari as an intelligent terminal and hook it up to a CP/M system. While this sounds like overkill, remember that most CP/M systems do not come with a terminal (screen and keyboard), and none can offer the color graphics capabilities of the Atari. But Vincent Cate (alias USS Enterprises) of San Jose, California, has come out with a hardware/software package that does more than make an Atari into an intelligent terminal. His package also allows most CP/M based computers with a 19,200 baud serial port to effectively replace the disk(s) and printer of an Atari computer.

The CP/M system is turned on and started up first, and it fools the Atari into believing that it is an 810 disk drive (just as does the 850 Interface Module in diskless systems). It thus boots a mini-pseudo-DOS into the Atari which simply passes file requests over the serial bus to the CP/M system. A great idea for someone who has a CP/M system and wants either to get a graphics terminal or to justify buying a game machine.

The primary limitation of this system is simply that you won't be able to read or write Atari-formatted diskettes, though it may be possible to CLOAD from an Atari cassette and then SAVE to the CP/M disk. You won't be compatible with the rest of the Atari world, but for games you probably don't care. At $150, this is the cheapest CP/M to Atari connection, but it does presume the prior purchase of a CP/M-based system.

L. E. Systems (alias David and Sandy Small, et al.) has another method of doing co-processing: remove the cover of your 800 and replace it *and* the OS ROM board with an extension of the Atari's internal computer bus. On this bus one can stick more memory cards, disk controllers, and (of course) a Z80 card with its own 65K of memory. If your goal is to build a super powerful graphics machine, with access to the vast CP/M library, this is a workable approach (about $1900 with two disk drives, *plus* the cost of the Atari 800).

However, for about the same money, you could buy a *real* CP/M machine (such as the Cromemco C-10) with 80-column screen, full function keyboard, built-in printer interface, bigger disks, etc. And then, if you wished, you could hook up your Atari via Vincent Cate's interface. The L. E. Systems' approach, though, assures lightning fast data and control flow between the Z80 and the 6502. More importantly, it allows you to continue to buy and use Atari-compatible disk-based software.

Finally, my rumor mill says that by the time you read this there will be a product available which will function as a more or less conventional Atari-compatible disk controller (à la Percom). But, at the flip of a switch, it will instead boot up and run CP/M (internal to the controller box), treating the Atari as an intelligent terminal, much as Vincent Cate's system does with more conventional CP/M computers.

Do I have any recommendations? Not really. Personally, I like my 128K Byte Cromemco (with 10 Megabyte hard disk and dual 1 Megabyte floppies) for serious software development. But when I think about it, I realize that the thing that makes this system so nice is *not* the CP/M compatibility (I almost never use CP/M, preferring to stick with Cromemco's Cromix). Rather, it is simply nice to have all that disk space available on command. So why get CP/M? Because you want to get into exotic compiler languages or because you need some very sophisticated business packages. Fine. But for games? Home finances? Learning how to program in BASIC? Graphics? I suggest you avoid CP/M.

Going With Boing

At last, we have here the complete listing of Boing as written in assembly language. As much as practicable, I have done a direct one-for-one translation from BASIC to machine code, without taking advantage of most of the foibles of the machine. Perhaps the only major change I have introduced is also the most unnoticeable from a casual reading of the source: I have made all the variables (which are six-byte floating point numbers in BASIC) into single bytes. This is *not* always possible. Sometimes, when writing in assembler, one needs numbers greater than 255; then one "simply" uses two-byte integers (or three or four-byte integers, or floating point even).

Except that, on a 6502, that "simply" isn't so simple. There are no 16-bit (or larger) instructions on a 6502, and one must simulate them using series of eight-bit loads, adds, stores, etc. For example, if this program were using Mode 8 graphics, where the horizontal position can vary from 0 to 319 (thus requiring a two-byte number to hold it), all of the code involving the "X..." variables would be larger and more complex. Lesson to be learned: use byte-size numbers whenever possible on a 6502.

Anyway, with regard to the listing of Boing, please note that I didn't leave enough space between my BASIC line numbers to allow my assembly language to share the numbering scheme. So I have put the BASIC lines into the listing in a way that makes them stand out for ease of reading.

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Presuming that you have read my August and September columns, you will recognize the style and conversions that I have done. Statements such as PLOT, DRAWTO, COLOR, and others have been translated into JSRs to routines in my graphics package. (Note that the listing of the package has been omitted for space considerations. Simply include lines 9000 through 9999 of the listing in my August article.) I would, however, like to discuss a few points of interest.

Notice the coding of lines 2600 and 2700, where the BASIC program had used PTRIG(x)-PTRIG(x+1) to obtain a +1, 0, or -1 value from the joystick. But that requires turning the joystick 90 degrees from normal to play the game. As long as we are coding in assembly language, let's do it right!

What we have here, then, is essentially the code that BASIC A+ uses for its HSTICK(n) function. I think the code is easy to follow if you remember that the switches in the joystick force a zero bit in locations STICKn when they are pushed. By masking to only the bits we want, and by then inverting the bits, we are able to treat an "on" bit in a more or less normal fashion.

By the way, note that here, as elsewhere in the code, we are also using one-byte numbers to hold both positive and negative values. This works only so long as the absolute value of the signed numbers does not exceed 127, so be careful when using this technique.

Note the simulation of the array YP(n). First, look at how easy it is to handle array elements with constant subscripts, as in BASIC line 1010 (listing lines 1210 to 1230). Even variable subscripts aren't too hard when the array is byte sized and byte dimensioned. Look at BASIC line 4210 (listing lines 6030 and 6040). Admittedly, a true assembly language simulation of the BASIC line would probably go more like this:

```
LDX     HITP
LDA     SCORE,X
CLC
ADC     #1
LDX     HITP
STA     SCORE,X
          ;SCORE(HITP)=SCORE(HITP)+1
```

But why not be a *little* smart when making conversions? Besides, if we were writing in some higher level languages, we could have written "INCREMENT SCORE(HITP)".

Finally, the hardest part of this conversion needs some analysis. As we noted last month, in order to provide better movement and bounce characteristics for the ball, we allowed it to have movements (and positions!) of -1, -0.5, 0, +0.5, and +1. But now we're in assembly language using byte integers. How do we implement fractional movements? We can't really, so we must choose an equivalent scheme.

Notice the variables in the program called "Q.Yxxx". These variables all are used to hold values that represent *half* movements or positions. Example: if Q.YNEW contains 17, that means it is really representing position 8.5! Notice, then, that before plotting any point that is represented in this fashion, we must divide its value by 2 (by using a LSR instruction, c.f., listing lines 3820, 3930, etc.). Choosing this scheme has some interesting consequences: the last statement of BASIC line 3080 (listing lines 4500 through 4650) is, in some ways, the hardest part of this listing to understand, simply because of the implied "mixed-mode" arithmetic that is used. But it works!

Foibles Of The Assembler/Editor

Writing this article caused me to rediscover some of the foibles of the Atari Assembler/Editor cartridge (and EASMD, for that matter). For many of you, these quirks may seem normal, especially if you haven't used several different assemblers on various machines. But, to others, these eccentricities can be annoying or puzzling.

First, beware of the "*=" pseudo-operator. It is *not* an origin operator ("ORG" in many assemblers), even though it is used as such! Any label associated with this pseudo-op will take on the value of the instruction counter *before* the operator is executed. This is necessary since "*=" is *also* used to reserve storage ("DS" or "RMB" in some assemblers).

Examples:

```
LABEL1 *= *+5
    ; reserves five bytes of storage
    ; and assigns the label "LABEL1"
    ; to the five bytes
  *= $4000
    ; sets the instruction counter
    ; to 4000 hex
LABEL2 *= $5000
    ; assuming this line followed one
    ; above, assigns 4000 hex to
    ; "LABEL2" and sets instruction
    ; counter to 5000 hex!
```

Second, examine any references to location "CLOCK.LSB" in the Boing listing (e.g., line 5870). Notice that, even though CLOCK.LSB is in zero page, the assembler produced a three-byte instruction for all references to it. This is because the *definition* of CLOCK.LSB did not occur until *after* the first *reference* to it! Actually, the assembler/editor is being remarkably clever here. Remember that the cartridge is, like most assemblers, a two-pass program. It reads the source once to determine where things are and will be, and then it reads the

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source again to produce the listing and code. But, during the first pass through the source, it can't possibly know whether CLOCK.LSB is in zero page or not, so it chooses the safe route and assumes non-zero page. Then, lo and behold, it discovers that we really wanted the label to be in zero page. What to do?

If we now assign that label to zero page, the second pass of the assembler will produce only two bytes of code here, and all references to labels past that point will be off by one byte. We will have the infamous "phase error." So the assembler has a rule that states "once non-zero page, always non-zero page," and it continues to generate three-byte references. For a simple assembler like the Atari cartridge, this is a big step. It is still possible to produce phase errors with the cartridge, but it is more difficult than with many 6502 assemblers.

Third and last, there is a problem with the assembler/editor when it comes to multiple forward references. Consider the following code fragment:

AAA = BBB
BBB = CCC
CCC = 5

There is no way for a two-pass assembler to determine what the value of AAA is! On the first pass, it says "AAA is undefined, because BBB hasn't been defined yet." And then it thinks "BBB is undefined, similarly because of CCC." On the second pass, it *should* say "ERROR!!AAA is undefined, because BBB still hasn't been defined yet." But it can then produce "BBB is equal to 5 because that's what CCC is equal to."

Unfortunately, the assembler/editor doesn't keep a separate flag meaning "label as yet undefined." The "BBB = CCC" line is sufficient, from the assembler's viewpoint, to establish the existence of "BBB." So, on the second pass, it blindly puts the value of BBB (presumably zero) into AAA. Watch out for this trap! It has snared many a good programmer! I hope you realize that there would be no problems if you had coded that sequence in this order:

CCC = 5
BBB = CCC
AAA = BBB

That's it for this month. Next month we will investigate the many languages available to the Atari programmer. We will discuss and fix the major bug in Atari's 850 interface handler (the "Rn:" drivers). And maybe, just maybe, we will try to add cassette tape verification to BASIC.

```
0000            1000        .PAGE  "    === GAME STARTUP ==="
                1010 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                1020 ;
                1030 ; This is the startup of BOING
                1040 ;
                1050 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                1060 ;
                1070 ; CAUTION:  set memory origin according to
                1080 ;           your system needs!
                1090 ;
                1100 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                1110 ;
0000            1120        *=    $6000
                1130 ;
                1140 BOING
                1150 ;

:BASIC:  1010 DIM YP(1),SCORE(1):SCORE(0)=0:SCORE(1)=0

6000 4C0760 1160        JMP   AROUND.DIM
6003 00     1170 YP     .BYTE 0,0       ; y-position
6004 00
6005 00     1180 SCORE  .BYTE 0,0       ; and score
6006 00
            1190 ;
            1200 AROUND.DIM
6007 A900   1210        LDA   #0
6009 8D0560 1220        STA   SCORE+0   ; SCORE(0)=0
600C 8D0660 1230        STA   SCORE+1   ; SCORE(1)=0
            1240 ;
            1250 ;

:BASIC:  1020 SINGLE=PEEK(53279)<>7)

600F AD1FD0 1260        LDA   53279     ; peek at console switches
6012 4907   1270        EOR   #$07      ; A=7? Then A=0.  A<>7? Then A<>0.
6014 8DE062 1280        STA   SINGLE    ; set up our flag
            1290 ;

:BASIC:  1100 LASTWIN=1:IF RND(0)>=0.5 THEN LASTWIN=-LASTWIN

6017 A001   1300        LDY   #1        ; use y as temp for lastwin
6019 AD0AD2 1310        LDA   RANDOM    ; get a random byte
601C 1002   1320        BPL   HALFCHANCE
601E 88     1330        DEY             ; 50-50 chance that we do this
601F 88     1340        DEY             ; ...makes Y = $FF, same as -1
            1350 HALFCHANCE
6020 8CE162 1360        STY   LASTWIN   ; store temp in final place
            1370 ;

:BASIC:  2000  REM prepare for a serve

            1380 LINE2000
            1390 ;

:BASIC:  2010 GR.3 : COLOR 2 : PLOT 0,0 : DRAWTO 39,0

6023 A903   1400        LDA   #3
6025 20F362 1410        JSR   GRAPHICS  ; GR.3
            1420 ;
6028 A902   1430        LDA   #2
602A 202063 1440        JSR   COLOR     ; COLOR 2
            1450 ;
602D A900   1460        LDA   #0
602F A8     1470        TAY
6030 AA     1480        TAX
6031 202B63 1490        JSR   PLOT      ; PLOT 0,0
            1500 ;
6034 A900   1510        LDA   #0
6036 A227   1520        LDX   #39
6038 A8     1530        TAY
6039 204463 1540        JSR   DRAWTO    ; DRAWTO 39,0
            1550 ;

:BASIC:  2020 PLOT 0,19 : DRAWTO 39,19

603C A900   1560        LDA   #0
603E AA     1570        TAX
603F A013   1580        LDY   #19
6041 202B63 1590        JSR   PLOT      ; PLOT 0,19
            1600 ;
6044 A900   1610        LDA   #0
6046 A227   1620        LDX   #39
6048 A013   1630        LDY   #19
604A 204463 1640        JSR   DRAWTO    ; DRAWTO 39,19
            1650 ;

:BASIC:  2030 .... NOTE: We don't print the scores in this version ....

            1660 ;
            1670 ;
```

```
:BASIC: 2040 COLOR 3:PLOT 0,9:DRAWTO 0,11:PLOT 39,9:DRAWTO 39,11

604D A903   1680        LDA  #3
604F 202063 1690        JSR  COLOR      ; COLOR 3
            1700 ;
6052 A900   1710        LDA  #0
6054 AA     1720        TAX
6055 A009   1730        LDY  #9
6057 202B63 1740        JSR  PLOT       ; PLOT 0,9
            1750 ;
605A A900   1760        LDA  #0
605C AA     1770        TAX
605D A00B   1780        LDY  #11
605F 204463 1790        JSR  DRAWTO     ; DRAWTO 0,11
            1800 ;
6062 A900   1810        LDA  #0
6064 A227   1820        LDX  #39
6066 A009   1830        LDY  #9
6068 202B63 1840        JSR  PLOT       ; PLOT 39,9
            1850 ;
606B A900   1860        LDA  #0
606D A227   1870        LDX  #39
606F A00B   1880        LDY  #11
6071 204463 1890        JSR  DRAWTO     ; DRAWTO 39,11
            1900 ;
            1910 ;


:BASIC: 2050 IF SINGLE THEN COLOR 2:PLOT 39,0:DRAWTO 39,19

6074 ADE062 1920        LDA  SINGLE
6077 F016   1930        BEQ  NOTTHEN2050 ; not single player mode
            1940 ;
6079 A902   1950        LDA  #2
607B 202063 1960        JSR  COLOR      ; COLOR 2
            1970 ;
607E A227   1980        LDX  #39
6080 A900   1990        LDA  #0
6082 A8     2000        TAY
6083 202B63 2010        JSR  PLOT       ; PLOT 39,0
            2020 ;
6086 A227   2030        LDX  #39
6088 A013   2040        LDY  #19
608A A900   2050        LDA  #0
608C 204463 2060        JSR  DRAWTO     ; DRAWTO 39,19
            2070 ;
            2080 NOTTHEN2050
            2090 ;
            2100 ;


:BASIC: 2060 YP(0)=10:YP(1)=10

608F A90A   2110        LDA  #10
6091 8D0360 2120        STA  YP         ; YP(0)=10
6094 8D0460 2130        STA  YP+1       ; YP(1)=10
            2140 ;


:BASIC: 2070 IF SINGLE THEN LASTWIN=1

6097 ADE062 2150        LDA  SINGLE
609A F005   2160        BEQ  LINE2100   ; NOT SINGLE
609C A901   2170        LDA  #1
609E 8DE162 2180        STA  LASTWIN    ; LASTWIN=1 BECUZ SINGLE<>0
            2190 ;


:BASIC: 2100 REM SET UP BALL

            2200 LINE2100
            2210 ;
            2220 ;

:BASIC: 2110 XMOVE=LASTWIN:YMOVE=INT(3*RND(0))-1:Y=INT(12*RND(0))+4

60A1 ADE162 2230        LDA  LASTWIN
60A4 8DE362 2240        STA  XMOVE      ; XMOVE=LASTWIN
            2250 ;
60A7 A902   2260        LDA  #2
60A9 206263 2270        JSR  RND        ; get random number from 0 to 2
60AC 8DE662 2280        STA  Q.YMOVE
60AF CEE662 2290        DEC  Q.YMOVE    ; then do the '-1'
60B2 0EE662 2300        ASL  Q.YMOVE    ; and convert to "half-moves"
            2310 ;
60B5 A90B   2320        LDA  #11
60B7 206263 2330        JSR  RND        ; get random number from 0 to 11
60BA 18     2340        CLC
60BB 6904   2350        ADC  #4         ; '+4' as above
60BD 0A     2360        ASL  A          ; double number of moves to get
                                            half-moves
60BE 8DE562 2370        STA  Q.Y        ; Again, this is a 'half-position'
                                            variable
            2380 ;
            2390 ;


:BASIC: 2120 YNEW=Y : X=19-5*XMOVE:XNEW=X

60C1 ADE562 2400        LDA  Q.Y
60C4 8DE762 2410        STA  Q.YNEW     ; YNEW=Y
            2420 ; Here, we take advantage of the fact that XMOVE
            2430 ;    can only have values -1 or +1
60C7 A9FB   2440        LDA  #0-5       ; assume XMOVE = +1
60C9 ACE362 2450        LDY  XMOVE      ; does XMOVE = +1?
60CC 1002   2460        BPL  XMOVEPLUS  ; yes
60CE A905   2470        LDA  #5         ; no...so -5*-1 = +5
            2480 XMOVEPLUS
60D0 18     2490        CLC
60D1 6913   2500        ADC  #19        ; 19-5 OR 19+5
60D3 8DE262 2510        STA  X
            2520 ;
60D6 ADE262 2530        LDA  X          ; but you can see we don't really
                                            need this
60D9 8DE462 2540        STA  XNEW       ; XNEW = X
            2550 ;
            2560 ;


:BASIC: 2500 REM MAIN PLAYING LOOP

            2570 ;
            2580 ;


:BASIC: 2600 V0=PTRIG(0)-PTRIG(1):IF NOT V0 THEN 2700

            2590 ; note that what we really want is V0=+1 if
            2600 ;   stick is pushed one way and V0=-1 if
            2610 ;   stick is pushed the other.
            2620 ;
            2630 LINE2600
60DC AD7802 2640        LDA  STICK0     ; OS shadow location
60DF 2903   2650        AND  #3         ; look at just fwd and backwd
                                            switches
60E1 4903   2660        EOR  #3         ; invert the sense
60E3 F006   2670        BEQ  GOTV0      ; if zero, stick not pushed
60E5 C901   2680        CMP  #1         ; FWD pushed?
60E7 F002   2690        BEQ  GOTV0      ; good...what we wanted
60E9 A9FF   2700        LDA  #0-1       ; must be pulled back
            2710 GOTV0
60EB 8DEB62 2720        STA  V0         ; ta-da
            2730 ;
60EE ADEB62 2740        LDA  V0         ; so is stick pushed?
60F1 F03E   2750        BEQ  LINE2700   ; IF NOT V0 THEN 2700
            2760 ;
            2770 ;


:BASIC: 2610 VP0=YP(0)-V0:IF VP0<2 OR VP0>17 THEN 2700

60F3 AD0360 2780        LDA  YP+0       ; YP(0)
60F6 38     2790        SEC
60F7 EDEB62 2800        SBC  V0
60FA 8DED62 2810        STA  VP0        ; VP0=YP(0)-V0
            2820 ;
60FD C902   2830        CMP  #2
60FF 9030   2840        BCC  LINE2700   ; IF VP0<2 THEN 2700
6101 C912   2850        CMP  #18
6103 B02C   2860        BCS  LINE2700   ; or IF VP0>17 THEN 2700
            2870 ;
            2880 ;


:BASIC: 2620 COLOR 0:PLOT 0,YP(0)+V0:COLOR 3:PLOT 0,VP0-V0:YP(0)=VP0

6105 A900   2890        LDA  #0
6107 202063 2900        JSR  COLOR      ; COLOR 0
            2910 ;
610A AD0360 2920        LDA  YP+0
610D 18     2930        CLC
610E 6DEB62 2940        ADC  V0         ; YP(0)+V0
6111 A8     2950        TAY             ; is y position
6112 A900   2960        LDA  #0
6114 AA     2970        TAX
6115 202B63 2980        JSR  PLOT       ; PLOT 0,YP(0)+V0
            2990 ;
6118 A903   3000        LDA  #3
611A 202063 3010        JSR  COLOR      ; COLOR 3
            3020 ;
611D ADED62 3030        LDA  VP0
6120 38     3040        SEC
6121 EDEB62 3050        SBC  V0
6124 A8     3060        TAY
6125 A900   3070        LDA  #0
6127 AA     3080        TAX
6128 202B63 3090        JSR  PLOT       ; PLOT 0,VP0+V0
            3100 ;
612B ADED62 3110        LDA  VP0
612E 8D0360 3120        STA  YP+0       ; YP(0)=VP0
            3130 ;
            3140 ;
```

```
:BASIC: 2700 V1=PTRIG(2)-PTRIG(3):IF SINGLE OR V1=0 THEN 3000

                3150 LINE2700
                3160 ; note that what we really want is V0=+1 if
                3170 ;   stick is pushed one way and V1=-1 if
                3180 ;   stick is pushed the other.
                3190 ;
6131 AD7902     3200        LDA  STICK1     ; OS shadow location
6134 2903       3210        AND  #3         ; look at just fwd and backwd
                                                switches
6136 4903       3220        EOR  #3         ; invert the sense
6138 F006       3230        BEQ  GOTV1      ; if zero, stick not pushed
613A C901       3240        CMP  #1         ; FWD pushed?
613C F002       3250        BEQ  GOTV1      ; good...what we wanted
613E A9FF       3260        LDA  #0-1       ; must be pulled back
                3270 GOTV1
6140 8DEC62     3280        STA  V1         ; ta-da
                3290 ;
6143 ADE062     3300        LDA  SINGLE
6146 D045       3310        BNE  LINE3000   ; IF SINGLE THEN 3000
6148 ADEC62     3320        LDA  V1         ; so is stick pushed?
614B F040       3330        BEQ  LINE3000   ; or IF V1=0 THEN 3000
                3340 ;
                3350 ;


:BASIC: 2710 VP1=YP(1)-V1:IF VP1<2 OR VP1>17 THEN 3000

614D AD0460     3360        LDA  YP+1       ; YP(1)
6150 38         3370        SEC
6151 EDEC62     3380        SBC  V1
6154 8DEE62     3390        STA  VP1        ; VP1=YP(1)-V1
                3400 ;
6157 C902       3410        CMP  #2
6159 9032       3420        BCC  LINE3000   ; IF VP1<2 THEN 3000
615B C912       3430        CMP  #18
615D B02E       3440        BCS  LINE3000   ; or IF VP1>17 THEN 3000
                3450 ;
                3460 ;


:BASIC: 2720 COLOR 0:PLOT 39,YP(1)+V1:COLOR 3:PLOT 39,VP1-V1:YP(1)=VP1

615F A900       3470        LDA  #0
6161 202063     3480        JSR  COLOR      ; COLOR 0
                3490 ;
6164 AD0460     3500        LDA  YP+1
6167 18         3510        CLC
6168 6DEC62     3520        ADC  V1         ; YP(1)+V1
616B A8         3530        TAY             ; is y position
616C A900       3540        LDA  #0
616E A227       3550        LDX  #39
6170 202B63     3560        JSR  PLOT       ; PLOT 39,YP(1)+V1
                3570 ;
6173 A903       3580        LDA  #3
6175 202063     3590        JSR  COLOR      ; COLOR 3
                3600 ;
6178 ADEE62     3610        LDA  VP1
617B 38         3620        SEC
617C EDEC62     3630        SBC  V1
617F A8         3640        TAY
6180 A900       3650        LDA  #0
6182 A227       3660        LDX  #39
6184 202B63     3670        JSR  PLOT       ; PLOT 39,VP1+V1
                3680 ;
6187 ADEE62     3690        LDA  VP1
618A 8D0460     3700        STA  YP+1       ; YP(1)=VP1
                3710 ;
                3720 ;
                3730 ;


:BASIC: 3000 REM *** BALL CONTROL ***

                3740 LINE3000
                3750 ;
                3760 ;


:BASIC: 3010 COLOR 0 : PLOT X,Y

618D A900       3770        LDA  #0
618F 202063     3780        JSR  COLOR      ; COLOR 0
                3790 ;
6192 AEE262     3800        LDX  X
6195 ADE562     3810        LDA  Q.Y
6198 4A         3820        LSR  A          ; Divide half-position by 2 to
                                                get real pos'n
6199 A8         3830        TAY
619A A900       3840        LDA  #0
619C 202B63     3850        JSR  PLOT       ; PLOT X,Y
                3860 ;
                3870 ;


:BASIC: 3020 COLOR 1:PLOT XNEW,YNEW

619F A901       3880        LDA  #1
61A1 202063     3890        JSR  COLOR      ; COLOR 1
                3900 ;
61A4 AEE462     3910        LDX  XNEW
61A7 ADE762     3920        LDA  Q.YNEW
61AA 4A         3930        LSR  A          ; Divide half-position by 2 to
                                                get real pos'n
61AB A8         3940        TAY
61AC A900       3950        LDA  #0
61AE 202B63     3960        JSR  PLOT       ; PLOT XNEW,YNEW
                3970 ;
                3980 ;


:BASIC: 3030 X=XNEW:Y=YNEW

61B1 ADE462     3990        LDA  XNEW
61B4 8DE262     4000        STA  X          ; X=XNEW
                4010 ;
61B7 ADE762     4020        LDA  Q.YNEW
61BA 8DE562     4030        STA  Q.Y        ; Y=YNEW
                4040 ;
                4050 ;


:BASIC: 3040 XNEW=XNEW+XMOVE:YNEW=YNEW+YMOVE

61BD ADE462     4060        LDA  XNEW
61C0 18         4070        CLC
61C1 6DE362     4080        ADC  XMOVE
61C4 8DE462     4090        STA  XNEW       ; XNEW=XNEW+XMOVE
                4100 ;
61C7 ADE762     4110        LDA  Q.YNEW
61CA 18         4120        CLC
61CB 6DE662     4130        ADC  Q.YMOVE
61CE 8DE762     4140        STA  Q.YNEW     ; YNEW=YNEW+YMOVE
                4150 ;
                4160 ;


:BASIC: 3050 IF XNEW<38 AND XNEW>1 THEN 3200

                4170 ;
61D1 ADE462     4180        LDA  XNEW
61D4 C926       4190        CMP  #38
61D6 B004       4200        BCS  NOTTHEN3050
61D8 C902       4210        CMP  #2
61DA B04C       4220        BCS  LINE3200   ; XNEW<38 AND XNEW>1, SO GO
                4230 ;
                4240 NOTTHEN3050
                4250 ;
                4260 ;


:BASIC: 3060 HITP=(XNEW>20):XHIT=39*HITP

61DC A200       4270        LDX  #0
61DE A000       4280        LDY  #0
61E0 ADE462     4290        LDA  XNEW
61E3 C914       4300        CMP  #20        ; XNEW>20 ?
61E5 9004       4310        BCC  XNEWLT20   ; NO
61E7 A001       4320        LDY  #1         ; YES...SO 'TRUE' IS 1
61E9 A227       4330        LDX  #39
                4340 XNEWLT20
61EB 8CE962     4350        STY  HITP
61EE 8EEA62     4360        STX  XHIT
                4370 ;
                4380 ;


:BASIC: 3070 IF SINGLE THEN IF HITP THEN 3100

61F1 ADE062     4390        LDA  SINGLE
61F4 F005       4400        BEQ  LINE3080   ; NOT SINGLE
61F6 ADE962     4410        LDA  HITP
61F9 D024       4420        BNE  LINE3100   ; YES, SINGLE AND HITP
                4430 ;
                4440 ;


:BASIC: 3080 YMSAVE=YMOVE:YNEW=INT(YNEW):YMOVE=(YNEW-YP(HITP))/2

                4450 ;
                4460 LINE3080
61FB ADE662     4470        LDA  Q.YMOVE
61FE 8DE862     4480        STA  Q.YMSAVE   ; YMSAVE=YMOVE
                4490 ;
                4500 ; REMEMBER: we are using half move increments in Q.Y...
                4510 ;   variables...so we really simply want to get
                4520 ;   rid of the lowest bit (the half step)
                4530 ;
6201 ADE762     4540        LDA  Q.YNEW
```

```
6204 29FE   4550        AND  #$FE       ; mask off last bit
6206 8DE762 4560        STA  Q.YNEW     ; YNEW=INT(YNEW)
            4570 ;
6209 AEE962 4580        LDX  HITP       ; so X is either 0 or 1
620C 4A     4590        LSR  A          ; Q.YNEW / 2 gives the true YNEW
620D 38     4600        SEC
620E FD0360 4610        SBC  YP,X       ; YNEW-YP(HITP)
            4620 ; we don't need to divide by 2, because Q.YMOVE wants
                   half-moves
6211 8DE662 4630        STA  Q.YMOVE    ; done
            4640 ;
            4650 ;


:BASIC: 3090 IF ABS(YMOVE)>1 THEN 4000

6214 ADE662 4660        LDA  Q.YMOVE
6217 C903   4670        CMP  #3         ; halfsteps, remember
6219 9004   4680        BCC  LINE3100   ; 0,1, or 2 halfsteps
621B C9FE   4690        CMP  #$FE
621D 902C   4700        BCC  LINE4000   ; aha...>2 halfsteps, <-2
                                          halfsteps
            4710 ;
            4720 ;


:BASIC: 3100 XMOVE= -XMOVE

            4730 LINE3100
621F A900   4740        LDA  #0
6221 38     4750        SEC
6222 EDE362 4760        SBC  XMOVE
6225 8DE362 4770        STA  XMOVE      ; xmove = -xmove
            4780 ;
            4790 ;


:BASIC: 3200 IF YNEW=1 OR YNEW=18 THEN YMOVE= -YMOVE

            4800 LINE3200
6228 ADE762 4810        LDA  Q.YNEW
622B C902   4820        CMP  #1+1       ; remember: half moves
622D F004   4830        BEQ  THEN3200
622F C924   4840        CMP  #18+18
6231 D009   4850        BNE  NOTTHEN3200
            4860 ;
            4870 THEN3200
6233 A900   4880        LDA  #0
6235 38     4890        SEC
6236 EDE662 4900        SBC  Q.YMOVE    ; 0-YMOVE
6239 8DE662 4910        STA  Q.YMOVE    ; is obviously the same as -YMOVE
            4920 ;
            4930 NOTTHEN3200
            4940 ;
            4950 ;


:BASIC: 3290 GOTO 2600

            4960 ;
            4970 ; if we simply jumped back to LINE2600 here, the game
            4980 ;   would play impossibly fast...
            4990 ;   so we put in a delay
            5000 ;
623C A900   5010        LDA  #0
623E 8D1400 5020        STA  CLOCK.LSB ; the 60th of a second ticker
            5030 DELAY1
6241 AD1400 5040        LDA  CLOCK.LSB
6244 C902   5050        CMP  #2         ; a 30th of a second?
6246 D0F9   5060        BNE  DELAY1
            5070 ;
6248 4CDC60 5080        JMP  LINE2600
            5090 ;
            5100 ;


:BASIC: 4000 REM *** the LOSE routine ***

            5110 LINE4000
            5120 ;
            5130 ; we will score the misses, even though we don't
            5140 ;   display the results
            5150 ;
            5160 ;


:BASIC: 4010 COLOR 0:PLOT X,Y

624B A900   5170        LDA  #0
624D 202063 5180        JSR  COLOR      ; COLOR 0
            5190 ;
6250 AEE262 5200        LDX  X
6253 ADE562 5210        LDA  Q.Y        ; the half step
6256 4A     5220        LSR  A          ; becomes an integral step
6257 A8     5230        TAY
6258 A900   5240        LDA  #0
625A 202B63 5250        JSR  PLOT       ; PLOT X,Y
            5260 ;
            5270 ;


:BASIC: 4020 COLOR 1:PLOT XNEW,YNEW

625D A901   5280        LDA  #1
625F 202063 5290        JSR  COLOR      ; COLOR 1
            5300 ;
6262 AEE462 5310        LDX  XNEW
6265 ADE762 5320        LDA  Q.YNEW
6268 4A     5330        LSR  A          ; again, half step to full step
6269 A8     5340        TAY
626A A900   5350        LDA  #0
626C 202B63 5360        JSR  PLOT       ; PLOT XNEW,YNEW
            5370 ;
            5380 ;


:BASIC: 4030 FOR I=1 TO 10:NEXT I

            5390 ; shoddy, shoddy —— using a for/next loop for timing!
            5400 ;
            5410 ; here, we do it right
626F A900   5420        LDA  #0
6271 8D1400 5430        STA  CLOCK.LSB
            5440 ;
            5450 DELAY2
6274 AD1400 5460        LDA  CLOCK.LSB
6277 C902   5470        CMP  #2         ; tick tock yet?
6279 D0F9   5480        BNE  DELAY2     ; nope, maybe just tick
            5490 ;
            5500 ;


:BASIC: 4040 COLOR 0:PLOT XNEW,YNEW

627B A900   5510        LDA  #0
627D 202063 5520        JSR  COLOR
            5530 ;
6280 AEE462 5540        LDX  XNEW
6283 ADE762 5550        LDA  Q.YNEW     ; starting to look familiar?
6286 4A     5560        LSR  A
6287 A8     5570        TAY
6288 A900   5580        LDA  #0
628A 202B63 5590        JSR  PLOT       ; PLOT XNEW,YNEW
            5600 ;
            5610 ;


:BASIC: 4050 COLOR 2:PLOT XNEW+XMOVE,YNEW+YMSAVE

628D A902   5620        LDA  #2
628F 202063 5630        JSR  COLOR      ; COLOR 2
            5640 ;
6292 ADE462 5650        LDA  XNEW
6295 18     5660        CLC
6296 6DE362 5670        ADC  XMOVE
6299 AA     5680        TAX             ; x register = XNEW+XMOVE
629A ADE762 5690        LDA  Q.YNEW
629D 18     5700        CLC
629E 6DE862 5710        ADC  Q.YMSAVE
62A1 4A     5720        LSR  A          ; integerize the sum
62A2 A8     5730        TAY             ; y register = YNEW+YMSAVE
62A3 A900   5740        LDA  #0
62A5 202B63 5750        JSR  PLOT       ; PLOT it
            5760 ;
            5770 ;


:BASIC: 4130 SOUND 0,132,12,12:POKE 20,0

62A8 A984   5780        LDA  #132
62AA 8D00D2 5790        STA  SOUND.FREQ ; implicitly channel 0
62AD A9CC   5800        LDA  #12*16+12
62AF 8D01D2 5810        STA  SOUND.CONTROL ; ,12,12 also for channel 0
62B2 A900   5820        LDA  #0
62B4 8D1400 5830        STA  CLOCK.LSB ; finally, BASIC did it right!
            5840 ;
            5850 ;


:BASIC: 4140 SETCOLOR 1,0,PEEK(20)*4:IF PEEK(20)<32 THEN 4140

            5860 LINE4140
62B7 AD1400 5870        LDA  CLOCK.LSB ; same as PEEK(20)
62BA 0A     5880        ASL  A
62BB 0A     5890        ASL  A          ; * 4
62BC 8DC502 5900        STA  SETCOLOR1 ; control register number 1
            5910 ;
```

```
62BF C980   5920        CMP  #32*4     ; a little tricky...can you
                                           follow it?
62C1 90F4   5930        BCC  LINE4140  ; it works...really
            5940 ;
            5950 ;

:BASIC: 4150 SOUND 0,0,0,0

62C3 A900   5960        LDA  #0
62C5 8D00D2 5970        STA  SOUND.FREQ
62C8 8D01D2 5980        STA  SOUND.CONTROL
            5990 ;
            6000 ;

:BASIC: 4200 REM *** SCORE IT ***

            6010 ;
            6020 ;

:BASIC: 4210 SCORE(HITP)=SCORE(HITP)+1

62CB AEE962 6030        LDX  HITP
62CE FE0560 6040        INC  SCORE,X   ; isn't assembler easy?
            6050 ;
            6060 ;

:BASIC: 4220 LASTWIN=1 : IF HITP THEN LASTWIN=-LASTWIN

62D1 A901   6070        LDA  #1
62D3 AEE962 6080        LDX  HITP      ; if HITP?
62D6 F002   6090        BEQ  NOT.HITP  ; no
62D8 A9FF   6100        LDA  #0-1      ; yes...so make it -1
            6110 NOT.HITP
62DA 8DE162 6120        STA  LASTWIN   ; that's all that is needed
            6130 ;
            6140 ;

:BASIC: 4990 GOTO 2000

            6150 ;
62DD 4C2360 6160        JMP  LINE2000
            6170 ;

BOING — not quite up to PONG
GENERAL RAM USAGE

62E0        6180        .PAGE "GENERAL RAM USAGE"
            6190 ;
62E0 00     6200 SINGLE BRK            ; flag for one-player game
62E1 00     6210 LASTWIN BRK           ; who won last time?
            6220 ;
            6230 ; the x moves
            6240 ;
62E2 00     6250 X      BRK            ; current x position
62E3 00     6260 XMOVE  BRK            ; current x movement
62E4 00     6270 XNEW   BRK            ; new x position
            6280 ;
            6290 ; and the y positions and moves
            6300 ;
            6310 ; remember: the Q.Yxxx locations reference positions
            6320 ;   or movements in terms of half steps
            6330 ;
62E5 00     6340 Q.Y    BRK            ; current y position
62E6 00     6350 Q.YMOVE BRK           ; current y movement
62E7 00     6360 Q.YNEW BRK            ; new y position
62E8 00     6370 Q.YMSAVE BRK          ; saved for LOSE routine only
            6380 ;
            6390 ; other misscellany
            6400 ;
62E9 00     6410 HITP   BRK            ; the HIT Person...who missed
62EA 00     6420 XHIT   BRK            ; where the miss occurred
                                           (x position)
            6430 ;
62EB 00     6440 V0     BRK            ; just a temporary
62EC 00     6450 V1     BRK            ; ditto
            6460 ;
62ED 00     6470 VP0    BRK            ; Vertical position of Paddle 0
62EE 00     6480 VP1    BRK            ; Vertical position of Paddle 1
            6490 ;
            6500 ; system equates
            6510 ;
0012        6520 CLOCK  =    18        ; the system clock
0014        6530 CLOCK.LSB = CLOCK+2   ; the 60th of a second ticker
0278        6540 STICK0 =    $278      ; OS shadow read of first stick
0279        6550 STICK1 =    $279      ; ditto for second stick
D200        6560 SOUND.FREQ = $D200    ; port which controls channel
                                           0 freq
D201        6570 SOUND.CONTROL = $D201 ; and control
            6580 ;
02C5        6590 SETCOLOR1 = $2C5      ; also known as COLPF1

BOING — not quite up to PONG
The GRAPHICS subroutines

62EF        6600        .PAGE "The GRAPHICS subroutines"

6372        6630        .OPT LIST
6372        6640        .END
```

