NO. 34
SEPTEMBER 1985

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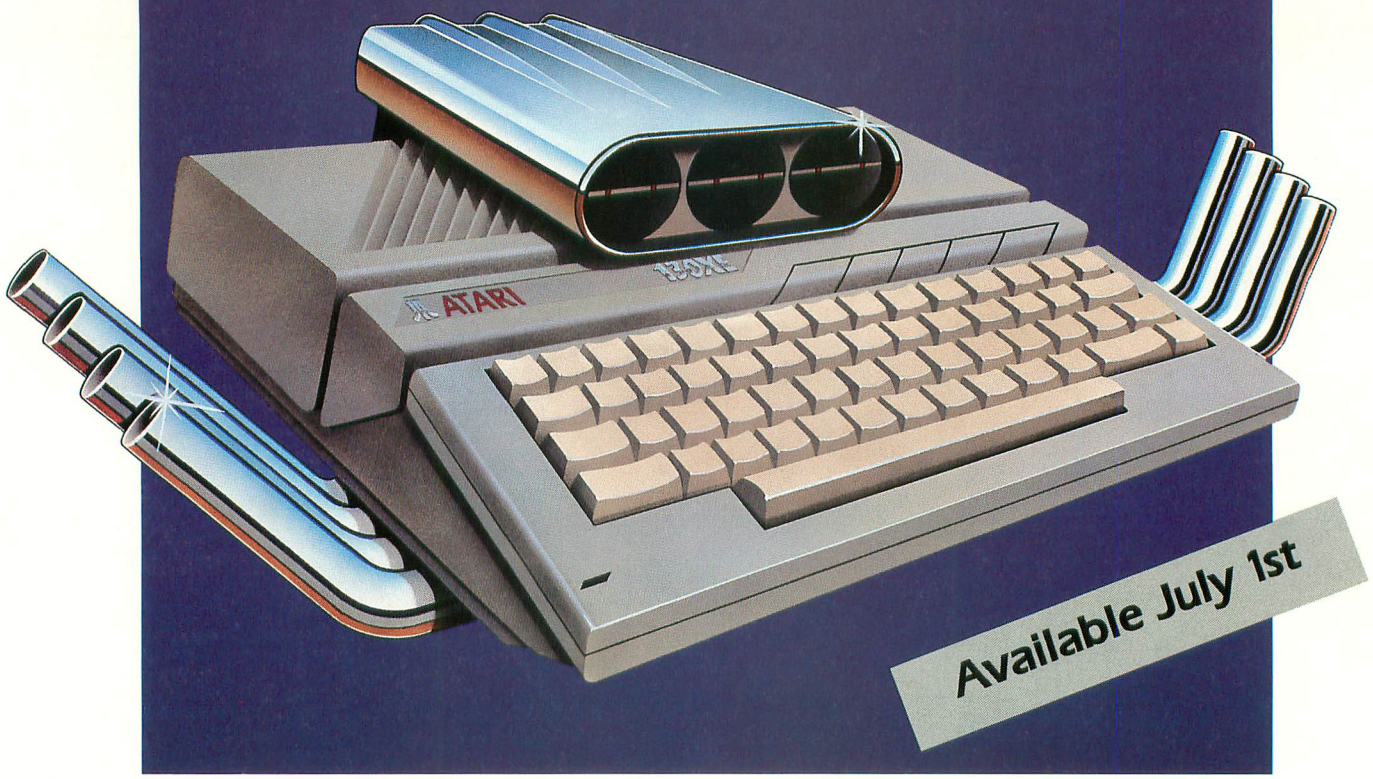

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SEPTEMBER 1985

THE #1 MAGAZINE FOR ATARI® COMPUTER OWNERS™

ANALOG COMPUTING

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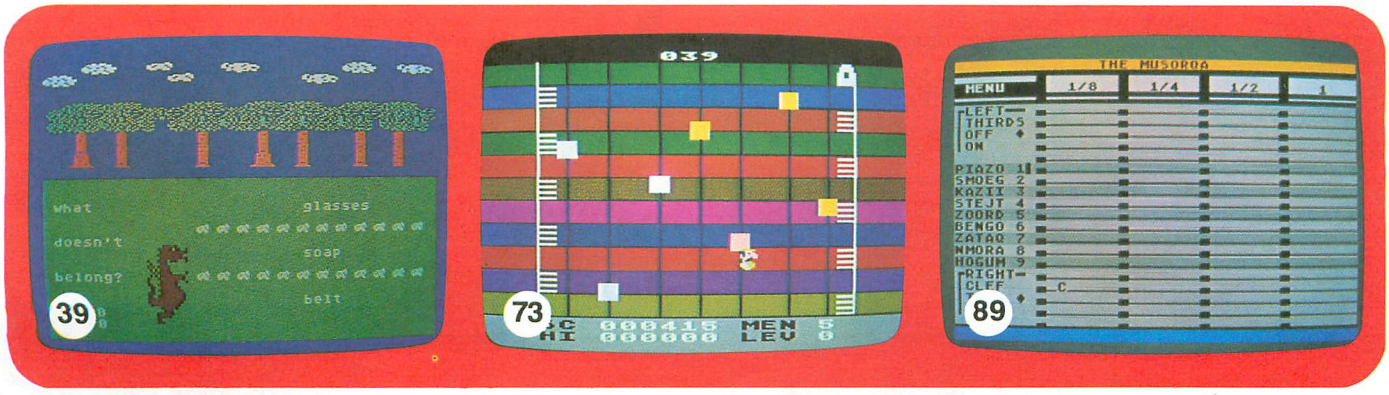

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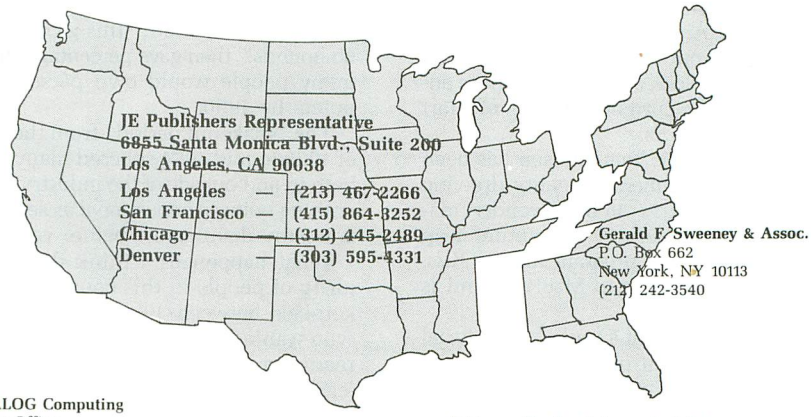

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AUTHORS

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EDITORIAL

The last two issues, in lieu of editorials, have featured coverage of Comdex and Atari's surprise showing there, and Part 1 of our Summer CES coverage (two weeks after the event, having beaten the lead time insensate via hot coffee and hair torn from the scalp of the managing editor; a few more computer shows, and I'll be up for the lead in *The King and I*).

This issue, Art Leyenberger and Lee Pappas conclude our coverage of CES with a comprehensive look at the new software announced for the current 8-bit line of Atari computers, the XEs.

On the ST front, Tom Hudson has been developing a commercial-quality drawing program for Atari's 16-bit "wonder machine." The program is a quantum leap above any drawing program for the XEs, has more functions than MacPaint and is in color, to boot!

We hope to present a multi-part tutorial on the development of this program, outlining Tom's usage of C, his familiarization with the 68000 chip and his incorporation of GEM into the program.

We've been keeping you informed on the ST, and, starting next month, **ANALOG Computing** will be featuring ST coverage in every issue: reviews of ST software and hardware, sneak previews of new products, tutorials and, of course, type-in programs. As we learn about the ST, so shall you.

The view from here.

I don't know about you, but I'm tired of reading "industry analysts" (a euphemism describing someone paid a great deal of money to state the obvious) commenting about the hideous slump in the computer industry.

What's even more annoying are those individuals totally outside the computer industry who make such learned statements as, "Well, home computers were just the hula-hoops of the eighties. The 'fad' is over. Home computers and video games are going to go the way of mood rings, CB radios and the Bay City Rollers."

Nonsense. The downturn in the computer industry is a slump only in comparison to the extraordinary growth it registered in the period from, say, 1978 to 1983. If you consider 50% growth or more each year (for some companies) as "nosediving" to a mere 25% last year, then you'll see what I mean. It's a matter of comparative perception. Almost any other business in the world would be *thrilled* with 25% growth from year to year.

From 1978 to 1983, hardware and software companies sprang up like shelf fungi, feeding on the mighty oaken body of the Personal Computer. Many people made their fortunes off of this fledgling industry. Analysts crowed, "this growth knows no bounds!" then gave percentages for how many people would own personal computers by 1990.

The "shakeout period" from the middle of 1983 to mid-1984 sobered many people, both in and outside of the industry. (There's nothing quite so educational as seeing your company disintegrate before your eyes.)

What happened? I think that the majority of people in this country (the marketplace between 1978 and the present) who wanted a personal computer have already bought one. They rushed out, unleashed their wallets and bought machines ranging from inexpensive Commodore and Atari systems all the way up to Macintoshes and IBM PC ATs.

Then what? What did they do with them?

Let's jump back a little bit. It stands to reason that, if you shelled out thousands of dollars for a computer system, you're going to use it. It also indicates that you weren't an impulse buyer; you had important reasons for buying what you did.

On the other hand, "cheap" computers, such as the Commodore 64 and the Atari 800XL, succeeded in doing one thing: they separated the wheat from the chaff.

If you bought an inexpensive computer, then you probably either worked yourself to death and forced yourself to understand it, making it a useful tool; or you got frustrated, gave up, decided that "computers are worthless," and banished the machine to a closet.

Jack Tramiel and the new Atari want to change that, and they want us—all of us, as Atari users—to help.

Both the XE and ST lines are powerful personal computers at affordable prices. But ardent Atari fans already know that, right?

So, spread the word. Become a spokesperson for Atari. If you, as a programmer, user group member, or knowledgeable Atari owner, know someone who's interested in buying a personal computer, consult with them. Find out their needs and help them make a decision.

Don't leave them out in the cold. Support them. Don't let them be frustrated because they don't know how to exploit their wonderful new machine. Invite them to user group meetings. Tell them about useful software—educate them (but, please, don't undermine the software industry; let them buy it themselves).

If all of the "old guard" Atari owners out there spread the word and support the neophytes (and many of you have done so all along), we'll end up strengthening Atari and, ultimately, ourselves.

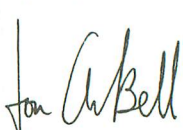
Last words.

One of the common complaints of readers typing in programs from computer magazines is the coated stock (slick paper) that most magazines are printed on. Advertisers, distributors and the typical reader like coated stock, obviously—it looks more professional. A computer magazine on newsprint would probably only get ads for Burpee Seeds and Silicon Bill's Discount Computer Barn.

Unfortunately, the shiny surface of the paper reflects light and produces glare, making it difficult to type long programs. It also tends to smear easily, leading to blurred program lines, shrieked invectives and the unwrapping of single-edged razor blades.

We think that we've captured the best of both worlds with our new paper. It's moderately slick, resistant to smearing and easier on the eyes than our other stock. (It's also only a little more expensive than the old paper. Our accountant loves us.)

So code in good health. We hope that everybody likes it. You deserve it.



Jon A. Bell
Managing Editor
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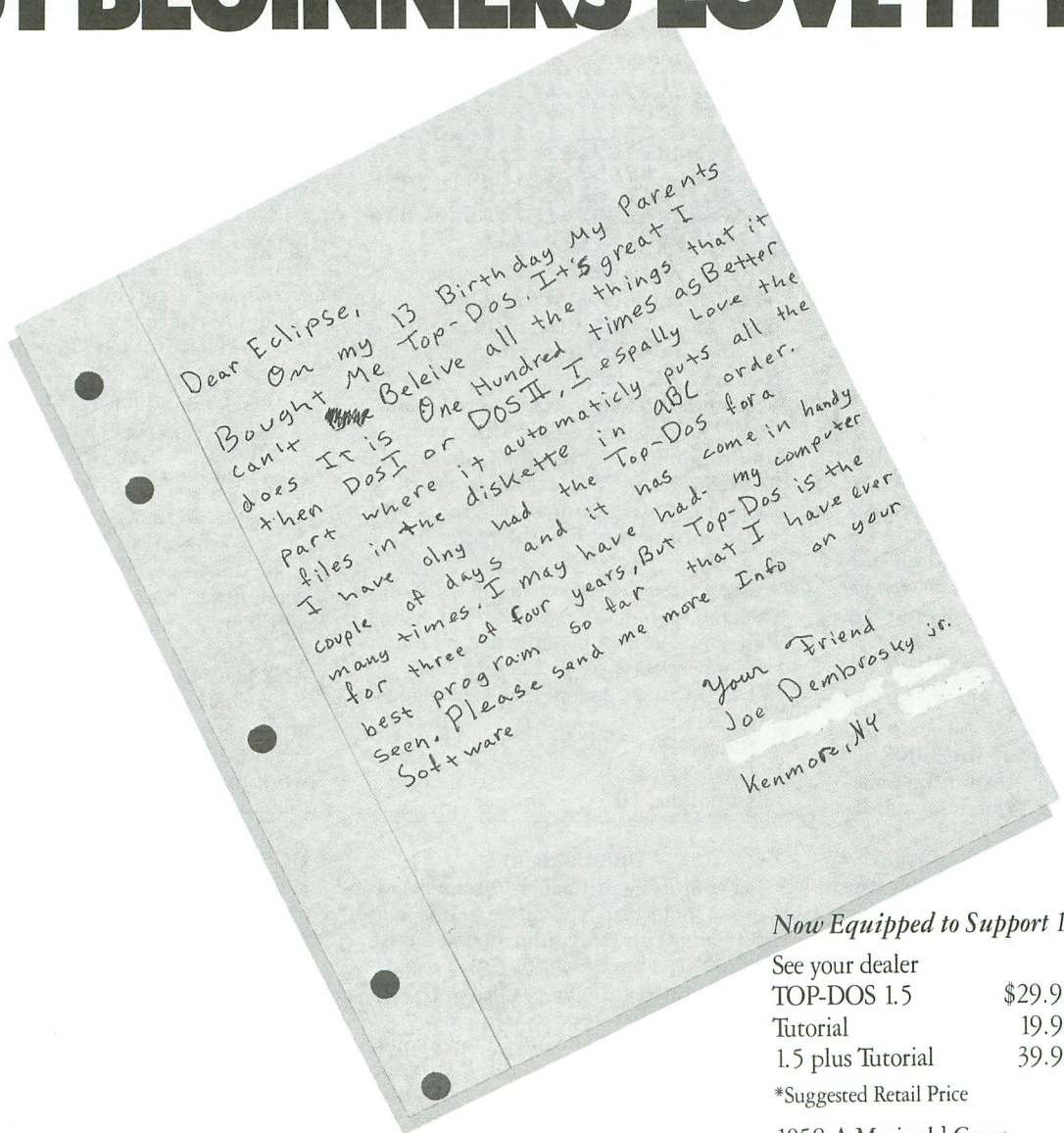

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READER COMMENT

Calendar consult.

I wonder if you or anyone else has encountered the same problem I have with issue 31's **Personal Planning Calendar**.

It seems, whenever you attempt to create a month after using the program, you end up with a mixture of the new month and the last one in memory. Try it; you'll see what I mean!

I don't know what Wayne Gautney would do, but here's what I did. Change Line 910 to read:

```
910 TRAP 2000:CLOSE #1:GOT
O 2000
```

Change Line 2004 to read:

```
2004 G=PEEK(CONSOL):IF G=6
 THEN 911
```

Wayne had intended Lines 2000-2007 to be a subroutine called when the program didn't find the month on the disk. Instead, the RETURN statement in Line 2004 returned control to the main program and not the file portion, as was intended. These two corrections remedy this problem.

Brent Barrett
Citrus Heights, CA

Translator without the 800.

I have an optional method for creating the **Home-made Translator** as described in issue 32. The method I suggest results in exactly the same translator. However, it does not require that one obtain the use of a model 800 computer to dump its OS.

Since most XL owners already have access to the Atari Translator disk, they have the source for the Rev B OS right in their midst. You see, the B side of Atari's translator loads in exactly the Rev B OS, save 12 bytes which are different.

If you boot with Translator B and then POKE these 12 bytes with what they are in the Rev B OS, you can then RUN Angelo Giambra's **Home-made Translator** BASIC program. Voila! You have the **Translator**. No need to find an 800.

The corrected POKEs can be inserted with the following lines:

```
71 POKE 59103,141:POKE 591
04,3:POKE 59105,211
72 POKE 59111,141:POKE 591
12,1:POKE 59113,211
73 POKE 62063,24:POKE 6206
4,105:POKE 62065,16
74 POKE 62083,157:POKE 620
84,0:POKE 62085,211
```

By the way, since Atari's Translator B is, in essence, exactly the Rev B OS, I have *never* found it to fail in solving a compatibility problem with a program that was XL sensitive.

Congratulations to you and Mr. Giambra for an outstanding piece of truly useful programming. I use the **Home-made Translator** mostly to get the extra 4K of memory. With terminal programs and with word processors, the larger buffer is great.

Even though I enjoy the extra bank-selected memory of my 130XE, it seems that, once you've tasted extra memory, you never want to go back to less.

I hope your readers find my suggestion useful.

Sincerely,
D.D. Davids, II
Honolulu, HI

Unicheck it!

In your issue 31 **Reader Comment** column, I note Mr. L. Eugene Donie had problems with **Dragonlord** (isse 29) on his 800XL. I have an 800XL and experienced similar problems, but his fix did not work for me. Your recommendations for LIST, ENTER and SAVE techniques did not work, either, but it did work on some other programs I have—thanks.

Fortunately, the same issue had the program listing for **Unicheck**! After typing it in and checking **Dragonlord**, three hard-to-spot errors were found in my original typing. These were corrected, and **Dragonlord** ran perfectly.

The reason I am writing is to let you know that there is no problem with the program as listed for the 800XL. It's very hard to find certain typing errors, and long programs such as **Dragonlord** make it extra tough. My wife and I closely checked the typing several times, but we still missed these three errors—could happen to anyone. **Unicheck** is an extremely helpful test for program typing errors, and I surely recommend it.

I enjoy reading your excellent magazine and look forward to receiving each issue.

Very truly yours,
Roger E. Kirkpatrick, Sr.
Mobile, AL

DOS XL 2.3 with machine language.

For those people who own DOS XL version 2.3 in double density, I think I can help if you've had trouble loading many of the machine language games in **ANALOG Computing** or elsewhere.

I recently wrote to O.S.S. about this, and was told that programs that take LOMEM for granted sometimes will not work properly in double density. I was told to take the following steps:

(1) Boot up with your Double Density DOS XL Master disk with BASIC installed (do *not* use BASIC XL or any other language).

(2) When in BASIC, type *POKE 1802, 1* and RETURN, then *POKE 1801,4* and RETURN. Next, press SYSTEM RESET. You'll notice when you press RESET that the longer, low humming noise will be replaced by a very short humming noise.

(3) Now go to DOS and make sure your master disk is in drive 1. Type *INIT* to load the "initialize disk" program.

(continued on page 9)

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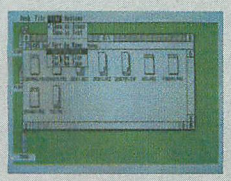

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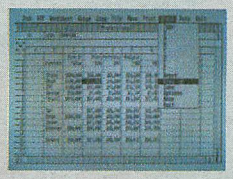

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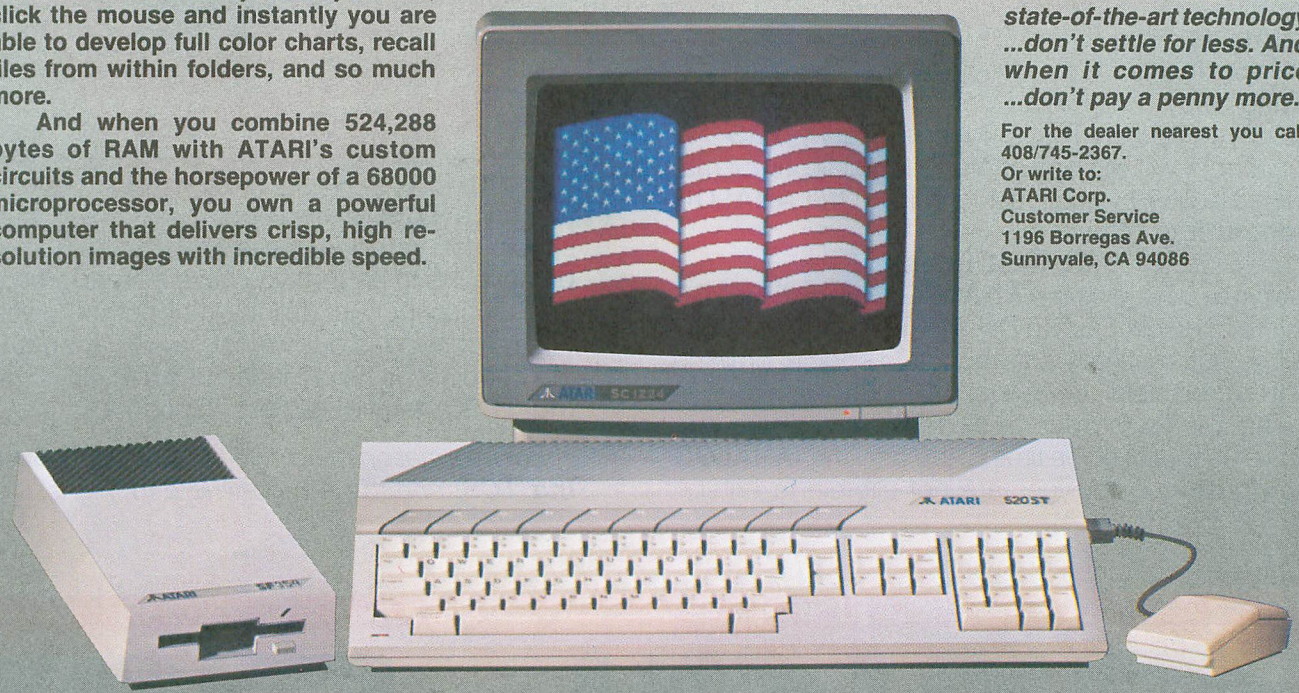

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When faced with the usual prompts, remove your master disk from the drive and insert a blank disk.

(4) Use option 2 to format disk and write your new, compatible DOS to the blank disk.

(5) Now simply copy all your machine language games over to the blank disk. Make sure you give them the *.COM* extension: e.g., *DEFENSE.COM*. Reboot your system and type the name of the game.

You should *not* use the MENU.COM file, as I was told not to.

What all of this does is limit the number of addressable drives to one and the number of openable files to two. It fixes the LOMEM problem. It may be limiting for programming, but you'll only use this disk for your **ANALOG Computing** games, anyway.

I hope this has helped any readers who've experienced this problem.

Robbie Catron
Flemingsburg, KY

Wire color confusion.

Sorry to rain on Mr. Anthony A. Nogas' parade, but a suggestion he offers in his page 7, issue 32 letter could get some Atari enthusiasts in trouble.

His idea to use Radio Shack joystick extension cords as cheaper sources of prewired plugs for **Cheep Talk** (issue 29) is fine, and is popularly used by Atari hardware hobbyists. In the text of the letter published, you gave the pin number/wire colors for these cables.

No. No. No. . .!

The colors of the wires in the joystick extension cables is *not* consistent from one cable to the next. The cables are wired correctly, but Radio Shack never figured that people would be opening the things up. I found this out, in fact, when debugging my own **Cheep Talk**. Since then, I have heard other Atari experimenters confirm the fact.

As it could possibly cause internal harm to an Atari computer, please point out in your next issue that it is fine to use the joystick cables, as long as one is sure to use a meter to find the colors of the wires *on each particular cable*.

Thank you. Oh, yes. . .**Cheep Talk** works great.

Sincerely,
D.D. Davids, II
Honolulu, HI

Printer Driver suggestions.

Can't tell you how delighted I am with the **AtariWriter Printer Driver** program in **ANALOG Computing**'s issue 32 (at last, a *continuous underline*).

There are two errors in the suggested Epson codes. The *48*s and *49*s are okay, although *0*s and *1*s will work just as well. However, the Master Select Code for the default mode *must* be *27,33,8* for emphasized pica (or *27,33,0* for standard pica), and the Master Select Code for condensed *must* be *27,33,4*. The codes in the article will give expanded, emphasized and double-strike as default.

However, I strongly recommend that the codes for pica and for condensed be entered as *18* and *15*, respectively, for the following reasons:

(1) If you select italics (CTRL-O 27 CTRL-O 52) in the body of your document, it will be effective until the italics-off code (CTRL-O 27 CTRL-O 53) is given. Whereas, if the Master Select Code is used in the driver program, the italics will be cancelled at the beginning of the next line.

(2) Similarly, the codes for emphasized (CTRL-O 27E) or for double-strike (CTRL-O 27G) will be cancelled after the first page if the driver program uses the Master Select Codes.

(3) Many of today's printers allow one to select print modes with pushbuttons on the printer. If Master Select Codes are used in the **Printer Driver**, these modes will be reset to the default mode before printing begins.

The APX driver programs have long frustrated me with just these problems (first on my Gemini 10 and then on my new Epson LX-80), only I never knew the cause! Thank you, C.D. Welker, for a program that I can tailor just the way I want it.

Now, if someone could just figure out how to toggle between INSERT and REPLACE modes. . .

Sincerely
Carolyn Hoglin
Orlando, FL

(continued on page 94)

Two Great New Products From CDY
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OMNIVIEW XL/XE & *SpeedScript 80*

WARNING: No 800XL/130XE owner should read this ad unless they have 60 bucks to invest in their computer! Due to the outstanding value of this product, you may find it too irresistible to be without.

OK, don't say you were not warned. We are now going to entice you with some of OMNIVIEW XL/XE's bountiful features:

★**800 compatible operating system** that runs virtually every piece of commercial ATARI software. Press a console switch to copy the OS into RAM and free up the $C000 page (i.e., a built-in translator disk).

★The**resident ramdisk handlers** can be used by XE owners with many popular programs and DOS's to treat the extra 64K of RAM as an ultra-fast disk drive.

★The **FASTCHIP** floating point package is provided for significantly faster and more accurate math operations.

★**80 columns operation** under many environments including Letter/Data Perfect, BASIC, MAC65, and ATR8000 CPM.

★**And here comes the real teaser!** For a long time people have been asking if OMNIVIEW can be used to give ATARIWRITER 80 column screen output. Regretfully we have always had to say no. In fact, we must still say no, but we have got something even better to offer! *SpeedScript 80* is a wonderful new word processor designed for use with OMNIVIEW. It is as easy to use as ATARIWRITER and much more powerful! And CDY will provide *SpeedScript 80* with every OMNIVIEW at no extra charge! Current OMNIVIEW owners can purchase *SpeedScript 80* directly from us for only $10.

Of course, 400/800 owners can also enjoy the power and convenience of OMNIVIEW (including *SpeedScript 80*)by adding the 4K or 8K OMNIVIEW to the OMNIMON piggyback board or the Ramrod OS board. These OMNIVIEWs also include resident ramdisk handlers for use with the AXLON Ramdisk. If you are serious about enhancing the performance of your computer, you will be delighted with the unique features of OMNIVIEW!

Feature Comparision Chart

	OMNIMON Piggyback	Ramrod OS board	-----Upgrades for----- ---OMNIMON or Ramrod---			Ramrod XL Add-on for Piggyback Ramrod XL	
	400/800	800	8K OMNI	8K VIEW	4K VIEW	800XL	VIEWXL/XE
Enhanced OS		★				★	★
Includes FASTCHIP FP						★	★
80 Column Emulation				★	★		★
Ramdisk Handlers			★	★	★		★
OMNIMON Features:							
A:Alter Memory	★	★	★	★		★	
B:Boot (Ram) disk			★	★	★		
C:CPU Registers	★	★	★	★		★	
D:Display Memory	★	★	★	★		★	
E:Single Step Execution	★	★	★	★		★	
F:Fill Program Buffer			★			★	
G:Binary Load/Directory			★			★	
H:Hex Conversion			★	★		★	
H:Hex Arithmetic			★			★	
I:Install Ramdisk Handlers			★	★	★		
J:Jump Subroutine (JSR)	★	★	★	★		★	
L:Drive Selection/Control	★	★	★	★		★	
M:Move Block of Memory			★			★	
N:Relocate 6502 Code			★			★	
O:Operate from Prog. Buffer			★			★	
P:Printer Control	★	★	★	★		★	
R/Read Sector(s)from Disk	★	★	★	★		★	
S:Search Mem. for Sequence	★	★	★	★		★	
T:Tog. Hex Char Display Mode	★	★	★	★		★	
U:User's Custom Command			★				
V:Verify 2 Blocks of Memory			★	★		★	
W:Write Sector(s) to Disk	★	★	★	★		★	
X:Disassemble Memory	★	★	★	★		★	
Y:Line Assembler			★			★	
Z:Exit Monitor			★				
Lockup Recovery			★	★		★	
Redirection of Printer I/O			★	★		★	
Talk to Happy Ram Buffer			★	★		★	
80 Column ATRMON for	ATR8000						★
Includes SpeedScript 80				★	★		★

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If all of this power weren't enough, certain versions of OMNIMON have even more features! The 8K OMNIMON and OMNIMONXL have Hex Conversion and Hex Arithmetic, Block Move, a Relocator, and a Line Assembler. A Binary Load command allows you to load any binary load file without DOS and doubles as a disk directory command which prints out the start sector of each file. Lockup recovery allows you to recover from system lockup, meaning that when your computer freezes, you can usually salvage the program or text file in memory by popping into OMNIMON and dumping memory to disk. Advanced users will like the user extendibility feature which allows them to make use of the interface routines of 8K OMNIMON in their own software. The 8K OMNIMON also has resident AXLON Ramdisk handlers, allowing you to use this powerful device as an ultra fast disk drive with almost any DOS which uses standard SIO calls and even boot programs like word processors, data bases, and games which access the disk a lot. Once you have an OMNIMON in your system, you will wonder how you ever did without it!

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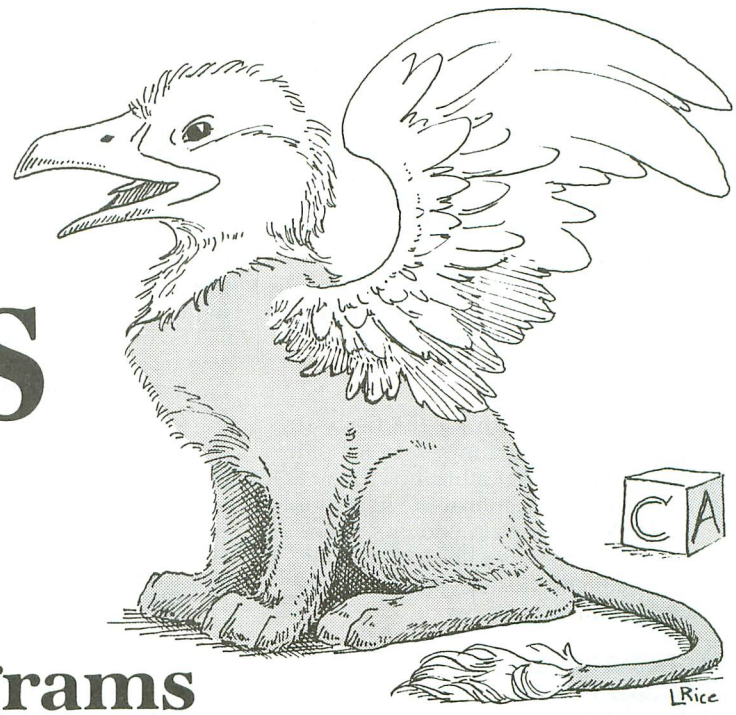


Educational Programs Review

by Braden E. Griffin, M.D.

And crawling on the planet's face. . . some insects, called the Human Race . . . lost in Time. . . and lost in Space. . . and meaning. With that perspective of our galactic importance, borrowed from *The Rocky Horror Picture Show*, I will proceed to climb upon my shaky soapbox to introduce this month's column in an issue featuring education.

It's obvious that software producers responsible for the design of educational objectives—and for the means to accomplish those objectives—need a keen understanding of the learning capabilities of the specific target group. This is particularly true in designing programs for the preschooler.

Many educational programs aimed at this group profess to enhance numerous learning skills. A parent's cursory viewing of these programs seems to confirm this, but we must be sure that they truly are designed to educate children—and not just to make adults *think* they will do so.

Several methods are available to prevent this pitfall. The best way to be sure that a program is appropriate for an individual child is to have that child play the desired game in a software store. This is often difficult to accomplish and not usually encouraged by salespeople. Surely, time spent pushing the new and popular action games to juveniles and "juvenists" (i.e., adult juveniles) is more profitable.

A second method is through study of reviews in computer magazines. Here, the potential problem is that reviewers are no more aware of the educational capabilities of different age groups than their readers. I claim little, if any, advantage over other reviewers because of my background as a pediatrician.

The usual training in this specialty is great for treating asthma, but abysmal in the area of normal development of learning skills. The medical-legal liability of not knowing that logical thinking develops around age eight or nine becomes a whiter shade of pale when compared to not knowing the correct dose of adrenalin.

Maybe the most reliable and universally accessible method for selection of educational software, particularly for the very young, is based on the reputation of the manufacturer. If one has previous positive experience with a product line, then rely on that. . . until it proves false. Companies need to maintain a consistent level of quality to be successful.

An example of an organization with an excellent reputation for a specific age group is the Children's Television Workshop. If I were going to buy a program to teach advanced physics, one featuring Niels "Big Bird" Bohr wouldn't exactly make my credit card jump from my wallet. However, the reputation of CTW and their educational TV shows aimed at preschool children does lend credibility to the expected quality of software designed for that age group.

Established and reputable names in other fields of software design need to first demonstrate their ability in the development of educational material appropriate for young children, not just their abilities in programming.

Alas, be careful of purported expertise of designers. I recall the dilemma of the barbershop quartet in *The Music Man*, as they were constantly being side-

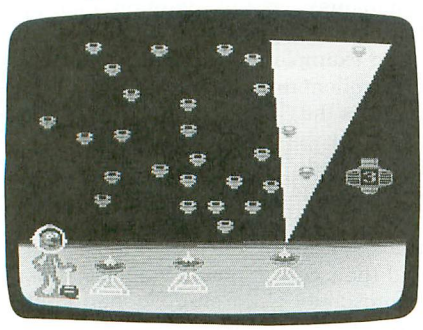
tracked by the evasive Professor Harold Hill in their quest for his "creee-dentials." (This is likely the first time that the two motion picture musicals referred to this month have been used in the same article. Is that eclectic, or what? Did I hear someone say *emetic*?)

That well-credentialed game designer may be the Professor of Math and Computer Science at the University of the Trees! The sci-fi flicks of the fifties from RKO gave the aura of competence as we entered buildings bearing the stone inscription "Doctor of Research." They were usually the ones who wanted to develop your brain in a solution of bubbling formaldehyde.

Look past the flash for the flesh. (I seem to be repeating myself in my old age.) I seem to be repeating myself in . . . Anyway, two educational programs for preschoolers from the Children's Television Workshop, a group with a well-established and trusted reputation, are reviewed this month.

ASTRO-GROVER
CBS SOFTWARE
A Unit of CBS, Inc.
Greenwich, CT 06836
Cartridge, 48K Cassette or Disk
$34.95

A few months ago, I reviewed a couple of educational games from the Children's Television Workshop's "Sesame Street" series. This is the first of two more superb offerings from the world of the Muppets.



Astro-Grover.

This game is designed to teach early number concepts to children from the ages of three to six years. Who better to do this than Grover, er. . . should I say **Astro-Grover**? If he had been aboard the space shuttle which had difficulty deploying a functioning satellite for India, the Sikhs could have been preoccupied watching "Legends of Miniature Golf" on ESPN!

The game employs a vinyl EasyKey keyboard overlay similar to those used in previous "Sesame Street" programs. This makes it easier for preschoolers to interface with the computer, or, in other words, to keep grimy little, Popsicle-laden fingers off the actual keyboard.

Everything necessary for parents to understand how the game is played can be found in a comprehensive manual or on the Easy-To-Play card. The kids will probably not need either to begin playing. Kids are like that. . .yeah, they are.

The overlay consists of the numbers 1 to 9, up and down arrows to control the Beam, a handy PAUSE key, the LEVEL key to access any of the five available levels, and the PLAY key to start the game.

The different levels use small flying spaceships, called Zips, to help one's child develop skills in counting, adding and subtracting, in a progressive fashion. Either matching numbers of Zips or performing basic math operations on two groups of Zips displayed on the screen results in watching these helpful aliens construct a city.

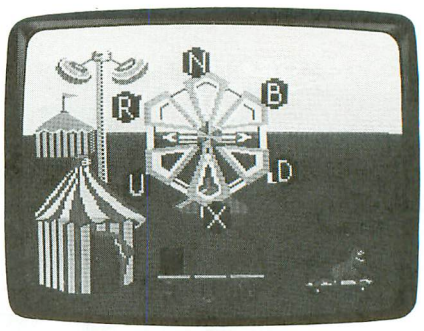
Clever, colorful graphics which don't overwhelm children are used to enhance the learning process. This game is well designed and quite appropriate for preschoolers. The combination of computer assisted instruction and the "Sesame Street" surroundings provides an ideal environment for young, eager minds.

LETTER-GO-ROUND
CBS SOFTWARE
A Unit of CBS, Inc.
Greenwich, CT 06836
Cartridge, 48K Cassette or Disk
$34.95

The second piece of "Sesame Street" educational software for three- to six-year-olds reviewed this month, **Letter-Go-Round**, uses a sound approach to the development of early reading skills.

Letter recognition, upper/lower case matching, word recognition and matching, and simply spelling are all encompassed in this visit to a carnival's Ferris wheel with some familiar Muppet characters. A child may pick any of three Muppet pals with whom to play: Barkley, the Cookie Monster or the ubiquitous Grover.

Employing the EasyKey type of keyboard overlay previously described gives the child a limited number of keyboard entries from which to choose. Added to the PAUSE, LEVEL and PLAY keys are three keys used to select the Muppet playmate, two keys used to change the speed of the letter-containing Ferris wheel, and a STOP key placed over the entire SPACE BAR area, which is used to select desired letters.



Letter-Go-Round.

Again, along with protecting the keyboard from pervasive glomp, the overlay helps to promote letter recognition on the screen and doesn't distract the child's attention from this objective by introducing a non-productive keyboard search for the matching letter.

Older children can accomplish this keyboard search without difficulty, but they've already developed letter recognition. Without this skill, the retention of the mental image, even for a few seconds, tends to distract the young mind. The designers of this game show the awareness of learning techniques necessary for preschoolers alluded to in the introduction this month.

The six levels provide the progression from very basic letter recognition to simple spelling, with opportunities to practice learned skills before advancing to greater challenges.

Levels 1, 2 and 3 have the child match letters in upper and lower case formats. Level 4 requires the child to match each letter of a displayed three-letter word.

In level 5, a three-letter word is displayed, with one of the letters missing. The missing letter is picked from one of the six letters which make up the spinning Ferris wheel.

In the final level, three blank spaces are shown. The child must spell a word from the letters displayed on the Ferris wheel. The secret word comes from a list of over one hundred and seventy words in the game's vocabulary.

Selection of the first letter is a matter of trial and error. Once this is done, the child is able to choose subsequent letters based on recognizable spelling pat-

terns. Though this is fairly challenging, it's amazing to see how quickly youngsters pick up these techniques.

All of the levels reward correct responses with visual and auditory stimuli and do not discourage wrong entries. Additionally, those levels where correct responses aren't apparent after a reasonable number of attempts supply the correct answer.

As with all CBS Software products, delightful graphics and music complement an excellent educational design. **Letter-Go-Round**? *Go for it!* □

Dr. Griffin, as Chief of Newborn Medicine at a perinatal center, spends most of his time in the newborn intensive care ward. Off-hours, he's been using an Atari 800 for four years. In keeping with his gentle profession of nurturing preemies, Dr. Griffin's number one game is ***Crush, Crumble, Chomp****.*

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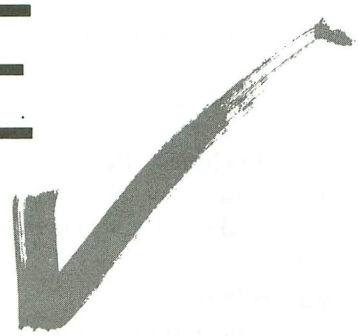
MULTIPLE CHOICE VOCABULARY QUIZ



by Alfred H. Filskov, III

Any student who takes an English class, a foreign language class or an SAT preparation class can appreciate the importance of doing well on vocabulary tests. Words and definitions are given, leaving the student with the job of memorizing them.

Unfortunately, memorizing vocabulary is a difficult task, as human memory isn't very stable, and people have a nasty habit of growing bored with studying. This is what prompted me to write **Multiple Choice Vocabulary Quiz** (hereafter called **MCVQ**). It makes studying at least bearable, while really teaching you vocabulary.

The program.

MCVQ is a BASIC program designed to drill the student in a list of words entered by the user. It's menu driven and provides plenty of instructions. Options can be selected with a joystick, thus minimizing keyboard use. As you move the pointer between menu options, a familiar tune is played in the background. Other features include error trapping and "are you sure?" prompts.

The quiz **MCVQ** gives is in multiple choice format. The program will ask you to choose the definition of a word out of a list of five definitions printed on the screen. If the correct definition is chosen, the program will tell you you're right and move on to the next word. If you're wrong, you'll be shown the correct definition and quizzed on that word again later. At the end of the quiz, you will be given a score in percent form.

Menu options.

The following is a listing and description of options shown on the menu of **MCVQ**.

Create a vocabulary list—Allows you to enter a new list of words and definitions.

Add to the list—Lets you add words and definitions to a list already in memory.

Delete a word on the list—Takes words off the list.

Sort the words—Performs an alphabetical or random sort.

Take the quiz—Gives the vocabulary quiz.

Save the list of words—Saves the list of words in memory to disk or cassette.

Load a list of words—Loads a list of words into memory from disk or cassette.

Delete a disk file—Allows the disk user to delete any file.

Disk directory—Prints the disk directory onto the screen.

Print the words on the screen—Prints the list of words onto the screen.

Print the words on the printer—Prints out the list of words on the printer.

End this program—Breaks out of the program and puts you in BASIC.

Typing it in.

Type in *MCVQ*, just as you would any other BASIC program. Then check it with **Unicheck** (see page 30) to catch all typing errors. Once **MCVQ** is typed in, you can make some of your own modifications to it. Here are some suggestions.

The background music that's played as you choose between menu options can be changed by changing the tone data in Line 1720. The length of the new song must be entered in Line 1640 in the variable SNGLN.

In Line 1670, the screen color can be changed by changing the COLR variable; the intensity of the letters can be changed by changing the LUM2 variable; and the intensity of the background can be changed by changing the LUM1 variable.

To print out the list of vocabulary words on a 40-column printer, change the variable FLAG in Line 300 to equal F0.

Final words.

If you happen to press the BREAK key by mistake, type *GOTO MENU* to return to the program. Also, notice the number of words **MCVQ** says you're allowed to enter when you first run it. This number is dependent on how much memory you have.

Finally, I'd like to say that this program proves that strings in Atari BASIC are just as useful as in any other BASIC. I've heard many complaints about Atari strings, but there's nothing that can't be done through shrewd programming techniques. □

Alfred Filskov is a freshman majoring in Industrial Engineering at North Carolina State University. His first exposure to computers was four years ago, in Duke University Computer Kamp (DUCK). His interest was heightened soon after that, when his grandparents gave him an Atari.