*[Put the graphics subroutines from line 9000 on up (pg. 150, **COMPUTE!**, August 1982) here.]*

Telecommunications

TELEGAMING

Michael E. Day
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Telegaming brings to mind many things, from simple games played via a telephone link to interactive games such as chess, and on to multiple-participant *macrogames*. Indeed, the farther you go when thinking along these lines, the more difficult it becomes to separate gaming from real life, simulations from the events they imitate.

Actually, telegaming has been around for a long time. Probably the earliest form of telegaming was the use of couriers to carry letters between two or more individuals noting the moves of the particular game in progress. The official postal service eventually replaced the couriers. Later, with the development of the ability to communicate via electrical means, telegaming as we would normally consider it – via electrical communication devices – came about.

One game that has received notice in this regard is chess, which lends itself easily to telegaming since strategy is of greater importance than speed. There are many chess games in progress at this very moment by mail, by telephone, by radio, and yes, even by computer.

Telegaming is certainly not just for computers though. Airborne television and cable television can (in some locales do) support telegaming. In Britain, one major system is the Prestel Videotex system, which uses the television in conjunction with the telephone to provide its services. The Prestel system currently supports approximately 16,000 users. While the system normally provides the usual fare of stock reports, news, etc., it also provides for telegaming.

Even something as simple as gaming can sometimes run afoul of politics, however. Last April, during the Falkland Islands problem, Prestel added a video game called "Obliterate." The object was to sink an Argentine flagship. A good shot brought the comment, "Well done, sir! You are a national hero. Horatio would be proud of you," while a poor shot would elicit, "Your poor judgment is endangering the reputation of your country and giving the enemy a chance to retaliate." A rather loud protest from the House of Commons scotched the game after only a week.

Five Adventurers, Three Maps

Telegaming is, of course, not limited to television. In fact, gaming via a terminal to a master computer at some remote location – which allows access to complex games not normally available to the game player – is more common. These games are often provided by timeshare computer networks such as "CompuServe." While other special-purpose computer systems for public use can support gaming, they seldom make it available, largely because there is only a single phone line to the system. In order to allow high volume use of the single line, such systems necessarily limit gaming activities.

While many private systems do not restrict use, systems available for free public use are mostly privately supported. The timeshare networks, which have the multiple communications capability already installed, do not have the restriction problem of the smaller private systems. In fact, they charge for the use of their facilities and, to increase revenues, tend to provide games which are oriented to lengthy line times and, if possible, more than one user.

One of the more popular games is the multi-user adventure, which allows more than one person to play at once. This adds interest: there is now competition for the available resources of the simulation. There might be five adventurers but only three treasure maps.

One problem with the current telegaming structure is response time. In order to have the fast response time needed for interactive gaming, you must be in direct contact with the gaming computer. This means line charges are accumulated even when you're not actively communicating with the system. In games such as chess where the response time is not critical, you can avoid these charges by not staying in direct communication, but instead breaking the link and calling back at a later time after the next move has been planned.

Having a reasonable response time while not actually using the communications link would lead to increased telegaming by reducing the connect time and its associated cost. Some interactive cable systems come close to this. While many still require that the communications be done via the telephone, some provide the ability to interrogate the "black box" on the TV set which attaches the set to the cable, providing a lower cost means of returning information to the cable system. The limitation here is that the system must interrogate each set on the line to get information, and this can slow performance in interactive game uses.

An interactive telegaming system of this sort could be of immense use to the general telecommunications market. Widespread use of interactive data systems is now impeded by requirements to

get on to the system and by the charges generated once there. The usual method of operation is to plan for the activity ahead of time, call up the data base, get the desired information, and get off as quickly as possible. This means that the information is being inefficiently used since only the known information is being retrieved.

Metagames

Ideally, both a proper information retrieval system and a good interactive telegaming system should be easy to access and inexpensive.

There is one company around that could build such a system. Bell Telephone already has a communications network in place that is easy to use and relatively inexpensive to operate. One major problem is that it still can take ten to 30 seconds or more to establish a connection to another phone. This means that the information retrieval/gaming system would have to have a different means of access if it was intended to be disconnected between operations. This could be done, but would be more expensive than the current method of telephone interconnect since more equipment would be involved. If the data access/gaming computer is not located inside the local exchange, high priority lines to the computer will also have to be accounted for. All this, of course, adds to the cost.

In the end, a quick retrieval data system will be implemented one way or another, simply because there is a need for it. How it will be implemented is yet to be seen. Once the system has been implemented, telegaming will quickly follow. If, however, telegaming comes into being first, a data system will soon follow it. Both systems require the same type of telecommunications capabilities; it is simply a matter of which will be first.

It is perhaps not too far off when we will be able to join in metagames – simulations so large that they are, in effect, hard to distinguish from reality. If memory becomes very cheap and computer switching becomes very fast, games might be built which contain so many variables that nearly any decision (or move) could be accommodated by the game. Add telecommunication to this metagame, and you have historical re-enactments or imaginary events taking place all over the world simultaneously (on videoscreens or in "environmental rooms"). An adventure game could take months or years to reach its conclusion.

You could join an army as a private and, after months of part-time "playing," you could work your way up to become a general or a spy or whatever. All the players would join or leave this network simulation as their time and interests permitted. Imagine a computer-controlled, world-wide simulation so full, so convincing that millions of players could experience (and influence) a make-believe first contact with aliens. You might be assigned to the team which decodes their language, or you might choose to just watch the event unfold on the Simulated Evening News. Whatever happens, the coming marriage of games and telecommunications will bring about some surprises. [For additional thoughts about gaming in the coming years, see "Future Games" elsewhere in this issue.] ©

A Monthly Column

Machine Language: The Beginner's Dilemma

Jim Butterfield
Associate Editor

The beginner in machine language programming is faced with a three-way task. It's not enough to learn about machine code itself; the beginner must also develop skills on the particular machine that has been chosen. These extra skills fall into two general categories: using the tools that are provided and finding your way around the architecture.

Machine Language Itself

The machine code is the easiest part. There are numerous books and reference sources that will supply this information.

The matter is confused slightly by approaches and titles. Some teach machine language, some teach assembly language, and others identify themselves as books on "programming" or "program design." There isn't really much difference; they all develop the same skills.

I tend to favor learning the machine itself first – hexadecimal codes and such – and working up to the more general assembly language level later. It seems to me that if you can retain a firm image of the instructions as they lie in memory, you will always have a strong feeling for the real nature of the machine. For a beginner, assemblers do too much; it's easy to lose touch with how the machine is really doing the job. Later, assemblers will prove to be a powerful aid to programming, but they may be too powerful for the beginner.

But the neophyte may find himself blocked at the start. It's all very well to read about these codes, but how do you get them into the machine? And how do the codes create output to screen or printer?

Machine Language Tools: Monitors And Interfaces

The user needs some understanding of the *monitor* before he can do anything useful. This is the tool that allows him to enter code into the machine; to check code for correctness; to initiate a program test run; and to intercept a program during the run in order to investigate its performance.

The monitor for a given machine may come in many forms. It may be built in, or loaded from tape or disk, or plugged in as a ROM cartridge. A given system may have one monitor, or a choice of several, or even extensions that can be added to a built-in monitor. Variety may be the spice of life, but it makes things difficult for textbooks. It's easy to show how to add two numbers together with a 6502; the coding is the same for all systems. But an outline of how to put this addition program into the computer must vary from machine to machine, from monitor to monitor.

There's another problem that needs to be solved. Different machines call for different interfaces to input and output. As a result, a general textbook can't complete the picture, since the input and output mechanics vary from machine to machine. On Commodore products, output (print) is generated by a call to $FFD2; but the identical activity on Apple, KIM, Atari, AIM, or OSI is coded in a manner unique to that machine. Pity the poor machine language book author: he/she can't complete the picture without either tying himself to a specific machine or attaching a long rambling list of interfaces.

Architecture

Even identifying the tools specific to your machine isn't enough. We need to know how the machine is structured: in particular, what parts of memory are used for what purposes.

Where is the screen? It's often memory-mapped, but might be one place on a PET and another place on an Apple. Machines like Atari and VIC have "mobile" screens. There are several places in memory which might reflect the screen, depending on circumstances.

More importantly: what space is available on your computer, and what is in use? It's hard to enter a program into your computer if you don't know how to find or create a safe place in RAM for the program to go.

Again, it's hard for the textbook. Either it specializes in your machine, or leaves the poor beginner without the information he needs to fit the program to his machine.

You cannot effectively learn machine language in a vacuum. Each learner must have a chance to try his hand at coding the things he learns. Yet it seems to the beginner that he's being prevented from doing this: his books don't tell him enough.

Try to gain information on your machine. It may come from various sources: manufacturer's

literature, books, magazine articles, clubs, or examination of other people's programs.

Learn how to use the tools, especially the monitor. Find the best input/output interfaces for your machine. Study the mapping to find safe places to put your programs.

You'll find that all three skills will develop together. You'll learn machine language, machine tools, and machine architecture at the same time. Later you may want to transfer your skills to another machine and may need to learn new tools and architecture. By that time, you'll know enough about the whole machine environment to pick up very quickly.

For the beginner, machine language programming often seems to be an insurmountable obstacle. No single book gives all things needed to make a decent start. But a minimum set of skills can be developed, and after that the path becomes much easier.

An old joke tells of a drunk who falls down an open elevator shaft and then calls back to his friend, "Watch that first step – it's a big one!" The first step in machine language learning is a big one, too, but it sets the stage for unlimited further development – painlessly. ©

With this technique, your PET/CBM (4.0 BASIC or Upgrade, 16 or 32K) can store and play digitized speech. No special hardware is required. This program lets the PET digitize, store, playback and monitor speech or other audio signals from the tape deck. It also is a beginning for the processing of the digitized audio signals and can be used for a rudimentary voice-print analysis allowing you to discriminate between different people's voices.

Digital Speech

Kenneth Finn
Bedford, NY

The machine language of the program (from $033A to $03BD) is called Voice-Rec. Its job is to take the information from the cassette tape and store it in memory from $1000 to $4000. (Note: If you change locations $035E and $0391 to $30 [which is machine language BMI] the memory will be saved from $1000 to $8000.)

A 20K Hz Sampling Rate

This program is interesting in several ways. The first is that the sampling time for the audio signal has been reduced to about 41 microseconds. This corresponds to a sampling rate of better than 20 KHz/second. One of the ways this was accomplished was by taking the program and practically duplicating it for the high-low and low-high transitions on CA1, which is the cassette read head. The sections from $0349-$037B and $037C-$03AE are almost identical. This was done to make the sampling rate the fastest possible.

Another peculiarity of the program is that the data is packed. Each memory byte contains either a number or $FF, which means an overflow. The number corresponds to how many 40 microsecond loops went by before the signal changed from high to low or vice versa. This packing method allowed us to store about 20 seconds of audio in the 12K of memory allocated. While this does not seem like much time, remember that about 20K samples are taken every second. Without this packing, the entire 32K PET would fill up in about one and a half seconds. This packing is made possible by the silent periods between words and the presence of other low frequency components of human voice.

A third peculiarity of this program is that the paths taken by the program for the three possible conditions – no transition, overflow, transition – have all been equalized to within four or five microseconds. This is evident by the number of NOPs or ($EA) in the program.

The second section of the program is called Voice. It goes from $03B0 to $03F6. It has been previously published in the November 1981 issue of **COMPUTE!** but has been modified here so that it can be co-resident with Voice-Rec; the two programs go well together. Its job is to allow you to position a voice tape by monitoring or listening to what is on it. It is very useful when you are trying to get the tape set up to record a specific segment of it.

A couple of things about it are interesting. First of all, it shows you how the stop key, the CB2 line, the tape read line, and the cassette motor can all be used from machine language. Second, it has an even higher sampling rate than Voice-Rec. Both this program and Voice-Rec can be in the second cassette buffer without any trouble, or they can be separated easily. Both are also relocatable.

The third part of the program is called Voice-Play. It goes from $033A to $03B3, and it can play back the recorded speech from memory $1000 to $4000. (This program also can be modified by changing $036C and $0397 to $30 or BMI, and then it will play from $1000 to $8000.)

It has been designed to work with Voice-Rec in a similar way. Its timing loops at 43 microseconds match closely the loops of Voice-Rec; the playback is at least uniform, if not good.

Now let's examine the process that we have been using and see what we can now do with our digitized voice. What we have been doing is making the PET into a one-bit analog to digital converter. Another way of describing the process is saying that we have been making a record of an infinitely clipped signal. While this method is not quite as good as using an eight-bit ADC, it at least has the benefit of allowing us to get some experience cheaply and can be improved by the use of a good amplifier with tone controls on the PET's CB2 line. Since we are not capturing the signal in a very sophisticated way, I have chosen to make the sampling rate as high as possible to make up for it. That is why the first two program sections were not merged.

Let's begin by looking at the digitized data that we made and seeing how densely it has been packed.

```
10 POKE53,13:POKE52,0:CLR
20 FORI=4096TO16384
30 S=S+PEEK(I)
40 NEXTI:PRINTS/12288
```

This little program will produce the average byte value in the program. When I ran it, I got about 32, the average number of samples packed into each byte. This is why we can compress 20 seconds of information at a 20K Hz sample rate into only 12K bytes of memory.

Voice Analysis

A second analysis of the program was to produce a histogram of the signal. Remember that each byte represents a sort of instantaneous frequency. Thus, we want to examine what amounts of each frequency were present.

```
10 POKE53,13:POKE52,0:CLR:DIMA%(256)
20 FORI=4096TO16384
30 A%(PEEK(I))=A%(PEEK(I))+1:NEXTI
40 OPEN4,4,0
50 FORI=1TO70
60 PRINTA%(I),A%(I+70),A%(I+140),A%(I+210)
70 NEXTI:CLOSE4:END
```

This little program will produce a histogram, running down the page, on the PET printer. For the sample that I used, the majority of the important information was contained in the first 50 or so numbers running down. This is not too surprising, since the average value of the sample was 32. (Note, please, that overflow samples of 256 or $FF were not really treated correctly in this little analysis. They should have been added to the next following byte to get the correct frequency.) This data is a kind of voice-print for a person's speech. If you have different people say the same thing into a tape recorder and then analyze each voice with our system, you will get a separate voice-print. Women's voices, since they tend to be higher, will have higher amounts of lower numbers, which correspond to the higher frequency. While this system is crude, it does provide a departure point.

A third analysis of this data is to transform the signal via differentiation. Before you wring your hands in despair, remember that we are dealing with digitized information, and all we have to do is to transform the data by taking the difference between each number in our stored data base. The ease with which we can manipulate a signal once it is in memory is why we started this project in the first place.

Another thing we can do quite easily is to filter the signal any way we like. Try adding two or three numbers to each datum, and see how each modification changes the signal. While this technique is not strictly a filter, it illustrates the idea that digital processing of speech data is useful.

Remember that once the rough parts of the work have been done in machine language, the fun parts can be done in BASIC. This makes it simple to process the data.

One final point. Up to now we have been working in the time domain. We have a representation of how the voice looks at each point in time. There are other ways we can present this signal. While the other methods cannot mathematically tell us more about the signal, they can give us other ways to look at it.

One famous method is to transform the signal into the frequency domain by using a fourier transform. This analysis gives an altogether different type of histogram of the signal.

How To Use The PET/CBM Software Voice Synthesizer

The program is a combination BASIC loader and a runtime helper. When RUN, it loads the machine language programs from the DATA statements. Type each number carefully, and save the program before you run it, in case you've made an error (remember to change the indicated lines if you have Upgrade ROMs or 16K memory).

The program presents you with three options: Monitor Tape, Record, and Play. The Monitor program simply plays the tape. Press the RUN/STOP key to stop monitoring. You must press RUN/STOP while the tape is playing something audible, or the program won't acknowledge you. If you press it quickly, without holding down, you'll be returned to the menu of options; otherwise you'll see the message: BREAK AT LINE XXX. You can type RUN to restart the program.

When you're ready to record the tape into your computer's memory, press PLAY on the tape player first, then press R for Record. The tape will run for about 20 seconds. You can then listen to the digitized voice or sound with Play. The quality is best with an external CB2 speaker (some 4032's and all 8032's have a built-in piezoelectric "bell" that can produce low volume, high pitched CB2 sound). You can attach an amplifier to pins M and N on the user port if you want to add CB2 sound.

Change these lines for a 16K PET/CBM

```
1090 DATA 36, 37, 112, 45, 234, 234
1160 DATA 234, 36, 37, 112, 2, 80
1290 DATA 112, 80, 160, 6, 136, 208
1370 DATA 184, 36, 37, 112, 29, 160
```

Change these lines for Upgrade ROM PET/CBM

```
1170 DATA 173, 32, 123, 252, 88, 96
1420 DATA 16, 219, 48, 153, 32, 123
```

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```
100 POKE53,16:POKE52,0:CLR:GOSUB1000
105 PRINT"{CLEAR}{REV}VOICE SYNTHESIS{DOWN}":P
    OKE59468,12
110 PRINT"{REV}M{OFF}ONITOR TAPE{DOWN}":PRINT"
    {REV}R{OFF}ECORD{DOWN}":PRINT"{REV}P{
    OFF}LAY{02 DOWN}"
120 PRINT"{UP}CHOICE?":GETA$:IFA$=""THEN120
130 ON -(A$="M")-(A$="R")*2-(A$="P")*3 GOSUB 1
    50,160,170
140 GOTO105
150 PRINT"{DOWN}PRESS {REV}RUN/STOP{OFF} TO QU
    IT":SYS958:RETURN
160 PRINT"{DOWN}NOW RECORDING...":SYS826:RETUR
    N
170 PRINT"{DOWN}PLAYING...":SYS634:RETURN
1000 FOR ADRES=634TO759:READ DATTA:POKEADRES,DA
    TTA:NEXT ADRES
1010 DATA 120, 206, 19, 232, 169, 16
1020 DATA 133, 37, 165, 0, 133, 36
1030 DATA 168, 170, 177, 36, 170, 197
1040 DATA 255, 208, 5, 32, 225, 2
1050 DATA 80, 244, 169, 204, 141, 76
1060 DATA 232, 202, 240, 7, 160, 10
1070 DATA 136, 208, 253, 240, 246, 230
1080 DATA 36, 208, 2, 230, 37, 184
1090 DATA 36, 37, 48, 45, 234, 234
1100 DATA 234, 177, 36, 170, 197, 255
1110 DATA 208, 5, 32, 225, 2, 80
1120 DATA 244, 169, 236, 141, 76, 232
1130 DATA 202, 240, 7, 160, 10, 136
1140 DATA 208, 253, 240, 246, 230, 36
1150 DATA 208, 2, 230, 37, 184, 234
1160 DATA 234, 36, 37, 48, 2, 80
1170 DATA 173, 32, 192, 252, 88, 96
1180 DATA 234, 202, 240, 7, 160, 10
1190 DATA 136, 208, 253, 240, 246, 230
1200 DATA 36, 208, 2, 230, 37, 184
1210 DATA 96, 88, 169, 52, 133, 249
1220 FOR ADRES=826TO1014:READ DATTA:POKE ADRES,
    DATTA:NEXT ADRES
1225 RETURN
1230 DATA 120, 169, 16, 133, 37, 169
1240 DATA 0, 133, 36, 170, 169, 53
1250 DATA 141, 19, 232, 173, 16, 232
1260 DATA 169, 60, 141, 17, 232, 44
1270 DATA 17, 232, 48, 21, 232, 224
1280 DATA 255, 240, 12, 184, 36, 37
1290 DATA 48, 80, 160, 6, 136, 208
1300 DATA 253, 240, 234, 234, 234, 234
1310 DATA 234, 138, 145, 36, 162, 0
1320 DATA 230, 36, 208, 2, 230, 37
1330 DATA 44, 17, 232, 16, 219, 234
1340 DATA 173, 16, 232, 169, 62, 141
1350 DATA 17, 232, 44, 17, 232, 48
1360 DATA 21, 232, 224, 255, 240, 12
1370 DATA 184, 36, 37, 48, 29, 160
1380 DATA 6, 136, 208, 253, 240, 234
1390 DATA 234, 234, 234, 234, 138, 145
1400 DATA 36, 162, 0, 230, 36, 208
1410 DATA 2, 230, 37, 44, 17, 232
1420 DATA 16, 219, 48, 153, 32, 192
1430 DATA 252, 88, 169, 52, 133, 249
1440 DATA 169, 61, 141, 19, 232, 96
1450 DATA 120, 169, 53, 141, 19, 232
1460 DATA 169, 249, 141, 16, 232, 169
1470 DATA 16, 45, 18, 232, 240, 224
1480 DATA 173, 16, 232, 169, 62, 141
1490 DATA 17, 232, 44, 17, 232, 16
1500 DATA 251, 169, 204, 141, 76, 232
1510 DATA 173, 16, 232, 169, 60, 141
1520 DATA 17, 232, 44, 17, 232, 16
1530 DATA 251, 169, 236, 141, 76, 232
1540 DATA 208, 206, 0, 0, 0, 0
```

Programming The PET/CBM

by Raeto Collin West

The book described by Jim Butterfield as

"...unquestionably the most comprehensive and accurate reference I have seen to date..."

The Reference Encyclopedia for Commodore 2000, 3000, 4000, and 8000 series computers and peripherals.

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"Of all the books I have read on the PET this book *Programming the PET/CBM* by Raeto West must rank as one of the most comprehensive and readable accounts on the PET that I have ever had the pleasure to see...

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"...this book, with its lucid explanations of the PET, its useful routines and programming hints, is an essential purchase."

IPUG Magazine Review (British PET User Group) by Ron Geere

"This publication represents over a year's intensive research ... and the resulting product is a valuable work of reference. A tremendous amount of useful information has been packed in this 500+ page work at which I was so over-awed that I did not know how to start this review at first...

"This book is a must for every CBM/PET user."

From readers:

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1 Introduction and overview: Plan of the book, sources of information, features and chronology of CBM hardware.
2 BASIC and how it works: Storage of BASIC and its variables; tokens, pointers, syntax; optimising BASIC.
3 Program and system design: Capabilities of the equipment; charts, algorithms, space, timing.
4 Effective programming in BASIC: Seventeen examples, including subroutines, dates, DATA, INPUT, rounding.
5 Alphabetic reference to BASIC keywords: Full descriptions, with examples, of all keywords, with methods for adding additional commands not present in CBM BASIC, e.g. AUTO, DEL, OLD, POP, PRINT USING, SORT, VARPTR.
6 Disk drives: Descriptions of operation and workings of disk drives, with BASIC and machine-code examples; bugs.
7 Alphabetic reference to disk BASIC commands: BASIC 4 disk commands with examples and notes.
8 Other peripherals and hardware: Tape storage and handling; printers; modem; keyboard; EPROMs; reset switches.
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VIC Ringer is a utility that should be in any programmer's bag of tricks. Those who are used to wide screen computers will find it especially helpful in working with VIC's screen wraparound.

VIC Ringer

Thomas Henry, Mankato, MN

The Commodore VIC-20 computer has got to be one of the most pleasant computers to program. However, you might find the 22-column screen a little disconcerting, especially if you were brought up on other computers. Of course, the VIC-20 does have screen wraparound, meaning that your BASIC lines can be a full 88 characters wide, including the line numbers. A BASIC line can actually occupy four normal screen display lines. This is a great scheme, but if your mind is on programming you may forget to watch for the end of this four-line limit. This is especially true if you are adding a line and the screen is already full of other statements.

Let's add an end-of-the-line bell. This bell should ring when the cursor is within, say, eight spaces of the end of a BASIC line. This gives enough warning so that you can finish up the line or make the necessary changes to start a new line. The Commodore CBM-8032 has such a bell, and so does every typewriter; why shouldn't the VIC-20?

"VIC Ringer" is written in machine language and sits at the top of memory. The top of memory pointers at $37 and $38 are automatically adjusted so that they point just below the Ringer. Thus the program is "locked in" and safe from BASIC program interference. It can then peacefully coexist with any other programs you may care to enter in.

The principle of operation is quite simple. On the VIC-20 every 1/60 of a second, the computer stops doing whatever it may have been doing and goes to an *Interrupt Request* service routine. This routine scans the keyboard for key closures, refreshes the display, updates the realtime clock, and so forth. The VIC Ringer program is inserted into this Interrupt Request routine. Essentially, when the computer receives the interrupt signal, it will jump to the VIC Ringer routine and check to see if the cursor is at the 80th position on a BASIC line. If it is, and if this is the first time the 80th position has been found, then the bell rings. The computer then jumps to the normal Interrupt Request routine. If the cursor is not on the 80th position, the bell ringer routine is skipped.

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TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players—This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players—This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

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A Carefully Designed Sound

Locations $0314 and $0315 contain the address (hexadecimal, low byte and high byte) of the normal Interrupt Request entry point. These are modified by the program to point at the start of the VIC Ringer.

A great deal of attention was given to the actual bell subroutine. The bell had to be noticeable, but not objectionable. The low voice of the VIC-20 was used (location $900A), but it is used in its very highest range. To make the bell stand out, it is made to go through a series of tones quite rapidly. The result is a "tweedle-tweedle" sound not unlike the bell in a Commodore CBM-8032.

The bell subroutine has been written so that if the programmer is already using the various voices for something, he won't tamper with their amplitudes. The value in location $900E which specifies the volume or amplitude of the voices is pushed into the stack and saved. This value is restored when the bell is through ringing. This helps make the VIC Ringer transparent to the computer. Just load it and forget about it!

The program is written as a BASIC loader. This loader automatically compensates for any memory attachments, making the program suitable for VICs with any amount of memory. In addition, the SYS command in line number 300 initializes the program. So, you can use the quick load feature (shift [RUN] key) to put the VIC Ringer into memory.

The location at which the bell rings can be modified, if desired, by changing the 80 in line 330 to any number between 0 and 88. Most typewriters ring when they're five spaces from the end. If this is desired, change the number to 83.

```
200 PRINT"WAIT A FEW MOMENTS..."
210 T=256*PEEK(56)+PEEK(55):X=T-1
220 GOSUB 310:T(1)=L:T(2)=H%
230 X=T-71
240 GOSUB 310:T(3)=L:T(4)=H%
250 POKE 55,T(3):POKE 56,T(4)
260 FORA=T-84TOT-1
270 READD$:IFLEFT$(D$,1)="T"THENS=VAL(RIGHT$(D
    $,1)):D=T(S):GOTO290
280 D=VAL(D$)
290 POKEA,D:NEXT
300 SYS(T-84):NEW
310 H%=X/256:L=X-256*H%:RETURN
320 DATA120,169,T3,141,20,3,169,T4,141,21,3,88
    ,96,72,138,72
330 DATA152,72,165,211,208,5,162,248,142,T1,T2
    ,201,80,208,44,173
340 DATAT1,T2,240,39,173,14,144,72,169,15,141,
    14,144,173,T1,T2
350 DATA41,254,141,10,144,162,16,160,255,136,2
    08,253,202,208,248,238
360 DATAT1,T2,208,233,142,10,144,104,141,14,14
    4,104,168,104,170,104
370 DATA76,191,234,170
```

Mysterious and even disastrous effects can result from improperly CLOSEd PET/CBM files. This utility provides a convenient way to avoid these problems.

Is Anyone Open?

Elizabeth Deal
Malvern, PA

It is sometimes important to know which files on the PET have not been closed. The simplest way to find the file status is by asking the PET's machine language monitor, but you have to type error-prone inquiries. I got tired of this and adopted Mike Louder's "dynamic keyboard" routine to do the typing for me. The listing in lines 2000-2070 contains the routine. Users of BASIC 4 equipment must substitute SYS 54386 in lines 2050 and 2070. Line 2070 is important – it does the job.

Enter the code and execute by GOTO2000 or RUN. The program will print the desired inquiries, will "press" RETURN several times, and will display the data on the screen. There is one extra carriage return stuffed in to re-enable Power. [*A BASIC-enhancement program sold by Professional Software.*] On Power-less systems the cursor will land one line too low. If this bothers you, change J-loop index M from 5 to 4. The display looks like you are in the monitor, but you are not. When all is done, you land safely back in BASIC. If you choose to modify the monitor display, placing the cursor over the SYS command and hitting RETURN will re-enter the monitor.

The display consists of three parts:

1) On the $00D1 line the PET recalls the file it worked with most recently. $D1 contains length of file name, $D2 contains file number, $D3 contains the secondary address or, in the case of tapes, the read/write flag, and $D4 contains the device number. You can also go after the file name in 4, but in Upgrade, PET's PRINT commands obliterate the data.

2) On the $00AE line we see PET's count of the number of active files. If you typed RUN or CLR; if no files were open; if you modified the program; or if you did anything that makes your PET think you modified a program – this value will be zero, hence useless to us. If it is not a zero, it is meaningful.

(3) Locations $0251-026F contain the table of files. The first ten values are logical file numbers, the middle ten are device numbers, and

the last ten are coded secondary addresses. If the secondary address is $FF, disregard it. Otherwise, subtract $60 (96 dec) to get the secondary address. These values usually remain in the PET. PET considers them irrelevant if $AE contains zero. (You may change $AE to re-enable access to the files.) Otherwise, these are our OPEN files. As you CLOSE them, $AE decreases by one and the display shifts to the left, always leaving a set of data in memory.

A CLOSE Option

For users who prefer not to read the information in hex, BASIC lines 2100-2250 do the same job. Additionally, this routine POKEs a count of "possibly" open files into 174, so that you may CLOSE them. Needless to say, if you don't plan to close anything, you make POKE location 174 with zero; otherwise, the PET will not let you open an already active file.

There is circularity built into the routine: even if you just did CLOSE5, 5 will still be displayed. Disregard it. The purpose of the routine is to provide as much information as possible; it is up to you to use it with some thought.

The key reason for this exercise is the fact that files must be closed. If they are not, the final piece of information cannot be written. In the case of tape files, it's inconvenient. In the case of floppy files, it could lead to the disaster of losing other information already on the disk (especially if you plan to use a scratch command). It's easy to have some unclosed files dangling around – a disk error, a program error, or use of the STOP key may not allow the files to be properly closed. In direct mode, of course, an aborted SAVE command leaves an asterisk behind, meaning unfinished writing, an invitation to trouble that should be corrected immediately.

Some kinds of trouble may not show up for some time. A directory can look pretty good (though blocks free may tell you something), but when you attempt to bring a program in, for instance, it may look pretty weird (the same way as when you write a disk with a non-unique ID).

In any case, the usual procedure for handling such problems is to VALIDATE (COLLECT in 4.0 BASIC) the disk. That's a time-consuming nuisance if a disk is pretty full. It must be used in case of unfinished SAVEing. But we can skip VALIDATE by using the data provided by the above routine(s). With such an amount of displayed information, you're bound to be able to recognize which files are really OPEN and which have been closed. It often makes no difference that you know it, since it is all right to CLOSE an already closed file (hence you can close them in a jiffy in a loop). But if you don't want to touch some device, a selective CLOSE is handy.