Listing 1.

```
10 REM MULTIPLE CHOICE VOCABULARY QUIZ
20 REM BY ALFRED FILSKOV IN OCT, 1984.
30 GOSUB 1630
40 REM MENU
50 TRAP 33333:POKE F752,F1:SETCOLOR F1
,F0,LUM2:SETCOLOR F2,COLR,LUM1
60 ? "5";:POKE 82,7:POSITION F0,F1:? "
                M E N U
"
70 ? "Create a vocabulary list":? "Add
 to the list":? "Delete a word on the
list"
80 ? "Sort the words":? "↓Take the qui
z":? "↓Save the list of words"
90 ? "Load a list of words":? "Delete
a disk file":? "Disk directory"
100 ? "↓Print the words on the screen"
:? "Print the words on the printer":?
"↓End this program"
110 POKE 82,F2:POSITION F0,20:? "
                                ";
120 ? "Move up and down to choose, and
 then      press the 'fire' button."
130 POKE KB,F255:POSITION 4,ARW(P):? "
->";:SOUND F0,SN(NT),F10,F6
140 FOR A=F1 TO 40:NEXT A:SOUND F0,F0,
F0,F0:NT=NT+F1:IF NT>SNGLN THEN NT=F1
150 IF STICK(F0)=14 OR PEEK(KB)=14 THE
N POSITION 4,ARW(P):? "  ";:P=P-(P>F1)
:GOTO 130
160 IF STICK(F0)=13 OR PEEK(KB)=15 THE
N POSITION 4,ARW(P):? "  ";:P=P+(P<12)
:GOTO 130
```

```
170 IF STRIG(F0) AND PEEK(KB)<>33 THEN
 150
180 IF  NOT STRIG(F0) THEN 180
190 SOUND F0,F50,F10,F8:POKE KB,F255:?
 "↰↓":SOUND F0,F0,F0,F0
200 IF P=F1 THEN 340
210 IF P=F2 AND AMT AND AMT<MAX THEN F
LAG=F0:POKE F752,F0:AMT=AMT+F1:GOTO 37
0
220 IF P=3 AND AMT THEN 490
230 IF P=4 AND AMT>F1 THEN 610
240 IF P=5 AND AMT>4 THEN 730
250 IF P=F6 AND AMT THEN 1170
260 IF P=7 THEN 1210
270 IF P=F8 THEN 1270
280 IF P=9 THEN 1310
290 IF P=F10 AND AMT THEN A$="S":FLAG=
F0:C=F0:GOTO 1370
300 IF P=11 AND AMT THEN A$="P":TRAP 1
540:FLAG=F1:C=F0:GOTO 1370
310 IF P=12 THEN A$="end      this prog
ram":GOSUB 1500:GRAPHICS F0:END
320 ? "I cannot do that!":GOTO 1550
330 REM ENTER WORDS
340 POKE F752,F0:IF AMT THEN A$="creat
e  a new list":GOSUB 1500
350 POKE KB,F255:FLAG=F0:AMT=F1:? "↰"
360 IF FLAG THEN ? " Enter the definit
ion of word #";AMT;".":? " ";:GOTO 390
370 ? "↓Enter word #";AMT;".";:IF AMT>
5 THEN ? "  (Type BYE to stop)";
380 ?
390 INPUT A$:IF LEN(A$)>25 THEN ? "Tha
t word is more than 25 characters!":GO
TO 360
400 IF A$<>"BYE" OR FLAG THEN 430
410 IF AMT<F6 THEN ? "You have to have
 at least 5 words!":GOTO 360
420 AMT=AMT-F1:GOTO MENU
430 A$(LEN(A$)+F1)="
    "
440 W$(AMT*F50-F49+FLAG*25,AMT*F50-25+
FLAG*25)=A$
450 FLAG=F1-FLAG:IF  NOT FLAG THEN AMT
=AMT+F1:FOR A=F1 TO F8:? :NEXT A:? "↑↑
↑↑↑↑↑↑"
460 IF AMT>MAX THEN 420
470 GOTO 360
480 REM DELETE WORD
490 POKE F752,F0:? "Do you want a list
ing of the words    first (Y/N)?";
500 GET #F1,A:IF A=89 THEN ? "Y↓↓":A$=
"S":FLAG=F0:C=480:POKE F752,F1:GOTO 13
70
510 IF A<>78 THEN 500
520 ? "N↓"
530 ? "Which word & definition do you
want   to delete (1-";AMT;")?":WH=-1:T
RAP 540:INPUT WH
540 ? :IF WH>AMT OR WH<F1 OR WH<>INT(W
H) THEN ? "Bad number!":GOTO 1550
550 ? "WORD = ";W$(WH*F50-F49,WH*F50-2
5):? "DEF. = ";W$(WH*F50-24,WH*F50)
560 A$="delete  this word":GOSUB 1500
570 IF WH=AMT THEN 590
580 FOR A=WH TO AMT-F1:W$(A*F50-F49,A*
F50)=W$(A*F50+F1):NEXT A
590 AMT=AMT-F1:GOTO MENU
600 REM SORT WORDS
610 ? "Do you want an (A)lphabetical o
r a    (R)andom sort?";
620 GET #F1,A:? CHR$(A):? :IF A=65 THE
N 650
630 IF A=82 THEN 700
640 ? "No choice!":GOTO 1550
650 IF AMT>20 THEN ? "This will take a
pprox. ";INT(AMT*AMT/60);" secs.":FOR
A=F1 TO F255:NEXT A
660 POKE 559,F0:FOR A=F1 TO AMT-F1:C=A
*F50:FOR B=A+F1 TO AMT
670 IF W$(C-F49,C)<=W$(B*F50-F49,B*F50
) THEN 690
680 A$=W$(B*F50-F49):W$(B*F50-F49,B*F5
0)=W$(C-F49):W$(C-F49,C)=A$
690 NEXT B:NEXT A:POKE 559,34:GOTO MEN
U
700 ? "Working...":FOR A=F1 TO AMT:B=I
NT(RND(F1)*AMT+F1)
710 A$=W$(A*F50-F49):W$(A*F50-F49,A*F5
0)=W$(B*F50-F49):W$(B*F50-F49,B*F50)=A
$:NEXT A:GOTO MENU
720 REM TAKE QUIZ
730 FOR A=F1 TO AMT:RIGHT(A)=F0:NEXT A
:NET=AMT:GUESS=F0:WH=F1
740 ? "You are about to take the quiz.
  You  must choose the correct definit
ions"
750 ? "of the ";AMT;" words I have in
memory."
760 ? "↓Choose the answers using the j
oystick.If you do not know an answer,
choose"
770 ? "the last option which counts on
ly 1/2 a miss."
780 ? "↓Press ESC during the quiz to r
eturn   to the menu.":? :GOSUB FIRE
790 ? "↰":SETCOLOR F1,F0,LUM1:IF NET=F
1 THEN ? "          THIS IS THE LAST WORD
":GOTO 810
800 ? " THERE ARE ";NET;" WORDS LEFT T
O DEFINE."
810 ? "↓   DEFINE:  ";W$(WH*F50-F49,WH
*F50-25):POKE 82,F10:? :? :GUESS=GUESS
+F1:D=INT(RND(F1)*5+F1)
820 FOR A=F1 TO 5:USED(A)=0:NEXT A:FOR
 A=F1 TO 5:IF A=D THEN ? W$(WH*F50-24,
WH*F50):GOTO 860
830 C=INT(RND(F1)*AMT+F1):FLAG=F0:FOR
B=F1 TO 5:IF USED(B)=C THEN FLAG=F1
840 NEXT B:IF FLAG OR C=WH THEN 830
850 USED(A)=C:? W$(C*F50-24,C*F50)
860 NEXT A
870 ? "DO NOT KNOW":POKE 82,F2:SETCOLO
R F1,F0,LUM2:P=F8:POKE 77,F0
880 POKE KB,F255:POSITION 7,P:? "->";:
SOUND F0,SN(NT),F10,F6
890 FOR A=F1 TO 20:NEXT A:SOUND F0,F0,
F0,F0:NT=NT+F1:IF NT>SNGLN THEN NT=F1
900 IF STICK(F0)=14 OR PEEK(KB)=14 THE
N POSITION 7,P:? "  ";:P=P-(P>F6):GOTO
 880
910 IF STICK(F0)=13 OR PEEK(KB)=15 THE
N POSITION 7,P:? "  ";:P=P+(P<11):GOTO
 880
920 IF PEEK(KB)=28 THEN P=5:GOTO MENU
930 IF STRIG(F0) AND PEEK(KB)<>33 THEN
 900
940 IF  NOT STRIG(F0) THEN 940
950 P=P-5:IF P=F6 THEN SOUND F0,30,F10
,F8:FOR A=F1 TO F8:NEXT A:GUESS=GUESS-
0.5:GOTO 1100
960 IF P<>D THEN 1080
970 REM RIGHT
980 POSITION 11,14:? "YOU ARE RIGHT!!!
":RESTORE 1010
990 FOR A=F1 TO F6:READ B,C:SOUND F0,B
,F10,F6:SOUND F1,B+F1,F10,F6
1000 FOR D=F1 TO C*12:NEXT D:NEXT A:SO
UND F0,F0,F0,F0:SOUND F1,F0,F0,F0
1010 DATA 140,1,110,1,90,1,75,2,90,1,7
5,3
1020 NET=NET-F1:RIGHT(WH)=F1:IF NET TH
EN 1120
1030 POSITION F6,16:? "YOU HAVE FINISH
ED THE QUIZ.":A$=STR$(INT((2*AMT-GUESS
)/AMT*100+0.5)):A$(LEN(A$)+1)="%"
```

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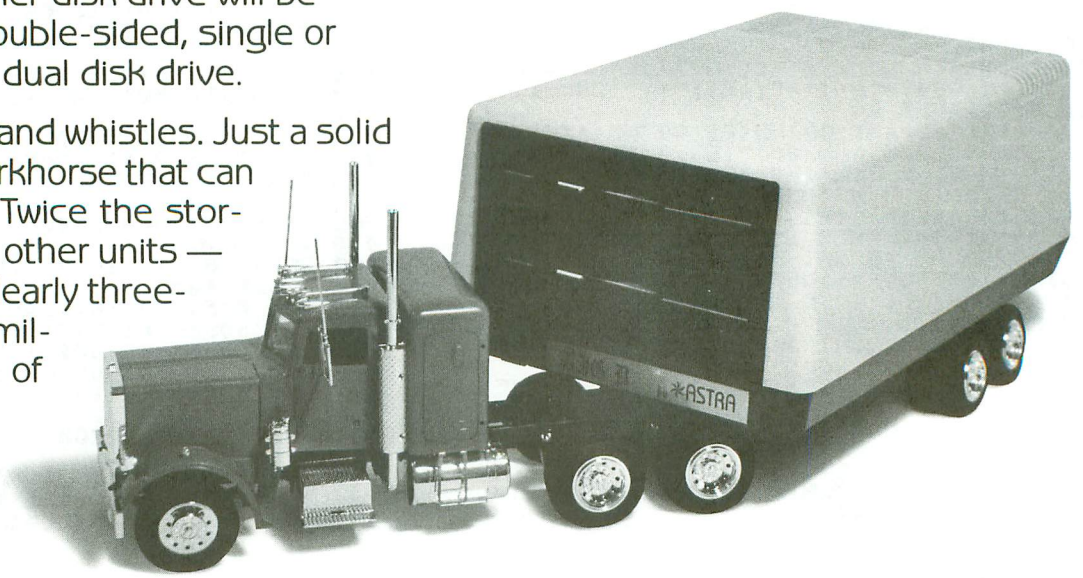


CIRCLE #109 ON READER SERVICE CARD

```
1040 ? "↓         YOUR SCORE IS":FOR A=
F0 TO 23:SOUND F0,195-A*F8,F10,F8:POSI
TION A,17:? " ";A$;
1050 B=SIN(F1):NEXT A:SOUND F0,F0,F0,F
0:FOR A=F0 TO 80:NEXT A:POSITION 24,17
:? "      ↓←←←←←";A$;".↓"
1060 SOUND F0,210,F10,F10:B=F1^F1:SOUN
D F0,F0,F0,F0:GOSUB FIRE:P=5:GOTO MENU
1070 REM WRONG
1080 POSITION 11,14:? "YOU ARE WRONG..
.":SOUND F0,200,F10,F6:FOR A=F1 TO 40:
NEXT A
1090 SOUND F0,241,F10,F6:FOR A=F1 TO 6
0:NEXT A
1100 SOUND F0,F0,F0,F0:POSITION F2,16:
? "THE RIGHT ANSWER IS:":? "
  ";W$(WH*F50-24,WH*F50)
1110 REM FIND NEW WORD
1120 WH=WH+F1:A=WH
1130 IF A>AMT THEN A=F1
1140 IF RIGHT(A) THEN A=A+F1:GOTO 1130
1150 WH=A:? :GOSUB FIRE:GOTO 790
1160 REM SAVE
1170 POKE F752,F0:? "What is the full
name of the file to  save";:INPUT A$
1180 TRAP 1540:CLOSE #F2:OPEN #F2,F8,F
0,A$:? "↓Saving...";
1190 FOR A=F1 TO AMT:? #F2;W$(A*F50-F4
9,A*F50):NEXT A:CLOSE #F2:GOTO MENU
1200 REM LOAD
1210 IF AMT THEN A$="load a  file":GOS
UB 1500
1220 POKE F752,F0:? "↓What is the full
 name of the file to  load";:INPUT A$
1230 TRAP 1540:CLOSE #F2:OPEN #F2,4,F0
,A$:? "↓Loading...";:TRAP 1250:AMT=F0
1240 INPUT #F2;A$:AMT=AMT+F1:W$(AMT*F5
0-F49)=A$:IF AMT<MAX THEN 1240
1250 CLOSE #F2:GOTO MENU
1260 REM DELETE FILE
1270 POKE F752,F0:? "What is the full
name of the file to  delete";:INPUT A$
:IF A$="" THEN GOTO MENU
1280 ? "↓Are you sure that you want to
 delete  ";A$;" (Y=YES)?";:GOSUB 1510
1290 TRAP 1540:? "↓Erasing...";:XIO 33
,#F2,F0,F0,A$:GOTO MENU
1300 REM DIRECTORY
1310 ? "     This is the disk directory
:":POKE 82,F10:? :TRAP 1540
1320 CLOSE #F2:OPEN #F2,F6,F0,"D:*.*":
A=F2
1330 INPUT #F2,A$:? A$:IF A$(5,16)="FR
EE SECTORS" THEN POKE 82,F2:CLOSE #F2:
GOSUB FIRE:GOTO MENU
1340 A=A+F1:IF A/20=INT(A/20) THEN ? :
? "   Press 'fire'":GOSUB 1580:? :A=F0
1350 GOTO 1330
1360 REM PRINT
1370 ? " Press 'fire' to delay and re-
start    printing, and press ESC to ab
ort.":GOSUB FIRE
1380 CLOSE #F2:OPEN #F2,F8,F0,A$:SETCO
LOR F1,F0,LUM2:SETCOLOR F2,COLR,LUM1:P
OKE F752,F1:POKE KB,F255
1390 FOR D=F1 TO AMT:? #F2;D;". ";W$(D
*F50-F49,D*F50-25);
1400 IF  NOT FLAG THEN ? #F2:? #F2;"
       ";
1410 ? #F2;"-";
1420 ? #F2;W$(D*F50-24,D*F50)
1430 IF PEEK(KB)=28 THEN GOTO MENU
1440 IF PEEK(KB)=33 OR  NOT STRIG(F0)
THEN GOSUB 1610:GOTO 1470
1450 NEXT D:IF FLAG+C THEN GOTO MENU+C
1460 GOSUB FIRE:GOTO MENU
1470 IF  NOT STRIG(F0) THEN 1470
1480 GOSUB 1580:GOTO 1450
1490 REM ASK IF SURE
1500 ? :? "Are you sure that you want
to ";A$;" (Y=YES)?";
1510 POKE KB,F255:GET #F1,B:IF B=89 TH
EN SOUND F0,F50,F10,F8:? "Y":A=F1^F1:S
OUND F0,F0,F0,F0:RETURN
1520 SOUND F0,230,F10,F8:? "N":POP :A=
F1^F1:SOUND F0,F0,F0,F0:GOTO MENU
1530 REM ACCESS ERROR
1540 POKE 82,F2:? "↑↓Device access err
or!"
1550 SOUND F0,240,F10,F8:FOR A=F1 TO 6
0:NEXT A:SOUND F0,F0,F0,F0:FOR A=F1 TO
 160:NEXT A:GOTO MENU
1560 REM WAIT FOR FIRE
1570 ? :? "       Press the 'fire' butt
on"
1580 POKE KB,F255
1590 IF PEEK(KB)<>33 AND STRIG(F0) THE
N 1590
1600 IF  NOT STRIG(F0) THEN 1600
1610 SOUND F0,40,F10,F8:POKE KB,F255:A
=SIN(F1):SOUND F0,F0,F0,F0:RETURN
1620 REM START
1630 F0=0:F1=1:F2=2:F6=6:F8=8:F10=10:F
49=49:F50=50:F255=255:F752=752
1640 MENU=50:FIRE=1570:AMT=F0:KB=764:S
NGLN=25
1650 MAX=INT(FRE(F0)/F50)-74:IF MAX>40
0 THEN MAX=400
1660 GRAPHICS F0:POKE 82,F2:POKE 83,39
:POKE F752,F1:? :CLOSE #F1:OPEN #F1,4,
F0,"K"
1670 LUM1=8:LUM2=0:COLR=15:SETCOLOR F1
,F0,LUM2:SETCOLOR F2,COLR,LUM1
1680 DIM W$(MAX*F50),ARW(12),A$(F50),U
SED(5),RIGHT(MAX),SN(SNGLN)
1690 RESTORE 1700:FOR A=F1 TO 12:READ
B:ARW(A)=B:NEXT A:P=7
1700 DATA 3,4,5,6,8,10,11,12,13,15,16,
18
1710 FOR A=F1 TO SNGLN:READ B:SN(A)=B:
NEXT A:NT=F1
1720 DATA 81,96,121,96,81,60,47,53,60,
96,85,81,81,81,47,53,60,64,72,64,60,60
,81,96,121
1730 REM INSTRUCTIONS
1740 A$="MULTIPLE CHOICE VOCABULARY QU
IZ":FOR A=F1 TO 30
1750 SOUND F0,200-F6*A,F10,F6:POSITION
 5,F2:? A$(31-A,31):NEXT A
1760 ? "↓    BY ALFRED FILSKOV IN OCT.,
 1984":SOUND F0,F0,F0,F0
1770 ? "↓↓This program allows you to e
nter up   to ";MAX;" words and definit
ions."
1780 ? "↓It will then quiz you on the
words    and give you a score.  The qu
iz is    in multiple choice format."
1790 ? "↓To take the quiz you will nee
d a      joystick in port 1.  You can
also use"
1800 ? #F6;"the ↑, ↓, and SPACE keys a
s up, down, and 'fire'.":? :GOTO FIRE
```

●

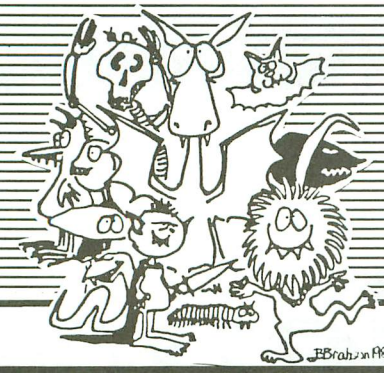
CHECKSUM DATA.

(see page 30)

```
10 DATA 516,944,12,810,872,43,51,885,7
06,447,251,915,48,500,538,7538
160 DATA 471,319,987,613,488,782,541,9
09,599,573,405,748,416,86,27,7964
```

Vocabulary Quiz *continued*

```
310 DATA 891,209,616,718,932,315,895,9
13,383,150,119,411,209,43,149,6953
460 DATA 16,732,641,142,229,718,453,84
5,212,623,5,81,421,434,97,5649
610 DATA 56,199,431,162,157,620,707,27
4,298,386,238,712,245,843,467,5795
760 DATA 923,849,800,46,26,756,197,511
,539,336,744,517,565,523,614,7946
910 DATA 574,265,324,995,178,777,254,9
40,394,839,266,875,244,786,643,8354
1060 DATA 36,403,343,881,462,569,433,7
97,497,162,48,66,598,250,50,5595
1210 DATA 986,440,449,251,210,660,619,
465,62,941,109,4,910,547,719,7372
1360 DATA 430,650,910,611,284,669,75,5
80,721,33,741,871,377,661,931,8544
1510 DATA 417,689,69,486,119,570,831,1
60,286,858,801,447,840,913,618,8104
1660 DATA 22,82,869,462,428,438,634,26
7,473,959,531,174,979,21,398,6737
```



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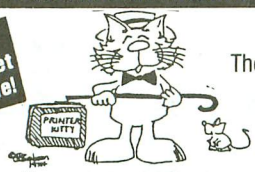

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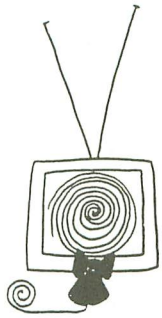

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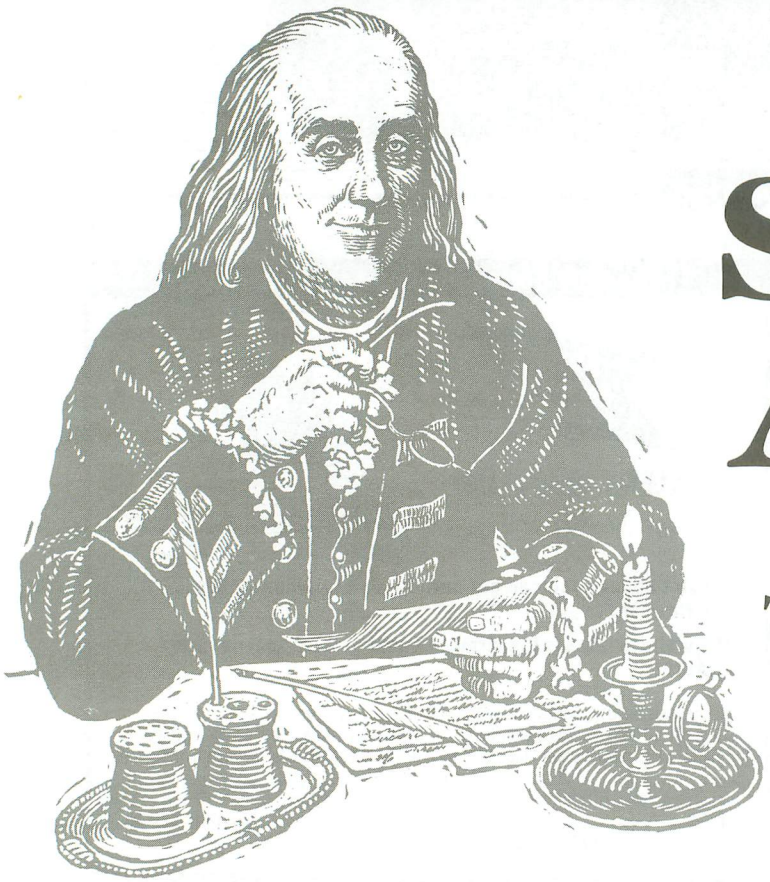


Science Arcade

The Franklin Institute Science Museum and Atari

by William J. Rooney, Jr.

If Benjamin Franklin were alive today, he would more than likely be involved in the information revolution. He loved to tinker and see what practical use he could get out of the latest technology; he surely would have been the first on his block with a personal computer hobby kit.

But, since Dr. Franklin isn't around, it falls to the Franklin Institute Science Museum in Philadelphia to carry on his legacy. One of their latest exhibits is Science Arcade, a room where Atari 800s are used in making science learning fun, in a format that's appealing to today's museum audience.

The Franklin Institute was one of the first science museums built in the United States. It stresses hands-on participation in science activities, and its staff firmly believes that science education can be enjoyable.

Lately, science education in this country has faced some stiff criticism. A national commission took a look at American schools and found them lacking. At the same time, the growing use of computers in schools has created a real challenge for teachers.

How do they learn enough about computers to teach their students properly? How do they keep from falling into the trap that encourages them to use programs that try to teach concepts while disguised as fast-paced shoot-'em-ups? Or multiple choice programs that come with pretty graphics and are dubbed "games"?

The former encourage students to go for high scores without worrying about what they're learning. The latter get students to quickly memorize the correct letter of the answer; again, without really knowing what they've answered.

The Franklin Institute has come to grips with these and other problems in Science Arcade, which gives a glimpse of some ways the computer can be used effectively in education.

"We worked on so many projects in which the computer was used for instructional purposes that it seemed we could add a little entertainment to the instruction and really have an exciting program. After all, that's what the Institute is all about," said Minda Borun, head of the Computer Activities Group. The result is Science Arcade, a collection of educational computer games that tie in with science principles and content matter of exhibits in the Museum.

For instance, non-sailors who've always wondered how sailboats can make headway into the wind can find out in a game called "Microsailing." Using a joystick for a rudder, you sail your boat around a course, battling the wind and waves all the way. For the more proficient seaman, there's an option that uses official yachting rules and assesses penalties for infractions.

A classic problem faced by trainmen since the dawn of the "iron horse" has been the switching... how to get all those boxcars in the proper order before pulling out of the switching yard. "Text Train" addresses that dilemma, using letters instead of boxcars. The player must form a word using letter "boxcars" scattered randomly around the track. But how do you get the engine backed up to the proper cars? And how do you get them in the right order? Players can find out in "Text Train."

If you must have a space game, there's the "Lunar Lander." Try to land a lunar module gently on the Moon's surface by firing the retro-rockets at just the right time.

For those not interested in space travel, how about a leisurely game of "Pool"? This game is truly astounding in the way it simulates the action of pool balls as

they collide, following the real laws of momentum. Moms and dads can relax with this one while the kids are off playing "Lunar Lander."

For those who enjoy math and logic, there are "Golf Classic," "Hurkle" and an extremely challenging game called "Snark Hunt." This last game draws on Lewis Carroll's writings to fire "vorpal beams" into a box to track down hidden "snarks." "Laser Maze" is a similar game, with the difference that, here, the problem is to guess where the beam's going to come out, instead of finding where something is hidden.

Two of the more innovative games are "Parachuter"—where the object is to open the chute in time and land on a target—and "Rocket Mail." Legend has it (and the Institute staff swears that this is true) that in the 1940s, a small village snuggled deep in the Austrian Alps received its mail via a rocket shot over the mountains to a clearing in the woods.

The Institute has recreated this difficult assignment by varying the wind speed and weight of the rocket (it was probably heavier around Christmas). The player has to decide how much fuel to use and at what angle to shoot. It's a very enjoyable game, with a beautiful drawing of the Alps to boot.

Project Director Borun explained the stringent criteria that her staff applied when looking for games for the Arcade. "We wanted to create a facility in which visitors could play computer games that didn't involve blasting aliens. Nonviolence was a high priority. Of course, we were looking for games that were educational and reinforced skills other than hand-eye coordination.

"Both educational and recreational software is available, but, as we quickly discovered, it's a rarity to find a good combination of the two. Finally, all of the games had to have science content which connected with our exhibits."

As long-time Atari users may have noticed, the old Atari Program Exchange was a great source of materials for the Arcade, as were other third-party software companies. In addition, some of the games were translated from other computers or written from scratch.

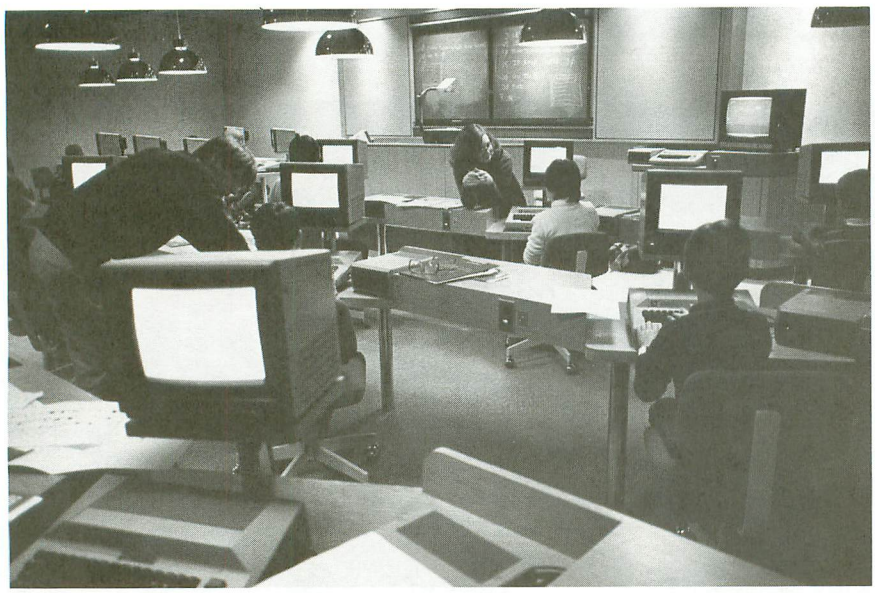
But Science Arcade is only the latest application of computers at the Franklin Institute. Visitors to the Museum find many computers prominently placed and ingeniously used to help extend enjoyment of the exhibits.

Across the hall from the Arcade is the Computer Activities Center, a companion project to Science Arcade. In this special computer classroom, visitors can acquire the necessary skills to use computers effectively, in a wide variety of courses that range from "Getting Into It," to BASIC or Logo programming, to specific applications like spreadsheets or word processing.

Right in the same area is one of five "Poor Richard's Computer" terminals. There's at least one of these on each floor, offering information about the Museum and quizzing visitors about the exhibits on that floor.

In the Shipbuilding Exhibit is a game that should be in every classroom. "Sea Trader" asks you to imagine that you're a sea trader in 1772. Your brother-in-law has loaned you 2,000 English pounds to get started. You're then faced with nasty weather, shipwrecks, pirates and other tribulations. Keep a close eye on your ledger, though, because it wasn't easy to earn a living from the sea in those days.

Perhaps the most ambitious of the computer projects in the building is "Flying Facts" in Aviation Hall. It could easily be used in any library. With over 600 screens of information about flight, most of them illustrated, arranged on 3 levels of difficulty and covering 4 main topics, a visitor could spend a great deal of time in front of one of these terminals.



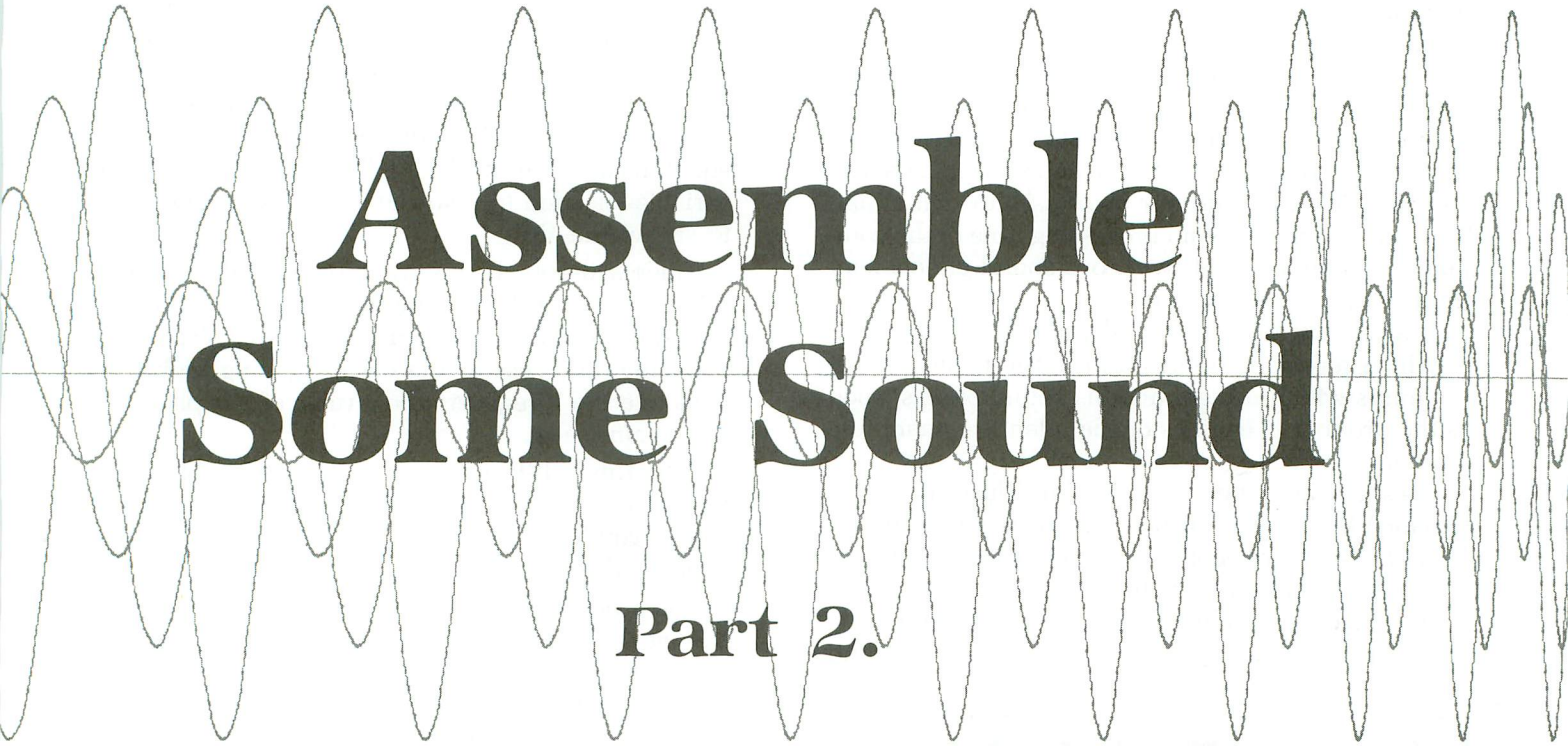
And, to discover what's going on inside all these computers, there's "Secrets of the Computer," which offers a clear, illustrated explanation of what a computer can do and how it works.

Ben Franklin may not be around any more, but his spirit is alive and well at the Franklin Institute. Any visit to Philadelphia is incomplete without a stop at this stimulating museum. . .especially if you want to see unique computer applications in action. □

William J. Rooney, Jr. is an Instructor and Computer Systems Coordinator in the Computer Activities Division of the Education Department of the Franklin Institute Science Museum.

Some program listings reproduced in **ANALOG Computing** may contain "strange" characters not shown on the keyboards of earlier Atari models. These are special characters which use the CTRL, ESC and "ATARI LOGO" (inverse) keys. Shown below is a list of these characters and the keystrokes used to get them.

♥ --- CTRL ,
├ --- CTRL A
| --- CTRL B
┘ --- CTRL C
┤ --- CTRL D
┐ --- CTRL E
/ --- CTRL F
\ --- CTRL G
◢ --- CTRL H
▝ --- CTRL I
◣ --- CTRL J
▘ --- CTRL K
▖ --- CTRL L
▔ --- CTRL M
_ --- CTRL N
▗ --- CTRL O
┼ --- CTRL P
▐ --- CTRL Q
▂ --- CTRL R
┼ --- CTRL S
● --- CTRL T
▄ --- CTRL U
▕ --- CTRL V
┬ --- CTRL W
┴ --- CTRL X
▌ --- CTRL Y
└ --- CTRL Z
ESC --- ESC ESC
↑ --- ESC CTRL UP-ARROW
↓ --- ESC CTRL DOWN-ARROW
← --- ESC CTRL LEFT-ARROW
→ --- ESC CTRL RIGHT-ARROW
♦ --- CTRL .
♠ --- CTRL ;
↖ --- ESC SHIFT CLEAR
◀ --- ESC BACK S
▶ --- ESC TAB
▒ --- INVERSE CTRL ,
▒ --- INVERSE CTRL A
▒ --- INVERSE CTRL B
▒ --- INVERSE CTRL C
▒ --- INVERSE CTRL D
▒ --- INVERSE CTRL E
▒ --- INVERSE CTRL F
▒ --- INVERSE CTRL G
▒ --- INVERSE CTRL H
▒ --- INVERSE CTRL I
▒ --- INVERSE CTRL J
▒ --- INVERSE CTRL K
▒ --- INVERSE CTRL L
▒ --- INVERSE CTRL M
▒ --- INVERSE CTRL N
▒ --- INVERSE CTRL O
▒ --- INVERSE CTRL P
▒ --- INVERSE CTRL Q
▒ --- INVERSE CTRL R
▒ --- INVERSE CTRL S
▒ --- INVERSE CTRL T
▒ --- INVERSE CTRL U
▒ --- INVERSE CTRL V
▒ --- INVERSE CTRL W
▒ --- INVERSE CTRL X
▒ --- INVERSE CTRL Y
▒ --- INVERSE CTRL Z
▒ --- ESC DELETE
▒ --- ESC INSERT
▒ --- ESC CTRL TAB (CLR)
▒ --- ESC SHIFT TAB (SET)
▒ --- INVERSE SPACE
▒ --- INVERSE _
▒ --- INVERSE CTRL .
▒ --- INVERSE CTRL ;
▒ --- INVERSE |
▒ --- ESC CTRL 2
▒ --- ESC CTRL BACK S
▒ --- ESC CTRL INSERT



Assemble Some Sound

Part 2.

by Karl E. Wiegers

Part 1 of **Assemble Some Sound** (issue 33) presented fundamental concepts of sound generation on the Atari and illustrated basic audio techniques in assembly language. The final example showed how to play a simple tune in three-part harmony. Now, Part 2 explores some of the more elaborate sound capabilities. *Light torch. Grasp keyboard. Follow me. . .*

Macro sound.

So far, all of these examples have been written in Atari Assembler Editor format. Those of you using macro assemblers may detect the possibility of using a macro to eliminate the tedium of setting up each register whenever you want sound. Herewith, see Listing 1.

This example defines a SOUND macro which emulates the SOUND statement used in Atari Microsoft BASIC. It's just like the SOUND statement in regular Atari BASIC, but has a duration parameter added (in jiffies, of course).

This macro is defined for use with the Atari Macro Assembler, but it could be adapted for use with other macro assemblers. To use the macro, first include it in a SYSTEXT file or other source file in your own program. Then, to invoke it, use this format:

```
SOUND voice,pitch,distortion,volume,duration
```

The appropriate object code will be generated automatically. Don't forget to include the DELAY subroutine somewhere in your source program. A very short sample program is included in Listing 1, which uses this macro to play an undistorted middle C on audio channel 1 for 1.25 seconds (75 jiffies) at volume 8.

This SOUND macro sets the AUDFX register for the indicated voice, combines the specified distortion and volume, and stores the result in the correct AUDCX register, then sets the timer variable based on your duration.

After calling the DELAY subroutine, the macro stores a *0* in the frequency register to shut off the sound. Since the macro generates a new block of object code every time it is invoked, it's not ideal for use in a loop. However, this SOUND macro is very convenient for individual tones or short sequences. Plus, you could put the macro call in a subroutine and call it from elsewhere in a program with a JSR instruction, as often as necessary.

Using the VBI.

By now, you've probably thought that it's a shame to waste all the computing power of the Atari on a silly delay loop, simply doing nothing until we're done playing the sounds we want. Fortunately, the Atari

designers gave us an alternative.

We can take advantage of the precisely timed vertical blank interval to insert our own sound generating program as a vertical blank interrupt or VBI. During the vertical blank interval every sixtieth of a second, the computer does some housekeeping chores, and we can easily add our own tasks to that ritual. This way, the mainstream processing time of the computer goes on as usual, with our sound effects continuing in the background.

The use of a VBI is especially suited for programs in which repeating background music is desired, or programs which use continuous sound effects, such as the droning of engines or the relentless marching of alien invaders.

Listing 2 shows how to do it. This illustration contains a VBI suitable for use in a road racing game, in which the movement of a joystick plugged into port 1 is the means of adjusting the frequency of a distorted sound effect resembling a revving car engine.

As usual, the main program initializes POKEY and sets AUDF1 and AUDF2 (Lines 230-310). A distortion level of 6 gives a pretty good imitation of a race car engine. Since we can't read the POKEY registers to see what the current value of AUDF1 is, we've defined another variable called PITCH, which will always equal the contents of AUDF1. The equates also define variables needed to read the joystick deflection and to set up the VBI.

Lines 370-400 show how to begin a VBI routine. The low byte of the starting memory location of the VBI routine itself is stored in the Y-register of the 6502 microprocessor; the corresponding high byte goes into the X-register; and a value of 7 is placed in the accumulator.

After this, a JSR operation to the vertical blank entry point at hex location $E45C turns on our own VBI— you'll have to press SYSTEM RESET to turn it off in this example.

The procedure shown here establishes a "deferred" VBI, as opposed to an "immediate" VBI, which is handled exactly the same, except that a value of 6 is placed in the accumulator before the JSR SETVBV instruction. The deferred VBI is best for most applications.

The VBI routine itself is found in Lines 450-660. This program simply reads the joystick every sixtieth of a second and modifies the frequency in AUDF1 accordingly. If the stick is deflected forward, then the pitch value is decreased to get a higher frequency (remember that inverse relationship). Conversely, pulling the joystick toward you lowers the frequency, as if the car is slowing down.

Checks are included to make sure that the value in AUDF1 is always between 40 and 255. To RUN this program, I had to use the TRACE feature of the Atari Assembler Editor debugger. Simply RUNning the assembled program with a G3000 command in the debugger turned on the sound, but didn't enable the VBI properly for some reason.

So use a T3000 instruction after assembling and entering the debugger, and play with the joystick. Can't you just visualize the Grand Prix action which should accompany that roar? Using sound effects in a VBI like this adds a lot to a game, without distracting the microprocessor from all the other action going on.

More frequencies.

The limitations of an 8-bit register inflict a penalty on the precision and variety of frequencies which can be generated with a single sound channel. Eight bits only permit 255 distinct frequencies, although

(continued on page 28)

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we've seen how to shift the absolute frequency range by changing AUDCTL to other clock rates.

A more powerful option is available to give very fine frequency tuning. This is done by combining two sound channels into a single 16-bit frequency register, which yields over 65,000 distinct frequencies.

Again, AUDCTL holds the key. By setting bit 4 of AUDCTL (decimal value 16), you can combine channels 1 and 2 into a single voice, with AUDF1 being the low byte and AUDF2 the high byte of the resulting 16-bit frequency register.

Similarly, setting bit 3 (decimal 8) of AUDCTL joins AUDF3 and AUDF4. The control registers for the high bytes (AUDC2 and AUDC4) now govern the volume and distortion of the new double-sized frequency registers. Selecting an appropriate clock rate (by setting other bits in AUDCTL as discussed above) makes an enormous range of frequencies available.

Listing 3 shows off this new capability. This program uses two nested loops to increase the low byte (inside loop, X-register) and high byte (outside loop, Y-register) of the 16-bit voice created by joining channels 1 and 2. Lines 210-220 accomplish this fusion and also select the 1.79 MHz clock rate to get high frequencies.

Setting AUDCTL to 16 rather than 80 will give 16-bit sound at the normal 64 KHz clock rate, to create some very low frequencies indeed. Even at 1 jiffy per note, this program will take over 18 minutes to execute completely. If you can't wait that long, just press SYSTEM RESET.

Notice again that the highest frequencies drop fairly rapidly, but frequency changes get progressively slower as time goes on. If you want to hear the really low frequencies that can be produced with the 64 KHz clock (down to about 1 pulse per second), start with the Y-register at about 200 instead of 0 (Line 340). Y values of 5 and 10 are also amusing to try. Sixteen bits gives Atari audio a new dimension of sound quality.

More sound components.

All of our sample sounds so far have used tones with constant volume: just turn the sound on, wait a while and turn it off again. Most audio inputs we encounter in daily life are far more complex than that, however.

The volume characteristics of a tone can be described in terms of its attack (how rapidly the volume increases from 0 to maximum), sustain (how long the maximum volume is maintained) and decay (how quickly the volume diminishes back to 0). By manipulating these components of even a pure tone, much more interesting sounds can be produced. Listing 4 allows you to play with attack, sustain and decay.

Because we will sometimes want a very short attack or decay period, the timing method we've been using based on the real-time clock may actually be too slow. Thus, Listing 4 incorporates a different delay subroutine in Lines 540-590.

This is simply a nested loop using the X- and Y-registers of the 6502. The value in the X-register at the time the subroutine is called determines how many complete loops of the Y-register (0 to 255) will take place. So we can define our attack, sustain and decay times by setting the X-register to various values from 0 to 255 before the JSR DELAY instruction.

Unfortunately, these values no longer correspond to some actual unit of time; rather they're just arbitrary time units. Lines 110-130 define memory locations to hold the attack, sustain and decay values for convenience. Lines 260-310 show sample settings of these variables.

First, the attack. We begin at Line 320 by setting the volume to 0. In this case, distortion is 10 for a pure tone, but you might try other settings for special sound effects. The statements in Lines 330-400 increase the volume one unit at a time, up to a maximum of 10, pausing at each step for the time indicated by the contents of the variable ATTACK. The smaller the number in ATTACK, the faster the volume will rise from 0 to 10.

Lines 410-420 simply hold the tone at maximum volume for a time, based on the contents of SUSTAIN. Finally, Lines 430-510 form the decay routine, which is exactly the opposite of the attack segment. The particular settings of AUDF1, ATTACK, SUSTAIN and DECAY in Listing 4 will create a "pinging" tone with a short attack, moderate sustain and fairly long decay.

You can use the change memory command in the debugger to modify these values, so that you can try new sounds without reassembling the program. For a long attack and short decay, try setting AUDF1 to 200, ATTACK and SUSTAIN to 30, and DECAY to 5. A wide variety of inflections can be achieved through manipulation of these volume parameters.

Sound advice.

The sample programs and discussion in this article are meant just to open up some of the enormous sound-generating potential of the Atari, and to show how to implement some of the effects within assembly language programs.

This is by no means a complete discussion of the audio features lurking within the Atari. For example,

we've barely touched on the creative use of distortion or simultaneous playing of multiple voices with different characteristics to synthesize unusual sound effects.

It's always difficult for me to create just the sound effects I want. I encourage you to use the program examples presented here to experiment with the diversity of audio capabilities you have at hand.

More specific information about the life and times of POKEY can be found in *De Re Atari* and the *Atari Personal Computer System Hardware Manual*. *De Re Atari* has especially good discussions of the clocking operation's use to produce various output frequencies and the use of polynomial counters to create distorted sounds.

Many good sound editing programs are available to help you synthesize the sound you seek, and sample programs (generally in BASIC) show up all over the place for commonly used sound effects. You might also study program listings in books and magazines to see how other programmers cleverly generate their unique sound effects. But nothing will replace the trial-and-error method, and here you have the tools to help you get started. □

With his B.S., M.S. and Ph.D. degrees in chemistry, Karl E. Wiegers is a Senior Research Chemist at Eastman Kodak Company. He has worked with mainframe and microcomputers for fourteen years and has written for several computer magazines, with a number of applications programs published.

Listing 1.

```
;       Sound Example #6
;       by Karl E. Wiegers
;
;This macro can be used with the
;Atari Macro Assembler to simulate
;the SOUND command in Atari Microsoft
;BASIC.  It is like the SOUND
;statement in regular Atari BASIC,
;but with a duration parameter added.
;The duration is expressed in jiffies
;(1/60 second).  The following program
;illustrates how to use this macro.
```

(continued on page 31)

WHAT IS CHECKSUM DATA?

Most program listings in **ANALOG Computing** are followed by a table of numbers appearing as DATA statements, called "CHECKSUM DATA." These numbers are to be used in conjunction with **D:CHECK** and **C:CHECK** (which appeared in **ANALOG Computing** issue 16 and the **ANALOG Compendium**) or with **Unicheck** (from issue 24).

D:CHECK and **C:CHECK** (written by Istvan Mohos and Tom Hudson) and **Unicheck** (by Tom Hudson) are designed to find and correct typing errors when readers are entering programs from the magazine. For those readers who would like copies of these articles, you may send for back issue 24 ($4.00 each) or the **ANALOG Compendium** ($14.95 plus $2.00 shipping and handling from:

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```
;
;Here are the necessary equates:
;
RTCLOK  = $12
TIMER   = $CB
AUDF1   = $D200
AUDC1   = $D201
AUDCTL  = $D208
SKCTL   = $D20F
;
;Here is the macro itself.  VOICE can
;be 0-3, PITCH can be 0-255, DIST can
;be even values from 0-14, VOL can be
;0-15, and DUR can be 1-65535.
;
SOUND   MACRO VOICE,PITCH,DIST,VOL,DUR
        LDA #%2
        STA AUDF1+2*%1
        LDA #[[%3 SHL 4] OR %4]
        STA AUDC1+2*%1
        LDA #LOW %5
        STA TIMER
        LDA #HIGH %5
        STA TIMER+1
        JSR DELAY
        LDA #0
        STA AUDF1+2*%1
        ENDM
;
;Here is the sample program.  It plays
;an undistorted middle C at volume 8
;for 1.25 seconds (75 jiffies).
;
        ORG $3000
;
START   LDA #0
        STA AUDCTL
        LDA #3
        STA SKCTL
        SOUND 0,121,10,8,75
        BRK
;
;Here is the timing loop.
;
DELAY   LDA #0
        STA RTCLOK+1
        STA RTCLOK+2
LOOP1   LDA RTCLOK+1
        CMP TIMER+1
        BNE LOOP1
LOOP2   LDA RTCLOK+2
        CMP TIMER
        BNE LOOP2
        RTS
;
;Set up autorun feature so you can
;run this from the DOS menu with
;the L option.
;
        END START
```

Listing 2.

```
0100 ;   SOUND EXAMPLE #7
0110 ;   by Karl E. Wiegers
0120 ;
0130 ;This example uses a vertical
0140 ;blank interrupt routine to get
0150 ;continuous sound.  Use a
0160 ;joystick in port 1 to increase
0170 ;or decrease the frequency of
0180 ;the race car sound effect.
0190 ;Assemble, then run using the
0200 ;TRACE option in the debugger.
0210 ;
0220 RTCLOK   = $12
0230 TIMER    = $CB
0240 PITCH    = $CD
0250 AUDF1    = $D200
0260 AUDC1    = $D201
0270 AUDCTL   = $D208
0280 SKCTL    = $D20F
0290 STICK0   = $278
0300 SETVBV   = $E45C ;VBI entry point
0310 XITVBV   = $E462 ;VBI exit point
0320 ;
0330  *=$3000
0340 ;
0350  LDA #0
0360  STA AUDCTL
0370  LDA #3
0380  STA SKCTL
0390  LDA #100
0400  STA AUDF1
0410  STA PITCH
0420  LDA #104   ;distortion=6,volume=8
0430  STA AUDC1
0440 ;
0450 ;set up the vertical blank
0460 ;interrupt like this, where VBI
0470 ;is the label of the beginning
0480 ;of your VBI routine
0490 ;
0500  LDY #VBI&255
0510  LDX #VBI/256
0520  LDA #7
0530  JSR SETVBV
0540  BRK
0550 ;
0560 ;Here is the VBI routine itself
0570 ;
0580 VBI
0590  LDA STICK0   ;get stick reading
0600  AND #1       ;pointing up?
0610  BNE STICKDN  ;no, check for down
0620  LDA #40      ;yes,
0630  CMP PITCH    ;pitch at minimum?
0640  BEQ EXIT     ;yes, exit VBI
0650  DEC PITCH    ;reduce pitch value
0660  LDA PITCH    ;get it
0670  STA AUDF1    ;put in freq reg
0680  JMP EXIT     ;leave VBI routine
0690 STICKDN
0700  LDA STICK0   ;get stick reading
0710  AND #2       ;pointing down?
0720  BNE EXIT     ;no, exit VBI
0730  LDA #255     ;yes, check if
0740  CMP PITCH    ;pitch at maximum?
0750  BEQ EXIT     ;yes, exit VBI
0760  INC PITCH    ;no, increment it
0770  LDA PITCH    ;get it
0780  STA AUDF1    ;stuff in freq reg
0790 EXIT
0800  JMP XITVBV   ;leave VBI routine
0810  .END
```

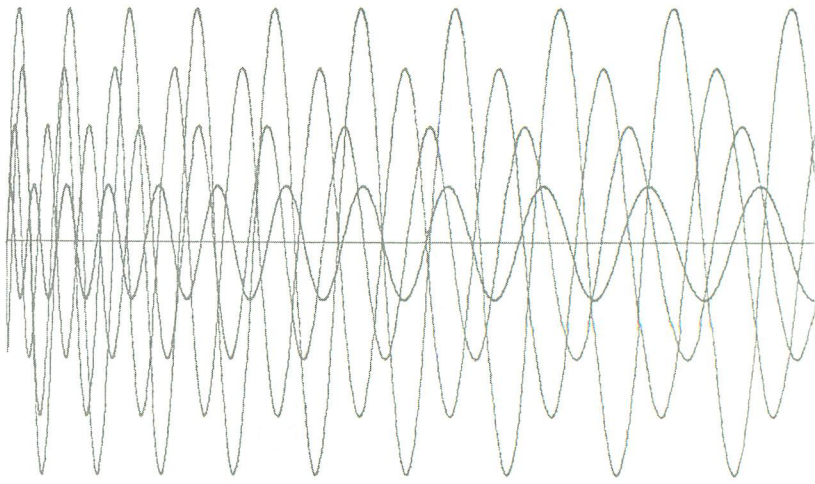
Listing 3.

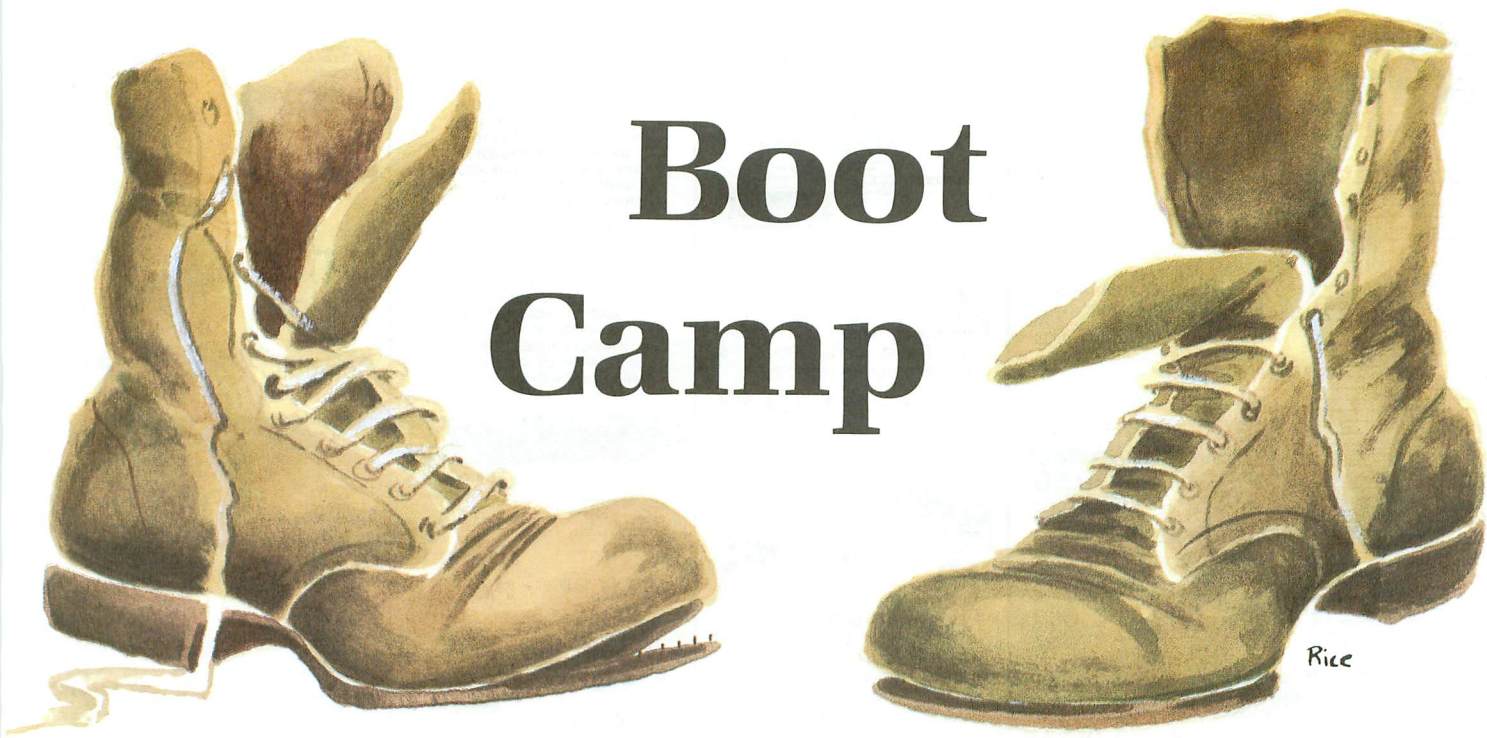
```
0100 ;   SOUND EXAMPLE #8
0110 ;   by Karl E. Wiegers
0120 ;
0130 ;This example plays all tones
0140 ;possible by joining channels 1
0150 ;and 2 to form a single 16-bit
```

```
0160 ;register.  Played at a rate of
0170 ;60 tones per second, it will
0180 ;take over 18 minutes to
0190 ;complete the program!  Press
0200 ;SYSTEM RESET to stop the sound.
0210 ;
0220 RTCLOK = $12
0230 TIMER  = $CB
0240 AUDF1  = $D200
0250 AUDC1  = $D201
0260 AUDF2  = $D202
0270 AUDC2  = $D203
0280 AUDCTL = $D208
0290 SKCTL  = $D20F
0300 ;
0310  *=$3000
0320 ;
0330  LDA #80       ;join channels 1+2
0340  STA AUDCTL    ;clock at 1.79 MHz
0350  LDA #3
0360  STA SKCTL
0370  LDA #160      ;turn off
0380  STA AUDC1     ;channel 1 volume
0390  LDA #168      ;normal channel 2
0400  STA AUDC2
0410  LDA #1        ;1 jiffy per tone
0420  STA TIMER
0430  LDA #0
0440  STA TIMER+1
0450  LDX #0
0460  LDY #0
0470  STY AUDF2     ;start with both
0480 NEXTTONE
0490  STX AUDF1     ;channels silent
0500  JSR DELAY
0510  INX           ;inc channel 1
0520  BNE NEXTTONE ;low byte
0530  INY           ;when X reaches 0
0540  STY AUDF2     ;again, increment
0550  BNE NEXTTONE ;channel 2 hi byte
0560  BRK           ;finally stop
0570 ;
0580 DELAY
0590  LDA #0
0600  STA RTCLOK+1
0610  STA RTCLOK+2
0620 LOOP1
0630  LDA RTCLOK+1
0640  CMP TIMER+1
0650  BNE LOOP1
0660 LOOP2
0670  LDA RTCLOK+2
0680  CMP TIMER
0690  BNE LOOP2
0700  RTS
0710  .END
```

Listing 4.

```
0100 ;   SOUND EXAMPLE #9
0110 ;   by Karl E. Wiegers
0120 ;
0130 ;In this program you can set
0140 ;the attack, sustain, and decay
0150 ;times for a tone to modify its
0160 ;acoustic character.  A different
0170 ;delay loop is used.  Times now
0180 ;are in arbitrary units, not
0190 ;jiffies.
0200 ;
0210 ;
0220 ATTACK = $CD
0230 SUSTAIN= $CE
0240 DECAY  = $CF
0250 AUDF1  = $D200
0260 AUDC1  = $D201
0270 AUDCTL = $D208
0280 SKCTL  = $D20F
0290 ;
0300  *=$3000
0310  LDA #0
0320  STA AUDCTL
0330  LDA #3
0340  STA SKCTL
0350  LDA #35       ;set frequency
0360  STA AUDF1     ;of channel 1
0370  LDA #2        ;set duration for
0380  STA ATTACK    ;attack,
0390  LDA #30
0400  STA SUSTAIN   ;sustain,
0410  LDA #30       ;and decay
0420  STA DECAY     ;portions of tone
0430  LDA #160      ;start w/volume off
0440 ATLOOP
0450  STA AUDC1     ;gradually increase
0460  LDX ATTACK    ;volume in a loop
0470  JSR DELAY     ;according to attack
0480  CLC           ;time set earlier
0490  ADC #1
0500  CMP #171      ;stop at volume = 10
0510  BNE ATLOOP
0520  LDX SUSTAIN   ;hold (sustain) tone
0530  JSR DELAY     ;for specified time
0540  LDA #169      ;start decreasing
0550 DKLOOP
0560  STA AUDC1     ;volume, just the
0570  LDX DECAY     ;opposite of attack
0580  JSR DELAY     ;technique used
0590  SEC
0600  SBC #1
0610  CMP #159      ;stop when volume=0
0620  BNE DKLOOP
0630  BRK
0640 ;
0650 DELAY
0660  LDY #0        ;this delay loop
0670 DELAY2
0680  DEY           ;uses X and Y regs
0690  BNE DELAY2    ;to loop as fast as
0700  DEX           ;the microprocessor
0710  BNE DELAY     ;will let you
0720  RTS
0730  .END
```





Boot Camp

by Tom Hudson

Last issue's **Boot Camp** introduced you to the exciting world of the Atari computers' Central Input-Output system, CIO. This issue, we'll conclude our examination of the CIO functions and write a short program demonstrating the various CIO routines.

If you haven't read last issue's **Boot Camp**, I suggest you do so before tackling this installment. There is a lot of background information you'll need to understand before trying to use these functions.

Reading records.

We've already seen how the Atari CIO routine can read and write individual characters. What happens when we want to work with whole sentences? Fortunately, CIO has the ability to work with data in sentence form as well, by using the GET and PUT RECORD commands.

The Atari CIO routines consider a "record" to be any group of characters which ends with the ATASCII end-of-line (EOL) character, *$9B* (*155* decimal). When typing, the EOL character is generated each time you press the RETURN key on your keyboard. Files such as LISTed BASIC and assembly language programs are lines of text terminated with EOLs. To read them, you would use the CIO GET RECORD command; to write them, you would use the CIO PUT RECORD command.

To use the GET RECORD command, you need to set the following IOCB parameters:

ICCMD — Set to $05
ICBAL & ICBAH — Pointer to start of input data buffer
ICBLL & ICBLH — Maximum number of bytes to read, including EOL.

This command is rather straightforward. When you call CIO, it will read characters from the specified file until an EOL character is read. The 2-byte pointer made up of ICBAL and ICBAH tells CIO the address where you want it to place the record read from the file. You must be sure that the 2-byte value ICBLL and ICBLH is set to the size of the buffer you've reserved, otherwise CIO may read in extra characters and wipe out important data that resides in the memory after the buffer.

You must also be sure that your input buffer is large enough to hold the biggest record that will be read from the file. If CIO reads a record too long to fit in the buffer, it will fill the buffer with as many characters as it can, then continue reading until an EOL character is read or the end of the file is reached.

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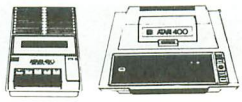

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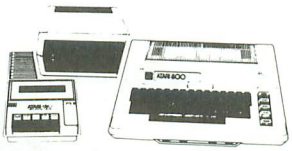

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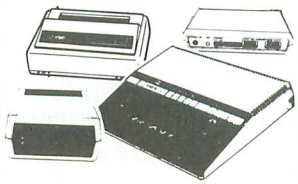

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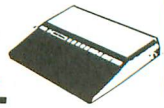

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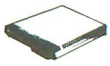

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All the characters read after the buffer is full will be discarded, and your program will never see them. After the EOL is read from the file, CIO places an EOL at the end of the buffer and returns an ERROR #137, to indicate that a "truncated record" was read. It's not a good practice to have records truncated in your programs, so just be sure you've made your buffer large enough to hold the largest record that's possible in the file.

Typical text files created by the Atari screen editor will have records of less than 128 characters. I usually allocate a 256-byte buffer for text I/O operations, to provide a wide safety margin.

After issuing a GET RECORD command, CIO will set the ICSTA (status) byte and the Y register to indicate the result of the input operation. It will also change the ICBLL and ICBLH bytes to inform you of the number of bytes that were actually read from the file. With a 256-byte buffer, the number of bytes read could range from 1 to 256. This number can come in handy in some types of I/O processing.

The example below shows a typical GET RECORD operation from a file. The IOCB used is number four, and is assumed to be open already.

```
0100     LDX #$40          ;IOCB #4
0110     LDA #$05          ;GET RECORD
0120     STA ICCMD,X       ;PUT IN IOCB 4
0130     LDA #BUFFER/256   ;PUT BUFFER...
0140     STA ICBAH,X       ;ADDRESS...
0150     LDA #BUFFER&255   ;IN IOCB...
0160     STA ICBAL,X       ;NUMBER 4
0170     LDA #256/256      ;PUT NUMBER...
0180     STA ICBLH,X       ;OF BYTES...
0190     LDA #256&255      ;IN IOCB...
0200     STA ICBLL,X       ;NUMBER 4
0210     JSR CIOV          ;GET RECORD!
0220     BPL RECOK         ;NO ERROR!
0230     CPY #137          ;TRUNCATED?
0240     BEQ TRUNREC       ;YES!
0250     CPY #136          ;END-OF-FILE?
0260     BEQ EOFILE        ;YES!
0270 BUFFER *=*+256        ;RESERVE BUFFER
```

Line 100 of this code tells the CIO that it is to use IOCB number four for this I/O operation. Remember, the IOCB number is passed to CIO through the X register, and is the value of the IOCB number times 16. Fortunately for us humans, who don't *enjoy* working in base 16, this number works out nicely: IOCB number 0 is indicated by *$00, IOCB number 1 by $10,* IOCB number 2 by *$20,* and so on.

Lines 110-120 set the CIO command byte (ICCMD) in IOCB number four (indexed by the X register) to *$05,* the command byte for the GET RECORD command.

Lines 130-160 set the ICBAL and ICBAH bytes to point to the input buffer we've set up at Line 270. All characters read from the file will be placed in memory starting at this address.

Lines 170-200 set ICBLL and ICBLH to the length of our data buffer. It's been set up to hold 256 bytes, so we place the value 256 into the ICBLL and ICBLH bytes. It's important that you always set these bytes to the buffer length—if this value is smaller than the buffer size, you may get a truncated record error; if it's larger than the buffer, the GET RECORD operation may wipe out important data that follows the buffer.

Line 210 jumps to the CIO subroutine vector, CIOV, to perform the GET RECORD function. After CIO has completed the I/O operation, it will return to this point in the code.

Line 220 branches to the label RECOK, if the GET RECORD operation was completed successfully. Remember, if CIO returns with a negative value in the Y register, some sort of error has occurred, and your program must take the appropriate action. The BPL RECOK instruction is only executed if the Y register is POSITIVE (after a JSR CIOV call, the sign flag contains the status of the Y register), indicating a successful operation.

Lines 230-240 compare the Y register to the value 137, the error code for a truncated record. As indicated above, the truncated record error lets you know that the I/O buffer was too small for the record you tried to read. In the case of this example, a truncated record error would occur if the code tried to get a record longer than 256 bytes. If the error is equal to 137, the program branches to the label TRUNREC, where appropriate code would handle the error and report it to the user.

Lines 250-260 check to see if the error that occurred was a 136, or an end-of-file condition. If so, the program branches to the label EOFILE, where the file would be closed, and processing would continue.

Testing for other errors could also be added, if necessary. I've only showed a couple of the possible tests, so you can see how they would be handled.

Putting records.

As with the GET CHARACTERS command discussed last issue, the GET RECORD command has an output counterpart, known as the PUT RECORD command. It works just like the GET RECORD command, but, instead of reading records from an I/O device, it writes them. Let's see how it works.

The following fields must be set up in the IOCB before executing the PUT RECORD command:

ICCMD — Set to $07

ICBAL & ICBAH — Two-byte pointer to output data buffer
ICBLL & ICBLH — Two-byte value indicating maximum data length

Like the GET RECORD function, the PUT RECORD function operates on data that is terminated with the EOL character (ATASCII 155 decimal, $9B hex). The file that you're writing to must be opened for either output or input/output operations.

The PUT RECORD function is also similar to the GET RECORD function in that the ICBAL and ICBAH values must be set to the starting address of the data buffer.

The ICBLL and ICBLH values are similar to those used by the GET RECORD command, in that they tell CIO the maximum number of bytes contained in the buffer. When the PUT RECORD command is issued, CIO will write bytes to the output device until it sends an EOL character or reaches the end of the data buffer.

If the end of the buffer is reached before an EOL character is encountered, it will automatically send the EOL character to the file for you. It's better programming practice, however, to make sure your output buffer contains an EOL character. It is always better to rely on your own programming than to assume that the system will do the operation for you.

The following example shows how to write a text message to a file. The program assumes that IOCB number three is already opened as output to some I/O device. It could be a printer, disk drive, screen or any other I/O device, but it doesn't matter as far as our program is concerned—CIO's "device independence" lets us perform most I/O operations without regard to what type of device we're using.

```
0100     LDX #$30          ;IOCB #3
0110     LDA #$09          ;PUT RECORD
0120     STA ICCMD,X       ;PUT IN IOCB 3
0130     LDA #RECORD/256   ;PUT BUFFER...
0140     STA ICBAH,X       ;ADDRESS...
0150     LDA #RECORD&255   ;IN IOCB...
0160     STA ICBAL,X       ;NUMBER 3
0170     LDA #92/256       ;PUT NUMBER...
0180     STA ICBLH,X       ;OF BYTES...
0190     LDA #92&255       ;IN IOCB...
0200     STA ICBLL,X       ;NUMBER 3
0210     JSR CIOV          ;PUT RECORD!
0220 RECORD .BYTE "THIS IS A TEST",$9B
```

Line 100 of this example sets the X register to *$30*, indicating that we're using IOCB number three for our output operation.

Lines 110-120 set the CIO command byte to *$09*, telling CIO that the command we're issuing is a PUT RECORD command.

Lines 130-160 point the ICBAL and ICBAH pointer to our I/O record, which, in this case, is a simple string in Line 220 stating, *THIS IS A TEST*. Note that the text is terminated with the ATASCII EOL character, *$9B*. More on this in a moment.

Lines 170-200 set the CIO buffer length to 92. This is obviously longer than our short message, but that's all right—CIO will stop as soon as it reaches the EOL character at the end of the message. What if we had not included the EOL? CIO would simply keep sending characters until all 92 were sent or an EOL had been encountered in the memory following the message. The moral: *Always specify an EOL character at the end of each text string!*

Line 210 calls CIO to perform the PUT RECORD operation.

Upon return from the CIOV subroutine, the Y register and ICSTA location will contain the result of the output operation. A successful operation will result in a status value of *$01*, while an error will give a result of *$80* or greater.

Finding the status.

There are times when you'll want to get the current status of an I/O device without actually performing a function that will transfer data. CIO provides a special STATUS function to let you do this quickly and easily.

In order to execute the STATUS function, you must set the following IOCB parameters:

ICCMD — Set to $0D
ICBAL & ICBAH — Pointer to device/filename specification if the file isn't already open

As with the other commands used by CIO, the command byte tells the CIO subroutine what function it's to perform. For the STATUS command, the command byte is *$0D*.

The second setting for the STATUS command, ICBAL and ICBAH, is optional. If you want to check the status of the device and the IOCB is already opened to that device, you don't need to set this parameter.

If the IOCB isn't already opened, you must set the ICBAL and ICBAH bytes to point to a string which indicates the device (and the filename, if applicable) you want to check. Let's look at two examples:

```
0100     LDX #$10          ;IOCB #1
0110     LDA #$0D          ;STATUS...
0120     STA ICCMD,X       ;IN IOCB #1
0130     JSR CIOV          ;GET STATUS!
```

The above code shows how to check the status of

a device if the IOCB is already opened to it. All you need to do is specify the IOCB number in the X register (Line 100), set the command number to *$0D* (Lines 110-120), and call the CIO subroutine (Line 130). CIO will return the device status in the ICSTA location and the Y register, as well as 4 bytes from the device controller in the DVSTAT locations, from $2EA to $2ED in memory.

Location $2EA in DVSTAT contains device error status and command status information as follows:

Bit	Meaning
0	Invalid command frame received.
1	Invalid data frame received.
2	Output operation error.
3	Write-protected disk.
4	System inactive (on standby).
7	Intelligent peripheral controller.

Location $2EB in DVSTAT holds device status information. For the disk drive, it contains information from the drive's controller chip status register.

Location $2EC in DVSTAT contains the maximum device timeout value in seconds.

Location $2ED in DVSTAT contains the number of bytes in the output buffer.

When the device whose status you wish to check on isn't open, you must use the "implied open" option of the STATUS command. Here's an example:

```
0100     LDX #$40          ;IOCB #4
0110     LDA #$0D          ;STATUS...
0120     STA ICCMD,X       ;IN IOCB #4
0130     LDA #DEVICE/256   ;PUT DEVICE...
0140     STA ICBAH,X       ;ADDRESS...
0150     LDA #DEVICE&255   ;IN...
0160     STA ICBAL,X       ;IOCB #4
0170     JSR CIOV          ;GET STATUS!
0180 DEVICE .BYTE "R:",$9B
```

Line 100 of this code sets the X register to *$40*, indicating that the command is to use IOCB number four.

Lines 110-120 set the CIO command byte to *$0D* (STATUS).

Lines 130-160 set the ICBAL and ICBAH pointer to point to the string located at the label DEVICE. This string indicates the device we want to check the status of, and must be terminated by an EOL character. In this particular example, we're checking the status of *R:*, the number one RS-232 port of the 850 interface module. You could have specified any device or device:filename specification.

Line 170 executes the usual CIO subroutine, CIOV. CIO will perform an implied OPEN operation, check the status of the device, CLOSE the device, and return to the calling program. Upon return, you can examine the ICSTA location, Y register, and the contents of the four DVSTAT bytes.

Line 180 contains the device which is to be examined for status information. Always be sure you terminate device name strings with the EOL character (*$9B*).

Special functions.

One of the nice things about CIO is that you can write your own custom device handlers with functions that are unique to that device. For example, the disk file system used by the Atari computers has several functions that other devices, such as cassette drives, cannot use. In these cases, the device drivers can be written to use command numbers greater than *$0D*. These commands are known as "special" commands.

Special command values are specified by the device they're to be used with, and we'll cover them as required in future installments. Right now, let's write a program that uses some CIO calls!

(continued on page 54)

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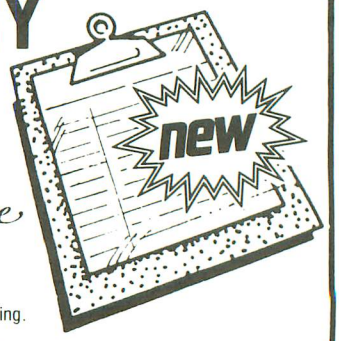

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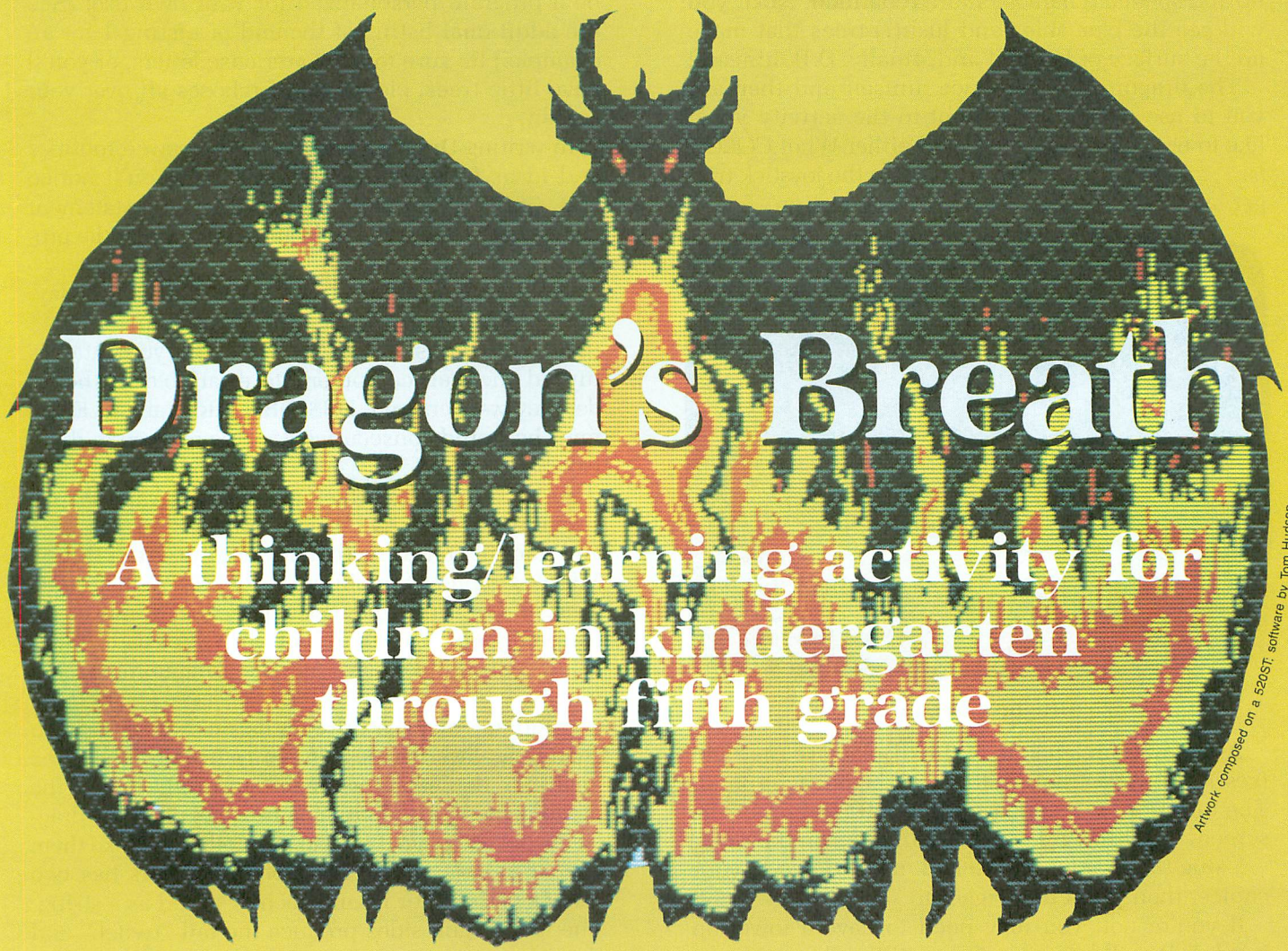


Dragon's Breath

A thinking/learning activity for children in kindergarten through fifth grade

Artwork composed on a 520ST; software by Tom Hudson

by Larry W. Linson

Hidden beneath the blue skies, green trees and thick underbrush of the deserted planet Leimart, there lives the last of a dying breed, a dragon named D.B. This somewhat friendly reptile loves children, puppies and other neat things. . . and he'd love to have *you* for lunch sometime!

D.B. has a thinking activity called **Dragon's Breath** for young children to play. The activity has two categories—*What COLOR is. . .?* and *What doesn't belong?* Both quiz a child on his or her thinking skills, in different ways.

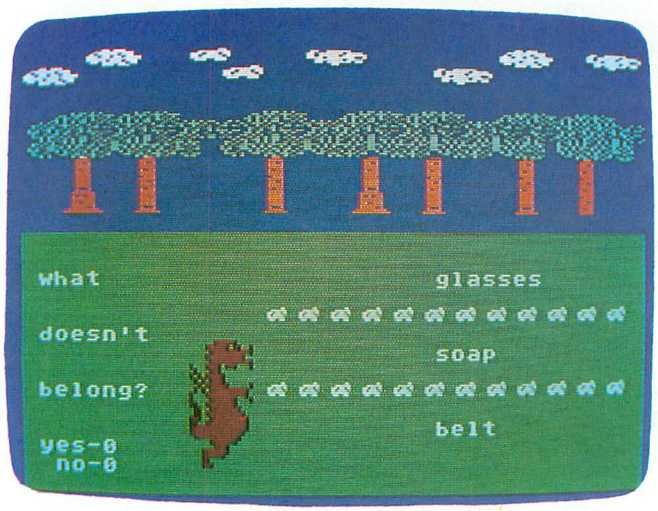
What COLOR is. . .? asks children to identify the color associated with some common (and some not-so-common things) in the world around them. *What doesn't belong?* is a classifying activity. Three words are listed, such as: *light, lamp* and *chair.* The child needs to identify which of the three words does not belong in the group. D.B. keeps score and reports after each answer.

Dragon's Breath may be a bit difficult for some very young children to do independently. With the help of a parent or older sibling, though, it will be an enjoyable learning experience for any child.

The program is set down in a fairly logical order.

After the title page is displayed, the screen will blank for about nine seconds as the new display list is set up and special "characters" are redefined. Next, you will see the blue skies and lush(?) trees that make up the surface of Leimart and, finally, D.B. himself!

The dragon will introduce himself and then ask you to use a joystick to point to the activity you'd like to try. After you've selected either *What COLOR is. . .?* or *What doesn't belong?*, press the joystick trigger, and D.B. will go get the first question.



Dragon's Breath.

At the bottom left side of the display are the right (*yes*-) and wrong (*no*-) running totals for each round. The question will appear on the left portion of the screen, with the three possible answers on the right.

Using the joystick, move D.B. up or down to your choice, then press the trigger to see if you're right!

If you're not, you may need to have a towel on hand. D.B. will keep counting until you have ten correct answers, then you can try the other activity. If you want to change levels in the middle of a game, press the START key, and D.B. will return to the main menu.

It would not be too difficult for someone even remotely familiar with BASIC programming to change the questions in this program. It *could* be a math program, or a history test, or even a trivia quiz. . . I've included a listing with trivia questions which can be ENTERed into this program; more later.

To do this on your own, all you need change are the DATA statements in Lines 540-880 and 970-1310. Be sure to follow the pattern established in each of the READ statements (360 and 920). If you're careful, you could even change the READ statements to fit your needs.

After that, all you'd have to do is change the clues in Lines 3050 and 3060, and **Dragon's Breath** would be a program personalized for your own use! (See the additional listing at the end of Listing 1 for an example.) Be sure to use *lower case* letters, or you'll have little trees, clouds and firehoses all over your screen.

In writing **Dragon's Breath**, I've borrowed routines and ideas from a number of sources. You'll notice that, in the program listing, a DIMension statement comes before the REM statements identifying the program.

This is because I used a method called "overlaying" for the player/missile graphics. It's important that this be the first statement entered after your Atari is turned on. Atari computers store variables in the order they were entered. DB$, DB2, FIRE$ and CLEAR$ must be stored consecutively, or the method will not work.

As you can see, in this method, the player shapes are stored in strings. A more complete explanation and tutorial on this method is found in "Atari Player/Missile Graphics Simplified" (*COMPUTE!* magazine, June, 1983). I like this method because it makes for extremely quick vertical motion, which is difficult using conventional player/missile programming techniques.

Another great feature of this method is ease in changing player shapes. **Dragon's Breath** uses three "players," one each for the left and right side of the dragon, and a third for the flame/ashes. The two dragon shapes are placed next to each other to make them appear as one shape. Each of the players has two shapes defined for it, and each is stored as a string. The left dragon sides produce the tail "twitch" and flapping wings, and the right sides open and close D.B.'s mouth.

The flame and the burning ashes are really the same player displaying different shapes. The shapes are flipped back and forth to produce an animated sequence. This is an extremely versatile and easy-to-use player/missile graphics method.

I used **Create-A-Font** from **ANALOG Computing**'s issue 16 to create the special characters in the program. If you haven't typed in **Create-A-Font** yet, I suggest you start *right after* you type in **Dragon's Breath**. It's well worth the effort.

I also worked with **Create-A-Font**'s companion program, **Font Datamaker** (**ANALOG Computing**, issue 22), to include the redefined characters made with **Create-A-Font** in my program.

(continued on page 42)

Program description.

Here's a section-by-section description of the **Dragon's Breath** program. I'll point out special features of interest as we go along.

Lines 10-60 — Send program to title screen, initialize variables, set up new display list and redefine some characters.

Lines 70-100 — Wing flap routine for dragon.

Lines 110-180 — D.B. breathes fire here.

Lines 190-290 — If response is incorrect, D.B. gets "hosed" off.

Lines 300-390 — Randomly select one of the question and answer statements and print it on the screen.

Lines 400-490 — Reward sequence.

Lines 500-520 — D.B.'s tail wag.

Lines 530-880 — DATA statements for *What COLOR is. . .?* Each statement includes three possible answers and the row containing the correct answer.

Lines 890-900 — Clear player image for upcoming move.

Lines 910-960 — Question routine for *What doesn't belong?*

Lines 970-1310 — DATA statements for *What doesn't belong?*

Lines 1320-1760 — Initialization routine for the player/missile graphics. DB$, DB2$, FIRE$ are the players, which can either have the form of D.B. (DB$,DB2$) or be transparent (CLEAR$), aiding movement. This section also sets up the vertical and horizontal position of D.B. and includes the joystick routine for moving D.B. and selecting an answer.

Lines 1770-2060 — Give the child a choice of which activity to try.

Lines 2070-2140 — The ending sequence that tells the player how he/she did and sets the program up to go again.

Lines 2150-2180 — This routine acts as a delay timer.

Lines 2190-2370 — D.B. is introduced, and the game is described.

Lines 2380-2390 — Erase the bottom half of the screen when needed.

Lines 2400-2550 — A new display list is defined, with the top half of the screen in graphics 2 and the bottom in graphics 0. The screen colors are POKEd into place, and the clouds and trees are printed on the screen.

Lines 2560-2920 — New characters are defined for use in the program.

Lines 2930-3130 — Variables are dimensioned or defined here, including the title page. Numeric variables are used for numbers that come up often. Every time a number is used, it takes up 7 bytes of memory, as opposed to 1 byte for a numeric variable. I knocked off over 2K (2000 bytes) from this program by replacing often-used numbers with variables!

Trivia test.

Listing 2 is a series of trivia questions that you can add to **Dragon's Breath**, instead of *What COLOR is. . .?* If you want to do this, type these line numbers instead of Line 360 and 370, 530-880 and Lines 3115 and 3125 of Listing 1.

If you'd like to have both, then you'll need two versions of the program. Don't panic; here's how to do just that:

1. Type in the original program, Listing 1.
2. LIST it to the disk or cassette.
3. Check the program with **Unicheck**.
4. Make any corrections and SAVE it to cassette or disk as D:DRAGON.1.
5. Type *new*, then type Listing 2 into your computer.
6. LIST it to cassette or disk as D:TRIVIA.LIST.
7. Check this with the appropriate checking program.
8. LIST the corrected version to disk or cassette.
9. LOAD D:DRAGON.1 or CLOAD the program from cassette, then ENTER C: or ENTER D:TRIVIA.LST.
10. Now SAVE D:DRAGON.TRV (for trivia) or CSAVE.

You'll now have two versions of **Dragon's Breath**—the original and the trivia version.

My thanks go to Charles Bachand and Lee Pappas of **ANALOG Computing** for all their help and suggestions on my original **Dragon's Breath**. They forced me to try new techniques and to be more creative, resulting in a far more entertaining program. □

Larry W. Linson has taught first, second and fourth grades, and special education classes, since graduating from Miami University in Ohio. He uses two Atari computers in his fourth grade classroom. This is Larry's second program for ***ANALOG Computing****. **What is it?** appeared in issue 20.*

(Variable Table and listings start on page 44)

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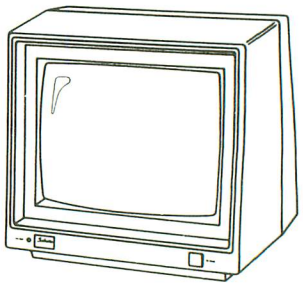

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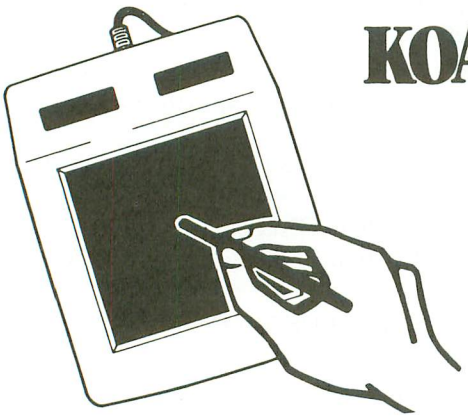

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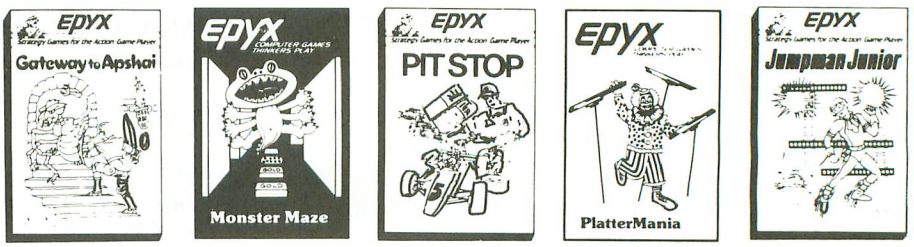

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Variable table.

DB$,DB2$,FIRE$, CLEAR$	Store player shapes as strings, holding either the value of the dragon or of the blank player.
DRAGL$,DRAGR$, DRAGT$,TAIL$,DRFR$, BOF$,ASH$,BLAST$	Left side, right side of dragon, along with twitching tail and fire ball.
WAIT	Holds the line number for the routine that acts as a delay in the program.
Q0,Q1,Q2,Q3,Q4. . .	Hold value of numbers 0-10 and others.
FIRE$	Any self-respecting dragon has this.
TGROW	The TarGet ROW of D.B.'s breath.
CROW	Correct ROW, with the right answer.
REWARD	Routine to reward a correct response.
JIF, TICK	Used as the timer in the WAIT routine, JIF holds the amount of time to WAIT.
H2O$	This cools an incorrect D.B. off.
DBCOL,DBCOL+1, DBCOL+2	Hold memory location 704 (750 and 706), which determines players' colors.
RA & WA	Number of Right/Wrong Answers.
RAL & WAL	Lines where running totals will print.
CO$	A blank used to Clear Out specific parts of the screen.
QUIZ	The question routine.
ERASE	Clears the entire bottom half of screen.
DIVID$	Line of rocks that DIVIDe the possible answers from each other.
H1$,H2$,AN1$,AN2$, AN3$	Hold questions and answers from DATA statements; check for correct answers.
PM,DISP,ADD,PMHI, PMLO	Used in the player/missile graphics setup.
MENU	Tells the program whether it needs to go to the introduction or the menu.
Y1	Holds the vertical position of players.
DB,DB+1,DB+2	Store locations 53248 to 53250, to determine the players' horizontal position.
QUEST	The current DATA statement (questions and answers) being used.
CAT1$,CAT2$,ICAT1$, ICAT2$	Hold the title of the CATegories, and their Inverse counterparts.
TTOP$,TOP$,BOT$	Make up the leaves of the trees.
TRE$,TNK$	Make up the trunks of the trees.
BCLD$,MCLD$,LCLD$	Big, Medium and Little CLouDs.
DL,Z1,Z2	Used in the display list routine.
CHI,CHSET,XFR$	Routine from **Font Datamaker** which redefines special characters.
X,T,D,K,J	Used as counters.
SO1,SO2	Hold memory locations 53760 and 53761 to sound wing flap and tail wag.
MU	Used in musical reward for a correct answer.
FLAP	A routine that literally "wings it."
BLNK	Clears players for upcoming movement.
AB,BC	Determine location of FIRE$ on screen.
MKR	Tells wing flap and fire breath whether introducing the activity or in the game.

Listing 1.