```
2000 REM * DYNAMIC MLM FILES DISPLAY
2010 PRINT"{05 DOWN}.M 00D1 00D1"
2020 PRINT"{DOWN}.M 00AE 00AE"
2030 PRINT"{DOWN}.M 0251 026F"
2040 PRINT"{04 DOWN}.X"
2050 PRINT"{15 UP}SYS64785"
2060 M=5:POKE158,M:FORJ=0TOM
2070 POKE623+J,13:NEXT:SYS64785
2090 :
2100 REM * FILE STATUS DISPLAY
2110 F1=174:F2=210:F3=593:F5=PEEK(F2)
2120 F4=PEEK(F1):IFF4=0THENF4=10
2130 PRINT"   F#  DN  SA";:F6=0:F7=0
2140 : FORI=F4-1TO0STEP-1:F$=" "
2150 F4=PEEK(F3+I) :REM FILE#
2160 IFF4=F7ORF4=255GOTO2220
2170 F6=F6+1:F7=F4:IFF4=F5THENF$="*"
2180 PRINT:PRINTF$;:GOSUB2240
2190 F4=PEEK(F3+10+I):GOSUB2240:REM DEVICE
2200 F4=PEEK(F3+20+I) :REM SEC ADDRESS
2210 IFF4<>255THENF4=F4-96:GOSUB2240
2220 : NEXTI:PRINT
2230 POKEF1,F6:RETURN:ACTIVATE FILES
2240 PRINTRIGHT$("    "+STR$(F4),4);
2250 RETURN
```

For Apple, PET/CBM, VIC – this ripple sort will sort records using any internal location as its key. For example, R. J. Brown can be alphebetized starting at the "B" in Brown and ignoring "R. J."

SORTING BY FIELDS

Rick Keck
Overland Park, KS

Occasionally computer users need to sort data in a special way. Several sort routines are available, however most do not allow the flexibility of sorting data by fields. The program with this article illustrates a different type of application for a sort routine. The sorting algorithm used in this example is a ripple sort. The code as shown will work on either a Commodore or an Apple computer. Specifically, this program demonstrates a sorting routine which allows sorting of a file of string records by a user-specified field.

Observe the ten data statements at the top of the program noting that each record consists of three fields of data. It is essential that these fields start at a specified column in each of the records so that the file is consistent in its construction. In this case, the following fields start at the stated columns in each record in the file.

Field (1): Name - column 1
Field (2): Number - column 11
Field (3): Code - column 21

With this program the user responds to a computer request by stating which column position the file of records is to be sorted by. The important factors which contribute to the ability to sort the file by a field are as follows: First, each record consists of a large, single string of data. Second, the utilization of the MID$ function in the sorting section of the program allows comparison of a substring of each record.

This sorting program can be made into a subroutine and inserted into an existing program by doing the following. Delete lines 10 through 230; renumber the code as desired; replace the END statement with a RETURN statement; and call the subroutine with a GOSUB statement. Note that the variable N must be assigned the value of the number of records in the file to be sorted. The variable C$ is a variable string array with each element holding a record. This array must be dimensioned to at least size N. The variable B specifies the length of the field which will be sorted. In this code example it is set to the value of six. Since the data consists of a file of character string records, it is suggested that the data be sorted in the form of a sequential data file on external storage devices.

This sorting program can be used in a variety of applications. For example, sorting addresses by zip code, sorting transactions by account number, or sorting records by a date field.

```
90 N=10: REM N IS # OF RECORDS
100 DIM C$(N)
110 DATA "RICHIE     231105     COOL4"
120 DATA "PAT        250421     BASE9"
130 DATA "TRENT      200818     FARM1"
140 DATA "TRIXIE     222222     KITY3"
150 DATA "ERIC       154210     HSIF8"
160 DATA "ANGIE      021356     SYOB3"
170 DATA "DARRON     312540     DIK12"
180 DATA "TINKER     312450     TIGR7"
190 DATA "THEO       110055     CAT28"
200 DATA "JAK        003451     ACCT5"
210 FOR J=1 TO N
220 READ C$(J)
230 NEXT J
240 PRINT:PRINT:PRINT
250 PRINT"1234567890....5...20....5...30"
255 PRINT
260 PRINTC$(1)
270 PRINT:PRINT "ENTER THE COLUMN # OF THE
    FIELD"
280 PRINT:PRINT "THAT THE FILE IS TO BE SO
    RTED BY";
290 INPUT A
295 PRINT:PRINT
300 REM SET THE LENGTH OF THE FIELD
310 REM TO THE VALUE OF (6)
320 B=6
330 REM ******  SORT BEGINS  ******
340 FOR J=1 TO N-1
350 IF (MID$(C$(J),A,B) < MID$(C$(J+1),A,B
    )) THEN 420
360 T$=C$(J+1)
370 FOR K=J TO 1 STEP -1
380 IF (MID$(C$(K),A,B) < MID$(T$,A,B)) TH
    EN C$(K+1)=T$:GOTO 420
390 C$(K+1)=C$(K)
400 NEXT K
410 C$(1)=T$
420 NEXT J
430 REM ******   SORT ENDS   ******
440 FOR J=1 TO N
450 PRINT C$(J)
460 NEXT J
470 PRINT:PRINT "NORMAL TERMINATION"
480 END
```

A Word-Based Voice Synthesizer For The Apple II

David Barron
Spring Valley, NY

Since I purchased my computer I have been interested in voice synthesis. Its applications in CAI, games, and error handling seemed extensive. I decided to apply my newly learned machine language skills to writing my own voice routines.

My routines would have to meet several requirements:

1. They would have to be word based. This would keep the amount of memory per word constant. It would also provide for block memory organization. As well as this, it would simplify the program itself.
2. The routines would have to be easy to use. They would be activated by a POKE and a call, or by similar means. This would enable beginners to use the programs with ease.
3. To eliminate any excess costs, the routines would be hardware independent. They would make use of the Apple's cassette port and built-in speaker.

Memory Organization

The memory used to store a vocabulary is divided into 2000-byte blocks. Each of these blocks will be used to store eight, distinct words. Each word will be stored in its own bit of the block of memory. In other words, bit 0 stores word 0, bit 1 stores word 1, and so on. I chose to store the words this way rather than sequentially to reduce the complexity of the program. If I chose the latter way, many rotate commands would be required. These tend to get confusing, and, if you are not careful, very sloppy.

Since a single word rarely contains periods of silence, no data compression is necessary. Again, this simplifies the program. In order to store data in the correct bit, a few things must be done:

1. Load in the old byte.
2. Get a bit from the input port.
3. Move the input bit to the right position.
4. Plug this bit into the old byte.
5. Store the old byte.

Exactly how this is done will be explained in further detail later on.

How Speech Enters And Exits

The data enters into the program through the cassette and exits through the Apple on-board speaker. First let's talk about recording. Location $C060 is the *cassette in.* When a byte is read from this location, the seventh bit is affected according to the audio signal present. After this location has been sampled, the seventh bit is isolated. It is then plugged into the correct position as explained above.

When in the playback mode, your voice is produced by the on-board speaker. Because the case resonates at certain frequencies, I would recommend hooking up an external speaker, as I have. This greatly improves the quality of any sound produced by the computer, especially voice. One note: when wiring up the speaker, use shielded cable. If you do not, a tremendous amount of RF interference will occur.

The speaker is controlled by location $C030. Every time this memory location is accessed, a click is produced by the speaker. Be careful here. If you use a store instruction to toggle the speaker, it will be toggled twice. This is so because the 6502 does a read before any write. This accesses the location twice, thus producing two clicks.

Getting back to the program – once the correct data byte is loaded, the correct bit is isolated. If this bit is different than the last sample obtained, a change in state has occurred. This will result in the toggling of the speaker, producing a sound. Doing this at the proper rate reproduces the recorded word.

Here's a brief explanation of the machine language "record" and "playback" routines:

Record

The Record routine is probably the most complex part of this program. The entry point is $9000. Here is how it works:

1. All pointers are set. This includes the calculation of the position of the word and the bit that the word is located in.
2. The Y register is set to zero. This will be

the index of the indirect address of the word.

3. A delay loop is executed. This is the start of the main program loop. The delay determines the sampling rate.

4. The sample byte is taken from the cassette port. The seventh bit is then isolated via an AND instruction.

5. The X register is set to $FF if the input bit was high, or $00 if the bit was low.

6. This result is moved to the accumulator. There it is ANDed with the byte that contains the bit that the word is to be stored in high. This provides us with a byte that has the bit we want the word in set according to the cassette input. All other bits in the byte are zero. This value is saved.

7. The accumulator is loaded with the mask byte and then inverted. This forms a byte with all bits set, except for the bit that the word will be stored in.

8. The current byte is loaded and then ANDed with the previously obtained value. This leaves the byte undisturbed except for the bit that the word will be stored in. This is set to zero.

9. This value is logically ORed with the byte that contained the data sample in the proper place.

10. At this point we have successfully plugged the input sample into the current byte.

11. The current byte is now stored. We are almost finished.

12. The Y register is incremented. If it is zero, then a page has been completed. In this case the page is incremented.

13. If the last page has been done, the routine ends. If not, then it jumps back to the delay routine and goes one more time.

Play

The playback routine is far simpler than the recording routine. Its entry point is $9049.

1. All pointers are set. The positions of the word and of its bit are also calculated.

2. This is the beginning of the main loop. A delay is executed. This determines the sampling rate.

3. The Y register is zeroed. It will be the index to the indirect address.

4. The current data byte is sampled.

5. This value is ANDed with the mask byte. This results in all bits being zero except for the bit containing the word data, which is unaffected.

6. This is compared to the last data bit obtained.

7. If the value is the same, then nothing happens.

8. If there is a difference, the speaker is toggled.

9. The Y register is incremented, and the program checks whether a page has been completed.

10. If a page has been completed, the current page is incremented.

11. If the last page was done, the program ends.

12. Otherwise the program loops back until done.

Entering The Program Into Memory

Type in the BASIC Loader (Program 1) and RUN it to put the machine language program into memory. Then type CALL-151 to enter the monitor. Once this has been done, SAVE the program by typing: BSAVE VOC 1.1OBJ0, A$9000,L$C3.

The next step is to generate the table used by the mask subroutine. To do this, type the following:

```
*310:01 02 04 08 10 20 40 80
```

To save it, type:

```
BSAVE TABLE,a$310,L$10
```

Using The Program

To use the program requires only three simple steps:

1. POKE 0 with the word number.
2. POKE 772 with the speed.
3. Call the appropriate routine.

A sample program would look something like this:

```
10 POKE 0,1: REM WORD
20 POKE 772,10 : REM SPEED
30 CALL 9*4096+64+9 : REM PLAY
40 END : REM DONE
```

I have included three sample programs:

Program 2: This is a simple routine that speaks any number put in. You must enter the vocabulary from Table 1 before using it.

Program 3: This is a CAI demo. It is an addition quiz that uses Program 1 as a subroutine. This program shares a vocabulary with Program 1.

Program 4: This is a vocabulary builder. It should be used to build the vocabulary in Table 1.

I hope you enjoy using these routines, as I have. They make your programs many times more pleasant and impressive.

Table 1.

WORD NUMBER	WORD	WORD NUMBER	WORD
0	ZERO	27	NINETY
1	ONE	28	HUNDRED
2	TWO	29	THAT
3	THREE	30	IS
4	FOUR	31	CORRECT
5	FIVE	32	WRONG
6	SIX	33	TRY
7	SEVEN	34	AGAIN
8	EIGHT	35	WHAT
9	NINE	36	PLUS
10	TEN	37	MINUS
11	ELEVEN	38	NEGATIVE
12	TWELVE	39	WELCOME
13	THIRTEEN	40	MATH
14	FOURTEEN	41	QUIZ
15	FIFTEEN	42	PROBLEM
16	SIXTEEN	43	NUMBER
17	SEVENTEEN	44	YOU
18	EIGHTEEN	45	GOT
19	NINETEEN	46	OUT
20	TWENTY	47	OF
21	THIRTY	48	PROBLEMS
22	FORTY	49	OR
23	FIFTY	50	PERCENT
24	SIXTY	51	HOW
25	SEVENTY	52	MANY
26	EIGHTY		

Program 1.

```
10 FOR ADRES=36864TO37055:READ DATTA:POKE ADR
    ES,DATTA:NEXT ADRES
36864 DATA 32, 153, 144, 32, 121, 144
36870 DATA 160, 0, 32, 136, 144, 173
36876 DATA 96, 192, 41, 128, 141, 5
36882 DATA 3, 162, 0, 201, 0, 240
36888 DATA 2, 162, 255, 138, 45, 0
36894 DATA 3, 141, 6, 3, 173, 0
36900 DATA 3, 73, 255, 141, 5, 3
36906 DATA 177, 1, 45, 5, 3, 13
36912 DATA 6, 3, 145, 1, 200, 192
36918 DATA 0, 208, 207, 32, 148, 144
36924 DATA 205, 2, 3, 240, 5, 160
36930 DATA 0, 76, 8, 144, 76, 191
36936 DATA 144, 32, 153, 144, 32, 121
36942 DATA 144, 160, 0, 32, 136, 144
36948 DATA 177, 1, 45, 0, 3, 205
36954 DATA 3, 3, 240, 6, 141, 3
36960 DATA 3, 174, 48, 192, 141, 3
36966 DATA 3, 200, 192, 0, 208, 229
36972 DATA 32, 148, 144, 205, 2, 3
36978 DATA 240, 75, 160, 0, 76, 81
36984 DATA 144, 169, 0, 133, 1, 173
36990 DATA 1, 3, 133, 2, 105, 8
36996 DATA 141, 2, 3, 96, 173, 4
37002 DATA 3, 141, 5, 3, 206, 5
37008 DATA 3, 208, 251, 96, 230, 2
37014 DATA 165, 2, 96, 165, 0, 41
37020 DATA 7, 170, 189, 16, 3, 141
37026 DATA 0, 3, 165, 0, 41, 24
37032 DATA 42, 105, 80, 141, 1, 3
37038 DATA 165, 0, 41, 32, 201, 0
37044 DATA 240, 8, 173, 1, 3, 105
37050 DATA 8, 141, 1, 3, 96, 96
```

Program 2.

```
10 HIMEM: 8192
15 IF  PEEK (768 + 17) = 2 THEN 50
20 PRINT  CHR$ (4);"BLOAD TABLE"
30 PRINT  CHR$ (4);"BLOAD VOC 1.1.OBJ0"
40 PRINT  CHR$ (4);"BLOAD NUMBERS.VOCAB,"
50 HOME
60 INPUT "TYPE IN YOUR NUMBER (<1000) ";N
70 GOSUB 100
80 GOTO 50
100 REM
110 IF N > 1000 OR N < >  INT (N) THEN  RETURN

130 IF N = 0 THEN RETURN
135 IF N < 21 THEN W = N: GOSUB 500: RETURN
140 IF N > 99 THEN 300
150 A1 = INT (N / 10)
160 W = A1 + 18: GOSUB 500
170 N = N - 10 * A1
180 GOTO 130
300 A1 = INT (N / 100)
310 W = A1: GOSUB 500
315 W = 28: GOSUB 500
320 N = N - A1 * 100
330 GOTO 130
500 POKE 772,17
510 POKE 0,W
520 CALL 9 * 4096 + 4 * 16 + 9: REM $9049
530 RETURN
```

Program 3.