```
10 DIM DB$(128),DB2$(128),FIRE$(128),C
LEAR$(128),DRAGL$(31),DRAGR$(29),DRAGT
$(31),BOF$(31),DRFR$(29),TAIL$(31)
20 DIM ASH$(31),BLAST$(31),XFR$(28)
30 REM  DRAGON'S BREATH.3
40 REM  Larry W. Linson
50 WAIT=2160:GOSUB 2940:GOSUB 2410:POK
E 16,Q64:POKE 53774,Q64
60 SOUND Q0,Q0,Q0,Q0:GOSUB 1780:GOTO 1
610
70 REM FLAP
80 DB2$(Y1)=DRAGT$:DB$(Y1)=DRAGR$:JIF=
Q1:GOSUB WAIT:FOR K=Q6 TO Q0:POKE 501,
195:POKE 502,K:NEXT K
90 GOSUB WAIT:POKE 502,Q0:DB$(Y1)=DRAG
R$:DB2$(Y1)=DRAGL$:JIF=Q1:GOSUB WAIT:F
OR K=Q0 TO Q6:POKE 502,K:NEXT K
100 GOSUB WAIT:POKE 502,Q0:RETURN
110 REM FLAME
120 AB=108:BC=160
130 FOR X=Q1 TO Q2:GOSUB FLAP:NEXT X:D
B$(Y1)=DRFR$
140 FOR X=Q0 TO 39 STEP Q2:POKE 502,Q1
3:POKE 501,X:NEXT X:POKE 501,X:POKE 50
2,Q13
150 POKE DB+Q2,AB:POKE DBCOL+Q2,Q30:FI
RE$(Y1)=BOF$:FOR D=Q1 TO Q5:NEXT D
160 FOR X=AB TO BC:POKE DB+Q2,X:NEXT X
:POSITION Q20,TGROW:? CO$:JIF=Q4:GOSUB
 WAIT:FIRE$(Y1)=BLAST$:GOSUB WAG
170 IF MKR=Q1 THEN RETURN
180 IF TGROW=CROW THEN 410
190 REM HOSE
200 JIF=Q5:GOSUB WAIT:SOUND Q0,Q0,Q0,Q
0:FIRE$=CLEAR$
210 POSITION 33,TGROW:? "WXYZYZ":JIF=Q
15:GOSUB WAIT
220 POKE 501,Q3:POKE 502,Q6:POSITION Q
13,TGROW:? H2O$:POKE DBCOL,Q46:POKE DB
COL+Q1,Q46:DB2$(Y1)=TAIL$
230 POKE DBCOL+Q2,150:JIF=Q10:GOSUB WA
IT
240 WA=WA+Q1:POSITION Q5,WAL:? WA:JIF=
Q5:GOSUB WAIT
250 POSITION Q13,TGROW:? CO$;"       "
:POKE DBCOL,Q32:POKE DBCOL+Q1,Q32:POKE
 502,Q0
260 POKE DBCOL+Q2,Q14:DB2$(Y1)=DRAGL$
270 FOR D=Q7 TO Q15 STEP Q4:POSITION Q
26,D:? "       ":NEXT D:POKE Q77,Q0
280 DB$(Y1)=DRAGR$:IF QUIZ=970 THEN 94
0
290 GOTO 370
300 REM  QUIZ
310 GOSUB ERASE:POSITION Q15,Q9:? DIVI
D$:POSITION Q15,Q13:? DIVID$
320 WAL=Q17:RAL=WAL-Q1:FOR Z2=Q0 TO Q3
5
330 K=INT(PEEK(53770)*Q35/Q256)*Q10
340 NEXT Z2:RESTORE QUIZ+K
350 IF QUIZ=970 THEN 920
360 READ H1$,H2$,AN1$,AN2$,AN3$,CROW
370 POSITION Q1,Q8:? "what":POSITION Q
1,Q10:? "color":POSITION Q1,Q12:? H1$:
POSITION Q1,Q14:? H2$
380 POSITION Q26,Q7:? AN1$:POSITION Q2
6,Q11:? AN2$:POSITION Q26,Q15:? AN3$
390 POSITION Q1,RAL:? "yes-";RA:POSITI
ON Q2,WAL:? "no-";WA:RETURN
400 REM REWARD
410 JIF=Q5:GOSUB WAIT
420 POKE DB+Q2,160:POKE DBCOL+Q2,Q0:FI
RE$(Y1)=ASH$:RA=RA+Q1:POSITION Q5,RAL:
? RA:POKE 502,Q0
```

```
430 IF RA=Q1 OR RA=Q3 OR RA=Q5 OR RA=Q
7 OR RA=Q9 THEN RESTORE 460
440 IF RA=Q2 OR RA=Q4 OR RA=Q6 OR RA=Q
8 OR RA=Q10 THEN RESTORE 470
450 FOR X=Q1 TO Q20:READ MU:POKE 710,X
+50:SOUND Q0,MU,Q10,Q6:FOR D=Q1 TO Q10
:NEXT D:NEXT X:POKE 710,180
460 DATA 80,80,95,95,95,80,80,113,113,
113,0,0,100,100,80,80,100,100,95,95,95
470 DATA 133,133,133,95,100,95,95,142,
142,100,100,0,0,0,95,95,142,142,133,13
3
480 POKE 501,Q0:JIF=Q20:GOSUB WAIT:DB$
(Y1)=DRAGR$:FIRE$=CLEAR$
490 JIF=Q20:GOSUB WAIT:GOTO 1620
500 REM WAG
510 FOR X=Q1 TO Q3:DB2$(Y1)=TAIL$:SOUN
D Q0,Q32,Q0,Q3:FOR D=Q1 TO Q21:NEXT D:
DB2$(Y1)=DRAGL$:POKE 502,Q0
520 FOR D=Q1 TO Q21:NEXT D:NEXT X:RETU
RN
530 REM COLOR
540 DATA is the,sun?,yellow,blue,brown
,7
550 DATA is the,sky?,blue,orange,pink,
7
560 DATA are,apples?,brown,grey,red,15
570 DATA is a,football?,brown,blue,whi
te,7
580 DATA is,grass?,red,green,purple,11
590 DATA is the,night sky?,green,orang
e,black,15
600 DATA is,snow?,white,black,purple,7
610 DATA are,lemons?,green,yellow,blue
,11
620 DATA are,watermelons?,black,pink,g
reen,15
630 DATA are,golfballs?,white,black,br
own,7
640 DATA are,elephants?,pink,gray,oran
ge,11
650 DATA are,alligators?,green,blue,re
d,7
660 DATA is a,potato?,yellow,brown,bla
ck,11
670 DATA is a,tomato?,brown,white,red,
15
680 DATA is a,carrot?,orange,red,pink,
7
690 DATA is cheddar,cheese?,yellow,red
,white,7
700 DATA is a,lime?,yellow,red,green,1
5
710 DATA are,sharks?,gray,blue,brown,7
720 DATA is a,pumpkin?,brown,orange,bl
ue,11
730 DATA is a,swan?,brown,yellow,white
,15
740 DATA are,oceans?,blue,red,black,7
750 DATA are,bananas?,yellow,black,blu
e,7
760 DATA is grape,jelly?,blue,purple,g
reen,11
770 DATA is peanut,butter?,black,pink,
brown,15
780 DATA is,butter?,yellow,purple,whit
e,7
790 DATA is,lettuce?,black,green,orang
e,11
800 DATA is a,radish?,brown,yellow,red
,15
810 DATA are,basketballs?,orange,black
,white,7
820 DATA are,stop signs?,blue,red,yell
ow,11
830 DATA are,car tires?,brown,pink,bla
ck,15
840 DATA is strawberry,jelly?,blue,red
,green,11
850 DATA is a,baseball?,blue,black,whi
te,15
860 DATA are,clouds?,yellow,white,red,
11
870 DATA is a,cardinal?,red,blue,black
,7
880 DATA is a,hockey puck?,red,brown,b
lack,15
890 REM BLANK
900 DB$=CLEAR$:DB2$=CLEAR$:FIRE$=CLEAR
$:RETURN
910 REM DOESN'T BELONG
920 READ AN1$,AN2$,AN3$,CROW
930 POSITION Q1,Q7:? "what":POSITION Q
1,Q10:? "doesn't":POSITION Q1,Q13:? "b
elong?"
940 POSITION Q1,RAL:? "yes-";RA:POSITI
ON Q2,WAL:? "no-";WA:JIF=Q0
950 POSITION Q26,Q7:? AN1$:GOSUB WAIT:
POSITION Q26,Q11:? AN2$:GOSUB WAIT
960 POSITION Q26,Q15:? AN3$:RETURN
970 DATA car,dog,truck,11
980 DATA blue,red,book,15
990 DATA radio,flower,tree,7
1000 DATA piano,shoe,trumpet,11
1010 DATA dime,penny,bat,15
1020 DATA paper,orange,watermelon,7
1030 DATA pencil,tv,pen,11
1040 DATA shirt,sweater,picture,15
1050 DATA computer,horse,cow,7
1060 DATA snow,sand,ice,11
1070 DATA ball,bat,matches,15
1080 DATA elephants,cows,pigs,7
1090 DATA robins,penquins,eagles,11
1100 DATA water,milk,ham,15
1110 DATA bowl,glass,cup,7
1120 DATA pants,blanket,socks,11
1130 DATA grass,lettuce,rocks,15
1140 DATA table,oven,fire,7
1150 DATA chair,wall,sofa,11
1160 DATA horse,bike,light,15
1170 DATA table,printer,monitor,7
1180 DATA glasses,soap,belt,11
1190 DATA trunk,box,show,15
1200 DATA fork,bowl,dish,7
1210 DATA run,have,walk,11
1220 DATA talk,sing,run,15
1230 DATA pants,blanket,socks,11
1240 DATA tomato,glove,apple,11
1250 DATA coat,shirt,quilt,15
1260 DATA hippo,cat,dog,7
1270 DATA apple,chair,desk,7
1280 DATA car,dog,truck,11
1290 DATA apple,pear,chair,15
1300 DATA horse,house,cabin,7
1310 DATA socks,shoes,hat,15
1320 REM P-M INIT
1330 RESTORE 1340:FOR X=Q1 TO Q29:READ
 T:DRAGR$(X)=CHR$(T):NEXT X
1340 DATA 0,0,240,217,255,252,255,113,
0,128,128,193,254,254,241,240,248,252,
254,254,254,252
1350 DATA 248,240,192,192,128,0,0
1360 FOR X=Q1 TO Q29:READ T:DRFR$(X)=C
HR$(T):NEXT X
1370 DATA 0,0,241,219,252,248,252,115,
1,128,128,193,254,254,241,240,248,252,
254,254,254,252
1380 DATA 248,240,192,192,128,0,0
1390 FOR X=Q1 TO Q31:READ T:DRAGL$(X)=
CHR$(T):NEXT X
1400 DATA 0,0,3,15,7,15,7,143,71,175,8
7,47,87,143,135,207,103,111,231,207,25
5,255,127,7,3,31,31,24,28,0,0
1410 FOR X=Q1 TO Q10:READ T:BOF$(X)=CH
R$(T):NEXT X
1420 DATA 0,0,10,85,171,10,0,0,0,0
1430 FOR X=Q1 TO Q10:READ T:ASH$(X)=CH
R$(T):NEXT X
```

```
1440 DATA 0,72,36,72,36,0,60,126,255,0
1450 FOR X=Q1 TO Q31:READ T:DRAGT$(X)=
CHR$(T):NEXT X
1460 DATA 0,0,3,15,7,15,7,15,7,15,7,47
,87,207,103,143,103,111,231,207,255,25
5,127,7,3,31,31,24,28,0,0
1470 FOR X=Q1 TO Q31:READ T:TAIL$(X)=C
HR$(T):NEXT X
1480 DATA 0,0,3,15,7,15,7,143,71,175,8
7,47,87,31,23,63,103,111,231,207,255,2
55,127,7,3,31,31,24,28,0,0
1490 FOR X=Q1 TO Q10:READ T:BLAST$(X)=
CHR$(T):NEXT X
1500 DATA 136,2,40,181,24,109,160,84,2
,136
1510 CLEAR$=CHR$(Q0):CLEAR$(128)=CLEAR
$:CLEAR$(Q2)=CLEAR$
1520 A=Q4*(INT(PEEK(742)/Q4)-Q1):POKE
54279,A
1540 N=Q256*PEEK(135)+PEEK(134):K=Q256
*PEEK(141)+PEEK(140)
1550 X=Q256*A+512:DISP=X-K:ADD=Q2
1560 FOR T=Q1 TO Q3
1570 PMHI=INT(DISP/Q256):PMLO=DISP-Q25
6*PMHI
1580 POKE N+ADD,PMLO:POKE N+ADD+Q1,PMH
I:DISP=DISP+128:ADD=ADD+Q8
1590 NEXT T
1600 IF MENU>Q1 THEN 1790
1610 GOSUB ERASE:POKE 764,255:POKE DB,
Q98:POKE DB+Q1,Q90:POKE DB+Q2,Q87
1620 IF RA=Q5 THEN Y1=Q30:N=140:GOSUB
ERASE:POSITION Q9,Q10:? "you're halfwa
y done!":GOSUB BLNK:GOSUB 1990:Y1=86
1630 IF RA<Q10 THEN GOSUB QUEST:DB$(Y1
)=DRAGR$:DB2$(Y1)=DRAGL$
1640 IF RA=Q10 THEN DB$=CLEAR$:DB2$=CL
EAR$:FIRE$=CLEAR$:GOTO 2080
1650 IF STRIG(Q0)=Q0 AND Y1>=Q60 AND Y
1<=Q64 THEN TGROW=Q7:GOSUB FLAME
1660 IF Y1=Q70 OR Y1=82 OR Y1=Q90 THEN
 GOSUB FLAP
1670 IF STRIG(Q0)=Q0 AND Y1>=76 AND Y1
<=80 THEN TGROW=Q11:GOSUB FLAME
1680 IF STRIG(Q0)=Q0 AND Y1>=92 AND Y1
<=Q96 THEN TGROW=Q15:GOSUB FLAME
1690 IF PEEK(53279)=Q6 THEN POP :RA=Q0
:WA=RA:Y1=80:GOSUB ERASE:GOSUB 1750:GO
SUB 1810:GOTO 1610
1700 IF STICK(Q0)=Q14 THEN Y1=Y1-Q2
1710 IF STICK(Q0)=Q13 THEN Y1=Y1+Q2
1720 IF Y1>Q96 THEN Y1=Q96
1730 IF Y1<Q60 THEN Y1=Q60
1740 DB$(Y1)=DRAGR$:DB2$(Y1)=DRAGL$:GO
TO 1650
1750 GOSUB BLNK:POKE DB,Q70:POKE DB+Q1
,Q62:POKE DB+Q2,Q59
1760 DB$(Y1)=DRAGR$:DB2$(Y1)=DRAGT$:RE
TURN
1770 REM CATEGORY
1780 POKE 752,Q1:MENU=Q2:GOTO 1320
1790 GOSUB 2200
1800 MKR=Q1:AB=80:BC=120:GOSUB 130:GOS
UB WAIT:FIRE$=CLEAR$
1810 GOSUB ERASE:POSITION Q5,Q7:? "her
e are your choices--    "
1820 JIF=Q20:GOSUB WAIT:MKR=Q0
1830 POSITION Q8,Q10:? CAT1$:JIF=Q20:G
OSUB WAIT
1840 POSITION Q8,Q14:? CAT2$:JIF=Q20:G
OSUB WAIT:POKE DB,Q70:POKE DB+Q1,Q62:P
OKE DB+Q2,Q59:JIF=Q35
1850 IF STICK(Q0)=Q13 THEN Y1=Y1+Q2
1860 IF STICK(Q0)=Q14 THEN Y1=Y1-Q2
1870 IF Y1>94 THEN Y1=94
1880 IF Y1<72 THEN Y1=72
1890 IF Y1<Q77 THEN POSITION Q8,Q10:?
ICAT1$:POSITION Q8,Q14:? CAT2$
1900 IF Y1>Q87 THEN POSITION Q8,Q14:?
ICAT2$:POSITION Q8,Q10:? CAT1$
1910 IF STRIG(Q0)=Q0 AND Y1<Q77 THEN D
B$(Y1)=DRFR$:GOTO 1950
1920 IF STRIG(Q0)=Q0 AND Y1>Q87 THEN D
B$(Y1)=DRFR$:GOTO 1960
1930 IF Y1=78 OR Y1=88 THEN GOSUB FLAP
1940 DB$(Y1)=DRAGR$:DB2$(Y1)=DRAGL$:GO
TO 1850
1950 POSITION Q1,Q14:? CO$;CO$:QUIZ=54
0:GOTO 1970
1960 POSITION Q1,Q10:? CO$;CO$:QUIZ=97
0
1970 FOR X=Q1 TO Q3:GOSUB WAG:NEXT X
1980 JIF=Q48:GOSUB WAIT:GOSUB ERASE:N=
97
1990 Z1=Q62:Z2=Q59:POKE DB,Q70:POKE DB
+Q1,Z1:POKE DB+Q2,Z2
2000 GOSUB BLNK:DB$(Y1)=DRFR$:DB2$(Y1)
=DRAGL$
2010 FOR X=Q70 TO N:Z1=Z1+Q1:Z2=Z2+Q1:
POKE DB,X:POKE DB+Q1,Z1:POKE DB+Q2,Z2
2020 IF X=76 OR X=84 OR X=92 THEN GOSU
B FLAP
2030 IF X=Q98 OR X=110 OR X=118 OR X=1
25 OR X=132 THEN GOSUB FLAP
2040 NEXT X
2050 IF RA=Q0 THEN POKE DB,Q98:POKE DB
+Q1,Q90:POKE DB+Q2,Q87:GOTO WAG
2060 GOSUB BLNK:POKE DB,Q98:POKE DB+Q1
,Q90:POKE DB+Q2,Q87:RETURN
2070 REM END
2080 GOSUB ERASE:POKE 752,Q1:POKE 764,
255:X=Q0
2090 POKE DB,Q70:POKE DB+Q1,Q62:POKE D
B+Q2,Q59:Y1=Q70:DB$(Y1)=DRFR$:DB2$(Y1)
=DRAGL$
2100 POSITION Q7,Q9:? "     you scored
  ";RA;"  correct,":? :? "          out
 of ";WA+RA;" problems!"
2110 ? :? "       press any key to try
 again,":? :? "          or to change le
vels"
2120 GOSUB WAG:GOSUB WAIT
2130 IF PEEK(764)=255 THEN 2120
2140 WA=Q0:RA=WA:POP :GOSUB ERASE:GOSU
B 2210:GOSUB 1810:GOTO 1610
2150 REM WAIT
2160 FOR D=Q1 TO JIF:TICK=PEEK(Q20)
2170 IF TICK=PEEK(Q20) THEN 2170
2180 NEXT D:RETURN
2190 REM INTRO
2200 POKE Q559,34:POKE Q559,Q46:POKE 5
3277,Q3:POKE 623,Q1
2210 GOSUB BLNK:POKE DB,Q70:Y1=80:POKE
 DB+Q1,Q62:POKE DB+Q2,Q59
2220 POKE DBCOL,Q32:POKE DBCOL+Q1,Q32:
DB$(Y1)=DRAGR$:DB2$(Y1)=DRAGL$
2230 JIF=Q35:GOSUB WAIT
2240 MKR=Q1:TGROW=Q9:AB=80:BC=120:GOSU
B 130:GOSUB WAIT:FIRE$=CLEAR$
2250 POSITION Q15,Q9:? "hi there!,":PO
SITION Q17+Q1,Q11:? "i'm d.b.  !"
2260 DB$(Y1)=DRFR$:JIF=Q20:GOSUB WAIT
2270 FOR X=Q1 TO Q3:GOSUB FLAP:GOSUB W
AIT:NEXT X
2280 GOSUB WAIT:DB$(Y1)=DRAGR$
2290 FOR X=Q1 TO Q3:GOSUB WAG:NEXT X
2300 JIF=Q87:GOSUB WAIT:DB$(Y1)=DRAGR$
:GOSUB ERASE
2310 GOSUB 130:GOSUB WAIT:FIRE$=CLEAR$
2320 POSITION Q12,Q7:? "i'm going to a
sk":POSITION Q15,Q9:? " you some quest
ions."
2330 POSITION Q12,Q11:? "use your joys
tick ":POSITION Q15,Q13:? "to point to
 the ones  "
```

```
2340 POSITION Q12,Q15:? "you would lik
e!  ";DB$(Y1)=DRFR$
2350 FOR X=Q1 TO Q3:GOSUB WAG:NEXT X
2360 FOR X=Q1 TO Q6:GOSUB FLAP:GOSUB W
AIT:NEXT X
2370 JIF=Q25:GOSUB WAIT:DB$(Y1)=DRAGR$
2380 REM ERASE
2390 FOR D=Q5 TO Q20:POSITION Q1,D:? C
O$;CO$:NEXT D:RETURN
2400 REM DISPLAY LIST
2410 GRAPHICS Q0:POKE Q559,Q0:GOSUB 25
70:GOSUB 2460:POKE 752,Q1
2420 POKE Q559,34:POKE 708,52:POKE 709
,124:POKE 711,184:POKE 710,180:POKE 71
2,114:POKE 756,CHSET/Q256
2430 POSITION Q0,Q2:? TOP$;BOT$:POSITI
ON Q0,Q3:? TRE$:POSITION Q0,Q4:? TNK$:
POSITION Q20,Q1:? TTOP$
2440 POSITION Q2,Q0:? BCLD$;" ";LCLD$;
"  ";MCLD$;"    ";BCLD$;" ";MCLD$;
2450 ? BCLD$;"    ";LCLD$;"    ";MCLD
$:RETURN
2460 GRAPHICS Q0:POKE Q559,Q0
2470 DL=PEEK(560)+Q256*PEEK(561)
2480 Z1=PEEK(DL+Q4):Z2=PEEK(DL+Q5)
2490 X=Q1:RESTORE 2550
2500 READ A:IF A=Q0 THEN RETURN
2510 POKE (DL+X-Q1),A
2520 IF X=Q5 THEN POKE DL+Q4,Z1
2530 IF X=Q6 THEN POKE DL+Q5,Z2
2540 X=X+Q1:GOTO 2500
2550 DATA 112,112,112,70,56,79,6,6,6,6
,6,6,6,6,6,2,2,2,2,2,2,2,2,2,2,2,2,2,2
,65,32,156,0
2560 REM CHAR. SET
2570 POKE 106,PEEK(106)-Q5:CHSET=(PEEK
(106)+Q1)*Q256
2580 D=CHSET/Q256:POKE 203,Q0:POKE 204
,D
2590 RESTORE 2600:FOR N=Q1 TO 28:READ
K:XFR$(N)=CHR$(K):NEXT N
2600 DATA 104,169,0,133,205,168,169,22
4,133,206,177,205,145,203,200,208
2610 DATA 249,230,204,230,206,165,206,
201,228,208,239,96
2620 X=USR(ADR(XFR$)):RESTORE 2630
2630 READ A:IF A=-Q1 THEN RETURN
2640 FOR Z1=Q0 TO Q7:READ Z2:POKE CHSE
T+A*Q8+Z1,Z2:NEXT Z1:GOTO 2630
2650 DATA 5,0,0,0,255,255,0,0,0
2660 DATA 6,0,0,0,255,255,255,0,0
2670 DATA 11,64,32,128,0,128,32,0,128
2680 DATA 33,5,7,7,6,7,7,15,31
2690 DATA 34,96,224,224,224,224,160,24
0,248
2700 DATA 35,3,3,3,3,3,3,2,3,7
2710 DATA 36,192,192,192,192,192,64,19
2,224
2720 DATA 37,5,26,21,43,57,18,29,5
2730 DATA 38,85,186,149,107,89,210,169
,85
2740 DATA 39,138,81,54,64,118,40,145,1
70
2750 DATA 40,160,184,80,168,216,32,216
,112
2760 DATA 41,0,0,0,0,5,55,90,213
2770 DATA 42,0,0,0,0,168,119,170,181
2780 DATA 43,181,149,235,170,213,90,55
,5
2790 DATA 44,149,43,237,83,181,170,118
,168
2800 DATA 45,1,3,3,3,3,2,3,3
2810 DATA 46,192,192,64,192,192,192,19
2,192
2820 DATA 47,6,31,47,118,127,125,55,7
2830 DATA 48,224,248,184,222,254,220,2
36,112
2840 DATA 49,0,7,29,27,31,14,0,0
2850 DATA 50,48,248,216,232,240,112,0,
0
2860 DATA 51,28,114,112,63,127,112,50,
28
2870 DATA 53,0,103,223,223,247,63,55,3
2880 DATA 54,0,224,188,126,242,188,236
,0
2890 DATA 55,0,0,7,127,127,7,0,0
2900 DATA 56,0,0,192,220,223,223,3,0
2910 DATA 57,0,0,3,31,255,240,128,0
2920 DATA 58,0,0,0,224,248,127,15,0,-1
2930 REM INIT & TITLE
2940 RESTORE 3140:READ Q1,Q2,Q3,Q4,Q5,
Q6,Q7,Q8,Q9,Q10,Q11,Q12,Q13,Q14,Q15,Q1
7,Q19
2950 READ Q20,Q21,Q25,Q26,Q29,Q30,Q31,
Q32,Q35,Q46,Q48,Q59,Q60,Q62,Q64,Q70
2960 READ Q77,Q87,Q90,Q96,Q98,Q256,Q55
9,SO1,SO2
2970 GRAPHICS Q0:POKE 752,Q1:DL=PEEK(5
60)+PEEK(561)*Q256:DL=DL+Q5
2980 POKE DL+Q5,Q7:POKE DL+Q6,Q7:POKE
DL+Q12,Q6:POKE DL+Q13,Q6
2990 POKE DL+28,65:POKE DL+Q29,PEEK(56
0):POKE DL+Q30,PEEK(561):? CHR$(125)
3000 POKE 708,Q14:POKE 710,Q48:POKE 71
2,Q48:? "A.N.A.L.O.G. Presents...":FOR
 D=Q1 TO 150:NEXT D
3010 POSITION Q3,Q5:? "DRAGON'S BREATH
":POSITION Q6,Q6:? "(featuring  ";CHR$
(34);"D.B.";CHR$(34);" the dragon)"
3020 POSITION Q5,Q11:? "a thinking":PO
SITION Q25,Q11:? " activity"
3030 POSITION Q7,Q17:? "(C) 1985 -- La
rry W. Linson"
3040 DIM CO$(Q19),CAT1$(Q21),CAT2$(Q25
),ICAT1$(Q21),ICAT2$(Q25):CAT1$=" 1. w
hat color is... ":FLAME=120:FLAP=80
3050 CAT2$=" 2. what doesn't belong? "
:ICAT1$=" 1. what color is... "
3060 ICAT2$=" 2. what doesn't belong?
":CO$="                    "
3070 ERASE=2390:DB=53248:BLNK=900:DBCO
L=704:QUEST=310:WAG=510
3080 DIM TOP$(Q20),TRE$(39),BCLD$(Q2),
MCLD$(Q2),BOT$(Q20),LCLD$(Q2),TNK$(Q19
),TTOP$(Q19),H2O$(Q20)
3090 TOP$="efgfgfgfgfffgfgfggffgh":TRE$
=" MNMN  MN MNMN MNMN  CDMN  MN CDMN M
NMN"
3100 BOT$="eklklheklklklklkhklh":TTOP$
=" ijij  ij ijij ijij"
3110 BCLD$="op":MCLD$="uv":LCLD$="qr":
TNK$=" ABCD  CD ABCD CDMN"
3120 DIM H1$(Q20),H2$(Q21),AN1$(Q15),A
N2$(Q15),AN3$(Q15),DIVID$(Q25)
3130 H2O$="SSXXXXXXXXXXXXXXXXXX":DIVID
$="QRQRQRQRQRQRQRQRQRQRQRQR":FOR D=Q1
TO Q559:NEXT D:RETURN
3140 DATA 1,2,3,4,5,6,7,8,9,10,11,12,1
3,14,15,17,19
3150 DATA 20,21,25,26,29,30,31,32,35,4
6,48,59,60,62,64,70
3160 DATA 77,87,90,96,98,256,559,53760
,53761
```

•

CHECKSUM DATA.

(see page 30)

```
10 DATA 270,65,354,204,889,251,761,812
,130,962,171,63,470,749,197,6348
160 DATA 664,460,552,700,211,158,993,6
16,154,39,993,910,105,737,412,7704
```

```
310 DATA 872,300,223,722,272,443,617,4
82,169,530,963,12,581,765,410,7361
460 DATA 90,885,183,258,80,47,459,249,
501,912,640,466,645,635,929,6979
610 DATA 322,949,141,767,326,731,228,8
63,559,680,691,637,118,651,181,7844
760 DATA 245,515,555,698,93,621,977,64
2,475,475,320,244,919,218,110,7107
910 DATA 672,794,727,821,547,605,247,2
95,235,565,497,118,43,220,210,6596
1060 DATA 158,794,616,987,474,391,562,
574,581,822,861,974,84,444,240,8562
1210 DATA 155,222,566,324,35,257,897,1
58,848,869,819,438,403,532,653,7176
1360 DATA 515,552,656,870,737,158,811,
165,53,877,149,516,451,898,536,7944
1510 DATA 81,417,212,302,621,902,536,5
41,432,602,616,691,77,187,583,6800
1670 DATA 983,158,73,356,354,163,110,5
54,576,659,598,566,955,695,51,6851
1820 DATA 284,148,427,361,365,0,981,46
3,473,375,384,658,564,478,64,6025
1970 DATA 743,836,574,643,517,575,526,
535,990,619,492,930,359,645,816,9800
2120 DATA 705,848,362,74,453,866,863,4
07,124,329,561,190,17,173,94,6066
2270 DATA 474,939,726,808,988,606,296,
845,725,482,53,369,542,81,61,7995
2420 DATA 7,968,251,300,729,729,534,21
1,77,624,133,139,762,90,808,6362
2570 DATA 432,206,839,312,845,732,394,
679,567,631,176,360,824,289,857,8143
2720 DATA 994,427,502,556,393,943,539,
608,281,863,264,665,411,235,488,8169
2870 DATA 50,534,429,923,712,8,988,408
,775,622,994,867,895,46,856,9107
3020 DATA 637,205,697,519,177,884,521,
999,538,365,707,262,329,13,779,7632
```

●

```
45 REM TRIVIA LISTING
360 READ H1$,H2$,H3$,H4$,AN1$,AN2$,AN3
$,CROW
370 POSITION Q1,Q8:? H1$:POSITION Q1,Q
10:? H2$:POSITION Q1,Q12:? H3$:POSITIO
N Q1,Q14:? H4$
530 REM TRIVIA
540 DATA what,animal,lives longest,in
captivity,bear,monkey,tortoise,15
550 DATA what letter,is least,used in,
our language?,z,q,x,11
560 DATA how many,nail holes,in a stan
dard,horseshoe?,8,12,15,7
570 DATA who created,wierd harold,and,
fat albert?,woody allen,bill cosby,edd
ie murphy,11
580 DATA who is only,president carved,
in mt. rushmore,wearing glasses?,kenne
dy,roosevelt,washington,11
590 DATA who is,fred flintstone's,best
,friend?,betty,dino,barney,15
600 DATA what travels,through space,at
 66700,miles per hour?,earth,the sun,t
he moon,7
610 DATA what,state,receives the,least
 sunshine?,maine,alaska,indiana,11
620 DATA how,many,feet in,a mile,250,5
280,9879,11
630 DATA who,was the,tallest,president
?,reagan,johnson,lincoln,15
640 DATA which of your,senses is,less
sharp after,a big meal?,hearing,sight,
taste,7
650 DATA how many,bowling balls,does i
t take,to make a spare?,1,2,3,11
660 DATA what was,first known,as the,p
luto platter?,the hot dog,the frisbee,
a 45 record,11
670 DATA what is,captain marvel's,magi
c,word?,hocus pocus,please,shazam,15
680 DATA what is,the,largest,cat?,tige
r,lion,cheetah,7
690 DATA how many,calories in,a glass,
of water?,5,0,10,11
700 DATA what is the,most southern,sta
te in the,u.s.?,florida,california,haw
aii,15
710 DATA what is,the best,selling week
ly,magazine?,time,tv guide,people,11
720 DATA how,many,yards in,a mile?,528
0,1000,1760,15
730 DATA who,invented the,pot-belly,st
ove,franklin,edison,jefferson,7
740 DATA what is,the world's,fastest,d
og?,doberman,greyhound,poodle,11
750 DATA how many,wings,does a,flea ha
ve?,0,2,4,7
760 DATA what,is,a,wallaby?,whale,kang
aroo,fish,11
770 DATA what,animal,lives in a,lodge?
,moose,bear,beaver,15
780 DATA what moves,away from earth,on
e-half inch,each year?,the moon,venus,
the sun,7
790 DATA what's the,only day,named for
,a planet?,sunday,monday,saturday,15
800 DATA what,animals,travel,in pods?,
monkeys,whales,birds,11
810 DATA what is,a group,of bears,call
ed?,a group,a band,a sleuth,15
820 DATA what's the,brightest,planet s
een,from earth?,venus,mars,the moon,7
830 DATA who is,luke,skywalker's,fathe
r?,yoda,darth vader,ben kenobi,11
840 DATA how many,reindeer,pull santa'
s,sleigh?,6,10,8,15
850 DATA who is,batman's,side,kick?,to
nto,robin,bambi,11
860 DATA how many,legs does,a spider,h
ave?,8,6,12,7
870 DATA who (besides,grant) is,buried
 in,grant's tomb?,grant's wife,grant's
 sons,no one,7
880 DATA what part,of a,face has,550 h
airs?,mustache,beard,eyebrow,15
3115 CAT1$=" 1. trivia test ":ICAT1$="
 1. trivia test "
3125 DIM H3$(Q21),H4$(Q21)
```

●

CHECKSUM DATA.

(see page 30)

```
45 DATA 365,188,655,521,372,768,613,17
0,105,342,590,213,481,919,883,7185
650 DATA 1,419,290,718,433,544,90,36,2
51,44,355,881,563,669,228,5522
800 DATA 94,519,852,728,613,27,497,926
,799,270,34,5359
```

●

Resident DOS 2.0 Mod

A permanent RAM resident DOS 2.0 modifier

by James G. Hollinger

Have you ever gotten tired of waiting for the DUP.SYS file to load whenever you go to DOS? Or have you ever gone to DOS thinking MEM.SAV was on your disk, only to discover later that it wasn't and you've lost your program? If these have ever happened to you, or if you want to make sure they don't (and if you can spare 5K of user memory), then take a look at this permanent RAM resident DOS modifier, **Resident DOS 2.0 Mod**.

What the modifier does.

Resident DOS 2.0 Mod is a BASIC program which modifies version 2.0 of DOS (Disk Operating System) and DUP (Disk Utility Package) on any Atari computer, so they'll both load in when you turn on your computer. MEMLO is also changed, so BASIC or other programming languages like MAC/65 will place your program after DUP. This will, however, decrease the amount of user memory by about 5000 bytes.

These modifications will enable you to call DOS without losing your program and without having to wait for DUP to load in. The DOS menu will be displayed instantly. The only way your program can be erased is if you use the Copy File, Duplicate File or Duplicate Disk commands, allowing DOS to use the program area as a buffer.

MEM.SAV is no longer needed, unless you attempt to load a binary file without a run address on top of DUP, in which case MEM.SAV will be used if it's present on the disk in drive 1.

How to use it.

After typing in and SAVEing the **Resident DOS 2.0 Mod** program, RUN it. The message *Modifying...* will be displayed. After a few seconds, the DOS modifications will be complete.

Type *DOS*, and the DUP.SYS file will be loaded into memory from disk. The DOS 2.0 menu will be displayed. Type *M* to run at address and enter *600* when asked for the run address. The DUP modification subroutine will then be executed, and the DOS 2.0 menu will again be displayed. This subroutine must be executed, or the computer will not boot up properly.

All modifications to DOS and DUP will now be completed, and you can write the DOS files to disk. To return to BASIC, push the SYSTEM RESET key.

Whenever you turn on the computer and the disk in drive 1 has the modified DOS on it, a message will be displayed informing you that the DOS has been modified. The only noticeable differences between the modified DOS and the regular DOS 2.0 will be that 5K loss in user memory. The DOS menu will be displayed immediately after you've executed

the DOS command, and the user program will still be in memory after you've exited DOS, without the need for the MEM.SAV file.

If DUP is ever overwritten in memory by loading a binary file on top of it, or because of a program, you can reload DUP by making a USR call to 5936 or an Assembly language JMP to $1730.

It would be advisible to leave at least one copy of the DOS files unmodified, in case you should need the extra 5K of memory—or if a program should require an unmodified copy of DOS 2.0. □

James G. Hollinger is a 16-year-old honor student in high school. He has been programming for five years, starting with BASIC on an Interact computer. He now uses an Atari 800 and an Apple II+ with BASIC, Assembly language, FORTH and C.

Listing 1.
BASIC listing.

```
10 REM --------------------------
20 REM : Permanent RAM Resident :
30 REM :       DOS Modifier     :
40 REM :                        :
50 REM : By  James G. Hollinger :
60 REM :          1984          :
70 REM --------------------------
80 ? :? "Modifying..."
90 REM
100 REM --- SETS DOS INIT ADR ---
110 REM
120 POKE 1796,48:POKE 1797,23
130 REM
140 REM --- SETS MEM LOW ---
150 REM
160 FOR I=0 TO 6
170 READ A:POKE 2147+I,A:NEXT I
180 REM
190 REM --- INSERT A JSR ---
200 REM
210 POKE 5482,32
220 POKE 5483,194:POKE 5484,23
230 REM
240 REM --- SETUP ROUTINE ---
250 REM
260 FOR I=0 TO 11
270 READ A:POKE 5935+I,A:NEXT I
280 REM
290 REM --- PRINTS BOOT MESSAGE ---
300 REM
310 FOR I=0 TO 46
320 READ A:POKE 6059+I,A:NEXT I
330 FOR I=0 TO 27
340 POKE 6106+I,PEEK(ADR("DUP wont era
se user program.")+I):NEXT I
350 POKE 6134,155:FOR I=0 TO 28
360 POKE 6202+I,PEEK(ADR("This DOS has
 been modified to")+I):NEXT I
370 POKE 6231,155:FOR I=0 TO 25
380 POKE 6232+I,PEEK(ADR("permanently
reside in RAM.")+I):NEXT I
390 REM
400 REM --- RESETS DOS INIT ADR ---
410 REM
420 FOR I=0 TO 6
430 READ A:POKE 6145+I,A:NEXT I
440 POKE 5479,43
450 REM
460 REM --- DUP MODIFICATION SUB ---
470 REM
480 FOR I=0 TO 33
490 READ A:POKE 1536+I,A:NEXT I
500 FOR I=0 TO 25
510 POKE 1570+I,PEEK(ADR("DOS II V2.05
 (C)1980 ATARI")+I):NEXT I
520 FOR I=0 TO 32
530 READ A:POKE 1596+I,A:NEXT I
540 ? :? "DOS has been modified.":? :?
 "Next type 'DOS', 'M' and '600'."
550 ? "DUP will then be modified and y
ou can":? "write the DOS files to disk
."
560 ? :? "When done with DOS, push RES
ET":? "to go to BASIC."
570 POKE 10,247:POKE 11,23:POKE 8,0
580 POKE 6046,0:END
590 REM
600 REM === MEM LOW SET DATA ===
610 REM
620 DATA 169,16,141,231,2,169,51
630 REM
640 REM === SETUP ROUTINE DATA ===
650 REM
660 DATA 155,169,0,141,158,23
670 DATA 32,64,21,76,247,23
680 REM
690 REM === PR. BOOT MESS. DATA ===
700 REM
710 DATA 117,32,173,68,2,240,1,96
720 DATA 76,117,32,234,234,32,70,23
730 DATA 48,58,206,158,23,48,53
740 DATA 141,84,3
750 DATA 169,58,162,24,32,190,25
760 DATA 169,88,162,24,32,190,25
770 DATA 169,218,162,23,76,190,25
780 REM
790 REM === DOS INIT RESET DATA ===
800 REM
810 DATA 169,64,141,156,23,169,21
820 REM
830 REM === DUP MODIFY DATA ===
840 REM
850 DATA 169,173,141,99,40
860 DATA 169,23,141,104,40
870 DATA 169,2,141,40,33
880 DATA 169,22,141,47,33
890 DATA 162,58,189,34,6
900 DATA 157,16,31,202,16,247
910 DATA 76,117,32
920 DATA 155,205,207,196,201,198
930 DATA 201,197,196,160,194,217
940 DATA 160,202,225,237,229,243
950 DATA 160,200,239,236,236,233
960 DATA 238,231,229,242,160,167
970 DATA 184,180,155
```

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CHECKSUM DATA.
(see page 30)

```
10 DATA 436,506,359,870,227,47,448,500
,267,223,77,495,83,705,89,5332
160 DATA 302,300,98,748,76,233,681,85,
744,91,131,311,100,538,78,4516
310 DATA 139,308,144,790,955,981,952,8
83,105,307,83,296,300,262,95,6600
460 DATA 708,101,151,308,133,204,132,3
04,311,523,551,261,474,109,73,4343
610 DATA 87,512,93,833,99,231,170,108,
531,86,686,822,703,49,520,5530
760 DATA 532,781,110,641,88,743,94,294
,100,964,921,849,90,860,206,7273
910 DATA 254,554,543,529,534,545,361,3
320
```

PANAK STRIKES!

Reviews of the latest software

by Steve Panak

A lot of people ask me all the time—okay, one person asked me once—how I go about analyzing a game. What do I look for? What makes a good game? The answer is simple and straightforward. I think a game is good when I like it. Just like everyone else.

But my tastes aren't *everyone* else's, and whether or not you like a game is very subjective. So I have to tell you why. . .why I liked it; why I hated it; what was right with it; and what was wrong with it.

I've got to try to determine just what the critical points are, then analyze them for you.

But I can't set aside my personal likes. Nobody can. And it's even harder to hide them in a shroud of colorless prose. As a result, you can always tell whether I liked the game or not.

Now, who ya gonna call?. . .

GHOSTBUSTERS
by David Crane
ACTIVISION
P.O. Box 7287
Mountain View, CA 94039
48K Disk $34.95

When sequels come out, they're nearly always inferior to the original. This seems preordained, with the possible exception of the Lucas and Spielberg films.

This principle applies to spin-offs, too, probably more so, due to the fact that something is lost in the translation to a different medium. As a result, I tend to be more critical in my evaluation, and this bias is only intensified when I consider the inspiration to be one of the best comedies of all time.

Somehow, though, I don't think that **Ghostbusters** is a truly bad game, only difficult and annoying.

The annoying part is the music—it plays continuously. Top-40 radio and MTV grated the *Ghostbusters* theme through my head like an old crone's nails on a blackboard, and if I never hear it again, it will be too soon. But this can be cured—simply turn down the sound. Other problems can't be solved so easily.

Rather than simply rip off the movie for a quick buck (see **Ghostchasers** below), **Ghostbusters** attempts to recreate the movie, by allowing you to start your own **Ghostbuster** franchise. This is done through a series of game phases.

On booting the disk, you're greeted by the title screen and a *Ghostbusters* sing-along. I recommend pressing the START key and passing right over this, unless you're one of the two people in this country who isn't familiar with the words to this song.

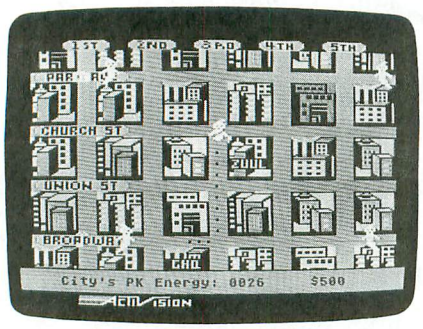
After the sing-along, you get a loan to start your business. You purchase one of four cars, from Beetle to high performance. Each can carry different loads and travel at different speeds. Then you outfit the vehicle with the best in **Ghostbusting** equipment. Traps, ghost vacuums, bait, etc. may be purchased until you're out of money. Then the game begins.

You cruise the city streets, looking for Slimers. On your way to infected buildings, you encounter Roamers, which you must freeze (by touching them) and then sweep up. You drive around until they've all been sucked up, then arrive at your chosen destination.

Once at the building, you set a trap. Using your negative ionizer backpacks, you force the Slimer into the trap's beam for additional credit. If you fail, the vicious Slimer will wipe out one of your

Ghostbusters. When you're down to one buster, you've got to go back to HQ for reinforcements.

The problem is that it's not that easy. It's not hard as in difficult, but hard because the instruction manual just doesn't seem to tell you what to do or what to expect. The joystick doesn't seem to respond, and you're left cruising around with that music in the background. Wait a second, and I'll try it again.



Ghostbusters.

There, I finally got the hang of it. It takes a good deal of time to get going, and once you do, it's still awfully tough. Just play around with it until you learn what it does. And what it does is, I feel, boring.

Sometimes, the four Roamers join to form the dreaded Marshmallow Man. If you fail to neutralize him, he'll damage the city and cost you credit points. To rid yourself of the white monolith, you must jab at the *B* key, which drops bait to attract the Roamers. Now sweep them up, before they can congeal into the "M-Man." Unlike the movie, he cannot be toasted.

Finally, if you've acquired enough credit (at least more than you started with), you may attempt to sneak two busters into the Temple of Zuul. If this is completed successfully, the game ends —and you win if you've made money. More money means that you can save that game amount and start again (now or later) purchasing more/better equipment. The game grows harder as the ghosts move faster and faster.

The graphics are very good and highly detailed, the cars in particular being vivid. One problem was a crash which forced me to reboot the disk. This occurred at the end of the game, on an infrequent, irregular basis.

The manual, as I said before, didn't seem to help me play the game, the main problem being that I didn't know what to expect. However, it was otherwise nicely written and put together, with a fan club for true **Ghostbusters**.

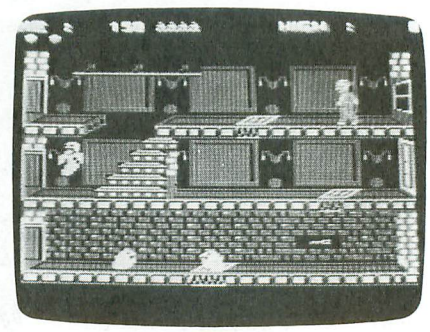
For the rabid **Ghostbuster**, this game is a must. But for me, the movie will suffice.

GHOST CHASER
by Frank Cohen
ARTWORX SOFTWARE
150 North Main Street
Fairport, NY 14450
48K Disk $19.95

This game isn't fooling anyone—it's a rip-off of *Ghostbusters*, the movie. I can deal with that, as lack of originality is one of the seven sins of video games. What I can't tolerate is poor quality.

In **Ghost Chaser**, you move through the sixteen rooms of Fairport Manor, searching for keys and the elusive treasure room, scoring points by blasting the ghosts which materialize near you.

Through the library, kitchen and even bathroom you move, each room having its own surprises and dangers (the secret bookcases in the library are helpful, while the slippery soap in the bathroom is deadly, as are the many trap doors). While the rooms are technically different, their similarity and drabness make them uninteresting.



Ghost Chaser.

Controlled by the joystick, Harry the **Ghost Chaser** runs and jumps about, avoiding ghosts and collecting keys and ectoplasmic globs, the latter to lob at his adversaries. The joystick, while hard to get used to, is easy once mastered.

A typical problem concerns the tolerances around the obstacles which Harry must miss. Often, many attempts are necessary before a particular trap door can be successfully jumped.

Also, as the picture may show, there is a wrap-around problem in the program, and ghosts which are visible at the bottom of the screen also infiltrate the top (up above the score areas). However, this annoying distraction is otherwise harmless.

Most of the rooms are hidden and require keys to enter. I found the game very simple and unchallenging; I rapidly made it through most of the rooms. Making a map only shortens the playability of this game.

As to what happens after you've visited all sixteen rooms—your guess is as good as mine. I lacked the interest to make it all the way through (I wasted a lot of my time on our next two games), but since the instructions say nothing about additional rooms, I guess you'll have to begin over—either in a more difficult mode with more creatures or by simply starting again. Either way, it's doubtful you'll be satisfied.

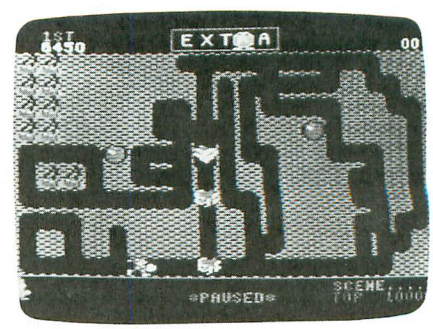
The best thing about **Ghost Chaser** is the plastic case containing the disk, as it will both protect the contents and look good on your shelf collecting dust.

MR. DO
by Tim Ferris
DATASOFT
19808 Nordhoff Place
Chatsworth, CA 91311
48K Disk $29.95

I don't know what **Mr. Do** is. I don't know who **Mr. Do** is. What's more important, I don't care—as long as someone will just help me forget about this game.

It's a really dumb game, little new here, but I played and played **Mr. Do**, unable to stop, even to take nourishment. This home version of the arcade game really had me sucked in.

Upon reflection, **Mr. Do** appears to me to be some sort of clown creature who's caught underground with scores of hideous monsters. Don't ask me why he's there, but his goal is to tunnel and recover all the cherries and center treats (cakes, eggs, milk, cookies, and so on).



Mr. Do.

His only protection is a super powerball and giant falling apples. The former is fairly reliable—though, if you're not careful, the ball can become lodged in an out-of-the-way part of the maze, and you'll not get another.

As for the apples, while they can and do squash the monsters most of the time, they also have a rather nasty quality—they can be turned against you.

As you're gathering up cherries, looking forward to the next screen, suddenly one of the monsters will have mindlessly pushed an apple off a ledge, and you're the one being beaned. But rejoice; you can earn additional men.

Extra men are awarded in a unique way. Each time you capture a center treat (or at every 5000 points), BOSS monsters are released into the maze. By destroying one of these, you light up the letter on the top of the screen, corresponding with the one on the creature's belly.

You guessed it—when you get *E*, *X*, *T*, *R* and *A*, you get an extra man. It's analogous to methods used in many pinball machines, and you can earn free men as quickly or slowly as you're able.

You'll wish to often, because **Mr. Do**'s life span is very short, especially as the maze begins to get crowded with creatures. There are four types of monsters: regular, BOSS, henchmen and diggers. Each has its own powers.

Diggers, for example, can tunnel after you. And every time you hit the center treat, in addition to a BOSS, henchmen also appear. Some of these cannot be hurt by the falling apples. Instead, they simply swallow the apples up and continue to bear down on you. These things follow you until one of you is dead, and it's you more often than it's them.

Turning corners trying to lose them might help, but not much. Your only chance is to get those cherries harvested and move on to the next screen.

The graphics are excellent, no complaints. Control seems a little hard, especially around corners, but it's acceptable. The program allows you to choose right- or left-handed control, so you can use either your right or left hand on the stick.

There are little intermissions, like the **PacMan** series used to have. I'm not sure whether these are present on the arcade version, as I rarely played it. However, while not overly elaborate, they were welcome relief from the relentless attacks in the maze.

The manual, while a bargain basement black-and-white piece, still gives you all you may have wanted to know about **Mr. Do**, and a little more.

So, while I hate to do it, I have to give a "thumbs up" to **Mr. Do**. The thing was addictive, and that's a major consideration.

Until next time, I'll be testing and battling, in rotation, a trio of chess simulations. May the best man(?) win. Don't worry; there will be a couple of arcade games, too. □

continued from page 37

A keyboard test.

Listing 1 shows a simple program which uses CIO to get characters from the computer keyboard. If the key is one of the numbers 0 through 9, the program selects the corresponding color and changes color of the screen to that value. Any other key will have no effect. If any errors are encountered during the program's execution, it will change the screen's border color to red. The program must be stopped with SYSTEM RESET or the BREAK key, if you're using the Atari Assembler Editor cartridge or **ANALOG Computing**'s **H:BUG**.

Let's walk through the program in Listing 1 and see what it does.

Lines 140-200 define equates for the CIO commands. Instead of performing an LDA #$07, you can specify *LDA #GETCHR*. You'll probably agree that this makes your assembly language source code much easier to follow, since the GETCHR label instantly tips you off that the operation is getting ready for a GET CHARACTER CIO call. Remember that, when you use these equates for CIO commands, you must place the # symbol in front of the equate label, indicating that it's an *immediate* instruction. LDA # GETCHR loads the accumulator with the value *$07*; LDA GETCHR loads the accumulator with whatever is stored in memory location $0007.

Lines 240-250 set up equates for the screen color registers 2 and 4. COLOR2 is the register which controls the character color in graphics mode 0, and COLOR4 controls the screen's border color.

Lines 290-360 set up equates for the CIO IOCB fields. Again, using descriptive labels like ICCMD (COMMAND) make your program easier to follow when reading the source code. Remember that there are actually eight IOCBs, and these equates merely point to the first IOCB. We will use the X register to "index" into the IOCB we want to use.

Line 370 sets up the CIO subroutine equate, CIOV. After setting up all the appropriate CIO information in the IOCB, perform a JSR CIOV to execute the I/O operation.

Line 410 sets the starting address for our keyboard input test program. The program will load at $3000 (you can change this value to any address in free RAM that you like—I arbitrarily picked $3000).

Line 420 sets the X register to *$10*, indicating that we will be using IOCB number one. This is a "safe" IOCB to use, since the only IOCB opened by the system is IOCB number zero. More on this later.

Lines 430-440 set the command byte in IOCB number one to the value for the OPEN command, $03. The X register is used to index 16 ($10) bytes past IOCB number zero, which is IOCB number one.

Lines 450-480 point the ICBAL and ICBAH to the filename we want to open. In this case, we're opening the keyboard, which is specified by the string *K:* in Line 930. Note that the string is terminated with the ATASCII EOL character, *$9B*.

Lines 490-500 place the number *4* in the ICAX1 byte of IOCB number one. This tells CIO that the keyboard is to be opened as *input*.

Lines 510-520 set the ICAX2 byte of IOCB number one to 0. The keyboard does not use ICAX2, but it's a good idea to zero this byte, anyway. Other functions use this byte, and getting into the habit of setting all the IOCB parameters affecting a function to a known value is a good idea.

Line 530 performs a JSR to the CIOV subroutine, opening the keyboard for us.

Line 540 branches if the 6502 SIGN flag is set to the ERROR routine at Line 870. This happens if CIO encounters an error condition when it tries to open the keyboard. The Y register will contain the error number. If the open was successful, the Y register and the status byte of IOCB number one will contain *$01* (operation successful), the SIGN flag will be cleared, and the program will continue operating at Line 610.

Line 610, labeled GETKEY, is where we'll try to GET a character from the keyboard. This line sets the X register to *$10*, once again indicating that we're going to use IOCB number one for a CIO operation.

Lines 620-630 place the GET CHARACTER command in IOCB number one's command byte. This will instruct CIO that it is to GET a character from the keyboard.

Now we must tell CIO how many characters we want to get from the keyboard. Lines 640-660 do this by placing *0*s in both the BUFFER LENGTH LOW (ICBLL) and BUFFER LENGTH HIGH (ICBLH) bytes. "A buffer length of zero?" you ask. Remember the special case of the GET CHARACTERS and PUT CHARACTERS commands mentioned last issue? If you set the buffer length to *0*, CIO will get 1 byte and place it in the 6502 accumulator! This is a handy option when you only want to GET one byte from a device. No buffer address is needed for this option.

Line 670 performs a JSR to CIOV to GET the character from the keyboard. When we JSR to CIOV, it will wait until a key is pressed, get the key's ATASCII code, and return it to the calling program in the accumulator.

If any error occurred during the GET CHARAC-

TER operation, Line 680 will detect it and branch to the ERROR location, where the screen's border color will be changed to red, to let you know an error occurred. If the GET CHARACTER function operated properly, the character typed on the keyboard is in the accumulator, ready to be used, and execution continues at Line 730.

Lines 730-740 subtract 48 from the ATASCII value of the key, which is in the accumulator. If the key was the zero key, whose ATASCII value is 48, the accumulator will contain $00 after the subtraction. If the key was the one key, the ATASCII value of the number *1* (49) will be reduced to $01. The same applies to the other keys from two through nine. After this operation, if a key from zero through nine has been pressed, the accumulator will contain a value from $00 through $09. Other keys on the keyboard will have their ATASCII values adjusted in the same manner, but the final value in the accumulator will be something other than $00-$09.

Line 750 compares the accumulator to the number *10*, to see if the key pressed was from one to nine.

If the key value was greater than nine, Line 760 branches to the GETKEY label to try getting another key from the keyboard.

If the key pressed was in the range one through nine, Lines 770-820 shift the numeric value of the key left 4 bits (a multiply-by-16 operation), OR this result with $04, and place it in the COLOR2 color register. This sequence of instructions has the same effect as the BASIC instruction:

```
SETCOLOR 2,N,4
```

where *N* is the number of the key pressed, from zero through nine. The color registers of the Atari computers contain a color value from 0 through 15 in the upper 4 bits, and a luminance value from 0 through 15 in the lower 4 bits. Shifting the key number (zero-nine) left 4 bits places the key number in the color bits, and ORing the byte with $04 sets the luminance to 4.

Line 830 loops back to the GETKEY label to get another key. This process continues until you stop the program or an error occurs.

Lines 870-880, labeled ERROR, are executed when a CIO error occurs. These lines change color register 4 (the Atari's screen border color) to *$32* (*$30* for red + $02 for luminance), making the border a dark red.

Line 890, labeled FOREVER, is an infinite loop which merely JMPs to itself until you stop the program. When an error occurs, the screen border will change to red, and the program will loop here forever.

What kind of errors?

What kind of errors could occur with this program? Type it in, and let's find out.

After typing and assembling the program into memory, execute it. Press each of the keys from zero through nine and note that the screen color changes each time a different key is pressed. Press the alphabetic keys on the keyboard and note that nothing happens. This is because Lines 730-760 reject any keys other than zero through nine.

No errors yet? Good! This indicates that you've probably typed the program in properly. Now, if you're not using a debug program, press the BREAK key. The screen border should turn red, indicating an error has occurred.

What happened? Simple—pressing the BREAK key during any type of input (to the screen editor or keyboard) generates an ERROR 128, or BREAK KEY ABORT. This is a way for your program to detect

when the user presses the BREAK key during program operation.

Now let's see what other errors can occur. Change Line 420 in the program's source to read:

```
0420     LDX #$00   ;POINT TO IOCB #0
```

and re-assemble the program. Using your debugging utility, execute the code as before. The screen border should instantly change to red, indicating an error. Using your debugging utility, intercept the program and examine the Y register. It should contain $81, or 129 decimal.

This is the IOCB error number, which indicates that you tried an operation on an IOCB that was already open. By changing Line 420 as above, you told CIO to OPEN IOCB zero for the keyboard. Unfortunately, IOCB zero is used by the operating system for the screen editor device, E:, and we can't use it. All the other IOCBs, from one to seven, are usually available for our use.

More fun coming up.

Next issue's **Boot Camp** will concentrate on more interesting applications of CIO, with several useful programming examples. Until then, please review this and last month's **Boot Camp** articles, so that you'll be familiar with the CIO terminology. The best is yet to come! □

Listing 1.
BASIC listing.

```
0100      .OPT NO LIST
0110 ;
0120 ;KEYBOARD INPUT TEST PROGRAM
0130 ;
0140 OPEN =  $03
0150 CLOSE = $0C
0160 GETCHR = $07
0170 PUTCHR = $0B
0180 GETREC = $05
0190 PUTREC = $09
0200 STATUS = $0D
0210 ;
0220 ;SCREEN COLOR REGISTERS
0230 ;
0240 COLOR2 = $02C6
0250 COLOR4 = $02C8
0260 ;
0270 ;CIO EQUATES
0280 ;
0290 ICCMD = $0342
0300 ICSTA = $0343
0310 ICBAL = $0344
0320 ICBAH = $0345
0330 ICBLL = $0348
0340 ICBLH = $0349
0350 ICAX1 = $034A
0360 ICAX2 = $034B
0370 CIOV =  $E456
0380 ;
0390 ;NOW, HERE'S THE PROGRAM!
0400 ;
0410      *=  $3000    ;START AT $3000
0420      LDX #$10     ;POINT TO IOCB #1
0430      LDA #OPEN    ;OPEN COMMAND
0440      STA ICCMD,X  ;PUT IN IOCB #1
0450      LDA #KEYBD/256 ;HI ADDR OF "K:"
0460      STA ICBAH,X  ;PUT IN IOCB #1
0470      LDA #KEYBD&255 ;LO ADDR OF "K:"
0480      STA ICBAL,X  ;PUT IN IOCB #1
0490      LDA #4       ;INPUT
0500      STA ICAX1,X  ;PUT IN IOCB #1
0510      LDA #0       ;NO AUX 2 USED
0520      STA ICAX2,X  ;PUT IN IOCB #1
0530      JSR CIOV     ;NOW OPEN IT!
0540      BMI ERROR    ;IF Y<0, BAD OPEN!
0550 ;
0560 ;NOW THAT THE KEYBOARD IS OPEN,
0570 ;WE WILL GET CHARACTERS FROM IT
0580 ;AND CHANGE THE SCREEN COLOR
0590 ;ACCORDING TO THE CHARACTER!
0600 ;
0610 GETKEY LDX #$10 ;IOCB #1
0620      LDA #GETCHR ;GET CHAR COMMAND
0630      STA ICCMD,X ;STORE COMMAND
0640      LDA #0      ;ZERO OUT BUFFER...
0650      STA ICBLL,X ;LENGTH (PUTS BYTE...
0660      STA ICBLH,X ;IN ACCUMULATOR)
0670      JSR CIOV    ;GET A BYTE!
0680      BMI ERROR   ;IF Y<0, BAD GET!
0690 ;
0700 ;NOW TURN BYTE INTO A NUMBER
0710 ;FROM 0-9 FOR SCREEN COLOR!
0720 ;
0730      SEC         ;GET READY FOR SUB.
0740      SBC #48     ;SUBTRACT 48 FROM IT
0750      CMP #10     ;>9?
0760      BCS GETKEY  ;YES, TRY AGAIN!
0770      ASL A       ;SHIFT BYTE...
0780      ASL A       ;LEFT 4 TIMES...
0790      ASL A       ;FOR THE...
0800      ASL A       ;COLOR,
0810      ORA #$04    ;ADD BRIGHTNESS
0820      STA COLOR2  ;STORE IT
0830      JMP GETKEY  ;AND LOOP BACK!
0840 ;
0850 ;CHANGE BORDER TO RED IF ERROR
0860 ;
0870 ERROR LDA #$32   ;GET RED COLOR
0880      STA COLOR4  ;CHANGE BORDER!
0890 FOREVER JMP FOREVER
0900 ;
0910 ;OTHER DATA
0920 ;
0930 KEYBD .BYTE "K:",$9B
0940 ;
0950 ;THAT'S ALL, FOLKS!
0960 ;
0970      .END
```

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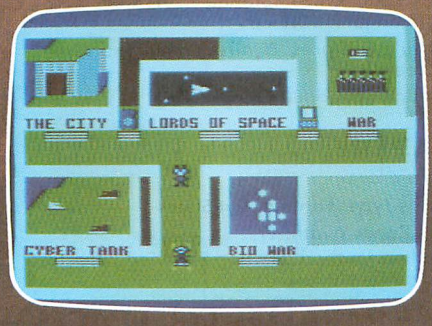

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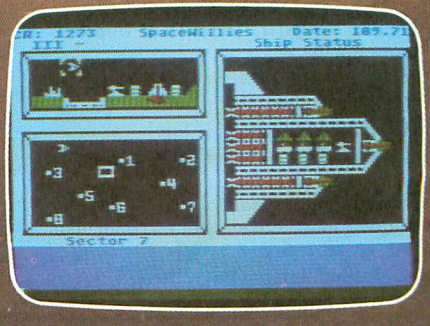

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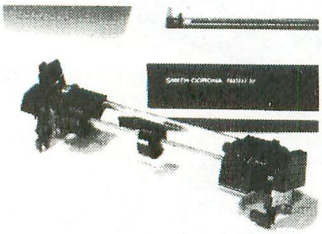

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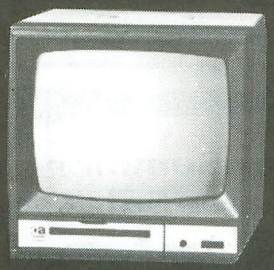

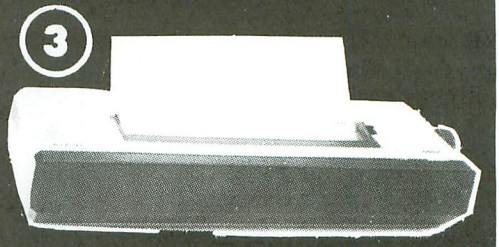

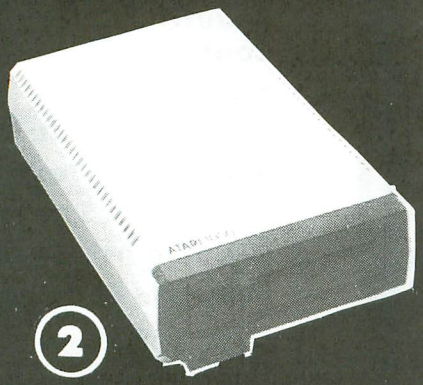

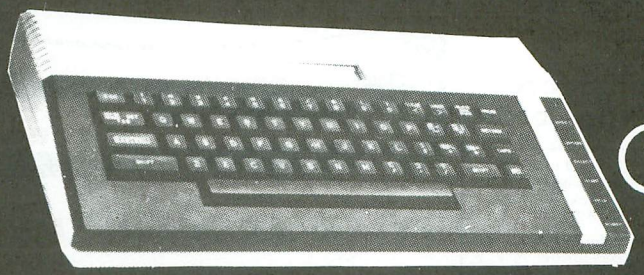

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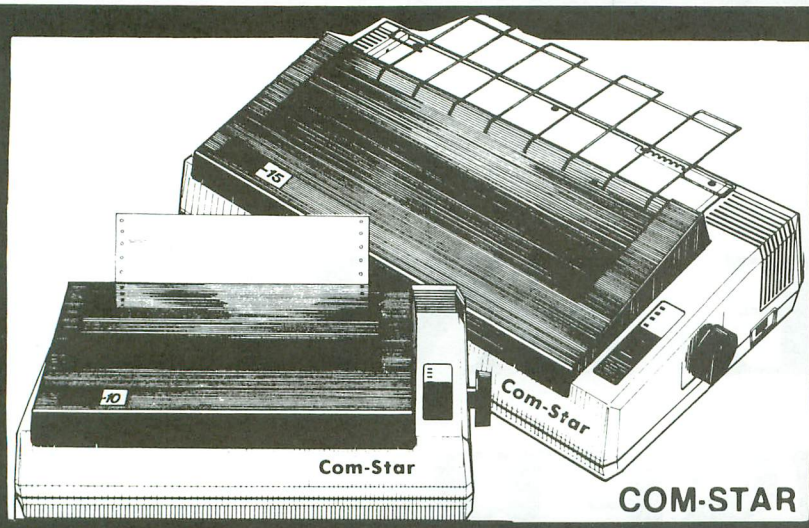

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THE END USER

THIS MONTH:

The last of Atari's 8-bit computers—the 130XE.

by Arthur Leyenberger

Welcome back to the **End User**. As Bob Dylan noted two decades ago, "the times they are a-changin'." That comment is just as appropriate today as it was in the mid-sixties. Consider last year. . .

About a year ago, I was attending a press conference in New York City (at the Warner Communications Building), listening to James Morgan (then Atari's CEO) explain how the 7800 game machine was going to rescue Atari from oblivion. If you recall, it was a $150 game machine with a $100 add-on keyboard and a whopping 32K memory. I admit I was impressed with the graphics, but I doubted that it would really sell.

Now, a year later, what have we here? A *new* Atari Corp., under *new* management, with at least two *new* computers under its corporate belt. From the game machines to 68000-based microprocessor computers with pull-down menus, icons, etc., etc.—all in less than a year. Remarkable!

With Atari out of intensive care, there is good news and a lot of information to pass along this month. But first, a brief diversion, if you please.

When I originally discussed writing this column with your (and my) favorite editors of **ANALOG Computing**, I secretly worried that I would run out of topics to discuss. Boy, was I *wrong*.

There are all kinds of things to talk about that will help make our Atari adventure together a rewarding and educational one. Here's just a sample of what I hope to discuss in the months ahead: LISP programming and Artificial Intelligence, controlling the outside world with your Atari, designing the right programs for the right user (human factors), do-it-yourself software, the Atari XE and ST computers, operating systems for the Atari machines, inexpensive software, robotics, the MIDI musical interface, non-educational educational software, and how to write documentation.

My list could keep on, but I would soon run out of room for this month's topic.

If you'd like to see other topics covered in the **End User**, please write to me (see the box at the end of this column) and let me know what you want. I'll try to include your favorites.

Now, on to this month's topic, which is (drum roll, lights and camera, please) the Atari 130XE computer.

The Atari 130XE.

In less than eight months from the time they took over, Tramiel and company had delivered their first offspring. Let's take a close look at this machine, from the outside in. First, the box.

The colors are red and gray, a distinct change from the traditional Atari silver and black. This is a new company, therefore, a new box. Atari's new motto "Power without the Price," is everywhere on the box.

Arthur Leyenberger is a human factors psychologist and free-lance writer living in New Jersey. He has been an Atari enthusiast for four years. When not computing, he enjoys playing with robotic toys.

The 130XE.

The carton also briefly mentions new —yet unavailable at this time—software: **Silent Butler** (personal finance), **Music Painter** and **AtariWriter Plus**. On the back panel is a picture of what looks like a 1050 disk drive in XE clothing. Atari still denies that there will be a new or modified disk drive for the 130XE.

Like a box of Cracker Jacks.

Opening the carton, we find that the power supply and TV video cable are identical to those used by the 800XL. There's also the familiar TV switch box.

The big surprise is that there, in white with red trim, is something that the old Atari felt was unnecessary: a manual. No, this isn't the colorful 8-page fluff that accompanied the old 800 (in its last days), 600XL, 800XL and 1200XL. This is a real, 132-page, well-written, useful document. Just like Cracker Jacks—a prize in every box.

The manual is printed on glossy stock and has a spiral binding. It's divided into three sections. The first section, called "Getting Started," shows the computer neophyte how to get up and running. With plenty of diagrams and illustrations, this section is easy to understand. There are chapters covering use of the keyboard, graphics, hook-up and other fundamental information.

The second section consists of general programming information concerning the built-in Atari REV-C BASIC. Chapter topics include editing with the keyboard, writing simple BASIC programs, giving rudimentary commands, and using sound and graphics. Program examples are widely used and thoroughly explained.

The third section of the manual contains various appendices for BASIC reserved words, error messages, ATASCII character set and troubleshooting. There are also a couple of important topics.

A chapter on accessing the full 128K RAM memory of the computer is welcome technical information (more on this topic a little later). There's also a complete set of specifications on the 130XE, including pinouts of all the connectors.

The hardware.

The 130XE itself is slightly smaller and lighter than the 800XL. Its most striking characteristic is the low profile look (more so than the 800XL), with many angular lines adding to a high-tech look.

The function keys are placed above the keyboard on the top right side. Joystick ports (still only two) are located on the right side of the machine. All other jacks are on the rear.

As seen from the back, there are (from left to right): the Serial I/O jack, cartridge port, Enhanced Cartridge Interface (ECI), monitor jack, channel selector, RF (TV) jack, power jack and ON/OFF switch. All of the jacks have both a word label and a symbol. This machine was obviously intended for overseas marketing.

Somewhat similar to an 800XL, which has a parallel interface jack on the rear of the computer, the 130XE has the ECI. This 14-pin jack is used in conjunction with the cartridge slot to allow connection of high speed peripherals.

The pins provide +5 volt power and access to the computer's memory and I/O chip select lines. Atari says that this arrangement of the cartridge slot and adjacent ECI provides the same or more functions than the parallel port on the 800XL. It will be interesting to see if any companies bring out products for this interface on the computer.

The XE keyboard seems more responsive than the 800XL. It also seems that the keys are larger, although it may be that they're sculptured more and, therefore, feel better to your fingers. It didn't take me long to get used to, and now I prefer it to the 800XL keyboard.

The only aspect of the keyboard that I don't like is the location of the RESET key. It's next to the OPTION key, without any guard around it. Several times I've inadvertently pressed RESET when I intended only to press OPTION.

The severe consequences (rebooting) have taught me to be more careful. I would have preferred to have the START key located on the far right and RESET on the far left of the cluster, separated by the HELP key.

The RF output (channel 2 or 3 to the TV) of the 130XE is far superior to the 800XL. And the monitor output is as good as or better than even the early 800 computers.

(continued on page 65)

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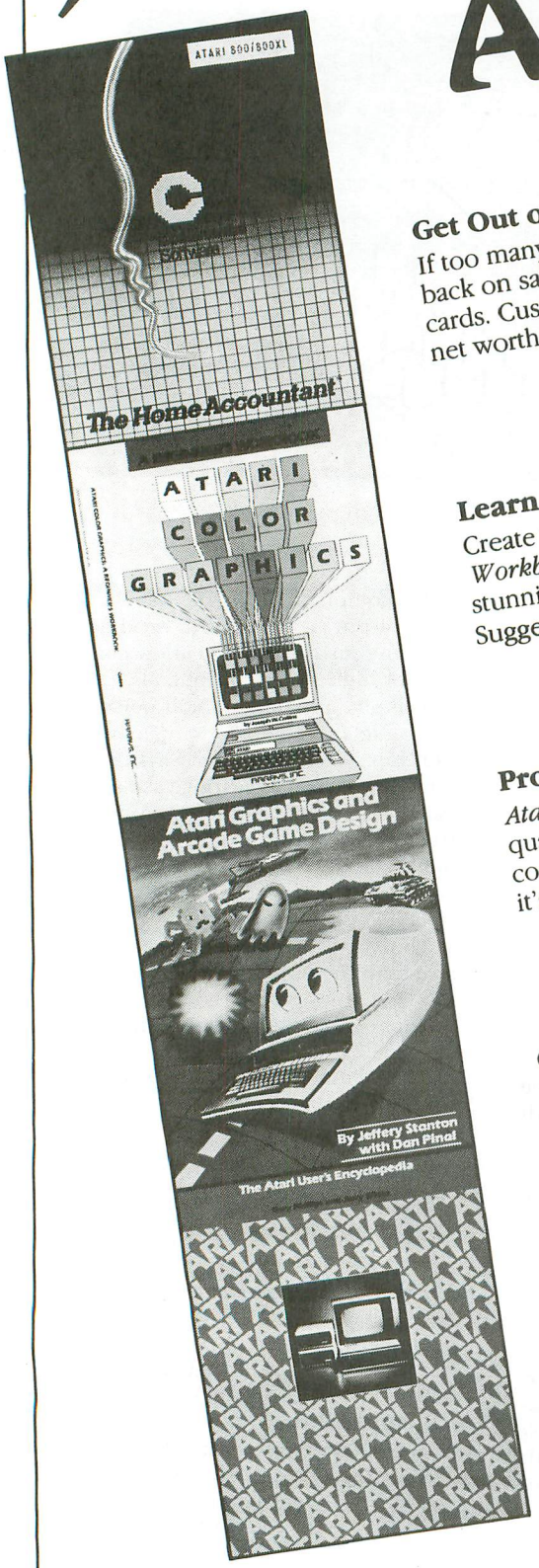

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The 130 is a nice machine, although basically an 800XL with 128K of memory. Since it uses the same 6502 microprocessor, it can only address 64K of memory at a time. Therefore, a form of bank switching is used to access the extra 64K.

The extra memory is divided into four separate groups of 16K each. With bank switching, the computer can be "told" to look at a particular 16K memory section at a time. In this way, the 130XE can be fooled into using more memory.

On the 130XE, the second bank of memory is located from memory location 16384 to 32767 (hexidecimal, $4000 to $7FFF). By changing the value of the bank switch, located at memory location 54017 ($D301), you can select which of five 16K banks the computer will address (the original 16K bank or one of the four "extra" banks).

The location of the memory switch is the port B address of the 6520 peripheral interface adapter chip, which controls the computer's input and output. In addition to controlling which memory the 6502 looks at, the port B address can also control where the ANTIC video chip looks for memory. The 130XE manual explains how to address this memory for the 6502 processor or the ANTIC chip.

What good is this extra memory if you have to specifically instruct the computer to use a certain bank? The answer lies in the use of new software or more powerful versions of existing commercial software.

Already, Atari has announced that **AtariWriter Plus** will take advantage of the extra memory in the 130XE to allow you larger text files in memory. Another word processor, **Paper Clip**, from Batteries Included, is said to have a version that will use the XE's extra memory. Synapse's **SynFile+** database program will have a modified version to use the extra memory. And there should also be new software that's designed specifically for the 130XE.

DOS 2.5.

Another major use of the extra memory of the 130XE is for DOS 2.5. This is the new Disk Operating System for Atari computers that has been developed by O.S.S. It's main advantage for the 130XE is that it allows you to configure the extra memory as a RAMDISK.

As you probably know, a RAMDISK is software that uses a part of the computer's memory to simulate a very fast disk drive. Since there are no moving parts inside the computer's memory, just about instant access is available to read or save files.

The RAMDISK software used with DOS 2.5 loads automatically when you turn on the computer with the DOS disk in the drive. The extra 64K of RAM translates into the equivalent of 499 sectors, and the RAMDISK is defined as drive 8 (D8:).

Also, DUP.SYS and MEM.SAV are copied to the RAMDISK, so when you type *DOS* from BASIC, DOS loads in about 2 seconds (from the RAMDISK), rather than in about 15 seconds as from a normal disk.

In use, DOS 2.5 is very similar to DOS 2.0. The major difference is in the Format command. If the menu item I (format disk) is selected with an Atari 1050 disk drive connected to the computer, the disk will be formatted in dual density (140K) format. Menu item P will allow you to format a single-density disk, even if one 1050 is attached. If no 1050 drives are connected to your system, option I will format disks in single-density format.

No question about it: the 130XE is a powerful machine. At under $200 (I paid $140 locally for mine), it's quite competitive with computers from both the "nautical" and "fruit" companies. Only you can decide if it's worth trading up to what is destined to be the last 8-bit computer from Atari. The end of an era, I guess. □

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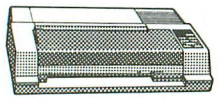

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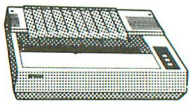

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CIRCLE #128 ON READER SERVICE CARD

Keyboard Encoding for Computer Music Applications

PART 2.

by Mario Perdue

I hope you were all able to get through last month's article, and that you now have a functional keyboard. This month we're going to put together some software to run it. If you can't wait to hear it play, skip through this text until you get to Listing 1. Type it in and follow the instructions to run it. If, on the other hand, you want to know what the program's doing, read on!

The minimum software configuration.

Before we get involved in any actual programming code, let's look at some block diagrams of what it is we want to do. Figure 1 is a diagram of the "bare minimum" software configuration. The minimum setup requires three modules: the keyboard scan routine (SCAN); a table of notes to be played (PTABLE); and the note output routine (NOUT).

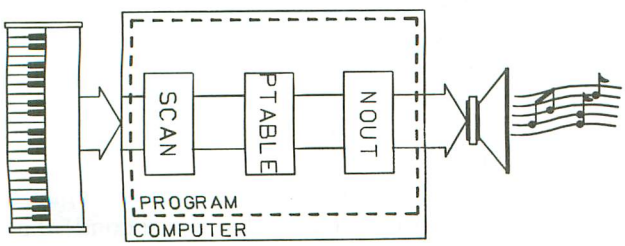


Figure 1.
Minimum software block diagram.

It works like this. SCAN reads the keyboard via the keyboard register, verifies the data, checks for a key-down flag and builds the PTABLE. Then NOUT takes the data from the PTABLE and puts it into the sound registers. Simple, right? Yes, but like the "brute force" encoder from last month, it's too simple.

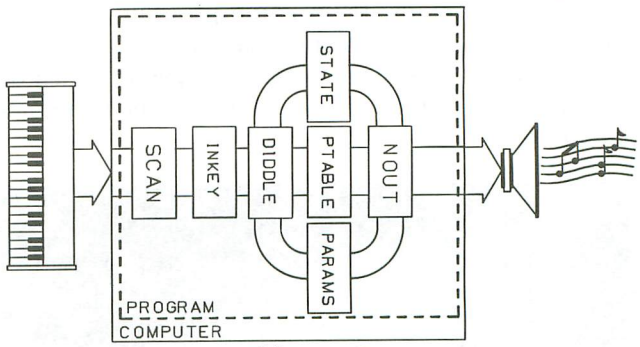


Figure 2.
A better mousetrap.

Figure 2 shows a more complex, but more versatile arrangement. In this program, SCAN still looks at the keyboard, but now it builds INKEY. Then DIDDLE comes along.

DIDDLE does several things. First, it compares INKEY to PTABLE and uses this data to update the STATE table. The STATE table tells the program what the state of each note is (i.e., ATTACK, DECAY, SUSTAIN or RELEASE). Then, DIDDLE builds the new

PTABLE from the combined data of INKEY and the old PTABLE.

When the new PTABLE is built, priority is given to keys which are still depressed. This insures that a newly depressed key will sound immediately, even if all the channels are currently busy with notes in the release state.

The last function of DIDDLE is to update the parameter table (PARAMS), which contains the volume and distortion values for each note. Finally, NOUT gets data from both PTABLE and PARAMS, and uses this data to play the notes.

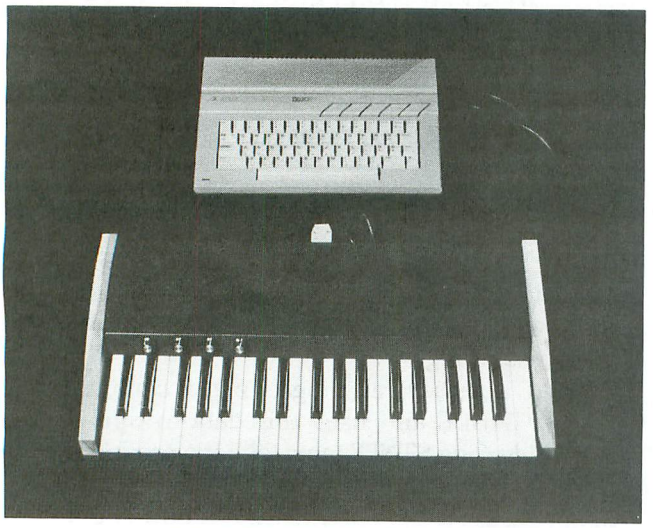
The program.

Listing 1 is a BASIC program which will build a file called MUSIC.COM. This is a binary load file with a starting address of 4000 hex. The way you load and run this program depends on what DOS you're running.

If you're using DOSXL by O.S.S., just type *MUSIC* at the system prompt. If you're using DOS 2 or a similar menu-driven DOS, simply type *L*, and then type *MUSIC.COM* when you're asked for the name of a file to load. If you'd rather not do any typing to load the program, you can rename the file MUSIC.COM to AUTORUN.SYS, and it will load when the disk is booted.

When you run MUSIC.COM, the screen will simply display a prompt. No bells. No whistles. No awesome graphics displays. Don't get angry; this is, after all, an article about making music. If you want something with graphics, try a game program.

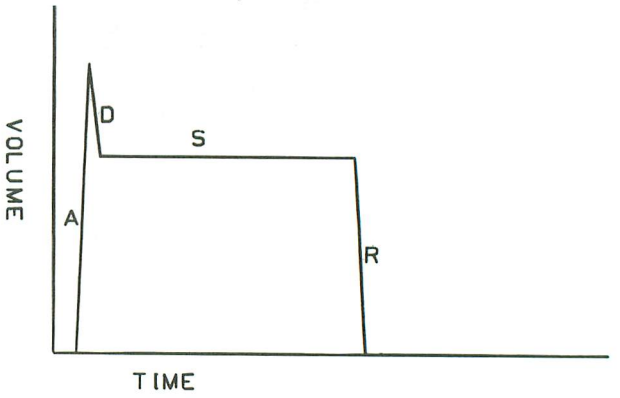
If you *don't* get the prompt, make sure the keyboard is connected to the computer. The keyboard must be connected *before* the program is run, or the computer will hang.



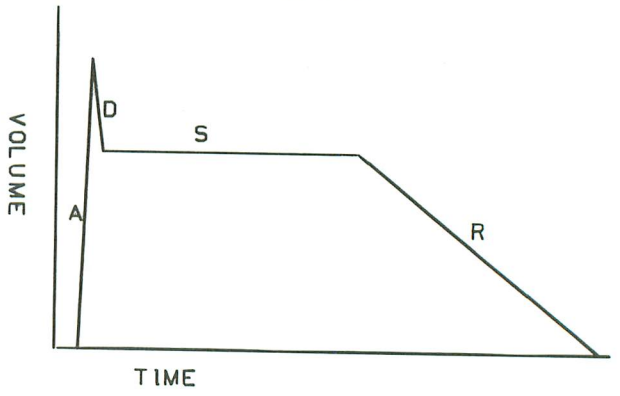
Using the keyboard.

Before hitting any keys, set the four knobs: ATTACK, DECAY and RELEASE to fully counterclockwise; SUSTAIN to fully clockwise. These settings will cause an envelope similar to the one labeled WAVE A in Figure 3.

Now, press and release a key on the keyboard. What you should hear is a tone that starts at full volume as soon as the key is depressed, holds that volume for as long as the key is depressed, and drops to no volume as soon as the key is released. If this isn't what you hear, check to make sure you wired everything correctly.



Wave A.



Wave B.

Figure 3.

Next, set the RELEASE knob to its mid-point setting and hit a few more keys. The new envelope will sound the same as the last one until you release the key. The program sees that the key is no longer down and changes its STATE to—you guessed it—the RELEASE STATE.

In this state, the value from the pot is compared to the number of jiffies (sixtieths of a second) that have passed. When they're equal, it steps the volume down one notch. What you hear is the note sort

of fading out (similar to a piano's note), rather than just stopping. Graphically, it looks like WAVE B of Figure 3.

Two of the other knobs (ATTACK and DELAY) also control time constants. So the note doesn't have to just "come on," either. ATTACK works like RELEASE does, only in reverse. DECAY starts after ATTACK reaches its peak, but it stops dropping when it gets to the SUSTAIN level. SUSTAIN is the only knob that doesn't control time. It sets the level (volume) that is output while the note is still depressed but not currently in one of the other states.

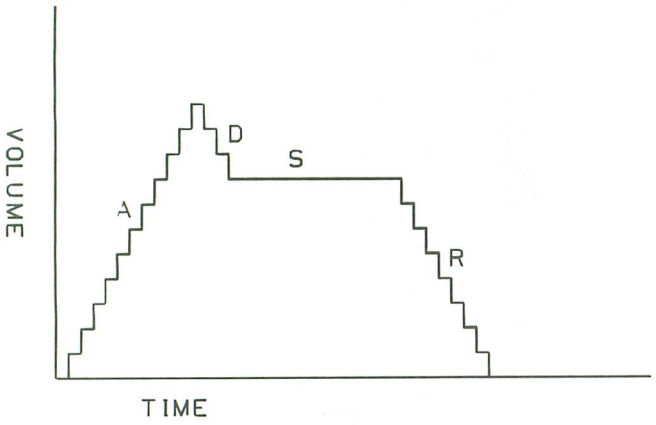


Figure 4.

As you can probably guess, the possible settings of these controls—and, therefore, the different envelopes—are unlimited, theoretically. In practice, the waveforms of Figure 3 can't really be achieved.

They look more like the waveform in Figure 4. Each step is caused by a change in the volume setting, and you don't have to listen very closely to hear them. Still, some very pleasing effects can be achieved despite this limitation

The assembly listing.

That brings us to Listing 2. This is the source code for Listing 1. You *do not* have to type this program in, unless you plan to make changes to the code. The program was written with the MAC/65 cartridge from O.S.S., but should only require minor modification to be used with another assembler.

Listing 2 follows the second block diagram pretty closely. There are changes in terminology. SCAN has become KBDSCN, and DIDDLE is comprised of ALCHAN, TRANS, ADSR and CLOCK.

INIT is a routine not shown in the block diagram. It runs one time to clear some memory locations and set up the VBI vector. If you're interested in more detail, the comments should help get you through it.

Feel free to make changes to this program. It's really not intended to be the "ultimate" music program. In fact, it is really nothing more than a starting point, something you can build on.

One area that should be worked on is program protection. This program does nothing to protect itself. If you hit the RESET button, the program is gone. If you do any SIO transfers, the program is gone. You can't run BASIC while this program is running, either. There's plenty of room for improvement.

You should now have enough to get you started making computer music in "real time," but not much more than that. □

Mario Perdue has been a Field Engineer in the computer world for about ten years. He got an Atari 800 three years ago, using it mostly for games. The 800 has been replaced with an 800XL on which his work centers around music, although he doesn't play any instruments.

Listing 1.
BASIC listing.