```
10 HIMEM: 8192
15 IF PEEK (768 + 17) = 2 THEN 50
20 PRINT CHR$ (4);"BLOAD TABLE"
30 PRINT CHR$ (4);"BLOAD VOC 1.1.OBJ0"
40 PRINT CHR$ (4);"BLOAD NUMBERS.VOCAB,"
50 HOME
52 NR = 0
55 GOSUB 1000
60 GOTO 600
99 HOME
100 REM
110 IF N > 1000 OR N < > INT (N) THEN 100
130 IF N = 0 THEN RETURN
135 IF N < 21 THEN W = N: GOSUB 500: RETURN
140 IF N > 99 THEN 300
150 A1 = INT (N / 10)
160 W = A1 + 18: GOSUB 500
170 N = N - 10 * A1
180 GOTO 130
300 A1 = INT (N / 100)
310 W = A1: GOSUB 500
315 W = 28: GOSUB 500
320 N = N - A1 * 100
330 GOTO 130
500 POKE 772,17
510 POKE 0,W
520 CALL 9 * 4096 + 4 * 16 + 9: REM $9049
530 RETURN
600 FOR C = 1 TO P
605 A = INT ( RND (1) * 500):B = INT ( RND (1)
     * 500)
610 W = 35: GOSUB 500
615 PRINT "WHAT ";
620 W = 30: GOSUB 500
625 PRINT "IS ";
630 N = A: GOSUB 100
635 PRINT A;" + ";B
637 PRINT
638 FOR D = 1 TO 200: NEXT D
640 W = 36: GOSUB 500
650 N = B: GOSUB 100
```

```
660 INPUT N
662 IF N = A + B THEN NR = NR + 1: GOTO 800
665 Q = Q + 1: IF Q > 2 THEN Q = 0: GOTO 850
680 W = 33: GOSUB 500:W = 34: GOSUB 500
700 GOTO 610
800 W = 29: GOSUB 500
805 PRINT "THAT ";
810 W = 30: GOSUB 500
815 PRINT "IS ";
820 W = 31: GOSUB 500
825 PRINT "CORRECT"
830 FOR R = 1 TO 200: NEXT
850 N = A: GOSUB 100
855 PRINT : PRINT A;
860 W = 36: GOSUB 500
865 PRINT " + ";
870 N = B: GOSUB 100
875 PRINT B;
880 W = 30: GOSUB 500
885 PRINT " IS ";
890 N = A + B: GOSUB 100
895 PRINT A + B
897 FOR R = 1 TO 150: NEXT R
900 NEXT C
910 FOR D = 1 TO 300: NEXT
915 PRINT "YOU ";:W = 44: GOSUB 500
917 PRINT "GOT ";:W = 45: GOSUB 500
919 PRINT NR;" ";:N = NR: GOSUB 100
921 PRINT "OUT ";:W = 46: GOSUB 500
923 PRINT "OF ";:W = 47: GOSUB 500
925 PRINT P;" ";:N = P: GOSUB 100
927 PRINT "CORRECT ";:W = 31: GOSUB 500
929 PRINT : PRINT "OR ";:W = 49: GOSUB 500
931 PRINT INT ((NR / P) * 100);" ";:N = INT ((
    NR / P) * 100): GOSUB 100
935 PRINT "PERCENT":W = 50: GOSUB 500
940 END
1000 DATA 39,WELCOME,2,TO,40,MATH,41,QUIZ,1,ONE

1010 DATA 51,HOW,52,MANY,48,PROBLEMS
1020 FOR R = 1 TO 5: READ W,A$
1030 GOSUB 500
1040 PRINT A$;" ";
1045 FOR D = 1 TO 130: NEXT D
1050 NEXT
1055 PRINT : PRINT : FOR D = 1 TO 300: NEXT D
1060 FOR R = 1 TO 3: READ W,A$: GOSUB 500
1065 FOR D = 1 TO 130: NEXT D
1070 PRINT A$;" ";: NEXT
1080 INPUT P
1090 N = P: GOSUB 100
1100 RETURN
```

Program 4.

```
5 SP = 10
7 DIM W$(65)
100 TEXT : HOME
110 HIMEM: (5 * 4096) - 1: REM $4FFF
112 REC = 9 * 4096: REM   $9000
113 PLAY = 9 * 4096 + 4 * 16 + 9: REM  $9049
115 IF  PEEK (REC) = 32 THEN 140
120 PRINT CHR$ (4);"BLOAD TABLE,A$310"
130 PRINT CHR$ (4);"BLOAD VOC 1.1.OBJ0,A$9000"

140 HTAB 10
150 PRINT "VOCABULARY BUILDER"
160 POKE 34,1
170 VTAB 5
180 PRINT "HAVE YOU ALREADY MADE A VOCABULARY ~
    ?";
185 GOSUB 5000
190 IF F = 0 THEN 260
200 PRINT : PRINT : PRINT "HIT A KEY";
210 GET T$
215 PRINT
220 PRINT CHR$ (4);"CATALOG"
230 INPUT "TYPE YOUR FILENAME AND HIT RETURN  ~
      (RET FOR NONE)===>";N$
240 IF N$ = "" THEN 260
250 PRINT CHR$ (4);"BLOAD ";N$;",A$5000"
252 PRINT CHR$ (4);"OPEN";N$;".VOC"
253 PRINT CHR$ (4);"READ";N$;".VOC"
254 FOR R = 0 TO 64
255 INPUT W$(R)
256 NEXT R
257 PRINT CHR$ (4);"CLOSE"
260 REM  MAIN MENU
270 HOME
280 HTAB 15: PRINT "MAIN MENU"
290 VTAB 7
300 PRINT "1-ENTER A WORD
310 PRINT
320 PRINT "2-PLAY A WORD
330 PRINT
340 PRINT "3-PRINT A VOCABULARY SHEET"
350 PRINT
360 PRINT "4-QUIT"
370 PRINT : PRINT
380 PRINT "ENTER YOUR SELECTION==>";
390 GET C$
400 IF C$ < "1" OR C$ > "4" THEN 390
410 PRINT C$
420 ON VAL (C$) GOTO 1000,2000,3000,430
430 PRINT : PRINT "DO YOU REALLY WANT TO QUIT ~
    ";
440 GOSUB 5000
450 IF F = 0 THEN 260
460 FOR R = 1 TO 20: PRINT : NEXT
470 INPUT "ENTER FILENAME TO SAVE AND HIT RETU
    RN  (RET FOR NONE)";N$
480 IF N$ = "" THEN 30000
490 PRINT CHR$ (4);"BSAVE";N$;",A$5000,L$3FFF"


500 PRINT CHR$ (4);"OPEN";N$;".VOC"
510 PRINT CHR$ (4);"WRITE";N$;".VOC"
520 FOR WO = 0 TO 64
530 PRINT W$(WO)
540 NEXT WO
550 GOTO 30000
1000 HOME
1010 PRINT "SINGLE WORD OR SERIES (S OR E)?";
1020 GET T$
1025 PRINT
1030 IF T$ = "S" THEN 1090
1050 PRINT : PRINT "ENTER STARTING WORD NUMBER ~
     ";
1060 INPUT ST
1070 INPUT "ENDING WORD NUMBER ";EN
1080 GOTO 1100
1090 INPUT "ENTER WORD NUMBER ";ST:EN = ST
1100 FOR WO = ST TO EN
1110 HOME
1120 PRINT "WORD NUMBER :";WO
1130 VTAB 5
1140 PRINT "ENTER WORD NAME - DEFAULT=";W$(WO)
1150 INPUT N$
1160 IF N$ = "" THEN N$ = W$(WO)
1170 W$(WO) = N$
1180 VTAB 10
1190 PRINT "ENTER SPEED - DEFAULT=";SP
1200 INPUT N$
1210 IF N$ = "" THEN 1230
1220 SP = VAL (N$)
1230 POKE 772,SP
1240 POKE 0,WO
1250 PRINT : PRINT "HIT ANY KEY TO RECORD"
1260 GET T$
1270 CALL REC
```

```
1280 PRINT : PRINT "HIT ANY KEY FOR PLAYBACK"
1290 GET T$
1300 CALL PLAY
1310 PRINT "WAS THAT OK ?";: GOSUB 5000
1320 IF F = 0 THEN 1110
1330 NEXT WO: GOTO 260
2000 HOME
2010 PRINT "SINGLE WORD OR SERIES (S OR E)?";
2020 GET T$
2030 PRINT
2040 IF T$ = "S" THEN 2090
2050 PRINT : PRINT "ENTER STARTING WORD NUMBER ~
   ";
2060 INPUT ST
2070 INPUT "ENDING WORD NUMBER ";EN
2080 GOTO 2100
2090 INPUT "ENTER WORD NUMBER ";ST:EN = ST
2100 FOR WO = ST TO EN
2110 HOME
2120 PRINT "WORD NUMBER :";WO
2130 VTAB 5
2140 PRINT "ENTER WORD NAME - DEFAULT=";W$(WO)
2150 INPUT N$
2160 IF N$ = "" THEN N$ = W$(WO)
2170 W$(WO) = N$
2180 VTAB 10
2190 PRINT "ENTER SPEED - DEFAULT=";SP
2200 INPUT N$
2210 IF N$ = "" THEN 2230
2220 SP = VAL (N$)
2230 POKE 772,SP
2240 POKE 0,WO
2280 PRINT : PRINT "HIT ANY KEY FOR PLAYBACK"
2290 GET T$
2300 CALL PLAY
2330 NEXT WO: GOTO 260
2670 CALL REC
3000 HOME
3005 HTAB 5
3010 PRINT "HIT ANY KEY TO START PRINTOUT"
3020 PRINT CHR$ (4);"PR#1"
3030 PRINT "WORD NUMBER"; TAB( 20);"WORD"
3040 FOR X = 1 TO 40: PRINT "-";: NEXT X
3045 PRINT
3050 FOR WO = 0 TO 63
3060 PRINT WO; TAB( 20);W$(WO)
3070 NEXT WO
3075 PRINT CHR$ (4);"PR#0"
3080 GOTO 260
4999 END
5000 GET T$
5010 IF T$ < > "Y" AND T$ < > "N" THEN 5000
5020 F = 0
5030 IF T$ = "N" THEN PRINT "NO"
5040 IF T$ = "Y" THEN F = 1: PRINT "YES"
5050 RETURN
30000 END
```

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Function VAL (X) In UCSD PASCAL For Apple II

Michael Erperstorfer
Vienna, Austria

Function VAL (X) is similar to BASIC's VAL-function:
X must be a string of an integer number;
VAL returns a true integer number;
If X is no integer number VAL returns 0;
String X may have leading or trailing spaces.

```
PROGRAM VALTEST;
VAR INPUT : STRING;
FUNCTION VAL (S : STRING) : INTEGER;
 VAR START,I,LEN,O,V : INTEGER;
      NEG : BOOLEAN;
 BEGIN
  V:=0;
  NEG:=FALSE;
  WHILE COPY (S,1,1) = ' ' DO S:=COPY (S,2,
    LENGTH (S)-1);
  (* remove blanks from left *)
  WHILE COPY (S,LENGTH (S),1)=' ' DO S:=COPY
    (S,1,LENGTH (S)-1);
  (* remove blanks from right *)
  START:=1;
  IF COPY (S,1,1) = '-' THEN
   BEGIN
    START:=2;
    NEG:=TRUE
   END;
   (* if first char = '-' *)
   (* number is negative *)
   (* increment start value *)
   (* to skip '-' sign *)
   (* set neg-flag *)
  LEN:=LENGTH (S);
  FOR I:=START TO LEN DO
   BEGIN
    O:=ORD (S[I]);
    IF (O>47) AND (O<58) THEN
    (*check if char is number *)
     V:=V + TRUNC (PWROFTEN (LEN-I)) * (O-48)
     (* calculate value *)
    ELSE
     BEGIN
     (* if char is not number *)
      VAL:=0;
      (* set value to 0 *)
      EXIT (VAL)
      (* and exit function *)
     END
   END;
  IF NEG THEN VAL:=-V ELSE VAL:=V
 END;
BEGIN
 REPEAT
  WRITE ('STRING: ');
  READLN (INPUT);
  WRITELN ('=',VAL (INPUT))
 UNTIL INPUT=''
END.
```

©

To check a tape using this program, rewind the tape after a SAVE (while the program is still also in the computer's memory), type CALL 768, and do not hit return until after *you have started your tape.*

Verify Your Applesoft Tapes

Keith Falkner
Venice, FL

Imagine this – you've written a dandy program in Applesoft, tested it, debugged it, perfected it, and of course SAVEd it.

But is the program *really* saved? Can you load the tape? If the tape recorder has developed a problem, you may lose this program forever as soon as you type NEW or turn off your Apple.

Here is how to know for sure. Below is a machine language program which verifies the accuracy of a SAVEd Applesoft program on tape. To make use of this program:

1. Type in Program 1 and RUN it.

2. From the machine language monitor, SAVE it to tape via 300.393W or to disk via BSAVE VERIFY,A$300,L$94.

3. When you need it, BLOAD VERIFY from disk or enter the monitor with CALL -151 and reload it from tape via 300.393R (this does *not* affect an Applesoft program in memory).

4. SAVE the Applesoft program as normal.

5. Operate the tape recorder just as you would to LOAD an Applesoft program, but type CALL 768 instead of LOAD. The tape will be read and compared to the Applesoft program.

6. If the comparison is successful, there will be no error message, just the two BEEPs which accommpany LOAD.

7. If, alas, the tape is not a readable copy of the program, the message ERR will appear, with the address of the error and the values of the byte on tape and the byte in memory.

An error message is never good news, but it is far better to know of a problem before the program is lost than to rely on a tape which later proves unreadable.

An Applesoft program on tape is really two data records: the first record is four bytes long and indicates the size of the Applesoft program. If this header is read accurately, the computer beeps, but prints nothing. The second data record on tape is as long as the header indicates, and contains an image of the program. When this is successfully read, whether by LOAD or by the verify program below, the computer beeps again.

Load naturally shoves the incoming data into memory, but Program 1 harmlessly compares what is read with what is in memory. If those bytes differ, an error message appears: ERR 08EB-88 (8C) for example, which means that at location $8EB, the byte in memory is $88 (the token for GR), but the tape contains $8C (the token for CALL). As soon as it reports such an error, the VERIFY routine quits. At this point, nothing in memory has been altered, so the SAVE can be retried, perhaps with a different tape or a different volume level.

Take the time to type this routine into your Apple and save it. Sooner or later you will want assurance that a saved Applesoft tape is the accurate program you hope it is.

Type in the Applesoft program and it will build this machine language verify routine starting at address 768 when you type RUN.

```
100 FOR I=768 TO 915:READ X:POKE I,
      X:NEXT
768 DATA 162, 0, 32, 117, 253, 160, 2,
      138, 145, 105
778 DATA 200, 169, 0, 145, 105, 200, 169,
      2, 145, 105
788 DATA 189, 9, 2, 41, 127, 157, 0,
      2, 202, 224
798 DATA 255, 208, 243, 96, 32, 61, 3,
      165, 103, 133
808 DATA 60, 165, 104, 133, 61, 165, 175,
      133, 62, 165
818 DATA 176, 133, 63, 32, 61, 3, 169,
      141, 76, 237
828 DATA 253, 32, 250, 252, 169, 22, 32,
      201, 252, 133
838 DATA 46, 32, 250, 252, 160, 36, 32,
      253, 252, 176
848 DATA 249, 32, 253, 252, 160, 59, 32,
      236, 252, 240
858 DATA 14, 69, 46, 133, 46, 32, 186,
      252, 160, 52
868 DATA 144, 240, 76, 38, 255, 234, 234,
      234, 193, 60
878 DATA 240, 235, 72, 32, 45, 255, 32,
      146, 253, 177
888 DATA 60, 32, 218, 253, 169, 160, 32,
      237, 253, 169
898 DATA 168, 32, 237, 253, 104, 32, 218
    , 253, 169, 169
908 DATA 32, 237, 253, 169, 141, 76, 237
    , 253
```

CAPUTE!:
Modifications Or Corrections To Previous Articles

Machine Language: First Steps

There are two corrections to be made to Jim Butterfield's series of columns "Machine Language: First Steps" (May through July, 1982). In the BASIC program which appeared several times in this series, line 220 should be changed to read:

```
220 J=48:FOR K=1 TO V
```

and in Part III (July 1982, p. 150), line 120 should read:

```
120 DATA 3,144,239,169,13,32,210,255,96
```

VIC Curiosities

The correct POKE to disable the LIST command on the VIC ("VIC Curiosities," August 1982, p. 140) is POKE 775,200.

Apple Chemistry Lab

There are several typos in the chemistry simulation ("Chemistry Lab," August 1982, p. 75). Line 1220 should include a second parenthesis (X0) and lines 6035, 6050, and 6120 use a colon, not a semicolon. Lines 1041 and 1047 should start with PRINT " and line 7001 should start with DATA. ©

COMPUTE! is looking for programs and tutorial articles on the Sinclair, TI, and Radio Shack Color Computer

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COMPUTE!'s Listing Conventions

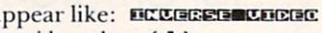
Many of the programs which are listed in **COMPUTE!** use special keys (cursor control keys, color keys, etc.). To make it easy to tell *exactly* what should be typed in when copying a program into the computer, we have established the following listing conventions.

For The Atari

In order to make special characters, inverse video, and cursor characters easy to type in, **COMPUTE!** magazine's Atari listing conventions are used in all the program listings in this magazine.

Please refer to the following tables and explanations if you come across an unusual symbol in a program listing.

Atari Conventions

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.

For 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, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen.

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*.

For The Apple

Programs listed as "Microsoft" are written for the PET/CBM, Apple, OSI, etc. Although the programs are general in nature, you may need to make a few changes for them to run correctly on your Apple. Microsoft BASIC programs written for the PET/CBM sometimes contain special cursor control characters. The following table shows equivalent Apple words. Notice that these Apple commands are *outside* quotations (and even separate from a PRINT statement). PRINT"[RVS]YOU WON" becomes INVERSE: PRINT"YOU WON":NORMAL

[CLEAR[(Clear Screen) HOME

[DOWN] (Cursor down)
Apple II +: Call -922
POKE 37,PEEK(37)+(PEEK(37)<23)

[UP] (Cursor up)
POKE 37,PEEK(37)-(PEEK(37)>0))

[LEFT] (Cursor left) PRINT CHR$(8);

[RIGHT] (Cursor right)
PRINT CHR$(21)

[RVS] (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the PRINT statement ends with a semicolon.)
INVERSE

[OFF] (Inverse video off) NORMAL

Shifted characters can represent either graphics characters or uppercase letters. If within text, just use the non-shifted character, otherwise substitute a space. Some "generalized" programs contain a POKE such as POKE 59468,14. Omit these from the program when typing it in. One final note: you will probably want to insert a question mark or colon within an INPUT prompt. PET/CBM and many other BASICs automatically print a question mark:

```
INPUT "WHAT IS YOUR NAME";N$
   becomes
INPUT "WHAT IS YOUR NAME?";N$
```

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 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}		

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}		

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.

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.

Back issues are $3.00 each or six for $15.00. Price includes freight in the US. Outside the US add $1.00 per magazine ordered for surface postage. $3.00 per magazine for air mail postage. All back issues subject to availability.

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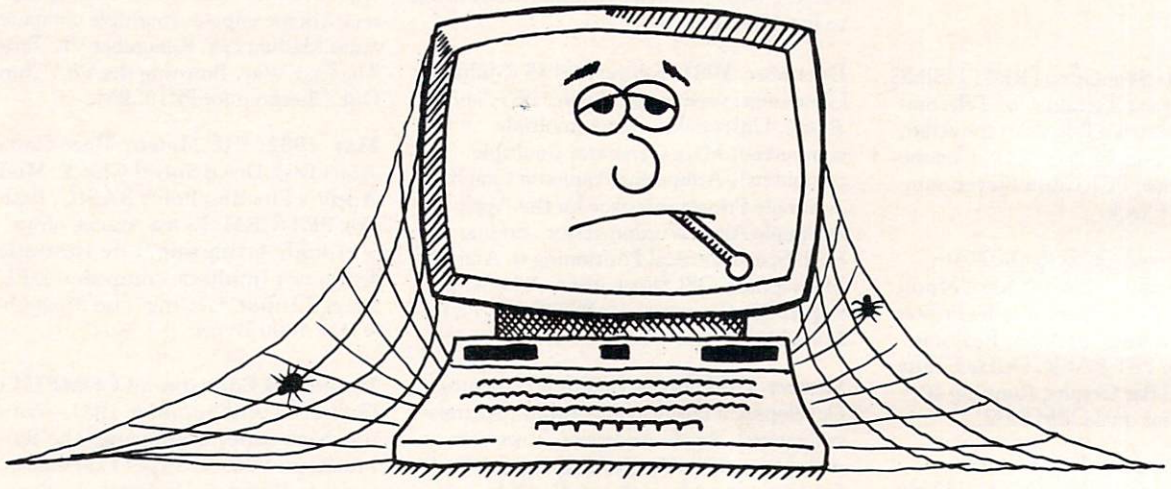

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New Products

Christmas Music For The Atari

B.I.G. Software announces the release of the first three of a scheduled seven volumes of Christmas Music for the Atari 400/800 Computer.

Each volume contains ten Christmas favorites and requires only a BASIC cartridge for operation. Every volume contains a different set of songs such as *Silent Night, The First Noel,* and many other favorites. Each song features four-part harmony and smooth, accurate song reproduction.

The program is available in two formats: Version One for 8K to 24K tape drives or 16K to 32K disk drives; and Version Two for 32K tape or 40K disk. Version Two allows the user a wide variety of options for song play. Individual songs can be selected, and each song can be repeated a given number of times or allowed to play continuously. In addition, the user can play all ten songs in the order they are listed in the program, or he can select from the available songs. This sequence can then be repeated indefinitely, and each song within the sequence can also be set for multiple play.

Christmas Music Volumes 4, 5 and 6 are scheduled for release in October, and Volume 7 in early November. Volume 7 will feature the *Hallelujah Chorus* from Handel's *Messiah, Ave Maria, O Holy Night,* and several other well-known selections. Due to the memory requirements for Volume 7, it will be available only in the Version Two format.

Future releases will include Pop and Show Tunes, Country and Western, as well as a wide selection of Classical music.

Retail prices range from $12.95 for a one-volume tape version to $34.95 for the three-volume disk. Words to all songs are available at a small additional cost.

B.I.G. Software
533 Airport Blvd., Suite 518
Burlingame, CA 94010
(415)347-1063

Expansion Chassis For VIC

Arfon Microelectronics, Ltd. has announced a new product – the Arfon Micro VIC-20 Expansion Chassis. The Micro VIC-20 Expansion Chassis enhances the VIC-20 system by fully expanding the VIC-20 memory; plugging in interfaces for data retrieval; and controlling applications, other computer peripherals, cartridges for expanded BASIC language functions, and programming utilities.

The Arfon Micro VIC-20 Expansion Chassis has the following features: seven expansion slots; all aluminum construction; large power supply with torodial transformer; five volt supply direct to the VIC-20 for cooler operation; 24 volt supply for the Arfon Micro VIC printer; detachable cover to protect cartridges; housing for VIC and Expansion in one portable unit; holder for RF modulator; and support for all VIC-20 cartridges from Arfon Micro, Commodore, and others.

Arfon Microelectronics, Ltd.
111 Rena Drive
Lafayette, LA 70503
(318)988-2478

Arfon Micro VIC-20 Expansion Chassis shown here with cover removed.

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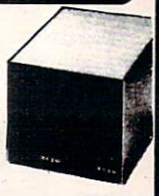

Finally, a dual disk drive for the Atari 800/400. Both single and dual drive models read both sides of the disk! Will read all disks written for Atari 810. *CALL FOR INTRODUCTORY PRICE!*

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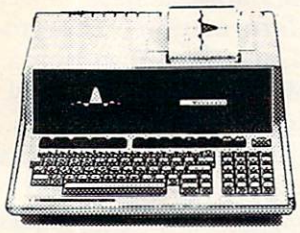

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Data Perfect Apple From LJK

LJK Enterprises, Incorporated announced the release of their new program Data Perfect Apple, for the Apple II and II+ computer. Written in machine language, Data Perfect requires no disk swapping and is fully interactive with LJK Word Processor, Letter Perfect. This user-friendly program allows the operator to design his own screen mask, in either 40 or 80 column. The single-load program, which is menu driven, has an incorporated utilities section, as well as a report generator and a mailing label generator. Multiple searches and sorts are allowed. Complete formula operations, as well as mathematical operations, may be performed on and between fields. The program supports one or two disk drives and requires a minimum of 32K memory. Use with any printer is allowed. The introductory cost for the program is $99.95.

LJK Enterprises, Inc.
P.O. Box 10827
St. Louis, MO 63129
(314) 846-6124

Computer Conference

The Mid-South Association for Educational Data Systems is calling for proposals for its 10th Annual Conference to be held February 24-26, 1983 in Jackson, MS. The theme will be "The Computer As A Universal Machine."

Papers, workshops, demonstrations, and ideas for discussion sessions are being solicited on ways computers are and can be used as universal machines in educational settings. Areas of special interest include the computer's use as a tool for administrators, for teachers, and for students – especially in interdisciplinary approaches.

For information on how to submit abstracts, contact Linda Wyrick Winkle, Department of Curriculum and Instruction, School of Education, University of Mississippi, University, MS 38677 (601-232-5906). Abstracts should be submitted by November 1.

Ledger System For Radio Shack Computers

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Standard 6' Centronics Parallel Cable for EPSON, C-ITOH, NEC, ANADEX, and others	$22.00
Standard 6' Paper Tiger or Prism Printer cable. Parallel Centronics Male DB25	$26.00
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80 Column card	$169.00
Z80 card (no CP/M software included)	$149.00
Controller for Apple II including hardware diagnostics	$95.00

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*Apple II is a trademark of Apple Inc.

are written in ex-basic for computers using the Flex or Uniflex operating systems with 8" or 5.25" disk drives. A minimum of 56K of memory is needed. It is also now available for the TRS-80 Model III and the TRS Color Computer.

Some of the outstanding features of this new package are:

— The data files may contain any number of accounts and any number of transactions; the only limit is the size of the storage medium.

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Price: $125, Uniflex; $100, Flex; $95, TRS-80 Model III and TRS Color Computer.

Universal Data Research, Inc.
2457 Wehrle Drive
Buffalo, NY 14221
(716)631-3011

New Floating Point ROM For Atari

Fastchip is designed to give you up to three and 1/2 times the speed of the original floating point routines. Atari BASIC uses these routines for most everything.

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Fastchip is being offered for $41.95 each, including shipping and handling. Texas residents add 5% sales tax. Overseas orders add $2.00. Allow two to four weeks for delivery. Call or write for additional information.

Send check or money order payable to:

Newell Industries
3340 Nottingham Ln.
Plano, TX 75074
(214)423-1781
(or check with local dealer)

Amber Screen Monitor

USI Computer Products Division has introduced the USI Pi-4, a monochromatic video monitor with a 9" amber display. Featuring the low-fatigue amber phosphor adopted as a standard by European nations, the USI Pi-4 has 1000-lines at center resolution with 20 MHz bandwidth.

The USI Pi-4 has a 44 square-inch (9" diagonal) screen, with a full 80-character by 24-line text display. Clear, crisp graphics are ensured by USI Pi-4's wide bandwidth and high resolution, adding to the monitor's comfort factor. Corner-to-corner legibility, even with lower-case descenders, assures a high-quality, easily-readable display.

USI Pi-4 monitors are supplied in computer-coordinated enclosures that feature convenient front panel display brightness/contrast controls, power switch, and LED power indicator.

The compact and stackable Pi-4 weighs only 15 pounds. RCA phone jacks and a standard SO-239 connector make possible easy connection to major small business or personal computers.

Sold with a 90-day over-the-counter warranty, all USI Pi-4 monitors receive 100-hour factory burn-in and reinspection before being shipped. Available from computer stores nationally, the Pi-4 is offered at a suggested list price of $215.

USI Consumer Products Division
71 Park Lane
Brisbane, CA 94005
(415)468-4900

Publications From K-12 MicroMedia

The fall 1982 edition of the K-12 MicroMedia catalog of selected books and programs for microcomputer-assisted learning is now available.

Describing over 350 items from over 75 publishers, the catalog is organized according to subject, with recommended grade levels, machine compatibility, and media format (tape or disk) all clearly indicated. All materials may be ordered directly from K-12 MicroMedia on a thirty-day approval basis.

Offering programs for the Apple, Atari, PET, and TRS-80 microcomputers, the new catalog includes 23 new releases.

Educators may obtain a free copy by writing to K-12 MicroMedia.

* * * * * * *

Getting Down to BASIC is the first book published by K-12 MicroMedia. The 64-page workbook is for students in grades 7-10 who have had no prior programming coursework.

Designed to be used while students are working at the microcomputer, *Getting Down to BASIC* clearly and concisely explains and illustrates key BASIC commands, statements, and elementary programming techniques, including loops, flowcharting, and graphics commands. Differences among Apple, PET, and TRS-80 are noted throughout. Eight labs conveniently segment the material into manageable lessons. A glossary explains over 50 common computer terms.

Getting Down to BASIC costs $4.95 (plus 50¢ postage). School discounts are available for quantity purchases.

K-12 MicroMedia
172 Broadway
Woodcliff Lake, NJ 07675

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.

TRS-80 Color Computer Program

Micro School Programs has announced a new program, *Colortext*, for use on TRS-80, 32K Color Computers, with one disk drive. Colortext is an easy-to-use high-resolution text driver which displays a variety of character fonts and graphics on the screen simultaneously, including the use of all features of Extended BASIC. It permits the intermixing of upper and lowercase text and graphics in various sizes and colors.

Other features include nondestructive overwrite for animation, variable screen scrolling speed, a BREAK key lock-up option, and ADDCHR – a program for creating and editing all characters (including graphics, alphanumeric, etc.). ADDCHR can be used to create character sets of up to 200 characters. The defined character sets may be used for foreign languages such as Greek, Hebrew, Russian, or for various other print types.

The TRS-80 Model III graphics character set is included in Colortext. This permits the user to enter and use programs written for Models I and III very quickly, using the same graphics character set numbers used in the other programs. This character set may be changed by the user if desired.

This program is intended for use by curriculum authors, teachers, game designers, or by anyone who wishes to prepare programs which involve the simultaneous use of text, graphics, and color. User programs (up to 16K) will run with Colortext on 32K machines.

The more than 50-page user's manual provides complete instructions on the use of the program. Users are led through a practice program which introduces them to the various features of Colortext. A demonstration program is also included on the disk to illustrate character sets, colors, display techniques, and animation. Two reference sections are also included, one for Colortext and one for the ADDCHR program.

Colortext comes on disk with manual. Price is $79.80.

Bertamax Inc.
101 Nickerson, Suite 202
Seattle, WA 98109
(206)282-6249

Graphics + Plus From Lazer MicroSystems

Lazer MicroSystems announces the availability of its Graphics + Plus module for the Apple II microcomputer system. This

board teams up with Lazer's earlier units, the Lower Case + Plus and Lower Case + Plus III, to give the user a RAM based character set on the Apple II. With the Graphics + Plus, the Apple user can easily define and redefine the characters that appear on the text screen.

Although the Graphics + Plus lets you define any character you can fit in a 7x8 cell (like the hires character generators), absolutely *no* use of the hires graphics page is made! So 280x192 hires-style graphics becomes available on the Apple's 1K screen. You manipulate the 960 bytes of data on the text page instead of the 8K bytes on the hires graphics page; you therefore manipulate the graphics characters on the screen – less than one-eighth the work. Since the graphics manipulation section of a program would be running eight to ten times faster, more time is available for performing more complex calculations, improving the sound effects, or, even better, allowing the user to write the program in BASIC instead of assembly language.

With Graphics + Plus, a whole new range of word processing, business, scientific, and game applications are possible.

Included with the Graphics + Plus are over 20 example fonts, an excellent font editor (and the fonts created by any hires character generator are compatible with the Graphics + Plus), several utility programs and example files. Both Pascal and DOS 3.3 software are provided on diskette for the Graphics + Plus user. Complete documentation for use and installation is provided with each board. The Graphics + Plus is available from your local dealer (or direct from Lazer MicroSystems) for only $159.95. For those who do not own a Lower Case + Plus or a Lower Case + Plus III, Lazer offers a special package price consisting of a Lower Case + Plus III and Graphics + Plus for only $199.95.

Lazer Microsystems, Inc.
1791 Capital, Unit G
Corona, CA 91720
(714)735-1041

Software For Gifted And Talented Students

Island Software has released the Mindstretcher Series, a set of programs for gifted and talented students in grades three through nine.

Jigsaw (MS 1) is a group of four programs that present 16 picture puzzles, ranging from a view of New York city to Whistler's Mother.

Traffic Jam / Chain Reaction (MS 2) consists of two programs

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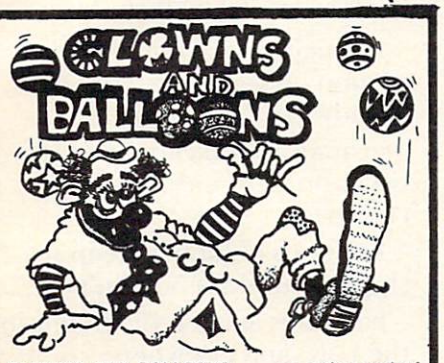

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Eugene, Oregon 97402

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that provide exercise in strategy, as players try to force their opponents into vulnerable situations.

Rubik / Candles (MS 3) contains two programs that challenge students to develop problem-solving skills.

Black / Kayles (MS 4) presents two contests, with deceptively simple rules, that use advanced mathematical theory.

Jinx / Welter (MS 5), also two programs, develops deductive reasoning and insight into the structure of mathematical abstractions.

All programs work with any 8K PET. Every program includes a teacher's guide sheet with specific teaching suggestions.

Each set of programs is available for $20.

Island Software
Box 300
Lake Grove, NY 11755

Contest Marks Merger

The Paper, one of the oldest independent publications supporting Commodore computers, is merging with the *Midnite Software Gazette*, beginning with the October 1982 issue.

To celebrate the merger, a contest is underway to rename the merged magazines. The person suggesting the best name will receive a free VIC computer, courtesy of Computer Country of Springfield, Illinois. Judging will be by the editors, and in case of ties, by the readers of the combined magazine. Entries must be received by November 1 at the address below.

Midnite specializes in brief independent reviews of products for Commodore computers. Its current issue is a 300+ page $10 book.

The Paper has traditionally been a source of articles and tutorials for users of Commodore computers, with series on such topics as first steps in machine language, as well as extended reviews of important products.

Subscriptions to the combined magazine are $20 U.S. or $25 CDN. in North America for six bi-monthly issues. Overseas subscriptions are $45 U.S.

Midnite Software Gazette
635 Maple
Mt. Zion, IL 62549
217/864-5320

Logica Software For World Videotex Service

Logica's new Appletel Disk allows Apple computer users to plug into the Prestel World Videotex Service. The easy-to-use software turns the personal computer into a terminal to retrieve a wide range of international data including regularly updated prices of: 63 commodities from exchanges in the U.S., Europe, and the Far East; 64 currency exchange and IMM rates; and 713 U.K. and other stocks.

Many other useful data bases are also available, including:

– financial/management information on corporate sectors worldwide.

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– bookings at over 400 hotels in the U.K. and elsewhere.

– airline schedules on over 50 carriers, with reservation facilities on major airlines.

– electronic messaging to other Prestel users.

– international news, sports, and weather.

In addition, a wide range of teleshopping services are available, most aimed at U.K. shoppers. Information and services are provided by over 900 companies, some based in the U.S.

With the Appletel Disk, the Apple, and a Hayes micromodem, the user simply accesses a local telephone number, enters a password, and retrieves any of the more than 220,000 pages in the Prestel database.

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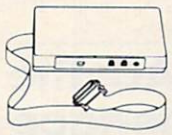

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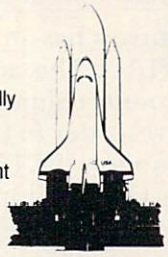

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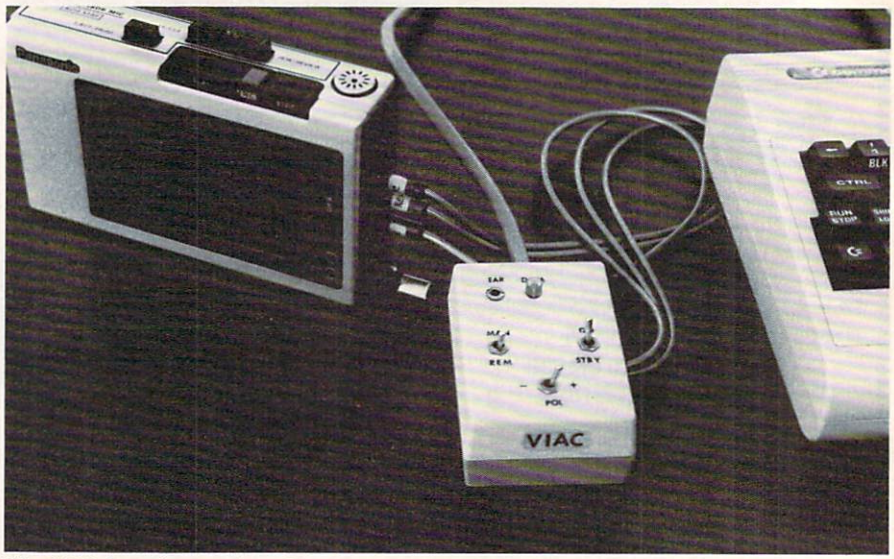
VIAC: The VIC Interface To Any Cassette

Integrated Controls has announced the VIAC. This adapter allows you to connect almost any audio cassette recorder to the VIC-20, Commodore PET, CBM, and all the new Commodore computers that employ the same existing six-pin cassette interface. The VIAC has three plugs that connect directly to the microphone, earphone and remote jacks of any standard audio cassette recorder, and a six-pin edge connector cable that interfaces directly to the computer cassette slot.



The VIC Interface to Any Cassette

In the Playback mode, the audio cassette signal is transformed to the proper polarity and level required by the computer. In the Record mode, the computer data is attenuated and fed to the Microphone input for recording on tape. The computer will control the Start and Stop of the cassette via the Remote jack input if so equipped; otherwise, the operator would have to manually Start and Stop the cassette.

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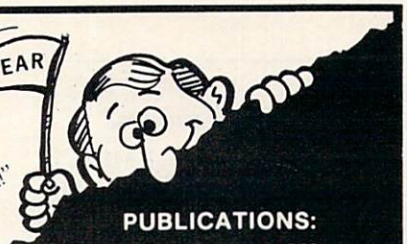

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Queue, Inc., has planned several hands-on workshops on microcomputers in education for this fall and winter. All will be held in the Greater New York and Connecticut area.

The first symposium and exhibit will be on *Microcomputers in the Language Arts Curriculum.* The two day program (Friday and Saturday, November 5-6) will include hands-on exhibitions of leading software products in reading, vocabulary, spelling, language, and social studies.

The second seminar, *Microcomputers in Mathematics, Science, and Computer Education Curriculum* (Friday and Saturday, November 12-13), will include hands-on exhibitions of a wide variety of

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software on computer education, computer literacy, mathematics education (pre-school through calculus), and science.

A third seminar on *Administrative and Classroom Management Applications of Microcomputers* (January 21-22) will exhibit a wide variety of software for teacher authoring systems, classroom management, and school administration.

Prices for the seminars will be $45 for one day, $75 for the entire session. A school system may enroll for both sessions for $135, and may designate different personnel to attend each session, or even each day.

For further information, contact:

Joy Segall
c/o Queue, Inc.
5 Chapel Hill Drive
Fairfield, CT 06432
(203)335-0908

Apple And Atari Programs From Synergistic Software

Synergistic Software has released the Inventory Manager, an inventory control software package for the Apple II computer.

The Inventory Manager can deal with 2700 different inventory items on a two disk system and with 1200 inventory items on a one disk system. It can break the inventory items down to 13 different categories of stock and can list 99 vendors who supply those inventory items.

The Inventory Manager issues reports which summarize profit margins, calculate wholesale to retail mark-ups, list back order status, recommend reorder points, print purchase orders, and more. The program can list the 75 top selling items with their profit margins or can list the profit margins of the 13 different categories.

Owners of small to medium-sized retail businesses can use the Inventory Manager to check what they have ordered, what they have received, and what is on back order. This program is fast, menu-driven, and user-friendly. Cost is $149.95.

* * * * * * *

Synergistic Software also announces the release of Probe One, a new action adventure game for the Atari 400/800.

Probe One combines high-resolution color graphics, sound effects, arcade-like action, and adventure strategy. The Terran Confederation is fighting the domineering Drelgan Hegemony for possession of a newly de-

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CBM 4022,80cps/graphics	$450
CBM 8023,150 cps/graphics	699
Okidata 82A,120cps/serial or par	449
Nec 8023A(parallel)	499

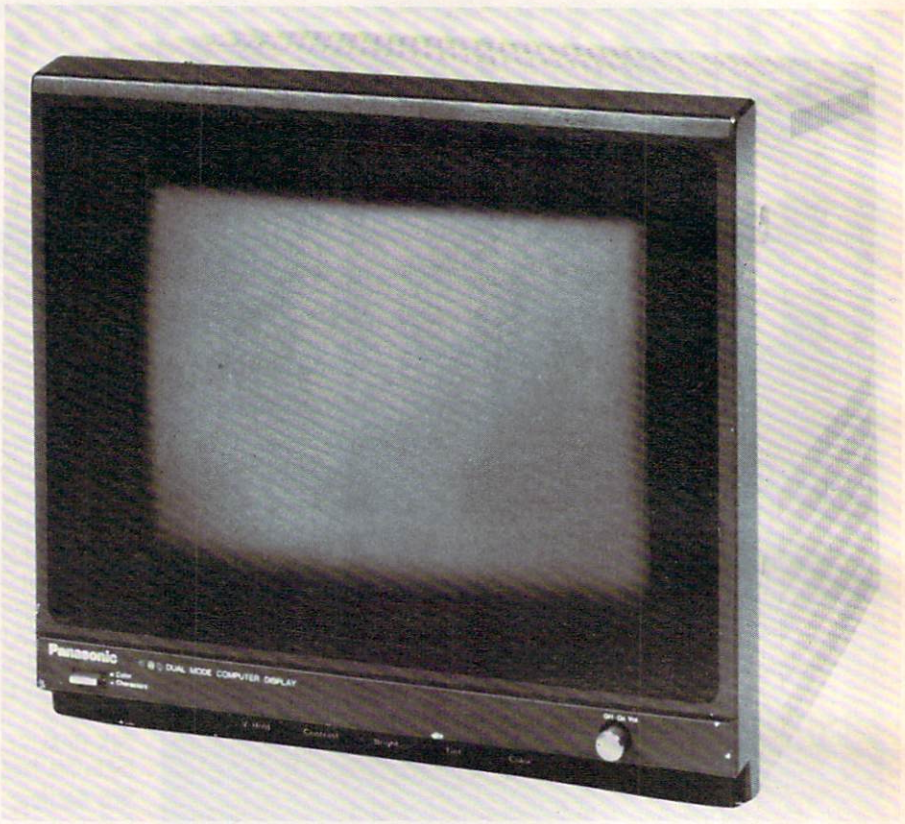
veloped matter transmission device. The player must battle the guard droids through a labyrinth of rooms in a remote space colony before capturing the matter transmitter. Each time the game is played, the obstacles are different.

Probe One requires a 40K Atari 400/800, BASIC cartridge, and paddles or joystick. It sells for $34.95.

Synergistic Software
830 N. Riverside Drive, Suite 201
Renton, WA 98055
(206)226-3216

Dual-Mode Color Computer Display From Panasonic

The Panasonic Industrial Company Custom Products Department, Industrial Sales Division, has introduced a dual-mode 10" (diagonal) color computer display and home computer applications. The unit, model CT-160, features a front panel switch that changes the display from a full-color unit for color graphics or video games to a sharp black and white data display for business use.



Panasonic's dual-mode 10" color computer display

Model CT-160 accepts a composite video input signal and incorporates a built-in audio system for use with games or speech synthesizers. It easily reproduces a 40x25 character display.

Equipped with video input/output connectors with 75 ohm/Hi Z termination switch, the new Panasonic computer display is UL listed and carries a FCC Class B computing device certification. Suggested retail is $400.

Panasonic
One Panasonic Way
Secaucus , NJ 07094
(201)348-5330

Grades Management System For Teachers

Master Grades program, a complete grades management system for secondary teachers, is now available from Midwest Software. This program was written by teachers for teachers and took two years to develop and test. With it you can produce pages for your record book, alphabetized grade summaries of all students by grade level or subject, progress notes to parents, and weekly (or oftener) reports in alpha or percentage order for all of your classes.

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The interests covered in the directory are: Adventure, Aerospace, Architecture, Art, Astrology, Blind, Business, Chemistry, Biology, Physics, Commercial Applications, Commodity Markets, Communications, Consultant, Data Acquisition, Data Base Management, Demographics, Education, Electronics, Engineering, Farming, Financial, Fish, Gambling, Games, Geology, Graphics, Hardware, Hobbyist, Home Management, Income Tax, Insurance, Knitting, Languages, Law, Library File Processing, Math, Medical, Music, Modems, Property Management, Psychology, Radio, Real Estate, Robotics, Sales, Science, Secretarial, Simulation, Software, Speech, Sports, Statistics, Stock, Telecommunications, Transportation, Utilities, and Word Processing.

A table is included to reference interests and computers to their owners.

For a free, permanent listing in the directory, send your name, address, computer type, interests, and state whether you are willing to trade information with other personal computer owners. To receive the current issue and the next issue with your listing, send $9.95 and the above information to:

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Commodore Announces Bilingual Keyboard For Microcomputers

Commodore Business Machines Limited, Scarborough, Ontario, and Creargie Inc., Montreal, have announced their bilingual keyboard and French word processing software.

Jacques Brun of Creargie has designed a new character generator, and modified the keyboard of the Commodore 8000 series personal computers to be compatible with recent federal regulations and with the approval of Professional Software Inc., Mississauga, Ontario.

The name of the new program is "WordPro 4-Plus ML".

The word processing software, WordPro 4-Plus, has been translated and modified so that in using it, along with certain redesignated keys, the French characters appear on the screen – including capital letters with accents – and can be printed out on any letter quality printer. The WordPro manual has been rewritten to reflect the changes and is translated into French.

The keyboard, however, is not only bilingual but multilingual. In addition to French, character generator sets for German, Spanish and Italian have been created, all available with the same program and with the proper accents and marks for each of these languages. The plan is to market the four versions

Commodore bilingual keyboard for word processing

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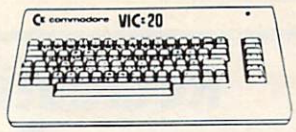

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Last fall, *Recreational Computing* was merged into **COMPUTE!** and we are now offering available back issues. Whatever your interest, you'll find something here – from Spanish BASIC to Computers in Sports Medicine, from Future Fantasy Games to Robot Pets.

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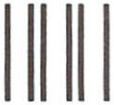

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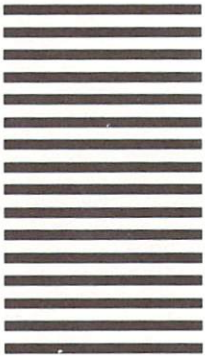

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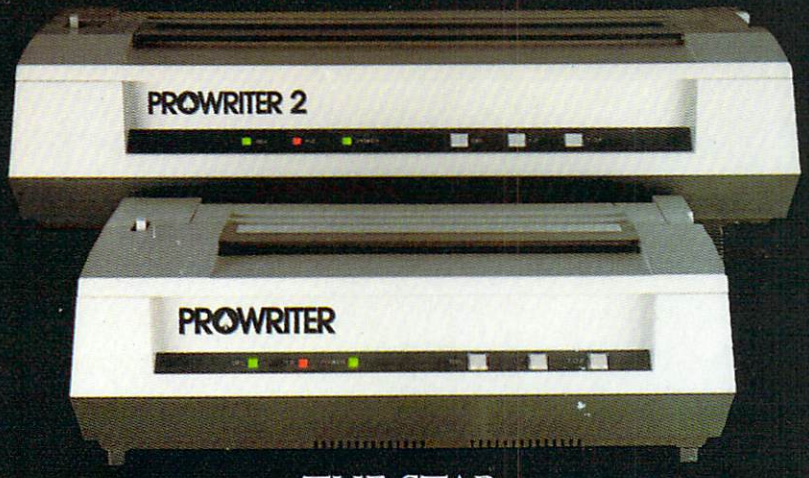

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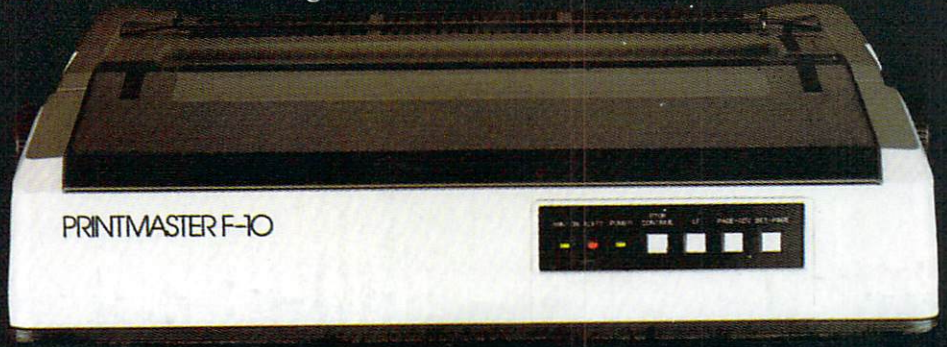

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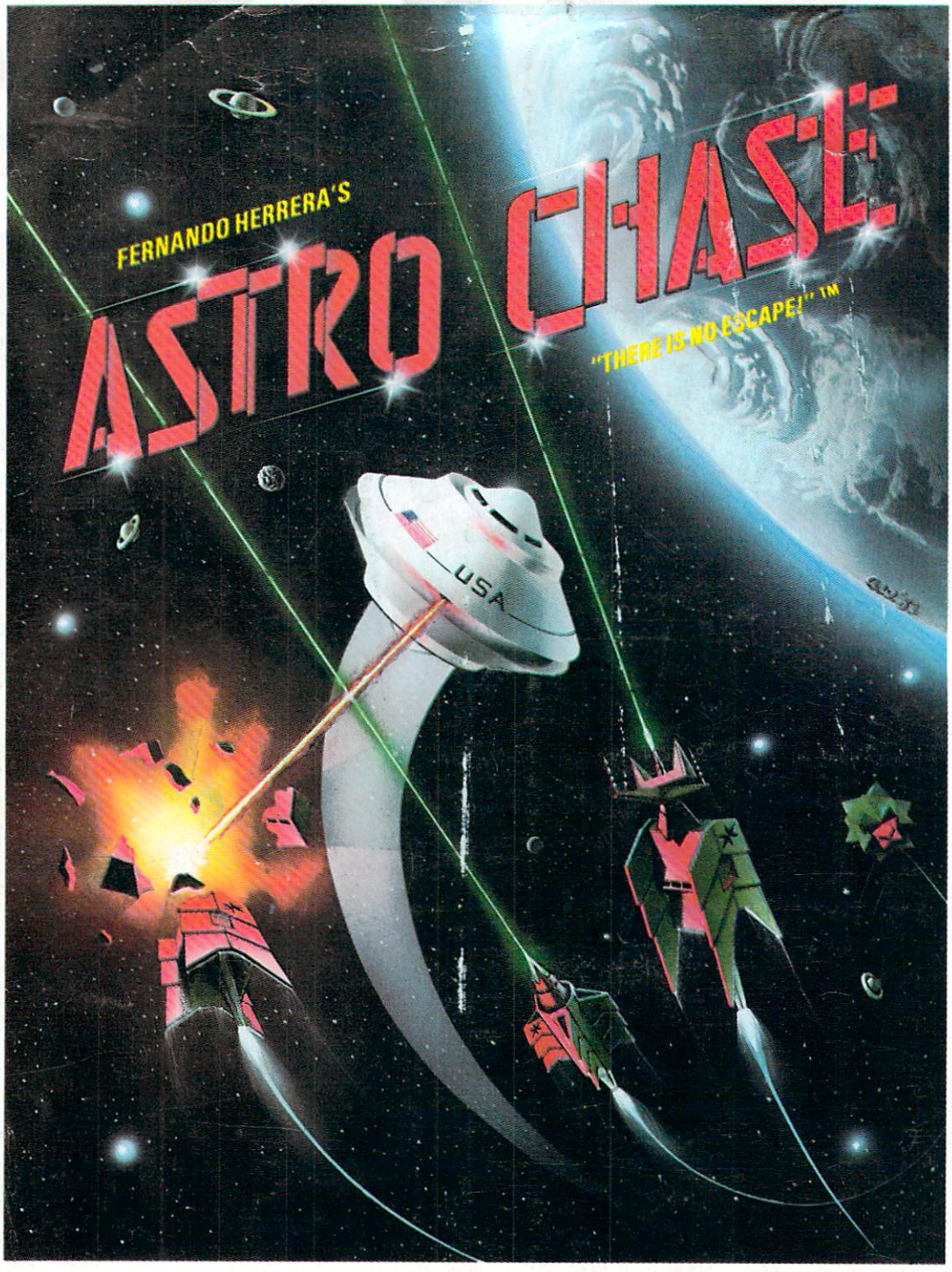

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