```
100 REM ********************************
110 REM * MUSIC.BAS                    *
120 REM * BY MARIO PERDUE              *
130 REM *                            *
140 REM * COPYRIGHT NOVEMBER 1984     *
150 REM *                            *
160 REM * THIS PROGRAM MAKES A FILE *
170 REM * NAMED "D:MUSIC.COM" WHICH *
180 REM * IS USED WITH A SCANNING 3 *
190 REM * OCTAVE MUSIC KEYBOARD.     *
200 REM * THE FILE IS THEN RUN AS A *
210 REM * BINARY LOAD FILE.  THE     *
220 REM * KEYBOARD MUST BE PROPERLY *
230 REM * CONNECTED BEFORE RUNNING   *
240 REM * OR THE PROGRAM WILL LOCK. *
250 REM ********************************
260 REM
270 TRAP 270:? "MAKE CASSETTE (0), OR
DISK (1)";:INPUT DSK:IF DSK>1 THEN 270
280 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,
9,0,0,0,0,0,0,0,10,11,12,13,14,15
290 DIM DAT$(91),HEX(22):FOR X=0 TO 22
:READ N:HEX(X)=N:NEXT X:LINE=990:RESTO
RE 1000:TRAP 370:? "CHECKING DATA"
300 LINE=LINE+10:? "LINE:";LINE:READ D
AT$:IF LEN(DAT$)<>90 THEN 470
310 DATLIN=PEEK(183)+PEEK(184)*256:IF
DATLIN<>LINE THEN ? "LINE ";LINE;" MIS
SING!":END
320 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X
,X))-48:D2=ASC(DAT$(X+1,X+1))-48:BYTE=
HEX(D1)*16+HEX(D2)
330 IF PASS=2 THEN PUT #1,BYTE:NEXT X:
READ CHKSUM:GOTO 300
340 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
 TOTAL=TOTAL-1000
350 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
 THEN 300
360 GOTO 470
370 IF PEEK(195)<>6 THEN 470
380 IF PASS=0 THEN 420
390 IF  NOT DSK THEN 410
400 PUT #1,224:PUT #1,2:PUT #1,225:PUT
 #1,2:PUT #1,0:PUT #1,32:CLOSE #1:END
410 FOR X=1 TO 60:PUT #1,0:NEXT X:CLOS
E #1:END
```

```
420 IF  NOT DSK THEN 450
430 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
,"D:MUSIC.COM"
440 PUT #1,255:PUT #1,255:PUT #1,0:PUT
 #1,32:PUT #1,27:PUT #1,34:GOTO 460
450 ? "READY CASSETTE AND PRESS RETURN
";:OPEN #1,8,128,"C:":RESTORE 480:FOR
X=1 TO 40:READ N:PUT #1,N:NEXT X
460 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 370:GOTO 300
470 ? "BAD DATA: LINE ";LINE:END
480 DATA 0,5,216,31,255,31,234,234,234
,234,234,169,60,141,2,211,169,0,141,23
1,2,133,14,169,56,141,232,2
490 DATA 133,15,169,0,133,10,169,32,13
3,11,24,96
1000 DATA A9388D02D3A9808D00D32065E4A2
20A039A907205CE4A9008D08D2A20795989 5A0
CA10F9A9A0A2079590CA10FB,562
1010 DATA A9FFA20F9580CA10FB4C3620A203
A9808D00D3A0088810FDA9008D00D3AD00D3CD
00D3D0F8C938F0102A10F16A,153
1020 DATA 9580CD00D3F0FBCA10E63007A9FF
9580CA10FBA203B588C9FFF043A003D98000D0
17A9FF998000B598C903D031,493
1030 DATA A90095A09598A9A19590D0258810
E1B598C903F008A9039598A90095A0B590C9A1
100EA9FF9588A9A09590A900,470
1040 DATA 959895A0CA10B4A203B580C9FFF0
21A003B98800C9FFF0058810F63013B5809988
00A9A1999000A90099A000A9,207
1050 DATA FF9580CA10D6A203B580C9FFF021
A003B99800C903F0058810F63013B580998800
A9A1999000A90099A000A9FF,919
1060 DATA 9580CA10D6A203B588C9FFF05DB5
98C901F020C902F0331036B5A0C5B5304BA900
95A0B5906901C9A8303DA901,669
1070 DATA 9598A9A8D035B5A0C5B63031A900
95A0B59038E901C5B71022A9029598A5B74C76
21B5A0C5B83015A90095A0B5,405
1080 DATA 9038E901C9A01006A9009598A9A0
9590CA109AA203A006B588C9FFD00CA9009901
D29900D29598F01338E94F86,968
1090 DATA B0AABDCF219900D2A6B0B5909901
D2CA888810D6A203BD70024A4A4A4A95B5CA10
F4A5B7290F09A0C9A83002A9,558
1100 DATA A885B7A203F6A0CA10FB4C62E4F3
E6D9CCC1B6ADA2999088807972 6C66605B5551
4C4844403C3935322F2D2A28,121
1110 DATA 2523211F1D0000000000000000000
0000000000000000000000000000000000000
0000000000000000000000,286
```

●

CHECKSUM DATA.

(see page 30)

```
100 DATA 778,954,357,247,889,253,97,94
6,980,866,935,625,361,127,103,8518
250 DATA 795,94,548,391,750,455,970,65
2,940,920,424,732,643,52,215,8581
400 DATA 285,733,208,678,761,522,305,1
74,717,188,800,891,978,774,712,8646
1050 DATA 742,816,796,890,16,952,431,4
643
```

●

Listing 2.
Assembly listing.

```
; ================
; MUSIC SYNTHESIZER
; ================
;
; THIS PROGRAM IS A POLYPHONIC
; ALGORITHM TO BE USED IN CONJUNCTION
; WITH A SCANNING 3 OCTAVE KEYBOARD.
;
; PROGRAMMER: M PERDUE
;
; --------------
; SYSTEM EQUATES
; --------------
;
PORTA   =   $D300
PACTL   =   $D302
AUDCTL  =   $D208
AUDF1   =   $D200
AUDC1   =   $D201
SETVBV  =   $E45C
XITVBV  =   $E462
SIOINV  =   $E465
PADDL0  =   $0270
;
; ---------
; PAGE ZERO
; ---------
;
INKEY   =   $80
PLTBL   =   $88
PARAM   =   $90
STATE   =   $98
TIME    =   $A0
TEMP    =   $B0
ATTACK  =   $B5
DECAY   =   $B6
SUSTAIN =   $B7
RELEASE =   $B8
;
        *=  $2000
;
; ------------------------------------
; INITIALIZE TABLES, VARIABLES AND I/O
; ------------------------------------
;
INIT    LDA #$38    ;SET UP TO WRITE
        STA PACTL   ;DIRECTION BITS
        LDA #$80    ;D7 ===== INPUT
        STA PORTA   ;D6-D0 == OUTPUT
        JSR SIOINV  ;INIT FOR SOUND
        LDX # >KSCN ;VBI ADDR HIGH
        LDY # <KSCN ;VBI ADDR LOW
        LDA #$07    ;DEFERRED VBI
        JSR SETVBV  ;ENABLE VBI
        LDA #0      ;GET ZERO
        STA AUDCTL  ;RESET AUDIO CTRL
        LDX #7      ;DO EIGHT BYTES
CLR4    STA STATE,X ;ZERO STATE TBL
        STA TIME,X  ;ZERO TIME TBL
        DEX         ;NEXT BYTE
        BPL CLR4    ;DONE? NO.
        LDA #$A0    ;ZERO VOLUME
        LDX #7      ;DO EIGHT BYTES
CLR1    STA PARAM,X ;ZERO PARAM TBL
        DEX         ;NEXT BYTE
        BPL CLR1    ;DONE? NO.
        LDA #$FF    ;NULL VALUE
        LDX #$0F    ;DO 16 BYTES
CLR2    STA INKEY,X ;INIT KEY BUFFER
        DEX         ;NEXT BYTE
        BPL CLR2    ;DONE? NO.
;
LOOP    JMP LOOP    ;LOOP FOREVER
;
; ------------------------------------
; SCAN KEYBOARD AND BUILD INKEY TABLE
; ------------------------------------
;
KSCN    LDX #3      ;SET NOTE COUNTER
        LDA #$80    ;PREPARE TO RESET
        STA PORTA   ;RAISE RESET
        LDY #8      ;INIT COUNTER AND
KB1     DEY         ;USE AS TIMER
        BPL KB1     ;TIME UP? NO.
        LDA #0      ;SET ZERO
        STA PORTA   ;CLEAR RESET
KB2     LDA PORTA   ;GET NOTE
        CMP PORTA   ;SAME NOTE?
        BNE KB2     ;NO. TRY AGAIN
        CMP #$38    ;END OF KEYBOARD?
        BEQ DONE    ;EXIT WHEN DONE
        ROL A       ;KEY DOWN?
        BPL KB2     ;LOOP IF NO
        ROR A       ;RESTORE DATA
        STA INKEY,X ;STORE IN BUFFER
KB3     CMP PORTA   ;CHECK KEYBOARD
        BEQ KB3     ;SAME DATA? YES.
        DEX         ;DEC COUNTER
        BPL KB2     ;BUFFER FULL? NO.
        BMI ALCHAN  ;CONTINUE
;
DONE    LDA #$FF    ;UNUSED FLAG
KB4     STA INKEY,X ;CLEAR UNUSED
        DEX         ;BUFFER LOCATIONS
        BPL KB4     ;DONE? NO.
;
; ------------------------
; ALLOCATE SOUND CHANNELS
; AND SET RELEASE STATE
; ------------------------------------
; PART ONE OF THIS ROUTINE CHECKS FOR
; SAME KEY DEPRESSED, AND REACTIVATES
; THAT CHANNEL
; ------------------------------------
;
ALCHAN  LDX #3      ;SET CNT1
ALCH1   LDA PLTBL,X ;GET NOTE
```

```
          CMP #$FF     ;NULL KEY?
          BEQ ALCH4    ;YES. GET NEXT
          LDY #3       ;SET CNT2
ALCH2     CMP INKEY,Y  ;COMPARE NOTES
          BNE ALCH3    ;EQUAL? NO.
          LDA #$FF     ;CLEAR KEY FLAG
          STA INKEY,Y  ;TO INKEY BUFFER
          LDA STATE,X  ;GET NOTE STATE
          CMP #3       ;RELEASE?
          BNE ALCH4    ;NO. CONTINUE
          LDA #0       ;YES. GET ZERO
          STA TIME,X   ;ZERO TIME
          STA STATE,X  ;SET ATTACK STATE
          LDA #$A1
          STA PARAM,X
          BNE ALCH4
;
ALCH3     DEY
          BPL ALCH2    ;END OF INKEY? NO
;
; ---------------------------------
; CHECK KEYS NOT DOWN FOR RELEASE
; ---------------------------------
;
          LDA STATE,X  ;GET NOTE STATE
          CMP #3       ;RELEASE STATE?
          BEQ ALCH9    ;YES. CONTINUE
          LDA #3       ;NO. SET RELEASE
          STA STATE,X  ;+ CHK IF ACTIVE
          LDA #0       ;GET ZERO
          STA TIME,X   ;CLEAR TIME
ALCH9     LDA PARAM,X  ;GETNOTE PARAM
          CMP #$A1     ;VOLUME > 0?
          BPL ALCH4    ;YES. NEXT KEY
          LDA #$FF     ;NO. CLEAR KEY
          STA PLTBL,X  ;FROM PLTBL
          LDA #$A0     ;AND SET VOLUME
          STA PARAM,X  ;TO ZERO
          LDA #0       ;GET ZERO
          STA STATE,X  ;STATE TO ATTACK
          STA TIME,X   ;TIME TO ZERO
ALCH4     DEX          ;NEXT KEY
          BPL ALCH1    ;DONE? NO.
;
; ------------------------------------
; PART TWO OF THIS ROUTINE PUTS NEW
; KEYS INTO UNUSED PLTBL REGISTERS
; ------------------------------------
;
          LDX #3       ;INKEY PNTR
ALCH5     LDA INKEY,X  ;GET KEY DATA
          CMP #$FF     ;VALID KEY?
          BEQ ALCH7    ;NO. SKIP
          LDY #3       ;PLTBL PNTR
ALCH6     LDA PLTBL,Y  ;PLAY TABLE DATA
          CMP #$FF     ;EMPTY SLOT?
          BEQ ALCH8    ;YES. USE IT
          DEY          ;TRY ANOTHER
          BPL ALCH6    ;DONE? NO.
          BMI ALCH7    ;NO EMPTY SLOTS
;
ALCH8     LDA INKEY,X  ;GET KEY DATA
          STA PLTBL,Y  ;PUT PLAY TABLE
          LDA #$A1     ;SET LOW VOLUME
          STA PARAM,Y  ;TO START NOTE
          LDA #0       ;GET ZERO
          STA TIME,Y   ;INIT NOTE TIME
          LDA #$FF     ;GET CLEAR FLAG
          STA INKEY,X  ;CLEAR INKEY DATA
ALCH7     DEX          ;NEXT KEY
          BPL ALCH5    ;DONE? NO.
;
; ------------------------------------
; PART THREE GIVES ANY REMAINING NEW
; KEYS PRIORITY OVER RELEASED KEYS
; ------------------------------------
;
          LDX #3       ;INKEY INDEX
ALCH10    LDA INKEY,X  ;GET KEY
          CMP #$FF     ;VALID KEY?
          BEQ ALCH14   ;NO. TRY NEXT
          LDY #3       ;PLTBL INDEX
ALCH11    LDA STATE,Y  ;GET NOTE STATE
          CMP #3       ;OPEN SLOT?
          BEQ ALCH13   ;YES. CONTINUE
          DEY          ;TRY NEXT
          BPL ALCH11   ;DONE? NO.
          BMI ALCH14   ;NO EMPTY SLOTS
;
ALCH13    LDA INKEY,X  ;GET KEY DATA
          STA PLTBL,Y  ;PUT PLAY TBL
          LDA #$A1     ;VOLUME = 1
          STA PARAM,Y  ;START SOUND
          LDA #0       ;GET ZERO
          STA TIME,Y   ;SET TIME
          LDA #$FF     ;NULL FLAG
          STA INKEY,X  ;CLEAR INKEY
ALCH14    DEX          ;NEXT KEY
          BPL ALCH10   ;DONE? NO.
;
; ---------------------------
; TRANSIENT GENERATOR (ADSR)
; ---------------------------
;
          LDX #3       ;SET NOTE COUNT
TR1       LDA PLTBL,X  ;PLAY TBL ENTRY
          CMP #$FF     ;VALID NOTE?
          BEQ TR3      ;NO. CONTINUE
          LDA STATE,X  ;CHECK STATE
          CMP #1       ;DECAY?
          BEQ DEC      ;YES. CONTINUE
          CMP #2       ;SUSTAIN?
          BEQ SUST     ;YES. CONTINUE
          BPL REL      ;3? RELEASE
          LDA TIME,X   ;START ATTACK
          CMP ATTACK   ;ATTACK TIME UP?
          BMI TR3      ;NO. NEXT KEY
          LDA #0       ;GET ZERO
          STA TIME,X   ;RESET TIME
          LDA PARAM,X  ;LOAD AND
          ADC #1       ;INC VOLUME
          CMP #$A8     ;COMPARE TO PEAK
          BMI TR2      ;PEAK? NO.
          LDA #1       ;STATE TO DECAY
          STA STATE,X  ;FOR NEXT PASS
          LDA #$A8     ;SET PARAM VALUE
          BNE TR2      ;CONTINUE
;
DEC       LDA TIME,X   ;GET TIME VALUE
          CMP DECAY    ;DECAY TIME?
          BMI TR3      ;NO. CONTINUE
          LDA #0       ;GET ZERO
          STA TIME,X   ;RESET TIME
          LDA PARAM,X  ;NOTE PARAMETER
          SEC          ;SET CARRY
          SBC #1       ;DECREMENT VOLUME
          CMP SUSTAIN  ;SUSTAIN LEVEL?
          BPL TR2      ;GT. CONTINUE
          LDA #2       ;STATE = SUSTAIN
          STA STATE,X  ;FOR NEXT PASS
SUST      LDA SUSTAIN  ;SET PARAM VALUE
          JMP TR2      ;CONTINUE
;
REL       LDA TIME,X   ;GET TIME VALUE
          CMP RELEASE  ;RELEASE TIME?
          BMI TR3      ;NO. CONTINUE
          LDA #0       ;GET ZERO
          STA TIME,X   ;RESET TIME
          LDA PARAM,X  ;NOTE PARAMETER
          SEC          ;SET CARRY
          SBC #1       ;DECREMENT VOLUME
          CMP #$A0     ;ZERO VOLUME?
          BPL TR2      ;NO. CONTINUE
          LDA #0       ;STATE TO ATTACK
          STA STATE,X  ;FOR NEXT NOTE
          LDA #$A0     ;ZERO VOLUME
TR2       STA PARAM,X  ;STORE PARAM TBL
TR3       DEX          ;NEXT KEY
          BPL TR1      ;DONE? NO.
;
; ------------------------------------
; OUTPUT NOTES AND VOLUME PARAMETERS
; ------------------------------------
;
          LDX #3       ;NOTE PNTR
          LDY #6       ;PARAMETER PNTR
NOUT1     LDA PLTBL,X  ;GET NOTE
          CMP #$FF     ;NULL NOTE?
          BNE NOUT3    ;NO. PLAY NOTE
          LDA #0       ;GET ZERO
          STA AUDC1,Y  ;CLR AUDIO CTRL
          STA AUDF1,Y  ;CLR AUDIO FREQ
          STA STATE,X  ;CLR STATE
          BEQ NOUT2    ;NEXT NOTE
;
NOUT3     SEC          ;SET CARRY
          SBC #$4F     ;SUB KBD OFFSET
          STX TEMP     ;STORE TEMP
          TAX          ;USE AS INDEX
          LDA NOTES,X  ;NOTE FROM TABLE
          STA AUDF1,Y  ;AUDIO FREQ REG
          LDX TEMP     ;RESTORE X REG
          LDA PARAM,X  ;VOL/DISTORTION
          STA AUDC1,Y  ;AUDIO CONTROL
NOUT2     DEX          ;NEXT NOTE
          DEY          ;NEXT SOUND REG
          DEY          ;DO AGAIN
          BPL NOUT1    ;GET NEXT NOTE
;
; ---------------
; SET ADSR VALUES
; ---------------
;
          LDX #3       ;LOAD COUNT
ADSR1     LDA PADDL0,X ;PADDLE VALUE
          LSR A        ;/2  SHIFT
          LSR A        ;/4  FOUR TIMES
          LSR A        ;/8  TO GET
          LSR A        ;/16 HIGH NIBBLE
          STA ATTACK,X ;STORE ADSR VAL
          DEX          ;DO NEXT
          BPL ADSR1    ;DONE? NO.
          LDA SUSTAIN  ;MOST SIG NIBBLE
          AND #$0F     ;SUSTAIN LEVEL TO
          ORA #$A0     ;$A0 = PURE TONES
          CMP #$A8     ;VOLUME > 8?
          BMI ADSR2    ;NO. CONTINUE
          LDA #$A8     ;VOLUME > 8?
ADSR2     STA SUSTAIN
;
; -------------------
; CLOCK (ADSR TIMER)
; -------------------
;
          LDX #3
CLK1      INC TIME,X
          DEX
          BPL CLK1
          JMP XITVBV
;
; ---------------
; FREQUENCY DATA
; ---------------
;
NOTES     .BYTE 243,230,217,204
          .BYTE 193,182,173,162
          .BYTE 153,144,136,128
          .BYTE 121,114,108,102
          .BYTE 96,91,85,81
          .BYTE 76,72,68,64
          .BYTE 60,57,53,50
          .BYTE 47,45,42,40
          .BYTE 37,35,33,31
          .BYTE 29
;
; ------------
; RUN ADDRESS
; ------------
;
          .ORG $02E0
;
          .WORD INIT
          .END
```

●

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ANALOG Computing is interested in programs, articles, and software review submissions dealing with the Atari home computers. If you feel that you can write as well as you can program, then submit those articles and reviews that have been floating around in your head, awaiting publication. This is your opportunity to share your knowledge with the growing family of Atari computer owners.

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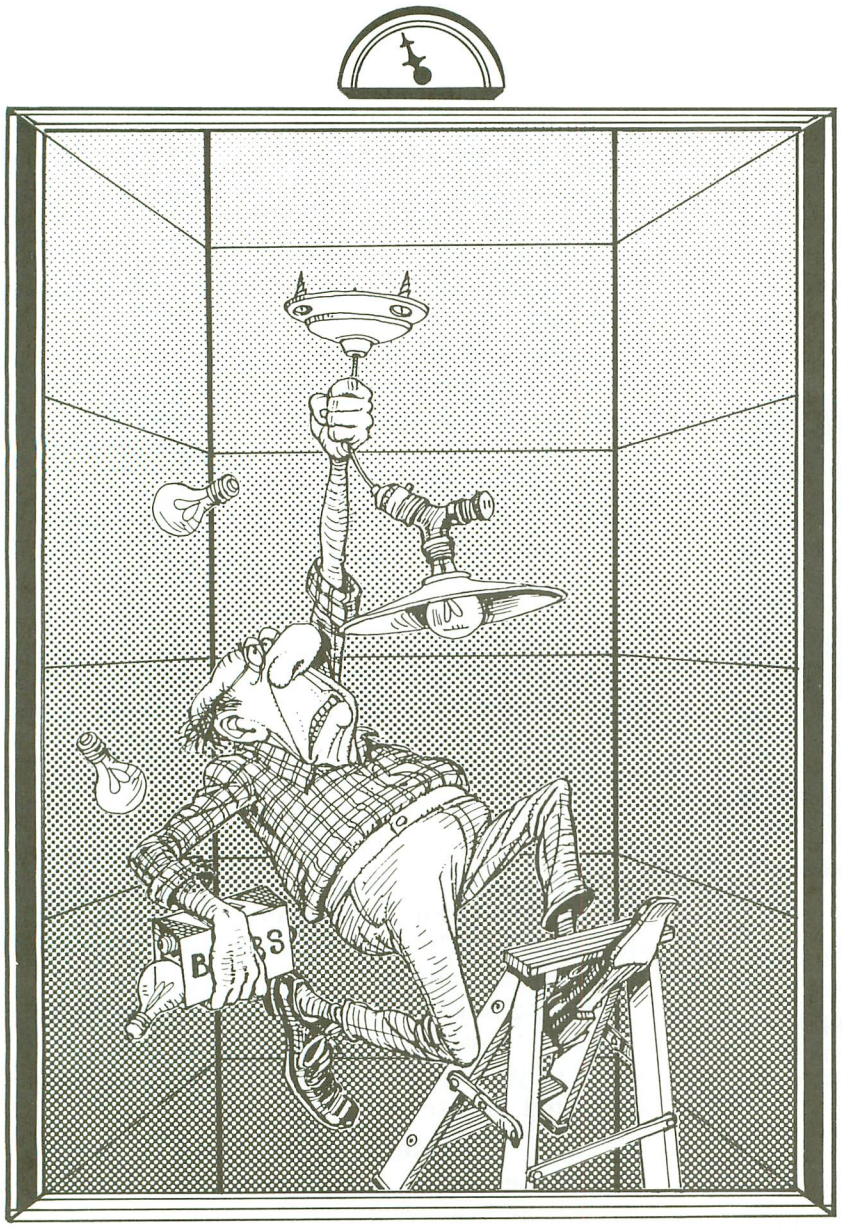


ELEVATOR REPAIRMAN

by Fred Caprilli

You are Dan the **Elevator Repairman**. You've been called into the Polychromatic Hotel to fix its elevators, which have been sabotaged and are going haywire. One problem: this hotel wasn't very well engineered, and the only way to get to the engine room's entrance is to climb the fire escape, which is found on alternate sides of each floor as you go up.

The object, then, is to make your way across each floor toward the stairs, avoiding the elevators and, eventually, to reach the top right-hand side. (If you think this scenario is far-fetched, I suggest you pull out **ANALOG Computing**'s issue 10 and read the background for **Fill 'Er Up!**)

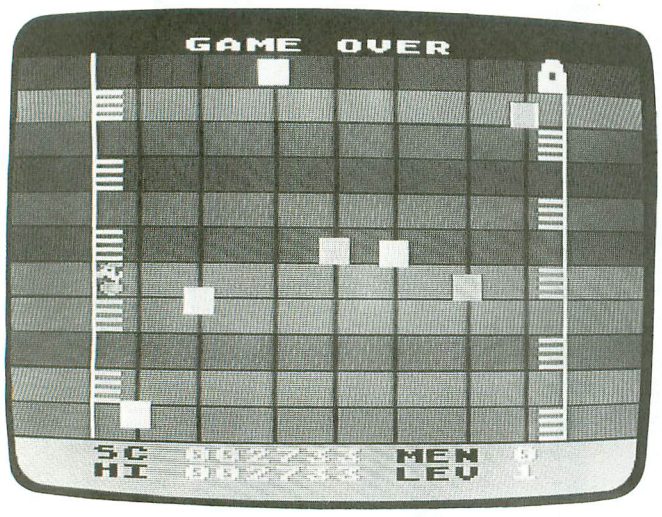
If an elevator hits you (or vice versa), you're sent back to the start of the same floor. When you reach the other side safely, you will automatically climb to the next floor. Reaching the top brings you to the next level, where a couple of elevators speed up. Subsequent levels bring more of the fast elevators; level 7 has a surprise (don't look at the source code—that's cheating).

The top of the screen shows a timer which starts counting down from 250 (about 25 seconds) when you start a floor. Whatever is left when you reach the other side is added to your score, so the faster you get across, the higher your score.

Score, High Score, Level (starting with 0) and Men Left are all shown at the bottom of the screen. I didn't

make allowances for levels higher than 9, so if you're good enough to get past level 9, I hope you won't mind funny characters on the status line.

Use a joystick to move Dan left and right. Notice that you can't really stop in one position—that would be too easy. However, repeated deft flicks of the stick can help you get out of most situations. Note, also, that the spaces between elevators are not all the same width. Use this to your advantage.



Elevator Repairman.

You get nine men to start with (you'll need them!), but no bonus lives are given. If you look carefully, you'll notice random elevators "stalling" temporarily ever few seconds. This changes the pattern of the elevators constantly, so that an "impossible" pattern won't last for long.

Some notes on programming.

Elevator Repairman uses lots of display list interrupts (DLIs) to generate the multicolored playfield and to switch between character sets. Virtually all the game runs in the vertical blank interval (VBI), where graphics changes can be executed smoothly before the screen is drawn, and where events can be monitored eighty times per second.

This time is also used to play the music, the theme from "Peter Gunn." I realize this has precious little to do with repairing elevators, but it's nice and short, and kind of catchy. Note that the bass notes are implemented in 16-bit sound (so they play more in tune) and an "envelope" is applied to shape their sound (i.e., the volume is changed during the duration of one note).

All the elevators and Dan are player/missile graphics. Dan is multicolored (overlapped players 2 and 3). Elevators 1 and 2 are player 0; elevators 3, 4 and 5 are missiles 0, 1 and 2; and elevators 6 and 7 are player 1. By bit-twiddling the players just like missiles, I got two seemingly independent objects out of each of them. All elevators are quadruple width.

If you look at the title screen carefully, you'll notice that *Repairman* is nicely centered below *Elevator*. This was done by shifting *Repairman* by half a character with the fine scroll register.

Finally, here are some tips I learned in the process of writing the game (the first I've managed to complete), which cost me days of debugging time to discover.

When using sound, always include an LDA #3, STA SKCTL as part of initialization. The Atari uses POKEY to make the beeping sound when loading, and this can cause your sound not to be heard (not to mention making a myriad of expletives issue forth from your mouth) when the game first boots up.

Also, when using VBI routines in conjunction with DLIs, do an LDA #$40, STA NMIEN before setting them up. Otherwise, your formerly functioning DLIs won't work when you implement your VBI routine.

Typing it in.

Listing 1 is the BASIC data and data checking routines. This listing is used to create both cassette and disk versions of **Elevator Repairman**. The data statements are listed in hexadecimal, so the program will fit in 16K cassette systems.

Listing 2 is the assembly language source code for the game (MAC/65). You don't have to type this listing to play the game. It's included for those readers interested in assembly language.

Cassette instructions.

1. Type Listing 1 into your computer, using the BASIC cartridge, and verify your typing with **Unicheck** (see page 30).

2. Type *RUN* and RETURN. The program will ask:

MAKE CASSETTE (0) OR DISK (1)?

Type *0* and press RETURN. The program will begin checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all of your DATA lines are correct, the computer will beep twice and prompt you to *READY CASSETTE AND PRESS RETURN*. Now, insert a blank cassette in your recorder, press the RECORD and PLAY buttons simultaneously, and hit RETURN. The message *WRITING*

FILE will appear, and the program will create a machine language boot tape version of **Elevator Repairman**, printing each DATA line number as it goes. When the *READY* prompt appears, the game is recorded and ready to play. CSAVE the BASIC program onto a separate tape before continuing.

4. To play the game, rewind the tape created by the BASIC program to the beginning. Turn the computer OFF and remove all cartridges. Press the PLAY button on your recorder and turn ON your computer, while holding down your START key. If you have a 600 or 800XL computer, you must hold the START and OPTION keys when you tun on the power. The computer will beep once. Hit the RETURN key, and **Elevator Repairman** will load and run automatically.

Disk instructions.

1. Type Listing 1 into your computer, using the BASIC cartridge, and verify your typing with **Unicheck** (see page 30).

2. Type *RUN* and press RETURN. The program will ask:

MAKE CASSETTE (0) OR DISK (1)?

Type *1* and press RETURN. The program will begin checking the DATA lines, printing the line number of each statement as it goes. It will alert you if it finds any problems. Fix incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all DATA lines are correct, you'll be prompted to *INSERT DISK WITH DOS, PRESS RETURN*. Put a disk containing DOS 2.0S into drive 1 and press RETURN. The message *WRITING FILE* will appear, and the program will create an AUTORUN.SYS file on the disk, displaying each DATA line number as it goes. When the *READY* prompt appears, the game is ready to play. Be sure the BASIC program is SAVEd before continuing.

4. To play the game, insert the disk containing the AUTORUN.SYS file into drive 1. Turn your computer OFF, remove all cartridges and turn the computer back ON. **Elevator Repairman** will load and run automatically.

That's it. I hope you don't fall down any elevator shafts. □

Fred Caprilli is an Information Analyst in Ontario. He has had his Atari 800 for three years and has served as president of the Hamilton-Burlington-Oakville Atari Users Group.

Listing 1.
BASIC listing.

```
10 REM *** ELEVATOR REPAIRMAN ***
20 TRAP 20:? "MAKE CASSETTE (0), OR DI
SK (1)";:INPUT DSK:IF DSK>1 THEN 20
30 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,9
,0,0,0,0,0,0,0,10,11,12,13,14,15
40 DIM DAT$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 120:? "CHECKING DATA"
50 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$)<>90 THEN 220
60 DATLIN=PEEK(183)+PEEK(184)*256:IF D
ATLIN<>LINE THEN ? "LINE ";LINE;" MISS
ING!":END
70 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X,
X))-48:D2=ASC(DAT$(X+1,X+1))-48:BYTE=H
EX(D1)*16+HEX(D2)
80 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 50
90 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
TOTAL=TOTAL-1000
100 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
 THEN 50
110 GOTO 220
120 IF PEEK(195)<>6 THEN 220
130 IF PASS=0 THEN 170
140 IF  NOT DSK THEN 160
150 PUT #1,224:PUT #1,2:PUT #1,225:PUT
 #1,2:PUT #1,0:PUT #1,32:CLOSE #1:END
160 FOR X=1 TO 21:PUT #1,0:NEXT X:CLOS
E #1:END
170 IF  NOT DSK THEN 200
180 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
,"D:AUTORUN.SYS"
190 PUT #1,255:PUT #1,255:PUT #1,0:PUT
 #1,32:PUT #1,66:PUT #1,40:GOTO 210
200 ? "READY CASSETTE AND PRESS RETURN
";:OPEN #1,8,128,"C:":RESTORE 230:FOR
X=1 TO 40:READ N:PUT #1,N:NEXT X
210 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 120:GOTO 50
220 ? "BAD DATA: LINE ";LINE:END
230 DATA 0,17,216,31,255,31,169,0,141,
47,2,169,60,141,2,211,169,0,141,231,2,
133,14,169,56,141,232,2
240 DATA 133,15,169,0,133,10,169,32,13
3,11,24,96
1000 DATA A93C8D02D3A9008D4402A9018509
A919850CA920850D20EF20D820242520C12020
07242051202OEB23A5A1F01A,956
1010 DATA A9088D1FD0AD1FD04906D0F985A1
A907A062A2E4205CE44C1920A59DF0DE200724
4C2920A2008E2F02A9408D0E,813
1020 DATA D4A92D8D3002A9278D3102A9688D
0002A9218D0102A0C9A221A907205CE4A93D8D
2F02A9C08D0ED4A90A8DC402,342
1030 DATA A9008DC5028DC80285BCA9CC8DC6
02A9508D08D2A9038D0FD2A9AA8D03D28D05D2
8D07D2A9FF85BF85BEA90E85,169
1040 DATA BDA237BDE4279D0006CA10F760A9
00A2109591CA10FBA90285B3A990A2059DAE26
CA10FA8DC926A9FF85B2A999,102
1050 DATA 8DB926A96B8D3027A9268D312760
A205A9909DBE26CA10FA60A9388D07D4A9038D
1DD0A900A899003B99003C99,981
1060 DATA 003D99003E99003F88D0EEA007B9
BC259900D08810F7A94085B0201423A97A8DC0
02A9F88DC102A9488DC202A9,147
1070 DATA 908DC302A93F8D08D08D09D08D0C
D0A9008D0AD08D0BD0A9218D6F02A93E858C85
848588A93F858E858685BA60,460
1080 DATA 488A48A206A9C28D0AD48E09D445
4F254E8D0AD48D1AD0A9218D0102A98D8D0002
68AA6840488A48A9008D0AD4,55
```

```
1090 DATA 8D1AD0A691BDC425454F254E8D0A
D48D1AD0E691A591C90BD016A9E08D09D4A900
85918D16D0A9688D0002A921,482
1100 DATA 8D010268AA6840A5A1F0034CDC22
A59CD06DA206B5A2C9201008C9441004A901D0
0AC99F3008C9C13004A90095,230
1110 DATA A9CA10E3A206E4B5D00CA5B6F008
C6B6A5B62903F032BDD6258581B5A28580BDCF
2549FF8582B5A9F00FB592F0,799
1120 DATA 04F6A2E680F6A2E6804C3422B592
F004D6A2C680D6A2C68020F222CA10BBA514D0
0320E222A59BF00620C2234C,776
1130 DATA D622A59CF006208D244CDC22A49A
B9E825C5B0D010C00A3006201A254CD62220B3
234CD6222001 25F006A97885,482
1140 DATA 9CD05DE6B4A5B4C5B33055A90085
B4A6B220A023E4B2F00320612 4A5B23041A49A
B9DD25C5B0F01818B9202669,308
1150 DATA 0FA8A5142907C9043004A918D002
A92499003EA5B26A900BA5B0C940F015C6B04C
CE22A5B0C9B8F00AE6B0A5B0,688
1160 DATA 8D02D08D03D020242320752 58D1E
D04C62E4AD0AD22907C907F0F785B5A9B085B6
60A00F20062388B18025821D,504
1170 DATA CF25918088C001D0F2B180258291
8088B180258291806 0A206AD0AD2293F0A6928
95A2CA10F360A59BD042A5BA,155
1180 DATA D006A5B9290FF038F838A5BBE911
85BBA5BAE90085BAA5B9E90085B9D8A5BA290F
09908D7326A5BA4A4A4A4A09,827
1190 DATA 908D7226A5B9290F85B909908D71
26A90085B860A203F818CAB59E75B8959E8AD0
F6D885B885B985BA85BBA202,847
1200 DATA A005B59E48290F099099AE26684A
4A4A4A09908899AE2688CA10E760AD00D32908
F009AD00D32904D004A90185,358
1210 DATA B260206B23A910859BA49AB92026
85B160A000A5B185838585C6B1A5B185878589
B1839187B1859189C8C01030,181
1220 DATA F3A9009187918 9C69BD002E69AA9
0085B8A90285B9A95085BAA9928D7126A9958D
7226A9908D732660A499C007,82
1230 DATA 3004A90185B3C004300 2A004980A
A8B91626858FC8B91626859 0A006B18F999200
8810F820FA20A900859A2048,658
1240 DATA 2420EB23A59909908DC926A90085
9D60A49AB9DD258D02D08D03D085B0206124A9
00854DA9FF85B260A49AB920,85
1250 DATA 26858B858DA00FA5B26AB00EB94B
26918BB95B26918D8810F360B92B26918BB93B
26918D8810F360A9008D00D2,285
1260 DATA 8D02D28D04D2C69CA59CF02AC93C
1006A9008D06D2602903D054A5B2F00B206124
A90085B2A920D009206124A9,182
1270 DATA 0185B2A9408D06D260204824CEB9
26ADB926290FD02BA9CA8D3027A9268D3127A9
0185A1A200BDAE26DDBE2630,11
1280 DATA 13D006E8E00630F160A205BDAE26
9DBE26CA10F760AD0ED00D0FD02903D00BAD08
D00D09D00D0AD0290C8D1ED0,781
1290 DATA 60206B23E699A901859D60A9008D
2F028DC402A95B8D3002A9278D3102A93D8D2F
02A90E8DC502A9048D04D4AD,185
1300 DATA 0BD4D0FBA8A6B78D0AD48D1AD0E8
8A29F00908C8C0F0D0EFE6B7A9088D1FD0AD1F
D04906F0088D0AD48D1AD0D0,524
1310 DATA D160A5BD1006A90E85BDE6BCA5BC
2907A8B9DA268D00D2B9E2268D02D2A6BDBDEA
268D03D2C6BDA5BF1013E6BE,659
1320 DATA A4BEC01A3006A9FF85BED00FB913
2785BFA4BEB9F9268D04D2C6BF6048A040406C
7C8C008222B2421252723262,990
1330 DATA E406C00C030C30C00C3C3C3B3B3B
3D3D40B840B840B840B840B840B840B840B840
B840B840B800000000000000,842
1340 DATA 0001000001000001010001000100
0001010101000101010101010101F325FA2501
2608260F26C0B0A090807060,573
1350 DATA 50403020000F3F1C347D7D6F0602
1E3F3F3F1E0C000F3F030B020210180E1E3D39
391E0000787E1C165F5F7B30,627
1360 DATA 203C7E7E7E3C1800787E60682020
040C383C5E4E4E3C0000000000000090909000
0000000000001460046000 0,706
1370 DATA 4100410041004600460503460046
0000410041004100460046020146004600004 1
0041004100460046043323 00,92
1380 DATA 9090909090900 02D252E00900028
2900909090909002C2536009000000027212
2D25002F3625320000000 06B,901
1390 DATA 6B966BEA6B036435352F352C3528
2AA2A6AAA8A8A8A8A8A8A8A7A5A3A0A0445100
4428390051443C3900390039,277
1400 DATA 00393C44515B516C600000722259
721313630E0E0E1300120012001213131313 13
0E0E7F507070C66B26C77B26,779
1410 DATA C78B26C79B26C78B26C79B26C78B
26C79B26C78B26C79B26C78B26C79B261046AB
2606412D2770707070707047,812
1420 DATA 7C27701770704 6A027707046B027
7006707056D027707041 5B270000000252C25
3621342F3200000000000000,560
1430 DATA 0000322530212 9322D212E000000
0000002239002632252400232 13032292C2C29
0000000082309001119 1815,670
1440 DATA 00000000212E212C2F2700232F2D
303534292E270000000070726573730073746 1
72740000000000000000000,433
1450 DATA 0000008080808080808080010101
0101010101 80FF80FF80FF80FF01FF01FF01FF
01FF3C7E7EE7E7FFFFFF0808,576
1460 DATA 0808080808080000000000000000
0000000000000000000000000000000000000000
0000000000000000000000,624
```

●

CHECKSUM DATA.

(see page 30)

```
10 DATA 321,351,496,811,423,729,200,60
3,555,573,694,613,29,205,214,6817
160 DATA 737,198,962,763,491,30,155,11
1,169,532,713,916,176,84,847,6884
1060 DATA 885,935,152,991,664,77,734,7
16,800,874,516,687,143,19,844,9037
1210 DATA 620,981,554,931,767,726,958,
36,817,349,339,950,508,777,628,9941
1360 DATA 92,812,974,741,319,66,975,81
7,907,825,412,6940
```

●

Listing 2.
Assembly listing.

```
        +-----------------------+
        |                       |
        |  ELEVATOR REPAIRMAN   |
        |                       |
        |    by Fred Caprilli   |
        |                       |
        |      (c) 1985         |
        |                       |
        |   Analog Computing    |
        |                       |
        +-----------------------+

        System equates

VDSLST  =   $0200
SDLSTL  =   $0230
SDMCTL  =   $022F
GRACTL  =   $D01D
NMIEN   =   $D40E
WSYNC   =   $D40A
```

```
COLBAK  =   $D01A
CHBASE  =   $D409
PMBASE  =   $D407
HSCROL  =   $D404
VCOUNT  =   $D40B
HPOSP0  =   $D000
HPOSP2  =   $D002
HPOSP3  =   $D003
COLRP0  =   $02C0
COLRP1  =   $02C1
COLRP2  =   $02C2
COLRP3  =   $02C3
SIZEP0  =   $D008
SIZEP1  =   $D009
SIZEP2  =   $D00A
SIZEP3  =   $D00B
SIZEM   =   $D00C
RANDOM  =   $D20A
SETVBV  =   $E45C
XITVBV  =   $E462
CONSOL  =   $D01F
STICK   =   $D300
P2PL    =   $D00E
P3PL    =   $D00F
M0PL    =   $D008
M1PL    =   $D009
M2PL    =   $D00A
COLPF0  =   $D016
HITCLR  =   $D01E
JIFFY   =   $14
GPRIOR  =   $026F
COLOR0  =   $02C4
COLOR1  =   $02C5
COLOR2  =   $02C6
SCOLBK  =   $02C8
BOOT    =   $09
COLDST  =   $0244
DOSINI  =   $0C
ATRACT  =   $4D
DRKMSK  =   $4E
COLRSH  =   $4F
CHSET   =   $0600
;
AUDF0   =   $D200
AUDF1   =   $D202
AUDC1   =   $D203
AUDF2   =   $D204
AUDC2   =   $D205
AUDF3   =   $D206
AUDC3   =   $D207
AUDCTL  =   $D208
SKCTL   =   $D20F
PACTL   =   $D302
;
; Player / Missile Area
;
        *=  $3800
;
PMAREA  .DS $0300
MAREA   .DS $0100
P0AREA  .DS $0100
P1AREA  .DS $0100
P2AREA  .DS $0100
P3AREA  .DS $0100
;
; Page Zero Variables
;
        *=  $80
;
EHT     .DS 2       ;P/M ht for elev
EMSK    .DS 1       ;msk to clr bits
D1S     .DS 2       ;climb fr height
D2S     .DS 2       ;same (P3)
D1D     .DS 2       ;climb to height
D2D     .DS 2       ;same (P3)
DAN1    .DS 2       ;P/M pg. Dan (P2)
DAN2    .DS 2       ;P/M pg. Dan (P3)
ESP     .DS 2       ;speed tbl pntr
COFSET  .DS 1       ;DLI tbl offset
ESPEED  .DS 7       ;elevator speeds
LEVEL   .DS 1       ;level no.
FLOOR   .DS 1       ;current floor
CLIMBF  .DS 1       ;Dan climbing flg
DIEFLAG .DS 1       ;indicates dying
NEWLVL  .DS 1       ;flags new level
SCORE   .DS 3       ;score in BCD
OVERFLG .DS 1       ;game over status
HITES   .DS 7       ;elevator heights
DIR     .DS 7       ;elevator dirs
DANHOR  .DS 1       ;Dan's hor pos
CLIMBHT .DS 1       ;climb height
DANDIR  .DS 1       ;Dan's direction
DANSPD  .DS 1       ;Dan's speed
SPDCNT  .DS 1       ;speed counter
ELDLAY  .DS 1       ;elev # to stall
DLYCNT  .DS 1       ;death delay
COLCNT  .DS 1       ;color counter
TIME    .DS 4       ;time in BCD
BASCNT  .DS 1       ;Bass note cntr
BASTIM  .DS 1       ;Bass timer
TRBCNT  .DS 1       ;Treble counter
TRBTIM  .DS 1       ;Treble timer
;
; Game starts here
;
        *=  $2000
;
INIT    LDA #$3C    ;cassette off
        STA PACTL   ;if necessary
        LDA #0
        STA COLDST  ;Warm start
        LDA #1
        STA BOOT    ;Disk boot OK
        LDA # <RST
        STA DOSINI
        LDA # >RST
        STA DOSINI+1 ;Trap S/RESET
        JSR CLRHI   ;clear hiscore
RST     CLD         ;just in case
        JSR TITLE   ;Title screen
        JSR ZERO    ;init. variables
        JSR SLEVEL
        JSR SETUP   ;main display
        JSR INITIM  ;reset timer
;
; Mainline (non-VBI) code
;
MAIN    LDA OVERFLG ;Game over?
        BEQ MN1     ;No.
        LDA #8      ;Yes, so clear
        STA CONSOL  ;CONSOL and
MN0     LDA CONSOL  ;poll START key
        EOR #6      ;Is it pressed?
        BNE MN0     ;No.
        STA OVERFLG ;Yes, zero flag
        LDA #7      ;back to
        LDY # <XITVBV ;standard VB
        LDX # >XITVBV ;routine
        JSR SETVBV
        JMP RST     ;and start at top
MN1     LDA NEWLVL  ;Check new level
        BEQ MAIN    ;Not yet, loop
        JSR SLEVEL  ;Yes, new level
        JMP MAIN    ;and loop back
;
; End of Mainline code
;
SETUP   LDX #0
        STX SDMCTL  ;Disable DMA
        LDA #$40
        STA NMIEN   ;Disable DLI
        LDA # <DLIST
        STA SDLSTL  ;Point to
        LDA # >DLIST ;the game
        STA SDLSTL+1 ;display list
        LDA # <DLI1 ;DLI vector
        STA VDSLST
        LDA # >DLI1
        STA VDSLST+1
        LDY # <VBI  ;Set up VBI
        LDX # >VBI
        LDA #7      ;Deferred
        JSR SETVBV
        LDA #$3D    ;P/M enable, and
        STA SDMCTL  ;narrow playfield
        LDA #$C0
        STA NMIEN   ;enable DLI's
        LDA #$0A    ;white
        STA COLOR0  ;for stairs
        LDA #$00    ;black
        STA COLOR1  ;for shafts
        STA SCOLBK  ;and screen top.
        STA BASCNT  ;bass notes index
        LDA #$CC    ;green
        STA COLOR2  ;for digits
;
        LDA #$50    ;16-bit ch. 0/1
        STA AUDCTL  ;8-bit ch. 2,3
        LDA #3
        STA SKCTL   ;reset POKEY
        LDA #$AA    ;vol.10, dist.10
        STA AUDC1
        STA AUDC2
        STA AUDC3
        LDA #$FF
        STA TRBTIM  ;timer for treble
        STA TRBCNT  ;treble note cntr
        LDA #14
        STA BASTIM  ;timer for bass
;
; Download charset to page 6
;
        LDX #55     ;# of bytes
CDL     LDA CSETB,X
        STA CHSET,X
        DEX
        BPL CDL
        RTS
;
ZERO    LDA #0      ;zero variables
        LDX #OVERFLG-COFSET
Z1      STA COFSET,X
        DEX
        BPL Z1
        LDA #2      ;Dan moves...
        STA DANSPD  ;every other VBI
        LDA #$30    ;ATASCII inv "0"
        LDX #5
L1      STA SSCORE,X ;0 score
        DEX
        BPL L1
        STA LEVBYTE ;level 0
        LDA #$FF
        STA DANDIR  ;no initial dir.
        LDA #$99    ;digit 9 on
        STA MENBYT  ;screen - 9 men
        LDA # <TLINE
        STA MSG
        LDA # >TLINE
        STA MSG+1   ;Top shows timer
        RTS
;
CLRHI   LDX #5      ;hi to 000000
        LDA #$30
CR1     STA HISCORE,X
        DEX
        BPL CR1
        RTS
;
PMSETUP LDA # >PMAREA
        STA PMBASE  ;to P/M area
        LDA #3
        STA GRACTL  ;enable P/M DMA
        LDA #0      ;clear P/M area
        TAY
CLN     STA MAREA,Y
        STA P0AREA,Y
        STA P1AREA,Y
        STA P2AREA,Y
        STA P3AREA,Y
        DEY
        BNE CLN
;
        LDY #7      ;8 P/M locs
INITPM  LDA ELEPOS,Y ;init P/M
        STA HPOSP0,Y ;horizontal pos
        DEY         ;next P/M
        BPL INITPM  ;done? No.
        LDA #64
        STA DANHOR
;
        JSR SETHTS  ;elev heights
;
        LDA #$7A    ;Set P/M colors
        STA COLRP0
        LDA #$F8
        STA COLRP1
        LDA #$48
        STA COLRP2
        LDA #$90
        STA COLRP3
;
        LDA #$3F    ;P/M widths
        STA SIZEP0  ;quadruple for
        STA SIZEP1  ;elevators (P0,
        STA SIZEM   ;P1,M0-M2)
        LDA #0      ;single for
        STA SIZEP2  ;Dan
        STA SIZEP3  ;(P2,P3)
        LDA #$21
        STA GPRIOR  ;Multicolor PL
        LDA # >P2AREA ;Set up zero
        STA DAN1+1  ;page pointers
        STA D1S+1
        STA D1D+1
        LDA # >P3AREA
        STA DAN2+1
        STA D2S+1
        STA D2D+1
        RTS
;
; The Display list interrupt routines
;
DLI1    PHA         ;Save registers
        TXA
        PHA
        LDX # >CHSET ;new charset
        LDA #$C2
        STA WSYNC
        STX CHBASE
        EOR COLRSH  ;mask attract
        AND DRKMSK
        STA WSYNC
        STA COLBAK  ;change color
        LDA # >DLI2
        STA VDSLST+1
        LDA # <DLI2
        STA VDSLST  ;next DLI
        PLA
        TAX
        PLA         ;Restore regs
        RTI
;
DLI2    PHA         ;Save registers
        TXA
        PHA
        LDA #0
        STA WSYNC
        STA COLBAK  ;Black ceiling
        LDX COFSET
        LDA COLORS,X ;get color
        EOR COLRSH  ;mask attract
        AND DRKMSK
        STA WSYNC
        STA COLBAK
        INC COFSET  ;inc index
        LDA COFSET  ;table index
        CMP #11     ;last DLI?
        BNE EX      ;no.
        LDA #$E0    ;Yes, so restore
        STA CHBASE  ;default cset.
        LDA #0
        STA COFSET  ;and zero index
        STA COLPF0  ;and color 0.
        LDA # <DLI1 ;Point back to
        STA VDSLST  ;first DLI.
        LDA # >DLI1
        STA VDSLST+1
EX      PLA
        TAX
        PLA         ;Restore registers.
        RTI
;
; The Vertical Blank routine
;
VBI     LDA OVERFLG ;Skip VBI if
        BEQ V0      ;game over.
        JMP XVB
V0      LDA DIEFLAG ;Dan dying?
        BNE DAN     ;Yes, skip elevs
;
; Check screen heights for elevators
; and reverse direction if necessary
;
C3      LDX #6      ;do 7 elevator
C0      LDA HITES,X
        CMP #32     ;At top?
        BPL C1      ;No. skip
        CMP #68     ;Intermediate
        BPL C1
        LDA #1      ;Going down!
        BNE C2A
;
C1      CMP #159    ;intermediate
        BMI C2
        CMP #193    ;At bottom?
        BMI C2      ;No. no change
        LDA #0      ;Yes, going up!
C2A     STA DIR,X
C2      DEX         ;next elevator
        BPL C0      ;done? No.
;
; Now set up for movement of elevators
;
        LDX #6      ;do 7 elevators
M1      CPX ELDLAY  ;slow it down?
        BNE M2      ;No.
        LDA DLYCNT  ;Yes.
        BEQ M2      ;Delay over yet?
        DEC DLYCNT  ;No.
        LDA DLYCNT  ;count down one
        AND #3      ;and skip a turn
```

```
          BEQ M5        ;every 1/15 sec.
M2        LDA ELOCS,X   ;P/M page
          STA EHT+1
          LDA HITES,X   ;byte loc in page
          STA EHT
          LDA EMASKS,X  ;Get mask
          EOR #$FF      ;save its inverse
          STA EMSK
          LDA DIR,X     ;0=up, 1=down
          BEQ UP
;
; Set up for down movement
;
          LDA ESPEED,X  ;elevator speed
          BEQ D1
          INC HITES,X
          INC EHT       ;double speed
D1        INC HITES,X
          INC EHT       ;normal speed
          JMP M4
;
; Set up for up movement
;
UP        LDA ESPEED,X
          BEQ U1
          DEC HITES,X
          DEC EHT       ;double speed
U1        DEC HITES,X
          DEC EHT       ;normal speed
;
; Execute the movement
;
M4        JSR MV        ;move the bytes
M5        DEX           ;next elevator
          BPL M1        ;done? No.
;
          LDA JIFFY     ;Stall elevator?
          BNE DAN       ;(when JIFFY=0)
          JSR ELNEW
;
; Elevators done. Now, we process
; Dan the Elevator Repair Man.
;
DAN       LDA CLIMBF    ;climbing?
          BEQ VB1       ;No.
          JSR CLIMB1    ;Yes, move him up
          JMP DANEND    ;and exit.
VB1       LDA DIEFLAG   ;Presently dying?
          BEQ VB2       ;No. skip
          JSR DEATH     ;Yes. keep dying
          JMP XVB       ;and exit.
VB2       LDY FLOOR
          LDA STAIRS,Y  ;Has he reached
          CMP DANHOR    ;the stairs?
          BNE VB4       ;No.
          CPY #10       ;Top floor?
          BMI VB3       ;No, climb stairs
          JSR ENDLEV    ;Yes, so end it
          JMP DANEND    ;and exit.
VB3       JSR SCLIMB    ;init climbing
          JMP DANEND    ;and exit.
VB4       JSR HITCHK    ;Chk collision
          BEQ VB5       ;Dan hit? No.
          LDA #120      ;Yes, start 120
          STA DIEFLAG   ;jiffy death...
          BNE DANEND    ;and exit
;
; If we make it to here, it means our
; hero is either starting or in the
; midst of his perilous trek across
; the screen.
;
VB5       INC SPDCNT    ;Speed counter
          LDA SPDCNT
          CMP DANSPD    ;Time to move?
          BMI DANEND    ;No, so exit.
          LDA #0
          STA SPDCNT    ;Zero the counter
          LDX DANDIR    ;Save old dir
          JSR JOY       ;dir change?
          CPX DANDIR
          BEQ MOVEDAN   ;No, skip
          JSR DRAWDAN   ;Yes, redraw him
MOVEDAN   LDA DANDIR
          BMI DANEND    ;Wait on joystick
          LDY FLOOR
          LDA STARTS,Y  ;Is Dan at start
          CMP DANHOR    ;of floor?
          BEQ F3        ;Yes, skip next
          CLC           ;animate feet
          LDA DANHT,Y
          ADC #15       ;Bottom of Dan
          TAY           ;for feet.
          LDA JIFFY
          AND #7        ;Mod 8 counter
          CMP #4        ;at 4 jiffies?
          BMI F2
          LDA #$18      ;"feet in" byte
          BNE F3A
F2        LDA #$24      ;"feet out" byte
F3A       STA P2AREA,Y
F3        LDA DANDIR
          ROR A         ;Right or left?
          BCC MVRT      ;Right (DANDIR=0)
          LDA DANHOR    ;trying to pass
          CMP #$40      ;left edge?
          BEQ DANEND    ;Yes, stop him
          DEC DANHOR    ;Dec horizontal
          JMP MVLF
MVRT      LDA DANHOR    ;Trying to pass
          CMP #$B8      ;right edge?
          BEQ DANEND    ;Yes, stop him
          INC DANHOR    ;No, so move it
MVLF      LDA DANHOR    ;position shadow
          STA HPOSP2    ;and do the
          STA HPOSP3    ;horizontal move
;
DANEND    JSR TIMER     ;Do the timer
          JSR MUSIC     ;Do the music
XVB       STA HITCLR    ;clr collisions
          JMP XITVBV    ;and finish VBI!
;
; Subroutines
; -----------
;
; Pick an elevator to stall [0-6]
;
ELNEW     LDA RANDOM
          AND #7        ;0-7
          CMP #7
          BEQ ELNEW     ;0-6
          STA ELDLAY
          LDA #$80
          STA DLYCNT
          RTS
;
; Animate the elevators - on entry,
; (EHT) points to the pertinent P/M
; area, and EMSK contains inverse bit
; mask, to zero out bits (tops and
; bottoms of elevators).  Elevators
; are 12 solid lines plus 2 blanks on
; top and 2 on bottom.
;
MV        LDY #15       ;16 bytes
          JSR V2        ;15-14 (bottom)
          DEY
V1        LDA (EHT),Y   ;lines 13 to 2
          AND EMSK      ;Clr current bits
          ORA EMASKS,X  ;set new ones
          STA (EHT),Y
          DEY
          CPY #1
          BNE V1
V2        LDA (EHT),Y   ;line 1
          AND EMSK      ;Zero out bits
          STA (EHT),Y   ;with mask
          DEY
          LDA (EHT),Y   ;line 0 (top)
          AND EMSK
          STA (EHT),Y
          RTS
;
; Generate elevator starting heights
;
SETHTS    LDX #6        ;7 elevators
SH1       LDA RANDOM
          AND #$3F      ;0-63
          ASL A         ;0-126 even
          ADC #40       ;40-166 even
          STA HITES,X
          DEX
          BPL SH1
          RTS
;
; This subroutine updates the
; countdown timer, and puts it to
; the screen
;
TIMER     LDA CLIMBF    ;Don't time
          BNE TI1       ;if climbing
          LDA TIME+2
          BNE TI0
          LDA TIME+1
          AND #$0F
          BEQ TI1       ;If 0 don't dec
TI0       SED           ;Decimal math
          SEC
          LDA TIME+3    ;Fractional byte
          SBC #17       ;approx. 0.1 sec
          STA TIME+3    ;(rolls over
          LDA TIME+2    ;every 6 jiffies)
          SBC #0
          STA TIME+2
          LDA TIME+1
          SBC #0
          STA TIME+1
          CLD
;
          LDA TIME+2    ;Take 3-byte (6
          AND #$0F      ;decimal digit),
          ORA #$90      ;take the low 3
          STA TLINE+8   ;digits and put
          LDA TIME+2    ;to the screen.
          LSR A         ;move high nybble
          LSR A         ;for 2nd decimal
          LSR A         ;digit down to
          LSR A         ;low nybble
          ORA #$90      ;make it ATASCII
          STA TLINE+7   ;put to screen
          LDA TIME+1    ;we only want low
          AND #$0F      ;nybble here
          STA TIME+1    ;(3 digits total)
          ORA #$90      ;make it ATASCII
          STA TLINE+6   ;put to screen
          LDA #0
          STA TIME      ;not used
TI1       RTS
;
; This subroutine updates the scoring
; when Dan reaches a new floor
;
SCORING   LDX #3        ;3-byte (6-digit)
          SED           ;decimal add
          CLC
SC1       DEX
          LDA SCORE,X
          ADC TIME,X
          STA SCORE,X
          TXA
          BNE SC1
          CLD
          STA TIME      ;Zero out timer
          STA TIME+1
          STA TIME+2
          STA TIME+3
          LDX #2
          LDY #5
SC2       LDA SCORE,X
          PHA           ;Save it
          AND #$0F      ;low nybble
          ORA #$90      ;make it ATASCII
          STA SSCORE,Y  ;put on screen
          PLA           ;use same byte
          LSR A         ;high nybble
          LSR A         ;we move it
          LSR A         ;down to
          LSR A         ;low nybble
          ORA #$90      ;make it ATASCII
          DEY
          STA SSCORE,Y  ;put to screen
          DEY
          DEX
          BPL SC2
          RTS
;
; This subroutine reads the joystick.
;
JOY       LDA STICK     ;Read joystick
          AND #8        ;Right?
          BEQ JLR       ;Yes.
          LDA STICK
          AND #4        ;No. left?
          BNE JE        ;No, dir same
          LDA #1        ;1 = left
JLR       STA DANDIR
JE        RTS
;
; This subroutine updates the score
; and sets up the climb.
;
SCLIMB    JSR SCORING   ;Update score
          LDA #16       ;16 scan lines
          STA CLIMBF    ;to climb.
          LDY FLOOR     ;index to screen.
          LDA DANHT,Y   ;height table
          STA CLIMBHT   ;start climb here
          RTS
;
; This subroutine makes Dan climb 1
; scan line per VBI (if CLIMBF<>0).
; It continues into the INITIM
; subroutine.
;
CLIMB1    LDY #0
          LDA CLIMBHT   ;Set up zero page
          STA D1S       ;pointers
          STA D2S
          DEC CLIMBHT   ;destination is
          LDA CLIMBHT   ;one scan line up
          STA D1D
          STA D2D
CL1       LDA (D1S),Y   ;Move P2 up one.
          STA (D1D),Y
          LDA (D2S),Y   ;Move P3 up one.
          STA (D2D),Y
          INY
          CPY #16       ;All bytes moved?
          BMI CL1       ;No.
          LDA #0        ;Erase last line
          STA (D1D),Y
          STA (D2D),Y
          DEC CLIMBF
          BNE INITIM    ;Is climb over?
          INC FLOOR     ;Yes, new floor.
;
; This subroutine sets timer to 250
;
INITIM    LDA #0        ;250 decimal
          STA TIME
          LDA #2
          STA TIME+1
          LDA #$50
          STA TIME+2
          LDA #$92      ;"2"
          STA TLINE+6
          LDA #$95      ;"5"
          STA TLINE+7
          LDA #$90      ;"0"
          STA TLINE+8
          RTS
;
; This subroutine sets up a new level,
; speeds of elevators and Dan, timer,
; Dan on bottom, increased level no.
;
SLEVEL    LDY LEVEL
          CPY #7        ;Level 7 or more?
          BMI SL0       ;No.
          LDA #1        ;Yes, so we have
          STA DANSPD    ;superfast Dan.
SL0       CPY #4        ;Level 4 or more?
          BMI SL1       ;No.
          LDY #4        ;Yes, lev.4 speed
SL1       TYA
          ASL A
          TAY           ;Lev #2 index
          LDA LEVSPD,Y  ;elev speed tbl
          STA ESP       ;init 0 page pntr
          INY
          LDA LEVSPD,Y
          STA ESP+1
          LDY #6        ;Download elev
SL2       LDA (ESP),Y   ;speeds to
          STA ESPEED,Y  ;zero page tbl
          DEY
          BPL SL2
          JSR PMBSETUP  ;reset P/M gr
          LDA #0
          STA FLOOR     ;floor 0
          JSR SFLOOR
          JSR INITIM
          LDA LEVEL
          ORA #$90      ;make it ATASCII
          STA LEVBYTE   ;put to screen.
          LDA #0
          STA NEWLVL    ;Turn off flag.
          RTS
;
SFLOOR    LDY FLOOR     ;find hor. start
          LDA STARTS,Y
          STA HPOSP2    ;put Dan there.
          STA HPOSP3
          STA DANHOR
          JSR DRAWDAN   ;Draw him
          LDA #0
          STA ATRACT    ;defeat attract
          LDA #$FF
          STA DANDIR    ;no initial dir.
          RTS
;
```

```
DRAWDAN   LDY FLOOR    ;index to height
          LDA DANHT,Y  ;tbl corresponds
          STA DAN1     ;to P/M memory
          STA DAN2     ;'height'
          LDY #15      ;draw 16 bytes
          LDA DANDIR
          ROR A        ;Right or left?
          BCS S2
;
; Draw Dan facing right
;
S1        LDA DANRT1,Y ;P2 data
          STA (DAN1),Y
          LDA DANRT2,Y ;P3 data
          STA (DAN2),Y
          DEY
          BPL S1
          RTS
;
; Draw Dan facing left
;
S2        LDA DANLF1,Y ;P2 data
          STA (DAN1),Y
          LDA DANLF2,Y ;P3 data
          STA (DAN2),Y
          DEY
          BPL S2
          RTS
;
; Death subroutine - flip-flop Dan
; for 1 second, then freeze for 1
; second.  If no lives are left,
; it ends the game.
;
DEATH     LDA #0
          STA AUDF0
          STA AUDF1
          STA AUDF2    ;Silence music
          DEC DIEFLAG  ;lower counter
          LDA DIEFLAG  ;Done yet?
          BEQ DE2      ;Yes.
          CMP #60      ;time for freeze?
          BPL DE8      ;No.
          LDA #0       ;Yes...
          STA AUDF3    ;silence
          RTS          ;skip flip-flop.
DE8       AND #3       ;No, flip Dan
          BNE DE3      ;every 4 jiffies
          LDA DANDIR
          BEQ DE1
          JSR DRAWDAN  ;flip left
          LDA #0       ;and set up for
          STA DANDIR   ;right flip
          LDA #$20     ;high note
          BNE DE0
DE1       JSR DRAWDAN  ;flip right
          LDA #1       ;and set up for
          STA DANDIR   ;left flip
          LDA #$40     ;low note
DE0       STA AUDF3
          RTS
;
; Death over
;
DE2       JSR SFLOOR   ;put Dan back
          DEC MENBYT   ;One less man...
          LDA MENBYT   ;Any men left?
          AND #$0F
          BNE DE3      ;Yes, continue.
          LDA # <OVERLN ;No, change
          STA MSG      ;top line LMS
          LDA # >OVERLN ;LMS to show
          STA MSG+1    ;"GAME OVER"
          LDA #1       ;set flag
          STA OVERFLG
          LDX #0       ;Compare score to
DE4       LDA SSCORE,X ;high score
          CMP HISCORE,X ;digit by digit
          BMI DE3      ;lt?, no change
          BNE DE5      ;gt?, update HI
          INX          ;next digit
          CPX #6
          BMI DE4
          RTS
DE5       LDX #5
DE6       LDA SSCORE,X ;Move score
          STA HISCORE,X ;to high score
          DEX
          BPL DE6
DE3       RTS
;
; This subroutine does collision
; detection.
;
HITCHK    LDA P2PL     ;Did P2
          ORA P3PL     ;or P3 hit
          AND #3       ;elev 0,1,5,6?
          BNE ENDCHK   ;Yes, Dan's dead.
          LDA M0PL     ;Did M0 (elev 2)
          ORA M1PL     ;or M1 (elev 3)
          ORA M2PL     ;or M2 (elev 4)?
          AND #$0C
ENDCHK    STA HITCLR   ;Clear collision
          RTS
;
ENDLEV    JSR SCORING  ;update score
          INC LEVEL    ;on to next level
          LDA #1       ;Flag so mainline
          STA NEWLVL   ;code can set up
          RTS          ;a new level
;
; This subroutine produces the title
; screen, and waits for START.
;
TITLE     LDA #0
          STA SDMCTL   ;disable DMA
          STA COLOR0   ;black letters
          LDA # <TDLIST ;Point to
          STA SDLSTL   ;Display list
          LDA # >TDLIST ;for title
          STA SDLSTL+1 ;screen
          LDA #$3D     ;narrow playfield
          STA SDMCTL
          LDA #$0E     ;white letters
          STA COLOR1
          LDA #4       ;center titles
          STA HSCROL
X1        LDA VCOUNT   ;rainbow backgrnd
          BNE X1       ;wait for line 0
          TAY          ;and keep track
          LDX COLCNT   ;colour counter
X2        STA WSYNC    ;sync to TV line
          STA COLBAK   ;store in reg
          INX          ;inc color #
          TXA
          AND #$F0     ;but make it
          ORA #$08     ;luminance 8
          INY
          CPY #$F0     ;screen bottom?
          BNE X2       ;No.
;
; Now increase the starting colour for
; next TV frame, produces scrolling
; rainbow effect
;
          INC COLCNT
          LDA #8       ;We have some
          STA CONSOL   ;time left to
          LDA CONSOL   ;check for START
          EOR #6       ;Pushed?
          BEQ X3       ;Yes, so exit
          STA WSYNC    ;keep stuffing
          STA COLBAK
          BNE X1       ;Infinite loop
X3        RTS          ;unless sent here
;
; This subroutine plays the music.
;
MUSIC     LDA BASTIM   ;New note time?
          BPL BN0      ;No.
          LDA #14      ;all notes
          STA BASTIM   ;are 15 jiffies.
          INC BASCNT
BN0       LDA BASCNT   ;Get the note.
          AND #7       ;mod 8 counter
          TAY
          LDA BASSLO,Y ;Bass is 16-bit
          STA AUDF0    ;sound, so stuff
          LDA BASSHI,Y ;lo and hi bytes
          STA AUDF1    ;in channels 0,1
          LDX BASTIM
          LDA BASENV,X
          STA AUDC1    ;Apply envelope
          DEC BASTIM   ;dec. duration
;
; Melody (Treble)
;
          LDA TRBTIM   ;Note timer done?
          BPL TN1      ;No.
          INC TRBCNT   ;Yes - inc cntr
          LDY TRBCNT   ;Are we at...
          CPY #26      ;end of tune?
          BMI TN0      ;No.
          LDA #$FF     ;Yes, reset
          STA TRBCNT   ;counter
          BNE TN2
TN0       LDA TRBDUR,Y ;load the
          STA TRBTIM   ;duration
TN1       LDY TRBCNT
          LDA TREBLE,Y ;Play the note..
          STA AUDF2
          DEC TRBTIM   ;and dec timer.
TN2       RTS
;
; Various Data Tables
;
ELEPOS    .BYTE 72,160,64,64
          .BYTE 108,124,140,0
COLORS    .BYTE $82,$22,$B2,$42,$12,$52
          .BYTE $72,$32,$62,$E4,$06
EMASKS    .BYTE $C0,$0C,$03,$0C
          .BYTE $30,$C0,$0C
ELOCS     .BYTE  >P0AREA, >P0AREA
          .BYTE  >MAREA, >MAREA
          .BYTE  >MAREA, >P1AREA
          .BYTE  >P1AREA
STARTS    .BYTE $40,$B8,$40,$B8,$40
          .BYTE $B8,$40,$B8,$40,$B8,$40
STAIRS    .BYTE $B8,$40,$B8,$40,$B8,$40
          .BYTE $40,$B8,$40,$B8,$40,$B8
ESPED1    .BYTE 0,0,0,0,0,0,0
ESPED2    .BYTE 0,1,0,0,1,0,0
ESPED3    .BYTE 1,1,0,1,1,0,1
ESPED4    .BYTE 0,1,1,1,1,1,1
ESPED5    .BYTE 1,1,1,1,1,1,1
;
LEVSPD    .WORD ESPED1,ESPED2,ESPED3
          .WORD ESPED4,ESPED5
;
; Vertical height of tops of floors
;
DANHT     .BYTE $C0,$B0,$A0,$90
          .BYTE $80,$70,$60,$50
          .BYTE $40,$30,$20
;
DANLF1    .BYTE $00,$0F,$3F,$1C
          .BYTE $34,$7D,$7D,$6F
          .BYTE $06,$02,$1E,$3F
          .BYTE $3F,$3F,$1E,$0C
DANLF2    .BYTE $00,$0F,$3F,$03
          .BYTE $0B,$02,$02,$10
          .BYTE $18,$0E,$1E,$3D
          .BYTE $39,$39,$1E,$00
DANRT1    .BYTE $00,$78,$7E,$1C
          .BYTE $16,$3F,$5F,$7B
          .BYTE $30,$20,$3C,$7E
          .BYTE $7E,$7E,$3C,$18
DANRT2    .BYTE $00,$78,$7E,$60
          .BYTE $68,$20,$20,$04
          .BYTE $0C,$38,$3C,$5E
          .BYTE $4E,$4E,$3C,$00
;
TLINE     .SBYTE "       "
          .SBYTE +$80,"000"
          .SBYTE "       "
TOPLINE   .BYTE 1,$46,0,$46,0,0,$41,0
          .BYTE $41,0,$41,0,$46,0,$46,5
LLINE     .BYTE 3,$46,0,$46,0,0,$41,0
          .BYTE $41,0,$41,0,$46,0,$46,2
RLINE     .BYTE 1,$46,0,$46,0,0,$41,0
          .BYTE $41,0,$41,0,$46,0,$46,4
INFOLN    .SBYTE "SC "
SSCORE    .SBYTE +$80,"000000"
          .SBYTE " MEN "
MENBYT    .SBYTE +$80,"0"
          .SBYTE " HI "
HISCORE   .SBYTE +$80,"000000"
          .SBYTE " LEV "
LEVBYTE   .SBYTE +$80,"0"
OVERLN    .SBYTE "    GAME OVER    "
;
; Music Data
;
BASSLO    .BYTE $6B,$6B,$96,$6B
          .BYTE $EA,$6B,$03,$64
BASSHI    .BYTE $35,$35,$2F,$35
          .BYTE $2C,$35,$2B,$2A
BASENV    .BYTE $A2,$A6,$AA,$A8
          .BYTE $A8,$A8,$A8,$A8
          .BYTE $A8,$A8,$A7,$A5
          .BYTE $A3,$A0,$A0
TREBLE    .BYTE 68,81,0,68,40,57,0,81
          .BYTE 68,60,57,0,57,0,57,0
          .BYTE 57,60,68,81,91,81,108
          .BYTE 96,0,0
TRBDUR    .BYTE 114,34,89,114,19,19,99
          .BYTE 14,14,14,19,0,18,0,18
          .BYTE 0,18,19,19,19,19,19,14
          .BYTE 14,127,80
;
; The Game Display List
;
DLIST     .BYTE $70,$70,$C6
MSG       .WORD TLINE
          .BYTE $C7
          .WORD TOPLINE
          .BYTE $C7
          .WORD LLINE
          .BYTE $C7
          .WORD RLINE
          .BYTE $C7
          .WORD LLINE
          .BYTE $C7
          .WORD RLINE
          .BYTE $C7
          .WORD LLINE
          .BYTE $C7
          .WORD RLINE
          .BYTE $C7
          .WORD LLINE
          .BYTE $C7
          .WORD RLINE
          .BYTE $C7
          .WORD LLINE
          .BYTE $C7
          .WORD RLINE
          .BYTE $10,$46
          .WORD INFOLN
          .BYTE $06,$41
          .WORD DLIST
;
; Title Screen Display List
;
TDLIST    .BYTE $70,$70,$70,$70
          .BYTE $70,$70,$47
          .WORD GAME
          .BYTE $70,$17,$70,$70,$46
          .WORD AUTHOR
          .BYTE $70,$70,$46
          .WORD COPYR
          .BYTE $70,$06,$70,$70,$56
          .WORD INSTR
          .BYTE $70,$70,$41
          .WORD TDLIST
;
GAME      .SBYTE "    ELEVATOR    "
          .SBYTE "     REPAIRMAN      "
AUTHOR    .SBYTE "BY FRED CAPRILLI"
COPYR     .SBYTE "    (C) 1985    "
          .SBYTE "ANALOG COMPUTING"
INSTR     .SBYTE "    press"
          .SBYTE " start     "
;
;MODIFIED CHARACTER SET
;
CSETB     .BYTE $00,$00,$00,$00
          .BYTE $00,$00,$00,$00
          .BYTE $80,$80,$80,$80
          .BYTE $80,$80,$80,$80
          .BYTE $01,$01,$01,$01
          .BYTE $01,$01,$01,$01
          .BYTE $80,$FF,$80,$FF
          .BYTE $80,$FF,$80,$FF
          .BYTE $01,$FF,$01,$FF
          .BYTE $01,$FF,$01,$FF
          .BYTE $3C,$7E,$7E,$E7
          .BYTE $E7,$FF,$FF,$FF
          .BYTE $08,$08,$08,$08
          .BYTE $08,$08,$08,$08
;
          *=  $02E0
;
          .WORD INIT
          .END
```

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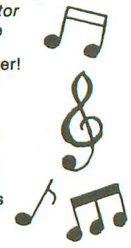

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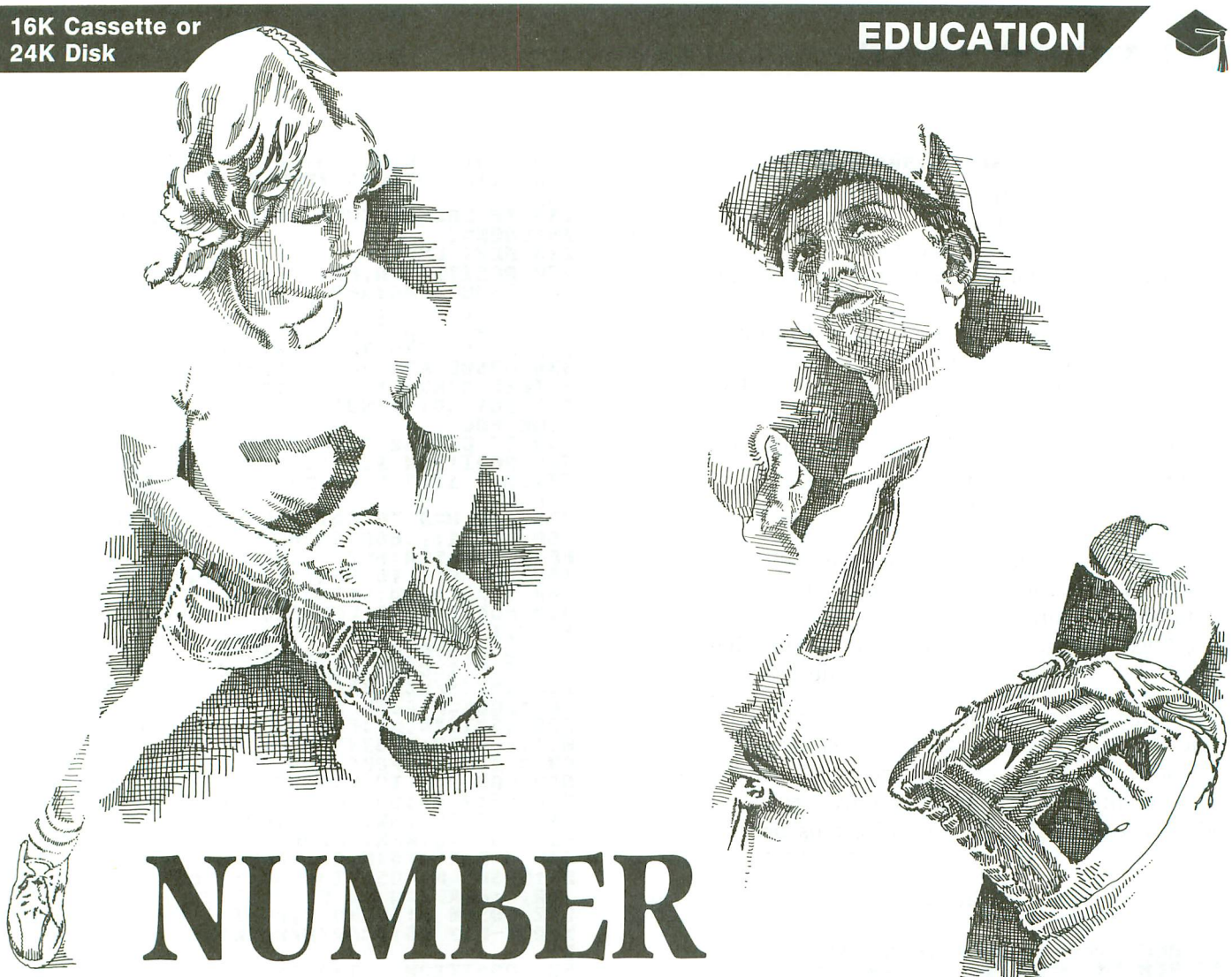


NUMBER CATCH

by David L. Clark

Mad Mordred the Magician is making numbers fall from above. In **Number Catch**, you must guide your players to retrieve these falling numbers. Each time one reaches the ground, you lose a catcher.

To stop you from intercepting the numbers, Mad Mordred has sent bombs, explosive spiders and radioactive bats. He's also cast a spell that causes some of the dropping digits to change into bombs, spiders and bats. If one of them hits or catches a catcher, that catcher is destroyed.

For every four numbers caught, a math problem is presented to be solved. You solve it by catching the correct answer as it falls from above. If the correct answer is not snared after seven numbers have fallen, it will be given. For each problem correctly solved, 100 points are earned. You're not penalized for incorrect or unanswered problems.

Additional points are earned by catching the falling numbers and successfully completing the game without losing all your catchers. Each number caught is worth 10 points. A bonus of 200 points is earned for each catcher remaining at the end of the game.

Number Catch ends after all catchers have been lost or after forty-two numbers (excluding answers) have been caught.

The type of arithmetic problem presented is based on which of five options is chosen at the beginning of play. The options include: addition and subtraction; addition, subtration and multiplication; addition only; subtraction only; or multiplication only.

Program breakdown.

Lines	Description
100-140	Main loop.
150-160	Player movement.
170-190	Number change to bomb, spider or bat.
200-250	Missed; lose a player if number.
300-350	Caught number.
360-380	Bonus routine if game complete.
400-410	Score routine.
500-597	Bomb, spider and bat routines.
600-630	Game over routine.
650-670	Screen setup.
700-780	Sound routines.
800-895	Arithmetic problem routine.
900-982	Title screen and option selection.
990-995	Initial value setup.
1000-1180	Game initialization. Set up character set, player/missile graphics.

David L. Clark, father of four, is a clinical pharmacist. He has been an Atari owner for two years, but began programming in Fortran IV and APL on IBM machines years ago. He enjoys writing games, educational and business applications programs.

Listing 1.
BASIC listing.

```
10 REM ***** NUMBER CATCH ****
15 REM ** by David L. Clark **
20 GOTO 990
100 FOR LOOP=C TO D STEP C:POKE 77,C:I
F RAN=C AND INT(RND(C)*Q)>H THEN GOTO
500+HC*INT(RND(C)*H)
104 IF RAN=D THEN CT=CT+D:J=VAL(CT$(CT
,CT)):A=P(J):C$=STR$(AN$(J)):GOSUB M:G
OTO DFC+BCR*(CT>5)
110 G=INT(RND(C)*12):C$=STR$(INT(RND(C
)*13)):A=INT(RND(C)*HC+Q):GOSUB M
120 POKE CR,C:POSITION A,K:? C$:FOR I=
Q TO FF:GOSUB M:SOUND C,DFC+I*5,V,V:PO
SITION A,I-D:? A$
125 IF G>T AND I=V+K*(G=U) THEN 170
130 POSITION A,I:? C$:GOSUB M:IF PEEK(
HITR)<>C THEN 300
140 NEXT I:ON LOOK+D GOTO 200,250,505
150 ST=STICK(C):IF ST>12 THEN FOR W=C
TO K:NEXT W:RETURN
160 B=(B=D)*F+(B=F):POKE PB,A(B):X=X+H
*((ST<T AND X<178)-(ST>T AND X>57)):PO
KE PL,X:RETURN
170 LOOK=G-5:C$=CHR$(D):FOR CNT=C TO H
C:SOUND C,CNT,C,15:NEXT CNT:SOUND C,C,
C,C:GOSUB M:IF G=U THEN G=C:GOTO 130
180 IF G=V THEN G=C:J=D:C$=T$(K,Q):FOR
 I=I TO FF:J=D*(J=F)+F*(J=D):GOTO 532
190 G=C:J=H:DJ=F:C$=T$(R,11):A=A-D:POS
ITION A,I:? C$(J,J+D):GOTO 562
200 FOR I=A TO 35:POSITION I,FF:? C$:S
OUND C,I,V,V:POSITION I-D,FF:? A$:SOUN
D C,C,C,C:GOSUB M:NEXT I
210 GOSUB PING:POSITION 35,FF:? A$
220 GOSUB 750:FOR I=141 TO 152:SOUND C
,I,V,V:NEXT I:SOUND C,C,C,C
230 POSITION 39-CATCH,F:? " ":CATCH=CA
TCH-D:IF CATCH=C THEN POKE CCR,HT:GOTO
 BI
235 IF LOOK>D THEN POKE PL,X:POKE CCR,
38:LOOK=C
240 NEXT LOOP
250 POSITION A,FF:? A$:POSITION A,K:?
C$:GOSUB PING:NEXT LOOP
300 POKE CR,C:POSITION A,I:? A$:IF RAN
=D THEN GOTO 830+FC*(AN$=VAL(C$))
310 IF LOOK>D THEN CNT=-1:GOTO 505
330 GOSUB PING:XX=XX+D-K*(XX>H):IF XX>
F THEN N(XX-F)=VAL(C$)
340 COT=COT+D:GOSUB SCR:IF XX=K THEN G
OSUB 800
350 IF COT<42 THEN NEXT LOOP
360 POSITION 13,T:? "YOU MADE IT!":POS
ITION T,11:? "You receive a BONUS of "
;:BON=C
370 FOR W=D TO CATCH:BON=BON+200:POSIT
ION 31,11:? BON:GOSUB PING:FOR J=D TO
FF:GOSUB SCR:NEXT J:NEXT W
380 FOR W=C TO SCR:NEXT W:GOTO BI
400 SC=SC+ADD:SC$=STR$(SC):LOC=D
410 FOR I=D TO LEN(SC$):SOUND C,160-I*
FC,V,12:POSITION LOC+I,F:? SC$(I,I):SO
UND C,C,C,C:NEXT I:RETURN
500 FOR I=C TO HC:SOUND C,I,C,15:NEXT
I:A=INT(X/XC-XB):SOUND C,C,C,C:C$=CHR$
(D):LOOK=F:GOTO DFC
505 C$=T$(D,H):FOR I=D TO H:SOUND C,15
0,T,16-I*H:POSITION A,FF:? C$(I,I):IF
CNT=-1 THEN POKE CCR,PEEK(FC)
510 FOR J=D TO V:NEXT J:NEXT I:POSITIO
N A,FF:? A$:SOUND C,C,C,C:IF CNT=-1 TH
EN POKE 704,BK:CNT=D:GOTO 220
515 LOOK=C:NEXT LOOP
530 J=D:C$=T$(K,Q):LOOK=H:A=INT(X/XC-X
B):GOSUB M:POSITION A,K:? C$(J,J):POKE
 CR,C:FOR I=Q TO FF:J=D*(J=F)+F*(J=D)
532 GOSUB M:SOUND C,FC+I*5,V,V:POSITIO
N A,I-D:? A$:A=A+(X/XC)A+XB)-(X/XC<A+X
B)
535 POSITION A,I:? C$(J,J):GOSUB M:IF
PEEK(HITR)<>C THEN 300
540 NEXT I:CNT=D:GOTO 505
560 J=H:DJ=F:I=K:C$=T$(R,11):LOOK=K:A=
19:GOSUB M:POSITION A,I:? C$(J,J+1):PO
KE CR,C
562 E=INT(RND(C)*R)
564 DJ=DJ+K*(J=D)-K*(J=Q):J=J+DJ:GOSUB
 M:SOUND C,FC+I*T,V,V:SOUND C,80+I*T,V
,V:IF E>I/U THEN 575
570 POSITION A,I:? A$:A=A+(X/XC)A+XB)-
(X/XC<A+XB):POSITION A,I:? C$(J,J+D):G
OTO 590
575 POSITION A,I:? A$:I=I+D:A=A+(X/XC)
A+XB)-(X/XC<A+XB)
580 IF I>21 THEN FOR I=D TO 50:SOUND C
,50+K*I,I*F,V:NEXT I:SOUND C,C,C,C:LOO
K=C:NEXT LOOP
585 POSITION A,I:? C$(J,J+D)
590 GOSUB M:IF PEEK(HITR)=C THEN SOUND
 C,C,C,C:GOTO 562
595 FOR W=D TO V:FOR J=D TO Q:FOR L=D
TO H:SOUND C,J*V+L*F,V,J+L:NEXT L:NEXT
 J:POKE CCR,PEEK(FC):NEXT W
597 POKE CR,C:POSITION A,I:? A$:POKE C
CR,BK:SOUND C,C,C,C:GOTO 220
600 IF SC>HISCORE THEN HISCORE=SC:SC$=
STR$(HISCORE):LOC=19-INT((LEN(SC$)+0.5
)/F):GOSUB SCR+V
610 POSITION 13,T:? " *GAME OVER*":POK
E BTN,T:POSITION 5,11:? "Another Game?
  Press START   ":POKE PB-11,C
620 GOSUB BCR:GOTO 950
650 POKE CUR,D:POSITION D,H:? "
                                ":POSIT
ION D,D:? "SCORE"
```

```
660 POSITION 31,D:? "CATCHERS":FOR I=D
 TO CATCH:POSITION 39-I,F:? CHR$(C):NE
XT I
670 POSITION 15,D:? "HIGH SCORE":SC$=S
TR$(HISCORE):LOC=19-INT((LEN(SC$)+0.5)
/F):POSITION LOC+D,F:? HISCORE:RETURN
700 FOR I=15 TO C STEP -1:SOUND C,40,V
,I:FOR J=C TO H:NEXT J:NEXT I:SOUND C,
C,C,C:RETURN
710 CNT=24:RESTORE 760:FOR I=D TO HC:R
EAD SA,SB:SOUND C,SA,V,T:FOR J=D TO SB
*CNT
720 NEXT J:ST=INT(RND(C)*Q+R):GOSUB 16
0:SOUND C,C,C,C:IF PEEK(BTN)<>R THEN N
EXT I:POKE CCR,PEEK(FC):GOTO 710
730 POKE PL,220:POKE PB-11,255:RETURN
740 CNT=15:RESTORE 770:FOR I=D TO R:RE
AD SA,SB:SOUND C,SA,V,T:FOR J=D TO SB*
CNT:NEXT J:SOUND C,C,C,C
745 NEXT I:RETURN
750 CNT=HC:RESTORE 780:FOR I=D TO K:RE
AD SA,SB:SOUND C,SA,V,T:FOR J=D TO SB*
CNT:NEXT J:SOUND C,C,C,C
755 NEXT I:RETURN
760 DATA 60,1,60,1,60,2,81,2,47,1,47,1
,47,2,60,2,60,1,47,1,40,3,40,1,45,1,47
,1,53,4,53,1,47,1,45,2,45,2,47,1
765 DATA 53,1,47,2,60,2,60,1,47,1,53,2
,81,2,64,1,53,1,60,4
770 DATA 121,2,108,2,96,2,81,3,96,2,81
,4
780 DATA 243,2,217,1,204,2,243,4
800 TYPE=INT(RND(C)*(OPT+D)+D):IF OPT>
F THEN TYPE=OPT-F
810 GOSUB 875+TYPE*Q:FOR I=D TO F:POSI
TION 14,I:? B$:NEXT I:J=INT(RND(C)*Q):
IF J>ANS THEN J=ANS
815 FOR I=D TO Q:ANS(I)=ANS-J+I-D:NEXT
 I:FOR I=D TO K:J=INT(RND(C)*Q+D):W=IN
T(RND(C)*Q+D):ANS(R)=ANS(J)
818 CT$(R,R)=CT$(J,J):CT$(J,J)=CT$(W,W
):CT$(W,W)=CT$(R,R)
820 ANS(J)=ANS(W):ANS(W)=ANS(R):NEXT I
:POSITION 13,F:? N(1);TP$;N(F);" = ?":
CT=C:RAN=D:LOOK=D
825 CT$(R,T)=CT$(D,H):FOR I=D TO Q:POS
ITION P(I),K:? ANS(I):NEXT I:GOSUB 740
:GOTO 100
830 GOSUB 750:POSITION U,R:? "THE CORR
ECT ANSWER IS":POSITION 19-INT(LEN(C$)
/F),T:? ANS
840 FOR I=D TO SCR:NEXT I:POSITION U,R
:? B$;B$:POSITION 15,T:? B$:GOSUB 895:
GOSUB 670:NEXT LOOP
850 POSITION V,S:? "THAT'S CORRECT!!!!
":POKE 19,C:POKE FC,C
855 POKE BCR,PEEK(FC):SOUND C,PEEK(FC)
,V,V:IF  NOT PEEK(19) THEN 855
860 SOUND C,C,C,C:POKE BCR,BK:FOR W=D
TO V:GOSUB SCR:NEXT W:GOSUB 895:POSITI
ON V,S:? B$;B$:GOSUB 670:GOTO 100
880 ANS=N(D)+N(F):TP$=" + ":RETURN
885 IF N(F)>N(D) THEN N(H)=N(D):N(D)=N
(F):N(F)=N(H)
887 ANS=N(D)-N(F):TP$=" - ":RETURN
890 ANS=N(D)*N(F):TP$=" X ":RETURN
895 POSITION 13,F:? B$:FOR I=D TO Q:PO
SITION P(I),K:? A$:NEXT I:RAN=C:LOOK=C
:CT=C:RETURN
900 GRAPHICS C:POKE BCR,64:POKE 712,64
:FOR I=C TO U:POSITION 13,I:? "NUMBER
CATCH":SOUND C,DFC+I*V,V,V
910 POKE CUR,D:FOR J=D TO 15:NEXT J:IF
 I<U THEN POSITION 13,I:? "
 "
920 NEXT I:GOSUB PING:POSITION 11,12:?
 "by David L. Clark":GOSUB PING
930 POSITION R,15:? "Press START butto
n when ready":POKE BTN,T:POKE CCR,BK
940 POKE PB-11,C:POKE 53277,H:POKE 532
56,D:POKE 623,T:POKE 559,62:GOSUB BCR
950 GRAPHICS D:POKE BCR,C:OPT=D:POSITI
ON Q,C:? #6;"OPTIONS":POSITION D,H:? #
R;"1. plus (+) and"
955 POSITION K,K:? #R;"minus (-)":POSI
TION D,R:? #R;"2. plus (+),":POSITION
K,S:? #R;"minus (-), and"
960 POSITION K,T:? #R;"times (X)":POSI
TION D,V:? #R;"3. plus (+)":POSITION D
,12:? #R;"4. minus (-)"
965 POSITION D,14:? #R;"5. times (X)":
POSITION D,16:? #6;"option- ";OPT:POKE
 CUR,D:POKE BTN,T
970 ? "     Press RETURN to change opti
on":? "     Press START to begin":POKE
BTN,T
975 IF PEEK(764)=12 THEN OPT=OPT+D*(OP
T<Q)-K*(OPT>K):POSITION U,16:? #R;OPT:
GOSUB PING:POKE 764,255
980 IF PEEK(BTN)<>R THEN 975
982 X=DFC:GOTO 1020
990 C=0:D=1:F=2:HISCORE=C:DN=C:DIM A(2
),SC$(8),TP$(3),C$(6),N(3),ANS(6),P(5)
,B$(14),A$(3),BT$(80),CT$(8),T$(11)
995 XC=123/28:XB=57/XC-5:H=3:K=4:Q=5:R
=6:S=7:T=8:U=9:V=10:HT=38:FC=20:FF=22:
HC=30:DFC=120:SCR=400:BI=600:BCR=710
997 CUR=752:CCR=704:HITR=53252:BTN=532
79:ADD=10:CT$="12345"
1000 RESTORE 1060:FOR I=D TO 32:READ A
:BT$(I,I)=CHR$(A):NEXT I:FOR I=D TO 11
:T$(I,I)=CHR$(I+D):NEXT I
1010 PING=700:M=150:X=DFC:RM=57344:PL=
53248
1020 XX=C:B=D:SC=C:CATCH=Q:A(D)=72:A(F
)=18:COT=C:RAN=C:P(D)=Q:P(F)=12:P(H)=1
9:P(K)=25:P(Q)=32:LOOK=C
1030 CNT=C:B$="                    ":A$="
":BK=114:CR=53278
1050 IF DN>C THEN GRAPHICS C:RESTORE 1
190:GOTO 1140
1060 DATA 104,104,133,213,104,133,212,
104,133,215,104,133,214,162,4,160,0,17
7,212,145,214,200,208,249,230,213,230
1070 DATA 215,202,208,240,96
1100 POKE 559,C:GRAPHICS 24:GRAPHICS C
:P=PEEK(106)-16:PMB=P*256+1024:CHB=PMB
+1024
1110 POKE 106,P:POKE 54279,P:GRAPHICS
C:PB=PMB+201
```

```
1120 RESTORE 1180:FOR I=PMB+190 TO PMB
+201:READ A:POKE I,A:NEXT I:POKE PL,22
0
1130 Z=USR(ADR(BT$),RM,CHB):DN=D:GOTO
900
1140 FOR I=D TO 104:READ A:POKE CHB+51
1+I,A:NEXT I:POKE 756,CHB/256:POKE 532
77,H:POKE 53256,D:POKE 623,T
1150 POKE BCR,BK:POKE 712,BK:POKE 559,
62:GOSUB 650:POKE CCR,HT:POKE PL,X:POS
ITION 11,T:? "*** GET READY ***"
1160 GOSUB 740:FOR I=D TO 200:NEXT I:P
OSITION 11,T:? B$;B$:GOTO 100
1180 DATA 255,66,90,90,126,24,24,24,36
,36,36,36
1190 DATA 24,24,255,24,24,60,102,102,0
,66,126,126,126,126,60,24,66,126,126,1
02,102,126,126,60,255,255,195,195,195
1200 DATA 195,255,255,255,129,129,129,
129,129,129,255,36,126,126,82,82,148,1
64,168,36,126,126,74,74,41,37,21,96
1210 DATA 50,25,15,7,1,0,0,6,76,152,24
0,224,128,0,0,0,2,1,255,3,1,0,0,0,64,1
28,255,192,128,0,0,0,2,1,7,15,25,48
1220 DATA 96,0,64,128,224,240,152,12,6
```

CHECKSUM DATA.

(see page 30)

```
10 DATA 630,360,463,266,394,913,314,32
4,386,872,828,535,671,267,239,7462
200 DATA 414,854,387,519,295,224,407,9
24,624,970,475,35,660,731,691,8210
400 DATA 186,994,271,185,530,917,335,1
54,879,705,462,678,314,319,238,7167
580 DATA 548,865,547,912,619,153,746,2
25,543,463,743,444,497,444,984,8733
740 DATA 429,763,463,766,953,275,566,5
08,699,459,760,867,7,942,467,8924
840 DATA 465,585,675,655,357,106,372,4
48,738,36,437,755,739,464,774,7606
955 DATA 148,787,290,188,937,879,832,3
27,951,143,217,494,694,779,670,8336
1060 DATA 336,293,15,231,623,212,698,3
07,404,975,404,446,132,45,5121
```

The Summer CES

Part 2.

What's new in hardware and software

by Arthur Leyenberger and Lee Pappas

As mentioned in last month's **ANALOG Computing**, Atari had the hit of the Consumer Electronics Show with their CD-ROM player. Their other products, the 260STD and inexpensive modems, were also well received.

This month, we wrap up CES coverage by reporting on other new products from companies exhibiting at the semi-annual electronics show.

Activision had several new programs for the Atari. Garry Kitchen's **Gamemaker: The Computer Game Design Kit** is a programming tool for the creation of your own games. Using only a joystick, you select from various menus to choose the different aspects of a game you wish to create. Pre-programmed characters such as an airplane, rocket ship, flying saucer, ducks and a running man are included.

The program lets you select the speed of movement and direction of characters, plus background scenes, sound effects and even music. **Gamemaker** also lets you save your game creations on a separate disk, so that you can give them to your friends. Saved games don't require the **Design Kit** in order to run.

Another new Activision game is **Fast Tracks: The Computer Slot Car Construction Kit**. Another do-it-yourself program, this lets you create, edit and save slot car tracks, then race on them. The program is joystick controlled, and you select from a menu of track sections such as curves, loops and underpasses in order to assemble your track piece by piece. The track difficulty level and the slot car itself can be custom designed however you want. **Fast Tracks** also includes several predesigned race courses to get you up and racing immediately.

Hacker is the third Activision game that was shown at CES. Much like a mystery movie, **Hacker** has no instructions, goal or guidelines. You simply boot the disk, and the program asks you to log on. What you do after that is totally up to you.

All you know when you begin the game is that you have "accidentally" broken into an unknown computer system and have stumbled onto a secret beyond anything you could imagine. With no rules, clues or background information, you must find out whose system you've logged onto and what's going on. All Activision will say about **Hacker** is that there is a mystery to be solved and there may be several solutions to the problem.

Alter Ego is Activision's game made for wimps. The program allows the player to vicariously experience living someone else's life. As you're presented with situations and events, you can respond in any way you want. . . and see how that behavior molds your personality.

With **Alter Ego**, you can consider different ways you might live. . . in an entertaining and totally risk free manner. After each decision is made and entered, the computer narrator explains the outcome and the possible consequences of that choice. Over time, the effects of choices made early in life will affect the situations you later face.

Gamemaker, **Fast Tracks** and **Alter Ego** will be available by the end of the year and each cost under $50.

Batteries Included, the Canadian firm responsible for two good programs, **Paper Clip** and **HomePak**, was showing a new 80-column cartridge for the 8-bit Atari computers. The BI-80 will work on the XL and XE machines, and plugs into the cartridge slot. It's priced at about $80 and will work with the new versions of **Paper Clip** and **HomePak** due out this fall.

Batteries Included announced that they would send a free BI-80 cartridge to any legitimate software developer, complete with specifications. This open-minded attitude is refreshing in the industry and may yield a significant number of programs that will work with the product. A standard may be created in the Atari 8-bit line, which is fine with me. It would also be fine with Batteries Included.

Broderbund Software had only a few Atari-related announcements. **Championship Lode Runner** will become avail-

able for the Atari computers this fall. Also, their new game, **Karetaka**, will be available for the Atari.

Karetaka is unique in that it's the first and only game that I know of using film-style cutaway views for game screens. When approaching an enemy, for example, the screen first shows your player, then it cuts to a view of the opponent approaching, then back to you again. It's an effective technique in this karate-combat-adventure game.

Another new game shown by Broderbund was **Lode Runner's Rescue**. This follows in the footsteps of **Lode Runner**, in that your character must traverse a series of forty-six mazes on the way to the goal.

You are Alexandra, the daughter of the famous **Lode Runner**, trying to reach your father's prison cell. Naturally, you must pick up keys and avoid the hostile guards on your journey.

Rescue features a game editor so that you can create your own screens, with elevators, trap doors, enemy guards and rushing rivers. **Lode Runner's Rescue** will be available for the Atari this fall at $30.

Broderbund also announced the **Print Shop Graphics Library** Disk Two. This $25 disk, coming in the fall, provides 120 additional designs, symbols and pictures for your **Print Shop** graphic creations.

Images in six new categories consist of such items as a tractor, jukebox, microscope, whale and cross. The **Print Shop** lets you easily write, design and print your own greeting cards, letterheads, banners and signs.

Computer Magic was showing an interesting product that will appeal to robot lovers of all ages. Called **Robot Link**, it runs on any Atari 8-bit computer and lets you control Tomy **Omnibot** and **Verbot** robots.

This software is unusual, in that you don't need to actually walk the robot through its series of steps to train it to do something. Various sequences can be saved to disk and later reloaded.

The software package also comes with several games that take advantage of the program's unique ability to make one of the Tomy robots move in a random fashion. In addition, for approximately $40, **Robot Link** allows you to have more precise control over the maneuverability of your robot.

A small Oregon company named Covox had an interesting product at the show. They were exhibiting a voice recognition and voice synthesis unit for Apple, Commodore and Atari computers.

Leonard Tramiel showing the myriad software titles available for the Atari XEs.

Called the **Voice Master**, it lets you record words in any language, using your own pitch and accent, and later have the program recognize and speak the words.

Included in its $90 price is another program, **Voice Harp**. This allows you to perform, compose and write music, simply by humming or whistling into the microphone. Seeing (and hearing) it in action is truly uncanny.

The **Voice Harp** lets you produce various tone qualities, different keys and multi-note harmonies. You can even see the notes scrolling on the screen's musical staff as you hum or whistle.

The results of your composition can be edited, saved and even printed. I look forward to obtaining a **Voice Master** in the near future, in order to do a full-scale review.

Datasoft was displaying something old, something new and something borrowed. The borrowed titles shown were licensed originals from other companies. From Atari, Datasoft is now marketing **Pole Position**, **PacMan** and **Dig Dug**. They're also marketing **Zaxxon** from Sega.

In the something old category, Datasoft continues to sell the **Conan**, **Mancopter** and **Bruce Lee** games.

For something new, they announced several games for the Atari. **Mr. Do** and **Pole Position II** have been around for a while, but are now making their debut on Atari machines. **Mr. Do** is similar to the popular arcade game. **Pole Position II** is also an arcade translation, complete with four tracks and the ability to create your own track.

Another acquired arcade license is **Elevator Action** by Taito. **Elevator Action** and **Pole Position II** will be out in the fall and will retail for about $30.

Three entirely new games were previewed by Datasoft. **Zorro**, based on the famous character created by Johnston McCulley in 1919, has appeared in the movies, on TV and in comics. Now the computer game arrives with the villain we all love to hate: Sergeant Garcia.

The game begins with the abduction of a fair maiden by Garcia's soldiers. **Zorro**'s pursuit takes him through fifteen increasingly difficult screens, including four in the catacombs beneath the mission graveyard. As **Zorro**, you leap from rooftops, trampoline your way from one floor to another and engage Garcia and his soldiers in duels.

Another new title from Datasoft ties in with the new Spielberg-produced film, *The Goonies*. Following the adventures of the **Goonies** kids, each screen is an elaborate Rube Goldberg maze. Your goal is to obtain the pirate's treasure and avoid the evil Mama Fratelli.

Datasoft's third new game is called **Alternate Reality**. It's a fantasy role-playing game in which you've been abducted by an alien spacecraft and transported to another time and place.

In the first episode, "the city," you must learn basic survival skills—finding food, shelter and money. The goal: return to Earth or seek revenge on your abductors.

Zorro, **The Goonies** and **Alternate Reality** will be available for the Atari computers this fall. **Alternate Reality** will sell for $40, while **Goonies** and **Zorro** will retail for $30. Datasoft hasn't been very strong in the Atari market lately, but we wish them success with their line of highly recognizable titles.

Electronic Arts was not at the show, but had a hotel suite in downtown Chicago. They were showing nothing new for the Atari at this time, but told me that **Skyfox**, **Adventure Construction Set** and **Road Racing Destruction Set** will probably be available for the Atari 8-bit computers by the end of the year.

They have purchased the rights to the arcade hit **Marble Madness** and mentioned that a version may appear for the ST computers. Also, an enhanced **Financial Cookbook** may become their first ST product.

Epyx Software, the folks who brought you the two great Lucasfilm games **Rescue on Fractalus** and **Ballblazer**, were proudly showing two additional Lucasfilm entries.

Eidolon allows you to become an adventurer on a magical journey. In a kind of inverted **Fractalus**, you roam through caverns populated by trolls, greps and dragons. Your goal is to find the inventor of a nineteenth century time machine and learn the secrets of its use.

The other new Lucasfilm game is **Koronis Rift**. This is really a strategy game in action game's clothing. You play the role of a futuristic techno-scavenger who discovers the **Koronis Rift**: the legendary weapons testing grounds for an ancient race of beings.

Unfortunately for you, this neat technology is guarded by a genetically engineered race of creatures who've outlived their creators. It's up to you to decide what weapons and technology to recover in order to survive.

Both **Eidolon** and **Rift** employ Lucasfilm's fractal generators to create ever-changing 3-D landscapes and caverns. These techniques appear to be even better than those used on the first two Lucasfilm games. Explosions look more realistic, objects seem lighter in the distance, and more colorful objects appear on the screen. The games will be available in the fall, selling for about $30.

Latest in the series of sports games from Epyx is the **World's Greatest Football Game**. As a computer coach, you can play against the computer or another opponent with up to 120 different plays, choosing either offense or defense. The game will sell for about $30 and should be out by the time you read this.

Epyx also announced that a new, enhanced version of **Temple of Apshai** will be available for the Atari computer soon. Called the **Trilogy**, this D&D adventure role-playing game features 1400 separate chambers, multiple dungeon levels, improved graphics and faster action play. It will cost $30 and includes the original **Temple of Apshai**, **Curse of Ra** and **Upper Reaches of Apshai**.

A company called Enhanced Technology Associates was demonstrating some interesting products in the back of the Atari booth. They have one called **Virtuoso** that allows you to create and edit sounds on the Atari computer.

What's unique about their program is that you don't need to read music in order to use it effectively. The program is primarily joystick controlled, and you simply draw the melody on the screen. Once this is done, note names can be displayed, timing changed, and sections cut and pasted for future use.

Virtuoso requires an Atari 130XE and will sell for under $50. It will be available by the time you read this.

A second ETA product is **Virtuoso MIDI**. This is a two-part product: an enhancement to the original **Virtuoso** program and a hardware interface.

The company says that existing owners of **Virtuoso** can upgrade to the new product for the difference in price. ETA's MIDI interface will sell for under $150, and the program will cost $50. The **Virtuoso MIDI** requires an Atari 130XE and will be out in January.

Joseph Lyons, one of the ETA partners, told me that they'll also be coming out with **Virtuoso MIDI** for the Atari STs by summer, 1986. Few details are available now, but they're committed to supporting the ST.

ICD, the makers of **SpartaDOS**, were showing some interesting products. The new **SpartaDOS Construction Set** appears to be the most sophisticated and powerful DOS for the 8-bit Atari.

The program sells for $40 and offers an amazing array of features, including many utilities. When used on a 130XE, a RAMdisk is created which can be configured as drive 1-8. Directories can be used, batch files created, individual files or entire disks locked (protected), and drive speed checked.

SpartaDOS also stamps files with the time and date and even lets you change these parameters. A disk can be given a volume name that can be changed at any time. There are just too many features to mention here.

Another product shown by ICD was

their **R-Time 8** cartridge. This is a real-time clock for the Atari. Using **Sparta-DOS** without this cartridge allows you to stamp the time and date on files, but you must enter the information every time you power up.

With **R-Time**, time and date information is automatically kept for you. Also, continuous time/date information can be displayed on the screen and is easily accessible from BASIC and other languages. The cartridge uses a 5-year battery, sells for $70 and has its own expansion port. That way, you can keep this cartridge in your computer at all times and plug other cartridges in.

Microbits Peripheral Products (MPP) has supported Atari owners for years and is one of the few "old timers" in this young industry. At CES, they were showing everything from hard disks to inexpensive 1200-baud modems.

MPP has two hard disks, a 5-megabyte and a 10-megabyte system. The 5-MB system will sell for under $1000 and includes the hard disk interface, hard disk and software. The 10-MB system will probably sell for under $1200.

If you already have a hard disk, then you can buy the hard disk interface for under $250. I saw the 10-MB system working with an 800XL, and loading files is fast.

MPP will also be introducing a 1200-baud modem for the Atari that will sell for under $200. That price is to include the terminal software. MPP is currently working on a brand new telecommunications program that will run on everything from Atari STs to IBM PCs to Atari 800s. The hard disk systems and modem will be available by the time you read this.

Another new product from MPP is the **Micronet** networking system. This will handle up to eight Atari computers running off of one set of peripherals. Standard Atari SIO peripherals may be used for a very cost effective multi-station Atari setup.

An eight-workstation arrangement of Atari XL computers, color monitors, one set of peripherals and **Micronet** would cost roughly $3500, about one-third the cost of a similar Apple setup.

A piece of hardware appealing mostly to hackers and hardware buffs is the **Microport**. This is a breadboard which interfaces the Atari with the real world. It plugs into the parallel port on either an XL computer or a 130XE and gives you eight control channels. It will sell for $50 by the time this article appears.

Mindscape announced that their only new product for the Atari, the **Halley Project: A Mission in Our Solar System**, is available now. This is a real-time space adventure simulation written by Tom Snyder. Every planet, star or moon depicted here moves at the same rate of speed and in the same orbit as in our actual solar system.

The **Halley Project** uses high resolution graphics and attention to detail in what looks like a very good simulation of outer space. Players must qualify for the top secret project by completing a series of navigational tests.

Through these tests and obstacles, the program helps players master facts about our solar system, plus Halley's Comet and its orbit. An understanding of gravity, atmospheric conditions, orbital motion, relative size, position and orbits of planets and moons, location of constellations, and how eclipses work are all provided in this $45 program.

Synapse Software, now owned by Broderbund, is reported to be in healthy financial condition. This is evident in their introduction of several new products for the 8-bit Atari line.

Mindwheel and **Essex** are two new text adventures announced by Synapse. Billed as electronic novels, these are said to pick up where the printed word leaves off. What's interesting is that you begin these adventures by reading a hardbound book that sets the stage and describes the characters. Then you start the text adventure on your computer, as a continuation of what you've read.

The parser used in these text adventure games is as good as that used by other text adventure publishers.

Mindwheel takes you into the minds of four deceased people of extraordinary power. Off-the-wall humor throughout the adventure adds to its unique quality. **Essex** is the story of an intergalactic search-and-rescue mission.

Synapse also announced new versions of **SynCalc** and **SynFile+** that will take advantage of the extra memory in the Atari 130XE. If you already own either of these excellent products, Synapse is offering a $10 upgrade policy. For $10 and your current disk, Synapse will send you the new, improved version of the program, through their customer service department.

Synapse took this opportunity to announce the **SynCalc Template Disk**. By the time you read this, it will be out, with twenty-two different templates for use with the **SynCalc** spreadsheet program.

Spreadsheet formats and formulas in such areas as stock/bond evaluation, expense reporting, personal net worth, mortgage payment analysis and conversion tables are offered on this $19.95 disk. These templates make an already excellent and useful program even more worthwhile.

Another new product announced by Synapse is **Letterhead**. This program integrates word processing, an address file and graphics capability.

Using windows and drop-down menus, **Letterhead** allows you to create and save letter formats, design letterheads using multiple fonts, and use a tickler-style address file for keeping track of your data. A keyboard, joystick, touch tablet or mouse can be used with the program. **Letterhead** will be available in late fall for under $50.

Microprose, a staunch Atari supporter, showed prerelease versions of several new simulations. **Silent Service** is a full-blown submarine warefare game featuring high resolution screens of bridge and periscope views, engine controls, damage schematics and South Pacific maps (in three magnifications), complete with sub and enemy ship movements. The 48K game will be available this fall at $34.95.

AcroJet is the next step up from a flight simulator. Here, you're a pro flying fast stunts in a BD5 jet (like James Bond in the beginning of *Octopussy*). Up to four players can compete in aerobatic olympics, always with the danger of engine malfunctions, weather conditions or "pile-ups" in the back of their minds. **AcoJet** should be out this fall at 48K, price to be announced.

Gunship will be an attack helicopter simulation with three-dimensional targets. Shipping will be before Christmas at a price to be announced. An ST version will follow in 1986.

Kennedy Approach will also be available in the fall at $34.95. You control up to twenty planes landing and taking off in the NYC area. Full voice synthesis takes the place of pilot-to-tower communications, adding realism to the game.

There you have it. By now, you should be able to see which new products will pique your interest and keep you up to date. □

Musorqa

A touch tablet musical instrument

by Ron Torborg

So you've purchased an Atari **Touch Tablet** and proven that you *are* an artist, after all. Congratulations. But what else can you use the **Tablet** for? Once again, **ANALOG Computing** comes to the rescue.

After a very expensive archeological dig at the little known site of a lost future civilization, we've discovered the **Musorqa**. It's a musical instrument that is, strangely enough, compatible with the Atari **Touch Tablet**. It can be played by anyone, even if they've no musical talent. (That's because this program was written by someone with no musical talent.)

The instruments it emulates haven't been found, so we don't know what they may have resembled. Thanks to the **Musorqa**, though, we *do* know what they could have sounded like.

Using a Musorqa.

The program will start with the "PIAZO" selected (I wonder if the civilization printed their *N*s sideways). Other instruments can be selected by hitting the appropriate key. A marker will move to show your selection on the screen. Like the other selections, the instrument won't be changed until you lift your hand off of the **Tablet**.

Normally, the program will play a single note at a time. To add richness, you can select THIRDS by hitting the left button on the **Tablet**, then lifting your hand from the **Tablet**. This section "adds thirds" to the notes you're playing. A pointer tells you whether the option is on or off. The color of the title at the top of the screen will toggle between black and white as you use this option.

We begin with the treble clef active. The location of middle C is shown on the screen. Hit the right button to toggle between the treble and bass clefs. The background color will change, and a pointer will help you remember which you've selected.

If you want to sustain a note, hold down the START button. The SELECT or OPTION keys would sound more logical to use here, but START is easier to hit when you're in the middle of your first concerto.

Move your hand up and down on the **Tablet** to play the various notes of the scale. Move left to right to play various kinds of notes (eighth, quarter, and so forth).

Customizing the program.

You'll get no marks as a pure archeologist, but you can change the sounds of the instruments easily. If you change the volume numbers contained in the DATA statements in Lines 720-800, the sounds will change. Each DATA statement must contain fourteen numbers, and each number must be less than 14. The last number in the line will be the volume that is sustained.

You can also add more instruments by adding more DATA statements, but don't forget to change variable V's size in Line 660. You will also need to choose a key to activate your new instrument and find the

code for that key to PEEK at in location 764 at Line 480.

Variables.

N . . . . . Primary note to be played.
N2 . . . . . "Thirds" note to be played.
N(. . . . . Array holding the codes for all notes.
V(. . . . . Array holding volume for the nine instruments.
X . . . . . X location to print note, read from **Tablet**; also used to establish duration.
Y . . . . . Y location to print note, read from **Tablet**; also used in array N() to establish note frequency.
D . . . . . Duration value.
Z . . . . . Code for screen character used after note is moved to maintain graphics.
THIRD . . . . . Toggle variable for playing "Thirds" — 1 = on, 0 = off.
T . . . . . Previous value of THIRD.
I . . . . . Instrument number.
I2 . . . . . Previous value of I.
OCT . . . . . Toggle variable for switching clefs — 1 = bass, 0 = treble.
OCTOLD . . . . . Previous value of OCT.
V,W,W1,W2 . . . . Counters.
P, MENU$ . . . . Storage variables used with read statements.

Program description.

Lines 100-180 — Select title screen colors, turn off cursor, set "key pressed" to 1 and execute initialization subroutines.

Lines 190-240 — Subroutine to play individual notes; branch to Line 260 if "Thirds" is on.

Lines 250-280 — Subroutine to play individual notes if "Thirds" is on.

Lines 290-420 — Main program. Read position of touch on **Tablet**; print "note" and branch to 430 if **Tablet** is not being touched.

Lines 430-530 — Read **Tablet**'s buttons and keys; adjust values to reflect status and print pointers to screen to reflect changes.

Lines 540-800 — Read note values into array N() and instrument's volume values into array V(). Also prints the instruction screen while these values are being read.

Lines 810-950 — Print main screen display.

Lines 960-1330 — Print title screen and read in machine language subroutine for the screen colors.

Thanks to Richard J. Kalagher, whose **Multi Screen Generator** appeared in **ANALOG Computing**'s issue 12. That generator was used to set up screen colors for **Musorqa**. □

Ron Torborg is vice president of Schenkel & Shultz, Inc., an architectural/engineering firm. He has three years' experience on Wang computers, two on the Atari 800 and one on a Computervision CAD-CAM system.

Listing 1.

```
100 REM MUSORQA
110 REM BY RON TORBORG
120 REM
130 K1=1:K2=2:K3=3:K4=4:K5=5:K6=6:K7=7
:K8=8:K9=9:K10=10:K12=12:K14=14:K23=23
140 GRAPHICS 0:SETCOLOR 2,0,0:SETC
OLOR 1,0,6:POKE 764,31
150 POKE 752,1:GOSUB 990:N=K0
180 GOSUB 550:GOSUB 820:GOTO 300
190 REM PLAY NOTE
200 N=N(Y+K12*(OCT=K1)):N2=N(Y-K2+K12*
(OCT=K1))
210 IF THIRD=K1 THEN 260
220 POSITION 19,K23:PRINT N;
240 FOR W=K1 TO K14:SOUND K0,N,K10,V(W
,I):NEXT W:FOR W1=K1 TO D*K6:NEXT W1:R
ETURN
250 REM PLAY NOTE WITH THIRDS
260 POSITION 15,K23:PRINT N;:POSITION
K23,K23:PRINT N2;
280 FOR W=K1 TO K14:SOUND K0,N,K10,V(W
,I):SOUND K1,N2,K10,V(W,I):NEXT W:FOR
W1=K1 TO D*K6:NEXT W1:RETURN
290 REM READ TABLE VALUES
300 TRAP 300
310 X=(K4+INT(PADDLE(K0)/45.6)*K8):Y=K
23-PADDLE(K1)/K10:D=(X-K4)/K8+K5*(X=20
)+K9*(X=28)+20*(X=36)
320 IF Y<K4 THEN 440
330 IF Y>22 THEN Y=22
340 IF X>36 THEN X=36
350 IF X<K12 THEN X=K12
360 LOCATE X,Y,Z:POSITION X,Y:PRINT CH
R$(20)
380 GOSUB 200:POSITION X,Y:PRINT CHR$(
Z)
390 IF PEEK(53279)=K6 THEN 390
420 POSITION 15,K23:PRINT "
      ";:GOTO 300
430 REM READ TABLET BUTTONS AND KEYS
440 SOUND K0,K0,K0,K0:SOUND K1,K0,K0,K
0
450 T=THIRD:IF PTRIG(K0) THEN 480
460 THIRD= NOT THIRD:SOUND K1,K0,K0,K0
:POSITION K6,K6+T:PRINT " ":POSITION K
6,K6+THIRD:PRINT CHR$(96)
470 SETCOLOR K1,K0,THIRD*K14
480 I2=I:K=PEEK(764):I=(K=31)+K2*(K=30
)+K3*(K=26)+K4*(K=24)+K5*(K=29)+K6*(K=
27)+K7*(K=51)+K8*(K=53)+K9*(K=48)
490 IF I2<>I THEN POSITION K7,K8+I2:PR
INT " ":POSITION K7,K8+I:PRINT CHR$(25
):SETCOLOR K2,I*1.66,K8
500 OCTOLD=OCT:IF PTRIG(K1) THEN 300
510 OCT= NOT OCT:POSITION K10,19*(OCT=
K0)+K7*(OCT=K1):PRINT "C":POSITION K10
,K7*(OCT=K0)+19*(OCT=K1):PRINT "_"
```

```
520 POSITION K6,20+OCTOLD:PRINT " ":PO
SITION K6,20+OCT:PRINT CHR$(96):SETCOL
OR K4,K3*OCT,K4*OCTOLD
530 GOTO 300
540 REM SET NOTE, INSTRUMENT VALUES
550 DIM N(37):I=K1:POSITION 17,K0:PRIN
T "TUNING"
560 POSITION K0,K10:PRINT "          L
EFT BUTTON = THIRDS          "
570 POSITION K0,K12:PRINT "          R
IGHT BUTTON = CLEFS          "
580 POSITION K0,K14:PRINT "          ST
ART = SUSTAIN PEDDLE         "
590 POSITION K0,16:PRINT "          K
EYS = INSTRUMENTS            "
620 RESTORE 640:FOR R=K1 TO 37:READ NT
:N(R)=NT:NEXT R
640 DATA 0,0,0,26,29,31,35,40,45,47,53
,60,64,72,81,91,96,108,121,128,144,162
650 DATA 182,193,217,243,255,26,29,31,
35,40,45,47,53,60,64,72,81
660 DIM V(14,9):RESTORE 720
670 FOR V=K1 TO K9:FOR W=K1 TO K14:REA
D P:V(W,V)=P:NEXT W:NEXT V
680 POSITION K3,K0:PRINT "Tuning compl
ete Hit START to begin"
690 POSITION K5,18:PRINT "Frequencies
appear as you play"
700 IF PEEK(53279)<>K6 THEN 700
710 RETURN
720 DATA 12,10,8,6,4,2,2,2,2,2,2,2,2,2
730 DATA 6,8,8,8,8,8,10,10,10,10,10,10
,10,10
740 DATA 0,0,0,0,0,10,2,2,2,2,2,2,2,2
750 DATA 8,2,2,2,0,0,0,0,0,0,0,0,0,0
760 DATA 4,6,8,10,12,8,6,4,2,2,2,2,2,2
770 DATA 4,10,4,10,8,10,4,10,4,10,4,10
,12,4
780 DATA 0,14,14,0,0,14,14,0,0,14,14,0
,0,10
790 DATA 14,12,10,8,10,12,10,12,14,12,
10,8,6,4
800 DATA 4,2,4,2,4,2,4,2,4,2,0,4,6,8
810 REM PRINT MAIN SCREEN
820 PRINT "K";:POSITION K14,K0:PRINT "
THE MUSORQA"
830 SETCOLOR K2,K2,K8:SETCOLOR K4,K0,K
4
840 POSITION K9,K1:PRINT "
"
850 POSITION K9,K2:PRINT "  1/8    1/
4     1/2     1   "
860 POSITION K9,K3:PRINT "
"
870 FOR Y=K4 TO 21:POSITION K0,Y:PRINT
 "
    ";:NEXT Y
880 POSITION K10,19:PRINT "C"
890 POSITION K0,22:PRINT "
";
900 DIM MENU$(K8):RESTORE 910:FOR W=K1
 TO 21:READ MENU$:POSITION K0,W:PRINT
MENU$:NEXT W
910 DATA ,  MENU  ,
920 DATA rLEFT- ,|THIRDS ,|OFF  ♦,|ON
,
930 DATA PIAZO 1 ,SMOEG 2 ,KAZII 3 ,ST
EJT 4 ,ZOORD 5 ,BENGO 6 ,ZATAQ 7 ,NMOR
A 8 ,HOGUM 9
940 DATA rRIGHT- ,|CLEF,|TREB ♦,|BASS
950 RETURN
960 REM **PRINT TITLE SCREEN AND SET S
CREEN COLORS USING RICHARD J. KALAGHER
'S "MULTI SCREEN GENERATOR"***
970 REM **ANALOG #12**
990 PRINT "K              THE MUSORQA"
1000 POSITION K0,K1:PRINT "
"
1010 PRINT "              Ron Torborg"
1020 POSITION K0,K23:PRINT " to be use
d with the ATARI Touch Tablet";
1030 RESTORE 1240:FOR N=K0 TO 99:READ
X:POKE 1664+N,X:NEXT N
1040 COLTAB=1712:LUMTAB=COLTAB+24
1060 X=USR(1693):POKE 512,128:POKE 513
,K6
1110 DSTART=PEEK(560)+256*PEEK(561)
1120 FOR N=DSTART+K6 TO DSTART+28
1130 POKE N,130:NEXT N:POKE DSTART+K3,
194:POKE 54286,192
1190 PRINT CHR$(125):POKE 710,PEEK(COL
TAB):POKE 709,PEEK(LUMTAB):RETURN
1240 DATA 72,138,72,174,156,6,189,176,
6,141
1250 DATA 10,212,141,24,208,189,200,6,
141,23
1260 DATA 208,238,156,6,104,170,104,64
,18,104
1270 DATA 169,7,160,168,162,6,32,92,22
8,96
1280 DATA 169,1,141,156,6,76,98,228,14
8,0
1290 DATA 0,0,8,8,8,8,8,6,8,6
1300 DATA 8,6,8,6,8,6,8,8,8,8
1310 DATA 8,148,0,10,10,10,0,0,0,0
1320 DATA 0,0,0,0,0,0,0,0,0,0
1330 DATA 0,0,0,0,0,0,0,0,0,0
```

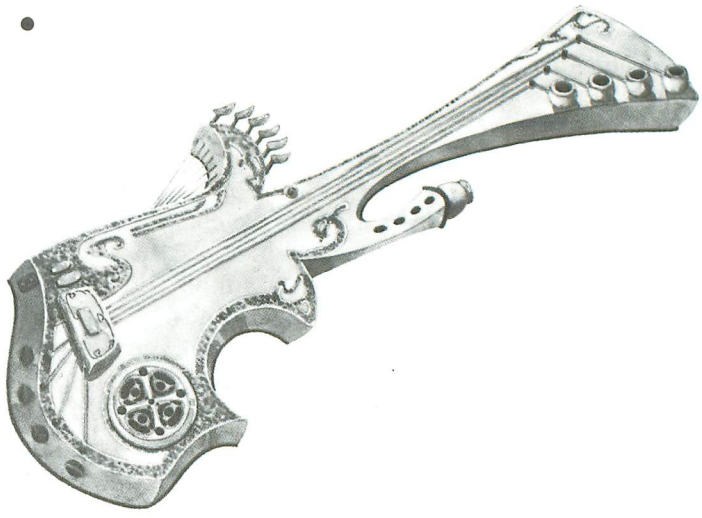
•

CHECKSUM DATA.

(see page 30)

```
100 DATA 276,313,80,285,451,998,15,556
,666,304,984,595,209,535,557,6824
290 DATA 521,698,580,542,757,777,26,91
7,652,905,975,199,239,609,478,8875
470 DATA 116,423,59,4,970,925,704,146,
329,76,913,189,4,42,196,5096
650 DATA 863,523,665,154,640,998,596,3
,634,128,867,41,768,736,55,7671
800 DATA 920,472,738,415,285,265,128,8
37,774,906,786,910,312,394,373,8515
950 DATA 612,352,904,261,946,638,452,7
20,422,887,258,654,958,416,824,9304
1250 DATA 593,863,599,344,149,181,840,
27,28,3624
```

•



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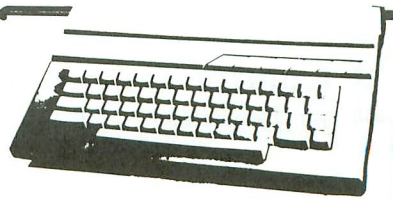

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Atari users in Poland.

We are members of a new Atari users family and the first Atari club in Poland. We now have eleven computers and we hope to develop in quantity and quality.

All the hardware is individually imported, because we cannot buy them in Poland. Our big problem is software and knowledge.

We are looking for friends who can support us in our computer childhood. We'd like to request your readers to send us second-hand magazines, books and programs for the Atari. Would you help us to start?

Sincerely,
Wieslaw Migut, Club Coordinator
ul.Budryka 9/216
30-072 Krakow
Poland

English Error.

I typed in the program **English Error Messages in BASIC** from the February, 1985 **ANALOG Computing** (issue 27). It will not run on my system. I've checked it with **D:Check** four times, and everything checks out okay.

I have an Atari 400 with 48K memory and a 1050 disk drive with DOS 3. Will it only work with DOS 2, or is there something that I can change to get it to work properly?

Sincerely,
Glenn Spurlock
Nashville, TN

*The article that accompanied **English Error Messages** specifically stated that the program would only work with DOS 2 and not DOS 3. We have found that it is compatible with Atari's new DOS 2.5, which will work with a 1050 in either enhanced or single density. —Ed.*

RAM-OS ROMs.

In your **RAM Operating System** article (issue 29, April, 1985), the value $FE is used to disable the ROM areas. This also disables the built-in BASIC on the 800XL. If you use the value $FC, you can return to BASIC and still retain the RAM-OS.

Also, is there any way to alter the old ROM locations and enable the ROM locations retaining those changes?

Thanks,
John M. Walter
Morningside, MD

P.S. The April issue is one of your best yet. Keep up the good work!

To have the ROMs in the Operating System remember any changes would require changing the chips for new ones. One of the characteristics of ROMs is that you cannot write to them without special equipment. —Ed.

Cheep Talk corrections.

In **Cheep Talk**, there were a couple of errors in my original material.

The labels in Figures 5 and 6 were reversed. Pin 9 on the processor is really LRQ and goes to pin 4 on joystick plug 2. Pin 20 on the processor is really ALD and should go to pin 3 on the plug.

The synthesizer, however, does work as presented in the magazine—only the labels were inaccurate.

I apologize for any confusion created by this.

Sincerely,
Lee S. Brilliant, M.D.
Granada Hills, CA

BASIC problems.

First, I would like to compliment you on your fine magazine. I received a copy of *The ABCs of Atari Computers* with my subscription and I couldn't be happier. My only regret is that I didn't try to get a copy of *Atari Roots* when they were available.

I would also like to say that the content of the July issue was simply the best I have seen anywhere. I typed all the big programs and use them, too.

Next, I would like to add to the **Reader Comment** from Matthew Ratcliff. He's indeed correct in his indignation about version 2 of Atari BASIC.

When I first got my 800XL, I thought that I was the problem. I found out later that I was not to blame. I have followed this controversy in several magazines and on the message bases of several bulletin boards. I believe, however, that some battles aren't worth fighting.

I tried to make the most of the bad situation, so I bought BASIC XL and was extremely pleased to find out what a great product it truly is. I had read remarks as to how good it is, but I had not read any review of BASIC XL. It is as good as the BASICs available here (Eastern Illinois University) on the terminals that are connected to a mainframe computer. BASIC XL is astonishing.

I am sure that there are other similar BASIC replacements available for the Atari. As for me, I am learning Action! now and I hope you continue to publish programs written in the Action! language. I also hope Russ Wetmore continues to cover the subject in his column.

Sincerely,
Harry L. McDonald
Charleston, IL

P/M Creator/Animator fix.

The following will fix a small display problem with **P/M Creator/Animator** from issue 23, page 33.

An extraneous *2* appears on-screen on an 800XL above *P0 P1 P2*, due to an error in Line 152. To correct the problem, change the number of blank spaces between the quotation marks in Line 152 from *9* to *10*. This will result in the checksum for Line 152 changing from *451* to *586*. The first checksum total will also change from *6501* to *6636*.

Dennis F. Hamilton
Cockeysville, MD

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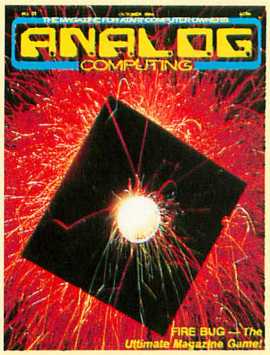

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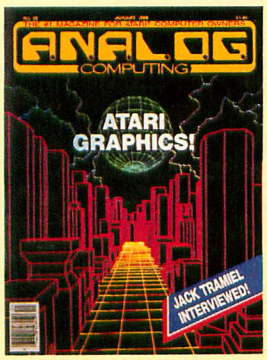

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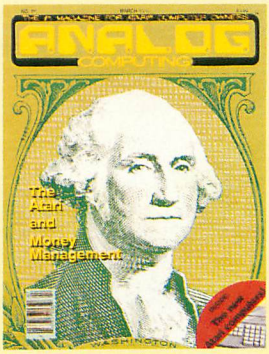

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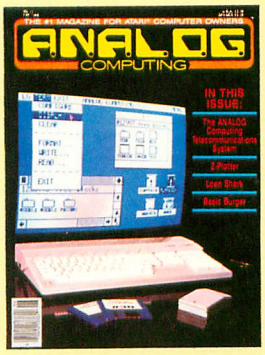

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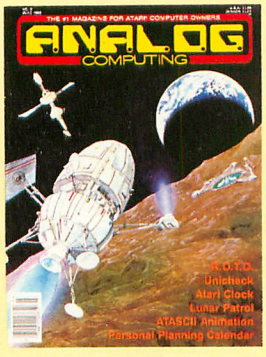

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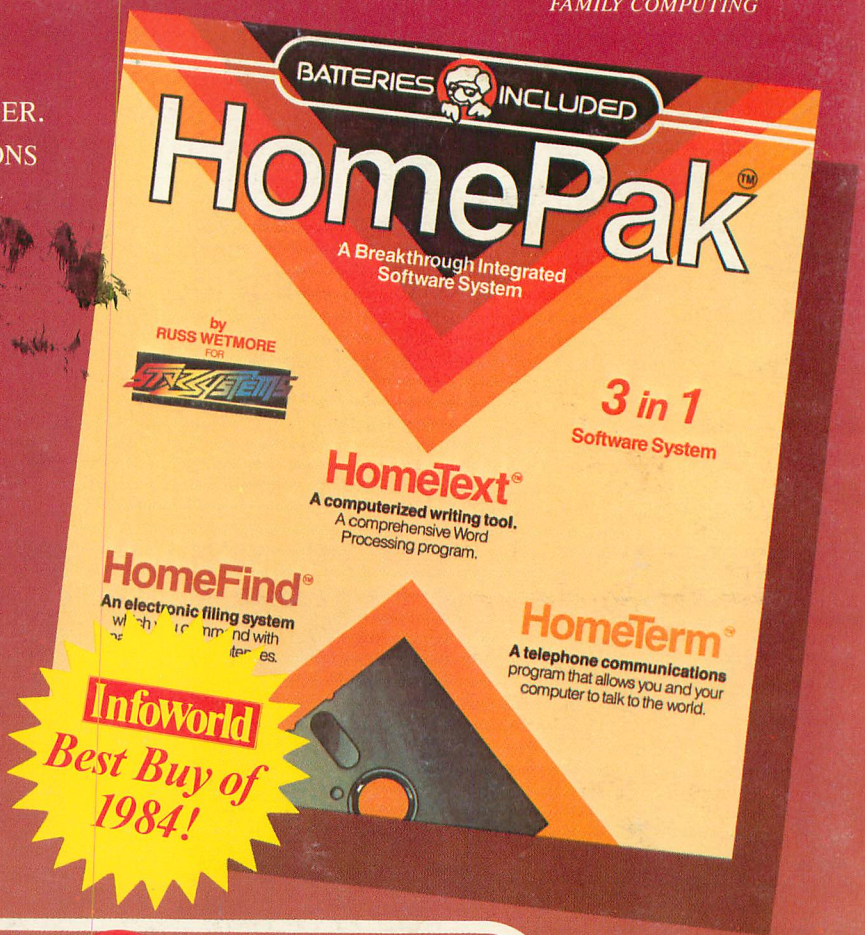

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